Hazen and Sawyer
4011 WestChase Boulevard, Suite 500
Raleigh, NC 27607 • 919.833.7152

City of Greenville Greens Mill Run Watershed Master Plan

Hazen No. 31187
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Table of Contents

List of Figures

List of Tables

List of Pictures

List of Appendices

List of Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AMC	Antecedent Moisture Conditions
BANCS	Bank Assessment for Non-point source Consequences of Sediment
BEHI	Bank Erosion Hazard Index
BMP	Best Management Practice
CIP	Cast Iron Pipe
CLOMR	Conditional Letter of Map Revision
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CN	Curve Number
COG	City of Greenville
DA	Difficult Access Structure
DIP	Ductile Iron Pipe
DO	Dissolved Oxygen
EA	Environmental Assessment
ECU	East Carolina University
EPA	Environmental Protection Agency
ETJ	Extraterritorial Jurisdiction
FEMA	Federal Emergency Management Agency
FIB	Fecal Indicator Bacteria
GIS	Geographical Information System
GMR	Greens Mill Run
GUC	Greenville Utilities Commission
HEC	Hydraulic Engineering Center
HMS	Hydrologic Modeling System
HQW	High Quality Waters
HSG	Hydrologic Soil Group
IP	Individual Permit
LAG	Lowest Adjacent Grade
LIDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
LOS	Level of Service
NBS	Near Bank Shear Stress
NCDEQ	North Carolina Department of Environmental Quality
NCDOT	North Carolina Department of Transportation
NCSU	North Carolina State University
NCWRC	North Carolina Wildlife Resources Commission

NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NS	Norfolk Southern
NSW	Nutrient Sensitive Waters
NTU	Nephelometric Turbidity Units
NWI	National Wetland Inventory
NWP	Nationwide Permit
ON	Organic Nitrogen
PCN	Pre-Construction Notification
PIO	Public Information Officer
PIP	Public Involvement Plan
RAS	River Analysis System
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe
SCS	Soil Conservation Service
SEPA	State Environmental Policy Act
SHPO	State Historic Preservation Office
SHWT	Seasonally high water table
SOP	Standard Operation Procedure
SWMM	Storm Water Management Model
TDN	Total Dissolved Nitrogen
TDP	Total Dissolved Phosphorous
TMDL	Total Maximum Daily Load
TS	Tropical Storm
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WQV	Water Quality Volume
WSMP	Watershed Master Plan
XS	Cross-Section

Executive Summary

As part of the effort to inventory and develop master plans for the City of Greenville (COG), the City retained Hazen and Sawyer to complete a Watershed Master Plan (WSMP) for Greens Mill Run (GMR). The goals of this watershed master plan (WSMP) were to: (1) evaluate the watershed for existing flooding, water quality, and erosion problems; (2) recommend and prioritize capital improvements to control existing flooding by reducing the frequency and severity of flooding, and (3) identify stream stabilization projects to reduce the risk of property loss along streams and to reduce sediment loads as a result of erosion. As part of the project, Hazen and Sawyer completed an inventory of stormwater infrastructure within the GMR watershed. **Table ES-1** summarizes inventory data collected as part of the project. Surveyed structures and field information were incorporated into a geographical information system (GIS) database and provided to the City.

Table ES-1: Summary of Stormwater Inventory

Structure Type	Number Inventoried
Closed System Structure	4,708
Bridge	7
Primary Cross-Section*	101
Secondary Channel Measurement*	184
Pond Structure	9
Drainage Pipe	76 miles
Channel (Primary and Secondary)	35 miles

*See Section 1.1 for additional information.

In addition to inventory of stormwater infrastructure, the project included a robust campaign to engage stakeholders and the public through a number of mediums in order to receive information regarding problem areas within the watershed, and feedback on areas where projects were identified. Hazen and Sawyer, in collaboration with the City of Greenville's Public Information Officer (PIO), developed a Public Involvement Plan (PIP) that outlined the process by which the public and stakeholders were engaged in all COG WSMPs. The general public was engaged through use of social media, the project website (www.greenvillewsmp.com), questionnaires, public meetings, and one-on-one onsite or phone interviews.

Stakeholders were engaged at a one day meeting in which various groups met with Hazen and Sawyer team members to discuss known problem areas and various issues within the watershed. City staff served as an important stakeholder by providing information on historical flooding and erosion problems within the watershed, as well as detailed feedback on potential capital improvement projects identified as part of the WSMP. Information collected thorough the PIP process is included in **Section 2.1** and also in **Appendix D**. **Appendix D** also includes a copy of the PIP which guided the overall project across all watersheds.

The Hazen and Sawyer team included East Carolina University (ECU) to provide ambient stream monitoring for Greens Mill Run. ECU is also located within the GMR watershed and was involved in the stakeholder process discussed above. East Carolina's findings are discussed in **Section 5.3**, with the full report included in **Appendix N**.

The GMR watershed is approximately 13.75 square miles, 11.12 square miles of which are located within the City limits, and 2.63 square miles within the extraterritorial jurisdiction (ETJ). The watershed is located centrally within Greenville, and contains much of downtown Greenville and East Carolina University. The watershed is generally bounded on the north by 5th Street, on the south by Greenville Boulevard/Red Banks Road, and to the west by the agricultural area between Allen Road and Kinsaul-Willoughby Road. The watershed drains from west to east, discharging directly into the Tar River. The eastern half of the watershed area is highly developed, with the degree of urbanization / imperviousness increasing from west to east.

Flood Control Projects

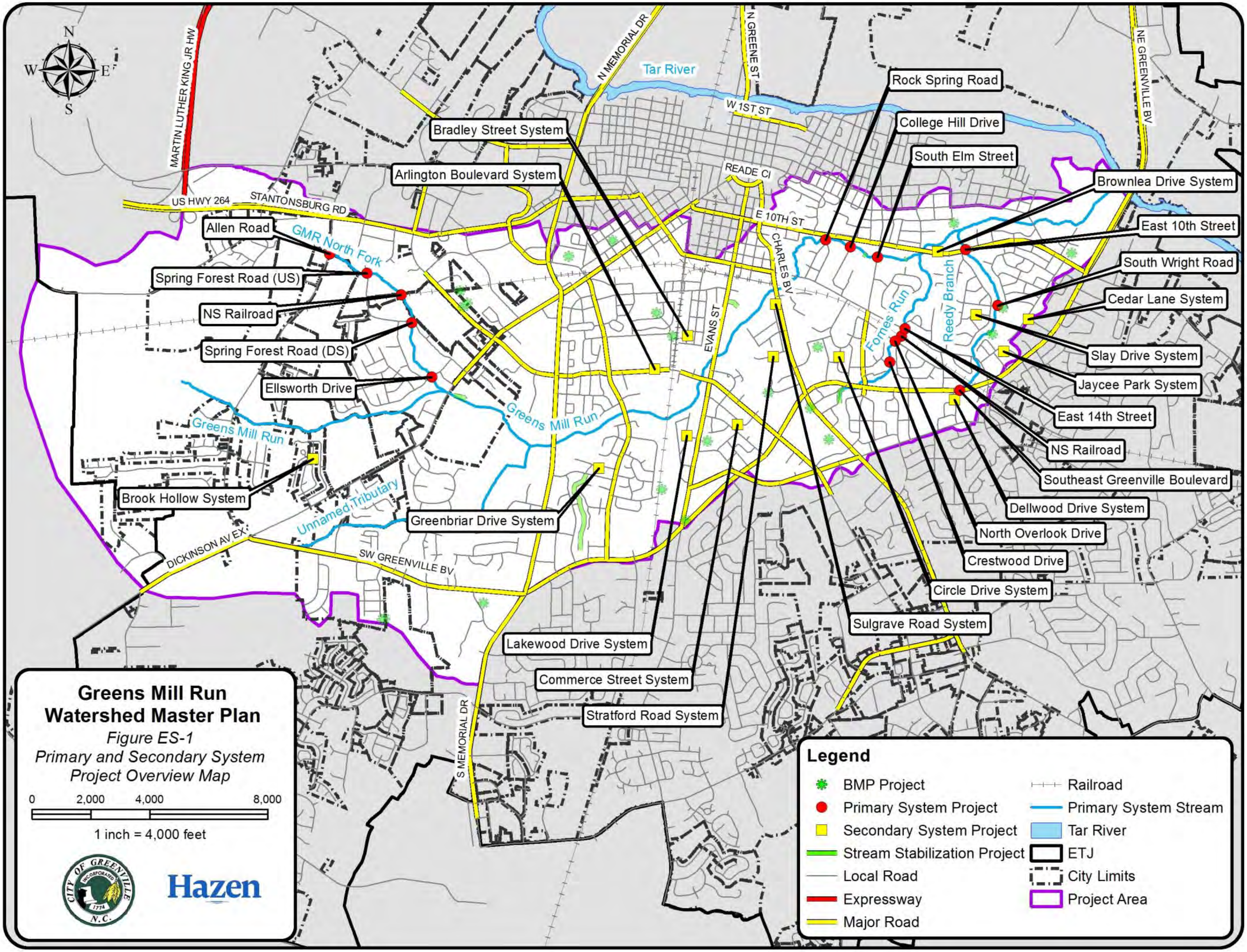
Utilizing data obtained as part of the infrastructure inventory, Hazen and Sawyer conducted an existing conditions analysis, which evaluated the hydrologic and hydraulic performance of existing conveyance infrastructure. This analysis was divided between two system types: Primary, which included culvert and bridge crossings along five streams within the watershed, and Secondary, consisting of closed pipes and small open-channels, conveying water from surrounding roads, structures, and lawns, ultimately discharging into the Primary System. The Primary System consisted of the following streams:

- Greens Mill Run – from Allen Road to the Tar River
- Reedy Branch – from Greenville Boulevard to its confluence with GMR
- Fornes Run – from Greenville Boulevard to its confluence with GMR
- Unnamed Tributary (through Greenville Country Club) – from Greenville Boulevard to its confluence with GMR
- Greens Mill Run North Fork – from Allen Road to its confluence with GMR

Each roadway crossing along the Primary System was studied in detail to determine its level of service under both existing development conditions and future development conditions (based on the City's future land-use GIS information). Improvements to crossings with an insufficient LOS were designed based upon future land-use conditions.

Secondary Systems within the watershed were evaluated, if identified by citizens or stakeholders as areas with significant flooding or erosion. The majority of Secondary System flooding issues that were identified occurred within private residential neighborhoods. The problems reported consisted primarily of street, yard, and crawl space flooding.

Based on the hydrologic and hydraulic analyses of the Primary System and Secondary Systems, Hazen and Sawyer identified a number of capital improvement and maintenance projects that reduce the severity and frequency of flooding within the GMR watershed. Following is a summary of the Primary and Secondary Systems projects, which are depicted in **Figure ES-1**. Primary System projects are presented from upstream to downstream progression, by stream.



Greens Mill Run Watershed Master Plan

Figure ES-1
Primary and Secondary System Project Overview Map

Greens Mill Run Primary System

Rock Spring Road – The existing twin 15' x 9.4' Corrugated Metal Pipe Arches (CMPAs) provide a 10-year level of service under existing land-use conditions, which is below the desired 25-year level of service. Meeting the desired LOS was determined to be unfeasible due to downstream channel and culvert constrictions resulting in high tailwater on the Rock Spring Road crossing. The improvements required to meet the desired 25-year LOS would include upsizing all crossings from Rock Spring Road to the East 5th Street bridge by two to four times their current size, including two crossings without LOS violations. In order to maintain a 10-year level of service under future land-use conditions, Alternative #1 is proposed to replace the existing culverts with triple 11' x 10' RCBCs. This alternative requires improvements at both College Hill Drive and South Elm Street in order to provide the stated LOS. Alternative #2 is to replace the existing culverts with quadruple 11' x 10' RCBCs, which also provides a 10-year level of service under future conditions, but requires downstream improvements only at South Elm Street.

College Hill Drive – The existing twin 12' x 10' RCBCs provide a 10-year level of service under existing land-use conditions and appear to be in good structural condition. The private roadway is owned by East Carolina University and is assumed to require a 10-year LOS. Tailwater from this crossing impacts performance of the Rock Spring Road crossing, thus Alternative #1 is proposed to supplement the existing culverts with an 8' x 4' RCBC to reduce the required upstream improvements required at Rock Spring Road. This improvement provides a 10-year LOS under future land-use conditions and reduces tailwater on Rock Spring Road. Alternative #1 requires downstream improvements at South Elm Street. Alternative #2 is to not improve this crossing and rely solely on improvements at South Elm Street and Rock Spring Road for reduction of overtopping frequency at Rock Spring Road and College Hill Drive. This alternative also results in a 10-year LOS at College Hill Drive.

South Elm Street – The existing twin 16.5' x 10.5' CMPAs provide a 25-year level of service under existing land-use conditions, which is below the desired 50-year level of service. The existing culverts appear to be in good structural condition; however, because they do not provide the desired level of service and need to be significantly upsized, replacing the culverts is proposed. The improvement at this crossing is to replace the existing culverts with quadruple 11' x 11' RCBCs, which will maintain the 25-year level of service under future land-use conditions. Meeting the desired 50-year LOS was determined to be unfeasible, as it required all crossings at and downstream of South Elm Street to be upsized two to four times their current size, including two crossings without LOS violations.

Greens Mill Run Floodplain Modifications – As a result of implementing the improvements at each of the GMR crossings presented above, the downstream reaches of the stream were shown to experience water surface elevation increases of up to 0.13 feet (average of 0.09 feet). To mitigate the increases due to implementation of Alternative #1 improvements, unmaintained floodplain benching, for approximately 2,125 feet long and 60 - 70 feet wide, is proposed to be constructed downstream of East 5th Street. The same benching is also required with GMR Alternative #2 improvements, in addition to an approximately 300 foot long by 10 foot wide unmaintained bench downstream of Rock Spring Road.

Reedy Branch Primary System

Southeast Greenville Boulevard – The existing 36” Corrugated Metal Pipe (CMP) provides a 2-year level of service under existing land-use conditions, which is below the desired 50-year level of service for the NCDOT roadway. The existing culvert appears to be in fair structural condition. Replacing the culvert with a 60” reinforced concrete pipe (RCP) is proposed to provide a 50-year level of service under future land-use conditions.

South Wright Road – The existing 48” CMP, which is in fair structural condition, provides a 2-year level of service under existing land-use conditions, which is below the desired 25-year LOS. Proposed Alternative #1 is to replace the existing culvert with twin 6’ x 5’ RCBCs, providing a 25-year level of service under future land-use conditions. This improvement requires downstream improvements at East 10th Street, as described below. Alternative #2 involves replacement of the existing culvert with a 7’ x 5’ RCBC to provide a 10-year level of service under future land-use conditions, with no required downstream improvements.

East 10th Street – The existing 48” and 54” RCPs meet the desired 50-year level of service for the NCDOT roadway under existing land-use conditions. However, in order to decrease upstream tailwater and limit the magnitude of upstream improvements, Alternative #1 is proposed to supplement the existing culverts with a 48” RCP located in the floodplain overbank. This will maintain the 50-year level of service under future land-use conditions and decrease tailwater at South Wright Road to permit achieving a 25-year LOS under future land-use conditions at South Wright Road. The second alternative is to not improve this crossing and provide 10-year level of service under future land-use conditions at South Wright Road.

Fornes Run Primary System

Crestwood Drive – The existing 9’ x 6’ CMPA and 48” CMP provide a 10-year level of service under existing land-use conditions, which is below the desired 25-year level of service. The existing culverts appear to be in good structure condition. In order to provide an increased level of service under future land-use conditions, Alternative #1 is proposed to supplement the existing culverts with a 60” RCP, providing a 25-year LOS. This improvement requires downstream improvements at East 14th Street, the Norfolk Southern (NS) Railway, and North Overlook Drive. Alternative #2 is to not improve the crossing, and instead rely on downstream improvements at the Norfolk Southern Railway, and North Overlook Drive to allow a 10-year level of service at Crestwood Drive.

North Overlook Drive – The existing 9’ x 6’ CMPA and 48” CMP provide a 10-year level of service under existing land-use conditions, which is below the desired 25-year level of service. Both Alternative #1 and Alternative #2 propose to replace the existing culverts with twin 7’ x 7’ RCBCs. For Alternative #1, which provides a 25-year level of service under future land-use conditions, requires downstream improvements at East 14th Street and the Norfolk Southern Railway. Alternative #2 provides a 10-year level of service, with required downstream improvements only at the Norfolk Southern Railway.

Norfolk Southern Railway – The existing 72” CMP and twin 48” RCPs meet a 100-year level of service under existing land-use conditions. However, to decrease tailwater on North Overlook

Drive, improvements are proposed. Alternative #1 involves replacing the existing culverts with twin 10' x 8' RCBCs. Alternative #2 proposes replacing the existing culverts with twin 8' x 8' RCBCs. Both alternatives provide a 100-year level of service under future conditions at the railroad; however, the first allows for a 25-year level of service at North Overlook Drive, while the second allows a 10-year level of service, both for future land-use conditions.

East 14th Street – The existing twin 72" CMPs meet the desired 25-year level of service for the NCDOT roadway under existing land-use conditions. The existing culverts appear to be in poor structural condition. In order to reduce upstream tailwater Alternative #1 is proposed to replace the existing culverts with twin 10' x 8' RCBCs. This provides a 50-year level of service under future land-use conditions and reduces upstream tailwater conditions to allow for a 25-year level of service at North Overlook Drive. Alternative #2 is to not improve this crossing, which allows for a 10-year level of service under future land-use conditions at North Overlook Drive.

Unnamed Tributary Primary System

With the exception of golf course car path bridges, no Primary System crossings with a deficient level of service were identified in the existing land-use conditions analysis; therefore, no improvements are recommended for the Unnamed Tributary crossings.

Greens Mill Run North Fork Primary System

Allen Road – The existing 72" CMP provides a 25-year level of service under existing land-use conditions, which is below the desired 50-year level of service. To provide the full 50-year LOS under future land-use conditions, an alternative is proposed to replace the existing culvert with twin 7' x 7' RCBCs. The NCDOT is planning to replace this culvert with a plated aluminum 14'-8" x 9'-8" arch pipe, which according to this WSMP's hydraulic model, also provides a 50-year LOS. Once the NCDOT project is implemented, the Allen Road improvements may be removed from this WSMP.

Spring Forest Road (US) – The existing twin 60" CMPs provide a 10-year level of service under existing land-use conditions, which is below the desired 25-year level of service. Alternative #1 is proposed to replace the existing culverts with triple 8' x 6' RCBCs. Alternative #2 proposes to supplement the existing culverts with triple 60" RCPs, for a total of five barrels. Both alternatives require improvements at all three downstream crossings on Greens Mill Run North Fork (Norfolk Southern Railway (NS), Spring Forest Road (Downstream), and Ellsworth Drive), and maintain a 10-year level of service under future land-use conditions. Meeting the desired LOS was determined unfeasible due to requiring the Spring Forest Road (US) culvert to be upsized by twice its current size and upsizing the downstream Norfolk South Railway crossing by more than 5 times its current size. Additionally, by significantly upsizing the railway crossing capacity, outflows from the crossing would be substantially increased, adversely impacting the hydraulic performance of all downstream crossings, including those on GMR, and exacerbating downstream water surface elevations, requiring additional floodplain benching.

Norfolk Southern Railway – The existing twin 48" RCPs meet the desired 100-year level of service under existing land-use conditions; however, in order to reduce tailwater on Spring Forest Road (US) supplementing the existing culverts with a 60" RCP located in the floodplain is proposed. This provides a 100-year level of service under future land-use conditions, and requires downstream improvements at Spring Forest Road (DS) and Ellsworth Drive.

Spring Forest Road (DS) – The existing triple 60” RCPs provide a 2-year level of service under existing land-use conditions, which is below the desired 25-year level of service. To provide an improved future level of service, Alternative #1 replaces the existing culverts with triple 8’ x 6’ RCBCs; Alternative #2 requires supplementing the existing culverts with twin 60” RCPs. Either alternative provides a 10-year level of service under future land-use conditions, provided downstream improvements at Ellsworth Drive are implemented. Meeting the desired 25-year level of service was determined to be unfeasible as required improvements included increasing the size of the Spring Forest Road (DS) culvert by nearly three times its current size, upsizing the Ellsworth Lake principal and emergency spillways, and upsizing the Dickinson Avenue Extension crossing along GMR.

Ellsworth Drive – The existing crossing consists of an earthen dam, impounding a lake with a surface area of 6 acres. Ellsworth Drive is located along the crest of the dam. The principal spillway consists of a riser and 42” CMP barrel; the emergency spillway contains triple 30” CMPs. The dam, outlets, and lake are all located on private property, except for the City-owned roadway and right-of-way. Combined, the outlets provide a 2-year level of service under existing land-use conditions, which is less than the desired 25-year level of service. Any improvements to the dam’s outlets likely initiates dam safety requirements, such as clearing of trees on the embankments, embankment stability improvements, hydrological and hydraulic analyses for large storm events, and other maintenance items. Improvements proposed in this WSMP address only the roadway LOS and do not include considerations related to dam safety requirements. Improvements at this crossing require the City to obtain an agreement to enter private property, or the City may wish to investigate assuming ownership of the lake and dam. The proposed improvement to provide a future 10-year level of service is to replace the existing emergency spillway culverts with quadruple 8’ x 2.5’ RCBCs. Meeting the desired LOS was determined to be unfeasible, requiring improvements to the outlet structure to nearly eight times the current capacity. Such improvements would also result in increased outflows from the lake, causing additional downstream water surface elevation increases.

Greens Mill Run North Fork Floodplain Modifications – As a result of implementing the GMR North Fork improvements presented above, portions of both North Fork and GMR were shown to experience water surface elevation increases of up to 0.13 feet (average of 0.07 feet). To mitigate the increases due to either alternative, a combination of maintained and unmaintained floodplain benching and leveling is proposed, ranging from 10 to 330 feet wide, for approximately 8,025 LF along the streams. Alternative #1 includes 2,450 LF of maintained floodplain benching; Alternative #2 includes 3,900 LF. Specific to North Fork, 750 LF of benching is required downstream of the Norfolk Southern Railway; the remainder of the floodplain modifications are proposed along portions of GMR, between Dickinson Avenue Extension and the Norfolk Southern Railway.

Secondary Systems

Arlington Boulevard System – This system is located along Arlington Road and is bounded to the north by J.H. Rose High School, to the south by Evans Park, and to the east by the CSX Railroad. Most stormwater structures in this system experience surface surcharging in the 10-year event. Improvements include installation of a parallel piping system, primarily along the south side of Arlington Boulevard (size ranging from 24” - 36” in diameter) with a shorter section of parallel 15” diameter piping along the north side. The improvements also include additional discharge capacity in the form of a new pipe from the constructed wetland on the J.H. Rose site, crossing Arlington Boulevard, to an independent discharge to the channel adjacent to Evans Park.

Bradley Street System – This system drains the Bradley Street stub as well as inlet bypass flows from upgradient drainage in Norcott Circle and Kennedy Circle. The stub street curbing discharges to a concrete channel which flows into a 36” diameter pipe under the CSX railroad and continues into a closed system to its discharge point below Greene Street. Models showed that most of the system upstream of the railroad crossing experiences surcharging in the 10-year event. Improvements include upsizing the railroad crossing and removing closed conduits downstream of the railroad and replacing with open channels, while increasing road crossing culvert sizes.

Brook Hollow System – Brook Hollow is a comparatively recent development consisting of duplexes. The system model indicated surface surcharging at ten stormwater structures in the 10-year event. Various runs of pipe within the system were identified as constricting flows, thus pipe sizes were adjusted to allow greater flow through the system. Generally, the system has significant depth throughout the development, allowing for increases in pipe sizes where necessary. Modifications include adding an additional discharge from the system (48” diameter), increasing the diameter of most of the main branch of the system (sizes ranging from 18” - 54” in diameter), and adding an additional 18” discharge at the upper end of one of the system branches.

Brownlea Drive System – The majority of this system is within East 10th Street, a NCDOT roadway, near its intersection with Brownlea Drive. The model indicated surface surcharging at two inlets during the 10-year event. The two inlets are located on the north side of East 10th Street. Eliminating surface surcharging at these inlets requires replacement of three runs of 24” with 30” pipe, as well as one run of 18” diameter pipe with 24” diameter pipe. Reconstruction of one commercial driveway is also recommended.

Cedar Lane System – The Cedar Lane system is located along Cedar Lane between Jaycee Park and Tryon Drive. This system drains runoff along Cedar Lane, with deficiencies noted in the area of the Cedar Lane / Wright Road intersection, as well as at the entrance to Eastern Elementary School. System capacity is proposed to be increased by replacing the existing single-barrel storm pipes with double-barrel pipes ranging from 15” - 36” in diameter.

Circle Drive System – This system originates on East Berkley Road, travels down Forest Hill Drive, across private property to Circle Drive, along Birch Street to Rosewood Drive, then discharges to a dry detention pond adjacent to ECU athletic facilities. Modeling results showed widespread surface surcharging at various system inlets during the 10-year storm event. The drainage system is shallow, and therefore, larger diameter pipes are challenging to install without major impacts to the neighborhood. Additionally, many utilities are shown to be impacted by improvements, including water, sanitary sewer, gas, and electric. Improvements within this neighborhood generally propose adding system capacity through use of multi-barrel pipe systems. A significant portion of the system requires replacement in order to mitigate flooded areas. Proposed piping ranges 24” - 48” in diameter.

Commerce Street System – The Commerce Street system extends from Commerce Street to Kirkland Drive. The model showed the upstream-most inlets (within Commerce Street) experience surface surcharging in the 10-year event. Improvements to this system include the addition of a 42” diameter parallel pipe, starting at Commerce Street and extending below Kirkland Drive to the system discharge point.

Dellwood Drive System – This Secondary System begins at Azalea Drive and extends downstream through Dellwood Drive, ultimately discharging onto private property south of Greenville Boulevard. Most of the inlets in this system exhibited surface surcharging when modeled for a 10-year rainfall event. Proposed improvements include addition of a second pipe system (24” - 36” in diameter) extending north along Dellwood, then turning east and following Greenville Boulevard, ultimately tying into the Greenville Boulevard culvert.

Greenbriar Drive System – This system has two branches, including both open channel and closed pipe systems. One branch flows perpendicular to the roadways, extending from upstream of Fairlane Road, to downstream of Greenbriar Drive, where it converges with the second branch. The second branch starts at Hooker Road and travels between homes on Greenbriar and Fairlane Roads. The branch then crosses Greenbriar where it begins to parallel the road until the confluence with the first branch. The system discharge point is an open channel north of Greenbriar Drive. Improvements to this system include channel widening and new piping ranging in diameter from 48” - 72”.

Lakewood Drive System – This system is directly downstream of the University Commons shopping center located at the intersection of Evans Street and Southeast Greenville Boulevard. The system receives runoff from two drainage systems: 1) the University Commons shopping center and 2) Evans Road and Greenville Boulevard, from their intersection north to Red Banks Road. From 2009 to 2014, the City initiated a study and design project in which the system was analyzed and a solution proposed to divert offsite drainage coming into the Lakewood system to another location. The design, which was never implemented, significantly reduced the amount of runoff being conveyed through the channel which was the source of many of the problems reported. The project was delayed until it could be further studied as part of this WSMP.

The Storm Water Management Model (SWMM) for this system indicated that six nodes within the system surcharge in the 10-year event, including an area with reported yard and street flooding (Lindell Drive). Citizen feedback, past studies, and a field investigation indicated that the detention pond behind the Target shopping center is not being fully utilized. Improvements to this system include eliminating the pond’s bypass orifice (located in the control structure) and creating a new outlet structure that discharges adjacent to the CSX railroad right-of-way. This is similar to the designs proposed under the previous study, but prioritizes making the commercial detention pond operate more efficiently, eliminating bypass discharge into the Lakewood system. In order to alleviate the Lakewood system problems, the flow therein must be reduced, which requires pond outflows to be discharged elsewhere. It is not possible to solve these drainage problems without impacting unaffected private properties. Improvements include a new outlet structure in the commercial pond with 2,000 LF of 24" diameter discharge piping.

Jaycee Park System – This system drains the road at the entry to Jaycee Park and lacks the capacity to pass the 10-year storm event according to model results. Maintaining existing pipe sizes, but lowering the invert elevations to gain clearance from the 10-year water surface elevation provides a feasible solution. The lowered pipes are proposed to be 30" - 36" in diameter.

Slay Drive System – This system runs along Slay Drive from Ragsdale Road to East Wright Road. The model showed six structures with surface surcharging in the 10-year event. System improvements to address this are extensive, as nearly the entire system is proposed to be upgraded. Upgraded pipes range in size from 18" - 42" in diameter.

Stratford Road System – This system is located in a portion of Stratford Road and drains most of Stratford Road, west of Sulgrave Road. The model indicated that a single inlet experiences 0.04 feet of surface surcharging in the 10-year event. This system was modeled based on stakeholder reports; there were no resident reports of flooding in the area. Because of the small amount of flooding shown in the model, no improvements are proposed for this system.

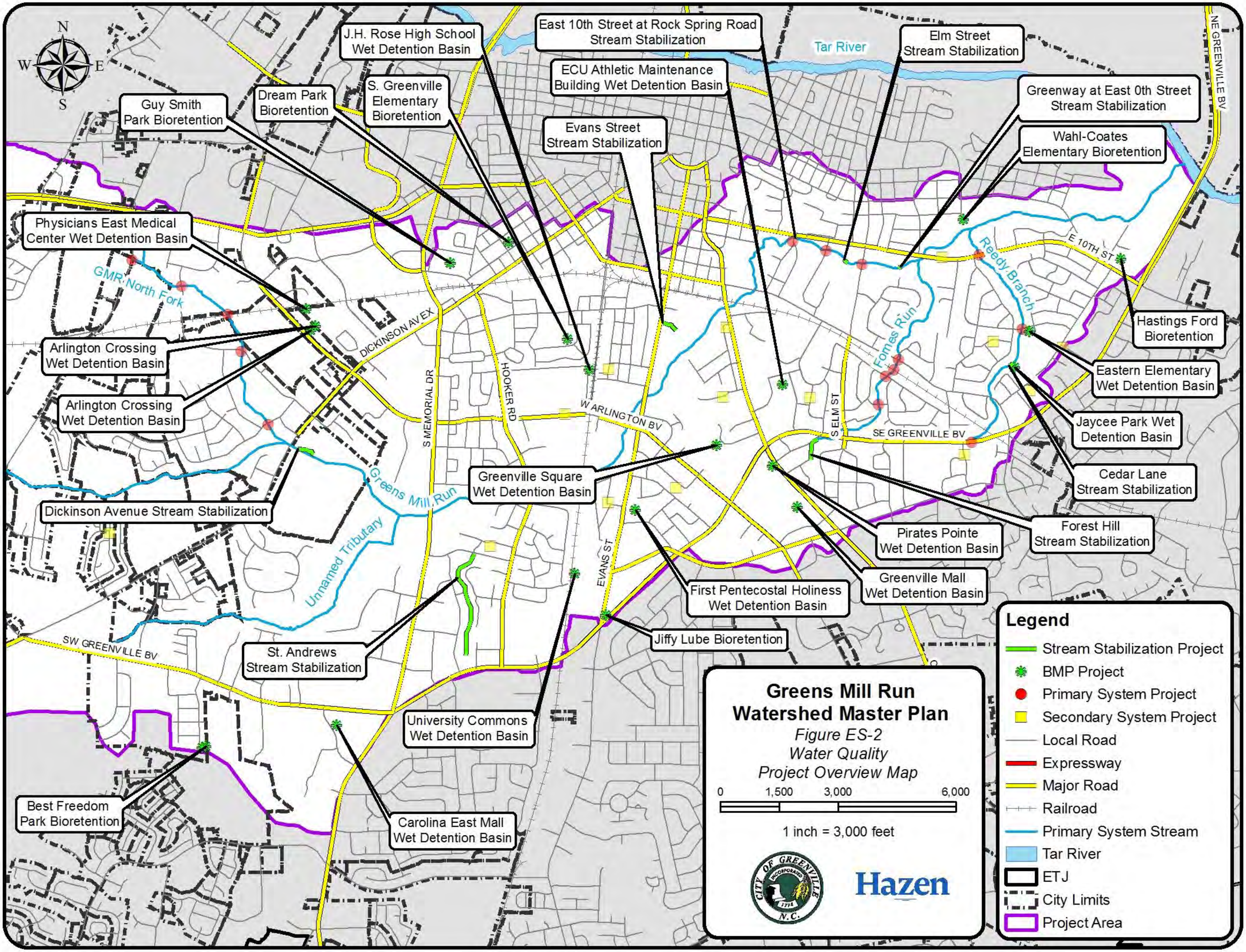
Sulgrave Road System – Citizen reports indicated flooding at the north end of Sulgrave Road. This system directly ties into culverts conveying Greens Mill Run under Charles Boulevard. Modeling the system independently of tailwater effects of Greens Mill Run indicated only minor capacity deficiencies in the 10-year storm event at a location which does not impact roads or structures. Modeling system performance independently of Greens Mill Run was appropriate because the time to peak for the subject system is hours prior to the Greens Mill Run peak.

The system was also evaluated to determine what, if any, events may result in flooding as a result of Greens Mill Run tailwater. Under existing land-use conditions, GMR was determined to overtop Charles Boulevard in the 10-year event. This resulted in surcharging of the Sulgrave Road system. Since the root cause of the reported flooding is GMR, no localized drainage system improvements are proposed to address the issue.

Water Quality Projects

The Greens Mill Run watershed was evaluated for water quality project opportunities. Using a multitude of sources, including public and City input, the Primary System streams and tributaries were assessed to identify locations of stream instability. In all, 39 locations were identified and examined. Ultimately, 29 locations were selected for further investigation, and seven were chosen for stream stabilization projects. These projects incorporate natural stream design techniques, including stream bank grading to address vertical/dilapidated banks, floodplain benching, installation of vegetated soil lifts or imbricated riprap walls, and establishing appropriate floodplain vegetation. The stream stabilization measures are intended to improve water quality by decreasing stream sedimentation and bank erosion, and to protect private and public infrastructure and structures.

The watershed was also examined for opportunities to install new, and retrofit existing, stormwater best management practices (BMP) to provide water quantity improvements within the watershed. While determining locations for implementation of new BMPs was part of this process, identifying opportunities to retrofit existing BMPs was a primary focus. Retrofits typically present lower cost but highly effective improvements. Other parameters considered in the BMP identification process included: amount of imperviousness, availability of space for implementation, proximity to existing drainage infrastructure, land ownership, and topography. Based on these assessments, 19 BMPs are proposed, 11 of which are retrofit projects. The water quality project locations are depicted in **Figure ES-2**.



J.H. Rose High School Wet Detention Basin
East 10th Street at Rock Spring Road Stream Stabilization
Tar River
Elm Street Stream Stabilization
ECU Athletic Maintenance Building Wet Detention Basin
Greenway at East 0th Street Stream Stabilization
Dream Park Bioretention
S. Greenville Elementary Bioretention
Guy Smith Park Bioretention
Evans Street Stream Stabilization
Wahl-Coates Elementary Bioretention
Physicians East Medical Center Wet Detention Basin
GMR North Fork
E 10TH ST
Reedy Branch
Fornes Run
DICKINSON AV EX
Hastings Ford Bioretention
Arlington Crossing Wet Detention Basin
Eastern Elementary Wet Detention Basin
Arlington Crossing Wet Detention Basin
S MEMORIAL DR
HOOKER RD
W ARLINGTON BV
S ELM ST
SE GREENVILLE BV
Jaycee Park Wet Detention Basin
Cedar Lane Stream Stabilization
Greenville Square Wet Detention Basin
Greens Mill Run
Dickinson Avenue Stream Stabilization
Forest Hill Stream Stabilization
Pirates Pointe Wet Detention Basin
Unnamed Tributary
EVANS ST
Greenville Mall Wet Detention Basin
First Pentecostal Holiness Wet Detention Basin
Jiffy Lube Bioretention
SW GREENVILLE BV
St. Andrews Stream Stabilization
University Commons Wet Detention Basin
Best Freedom Park Bioretention
Carolina East Mall Wet Detention Basin
NE GREENVILLE BV
Greens Mill Run Watershed Master Plan
Figure ES-2
Water Quality Project Overview Map
0
1,500
3,000
6,000
1 inch = 3,000 feet
CITY OF GREENVILLE INCORPORATED 1774 N.C.
Hazen
Legend
Stream Stabilization Project
BMP Project
Primary System Project
Secondary System Project
Local Road
Expressway
Major Road
Railroad
Primary System Stream
Tar River
ETJ
City Limits
Project Area

Project Prioritization

To appropriately allocate City resources, the flood control and water quality projects were prioritized based on the following categories as described in **Appendix M**:

- Public health and safety
- Severity of street flooding
- Cost effectiveness
- Effect of improvements
- Water quality – Best Management Practice
- Open Channel – Stream Stabilization
- Implementation constraints
- Grant funding
- Constructability

Scores were assigned to each project for the factors listed above, then weighted, and lastly summed to determine the prioritization rankings. Flood control and water quality projects were prioritized separately. The Primary System flood control projects include two alternatives, of which, only one may be selected per Primary System stream. Selection of projects from more than one alternative per stream may not provide the improvements and performance described in this WSMP, as projects within each alternative were evaluated assuming cumulative effects. In some instances, one or both of the alternatives did not result in the desired level of service due to infeasibility of the improvements required to meet this LOS. Generally, Alternative #1 improvements incorporated the highest LOS feasibly attainable, ideally meeting the desired LOS. Alternative #2 improvements, if presented, generally had a lower LOS due to minimizing the number or magnitude of projects required to provide an improved LOS under future land-use conditions. Improvements were not proposed for any locations where a 10-year LOS could not be achieved. Additionally, prioritization of the Primary System improvements incorporated project dependency, where the implementation of one Primary System project is dependent upon the implementation of another/others to achieve the stated performance.

The proposed prioritization and conceptual cost estimates are summarized in **Tables ES-2** through **Table ES-5.** The prioritization scoring for each project, and a description of the aforementioned categories, is included in **Appendix M**.

Table ES-2: Primary System Flood Control Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank	Estimated Cost
Allen Road - North Fork Greens Mill Run (Alternative #1 / #2)	187	1	1	$800,000
Southeast Greenville Boulevard - Reedy Branch (Alternative #1 / #2)	181	2	2	$680,000
Reedy Branch Project Group (Alternative #1)	169	3	3	$1,280,000
South Wright Road - Reedy Branch (Alternative #1)				$620,000
East 10th Street - Reedy Branch (Alternative #1)				$660,000
Greens Mill Run Project Group (Alternative #2)	149	4	4	$5,170,000
Rock Spring Road - Greens Mill Run (Alternative #2)				$2,100,000
South Elm Street - Greens Mill Run (Alternative #2)				$3,070,000
Greens Mill Run Project Group (Alternative #1)	149	4	5	$5,320,000
Rock Spring Road - Greens Mill Run (Alternative #1)				$1,590,000
College Hill Road - Greens Mill Run (Alternative #1)				$920,000
South Elm Street - Greens Mill Run (Alternative #1)				$2,810,000
North Fork Project Group (Alternative #2)	141	6	6	$4,860,000
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #2)				$620,000
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #2)				$1,190,000
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #2)				$1,390,000
Ellsworth Drive - North Fork Greens Mill Run (Alternative #2)				$1,660,000
Fornes Run Project Group (Alternative #1)	139	7	7	$15,540,000
Crestwood Drive - Fornes Run (Alternative #1)				$260,000
North Overlook Drive - Fornes Run (Alternative #1)				$780,000
Norfolk Southern Railway (FR) - Fornes Run (Alternative #1)				$13,300,000
East 14th Street - Fornes Run (Alternative #1)				$1,200,000
South Wright Road - Reedy Branch (Alternative #2)	135	8	8	$490,000
North Fork Project Group (Alternative #1)	131	9	9	$6,700,000
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #1)				$1,100,000
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #1)				$1,400,000
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #1)				$2,330,000
Ellsworth Drive - North Fork Greens Mill Run (Alternative #1)				$1,870,000
Fornes Run Project Group (Alternative #2)	115	10	10	$13,430,000
North Overlook Drive - Fornes Run (Alternative #2)				$780,000
Norfolk Southern Railway (FR) - Fornes Run (Alternative #2)				$12,650,000
Primary System Alternative #1 Total				**$ 30,320,000**
Primary System Alternative #2 Total				**$ 25,430,000**

*Project groups indicate project-dependency. Only one set of alternatives may be chosen per Primary System stream in order to achieve stated performance.

**Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table ES-3: Secondary System Flood Control Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank	Estimated Cost
Greenbriar Drive System	151	1	1	$770,000
Cedar Lane System	143	2	2	$650,000
Dellwood Drive System	135	3	3	$750,000
Circle Drive System	133	4	4	$1,680,000
Jaycee Park System	125	5	5	$480,000
Arlington Boulevard System	123	6	6	$920,000
Slay Drive System	121	7	7	$1,640,000
Commerce Street System	113	8	8	$430,000
Brownlea Drive System	105	9	9	$650,000
Bradley Street System	81	10	10	$970,000
Lakewood Drive System	77	11	11	$550,000
Brook Hollow System	69	12	12	$2,550,000
Secondary System Total				**$12,040,000**

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table ES-4: Stream Stabilization Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank	Estimated Cost
Forest Hill Drive	131	1	1	$820,000
St Andrews Drive	119	2	2	$3,430,000
East 10th Street at Rock Spring Road	119	2	3	$240,000
Dickinson Avenue	91	4	4	$500,000
South Evans Street	75	5	5	$1,110,000
Cedar Lane	69	6	6	$400,000
South Elm Street	69	6	7	$440,000
Greenway at East 10th Street	63	8	8	$320,000
Stream Stabilization System Total				**$7,260,000**

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost per linear foot, with lower costs receiving a higher tie-breaking rank.

Table ES-5: Stormwater Best Management Practice Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank	Estimated Cost
Jaycee Park	143	1	**1**	$180,000
Eastern Elementary School	143	1	**2**	$890,000
University Commons Shopping Center	131	3	**3**	$300,000
ECU Athletic Maintenance Building	131	3	**4**	$150,000
Greenville Square Shopping Center	131	3	**5**	$440,000
Carolina East Mall	131	3	**6**	$340,000
Pirates Pointe Shopping Center	131	3	**7**	$76,000
First Pentecostal Holiness Church	131	3	**8**	$170,000
Physicians East Medical Center	131	3	**9**	$330,000
J.H. Rose High School	125	10	**10**	$170,000
Jiffy Lube	125	10	**11**	$110,000
Greenville Mall	119	12	**12**	$470,000
Arlington Crossing Shopping Center	119	12	**13**	$130,000
Guy Smith Park	111	14	**14**	$160,000
Dream Park	111	14	**15**	$140,000
Andrew A. Best Freedom Park	111	14	**16**	$99,000
S. Greenville Elementary School	105	17	**17**	$170,000
Hastings Ford Dealership	101	18	**18**	$260,000
Wahl Coates Elementary School	75	19	**19**	$130,000
Stormwater BMP Total				**$4,720,000**

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

25-Year Special Risk Areas

In 2014, the City of Greenville passed an ordinance requiring attenuation for new development and re-development for the one-year, five-year, and ten-year, 24-hour storm events. In addition, Section 9-9-10 of Ordinance No. 13-054 states the following:

> *"New development and redevelopment, as described in section 9-9-3, in areas at special risk with well documented water quantity problems as determined by the City Engineer, shall not result in a net increase in peak flow leaving the site from pre-development conditions for the 25-year, 24-hour storm event."*

As part of the GMR WSMP, an analysis was completed to determine if areas within the watershed should be considered to have "well documented water quantity problems". Areas may be defined, as "well documented water quantity problems" if either of the following is true:

- Structural flooding has been historically noted by property owners during storms considered smaller than the design event and this structural flooding has been corroborated by either high water marks, City staff input, or model results.

- Model results indicate structural flooding or roadway overtopping during storms smaller than the design storm and models results are corroborated by City staff input.

Portions of the watershed draining to the “well documented water quantity problems” may be considered for 25-year detention if any of the following are true:

- Future condition flows are 10% or greater than existing flows for a given subwatershed upstream of the water quantity problem.
- Proposed capital projects are not deemed to be feasible or cost effective for providing the required level of service for these water quantity problems based on future land-use conditions.
- Cost differential between designing for existing conditions and future conditions is deemed to be significant and/or a significant number of structures become floodprone during the 25-year design storm based on future conditions flows when compared to existing conditions flows.

As discussed in this WSMP document, a number of crossings do not meet the desired LOS based upon the existing conditions model results, which have been corroborated by City staff (therefore constituting a “well documented water quantity problem”). Of 33 crossings evaluated, 14 (42%) exhibited substandard performance in the existing condition. Several of these LOS violation crossings are located along GMR proper, in the lower portions of the watershed, and downstream of all undeveloped areas within the watershed. As discussed in this WSMP, meeting the required level of service at these locations is not feasible, however a reduced level of service is proposed. Additionally, three other crossings (East 14th Street, Charles Boulevard, and Evans Street) along GMR exhibit such severe LOS violations that no feasible solutions exist, even for a reduced LOS. For those crossings, future development within the watershed will continue to degrade their performance beyond current conditions. For all crossings along GMR which exhibit level of service violations, either a reduced LOS is proposed or there is no feasible solution, therefore undeveloped areas upstream of these crossings (which includes all undeveloped area within the watershed) are recommended to be designated 25-year special risk based on criteria #2, above.

In all GMR proper locations with “well documented water quantity problems”, predicted future flows during the 25-year event increase by significantly greater than 10%, further confirming that all undeveloped areas upstream of these locations should be considered special risk based on criteria #1, above.

Finally, future conditions flows (and the associated expansion of the floodplain) for the 25-year event result in 142 additional structures being classified as floodprone (note that this analysis focuses on Greens Mill Run, as all undeveloped areas ultimately flow into GMR, thus if GMR Implementation of the 25-year Special Risk Area throughout the GMR watershed aids in reducing the frequency of flooding along the Primary System streams and negate the need to implement future capital improvement projects at several roadway crossings. The hydraulic model was analyzed to identify crossings meeting the desired 25-year LOS under existing land-use conditions, but in violation under future land-use conditions. Crossings that showed this change were those that may benefit from the special risk designation. This analysis identified three crossings: Hooker Road on GMR, Dalebrook Circle on Fornes Run, and Williams Road on the Unnamed Tributary to GMR. The estimated cost to address potential future LOS violations at these crossings, should the 25-year Special Risk designation not be implemented, is approximately $3,430,000.

Based on the above discussion and justification, it is recommended that the entire Greens Mill Run watershed be classified as Special Risk, requiring 25-year detention for all new development.

Assessment and Management of Impaired Waters

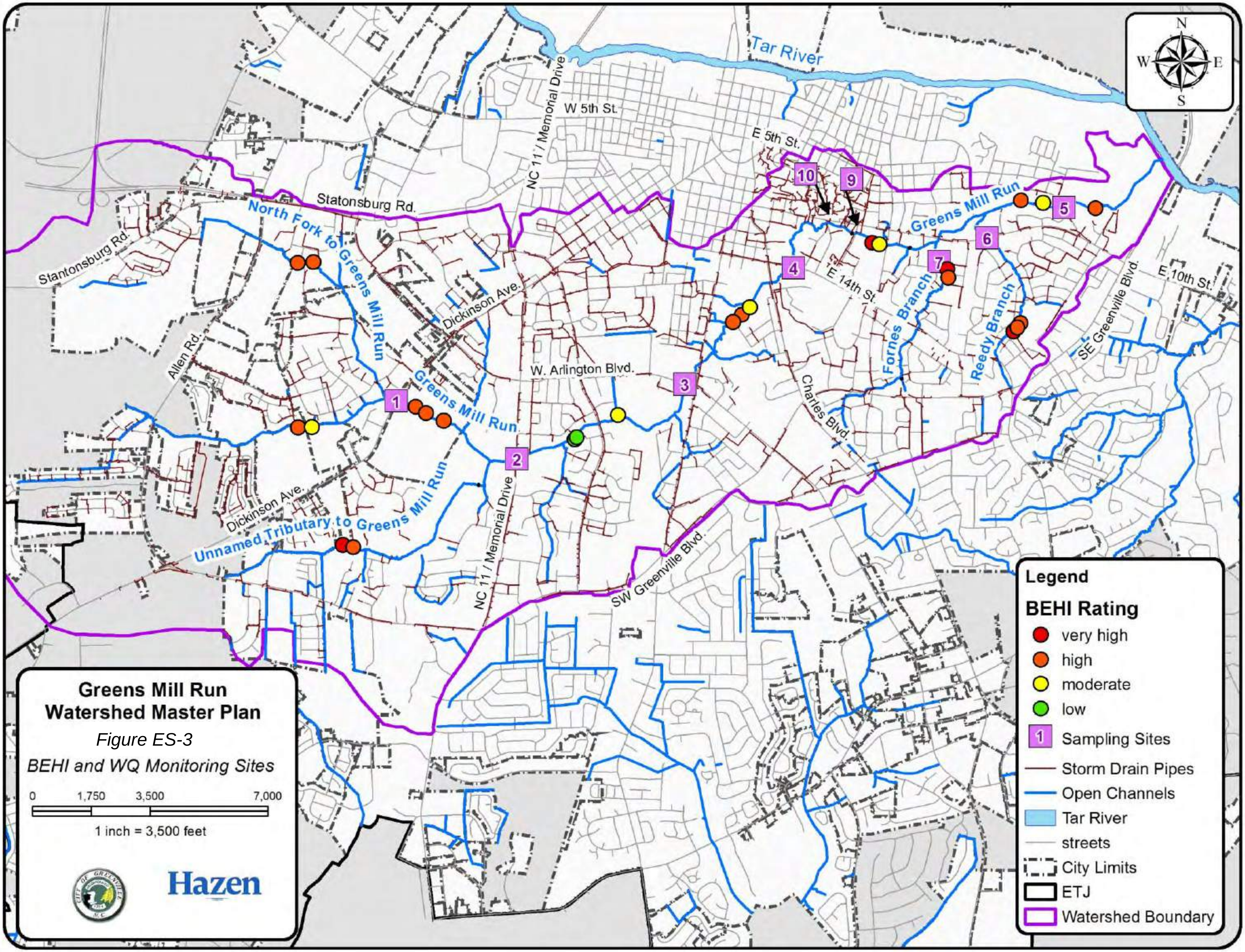
Based on a single benthic macroinvertebrate community sampling event in 2004 performed in conjunction with the NCEEP Local Watershed Plan, NCDEQ has placed the entirety of Greens Mill Run (from source to the Tar River) in Category 5 of the 303(d) List of Impaired Waters. Unless they are de-listed, or re-categorized on the List, waters in Category 5 are subject to development of a Total Maximum Daily Load which will identify the primary stressors (pollutants) which are causing the impairment and determine the pollutant load reductions necessary to achieve compliance with water quality standards and eliminate the impairment.

Water Quality Assessment

As a subcontractor on the Hazen Team, East Carolina University conducted an 18-month monitoring program to assess water quality in the Greens Mill Run (GMR) watershed. The assessment of water quality in the GMR watershed was of particular interest given the 303d list status of GMR as Impaired. The goals of the water quality monitoring program were to determine whether nutrients, pathogens, sediments, or metals are impairing GMR, and if so, to locate any potential sources of degradation.

Nine sampling and monitoring sites were selected along Greens Mill Run, including five on the main stem, two on its tributary streams, Reedy Branch and Fornes Run, and two at stormwater outfalls (**Figure ES-3**). Baseflow and wet weather flow samples were collected across seasons. The water quality parameters sampled included temperature, pH, dissolved oxygen, conductivity, turbidity, total suspended solids, numerous chemical species of nitrogen and phosphorus, dissolved organic carbon, chlorides, key indicator bacteria, and several metals. The full Water Quality Monitoring Report is presented in Appendix N.

To summarize the results of the water quality monitoring effort, several indicators suggested that pollutant and sediment inputs increased downstream. Overall, the water quality data suggested that urban and agricultural land-uses in the watershed have contributed non-point source pollution resulting in increases in nutrient, sediment, and bacteria inputs to Greens Mill Run. Most water quality parameters, with the exception of nitrate and dissolved oxygen, increased with storm flow suggesting that improved stormwater management could help reduce water quality degradation. The nitrate decline during storm events, suggests a groundwater source of nitrate, presumably related to agricultural fertilizer inputs as the increases correspond to the upper portions of the watershed that contain extensive agricultural drainage.



Tar River
W 5th St.
E 5th St.
NC 11 / Memorial Drive
Statonsburg Rd.
Stantonsburg Rd.
North Fork to Greens Mill Run
Greens Mill Run
Dickinson Ave.
Allen Rd.
W. Arlington Blvd.
Unnamed Tributary to Greens Mill Run
SW Greenville Blvd.
Charles Blvd.
E 14th St.
Fornes Branch
Reedy Branch
SE Greenville Blvd.
E 10th St.
1
2
3
4
5
6
7
9
10
N
S
E
W
Legend
BEHI Rating
very high
high
moderate
low
Sampling Sites
Storm Drain Pipes
Open Channels
Tar River
streets
City Limits
ETJ
Watershed Boundary
Greens Mill Run Watershed Master Plan
Figure ES-3
BEHI and WQ Monitoring Sites
0
1,750
3,500
7,000
1 inch = 3,500 feet
Hazen

Turbidity and totals suspended solids (TSS) data indicated that agricultural land uses within the headwaters of GMR may be contributing sediment to the stream, and that instream sources of sediment play an important role. However, it should be noted that the BEHI analysis also identified areas with high rates of bank erosion in the upper reaches of GMR, so instream sources are likely to be significant contributors there as well.

Taken collectively, the monitoring effort in this study shows that water quality is not as degraded as might be expected in such a heavily urbanized stream. While sediment and nutrient levels are elevated, especially during storm events, only two parameters were found to exceed water quality standards which are applicable to Greens Mill Run, turbidity (three instances in one storm) and E. coli (which is not a contributor to the impairment for which GMR is listed). Given that none of the toxicant (metals) parameters that were sampled exceeded established water quality standards and dissolved oxygen levels in the stream were never shown to be below the water quality standards which reflect the level necessary to sustain healthy aquatic ecosystems, the water quality monitoring effort in this study has indicated that it is highly unlikely that the physical/chemical water quality parameters are causing the degradation of the benthic macroinvertebrate population in Greens Mill Run. Rather, as discussed in the other parts of this Section, the 303(d)-listed impairment of Greens Mill Run (resulting from poor health of the benthic macroinvertebrate community) is far more likely to be the result of the excess sediment moving through the system and the associated physical degradation of the benthic habitat.

Recommendations to Improve Water Quality

- Continue effort to retrofit structural BMPs to existing built landscapes.
- Conduct a more detailed source investigation into watersheds contributing to the GMR 9 and GMR 10 outfalls monitored in this study.
- Initiate a Pet Waste Awareness Program.

Assessment of Existing Benthic Macroinvertebrate Community

Given that Greens Mill Run was listed as impaired because of poor benthic community ratings, as part of this overall stormwater master planning effort, WK Dickson, was engaged to perform benthic macroinvertebrate sampling to evaluate the current conditions of the aquatic ecology in the watershed. In August 2014, seven sites were sampled in the GMR watershed. In addition, the Hardee Creek watershed, near Greenville was identified as an appropriate reference reach and also sampled.

Overall, the sampling results in GMR were consistently worse than the sampling results from Hardee Creek, and those results would not support a proposal for delisting GMR on the basis of sampling data alone. Additional conclusions from the WK Dickson report included the following: “Ambient data results do not indicate that water quality is the primary contributor to low benthic diversity and associated impairment. The lack of adequate habitat conditions throughout the watershed is likely to be the primary contributor to the benthic community’s low diversity.”

Benthic Monitoring Recommendations

- Continue benthic community monitoring at sites in the middle and lower GMR mainstem.
- Establish additional benthic community monitoring sites between the existing sites in middle and lower GMR mainstem.
- If the improved bioclassification from the middle GMR site is found to be persistent, submit data to NCDEQ with a request for delisting a portion of Greens Mill Run.

Strategy to Address Impairment of Greens Mill Run

The water quality monitoring program for this master planning effort has shown that sediment levels are elevated in all streams within the GMR watershed, especially during storm events. The geomorphic assessment has shown that stream banks erosion in numerous locations throughout the watershed is a significant source of sediment in the system.

All the available lines of evidence in that master planning effort indicate that habitat degradation is the primary stressor on the health of the GMR aquatic ecosystem, and the benthic macroinvertebrate community in particular, and that excessive sedimentation and channel modification are the sources.

Recommended Measures to Improve Habitat and Alleviate Impairment

- Identify opportunities and implement stream restoration projects.
- Continue implementation of stream bank stabilization projects within a cycle of adaptive management.
- Introduce woody structures and debris to the stream.
- Identify appropriate sources for the capture of desired benthic macroinvertebrate species and relocate organisms to the Greens Mill Run watershed.

Recommended Strategy to Address 303(d) Listing Status

Request a Category 4C designation on the 303(d) List of Impaired Waters developed by NCDEQ – Category 4C on the list comprises waters that are impaired by pollution, not specific pollutants, and a recent USEPA technical memorandum to the directors of the Water Divisions within the 10 USEPA Regions specifically mentions waters where excessive runoff and stream scour have contributed to habitat degradation. The memo is available online here:

https://www.epa.gov/sites/production/files/2015-10/documents/2016-ir-memo-and-cover-memo-8_13_2015.pdf

As noted in the description of Category 4C, water bodies designated in this category will not be subject to TMDL development. However states are given the latitude to apply other watershed restoration tools to address the problem.

Through this recent clarification, the USEPA now allows States to utilize the 4C option when plans are developed to address specific circumstances in a watershed which include adaptive management and approaches to pollutant reduction which are better suited to achieving results than the TMDL approach. The specific circumstances in Greens Mill Run are ideally suited for a 4C designation. With this recent clarification on Category 4C available from USEPA, the Water

Planning Branch at NCDEQ may begin to exercise the latitude to apply the category to streams like Greens Mill Run.

If NCDEQ is unwilling to consider movement to Category 4C, request a Category 4b designation – Category 4b of the 303(d) list comprises impaired waters that are expected to meet water quality criteria within a reasonable period of time as a result of pollution controls implemented voluntarily. In the case of Greens Mill Run, a 4b designation would be an alternative to having a Total Maximum Daily Load (TMDL) developed and documented, most likely by NCDEQ, which would require pollution controls to be implemented on a mandatory basis.

As discussed in the above sections of recommendations for implementation of measures to address the sources of impairment in Greens Mill Run, the guidance for Category 4b designation indicates that it would still require a quantifiable pollutant load reduction to be established.

Re-assignment of Greens Mill Run to another category of the 303(d) list, thereby avoiding the mandatory efforts to implement a TMDL (which would likely be developed by NCDEQ, or a third party on their behalf), could represent a significant potential cost savings to the City of Greenville. The estimated cost of all structural measures required as part of a TMDL implementation plan to address sediment and bacteria pollution in the Crab Creek watershed, a 19 square mile catchment in western Virginia, was $10.4M. However, this example does not represent clear indication of savings that might be realized by the City of Greenville by not having to implement a TMDL; the absence of the formal TMDL would not mean the City would take no action to address the degradation of Greens Mill Run. Perhaps the greater benefit to the City in avoiding the imposition of a TMDL would be to have greater control its own approach regarding how, where, and when capital expenditures will be invested toward the improvement and rehabilitation of the stream.

Impaired Waters Conclusion

The assessments of geomorphology and water quality performed for this WSMP, and the stormwater management and stream stabilization projects set forth within it, are a strong step toward alleviating the impairment. The water quality monitoring program was sufficiently robust to indicate that water quality, in and of itself, is not likely to be an important driver of the impairment of Greens Mill Run. Rather, the lines of evidence, as well as numerous field observations, point directly to habitat degradation through past channel modification and excess sediment deposition stemming from channel instability and stream bank erosion as the main driver of the substandard benthic community bioclassifications.

With this beginning in place, the City of Greenville can avoid the imposition of a TMDL by pursuing and documenting a deliberate program aimed at stabilizing and restoring streams, and reducing the excessive sediment loads coming from eroding banks and potential upland sources. If the program exhibits principles of adaptive management with ongoing monitoring to provide the necessary feedback for continued implementation and adaptation, it will provide the justification to move Greens Mill Run from Category 5, to Category 4B or, ideally, to 4C (should that be the designation of the new alternate category).

1. Introduction

The City of Greenville (COG) retained Hazen and Sawyer to complete a Watershed Master Plan (WSMP) for Greens Mill Run (GMR). As shown in **Figure 1-1**, the GMR watershed is located centrally within Greenville and contains much of downtown Greenville and East Carolina University (ECU). The Watershed is generally bounded on the north by 5th Street, on the south by Greenville Boulevard / Red Banks Road, and to the west by the agricultural area approximately between Allen Road and Kinsaul-Willoughby Road. The watershed generally drains from west to east, discharging directly into the Tar River.

1.1 Project Description

The goals of this watershed master plan were to: (1) evaluate the watershed for existing flooding, water quality, and erosion problems, (2) recommend and prioritize capital improvements to control existing flooding by reducing the frequency and severity of flooding for property owners, and (3) identify stream stabilization projects to reduce the risk of property loss along streams and to reduce sediment loads as a result of erosion. As part of the project, Hazen and Sawyer completed an inventory of stormwater infrastructure within the GMR watershed. The WSMP includes evaluation of the following streams, within the limits as shown on **Figure 1-2** (referred to herein as the “Primary System”):

- Greens Mill Run – from Allen Road to the Tar River
- Reedy Branch – from Greenville Boulevard to its confluence with GMR
- Fornes Run – from Greenville Boulevard to its confluence with GMR
- Unnamed Tributary to Greens Mill Run (through Greenville Country Club) – from Greenville Boulevard to its confluence with GMR
- Greens Mill Run North Fork – from Allen Road to its confluence with GMR

Also included in this WSMP is evaluation and analysis of several localized drainage systems (referred to herein as “Secondary Systems”) that discharge to the Primary System. A list of all the conveyance systems evaluated as part of this WSMP is provided on the following page. A map of the overall GMR watershed, including Primary and Secondary System project locations, is depicted in **Figure 1-2**.

Detailed hydraulic analysis of road crossings and conveyance systems included the following:

Primary System:

Greens Mill Run

East 5th Street Bridge
East 10th Street Culvert
South Elm Street Culvert
College Hill Drive Culvert
Rock Spring Road Culvert
East 14th Street Bridge
Norfolk Southern Railway Bridge
Charles Boulevard Culvert
Evans Street Culvert
West Arlington Boulevard Culvert
CSX Railroad Bridge
Hooker Road Culvert
South Memorial Drive Culvert
Dickinson Avenue Culvert
Allen Road Culvert

Reedy Branch

East 10th Street Culvert
South Wright Road Culvert
East 14th Street Culvert
Norfolk Southern Railway Culvert
Southeast Greenville Boulevard Culvert

Fornes Run

Dalebrook Circle Culvert
East 14th Street Culvert
Norfolk Southern Railway Culvert
North Overlook Drive Culvert
Crestwood Drive Culvert
Southeast Greenville Boulevard Culvert

Unnamed Tributary to Greens Mill Run

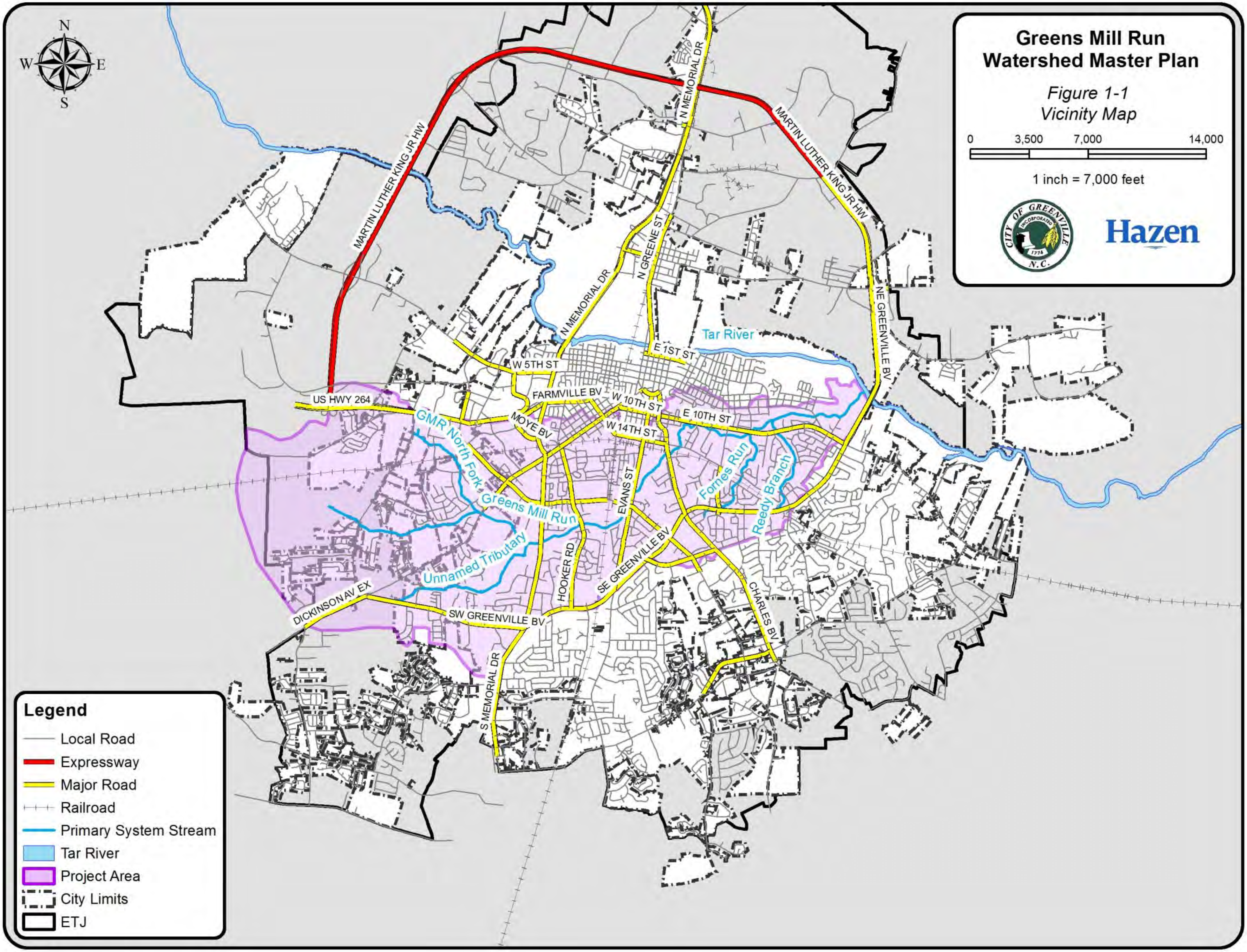
Golf Course Bridges/Culverts
Williams Road Culvert
Southwest Greenville Boulevard Culvert

Greens Mill Run North Fork

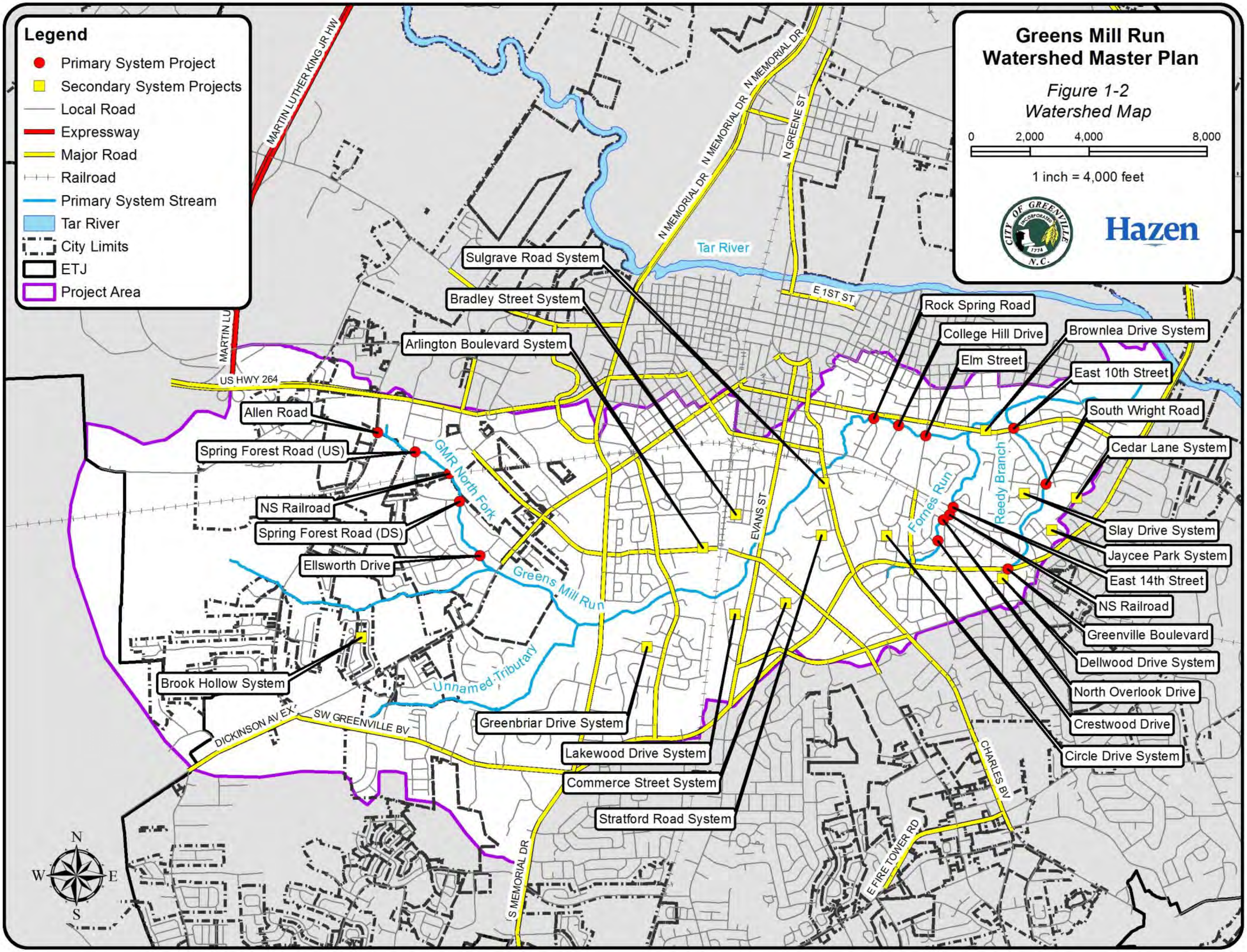
Ellsworth Drive/Lake Ellsworth Outlet Structure
Spring Forest Road Culvert (Downstream)
Norfolk Southern Railway Culvert
Spring Forest Road Culvert (Upstream)
Allen Road Culvert

Secondary Systems:

Arlington Boulevard System
Bradley Street System
Brook Hollow System
Brownlea Drive System
Cedar Lane System
Circle Drive System
Commerce Street System
Dellwood Drive System
Greenbriar Drive System
Lakewood Drive System
Jaycee Park System
Slay Drive System
Stratford Road System
Sulgrave Road System



Greens Mill Run
Watershed Master Plan
Figure 1-1
Vicinity Map
0
3,500
7,000
14,000
1 inch = 7,000 feet
CITY OF GREENVILLE
INCORPORATED
1774
N.C.
Hazen
N
S
E
W
MARTIN LUTHER KING JR HW
N MEMORIAL DR
N GREENE ST
NE GREENVILLE BV
Tar River
E 1ST ST
W 5TH ST
US HWY 264
FARMVILLE BV
W 10TH ST
E 10TH ST
MOYE BV
W 14TH ST
GMR North Fork
Greens Mill Run
Fornes Run
Reedy Branch
EVANS ST
Unnamed Tributary
HOOKER RD
SE GREENVILLE BV
CHARLES BV
DICKINSON AV EX
SW GREENVILLE BV
S MEMORIAL DR
Legend
Local Road
Expressway
Major Road
Railroad
Primary System Stream
Tar River
Project Area
City Limits
ETJ


Greens Mill Run
Watershed Master Plan
Figure 1-2
Watershed Map
0
2,000
4,000
8,000
1 inch = 4,000 feet
Hazen
Legend
Primary System Project
Secondary System Projects
Local Road
Expressway
Major Road
Railroad
Primary System Stream
Tar River
City Limits
ETJ
Project Area
Sulgrave Road System
Bradley Street System
Arlington Boulevard System
Allen Road
Spring Forest Road (US)
NS Railroad
Spring Forest Road (DS)
Ellsworth Drive
Brook Hollow System
Greenbriar Drive System
Lakewood Drive System
Commerce Street System
Stratford Road System
Rock Spring Road
College Hill Drive
Elm Street
Brownlea Drive System
East 10th Street
South Wright Road
Cedar Lane System
Slay Drive System
Jaycee Park System
East 14th Street
NS Railroad
Greenville Boulevard
Dellwood Drive System
North Overlook Drive
Crestwood Drive
Circle Drive System
Tar River
GMR North Fork
Greens Mill Run
Unnamed Tributary
Fornes Run
Reedy Branch
MARTIN LUTHER KING JR HW
N MEMORIAL DR
N GREENE ST
E 1ST ST
US HWY 264
EVANS ST
DICKINSON AV EX
SW GREENVILLE BV
S MEMORIAL DR
CHARLES BV
E FIRE TOWER RD
N
S
E
W

1.2 Design Standards and Criteria

The following design storms were used to evaluate the performance of the Primary and Secondary Systems in this WSMP:

- 10-year storm event - piped collection and secondary open-channel systems (Secondary Systems)
- 25-year storm event - non-thoroughfare, minor thoroughfare, and minor NCDOT roadway bridges and culverts
- 50-year storm event - thoroughfare and major NCDOT roadway bridges and culverts
- 100-year storm event - structural flooding of homes and railroads

In the case of Secondary Systems (piped collection systems), the level of service (LOS) requirement was considered to be met if the system had sufficient capacity to prevent surface surcharging at system structures. Private bridges (such as golf course bridges) were included in the hydraulic analysis to determine their impact on system performance, but no level of service applies and no alternatives were proposed for these structures. Types of roadway crossings (minor/major thoroughfare) were identified based on the City's Thoroughfare Plan. **Table 1-1** shows the applicable storm for the project areas evaluated as part of this WSMP. The corresponding rainfall depths for the design storms were obtained from the City's WSMP standard operating procedures (SOP), and are included in **Appendix A** (W.K. Dickson and Co., Inc., 2013).

Table 1-1: Project Area Design Standards and Criteria

Drainage Type	Desired Level of Service (Frequency Storm Event)	Project Area
Piped Collection Systems	10	Arlington Boulevard System Bradley Street System Brook Hollow System Brownlea Drive System Cedar Lane System Circle Drive System Commerce Street System Dellwood Drive System Greenbriar Drive System Lakewood Drive System Jaycee Park System Slay Drive System Stratford Road System Sulgrave Road System
Non-Thoroughfare, Minor Thoroughfare, and Minor NCDOT Roadway Crossings	25	East 5th Street Bridge College Hill Drive Culvert Rock Spring Road Culvert Hooker Road Culvert Dalebrook Circle Culvert East 14th Street Culvert North Overlook Drive Culvert Crestwood Drive Culvert Williams Road Culvert Ellsworth Drive/Lake Ellsworth Outlet Structure Spring Forest Road Culvert (DS) Spring Forest Road Culvert (US)
Thoroughfare and Major NCDOT Roadway Crossings	50	East 10th Street Culvert South Elm Street Culvert East 14th Street Bridge (2) Charles Boulevard Culvert Evans Street Culvert West Arlington Boulevard Culvert South Memorial Drive Culvert Dickinson Avenue Culvert Allen Road Culvert East 10th Street Culvert Southeast Greenville Boulevard Culvert South Elm Street/Southeast Greenville Boulevard Culvert Lower Southwest Greenville Boulevard Culvert Allen Road Culvert
Railroad Crossings	100	Norfolk Southern Railway Bridge Norfolk Southern Railway Culvert (3) CSX Railroad Bridge

2. Existing Watershed Conditions

2.1 Citizen and Stakeholder Input

The WSMP included a robust campaign to engage stakeholders and the public through a number of mediums in order to collect information regarding problem areas within the watershed and feedback on areas where projects have been identified through the WSMP planning effort. Hazen and Sawyer, in collaboration with the COG Public Information Officer (PIO), developed a Public Involvement Plan (PIP) that outlined the process by which the public and stakeholders were engaged in the WSMP. The PIP addressed all watersheds and generally served as the guide for citizen and stakeholder input throughout project execution. **Appendix D** includes the full PIP.

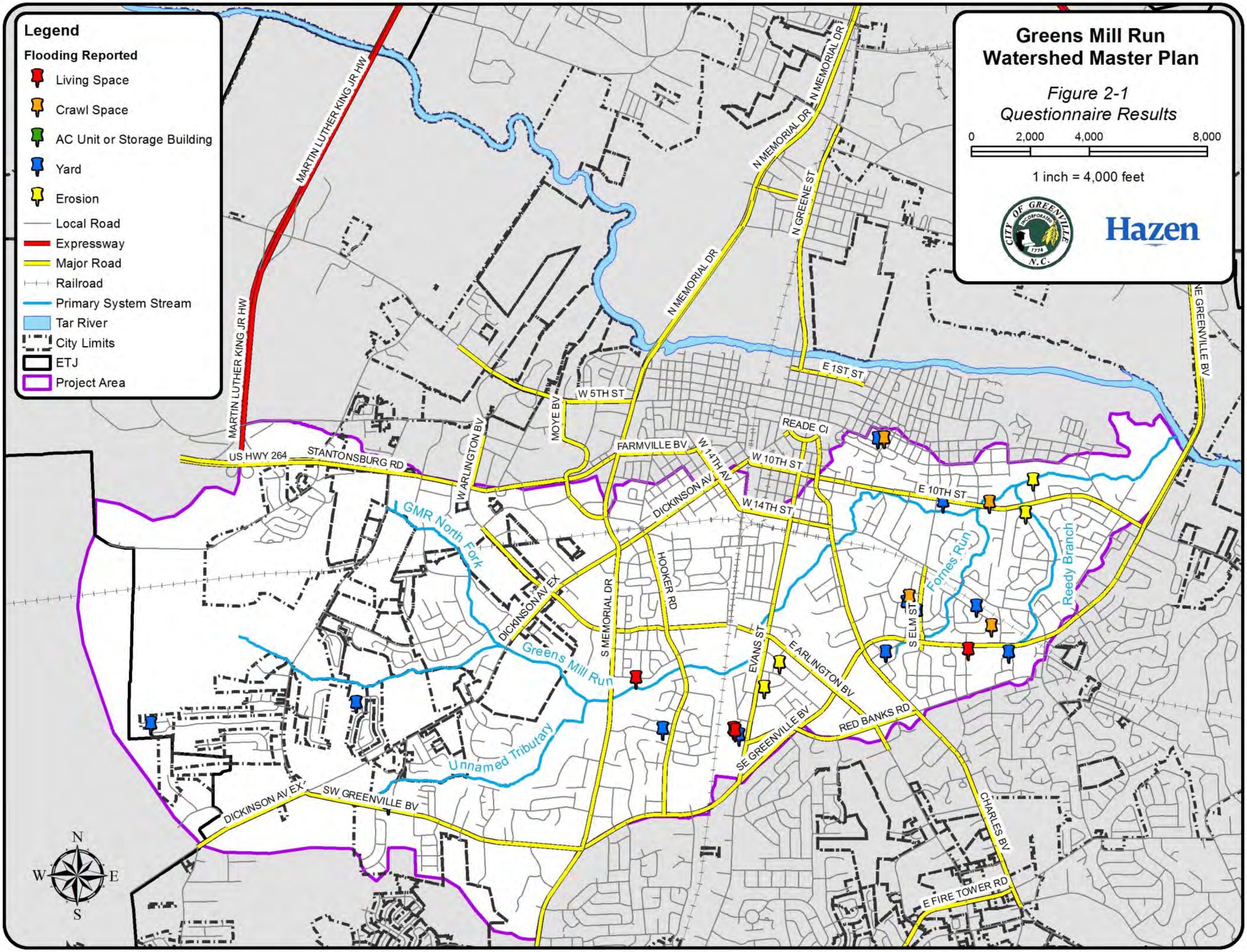
2.1.1 Citizen Input

The general public was engaged through use of social media, the project website (www.greenvillewsmp.com), online and paper questionnaires, public meetings, and one-on-one onsite or phone interviews.

Questionnaires were distributed within the watershed to obtain feedback from citizens regarding flooding or erosion issues. Questionnaires were distributed in a variety of ways including online, public locations such as libraries, social events such as Sunday in the Park, email and/or hard copy to homeowner's associations and East Carolina University staff, and in coordination with other community and faith-based organizations. Within the GMR watershed, 47 questionnaire responses were received, all of which reported some degree of flooding or surface drainage issue, while 26% reported some type of erosion. **Figure 2-1** shows the location of the reports received via the questionnaire. Detailed, tabulated results are included in **Appendix D**.

Two citizen feedback public meetings were held prior to system analyses. At these meetings, Hazen and Sawyer and City staff gave a presentation regarding the project process and goals, which was followed by an opportunity for citizens to engage directly with project staff to identify problem areas. Large maps of the watershed were staged around the venue and used as the basis for discussion of geographic areas. The first public meeting was held on November 5th, 2014 at Sheppard Memorial Library on Evans Street at 4:30 p.m., where 15 citizens attended. Various geographic areas were represented at the meeting, with many concerns expressed regarding problems in the Lakewood Subdivision. Meeting minutes are included in **Appendix D**.

The second public meeting was held at the Murphy Center on ECU's campus on November 5th, 2014 at 7:00 p.m. Two residents attended, both regarding the same problem. Rather than a formal presentation, Hazen and Sawyer and City staff interacted directly with the residents to summarize the project and receive feedback regarding the residents' concerns. Their issue was street/yard flooding on Alice Drive. Hazen and Sawyer staff later visited the location and identified that the street drainage system discharge was completely obstructed. City maintenance staff later resolved the issue. Minutes from this meeting are included in **Appendix D**.


Greens Mill Run
Watershed Master Plan
Figure 2-1
Questionnaire Results
0
2,000
4,000
8,000
1 inch = 4,000 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Local Road
Expressway
Major Road
Railroad
Primary System Stream
Tar River
City Limits
ETJ
Project Area
MARTIN LUTHER KING JR HW
N MEMORIAL DR
N GREENE ST
E 1ST ST
W 5TH ST
MOYE BV
READE CI
FARMVILLE BV
W 14TH AV
W 10TH ST
E 10TH ST
US HWY 264
STANTONSBURG RD
W ARLINGTON BV
DICKINSON AV
W 14TH ST
GMR North Fork
Fornes Run
Reedy Branch
DICKINSON AV EX
S MEMORIAL DR
HOOKER RD
EVANS ST
S ELM ST
E ARLINGTON BV
Greens Mill Run
RED BANKS RD
SE GREENVILLE BV
Unnamed Tributary
SW GREENVILLE BV
CHARLES BV
E FIRE TOWER RD
NE GREENVILLE BV

2.1.2 Stakeholder Input

Stakeholders included the COG Public Works Department, COG Street Maintenance, COG Parks and Recreation Commission, COG Planning Department, and ECU. City staff attempted to contact Greenville Mall and University Commons Shopping Center management, but received no input. Representatives from these entities were engaged at a one day meeting on September 3, 2014, in which various groups met with Hazen and Sawyer team members to discuss known problem areas and various issues within the watershed. Throughout the project, City staff served as an important stakeholder by providing information on historical flooding (for model validation) and erosion problems within the watershed, as well as detailed feedback on potential capital improvement projects identified as part of the WSMP.

2.2 Watershed Characteristics

The Greens Mill Run watershed is approximately 8,800 acres (13.75 square miles) and is located centrally within Greenville. The watershed contains much of downtown Greenville and East Carolina University. The GMR watershed is generally bounded on the north by 5th Street, on the south by Greenville Boulevard/Red Banks Road, and on the west by the agricultural area between Allen Road and Kinsaul-Willoughby Road. The watershed generally drains from west to east, discharging directly into the Tar River. The eastern half of the watershed area is highly developed. Generally, the degree of urbanization / imperviousness increases from west to east. As shown in **Table 2-1**, the largest land-use within the watershed is Conservation / Open Space, followed by Office / Institutional / Multi-family. There is a broad distribution of Natural Resources Conservation Service (NRCS) hydrologic soil groups (HSG) within the watershed. Type A/D (31%) is the largest constituent, followed by type A (23%). Detailed information on both land-uses and the soil makeup of the watershed is included in **Appendix A** and maps are provided in **Appendix C**.

Table 2-1: GMR Land-Use

Land-use Category	Existing Conditions Area (acres)	Existing Conditions Total Area (%)	Future Conditions Area (acres)	Future Conditions Total Area (%)
Industrial	154	1.8%	785	8.9%
Commercial	814	9.2%	1321	15.0%
Office/Institutional/Multi-Family	1611	18.3%	2070	23.5%
High Den Res	475	5.4%	844	9.6%
Med Den Res	454	5.1%	1427	16.2%
Low Den Res	773	8.8%	433	4.9%
Very Low Den Res	194	2.2%	27	0.3%
Open	3281	37.2%	1059	12.0%
Parking	65	0.7%	54	0.6%
ROW	990	11.2%	793	9.0%
Total	8,810	100%	8,810	100%

2.3 Existing Conditions Survey and Field Data Collection

A major part of the WSMP was to inventory the closed and open drainage systems within the watershed. Various criteria determined which structures and channels were inventoried. Generally, all structures connected to pipes 15” and greater in diameter, which receive runoff from public right-of-way were surveyed. The exception was on the ECU Campus (main campus and College Hill campus), where pipes down to 12” in diameter and limited smaller pipes were also surveyed. Surveying was critical to developing the improvements and provided the basis for determining hydraulic performance of the existing systems under existing and future flows. **Table 2-2** and **Table 2-3** summarize the structures and pipes inventoried. Open channels were mapped and cross-sectional data obtained for 35 miles of Primary and Secondary channel. Depending on the type of channel and the level of detail needed, either hand-measured widths and depths, or surveyed channel cross-section (XS) dimensions were obtained. Seven bridges were also inventoried.

Table 2-2: Summary of Closed System Structure Inventory

Structure Type	Number Inventoried
Catch Basin	2,056
Drop Inlet	255
Junction Box	629
Pipe End	874
Pond Structure	9
Slab Top	39
Yard Inlet	483
Underground Pipe Junction	203
Difficult Access Remaining at Project Completion	169
Total	**4,717**

Table 2-3: Summary of Pipe Inventory

Pipe Diameter	Length (Linear Feet)
<12”	1,143
12”	11,494
15”	104,018
18”	82,039
24”	75,161
30”	33,811
36”	38,294
42”	15,180
48”	12,948
54”	3,987
60”	8,208
72”	1,300
84”	1,490
Other (i.e. elliptical, arch, box, etc)	13,755
Total	**402,828**

3. Existing and Future Conditions Analyses

3.1 Primary System Hydrologic and Hydraulic Analyses

3.1.1 Hydrology

3.1.1.1 Existing Conditions

The purpose of the hydrologic analysis was to develop discharges for the 2-, 10-, 25-, 50-, and 100-year storm events for the Greens Mill Run watershed. As specified in the City's SOP, the United States Army Corps of Engineers (USACE) HEC-HMS (Hydraulic Engineering Center-Hydrologic Modeling System) program was used to develop the peak discharges for the selected frequency floods. The hydrologic model was developed using available soils, topographic data, land-use, and aerial photography to delineate subbasins. As specified in the SOP, subbasin boundaries were created at major roadway crossings, stream confluences, and known problem areas.

Using the Soil Conservation Service (SCS) methodologies outlined in Urban Hydrology for Small Watersheds (NRCS, 1986), a Type III, 24-hour synthetic rainfall event was used based on the City of Greenville's proximity to the coastal region of North Carolina. Using the SCS rainfall-runoff loss computation in HEC-HMS, curve numbers (CN) were developed for each subbasin using a combination of the City of Greenville existing land-use geographical information system (GIS) layer and the Natural Resources Conservation Service (NRCS) soils downloaded from the NRCS web soil survey (NRCS, 2015). Aerial photography was used to correct discrepancies in the GIS data, such as vacant lots having been recently developed. Combination soils (A/D, B/D, and C/D), when saturated, tend to have reduced capacity for infiltration and storage within the soil media, compared to the higher infiltration soil type of each combination soil. However, it was found during model validation that the soils tended to have a significant amount of storage, especially in the western portion of the Greens Mill Run watershed, where agricultural land-uses are more prevalent. Therefore, the higher infiltrating soil type was used for combination soils. Detailed descriptions of model input parameters can be found in **Appendices A** and **H**.

To account for storage attenuation behind major road crossings, reservoirs were added to HEC-HMS to represent the ponded water behind the structure. Per the City's SOP, attenuation was modeled at crossings where the fill height was at least 50% of the structure height (excluding pedestrian crossings). As part of the calibration / validation phase, additional attenuation was added where significant impounding of water occurred behind structures, noted by the formation of a level pool (flat water surface) in the hydraulic model.

Attenuation was assumed to occur behind the following existing structures:

Greens Mill Run:
- Allen Road
- Dickinson Avenue
- South Memorial Drive
- Hooker Road
- CSX Railroad
- West Arlington Boulevard
- Charles Boulevard
- Norfolk Southern Railway
- Rock Spring Road
- College Hill Drive
- South Elm Street
- East 10th Street
- East 5th Street

Fornes Run
- Charles Boulevard
- Southeast Greenville Boulevard
- Norfolk Southern Railway
- Dalebrook Circle

Unnamed Tributary to Greens Mill Run
- Southeast Greenville Boulevard
- Williams Road

Greens Mill Run North Fork
- Allen Road
- Norfolk Southern Railway
- Ellsworth Drive

Reedy Branch:
- Norfolk Southern Railway
- East 14th Street
- South Wright Road
- East 10th Street

The combination of flat slopes and undersized structures caused water to significantly impound behind structures, especially during larger storm events (10-year and above). It was found that during the 2-year storm event, the structures tended not to impound water and the majority of attenuation occurred in the channels. The decision was made to develop a low-flow model (for storms up to a 2-year storm) and a high flow model (10-year and above). This approach allowed for more accurate representation of how the system interacted with the available storage behind the structures. During larger storm events, water tended to impound from one structure to the next, effectively flooding the entire reach. To ensure that storage within the watershed was not over-estimated, reach lengths within the model were adjusted to where the storage pool stopped and the normal stream slope began. Results from the HEC-HMS model used as input into the Hydraulic Engineer Center-River Analysis System (HEC-RAS) models are summarized in **Table 3-1**.

Table 3-1: Existing Conditions Flows from HEC-HMS

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run							
Reach-660	U/S Limit of GMR	40149	49	183	304	421	558
Reservoir-770	Allen Road	37950	125	455	748	1,019	1,139
Reach-770	D/S of Allen Road	37781	116	423	698	955	1,135
Reach-3100	U/S of Confluence with GMR North Fork	32869	164	544	923	1,277	1,577
Reservoir-2600	Dickinson Avenue	29957	303	825	1,295	1,737	2,054
Reach-780	D/S of Dickinson Avenue	29791	295	808	1,257	1,685	2,046
Reach-820	U/S of Confluence with Unnamed Tributary to GMR	27096	341	901	1,406	1,891	2,315
Reach-2500	D/S of Confluence with Unnamed Tributary to GMR	26096	670	1,666	2,455	3,188	4,045
Reservoir-860	Memorial Drive	25660	669	1,622	2,234	2,858	3,611
Reach-860	D/S of Memorial Drive	25462	641	1,567	2,177	2,799	3,559
Reach-810	U/S of Hooker Road	23596	704	1,679	2,323	2,971	3,765
Reservoir-2400	Hooker Road	22893	699	1,665	2,208	2,834	3,578
Reach-2400	D/S of Hooker Road	22704	690	1,655	2,205	2,831	3,572
Reach-790	U/S of CSX Railroad	21638	712	1,695	2,253	2,884	3,638
Reservoir-2300	CSX Railroad	21373	710	1,685	2,256	2,887	3,640
Reach-2300	D/S of CSX Railroad	21198	709	1,683	2,255	2,886	3,638
Reach-720	U/S of Arlington Boulevard	20096	736	1,735	2,313	2,951	3,721
Reservoir-2200	Arlington Boulevard	19396	736	1,730	2,312	2,947	3,722
Reach-2200	D/S of Arlington Boulevard	19096	736	1,730	2,311	2,947	3,722
Reach-600	U/S of Charles Boulevard	17596	974	2,108	2,882	3,559	4,272
Reservoir-3800	Charles Boulevard	15308	992	2,186	3,001	3,697	4,445
Reach-3800	D/S of Charles Boulevard	15023	992	2,177	2,990	3,686	4,431
Reservoir-2100	Norfolk Southern Railroad	14968	1,002	2,084	2,758	3,366	4,072
Reach-2100	D/S of Norfolk Southern Railroad	14807	1,001	2,082	2,755	3,361	4,063
Reach-4700	Near 11th Street	13604	996	2,084	2,755	3,351	4,044
Reach-2000	U/S of Rock Spring Road	12805	997	2,101	2,778	3,379	4,079
Reservoir-1900	Rock Spring Road	11822	1,006	2,108	2,783	3,410	4,122
Reach-1900	D/S of Rock Spring Road	11750	1,005	2,107	2,782	3,404	4,118
Reservoir-1800	College Hill Drive	10936	1,015	2,113	2,783	3,420	4,164
Reach-1800	D/S of College Hill Drive	10806	1,015	2,112	2,783	3,419	4,163
Reservoir-530	Elm Street	9856	1,027	2,098	2,746	3,355	4,178
Reach-530	D/S of Elm Street	9732	1,026	2,095	2,738	3,325	4,121
Reach-Fornescont	D/S of Confluence with Fornes Run	8229	1,137	2,374	3,193	3,877	4,779
Reservoir-510	10th Street	8019	1,131	2,367	3,184	3,871	4,739

Table 3-1 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run Continued							
Reach-510	D/S of 10th Street	7471	1,126	2,357	3,172	3,862	4,732
Reach-500	D/S of Confluence with Reedy Branch	6500	1,112	2,542	3,282	4,114	5,072
Reservoir-400	5th Street	4008	1,113	2,516	3,307	4,111	5,100
Reach-400	D/S of 5th Street	3835	1,082	2,441	3,246	3,994	4,922
Outlet	D/S Limit of GMR	1890	1,060	2,412	3,198	3,941	4,813
Reedy Branch							
Reservoir-1700	Norfolk Southern Railroad	7801	36	75	95	116	139
Reach-1700	D/S of Norfolk Southern Railroad	6288	35	75	95	116	139
Reservoir-1200	14th Street	5356	50	99	117	135	158
Reach-1200	D/S of 14th Street	5241	49	99	117	135	158
Reservoir-1300	Wright Road	3208	92	224	297	362	443
Reach-1300	D/S of Wright Road	3113	91	223	297	362	442
Reach-4500	U/S of 10th Street	2002	125	355	495	612	752
Reservoir-520	10th Street	918	154	314	384	452	531
Reach-520	D/S Limit of Reedy Branch	734	154	314	384	452	531
Fornes Run							
Reservoir-1400	Charles Boulevard	8363	114	172	295	395	492
Reach-1400	D/S of Charles Boulevard	8188	114	172	279	361	461
Resevoir-1000	Greenville Boulevard	6071	134	226	296	334	361
Reach-1000	D/S of Greenville Boulevard	5636	134	226	296	334	361
Reach-1500	U/S of Norfolk Southern Railroad	4682	183	360	473	564	660
Reservoir-570	Norfolk Southern Railroad	3491	202	398	453	494	557
Reach-570	D/S of Railroad	3336	202	398	453	494	557
Reservoir-1100	Dalebrook Circle	2991	216	445	512	562	633
Reach-100	D/S of Dalebrook Circle	2884	215	443	509	558	624
Reach-FornesRun	D/S Limit of Fornes Run	723	224	475	565	643	737
Unnamed Tributary to Greens Mill Run							
Reservoir-930	Greenville Boulevard	13353	73	186	274	317	455
Reach-930	D/S of Greenville Boulevard	10471	67	160	227	283	340
Reservoir-940	Williams Road	8922	80	184	258	320	427
Reach-940	D/S of Williams Road	8762	80	184	258	320	425
Reach-950	Near Country Club Road	5403	149	410	634	831	1,054
Reach-880	D/S Limit of Unnamed Tributary to GMR	3804	388	889	1,290	1,646	2,050

Table 3-1 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run North Fork							
Reach-3000	U/S of Allen Road	8786	84	232	307	378	461
Reservoir-990	Allen Road	6966	122	308	435	692	950
Reach-990	D/S of Allen Road	6830	118	306	432	666	901
Reservoir-2800	Norfolk Southern Railroad	4027	125	285	329	364	395
Reach-2800	D/S of Norfolk Southern Railroad	3894	124	284	329	363	395
Reach-630	Ellsworth Pond	3086	125	287	332	367	400
Reservoir-2700	Ellsworth Drive	841	134	294	358	410	459
Reach-2700	D/S Limit of GMR North Fork	664	134	294	358	410	459

3.1.1.2 Future Conditions

The existing conditions HEC-HMS model was built upon to create the future conditions model. Since the lower portion of the watershed is almost at full build-out, CN values were assumed to remain as existing conditions. The upper watershed contains mostly agricultural land-uses, therefore, the City's future zoning plans were used to adjust the CN values to account for future development of the parcels. The future land-use layer was obtained from the City of Greenville planning department. Using the future land-use, new curve numbers were developed with similar methodology as described in **Section 3.1.1.1**. As with the existing conditions, the higher infiltrating soil type was used for combination soils.

Attenuation was removed from the future conditions model as specified by the City at the floodplain review meeting held on August 5th, 2015. As directed by the City, attenuation remained in the model at locations where attenuation was anticipated to remain in the future, such as railroads and the Ellsworth Drive crossing, which consists of a dam and lake. Specifically, attenuation was kept in the future conditions model at the following locations:

<u>Greens Mill Run</u>

- CSX Railroad
- Norfolk Southern Railroad
- 5th Street

<u>North Fork Greens Mill Run</u>

- Norfolk Southern Railroad
- Ellsworth Drive

<u>Reedy Branch</u>

- Norfolk Southern Railroad

Detailed summary of results can be found in **Appendices A** and **H**. Results from the HEC-HMS model used as input into the HEC-RAS models are summarized in **Table 3-2**, listed upstream to downstream, by stream.

Table 3-2: Future Conditions Flows from HEC-HMS

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-use Conditions (cfs)					Existing Conditions
			2-year	10-year	25-year	50-year	100-year	100-year
Greens Mill Run								
Reach-660	U/S Limit of GMR	40149	315	597	798	975	1,170	558
Reservoir-770	Allen Road	37950	640	1,214	1,607	1,960	2,352	1,139
Reach-3100	U/S of Confluence with GMR North Fork	32869	710	1,460	1,986	2,458	2,986	1,577
Reservoir-2600	Dickinson Avenue	29957	903	1,762	2,416	3,107	3,849	2,054
Reach-780	D/S of Dickinson Avenue	29791	856	1,670	2,298	2,956	3,663	2,046
Reach-820	U/S of Confluence with Unnamed Tributary to GMR	27096	928	1,835	2,544	3,265	4,076	2,315
Reach-2500	D/S of Confluence with Unnamed Tributary to GMR	26096	1,279	2,624	3,689	4,731	5,989	4,045
Reach-860	D/S of Memorial Drive	25462	1,263	2,599	3,665	4,703	5,943	3,559
Reach-810	U/S of Hooker Road	23596	1,311	2,695	3,802	4,879	6,169	3,765
Reach-2400	D/S of Hooker Road	22704	1,311	2,701	3,812	4,891	6,182	3,572
Reach-790	U/S of CSX Railroad	21638	1,330	2,740	3,868	4,963	6,271	3,638
Reservoir-2300	CSX Railroad	21373	1,326	2,733	3,852	4,921	6,229	3,640
Reach-2300	D/S of CSX Railroad	21198	1,325	2,731	3,849	4,917	6,223	3,638
Reach-720	U/S of Arlington Boulevard	20096	1,348	2,780	3,917	5,002	6,329	3,721
Reservoir-2200	Arlington Boulevard	19396	1,352	2,788	3,929	5,017	6,346	3,722
Reach-600	U/S of Charles Boulevard	17596	1,413	2,912	4,093	5,235	6,604	4,272
Reach-3800	D/S of Charles Boulevard	15023	1,418	2,929	4,117	5,265	6,642	4,431
Reservoir-2100	Norfolk Southern Railroad	14968	1,419	2,914	4,058	5,206	6,603	4,072
Reach-2100	D/S of Norfolk Southern Railroad	14807	1,419	2,912	4,058	5,206	6,601	4,063
Reach-4700	Near 11th Street	13604	1,420	2,908	4,068	5,217	6,604	4,044
Reach-2000	U/S of Rock Spring Road	12805	1,421	2,910	4,078	5,231	6,615	4,079
Reach-1900	D/S of Rock Spring Road	11750	1,425	2,915	4,091	5,248	6,635	4,118
Reach-1800	D/S of College Hill Drive	10806	1,430	2,923	4,106	5,267	6,658	4,163
Reach-530	D/S of Elm Street	9732	1,437	2,920	4,117	5,275	6,646	4,121
Reach-Fornescont	D/S of Confluence with Fornes Run	8229	1,476	3,001	4,240	5,436	6,858	4,781
Reach-510	D/S of 10th Street	7471	1,475	2,998	4,237	5,431	6,849	4,733
Reach-500	D/S of Confluence with Reedy Branch	6500	1,490	3,031	4,292	5,499	6,931	5,075
Reservoir-400	5th Street	4008	1,492	3,033	4,301	5,508	6,376	5,103
Reach-400	D/S of 5th Street	3835	1,480	3,004	4,257	5,435	6,339	4,927
Outlet	D/S Limit of GMR	1890	1,474	2,987	4,228	5,383	6,331	4,823

Table 3-2 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-use Conditions (cfs) 2-year	10-year	25-year	50-year	100-year	Existing Conditions 100-year
Reedy Branch								
Reservoir-1700	Norfolk Southern Railroad	7801	36	75	95	116	139	139
Reach-1700	D/S of Norfolk Southern Railroad	6288	35	75	95	115	139	139
Reservoir-1200	14th Street	5356	49	110	140	167	200	158
Reach-1200	D/S of 14th Street	5241	96	235	328	412	509	158
Reservoir-1300	Wright Road	3208	138	355	509	640	788	443
Reach-4500	U/S of 10th Street	2002	177	467	677	855	1,054	752
Fornes Run								
Reservoir-1400	Charles Boulevard	8363	160	265	342	410	486	479
Resevoir-1000	Greenville Boulevard	6071	192	345	462	569	691	320
Reach-1500	U/S of Norfolk Southern Railroad	4682	245	479	651	810	997	650
Reservoir-570	Norfolk Southern Railroad	3491	274	551	751	939	1,165	567
Reservoir-1100	Dalebrook Circle	2991	293	600	824	1,032	1,282	653
Reach-FornesRun	D/S Limit of Fornes Run	723	306	632	876	1,102	1,371	808
Unnamed Tributary to Greens Mill Run								
Reservoir-930	Greenville Boulevard	13353	171	320	430	529	639	455
Reach-940	D/S of Williams Road	8762	226	452	632	795	978	425
Reach-950	Near Country Club Road	5403	399	833	1,128	1,404	1,760	1,054
Reach-880	D/S Limit of Unnamed Tributary to GMR	3804	639	1,336	1,808	2,234	2,732	2,050
Greens Mill Run North Fork								
Reach-3000	U/S of Allen Road	8786	163	297	384	464	554	461
Reservoir-990	Allen Road	6966	321	607	796	960	1,144	950
Reservoir-2800	Norfolk Southern Railroad	4027	263	349	402	428	500	395
Reach-2800	Norfolk Southern D/S of Railroad	3894	261	349	401	426	491	395
Reach-630	Ellsworth Pond	3086	263	353	406	431	496	400
Reservoir-2700	Ellsworth Drive	841	214	373	472	550	651	459
Reach-2700	D/S Limit of GMR North Fork	664	214	373	472	549	651	459

3.1.2 Hydraulics

3.1.2.1 Existing Conditions

The purpose of the hydraulic analysis was to determine existing floodwater elevations for the selected storm events, and to identify potential areas where flood mitigation is feasible. The USACE HEC-RAS software was selected as the basis for the hydraulic analysis. There were existing HEC-RAS models for Greens Mill Run, Greens Mill Run North Fork, Fornes Run, and Reedy Branch available from the Federal Emergency Management Agency (FEMA). These models were used as a basis for the existing models on these streams. The Unnamed Tributary to Greens Mill Run is not a FEMA-regulated stream, therefore a HEC-RAS model was created using available terrain data, stormwater inventory data, field visits, and aerial photography.

Existing FEMA cross-sections were utilized along with survey data collected during the inventory database development. Where appropriate, existing cross-sections were adjusted based on new or updated information. Cross-sections for the existing HEC-RAS models were developed using a combination of:

- 2007 Light Detection and Ranging (LIDAR) contour data provided by the City of Greenville
- 2005 Pitt County LIDAR data provided by North Carolina Floodplain Mapping Program (NCFMP, 2015)
- Manning's n-values were developed through 2015 Google Earth aerial photography and field visits
- Surveyed channel cross-sections provided during the stormwater inventory database collection
- Structure size, shape, invert, and characteristics of stream crossings taken during the stormwater inventory database collection. Road elevations were taken from available rim elevations of nearby stormwater infrastructure or LIDAR data
- Energy loss coefficients for natural channel and structure crossings
- Reach lengths were developed through GIS using a combination of available terrain data, survey data, and aerial photography

The hydraulic model required boundary conditions to establish starting water surface elevations at the limits of the model. Since all of the models utilized a subcritical flow regime, only a downstream boundary condition was required. A normal depth boundary condition (starting energy slope or average channel slope) was used for Greens Mill Run, Fornes Run, and Reedy Branch. The starting slopes were:

- Greens Mill Run – 0.0008 ft/ft
- Fornes Run – 0.0021 ft/ft
- Reedy Branch – 0.006 ft/ft

The boundary condition for Greens Mill Run North Fork and the Unnamed Tributary to Greens Mill Run was based upon Greens Mill Run water surface elevations, as it was determined that the hydrology of the two streams experienced coincident hydrograph peaks with Greens Mill Run during larger storm events. Use of a normal depth boundary condition for these streams would have underestimated the starting water surface elevations, due to not accounting for backwater conditions, assuming the storm event occurred simultaneously throughout the watershed. Therefore, correlating known water surface elevations were selected from the Greens Mill Run HEC-RAS model for the larger storm events (10-year and above) as the downstream water surface elevation boundary conditions for the two streams (**Table 3-3**). Normal depth was used as the starting boundary condition for low flow events (up to the 2-year storm).

Table 3-3: Downstream Boundary Conditions

Storm Event	Boundary Condition	Value
Unnamed Tributary to Greens Mill Run		
2-year	Normal Depth	0.003
10-year	Known Water Surface	44.7
25-year	Known Water Surface	46.4
50-year	Known Water Surface	47.8
100-year	Known Water Surface	48.5
Greens Mill Run North Fork		
2-year	Normal Depth	0.003
10-year	Known Water Surface	49.4
25-year	Known Water Surface	51.6
50-year	Known Water Surface	53.5
100-year	Known Water Surface	55.2

Twenty-nine roadway, and four railroad, crossings were analyzed as part of the existing conditions models. Descriptions of the structures are listed in **Table 3-4**; pictures are provided in **Appendix H**. The structural condition assessment provided in **Table 3-4** was based upon the condition noted in the inventory data, available photographs, presence of blockages noted in the inventory data, and NCDOT bridge inspection reports. The existing crossings were analyzed for the 2-, 10-, 25-, 50-, and 100-year storm events under existing land-use conditions to determine roadway overtopping. Numerous Primary System crossings across the watershed were determined to be undersized. Six crossings on GMR, two crossings on both Reedy Branch and Fornes Run, and four crossings on GMR North Fork were found to violate their desired LOSs. All Primary System crossings on the unnamed tributary to GMR included in the Primary System met their LOS. A summary of the Primary System crossings, including desired and calculated LOSs, and water surface elevations under existing land-use conditions, is provided in **Table 3-5**.

Table 3-4: Existing Condition of Primary System Crossings

Location	Size/Material	Condition
Greens Mill Run		
Allen Road	14' x 8' CMPA	Good
Dickinson Avenue	Twin 9' x 8.2' RCBCs	Fair – Right Barrel Partially Blocked by Sediment
South Memorial Drive	Triple 11.5' x 9.7' RCBCs	Good
Hooker Road	Triple 12.8' x 8.8' RCBCs	Good
CSX Railroad	12 span Girder Bridge	Good
West Arlington Boulevard	Quadruple 12' x 8.5' RCBCs	Fair – Outer Barrels Blocked by Sediment
Evans Street	Triple 12' x 6' RCBCs	Good
Charles Boulevard	Triple 12.4' x 9.6' RCBCs	Fair – Outer Barrels Blocked by Sediment
Norfolk Southern Railway	3 span Girder Bridge	Good
East 14th Street	3 Span Cored Slab Bridge	Good
Rock Spring Road	Twin 15' x 9.4' CMPAs	Good
College Hill Drive	Twin 12' x 10' RCBCs	Good
South Elm Street	Twin 16.5' x 10.5' CMPAs	Good – Debris Partially Blocking Culverts
East 10th Street	Triple 15' x 13' RCBCs	Good – Left Barrel Partially Blocked by Sediment
East 5th Street	Single Span Cored Slab Bridge	Good
Reedy Branch		
Southeast Greenville Boulevard	36" CMP	Fair – Inlet Pipes Need Repair
Norfolk Southern Railway	48" RCP	Good
East 14th Street	48" CMP	Good

Table 3-4 Continued

Reedy Branch Continued		
South Wright Road	48” CMP	Fair – Pipe Partially Crushed and Blocked by Sediment
East 10th Street	48” RCP & 54” RCP	Good
Fornes Run		
Southeast Greenville Boulevard	60” CMP & 36” PVC	Fair – Blind Junction Box to 9’ x 6.5’ CMPA Downstream
Crestwood Drive	9’ x 6’ CMPA & 48” CMP	Good
North Overlook Drive	9’ x 6’ CMPA & 48” CMP	Good – Arch Partially Blocked by Sediment
Norfolk Southern Railway	72” CMP, 48” RCP & 48” RCP	Poor – 84” CMP Slip-lined with 72” CMP; Both 48” Pipes are Blocked by Sediment
14th Street	Twin 72” CMPs	Poor – Pipes Rusted & Erosion Present Downstream
Dalebrook Drive	9’ x 6’ CMPA	Good
Unnamed Tributary to Greens Mill Run		
Southeast Greenville Boulevard	10’ x 7.8’ RCBC	Good
Williams Road	72” CMP	Fair – Erosion Present on Downstream Side
Greens Mill Run North Fork		
Allen Road	84” CMP	Good
Spring Forest Road (US)	Triple 60” CMPs	Good
Norfolk Southern Railway	Twin 48” RCPs	Good
Spring Forest Road (DS)	Triple 60” RCPs	Good
Ellsworth Drive	10’ Riser to 42” RCP & Triple 30” CMP Overflow	Fair – Riser Partially Crushed

See **Appendix H.1** for photographs of crossings.

Table 3-5: Hydraulic Performance for Existing Conditions

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Existing Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run							
Allen Road	70.5	50-year	59.2	62.6	64.9	67.4	68.8
Dickinson Avenue	56.2	50-year	46.6	49.7	51.9	53.8	55.4
South Memorial Drive	47.6	50-year	41.7	44.3	45.8	47.3	**48.2**
Hooker Road	43.8	25-year	38.6	41.0	42.2	43.6	**45.0**
CSX Railroad	50.1	100-year	37.2	39.3	40.3	41.2	42.4
West Arlington Boulevard	39.8	50-year	33.6	36.0	37.0	38.1	39.6
Evans Street	34.0	50-year	32.3	**34.5**	**35.1**	**35.5**	**35.9**
Charles Boulevard	31.0	50-year	29.1	**31.9**	**32.7**	**33.5**	**34.5**
Norfolk Southern Railway	47.3	100-year	28.8	31.4	32.5	33.4	34.4
East 14th Street	28.0	50-year	27.3	**29.2**	**30.4**	**31.1**	**31.7**
Rock Spring Road	28.0	25-year	23.0	27.6	**29.8**	**30.5**	**31.0**
College Hill Drive	25.8	25-year	20.4	23.7	**26.5**	**27.4**	**27.9**
South Elm Street	24.2	50-year	18.3	22.0	23.9	**25.2**	**26.0**
East 10th Street	23.0	50-year	14.2	16.1	17.5	19.0	20.6
East 5th Street	21.2	25-year	9.7	12.5	13.9	15.1	16.6
Reedy Branch							
Southeast Greenville Boulevard	66.4	50-year	62.3	**66.8**	**66.9**	**67**	**67.1**
Norfolk Southern Railway	66.4	100-year	57.8	59.2	59.9	60.6	61.7
East 14th Street	56.5	25-year	51.7	53.8	54.8	55.9	56.7
South Wright Road	33.5	25-year	32.2	**34.3**	**34.5**	**34.7**	**34.8**
East 10th Street	34.4	50-year	17.4	20.4	22.6	24.2	27.6
Fornes Run							
Southeast Greenville Boulevard	58.8	50-year	50.4	51.9	54.4	56.3	58.2
Crestwood Drive	42.7	25-year	38.4	40.4	**42.8**	**43.6**	**44.2**
North Overlook Drive	39.3	25-year	34.9	37.9	**40.2**	**41.2**	**42.8**
Norfolk Southern Railway	51.9	100-year	33.3	36.1	38.8	41.1	42.7
14th Street	37.3	25-year	29.4	33.5	35.5	37.2	**37.8**
Dalebrook Drive	34.1	25-year	27.6	31.4	32.9	34.1	**34.7**
Unnamed Tributary to Greens Mill Run							
Southeast Greenville Boulevard	68.5	50-year	62.7	64.3	65.4	66.2	67.4
Williams Road	65.3	25-year	58.7	61.1	62.9	64.6	**65.6**
Greens Mill Run North Fork							
Allen Road	70.6	50-year	64.9	68	70	**71.2**	**71.5**
Spring Forest Road (US)	64.3	25-year	59.8	63.1	**64.7**	**65.2**	**65.7**
Norfolk Southern Railway	67.9	100-year	58.3	62	63.3	64.4	65.5
Spring Forest Road (DS)	56.8	25-year	54.3	**57.3**	**57.6**	**57.7**	**57.8**
Ellsworth Drive	56.0	25-year	54.2	**56.9**	**57.3**	**57.5**	**57.6**

*Bold text indicates the existing water surface exceeded the minimum elevation at the road, thereby causing road flooding.
**Green shade indicates crossing meets desired level of service.
**Red shade indicates crossing does not meet desired level of service.
***Tan shade indicates existing level of service.

An evaluation of properties adjacent to the streams was also performed to determine the risk of flooding during the 25-year and 100-year storm events, under existing land-use conditions. The existing 25- and 100-year floodplains were mapped based on the model results. These results may differ from the effective FEMA floodplains as the study methodologies and calibration efforts were different. These are provided only for the City's reference to express the anticipated areas of flooding for capital improvements and should not be used for flood insurance purposes.

Structures deemed to be at risk for flooding during the calculated existing 25-year and 100-year flood events are listed in **Table 3-6**. The lowest adjacent grade (LAG) elevations were taken from available LIDAR data. It is important to note that LAG elevations were not surveyed, and therefore may differ from actual LAG or finished floor elevations. Only habitable buildings were analyzed in determining flood risk. There are several properties where accessory buildings were located within the floodplain; however, these were not deemed at-risk properties unless the primary residence or business was also located within the floodplain. Additionally, using the GIS datasets for parcels and buildings, the impacted parcels and structures at risk during these events were identified, as presented in **Figure 3-1** through **Figure 3-8**.

Table 3-6: Existing Conditions At-Risk Structures

Address	LAG	Calculated Water Surface Elevation Under Existing Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run			
1944 Allen Road	64.00	64.93	68.81
701 Kiesee Drive	56.11	54.87	56.45
704 Kiesee Drive	53.71	54.90	56.47
705 Kiesee Drive	55.63	54.83	56.42
708 Kiesee Drive	53.43	54.81	56.41
712 Kiesee Drive	53.87	54.72	56.35
2901 Ellsworth Drive	54.15	51.68	55.18
2903 Ellsworth Drive	51.77	51.81	55.31
2905 Ellsworth Drive	51.29	51.85	55.35
2907 Ellsworth Drive	55.40	51.91	55.41
2909 Ellsworth Drive	54.87	51.94	55.42
2911 Ellsworth Drive	53.19	51.96	55.43
2913 Ellsworth Drive	52.07	52.00	55.44
2915 Ellsworth Drive	50.66	52.05	55.46
2917 Ellsworth Drive	52.07	52.12	55.49
2919 Ellsworth Drive	52.68	52.19	55.51
3003 Ellsworth Drive	53.05	52.27	55.53
3005 Ellsworth Drive	53.44	52.35	55.55
3007 Ellsworth Drive	54.23	52.42	55.57
3009 Ellsworth Drive	53.15	52.48	55.59
3011 Ellsworth Drive	53.35	52.53	55.61
3013 Ellsworth Drive	54.57	52.60	55.63
3015 Ellsworth Drive	54.41	52.68	55.65
3017 Ellsworth Drive	55.21	52.73	55.67
3019 Ellsworth Drive	55.51	52.83	55.70
3101 Ellsworth Drive	53.78	53.55	55.84
3103 Ellsworth Drive	53.36	53.86	55.90
3105 Ellsworth Drive	53.55	54.14	56.00
3201 Ellsworth Drive	53.61	54.23	56.03

Table 3-6 Continued

Address	LAG	Calculated Water Surface Elevation Under Existing Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run Continued			
3203 Ellsworth Drive	51.79	54.34	56.09
3205 Ellsworth Drive	53.15	54.45	56.17
2900 Tripp Lane	52.55	51.97	55.43
2920 Tripp Lane	51.48	52.00	55.44
2940 Tripp Lane	51.88	52.09	55.48
2960 Tripp Lane	53.78	52.15	55.50
2940 Dickinson Avenue	51.31	51.93	55.41
191 Dansey Road	49.47	51.78	55.28
1237 Cross Creek Circle	47.39	46.45	48.64
1241 Cross Creek Circle	46.56	46.56	48.67
1245 Cross Creek Circle	48.47	46.89	48.84
2772 Meridian Drive	48.67	46.21	48.67
2774 Meridian Drive	46.65	46.66	48.47
2778 Meridian Drive	46.22	46.22	48.39
2780 Meridian Drive	46.80	46.03	48.34
2782 Meridian Drive	47.84	46.01	48.33
2801 S Memorial Drive	42.70	43.47	45.76
2826 S Memorial Drive	46.95	45.21	47.76
2828 S Memorial Drive	47.21	45.91	48.25
2711 Shawnee Place	45.00	42.67	45.32
2713 Shawnee Place	43.47	42.66	45.32
2716 Shawnee Place	44.45	42.75	45.36
2718 Shawnee Place	43.26	42.74	45.36
294 Millbrook Street	42.68	43.21	45.59
296 Millbrook Street	44.10	43.16	45.57
298 Millbrook Street	44.37	43.10	45.54
300 Millbrook Street	44.39	43.02	45.50
301 Millbrook Street	45.45	42.91	45.45
302 Millbrook Street	43.76	42.95	45.46
303 Millbrook Street	44.52	42.88	45.43
304 Millbrook Street	43.20	42.87	45.42
305 Millbrook Street	43.85	42.82	45.40
306 Millbrook Street	43.16	42.81	45.39
403 Millbrook Street	43.21	42.59	45.28
405 Millbrook Street	43.25	42.55	45.26
406 Millbrook Street	42.42	42.53	45.25
408 Millbrook Street	42.66	42.47	45.23
504 Millbrook Street	40.61	42.39	45.18
506 Millbrook Street	41.87	42.35	45.16
600 Millbrook Street	42.08	42.33	45.15
602 Millbrook Street	43.69	42.25	45.10
604 Millbrook Street	44.91	42.14	44.97
404 Aztec Lane	44.98	42.51	45.24
406 Aztec Lane	43.98	42.51	45.24
411 Aztec Lane	43.72	42.46	45.22
508 Pine Street	44.64	42.38	45.18
511 Pine Street	44.63	42.33	45.15
100 Ridge Place	43.25	42.19	45.03
102 Ridge Place	43.25	42.25	45.09

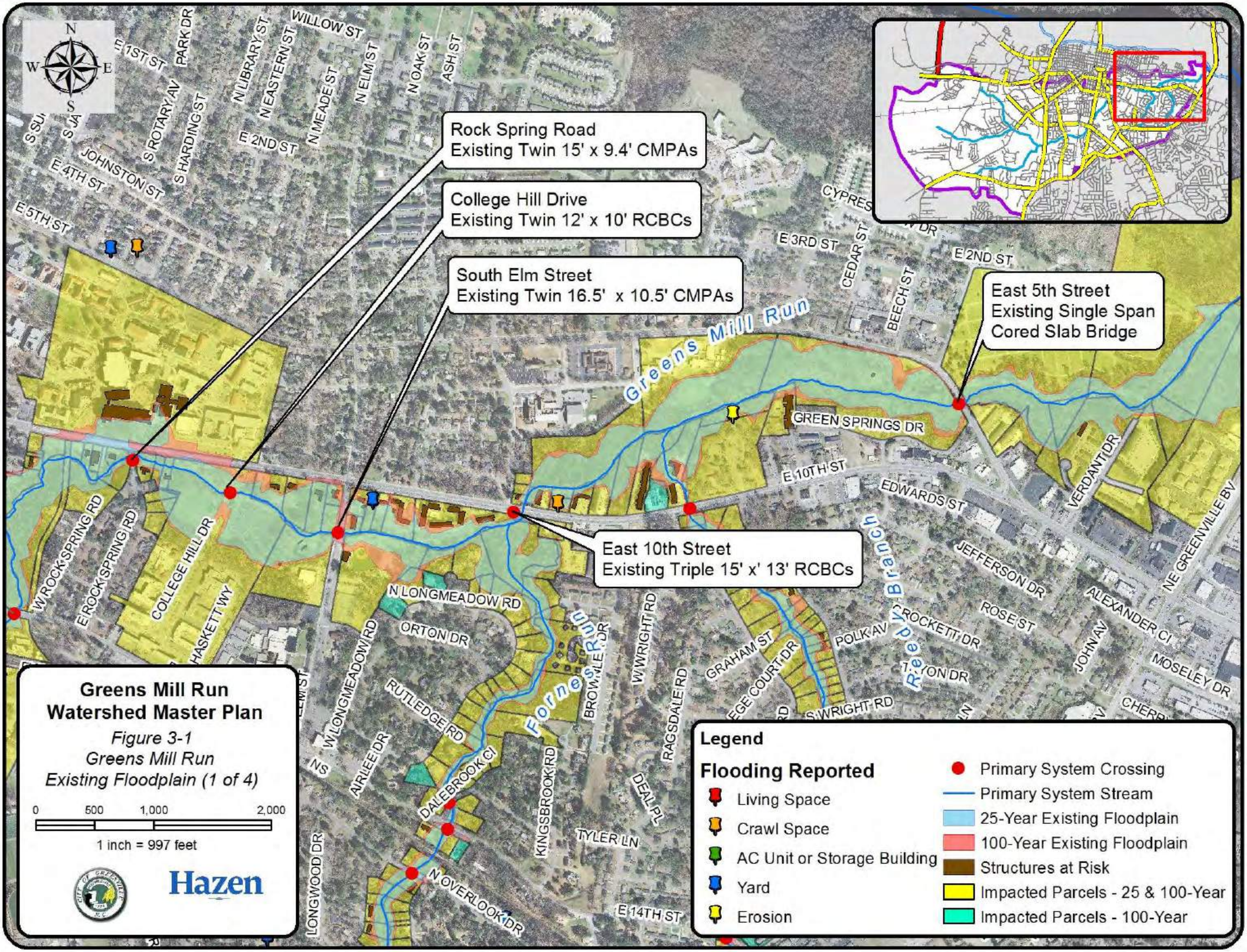
Table 3-6 Continued

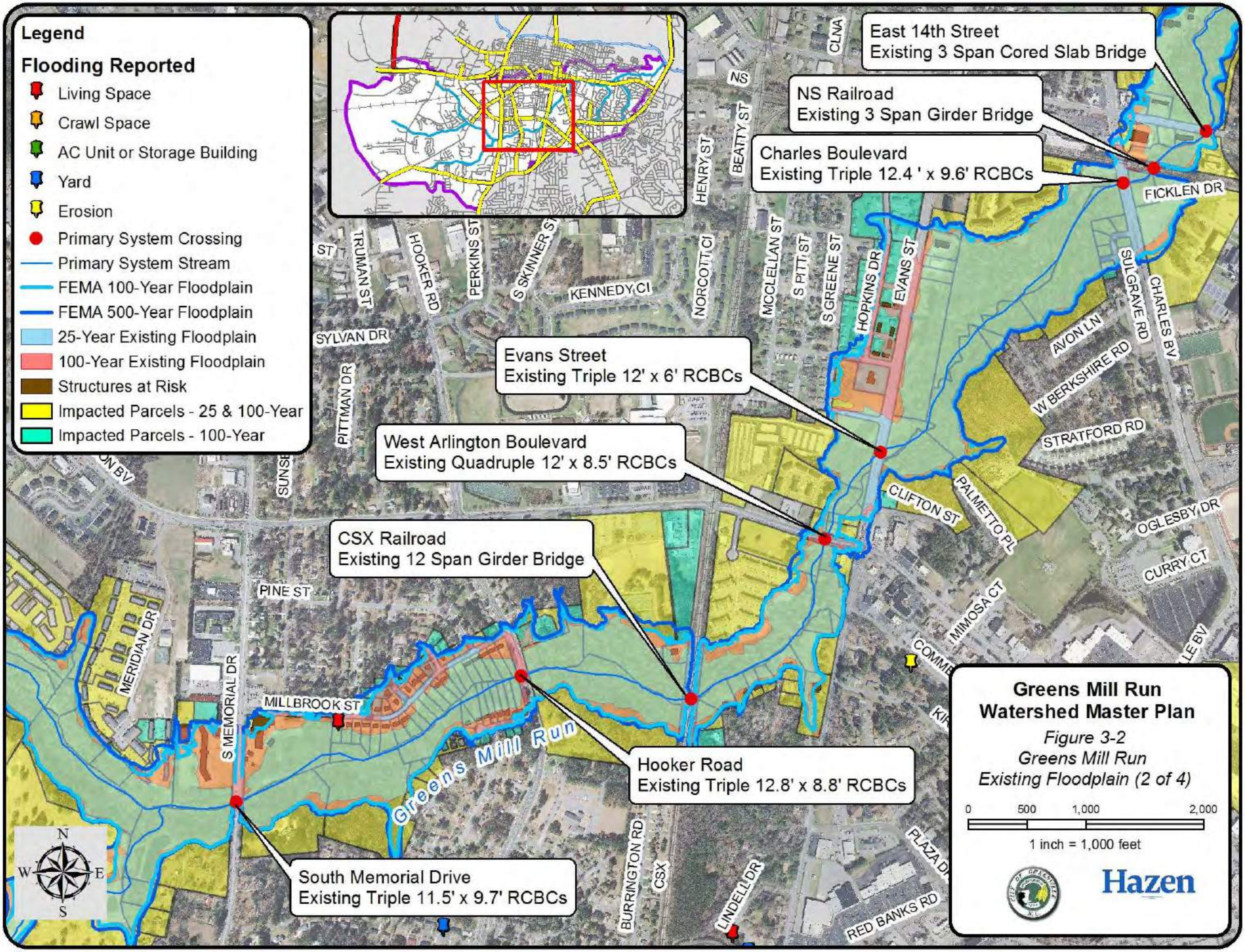
Address	LAG	Calculated Water Surface Elevation Under Existing Land-Use Conditions (ft, NAVD) 25-year	100-year
Greens Mill Run Continued			
104 Ridge Place	42.35	42.31	45.14
106 Ridge Place	43.08	42.34	45.16
108 Ridge Place	42.61	42.37	45.17
110 Ridge Place	42.08	42.40	45.19
112 Ridge Place	41.37	42.43	45.20
113 Ridge Place	43.45	42.62	45.30
114 Ridge Place	41.09	42.49	45.23
430 Arlington Boulevard	40.31	40.42	42.52
102 Pineview Drive	39.29	37.69	40.14
104 Pineview Drive	36.87	37.88	40.26
108 Pineview Drive	38.12	38.32	40.54
210 Lakewood Drive	37.50	37.56	40.07
1700 Evans Street	33.66	34.18	35.64
1705 Evans Street	30.68	33.27	34.93
1709 Evans Street	30.54	33.30	34.96
2192 Evans Street	35.79	35.26	36.10
2404 Evans Street	38.01	37.25	39.76
101 Arthur Street	34.67	33.91	35.42
1800 Hopkins Drive	34.82	33.50	35.10
1808 Hopkins Drive	34.87	33.66	35.22
1209 Charles Boulevard	25.99	30.22	31.47
1401 Charles Boulevard	30.04	30.56	31.79
1524 Charles Boulevard	31.92	33.07	34.78
504 14th Street	30.09	30.37	31.64
509 14th Street	27.39	30.41	31.67
516 14th Street	29.60	30.56	31.79
1011 Anderson Street	30.31	30.06	31.26
800 E 10th Street	22.65	29.99	31.17
802 E 10th Street	27.48	29.97	31.14
806 E 10th Street	25.51	29.95	31.11
810 E 10th Street	24.20	29.85	30.98
900 E 10th Street	27.31	26.72	28.04
906 E 10th Street	24.75	26.40	27.66
950 E 10th Street	26.05	24.07	26.05
956 E 10th Street	23.25	24.16	26.04
1000 E 10th Street	21.08	24.14	26.03
1010 E 10th Street	22.03	23.99	26.01
1100 E 10th Street	19.98	20.64	22.89
1104 E 10th Street	20.76	20.51	22.82
1106 E 10th Street	20.61	20.43	22.78
1108 E 10th Street	20.08	20.42	22.74
1116 E 10th Street	19.46	20.07	22.63
1303 E 10th Street	13.91	17.48	19.31
1305 E 10th Street	15.93	17.11	19.12
1323 E 10th Street	12.73	17.11	19.11
1401 E 10th Street	17.76	16.21	18.45
2201 E 10th Street	14.69	16.12	18.37
College of Engineering & Technology Bldg - ECU	27.32	29.83	30.96
1058 S Elm Street	21.18	24.15	26.03
1005 S Elm Street	19.57	20.64	22.89
905 Forest Hill Circle	16.36	17.53	19.35

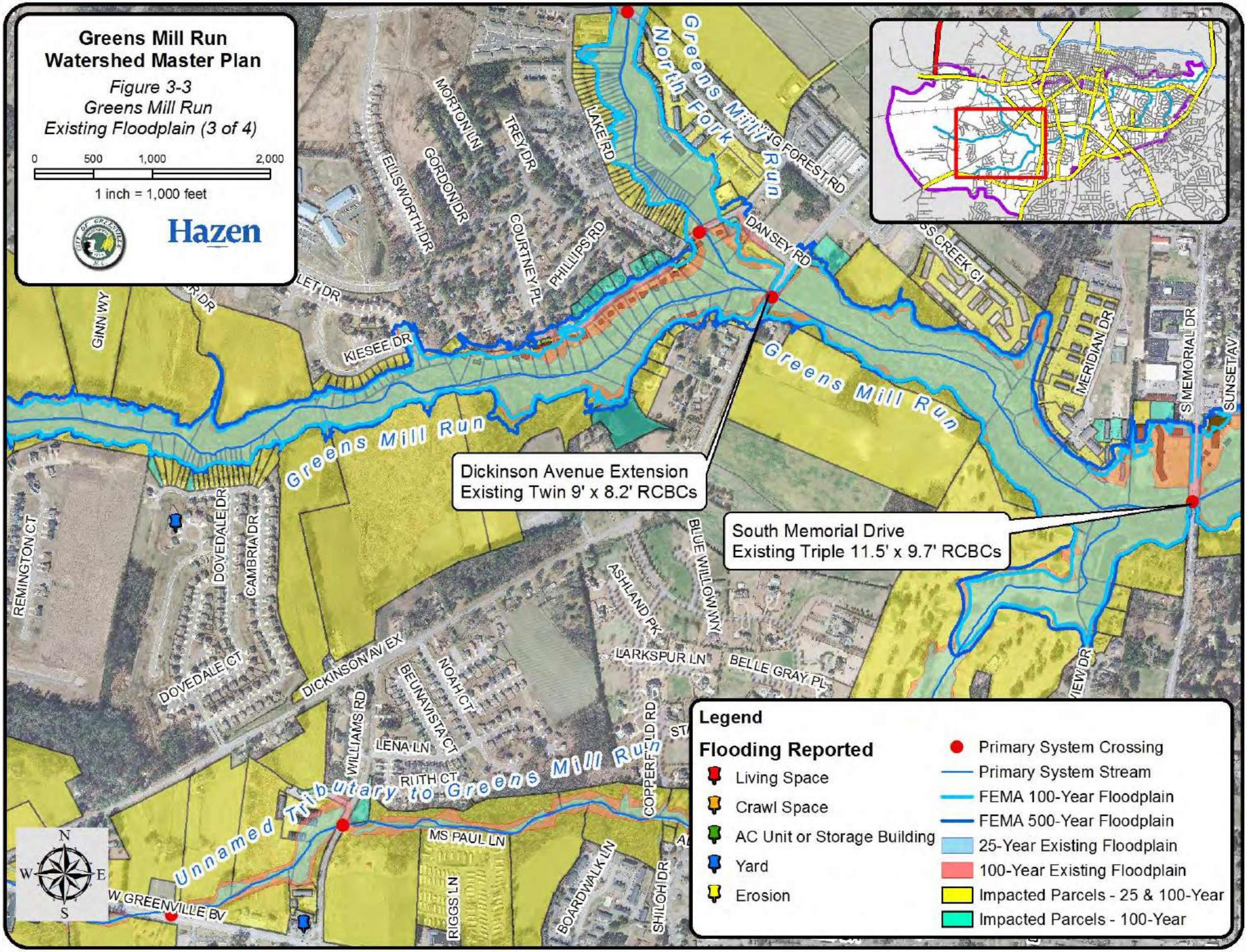
Table 3-6 Continued

Address	LAG	Calculated Water Surface Elevation Under Existing Land-Use Conditions (ft, NAVD) 25-year	100-year
Greens Mill Run Continued			
804 College View Drive	14.60	15.23	17.76
800 Heath Street	15.56	14.87	17.51
2915 Tammie Trail	10.54	10.68	11.94
Reedy Branch			
103 Dellwood Drive	66.00	66.97	67.13
105 Dellwood Drive	66.47	66.97	67.13
107 Dellwood Drive	66.41	67.03	67.20
109 Dellwood Drive	67.12	67.62	67.95
201 Dellwood Drive	68.30	68.93	69.09
207 Dellwood Drive	68.50	69.29	69.44
1500 Greenville Boulevard	56.68	54.85	56.68
1502 Greenville Boulevard	56.33	54.91	56.69
1500 14th Street	56.63	54.85	56.68
1502 14th Street	56.35	55.34	56.81
2401 Jefferson Circle	25.00	24.46	27.78
2403 Jefferson Circle	26.13	24.30	27.77
2405 Jefferson Circle	27.70	24.16	27.76
2507 Jefferson Circle	23.00	23.02	27.67
2504 Madison Drive	21.84	22.74	27.63
2410 E 10th Street	26.23	22.65	27.60
1003 E Wright Road	21.02	22.57	27.57
Fornes Run			
2202 Charles Boulevard	62.34	61.79	62.50
919 SE Greenville Blvd	58.20	54.60	58.20
1204 Crestwood Drive	43.05	42.94	44.22
1301 Overlook Drive	41.02	38.83	42.77
1118 Overlook Drive	42.14	40.27	42.83
1122 Overlook Drive	41.44	40.29	42.84
1601 Beaumont Drive	38.86	40.18	42.80
1108 14th Street	35.16	35.57	37.82
103 Dalebrook Circle	28.39	28.10	28.61
Unnamed Tributary to Greens Mill Run			
3002 Williams Road	64.70	62.32	64.86
403 Alice Drive	52.58	51.80	52.58
Greens Mill Run North Fork			
1200 Allen Road	71.37	70.05	71.56
1202 Allen Road	71.09	70.06	71.57
1204 Allen Road	71.56	70.07	71.58
1206 Allen Road	71.18	70.09	71.95
1208 Allen Road	71.62	70.11	71.62
1210 Allen Road	71.70	70.11	71.70
515 Spring Forest Road	57.78	57.86	58.08
880 Spring Forest Road	57.30	57.32	57.57
904 Spring Forest Road	57.20	57.32	57.66
910 Spring Forest Road	55.29	57.32	57.57
914 Spring Forest Road	55.20	57.32	57.57
540 Lake Road	56.45	57.33	57.58

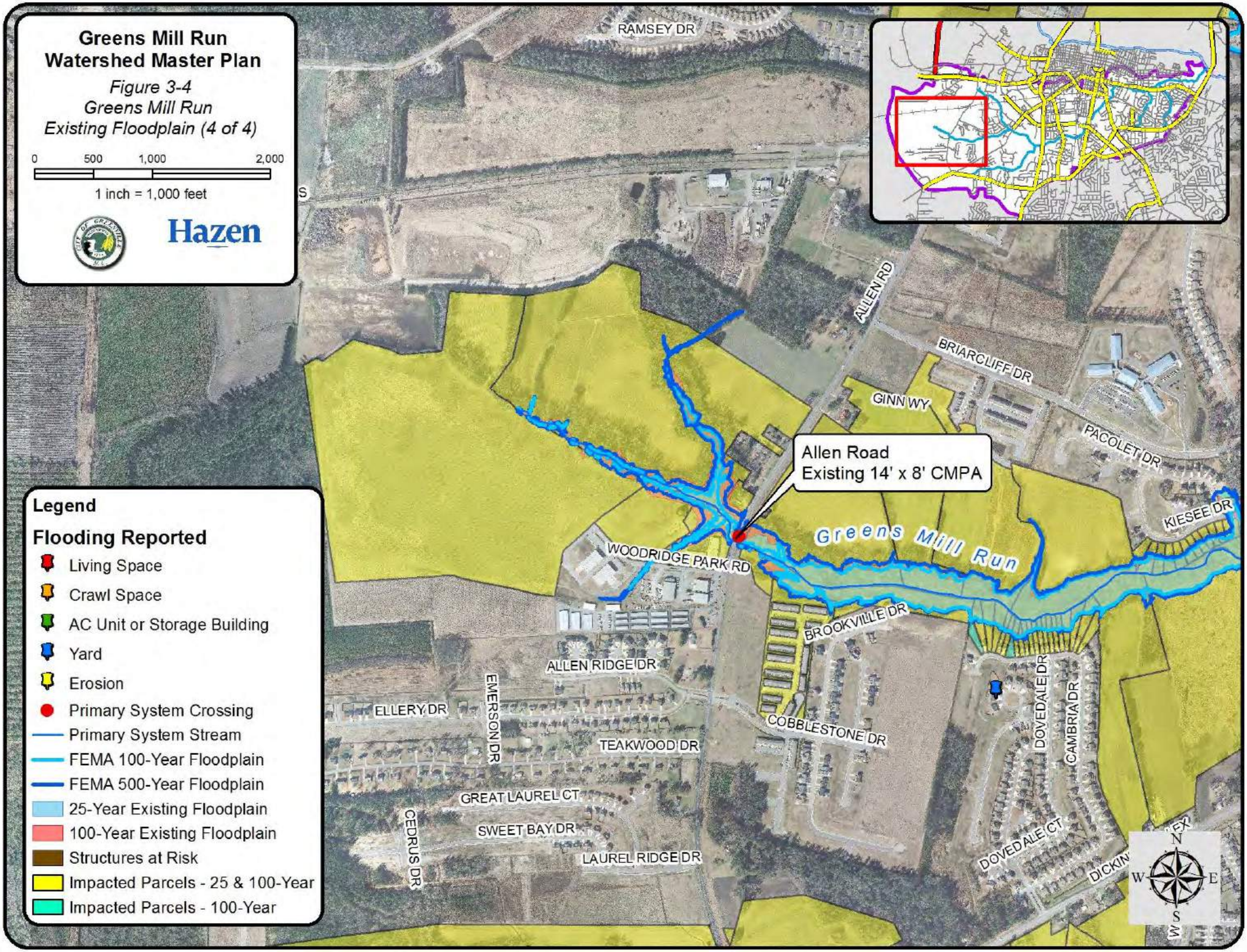
*Red shade indicates LAG flooding.


Rock Spring Road
Existing Twin 15' x 9.4' CMPAs
College Hill Drive
Existing Twin 12' x 10' RCBCs
South Elm Street
Existing Twin 16.5' x 10.5' CMPAs
East 5th Street
Existing Single Span
Cored Slab Bridge
East 10th Street
Existing Triple 15' x' 13' RCBCs
Greens Mill Run
Fornes Run
Reedy Branch
WILLOW ST
E 1ST ST
PARK DR
N LIBRARY ST
N EASTERN ST
N MEADE ST
N ELM ST
N OAK ST
ASH ST
S ROTARY AV
S HARDING ST
E 2ND ST
JOHNSTON ST
E 4TH ST
E 5TH ST
E 3RD ST
CEDAR ST
BEECH ST
E 2ND ST
GREEN SPRINGS DR
E 10TH ST
EDWARDS ST
VERDANT DR
NE GREENVILLE BV
JEFFERSON DR
ALEXANDER CI
ROSE ST
JOHN AV
MOSELEY DR
W ROCK SPRING RD
E ROCK SPRING RD
COLLEGE HILL DR
HASKETT WY
N LONGMEADOW RD
ORTON DR
W LONGMEADOW RD
RUTLEDGE RD
AIRLEE DR
DALEBROOK CI
KINGSBROOK RD
BROWNLEE DR
W WRIGHT RD
RAGSDALE RD
GRAHAM ST
POLK AV
ROCKETT DR
S WRIGHT RD
TYLER LN
DEAL PL
LONGWOOD DR
N OVERLOOK DR
E 14TH ST
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Greens Mill Run
Watershed Master Plan
Figure 3-1
Greens Mill Run
Existing Floodplain (1 of 4)
0
500
1,000
2,000
1 inch = 997 feet
Hazen

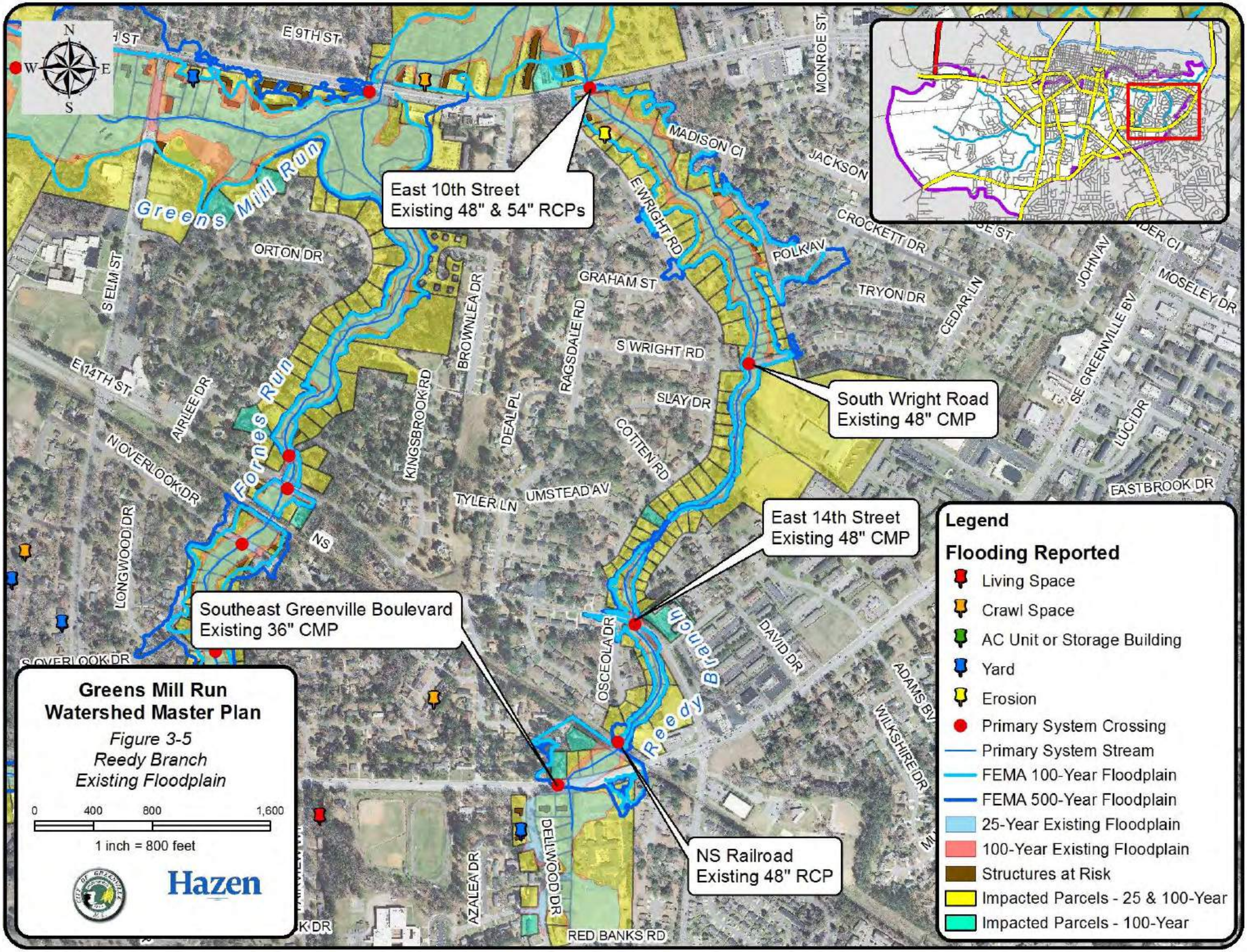

Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
East 14th Street
Existing 3 Span Cored Slab Bridge
NS Railroad
Existing 3 Span Girder Bridge
Charles Boulevard
Existing Triple 12.4 ' x 9.6' RCBCs
Evans Street
Existing Triple 12' x 6' RCBCs
West Arlington Boulevard
Existing Quadruple 12' x 8.5' RCBCs
CSX Railroad
Existing 12 Span Girder Bridge
Hooker Road
Existing Triple 12.8' x 8.8' RCBCs
South Memorial Drive
Existing Triple 11.5' x 9.7' RCBCs
Greens Mill Run
FICKLEN DR
SULGRAVE RD
CHARLES BV
AVON LN
W BERKSHIRE RD
STRATFORD RD
CLIFTON ST
PALMETTO PL
OGLESBY DR
CURRY CT
MIMOSA CT
HOPKINS DR
EVANS ST
S GREENE ST
S PITT ST
MCCLELLAN ST
NORCOTT CI
KENNEDY CI
S SKINNER ST
PERKINS ST
HOOKER RD
TRUMAN ST
SYLVAN DR
PITTMAN DR
HENRY ST
BEATTY ST
NS
CLNA
PINE ST
MERIDIAN DR
S MEMORIAL DR
MILLBROOK ST
BURRINGTON RD
CSX
LINDELL DR
RED BANKS RD
PLAZA DR
N
S
E
W
Greens Mill Run
Watershed Master Plan
Figure 3-2
Greens Mill Run
Existing Floodplain (2 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen



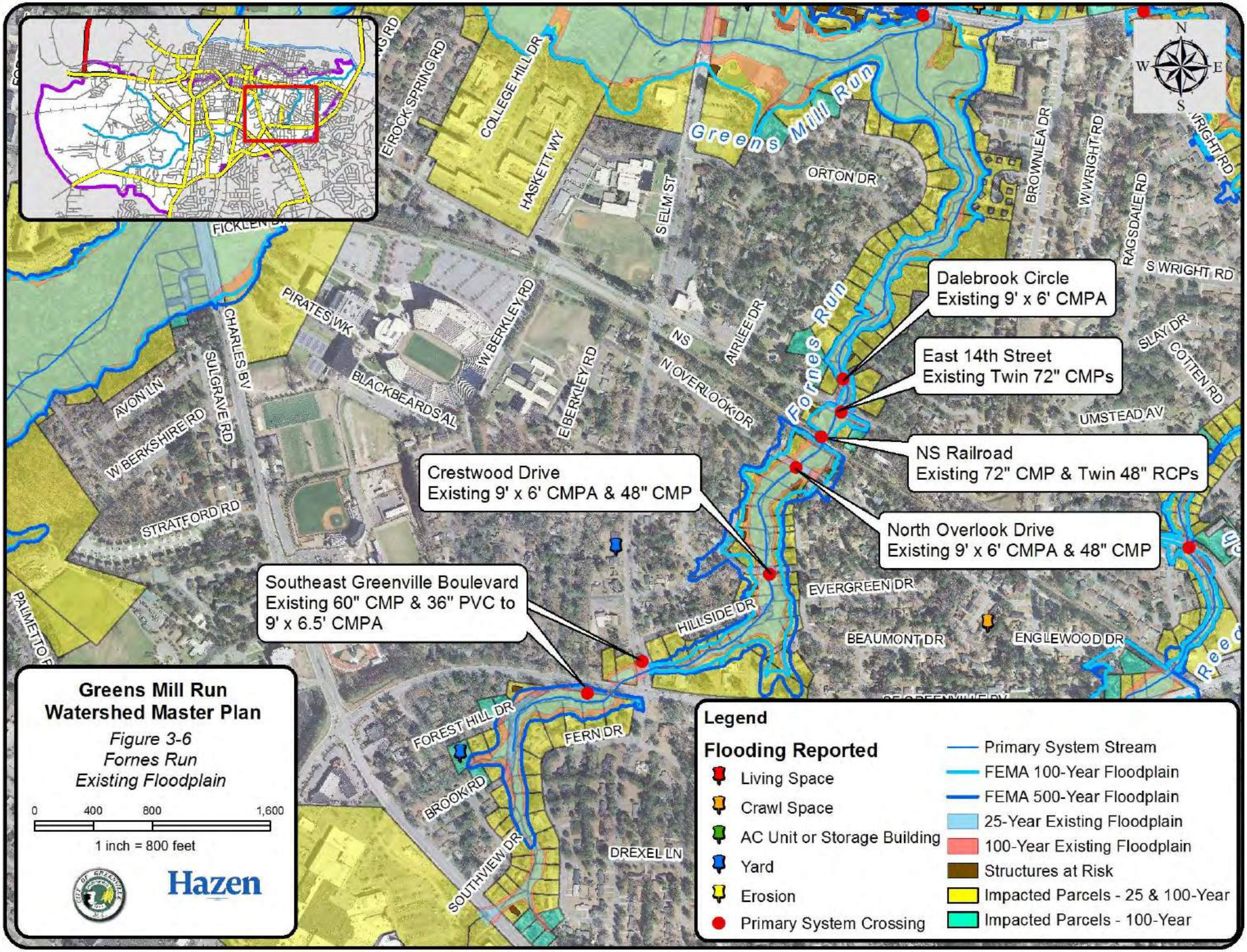
Greens Mill Run
Watershed Master Plan
Figure 3-3
Greens Mill Run
Existing Floodplain (3 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Dickinson Avenue Extension
Existing Twin 9' x 8.2' RCBCs
South Memorial Drive
Existing Triple 11.5' x 9.7' RCBCs
Greens Mill Run
North Fork Greens Mill Run
Unnamed Tributary to Greens Mill Run
MORTON LN
TREY DR
LAKE RD
ELLSWORTH DR
GORDON DR
COURTNEY PL
PHILLIPS RD
DANSEY RD
KIESEE DR
GINN WY
MERIDIAN DR
S MEMORIAL DR
SUNSET AV
REMINGTON CT
DOVEDALE DR
CAMBRIA DR
DOVEDALE CT
DICKINSON AV EX
WILLIAMS RD
BEUNAVISTA CT
NOAH CT
LENA LN
RUTH CT
ASHLAND PK
BLUE WILLOW WY
LARKSPUR LN
BELLE GRAY PL
COPPERFIELD RD
MS PAUL LN
RIGGS LN
BOARDWALK LN
SHILOH DR
W GREENVILLE BV
N
S
E
W
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year

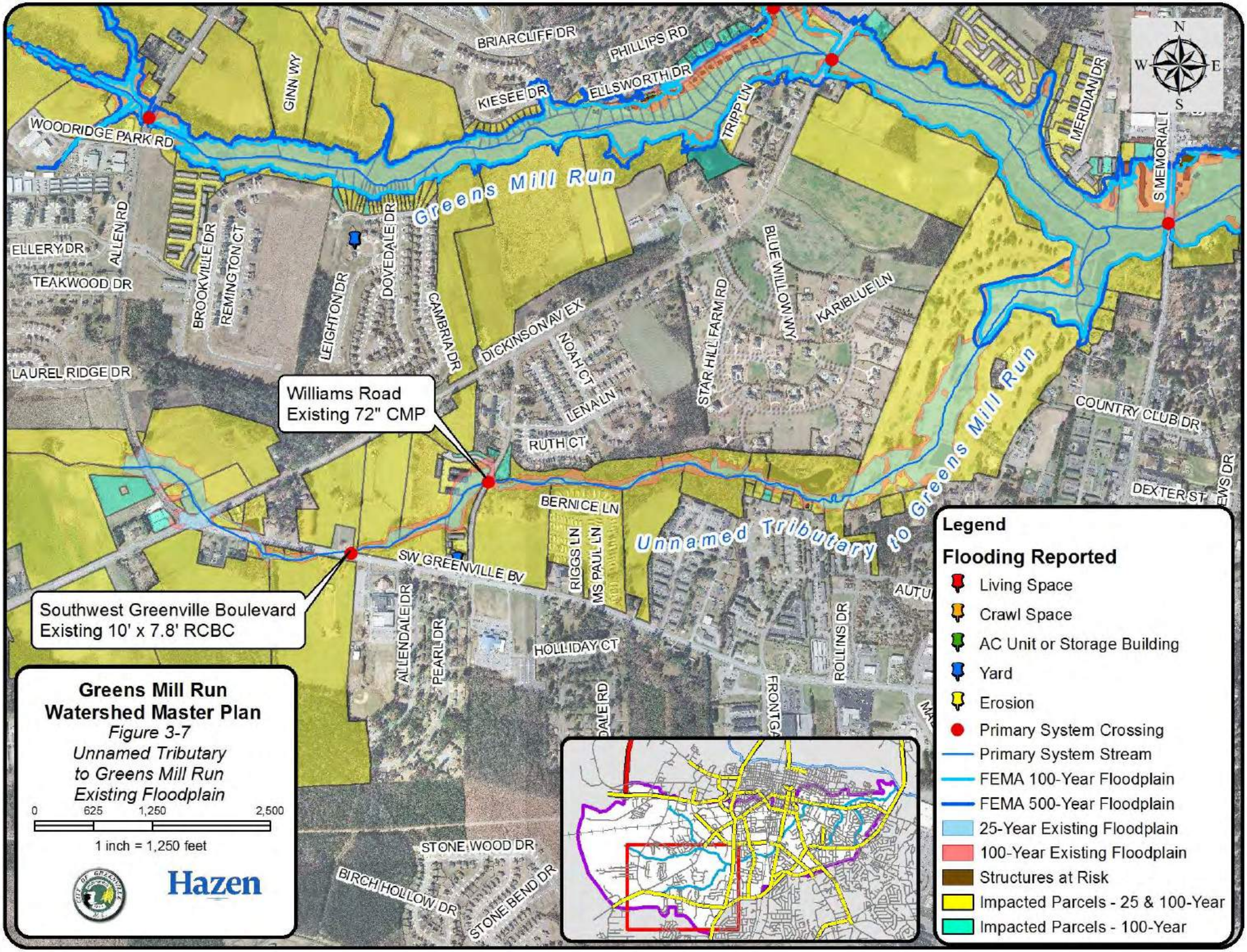


Greens Mill Run
Watershed Master Plan
Figure 3-4
Greens Mill Run
Existing Floodplain (4 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Allen Road
Existing 14' x 8' CMPA
Greens Mill Run
RAMSEY DR
ALLEN RD
BRIARCLIFF DR
GINN WY
PACOLET DR
KIESEE DR
WOODRIDGE PARK RD
BROOKVILLE DR
ALLEN RIDGE DR
EMERSON DR
ELLERY DR
COBBLESTONE DR
TEAKWOOD DR
DOVEDALE DR
CAMBRIA DR
GREAT LAUREL CT
CEDRUS DR
SWEET BAY DR
LAUREL RIDGE DR
DOVEDALE CT
N
S
E
W



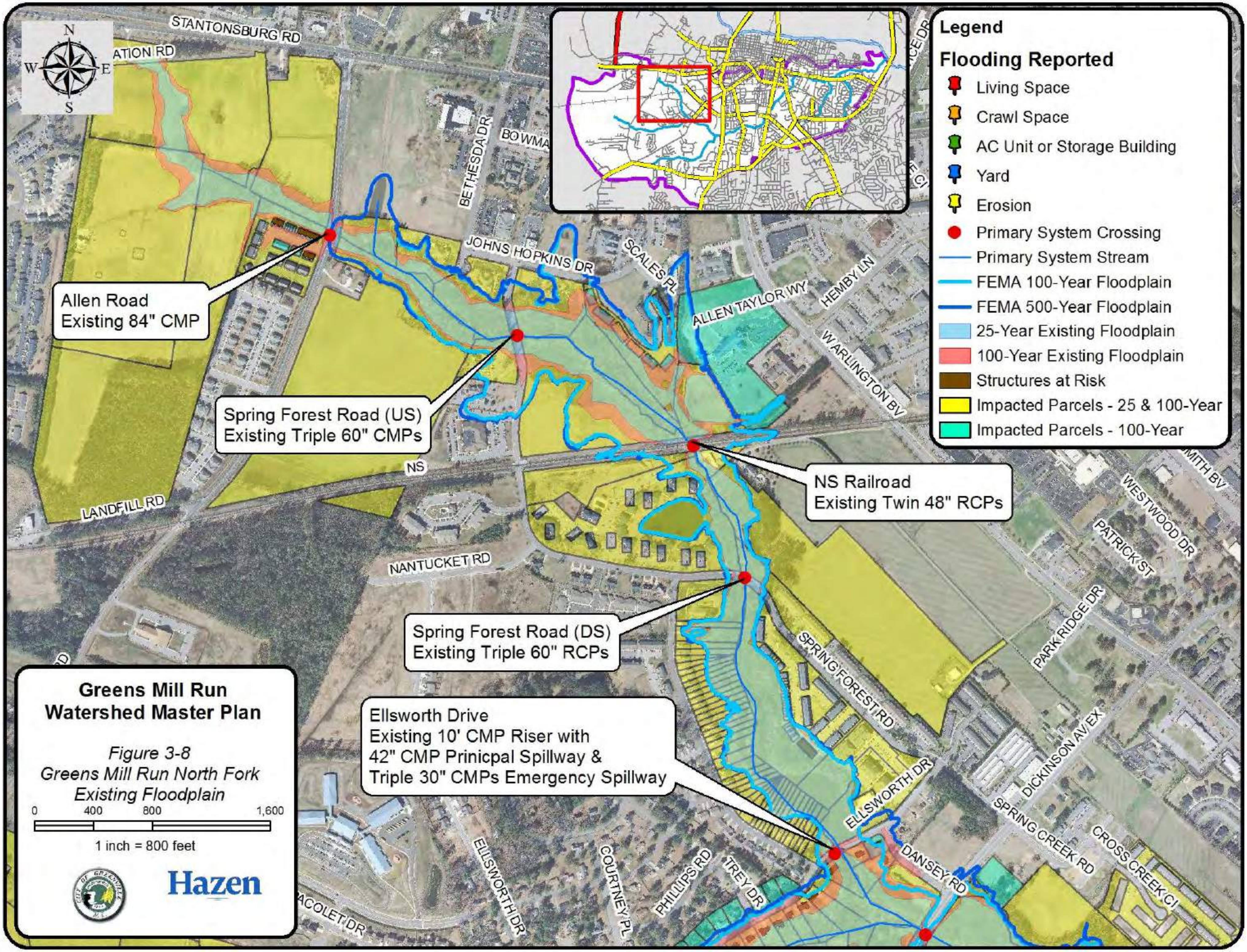
Greens Mill Run
Watershed Master Plan
Figure 3-5
Reedy Branch
Existing Floodplain
0 400 800 1,600
1 inch = 800 feet
Hazen
East 10th Street
Existing 48" & 54" RCPs
South Wright Road
Existing 48" CMP
East 14th Street
Existing 48" CMP
Southeast Greenville Boulevard
Existing 36" CMP
NS Railroad
Existing 48" RCP
Greens Mill Run
Fornes Run
Reedy Branch
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year


Greens Mill Run
Watershed Master Plan
Figure 3-6
Fornes Run
Existing Floodplain
0 400 800 1,600
1 inch = 800 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Dalebrook Circle
Existing 9' x 6' CMPA
East 14th Street
Existing Twin 72" CMPs
NS Railroad
Existing 72" CMP & Twin 48" RCPs
North Overlook Drive
Existing 9' x 6' CMPA & 48" CMP
Crestwood Drive
Existing 9' x 6' CMPA & 48" CMP
Southeast Greenville Boulevard
Existing 60" CMP & 36" PVC to
9' x 6.5' CMPA
Greens Mill Run
Fornes Run
N
E
S
W
E ROCK SPRING RD
COLLEGE HILL DR
HASKETT WY
S ELM ST
ORTON DR
BROWNLEA DR
W WRIGHT RD
RAGSDALE RD
S WRIGHT RD
FICKLEN DR
PIRATES WK
CHARLES BV
W BERKLEY RD
NS
AIRLEE DR
BLACKBEARDS AL
E BERKLEY RD
N OVERLOOK DR
SLAY DR
COTTEN RD
UMSTEAD AV
AVON LN
SULGRAVE RD
W BERKSHIRE RD
STRATFORD RD
EVERGREEN DR
HILLSIDE DR
BEAUMONT DR
ENGLEWOOD DR
FOREST HILL DR
FERN DR
BROOK RD
SOUTHVIEW DR
DREXEL LN



Greens Mill Run Watershed Master Plan

Figure 3-7
Unnamed Tributary to Greens Mill Run Existing Floodplain


STANTONSBURG RD
ATION RD
BOWMA
BETHESDA DR
JOHNS HOPKINS DR
SCALES PL
ALLEN TAYLOR WY
HEMBY LN
W ARLINGTON BV
NS
LANDFILL RD
NANTUCKET RD
SPRING FOREST RD
ELLSWORTH DR
DANSEY RD
SPRING CREEK RD
CROSS CREEK CI
DICKINSON AV EX
PARK RIDGE DR
PATRICK ST
WESTWOOD DR
SMITH BV
COURTNEY PL
PHILLIPS RD
TREY DR
PACOLET DR
Allen Road
Existing 84" CMP
Spring Forest Road (US)
Existing Triple 60" CMPs
NS Railroad
Existing Twin 48" RCPs
Spring Forest Road (DS)
Existing Triple 60" RCPs
Ellsworth Drive
Existing 10' CMP Riser with
42" CMP Prinicpal Spillway &
Triple 30" CMPs Emergency Spillway
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Existing Floodplain
100-Year Existing Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Greens Mill Run
Watershed Master Plan
Figure 3-8
Greens Mill Run North Fork
Existing Floodplain
0 400 800 1,600
1 inch = 800 feet
Hazen

3.1.2.2 Future Conditions

The existing structure crossings were analyzed using future land-use discharges for anticipated future performance, assuming that the upper portions of the watershed were fully developed in accordance with the City's future zoning. A combination of aerial photography, the City's future zoning layer, and engineering judgment was used to assign Manning's n-values to the future conditions in the hydraulic model. Except within the 50 foot stream buffer, undeveloped areas, such as forested or agricultural land-use (example Manning's n-values of 0.1 and 0.035, respectively), were modeled as developed under future conditions (example Manning's n-values of 0.11 and 0.035, respectively).

As illustrated in **Table 3-7**, most road crossings did not meet their desired LOS under future land-use conditions. Aside from all but one of the railroad crossings, only the East 5th and East 10th Street crossings on Greens Mill Run maintained their respective LOSs. The Norfolk Southern Railway on Greens Mill Run North Fork was the only railroad to not maintain its LOS under future land-use conditions.

An evaluation of properties adjacent to the streams was also performed to determine risk of flooding during the 25-year and 100-year storm events under future land-use conditions. The future 25- and 100-year floodplains were mapped based on the model results and may differ from the effective FEMA floodplains. These are only for the City's reference to express the anticipated areas of flooding for capital improvements and should not be used for flood insurance purposes.

Structures deemed to be at risk for flooding during the calculated 25-year and 100-year events are presented in **Table 3-8**. The LAG elevations were taken from available LIDAR data. It is important to note that LAG elevations were not surveyed, and therefore may differ from actual LAG or finished floor elevations. Only habitable buildings were analyzed in determining flood risk. There are several additional properties where accessory buildings were located within the floodplain; however, these were not deemed at-risk properties unless the primary residence or business was also located within the floodplain. Additionally, using the GIS datasets for parcels and buildings, the impacted parcels and structures at risk during these events were identified, as presented in **Figure 3-9** through **Figure 3-16**.

Table 3-7: Hydraulic Performance for Future Conditions

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)					Existing Conditions
			2-year	10-year	25-year	50-year	100-year	100-year
Greens Mill Run								
Allen Road	70.5	50-year	64.2	69.5	**71.4**	**71.9**	**72.2**	68.8
Dickinson Avenue	56.2	50-year	49.8	53.6	**56.5**	**56.9**	**57.3**	55.4
South Memorial Drive	47.6	50-year	43.1	47	**48.4**	**49.0**	**49.6**	48.2
Hooker Road	43.8	25-year	40.2	43.2	**45.4**	**46.5**	**47.3**	45.0
CSX Railroad	50.1	100-year	38.6	41.0	42.7	43.9	45.2	42.4
West Arlington Boulevard	39.8	50-year	34.7	37.2	39.3	**40.4**	**41.0**	39.6
Evans Street	34	50-year	33.3	**35.3**	**35.9**	**36.6**	**37.9**	35.9
Charles Boulevard	31	50-year	30.4	**32.9**	**34.5**	**35.8**	**37.4**	34.5
Norfolk Southern Railway	47.3	100-year	30.0	32.7	34.4	35.7	37.2	34.4
East 14th Street	28	50-year	28.1	**30.5**	**31.5**	**32.4**	**33.3**	31.7
Rock Spring Road	28	25-year	24.8	**29.6**	**30.4**	**31.0**	**31.6**	31.0
College Hill Drive	25.8	25-year	21.7	**26.9**	**27.8**	**28.3**	**28.8**	27.9
South Elm Street	24.2	50-year	19.8	**24.5**	**25.8**	**26.5**	**27.2**	26.0
East 10th Street	23	50-year	14.9	17.1	19.6	21.6	**24.6**	20.6
East 5th Street	21.2	25-year	10.6	13.5	15.5	17.3	21	16.6
Reedy Branch								
Southeast Greenville Boulevard	66.4	50-year	62.3	**66.8**	**66.9**	**67**	**67.1**	67.1
Norfolk Southern Railway	66.4	100-year	57.8	59.2	59.9	60.6	61.7	61.7
East 14th Street	56.5	25-year	51.7	54.3	**56.5**	**56.8**	**56.9**	56.7
South Wright Road	33.5	25-year	32.6	**34.3**	**34.9**	**35.3**	**35.5**	34.8
East 10th Street	34.4	50-year	17.8	24.8	**34.6**	**35.3**	**35.6**	27.6
Fornes Run								
Southeast Greenville Boulevard	58.8	50-year	51.3	57.1	**59.3**	**59.6**	**59.7**	58.2
Crestwood Drive	42.7	25-year	39.1	**43.8**	**47.3**	**52.0**	**52.3**	44.2
North Overlook Drive	39.3	25-year	35.7	**42.6**	**47.2**	**52.0**	**52.3**	42.8
Norfolk Southern Railway	51.9	100-year	34.1	42.6	47.2	**52.0**	**52.3**	42.7
14th Street	37.3	25-year	30.5	**37.7**	**38.2**	**38.5**	**38.8**	37.8
Dalebrook Drive	34.1	25-year	28.9	**34.6**	**35.3**	**35.8**	**36.2**	34.7
Unnamed Tributary to Greens Mill Run								
Southeast Greenville Boulevard	68.5	50-year	64.3	66.4	67.5	68.9	**68.9**	67.4
Williams Road	65.3	25-year	60.8	64.7	**65.6**	**65.8**	**66.0**	65.6
Greens Mill Run North Fork								
Allen Road	70.6	50-year	68.2	**71.1**	**71.4**	**71.6**	**71.8**	71.5
Spring Forest Road (US)	64.3	25-year	62.7	**65.1**	**65.9**	**67.0**	**68.1**	65.7
Norfolk Southern Railway	67.9	100-year	61.3	64.0	65.9	67.0	**68.1**	65.5
Spring Forest Road (DS)	56.8	25-year	56.7	**57.7**	**57.9**	**57.9**	**58.1**	57.8
Ellsworth Drive	56	25-year	56.0	**57.4**	**57.7**	**57.8**	**57.8**	57.6

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.
**Green shade indicates crossing meets desired level of service.
**Red shade indicates crossing does not meet desired level of service.
***Tan shade indicates level of service under future land-use conditions.
****See Table 3-5 for full existing conditions hydraulic performance.

Table 3-8: Future Conditions At-Risk Structures

Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run			
1990 Allen Road	71.07	71.42	72.16
1944 Allen Road	64.00	71.43	72.19
700 Kiesee Drive	57.75	57.42	58.42
701 Kiesee Drive	56.11	57.38	58.36
704 Kiesee Drive	53.71	57.39	58.38
705 Kiesee Drive	55.63	57.35	58.33
708 Kiesee Drive	53.43	57.35	58.33
709 Kiesee Drive	53.23	57.33	58.32
712 Kiesee Drive	53.87	57.31	58.30
716 Kiessee Drive	57.44	57.28	58.24
3108 Pacolet Drive	56.25	57.37	58.36
3112 Pacolet Drive	57.08	57.34	58.32
2901 Ellsworth Drive	54.15	56.41	57.10
2903 Ellsworth Drive	51.77	56.56	57.25
2905 Ellsworth Drive	51.29	56.58	57.28
2907 Ellsworth Drive	55.40	56.59	57.29
2909 Ellsworth Drive	54.87	56.59	57.30
2911 Ellsworth Drive	53.19	56.59	57.31
2913 Ellsworth Drive	52.07	56.61	57.33
2915 Ellsworth Drive	50.66	56.62	57.35
2917 Ellsworth Drive	52.07	56.64	57.38
2919 Ellsworth Drive	52.68	56.66	57.41
3003 Ellsworth Drive	53.05	56.68	57.44
3004 Ellsworth Drive	56.82	56.69	57.46
3005 Ellsworth Drive	53.44	56.69	57.46
3007 Ellsworth Drive	54.23	56.71	57.48
3008 Ellsworth Drive	56.75	56.75	57.51
3009 Ellsworth Drive	53.15	56.72	57.51
3010 Ellsworth Drive	56.54	56.74	57.54
3011 Ellsworth Drive	53.35	56.73	57.53
3013 Ellsworth Drive	54.57	56.75	57.55
3015 Ellsworth Drive	54.41	56.77	57.58
3017 Ellsworth Drive	55.21	56.78	57.60
3019 Ellsworth Drive	55.51	56.82	57.65
3101 Ellsworth Drive	53.78	56.89	57.74
3103 Ellsworth Drive	53.36	56.94	57.81
3105 Ellsworth Drive	53.55	56.99	57.88
3201 Ellsworth Drive	53.61	57.04	57.94
3203 Ellsworth Drive	51.79	57.10	58.01
3205 Ellsworth Drive	53.15	57.16	58.09
2900 Tripp Lane	52.55	56.60	57.32
2920 Tripp Lane	51.48	56.62	57.34
2940 Tripp Lane	51.88	56.64	57.38
2960 Tripp Lane	53.78	56.65	57.41
2940 Dickinson Avenue	51.31	56.58	57.34
101 Dansey Road	49.47	56.55	57.24
191 Dansey Road	54.31	56.56	57.25
1237 Cross Creek Circle	47.39	48.75	50.05
1241 Cross Creek Circle	46.56	48.80	50.10
1245 Cross Creek Circle	48.47	48.85	50.15

Table 3-8 Continued

Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run Continued			
2760 Meridian Drive	49.27	48.69	49.96
2762 Meridian Drive	49.16	48.67	49.94
2772 Meridian Drive	48.67	48.67	49.86
2774 Meridian Drive	46.65	48.54	49.77
2778 Meridian Drive	46.22	48.54	49.76
2780 Meridian Drive	46.80	48.50	49.71
2782 Meridian Drive	47.84	48.50	49.70
2790 Meridian Drive	49.21	48.52	49.74
2801 S Memorial Drive	42.70	45.80	47.65
2826 S Memorial Drive	46.95	48.39	49.58
2828 S Memorial Drive	47.21	48.41	49.60
2709 Shawnee Place	46.94	45.57	47.40
2711 Shawnee Place	45.00	45.57	47.41
2713 Shawnee Place	43.47	45.57	47.40
2714 Shawnee Place	46.00	45.59	47.43
2716 Shawnee Place	44.45	45.59	47.43
2718 Shawnee Place	43.26	45.59	47.42
294 Millbrook Street	42.68	45.70	47.53
296 Millbrook Street	44.10	45.69	47.52
298 Millbrook Street	44.37	45.68	47.51
300 Millbrook Street	44.39	45.66	47.49
301 Millbrook Street	45.45	45.63	47.47
302 Millbrook Street	43.76	45.64	47.47
303 Millbrook Street	44.52	45.62	47.45
304 Millbrook Street	43.20	45.62	47.46
305 Millbrook Street	43.85	45.61	47.44
306 Millbrook Street	43.16	45.61	47.44
308 Millbrook Street	42.69	45.59	47.43
403 Millbrook Street	43.21	45.55	47.39
405 Millbrook Street	43.25	45.54	47.38
406 Millbrook Street	42.42	45.54	47.37
408 Millbrook Street	42.66	45.53	47.37
504 Millbrook Street	40.61	45.51	47.35
506 Millbrook Street	41.87	45.51	47.34
600 Millbrook Street	42.08	45.50	47.34
602 Millbrook Street	43.69	45.46	47.29
604 Millbrook Street	44.91	45.32	47.19
2715 Webb Street	47.37	45.62	47.45
2719 Webb Street	46.66	45.63	47.46
2806 Webb Street	47.33	45.67	47.51
404 Aztec Lane	44.98	45.54	47.37
406 Aztec Lane	43.98	45.54	47.37
411 Aztec Lane	43.72	45.53	47.36
508 Pine Street	44.64	45.51	47.35
511 Pine Street	44.63	45.50	47.34
100 Ridge Place	43.25	45.45	47.28
101 Ridge Place	46.88	45.44	47.27
102 Ridge Place	43.25	45.48	47.31
103 Ridge Place	46.84	45.49	47.32
104 Ridge Place	42.35	45.50	47.34

Table 3-8 Continued

Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run Continued			
105 Ridge Place	47.03	45.50	47.34
106 Ridge Place	43.08	45.51	47.34
108 Ridge Place	42.61	45.51	47.35
110 Ridge Place	42.08	45.52	47.35
111 Ridge Place	45.90	45.53	47.37
112 Ridge Place	41.37	45.52	47.36
113 Ridge Place	46.63	45.54	47.37
114 Ridge Place	41.09	45.53	47.36
100 Cortland Road	47.31	45.52	47.36
200 West Arlington Boulevard	37.95	37.16	38.87
430 Arlington Boulevard	40.31	42.82	45.41
2248 University Suites Drive	40.28	40.73	42.54
100 Pineview Drive	40.59	40.40	42.21
102 Pineview Drive	39.29	40.46	42.27
104 Pineview Drive	36.87	40.57	42.38
108 Pineview Drive	38.12	40.81	42.62
200 Pineview Drive	38.85	40.91	42.72
210 Lakewood Drive	38.07	40.36	42.17
1700 Evans Street	33.66	35.47	37.84
1705 Evans Street	30.68	34.81	37.59
1709 Evans Street	30.54	34.82	37.59
2192 Evans Street	35.79	36.09	37.94
2200 Evans Street	40.00	39.86	41.38
2404 Evans Street	38.01	40.03	41.83
2206 Wadsworth Drive	37.76	36.04	37.93
101 Arthur Street	34.67	35.18	37.77
1800 Hopkins Drive	34.82	34.94	37.66
1808 Hopkins Drive	34.87	35.50	37.69
1601 Canterbury Road	36.46	34.84	37.60
1606 Sulgrave Road	36.04	34.49	37.38
1607 Sulgrave Road	35.78	34.46	37.36
1209 Charles Boulevard	25.99	31.50	33.16
1401 Charles Boulevard	30.04	32.00	33.52
1524 Charles Boulevard	31.92	34.71	37.52
504 E 14th Street	30.09	31.56	33.23
509 E 14th Street	27.39	31.53	33.20
516 E 14th Street	29.60	31.75	33.42
1011 Anderson Street	30.31	31.22	32.75
700 E 10th Street	31.04	31.19	32.70
800 E 10th Street	22.65	31.15	32.64
802 E 10th Street	27.48	31.10	32.57
806 E 10th Street	25.51	31.05	32.49
810 E 10th Street	24.20	30.95	32.34
900 E 10th Street	27.31	28.03	29.10
906 E 10th Street	24.75	27.57	28.28
950 E 10th Street	26.05	25.87	27.27
951 E 10th Street	26.42	25.86	27.27
953 E 10th Street	26.26	25.87	27.27
955 E 10th Street	24.39	25.86	27.26
956 E 10th Street	23.25	25.86	27.26

Table 3-8 Continued

Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Greens Mill Run Continued			
957 E 10th Street	23.26	25.86	27.25
1000 E 10th Street	21.08	25.84	27.24
1009 E 10th Street	24.08	25.84	27.24
1010 E 10th Street	22.03	25.82	27.20
1011 E 10th Street	23.06	25.82	27.21
1100 E 10th Street	19.98	22.17	25.67
1101 E 10th Street	25.51	22.19	25.68
1104 E 10th Street	20.76	22.09	25.65
1106 E 10th Street	20.61	22.04	25.63
1108 E 10th Street	20.08	21.89	25.58
1116 E 10th Street	19.46	21.77	25.54
1300 E 10th Street	21.97	19.50	24.41
1303 E 10th Street	13.91	18.38	22.17
1305 E 10th Street	15.93	18.35	22.22
1323 E 10th Street	12.73	18.33	22.25
1333 E 10th Street	21.95	18.15	22.20
1401 E 10th Street	17.76	17.50	21.94
2201 E 10th Street	14.69	17.39	21.90
952 Shady Lane	26.50	25.86	27.26
614 Maple Street	25.36	25.86	27.25
617 Maple Street	26.22	25.85	27.25
620 Maple Street	24.80	25.86	27.25
College of Engineering & Technology Bldg - ECU	27.32	30.94	32.33
College of Business Bldg - ECU	31.39	30.27	31.45
College of Mathematics Bldg - ECU	26.70	27.70	28.51
1005 S Elm Street	19.57	22.22	25.69
1055 S Elm Street	22.81	22.23	25.69
1058 S Elm Street	21.18	25.85	27.25
905 Forest Hill Circle	16.36	18.66	22.64
804 College View Drive	14.60	16.67	21.60
800 Heath Street	15.56	16.41	21.50
2505 E Fifth Street	19.34	16.19	21.38
2915 Tammie Trail	9.18	11.50	12.82
Reedy Branch			
102 Dellwood Drive	66.77	66.91	67.07
103 Dellwood Drive	66.00	66.97	67.13
105 Dellwood Drive	66.47	66.97	67.13
107 Dellwood Drive	66.41	66.98	67.14
109 Dellwood Drive	67.12	67.21	67.44
201 Dellwood Drive	68.30	68.94	69.10
207 Dellwood Drive	68.50	69.31	69.46
1430 SE Greenville Boulevard	65.12	65.24	65.48
1500 SE Greenville Boulevard	56.68	56.45	56.87
1502 SE Greenville Boulevard	56.33	56.54	56.93
1502 E 14th Street	56.35	56.57	56.97
2304 Jefferson Drive	33.47	34.64	35.65
2400 Jefferson Drive	33.29	34.64	35.65
2401 Jefferson Drive	25.00	34.64	35.66
2402 Jefferson Drive	34.52	34.64	35.65
2403 Jefferson Drive	26.13	34.64	35.66
2405 Jefferson Drive	27.70	34.64	35.66

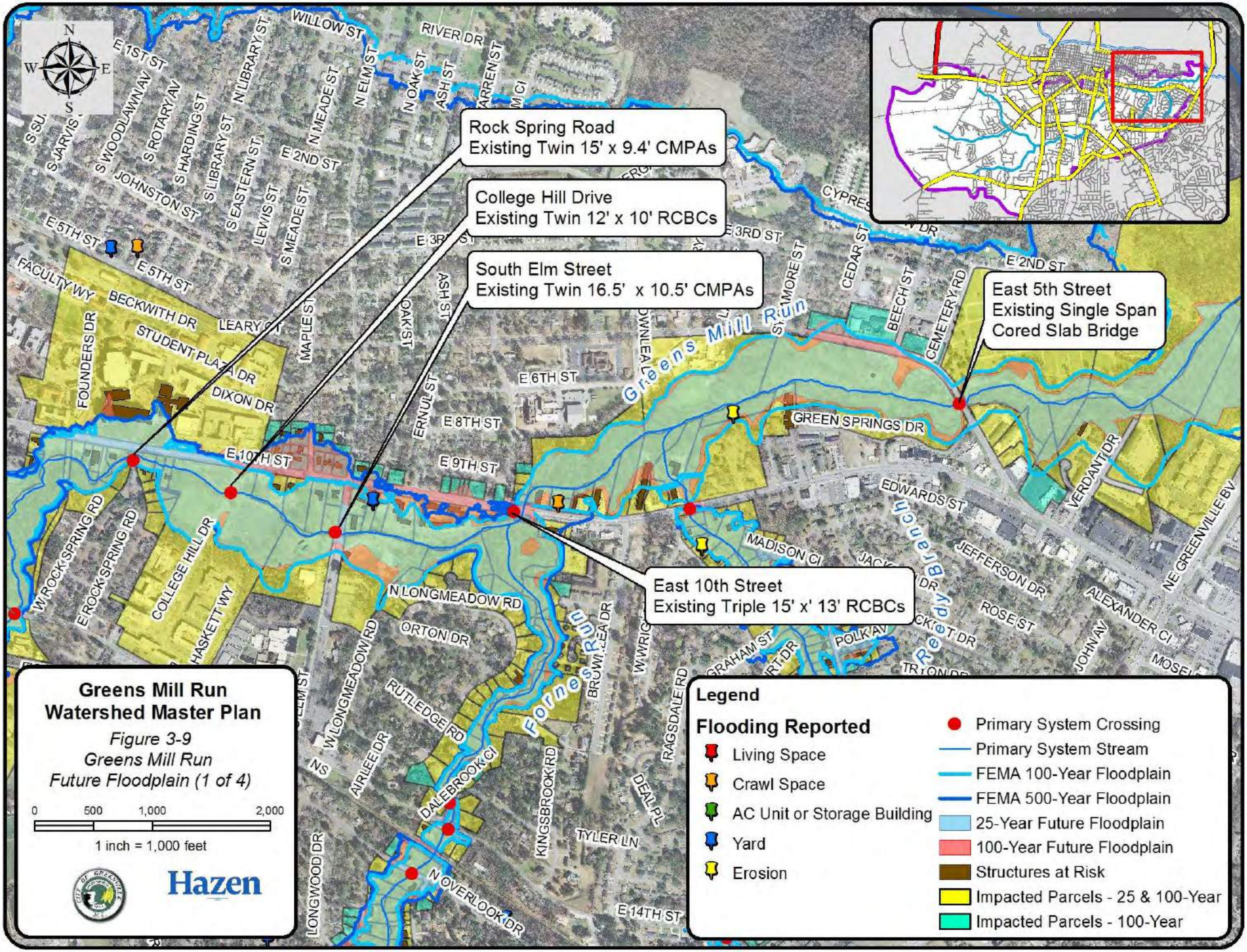
Table 3-8 Continued

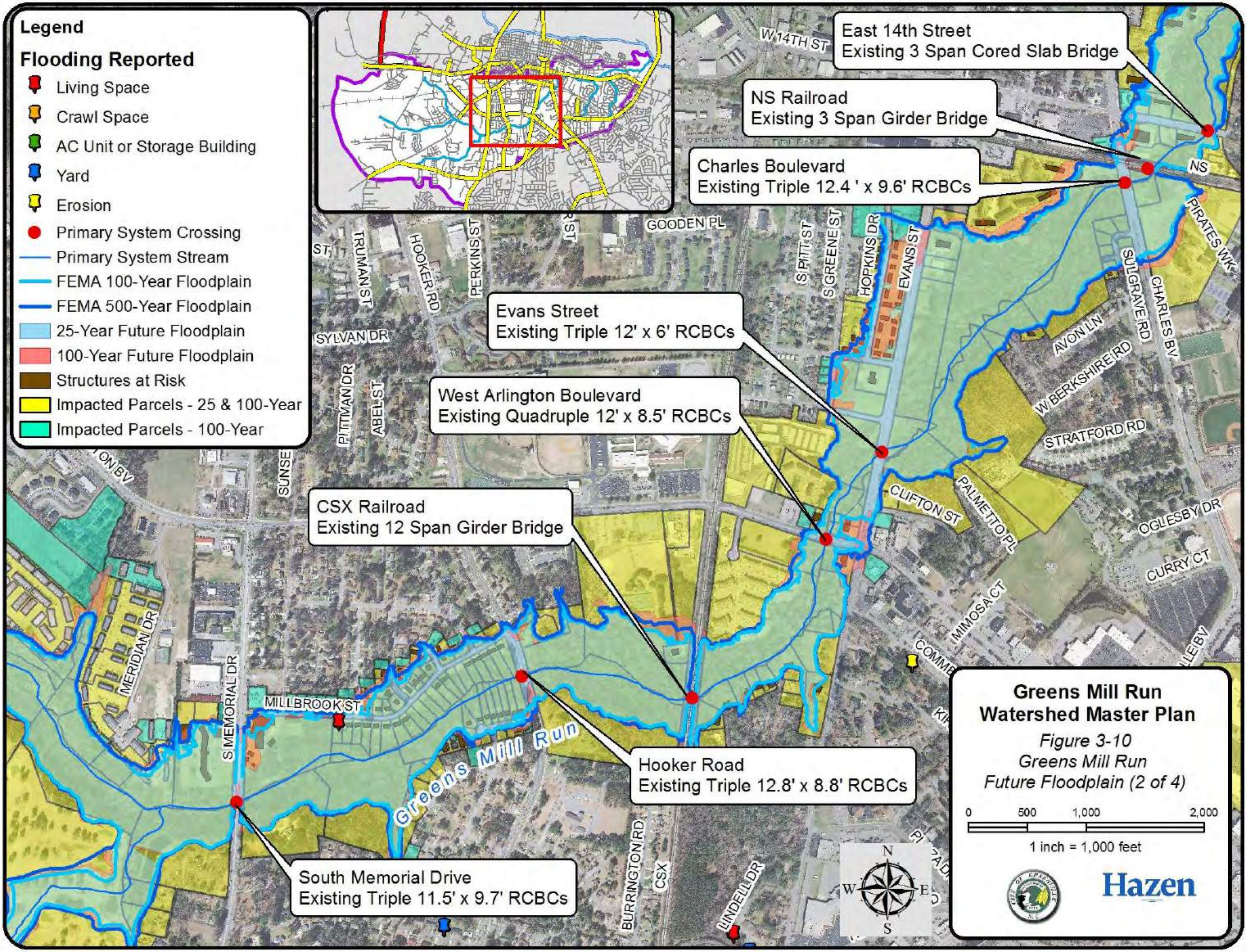
Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Reedy Branch Continued			
2407 Jefferson Drive	33.25	34.64	35.66
2507 Jefferson Drive	23.00	34.64	35.65
2509 Jefferson Drive	33.18	34.64	35.65
1408 Polk Avenue	34.71	34.64	35.66
1411 Polk Avenue	34.76	34.64	35.66
1413 Polk Avenue	34.54	34.64	35.66
2501 Madison Drive	30.84	34.63	35.65
2504 Madison Drive	21.84	34.63	35.65
2506 Madison Drive	29.17	34.63	35.65
2508 Madison Drive	35.28	34.63	35.65
2408 E 10th Street	29.08	34.63	35.64
2410 E 10th Street	26.23	34.63	35.65
1003 E Wright Road	21.02	34.62	35.64
1005 E Wright Road	32.61	34.63	35.65
1007 E Wright Road	31.49	34.63	35.65
1009 E Wright Road	31.81	34.63	35.65
1013 E Wright Road	31.83	34.63	35.65
1019 E Wright Road	25.87	34.64	35.65
1021 E Wright Road	32.98	34.64	35.66
1109 E Wright Road	32.58	34.64	35.66
1111 E Wright Road	35.54	34.64	35.66
1209 E Wright Road	35.44	34.64	35.44
1403 S Wright Road	32.46	34.65	35.68
Fornes Run			
2202 Charles Boulevard	62.34	62.20	62.71
1903 Brook Road	59.70	59.30	59.78
1912 Forest Hill Drive	59.34	59.33	59.82
1908 Forest Hill Drive	58.56	59.30	59.77
919 SE Greenville Boulevard	57.57	59.29	59.76
1111 SE Greenville Boulevard	47.99	47.05	52.33
1004 Hillside Drive	49.39	47.20	52.34
1006 Hillside Drive	48.60	47.20	52.34
1008 Hillside Drive	46.28	47.20	52.34
1117 Hillside Drive	51.29	47.20	52.34
1713 Morning Side Circle	46.21	47.20	52.34
1717 Morning Side Circle	51.18	47.02	52.34
1601 Beaumont Drive	38.87	47.24	52.32
1603 Beaumont Drive	39.76	47.24	52.32
1605 Beaumont Drive	49.77	47.24	52.32
1607 Beaumont Drive	48.74	47.24	52.32
1611 Beaumont Drive	51.32	47.25	52.33
1613 Beaumont Drive	52.32	47.25	52.32
1701 Beaumont Drive	49.91	47.27	52.33
1703 Beaumont Drive	51.20	47.27	52.33
1707 Beaumont Drive	46.34	47.20	52.33
1709 Beaumont Drive	46.76	47.20	52.33
1201 Crestwood Drive	46.26	47.25	52.32
1204 Crestwood Drive	43.05	47.20	52.33
1112 S Overlook Drive	49.65	46.98	52.31
1114 S Overlook Drive	45.21	47.24	52.32
1118 S Overlook Drive	42.14	47.24	52.32

Table 3-8 Continued

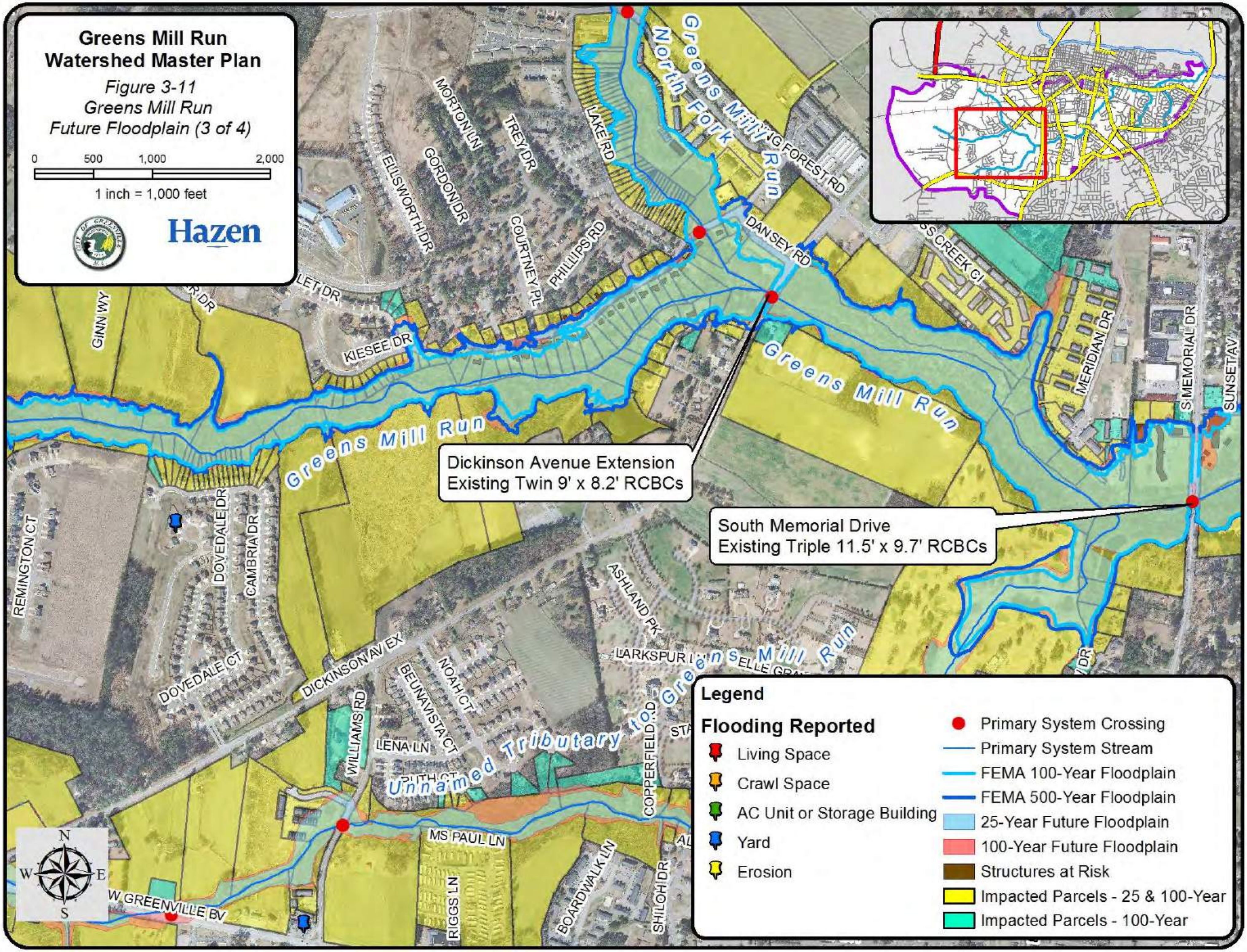
Address	LAG	Calculated Water Surface Elevation Under Future Land-Use Conditions (ft, NAVD)	
		25-year	100-year
Fornes Run Continued			
1122 S Overlook Drive	41.44	47.25	52.32
1202 N Overlook Drive	42.76	47.24	52.32
1205 N Overlook Drive	53.31	46.97	52.32
1207 N Overlook Drive	44.74	47.24	52.32
1301 N Overlook Drive	41.08	47.24	52.32
1303 N Overlook Drive	49.61	46.97	52.32
1108 E 14th Street	35.16	38.25	38.82
103 Dalebrook Circle	28.39	29.36	30.71
130 N Longmeadow Road	24.39	21.42	24.46
131 N Longmeadow Road	23.98	21.80	24.51
Unnamed Tributary to Greens Mill Run			
1600 SW Greenville Boulevard	65.43	65.80	66.22
1819 SW Greenville Boulevard	68.90	68.60	69.43
1815 SW Greenville Boulevard	68.25	68.58	69.41
3002 Willams Road	65.51	65.51	65.86
3194 Williams Road	65.98	65.71	66.10
1500 Manning Forest Drive	62.92	65.64	66.01
1504 Manning Forest Drive	62.35	65.64	65.98
1508 Manning Forest Drive	61.98	65.65	65.98
3104 Copperfield Road	55.99	55.13	56.39
401 Alice Drive	53.74	52.86	53.82
403 Alice Drive	52.58	52.67	53.51
405 Alice Drive	52.57	52.40	53.10
Greens Mill Run North Fork			
1200 Allen Road	71.37	71.36	71.82
1202 Allen Road	71.09	71.34	71.79
1204 Allen Road	71.56	71.37	71.84
1206 Allen Road	71.18	71.39	71.87
1208 Allen Road	71.62	71.41	71.89
1210 Allen Road	71.70	71.43	71.93
905 Johns Hopkins Drive	66.98	65.93	68.05
102 Scales Place	65.58	65.91	68.05
515 Spring Forest Road	57.78	58.20	58.42
880 Spring Forest Road	57.30	57.69	57.84
904 Spring Forest Road	57.20	57.69	57.84
910 Spring Forest Road	55.29	57.69	57.84
914 Spring Forest Road	55.20	57.69	57.84
540 Lake Road	56.45	57.70	57.86

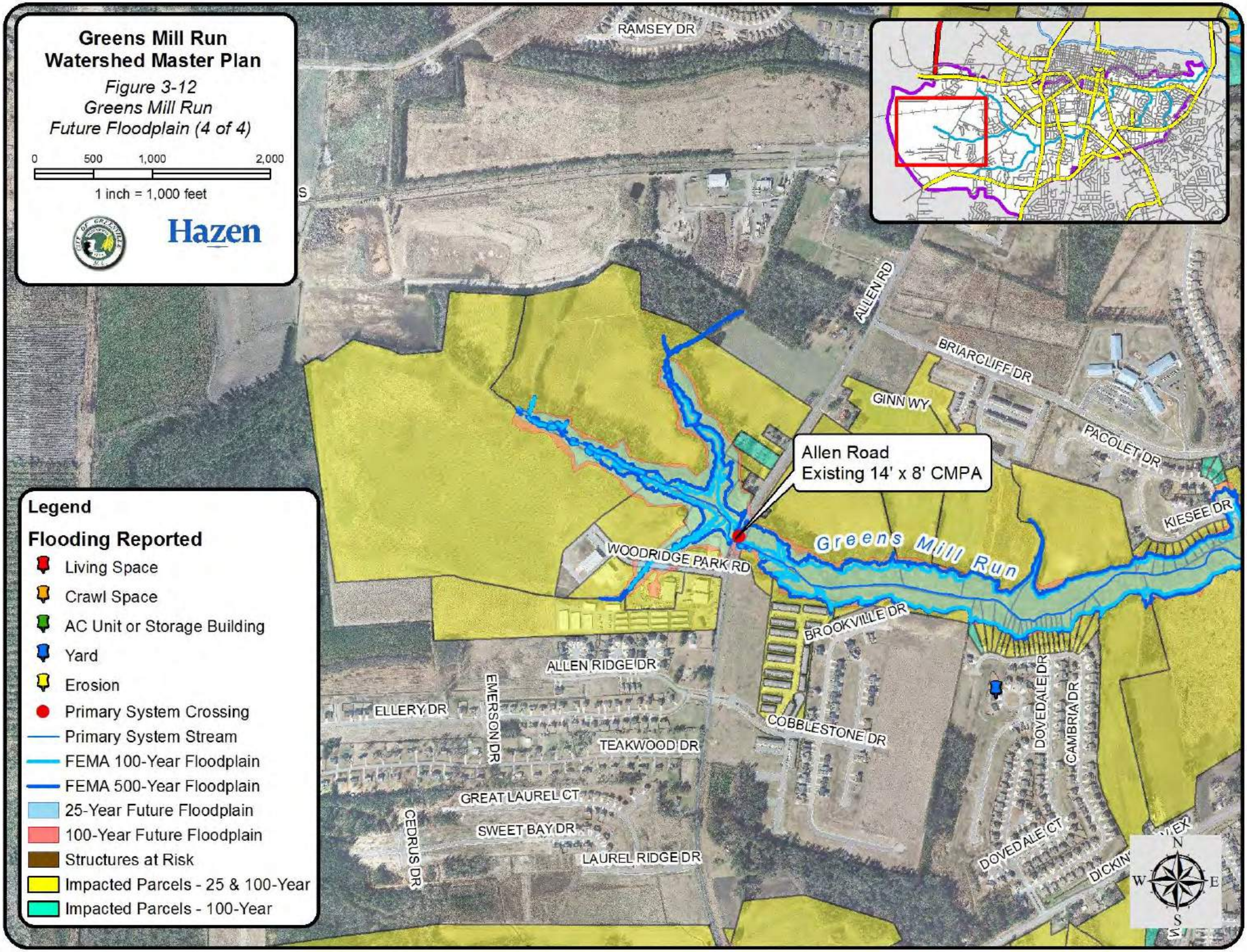
*Red shade indicates LAG flooding.

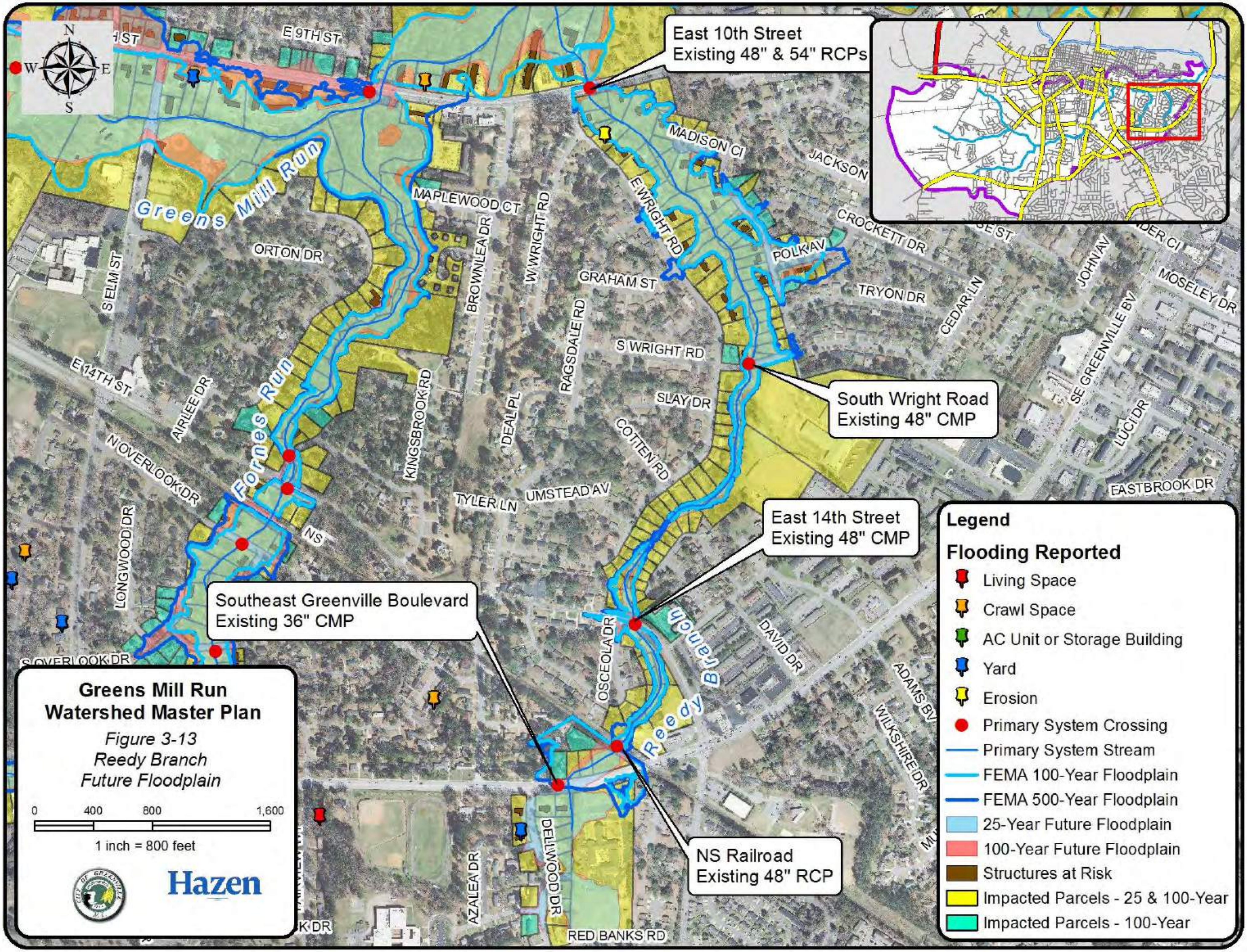

Greens Mill Run
Watershed Master Plan
Figure 3-9
Greens Mill Run
Future Floodplain (1 of 4)
0 500 1,000 2,000
1 inch = 1,000 feet
Hazen
Rock Spring Road
Existing Twin 15' x 9.4' CMPAs
College Hill Drive
Existing Twin 12' x 10' RCBCs
South Elm Street
Existing Twin 16.5' x 10.5' CMPAs
East 5th Street
Existing Single Span
Cored Slab Bridge
East 10th Street
Existing Triple 15' x' 13' RCBCs
Greens Mill Run
Fornes Run
Reedy Branch
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year



Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
East 14th Street
Existing 3 Span Cored Slab Bridge
NS Railroad
Existing 3 Span Girder Bridge
Charles Boulevard
Existing Triple 12.4 ' x 9.6' RCBCs
Evans Street
Existing Triple 12' x 6' RCBCs
West Arlington Boulevard
Existing Quadruple 12' x 8.5' RCBCs
CSX Railroad
Existing 12 Span Girder Bridge
Hooker Road
Existing Triple 12.8' x 8.8' RCBCs
South Memorial Drive
Existing Triple 11.5' x 9.7' RCBCs
Greens Mill Run
W 14TH ST
GOODEN PL
TRUMAN ST
HOOKER RD
PERKINS ST
S PITT ST
S GREENE ST
HOPKINS DR
EVANS ST
SULGRAVE RD
CHARLES BV
PIRATES WK
NS
SYLVAN DR
PITTMAN DR
ABEL ST
AVON LN
W BERKSHIRE RD
STRATFORD RD
CLIFTON ST
PALMETTO PL
OGLESBY DR
CURRY CT
MIMOSA CT
SUNSE
MERIDIAN DR
S MEMORIAL DR
MILLBROOK ST
BURRINGTON RD
CSX
LINDELL DR
N
S
E
W
Greens Mill Run
Watershed Master Plan
Figure 3-10
Greens Mill Run
Future Floodplain (2 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen

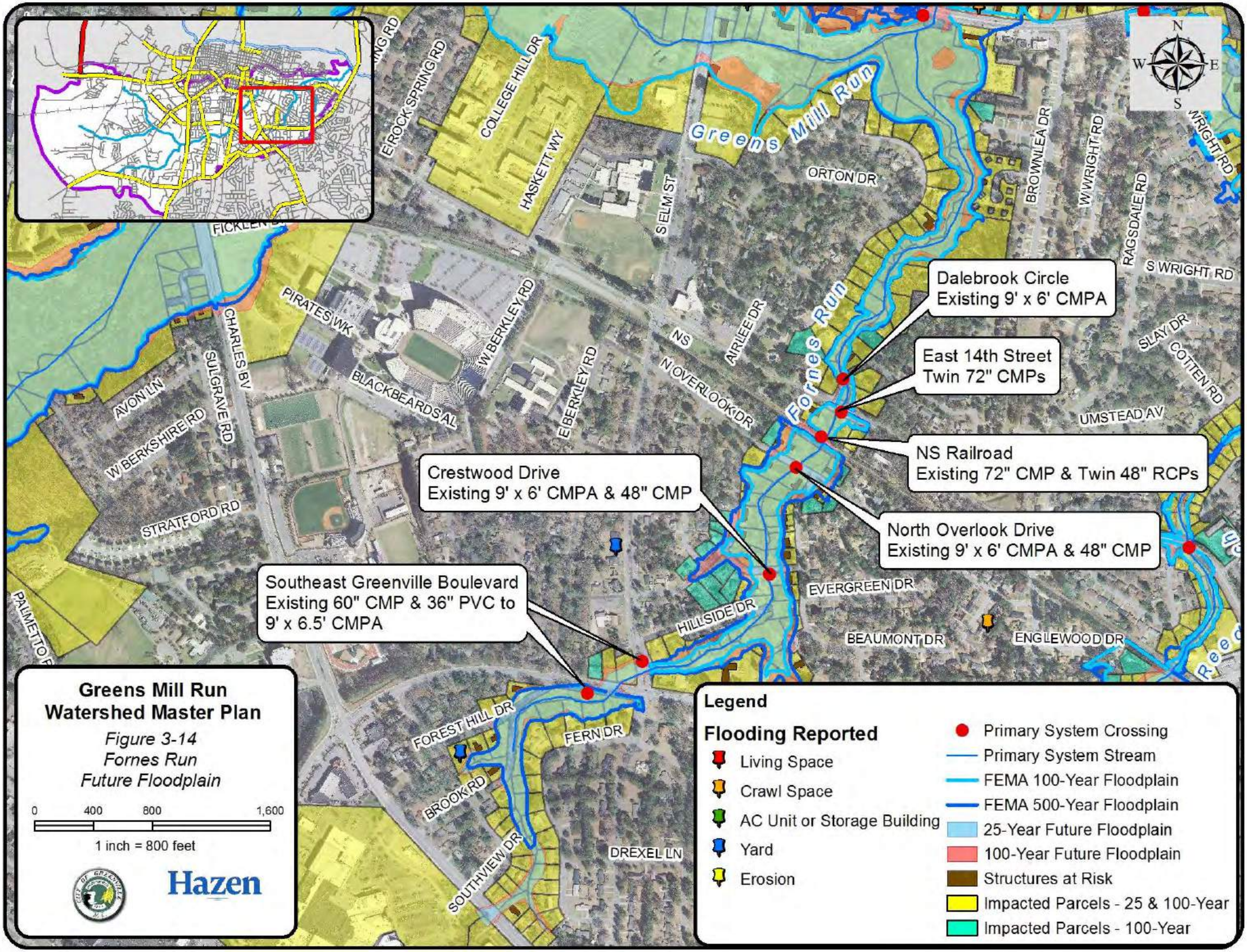

Greens Mill Run
Watershed Master Plan
Figure 3-11
Greens Mill Run
Future Floodplain (3 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Greens Mill Run
North Fork Greens Mill Run
Unnamed Tributary to Greens Mill Run
Dickinson Avenue Extension
Existing Twin 9' x 8.2' RCBCs
South Memorial Drive
Existing Triple 11.5' x 9.7' RCBCs
LAKE RD
MORTON LN
TREY DR
GORDON DR
ELLSWORTH DR
COURTNEY PL
PHILLIPS RD
DANSEY RD
KIESEE DR
GINN WY
MERIDIAN DR
S MEMORIAL DR
SUNSET AV
REMINGTON CT
DOVEDALE DR
CAMBRIA DR
DOVEDALE CT
DICKINSON AV EX
BEUNAVISTA CT
NOAH CT
WILLIAMS RD
LENA LN
ASHLAND PK
LARKSPUR LN
COPPERFIELD DR
MS PAUL LN
RIGGS LN
BOARDWALK LN
SHILOH DR
W GREENVILLE BV
N
S
E
W
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year

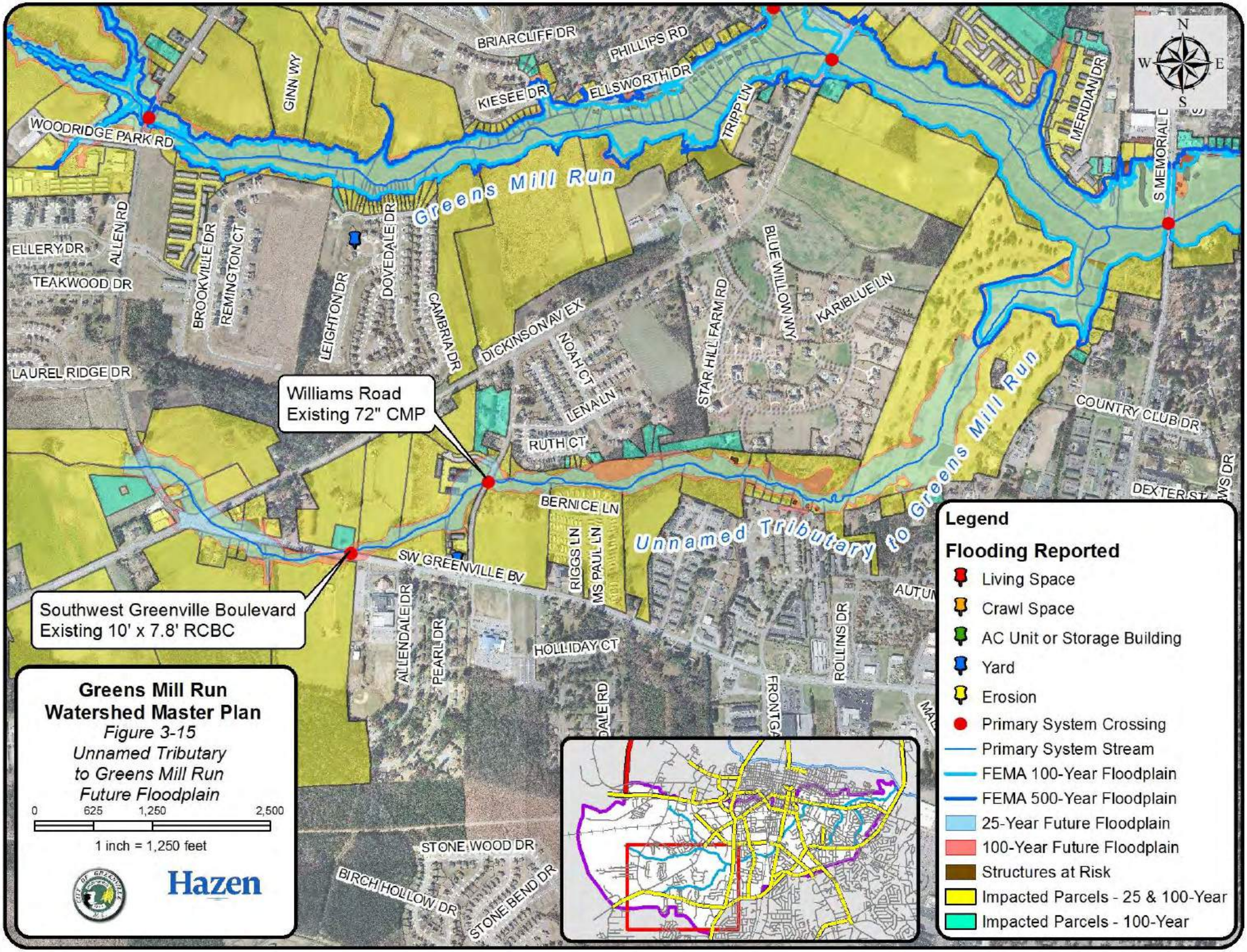

Greens Mill Run
Watershed Master Plan
Figure 3-12
Greens Mill Run
Future Floodplain (4 of 4)
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Allen Road
Existing 14' x 8' CMPA
Greens Mill Run
RAMSEY DR
ALLEN RD
BRIARCLIFF DR
GINN WY
PACOLET DR
KIESEE DR
WOODRIDGE PARK RD
BROOKVILLE DR
ALLEN RIDGE DR
ELLERY DR
EMERSON DR
TEAKWOOD DR
COBBLESTONE DR
DOVEDALE DR
CAMBRIA DR
GREAT LAUREL CT
SWEET BAY DR
CEDRUS DR
LAUREL RIDGE DR
DOVEDALE CT
N
S
E
W



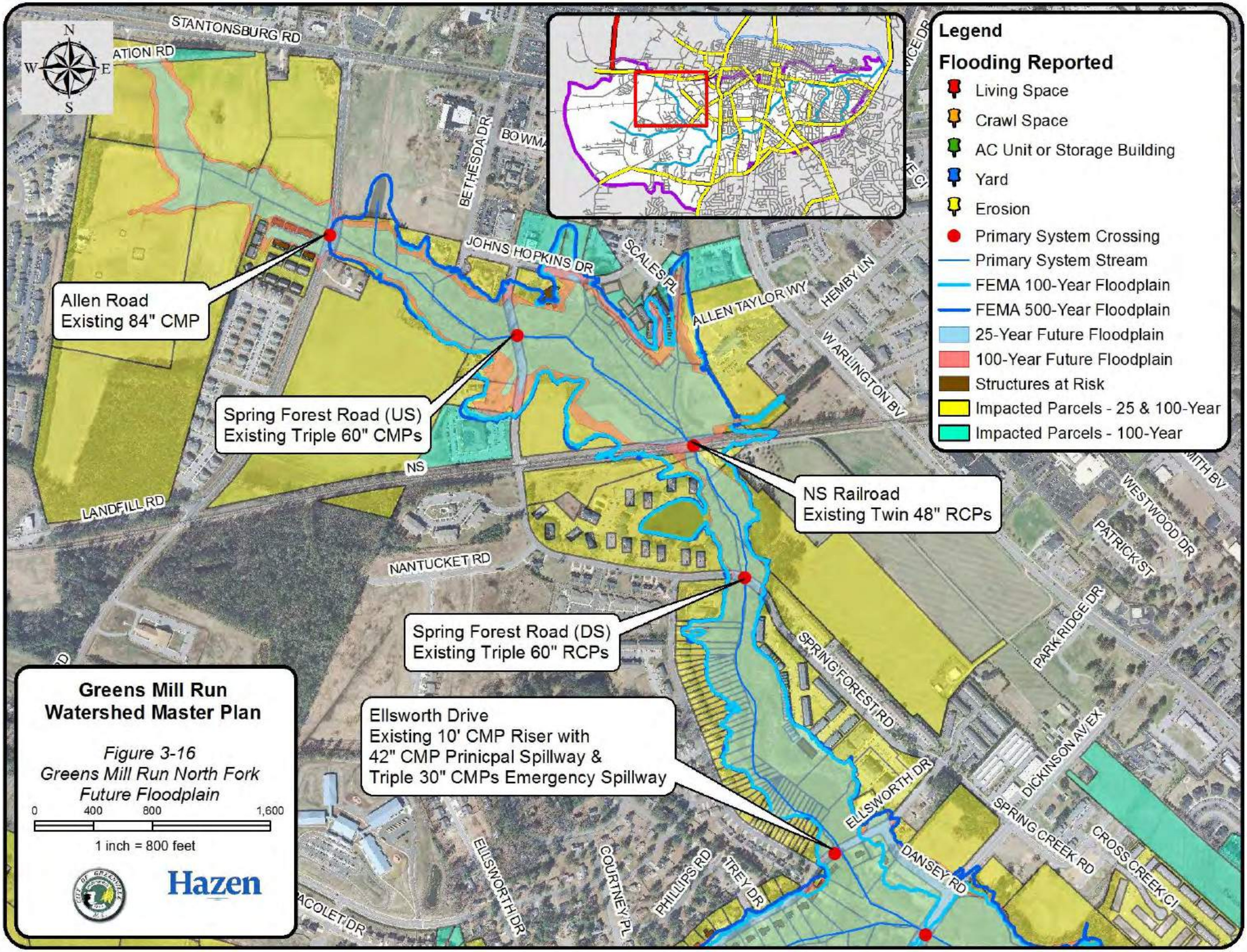
Greens Mill Run Watershed Master Plan

Figure 3-13
Reedy Branch
Future Floodplain


Greens Mill Run
Fornes Run
Reed
Dalebrook Circle
Existing 9' x 6' CMPA
East 14th Street
Twin 72" CMPs
NS Railroad
Existing 72" CMP & Twin 48" RCPs
North Overlook Drive
Existing 9' x 6' CMPA & 48" CMP
Crestwood Drive
Existing 9' x 6' CMPA & 48" CMP
Southeast Greenville Boulevard
Existing 60" CMP & 36" PVC to
9' x 6.5' CMPA
E ROCK SPRING RD
COLLEGE HILL DR
HASKETT WY
S ELM ST
ORTON DR
BROWNLEA DR
W WRIGHT RD
RAGSDALE RD
S WRIGHT RD
WRIGHT RD
PIRATES WK
CHARLES BV
SULGRAVE RD
AVON LN
W BERKSHIRE RD
STRATFORD RD
BLACKBEARDS AL
W BERKLEY RD
E BERKLEY RD
NS
N OVERLOOK DR
AIRLEE DR
SLAY DR
COTTEN RD
UMSTEAD AV
EVERGREEN DR
HILLSIDE DR
BEAUMONT DR
ENGLEWOOD DR
FOREST HILL DR
FERN DR
BROOK RD
SOUTHVIEW DR
DREXEL LN
N
S
E
W
Greens Mill Run
Watershed Master Plan
Figure 3-14
Fornes Run
Future Floodplain
0
400
800
1,600
1 inch = 800 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year



Greens Mill Run
Watershed Master Plan
Figure 3-15
Unnamed Tributary
to Greens Mill Run
Future Floodplain
0
625
1,250
2,500
1 inch = 1,250 feet
Hazen
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Primary System Crossing
Primary System Stream
FEMA 100-Year Floodplain
FEMA 500-Year Floodplain
25-Year Future Floodplain
100-Year Future Floodplain
Structures at Risk
Impacted Parcels - 25 & 100-Year
Impacted Parcels - 100-Year
Williams Road
Existing 72" CMP
Southwest Greenville Boulevard
Existing 10' x 7.8' RCBC
Greens Mill Run
Unnamed Tributary to Greens Mill Run
N
S
E
W
BRIARCLIFF DR
PHILLIPS RD
ELLSWORTH DR
KIESEE DR
GINN WY
WOODRIDGE PARK RD
TRIPP LN
MERIDIAN DR
S MEMORIAL DR
ALLEN RD
ELLERY DR
TEAKWOOD DR
BROOKVILLE DR
REMINGTON CT
LEIGHTON DR
DOVEDALE DR
CAMBRIA DR
DICKINSON AV EX
NOAH CT
LENA LN
RUTH CT
STAR HILL FARM RD
BLUE WILLOW WAY
KARIBLUE LN
LAUREL RIDGE DR
COUNTRY CLUB DR
DEXTER ST
BERNICE LN
RIGGS LN
MS PAUL LN
SW GREENVILLE BV
ALLENDALE DR
PEARL DR
HOLLIDAY CT
ROLLINS DR
STONE WOOD DR
BIRCH HOLLOW DR
STONE BEND DR



Greens Mill Run Watershed Master Plan

Figure 3-16
Greens Mill Run North Fork Future Floodplain

3.2 Secondary System Hydrologic and Hydraulic Analyses

Greens Mill Run and its tributaries are the primary source of flooding throughout the watershed. However, based on interviews with City personnel and resident input, fourteen areas were identified as stormwater networks with flooding concerns that warranted closer examination. These areas are primarily within developed neighborhoods and/or commercial districts that experience frequent nuisance flooding. The Secondary Systems evaluated were:

- Arlington Boulevard
- Bradley Street
- Brook Hollow Drive
- Brownlea Drive
- Cedar Lane
- Circle Drive
- Commerce Street
- Dellwood Drive
- Greenbriar Drive
- Lakewood Drive
- Jaycee Park
- Slay Drive
- Stratford Road
- Sulgrave Road

3.2.1 Hydrology

The Environmental Protection Agency Storm Water Management Model (EPA SWMM) was selected to model all of the Secondary Systems. SWMM is a dynamic rainfall-runoff simulation that incorporates both the hydrologic and hydraulic components into an integrated model. Through a series of subcatchment areas, SWMM calculates runoff from selected storm events.

As outlined in the City's SOP, the SCS Type III, 24-hour synthetic storm was used to develop discharges for the Secondary Systems. Five design storms were used for analysis of the existing conditions for each of the stormwater networks: 2-, 10-, 25-, 50-, and 100-year storms. A detailed description of the Secondary System model inputs and results can be found in **Appendix H**. A copy of the HEC-HMS models is provided digitally in **Appendix J**.

3.2.2 Hydraulics

Figures referred to in the following sections show the level of service for pipes within the systems analyzed. Level of service was determined based on surface surcharging of the upstream connected structure; for example, if the model showed surface surcharging at a structure in the 10-year event, but not the 2-year event, the connected downstream pipe was designated as <10-year LOS. Of note with respect to how SWMM models piping systems is that in some cases, system pipes showed up as adequately sized, or even with excess capacity, while upstream pipes showed up as undersized. The SWMM nodes that lead to undersized pipes were ponding water above them, or directing overflows to downstream nodes, thus the downstream nodes were not receiving the full flows from upstream nodes. The result was that when pipes known to be undersized were upsized, downstream pipes which were adequate were then overloaded with additional volume, and in many cases, required upsizing. These analyses considered pipe capacity and did not assess surface inlet capacity.

3.2.2.1 Arlington Boulevard System

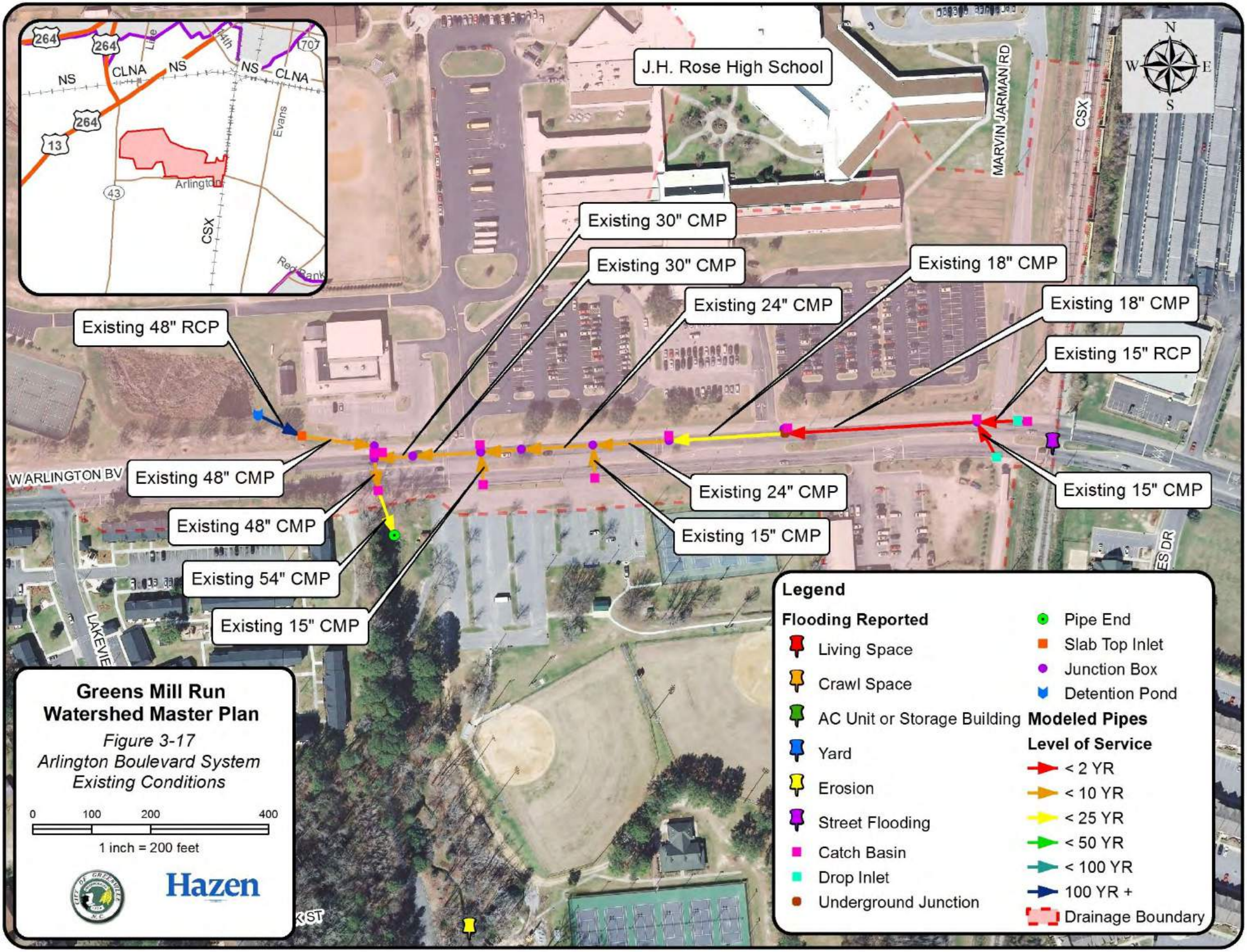
The Arlington system extends down West Arlington Boulevard, from the CSX Railroad at Marvin Jarman Road, to the outlet across the street from J.H. Rose High School, discharging into GMR. Portions of the overall system were combined into large subcatchment areas in locations where secondary branches entered into the main system. For example, the system that is piped into the large constructed wetland on the high school property was combined and represented by a single subcatchment area. The system has a combination of curb, drop, and slab top inlets. The City of Greenville reported road flooding where the railroad crosses West Arlington Boulevard. **Figure 3-17** illustrates the existing level of service for the Arlington Boulevard system. The entire system was determined to be undersized, except three pipes operating with a minimum 10-year LOS, including the outlet pipe.

3.2.2.2 Bradley Street System

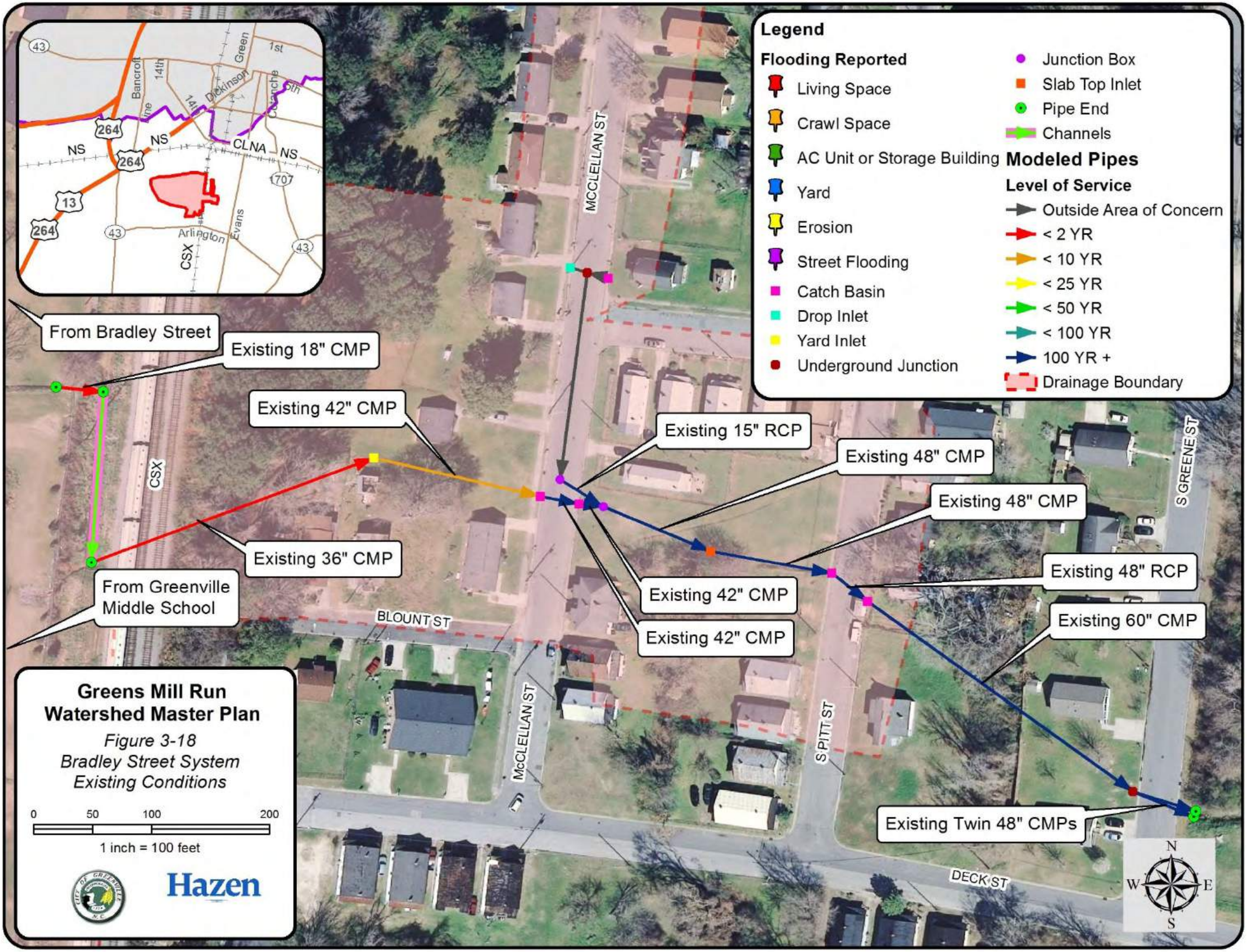
The Bradley Street system is located north of Greenville Middle School, off of West Arlington Boulevard. The stormwater network collects drainage from a housing development on Kennedy Circle and Bradley Street, and directs flows into a channel that is piped under the CSX Railroad. The network continues through a residential neighborhood, eventually discharging into another channel off of South Green Street, which flows directly into Greens Mill Run. The City of Greenville reported flooding at the end of Bradley Street, stating the railroad ditch frequently contains standing water that floods the yard at the end of Bradley Street. **Figure 3-18** shows the existing level of service for the Bradley Street system. Model results indicated that the 18” CMP at the end of Bradley Street and the 36” CMP that runs underneath the railroad perform at less than a 2-year level of service. The rest of the system was shown to be adequately sized.

3.2.2.3 Brook Hollow System

The Brook Hollow Drive system is located north of the intersection of Brook Hollow Drive and Dickinson Avenue. The drainage system encompasses approximately 39 acres of residential subdivision. The area is primarily multi-family residential 0.1 - 0.2 acre lots. The 48” reinforced concrete pipe (RCP) outfall discharges to a swale just outside of the stream buffer for Greens Mill Run. There was one flooding report from a resident of the Brook Hollow subdivision. The report addressed observed flooding on Brook Hollow Drive and erosion along the rear of the property, adjacent to the fence line. The existing LOS for the system is illustrated in **Figure 3-19**. Model results showed that much of the system is adequately sized, except in the area of Cambria Drive, which has a 2-year LOS. In the area of the erosion report along Croyden Circle, the system was shown to have adequate capacity. The erosion is believed to be caused by current construction in the immediate area. The subdivision is still undergoing construction and the temporary drainage may be diverting more offsite drainage than the surrounding drainage infrastructure (ditches and yard inlets) are designed to handle.



J.H. Rose High School
MARVIN JARMAN RD
CSX
W ARLINGTON BV
Existing 30" CMP
Existing 30" CMP
Existing 18" CMP
Existing 24" CMP
Existing 18" CMP
Existing 48" RCP
Existing 15" RCP
Existing 48" CMP
Existing 24" CMP
Existing 15" CMP
Existing 48" CMP
Existing 15" CMP
Existing 54" CMP
Existing 15" CMP
264
264
264
13
43
707
NS
CLNA
NS
NS
CLNA
Evans
Arlington
CSX
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Underground Junction
Pipe End
Slab Top Inlet
Junction Box
Detention Pond
Modeled Pipes
Level of Service
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary
Greens Mill Run
Watershed Master Plan
Figure 3-17
Arlington Boulevard System
Existing Conditions
0 100 200 400
1 inch = 200 feet
Hazen



Greens Mill Run Watershed Master Plan

Figure 3-18
Bradley Street System
Existing Conditions

Greens Mill Run Watershed Master Plan

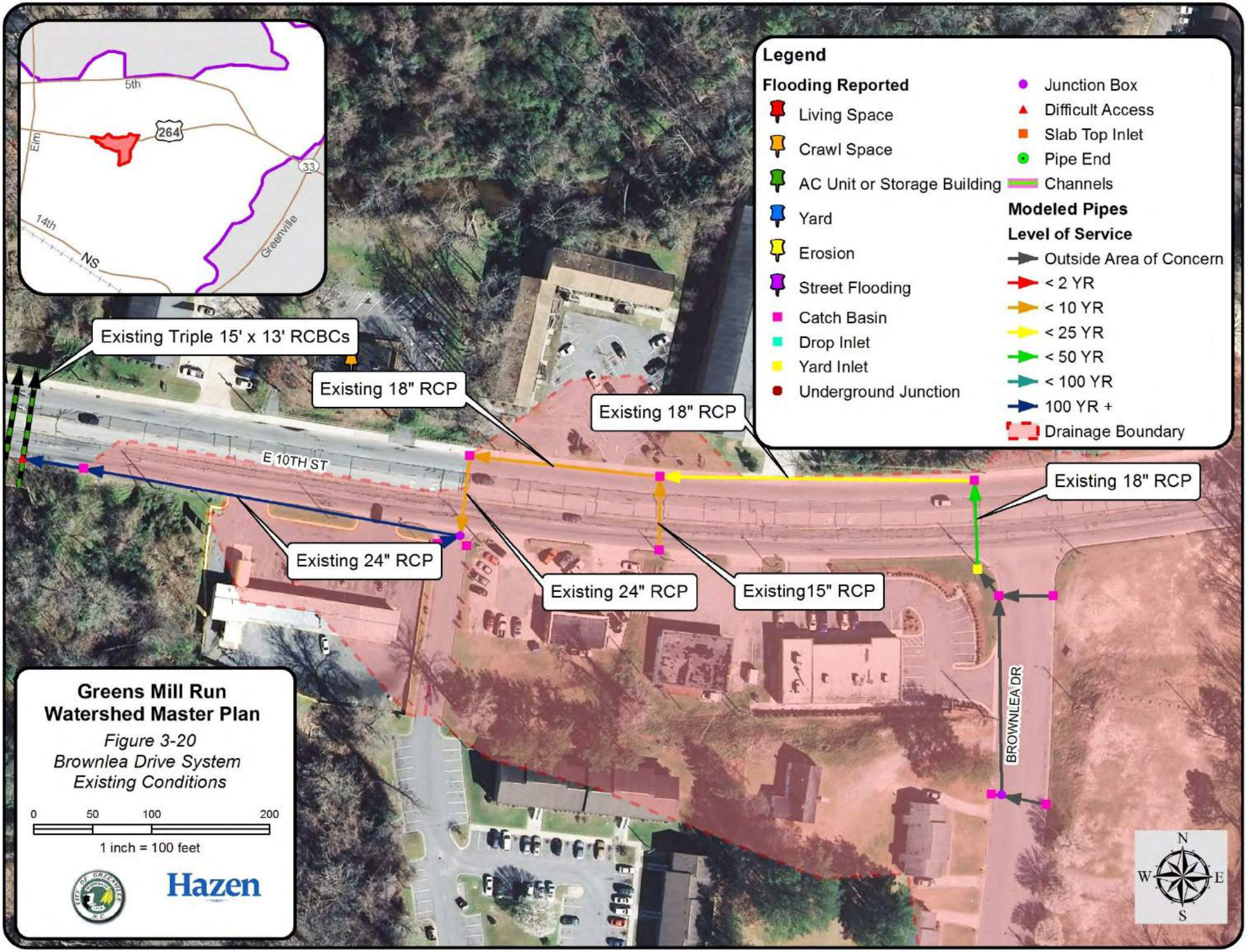
Figure 3-19
Brook Hollow Subdivision System Existing Conditions

3.2.2.4 Brownlea Drive System

The Brownlea Drive system is located along Brownlea Drive, north of Maplewood Court, to East 10th Street. The system then ties into the system that runs along East 10th Street to the culverts across Greens Mill Run to the west. The areas along Browlea Drive are primarily residential lots between 0.25 - 0.5 acres. Along East 10th Street, there is primarily commercial development and multi-family apartment complexes. A 24" RCP carries stormwater from Brownlea Drive and East 10th Street directly to Greens Mill Run. The outlet appears to be located inside the box culvert under East 10th Street. The owner of 1305 East 10th Street stated that 2 - 3 times per year, water runs from the street into the parking lot and is a few inches deep. The owner stated that street runoff enters his property via the upper of two driveways. The upper driveway does not have a concrete apron, and it appears that street runoff enters the driveway rather than being kept in the street, based on a qualitative analysis. Runoff that surcharges or bypasses the upgradient street inlet potentially impacts this property. **Figure 3-20** shows the existing LOS for the Brownlea System. The catch basins along 10th Street, between Brownlea Drive and the triple culverts along Greens Mill Run, were shown to surcharge during a 10-year storm event. The surcharging water then traveled down the street gutter causing flooding along 10th Street. For smaller storm events, an alternative that appears to have merit is to rebuild the upper driveway at 1305 East 10th Street.

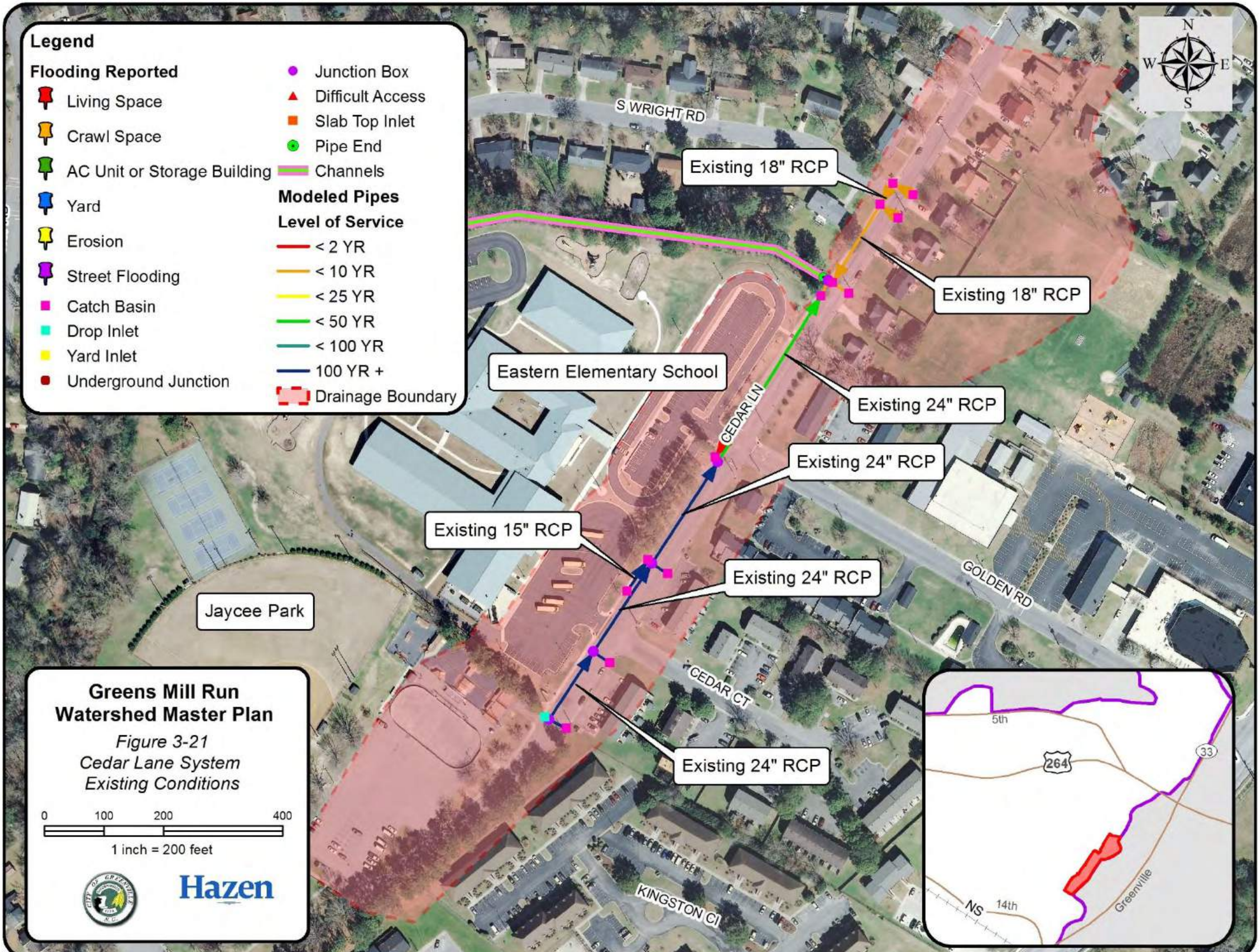
3.2.2.5 Cedar Lane System

The Cedar Lane system is located along Cedar Lane between Jaycee Park and Tryon Drive. The drainage area encompasses parking lots for Jaycee Park and Eastern Elementary School, and single family residential lots with < 0.5 acre lots. The outfall ditch is located between Eastern Elementary School and South Wright Road. The ditch joins another drainage system and continues until the confluence with Reedy Branch. The modeled outfall is located at the pipe end east of Jefferson Drive. The inlets are primarily catch basins with the central drainage pipe running underneath Cedar Lane. There were no reports of flooding in the immediate vicinity of this system; however, there was a report of street flooding at the intersection of Golden Road and Greenville Boulevard, but this is not part of the Cedar Lane system. According to modeling results, the northern portion of the Cedar Lane system did not meet a 10-year LOS. The existing 18" pipes surcharged and there was street flooding along Cedar Lane during the 10-year storm. The southern portion appeared to be adequately sized, even during a 100-year event. Refer to **Figure 3-21** for the level of service of individual pipes.



Greens Mill Run Watershed Master Plan

Figure 3-20
Brownlea Drive System
Existing Conditions



Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Modeled Pipes
Level of Service
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary
N
W
E
S
S WRIGHT RD
Existing 18" RCP
Existing 18" RCP
Eastern Elementary School
CEDAR LN
Existing 24" RCP
Existing 24" RCP
Existing 15" RCP
Existing 24" RCP
Jaycee Park
GOLDEN RD
CEDAR CT
Existing 24" RCP
KINGSTON CI
5th
264
33
14th
NS
Greenville
Greens Mill Run
Watershed Master Plan
Figure 3-21
Cedar Lane System
Existing Conditions
0
100
200
400
1 inch = 200 feet
Hazen

3.2.2.6 Circle Drive System

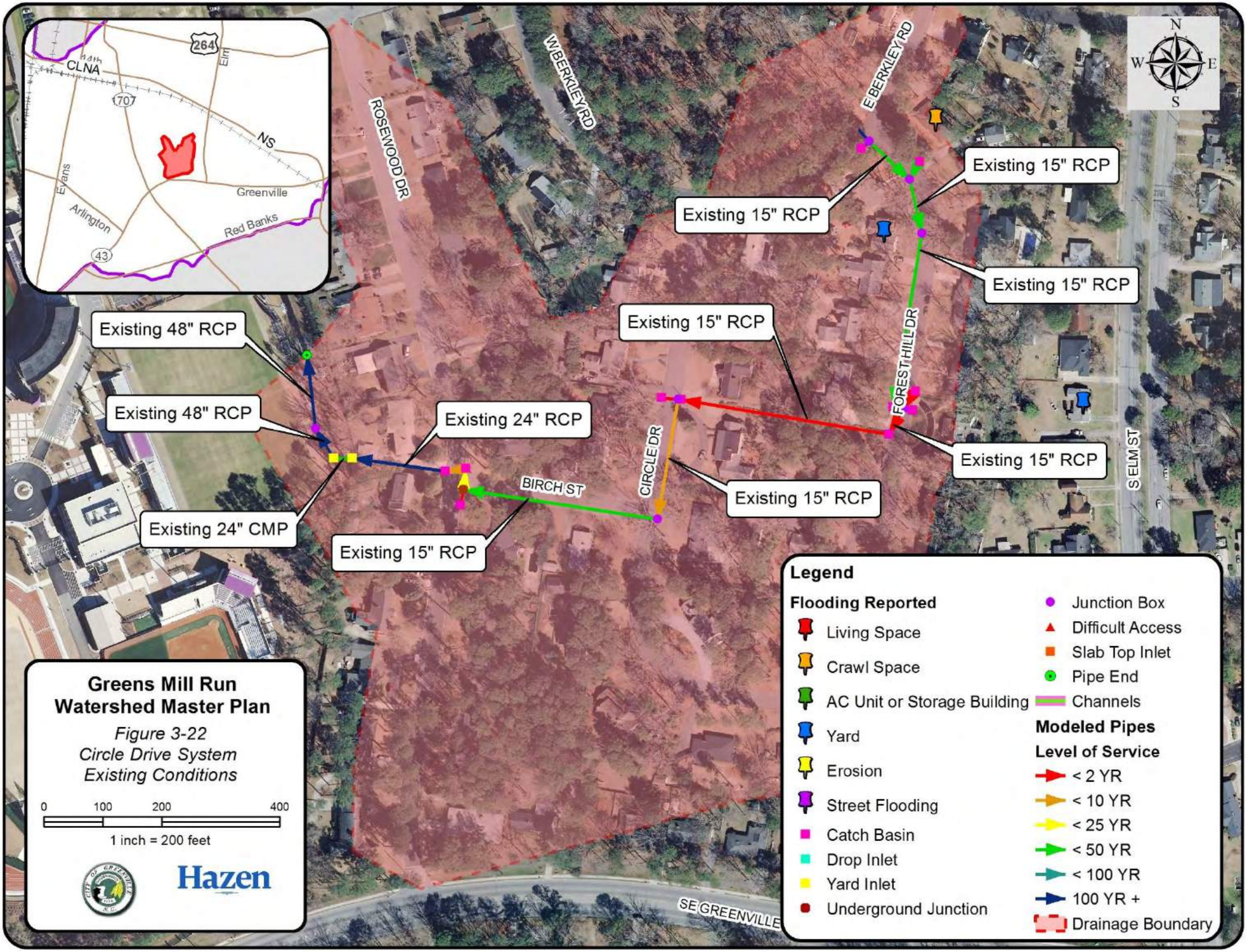
The Circle Drive system is located southeast of Dowdy-Ficklen Stadium, between Charles Boulevard and South Elm Street. The network runs through a residential neighborhood, starting on East Berkley Road and continuing down Forest Hill Drive. The network then cuts across Circle Drive, down Birch Street and then across Rosewood Drive. It outlets into a dry detention pond behind the stadium. Resident questionnaires reported street flooding and non-hurricane related flooding in this area, with water up to 6” in the street. One resident stated that the property has experienced crawl space flooding. There were additional reports of slow and possibly clogged drains. **Figure 3-22** illustrates the level of service for the existing system. The portion of the system crossing Circle Drive, at the intersection with Forest Hill Drive, appeared to be undersized, operating at less than the required 10-year LOS according to modeling results. The pipe crossing Rosewood Drive also failed to meet a 10-year LOS.

3.2.2.7 Commerce Street System

The area of concern for the Commerce Street system starts at a drop inlet on Commerce Street and runoff continues across several residential properties before discharging into a ditch. The ditch flows into a tributary leading to the Lakewood Drive system. Although outside the area of concern, the system includes the drainage network along Greenville Boulevard, East Arlington Boulevard, and the Best Management Practice (BMP) behind Greenville Square Shopping Center. This area was combined to create larger drainage areas where there were pipe size changes. The flooding report came from a business owner along Commerce Street. The owner specified that during heavy rains, the storm drains clogged and street flooding was a concern. The owner also reported parking lot flooding at his business. **Figure 3-23** shows the existing level of service for the portion of the Commerce Street system that is within the area of concern. Much of the system appeared to be appropriately sized. Pipes that surcharged at or below a 10-year LOS include the 18” CMP that runs underneath Commerce Street (surcharging during the 2-year storm), a 24” CMP immediately downstream (surcharging during the 10-year storm), and a 42” CMP running parallel to these pipes, eventually connecting to the system at a downstream manhole (surcharging in the 2-year event).

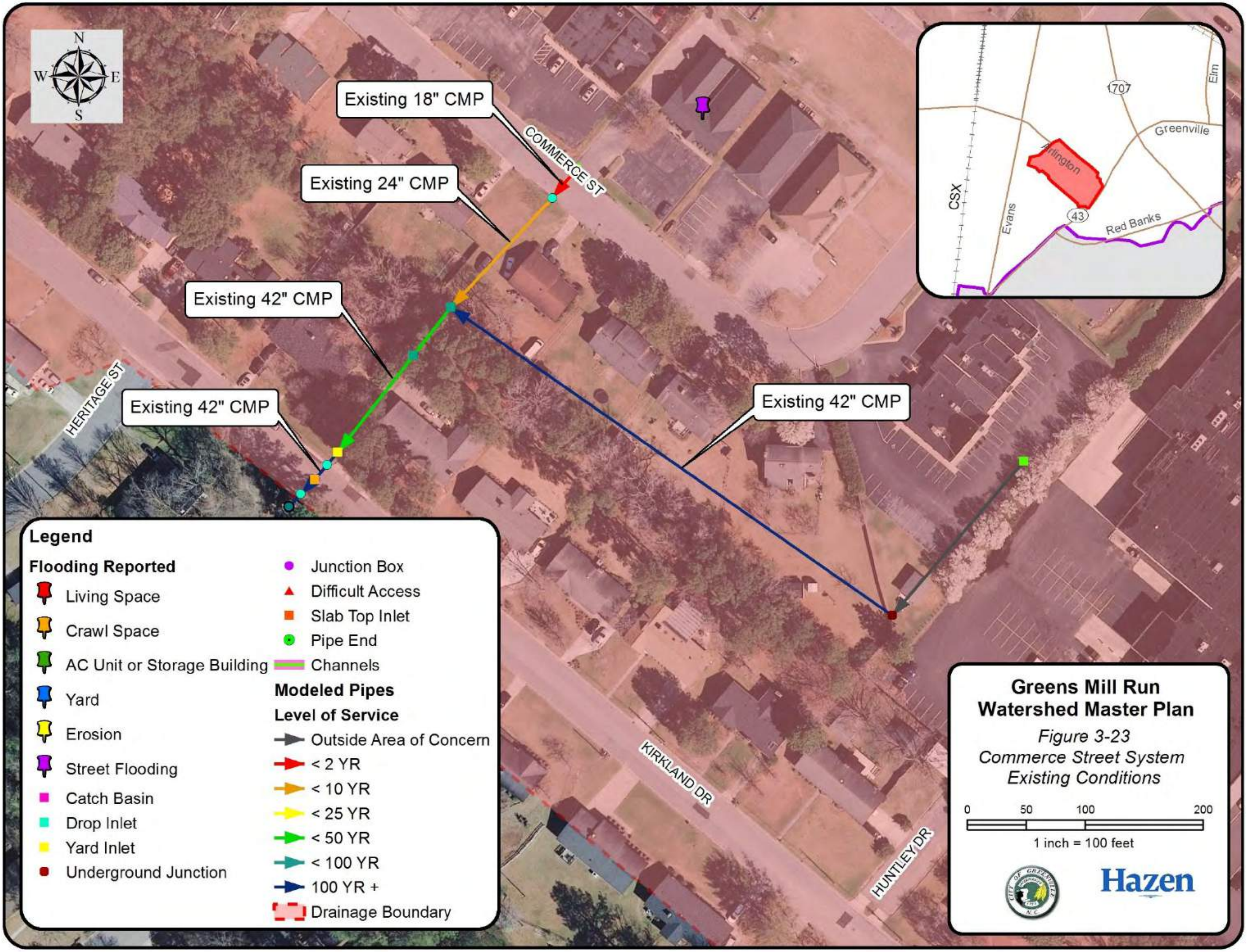
3.2.2.8 Dellwood Drive System

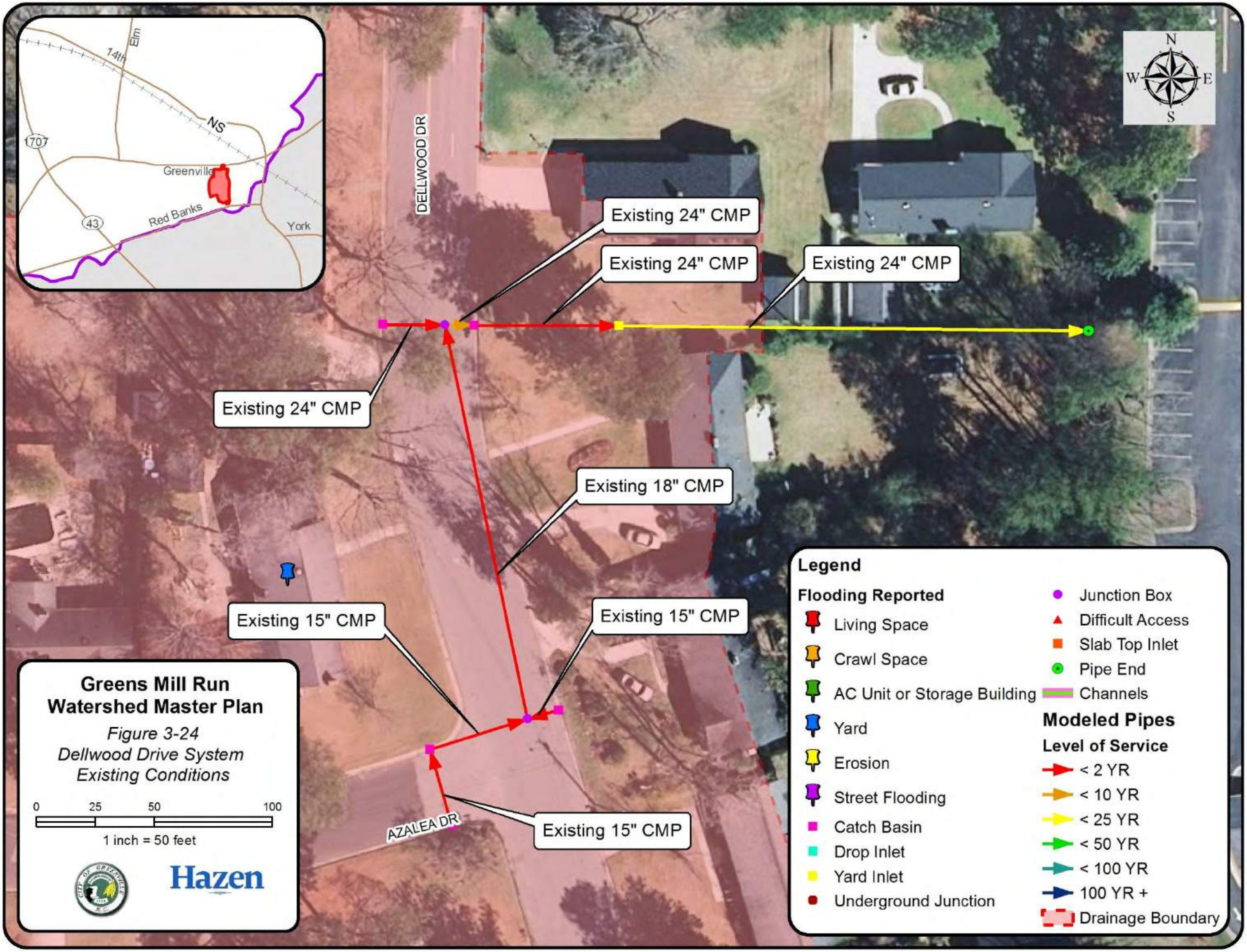
The Dellwood Drive system is located between Southeast Greenville Boulevard and Red Banks Road. The network drains the residential neighborhood between E.B. Aycock Middle School and Memorial Baptist Church. The system is primarily curb inlets with one yard inlet. The system discharges into a series of channels and pipes that leads to Reedy Branch. A resident in the area reported street flooding 2 - 3 feet deep, with water reaching over the hoods of cars. In addition, residents reported yard flooding 2 - 3 times per year. As illustrated in **Figure 3-24**, most of the system was shown to be undersized, with less than <2-year capacity. The 24” outlet pipe was the only pipe shown to meet the 10-year level of service.



Greens Mill Run Watershed Master Plan

Figure 3-22
Circle Drive System
Existing Conditions


N
S
E
W
Existing 18" CMP
Existing 24" CMP
Existing 42" CMP
Existing 42" CMP
Existing 42" CMP
COMMERCE ST
HERITAGE ST
KIRKLAND DR
HUNTLEY DR
CSX
Evans
Arlington
Greenville
Elm
Red Banks
707
43
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Modeled Pipes
Level of Service
Outside Area of Concern
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary
Greens Mill Run
Watershed Master Plan
Figure 3-23
Commerce Street System
Existing Conditions
0
50
100
200
1 inch = 100 feet
Hazen



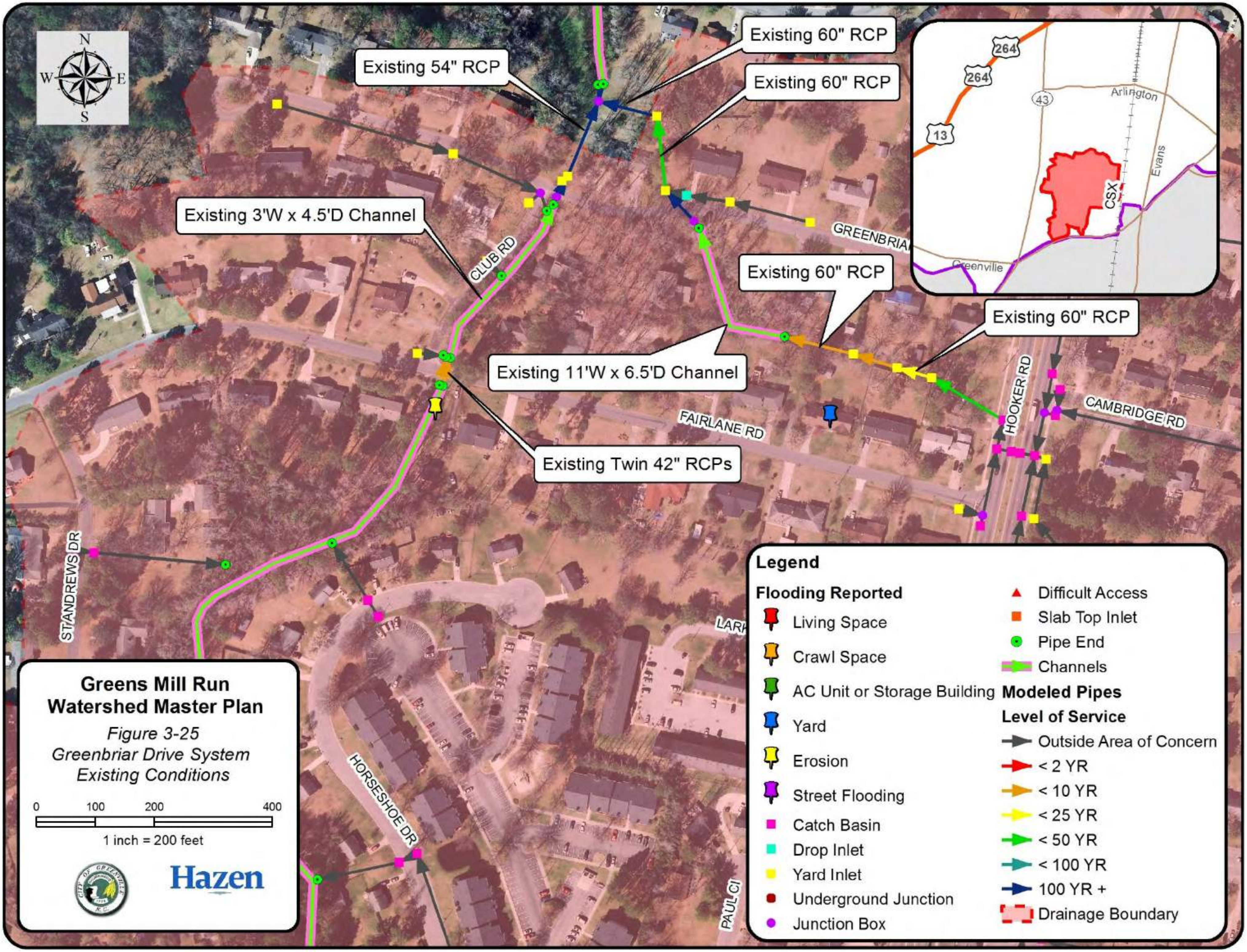
Greens Mill Run
Watershed Master Plan
Figure 3-24
Dellwood Drive System
Existing Conditions
0 25 50 100
1 inch = 50 feet
Hazen
Elm
14th
NS
707
Greenville
43
Red Banks
York
DELLWOOD DR
AZALEA DR
Existing 24" CMP
Existing 24" CMP
Existing 24" CMP
Existing 24" CMP
Existing 18" CMP
Existing 15" CMP
Existing 15" CMP
Existing 15" CMP
N
W
E
S
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Modeled Pipes
Level of Service
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary

3.2.2.9 Greenbriar Drive System

The area of concern for the Greenbriar Drive system is located between Fairlane Road and Greenbriar Drive. The network connects to a system flowing down Club Drive before discharging into Greens Mill Run. To accurately model the network, it was necessary to include the larger system that flows directly into the area of interest. The larger network has approximately 186 acres of drainage area and includes systems from Hooker Road, Fairlane Road, and Greenville Boulevard. The larger network was simplified to a series of larger subcatchments to focus on the area of concern. The Hooker Road and parallel networks are primarily commercial, multi-family and single family residential areas. City of Greenville staff reported that the main channel is incised with erosion problems along the entire reach. A resident on Fairlane Road reported yard flooding 2 - 3 times per year. As illustrated by **Figure 3-25**, the main 60" RCP trunkline between Fairlane Road and Greenbriar Drive was shown to be undersized. The double 42" RCP under Fairlane Road near Club Road also did not meet the required 10-year LOS.

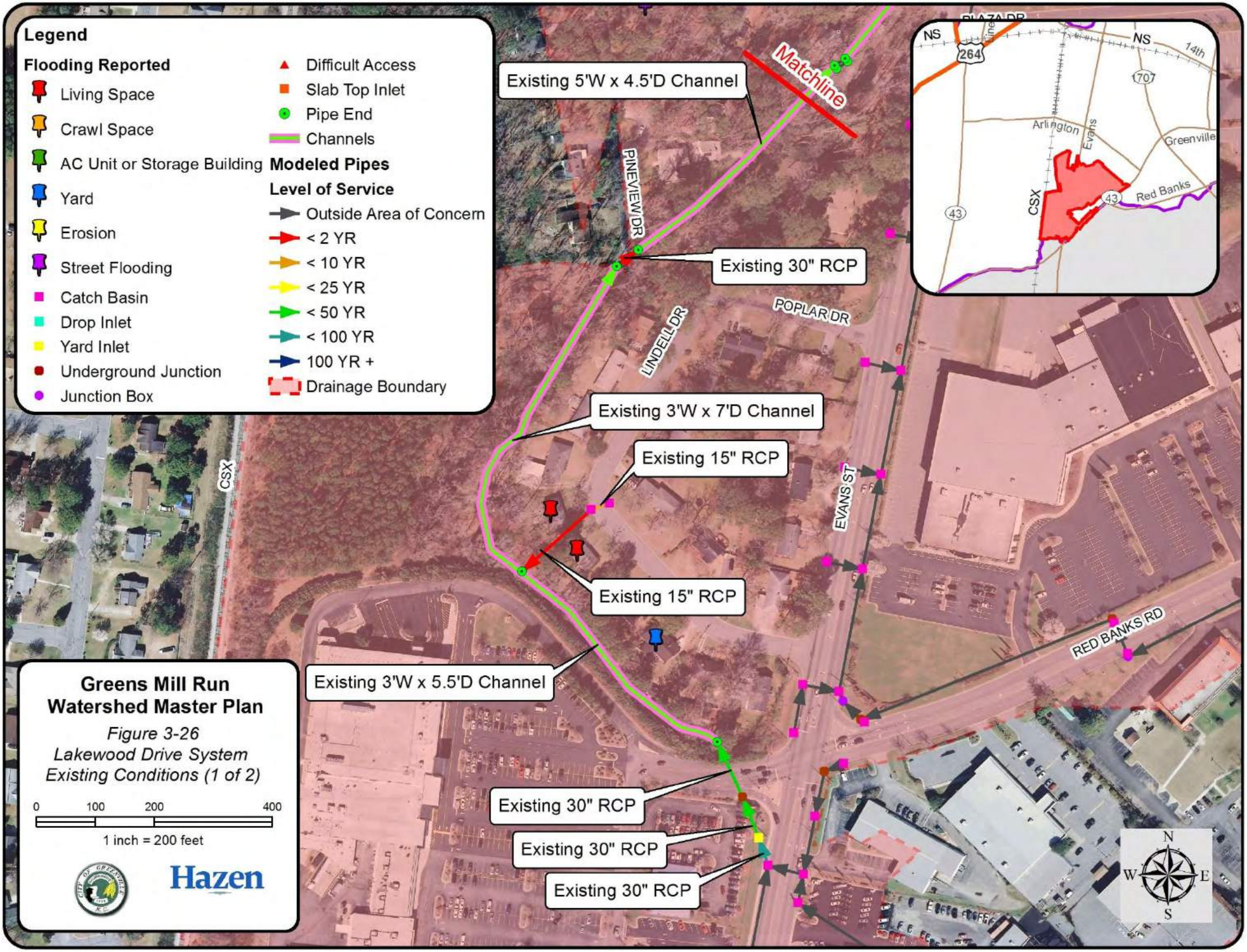
3.2.2.10 Lakewood Subdivision System

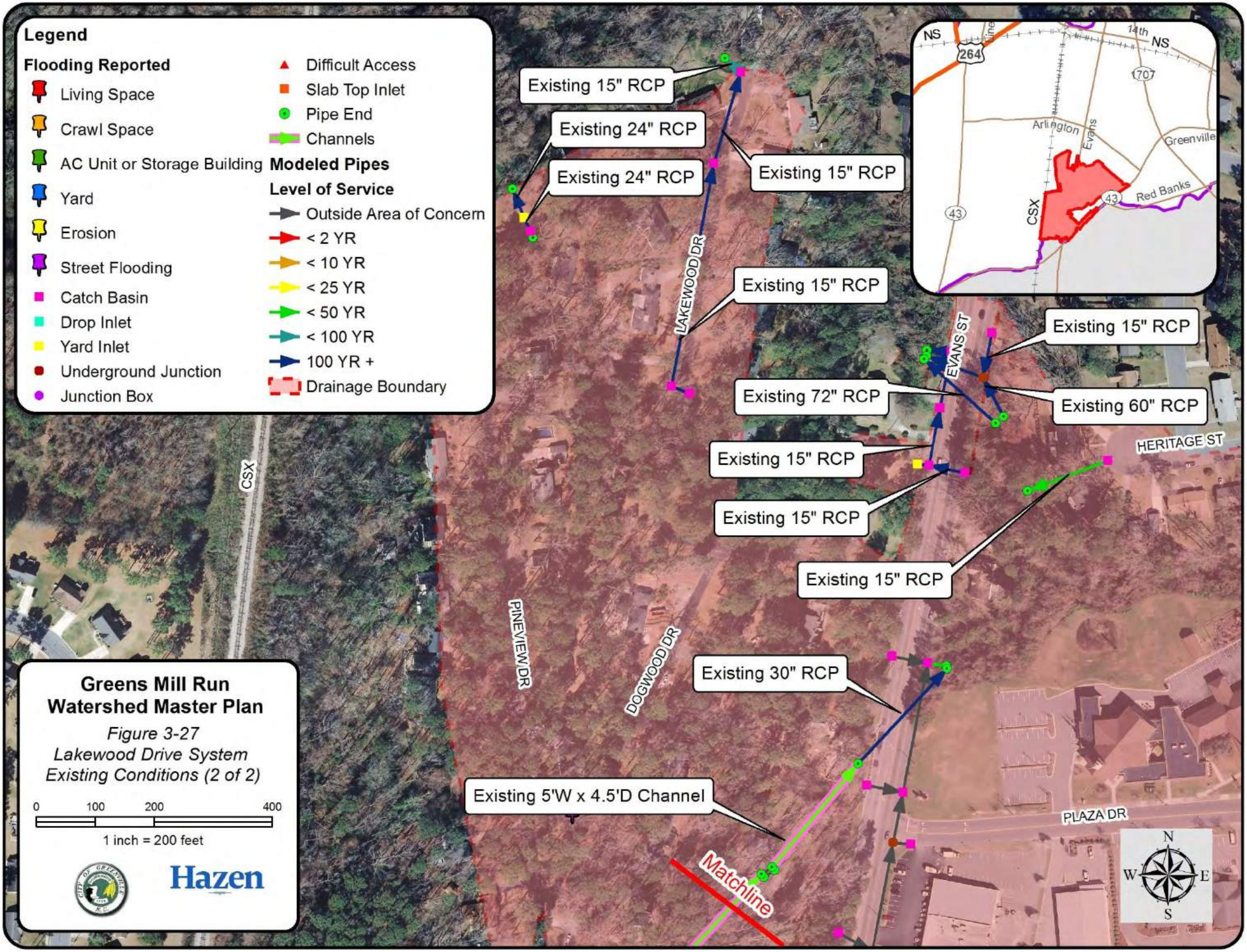
The Lakewood Drive system is located between the CSX Railroad and Greenville Boulevard. The system's drainage area encompasses approximately 152 acres, which includes drainage from University Commons Shopping Center, as it flows into a channel that passes through the residential neighborhood that ends at Lakewood Drive. The area of concern is the Lakewood subdivision. Residents of the subdivision have reported frequent flooding, stating that water backs up into the yards along Greens Mill Run, in addition to crawl space and residential building flooding. There were also three reports of residential building flooding along Lindell Drive. The reports stated that during rain events, water backed up into yards and crawl spaces. Lakewood residents reported the detention basin located behind the shopping center does not appear to receive runoff. Reports indicated that flooding has been exacerbated as the headwaters of the system have become more developed. The main channel shows signs of erosion and several large trees have been uprooted due to bank erosion. **Figure 3-26** and **Figure 3-27** shows the existing level of service for the system. The pipes along Lindell Drive were shown to be undersized, failing to meet the required 10-year LOS.



Greens Mill Run Watershed Master Plan

Figure 3-25
Greenbriar Drive System
Existing Conditions


Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Modeled Pipes
Level of Service
Outside Area of Concern
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary
Existing 5'W x 4.5'D Channel
Matchline
Existing 30" RCP
Existing 3'W x 7'D Channel
Existing 15" RCP
Existing 15" RCP
Existing 3'W x 5.5'D Channel
Existing 30" RCP
Existing 30" RCP
Existing 30" RCP
PINEVIEW DR
LINDELL DR
POPLAR DR
EVANS ST
RED BANKS RD
CSX
PLAZA DR
NS
264
707
14th
Arlington
Evans
Greenville
CSX
43
Red Banks
43
Greens Mill Run
Watershed Master Plan
Figure 3-26
Lakewood Drive System
Existing Conditions (1 of 2)
0
100
200
400
1 inch = 200 feet
Hazen
N
W
E
S



Greens Mill Run Watershed Master Plan

Figure 3-27
Lakewood Drive System
Existing Conditions (2 of 2)

3.2.2.11 Jaycee Park System

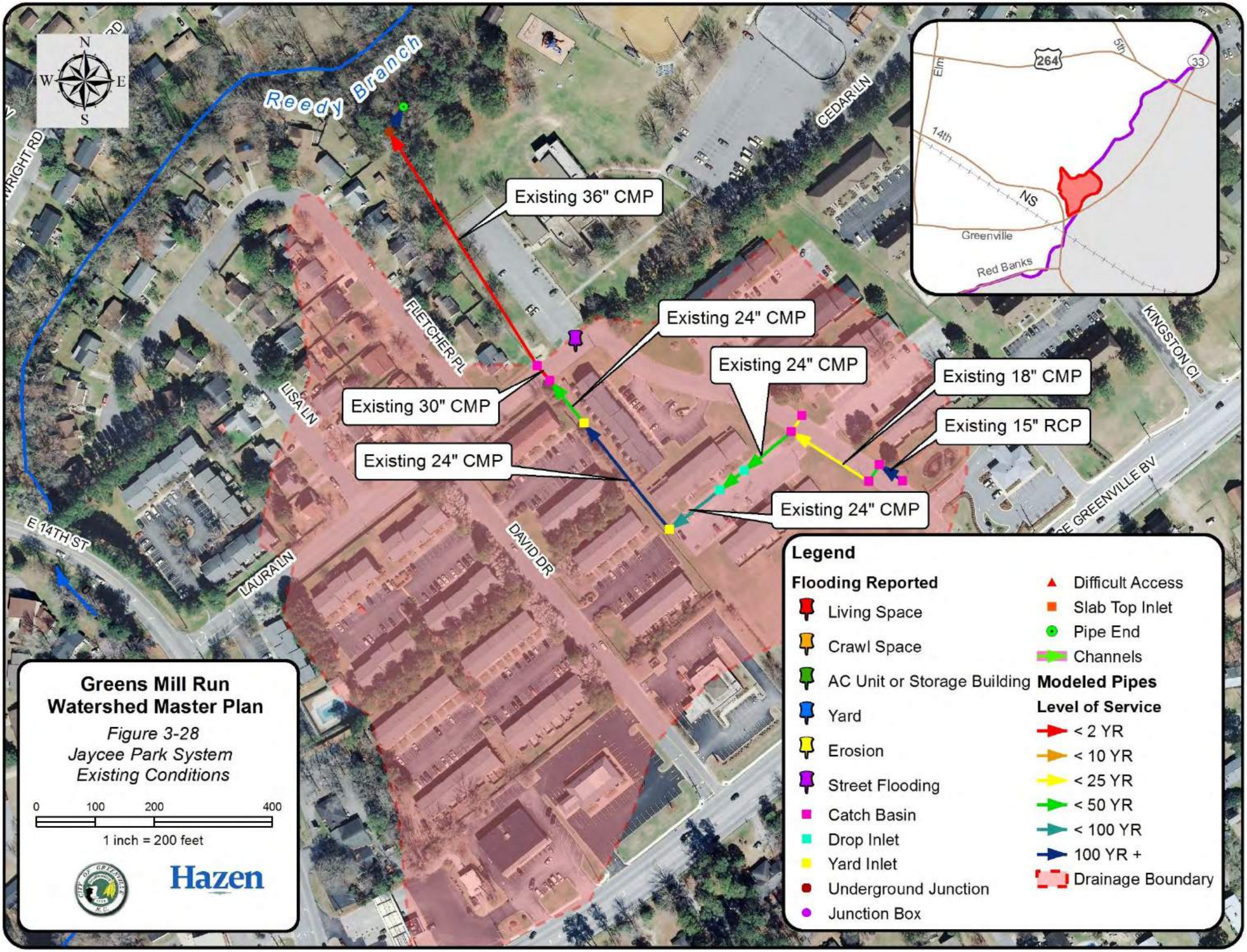
The Jaycee Park system is located off East 14th Street, before the intersection with Greenville Boulevard. The system's drainage area encompasses Laura Lane, David Drive, and portions of Fletcher Place. The total drainage area for the system is approximately 20 acres. The system is composed mainly of curb and gutter with catch basins along Laura Lane, and drop inlets located within a private parking lot. There is a drainage easement located between the multi-family residential lots along David Drive. The system discharges to Reedy Branch above the 100-year water surface elevation. The drainage area is comprised mainly of multi-family residential and small commercial lots along Greenville Boulevard, and single family residential with 1/8 acre lots. The City of Greenville reported frequent street flooding along Laura Lane in the sag adjacent to the Jaycee Park entrance, just past the intersection with Fletcher Place. **Figure 3-28** shows the existing system's level of service. The 30" pipe under Laura Lane and the 36" outlet pipe were shown to be undersized, with less than a 2-year LOS. The rest of the system appeared appropriately sized.

3.2.2.12 Slay Drive System

The Slay Drive system is located approximately 0.5 miles west of the US 64 Alt East, midway between East 10th and East 14th Streets. The area is primarily single-family residential lots with 0.25-0.33 acre lots. The Slay system drainage area encompasses approximately 25 acres of the residential subdivision. The 36" RCP outfall pipe discharges directly to Reedy Branch. There was one flooding report from the resident of 2405 Slay Drive. The resident reported yard flooding, but did not provide a frequency. As shown in **Figure 3-29**, two pipes along Ragsdale Road were shown to have less than a 2-year LOS. Along Slay Drive, several pipes appeared to operate at less than a 10-year LOS, though the main trunkline was shown to be appropriately sized.

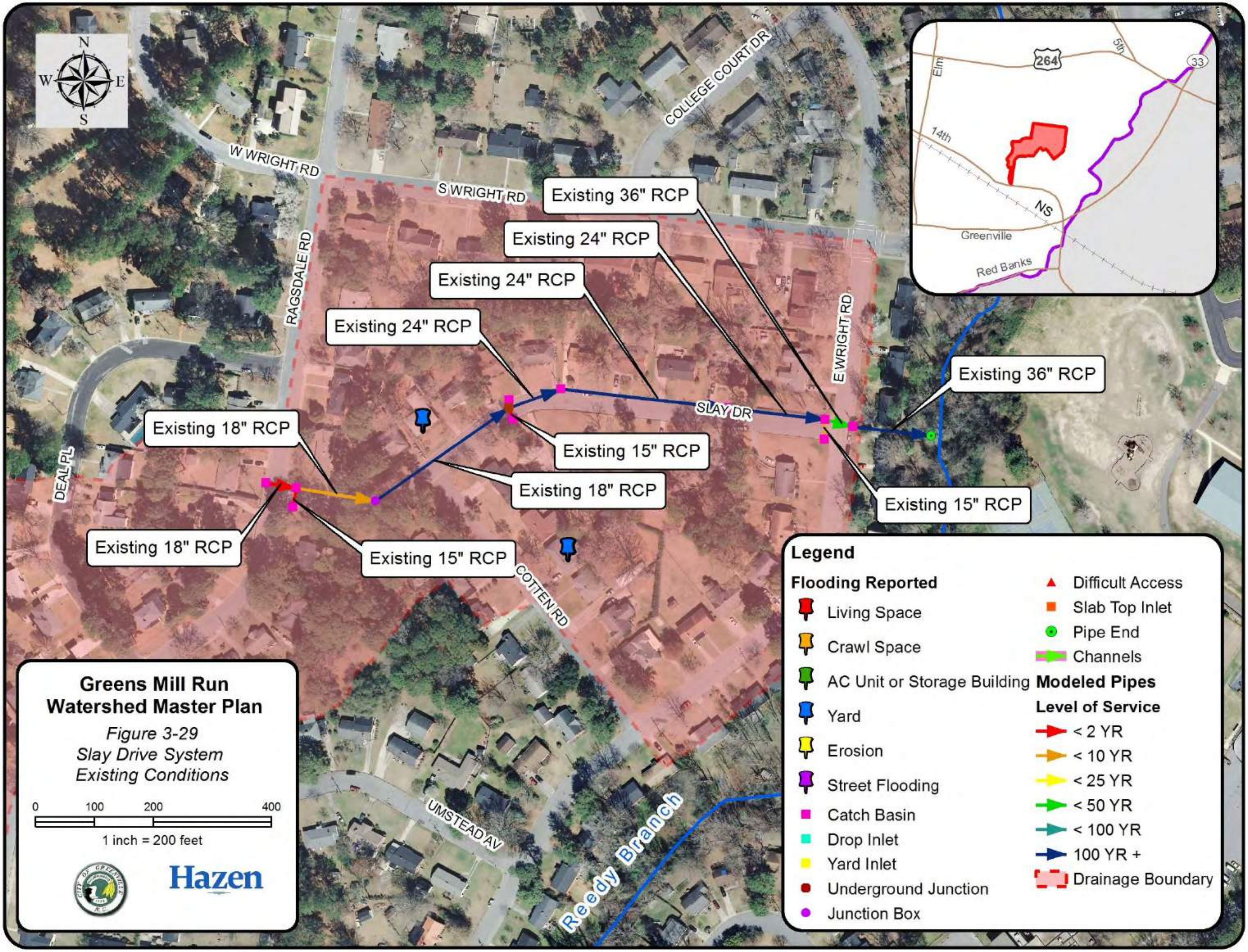
3.2.2.13 Stratford Road System

The Stratford Road system is located off of Charles Boulevard. Stratford Road is a small cul-de-sac, serving a residential neighborhood, which is the area of concern. The entrance to the neighborhood has double 36" elliptical culverts that run perpendicular to the road. The City of Greenville reported that these culverts have flooded 2 - 3 times in ten years. The culverts outlet into the same channel as the neighborhood's stormwater network, discharging to Greens Mill Run. The total drainage area for the culverts under Stratford Road is 86 acres. **Figure 3-30** illustrates the existing level of service for the stormwater network. Overall, modeling indicated that the system appeared to have adequate capacity to meet the 10-year LOS requirement, except for the eastern portion of the system. The models showed slight surface surcharging at the uppermost system structure for the 10-year event.



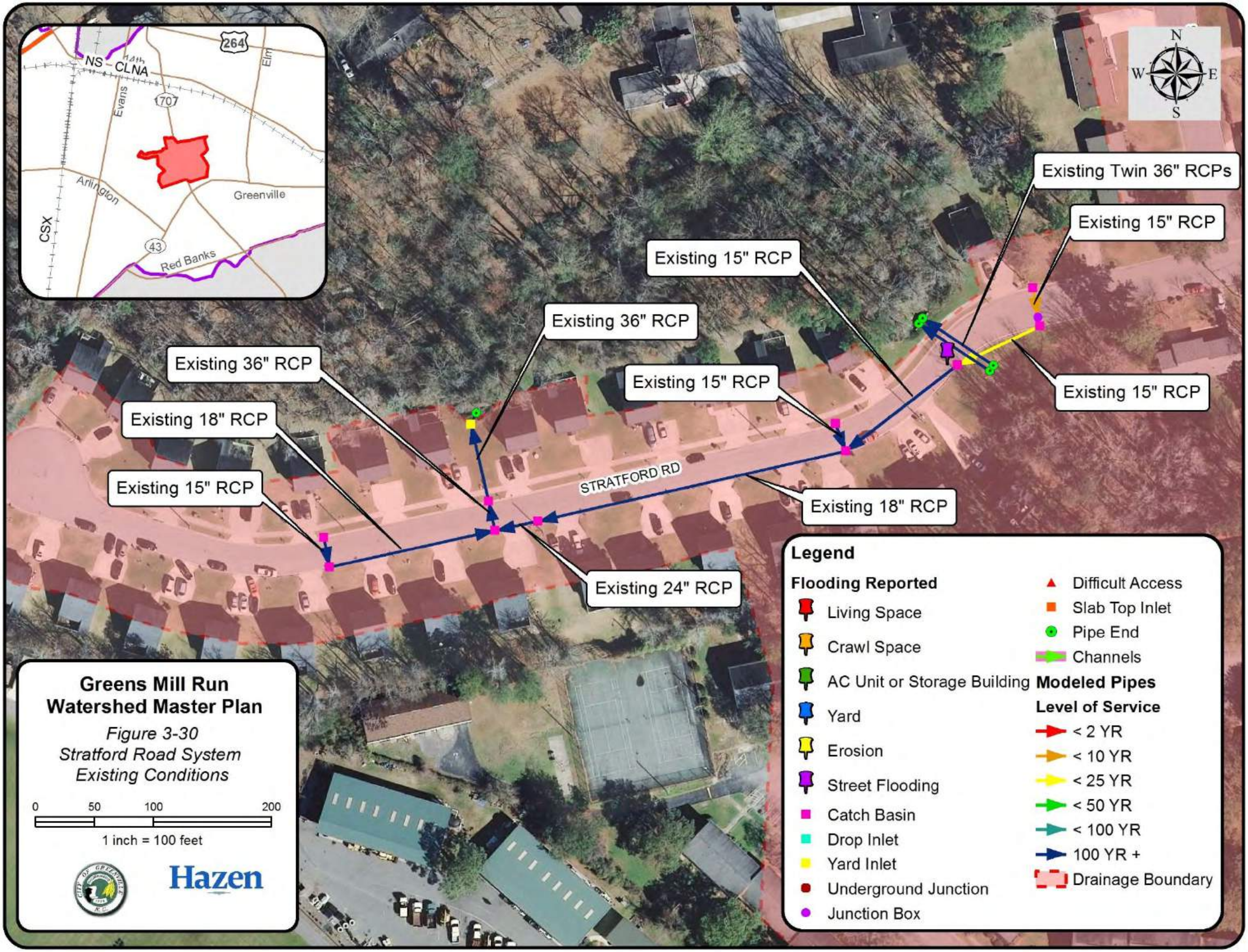
Greens Mill Run Watershed Master Plan

Figure 3-28
Jaycee Park System
Existing Conditions



Greens Mill Run Watershed Master Plan

Figure 3-29
Slay Drive System
Existing Conditions

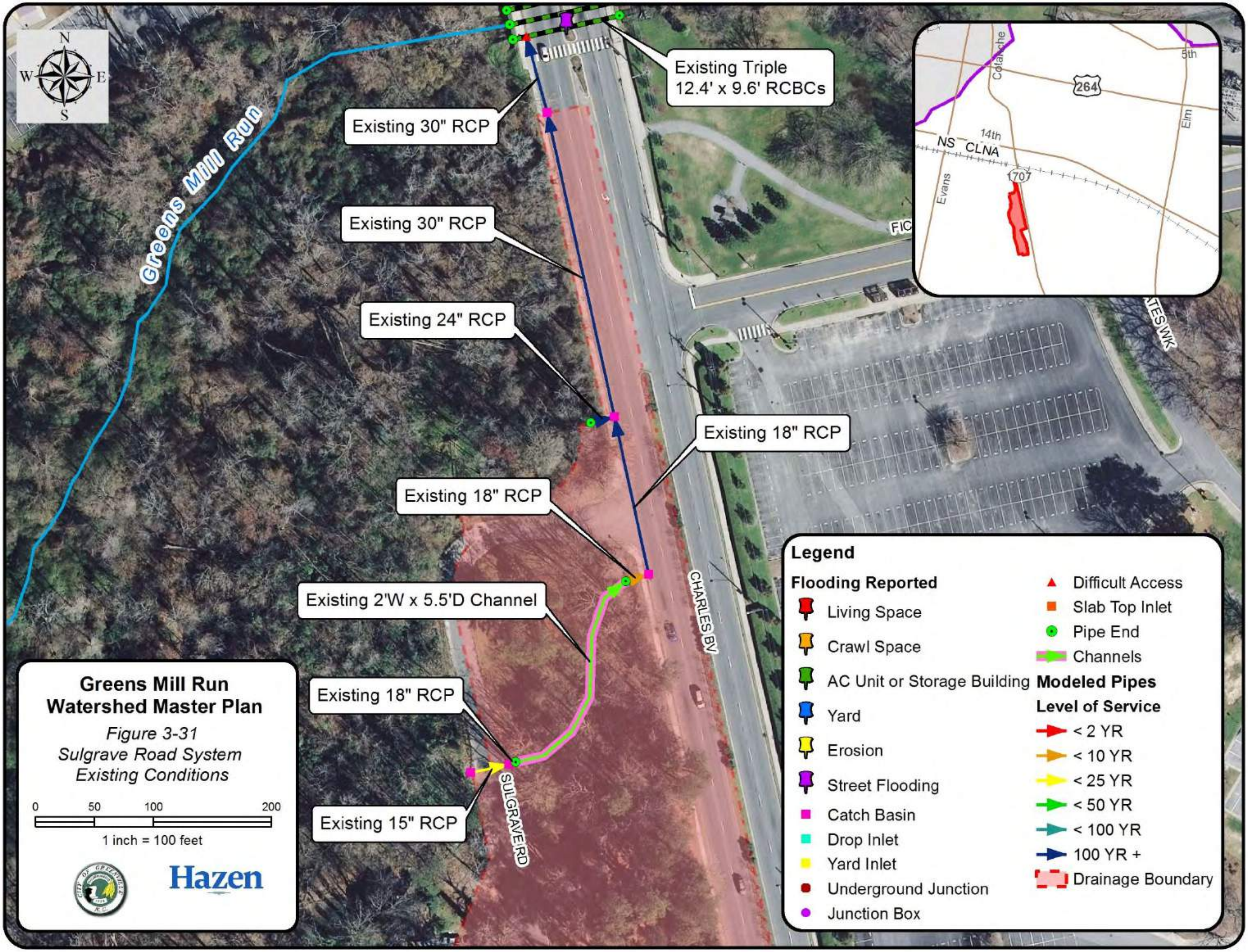


Greens Mill Run
Watershed Master Plan
Figure 3-30
Stratford Road System
Existing Conditions
0
50
100
200
1 inch = 100 feet
Hazen
Existing Twin 36" RCPs
Existing 15" RCP
Existing 15" RCP
Existing 36" RCP
Existing 36" RCP
Existing 15" RCP
Existing 15" RCP
Existing 18" RCP
Existing 15" RCP
STRATFORD RD
Existing 18" RCP
Existing 24" RCP
264
NS - CLNA
14th
Elm
Evans
707
Arlington
Greenville
CSX
43
Red Banks
N
W
E
S
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Modeled Pipes
Level of Service
< 2 YR
< 10 YR
< 25 YR
< 50 YR
< 100 YR
100 YR +
Drainage Boundary

3.2.2.14 Sulgrave Road System

The Sulgrave Road system is located across from Dowdy-Ficklen Stadium. It encompasses the system along Charles Boulevard and Sulgrave Road. The stormwater network drains a residential community through a series of pipes, which discharge into an open ditch before it re-enters a pipe network to discharge ultimately to Greens Mill Run. The modeled outfall is located inside the triple box culvert under Charles Boulevard that carries flows to Greens Mill Run. The City of Greenville staff reported that the GMR box culverts overtop the road 2 - 3 times per year. Field surveys indicated approximately 3 - 4 feet of sediment in the box culverts. Field photos also confirmed that the floodplain bench has not been maintained and that sediment is blocking a portion of the culvert. **Figure 3-31** depicts the system LOS. Modeling indicated that the main line along Charles Boulevard and the 15” pipe under Sulgrave Road were adequately sized for the required 10-year level of service, but the 18” inlet from the connecting ditch was undersized.

The system was also evaluated to determine what, if any, events might result in flooding as a result of Greens Mill Run tailwater. GMR water surface elevations just upstream of the Charles Boulevard crossing indicated that surcharging in the Sulgrave system occurred more frequently than a 2-year event. Therefore, it appears that the root cause of the reported flooding is tailwater from GMR.



Greens Mill Run Watershed Master Plan

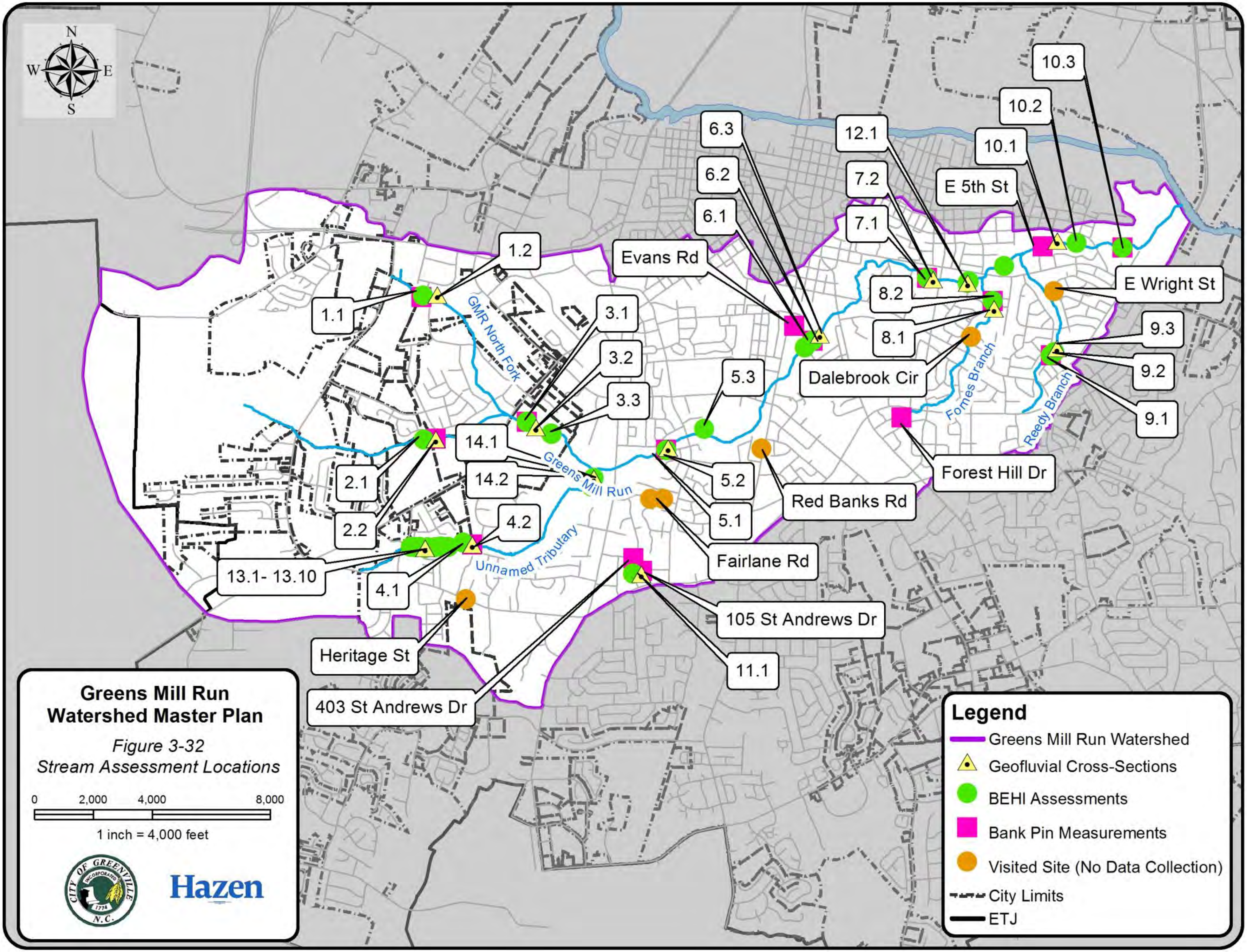
Figure 3-31
Sulgrave Road System
Existing Conditions

3.3 Stream Stability Field Assessments

The Primary System within the Greens Mill Run watershed includes approximately 13 miles of stream, including Greens Mill Run, Reedy Branch, Fornes Run, Greens Mill Run North Fork, and several unnamed tributaries. Initial assessments of potential stream stability issues were based upon several data sources, as listed below:

- Stakeholder reports
- Public questionnaire responses identifying bank erosion locations
- City of Greenville records of known bank erosion
- Pitt County parcels
- Streams
- Streets
- 2 foot LIDAR contours
- Greenville Utilities Commission (GUC) utilities geodatabase (electric, natural gas, water, sewer)
- Greenville stormwater geodatabase
- Aerial photography

Once potential bank stabilization opportunities were identified based on the above information, field visits were prioritized based upon location (i.e. ownership) and access for construction activities. A total of 39 sites were visited by field staff before selecting seven for consideration as possible water quality improvement projects (**Figure 3-32**). As discussed in the following sections, field data were collected at a total of 29 locations in the form of cross-sectional measurements and estimates of bank erosion and shear stress. This effort was followed by subsequent site visits to install bank pins at 15 locations to measure actual bank erosion. The objective in collecting the bank erosion measurements was to identify potential stabilization sites that have elevated levels of sediment loading and/or property damage.



N
E
S
W
1.1
1.2
GMR North Fork
2.1
2.2
3.1
3.2
3.3
14.1
14.2
Greens Mill Run
13.1- 13.10
4.1
4.2
Unnamed Tributary
Heritage St
403 St Andrews Dr
105 St Andrews Dr
11.1
Fairlane Rd
5.1
5.2
5.3
Red Banks Rd
Evans Rd
6.1
6.2
6.3
Dalebrook Cir
7.1
7.2
12.1
8.1
8.2
Fornes Branch
Forest Hill Dr
E 5th St
10.1
10.2
10.3
E Wright St
9.1
9.2
9.3
Reedy Branch
Greens Mill Run
Watershed Master Plan
Figure 3-32
Stream Assessment Locations
0
2,000
4,000
8,000
1 inch = 4,000 feet
Hazen
Legend
Greens Mill Run Watershed
Geofluvial Cross-Sections
BEHI Assessments
Bank Pin Measurements
Visited Site (No Data Collection)
City Limits
ETJ

3.3.1 Geomorphic Methodology

Data collection methodologies and geomorphic assessments were performed utilizing the Rosgen Natural Channel Design Methodology (Rosgen D. , 1996). The Rosgen Stream Classification System has four levels of assessment that utilize a combination of measureable parameters to characterize stream morphology, assess stream channel stability and validate prediction methods. Level I assessment is useful in providing a rapid delineation of general stream type (A through G) using broad-level criteria. These criteria can be determined at the watershed level using topographic and aerial maps.

Rosgen Level I stream assessments were performed in August 2014 and October 2015, along with further geomorphic data collection in the Greens Mill Run watershed. This work included the measurement of 10 permanent cross-sections, evaluation of bank erosion potential, near bank shear stress at 30 locations (including the ten cross-sections), and measurement of actual bank erosion with the installation of 42 bank pins at 15 locations.

3.3.2 Cross-Sections

All ten cross-sections were installed at riffle facets. Cross-sectional data included locating the following bank and bed features:

- Top of bank
- Bottom of bank
- Left and right edges of water
- Bankfull elevation
- Thalweg (deepest part of channel)

Bankfull channel dimensions (width, mean depth, maximum depth, cross-sectional area, width-to-depth ratio, and entrenchment ratio) were calculated after determining the bankfull elevation from the cross-section survey. Bankfull is defined as the elevation associated with the channel-forming discharge which is typically between the one and two-year storm events. Additionally, photographs were taken of each cross-section from the upstream, downstream, and left and right bank perspectives. The bankfull width-to-depth ratio describes the channel’s shape (i.e. a large number indicates a wide and shallow reach and small number indicates a narrow and deep channel). The entrenchment ratio represents the vertical containment of the reach.

The cross-sectional data provided in **Appendix K** provides a majority of the morphological measurements required for stream classification using the Rosgen methodology. **Table 3-9** summarizes a portion of the data collected for the broad, Level I stream classification protocol.

Table 3-9: Level I Stream Parameters and Classification

Cross Section Location	Reach	Drainage Area (sq mi)	Bankfull Width (ft)	Bankfull Depth (ft)	Bankfull Area (sf)	Rosgen Stream Classification
1.2	Greens Mill Run North	1.11	16.0	2.2	36	E5
2.2	Greens Mill Run	1.68	17.0	4.0	67	E5
3.2	Greens Mill Run	3.87	16.2	3.8	61	E5
4.2	Unnamed Tributary	1.56	19.9	3.4	67	E5
5.2	Greens Mill Run	7.68	19.4	3.9	76	E5
6.3	Greens Mill Run	10.1	21.6	3.1	66	E5
7.2	Greens Mill Run	10.7	29.1	3.3	96	G5
8.1	Fornes Run	0.91	13.6	3.3	45	E5
9.3	Reedy Branch	0.22	15.9	2.8	45	E5
11	Unnamed Tributary	0.04	4.0	2.1	8	G5
11.1	Unnamed Tributary	0.08	4.0	2.1	8	G5
12.1	Greens Mill Run	11.00	32.7	3.4	113	G6
13.1	Unnamed Tributary	1.44	20.3	3.1	63	E5
14.1	Unnamed Tributary	2.49	14.6	4.0	59	E5
14.2	Unnamed Tributary	2.49	14.3	3.3	47	E5

*Cross-section locations per **Figure 3-32**.

In the Rosgen Stream Classification system, E channels, typically, have a high sinuosity, a low width-to-depth ratio, and are stabilized with dense riparian vegetation from grasses and woody species. The E channel is hydraulically connected to its floodplain and is considered a stable form, however, it can be disturbed by changes in the watershed that affect sediment supply, streamflow or riparian vegetation. Classification G stream types are typically seen as a deeply incised, headcut gully found in the bottom of previous channels. G type channels typically exhibit vertical and lateral instability. Additional information regarding the Rosgen stream types, including additional stream types, may be found in *Applied River Morphology* (Rosgen D. , 1996).

3.3.3 Stream Bank Erosion

3.3.3.1 BANCS Model

Bank erosion was evaluated using methods from the Bank Assessment for Non-point source Consequences of Sediment (BANCS) model (Rosgen, 2006). Erosion rates were predicted by assigning a Bank Erosion Hazard Index (BEHI) and Near Bank Shear Stress (NBS) rating to various stream bank conditions. BEHI and NBS ratings range from “Very Low” to “Extreme” and were determined by evaluating the bank characteristics and flow distribution along stream reaches and mapping various risk ratings commensurate with bank and channel changes. The BEHI rating was determined by the physical condition of the stream banks which were evaluated based on the ratio of bank height to bankfull height, vegetative root depth and density, bank angle, percentage of surface protection, and composition of bank material. The NBS rating was determined by an assessment of shear stress on the stream bank. There are several methods that may be used to quantify the impact of shear stress. The method used to determine the NBS rating in this assessment was the ratio of the near-bank maximum bankfull depth to the mean bankfull depth. The BEHI and NBS ratings were compared with available stream bank erodibility curves to predict the annual erosion rates. North Carolina State University (NCSU) has developed curves for alluvial streams in North Carolina (2006). These erosion rates were used in the prediction of stream bank erosion since they were derived on data collected from similar geology (alluvium) as the streams in the Greens Mill Run watershed.

BEHI and NBS data were collected at 29 locations along the stream banks within the Greens Mill Run watershed. These points included the locations of the 10 cross-sections. Each location was evaluated as a single bank point, rather than for a length of bank. The complete field measurements and evaluation worksheets can be found in **Appendix K**. A summary of predicted erosion rates based on the BEHI and NBS ratings is provided in **Table 3-10.**

Based upon local experience, measured annual bank erosion rates for urban streams typically average 0.1 ft/yr. The BANCS assessment identified six areas where bank erosion was predicted to be greater than typical erosion rates: 1.2, 4.1, 7.1, 8.2, 9.1, and 12.1.

Table 3-10: Predicted Bank Erosion

Location	BEHI Rating	NBS Rating	Predicted Erosion Rate (ft/yr)	Location	BEHI Rating	NBS Rating	Predicted Erosion Rate (ft/yr)
1.1	High	Low	0.10	10.1	High	Low	0.10
1.2	High	Moderate	0.15	10.1	Moderate	Very Low	0.01
2.1	High	Low	0.10	10.2	Moderate	Low	0.02
2.2	Moderate	Low	0.02	10.2	Moderate	Very Low	0.01
3.1	High	Low	0.10	10.3	High	Low	0.10
3.2	High	Low	0.10	10.3	High	Very Low	0.07
3.3	High	Low	0.10	11.1 (L)	High	Low	0.10
4.1	Very High	Low	0.60	11.1 (R)	High	Low	0.10
4.2	High	Low	0.10	12.1	Very High	Low	0.60
5.1	Low	Low	0.02	13.1	High	Low	0.10
5.2	Low	Low	0.02	13.2	High	Low	0.10
5.3	Moderate	Very Low	0.01	13.3	High	Low	0.10
6.1	High	Low	0.10	13.4	High	Low	0.10
6.2	High	Low	0.10	13.5	High	Low	0.10
6.3	Moderate	Low	0.02	13.6	High	Low	0.10
7.1	Very High	Low	0.60	13.7	High	Low	0.10
7.2	Moderate	Low	0.02	13.8	High	Low	0.10
8.2	Very High	Low	0.60	13.9	High	Low	0.10
9.1	Very High	Low	0.60	13.1	High	Low	0.10
9.2	High	Low	0.10	14.1 (R)	High	Low	0.10
9.3	High	Low	0.10	14.1 (R2)	High	Low	0.10
9.3	High	Low	0.10	14.2	Moderate	Low	0.02

*Locations per **Figure 3-32**.
**Highlighted rows indicate predicted bank erosion greater than typical erosion rates.

3.3.3.2 Bank Pin Installation and Monitoring

In addition to the BEHI data, 39 bank pins were installed horizontally into the stream banks at 15 locations to measure actual bank erosion. The bank pins were initially installed in February 2015 and revisited in June and July 2015 to approximate annual bank erosion. An average of three pins (#5 rebar, typically 5/8” diameter by 36” long steel rods) were installed at each location for two scenarios: 1) banks considered to be particularly susceptible to bank erosion (typically outer stream banks in meander bends) and 2) banks in straight sections considered not to be particularly susceptible to bank erosion. Pins were installed above the water’s edge with the bottom pin installed at an average 1.2 feet vertical distance from the toe of bank. The second and third pins were spaced evenly from the bottom pin and top of bank, where reachable, at 1.4 feet, on average. Pins were driven with a sledge hammer, leaving approximately 2” to 4” of the bar exposed. The exposed end of the bar was marked with spray paint and photographs were taken for future discovery and measurement. The complete bank pin field measurements may be found in **Appendix K**. **Table 3-11** provides a summary of the measured bank erosion over a four to five month monitoring period and the estimated annual erosion rate.

It should be noted that bank pin erosion is typically measured over a minimum one year monitoring period to account for seasonal fluctuations in rainfall, peak discharge, and erosional processes related to vegetation and temperature (freeze/thaw). Due to the timing of the project deliverables, the estimated annual bank erosion rate was based on a monitoring period less than one year, ranging from 116 to 169 days. The estimated annual rates may not accurately reflect seasonal factors that affect bank erosion processes and could be higher or lower than what is reported in **Table 3-11**. Measured bank erosion rates exceeded typical, urban bank erosion of 0.1 ft/yr at Sites 3.1, 5.1, 6.2, 7.1, 10.3, Forest Hills Dr., Evans St., and East 5th St (site locations per **Figure 3-32**). Additionally, Sites 7.1, 9.1 and 10.3 showed signs of instability with bank slumping, burying, or partially burying of the bank pins.

Table 3-11: Measured Bank Erosion and Estimated Annual Erosion Rate

Location	Pin	Measured Bank Erosion at Pin (ft)	Estimated Annual Bank Erosion Rate (ft/yr)	Erosion Risk
1.1 (BEHI)[1]	Top	0.08	0.21	High
	Bottom	0.10	0.26	
2.2 (XS)[2]	Top	-0.02	N/A[3]	Very Low
	Bottom	-0.08	N/A[3]	
3.1 (BEHI)[1]	Top	1.51	3.91	Extreme
	Middle	1.29	3.34	
	Bottom	0.92	2.38	
4.2 (XS)[2]	Top	0.04	0.10	Moderate
	Middle	0.05	0.13	
	Bottom	0.02	0.05	
5.1 (BEHI)[2]	Top	-0.14	N/A[3]	Extreme
	Middle	-0.07	N/A[3]	
	Bottom	0.60	1.55	
6.2 (BEHI)[1]	Top	0.21	0.56	Extreme
	Bottom	0.12	0.32	
7.1 (BEHI)[1]	Top	-0.23	N/A[3]	Extreme
	Middle	0.09	0.23	
	Bottom	0.45	1.16	
8.2 (BEHI) [1]	Top	0.07	0.15	High
	Middle	0.10	0.22	
	Bottom	0.01	0.02	
9.1 (BEHI) [1]	Top	-0.02	N/A3	Extreme
	Middle	N/A[3]	N/A[3]	
	Bottom	N/A[3]	N/A[3]	
10.3 (BEHI) [1]	Top	-0.20	N/A[3]	Extreme
	Middle	0.19	0.51	
	Bottom	0.13	0.35	
105 St Andrews Dr[2]	Top	0.02	0.03	Moderate
	Middle	0.04	0.06	
	Bottom	0.10	0.16	
403 St Andrews Dr[2]	Top	0.15	0.23	High
	Middle	0.00	0.00	
	Bottom	0.01	0.02	
1908 Forest Hill Dr[2]	Top	2.77	8.72	Extreme
	Middle	0.11	0.35	
	Bottom	0.04	0.13	
1705 S Evans Street[1]	Top	0.38	1.20	Extreme
	Middle	0.21	0.66	
	Bottom	0.00	N/A[3]	
2200 East 5th St[1]	Top	0.26	0.82	Extreme
	Middle	-0.06	N/A[3]	
	Bottom	0.11	0.35	

*Locations per **Figure 3-32**.
**Bank pins were installed in February 2015 and re-measured in June 2015.
***Red shade indicates “Extreme” erosion risk.
[1]Banks considered to be susceptible to bank erosion at time of field assessment.
[2]Banks considered not to be susceptible to bank erosion at time of field assessment.
[3]In some locations, negative or zero values are reported for measured bank erosion due to bank sloughing burying pin or absence of bank erosion. Bank erosion rates are not applicable at these locations.

4. Flood Control Alternatives

4.1 Primary System

The Primary System within the Greens Mill Run Watershed consists of five streams: Greens Mill Run, Reedy Branch, Fornes Run, an unnamed tributary to Greens Mill Run, and Greens Mill Run North Fork. Roadway and railway crossings on each stream were analyzed under existing land-use conditions to identify locations of roadway overtopping. Crossings were categorized by owner (City of Greenville, NC Department of Transportation (NCDOT), CSX Railroad, Norfolk Southern Railway, etc). Roadways were further classified by traffic volume (Major, Minor), per the City of Greenville Urban Area Thoroughfare Plan.

4.1.1 Hydrology

The proposed improvements and associated levels of service were based upon future land-use conditions, using peak flows for the 2-, 10-, 25-, 50, and 100-year storm events developed using HEC-HMS. Most of the attenuation from the existing conditions HEC-HMS model was removed from the future conditions model, except for key points within Greens Mill Run and North Fork Greens Mill Run. Attenuation nodes used in future conditions model were:

- Greens Mill Run:
  - East 5th Street (River Station 4008)
  - Norfolk Southern Railway (River Station 14968)
  - CSX Railroad (River Station 21373)
- Greens Mill Run North Fork
  - Ellsworth Drive (River Station 841)
  - Norfolk Southern Railway (River Station 4027)

Attenuation was modeled in HEC-HMS using rating curves from HEC-RAS. When improvements in the hydraulic model resulted in changes to the stage-discharge curve of a modeled attenuation node, the rating curve from HEC-RAS was input to HEC-HMS to reflect the new relationship. The two models were then iterated until flowrates converged to within 1% difference and water surface elevations at the attenuation nodes were within 0.1 feet between the two models. The models were iterated and balanced for both Alternatives #1 and #2; however, the improvements associated with Alternative #2 remained balanced with the flows from Alternative #1, thus the same flow data were used in both HEC-RAS models. The improvements proposed in Alternative #2 had negligible effects on the stage-discharge relationships, compared to Alternative #1, thus the same flowrate data were used in both hydraulic models. The flow data is presented in **Table 4-1**. These flows are specific to the cumulative effect of improvements in the hydraulic models, thus all proposed improvements must be implemented for the stated performances to be achieved. Should certain projects not be implemented, or selections are made from more than one set of alternatives, then the hydrologic and hydraulic models should be rebalanced to develop appropriate flowrates. The selected projects should then be reevaluated to ensure adequate performance under the updated hydraulic regime.

4.1.2 Hydraulics

The hydraulic analysis for the proposed conditions was similar to the analysis completed for the existing conditions. The hydraulic model was updated to reflect proposed improvements to culverts, ineffective flow areas, and structure internal cross-sections. Where improvements caused a change to the stage-discharge curve of a modeled attenuation node, the updated rating curve was taken from HEC-RAS and input into HEC-HMS for flow balancing, as described above. The downstream boundary condition water surface elevations in the North Fork HEC-RAS model were updated to reflect the new elevations produced in the Greens Mill Run HEC-RAS model.

Table 4-1: Proposed Conditions Flows from HEC-HMS (Alternatives #1 & #2)

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Future Land-use Conditions (cfs) With Alternatives					Future Conditions
			2-year	10-year	25-year	50-year	100-year	100-year
Greens Mill Run								
Reach-660	U/S Limit of GMR	40149	315	597	798	975	1,170	1,170
Reservoir-770	Allen Road	37950	640	1,214	1,607	1,960	2,352	2,352
Reach-3100	U/S of Confluence with GMR North Fork	32869	710	1,460	1,986	2,458	2,986	2,986
Reservoir-2600	Dickinson Avenue	29957	973	1,955	2,632	3,189	3,959	3,849
Reach-780	D/S of Dickinson Avenue	29791	930	1,860	2,508	3,049	3,784	3,663
Reach-820	U/S of Confluence with Unnamed Tributary to GMR	27096	999	2,020	2,754	3,380	4,190	4,076
Reach-2500	D/S of Confluence with Unnamed Tributary to GMR	26096	1,338	2,797	3,902	4,901	6,092	5,989
Reach-860	D/S of Memorial Drive	25462	1,319	2,761	3,865	4,865	6,056	5,943
Reach-810	U/S of Hooker Road	23596	1,365	2,855	4,001	5,046	6,285	6,169
Reach-2400	D/S of Hooker Road	22704	1,364	2,857	4,007	5,056	6,299	6,182
Reach-790	U/S of CSX Railroad	21638	1,382	2,893	4,061	5,127	6,390	6,271
Reservoir-2300	CSX Railroad	21373	1,371	2,863	4,021	5,083	6,344	6,229
Reach-2300	D/S of CSX Railroad	21198	1,370	2,860	4,017	5,078	6,338	6,223
Reach-720	U/S of Arlington Boulevard	20096	1,392	2,905	4,080	5,161	6,439	6,329
Reservoir-2200	Arlington Boulevard	19396	1,395	2,913	4,091	5,175	6,457	6,346
Reach-600	U/S of Charles Boulevard	17596	1,449	3,013	4,217	5,338	6,663	6,604
Reach-3800	D/S of Charles Boulevard	15023	1,454	3,028	4,239	5,367	6,700	6,642
Reservoir-2100	Norfolk Southern Railroad	14968	1,410	2,898	4,021	5,029	6,195	6,603
Reach-2100	D/S of Norfolk Southern Railroad	14807	1,409	2,897	4,019	5,027	6,191	6,601
Reach-4700	Near 11th Street	13604	1,410	2,897	4,019	5,026	6,191	6,604
Reach-2000	U/S of Rock Spring Road	12805	1,411	2,901	4,024	5,033	6,200	6,615
Reach-1900	D/S of Rock Spring Road	11750	1,414	2,906	4,031	5,045	6,215	6,635
Reach-1800	D/S of College Hill Drive	10806	1,419	2,914	4,043	5,060	6,234	6,658
Reach-530	D/S of Elm Street	9732	1,425	2,913	4,039	5,054	6,228	6,646
Reach-Fornescont	D/S of Confluence with Fornes Run	8229	1,459	2,983	4,143	5,190	6,400	6,858
Reach-510	D/S of 10th Street	7471	1,457	2,980	4,139	5,185	6,394	6,849
Reach-500	D/S of Confluence with Reedy Branch	6500	1,470	3,008	4,179	5,237	6,462	6,931
Reservoir-400	5th Street	4008	1,464	2,992	4,146	5,186	6,104	6,376
Reach-400	D/S of 5th Street	3835	1,450	2,961	4,096	5,121	6,062	6,339
Outlet	D/S Limit of GMR	1890	1,439	2,937	4,059	5,074	6,042	6,331

Table 4-1 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Future Land-use Conditions (cfs) With Alternatives					Future Conditions
			2-year	10-year	25-year	50-year	100-year	100-year
Reedy Branch								
Reservoir-1700	Norfolk Southern Railroad	7801	36	75	95	116	139	139
Reach-1700	D/S of Norfolk Southern Railroad	6288	35	75	95	115	139	139
Reservoir-1200	14th Street	5356	49	110	140	167	200	200
Reach-1200	D/S of 14th Street	3208	96	235	328	412	509	509
Reservoir-1300	Wright Road	2002	138	355	509	640	788	788
Reach-4500	U/S of 10th Street	2002	177	467	677	855	1,054	1,054
Fornes Run								
Reservoir-1400	Charles Boulevard	8363	160	265	342	410	486	486
Resevoir-1000	Greenville Boulevard	6071	192	345	462	569	691	691
Reach-1500	U/S of Norfolk Southern Railroad	4682	245	479	651	810	997	997
Reservoir-570	Norfolk Southern Railroad	3491	274	551	751	939	1,165	1,165
Reservoir-1100	Dalebrook Circle	2991	293	600	824	1,032	1,282	1,282
Reach-FornesRun	D/S Limit of Fornes Run	723	306	632	876	1,102	1,371	1,371
Greens Mill Run North Fork								
Reach-3000	U/S of Allen Road	8786	163	297	384	464	554	554
Reservoir-990	Allen Road	6966	321	607	796	960	1,144	1,144
Reservoir-2800	Norfolk Southern Railroad	4027	328	507	584	637	685	500
Reach-2800	Norfolk Southern D/S of Railroad	3894	324	498	578	633	682	491
Reach-630	Ellsworth Pond	3086	325	501	584	639	689	496
Reservoir-2700	Ellsworth Drive	841	309	523	584	714	821	651
Reach-2700	D/S Limit of GMR North Fork	664	309	523	584	714	820	651

*Changes made in the HEC-RAS Alternative #2 model did not impact attenuation, thus the same flows from the HEC-RAS Alternative #1 model were used for Alternative #2.
**See Table 3-2 for full future conditions flows.

4.1.3 Alternatives Development

Using the LOS design standards outlined in **Section 1.2**, crossings shown to overtop in the existing land-use analysis were evaluated for proposed improvements to meet the established design standards under future land-use conditions. Where improvements to achieve the full design standard were determined to be unfeasible, improvements to meet a lower standard were investigated; however, no improvements were proposed unless they provided a 10-year LOS at a minimum. Feasibility was determined by comparing the existing section / channel width to the proposed improvement width. Improvements considered feasible were generally those that limited increasing the width by up to 200% for small crossings, such as single culverts, or by up to 50% for large crossings, such as box culverts.

Developing the improvements was a complex process involving consideration of interaction between crossings and streams, property and utility impacts, and constructability of improvements. Interaction between crossings and streams involved tailwater (backwater) effects from downstream crossings on crossings located further upstream, and flowrate increases due to reduced attenuation at modeled attenuation nodes. Of the 15 proposed improvement locations, only two did not exhibit interaction with other crossings where improvements were proposed. Tailwater interactions necessitated proposing improvements at some crossings that did not have level of service violations in order to reduce upstream tailwater elevations at crossings with LOS violations. These tailwater interactions also impacted flowrates from attenuation nodes, as discussed below.

Attenuation interactions affected crossings on and between Greens Mill Run and Greens Mill Run North Fork. These interactions were due to proposed improvements at or downstream of modeled attenuation nodes. Improvements at attenuation nodes increased the crossing’s flow capacity, thus discharging more flow to downstream structures. Improvements downstream of attenuation locations resulted in decreasing tailwater at the attenuation nodes, also increasing outflows. The attenuation and flow changes were accounted for in the models by using rating (stage-discharge) curves from HEC-RAS. These curves were input to HEC-HMS and the models iterated until flowrates and pool elevations were balanced between the two models.

Additionally, interaction between North Fork and Greens Mill Run was included in the analysis, as the starting water surface elevations in the North Fork model were obtained from just upstream of the Dickinson Avenue Extension crossing on GMR. Proposed improvements on North Fork resulted in increased outflows from its modeled attenuation points. These higher flows were then passed to Greens Mill Run, which then impacted the proposed improvements on GMR, necessitating re-evaluation of the alternatives.

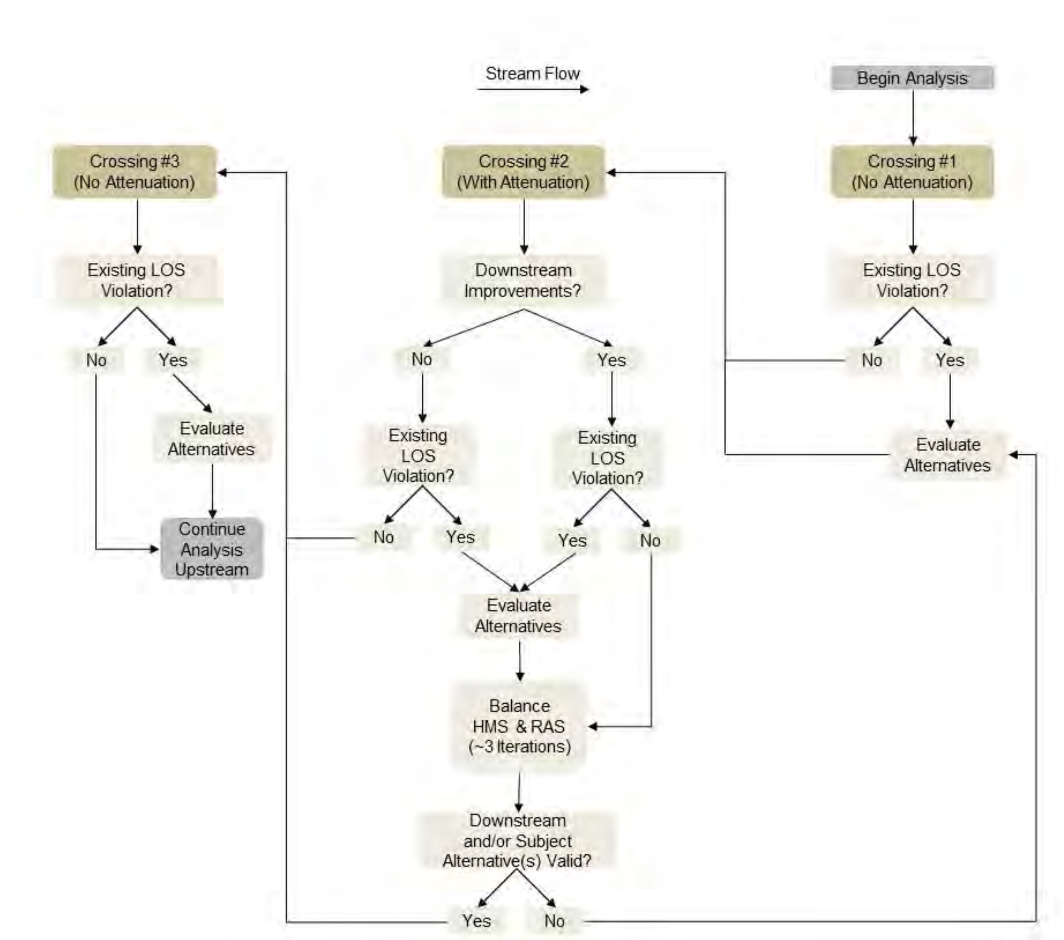
Flow changes and culvert improvements on Greens Mill Run also impacted tailwater conditions on the Dickinson Avenue crossing, which also impacted the starting water surface elevations in the North Fork model. This required re-evaluation of the North Fork alternatives, including impacts on attenuation, which began the process over. Thus, each change that impacted attenuation nodes or tailwater on either stream required re-evaluation of proposed alternatives on both streams. Due to these numerous levels and loops of interaction, both the hydrologic and hydraulic models for both streams were iterated until flows between models were balanced and feasible solutions on both streams could be identified.

The process of analyzing crossings and developing improvements is presented in **Figure 4-1**. Crossings were analyzed from downstream to upstream. In general, this process included determination of LOS violations, development of improvements, identification and balancing of attenuation between HEC-RAS and HEC-HMS, and re-evaluation of alternatives due to rebalancing of the models. Balancing typically required three iterations to converge on the solution. Once balancing, re-evaluation, and redevelopment of alternatives was completed, the analysis continued upstream.

The proposed improvements, designed using future land-use conditions and revised flowrates, are presented as two separate sets of alternatives (Alternative #1 and #2), with each alternative set reporting performance based on cumulative effects of all improvements within the alternative. Since most improvements are interactive with other improvements, all proposed improvements within an alternative set for each Primary System stream must be implemented to realize reported reductions in water surface elevations and to achieve the proposed levels of service (i.e. only Alternative #1 or Alternative #2 improvements may be selected for a given stream). In addition, GMR and GMR North Fork are interactive, thus implementation of different alternative sets for those two streams may yield results that vary from those presented herein. Alternative #1 provides the highest level of service that may be attained (up to the COG desired LOS) with feasible improvements. Alternative #2 presents minimal, or smaller, improvements to provide at least a 10-year level of service.

Improvements with culvert sizes larger than 48” in diameter were modeled with a one foot natural channel bottom, per the U.S. Army Corps of Engineers’ Nationwide Permit conditions. Proposed culvert sizes were based upon readily available precast reinforced concrete pipe (RCP) or reinforced concrete box culvert (RCBC) sizes, except under certain conditions where non-standard sizes were required due to crossing-specific constraints.

Figure 4-1: Analysis Flowchart for Primary System Crossings



4.1.4 Water Surface Elevation Changes

As previously discussed, improvements at or downstream of modeled attenuation nodes resulted in higher flows conveyed downstream of the attenuation location. Subsequently, downstream water surface elevations also increased within the stream. Specific to the GMR Primary System, improvements within North Fork, which is located in the upland portion of the GMR watershed, led to increased outflows that were then conveyed to Greens Mill Run. As a result of the flow increases, water surface elevations increased along North Fork and a significant portion of GMR. To a lesser degree, improvements along GMR itself also contributed to increased water surface elevations in the downstream portion of GMR.

Determination of water surface elevation increases was made based on comparison of the 100-year HEC-RAS results. Firstly, development of the Primary System Alternatives began with making certain modifications to the *Future Conditions Model* allow for more stable modeling of the infrastructure improvements. This modified model, herein referred to as the *Refined Future Conditions Model*, was then used as the basis to model the alternatives (the *Future Conditions with Alternatives Model*). Lastly, the *Refined Future Conditions Model* and *Future Conditions*

Model with Alternatives were compared to determine water surface elevation increases. The *Refined Future Conditions Model* was used in this comparison since the elevations varied slightly from the *Future Conditions Model* discussed and presented within the rest of this WSMP.

As discussed previously, the effect of improvements was evaluated cumulatively, therefore increased water surface elevations were the result of all improvements and not attributable to individual projects. It is recommended that water surface elevation increases be evaluated for individual projects, once selected for full design, in order to identify and mitigate increases resulting from the specific project, both in existing and future land-use conditions.

Due to the anticipated water surface elevation increases as a result of the proposed improvements, several mitigation alternatives were examined. Typically, floodplain modification is proposed to mitigate such increases; however, due to the anticipated extensive length of modifications within the Primary System, other alternatives were first explored:

- <u>100-year Detention for Future Development in North Fork</u>: In order to mitigate increased flows, and the subsequent water surface elevation increases, 100-year detention of future development in North Fork was examined as a means to offset the increased flows. This analysis was performed using the *Future Conditions Model* in HEC-HMS, by converting all future land-uses and lag times in the North Fork subbasins to match existing conditions, simulating 100-year detention. These flow results were then input to the *Future Conditions with Alternatives Model* to determine the benefit of this detention. The results of this analysis indicated water surface elevation decreases of 0.05 - 0.06 feet along much of GMR, with the highest being 0.13 feet at a single location. However, these decreases did not result in water surface elevations at or below the *Revised Future Conditions* model elevations, thus did not provide the required mitigation. Based on the minimal effect of 100-year detention, this concept is not recommended.

- <u>Modification of the Lake Ellsworth Outlet Structure</u>: Increasing the available storage volume in Lake Ellsworth to mitigate increased outflows was examined through lowering of the normal pool water surface elevation by 1 foot. This was accomplished by modifying the outlet structure to attenuate the increased peak flow from the lake. The analysis indicated that discharges from North Fork were reduced by approximately 20 cfs, an insufficient reduction to offset water surface elevation increases within GMR. Therefore, no modification to Lake Ellsworth is recommended on the basis of mitigating water surface elevation increases.

- <u>Offline Detention</u>: Offline detention was examined to determine the feasibility of providing additional storage volume along the Primary System to mitigate the flow and water surface elevation increases. This was performed by comparing the North Fork discharge hydrographs: *Refined Future Conditions* and *Future Conditions with Alternatives*. The area between these two hydrographs approximated the required detention volume necessary to mitigate increased flows. This calculation indicated the need for 5.5 million cubic feet (41.1 MG or 126 ac-ft). Assuming a 5 foot depth, a 25 acre facility was determined to be required. This result provided further evidence that lowering the water surface elevation in Lake Ellsworth by 1 foot did not provide sufficient volume for peak flow attenuation. An additional complication of this concept was that most parcels suitable for a facility of this size are several of feet higher than the stream and thus required pumping from the stream to the impoundment.

- Relocation of Additional Flow: Relocating flows from North Fork or GMR to another stream was also considered; however, this was determined unfeasible as it served only to relocate the problem of increased flows and water surface elevations to another stream.

Since none of the above alternatives effectively mitigated increased water surface elevations, floodplain modification, such as benching, was chosen as the most effective means of mitigation. These modifications were incorporated into the ***Future Conditions with Alternatives model*** at strategic locations. The analyses started at the downstream ends of GMR and North Fork, and continued upstream. The majority of mitigated increases were generally in the range of 0.10 feet or less, therefore, the models were not rebalanced as they were not sensitive to such small changes. The result was that in some cases where tailwater at an attenuation node was lowered by floodplain benching, slight increases in flow were not accounted for in the model. Likewise, the slight reduction in flow resulting from lowered headwater on that same structure due to upstream benching was also not modeled. It is possible that these two factors were offsetting, and regardless, their impact on model results was negligible.

As previously stated, floodplain modifications were included along GMR and North Fork and were the result of the cumulative effect of the majority of improvements proposed along the two streams. Therefore, it was not possible to attribute modifications to a particular stream crossing improvement project. Instead, the cost of floodplain modifications was evenly allocated among the next-upstream set of improvements that resulted in the need for mitigation. However, it is noted that any improvement that may result in increased water surface elevations may require mitigation, regardless of how the floodplain benching is allocated within this WSMP.

4.1.5 Greens Mill Run

Allen Road (NCDOT) – The existing (recently replaced) 14’ x 8’ corrugated metal pipe arch (CMPA) was determined to be in good structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed at this location. ***(Revised 1/4/17)***

Dickinson Avenue Extension (NCDOT) – The existing twin 9’ x 8.2’ reinforce concrete box culverts (RCBC) were determined to be in fair structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

South Memorial Drive (NCDOT) – The existing triple 11.5’ x 9.7’ RCBCs were determined to be in good structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

Hooker Road (COG) – The existing triple 12.8’ x 8.8’ RCBCs were determined to be in good structural condition and to meet the desired 25-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

Railroad (CSX) – The existing bridge was determined to be in good structural condition and to meet the desired 100-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

West Arlington Boulevard (COG) – The existing quadruple 12’ x 8.5’ RCBCs were determined to be in fair structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

Evans Street (NCDOT) – The existing triple 12’ x 6’ RCBCs were determined to be in good condition, but shown to provide less than a 10-year level of service under existing land-use conditions, below the desired 50-year LOS. The crossing was analyzed to determine feasible alternatives to provide an improved level of service under future land-use conditions; however, no viable alternatives were identified. This finding was confirmed by modeling the crossing under ideal tailwater conditions, with no downstream crossings (all crossing structures located downstream were removed from the model run). This analysis showed that in the 10-year event, the existing crossing overtopped with tailwater only 0.03 feet below the road, indicating that proposed improvements to provide an increased LOS would likely be unfeasible because the tailwater was effectively as high as the roadway surface.

Further confirmation that solutions were not feasible was accomplished by utilizing the full alternatives model (including downstream crossings). The Evans Street crossing was further analyzed to determine the magnitude of improvements required to provide the desired 50-year LOS. This analysis demonstrated that thirteen 11’ x 11’ RCBCs and elevating the roadway elevation by four feet were required. Based on LiDAR data, elevating the roadway may impact approximately 2,700 linear feet of Evans Road, including four intersections. The culvert improvement represents infrastructure over seven times larger (in cross-sectional area) than the existing culverts. This improvement also requires new improvement projects at East 14th Street, the Norfolk Southern Railway, and Charles Boulevard; in addition to the improvements listed in Alternative #1 for South Elm Street, College Hill Drive, and Rock Spring Road. The approximate cost of the Evans Street culvert improvement, not including elevating the roadway and its related impacts, is $13,270,000. Construction activities related to elevating the roadway include: significant volume of fill materials, asphalt paving, sidewalk construction, roadside grading and / or retaining walls, driveway reconstruction, utility adjustments / relocations, stormwater manhole / inlet modifications, landscaping, tree clearing, and potential overhead electrical and utility pole relocations / modifications.

A reduced LOS for the 10-year event was also examined, which indicated that eight 11’ x 7’ RCBCs and elevating the roadway by two feet were required. Additionally, new improvements at East 14th Street and Charles Boulevard; in addition to the improvements listed in Alternative #1 for South Elm Street, College Hill Drive, and Rock Spring Road were also required. The culvert improvement represents infrastructure nearly three times larger than the current culverts and elevating the roadway was shown to impact to three road intersections and approximately 2,400 linear feet of Evans Street. The cost associated with the 10-year Evans Street culvert improvement is $5,380,000, not including costs associated with elevating the roadway and its related impacts.

Due to the significant impacts, the fact that raising the road would result in a higher water surface elevation upstream of the crossing, and high cost associated with providing an improved LOS at Evans Street, no crossing improvements are proposed.

Charles Boulevard (NCDOT) – The existing triple 12.4' x 9.6' RCBCs were determined to be in fair structural condition, but shown to provide less than a 10-year level of service under existing land-use conditions, below the desired 50-year LOS. The crossing was analyzed to determine feasible alternatives to provide an improved level of service under future land-use conditions; however, no viable alternatives were identified. This finding was confirmed by modeling the crossing under ideal tailwater conditions, with no downstream crossings (all crossing structures located downstream were removed from the model run). This analysis showed that the existing crossing had a freeboard of 0.26 feet in the 10-year event with a tailwater 1.09 feet below the road.

While a solution is theoretically possible under the ideal tailwater scenario (i.e., no downstream crossings), no feasible solutions were identified for real-world conditions. This was determined by utilizing the full alternatives model (including downstream crossings) to quantify the magnitude of improvements required to provide the desired 50-year LOS. This analysis demonstrated the need for twelve 11' x 11' RCBCs and to increase the roadway elevation by 3.35 feet. Based on LiDAR data, this would impact approximately 1,100 linear feet of Evans Road, including one intersection, three driveways, and the Norfolk Southern railroad overpass. The culvert improvement represents infrastructure over four times larger (in cross-sectional area) than the existing culverts. This improvement also requires new improvements at East 14th Street and the Norfolk Southern Railway; in addition to the improvements listed in Alternative #1 for South Elm Street, College Hill Drive, and Rock Spring Road. The approximate cost of the Charles Boulevard culvert-related improvement, not including costs associated with elevating the roadway and its impacts, is $8,630,000.

A reduced 10-year LOS was also considered, which was shown to require six 11' x 11' culverts, in addition to elevating the roadway by two feet. This culvert improvement represents infrastructure nearly twice the size of the existing culverts, with the roadway modifications impacting nearly 1,000 linear feet, including one intersection, three driveways, and the Norfolk Southern railroad overpass. This improvement was also shown to require new improvements at East 14th Street, in addition to those listed under Alternative #1 for South Elm Street, College Hill Drive, and Rock Spring Road. The cost associated with the 10-year LOS Charles Boulevard culvert improvement is $4,590,000, not including costs associated with elevating the roadway and its impacts.

Due to the significant impacts, the fact that raising the road would result in a higher water surface elevation upstream of the crossing, and high cost associated with providing an improved LOS at Charles Boulevard, no crossing improvements are proposed.

total estimated construction cost for the Rock Spring Road Alternative #2 project is $2,100,000, including the allocated portion of floodplain benching.

Construction of either proposed alternative may result in impacts to existing utilities, including water, sewer, and gas lines. The two adjacent properties are single family residential lots; which may experience moderate to significant impacts, depending on the alternative chosen. A closure to Rock Spring Road is required, impacting access to the adjacent neighborhood. However, both East and West Rock Spring Road intersect East 14th Street to the south, providing reasonable ingress/egress points for the neighborhood.

This crossing was affected by both tailwater and attenuation interactions. Attenuation was modeled at both the CSX and Norfolk Southern Railway crossings on Greens Mill Run. The Norfolk Southern Railway is located two crossings upstream (with East 14th Street between Rock Spring Road and the railroad) and within the cumulative tailwater effects of multiple downstream crossings, including Rock Spring Road, College Hill Drive, and South Elm Street. Improvements downstream of the NS Railroad resulted in reduced tailwater elevations on the railroad, allowing additional flow through the crossing. The higher flows also resulted in higher water surface elevations, impacting performance of the downstream crossings. Consequently, larger proposed improvements were required to overcome the elevated flows/flooding. This process was iterated until downstream improvement solutions were achieved. However, these solutions were unfeasible, requiring increased culvert widths in excess of 200% of the existing width, with significant increases in downstream water surface elevations. Therefore, in order to provide feasible alternatives, the LOS goals were reduced (e.g. 25-year down to 10-year and 50-year down to 25-year) and the magnitude of the proposed improvements was balanced with water surface elevation impacts to the NS Railway. This approach and the associated improvements ultimately had small effects on tailwater at the railroad and provided reasonable culvert sizes.

College Hill Drive (ECU) – (**Figure 4-3**) The existing twin 12’ x 10’ RCBCs were determined to be in good structural condition and to provide a 10-year level of service under existing land-use conditions. Improvements to this crossing are proposed to reduce upstream tailwater, thus decreasing the magnitude of improvements at Rock Spring Road.

- Alternative #1 – Supplement the existing culverts with an 8’ x 4’ RCBC to maintain a 10-year LOS, and reduce tailwater on Rock Spring Road, under future land-use conditions. This alternative requires downstream improvements at South Elm Street. This improvement, along with the Rock Spring Road and South Elm Street projects, was shown to result in increased downstream water surface elevations; therefore, floodplain benching is proposed, as discussed in the Rock Spring Road section. Additionally, one building upstream of this crossing, located within the 100-year future conditions floodplain, was determined to be outside of the floodplain, provided implementation of the proposed improvements and floodplain benching at each crossing. The total estimated construction cost for the College Hill Drive project is $920,000, including the allocated portion of floodplain benching.

- Alternative #2 – Do not improve crossing. In order to meet the stated performance at Rock Spring Road, this alternative requires improvements at South Elm Street, in addition to floodplain benching, as discussed in the Rock Spring Road section. Combined, the downstream improvements would maintain a 10-year LOS at College Hill Drive and allow one building currently located within the 100-year future conditions floodplain to be located outside of the floodplain, following implementation of all Alternative #2 improvements.

Construction of the improvement at this location may result in impacts to a water utility. All adjacent property is ECU-owned and consists of parking lots, walkways, wooded areas, and an open field. A temporary road closure or reduced travel lanes are required, affecting mostly ECU traffic. Access from East 10th Street may be temporarily impacted; however, East 14th Street provides alternative local traffic access.

This crossing is affected by both tailwater from South Elm Street and attenuation interactions with the Norfolk Southern Railway. See the Rock Spring Road alternatives, above, for additional information regarding this interaction.

South Elm Street (COG) – (**Figure 4-3**) The existing twin 16.5' x 10.5' CMPAs were determined to be in good structural condition, but provide a 25-year level of service under existing land-use conditions, below the desired 50-year LOS. Replacing the culverts is proposed since the existing culverts do not provide the desired level of service.

- Alternative #1 – Replace the existing culverts with quadruple 11' x 11' RCBCs to provide a 25-year LOS under future land-use conditions. This improvement, combined with those at Rock Spring Road and College Hill Drive, was shown to result in increased downstream water surface elevations, and thus floodplain benching is proposed, as discussed in the Rock Spring Road section. The total estimated construction cost for South Elm Street Alternative #1 project is $2,810,000, including the allocated portion of floodplain benching.

- Alternative #2 – Same drainage infrastructure improvement and LOS as Alternative #1; however, due to not improving the College Hill Drive crossing, additional floodplain benching is required, as discussed in the Rock Spring Road section above. The total estimated construction cost for South Elm Street Alternative #2 project is $3,070,000, including the allocated portion of floodplain benching.

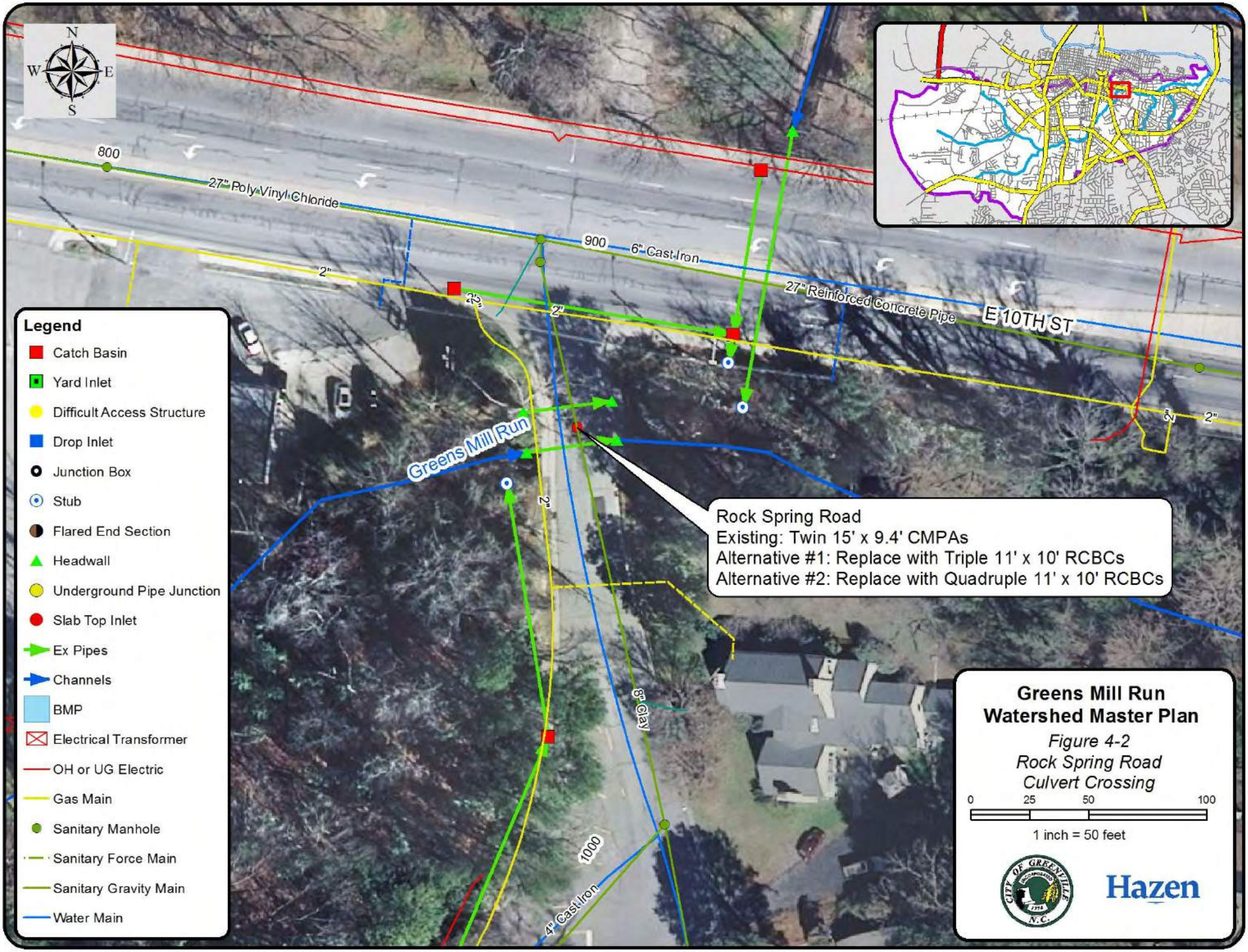
Construction of improvements at this location may result in impacts to water, sewer, gas, and underground and overhead electric utilities. Three of the four adjacent properties are city-owned; the fourth is a private parcel containing an apartment complex. Temporary closures or reduced travel lanes are required, resulting in impacts to local, school, and residential traffic.

This crossing is affected by tailwater from East 10th Street and by attenuation at the Norfolk Southern Railway. See the Rock Spring Road alternatives, above, for additional information regarding this interaction.

East 10th Street (NCDOT) – The existing triple 15' x 13' RCBCs were determined to be in good structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

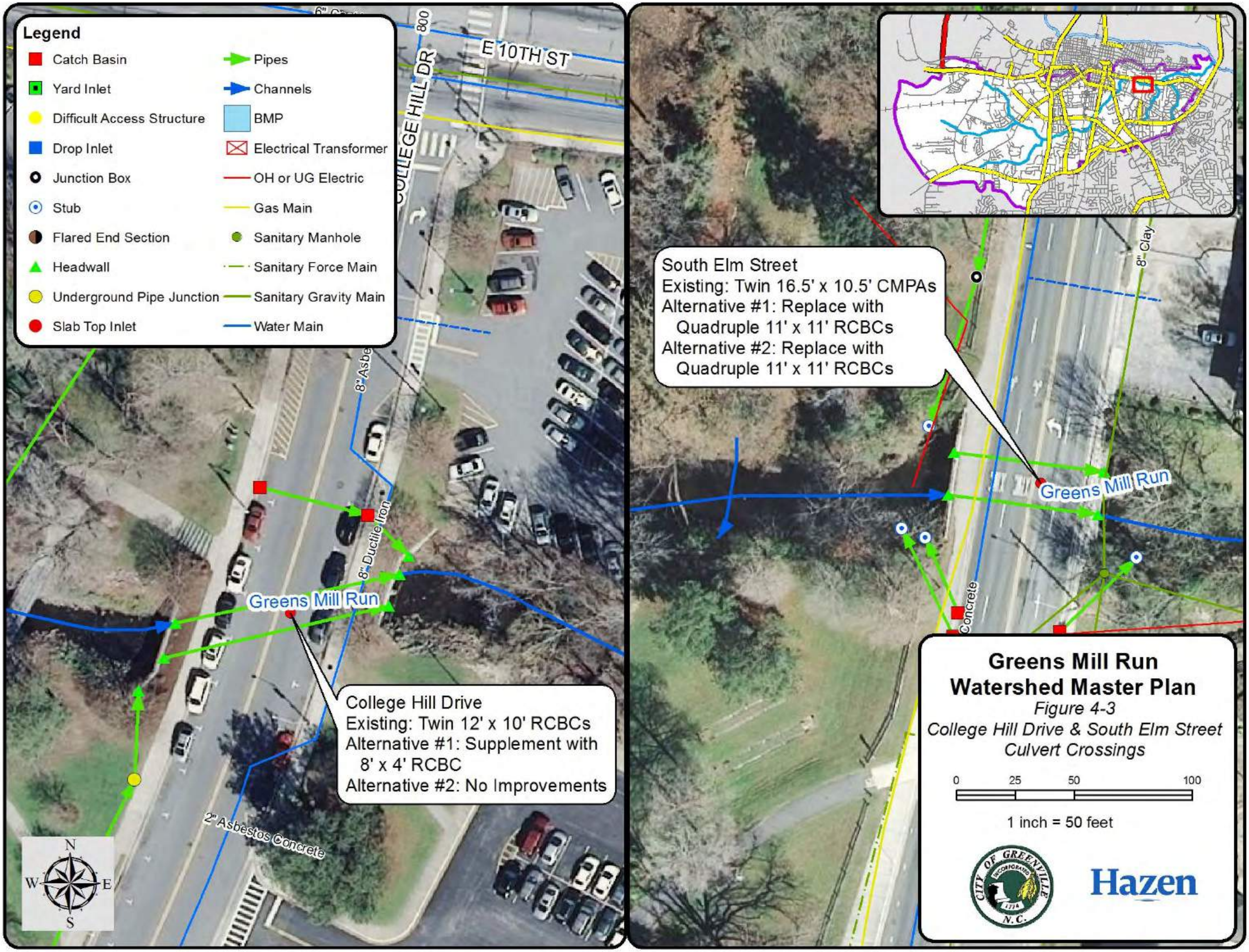
<u>East 5th Street (COG)</u> – The existing bridge was determined to be in good structural condition and to meet the desired 25-year level of service under existing land-use conditions, therefore no improvements are proposed at this location.

A summary of the hydraulic performance of the Greens Mill Run improvements proposed for Alternatives #1 and #2 are provided in **Table 4-2** and **Table 4-3**, respectively. The provided water surface elevations assume that all proposed improvements within one set of alternatives (Alternative #1 or #2) is implemented. Water surface elevations and the LOS provided will vary, until all projects are implemented.

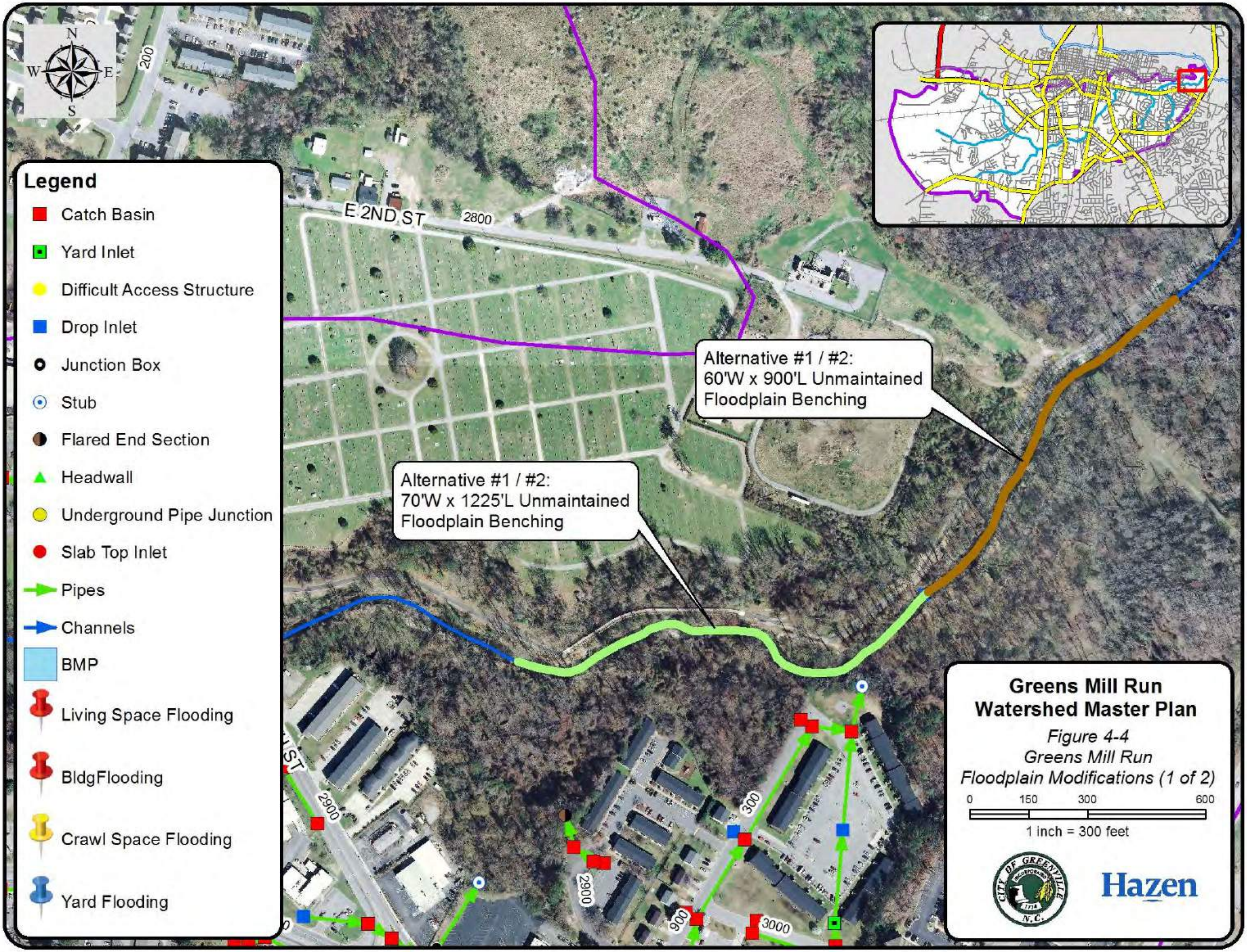


Greens Mill Run Watershed Master Plan

Figure 4-2
Rock Spring Road Culvert Crossing



Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
E 10TH ST
COLLEGE HILL DR
800
8" Ductile Iron
2" Asbestos Concrete
Greens Mill Run
College Hill Drive
Existing: Twin 12' x 10' RCBCs
Alternative #1: Supplement with 8' x 4' RCBC
Alternative #2: No Improvements
South Elm Street
Existing: Twin 16.5' x 10.5' CMPAs
Alternative #1: Replace with Quadruple 11' x 11' RCBCs
Alternative #2: Replace with Quadruple 11' x 11' RCBCs
Greens Mill Run
8" Clay
Concrete
N
S
E
W
Greens Mill Run
Watershed Master Plan
Figure 4-3
College Hill Drive & South Elm Street
Culvert Crossings
0
25
50
100
1 inch = 50 feet
CITY OF GREENVILLE
N.C.
Hazen



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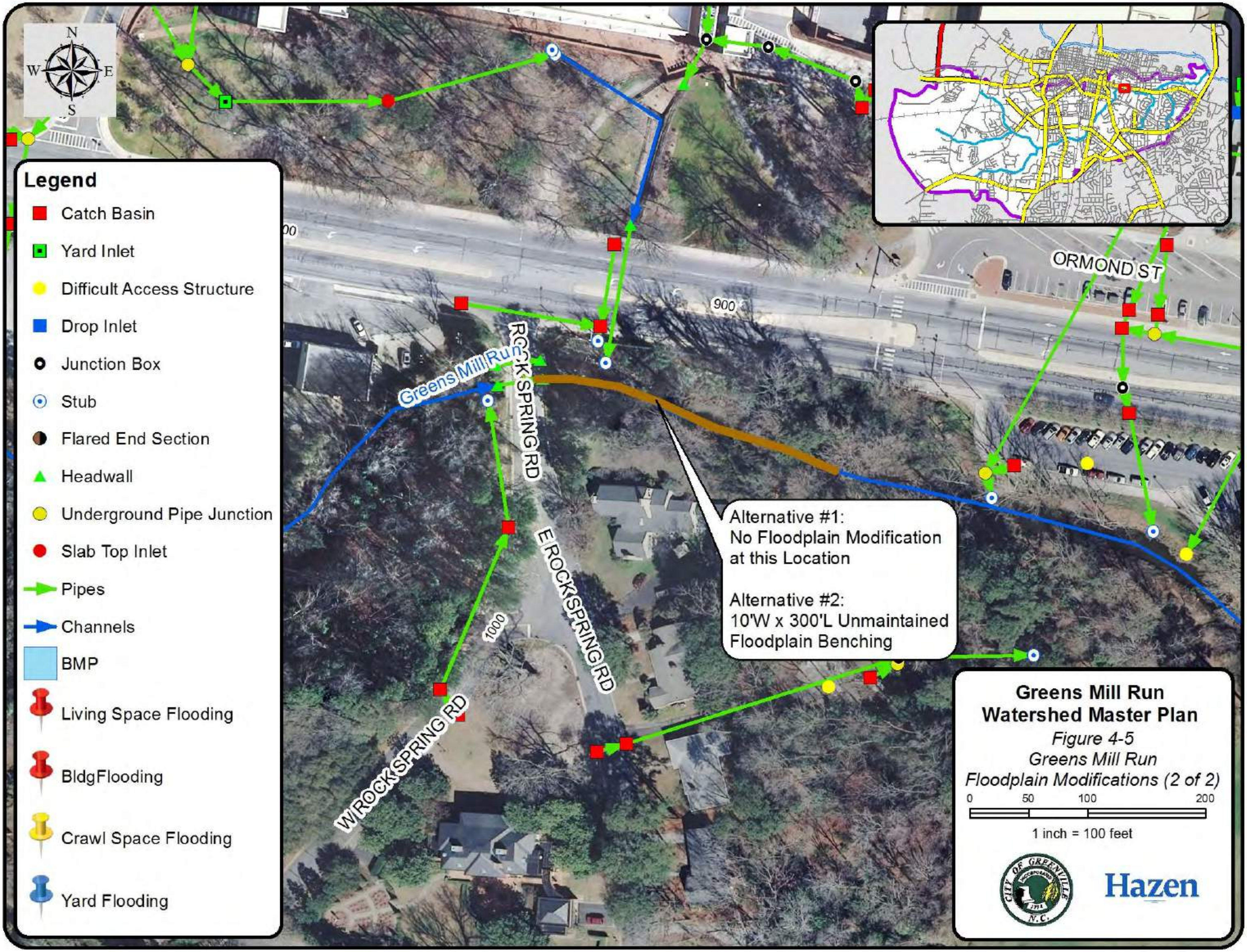
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Living Space Flooding
BldgFlooding
Crawl Space Flooding
Yard Flooding
E 2ND ST
2800
Alternative #1 / #2:
60'W x 900'L Unmaintained
Floodplain Benching
Alternative #1 / #2:
70'W x 1225'L Unmaintained
Floodplain Benching
2900
300
2900
900
3000
Greens Mill Run
Watershed Master Plan
Figure 4-4
Greens Mill Run
Floodplain Modifications (1 of 2)
0 150 300 600
1 inch = 300 feet
CITY OF GREENVILLE
INCORPORATED 1774
N.C.
Hazen



Greens Mill Run Watershed Master Plan

Figure 4-5
Greens Mill Run
Floodplain Modifications (2 of 2)

Table 4-2: Hydraulic Performance for Alternative #1 – Greens Mill Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Allen Road (Existing 14' x 8' CMPA)	70.5	50	64.2	69.5	**71.4**	**71.9**	**72.1**
Dickinson Avenue Extension (Existing Twin 9' x 8.2' RCBCs)	56.0	50	50.1	54.4	**56.7**	**57.0**	**57.3**
South Memorial Drive (Existing Triple 11.5' x 9.7' RCBCs)	47.6	50	43.3	47.3	**48.4**	**49.0**	**49.6**
Hooker Road (Existing Triple 12.8' x 8.8' RCBCs)	43.8	25	40.1	43.3	**45.5**	**46.5**	**47.2**
CSX Railroad (Existing Bridge)	50.1	100	38.5	41.0	42.7	43.9	45.2
West Arlington Boulevard (Existing Quadruple 12' x 8.5' RCBCs)	39.8	50	35.1	37.6	**39.9**	**40.5**	**41.0**
Evans Street (Existing Triple 12' x 6' RCBCs)	33.9	50	33.6	**35.3**	**35.8**	**36.3**	**37.0**
Charles Boulevard (Existing Triple 12.4' x 9.6' RCBCs)	31.0	50	29.7	**32.2**	**33.3**	**34.4**	**35.6**
Norfolk Southern Railway (Existing Bridge)	47.3	100	29.2	31.7	33.2	34.3	35.5
East 14th Street (Existing Bridge)	28.0	50	**28.1**	**29.8**	**31.2**	**32.1**	**33.0**
Rock Spring Road (Proposed Triple 11' x 10' RCBCs)	28.0	25	23.8	27.3	**29.2**	**29.8**	**30.3**
College Hill Drive (Proposed 8' x 4' Floodplain RCBC)	25.8	25	21.4	24.2	**26.9**	**28.0**	**28.5**
South Elm Street (Proposed Quadruple 11' x 11' RCBCs)	24.2	50	19.0	21.5	23.5	**25.6**	**26.5**
East 10th Street (Existing Triple 15' x 13' RCBC)	23.0	50	14.9	17.5	19.9	21.7	**23.8**
East 5th Street (Existing Bridge)	21.2	25	10.4	13.3	15.2	16.8	18.2

*Bold locations indicate proposed crossing improvement.
**Bold water surface elevation text indicates the water surface has exceeded the minimum elevation at the road, thereby signifying roadway flooding.
***Green shade indicates crossing meets desired level of service. Red shade indicates crossing does not meet desired level of service.
****Tan shade indicates the provided level of service.

Table 4-3: Hydraulic Performance for Alternative #2 – Greens Mill Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Allen Road (Existing 14' x 8' CMPA)	70.5	50	64.2	69.5	**71.4**	**71.9**	**72.2**
Dickinson Avenue Extension (Existing Twin 9' x 8.2' RCBCs)	56.0	50	50.1	54.4	**56.7**	**57.0**	**57.3**
South Memorial Drive (Existing Triple 11.5' x 9.7' RCBCs)	47.6	50	43.2	47.3	**48.4**	**49.0**	**49.6**
Hooker Road (Existing Triple 12.8' x 8.8' RCBCs)	43.8	25	40.1	43.2	**45.4**	**46.4**	**47.2**
CSX Railroad (Existing Bridge)	50.1	100	38.4	40.8	42.5	43.6	44.9
West Arlington Boulevard (Existing Quadruple 12' x 8.5' RCBCs)	39.8	50	35.1	37.6	**39.9**	**40.5**	**41.0**
Evans Street (Existing Triple 12' x 6' RCBCs)	33.9	50	33.6	**35.3**	**35.8**	**36.3**	**37.0**
Charles Boulevard (Existing Triple 12.4' x 9.6' RCBCs)	31.0	50	29.7	**32.2**	**33.2**	**34.3**	**35.6**
Norfolk Southern Railway (Existing Bridge)	47.3	100	29.2	31.7	33.1	34.2	35.5
East 14th Street (Existing Bridge)	28.0	50	**28.1**	**29.6**	**30.9**	**31.9**	**32.9**
Rock Spring Road (Proposed Quadruple 11' x 10' RCBCs)	28.0	25	23.6	26.5	**28.5**	**29.5**	**30.2**
College Hill Drive (Existing Twin 12' x 10' RCBCs)	25.8	25	21.5	24.7	**27.1**	**28.1**	**28.6**
South Elm Street (Proposed Quadruple 11' x 11' RCBCs)	24.2	50	19.0	21.5	23.5	**25.6**	**26.5**
East 10th Street (Existing Triple 15' x 13' RCBCs)	23.0	50	14.9	17.5	19.9	21.7	**23.8**
East 5th Street (Existing Bridge)	21.2	25	10.4	13.3	15.2	16.8	18.2

*Bold locations indicate proposed crossing improvement.
***Bold water surface elevation text indicates the water surface has exceeded the minimum elevation at the road, thereby signifying roadway flooding.
***Green shade indicates crossing meets desired level of service. Red shade indicates crossing does not meet desired level of service.
****Tan shade indicates the provided level of service.

4.1.6 Reedy Branch

Southeast Greenville Boulevard (NCDOT) – (**Figure 4-6**) The existing 36" corrugated metal pipe (CMP) was determined to be in fair structural condition and to provide a 2-year level of service under existing land-use conditions, below the desired 50-year LOS. Replacement of the culvert is proposed to provide the desired level of service.

- Alternative #1 – Replace the existing culvert with a 60" RCP to provide a 50-year LOS under future land-use conditions. Two buildings shown to be located within the 100-year future conditions floodplain would be located outside of the floodplain following implementation of the improvements. The total estimated construction cost for this project is $680,000.
- Alternative #2 – Same as Alternative #1.

Construction of this improvement at this location may result in impacts to water, sewer, overhead electric, and gas utilities. The existing culvert is approximately 260' in length, much of which is located on a private parcel (single family residence). Coordination with NCDOT is required, and traffic impacts are likely to be significant as the five-lane roadway serves as a major thoroughfare and serves as a main access to Greenville Mall.

Railroad (NS) – The existing 48" RCP was determined to be in good structural condition and to meet the desired 100-year level of service under existing land-use conditions, therefore no improvements are proposed at this location

East 14th Street (NCDOT) – The existing 48" CMP was determined to be in good structural condition and to meet the desired 25-year level of service under existing land-use conditions, therefore no improvements are proposed at this location

South Wright Road (COG) – (**Figure 4-7**) The existing 48" CMP was determined to be in fair structural condition and to provide a 2-year level of service under existing land-use conditions, below the desired 25-year LOS. Replacement of the culvert is proposed.

- Alternative #1 – Replace the existing culvert with twin 6' x 5' RCBCs to provide a 25-year LOS under future land-use conditions. This improvement requires downstream improvements at East 10th Street. The total estimated construction cost for this project is $620,000.
- Alternative #2 – Replace the existing culvert with a 7' x 5' RCBC to provide a 10-year LOS under future land-use conditions, with no required downstream improvements. The total estimated construction cost for this project is $490,000.

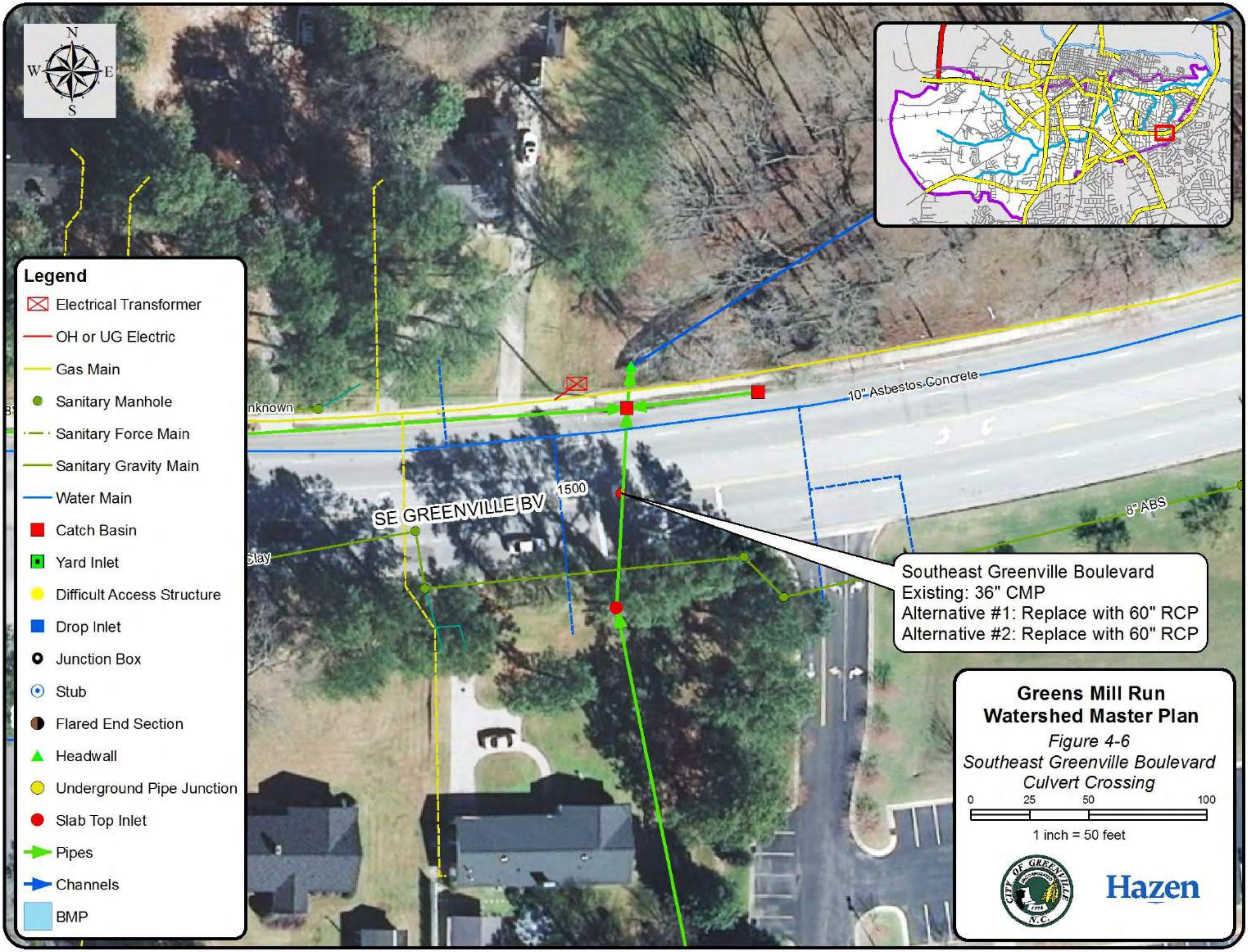
Construction at this location may result in impacts to water, sewer, overhead electric, and gas utilities. Three of the four adjacent properties are private, single family residences; the fourth is County-owned (Board of Education). Temporary closures or reduced travel lanes are required, which may result in moderate impacts to both local and school traffic.

East 10th Street (NCDOT) – (**Figure 4-8**) The existing 48” and 54” RCPs were determined to be in good structural condition and to meet the desired 50-year level of service under existing land-use conditions. In order to decrease upstream tailwater to benefit upstream crossing improvements, an infrastructure upgrade is proposed:

- Alternative #1 – Supplement the existing culverts with a 48” RCP located in the floodplain overbank to maintain a 50-year level of service under future land-use conditions and decrease tailwater on South Wright Road. The total estimated construction cost for this project is $660,000.
- Alternative #2 – Do not improve crossing, which provides a 10-year LOS under future land-use conditions at both East 10th Street and South Wright Road.

Construction of the Improvement at this location may result in impacts to water, sewer, overhead electric, and gas utilities. The upstream property is a single family residence parcel; the two properties on the downstream side are both apartment complexes. The left bank on the downstream side also contains a recently reconstructed retaining wall that will be impacted by improvements. Coordination with NCDOT is required and traffic impacts are likely to be significant as the five-lane roadway serves as a major thoroughfare for residential, commercial, shopping, and school traffic.

A summary of the hydraulic performance of the Reedy Branch improvements proposed for Alternatives #1 and #2 are provided in **Table 4-4** and **Table 4-5**, respectively. The provided water surface elevations assume that all proposed improvements within one set of alternatives (Alternative #1 or #2) is implemented. Water surface elevations and the LOS provided will vary, until all projects are implemented.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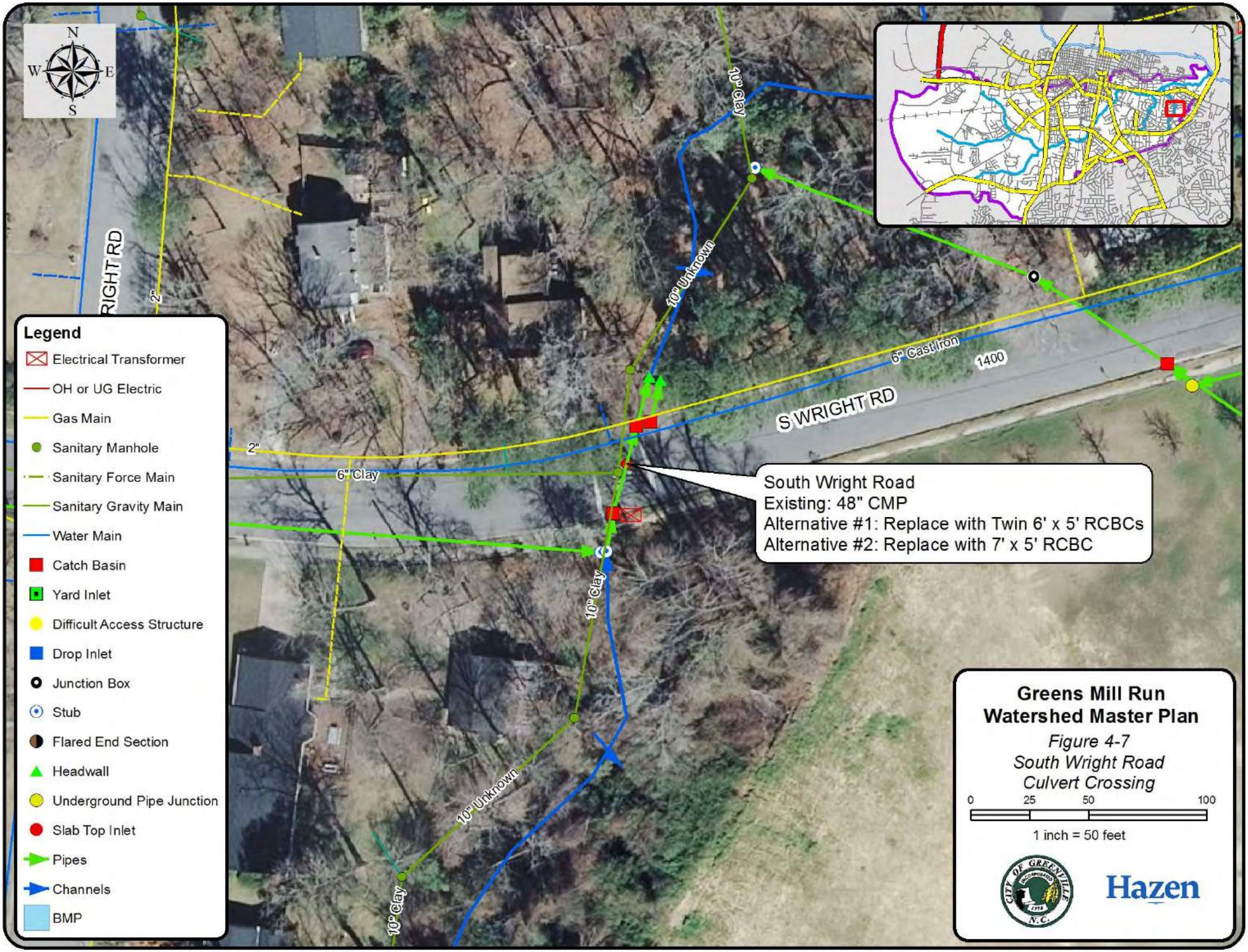
Legend
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
10" Asbestos Concrete
SE GREENVILLE BV
1500
8" ABS
Clay
Southeast Greenville Boulevard
Existing: 36" CMP
Alternative #1: Replace with 60" RCP
Alternative #2: Replace with 60" RCP
Greens Mill Run
Watershed Master Plan
Figure 4-6
Southeast Greenville Boulevard
Culvert Crossing
0 25 50 100
1 inch = 50 feet
Hazen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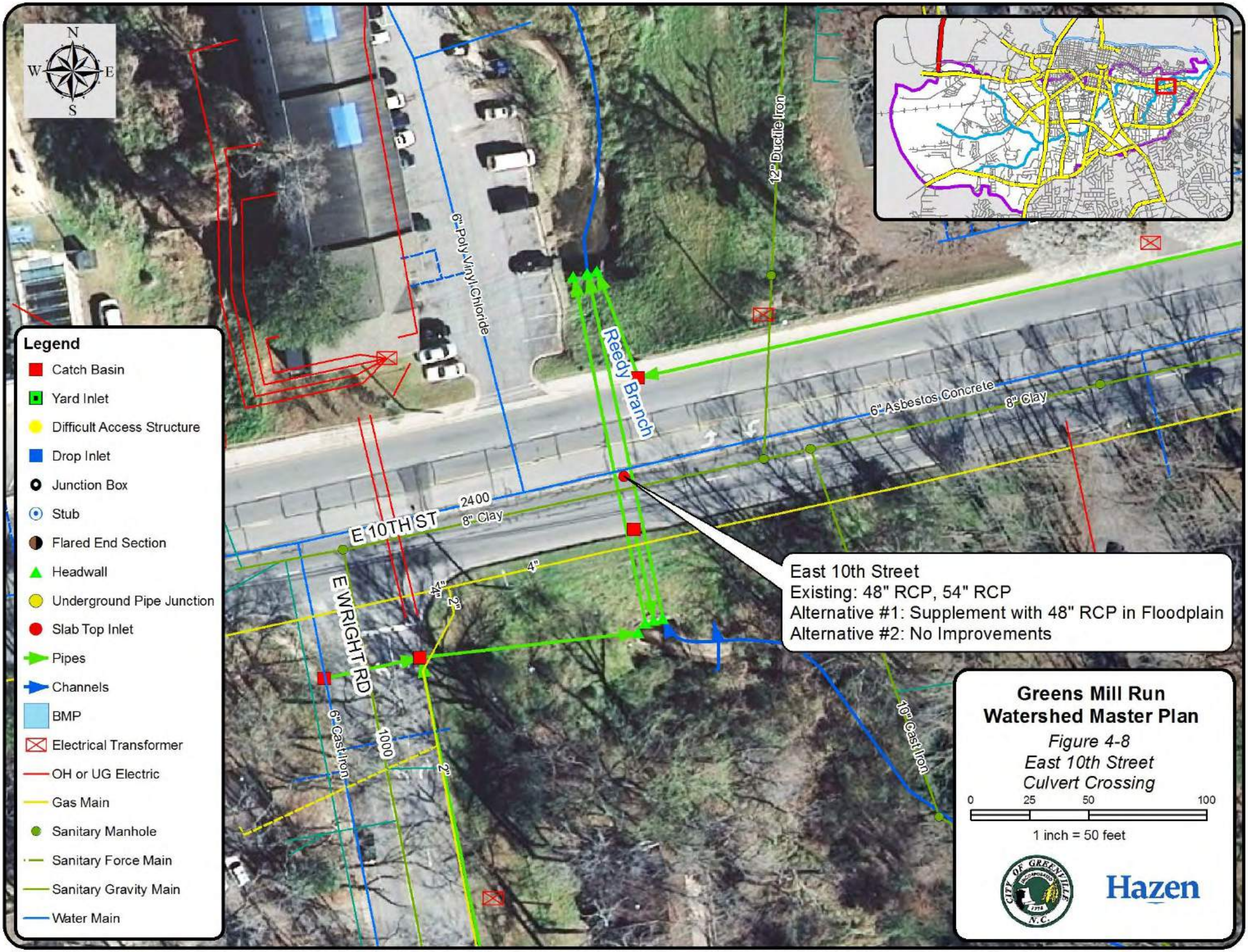
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
RIGHT RD
2"
10" Clay
10" Unknown
6" Cast Iron
1400
S WRIGHT RD
6" Clay
South Wright Road
Existing: 48" CMP
Alternative #1: Replace with Twin 6' x 5' RCBCs
Alternative #2: Replace with 7' x 5' RCBC
Greens Mill Run
Watershed Master Plan
Figure 4-7
South Wright Road
Culvert Crossing
0
25
50
100
1 inch = 50 feet
Hazen



N
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Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
6" Poly Vinyl Chloride
12" Ductile Iron
Reedy Branch
6" Asbestos Concrete
8" Clay
2400
E 10TH ST
8" Clay
4"
4"
2"
E WRIGHT RD
6" Cast Iron
1000
2"
10" Cast Iron
East 10th Street
Existing: 48" RCP, 54" RCP
Alternative #1: Supplement with 48" RCP in Floodplain
Alternative #2: No Improvements
Greens Mill Run
Watershed Master Plan
Figure 4-8
East 10th Street
Culvert Crossing
0
25
50
100
1 inch = 50 feet
Hazen

Table 4-4: Hydraulic Performance for Alternative #1 – Reedy Branch

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Southeast Greenville Boulevard (Proposed 60" RCP)	66.4	50	60.5	61.9	62.7	64.0	**66.5**
Norfolk Southern Railway (Existing 48" CMP)	66.4	100	57.8	59.2	59.9	60.6	61.7
East 14th Street (Existing 48" CMP)	56.5	25	51.7	54.3	56.5	**56.8**	**56.9**
South Wright Road (Proposed Twin 6' x 5' RCBCs)	33.5	25	30.5	32.4	33.3	**34.8**	**35.6**
East 10th Street (Proposed 48" Floodplain RCP)	34.3	50	17.8	23.7	28.1	33.6	**35.3**

Table 4-5: Hydraulic Performance for Alternative #2 – Reedy Branch

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Southeast Greenville Boulevard (Proposed 60" RCP)	66.4	50	60.5	61.9	62.7	64.0	**66.5**
Norfolk Southern Railway (Existing 48" CMP)	66.4	100	57.8	59.2	59.9	60.6	61.7
East 14th Street (Existing 48" CMP)	56.5	25	51.7	54.3	56.5	**56.8**	**56.9**
South Wright Road (Proposed Twin 7' x 5' RCBCs)	33.5	25	30.5	33.4	**35.0**	**35.5**	**35.9**
East 10th Street (Existing 48" RCP, 54" RCP)	34.3	50	17.8	24.8	**34.6**	**35.3**	**35.6**

*Bold locations indicate proposed crossing improvement.
**Bold water surface elevation text indicates the water surface has exceeded the minimum elevation at the road, thereby signifying roadway flooding.
***Green shade indicates crossing meets desired level of service. Red shade indicates crossing does not meet desired level of service.
****Tan shade indicates the provided level of service.

4.1.7 Fornes Run

Southeast Greenville Boulevard (NCDOT) – The existing 60" CMP, 36" PVC, and 9' x 6.5 CMPA were determined to be in fair structural condition and to meet the desired 50-year level of service under existing land-use conditions, therefore no improvements are proposed.

Crestwood Drive (COG) – (**Figure 4-9**) The existing 9' x 6' CMPA and 48" CMP were determined to be in good structural condition, but provide a 10-year level of service under existing land-use conditions, below the desired 25-year LOS. Therefore the following improvements are proposed:

- Alternative #1 – Supplement the existing culverts with a 60" RCP to provide a 25-year LOS under future land-use conditions. This improvement requires downstream improvements at East 14th Street, the Norfolk Southern Railway, and North Overlook Drive. Thirteen buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #1 improvements. The total estimated construction cost for this project is $260,000.
- Alternative #2 – Do not improve crossing. A 10-year LOS under future land-use conditions is provided with downstream improvements at the Norfolk Southern Railway and North Overlook Drive. Seven buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #2 improvements.

Construction of the Improvement at this location may result in impacts to water, sewer, and overhead electric utilities. The adjacent four properties are all single family residences. Traffic impacts are likely affect local residential traffic.

North Overlook Drive (COG) – (**Figure 4-10**) The existing 9' x 6' CMPA and 48" CMP were determined to be in good structural condition, but provide a 10-year level of service under existing land-use conditions, below the desired 25-year LOS. Therefore the following improvements are proposed:

- Alternative #1 – Replace the existing culverts with twin 7' x 7' RCBCs to provide a 25-year LOS under future land-use conditions. This improvement requires downstream improvements at East 14th Street and the Norfolk Southern Railway. Ten buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #1 improvements. The total estimated construction cost for this project is $780,000.
- Alternative #2 – Same infrastructure improvements as Alternative #1; however, the only downstream improvements required are at the Norfolk Southern Railway. This alternative maintains a 10-year LOS under future land-use conditions. This improvement requires downstream improvements at the Norfolk Southern Railway. Nine buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #2 improvements. The total estimated construction cost for this project is $780,000.

Improvements at this location may result in impacts to water, overhead electric, sewer, and gas utilities. The adjacent four properties are all single family residences. Traffic impacts are likely to affect local traffic.

Railroad (NS) – (**Figure 4-10**) The existing 72” CMP and twin 48” RCPs were determined to be in poor structural condition and to meet the desired 100-year level of service under existing land-use conditions. Improvements to this crossing are proposed in order to reduce upstream tailwater conditions:

- Alternative #1 – Replace the existing culverts with twin 10’ x 8’ RCBCs to maintain a 100-year LOS at the railroad under future land-use conditions and reduce tailwater on North Overlook Drive. This improvement requires downstream improvements at East 14th Street. Three buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #1 improvements. The total estimated construction cost for this project is $13,300,000.
- Alternative #2 – Replace the existing culverts with twin 8’ x 8’ RCBCs to maintain a 100-year LOS at the railroad under future land-use conditions and reduce tailwater on North Overlook Drive. Three buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of all Alternative #1 improvements. The total estimated construction cost for this project is $12,650,000.

Construction of the improvements at this location may result in impacts to overhead electric utilities. Three of the adjacent properties are single family residences; one is a multi-family residence; however, impacts to those properties are expected to be minor.

Improving storm drainage infrastructure that passes underneath a railroad presents several challenges, including a general prohibition on open-cut excavation. Instead, trenchless installation methods are normally used to install storm pipes in these locations. Traditional circular pipe may be installed via jack and bore, typically for diameters up to 60”. However, as presented above, both proposed alternatives involve installation of large RCBCs in order to realize upstream LOS improvements. Combined with the local geology and length of the culverts, several methods of installation were considered, including tunnel jacking, modular systems, secant pipe roof, and sprayed concrete lining tunneling. These methods are suitable for RCBC installation in loose soils, while allowing the overhead railroad to remain in operation; however, such methods typically come at a significantly higher price than open-cut, and even traditional tunneling methods. Ultimately, tunnel jacking was chosen as the basis for cost estimating; however, detailed evaluation of the installation methods should be conducted at the time of final design, during which, additional geotechnical information may be collected, and discussions with the railroad owner occur.

Tunnel Jacking, also known as box jacking with shield, involves the advancement of a reinforced concrete structure using high capacity hydraulic jacks. The structure to be installed is set on a launch pad in a pit or shaft on the crossing alignment at appropriate line and grade. It is then jacked horizontally using tunneling heading support such as a shield. Excavation by excavator arm or other hydraulic equipment, or by hand, takes place from inside the box culvert. Special face support is required in the form of louvers, sand tables, breasting boards, and forepoling with spiles. Additionally, chemical grouting of the entire alignment and/or use compressed air is necessary to prevent the flowing or running of soil materials, and otherwise control the face of excavation to prevent surface settlement.

The cost estimate for tunnel jacking at the NS Railroad location was developed using recent bids and with input from engineers and contractors. In addition to the line items used in the majority of the Primary System improvement cost estimates (e.g. mobilization, erosion control, hauling, riprap, etc.) the RCBC tunnel jacking includes estimates for additional permitting fees, tunnel jacking, pit excavation and dewatering, jet grouting of the tunnel, and various other items required for this method of construction. Also, an additional contingency was applied to the installation costs due to the complexity of the project and not having a detailed evaluation of the site (geotechnical, etc.). The cost of implementing the proposed NS Railroad improvements is approximately 11 times higher than similar projects with traditional construction presented in this WSMP.

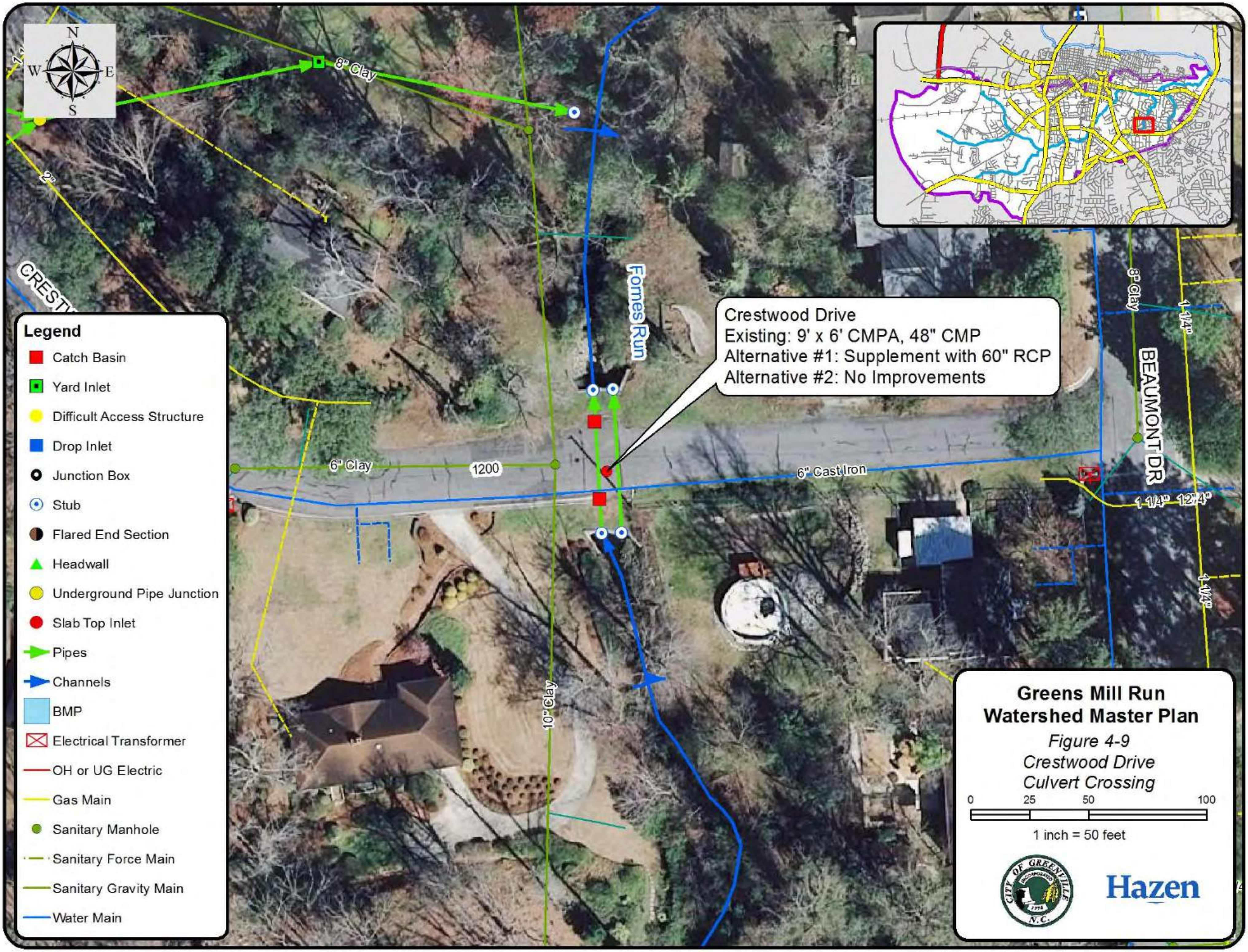
East 14th Street (NCDOT) – (**Figure 4-10**) The existing 9.5' x 6.4' CMPA and 72" CMP were determined to be in poor structural condition, but meet the desired 25-year level of service under existing land-use conditions. Replacing the culverts is proposed to reduce upstream tailwater conditions:

- Alternative #1 – Replace the existing culverts with twin 10' x 8' RCBCs to provide a 50-year level of service at East 14th Street under future land-use conditions and reduce tailwater on North Overlook Drive. The total estimated construction cost for this project is $1,200,000.
- Alternative #2 – Do not improve crossing, which provides a 2-year LOS under future land-use conditions.

Construction of the improvement at this location may result in impacts to sewer, water, and gas utilities. Three adjacent properties are single family residences; one is a multi-family residence. Coordination with NCDOT is required and traffic impacts are likely be significant as the roadway serves as a minor thoroughfare for a large residential area with schools in the nearby vicinity.

Dalebrook Circle (COG) – The existing 9' x 6' CMPA was determined to be in good structural condition and to meet the desired 25-year level of service under existing land-use conditions, therefore, no improvements are proposed.

A summary of the hydraulic performance of the Fornes Run improvements proposed for Alternatives #1 and #2 are provided in **Table 4-6** and **Table 4-7**, respectively. The provided water surface elevations assume that all proposed improvements within one set of alternatives (Alternative #1 or #2) is implemented. Water surface elevations and the LOS provided will vary, until all projects are implemented.



N
S
E
W
8" Clay
2"
CREST
Fornes Run
Crestwood Drive
Existing: 9' x 6' CMPA, 48" CMP
Alternative #1: Supplement with 60" RCP
Alternative #2: No Improvements
6" Clay
1200
6" Cast Iron
10" Clay
8" Clay
BEAUMONT DR
1 1/4"
1 1/4" 12"4"
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
Greens Mill Run
Watershed Master Plan
Figure 4-9
Crestwood Drive
Culvert Crossing
0 25 50 100
1 inch = 50 feet
Hazen

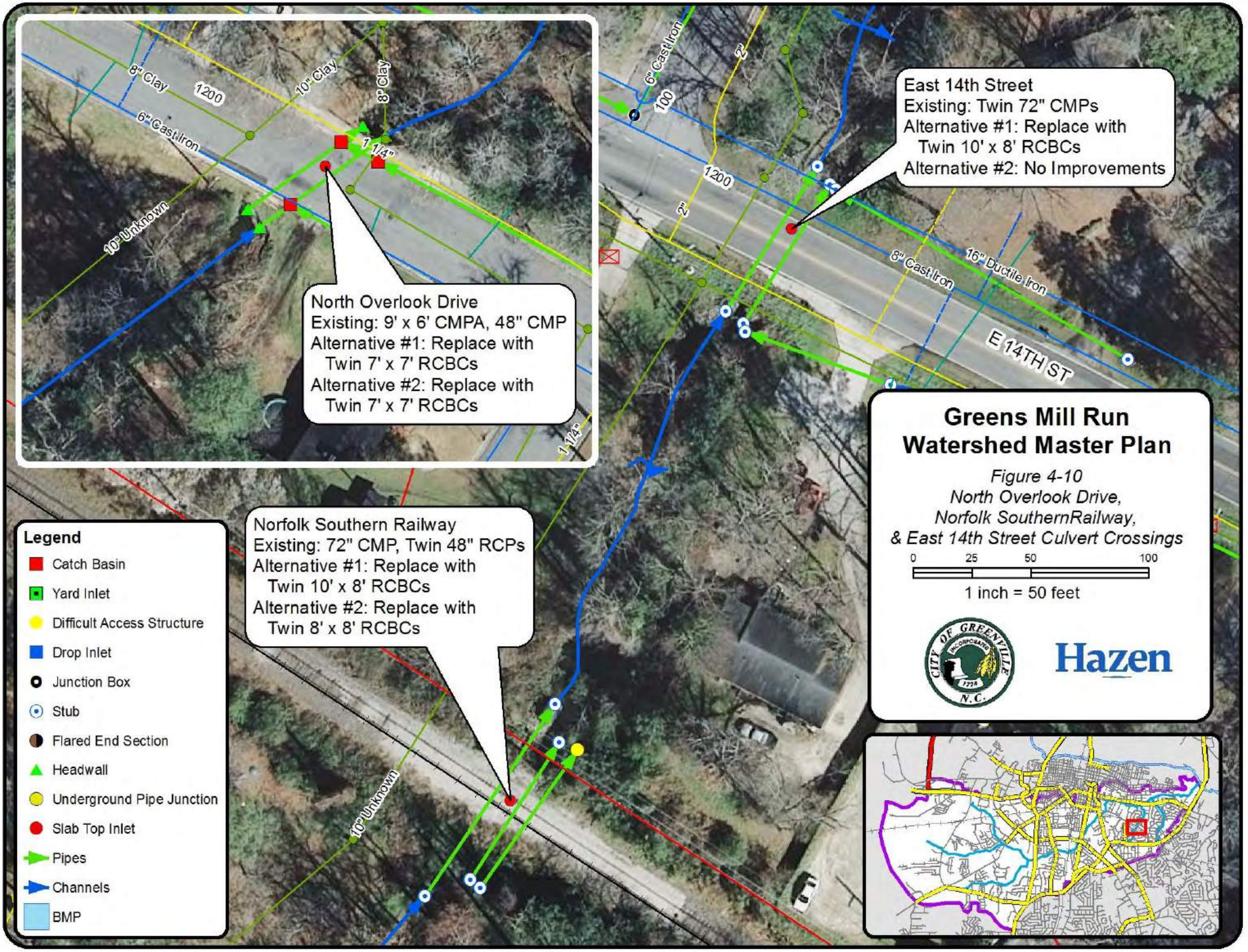

East 14th Street
Existing: Twin 72" CMPs
Alternative #1: Replace with
Twin 10' x 8' RCBCs
Alternative #2: No Improvements
North Overlook Drive
Existing: 9' x 6' CMPA, 48" CMP
Alternative #1: Replace with
Twin 7' x 7' RCBCs
Alternative #2: Replace with
Twin 7' x 7' RCBCs
Norfolk Southern Railway
Existing: 72" CMP, Twin 48" RCPs
Alternative #1: Replace with
Twin 10' x 8' RCBCs
Alternative #2: Replace with
Twin 8' x 8' RCBCs
8" Clay
10" Clay
1200
6" Cast Iron
10" Unknown
1 1/4"
6" Cast Iron
100
2"
8" Cast Iron
16" Ductile Iron
E 14TH ST
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Greens Mill Run
Watershed Master Plan
Figure 4-10
North Overlook Drive,
Norfolk SouthernRailway,
& East 14th Street Culvert Crossings
0 25 50 100
1 inch = 50 feet
Hazen

Table 4-6: Hydraulic Performance for Alternative #1 – Fornes Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Southeast Greenville Boulevard (Existing 60" CMP, 36" PVC, 9' x 6.5' CMPA)	58.8	50	52.0	57.1	**59.3**	**59.5**	**59.7**
Crestwood Drive (Proposed 60" RCP)	42.7	25	39.1	40.9	42.5	**43.7**	**44.2**
North Overlook Drive (Proposed Twin 7' x 7' RCBCs)	39.3	25	34.6	36.6	38.6	**40.1**	**40.9**
Norfolk Southern Railway (Proposed Twin 10' x 8' RCBCs)	51.8	100	32.7	35.6	37.3	38.8	40.4
East 14th Street (Proposed Twin 10' x 8' RCBCs)	37.3	25	29.3	35.0	36.2	37.1	**37.8**
Dalebrook Circle (Existing 9' x 6' CMPA)	34.1	25	28.9	**34.5**	**35.4**	**35.8**	**36.2**

Table 4-7: Hydraulic Performance for Alternative #2 – Fornes Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Southeast Greenville Boulevard (Existing 60" CMP, 36" PVC, 9' x 6.5' CMPA)	58.8	50	51.3	57.1	**59.2**	**59.5**	**59.6**
Crestwood Drive (Existing 9' x 6' CMPA, 48" CMP)	42.7	25	39.1	42.2	**43.6**	**44.1**	**44.6**
North Overlook Drive (Proposed Twin 7' x 7' RCBCs)	39.3	25	34.3	39.2	**40.4**	**41.1**	**42.6**
Norfolk Southern Railway (Proposed Twin 8' x 8' RCBCs)	51.8	100	32.3	38.5	39.7	40.8	42.4
East 14th Street (Existing Twin 72" CMPs)	37.3	25	30.5	**37.7**	**38.3**	**38.5**	**38.8**
Dalebrook Circle (Existing 9' x 6' CMPA)	34.1	25	28.9	**34.5**	**35.4**	**35.8**	**36.2**

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.
**Green shade indicates crossing meets desired level of service. Red shade indicates crossing does not meet desired level of service.
***Tan shade indicates provided level of service.

4.1.8 Unnamed Tributary

No crossings with a deficient level of service were identified in the existing land-use conditions analysis; therefore, no improvements are recommended for the Unnamed Tributary crossings.

4.1.9 Greens Mill Run North Fork

Allen Road (NCDOT) – (**Figure 4-11**) The existing 84" CMP was determined to be in good structural condition and to provide a 25-year level of service under existing land-use conditions, below the desired 50-year LOS. Replacing the culvert is proposed to meet the desired LOS.

- Alternative #1 – Replace the existing culvert with twin 7' x 7' RCBCs to provide a 50-year LOS under future land-use conditions. Four buildings located within the future conditions 100-year floodplain were show to be located outside of the floodplain following implementation of this improvement. The total estimated construction cost for this project is $800,000.
- Alternative #2 – Same as Alternative #1.

Construction of the improvement at this location may result in impacts to water, overhead electric, and gas utilities. The adjacent properties consist of single and multi-family residences. Coordination with NCDOT is required and traffic impacts are likely be significant as the roadway serves as a major thoroughfare for residents and local businesses.

NCDOT is planning widening / improvements along Allen Road that will extend from Stantonsburg Road to Dickenson Avenue, during which this culvert may be replaced. NCDOT has not yet sized the culvert, but expects design to begin in late 2016 / early 2017. ***(Revised 1/4/17)***

Spring Forest Road (COG) (US) – (**Figure 4-12**) The existing triple 60" CMPs were determined to be in good structural condition, but provide a 10-year level of service under existing land-use conditions, below the desired 25-year LOS. Providing the desired 25-year LOS under future land-use conditions was determined to be unfeasible due to the size of improvements required and their impact on flowrates exiting North Fork and entering Greens Mill Run. The culvert size (flow area) needed for the 25-year LOS was determined to be two times larger than the current infrastructure, in addition to requiring significant infrastructure upgrades at all downstream crossings on North Fork. These downstream crossing upgrades included: upsizing the NS railroad infrastructure by six times the current size, increasing the downstream Spring Forest Road crossing by 2.5 times the current size, and increasing the Ellsworth Drive infrastructure by over eight times its current size. Additionally, outflows from the NS Railroad and Ellsworth Drive crossings were shown to increase substantially as their attenuation capabilities were greatly reduced due to the large culvert sizes. This in turn, reduced the hydraulic performance of downstream crossings on both North Fork and GMR, resulting in the need for additional and larger downstream improvement projects. In addition to infrastructure upgrades, additional floodplain modifications were required to mitigate water surface elevation increases from the North Fork NS Railroad to the downstream extent of GMR. Based on these analyses, the proposed alternatives for the Spring Forest Road (US) crossing consider a 10-year LOS.

Improving the crossing is proposed.

- Alternative #1 – Replace the existing culverts with triple 8' x 6' RCBCs to provide a 10-year LOS under future land-use conditions. This improvement requires improvements at all downstream crossings on North Fork. The total estimated construction cost for this project is $1,100,000.
- Alternative #2 – Supplement the existing culverts with triple 60" RCPs to provide a 10-year level of service under future land-use conditions. This improvement requires improvements at all downstream crossings on North Fork. The total estimated construction cost for this project is $620,000.

Construction of the improvements at this location may result in impacts to water, sewer, gas, and electric utilities. The adjacent properties consist of commercial/office buildings. Traffic impacts are likely be limited to local residential and business traffic.

Railroad (NS) – (**Figure 4-13**) The existing twin 48" RCPs were determined to be in good structural condition and to meet the desired 100-year level of service under existing land-use conditions. Improving the crossing to decrease upstream tailwater conditions is proposed.

- Alternative #1 – Supplement the existing culverts with a 60" RCP located in the floodplain overbank to maintain a 100-year level of service at the railroad under future land-use conditions. This improvement requires downstream improvements at Spring Forest Road (DS) and Ellsworth Drive to allow for feasible improvements at Spring Forest Road (US). As a result of these three improvements, water surface elevations along portions of both GMR and North Fork are shown to increase, thus require floodplain modifications for mitigation. These modifications are presented following the Ellsworth Drive project description. The total estimated construction cost for the Norfolk Southern Railway Alternative #1 project is $1,400,000, including the allocated portion of floodplain modifications.
- Alternative #2 – Same drainage infrastructure as Alternative #1; however, due to differences between the two alternatives at other crossings, the required floodplain modifications also varied, as described following the Ellsworth Drive project description. The total estimated construction cost for the Norfolk Southern Railway Alternative #2 project is $1,190,000, including the allocated portion of floodplain modifications.

Construction of this improvement may result in impacts to water and underground and overhead electric utilities. Other than railroad property, adjacent properties consist of commercial/office buildings. No impacts to railroad traffic are expected as jack-and-bore may be utilized to install the additional pipe.

Additionally, attenuation was modeled at Lake Ellsworth and the Norfolk Southern Railway, thus improvements at and downstream of those locations resulted in decreases to attenuation, and subsequently higher flows and water surface elevations. These flow increases were then carried to Greens Mill Run, impacting performance of all crossings from Dickinson Avenue Extension to the Tar River. As such, reducing flooding adjacent to the attenuation locations was balanced with limiting flow increases on downstream crossings.

Spring Forest Road (COG) (DS) – (**Figure 4-13**) The existing triple 60" RCPs were determined to be in good structural condition, but provide a 2-year level of service under existing land-use conditions, below the desired 25-year LOS. Providing the desired 25-year LOS under future land-use conditions was determined to be unfeasible, as described in the Spring Forest Road (US) section; therefore, the following alternatives consider a 10-year LOS.

- Alternative #1 – Replace the existing culverts with triple 8' x 6' RCBCs to provide a 10-year level of service under future land-use conditions. This improvement requires downstream improvements at Ellsworth Drive and floodplain benching as described below the Ellsworth Drive section. The total estimated construction cost for this project is $2,330,000, including the allocated portion of floodplain modifications.
- Alternative #2 – Supplement the existing culverts with twin 60" RCPs to provide a 10-year level of service under future land-use conditions. This improvement requires downstream improvements at Ellsworth Drive and floodplain benching as described below the Ellsworth Drive section. The total estimated construction cost for this project is $1,390,000, including the allocated portion of floodplain modifications.

Construction of the improvements at this location may result in impacts to water, gas, and electric utilities. The adjacent properties consist of multi-family residences. Traffic impacts are likely be limited to local residential and business traffic.

This crossing is affected by tailwater and attenuation from Ellsworth Drive. See the Spring Forest Road (US) alternatives, above, for additional information regarding this interaction.

Ellsworth Drive (COG) – (**Figure 4-14**) The existing crossing consists of an earthen dam, impounding an approximate 6 acre lake. Ellsworth Drive is located along the crest of the dam. The principal spillway consists of a riser and 42" CMP barrel; the emergency spillway contains triple 30" CMPs. The dam, outlets, and lake are all located on private property, except for the City owned roadway and right-of-way. Combined, the outlets were determined to provide a 2-year level of service under existing land-use conditions, less than the desired 25-year LOS. The existing culverts were determined to be in fair condition. Any improvements to the dam's outlets initiate dam safety requirements, such as clearing of trees on the embankments, embankment stability analysis, hydrological and hydraulic analyses for large storm events, dam outlet capacity analysis, and other items as directed by the appropriate state agency. Analyses, improvements, and costs associated with dam safety are not included in this WSMP. In order to limit the magnitude of proposed projects, avoid changing the current nature of the lake, and to balance changes in attenuation, only the emergency spillway was considered for improvements. As such, providing the desired LOS was not feasible with emergency spillway upgrades only, thus the following alternatives consider a 10-year LOS.

- Alternative #1 – Replace the existing emergency spillway culverts with quadruple 8' x 2.5' RCBCs to provide a 10-year level of service under future land-use conditions. This improvement requires floodplain benching as described below. One building immediately upstream of this crossing is proposed to be removed from the future conditions 100-year floodplain due to lower water surface elevations. The total estimated construction cost for this project is $1,870,000, including the allocated portion of floodplain modifications. However, this does not include dam-safety related costs.
- Alternative #2 – Same drainage infrastructure as Alternative #1; however, due to various differences between the two alternatives, the required floodplain modifications also varied, as discussed below. One building immediately upstream of the crossing is proposed to be removed from the future conditions 100-year floodplain due to lower water surface elevations. The total estimated construction cost for this project is $1,660,000, including the allocated portion of floodplain modifications. However, this does not include dam-safety related costs.

Construction of this improvement may result in impacts to water, sewer, gas, and electric utilities. The adjacent properties consist of multi-family residences. Traffic impacts are likely be limited to local residential traffic. The City is required to initiate agreements with property owners to perform the improvements, or may investigate assuming ownership of the lake and dam.

Greens Mill Run North Fork Floodplain Modifications

Floodplain modifications proposed due to water surface elevation increases include benching and leveling. Benching involves the creation of a low bench, cut from the existing embankment, adjacent to the stream channel. Leveling involves smoothing the topography of the existing floodplain to eliminate natural levees, deposition, and other irregularities that impede flow access to the existing floodplain.

Maintenance of the proposed floodplain modifications refers to occasional clearing of large, thick vegetation that may significantly impede flow, such as trees and dense woody vegetation. Maintenance activities should not include use of chemicals, result in little remaining vegetation, or low vegetation height or density. The hydraulic analyses assumed brush and heavy weed growth conditions. Non-maintained modifications should not be maintained for vegetation purposes, other than to ensure vegetation is present.

Portions of the floodplain modifications attributed to North Fork are located along GMR. These modifications are located upstream of all GMR improvements. This was due to the water surface elevation increases being caused by the North Fork improvements, thus attributable only to those projects. Floodplain modifications further downstream on GMR, discussed in the Rock Spring Road portion of the Greens Mill Run section, are located downstream of the GMR improvements and were therefore attributed to those projects. However, it is noted that any improvement on

GMR or North Fork which may result in downstream water surface elevation increases, may require mitigation at any location along the two streams, regardless of the allocation in this WSMP.

A portion of the North Fork floodplain modifications proposed along GMR (from Dickinson Avenue Extension to Meridian Drive), overlap with the Dickinson Avenue stream stabilization project (**Section 5.1.1**). In order to analyze and account for the individual effects and benefits of these projects, the two were evaluated separately. Should both projects be selected for implementation, re-evaluation considering the cumulative effects of both should be conducted.

The cost of floodplain modifications was evenly allocated among the Norfolk Southern Railway, Spring Forest Road (DS), and Ellsworth Drive projects, as each partially contributed to the increased water surface elevations. A summary of the proposed modifications for Alternative #1 is presented in **Table 4-8** and modifications for Alternative #2 are summarized in **Table 4-9**. Figures depicting the floodplain benching are provided in **Figure 4-15** through **Figure 4-19**.

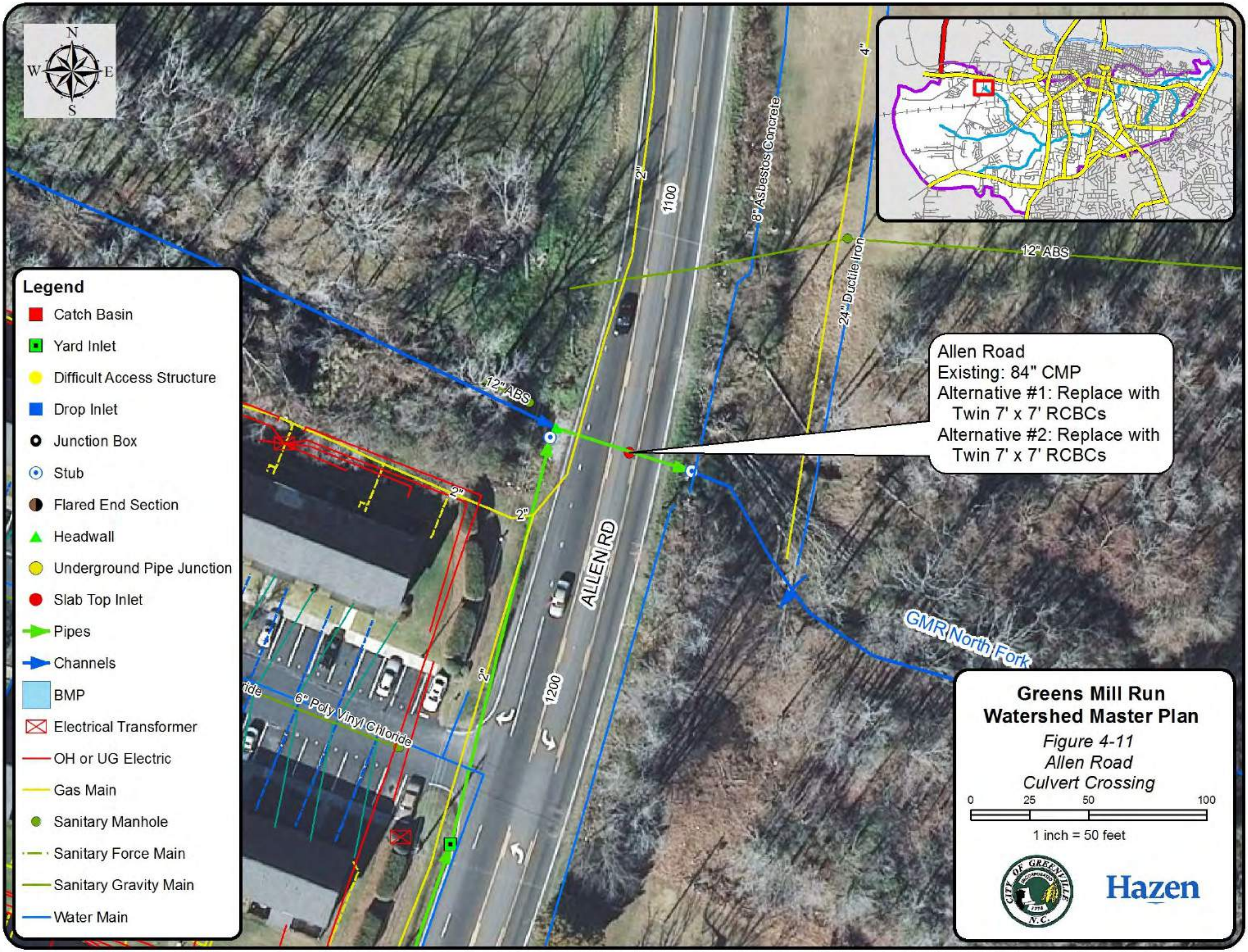
Table 4-8: North Fork Floodplain Modifications – Alternative #1

Stream	Floodplain Modification	Length (ft)	Width Range (ft)	Maintained
North Fork	Bench	750	60 - 80	No
GMR	Bench	2,450	45 - 60	Yes
	Bench	1,450	45 - 60	No
	Bench	125	10	No
	Leveling	3,250	100 - 330	No

Table 4-9: North Fork Floodplain Modifications – Alternative #2

Stream	Floodplain Modification	Length (ft)	Width Range (ft)	Maintained
North Fork	Bench	750	20 - 55	Yes
GMR	Bench	3,150	45 - 60	Yes
	Bench	725	45 - 50	No
	Bench	125	10	No
	Leveling	3,250	100 - 330	No

A summary of the hydraulic performance of the Greens Mill Run North Fork improvements proposed for Alternatives #1 and #2 are provided in **Table 4-10** and **Table 4-11** respectively. The provided water surface elevations assume that all proposed improvements within one set of alternatives (Alternative #1 or #2) is implemented. Water surface elevations and the LOS provided will vary, until all projects are implemented.



N
W
E
S
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
Allen Road
Existing: 84" CMP
Alternative #1: Replace with
Twin 7' x 7' RCBCs
Alternative #2: Replace with
Twin 7' x 7' RCBCs
ALLEN RD
GMR North Fork
12" ABS
8" Asbestos Concrete
24" Ductile Iron
6" Poly Vinyl Chloride
1100
1200
2"
4"
Greens Mill Run
Watershed Master Plan
Figure 4-11
Allen Road
Culvert Crossing
0
25
50
100
1 inch = 50 feet
Hazen

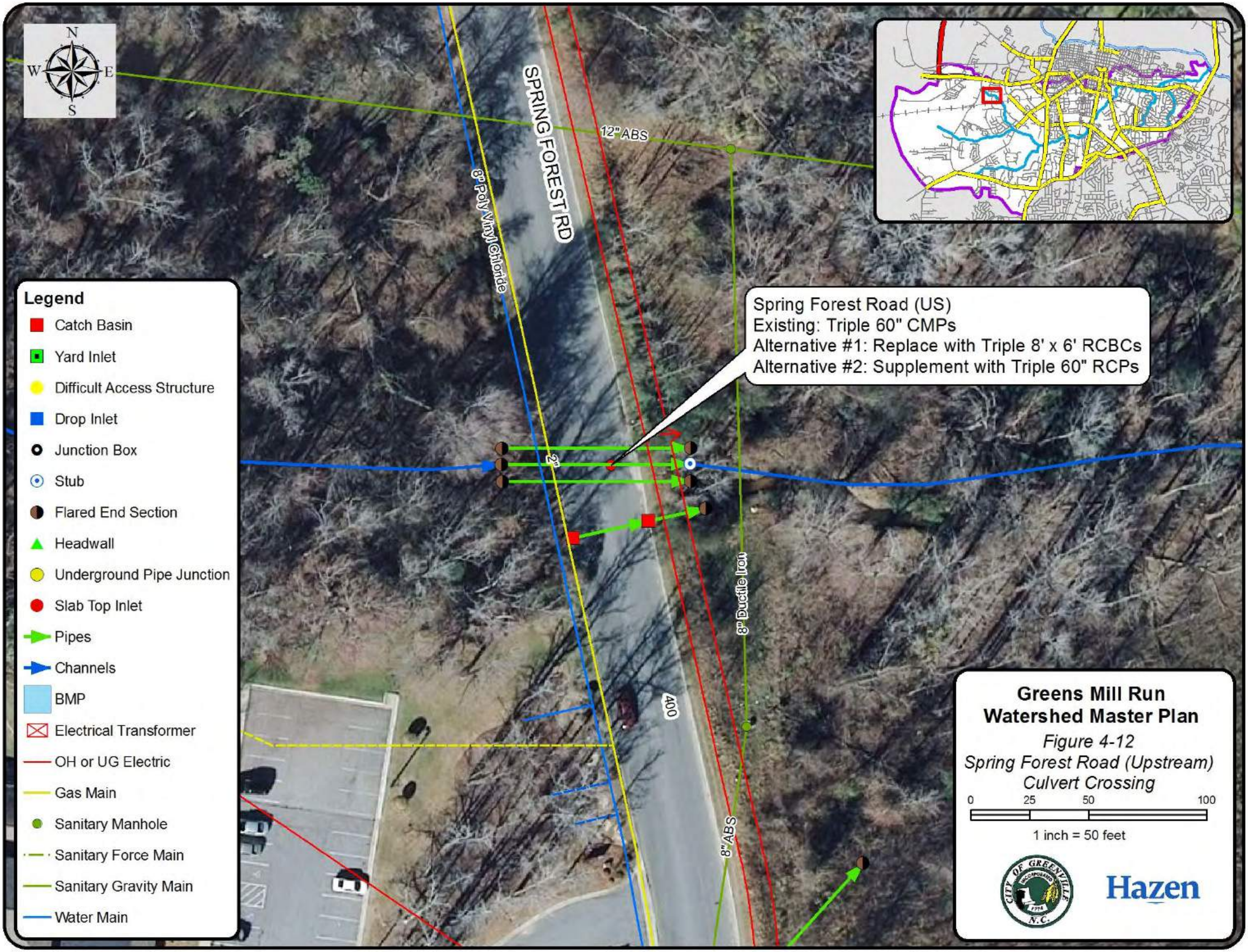
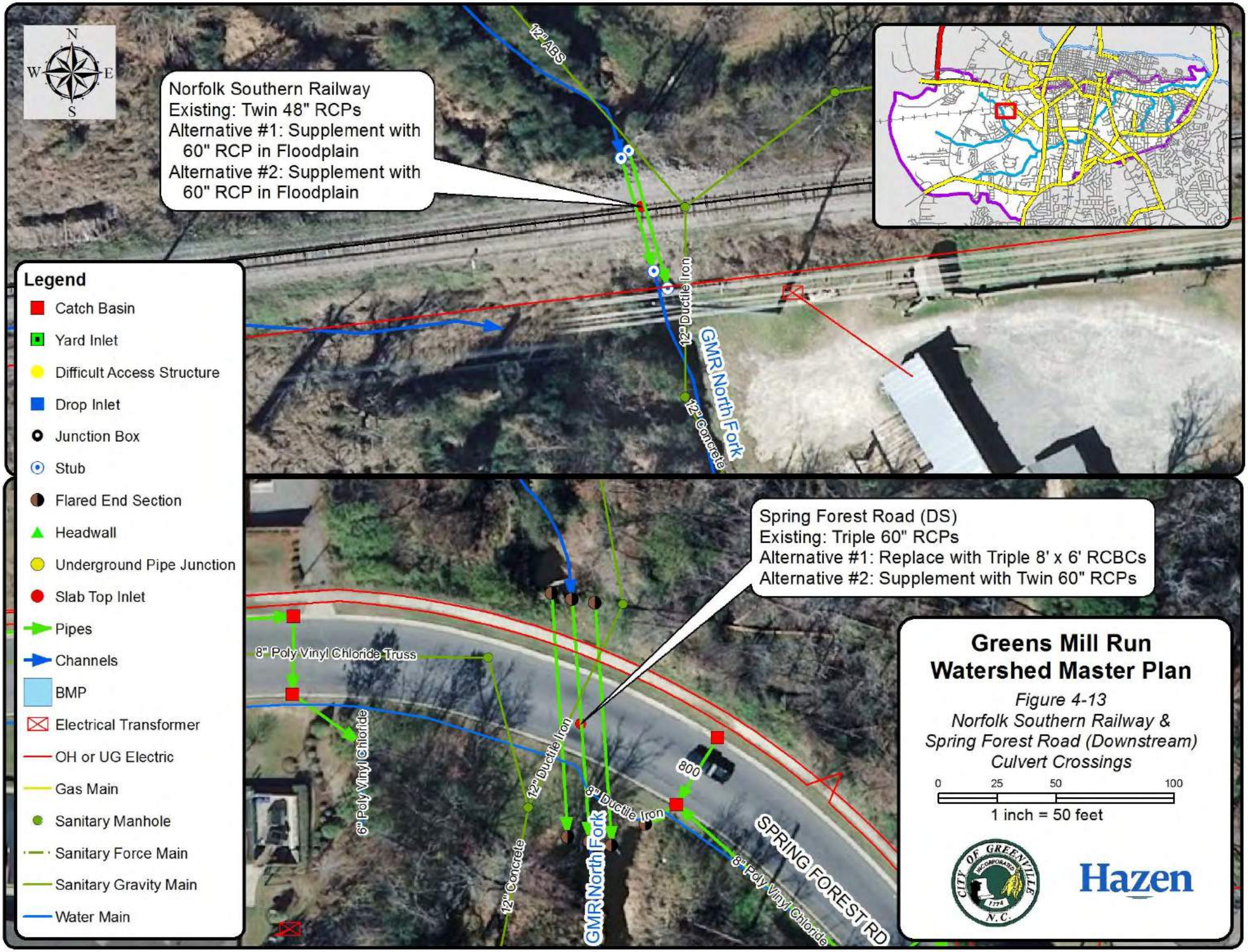
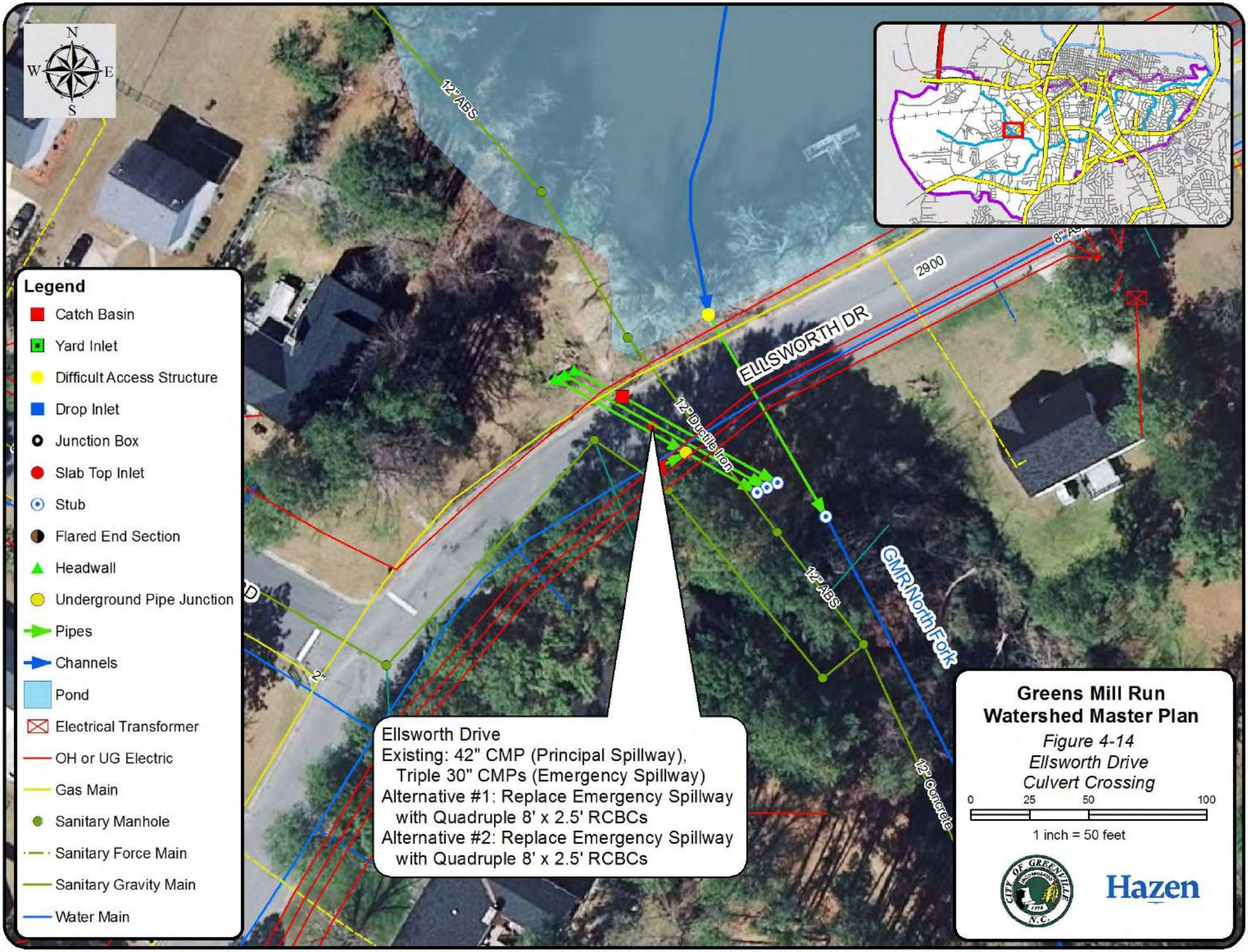
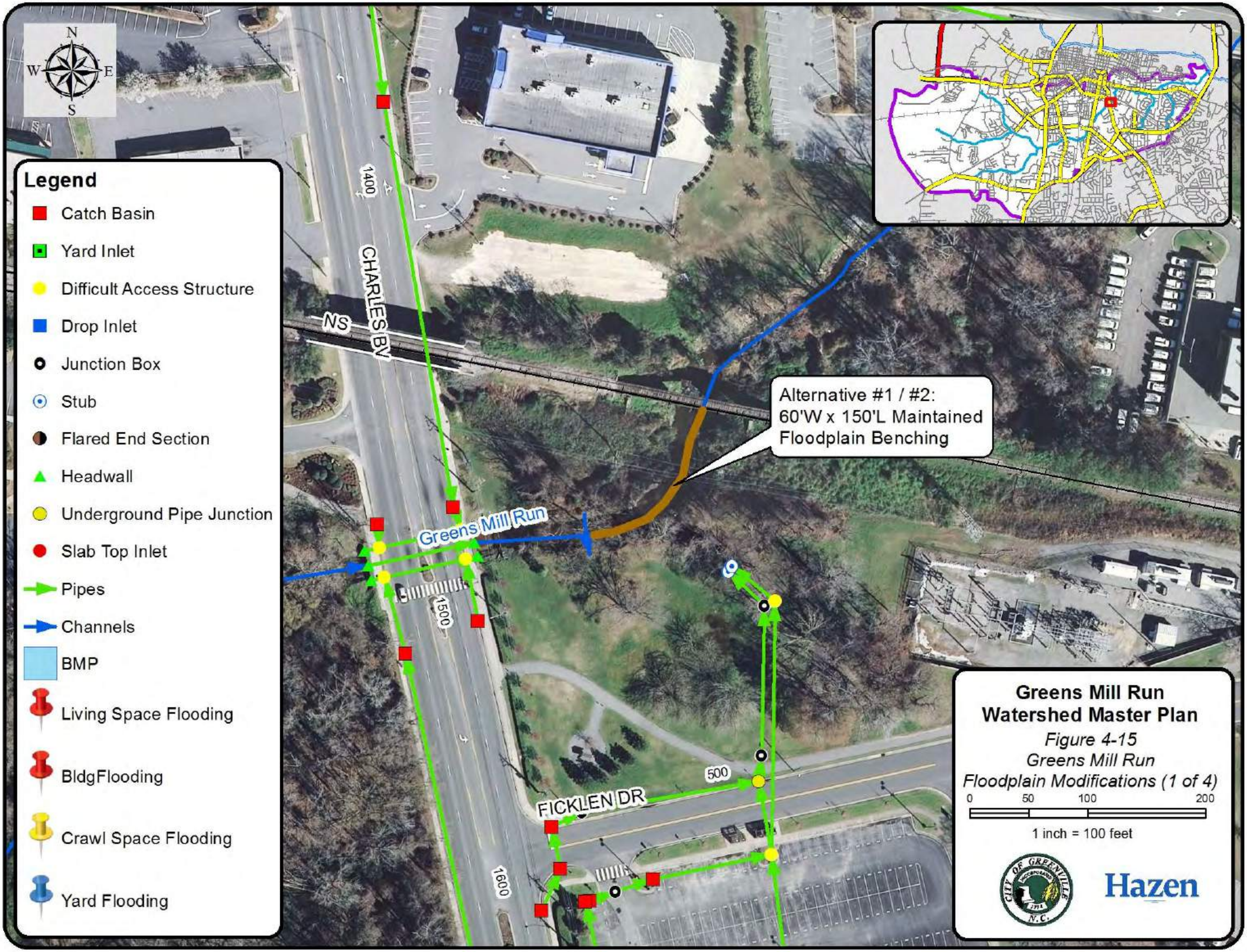


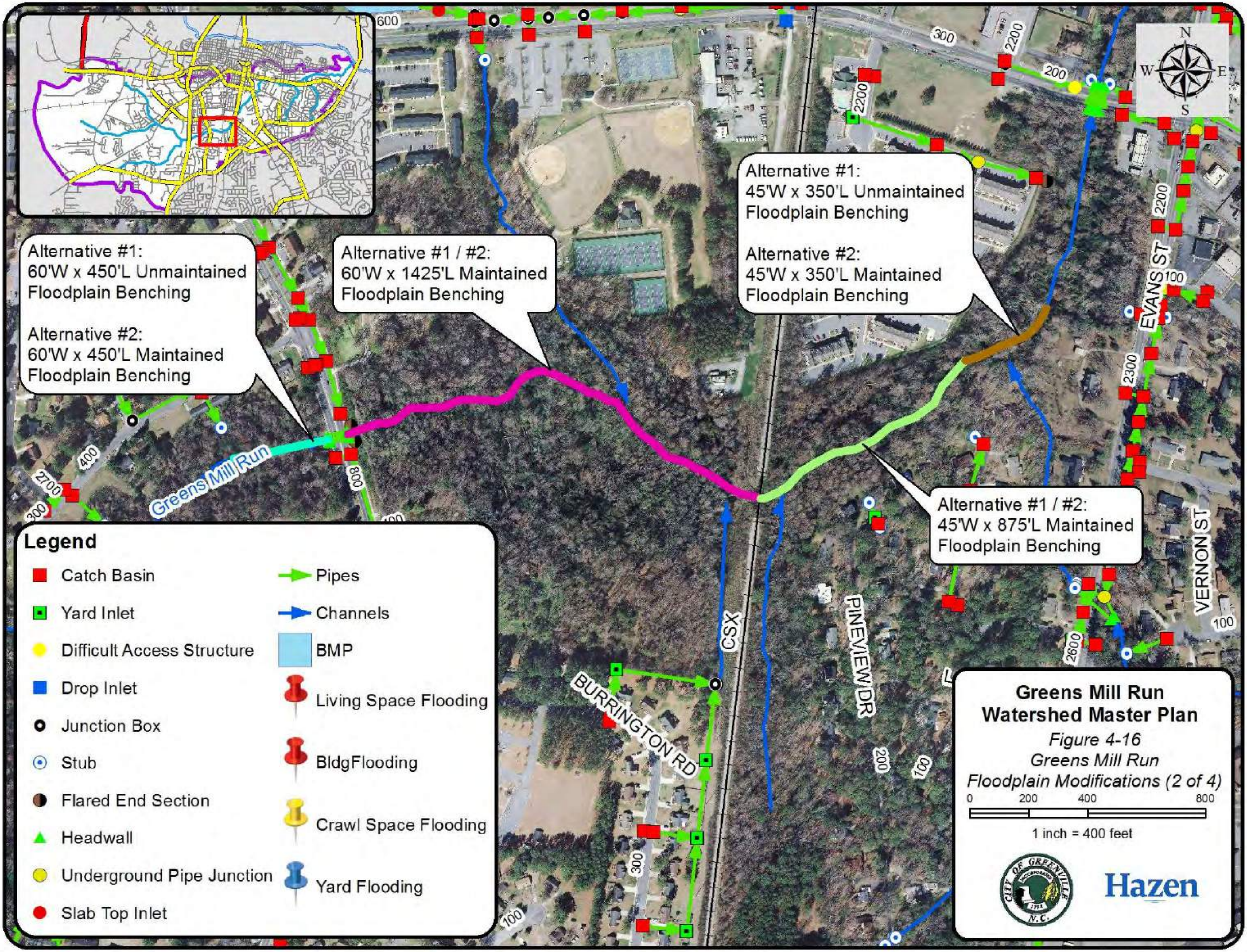
Figure 4-12
Spring Forest Road (Upstream) Culvert Crossing


Norfolk Southern Railway
Existing: Twin 48" RCPs
Alternative #1: Supplement with 60" RCP in Floodplain
Alternative #2: Supplement with 60" RCP in Floodplain
12" ABS
12" Ductile Iron
GMR North Fork
12" Concrete
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
Spring Forest Road (DS)
Existing: Triple 60" RCPs
Alternative #1: Replace with Triple 8' x 6' RCBCs
Alternative #2: Supplement with Twin 60" RCPs
8" Poly Vinyl Chloride Truss
6" Poly Vinyl Chloride
12" Ductile Iron
8" Ductile Iron
800
12" Concrete
GMR North Fork
8" Poly Vinyl Chloride
SPRING FOREST RD
Greens Mill Run
Watershed Master Plan
Figure 4-13
Norfolk Southern Railway &
Spring Forest Road (Downstream)
Culvert Crossings
0 25 50 100
1 inch = 50 feet
CITY OF GREENVILLE N.C. INCORPORATED 1774
Hazen


N
W
E
S
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Slab Top Inlet
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Pond
Electrical Transformer
OH or UG Electric
Gas Main
Sanitary Manhole
Sanitary Force Main
Sanitary Gravity Main
Water Main
12" ABS
12" Ductile Iron
12" ABS
12" Concrete
ELLSWORTH DR
2900
GMR North Fork
Ellsworth Drive
Existing: 42" CMP (Principal Spillway),
Triple 30" CMPs (Emergency Spillway)
Alternative #1: Replace Emergency Spillway
with Quadruple 8' x 2.5' RCBCs
Alternative #2: Replace Emergency Spillway
with Quadruple 8' x 2.5' RCBCs
Greens Mill Run
Watershed Master Plan
Figure 4-14
Ellsworth Drive
Culvert Crossing
0 25 50 100
1 inch = 50 feet
Hazen

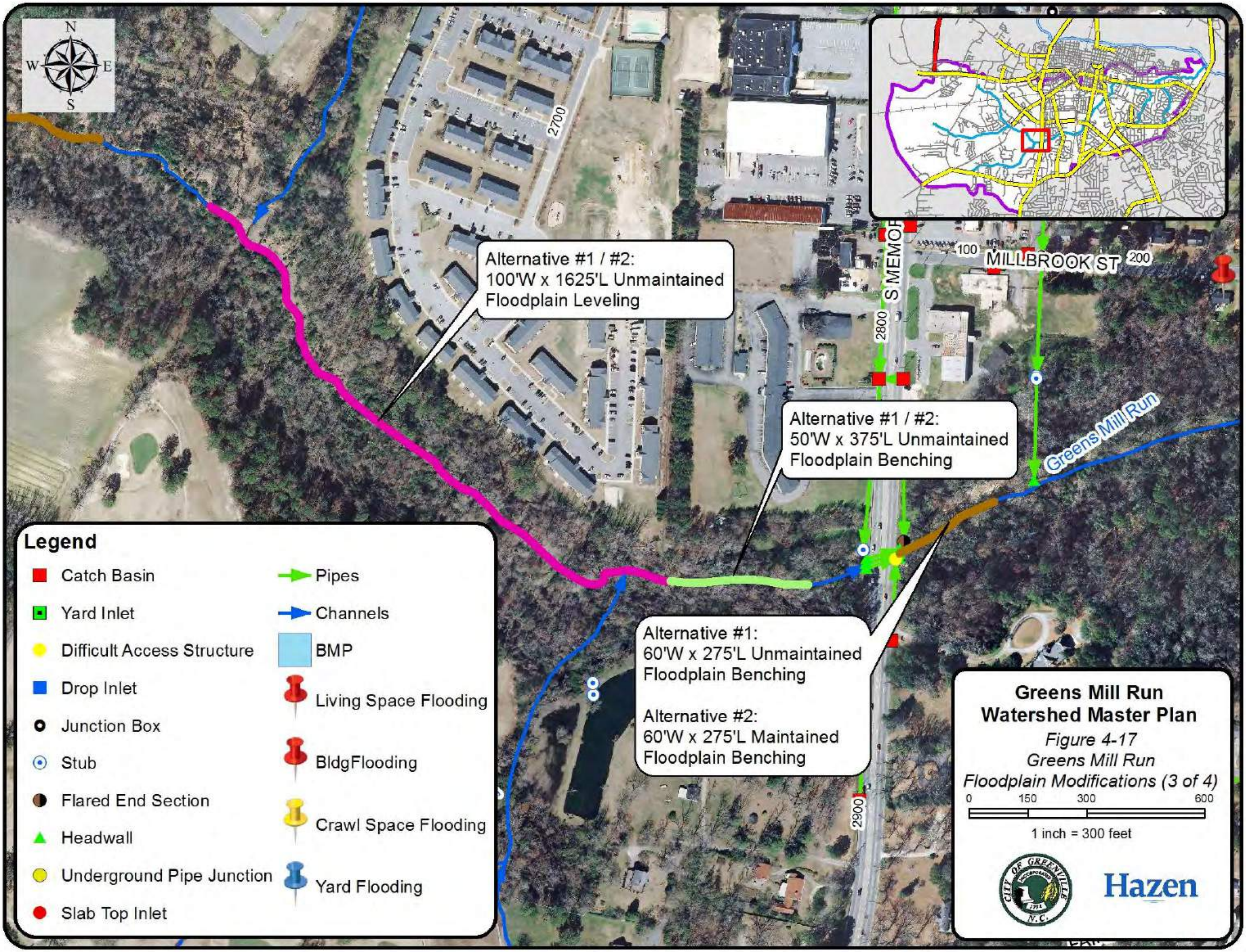


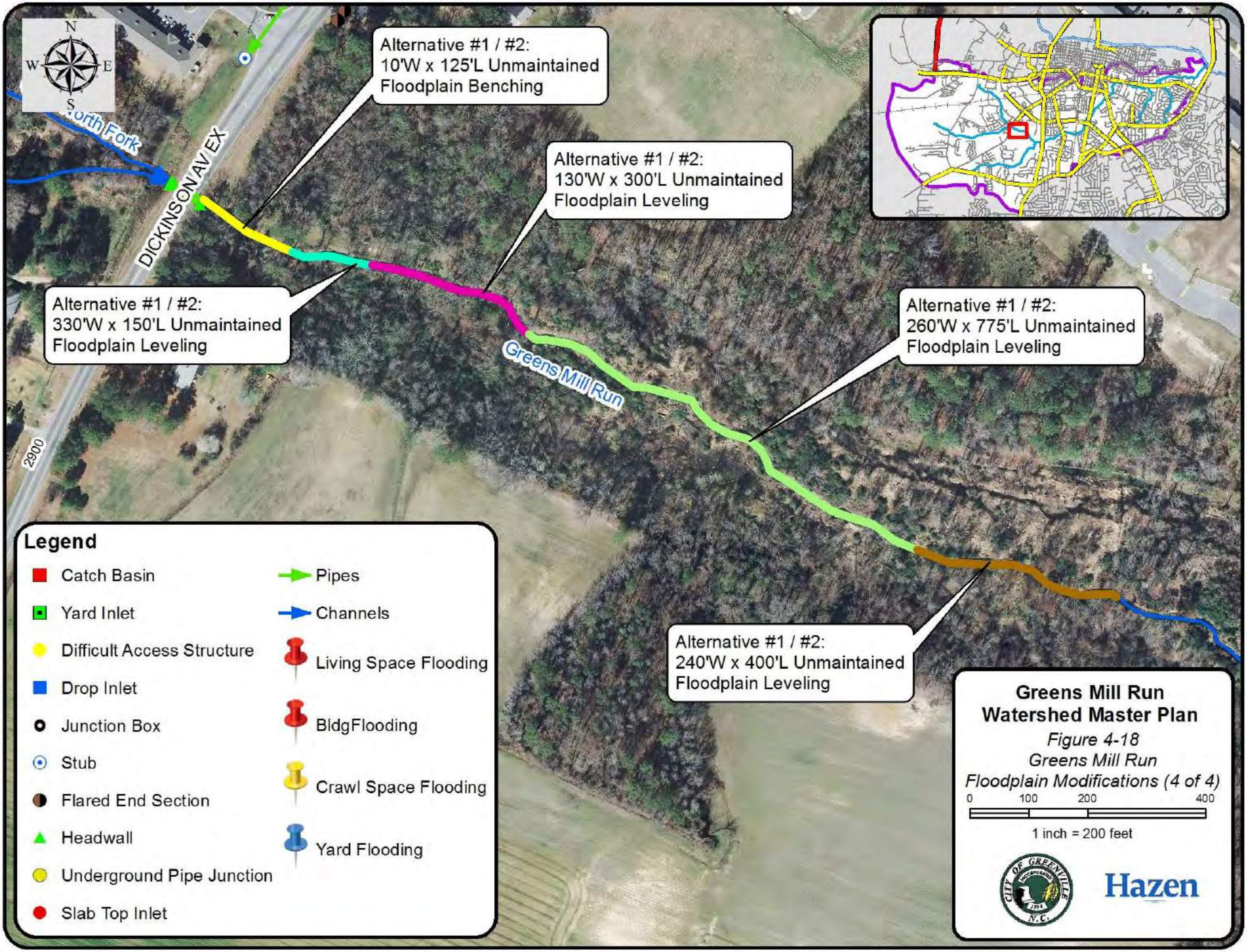
N
S
E
W
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Living Space Flooding
BldgFlooding
Crawl Space Flooding
Yard Flooding
CHARLES BV
NS
1400
1500
1600
500
Greens Mill Run
FICKLEN DR
Alternative #1 / #2:
60'W x 150'L Maintained
Floodplain Benching
Greens Mill Run
Watershed Master Plan
Figure 4-15
Greens Mill Run
Floodplain Modifications (1 of 4)
0
50
100
200
1 inch = 100 feet
CITY OF GREENVILLE
N.C.
Hazen



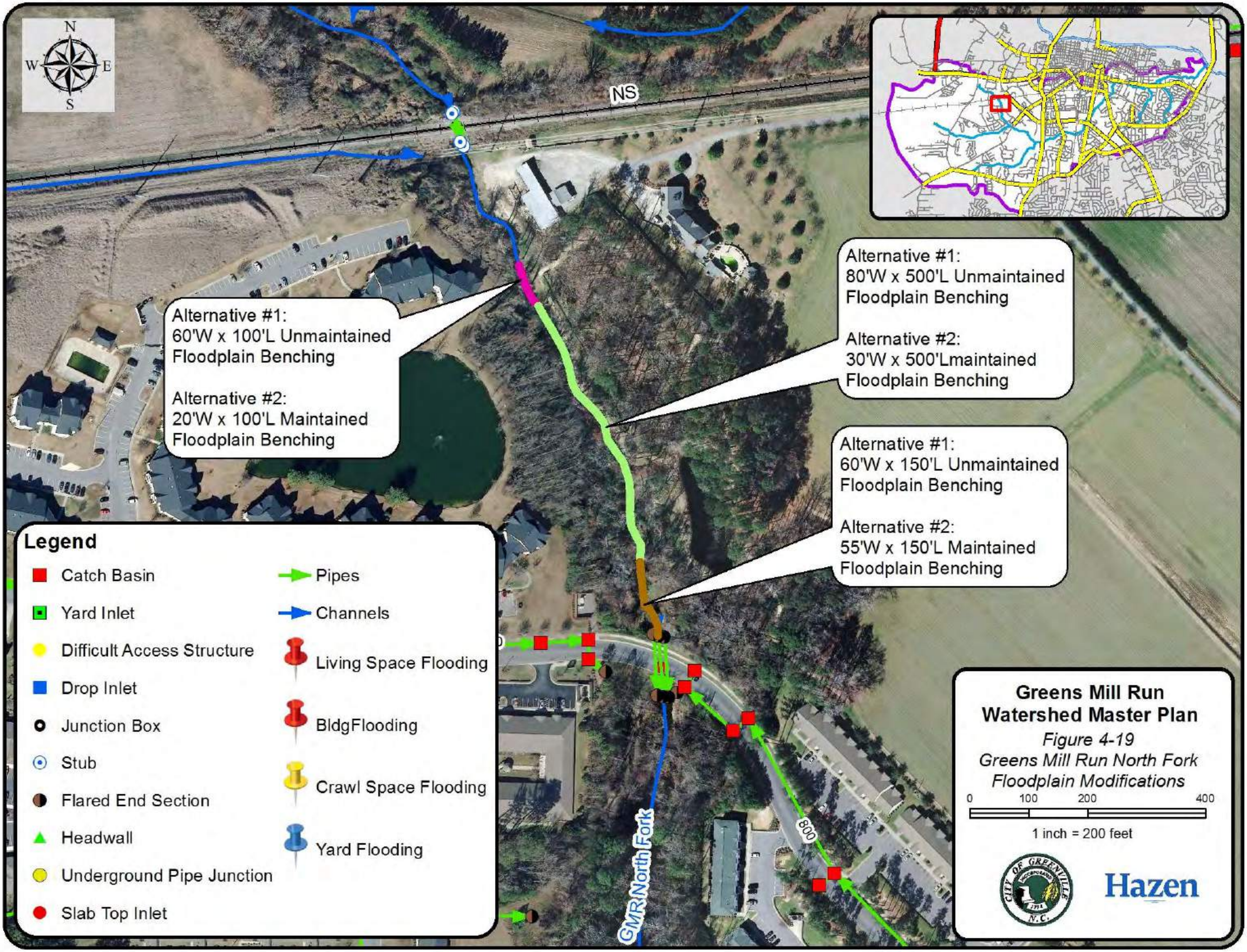
Greens Mill Run Watershed Master Plan

Figure 4-16
Greens Mill Run Floodplain Modifications (2 of 4)


N
E
S
W
2700
Alternative #1 / #2:
100'W x 1625'L Unmaintained
Floodplain Leveling
S MEMOR
100
MILLBROOK ST
200
2800
Alternative #1 / #2:
50'W x 375'L Unmaintained
Floodplain Benching
Greens Mill Run
Alternative #1:
60'W x 275'L Unmaintained
Floodplain Benching
Alternative #2:
60'W x 275'L Maintained
Floodplain Benching
2900
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
BMP
Living Space Flooding
BldgFlooding
Crawl Space Flooding
Yard Flooding
Greens Mill Run
Watershed Master Plan
Figure 4-17
Greens Mill Run
Floodplain Modifications (3 of 4)
0
150
300
600
1 inch = 300 feet
Hazen



N
W
E
S
North Fork
DICKINSON AV EX
2900
Greens Mill Run
Alternative #1 / #2:
10'W x 125'L Unmaintained
Floodplain Benching
Alternative #1 / #2:
130'W x 300'L Unmaintained
Floodplain Leveling
Alternative #1 / #2:
330'W x 150'L Unmaintained
Floodplain Leveling
Alternative #1 / #2:
260'W x 775'L Unmaintained
Floodplain Leveling
Alternative #1 / #2:
240'W x 400'L Unmaintained
Floodplain Leveling
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Living Space Flooding
BldgFlooding
Crawl Space Flooding
Yard Flooding
Greens Mill Run
Watershed Master Plan
Figure 4-18
Greens Mill Run
Floodplain Modifications (4 of 4)
0 100 200 400
1 inch = 200 feet
CITY OF GREENVILLE N.C.
Hazen



Greens Mill Run Watershed Master Plan

Figure 4-19
Greens Mill Run North Fork Floodplain Modifications

Table 4-10: Hydraulic Performance for Alternative #1 – Greens Mill Run North Fork

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Allen Road (Proposed Twin 7' x 7' RCBCs)	70.3	50	65.2	66.8	68.3	69.9	**71.0**
Spring Forest Road (US) (Proposed Triple 8' x 6' RCBCs)	64.3	25	61.2	64.0	**65.1**	**65.7**	**66.8**
Norfolk Southern Railway (Proposed 60" Floodplain RCP)	67.9	100	60.7	63.1	64.6	65.7	66.8
Spring Forest Road (DS) (Proposed Triple 8' x 6' RCBCs)	56.8	25	54.9	56.5	**57.7**	**57.9**	**58.1**
Ellsworth Drive (Proposed Quadruple 8' x 2.5' Emergency Spillway RCBCs)	56.0	25	54.5	55.8	**57.4**	**57.6**	**57.8**

Table 4-11: Hydraulic Performance for Alternative #2 – Greens Mill Run North Fork

Location	Minimum Elevation at Top of Road (ft, NAVD)	Desired Level of Service	Calculated Water Surface Elevations Under Future Land-Use Conditions (ft, NAVD)				
			2-year	10-year	25-year	50-year	100-year
Allen Road (Proposed Twin 7' x 7' RCBCs)	70.3	50	65.2	66.8	68.4	69.8	**71.0**
Spring Forest Road (US) (Proposed Triple 60" RCP)	64.3	25	61.1	63.7	**65.0**	**65.5**	**66.4**
Norfolk Southern Railway (Proposed 60" Floodplain RCP)	67.9	100	60.7	63.0	64.3	65.4	66.4
Spring Forest Road (DS) (Proposed Twin 60" RCPs)	56.8	25	55.0	56.6	**57.8**	**58.0**	**58.1**
Ellsworth Drive (Proposed Quadruple 8' x 2.5' Emergency Spillway RCBCs)	56.0	25	54.5	55.8	**57.4**	**57.6**	**57.8**

*Bold locations indicate proposed crossing improvement.
**Bold water surface elevation text indicates the water surface has exceeded the minimum elevation at the road, thereby signifying roadway flooding.
***Green shade indicates crossing meets desired level of service. Red shade indicates crossing does not meet desired level of service.
****Tan shade indicates the provided level of service.

4.2 Secondary Systems

Alternatives for Secondary Systems generally consist of additional conveyance capacity in the form of larger pipe sizes, additional barrels, or alternative routes for stormwater conveyance that add overall capacity to the systems. As stated in **Section 3.2**, Secondary Systems were modeled with EPA SWMM and generally less complex than the Primary System alternatives. The Secondary Systems have similar constraints to the Primary Systems, such as private property encroachment, utility conflicts, and spatial constraints; however, permitting is often less complex as 401/404 and FEMA permits are generally not required for Secondary Systems.

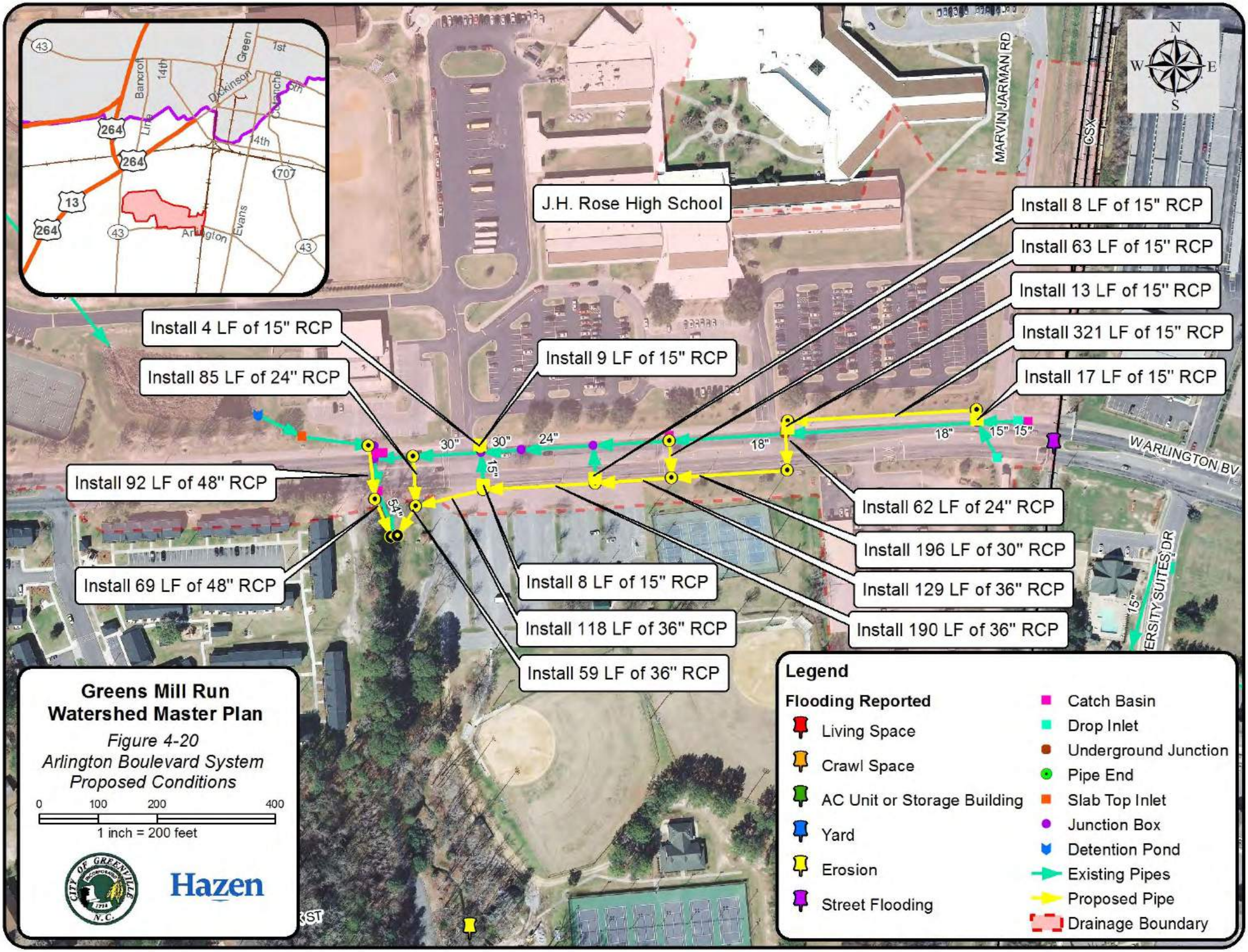
The following paragraphs describe the recommend alternatives for each of the Secondary Systems. **Section 3.2** provides detailed information, such as system modeling limits, explanations for detailed modeling, etc.; therefore, such information is not presented in this section. Alternatives were developed with the goal of alleviating surface surcharging during the 10-year storm event.

4.2.1 Arlington Boulevard System

Figure 4-20 shows improvements recommended for the Arlington Drive system to achieve a 10-year level of service. Alternatives that increased pipe sizes of the main system were analyzed; however, after increasing the diameters by three standard sizes, the desired LOS was still not met. Therefore, those alternatives were abandoned in favor of installing a parallel system that increases overall system capacity, while leaving the existing system in place. The recommended improvements include:

- Install 444 LF of 15” RCP
- Install 148 LF of 24” RCP
- Install 197 LF of 30” RCP
- Install 161 LF of 48” RCP
- Install 5 inlets
- Install 12 junction boxes
- Install 2 discharges

The model showed that the proposed improvements eliminated surface flooding within the system for the 10-year storm event. Utilities impacted include several water and sewer line crossings, as well as electrical modifications along the south side of Arlington Boulevard. The opinion of probable cost for improvements is $920,000. Most of the parallel system is located along the frontage of the Evans Park property and discharges into the same stream as the existing system. In addition, a new pipe is proposed to provide a dedicated discharge from the constructed wetland at J.H. Rose High School to the discharge on the Evans Park property.



Greens Mill Run Watershed Master Plan

Figure 4-20
Arlington Boulevard System Proposed Conditions

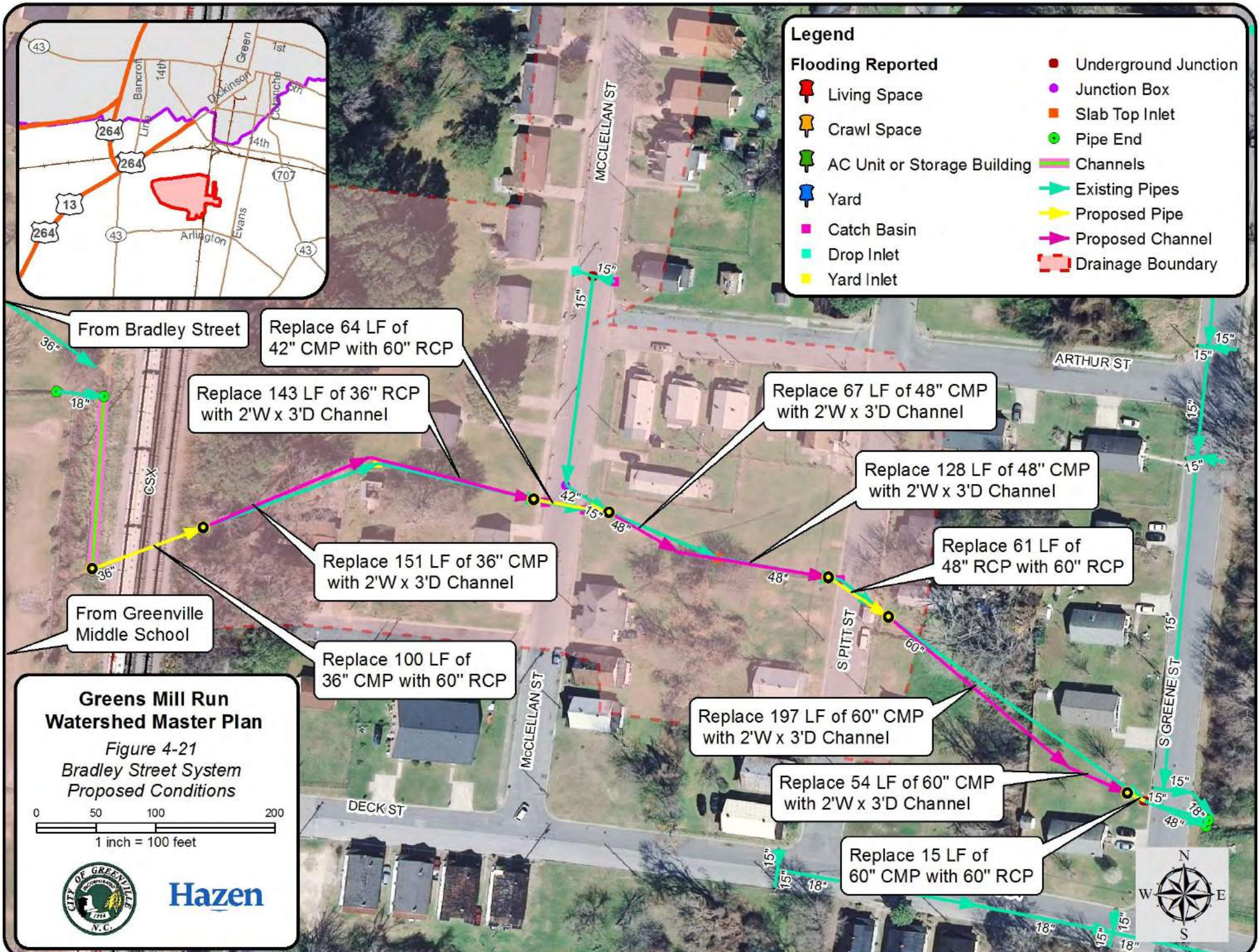
4.2.2 Bradley Street System

Figure 4-21 shows improvements recommended for the Bradley Street system. Improvements generally consist of removing a significant portion of the existing piping system and replacing with open channel, which is easier to access and maintain, and better for water quality in general. The improvements also include upsizing the pipe beneath the CSX Railroad. Note that upsizing the pipe beneath CSX Railroad will necessarily increase flows downstream (in order to reduce upstream flooding), but the model and alternative design accounts for that in sizes of receiving infrastructure. Various configurations were considered that allowed the system to remain piped, up to and including upsizing the entire main branch to 60" in diameter. At that point, analysis of upsizing pipes was discontinued, and installation of a channel was investigated and found to meet the LOS requirements.

The possibility of installing improvements along Deck Street was also investigated. Deck Street serves as a main artery for every utility included within the GUC GIS data: gas, electric, gravity sewer, force main, and water, as well as COG drainage. In addition to the costliness of relocating these utilities, space for an additional drainage line, or to upsize the existing drainage line, is limited due to both the number of utilities and the proximity of the home at the corner of Deck and Pitt Streets to the right-of-way. This alternative was not considered feasible. The proposed improvements include:

- Remove 1,030 LF of existing 42"-60" CMP
- Install 740 LF of open channel
- Tunnel installation of 100 LF of 60" RCP under the railroad
- Install 142 LF of 60" RCP associated with various road crossings
- Install 6 endwalls

The recommended improvements impact a number of private residential properties and public streets. Since these improvements are a significant change in how runoff is conveyed through the neighborhood, a significant public outreach / community involvement component is recommended. Impacted utilities include several water, sewer, and gas line crossings. It is likely that additional or modified easements across private property will be required. The opinion of probable cost for improvements is $970,000.



Greens Mill Run Watershed Master Plan

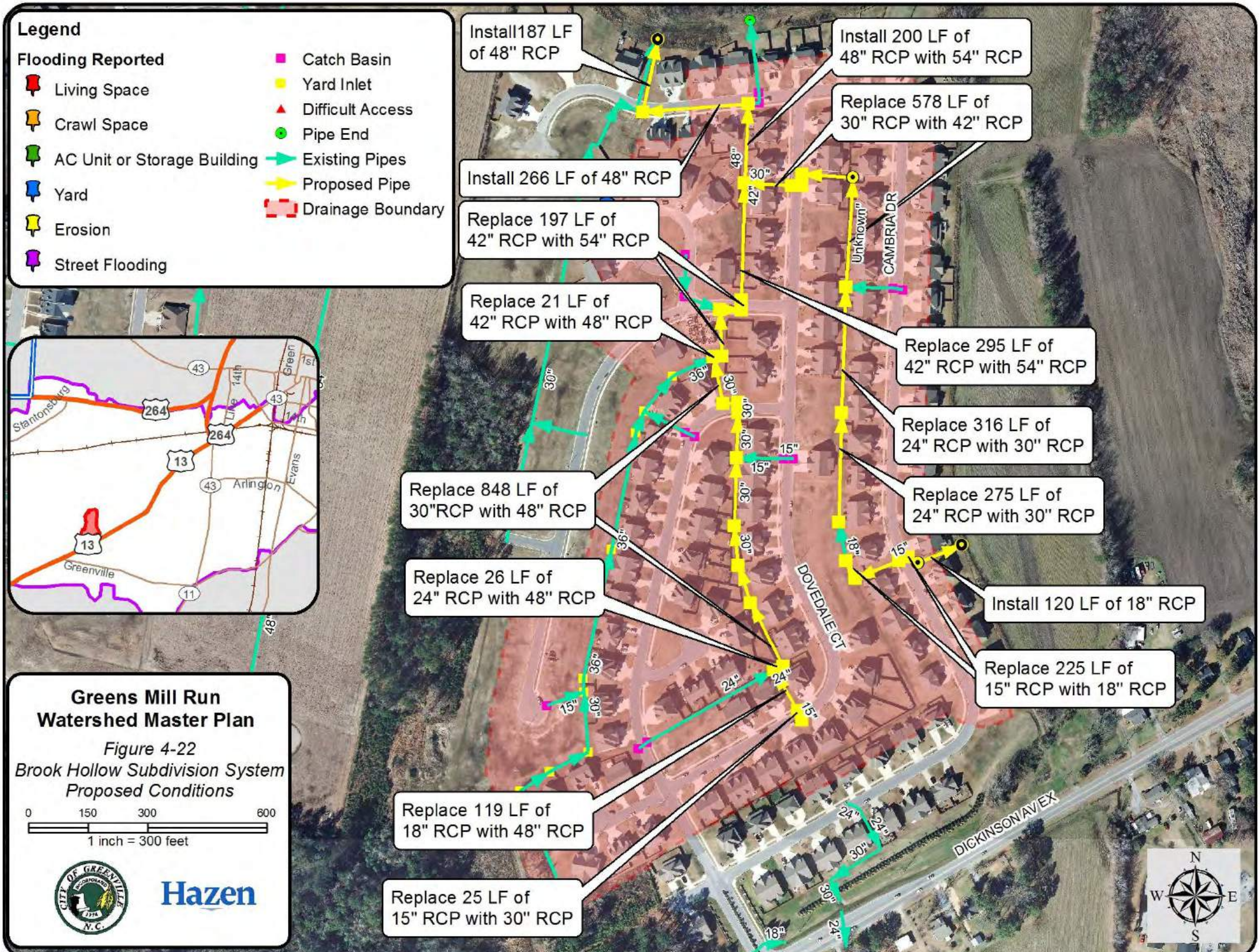
Figure 4-21
Bradley Street System
Proposed Conditions

4.2.3 Brook Hollow Subdivision System

The Brook Hollow system is among the newer systems modeled and analyzed as part of the GMR WSMP. As shown in **Figure 3-19**, several deficient pipes / inlets at the upper end of the system were identified. The system was determined to be largely undersized, and additional capacity was required to be added to lower water surface elevations enough to address areas where surface surcharging was shown to occur. The approach to alternative development for this system was to incrementally increase pipe sizes, first in limited areas directly downstream of surface surcharging, then working down the system with pipe size increases and additional parallel capacity, until surcharging was alleviated. The recommendations are shown in **Figure 4-22**, and summarized below:

- Remove 340 LF of 15”-18” RCP
- Remove 2,044 LF of 24”-36” RCP
- Remove 720 LF of 42”-60” RCP
- Install 348 LF of 18” RCP
- Install 619 LF of 30” RCP
- Install 581 LF of 42” RCP
- Install 1,472 LF of 48” RCP
- Install 694 LF of 54” RCP
- Install 29 inlets
- Install 2 junction boxes
- Install 2 endwalls

An issue for consideration is that numerous private residential properties are be impacted by the improvements. It is anticipated that, as a more recent subdivision, easements exist along the existing lines; however, in some cases, the pipe size increases are significant and result in significant disruption to private properties. While the existing system generally has sufficient depth to accommodate increases in pipe size and maintain cover (in some locations, slope adjustments are required), the depth of the installations require special shoring approaches to avoid impacts to residential structures. Additionally, several roads are impacted, but are residential and primarily crossed perpendicularly; therefore, major transportation impacts are not anticipated. Impacted utilities include water and sewer lines and electric. GUC data in this neighborhood is incomplete; therefore, utility impacts are not fully understood. While not shown in the GUC data, it is likely that gas is also impacted at road crossings. The opinion of probable cost for improvements is $2,550,000.



Greens Mill Run Watershed Master Plan

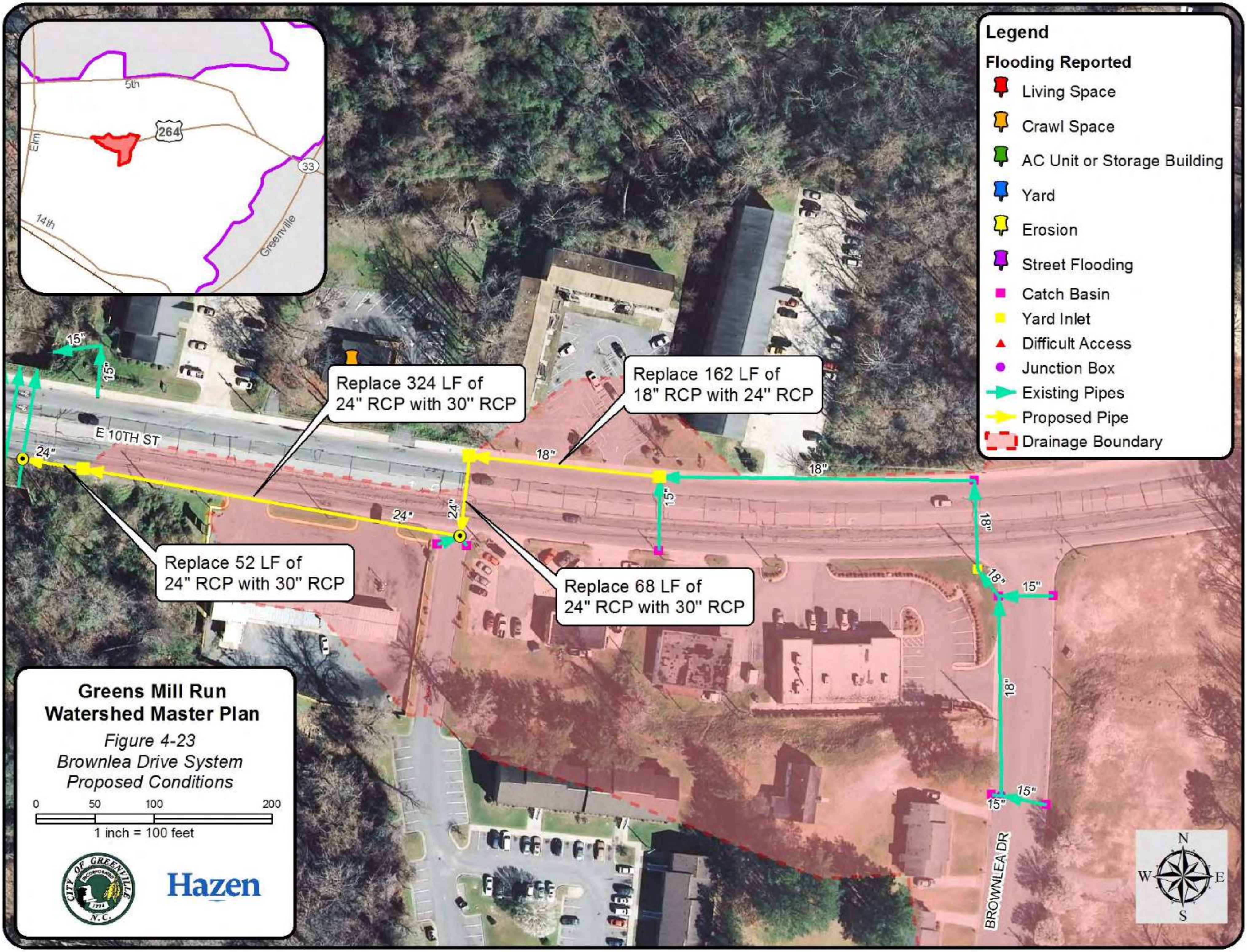
Figure 4-22
Brook Hollow Subdivision System Proposed Conditions

4.2.4 Brownlea Drive System

Recommendations for the drainage system extending to the west from the intersection of Brownlea Drive and East 10th Street are shown in **Figure 4-23**. As discussed in **Section 3.2**, the model showed system deficiencies at 1305 East 10th Street (Twist Salon), which supported a report from the business owner that street runoff exits the road and enters the property, causing erosion along the upper of two driveways. The recommended solution for these deficiencies consists of upsizing pipes from the two curb inlets, which are upgradient from the subject driveway, to the discharge point in the Greens Mill Run culvert under East 10th Street. These improvements include:

- Remove 163 LF of 15”-18” RCP
- Remove 447 LF of 24”-36” RCP
- Install 163 LF of 24” RCP
- Install 447 LF of 30” RCP
- Install 3 inlets
- Install 2 junction boxes

Of note is that much of the piping replacement is under the existing East 10th Street curbline, thus a significant amount of curb removal and replacement is required. The improvements also include one pipe crossing on East 10th Street. The existing pipes do not have an abundance of cover; however, there are several feet of topographic fall from the upper portion of the system to the discharge point. Since these improvements propose to replace the existing pipes, additional depth to allow for increased pipe diameters can be accomplished by slope adjustments. The opinion of probable cost for improvements is $650,000.



Greens Mill Run Watershed Master Plan

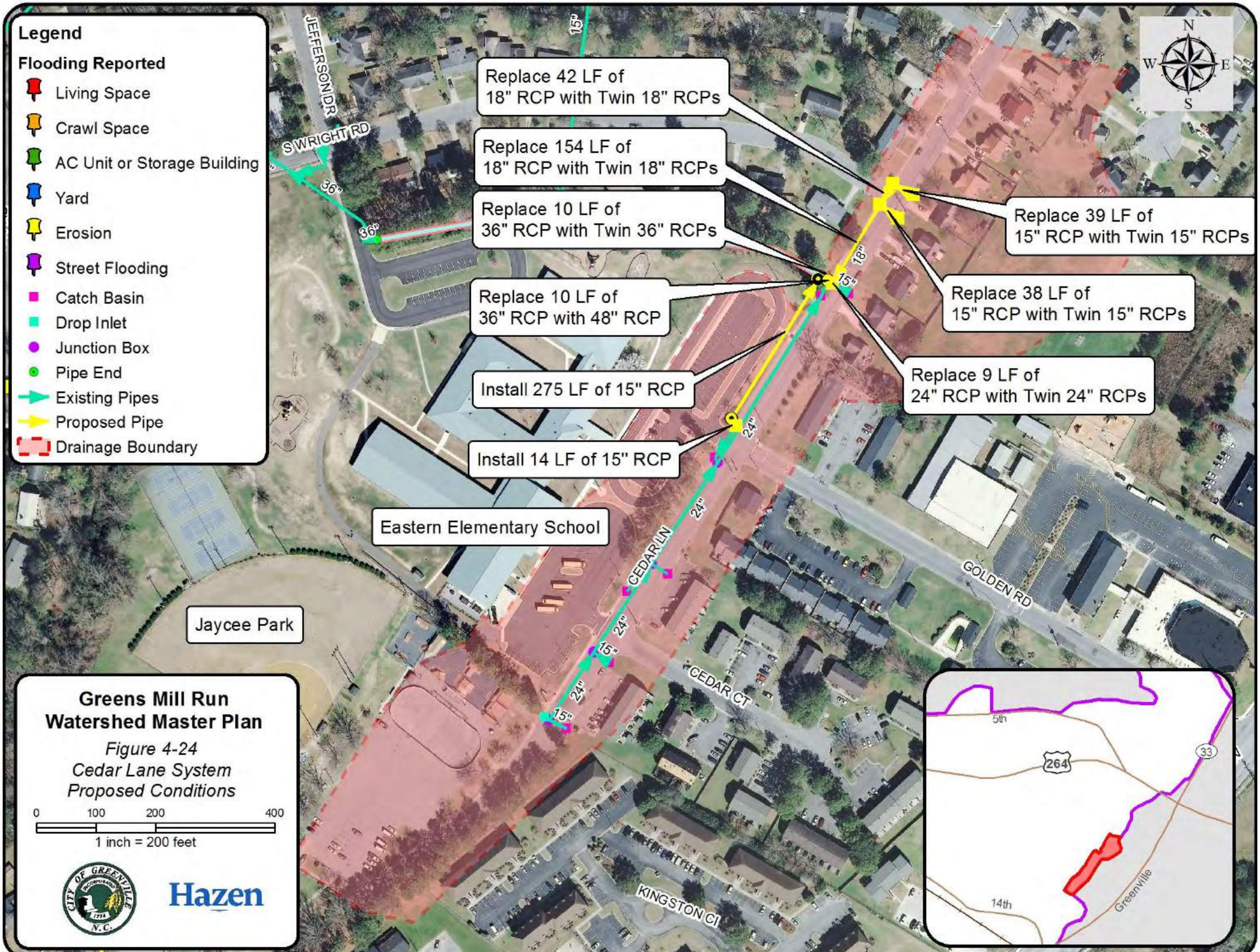
Figure 4-23
Brownlea Drive System
Proposed Conditions

4.2.5 Cedar Lane System

The recommended improvements to the Cedar Lane system are shown in **Figure 4-24**. The model reflected system deficiencies concentrated in the area of the Cedar Lane / Wright Road intersection, as well as at the entrance to Eastern Elementary School. Improvements consist of adding an additional parallel pipe along the Eastern Elementary School frontage and additional barrels in the area of the Cedar Lane / Wright Road intersection. Additional barrels were chosen, as opposed to increased pipe sizes, due to the existing system being shallow with a lack of topographic relief to allow for deeper, larger pipes. Where a double barrel section is proposed, it is assumed that existing pipe is to be removed (not reused), and new pipe installed for both barrels. In summary, the proposed improvements include:

- Remove 273 LF of 15”-18” RCP
- Remove 18 LF of 24”-36” RCP
- Install 443 LF of 15” RCP
- Install 392 LF of 18” RCP
- Install 18 LF of 24” RCP
- Install 21 LF of 36” RCP
- Install 6 inlets
- Install 2 junction boxes
- Install 2 endwall

Utilities impacted by the proposed improvements include water, sewer, and gas lines. Access to several residential properties may be impacted during construction. The opinion of probable cost for improvements is $650,000.



Greens Mill Run Watershed Master Plan

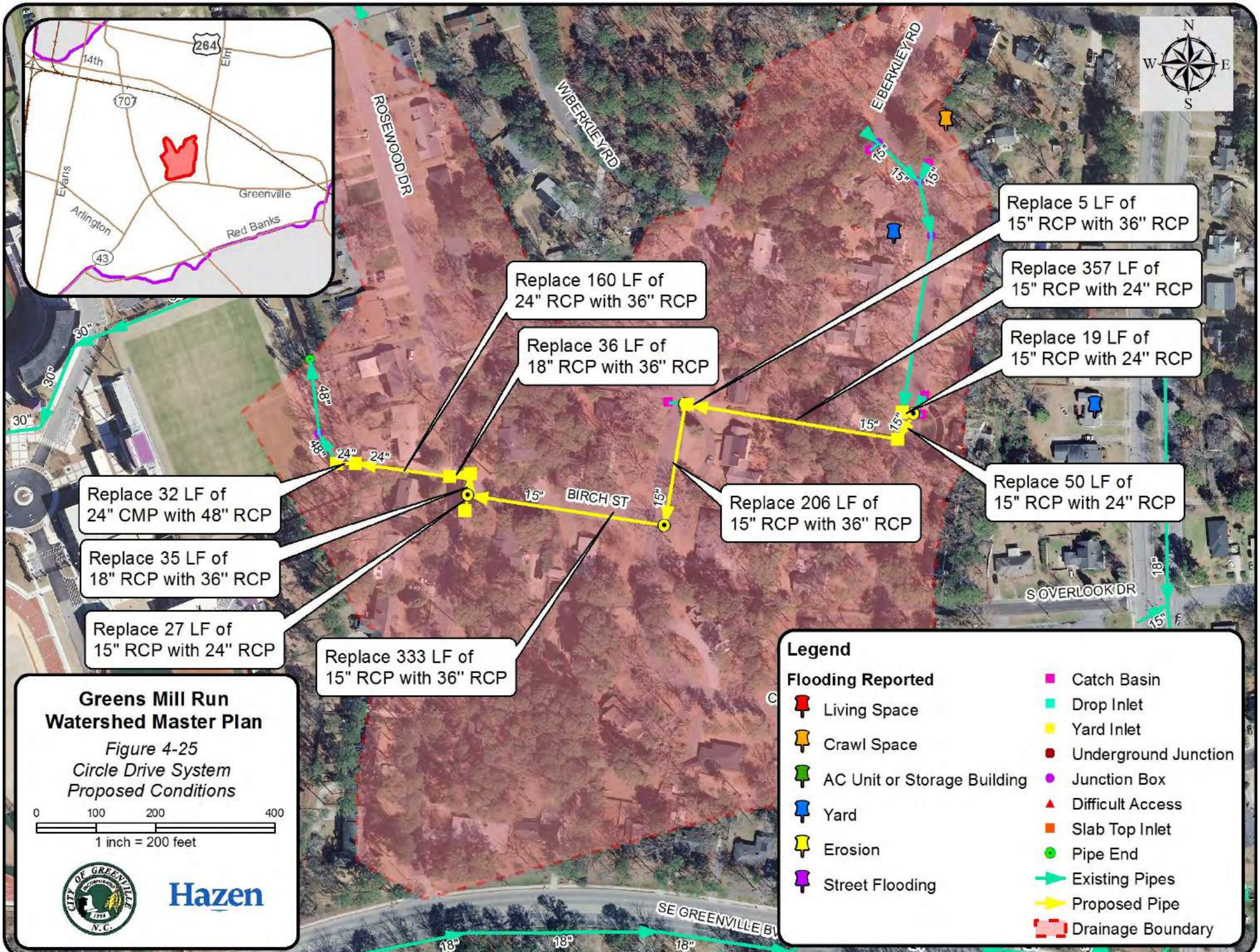
Figure 4-24
Cedar Lane System
Proposed Conditions

4.2.6 Circle Drive System

Like the Cedar Lane System, the Circle Drive system is shallow and flat, therefore improvements focused on adding capacity through additional barrels. The recommended improvements are shown in **Figure 4-25**. This system is located in a residential area and a number of pipes run between residences, and along narrow streets that have water, sewer and gas lines, in addition to drainage. The system discharges into a dry detention pond on ECU athletic property and is influenced by tailwater from the dry pond. The pond's outlet structure and volume were included within the model to quantify its effect on the system. Improvements to this system include:

- Remove 1,069 LF of 15”-18” RCP
- Remove 191 LF of 24”-36” RCP
- Install 881 LF of 24” RCP
- Install 1,553 LF of 36” RCP
- Install 32 LF of 48” RCP
- Install 8 inlets
- Install 4 junction boxes

GUC data shows sanitary sewer lines that run parallel to the proposed drainage improvement lines in several locations. Due to horizontal proximity of the new drainage lines to sanitary sewer, much of the clay sewer will is proposed to be replaced with ductile iron pipe (DIP). Additionally, at least four sanitary sewer laterals cross the proposed improvements and will require resolution as part of the overall design. It is likely that additional or modified easements across private property will be required. The opinion of probable cost for improvements is $1,680,000.



Greens Mill Run Watershed Master Plan

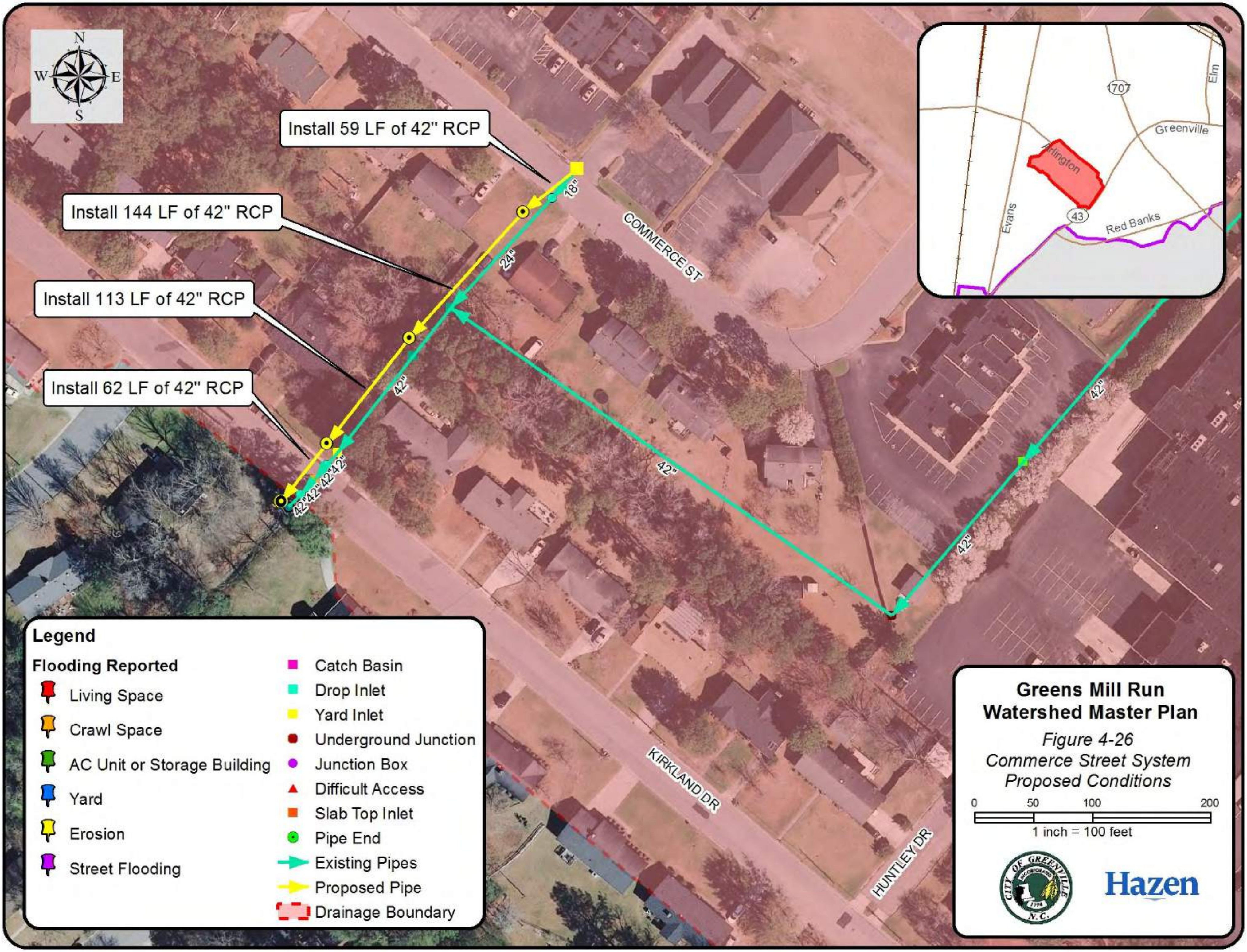
Figure 4-25
Circle Drive System
Proposed Conditions

4.2.7 Commerce Street System

The Commerce Street system receives runoff from a commercial area and conveys flow through several residential lots, before discharging to a drainage feature southwest of Kirkland Drive. The recommended improvements for this system are shown in **Figure 4-26**. Improvements include adding additional capacity through a parallel piping system from the area where surface surcharging was reported, to the discharge point. These improvements include:

- Install 381 LF of 42” RCP
- Install 1 inlet
- Install 3 junction boxes

Utilities impacted by the improvements include water, sanitary sewer, gas, and electric. Two streets, Commerce Street and Kirkland Drive, are affected by perpendicular crossings of the new 42” RCP. Cover conditions are generally moderate; therefore, it is anticipated that the new 42” diameter pipe will need to be run at minimum slope in order to have adequate cover at the upper end of the system. Four residential properties are anticipated to be impacted by the improvements. It is likely that additional or modified easements across private property will be required. The opinion of probable cost for improvements is $430,000.



Greens Mill Run Watershed Master Plan

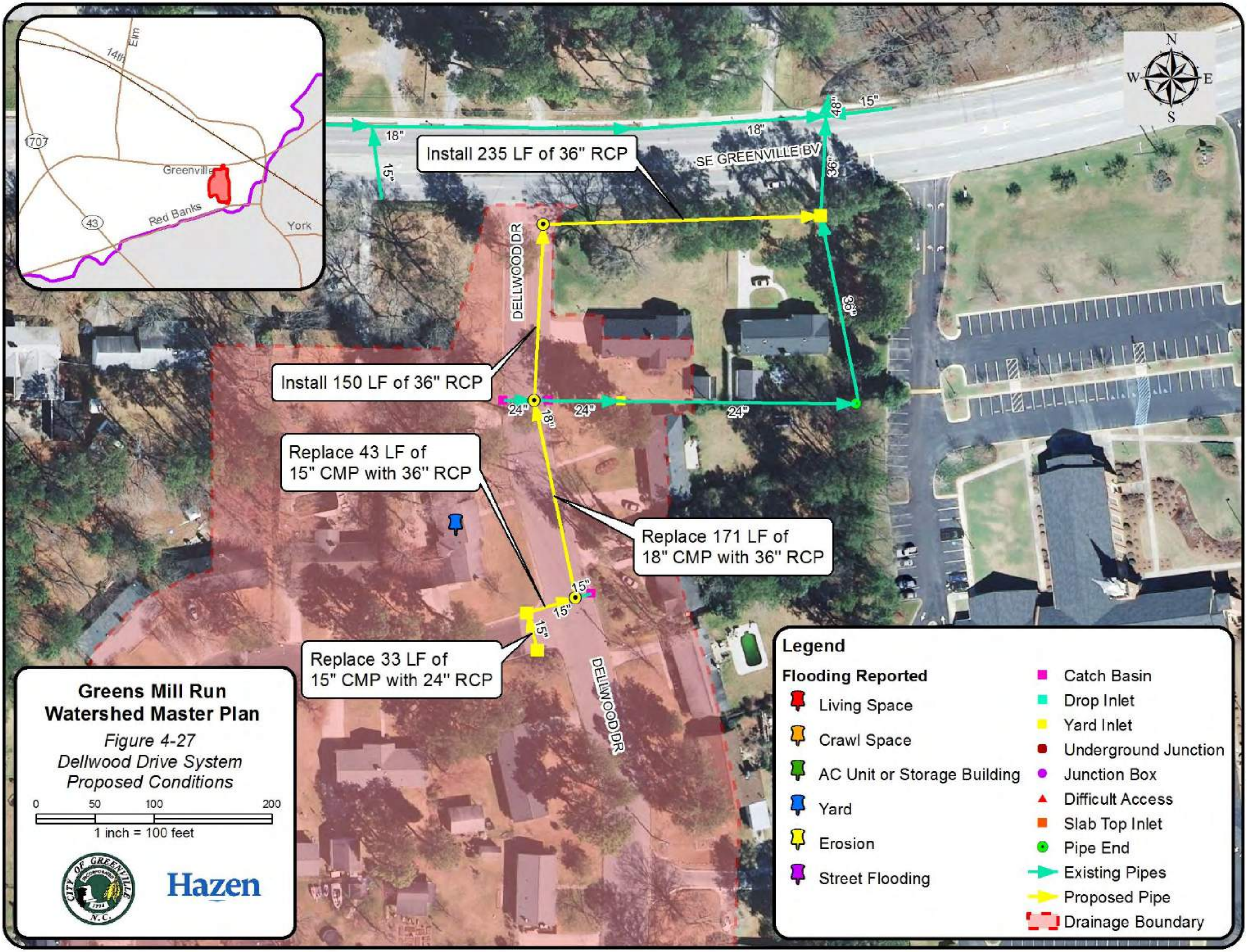
Figure 4-26
Commerce Street System
Proposed Conditions

4.2.8 Dellwood Drive System

The Dellwood Drive system improvements are shown on **Figure 4-27**. Improvements to this system consist of both replacing existing pipes with larger pipes and adding additional capacity through a parallel system that conveys runoff to the discharge point via an alternate route. Overall, these improvements include:

- Install 34 LF of 24” RCP
- Install 600 LF of 36” RCP
- Install 7 inlets
- Install 2 junction boxes

Significant improvements are proposed within the public right-of-way, thus asphalt, curb, and other roadway items represent a significant portion of the project cost. The drainage structures generally have 4 - 5 feet of depth; therefore, cover conditions for the proposed improvements is adequate. Utilities impacted include water, sanitary sewer, gas, and electric. The drainage improvements are in close proximity to a parallel cast iron pipe (CIP) sanitary sewer line. Due to the horizontal clearance and age of the existing sewer line, improvements include converting this to ductile iron pipe. Additionally, at least three sanitary sewer laterals cross the proposed improvements and will require resolution as part of the overall design. Additional easements across private property will likely be required. The opinion of probable cost for improvements is $750,000.



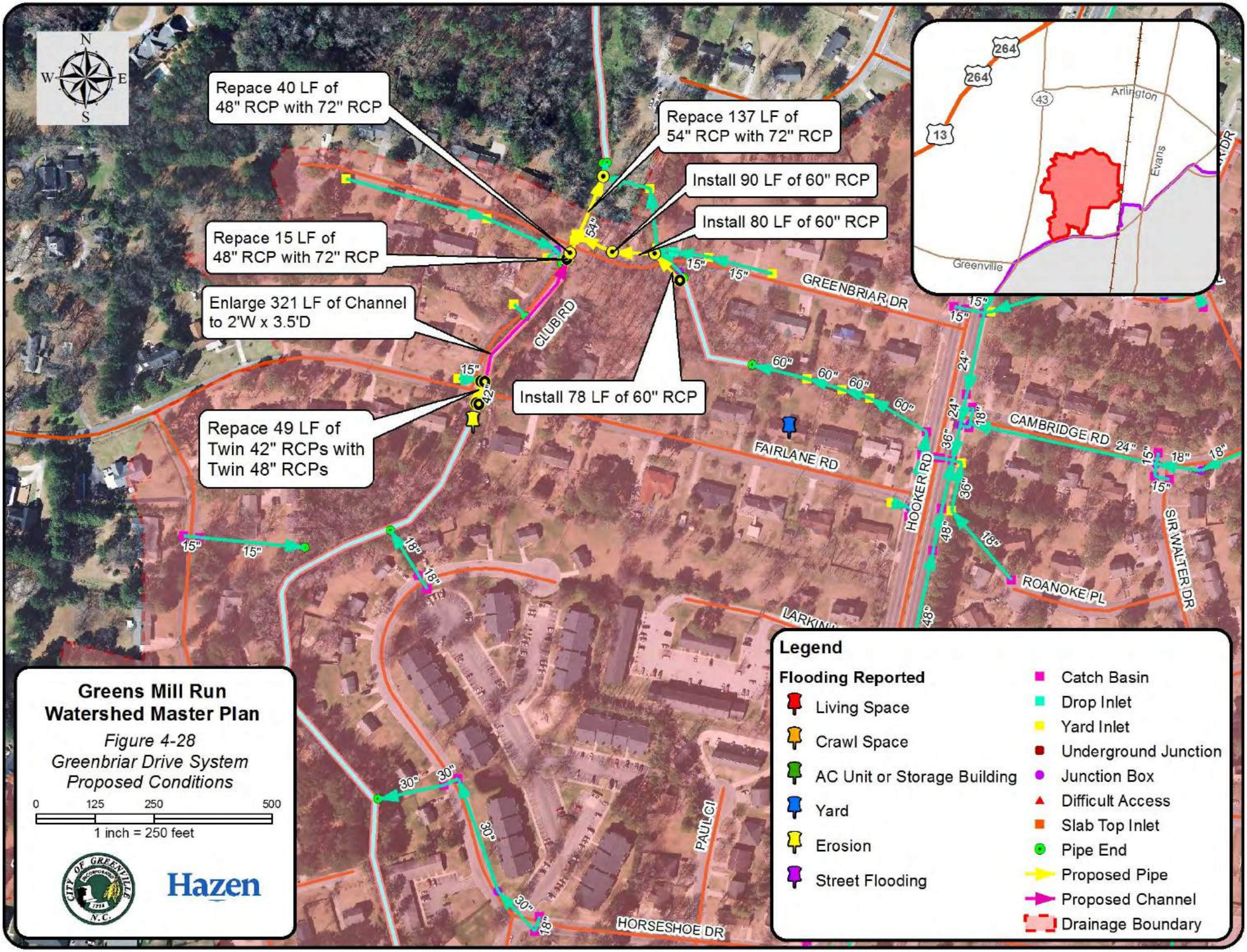
Greens Mill Run
Watershed Master Plan
Figure 4-27
Dellwood Drive System
Proposed Conditions
0
50
100
200
1 inch = 100 feet
Hazen
Install 235 LF of 36" RCP
Install 150 LF of 36" RCP
Replace 43 LF of 15" CMP with 36" RCP
Replace 171 LF of 18" CMP with 36" RCP
Replace 33 LF of 15" CMP with 24" RCP
SE GREENVILLE BV
DELLWOOD DR
DELLWOOD DR
18"
18"
15"
15"
48"
36"
36"
24"
18"
24"
24"
15"
15"
15"
N
S
E
W
14th
Elm
707
Greenville
Red Banks
43
York
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Existing Pipes
Proposed Pipe
Drainage Boundary

4.2.9 Greenbriar Drive System

The Greenbriar Drive system is composed of closed piping, roadway culvert, and open channel. The City previously upgraded the pipe under Greenbriar Drive to a 60” RCP. Residents reported that this upgrade improved conditions in the upstream drainage channel; however, the model indicated that the upstream system (between Greenbriar and Hooker Road) experienced surcharging in the 10-year event. In addition, the channel along Club Road was reported to be eroding and undersized. Recommended improvements are shown on **Figure 4-28**, and include:

- Install 98 LF of 48” RCP
- Install 248 LF of 60” RCP
- Install 192 LF of 72” RCP
- Regrade/expand 321 LF of channel adjacent to Club Road
- Install 1 inlet
- Install 4 junction boxes
- Install 4 endwalls

The improvements impact several residential properties, including driveway access to 110 Greenbriar Drive. In addition, upon implementation of the improvements, the residence at 110 Greenbriar is surrounded on all sides with public drainage infrastructure. Greenbriar Drive and Fairlane Road are proposed to be temporarily closed during construction. Utilities impacted include water, sewer, gas, and electric. The new 72” drainage pipe along the west side of 110 Greenbriar is in close proximity to an existing parallel sanitary sewer line (material unknown). Based on GIS data, the center-to-center distance is approximately 12 feet. Since GUC data may not be survey grade, and is on its own datum and coordinate system, the true proximity is considered approximate. With the approximate amount of horizontal clearance, replacement of this line was not included in the improvements. At least two sanitary sewer laterals cross the proposed improvements and will require resolution as part of the overall design. It is likely that additional or modified easements across private property will be required. The opinion of probable cost for improvements is $770,000.



Greens Mill Run Watershed Master Plan

Figure 4-28
Greenbriar Drive System
Proposed Conditions

4.2.10 Lakewood Subdivision System

The Lakewood Subdivision system has been the subject of study for several years. Residents have communicated with the City frequently prior to the GMR WSMP project. In 2010, A. Morton Thomas and Associates (AMT) completed a study of the drainage system and identified three alternatives to addressing neighborhood drainage problems. The City subsequently selected an Alternative "C" from that study and AMT proceeded with full design of Phase I of those improvements (along Evans Street). Design drawings and specifications were completed in early 2014. The design rerouted a pipe that discharged drainage from Evans Street into the Lakewood Subdivision, such that it ran along the Evans Street right-of-way, and discharged further downstream at 2706 Evans Street. Twelve residential properties were to be impacted by this design, which included a variable width temporary construction easement, installation of a 42" RCP, associated clearing / grubbing, erosion control, backfill, and seeding. The estimated construction cost of this project phase was approximately $590,000, which is likely a valid approximation for any configuration which flows along Evans. The remainder of Alternative "C" (Phase II) was to be designed at a later date. This portion of the project involved construction of a new outlet structure from the dry pond behind Harris Teeter / Target and discharge piping along the back of properties that front Pineview Drive. This design impacted ten residential properties, with impacts similar to those described above, except that a 30 foot permanent drainage easement was also to be required along the piping corridor.

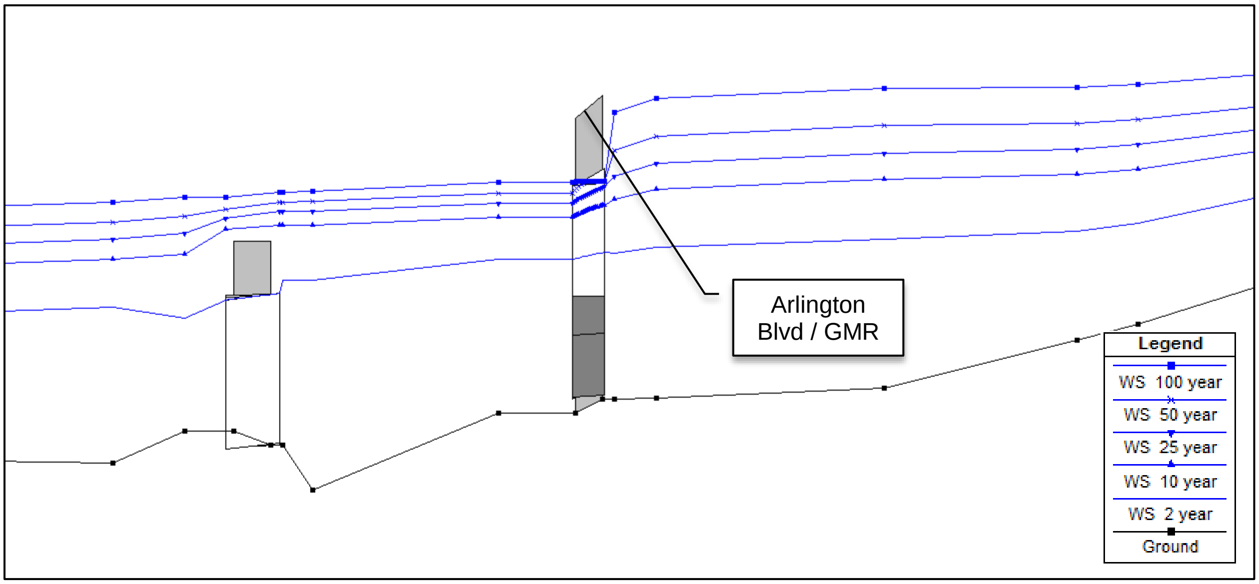
The study and design were reviewed as part of the GMR WSMP Secondary System analysis. The result of this review was concurrence with the basic concept that in order to improve drainage conditions within the Lakewood subdivision itself, all or a portion of the water entering the subdivision conveyances should be rerouted elsewhere. This approach avoids a complex and costly project of improving conveyance channels through the heart of the development, which in addition to being disruptive to residents, may present a permitting challenge as these conveyances may be jurisdictional.

During public meetings that were part of the GMR WSMP process, several neighborhood residents expressed frustration that the dry pond behind the Harris Teeter / Target shopping center does not appear to function properly, stating that it does not fill up during any rain event. Historical design documents of the pond were reviewed, which indicated that the configuration of the outlet structure creates a preference for runoff from the shopping center to exit the system and enter the Lakewood Subdivision prior to accessing the available volume within the dry pond for peak runoff reduction purposes. In order to ensure that runoff from the shopping center is directed to the dry pond first, the recommended improvements include plugging or blocking the discharge from the shopping center to the Lakewood Subdivision. This approach requires a new outlet structure for the pond. As stated previously, the objective of the improvements is to redirect flow out of the neighborhood conveyance system; therefore, a new discharge point for the pond was identified. By installing piping adjacent to the CSX railroad right-of-way, as shown in **Figure 4-30** and **Figure 4-31**, discharge from the pond bypasses the subdivision altogether. This design is similar to Phase II of AMT Alternative "C". In general, rerouting shopping center flows as presented herein lowers the 10-year water surface elevations in the area of concern (the low area along Lindell Drive) by 2 - 3 feet.

Another alternative investigated was to pipe discharge from Evans Street into the same system through which the pond discharges, as described in the above alternative (also shown in **Figure 4-30**). This rerouted Evans Street discharge bypasses the pond, as modeling indicated that the existing pond does not have surplus freeboard in the 100-year event. This piping configuration is similar to AMT Alternative “B”, except that the AMT design routed Evans Street flows through the pond. This alternative achieves results similar to AMT Alternative “C” because it redirects all flows entering Lakewood elsewhere, but impacts a significantly lower number of residential properties than Alternative “C” (21 in the AMT alternative, 15 as described here). While this approach further reduces runoff entering the subdivision, the model showed that water surface elevations were reduced only within the Lindell area by an additional 0.2 - 0.7 feet versus the improvement presented in **Figure 4-23**, and therefore this alternative was not considered any further.

In addition to flooding in the Lindell Drive area, yard and home flooding was reported in the lower portion of the neighborhood, adjacent to Greens Mill Run. This flooding was determined to be caused by tailwater from GMR on the Lakewood system. Based on HEC-RAS modeling for the Primary System, raised water surface elevations in GMR were due to channel and floodplain capacity for storms up to the 25-year event. For 50-year and larger storm events, the Arlington Boulevard culvert along GMR contributed to rising water surface elevations more significantly. The HEC-RAS profile, shown in **Figure 4-29** below, (existing culvert / existing flows) highlights the influence of the culvert on upstream water surface elevations. There was no deficiency identified at the Arlington Boulevard culvert crossing with respect to roadway LOS, thus no improvement alternatives were proposed at this location. As such, it was determined that culvert-related improvements at the Arlington Boulevard Crossing offered little benefit to upstream properties except in the 50-year storm and larger. Floodplain modifications may realize small WSE decreases with minimal impact on water surface elevations. In other areas of the watershed where significant floodplain benching was incorporated to mitigate WSE increases associated with Primary System improvements, water surfaces were generally lowered by <6”.

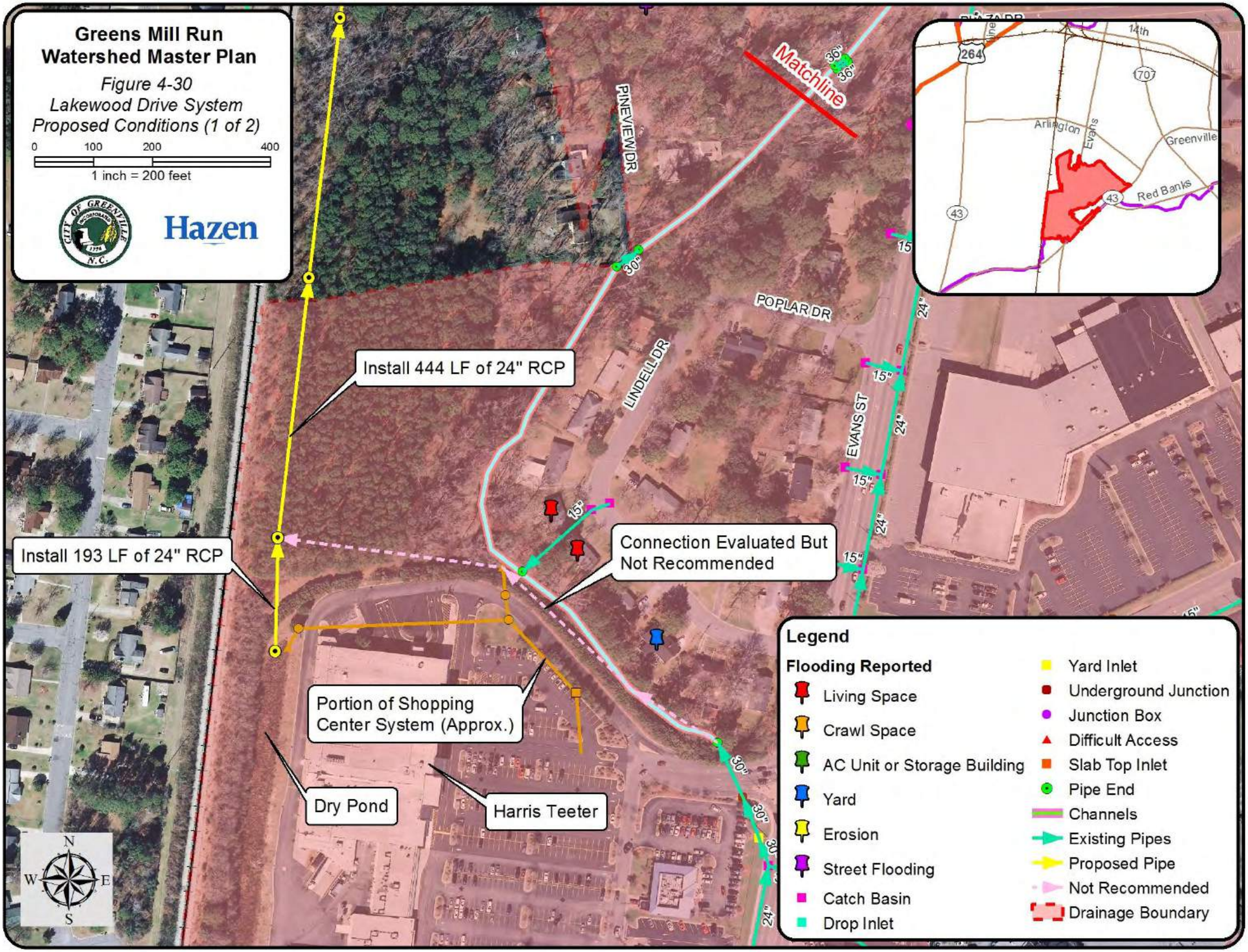
Figure 4-29: Existing Conditions HEC-RAS Profile at Arlington / GMR Crossing

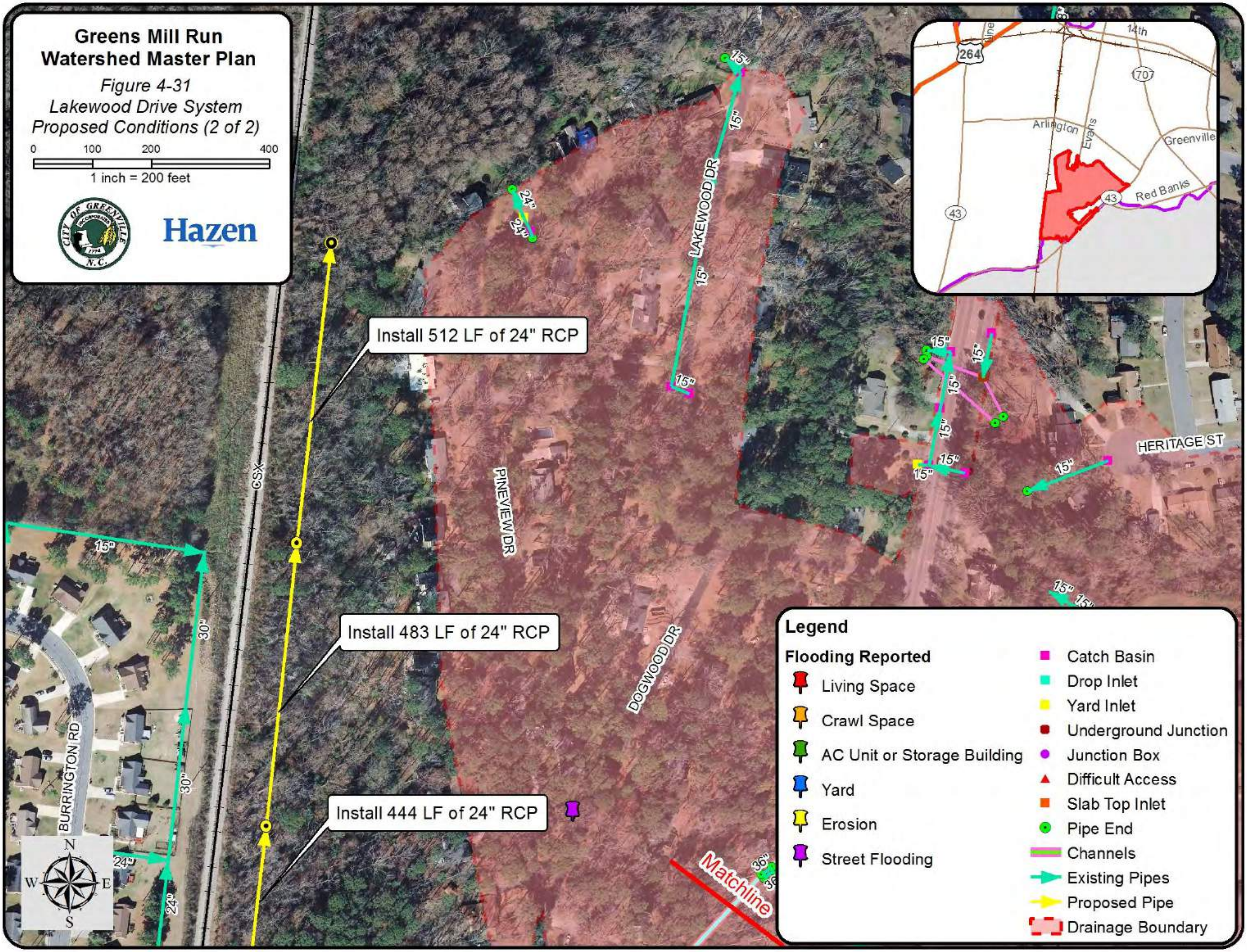


Both of the configurations described above (pond only and pond with Evans Road) are shown in **Figure 4-30**. Following is a summary of the recommended improvements:

- Install 2,079 LF of 24" RCP
- Install new pond outlet structure
- Install 4 junction boxes
- Install 1 endwall

The opinion of probable cost for improvements is $550,000. Note that the planned NCDOT improvements to Evans Street are located approximately 1 mile south of this system and are not expected to impact planned improvements to the Lakewood/Target system as presented herein.


Greens Mill Run
Watershed Master Plan
Figure 4-30
Lakewood Drive System
Proposed Conditions (1 of 2)
0 100 200 400
1 inch = 200 feet
CITY OF GREENVILLE INCORPORATED 1774 N.C.
Hazen
Matchline
PINEVIEW DR
POPLAR DR
LINDELL DR
EVANS ST
36"
30"
15"
24"
Install 444 LF of 24" RCP
Install 193 LF of 24" RCP
Connection Evaluated But Not Recommended
Portion of Shopping Center System (Approx.)
Dry Pond
Harris Teeter
264
707
43
14th
Arlington
Evans
Greenville
Red Banks
N
S
E
W
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Existing Pipes
Proposed Pipe
Not Recommended
Drainage Boundary

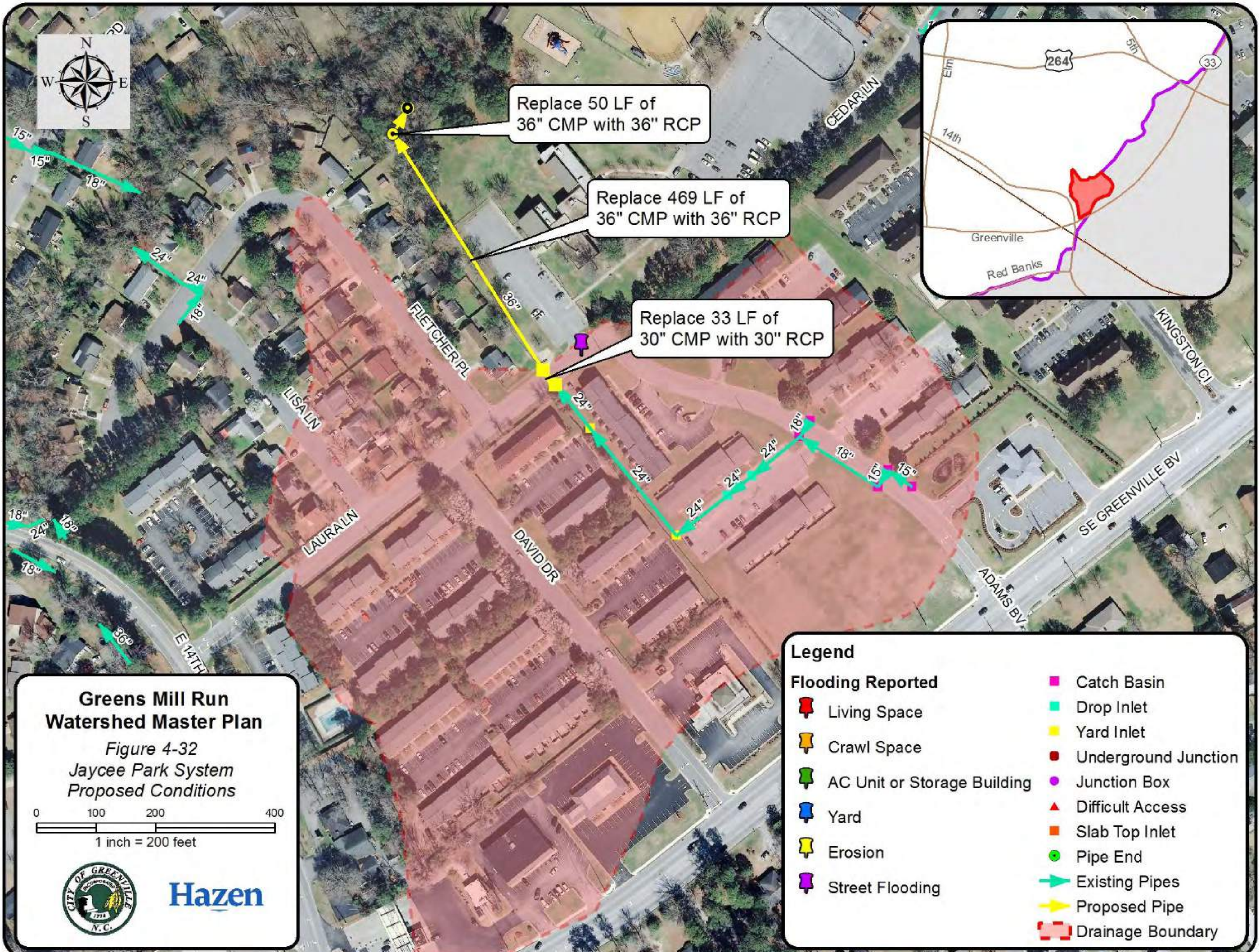

Greens Mill Run
Watershed Master Plan
Figure 4-31
Lakewood Drive System
Proposed Conditions (2 of 2)
0 100 200 400
1 inch = 200 feet
CITY OF GREENVILLE INCORPORATED 1774 N.C.
Hazen
Install 512 LF of 24" RCP
Install 483 LF of 24" RCP
Install 444 LF of 24" RCP
CSX
PINEVIEW DR
LAKEWOOD DR
DOGWOOD DR
HERITAGE ST
BURRINGTON RD
Matchline
15"
24"
30"
36"
264
707
43
14th
Arlington
Evans
Greenville
Red Banks
N
S
E
W
Legend
Flooding Reported
Living Space
Crawl Space
AC Unit or Storage Building
Yard
Erosion
Street Flooding
Catch Basin
Drop Inlet
Yard Inlet
Underground Junction
Junction Box
Difficult Access
Slab Top Inlet
Pipe End
Channels
Existing Pipes
Proposed Pipe
Drainage Boundary

4.2.11 Jaycee Park System

The Jaycee Park system recommended improvements are shown in **Figure 4-32**. The inlets at the sag adjacent to the park entrance were shown to experience surface surcharging in the 10-year event. The system discharges into an abandoned stormwater BMP. Note that a retrofit of this BMP is included as a water quality alternative, see **Section 5.2.2.12**. Several alternatives for the system were investigated, including adding pipe capacity by increasing diameters and lowering pipe elevations using existing pipe diameters. The latter was analyzed, and ultimately chosen, since increasing pipe diameters by one standard size resulted in alleviating surface surcharging, indicating the system was not grossly undersized. Analysis of replacing the pipes with the same diameters, but lower in elevation, showed that the 10-year water surface was lowered, achieving the desired 10-year level of service. The proposed project includes:

- Install 34 LF of 30” RCP
- Install 520 LF of 36” RCP
- Install 2 inlets
- Install 1 junction boxes
- Install 1 endwall

Cover conditions on the existing pipes are relatively shallow, but sufficient slope exists to allow the new pipe slopes to be flattened for additional cover. Utilities impacted include water, sewer, gas, and electric. The opinion of probable cost for improvements is $480,000.



Greens Mill Run Watershed Master Plan

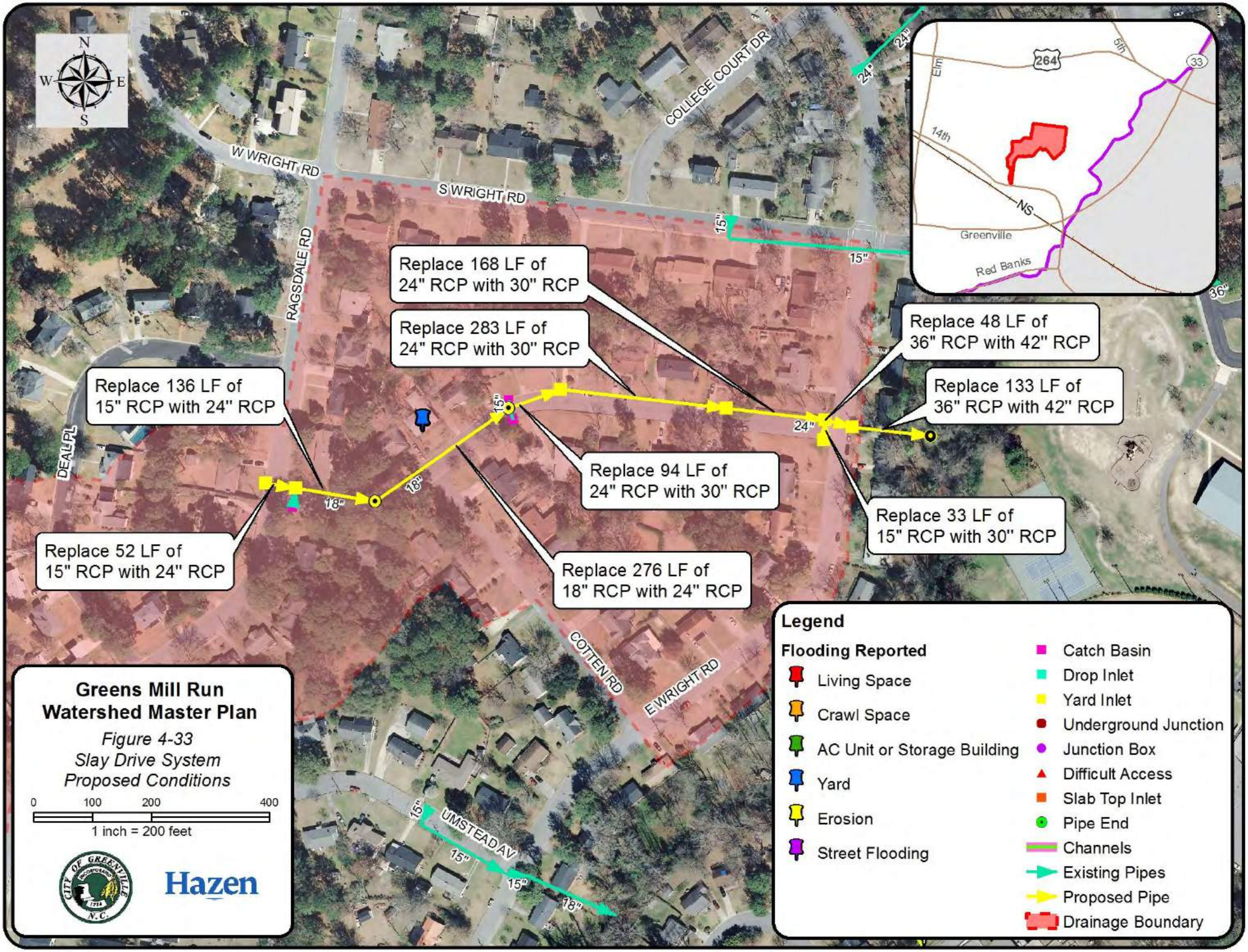
Figure 4-32
Jaycee Park System
Proposed Conditions

4.2.12 Slay Drive System

Extensive improvements are recommended for Slay Drive, as shown on **Figure 4-33**. Surface surcharging was shown to occur at the upper end of the system, and within the intersection of Ragsdale Road and Slay Drive. The proposed improvements include increasing pipe diameters by 6 inches from the upstream end of the system, to the discharge point in Reedy Branch. Utilities along Slay Drive include water, sanitary sewer, electric, and gas. GUC data shows the sanitary sewer line (8" clay) is in close proximity to the existing / proposed drainage line, therefore the project includes conversion of significant sanitary sewer underneath Slay Drive to DIP. Additionally, 12 sanitary sewer laterals will require resolution as part of the overall design. This resolution may be coupled with replacement of the 8" clay sewer line, based upon further site evaluation at final design. Due to the location of the drainage and sanitary sewer piping, replacing both likely requires the entire road to be excavated, including curb and gutter, for installation of the improvements. Overall, the proposed project includes:

- Install 466 LF of 24" RCP
- Install 580 LF of 30" RCP
- Install 183 LF of 42" RCP
- Install 7 inlets
- Install 2 junction boxes
- Install 1 endwall

Existing pipe covers are relatively shallow, however, the proposed increase in pipe diameters can be addressed by installing the new pipes slightly deeper with lower pipe slopes starting at the discharge end. Other than drainage infrastructure, utility impacts and addressing conflicts/clearance requirements contribute a significant portion to the project cost. The opinion of probable cost for improvements is $1,640,000.



Greens Mill Run Watershed Master Plan

Figure 4-33
Slay Drive System
Proposed Conditions

4.3 25-Year Special Risk Areas

In 2014, the City of Greenville passed an ordinance requiring attenuation for new development and re-development for the one-year, five-year, and ten-year, 24-hour storm events. In addition, Section 9-9-10 of Ordinance No. 13-054 states the following:

> *"New development and redevelopment, as described in section 9-9-3, in areas at special risk with well documented water quantity problems as determined by the City Engineer, shall not result in a net increase in peak flow leaving the site from pre-development conditions for the 25-year, 24-hour storm event."*

As part of the GMR WSMP, an analysis was completed to determine if areas within the watershed should be considered to have "well documented water quantity problems". Areas may be defined, as "well documented water quantity problems" if either of the following is true:

- Structural flooding has been historically noted by property owners during storms considered smaller than the design event and this structural flooding has been corroborated by either high water marks, City staff input, or model results.
- Model results indicate structural flooding or roadway overtopping during storms smaller than the design storm and models results are corroborated by City staff input.

Portions of the watershed draining to the "well documented water quantity problems" may be considered for 25-year detention if any of the following are true:

- Future condition flows are 10% or greater than existing flows for a given subwatershed upstream of the water quantity problem.
- Proposed capital projects are not deemed to be feasible or cost effective for providing the required level of service for these water quantity problems based on future land-use conditions.
- Cost differential between designing for existing conditions and future conditions is deemed to be significant and/or a significant number of structures become floodprone during the 25-year design storm based on future conditions flows when compared to existing conditions flows.

As discussed in **Section 3.1.2**, a number of crossings did not meet the desired LOS based upon the existing conditions model results, which have been corroborated by City staff (therefore constituting a "well documented water quantity problem"). **Table 3-5** identifies crossings analyzed within the watershed and their existing LOS. As shown in the table, of 33 crossings evaluated, 14 (42%) exhibited substandard performance in the existing condition. Several of the crossings are located along GMR proper, in the lower portions of the watershed, and downstream of all undeveloped areas within the watershed (i.e. South Elm Street, College Hill Drive, Rock Spring Road, etc.). As discussed in **Section 4.1.5**, and shown in **Table 4-2** and **Table 4-3**, meeting the required level of service at these locations is not feasible, however a reduced level of service is proposed. Additionally, three other crossings (East 14th Street, Charles Boulevard, and Evans Street) along GMR exhibit such severe LOS violations that no feasible solutions exist, even for a reduced LOS. For those crossings, future development within the watershed will continue to degrade their performance beyond current conditions. For all crossings along GMR which exhibit level of service violations, either a reduced LOS is proposed or there is no feasible solution, therefore undeveloped areas upstream of these crossings (which includes all undeveloped area within the watershed) are recommended to be designated 25-year special risk based on criteria #2, above.

Most of the undeveloped area within the GMR watershed is located to the west of Memorial Drive. **Table 4-12** shows the crossings on GMR which do not meet the required level of service and compares the existing flows to the future flows (25-year event). In all cases, future flows are increased by greater than 10% over existing flows, which triggers criteria #1, above, and designates undeveloped areas upstream of these crossings (which includes *all* undeveloped area within the watershed) as 25-year special risk properties.

Table 4-12: GMR Known Water Quantity Problem Crossing Flow Comparisons

Crossing	Existing 25-year Flow (cfs)	Future 25-year Flow (cfs)	% Change
Evans Street	2,311	3,929	+70%
Charles Boulevard	3,001	4,117	+37%
14th Street	2,755	4,058	+47%
Rock Spring Road	2,783	4,091	+47%
College Hill Drive	2,783	4,106	+48%
Elm Street	2,746	4,117	+50%

Finally, future conditions flows (and the associated expansion of the floodplain) for the 25-year event result in 142 additional structures being classified as “floodprone” (note that this analysis focuses on Greens Mill Run, as all undeveloped areas ultimately flow into GMR, thus if GMR meets the 25-year special risk criteria, the entire watershed does as well).

Implementation of the 25-year Special Risk Area throughout the GMR watershed aids in reducing the frequency of flooding along the Primary System streams and negate the need to implement future capital improvement projects at several roadway crossings. The hydraulic model was analyzed to identify crossings meeting the desired 25-year LOS under existing land-use conditions, but in violation under future land-use conditions. Crossings that showed this change were those that may benefit from the special risk designation. This analysis focused on crossings along streams that may be influenced by 25-year detention, including GMR, the Unnamed Tributary to GMR, and North Fork GMR. These streams are located within or downstream of large undeveloped areas and will experience the effects of detention requirements. The Reedy Branch and Fornes Run watersheds are nearly fully developed, thus have little opportunity for implementation of 25-year detention and thus little impact on flows in these two streams.

This analysis identified three crossings: Hooker Road on GMR, Dalebrook Circle on Fornes Run, and Williams Road on the Unnamed Tributary to GMR. The estimated cost to address potential future LOS violations at these crossings, should the 25-year Special Risk designation not be implemented, is approximately $3,430,000.

Comparatively small savings will be realized at locations where this WSMP already proposes alternatives due to LOS violations under existing conditions. At most, requiring 25-year detention will make those improvements incrementally smaller, resulting in small decreases in cost associated with the projects at those locations. These locations were not considered in this analysis due to the small effects of 25-year detention on the proposed infrastructure.

Based on the above discussion and justification, it is recommended that the entire Greens Mill Run watershed be classified as Special Risk, requiring 25-year detention for all new development. There may be cases along the fringes of the watershed boundary identified as part of this WSMP where certain properties do not drain to GMR; in those special cases if the property owner can demonstrate with certainty that the property in question does not drain to GMR, City staff may decide to only require the minimum 10-year detention, subject to determinations made in other WSMPs.

4.4 Regional Detention Facilities

Based on established criteria, this WSMP document recommends that all undeveloped areas within GMR be designated as 25-year Special Risk, meaning that future development will be required to provide detention facilities that attenuate peak flows up to the 25-year storm. If the City implements this recommendation, each new development will be required to provide its own detention up to the 25-year storm. On this basis, no regional detention facilities were investigated.

5. Water Quality Recommendations

In addition to flood control, addressing water quality is a vital piece to properly managing watersheds. Without water quality controls, pollutants are carried directly from the watershed, to receiving waters where water quality may be deteriorated over time. This is exacerbated by impervious surfaces and conveyance systems, where pollutants are not filtered out of runoff. Pollutants, such as sediments, nutrients, hydrocarbons, and bacteria, that are discharged into streams and lakes often result in decreases of biodiversity, stream sedimentation, disease and die-off of fish and wildlife, and even impacts to human health. These detriments to water quality then directly impact recreational and utility use of these waterways.

The State of North Carolina, and communities within the state, generally require not only quantity control of stormwater from new developments, but also treatment of runoff prior to discharge from the site. However, this does not address existing development, which can often be a major contributor to both water quantity and quality problems. Some existing BMPs may also suffer from lack of maintenance, improper design and/or construction, improper BMP selection, and undersizing due to changes within its watershed. These BMPs present retrofit opportunities as another means of watershed management. The City of Greenville enforces stormwater rules, in part, through its Stormwater Management Program (September, 2004).

Water quality controls are primarily implemented through use of BMPs, such as stormwater wetlands, wet detention basins, and bioretention cells. Additionally, water quantity control can also be provided through wetland and wet detention basin BMPs. These practices treat runoff via filtration, settling, infiltration, biotic take-up, and through other natural means, by temporarily capturing runoff in basins and slowly discharging the water over an extended period of time. Wetland and wet detention basin BMPs have permanent pools to support microbial and plant life, which are major components of the treatment processes. Bioretention cells also support these life forms, but do not hold water permanently, as they allow for infiltration into an engineered-soil media beneath the cell, then exfiltration into the surrounding soil, or discharge through and underdrain system.

The stability of stream channels and banks also plays a role in water quality, as eroding material may cause detrimental impacts to streams and lakes. Instability may also result in stream widening, which can threaten infrastructure, homes, business, and utilities. Instability is often a result of increased runoff associated with development within the watershed. To combat stream erosion, not only is quantity control required throughout a watershed, but streams themselves may require engineered stabilization to rectify instability and to withstand the increasing demands of the watershed. Stream stabilization aids in reducing sediment loads and controlling stream migration and bank erosion. Subsequently, these projects help to protect infrastructure and buildings located along waterways, and often provide improvements to support microbial and wildlife in streams, in addition to recreational and utility uses.

The Greens Mill Run watershed was evaluated for both stream stabilization and BMP project opportunities. Field visits, GIS analyses, public input, and City records were used to identify potential locations for implementation of these measures. The following sections detail the results and conceptual designs of these proposed projects.

5.1 Stream Stabilization Projects

As discussed in **Section 3.3**, 39 locations were visited to assess reports of bank erosion and 29 were chosen for collection of field data, including bank erosion measurements via installation of bank pins. The objective in collecting bank erosion rates was to quantify the instability of the potential stabilization sites. Ultimately, seven sites were selected for stream stabilization efforts, due to their characterization of “unstable” using the Channel Evolution Model (Schumm & Harvey M.D., 1984), moderate to very high erosion rates, and risk to infrastructure and property.

Additional criteria used to identify recommended stream stabilization projects included construction access, ability to establish a floodplain connection, wetland impacts, in-situ soil suitability to facilitate project success, and coordination with potential water quality retrofits and flood control projects.

As presented in the following sections, the locations identified for stabilization opportunities were characterized by their lateral confinement (confined or unconfined). Flow in a confined stream is generally restricted to the channel, as access to the floodplain is limited. Confined streams can be stable systems; however, such streams often exhibit instability in the form of channel enlargement, high bank erosion rates, and sediment transport problems. Unconfined streams have access to their floodplains where flows may spread laterally, and are typically stable.

The stream segments evaluated for stabilization projects were also classified using the Rosgen Stream Classification System, which classifies streams as Types A - G. The seven sites identified for projects include stream Types E and G. Rosgen Type E channels typically have a high sinuosity, a low width-to-depth ratio, and are stabilized with dense riparian vegetation from grasses and woody species. The E channel is hydraulically connected to its floodplain and is considered a stable form; however, it can be disturbed by changes in the watershed that affect sediment supply, streamflow, or riparian vegetation. Classification G stream types are typically seen as a deeply incised, headcut gully found in the bottom of previous channels. G type channels typically exhibit vertical and lateral instability.

The stream types presented in the following sections also characterize the dominant bed material, using a numeric suffix in the Rosgen stream type (e.g. E4, E5, or G5). The “4” suffix refers to a primarily gravel bed material. Stream types with a “5” suffix have a dominantly sand bed material. Stability of both E4 and E5 stream types depend heavily on the presence of an “extensive riparian or wetland vegetation that forms densely rooted sod mats from grass, grass like plants and woody species” (Rosgen D. , 1996). Stability of G5 stream types depends heavily on the presence of a dense woody vegetation extending from the toe of the stream bank (Rosgen D. , 1996).

5.1.1 Dickinson Avenue

The proposed Dickinson Avenue stream stabilization project (Site 3) is located along an unconfined section of Greens Mill Run that runs perpendicular to the roadway (**Figure 5-1**). This portion of the stream is situated on a large wooded parcel and surrounded by a mix of agricultural and residential land-use. The site's drainage area is approximately 3.9 square miles, consisting of 33% urban land-use and 10% impervious area. Wetlands are present per the National Wetland Inventory (NWI) GIS data.

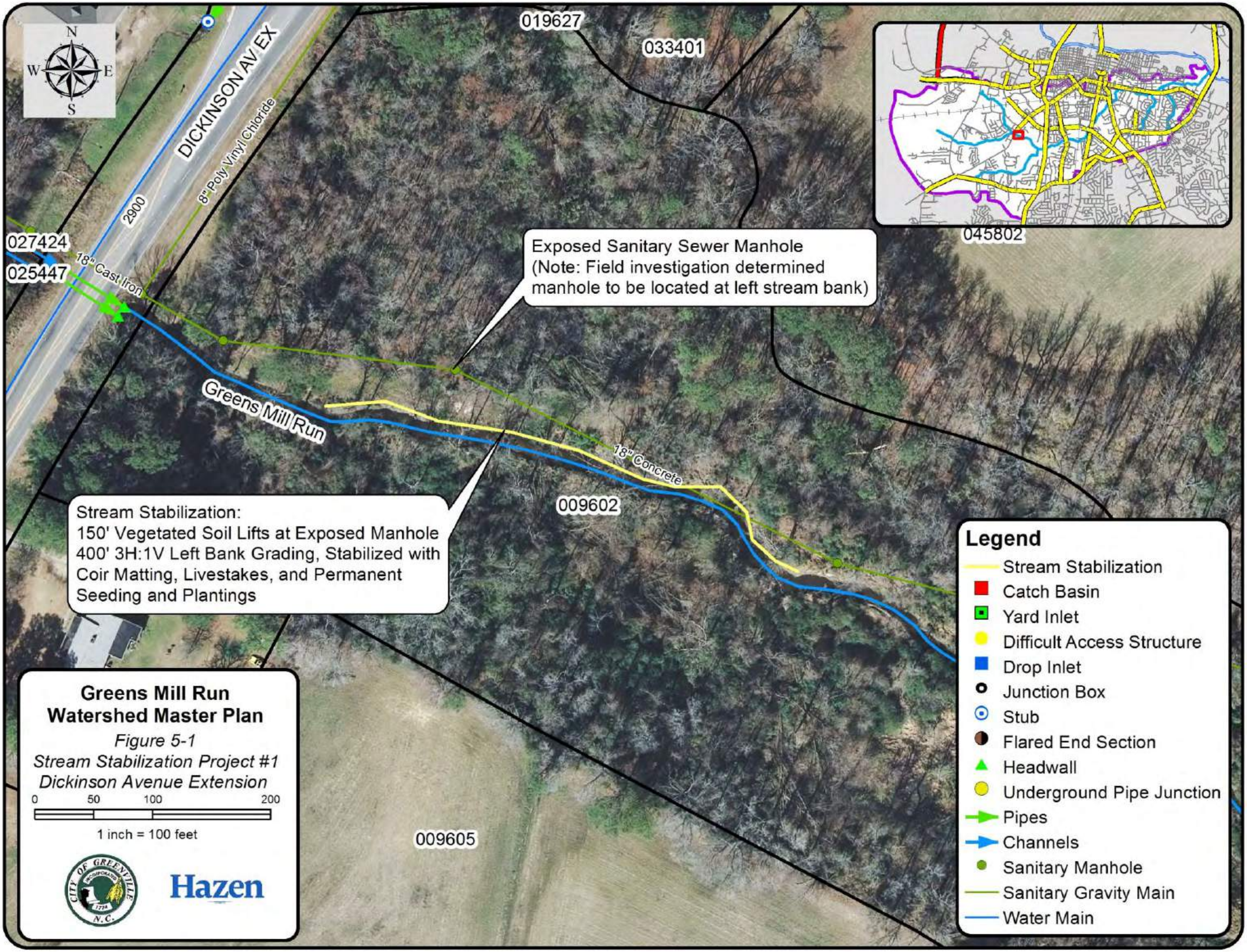
Picture 5-1: Exposed Manhole and Stream Bank Erosion

The soils, as identified by the NRCS soil maps, are Bibb fine sandy loam. Bibb soils qualify as HSG Class D and are considered a hydric soil. The soils consist of poorly drained fine sandy loam, sandy loam and sand, underlain by very friable fine sandy loam. The area is subject to a seasonal high water table (SHWT) and very frequent flooding.

A gravity sewer line runs parallel to the stream in the left floodplain (looking downstream), and one manhole has been exposed (**Picture 5-1**). Due to the unstable nature of GMR in this location, future erosion poses risks to the remainder of the sewer utility that has not yet been exposed. Without stabilization efforts, the stream may continue to degrade and widen as it establishes a new, lower channel and floodplain.

The existing left floodplain is sparsely vegetated (few trees, mostly grasses), but the right floodplain has abundant vegetation to the top of bank. Over time, the stream has shifted from the north to south.

Data collected at the site included one cross-section, three BEHI/NBS assessments, and three bank pins installation assessments. The existing channel has a predominately sand substrate, with partially vegetated stream banks and access to the floodplain. The channel bottom is approximately 5 feet wide, with a maximum bank height of 5 feet, and a top width of 16 feet. In the Rosgen stream classification system, the channel classifies as an E5 stream type.



Greens Mill Run Watershed Master Plan

Figure 5-1
Stream Stabilization Project #1
Dickinson Avenue Extension

The BEHI and NBS assessment resulted in High and Low values, respectively for the three locations at the site. Bank erosion was estimated to be 0.1 ft/yr; however the measured erosion at the bank pins averaged 1.2 feet over a five month period (**Picture 5-3** and **Picture 5-2**), equating to an erosion rate of 3 ft/yr.

Picture 5-3: Stream Bank Erosion and Pins at Installation

Picture 5-2: Stream Bank and Pins Five Months Later

Stabilization at Dickinson Avenue is proposed along 550 feet of the bank and will accomplish several objectives: reduce sediment loading and bank erosion, and protect public infrastructure (sewer utility). These objectives are achieved by installing a revetment to protect the exposed sewer manhole, stabilizing the eroding stream banks with native vegetation, and establishing a protected riparian buffer. Grading is proposed along the left bank at a maximum 3H:1V slope, to flatten the near vertical banks, while preserving the E stream type channel dimensions. Proposed grading will increase the wetted perimeter, thus reduce the hydraulic radius, increase the frictional drag, and reduce velocities and shear stress forces eroding the existing stream banks. The proposed bank stabilization includes coconut fiber matting, livestakes, and a permanent stream bank seed mix. Vegetated soil lifts are proposed to be installed to protect the exposed manhole, including placement of fill in front of the exposed sewer manhole to provide additional protection. Alternatively, an imbricated riprap wall could be installed instead of vegetated soil lifts. The right stream bank is vegetated with a dense riparian buffer and in stable condition, thus no stabilization is proposed along this bank.

The comprehensive planting plan includes a riparian seed mix, herbaceous and woody shrubs, and trees suitable for full-sun canopy and frequent flooding conditions. The riparian area is within an NWI wetland, so the riparian seed mix may need to be a facultative wet or obligate wetland seed mix, depending on the in-situ soil and hydrology. It is recommended the riparian buffer planting area extend from 25- to 50 feet landward from the proposed top of stream bank.

The total estimated construction cost is $500,000 and construction may impact one property:

- Dickinson Avenue Extension, Parcel #009602 (Private Property)

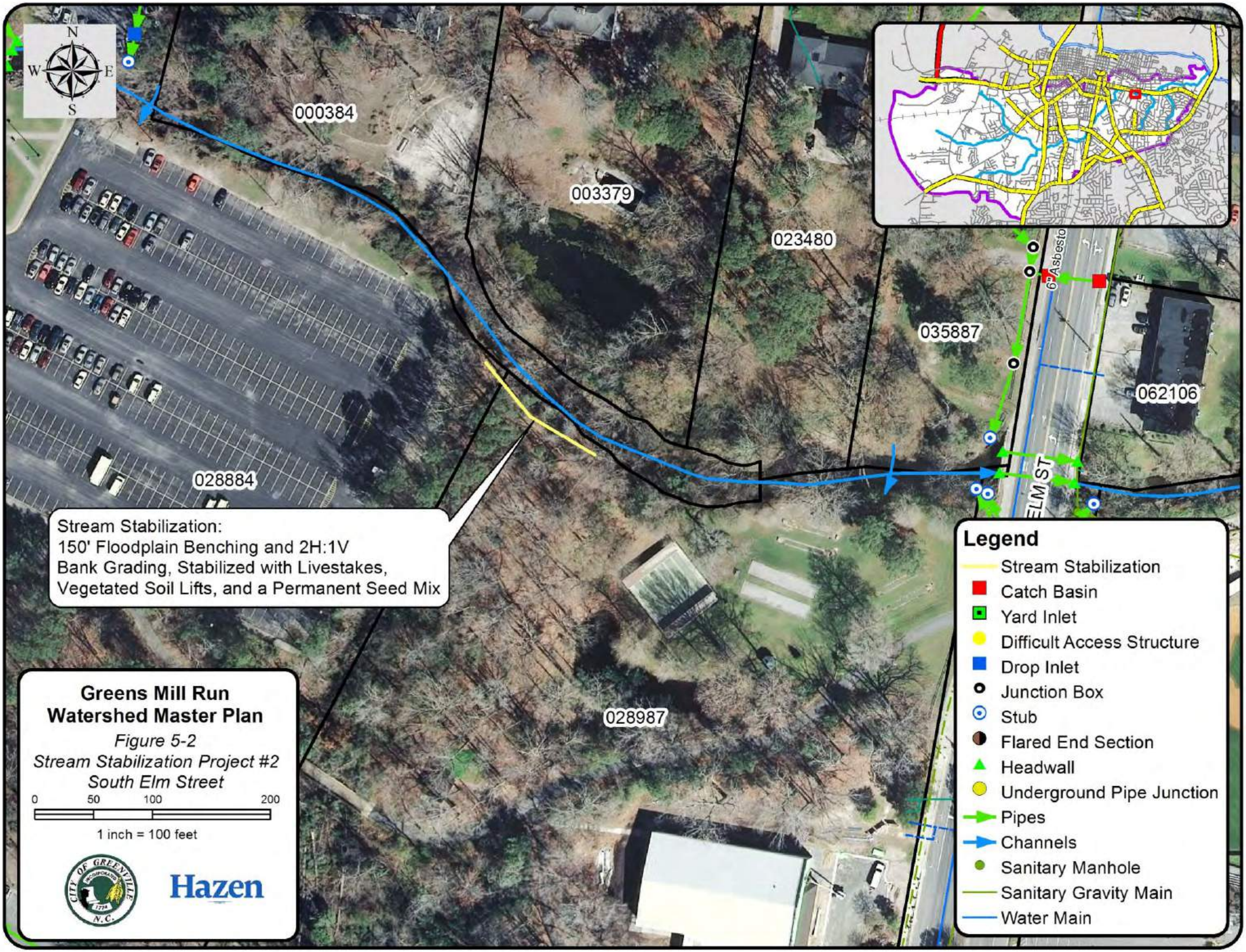
5.1.2 South Elm Street

The proposed South Elm Street stream stabilization project is located along a confined section of Greens Mill Run that runs perpendicular to the roadway (**Figure 5-2**). It is located on City-owned property and is surrounded by a mix of residential and institutional land-use. The site's drainage area is approximately 11 square miles, with 58% urban land-use, and 21% impervious area. Wetlands are present on the property per NWI GIS data; however, they are not present within the proposed project area. According to the NRCS soil map, the soils are Bibb fine sandy loam. There are no utility conflicts at the project location. Both floodplains have a vegetated riparian buffer, with a mix of herbaceous and woody shrubs and trees. Existing bank revetments (broken concrete, riprap etc.) are present at several locations, both upstream and downstream.

In addition to the data collection and analyses indicating that the site is in need of stabilization, it is also a location reported as having bank erosion according to City records. Data collection at this site included one cross-section, two BEHI/NBS assessments, and three bank pin installation assessments. The existing channel has a predominately sand/gravel substrate, with broken concrete along the channel bottom. The stream banks are vegetated (with the exception of the eroded stream section) and access to the floodplain is limited to larger flood events. The channel bottom is approximately 25 feet wide, with a maximum bank height of 9 feet, and a top width of 43 feet. In the Rosgen stream classification system, the channel classifies as a G5 stream type.

The BEHI and NBS assessment resulted in Very High/Moderate and Low values, respectively for the two locations. Maximum predicted bank erosion was estimated to be 0.6 ft/yr; however, the maximum measured erosion at the bank pins was 0.5 feet over a five month period, equivalent to 1 ft/yr. According to the Channel Evolution Model, this portion of GMR was determined to be unstable. Without stabilization efforts, channel widening and deepening may continue, posing risk to an adjacent parking lot. Bank erosion in the vicinity of the parking lot was noted during the field study, as shown in **Picture 5-4**.

Picture 5-4: Right Stream Bank Erosion


N
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003379
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035887
062106
028884
028987
Asbesto
ELM ST
Stream Stabilization:
150' Floodplain Benching and 2H:1V
Bank Grading, Stabilized with Livestakes,
Vegetated Soil Lifts, and a Permanent Seed Mix
Legend
Stream Stabilization
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Sanitary Manhole
Sanitary Gravity Main
Water Main
Greens Mill Run
Watershed Master Plan
Figure 5-2
Stream Stabilization Project #2
South Elm Street
0
50
100
200
1 inch = 100 feet
Hazen

Bank stabilization at South Elm Street has a high potential to reduce bank erosion and sediment loading to Greens Mill Run. These objectives are achieved by creating a small bankfull bench and stabilizing the eroding upper stream banks with vegetated soils and native plants. The proposed bank stabilization extends approximately 150 feet along the right bank. A small bench with vegetated soil lifts and upper bank grading at a maximum 2H:1V slope, are proposed in order to create a floodplain bench at a lower elevation, similar to the downstream section closer to the South Elm Street culvert. This approach provides additional flow area and mitigates some of the high shear stress forces acting on the existing stream bank. Bank stabilization is proposed to tie into the existing downstream bank revetment, which appears to be in stable condition.

The planting plan includes livestakes and both a temporary and permanent seed mix for the stream banks, suitable for a shaded tree canopy and frequent flood conditions. The riparian buffer disturbed during the construction phase is proposed to be replanted with a riparian seed mix, and herbaceous and woody shrubs and trees. Since the area is in close proximity to a greenway, it is recommended that a split rail fence and signs be posted to discourage pedestrian foot traffic through the riparian buffer during the re-establishment period of the first couple of growing seasons.

The total estimated construction cost is $440,000 and may impact the following properties:

- 1058 South Elm Street, Parcel #028987 (Elm Street Park/City Property)
- 950 East Tenth Street, Parcel #000384 (Private Property)
- 28884 College Hill Drive, Parcel #28884 (East Carolina University Property)

5.1.3 Cedar Lane

The proposed Cedar Lane stream stabilization project is located along a confined section of Reedy Branch that runs parallel to East Wright Road (**Figure 5-3**), at the southwestern corner of Jaycee Park. The site's drainage area contains residential areas, is approximately 0.2 square miles in size, with 75% urban land-use and 27% impervious area.

Wetlands are not present on the property per the NWI. The site is adjacent to the Jaycee Park wet detention basin retrofit (**Section 5.2.2.12**), thus presents an opportunity to coordinate design and construction of the projects.

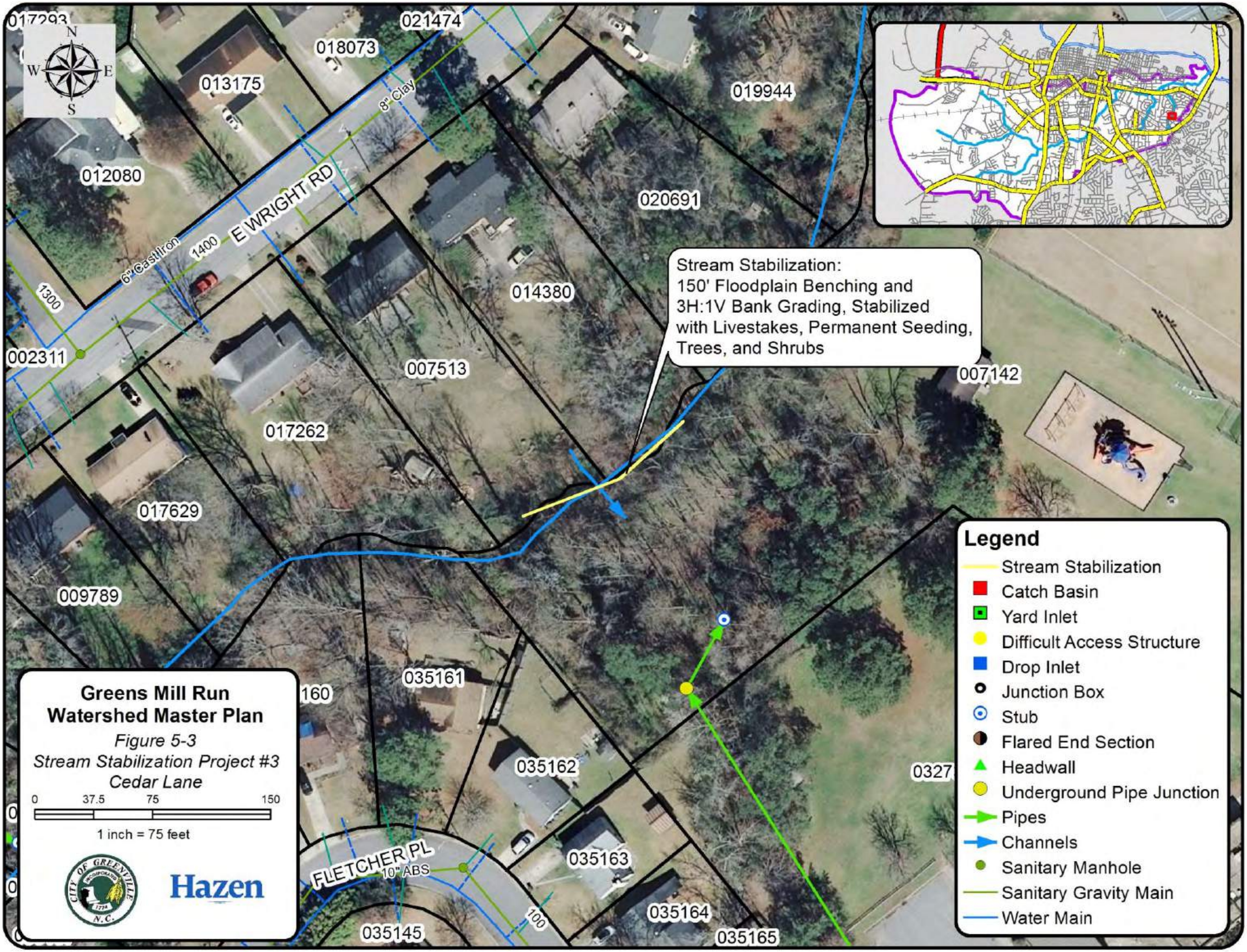
Picture 5-5: Right Stream Bank Erosion

Per the NRCS soil map, local soils are Bibb fine sandy loam. There are no utility conflicts at the site. The site is a location reported in City records as having extensive bank erosion (**Picture 5-5**). Both floodplains have a vegetated riparian buffer with a mix of herbaceous and woody shrubs and trees. Existing bank revetments (broken concrete, imbricated riprap, etc.) are present at several locations, both upstream and downstream of the proposed project site (**Picture 5-6**).

Picture 5-6: Existing Bank Revetments

Data collection at the Cedar Lane site included one cross-section, three BEHI/NBS assessments, and three bank pin installation assessments. The existing channel has a predominately sand/gravel substrate. The stream banks are vegetated, with the exception of outer cut-bank meander bends. Access to the floodplain varies along the reach, with some sections limited to larger flood events. The channel bottom is approximately 10 feet wide, with a maximum bank height of 4 feet, and a top width of 16 feet. The channel classifies as a Type E5 stream in the Rosgen classification system.

The BEHI AND NBS assessment resulted in Very High/High/High and Low values, respectively for the three locations. Bank erosion in an approximately 100 foot x 9 foot section on the right bank was estimated to be 0.6 ft/yr at the location where the bank pins were installed. Measured erosion was not determined due to slumping of the upslope bank material that covered the middle and bottom pins. This site was determined to be unstable, according to the Channel Evolution Model, exhibiting signs of channel widening, slumped material, and degradation. No structures or infrastructure were found to be at risk due to the erosion; however, property loss is expected to occur if the instability is not addressed.



Greens Mill Run
Watershed Master Plan
Figure 5-3
Stream Stabilization Project #3
Cedar Lane
0 37.5 75 150
1 inch = 75 feet
Hazen
Stream Stabilization:
150' Floodplain Benching and
3H:1V Bank Grading, Stabilized
with Livestakes, Permanent Seeding,
Trees, and Shrubs
Legend
Stream Stabilization
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Sanitary Manhole
Sanitary Gravity Main
Water Main
E WRIGHT RD
FLETCHER PL
8" Clay
6" Cast Iron
10" ABS
1400
1300
100
N
S
E
W
021474
018073
013175
012080
019944
020691
014380
007513
007142
017262
017629
002311
009789
035161
035162
035163
035164
035165
035145

Bank stabilization at Cedar Lane has a high potential to reduce bank erosion and sediment loading to Reedy Branch. These objectives are achieved by creating a bankfull bench and stabilizing the eroding stream banks with native vegetation. Grading activities are limited to the right bank (outer meander) for approximately 150 feet. Bank stabilization is proposed to be facilitated by creating a full bankfull bench and reconnecting the stream to its floodplain at a maximum 3H:1V slope. By creating a bankfull bench, the stream is reconnected to a lower floodplain, creating additional flow area, and mitigating some of the high shear stress forces acting on the existing stream banks. The existing concrete and imbricated revetments are proposed to remain in place upstream and downstream of the proposed project. The planting plan includes livestakes, seeding, herbaceous and woody shrubs, and trees that are suitable for a shaded tree canopy and frequent flooding conditions.

The total estimated construction cost is $400,000 and may impact the following properties:

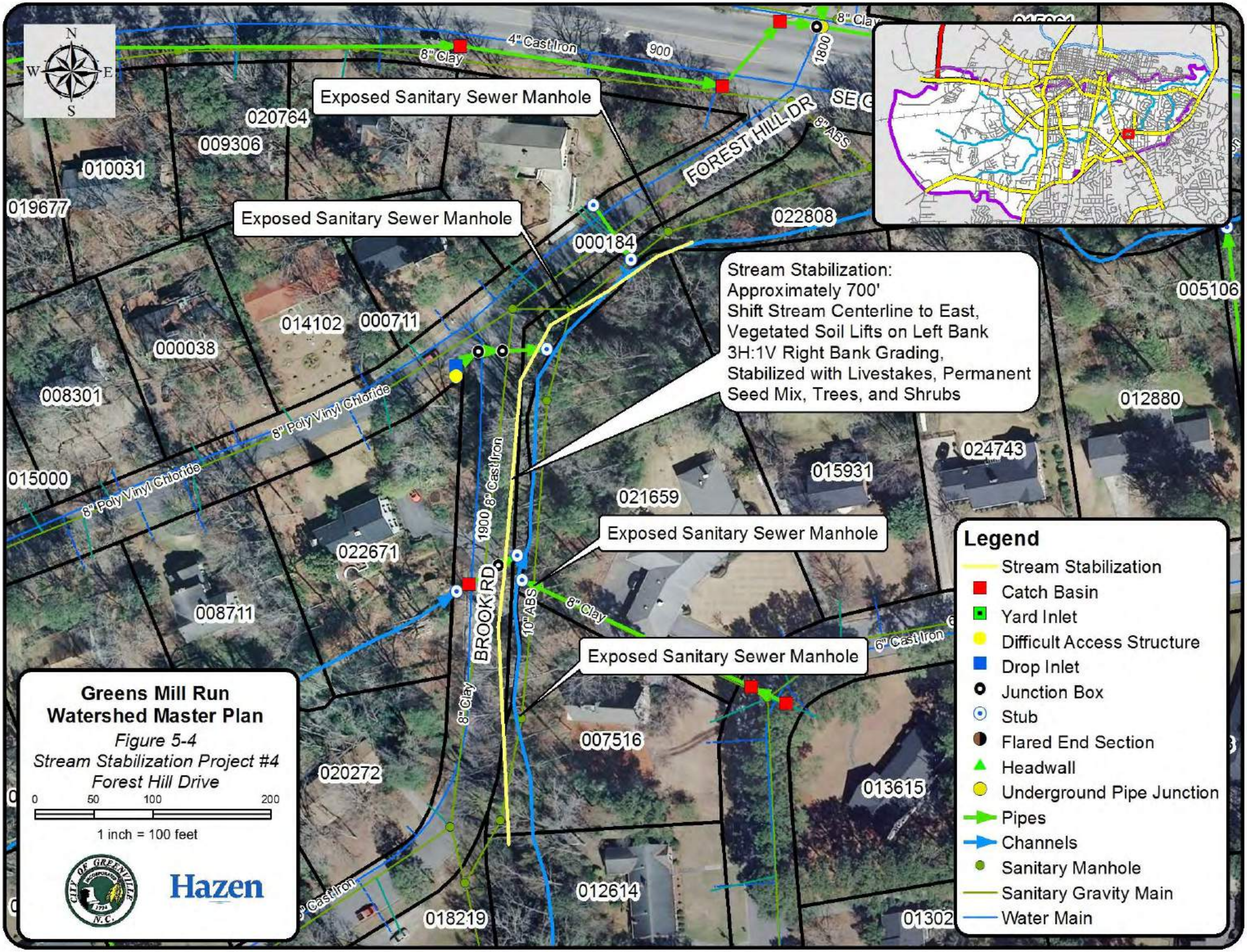
- 2000 Cedar Lane, Parcel #007142 (Jaycee Park/City Property)
- 1411 East Wright Road, Parcel #014380 (Private Property)
- 1413 East Wright Road, Parcel #007513 (Private Property)

5.1.4 Forest Hill Drive

The proposed stream stabilization project at Forest Hill Drive site is located along a confined section of Fornes Run that runs parallel to Forest Hill Drive and Brook Road (**Figure 5-4**). The surrounding area contains residential areas, with a drainage area of approximately 0.3 square miles, with 99% urban land-use, and 56% impervious area. Wetlands are present per the NWI. The site is a location reported in City records as having bank erosion (**Picture 5-7**).

Picture 5-7: Left Stream Bank Erosion

NRCS soil maps indicated Bibb fine sandy loam and Wagram loamy sand soils. The Bibb and Wagram soils qualify as a HSG D and A, respectively. Both soils are considered hydric. Wagram soils are well drained with moderately rapid permeability. The soil consists of loamy sand, sandy clay loam, and loamy sand, underlain by friable sandy clay loam.



Greens Mill Run Watershed Master Plan

Figure 5-4
Stream Stabilization Project #4
Forest Hill Drive

A gravity sewer line runs parallel to the stream in the left floodplain, with several exposed manholes. The left floodplain is composed of a 5- to 10 foot grassed right-of-way, from the edge of the roadway to the top of the stream bank (**Picture 5-8**). The right floodplain has abundant floodplain vegetation, predominately bamboo to the top of bank.

Picture 5-8: Right-of-Way on Left Floodplain and Sewer Utilities

The existing channel has a predominately sand substrate, with partially vegetated steam banks and access to the floodplain. Cross-sectional data was not collected at the site; however the channel bottom is approximately 6 feet wide with a maximum depth of 6 feet. The channel appears to be an E4 stream type. Three bank pins were installed at the site and re-measured four months later. Measured erosion was 2.8 feet with the top pin completely exposed and lying on the bank. Based on the measured erosion, the estimated annual erosion exceeds 8 ft/yr. Field investigations showed that runoff from the street and adjacent properties flows into the stream via the mowed right-of-way, creating several rills similar to the scoured area at the bank pins. Due to the unstable nature of the site, both the sanitary sewer and roadway are at risk of being damaged by future stream degradation.

The proposed project includes installation of vegetated soil lifts on the left stream bank, regrading the right stream bank with a maximum slope of 3H:1V, and shifting the stream centerline away from the existing sewer infrastructure. Combined, these changes help reduce sediment loading and bank erosion, and protect public infrastructure (sewer and roadway). Alternatively, if detailed project planning indicates insufficient room to relocate the stream and/or install vegetated soil lifts, an imbricated riprap wall on the left bank also meets the project goals. Additional measures that facilitate stream stability include: halting mowing operations along the stream bank and establishing a protected, vegetated riparian buffer. The planting plan includes livestakes and a permanent seed mix for the stream banks, suitable for the type of tree canopy and wet conditions. Additional seeding and plantings, such as shrubs and trees, are required to reestablish the riparian buffer.

The proposed stream stabilization extends for approximately 700 feet along Fornes Run, with a total estimated cost of $820,000. Several properties are likely to be impacted, including:

- 1900 Brook Road, Parcel #018219 (Private Property)
- 2006 Fern Drive, Parcel #015931 (Private Property)
- 2008 Fern Drive, Parcel #021659 (Private Property)
- 2010 Fern Drive, Parcel #007516 (Private Property)
- 2012 Fern Drive, Parcel #012614 (Private Property)
- Southeast Greenville Boulevard, Parcel #022808 (City Property)

5.1.5 South Evans Street

The proposed project located near South Evans Street is along an unconfined tributary to Greens Mill Run, running perpendicular to the street (**Figure 5-5**). The site receives flow from a 72” diameter double-barrel culvert. Two commercial properties, and one large, partially developed residential tract bound the project area. The site’s drainage area is approximately 10 square miles, 56% urban and 20% impervious. Wetlands are present in the downstream section, near the confluence with GMR, per the NWI.

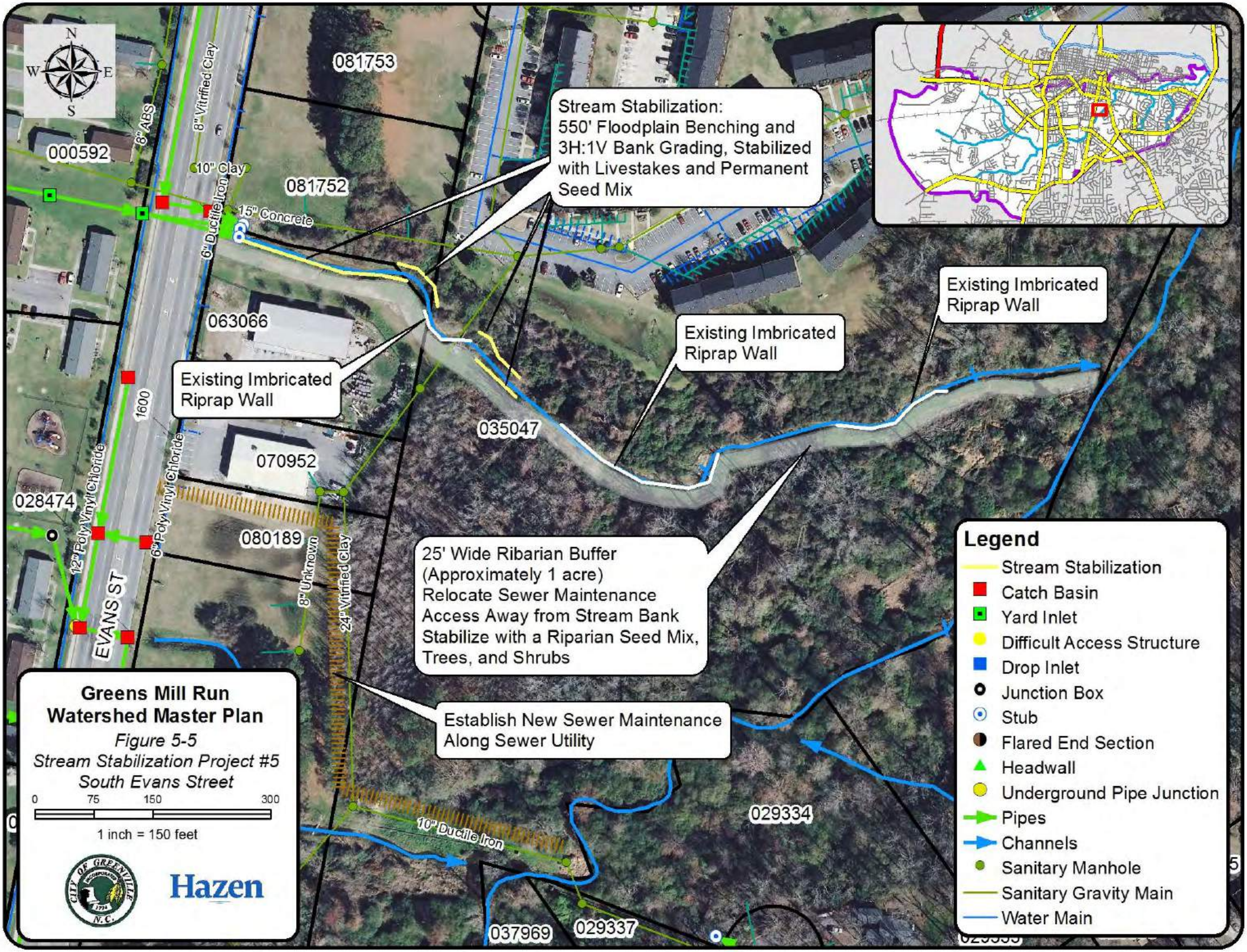
Soils at the proposed project location are Bibb fine sandy loam and Roanoke silt loam, according to NRCS soils maps. Both of these soils qualify as HSG D, and are considered hydric. Roanoke soils are poorly drained with moderate permeability. The soils consist of silt loam, clay loam, and loamy fine sand, underlain by very firm clay and firm silty clay loam.

The site also includes a gravity sewer line running parallel to the stream in the left floodplain, a 24” DIP sewer aerial crossing, and storm pipes. A manhole is present on the right overbank and is protected by riprap. Evidence of recent hard structure stability work was noted, as the outer meander bends at were recently protected via installation of several imbricated riprap walls (**Picture 5-9**). Additionally, in the upper section of the project site, the left bank is vegetated with gradually sloping banks, with the first 250 feet at a flatter slope to accommodate a small bankfull bench. This left bank is fairly stable with the exception of the first outer meander and expansion scour adjacent to the aerial sewer crossing. The left floodplain has abundant floodplain vegetation (herbaceous grasses, woody shrubs and trees) to the top of bank.

Picture 5-9: Existing Imbricated Riprap Wall on Right Bank

The riparian buffer on the right floodplain is vegetated by low growing grass which is maintained by mowing operations to the top of the bank. The upstream section’s banks are bare and approximately 5 feet high (**Picture 5-10**). This section is narrower than the downstream section, and peak bankfull flow cannot access the floodplain. The geometry of this section indicates there may not be enough cross-sectional area within the active channel for bankfull flow, which may be contributing to the accelerated bank erosion.

Picture 5-10: Stable Left Bank and Eroded Right Bank


Greens Mill Run
Watershed Master Plan
Figure 5-5
Stream Stabilization Project #5
South Evans Street
0 75 150 300
1 inch = 150 feet
Hazen
Stream Stabilization:
550' Floodplain Benching and
3H:1V Bank Grading, Stabilized
with Livestakes and Permanent
Seed Mix
Existing Imbricated
Riprap Wall
Existing Imbricated
Riprap Wall
Existing Imbricated
Riprap Wall
25' Wide Ribarian Buffer
(Approximately 1 acre)
Relocate Sewer Maintenance
Access Away from Stream Bank
Stabilize with a Riparian Seed Mix,
Trees, and Shrubs
Establish New Sewer Maintenance
Along Sewer Utility
EVANS ST
1600
081753
081752
000592
063066
035047
070952
028474
080189
029334
037969
029337
8" Vitrified Clay
8" ABS
10" Clay
15" Concrete
6" Ductile Iron
12" Poly Vinyl Chloride
6" Poly Vinyl Chloride
8" Unknown
24" Vitrified Clay
10" Ductile Iron
Legend
Stream Stabilization
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Sanitary Manhole
Sanitary Gravity Main
Water Main

In addition to mowing operations in the floodplains, field investigations revealed use of herbicidal spraying in the riparian buffer and NWI wetlands for an approximate 25 foot width, from the top of the stream bank, landward. This practice appeared to be implemented for access to the sewer manholes along GMR. Due to the impacts on native vegetation, it is suspected that these operations may be exacerbating bank erosion.

Cross-sectional data was not collected at this site; however, the channel bottom is approximately 12 feet wide, with a maximum depth of 5 feet. The channel appears to be a degraded E5 stream type. Three bank pins were installed and re-measured four months later. Measured erosion resulted in a maximum of 0.4 feet, or approximately 1 ft/yr. The site was classified as unstable, exhibiting signs of channel widening, aggradation of eroded materials into a lower floodplain, and bank failures. Future erosion poses risks primarily to the adjacent sewer utility; however, nearby electrical infrastructure may also be impacted.

Bank stabilization measures proposed at South Evans Street have a high potential to reduce bank erosion and sediment loading to the tributary and GMR. These objectives can be achieved by creating additional cross-sectional area for bankfull flow, stabilizing the eroding stream banks with native vegetation, and establishing a protected riparian buffer. Grading a small bench and upper banks at a 3H:1V slope along the straight section of the right bank section nearest the culvert is proposed to create a floodplain bench at a lower elevation, similar to the existing left bank. This creates additional flow area, mitigating some of the high shear stress forces acting on the stream banks. Vegetated soil lifts are recommended in this area and at the remaining outer meander bends that are actively eroding, namely the left banks adjacent to the existing storm sewer and aerial sewer crossing. The left bank in the upper section of the site is vegetated and in stable condition, thus stabilization is not recommended along this section. The existing imbricated riprap walls should remain in place.

The planting plan includes livestakes, and both a temporary and permanent seed mix for the stream banks, suitable for a full sun tree canopy and frequent flooding conditions. The grassed area in the right-side riparian buffer should be replanted with a riparian seed mix, herbaceous and woody shrubs, and trees suitable for full-sun canopy. Landscaping maintenance (mowing, weed-eating, and herbicidal spraying) should be prohibited within a 25 foot buffer from the top of the stream bank. Signage is recommended to delineate the protected area. The maintenance access to the existing sewer infrastructure should be re-routed. This may be achieved by accessing the sewer utilities from further south on Evans Street, shown in **Figure 5-5**.

The proposed project includes approximately 1 acre of riparian buffer and bank stabilization along approximately 550 feet of the tributary. The total estimated construction cost is $1,110,000 and may impact the following properties:

- 1705 South Evans Street, Parcel #063066 (Private Property)
- 1709 Evans Street, Parcel #070952 (Private Property)
- Evans Street, Parcel #000598 (Private Property)
- Evans Street, Parcel #080189 (Private Property)
- Evans Street, Parcel #081752 (Private Property)
- 1524 Charles Boulevard, Parcel #035047 (Private Property)

5.1.6 St. Andrews Drive

The proposed stabilization project located near St. Andrews Drive is along a confined section of an unnamed tributary to Greens Mill Run, positioned between Southwest Greenville Boulevard and Fairlane Road, running parallel to St. Andrews Drive (**Figure 5-6** and **Figure 5-7**). Several residential and commercial properties are adjacent to the site. The project extends for approximately 3,650 feet along the tributary, of which 3,200 feet are impaired. The site's drainage area is approximately 0.08 square miles, with 87% urban land-use and 48% impervious area. Wetlands are not present on the property per the NWI.

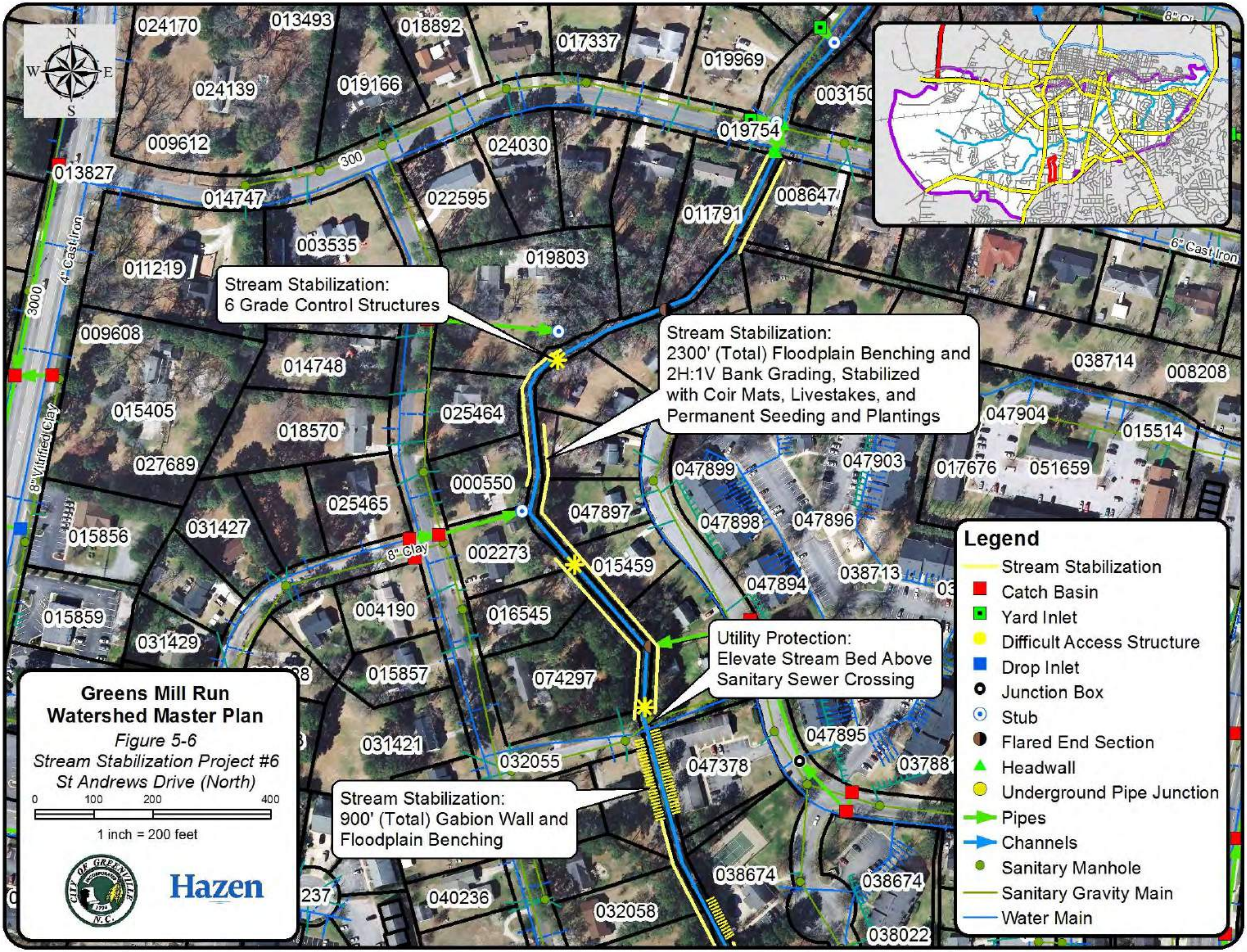
Picture 5-11: Exposed Gravity Sewer Crossing

The soils according to NRCS soil maps, are Lynchburg , Exum, Rains, and Coxville fine sandy loam, Goldsboro sandy loam, and Lenoir loam. The soils range from HSG B to D, and are considered hydric soils, with the exception of the Exum and Coxville series. The Lynchburg, Exum, Rains and Goldsboro soils are underlain by a friable sandy clay loam and experience a seasonal high water table and ponding. The Coxville and Lenoir soils have a subsoil consisting of firm sandy clay to clay and experience a seasonal high water tables as well.

Picture 5-12: Electric Transformers at Top of Bank

An exposed gravity sewer line crosses the stream in the middle section of the project (**Picture 5-11**), and numerous stormwater pipes discharge along the channel. There are several electric transformer boxes that are close to the top bank, with a few areas of localized scour threatening structures (**Picture 5-12**). Bank erosion is threatening the structural integrity of a residential building at 313 St. Andrews Drive (**Picture 5-13**). The top of bank is also close to the Keswick Apartment's pool deck and several residential fences. Additional utilities along the stream section include a water crossing at Sedgefield Drive and a water and gas line at near the culvert Fairlane Road.

Picture 5-13: Threatened Structures Near Top of Bank



Greens Mill Run
Watershed Master Plan
Figure 5-6
Stream Stabilization Project #6
St Andrews Drive (North)
0 100 200 400
1 inch = 200 feet
Hazen
Stream Stabilization:
6 Grade Control Structures
Stream Stabilization:
2300' (Total) Floodplain Benching and
2H:1V Bank Grading, Stabilized
with Coir Mats, Livestakes, and
Permanent Seeding and Plantings
Utility Protection:
Elevate Stream Bed Above
Sanitary Sewer Crossing
Stream Stabilization:
900' (Total) Gabion Wall and
Floodplain Benching
Legend
Stream Stabilization
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Sanitary Manhole
Sanitary Gravity Main
Water Main
4" Cast Iron
6" Cast Iron
8" Vitrified Clay
8" Clay
300
3000
024170
013493
018892
017337
019969
024139
019166
003150
009612
024030
019754
013827
014747
022595
008647
011791
003535
019803
011219
009608
014748
038714
008208
015405
025464
047904
018570
015514
027689
047899
047903
017676
051659
000550
025465
047897
047898
047896
015856
031427
002273
015459
038713
047894
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047895
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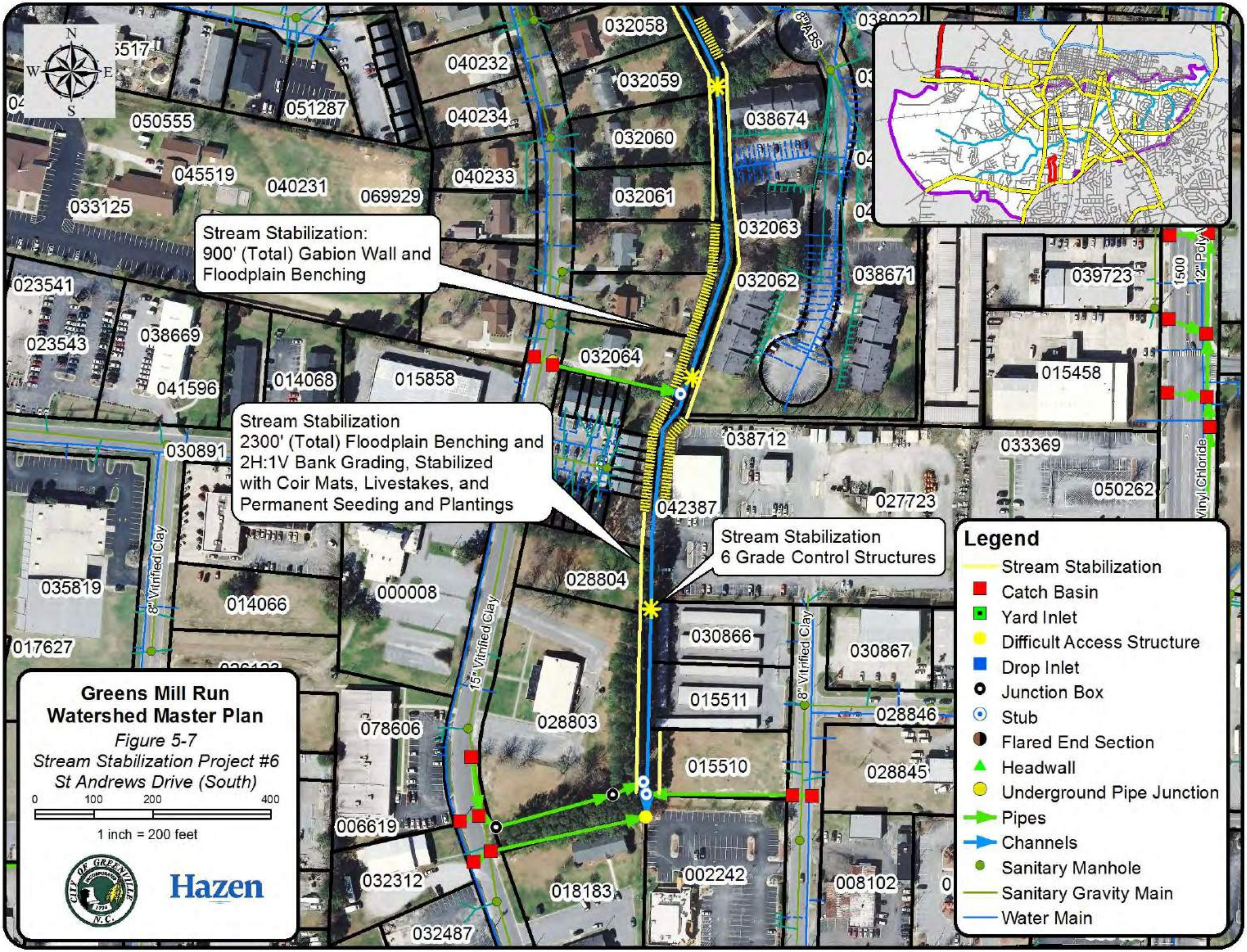
038674
040236
032058
038022



Greens Mill Run Watershed Master Plan

Figure 5-7

Stream Stabilization Project #6

St Andrews Drive (South)

The majority of the stream channel is deeply incised with bank heights approximately 7 feet to 12 feet. The stream is hydraulically disconnected from its floodplain. The channel at the upstream and downstream limits of the project is moderately incised, approximately 3 feet to 4 feet, and appears to be connected to the floodplain. There is a small section in the upstream area where a low bench was graded into the right bank and is vegetated (**Picture 5-14**). Although the left bank is nearly vertical at this location, this stream section appears to be stable. Additionally, there is a small section in the downstream channel where the bank height is approximately 3 feet and appears to be stable and connected to its floodplain.

Picture 5-14: Near Vertical Left Bank and Low Bench on Right Bank

The majority of the channel's riparian buffer is vegetated with a mix of herbaceous and woody shrubs and overstory trees. There are a numerous locations where scour has exposed tree root balls along the channel bank, and several locations where stream incision has caused trees to fall into/across the channel. At the upstream and downstream limits, the floodplain is maintained (mowed) to the top of bank. Existing stream bank revetments (stacked concrete sandbags, riprap, etc.) are present at several within the project area**.**

Data collected at the St. Andrews Drive site included one cross-section, one BEHI/NBS assessment, and installation of six bank pins. The cross-section was located about mid-channel, and the bank pins were installed approximately 1,500 feet upstream and 1,200 feet downstream of the cross-section location. The existing channel has a very fine sand substrate and the stream banks are sparsely vegetated. At the cross-section location, the channel bottom is approximately 3 feet wide, with a maximum bank height of 7 feet, and a top width of 13 feet. In the Rosgen stream classification system, the channel classifies as a G5 stream type.

The BEHI and NBS assessment conducted at the cross-section location resulted in High/Low values for the left and right bank, respectively. Maximum bank erosion was estimated to be 0.1 ft/yr. The measured bank erosion at the bank pins validated this estimate, with a measured average erosion at the bank pins of 0.05 feet over an eight month period, or approximately 0.08 ft/yr. While the measured bank erosion at the two locations was considered a typical erosion rate for urban channels (0.1 ft/yr), the channel is deeply incised with other areas of accelerated bank erosion. Using the Channel Evolution Model, many locations along this stretch of the stream were determined to be unstable, showing signs of channel degradation and bank failures. Without stabilization measures numerous gas, sewer, and stormwater utilities; commercial and residential structures; fences, and other adjacent features are at risk of being damaged by continued bank and channel erosion.

Bank stabilization, channel modifications, and grade controls are proposed to protect structure foundations and utilities, reduce sediment loading, prevent future channel downcutting, and reduce tree loss. These objectives are achieved by implementing several design elements:

- Small bankfull bench and grading upper bank to terrace floodplain at a maximum 2H:1V slope
- Gabion walls where utilities and structures constrain creation of a wider bankfull bench
- Elevate channel bed to provide cover over existing sewer crossing
- Grade controls (e.g. cross vanes, J-hooks, etc.)
- Stabilize graded and disturbed areas with coir mat and plantings (livestakes, shrubs, trees and permanent seeding)

Grading to create a bankfull bench and stabilize the upper banks is proposed for approximately 2,300 feet of channel to create a floodplain bench at a lower elevation, similar to the stable upstream section near the bank pins at 403 St. Andrews Drive. This also serves to provide additional flow area and mitigate some of the high shear stress forces acting on the existing stream bank. Gabion walls are proposed for a channel length of 900 feet to provide protection where existing infrastructure is close to the top of bank and insufficient space exists to create a bankfull bench while maintaining a setback from the top of bank. Walls are proposed specifically at residential structures located at 313 St. Andrews Drive, 319 St. Andrews Drive, 305 Bridle Circle, 302 Sedgefield Drive, and commercial infrastructure at 1530 Hooker Road. In total, the proposed stabilization will restore approximately 3,200 feet of stream.

The exposed sewer is a risk not only to the sewer infrastructure, but also for debris jams to form, which may constrict channel conveyance, increase shear stress, and potentially scour the stream bed and banks. It is proposed that the channel bed be raised to provide one foot of cover over the existing sewer pipe. A grade control located just downstream of the crossing is proposed to maintain the raised bed elevation. A series of grade controls downstream of the crossing are proposed to gradually lower the channel elevation to tie into the existing channel grade. Additionally, the grade controls are proposed to prevent future headcut migration and channel incision. A minimum of six grade controls are recommended, which equates to approximately one per 500 feet of channel.

The planting plan includes livestakes and both a temporary and permanent seed mix for the stream banks, suitable for frequent flooding conditions. The riparian buffer disturbed during the construction phase is proposed to be replanted with a riparian seed mix, and herbaceous and woody shrubs and trees.

The project extends approximately 3,200 feet along the stream, with a total estimated construction cost of $3,430,000. Implementation may impact the following properties:

- 103 St Andrews Drive, Parcel #019803 (Private Property)
- 105 St Andrews Drive, Parcel #025464 (Private Property)
- 107 St Andrews Drive, Parcel #000550 (Private Property)
- 109 St Andrews Drive, Parcel #002273 (Private Property)
- 203 St Andrews Drive, Parcel #016545 (Private Property)
- 205 St Andrews Drive, Parcel #074297 (Private Property)
- 303 St Andrews Drive, Parcel #032057 (Private Property)
- 305 St Andrews Drive, Parcel #032058 (Private Property)
- 307 St Andrews Drive, Parcel #032059 (Private Property)
- 309 St Andrews Drive, Parcel #032060 (Private Property)
- 311 St Andrews Drive, Parcel #032061 (Private Property)
- 313 St Andrews Drive, Parcel #032062 (Private Property)
- 315 St Andrews Drive, Parcel #032063 (Private Property)
- 317 St Andrews Drive, Parcel #032064 (Private Property)
- 319 St Andrews Drive, Parcel #028323, 042386, 042385, 042384, 042383, 042382 (Private Property)
- 403 St Andrews Drive, Parcel #022803, 028804 (Private Property)
- 305 Bridle Circle, Parcel #047378 (Private Property)
- 1569 Bridle Circle, Parcel #038674 (Private Property)
- Brimley Drive, Parcel #015510, 030866 (Private Property)
- 115 Fairlane Drive, Parcel #008647 (Private Property)
- 201 Fairlane Drive, Parcel #011791 (Private Property)
- 1530 Hooker Road, Parcel #030866 (Private Property)
- 307 Horseshoe Drive, Parcel #047894 (Private Property)
- 309 Horseshoe Drive, Parcel #047895 (Private Property)
- 311 Horseshoe Drive, Parcel #047896 (Private Property)
- 313 Horseshoe Drive, Parcel #047896 (Private Property)
- 315 Horseshoe Drive, Parcel #047898 (Private Property)
- 317 Horseshoe Drive, Parcel #047899 (Private Property)
- 321 Horseshoe Drive, Parcel #047901 (Private Property)
- 302 Sedgefield Drive, Parcel #032055 (Private Property)
- Parcel #038712 (Pitt County Property)

5.1.7 Greenway at East 10th Street

The Greenway at East 10th Street stream stabilization project is located along a confined section of Greens Mill Run that runs parallel to Greens Mill Run (**Figure 5-8**). Situated on a privately-owned property, the area is surrounded by a mix of residential and institutional land-use. Based on North Carolina StreamStats, the site's drainage area is approximately 11 square miles, with 61% urban land-use and 21% impervious area. Wetlands are not present on the property per the NWI GIS data.

Picture 5-15: Left Bank Erosion

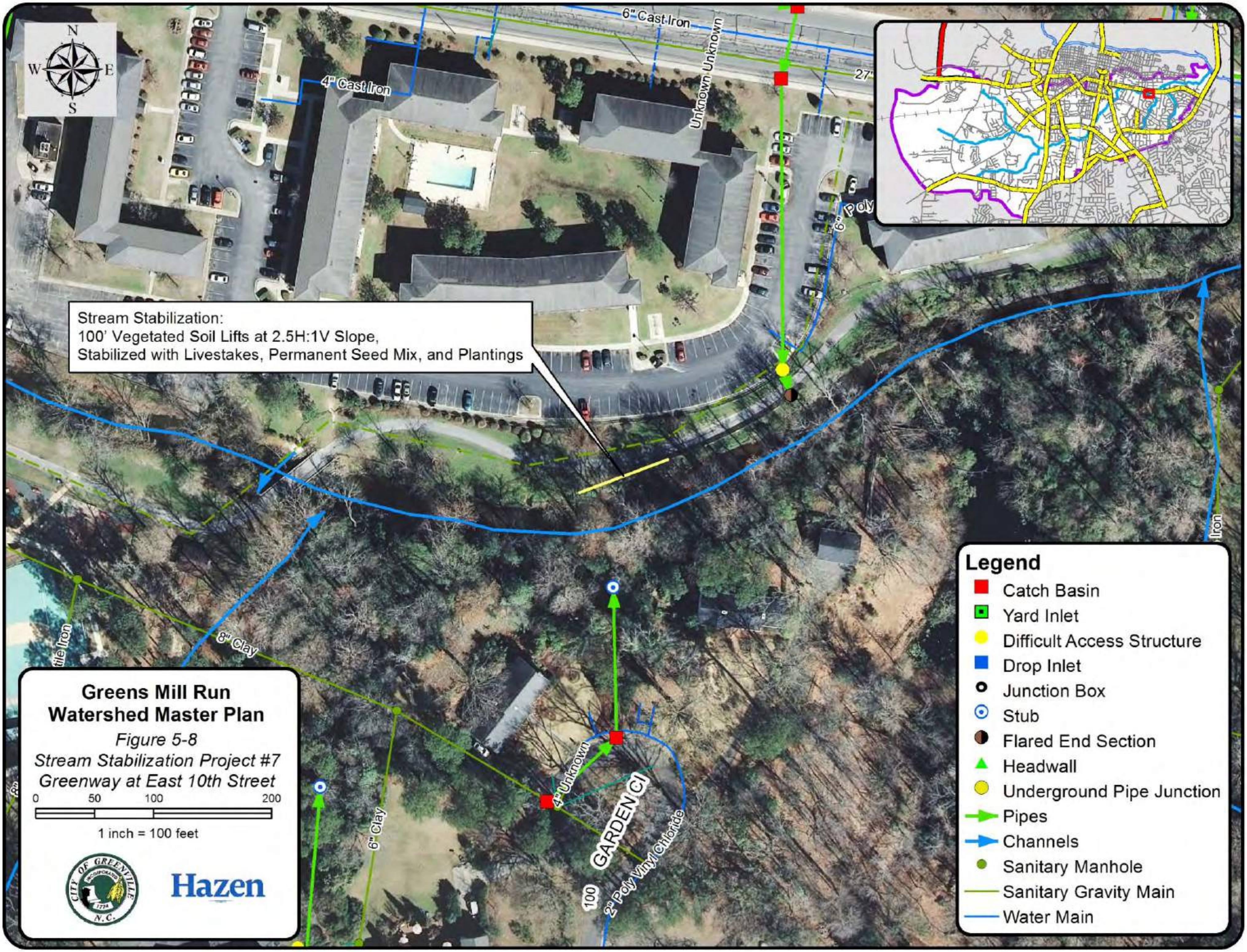
The soils, as identified by the NRCS soil maps, are Bibb fine sandy loam. There are no known utility conflicts at the site. The location has been reported by City records as having bank erosion (**Picture 5-15**). The right floodplain, looking downstream, has a vegetated riparian buffer with a mix of herbaceous and woody shrubs and trees (**Picture 5-16**), while the left consists of managed turf, a paved greenway, and a parking lot for an adjacent apartment complex (**Picture 5-17**).

Picture 5-16: Vegetated Right Bank and Eroded Left Bank

Data collection included one cross-section, and one BEHI/NBS assessment. The existing channel has a predominately clay substrate. The stream banks are vegetated (with the exception of the eroded stream section) and access to the floodplain is limited to larger flood events. The channel bottom is approximately 23 feet wide, with a maximum bank height of 10 feet and a top width of 43 feet. In the Rosgen stream classification system, the channel classifies as a G5 stream type. The BEHI and NBS assessment resulted in "Very High" and "Low" values, respectively for the measured location.

Bank erosion was estimated at 0.6 ft/yr. The site was determined to be unstable, exhibiting signs of channel widening and bank erosion, threatening greenway infrastructure.

Picture 5-17: Greenway Trail on Left Bank



Greens Mill Run Watershed Master Plan

Figure 5-8

Stream Stabilization Project #7

Greenway at East 10th Street

The proposed bank stabilization is limited to approximately 100 feet along the left bank. Soil lifts are proposed at a maximum 2.5H:1V slope to mimic the existing bank slope. The bank stabilization is proposed to tie into the existing gabion revetment, located downstream, which appears to be in stable condition.

The planting plan includes livestakes, and both temporary and permanent seed mixes for the stream banks, suitable for partial shade and frequent flooding conditions. The riparian buffer disturbed during construction is proposed to be replanted with a riparian seed mix, and herbaceous and woody shrubs and trees. Since the area is close to a greenway, it is recommended that a fence be considered to discourage pedestrian traffic through the riparian buffer during the first two growing seasons.

The total estimated construction cost is $320,000 and impacts the following property:

- 1116 East Tenth Street, Parcel #0006409 (Private Property)

5.1.8 East 10th Street at Rock Spring Road

Stream bank stabilization is proposed at the intersection of East 10th Street and Rock Spring Road (**Figure 5-9**). Greens Mill Run crosses under Rock Spring Road via a short bridge. The area is surrounded by a mix of residential, institutional, and commercial land uses. Based on North Carolina StreamStats, the site's drainage area is approximately 10.6 square miles and 21% impervious area. Wetlands are not present on the property per the NWI GIS data

Picture 5-18: Greenway Trail on Left Bank

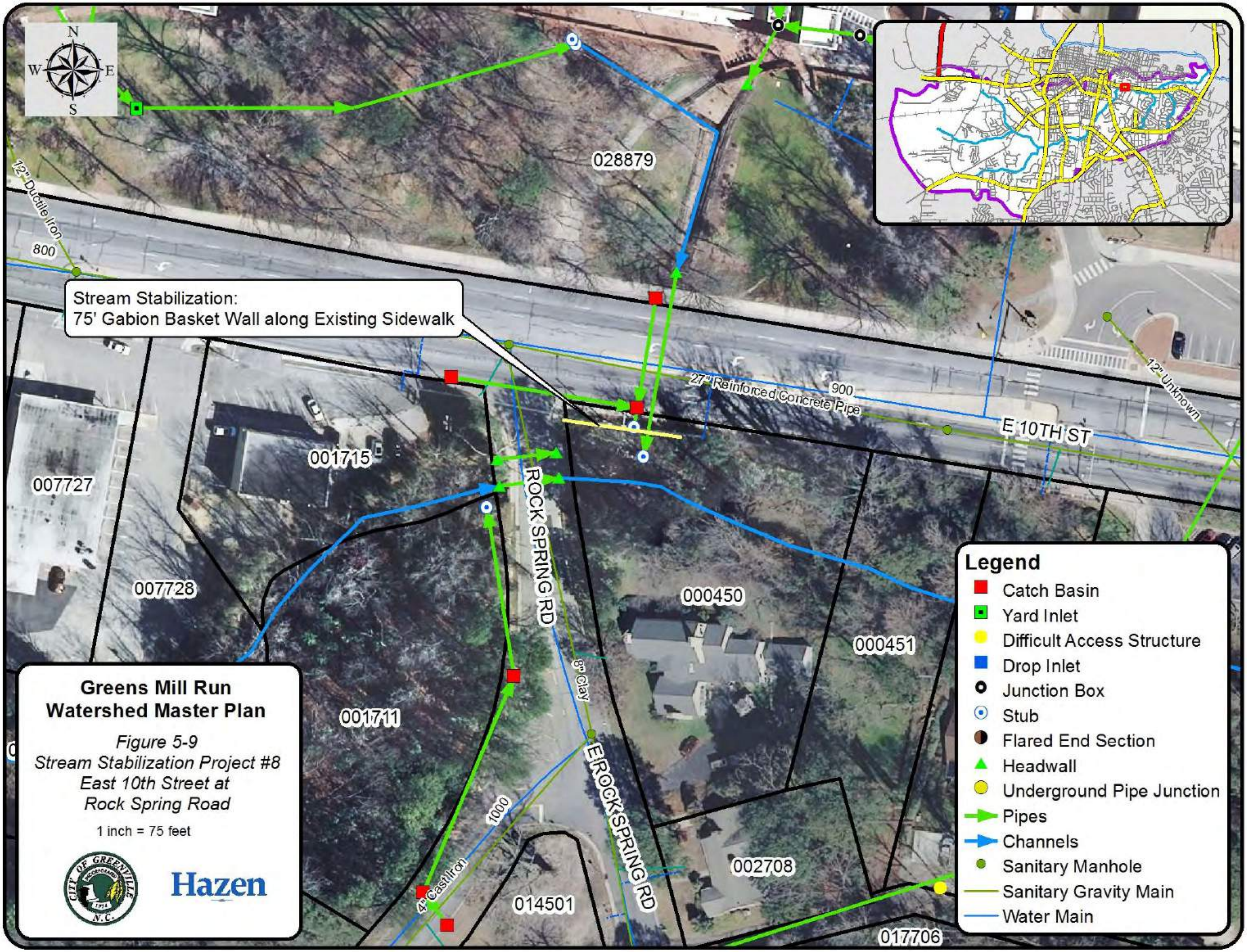
The NRCS soil map indicates that the site falls on the line between Bibb complex and Lynchburg fine sandy loam. GUC data indicates that a gas line runs through the project area, and stormwater inventory indicates that there are two drainage pipes which perpendicularly cross the project area. The right floodplain, looking downstream, has a vegetated riparian buffer with a mix of herbaceous and woody shrubs and trees, while the left consists of managed turf, woody shrubs, sidewalk, and East 10th Street.

Channel dimensions were measured from a combination of the FEMA model and storm drainage inventory data. The existing channel bank is approximately 12 feet high and is vegetated. The floodplain consists of East 10th Street; access to the floodplain is limited to larger flood events (100-year storm). The channel bottom is approximately 24 feet wide, with a top width of approximately 100 feet (measured from the edge of East 10th Street). In the Rosgen stream classification system, the channel classifies as an F5 stream type.

On the downstream side of the bridge, the sidewalk along East 10th Street is directly at the top of the stream bank, which is sloughing and has exposed the underside of the sidewalk (**Picture 5-18**). This bank is on the outer bend following the bridge headwall, and the resulting force of the stream on the bank is causing the sloughing. The proposed bank stabilization is limited to approximately 75 feet along the left bank. An 8 - 10 foot high gabion wall is proposed to provide protection where existing sidewalk is close to the top of bank and insufficient space exists to allow for installation of soil lifts or imbricated fill. Since the area is close to a sidewalk, it is recommended that a fence be considered to discourage pedestrian traffic through the riparian buffer during the first two growing seasons. Additionally, long term fall protection railing should be considered.

The total estimated construction cost is $240,000 and impacts the following property:

- 900 East Tenth Street, Parcel #000450 (Private Property)


N
S
E
W
028879
12" Ductile Iron
800
Stream Stabilization:
75' Gabion Basket Wall along Existing Sidewalk
27" Reinforced Concrete Pipe
900
E 10TH ST
12" Unknown
001715
007727
007728
ROCK SPRING RD
000450
000451
8" Clay
001711
E ROCK SPRING RD
1000
4" Cast Iron
014501
002708
017706
Greens Mill Run
Watershed Master Plan
Figure 5-9
Stream Stabilization Project #8
East 10th Street at
Rock Spring Road
1 inch = 75 feet
CITY OF GREENVILLE
N.C.
Hazen
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Stub
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Sanitary Manhole
Sanitary Gravity Main
Water Main

5.2 Stormwater Best Management Practice Projects

5.2.1 Stormwater Best Management Practice Project Identification

The Greens Mill Run watershed was analyzed to determine additional stormwater management opportunities to reduce stormwater runoff and improve water quality by retrofitting existing, and implementing new stormwater BMPs. These opportunities were identified through desktop analyses via GIS to evaluate land ownership, BMP type, and site characteristics suitable for BMP potential. Based on this analysis, viable opportunities were evaluated in the field to confirm the desktop analyses and provide additional site information not available through GIS. An example of the desktop and field BMP site evaluation worksheet is included in **Appendix I**; **Table 5-1** summarizes the influencing factors for siting BMPs.

Table 5-1: Stormwater Best Management Practice Opportunity Criteria

Watershed Considerations:	
Drainage Area Size	Managing runoff from a large drainage area through a BMP allows for greater stormwater volumes to be treated and reduced compared to a small drainage area.
Land-use/ Impervious Acres	Drainage areas that have a large impervious acreage or percentage of imperviousness (and therefore more stormwater runoff) were preferred over more pervious drainage areas, which have a greater opportunity to infiltrate stormwater runoff.
Stormwater Best Management Practice Considerations:	
Available Space/ Existing Land-use	The BMP surface area should be sufficient to treat as much of the water quality storm event as possible. Land-use was considered in conjunction with the available space, since pervious, unobstructed areas such as grassed lawns and medians with minimal vegetation are more cost-efficient and less disruptive to convert into BMPs than areas such as parking lots.
BMP Type/Retrofit	BMPs with high peak attenuation and volume control were preferred. Existing BMPs with good potential to be retrofitted for additional water quality and quantity benefits were also considered.
Proximity to Existing Drainage Infrastructure	BMP opportunities within close proximity to existing drainage infrastructure were preferred due to potential lower costs. Existing drainage infrastructure was also evaluated to ensure sufficient vertical clearance for BMP effluent.
Potential Constraints	BMP constraints such as steep grading, utility conflicts, and difficult access were taken into consideration where data was available. Opportunities were eliminated if these constraints were believed significantly reduce BMP surface area.
Topography	Flat areas with gentle slopes were preferred over steep grades for BMP locations.
Hydrologic Conditions	Potential BMP locations were evaluated for the soil type, seasonal high water table, flood hazard, and floodway areas. BMPs were not recommended within floodways. BMP types were selected based on preliminary soils and SHWT data from the NRCS Web Soil Survey, but further field tests will be required to verify the NRCS data.
Land Ownership	Publicly-owned land received the highest priority for BMP evaluation due to the opportunity for public education and lower land costs/partnerships. Privately-owned land with existing BMPs that collect public stormwater were also evaluated for BMP opportunities/retrofits. Finally, large, privately-owned shopping centers were evaluated due to the potential to treat large, highly impervious areas.

5.2.2 Recommended Stormwater Best Management Practices

Based on the BMP site evaluations (data collected at site evaluations is detailed on the BMP Site Evaluation Worksheet in **Appendix I**), 19 BMPs were recommended as opportunities to manage stormwater runoff within the GMR watershed. Many of the proposed BMP opportunities were retrofits to existing BMPs that have minimal water quality benefits as they currently function. Advantages to retrofitting and/or expanding existing BMPs include the presence of existing drainage infrastructure, particularly inlets and pipes to route runoff into, and allow discharge from BMPs. The 19 BMPs were designed, at a minimum, to treat runoff from the first inch of rainfall (the water quality volume (WQV), and either store or bypass excess flows, depending on the goal and type of BMP. This depth of rainfall corresponds to approximately 80% of the annual rainfall in non-coastal areas in North Carolina (Hunt, Smith, & Bean, 2006). However, a limited number of opportunities did not have sufficient surface area/volume available to treat the entire WQV, which was reflected in the calculations.

With limited exceptions, wet detention basins are proposed as replacements for existing water quantity control facilities (dry basins) because of their dual quality/quantity treatment nature. Existing dry basins are likely being used to meet a quantity control requirement associated with the development on the property. For the wet detention basin retrofits presented, a water balance calculation was performed to determine if the basin would remain continuously wet. High expected infiltration rates (based on USDA soils survey) indicated that wet pond retrofits require a low permeability liner (max. 0.01 in/hr infiltration rate) to impound water. The liner requirement may be eliminated if actual infiltration rates of in-situ soils (which should be determined based on field tests at time of retrofit design) indicates the basin can sustain a permanent pool. Because field infiltration rates can vary significantly from USDA predicted infiltration rates, liner cost was not included in the cost of BMPs. Should detailed analysis during full design of retrofits indicate that insufficient space exists to expand dry basin volume to allow for a wet basin, technological solutions such as OptiRTC (https://optirtc.com/) may be considered to provide for both quantity and quality benefits while actively managing the basin's volume based on expected storm events. In some cases, Opti technology may compare favorably to a full wet basin retrofit from a cost standpoint because it can limit or eliminate modification to the basin's storage volume.

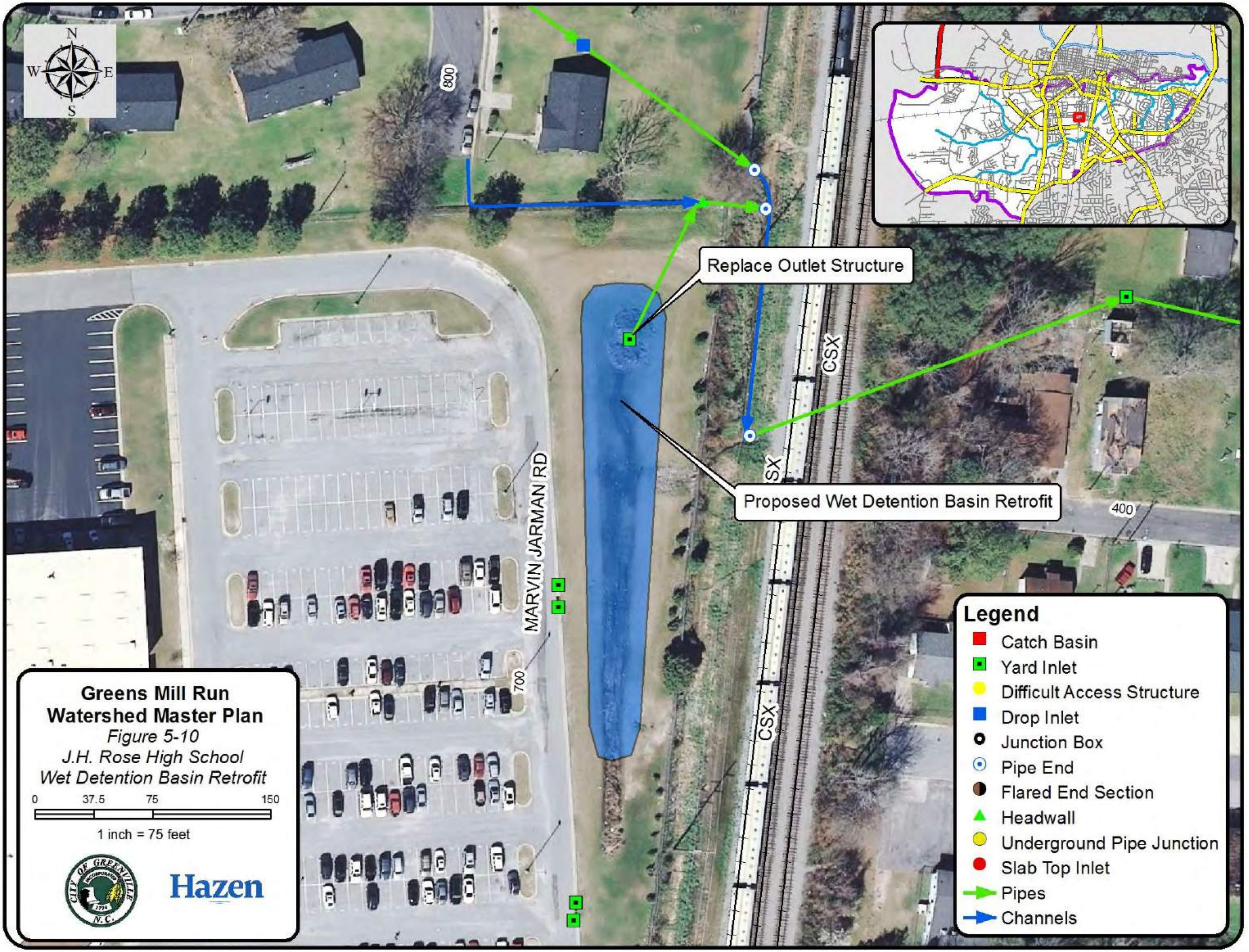
The BMP opportunities and estimated costs are presented in the following section. **Appendix I** provides detailed BMP design calculations and **Appendix G** contains the itemized cost estimates.

5.2.2.1 J.H. Rose High School

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at J.H. Rose High School (600 West Arlington Boulevard) (**Picture 5-19**).

Picture 5-19: J.H. Rose High School Wet Detention Basin Retrofit

Location	Between school parking lot and CSX Railroad
Drainage Area Description	5.6 acre, 62% impervious drainage area including school buildings, parking lots, and grassed areas
BMP Description	Convert existing dry basin into wet detention basin. New perimeter fence, outlet structure, and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays
Cost	$170,000
Conceptual Plan	Figure 5-10
Property Owner	Public
Notes/Comments	This BMP may also present an educational opportunity for students at J.H. Rose High School. An existing stormwater wetland located beside the school's tennis courts and track is used as an outdoor classroom for environmental science classes. The proposed wet detention basin could include educational signage and serve as an educational resource. Elevation of permanent pool would need to consider backwater effects on parking lot drainage.

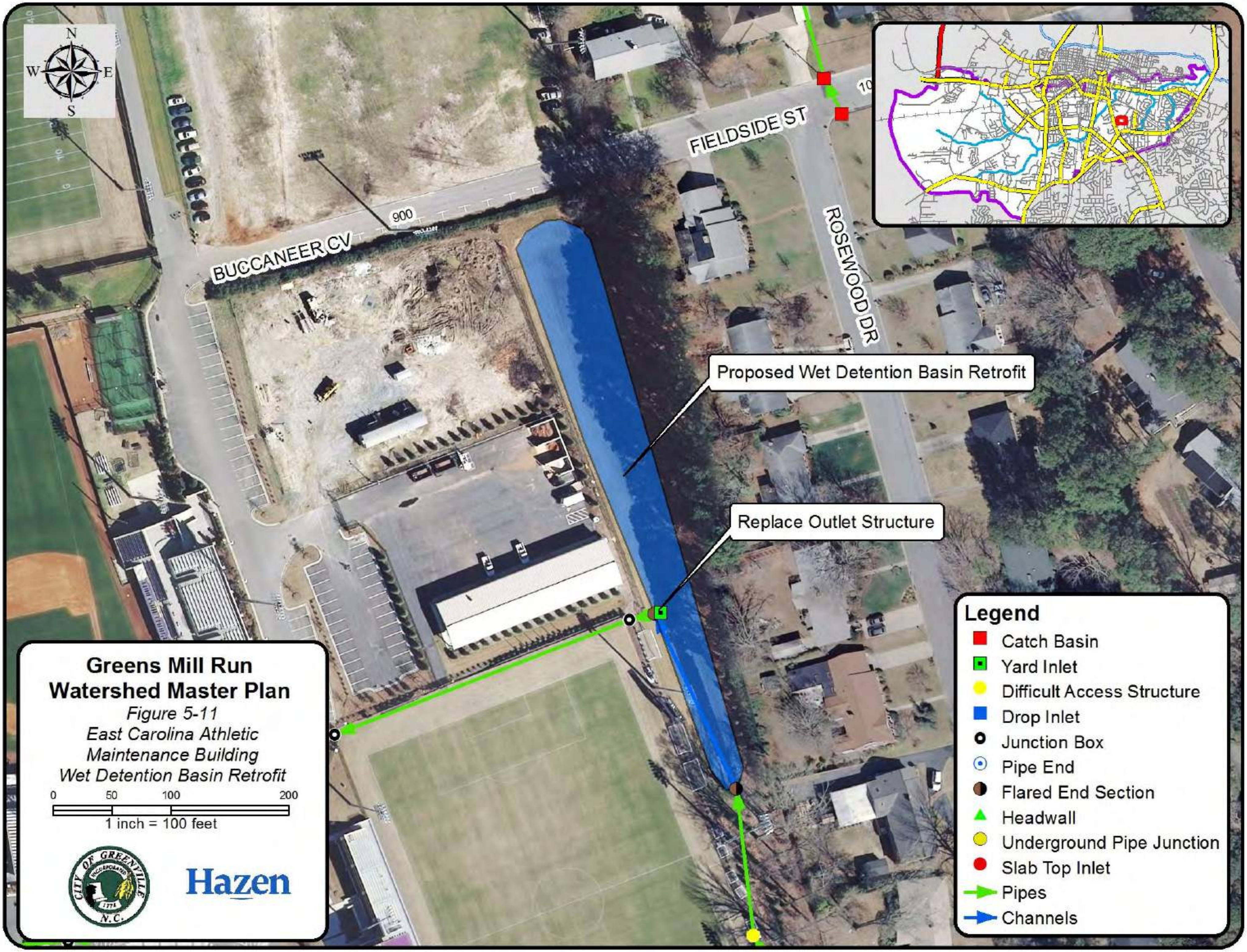

N
W
E
S
800
Replace Outlet Structure
CSX
Proposed Wet Detention Basin Retrofit
400
MARVIN JARMAN RD
700
CSX
CSX
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-10
J.H. Rose High School
Wet Detention Basin Retrofit
0
37.5
75
150
1 inch = 75 feet
CITY OF GREENVILLE N.C.
Hazen

5.2.2.2 ECU Athletic Maintenance Building

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the ECU Athletic Maintenance Building (Fieldside Drive) (**Picture 5-20**).

Picture 5-20: ECU Athletic Maintenance Building Wet Detention Basin Retrofit

Location	ECU Athletic Maintenance Building
Drainage Area Description	35 acre, 30% impervious drainage area, including adjacent neighborhood, softball and soccer fields, and maintenance building
BMP Description	Convert existing dry basin into wet detention basin. New outlet structure and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays
Cost	$150,000
Conceptual Plan	Figure 5-11
Property Owner	ECU
Notes/Comments	The Circle Drive Secondary System (**Section 4.2.6**) discharges into this BMP, thus future design of this facility requires coordination with the Secondary System improvement plans, particularly to ensure that LOS issues in the Circle Drive system are not exacerbated.



N
W
E
S
FIELDSIDE ST
BUCCANEER CV
900
ROSEWOOD DR
Proposed Wet Detention Basin Retrofit
Replace Outlet Structure
Greens Mill Run
Watershed Master Plan
Figure 5-11
East Carolina Athletic
Maintenance Building
Wet Detention Basin Retrofit
0
50
100
200
1 inch = 100 feet
CITY OF GREENVILLE
INCORPORATED
1774
N.C.
Hazen
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels

5.2.2.3 Greenville Square Shopping Center

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the Greenville Square Shopping Center (703 Southeast Greenville Boulevard).

Picture 5-21: Greenville Square Shopping Center Wet Detention Basin Retrofit

Location	Greenville Square Shopping Center
Drainage Area Description	21 acre, 81% impervious drainage area, including shopping center buildings and parking lots and WITN-TV property
BMP Description	Convert existing basin into wet detention basin. New outlet structure and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays
Cost	$440,000
Conceptual Plan	Figure 5-12
Property Owner	Private
Notes/Comments	This is an older BMP and is believed to originally been intended to serve as a dry facility; however, failure of the outlet has likely resulted in the wet condition (Picture 5-21). Possible opportunity for owner cost share with City in order to improve water quality function while restoring quantity function.

Greens Mill Run Watershed Master Plan

Figure 5-12
Greenville Square Shopping Center Wet Detention Basin Retrofit

5.2.2.4 Pirates Pointe Shopping Center

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the Pirates Pointe Shopping Center (1901 Charles Boulevard) (**Picture 5-22**).

Picture 5-22: Pirates Pointe Shopping Center Wet Detention Basin Retrofit

Location	Pirates Pointe Shopping Center
Drainage Area Description	1.6 acre, 90% impervious drainage area, consisting of approximately one half of shopping center buildings and parking lots
BMP Description	Convert existing dry basin into wet detention basin. New outlet structure, perimeter fencing, and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays or in-drainage structure pretreatment due to limited space
Cost	$76,000
Conceptual Plan	Figure 5-13
Property Owner	Private
Notes/Comments	Small, well maintained existing dry basin

.

Greens Mill Run Watershed Master Plan

Figure 5-13
Priates Pointe Shopping Center
Wet Detention Basin Retrofit

5.2.2.5 Greenville Mall

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the Greenville Mall (714 Southeast Greenville Boulevard) (**Picture 5-23**).

Picture 5-23: Greenville Mall Wet Detention Basin Retrofit

Location	Greenville Mall Wet Detention Basin Retrofit
Drainage Area Description	108 acre, 83% impervious drainage area, consisting of mall, parking lots, roadways, and buildings.
BMP Description	Convert existing dry basin into wet detention basin. New outlet structure, perimeter fencing, and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays
Cost	$470,000
Conceptual Plan	Figure 5-14
Property Owner	Private and Public
Notes/Comments	BMP located on three separate parcels, two private and one state. With such a large drainage area, it is likely that this was, at one time, a jurisdictional stream. Past experience indicates that permitting a permanent pool “on-line” is challenging because it effectively disconnects the upstream benthic community, however, in this case, it is believed that since the areas surrounding the existing basin are developed and historical stream features which may have existed were piped decades ago (effectively disconnecting the benthic community upstream), converting this dry basin to a wet basin may be acceptable to permitting agencies.

N
S
E
W
CHARLES
2200
Replace Outlet Structure
Proposed Wet Detention Basin Retrofit
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-14
Greenville Mall
Wet Detention Basin Retrofit
0 50 100 200
1 inch = 100 feet
CITY OF GREENVILLE
INCORPORATED
1774
N.C.
Hazen

5.2.2.6 University Commons Shopping Center

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the University Commons Shopping Center (3040 Evans Street) (**Picture 5-24**).

Picture 5-24: University Commons Shopping Center Wet Detention Basin Retrofit

Location	University Commons Shopping Center
Drainage Area Description	23 acre, 82% impervious, drainage area, consisting of shopping center buildings and parking lots
BMP Description	Convert existing dry basin into wet detention basin. New outlet structure, perimeter fencing, and planting of appropriate vegetation.
WQV Treated	100%
Pretreatment	Forebays
Cost	$300,000
Conceptual Plan	Figure 5-15
Property Owner	Private
Notes/Comments	Coordinate/incorporate into Secondary System improvements associated with Lakewood residential community. Note that this facility is directly adjacent to Railroad ROW, therefore if converted to wet pond, ensure that water is not impounded within Railroad ROW. Field investigation and historical documentation (AMT Study) indicated that the dry basin is not fully utilizing its available volume; however, SWMM modeling based on available information (shopping center design documents) indicated the basin does provide some peak flow attenuation, and has limited surplus capacity as currently configured. For further information, see Section 3.2.2.10.

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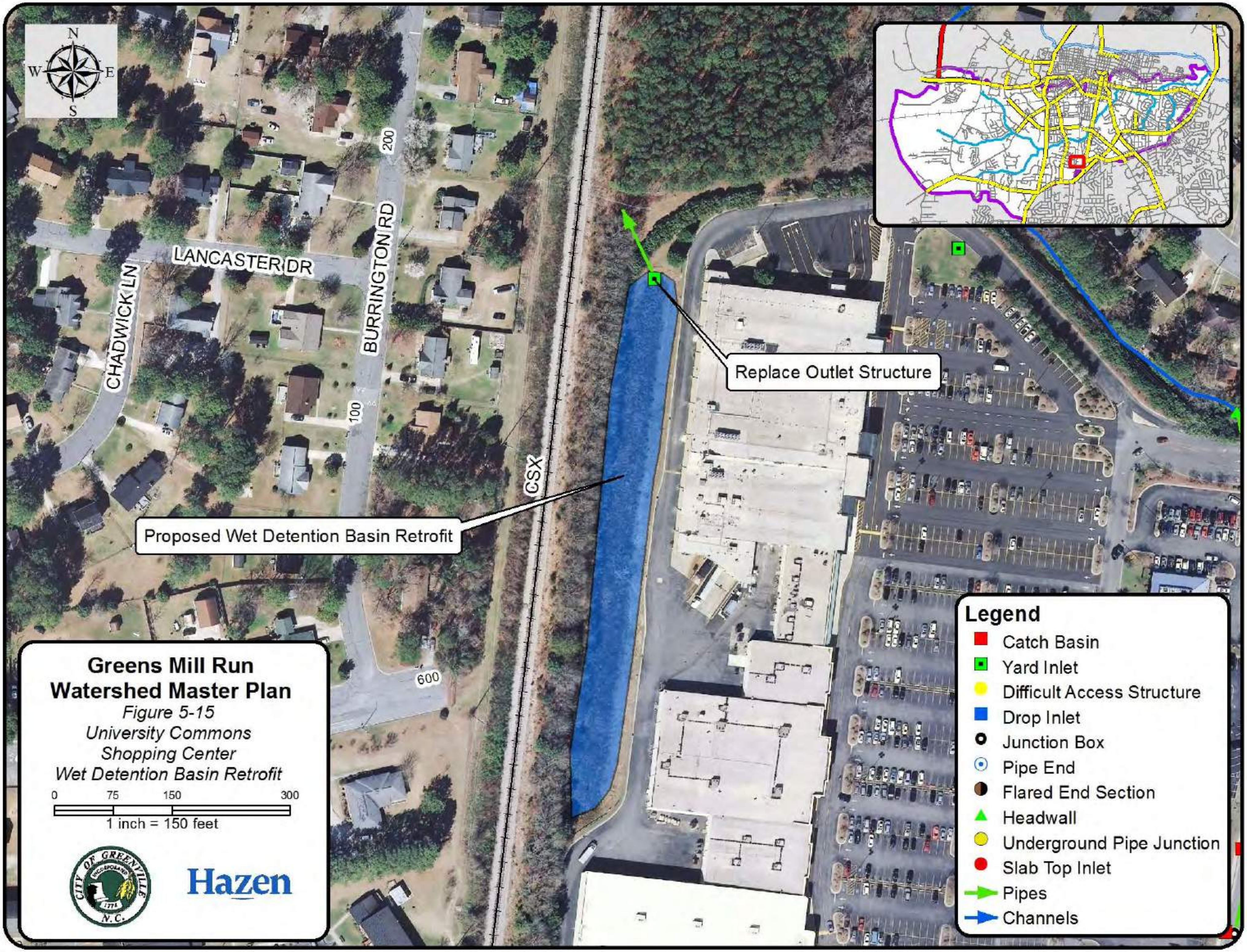
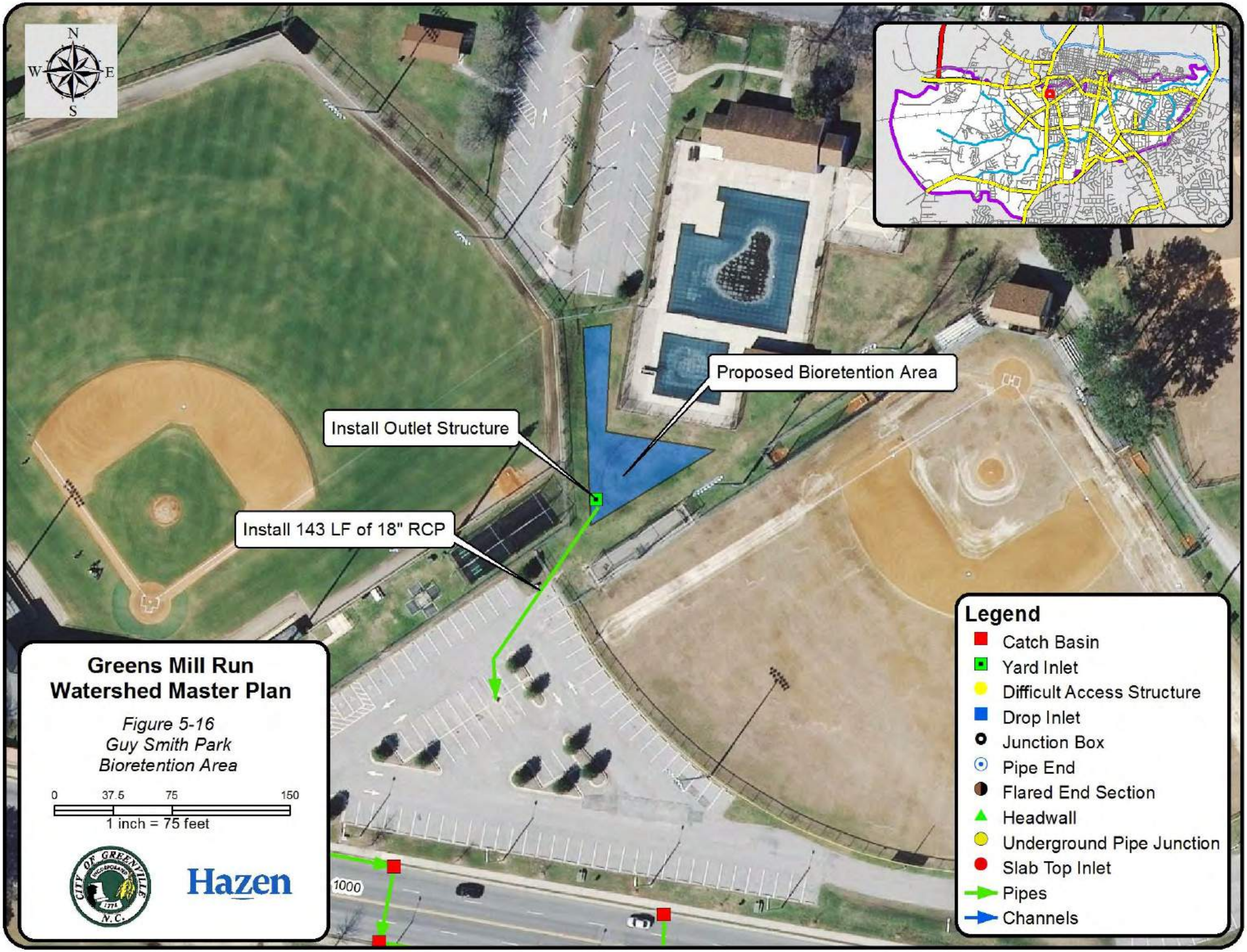

N
W
E
S
LANCASTER DR
CHADWICK LN
BURRINGTON RD
200
100
600
CSX
Replace Outlet Structure
Proposed Wet Detention Basin Retrofit
Greens Mill Run
Watershed Master Plan
Figure 5-15
University Commons
Shopping Center
Wet Detention Basin Retrofit
0 75 150 300
1 inch = 150 feet
CITY OF GREENVILLE
INCORPORATED 1774
N.C.
Hazen
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels

5.2.2.7 Guy Smith Park

A bioretention area is proposed at Guy Smith Park (2113 Myrtle Avenue) to provide water quality improvements (**Picture 5-25**). A grassed area located between the Park's baseball fields and swimming pool was identified during a public meeting as typically remaining wet during the late winter / early spring, thus provided an opportunity to solve a potential nuisance and serve water quality goals.

Picture 5-25: Guy Smith Park Bioretention Area

Location	Guy Smith Park
Drainage Area Description	1.3 acre, 62% impervious, drainage area consisting of pool area and parking lots
BMP Description	Create bioretention area in poorly drained area, centrally located within park
WQV Treated	100%
Pretreatment	Forebays or other pretreatment device within drainage structures if concentrated inflow.
Cost	$160,000
Conceptual Plan	Figure 5-16
Property Owner	City
Notes/Comments	If groundwater is causing wetness in the area, other options besides bioretention should be considered. Design assumes that surface water is the cause of wet area and runoff can be directed into bioretention area.



Greens Mill Run Watershed Master Plan

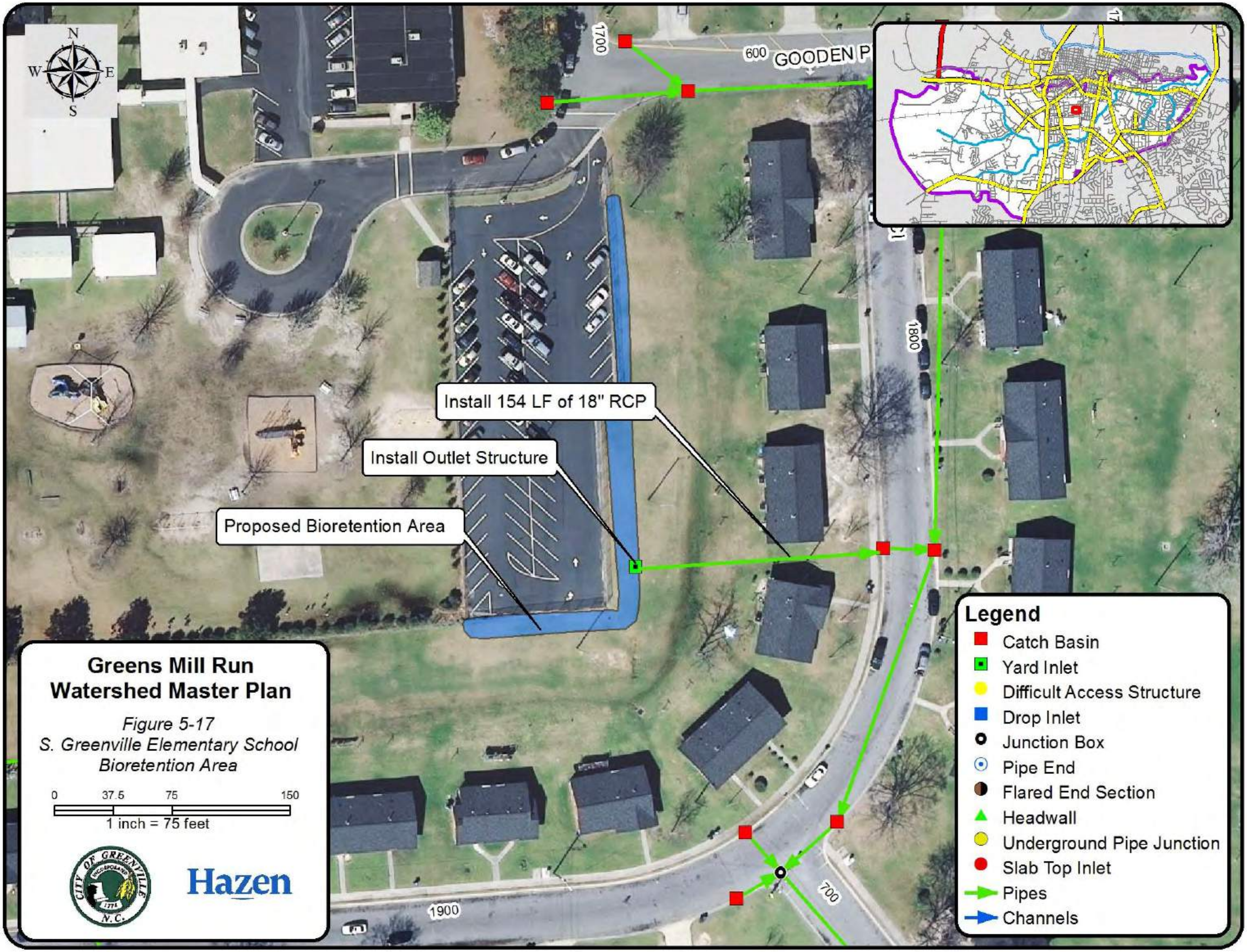
Figure 5-16
Guy Smith Park
Bioretention Area

5.2.2.8 South Greenville Elementary School

A bioretention area is proposed at the South Greenville Elementary School (811 Howell Street) to provide water quality improvements (**Picture 5-26).** The BMP is proposed to be located southeast of the school's parking lot, in an open lawn area.

Picture 5-26: South Greenville Elementary School Bioretention Area

Location	South Greenville Elementary School
Drainage Area Description	1.2 acre, 46% impervious drainage area, consisting of school building, parking lots, and lawn areas
BMP Description	Bioretention receiving sheet runoff from adjacent parking lot
WQV Treated	100%
Pretreatment	Forebays
Cost	$170,000
Conceptual Plan	Figure 5-17
Property Owner	Public
Notes/Comments	BMP on public land, discharge piping impacts private residential properties



N
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1700
600
GOODEN P
1800
Install 154 LF of 18" RCP
Install Outlet Structure
Proposed Bioretention Area
1900
700
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-17
S. Greenville Elementary School
Bioretention Area
0
37.5
75
150
1 inch = 75 feet
Hazen

5.2.2.9 Carolina East Mall

Conversion of an existing dry detention basin into a stormwater wetland is proposed to provide water quality improvement at the Carolina East Mall (902 Mall Drive) (**Picture 5-27**).

Picture 5-27: Carolina East Mall Stormwater Wetland Retrofit

Location	Carolina East Mall
Drainage Area Description	10 acre, 82% impervious drainage area, consisting of shopping center's buildings and parking lots
BMP Description	Convert existing dry basin to stormwater wetland, if adequate quantity attenuation can be accomplished, wet basin if not.
WQV Treated	100%
Pretreatment	Forebays
Cost	$340,000
Conceptual Plan	Figure 5-18
Property Owner	Private
Notes/Comments	Surface area sized for water quality volume. Retrofitting includes significant tree removal. Drainage area is at low end for wetland. Water balance indicates that liner would be required (subject to field verification of in-situ infiltration rates) unless SHWT is high enough to sustain wetland plants. Also must consider how to accomplish water quantity control if required for this development. Converting to wet pond (instead of wetland) or use of OptiRTC technology may be necessary.

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N
W
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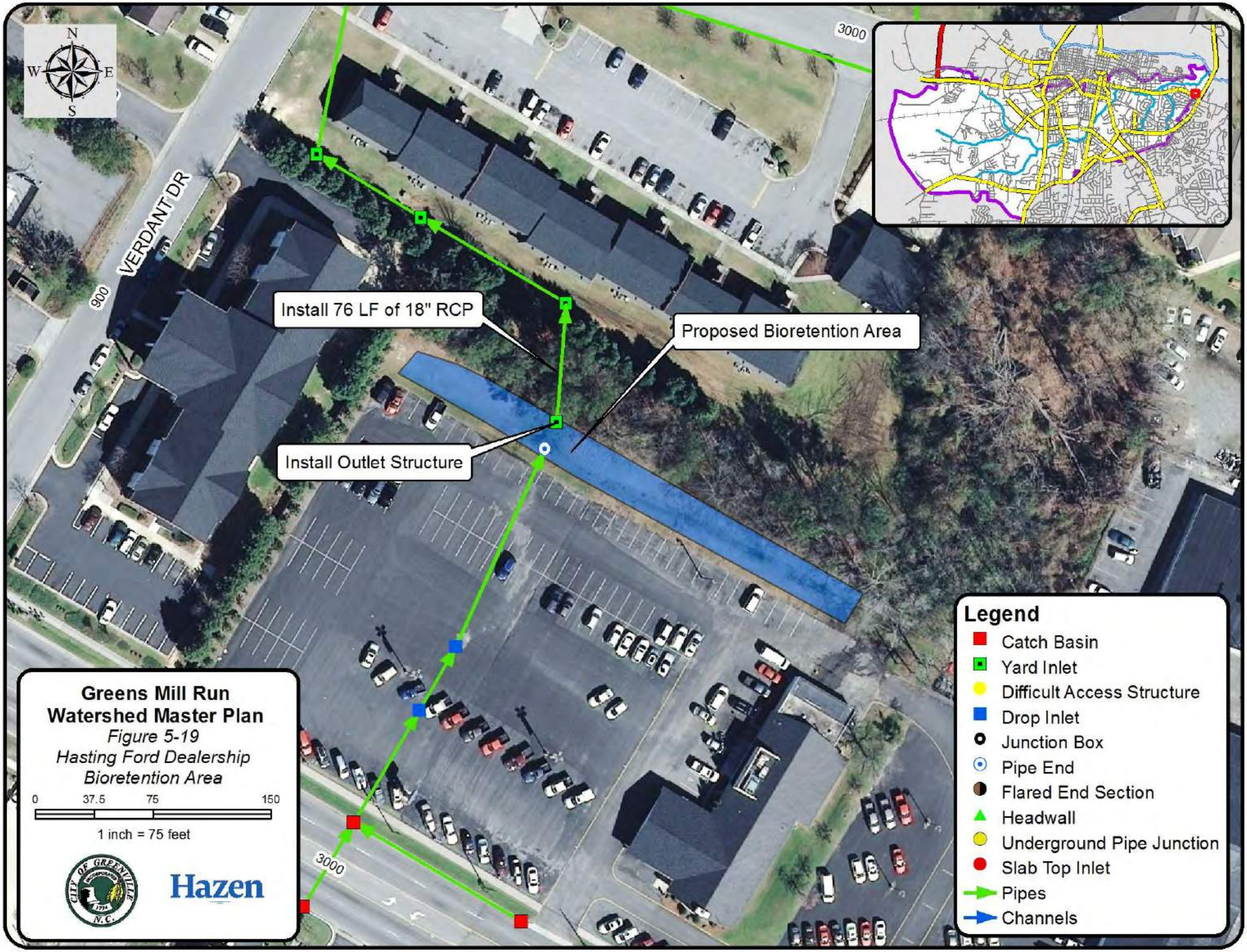
Replace Outlet Structure
Proposed Stormwater Wetland Retrofit
900
MALL DR
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-18
Carolina East Mall
Stormwater Wetland Retrofit
0
50
100
200
1 inch = 100 feet
CITY OF GREENVILLE
N.C.
Hazen

5.2.2.10 Hastings Ford Dealership

A bioretention area is proposed at the Hastings Ford Dealership (3013 East 10th Street) to provide water quality improvements (**Picture 5-28**). The BMP is proposed to be constructed in a grassed area between the dealership's parking lot and a wooded area to the north.

Picture 5-28: Hastings Ford Dealership Bioretention Area

Location	Hastings Ford Dealership Bioretention Area
Drainage Area Description	5 acre, 90% impervious drainage area, consisting of dealership's buildings and parking lots, adjacent streets, and a gas station. Dealership carwash and maintenance area also drain to proposed BMP location.
BMP Description	Bioretention receiving sheet and concentrated runoff from adjacent parking lot
WQV Treated	60%
Pretreatment	Pretreatment within drainage structure prior to discharge into bioretention area. Stone filter strip at edge of parking lot.
Cost	$260,000
Conceptual Plan	Figure 5-19
Property Owner	Private
Notes/Comments	Tight constraints (property line, parking lot, etc.) present challenge to maximize WQV treatment area. Large drainage area and limited space; therefore, volume to treat full WQV not available. Remainder of WQV and other flows proposed to bypass treatment; final design may consider flow splitter to divert WQV into cell and bypass other flow via different conveyance. Carwash and maintenance area draining to bioretention allows for treatment of this runoff, but also potential contamination of cell.

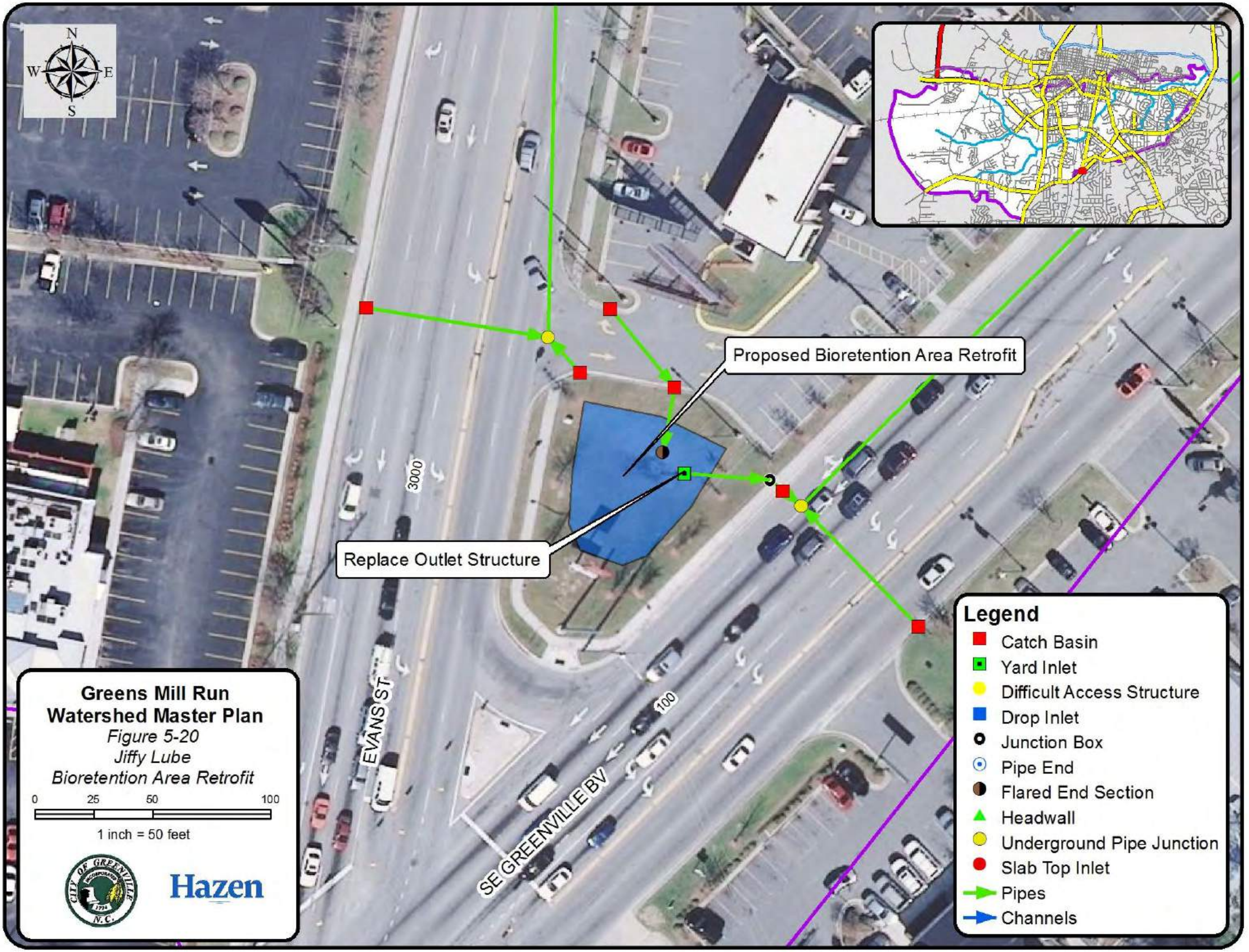

N
W
E
S
3000
VERDANT DR
900
Install 76 LF of 18" RCP
Proposed Bioretention Area
Install Outlet Structure
3000
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-19
Hasting Ford Dealership
Bioretention Area
0
37.5
75
150
1 inch = 75 feet
CITY OF GREENVILLE
N.C.
Hazen

5.2.2.11 Jiffy Lube

Conversion of an existing dry detention basin into a bioretention area is proposed to provide water quality improvement at the Jiffy Lube located at 101 Southeast Greenville Boulevard (**Picture 5-29**).

Picture 5-29: Jiffy Lube Bioretention Area Retrofit

Location	Jiffy Lube Bioretention Area
Drainage Area Description	0.8 acre, 76% impervious drainage area, consisting of Jiffy Lube facilities and adjacent lawn areas
BMP Description	Bioretention receiving sheet and concentrated runoff from adjacent parking lot
WQV Treated	100%
Pretreatment	Pretreatment within drainage structure prior to discharge into bioretention area.
Cost	$110,000
Conceptual Plan	Figure 5-20
Property Owner	Private
Notes/Comments	Small but highly impervious drainage area. Automotive maintenance area draining to bioretention allows for treatment of this runoff, but also potential contamination of cell. Water quantity attenuation may present challenge if required, depending on volume available and attenuation required.



N
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Proposed Bioretention Area Retrofit
Replace Outlet Structure
3000
EVANS ST
100
SE GREENVILLE BV
Greens Mill Run
Watershed Master Plan
Figure 5-20
Jiffy Lube
Bioretention Area Retrofit
0
25
50
100
1 inch = 50 feet
CITY OF GREENVILLE N.C.
Hazen
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels

5.2.2.12 Jaycee Park

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at Jaycee Park (2000 Cedar Lane) (**Picture 5-30**).

Picture 5-30: Jaycee Park Wet Detention Basin Retrofit

Location	Jaycee Park Wet Detention Basin Retrofit
Drainage Area Description	4.9 acre, 37% impervious drainage area, consisting of library, parking lot, and lawn areas
BMP Description	Convert existing overgrown dry detention basin into wet detention basin
WQV Treated	100%
Pretreatment	Forebay
Cost	$180,000
Conceptual Plan	Figure 5-21
Property Owner	City
Notes/Comments	Adjacent to Cedar Lane Stream Stabilization and Jaycee Park Secondary System; possible project coordination. Significant tree removal.

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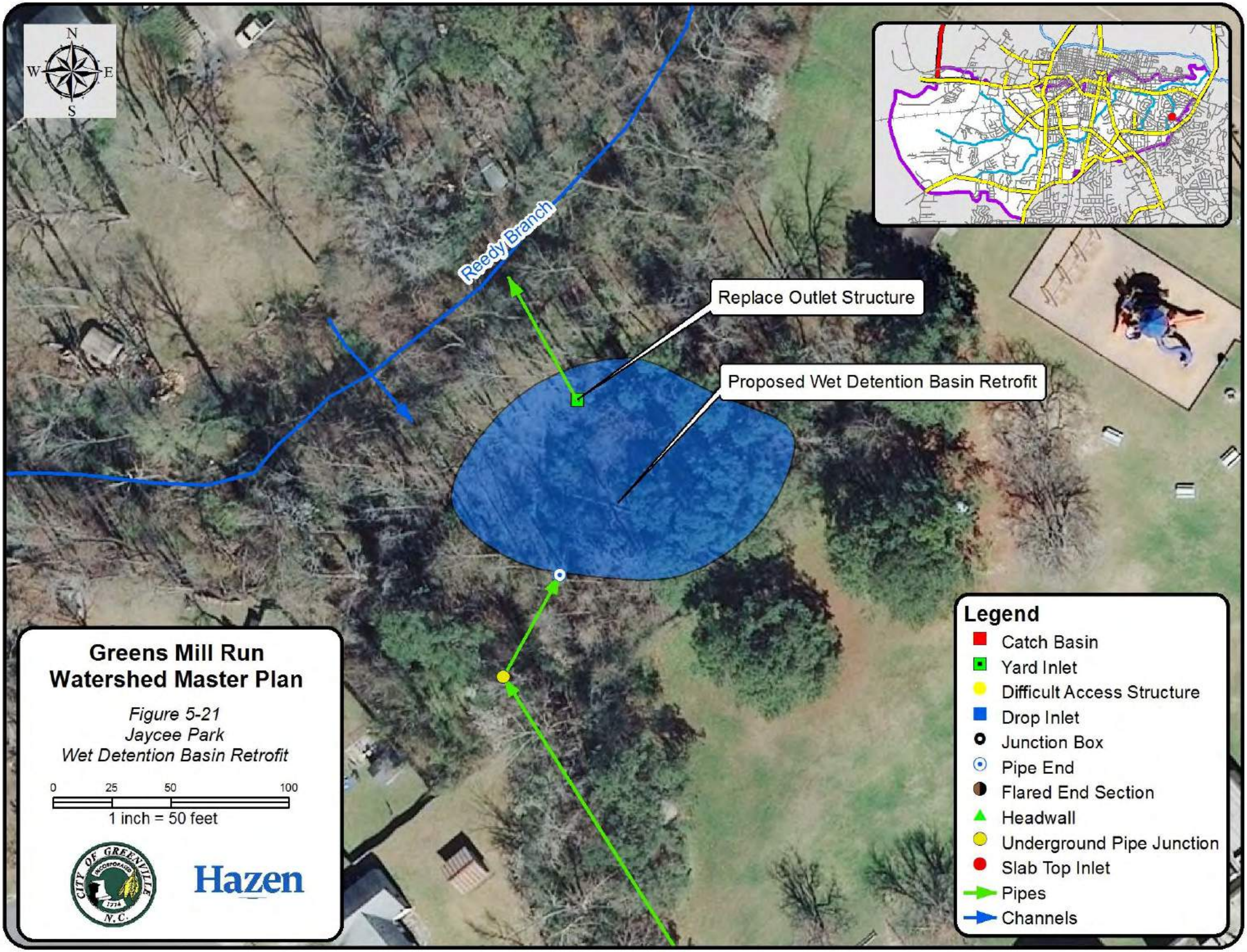

Figure 5-21
Jaycee Park
Wet Detention Basin Retrofit

5.2.2.13 Andrew A. Best Freedom Park

Two bioretention areas are proposed at the Andrew A. Best Freedom Park (315 Oakdale Road) to provide water quality improvement (**Picture 5-31**). The BMPs is proposed to be constructed in grassed areas on either side of the park's parking lots.

Picture 5-31: Andrew A. Best Freedom Park Bioretention Areas

Location	Andrew A. Best Freedom Park
Drainage Area Description	0.31 acres, 65% of which is impervious consisting of crowned parking lot and adjacent lawn areas
BMP Description	Bioretention receiving sheet flow from adjacent parking areas
WQV Treated	100%
Pretreatment	Filter strips along edge of pavement
Cost	$99,000
Conceptual Plan	Figure 5-22
Property Owner	City
Notes/Comments	

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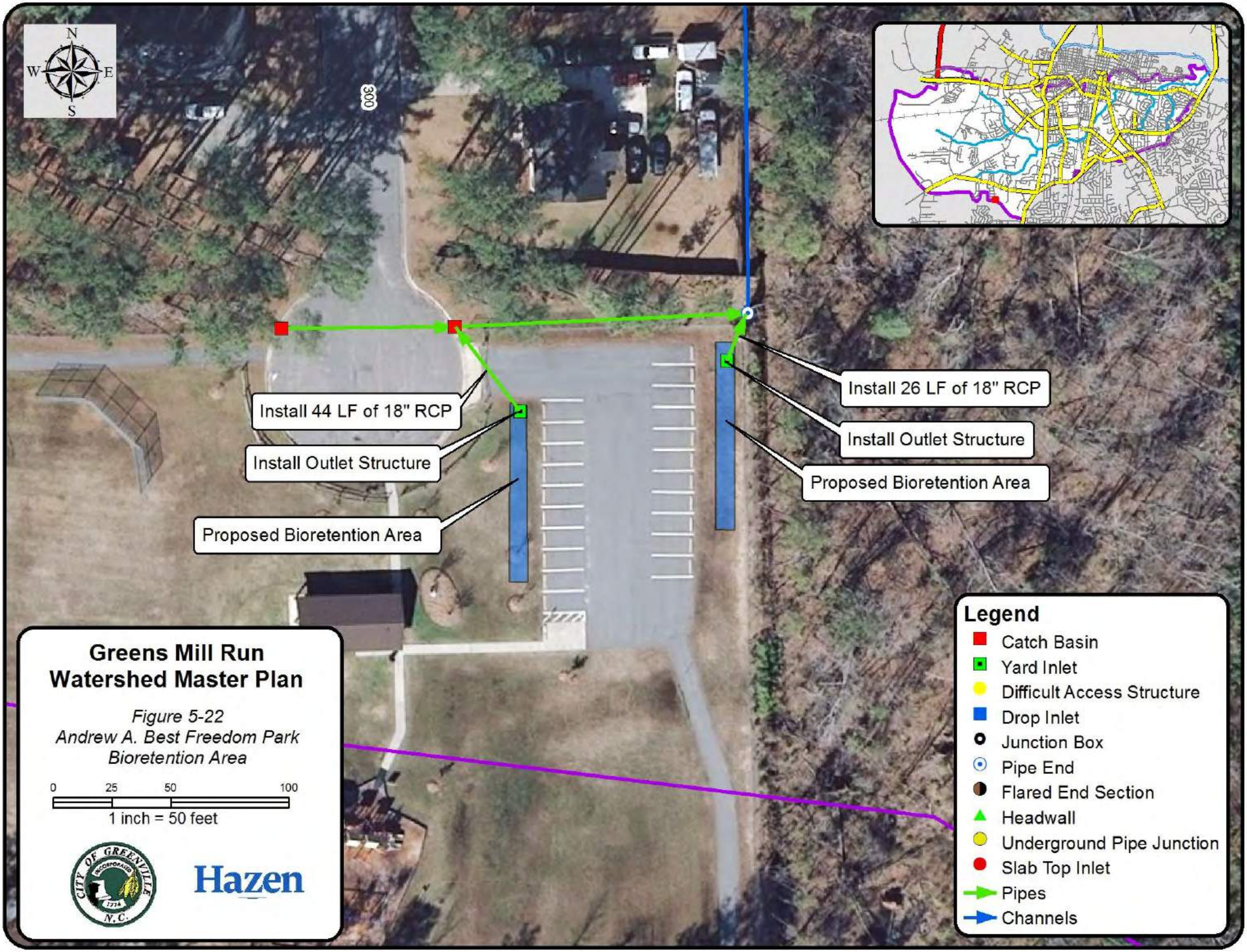

Greens Mill Run Watershed Master Plan

Figure 5-22
Andrew A. Best Freedom Park Bioretention Area

5.2.2.14 First Pentecostal Holiness Church

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the First Pentecostal Holiness Church (204 Brinkley Road) (**Picture 5-32**).

Picture 5-32: First Pentecostal Holiness Church Wet Detention Basin Retrofit

Location	First Pentecostal Holiness Church
Drainage Area Description	3.7 acre, 64% impervious drainage area, consisting of church facilities, parking lot, and grassed areas
BMP Description	Convert existing dry detention pond to wet detention pond
WQV Treated	100%
Pretreatment	Forebays or pretreatment within upstream drainage structure
Cost	$170,000
Conceptual Plan	Figure 5-23
Property Owner	Private
Notes/Comments	Existing basin holds water, as vegetation in photo suggests.

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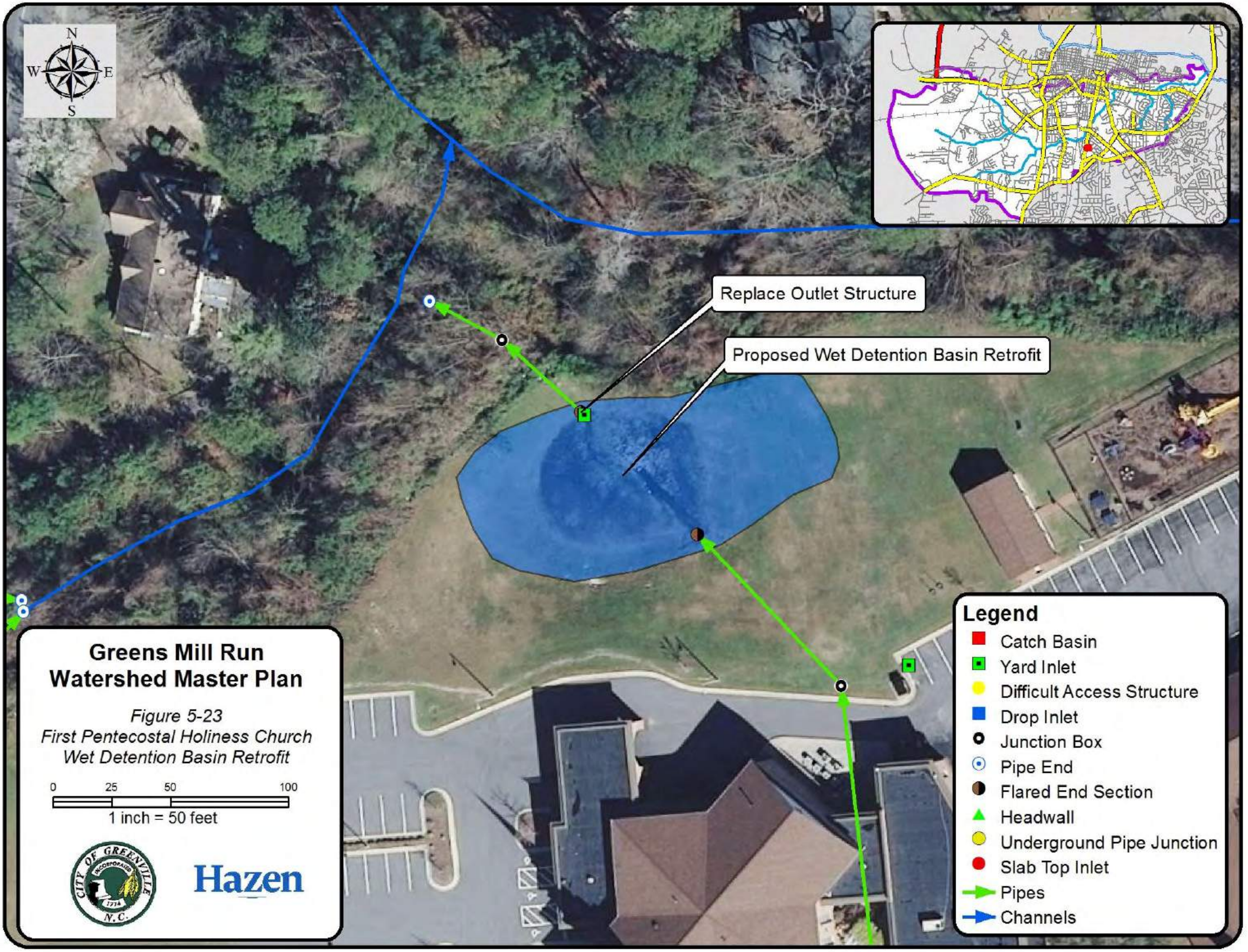

N
W
E
S
Replace Outlet Structure
Proposed Wet Detention Basin Retrofit
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels
Greens Mill Run
Watershed Master Plan
Figure 5-23
First Pentecostal Holiness Church
Wet Detention Basin Retrofit
0
25
50
100
1 inch = 50 feet
CITY OF GREENVILLE
INCORPORATED
1774
N.C.
Hazen

5.2.2.15 Dream Park

A new bioretention area is proposed at Dream Park (1711 Chestnut Street) to provide water quality improvement (**Picture 5-33**). The BMP is proposed to be constructed in a grassed area between two existing parking lots.

Picture 5-33: Dream Park Bioretention Area

Location	Dream Park Bioretention Area
Drainage Area Description	1.4 acre, 42% impervious drainage area, consisting of park, adjacent buildings, and parking lots
BMP Description	Create bioretention area in vacant space within park
WQV Treated	100%
Pretreatment	Forebays or pretreatment within upstream drainage structure
Cost	$140,000
Conceptual Plan	Figure 5-24
Property Owner	City
Notes/Comments	Flow enters via existing drainage system within park. Structures and piping directly adjacent to BMP location.

Greens Mill Run Watershed Master Plan

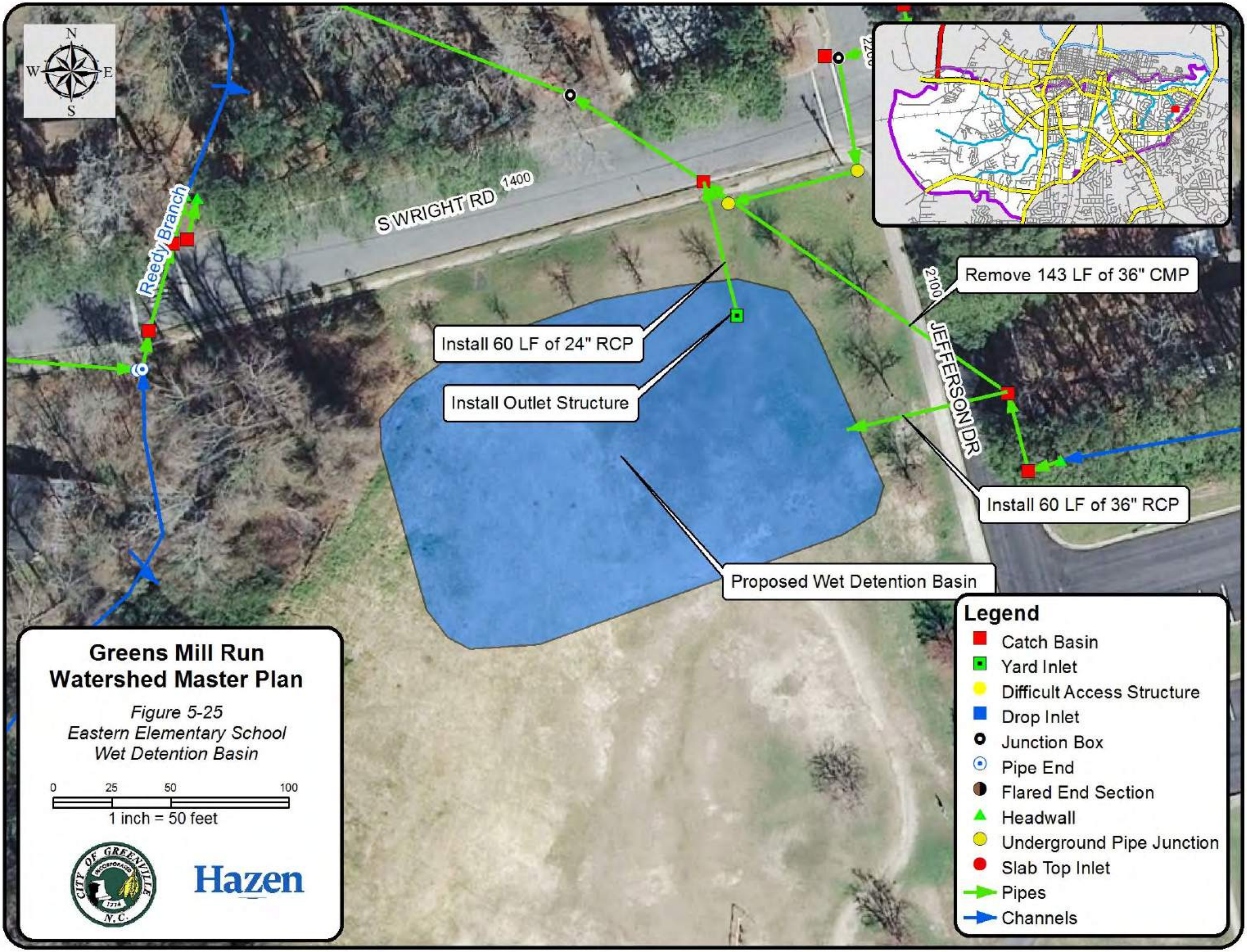
Figure 5-24
Dream Park
Bioretention Area

5.2.2.16 Eastern Elementary School

A wet detention basin is proposed at Eastern Elementary School (1700 Cedar Lane) to provide additional quantity control and water quality improvement (**Picture 5-34**). The BMP is proposed to be constructed in a grassed area north of the school, adjacent to South Wright Road.

Picture 5-34: Eastern Elementary School Wet Detention Basin

Location	Eastern Elementary School Wet Detention Basin
Drainage Area Description	31 acre, 42% impervious drainage area, consisting of school buildings and parking lots, residential areas, and Jaycee Park
BMP Description	New wet detention basin treating large drainage area.
WQV Treated	100%
Pretreatment	Forebay
Cost	$890,000
Conceptual Plan	Figure 5-25
Property Owner	Public
Notes/Comments	Flow enters by diverting from adjacent drainage system. Existing uses in the area are impacted: walking trail, recreational lawn. Possible permitting challenges due to likely jurisdictional stream 150’ (measured through piping) upstream. Upstream piping which already “disconnects” upstream benthic community from Reedy Branch (directly downstream) may make this acceptable to permitting agencies, but this case is not as strong as the Greenville Mall retrofit (Section 5.2.2.5).



Greens Mill Run Watershed Master Plan

Figure 5-25
Eastern Elementary School Wet Detention Basin

5.2.2.17 Arlington Crossing Shopping Center

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the Arlington Crossing Shopping Center (1872 West Arlington Boulevard). The existing basin is divided in two by an entrance road and the proposed facility retains this configuration (**Picture 5-35** and **Picture 5-36**).

Picture 5-35: Arlington Crossing Shopping Center Wet Detention Basin Retrofit (North)

Picture 5-36: Arlington Crossing Shopping Center Wet Detention Basin Retrofit (South)

Location	Arlington Crossing Shopping Center Wet Detention Basin
Drainage Area Description	3.4 acre, 85% impervious drainage area, consisting of shopping center buildings and parking lots
BMP Description	Convert existing dry detention basin to wet detention basin
WQV Treated	100%
Pretreatment	Forebays or in drainage structure pretreatment device
Cost	$130,000
Conceptual Plan	Figure 5-26
Property Owner	Private
Notes/Comments	High visibility location within commercialized area.

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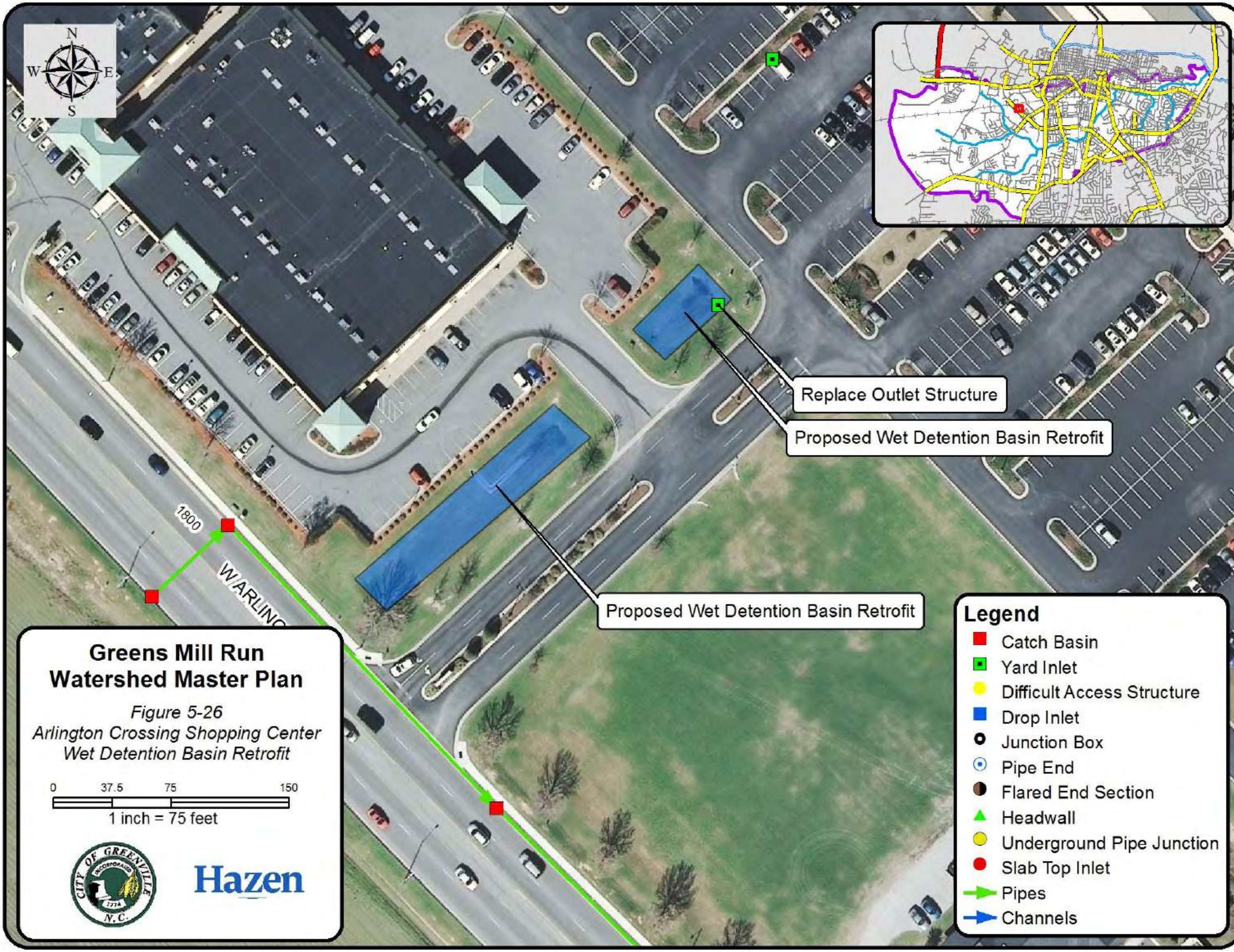


N
S
E
W
Replace Outlet Structure
Proposed Wet Detention Basin Retrofit
Proposed Wet Detention Basin Retrofit
1800
W ARLING
Greens Mill Run
Watershed Master Plan
Figure 5-26
Arlington Crossing Shopping Center
Wet Detention Basin Retrofit
0
37.5
75
150
1 inch = 75 feet
CITY OF GREENVILLE
INCORPORATED
1774
N.C.
Hazen
Legend
Catch Basin
Yard Inlet
Difficult Access Structure
Drop Inlet
Junction Box
Pipe End
Flared End Section
Headwall
Underground Pipe Junction
Slab Top Inlet
Pipes
Channels

5.2.2.18 Physicians East Medical Center

Conversion of an existing dry detention basin into a wet detention basin is proposed to provide water quality improvement at the Physicians East Medical Center (1850 West Arlington Boulevard) (**Picture 5-37**).

Picture 5-37: Physicians East Medical Center

Location	Physicians East Medical Center Wet Detention Basin
Drainage Area Description	5.9 acre, 70% impervious drainage area, consisting of medical center building and parking lot, as well as portions of adjacent shopping center buildings and parking lot
BMP Description	Convert existing dry detention basin to wet detention basin
WQV Treated	100%
Pretreatment	Forebays
Cost	$330,000
Conceptual Plan	Figure 5-27
Property Owner	Private
Notes/Comments	Tree removal required.

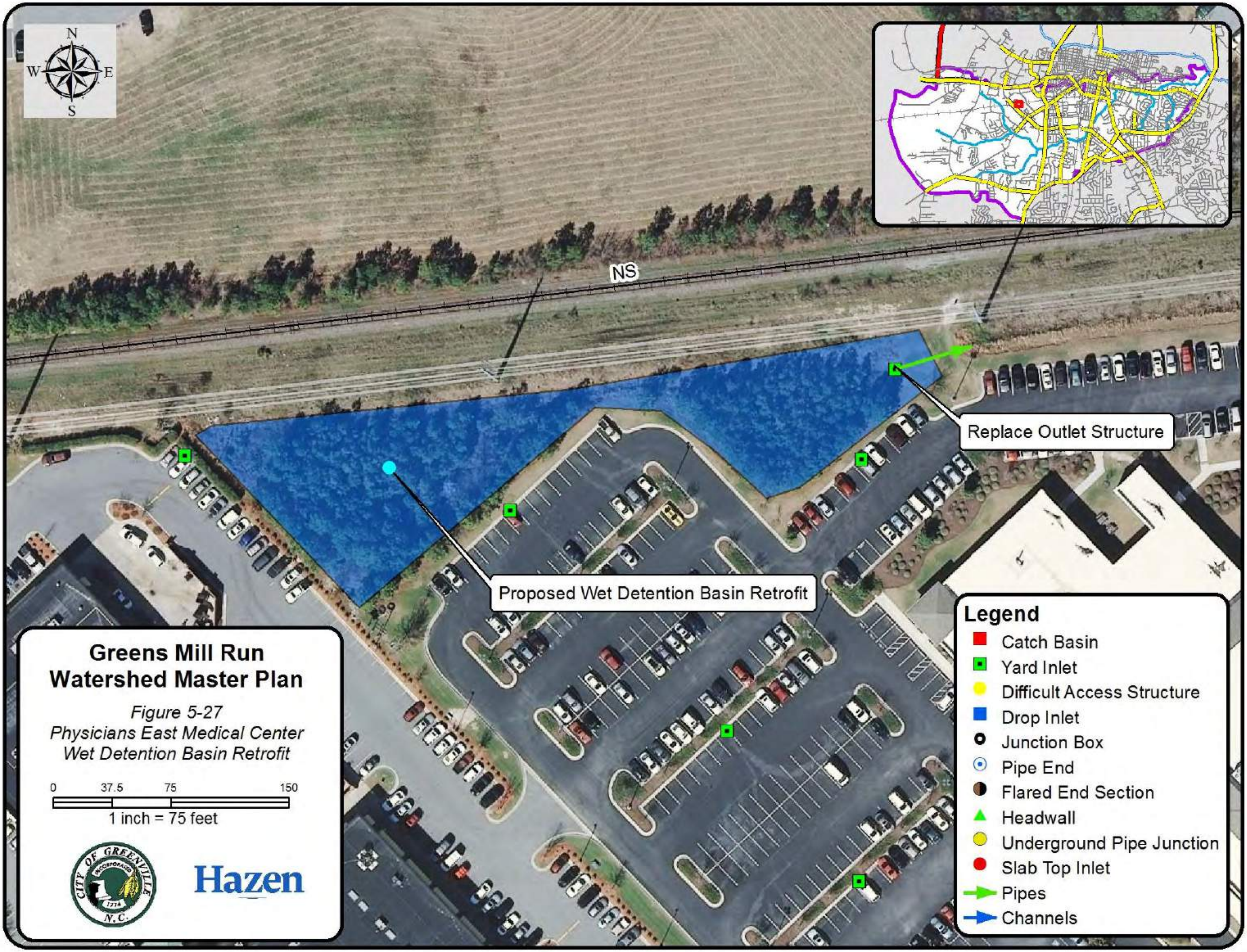


Figure 5-27
Physicians East Medical Center
Wet Detention Basin Retrofit

5.2.2.19 Wahl-Coates Elementary School

A bioretention area is proposed at Wahl-Coates Elementary School (2200 East 5th Street) to provide water quality improvement (**Picture 5-38**). The BMP is proposed to be constructed partially in a grassed area and partially in the existing school parking lot. Four parking stalls are proposed to be removed, and two sheds are relocated to construct the bioretention area.

Picture 5-38: Wahl-Coates Elementary School Bioretention Area

Location	Wahl-Coates Elementary School
Drainage Area Description	0.5 acre, 92% impervious drainage area, consisting of school's southwest parking lot and adjacent grassed areas
BMP Description	Create Bioretention area receiving sheet flow runoff from adjacent parking lot
WQV Treated	100%
Pretreatment	Filter strip along edge of pavement
Cost	$130,000
Conceptual Plan	Figure 5-28
Property Owner	Public
Notes/Comments	

Figure 5-28
Wahl-Coates Elementary School Bioretention Area

5.3 Assessment and Management of Impaired Waters

Based on a single benthic macroinvertebrate community sampling event in 2004 performed in conjunction with the NCEEP Local Watershed Plan, NCDEQ has placed the entirety of Greens Mill Run (from source to the Tar River) in Category 5 of the 303(d) List of Impaired Waters. Unless they are de-listed, or re-categorized on the List, waters in Category 5 are subject to development of a Total Maximum Daily Load which will identify the primary stressors (pollutants) which are causing the impairment and determine the pollutant load reductions necessary to achieve compliance with water quality standards and eliminate the impairment.

The 2004 sampling event conducted by NCDWQ resulted in a bioclassification of Severe (indicating severe degradation), and the DWQ assessment report alluded to physical habitat and water quality degradation as a result of urbanization in the watershed. No specific stressors were identified by NCDEQ as the primary causes of the impaired status. Over the course of the development of this WSMP, extensive water quality monitoring efforts were conducted in Greens Mill Run and its tributaries, and sampling of the benthic macroinvertebrate community was performed in order to more closely examine the current conditions within the watershed.

The purpose of this section is to review the results of those sampling efforts, discuss the insights they provide with regard to the causes of the impairment of Greens Mill Run, and set forth the appropriate recommendations to address and alleviate that impairment. Additional information is provided in the *Greens Mill Run Water Quality Monitoring* report and *Benthic Macroinvertebrate Sampling Summary – Swift Creek and Greens Mill Run: 2014 & 2015* memorandum, both included in **Appendix N** of this WSMP.

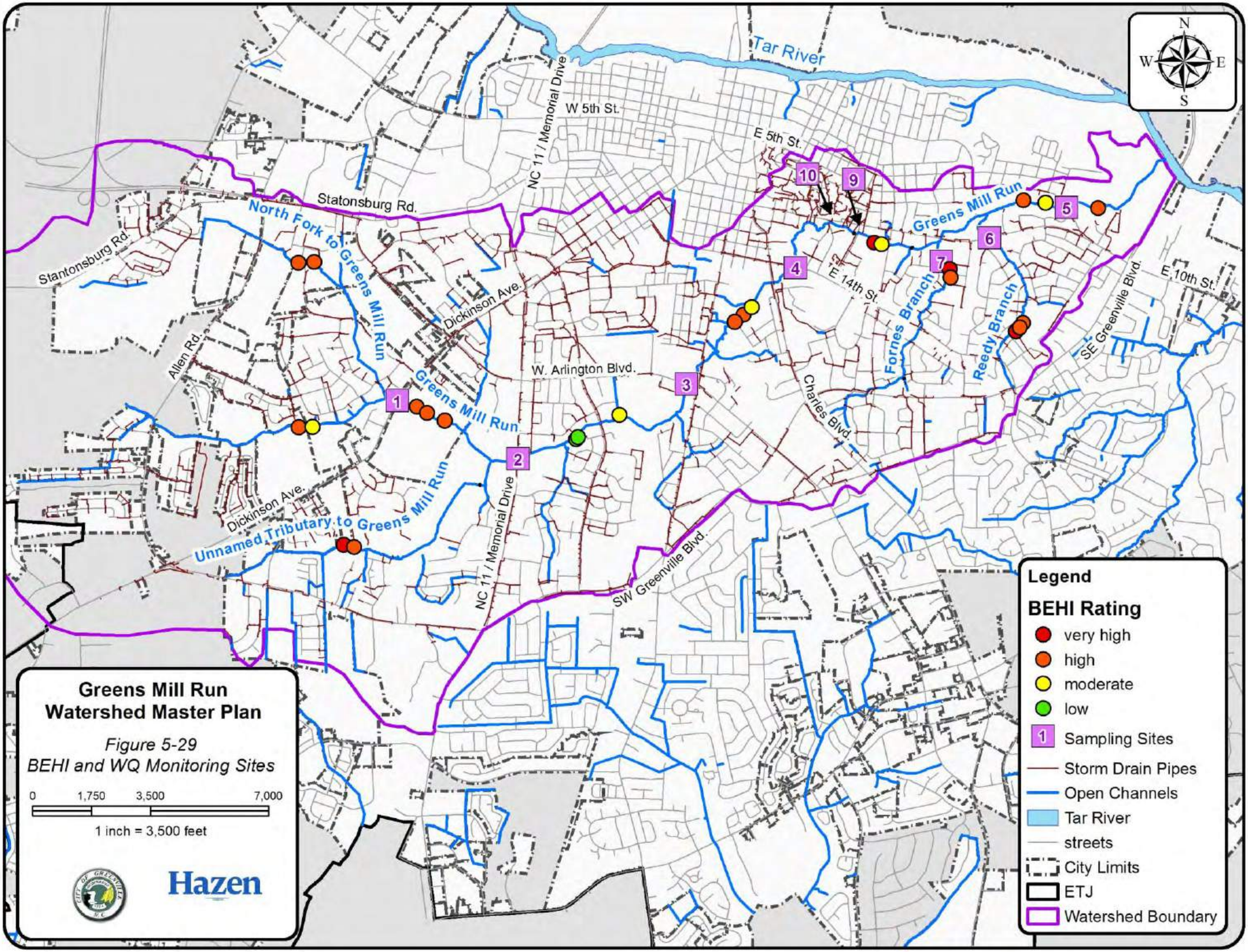
5.3.1 Assessment of Existing Water Quality Conditions

As a subcontractor on the Hazen Team, East Carolina University conducted an 18-month monitoring program to assess water quality in the Greens Mill Run watershed (13.75 mi^2) as part of the City of Greenville's Watershed Stormwater Master Planning project. The assessment of water quality in the GMR watershed was of particular interest given the fact that the stream is listed on the 303d list of impaired waters for North Carolina due to results of past biological monitoring by NCDEQ showing poor ratings for the health of the benthic macroinvertebrate community. The goal of the water quality monitoring program was to determine whether nutrients, pathogens, sediments, or metals are impairing GMR, and if so, to locate potential sources of degradation.

Nine sampling and monitoring sites were selected along Greens Mill Run, including five on the main stem (GMR 1-5), two on its tributary streams (GMR 6, Reedy Branch, and GMR 7, Fornes Run), and two at stormwater outfalls (GMR 9, 10) (**Figure 5-29**). These sites were distributed along GMR and its tributaries to evaluate water quality throughout the watershed and determine if any section(s) of GMR was more affected than others. The stormwater outfalls at GMR 9 and GMR 10 were selected for monitoring in order to evaluate differences in the water quality results from subwatersheds dominated by closed-pipe drainage systems, and because these subwatersheds represent some of the most intensively developed areas of the GMR watershed as a whole. In addition, baseflow and wet weather flow samples were collected across seasons to evaluate seasonal fluctuations of water quality.

Samples were collected during four baseflow and four wet weather flow (or storm flow) events. All sites were sampled for each base flow sampling and all sites were sampled for two wet weather flow events (November 24 and February 2), with all but the two outfall sites (GMR 9 and GMR 10) being sampled for the remaining two wet weather flow events (July 13 and September 25). Samples were also collected in coordination with benthic sampling on August 18-21, 2014; when available results were included with those from the other four baseflow events. Two longitudinal surveys were conducted (April 15 and August 24) during base flow conditions along the main stem and tributaries of GMR. These surveys were conducted to provide a finer spatial resolution of water quality variation along GMR.

The water quality parameters sampled included temperature, pH, dissolved oxygen, conductivity, turbidity, total suspended solids, numerous chemical species of nitrogen and phosphorus, dissolved organic carbon, chlorides, key indicator bacteria, and several metals. Wet weather samples collected on September 25, 2015 were also analyzed at the University of California at Davis for ^{15}N and ^{18}O isotopes in NO_3. The isotope data can sometimes provide information on the sources of nitrogen entering a stream system. The discussion here is limited to the results from those parameters which yielded important conclusions or which were deemed relevant to the impairment discussion. The full Water Quality Monitoring Report is presented in **Appendix N**.



Tar River
W 5th St.
NC 11 / Memorial Drive
E 5th St.
Statonsburg Rd.
Stantonsburg Rd.
North Fork to Greens Mill Run
Greens Mill Run
Dickinson Ave.
Allen Rd.
W. Arlington Blvd.
E 14th St.
Charles Blvd.
Fornes Branch
Reedy Branch
SE Greenville Blvd.
E 10th St.
Unnamed Tributary to Greens Mill Run
SW Greenville Blvd.
1
2
3
4
5
6
7
9
10
Legend
BEHI Rating
very high
high
moderate
low
Sampling Sites
Storm Drain Pipes
Open Channels
Tar River
streets
City Limits
ETJ
Watershed Boundary
Greens Mill Run
Watershed Master Plan
Figure 5-29
BEHI and WQ Monitoring Sites
0
1,750
3,500
7,000
1 inch = 3,500 feet
Hazen

5.3.1.1 Turbidity

Turbidity is an indicator of water clarity and serves as a metric for suspended sediment and colored dissolved organic matter. The results from the turbidity sampling are shown in **Figure 5-30**. The results are displayed using a box and whisker plot format, which is an effective way to illustrate the mean value reported, as well as the full distribution of the reported values for any given parameter. In the box and whisker plot, the bar in the box represents the mean value; the upper and lower bounds of the box represent the 25th and 75th percentile values, respectively and the T's extending from the box (the "whiskers") show the minimum and maximum values reported. Boxes with labels ending in B denote baseflow sample results and labels ending in W denote wet-weather sampling results. The plots of turbidity show results base (B) and wet weather (W) flows. GMR-B and GMR-W are also combined for all base and storm flow values, respectively, on the right. The NC water quality standard for instantaneous turbidity limit of 50 Nephelometric Turbidity Units (NTU) displayed for reference.

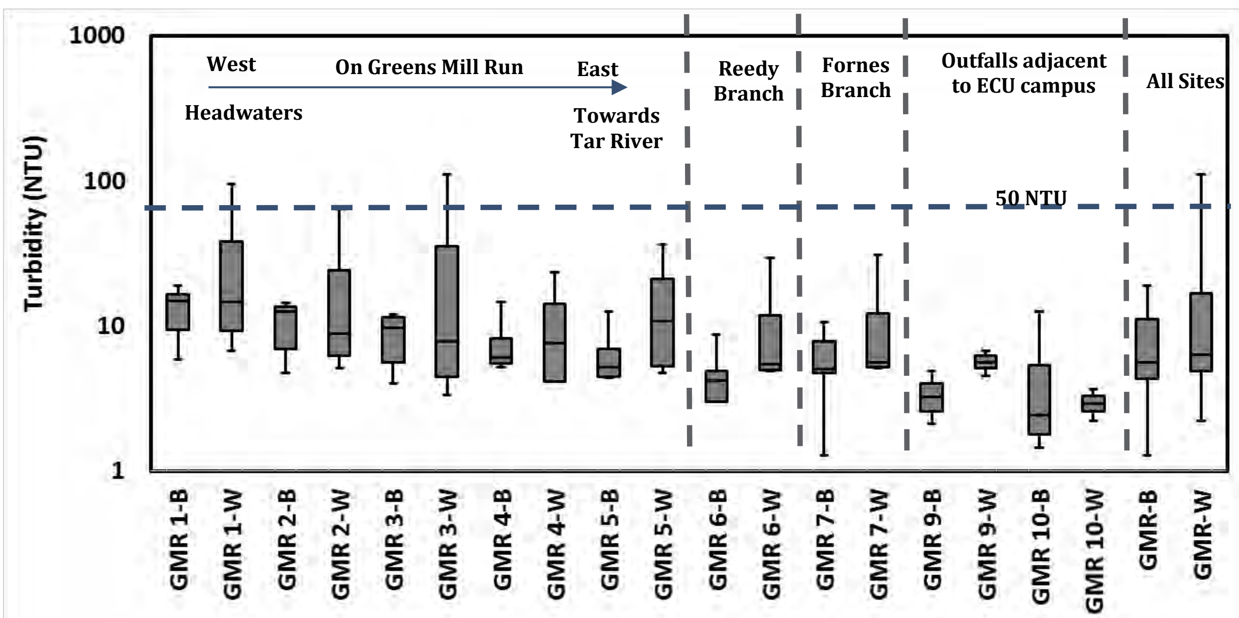


Figure 5-30: Box and Whisker Plots of Turbidity

All turbidity measurements, including from longitudinal surveys, were less than 20 NTU, except for one storm event, in which all in stream turbidities exceeded 20 NTU, and values at GMR 1, GMR 2, and GMR 3, exceeding the instantaneous standard of 50 NTU. The maximum turbidity measured in that Feb 2 storm was 110 NTU at GMR 3.

Among all sites, turbidities tended to be lowest at the two outfalls (GMR 9 and 10) and likely do not contribute significantly to the increases in turbidity from GMR 4 to GMR 5. This pattern may be attributed to the fact that the watersheds draining to these outfalls are dominated by closed-pipe drainage systems and already built landscapes which offer fewer sources of sediment turbidity from instream or landside sources. Note that, across all storm flows, turbidities decreased from GMR 1 to GMR 3 and tended to increase at GMR 4 or GMR 5. This tendency shows that the less urbanized, more agricultural lands in the headwaters of GMR may be sources of sediment delivered from the landscape. However, the downstream increases at GMR 4 and GMR 5 sites are more likely to be a result of sediment delivered from instream sources due to areas of high stream bank erosion upstream of those sites. BEHI values (discussed **Section 3.3**) are also shown in **Figure 5-29** for reference. Inputs from Fornes Run and Reedy Branch may also be significant, as high bank erosion rates were documented in each of those tributaries as well.

5.3.1.2 Total Suspended Solids

Total Suspended Solids (TSS) is another measure of sediment pollution in streams. The sampling results for TSS are shown in **Figure 5-31**. For reference, the NC water quality standard for TSS concentrations in high quality waters (HQW), 20 mg/L, is illustrated on the figure. Greens Mill Run is not classified as HQW, and there is no water quality standard for TSS which is applicable.

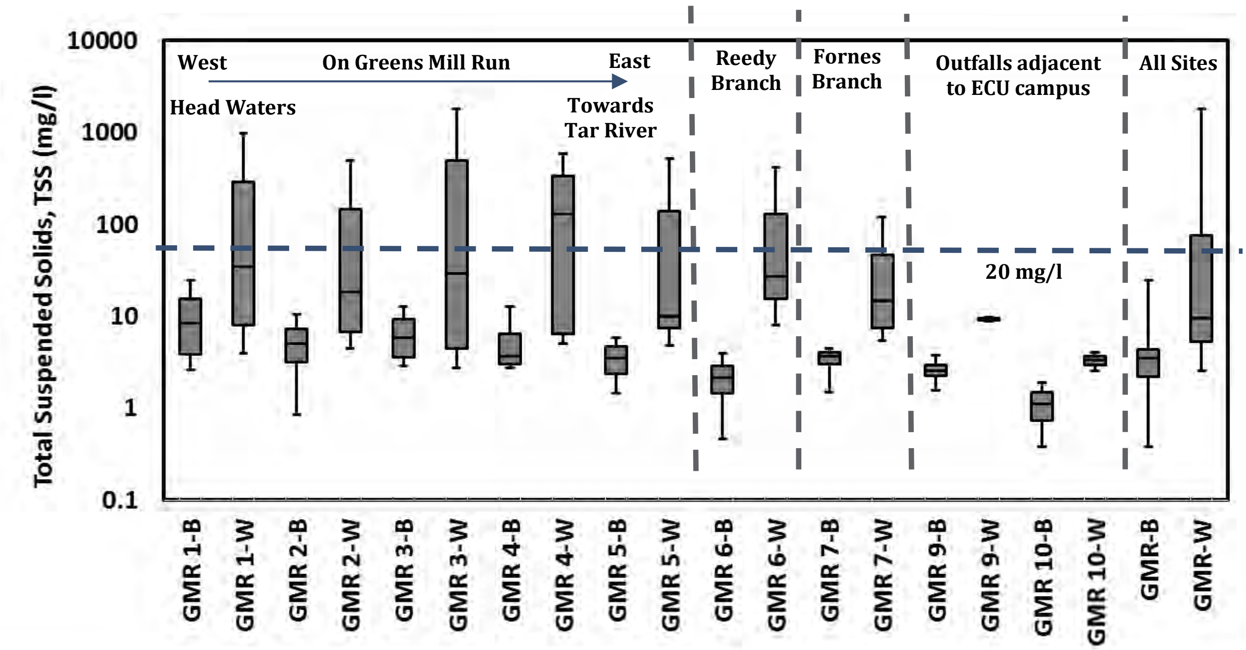


Figure 5-31: Box and Whisker Plots of Total Suspended Solids Concentrations

Baseflow TSS values ranged from less than 1 mg/l to just greater than 24 mg/l, while storm flow TSS values ranged from less than 3 mg/l to greater than 1800 mg/l. Outfall (GMR 9 & GMR 10) base flow TSS concentrations were generally less than all other stream sites for baseflow and storm flow samples. Base flow concentrations generally decreased from GMR 1 to GMR 5, with Fornes Run (GMR 7) and Reedy Branch (GMR 6) being equal or slightly less than TSS values at GMR 5. TSS loads from Fornes Run and Reedy Branch also increase substantially during storm events, which is not surprising given that these subwatersheds have substantial levels of imperviousness and high instream erosion rates.

Storm flow TSS concentrations were generally consistent between GMR 1 and GMR 3, increasing to GMR 4, and decreasing to GMR 5. The relatively large spike in wet-weather TSS values at GMR 4 is likely to be from instream sources due to the high rates of stream erosion observed and documented in the BEHI analysis between GMR 3 and GMR 4.

Similar to the turbidity data, the TSS data indicates that agricultural land uses within the headwaters of GMR may be contributing sediment to the stream, and that instream sources of sediment play an important role. However, it should be noted that the BEHI analysis also identified areas with high rates of bank erosion in the upper reaches of GMR, so instream sources are likely to be significant contributors there as well.

5.3.1.3 Nutrients

The State of North Carolina does not currently have numeric water quality standards for nutrients (nitrogen or phosphorous) in non-water supply waters. However, the Nutrient Sensitive Waters (NSW) supplemental classification for Greens Mill Run is due to it being a tributary to the Tar-Pamlico River System, which is adversely impacted by nutrients. The NSW strategy for the basin attempts to reduce nutrient inputs from agricultural and point sources. There are no requirements as of yet to control nutrients from existing built upon landscapes, but the strategy does include riparian buffer protection measures to minimize non-point nutrient loads.

Nitrogen is an essential, naturally occurring nutrient in the environment and can be transferred between different species through biological processes. Total Dissolved Nitrogen (TDN) includes Ammonium (NH_4), Nitrate and Nitrite (NO_{2+3}), and more complex dissolved forms of cumulatively referred to as Organic Nitrogen (ON). TDN concentrations for base flows and storm flows are summarized in **Figure 5-32**.

Base flow TDN concentrations generally decreased from GMR 1 to GMR 2, likely owing to agricultural inputs in the uppermost portion of the watershed showing up at GMR 1. Moving downstream, TDN concentrations generally remained consistent from GMR 2 to GMR 5. Although base flow TDN concentrations at Reedy Branch (GMR 6), Fornes Run (GMR 7), and the two outfalls adjacent to the ECU campus (GMR 9 and GMR 10) tended to be greater than concentrations at GMR 4, GMR 5 concentrations were not noticeably greater than GMR 4. Elevated levels of TDN from Reedy and Fornes Run likely reflects fertilizer sources from these highly residential subwatersheds. Concentrations of TDN from the two outfalls (GMR 9 and GMR 10) were elevated above in-stream concentrations at other sites and corresponded to elevated specific conductivity values, which could indicate a possible wastewater contribution, possibly from a leaking sewer line via unintentional connection or groundwater seepage. It should be noted that the closed-pipe drainage networks for GMR 9 and GMR 10 lack in-stream treatment processes (e.g. denitrification, biological uptake) that occur within open streams, so concentrations of TDN from GMR 9 and GMR 10 watersheds are likely not naturally mitigated as well as for areas draining to the other sampling sites.

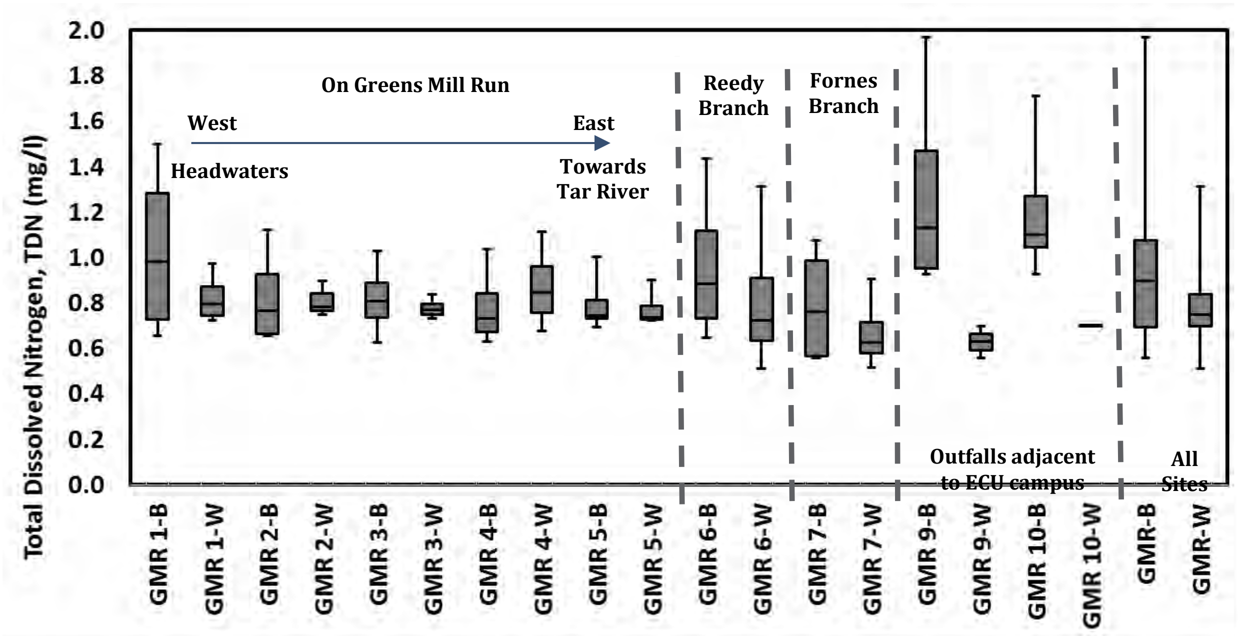


Figure 5-32: Box and Whisker Plots of Total Dissolved Nitrogen Concentrations

The isotope analysis of the nitrogen samples indicated that the dominant sources of nitrogen within the GMR watershed are likely fertilizer and soil-based, with increasing atmospheric deposition inputs during storms. The isotope also analysis showed that soil/groundwater sources of nitrogen are very significant within Fornes Run, not surprising given that the stream is highly incised throughout several reaches within the subwatershed. The results of the nitrogen isotope analysis also reinforced the importance of atmospheric nitrogen contributions in the highly impervious subwatersheds draining to the outfalls at GMR9 and GMR 10, contributing to high wet weather nitrogen loads form that source. However, the isotope analysis was not conclusive enough to eliminate the possibility of a fugitive wastewater contribution within the subwatershed.

Phosphorus is an essential nutrient in the environment as well, but in excess, can lead to algal blooms and eutrophication. Baseflow and storm flow total dissolved phosphorous (TDP) concentrations summarized in **Figure 5-33**. Concentrations of TDP were highly variable, with median storm flow concentrations being slightly higher than median base flow concentrations at each site except for GMR 3 and GMR 10. The outfall at GMR 10 exhibited the highest median TDP levels of all outfalls, again indicating the possibility of a wastewater input in the GMR 10 subwatershed. Fornes Run was also shown to be an important contributor of phosphorus to the system, likely owing to the density of residential development and lawns within the subwatershed. The inputs from Fornes and the GMR 10 outfall likely contribute to the consistent increase in TDP levels from GMR 4 to GMR 5.

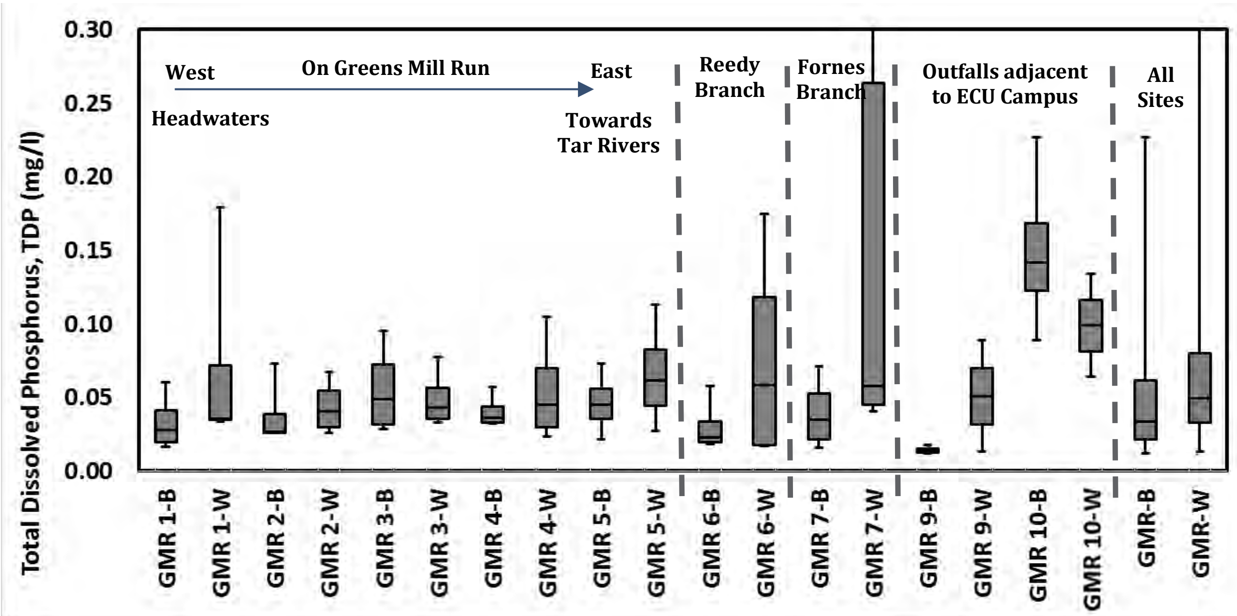


Figure 5-33: Box and Whisker Plots of Total Dissolved Phosphorus Concentrations

5.3.1.4 Other Parameters of Concern

Results for the fecal indicator bacteria (FIB), E. coli, exceeded the NC water quality standard for fresh water during baseflow and more frequently during storm flows (**Figure 5-34**). High FIB concentrations from Fornes Run and Reedy Branch likely contributed to the rise in total coliforms and E. coli on GMR between Charles Boulevard and Green Springs Park. Elevated FIB concentrations on Fornes Run and Reedy Branch may result from pet waste within these primarily residential subwatersheds. While FIB levels may be somewhat elevated in parts of the GMR system, especially during storm events, the results observed in this study are fairly typical of urbanized watersheds, and elevated FIB are not a potential contributor to impairment of the benthic macroinvertebrate community.

None of the metals sampled were found to exceed state standards, as concentrations were below detection limits for copper (10 µg/l) and lead (5 µg/l) and zinc concentrations were less than State of NC action level (50 µg/l).

Across all measurements for baseflow and wet weather, only a few samples showed dissolved oxygen (DO) concentrations approaching the NC water quality standard for minimum daily average DO of 5.0 mg/l, and no samples fell below that threshold. The standard is set as a minimum because organisms tend to be stressed at DO levels blow 5 mg/l and levels below 3 mg/l can be lethal to many aquatic organisms.

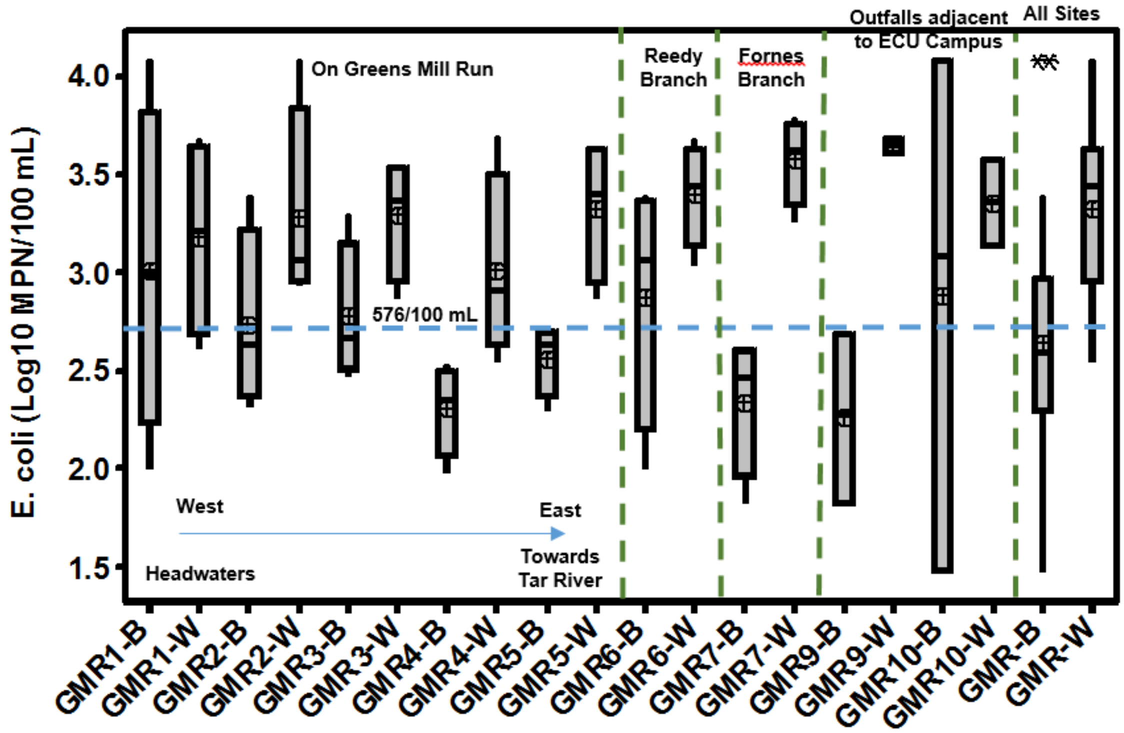


Figure 5-34: Box and Whisker Plots of E.coli Concentrations

5.3.1.5 Conclusions from Water Quality Monitoring

To summarize the results of the water quality monitoring effort, several indicators suggested that pollutant and sediment inputs increased downstream. In general most water quality parameters increased downstream of GMR 3. Overall, the water quality data suggested that urban and agricultural land-uses in the watershed have contributed non-point source pollution resulting in increases in nutrient, sediment, and bacteria inputs to Greens Mill Run. Pollutants originating upstream of GMR 1 tended to decrease between GMR 1 and GMR 3. However, future development without appropriate stormwater management could significantly impact stream stability and pollutant loadings on GMR. Most water quality parameters, with the exception of nitrate and dissolved oxygen, increased with storm flow suggesting that improved stormwater management could help reduce water quality degradation. The nitrate decline during storm events, suggests a groundwater source of nitrate, presumably related to agricultural fertilizer inputs as the increases correspond to the upper portions of the watershed that contain extensive agricultural drainage. Because of the long history of agricultural fertilizer inputs the groundwater source may be elevated for decades but stormwater BMP retrofits and in connection with new development could reduce surficial inputs over time.

Taken collectively, the monitoring effort in this study shows that water quality is not as degraded as might be expected in such a heavily urbanized stream. While sediment and nutrient levels are elevated, especially during storm events, only two parameters were found to exceed water quality standards which are applicable to Greens Mill Run, turbidity (three instances in one storm) and

E. coli (which is not a contributor to the impairment for which GMR is listed). Given that none of the toxicant (metals) parameters that were sampled exceeded established water quality standards and dissolved oxygen levels in the stream were never shown to be below the water quality standards which reflect the level necessary to sustain healthy aquatic ecosystems, the water quality monitoring effort in this study has indicated that it is highly unlikely that the physical/chemical water quality parameters are causing the degradation of the benthic macroinvertebrate population in Greens Mill Run. Rather, as discussed in Section, the 303(d)-listed impairment of Greens Mill Run (resulting from poor health of the benthic macroinvertebrate community) is far more likely to be the result of the excess sediment moving through the system and the associated physical degradation of the benthic habitat.

5.3.1.6 Recommendations to Improve Water Quality

Continue effort to retrofit structural BMPs to existing built landscapes – The City of Greenville's current stormwater management requirements will continue to facilitate the installation of effective BMPs to new development which will minimize further increases in upland pollutant loads and prevent excessive runoff from contributing to significant increases in stream erosion, and the resulting increases in turbidity and sediment loads. However, much of the older urban and suburban development within the GMR watershed occurred prior to those requirements being instituted. Achieving significant reduction in existing pollutant loads and stream erosion will require an ongoing effort to retrofit BMPs in areas that were previously developed. The water quality and quantity BMPs recommended in this stormwater master plan will make a difference, but alone are not likely to achieve the full range of reductions desired. They should be implemented as a first step in a cycle of adaptive management in which successive round of retrofits are deployed and then ongoing water quality monitoring is used to evaluate their effectiveness and target new BMPs. Given their significant contributions to pollutant loads at the watershed scale, especially with regard to sediment, nutrients, and bacteria, and the overall age of development within them, the Fornes Run and Reedy Branch subwatersheds would be beneficial areas to target retrofitting efforts.

Conduct a more detailed source investigation into watersheds contributing to the GMR 9 and GMR 10 outfalls monitored in this study – Water quality monitoring data showed significant spikes coming from the outfalls for several key pollutants, including nutrients and fecal indicator bacteria. The source investigation should allow for the possibility of an illicit wastewater discharge or groundwater seep of wastewater within the watershed. Alleviation of any specific sources of this nature (should they be found) could significantly reduce pollutant loads from the outfalls. However, it should be noted that the pollutant spike could also be attributed to the highly efficient nature of transport within such closed-pipe drainage systems. The high nutrient loads may be attributed to the lack of opportunity for the instream nutrient processing that would occur in open streams, and the high bacteria loads may be caused by simple build-up/wash-off mechanisms in one of the most highly impervious portions of the GMR watershed. Bacterial source loads could be exacerbated by the rapid delivery through a piped network to the outfall.

Initiate a Pet Waste Awareness Program – Studies have repeatedly shown that domestic dog and cats contribute significant fecal indicator bacteria loads in urban and suburban watersheds, and that significant load reductions can be achieved with relatively low capital expenditure by creating a greater awareness of the impacts of pet wastes and changing the behavior of the residents within a watershed with regard to pet waste management. Media campaigns can be highly effective in making citizen aware and motivating them to pick up after their pets, and the effectiveness of such effort can be increase by accompanying them with the installation of pet waste collection stations in parks and other public spaces within the watershed.

5.3.2 Assessment of Existing Benthic Macroinvertebrate Community

Given that Greens Mill Run was listed as impaired because of poor benthic community ratings, as part of this overall stormwater master planning effort, WK Dickson, was engaged to perform benthic macroinvertebrate sampling to evaluate the current conditions of the aquatic ecology in the watershed. In August 2014, seven sites were sampled in the GMR watershed. In addition, the Hardee Creek watershed, near Greenville was identified as an appropriate reference reach and also sampled. When evaluating the results, note that the sample site numbering and locations correspond to the water quality monitoring sites discussed in the previous section and shown in **Figure 5-29**. A baseflow water quality monitoring event was conducted by ECU concurrent within the benthic community sampling. Also note that a bioclassification of Good or Good-Fair would be required to remove the impaired designation from the 303(d) List. Bioclassifications of Fair or Poor will not support delisting. The summer 2014 sampling results confirmed that the upstream (above GMR 4) and tributary sampling sites within the watershed have drainage areas which are too small for collection of data that would be comparable to the NCDEQ data that led to the listing of the stream as impaired. As a result, subsequent sampling events were only performed at the two downstream-most sites on GMR (GMR 4 and GMR 5).

The optimal sampling period for the Standard Quantitative Method (i.e. no seasonal adjustment required for biotic index or bioclassification scores) is June – September. The optimal sampling period for the NCDEQ Swamp Method is February – Early March. Because the Swamp Method was used in the original sampling event that led to the impaired status, Swamp Method benthic sampling was again conducted in GMR, at the two downstream-most sites, and Hardee Creek in February 2015. Hardee Creek and GMR 4 and GMR 5 were also sampled again in August 2015 using the Standard Quantitative Method. Results from these two sampling events are also shown in **Table 5-2**.

5.3.2.1 Benthic Monitoring Conclusions

The 2014 sampling result of Good-Fair from GMR 4 indicate that portions of the GMR mainstem may exhibit improved benthic community health at times, but the rating declined to Fair at that site in 2015. Overall, the sampling results in GMR were consistently worse than the sampling results from Hardee Creek, and those results would not support a proposal for delisting GMR on the basis of sampling data alone. Additional conclusions from the WK Dickson report included the following: “Ambient data results do not indicate that water quality is the primary contributor to low benthic diversity and associated impairment. The lack of adequate habitat conditions throughout the watershed is likely to be the primary contributor to the benthic community’s low diversity. The ongoing maintenance (dredging) of stream for flood control removes large amounts of organic material and significantly disturbs stream channels. This is likely to be the primary contributor to habitat impacts.”

Table 5-2: 2014 and 2015 Benthic Community Monitoring Results

Site ID	Greens Mill Run							Hardee
	1	2	3	4	5	6	7	
EPT Taxa Richness	2	6	6	4	3	2	2	8
NC Biotic Index	7.1	6.8	6.8	6.5	7.2	6.7	7	5.9
Bioclassification[1]	F	F	F	G-F	F	G-F	F	Good
Sampling Method	Standard Qualitative							
---------- February 2015 ----------								
Site ID				Greens Mill Run				Hardee
				4	5			
EPT Taxa Richness				2	2			9
NC Biotic Index				7.3	7			6.3
Bioclassification[1]				F	F			G-F
Sampling Method	Swamp							
---------- August 2015 ----------								
Site ID				Greens Mill Run				Hardee
				4	5			
EPT Taxa Richness				9	4			6
NC Biotic Index				6.9	7			6.2
Bioclassification				F	F			F
Sampling Method	Standard Qualitative							

[1] Ratings based only on biotic index values

5.3.2.2 Benthic Monitoring Recommendations

Continue benthic community monitoring at sites GMR 4 and GMR 5 – Continued monitoring at these sites will allow for evaluation as to whether or not the 2014 increase in bioclassification at GMR 4 was an anomaly or if a healthier aquatic community exists in that reach. Continued monitoring will also allow for tracking of any improvements realized from habitat enhancements, stream restoration and stabilization efforts, or other measures to reduce upstream sediment loads and improve aquatic habitat.

Establish additional benthic community monitoring sites between GMR 4 and GMR 5 – Establishment of a more spatially refined monitoring regime throughout this stream reach will allow for identification of transition points in benthic diversity, should they be found to exist.

If the improved bioclassifications at GMR 4 are found to be persistent, submit them to NCDEQ with a request for delisting a portion of Greens Mill Run – Improved benthic ratings over a period of several sampling events would support delisting the stream from the GMR 4 sampling site extending upstream.

Additional recommendations aimed at affecting habitat improvement and increased benthic community diversity throughout the watershed are discussed in the following section.

5.3.3 Strategy to Address Impairment of Greens Mill Run

The water quality monitoring program for this master planning effort has shown that sediment levels are elevated in all streams within the GMR watershed, especially during storm events. The geomorphic assessment has shown that stream banks erosion in numerous locations throughout the watershed is a significant source of sediment in the system. **Picture 5-39** and **Picture 5-40** show a site near South Elm Street where a monitoring of stream cross-section showed bank erosion rates of approximately one foot per year on an exposed banks 10 feet in height. Other monitored cross sections within the GMR watershed have yielded estimated bank erosion rates of up to 8 feet of landward retreat annually.

Picture 5-39: Exposed and Eroding Vertical Bank Along GMR

Picture 5-40: Extreme Bank Erosion

A stable and competent stream channel is one that transports the sediment load supplied by its watershed while neither agrading (experiencing excessive deposition) nor degrading (experiencing excessive scour). When sediment is entering the channel from upstream, at rates greater than the stream has the hydraulic capacity to transport, excessive deposition occurs and the natural variability of the geomorphic channel features (the predictable sequence of riffles and pools) is buried in that sediment. This stream condition is often characterized by the formation of mid-channel sand bars such as the one evident in **Picture 5-41**. The end result is that the structural variability in habitats needed to support a healthy and diverse aquatic ecosystem is lost. The adverse impacts of excessive stream erosion and sedimentation are exacerbated in many reaches of GMR by past channelization of the stream to facilitate desired land uses or sewer line installation and the past practices of dredging (clearing) streams to promote drainage. Stream channelization is also evident in **Picture 5-41**.

It should be noted that the pictures shown in this section are not isolated cases, but rather are indicative of conditions that exist broadly in numerous stream reaches throughout the GMR watershed. All the available lines of evidence in that master planning effort indicate that habitat degradation is the primary stressor on the health of the GMR aquatic ecosystem, and the benthic macroinvertebrate community in particular and that excessive sedimentation and channel modification are the sources. In specific, data indicate that delivery from upland sources may be a contributor to sedimentation in the watershed. However, given that agricultural practices have been a target of the Tar-Pamlico NSW Strategy, in recent years the agricultural community within the river basin has been aggressively implementing best practices to reduce sediment and nutrient runoff. Upland sources of sediment from land disturbing activities are not likely to be a significant contributor in the lower half of the watershed as much of that portion is already fairly built out, and construction activities are minimal. However, in the upper portion of the watershed, conversion of agricultural land to commercial and residential uses is ongoing, so upland sediments sources from land disturbing activities may be more important there. In light of the collective results of the geomorphic assessment it is far more likely that the dominant sources of sediment are the stream banks themselves, which is not atypical of urbanized watersheds, where increased imperviousness leads to increases in stormwater runoff volumes and velocities there by inducing bank erosion and channel instability.

Picture 5-41: Sediment Deposition and Channelization of GMR near Evans Street

5.3.3.1 Recommended Measures to Improve Habitat and Alleviate Impairment

Identify opportunities and implement stream restoration projects – The stream stabilization projects identified in this master plan (**Section 5.1**) will help alleviate excessive sediment loads to downstream reaches, but in and of themselves, do not create a great deal of new diverse aquatic habitat. Re-establishing the diverse habitat niches necessary for a healthy aquatic ecosystem at the full reach scale will require implementation of stream restoration projects using natural channel design principles (Rosgen D. , 1996). Natural channel design, where feasible, will re-establish the predictable pattern of pools and riffles within reconstructed stream channels as well as offer opportunities to integrate woody materials to reintroduce structure and organic material within them. While such projects are challenging to carry out within the constraints of urbanized stream valleys, a systematic pursuit of stream restoration projects within a cycle of adaptive management utilizing successive rounds of follow-up monitoring of the benthic community to evaluate the effectiveness of the projects and to target and refine new projects for the next implementation cycle.

Continue implementation of stream bank stabilization projects within a cycle of adaptive management – The projects identified in this master plan area a strong beginning toward reducing the excessive loads of sediment degrading habitat in Greens Mill Run and its tributaries. However, the problem of stream erosion and instability is commonplace throughout much of the Primary System. The geomorphic assessment for this WSMP indicated that almost everywhere that BEHI assessments were performed, high stream bank erosion rates were identified. The current slate of stream stabilization projects were identified partly on the basis of selection criteria such as ease of implementation, construction access, land ownership and other factors, which are valid, but do not always target projects to the stream reaches of greatest need. This set of projects should be viewed as the initiation of an ongoing program to stabilize banks throughout the entire watershed, as funding and opportunities arise, integrated with successive monitoring cycles, utilizing geomorphic assessments and benthic community monitoring to gage their success.

Introduce woody structures and debris to the stream – the past practices of channel modification and the sediment deposition in the watershed have removed or buried much of the woody material in the stream. The woody material in the stream provides refugia to aquatic organisms and a source of needed organic carbon to the system. Restoration and stabilization projects can offer opportunities to introduce woody material by integrating it into instream structures and by using root wads as bank toe stabilization measures.

Identify appropriate sources for the capture of desired benthic macroinvertebrate species and relocate organisms to the Greens Mill Run watershed – Even after restoration projects have improved physical habitat and stabilization projects have reduced sediment loads, the stream will likely suffer from a lack of viable in-situ recruitment sources for a diverse benthic community, which can be alleviated with anthropogenic assistance. Hardee Creek will likely be a suitable source.

5.3.3.2 Recommended Strategy to Address 303(d) Listing Status

Request a Category 4C designation on the 303(d) List of Impaired Waters developed by NCDEQ – Category 4C on the list comprises waters that are impaired by pollution, not specific pollutants, and a recent USEPA technical memorandum to the directors of the Water Divisions within the 10 USEPA Regions specifically mentions waters where excessive runoff and stream scour have contributed to habitat degradation. The memo is available online here:

https://www.epa.gov/sites/production/files/2015-10/documents/2016-ir-memo-and-cover-memo-8_13_2015.pdf

The following is an excerpt from the memo:

"Category 4C: If States have data and/or information that a water is impaired due to pollution not caused by a pollutant (e.g., aquatic life use is not supported due to hydrologic alteration or habitat alteration), those causes should be identified and that water should be assigned to Category 4C. Examples of hydrologic alteration include: a perennial water is dry; no longer has flow; has low flow; has stand-alone pools; has extreme high flows; or has other significant alteration of the

frequency, magnitude, duration or rate-of-change of natural flows in a water; or a water is characterized by entrenchment, bank destabilization, or channelization. Where circumstances such as unnatural low flow, no flow or stand-alone pools prevent sampling, it may be appropriate to place that water in Category 4C for impairment due to pollution not caused by a pollutant. In order to simplify and clarify the identification of waters impaired by pollution not caused by a pollutant, States may create further sub-categories to distinguish such waters. While TMDLs are not required for waterbody impairments assigned to Category 4C, States can employ a variety of watershed restoration tools and approaches to address the source(s) of the impairment."

As noted in the description of Category 4C from the memo, water bodies designated in this category will not be subject to TMDL development. However states are given the latitude to apply other watershed restoration tools to address the problem.

The USEPA allows States to utilize the 4C option when plans are developed to address specific circumstances in a watershed which include adaptive management and approaches to pollutant reduction which are better suited to achieving results than the TMDL approach. The specific circumstances in Greens Mill Run are ideally suited for a 4C designation. Given that the primary stressor in the watershed is habitat degradation through sediment deposition and channel modification, there is not a specific numerical reduction in the mass load of sediment that could be determined to result in achievement of water quality standards, in this case meaning a recovery of benthic community bioclassifications to a rating of Good-Fair or better. For this reason, the TMDL approach is widely recognized as an ineffective means to address impairments of the nature experienced in Green Mill Run.

It is important to note that NCDEQ guidance on the assessment of water quality data indicates that Category 4c has been utilized in the past, but not for the specific purpose clarified in the referenced USEPA memo. The most recent NCDEQ guidance gives the following definition of category 4C:

"CATEGORY 4C ASSESSMENTS are assigned when a parameter exceeded criteria due to the presence of a water control structure such as a dam. In such cases where there is no identifiable pollutant, a TMDL is not required. A biological assessment exceeding criteria just downstream of an impoundment is an example of Category 4c."

Hopefully, with this recent clarification on Category 4C available from USEPA, the Water Planning Branch at NCDEQ will begin to exercise the latitude to apply the category to streams like Greens Mill Run.

If NCDEQ is unwilling to consider movement to Category 4C, request a Category 4b designation – Category 4b on the list comprises impaired waters that are expected to meet water quality criteria within a reasonable period of time as a result of pollution controls implemented voluntarily. In the case of Greens Mill Run, a 4b designation would be an alternative to having a Total Maximum Daily Load (TMDL) developed and documented, most likely by NCDEQ, which would require pollution controls to be implemented on a mandatory basis.

From NCDEQ guidance on requests to move a waterbody to Category 4b, the following elements and process are outlined:

1. *Requests can be submitted at any time to DWR.*
2. *Participants must address the six elements set forth in EPA/DWR requirements (see Section II of the Category 4b guidance).*
3. *DWR must make the final decision on submitting a 4b demonstration to EPA.*
4. *EPA will evaluate on a case-specific basis a State´s decision to move an impaired water from Category 5 to Category 4b and thereby not require a TMDL. Final designation of a waterbody for Category 4b is contingent upon concurrence with the 4b demonstration by EPA. In the case where there is no EPA concurrence, the waterbody will remain in Category 5 and a TMDL is required.*
5. *After EPA concurrence with a 4b demonstration, DWR will require progress reports from the participants for tracking purposes, and to ensure that the water remains appropriately categorized in 4b.*

More detailed guidance on the Category 4b process, including detailed description of the six elements in Step 2, is available here:

https://ncdenr.s3.amazonaws.com/s3fspublic/Water%20Quality/Planning/TMDL/Alternatives/NC_4b_Guidance2014.pdf

As discussed in the above sections of recommendations for implementation of measures to address the sources of impairment in Greens Mill Run, the guidance for Category 4b designation repeatedly stresses the important of adaptive management cycles with ongoing monitoring to evaluate the effectiveness of the measure implemented on a continual basis, and it would still require a quantifiable pollutant load reduction to be established.

5.3.4 Potential Cost Savings

Re-assignment of Greens Mill Run to another category of the 303(d) list, thereby avoiding the mandatory efforts to implement a TMDL (which would likely be developed by NCDEQ, or a third party on their behalf), could represent a significant potential cost savings to the City of Greenville. However, estimates of costs for TMDL development and implementation vary widely. On the lower end, a 2001 study of TMDL-associated costs conducted nationally by the USEPA found that TMDL implementation costs to be borne by local entities deemed “pollutant sources” ranged from \$95,000 - \$215,000 annually per impaired waterbody. Adjusted for inflation to 2016 dollars, the estimated range becomes \$133,000 - \$300,000 annually, per impaired waterbody. The study did not distinguish between capital cost and annual maintenance costs, and did not break out costs by TMDL type or the size of the waterbody or watershed. The USEPA study is available here: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=901K0800.TXT

A 2009 report from the City of Los Angeles on costs associated with implementation of TMDLs within their jurisdiction found that their smallest TMDL expenditure, to reduce toxic pollutants to Marina del Rey Harbor would result in initial capital costs of \$5.5-7.6M and annual O&M cost of \$0.8M. Their largest TMDL, to address metals pollution in the LA River was estimated to have over \$1.0B in capital costs and \$135M in annual O&M costs. The LA Water Quality Compliance

Master Plan is available here: http://www.lastormwater.org/about-us/water-quality-compliance-master-plan/

The most comparable TMDL implementation plan which could be identified for this report was developed to address sediment and bacteria pollution in the Crab Creek watershed, a 19 square mile catchment within the New River Basin, near Christiansburg in western Virginia. The 2014 implementation plan developed by the Virginia Department of Environmental Quality in conjunction with Virginia Tech estimate the total capital cost of all structural measures to fully implement the TMDL at $10.4M. The full implementation plan is available here: http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/ImplementationPlans/CrabCr_public.pdf

These studies and plans do not represent clear indication of savings that might be realized by the City of Greenville by not having to implement a TMDL; in the absence of the formal TMDL, the City would still be taking action to address the degradation of Greens Mill Run. Perhaps the greater benefit to the City in avoiding TMDL imposition of would be to have greater control its own approach regarding how, where, and when capital expenditures will be invested toward the improvement and rehabilitation of the stream.

5.3.5 Conclusion

The assessments of geomorphology and water quality performed for this WSMP, and the stormwater management and stream stabilization projects set forth within it, are a strong step toward alleviating the impairment. The water quality monitoring program was sufficiently robust to indicate that water quality, in and of itself, is not likely to be an important driver of the impairment of Greens Mill Run. Rather, the lines of evidence, as well as numerous field observations, point directly to habitat degradation through past channel modification and excess sediment deposition stemming from channel instability and stream bank erosion as the main driver of the substandard benthic community bioclassifications.

With this beginning in place, the City of Greenville can avoid the imposition of a TMDL by pursuing and documenting a deliberate program aimed at stabilizing and restoring streams, and reducing the excessive sediment loads coming from eroding banks and potential upland sources. If the program exhibits principles of adaptive management with ongoing monitoring to provide the necessary feedback for continued implementation and adaptation, it will provide the justification to move Greens Mill Run from Category 5, to Category 4B or 4C (should that be the designation of the new alternate category).

6. Public Education and Outreach

As part of the overall WSMP process, the City committed to a comprehensive public involvement program to educate, inform, and engage citizens and businesses about stormwater-related issues, and the benefits of watershed master planning to the quality of life in and around the City of Greenville. The public involvement component helped to ensure that the public was invested in the process, supported the recommendations, and that recommendations clearly reflect that the needs and expectations of the public have been heard, meaningfully evaluated, and incorporated into the final document. The project included a Public Involvement Plan which established general approaches for public outreach, as well as activities tailored to each watershed's unique characteristics. The PIP utilized a variety of communications tools to engage and solicit input from a wide range of stakeholders. To achieve the goal of educating and informing the general public, public involvement activities were focused on yielding maximum exposure and opportunities for participation.

Section 2 of this document discusses several elements of the public education and outreach program in detail. Elements incorporated into the GMR WSMP include: a public questionnaire, a series of three public meetings (held on November 5th, 2014 and November 17th, 2015), stakeholder input meeting (September 3rd, 2014), and direct resident contact and interviews.

Further public engagement as projects move from the watershed master planning process into implementation will help continue to build support for the orderly, objective approach to implementation of stormwater improvements and use of stormwater utility fee revenues. Continued communication through various mediums will give the public the opportunity to review, ask questions, and generally understand the stormwater big picture in Greenville.

7. Anticipated Permitting

The proposed improvements presented in **Section 4** and **5** will require permits or preconstruction approvals from either local, state, and/or federal agencies. These permits/approvals may include:

- NCDEQ 401/USACE 404 for stream and/or wetland impacts
- FEMA CLOMR/LOMR for regulatory floodway/floodplain impacts
- NCDEQ Land Disturbance for erosion control
- NCDOT for DOT-owned property impacts
- Railroad for railroad-owned property impacts

The anticipated permitting requirements for each proposed project are shown in **Table 7-1**. All Primary System culvert projects are expected to require a 401/404 certification/permit, a Conditional Letter of Map Revision (CLOMR) / Letter of Map Revision (LOMR) or "no-rise", and a Land Disturbance permit. Several will also require permits/approvals from the NCDOT and railroad owners. The Secondary System projects are all anticipated to require Land Disturbance permits, and two will require NCDOT approval. Proposed steam stabilization projects are anticipated to require a 401/404 certification/permit, a CLOMR / LOMR or "no rise", and a Land Disturbance permit. Lastly, the BMP projects are anticipated to require a Land Disturbance permit.

The three state and federal-level permits are described below. Permitting requirements for each project may change based upon final detail design and existing conditions at the time of design.

7.1 NCDEQ 401/USACE 404

Projects impacting USACE regulated waters require a 401 Water Quality Certification from the North Carolina Department of Environmental Quality (NCDEQ) and the corresponding 404 Clean Water Act Permit from the USACE. These permit applications are typically submitted and reviewed concurrently. The 404 permit may include a pre-authorization, pre-construction notification (PCN) for Nationwide Permits (NWP), or an Individual Permit (IP). All proposed Primary System and stream stabilization projects are anticipated to obtain coverage through the NWP process, such as a NWP #3 (Maintenance), NWP #13 (Bank Stabilization), or NWP #27 (Stream and Wetland Restoration Activities). While not anticipated, some projects may require an IP from the USACE, if the project has stream impacts greater than 300 feet and wetland impacts larger than 0.5 acres. The three types of NWPs are discussed in further detail below.

NWP #3 – Maintenance

A Nationwide Permit #3 pertains to maintenance activities of currently serviceable structures. Depending upon project conditions, a PCN may be required if significant excavation and/or fill is required within the channel, while minor changes may not require a PCN. Generally, the NWP #3 does not require a PCN; however, one is typically issued as a courtesy. This permit also requires that culverts 48" in diameter and larger be buried a minimum of 1 foot below the channel, and smaller culverts buried to at least 20% of their diameter.

NWP #13 – Bank Stabilization

A Nationwide Permit #13 includes bank stabilization measures to prevent erosion. The permit stipulates that the work be part of a single, complete project, and that materials are not placed so as to impede the flow of surface waters into or out of a wetland area, or placed where they may eroded during normal or high flow events. Additionally, a limit of 1 cubic yard of material per foot of stream below the ordinary high water mark applies. A PCN to both the USACE and NCDEQ is required for projects exceeding 500 feet in length. Placement of fill in the streambed also requires notification to NCDEQ.

NWP #27 – Stream and Wetland Restoration Activities

A Nationwide Permit #27 applies to stream and wetland restoration projects and requires a PCN to the USACE. A PCN to the NCDEQ is required if the project extends more than 500 feet or includes in-stream structures. Some stream impacts may also require evaluation under the State Environmental Policy Act (SEPA), including an Environmental Assessment (EA), if the project involves more than $10 million of state funding or disturbance of more than 10 acres of public land. Stream impacts include channelization, culvert placement, riprap placement, and installation of other hard structures. Additional permit conditions include:

- Use and proper maintenance of soil erosion and control measures during construction.
- Exposed soils shall be stabilized as soon as possible.
- Jeopardizing the existence or habitat of threatened or endangered species is not permitted under any NWP.
- Impacts to historic properties, either listed or eligible for inclusion in the National Register of Historic Places, is not permitted.
- Use of more than one NWP for a single complete project is not permitted.
- Impacts to US waters should be avoided, or minimized.
- Mitigation will be required to the necessary extents to minimize adverse impacts.
- Implementation of hardened structures should be minimized or avoided.

Individual Permit

Should a project upon detail design not meet the NWP conditions, an Individual Permit from the USACE may be required. In general, projects with more than 300 feet of stream and 0.5 acres of wetland impacts require an IP. As part of this process, IP applications may be reviewed by USACE, NCDEQ, EPA, SHPO, NCWRC, and USFWS, among potential other agencies. A public review is required (30 days review period followed by interpretation and incorporation of comments) as well as a 60 day review period for the USACE. The public review period coupled with additional permitting effort associated with Individual Permits can result in substantially longer permitting times.

7.2 Federal Emergency Management Agency

Projects located within FEMA regulated streams that include grading with the regulatory floodway may require a CLOMR (preconstruction) and LOMR (post-construction). FEMA regulated streams include those with at least a 1 square mile drainage area that have been modeled and mapped for flood protection purposes. All of the Primary System streams evaluated in this WSMP, except the Unnamed Tributary to Greens Mill Run, are regulated by FEMA, with 1% annual chance flood hazard areas and regulatory floodways. A CLOMR / LOMR may also be sought to revise the effective floodplain mapping if an improvement project results in lowered water surface elevations, allowing structures currently located within a mapped floodplain to be shown outside of the flood hazard.

Alternatively, for projects that do not require a CLOMR / LOMR, a “no rise” approval by the local Floodplain Administrator is required. A “no rise” consists of hydraulic evaluation which demonstrates that a proposed project does not result in increases to the effective base flood elevations as determined by a FEMA flood insurance study.

7.3 Land Disturbance

Projects with land disturbances greater than 1 acre require preconstruction notification to the NCDEQ. A sediment and erosion control plan must also be submitted prior to construction. All of the proposed projects are anticipated to require a Land Disturbance permit.

Table 7-1: Anticipated Permitting for Proposed Projects

Project	Permit					
	FEMA / No Rise	404/401 (NWP)	404/401 (IP)	Land Disturbance	NCDOT	Railroad
Primary System Projects - Alternative #1						
Greens Mill Run						
Rock Spring Road	X	X		X		
College Hill Drive	X	X		X		
South Elm Street	X	X		X		
Reedy Branch						
Southeast Greenville Boulevard	X	X		X	X	
South Wright Road	X	X		X		
East 10th Street	X	X		X	X	
Fornes Run						
Crestwood Drive	X	X		X		
North Overlook Drive	X	X		X		
Norfolk Southern Railway	X	X		X		X
East 14th Street	X	X		X	X	
Greens Mill Run North Fork						
Allen Road	X	X		X	X	
Spring Forest Road (US)	X	X		X		
Norfolk Southern Railway	X	X		X		X
Spring Forest Road (DS)	X	X		X		
Ellsworth Drive	X	X		X		
Primary System Projects - Alternative #2						
Greens Mill Run						
Rock Spring Road	X	X		X		
South Elm Street	X	X		X		
Reedy Branch						
Southeast Greenville Boulevard	X	X		X	X	
South Wright Road	X	X		X		
Fornes Run						
North Overlook Drive	X	X		X		
Norfolk Southern Railway	X	X		X		X
Greens Mill Run North Fork						
Allen Road	X	X		X	X	
Spring Forest Road (US)	X	X		X		
Norfolk Southern Railway	X	X		X		X
Spring Forest Road (DS)	X	X		X		
Ellsworth Drive	X	X		X		
Secondary System Projects						
Arlington Boulevard System		X		X		
Bradley Street System				X		X
Brook Hollow System				X		
Brownlea Drive System				X	X	
Cedar Lane System				X		
Circle Drive System				X		
Commerce Street System		X		X		
Dellwood Drive System				X	X	
Greenbriar Drive System		X		X		
Lakewood Drive System		X		X		
Jaycee Park System				X		
Slay Drive System				X		

Table 7-1 Continued

Project	Permit					
	FEMA / No Rise	404/401 (NWP)	404/401 (IP)	Land Disturbance	NCDOT	Railroad
Stream Stabilization Projects						
Dickinson Avenue	X	X		X		
South Elm Street	X	X		X		
Cedar Lane	X	X		X		
Forest Hill Drive	X	X		X		
South Evans Street	X	X		X		
St. Andrews Drive	X	X		X		
Greenway at East 10th Street	X	X		X		
East 10th Street at Rock Spring Road	X	X		X		
Stormwater Best Management Practice Projects						
J.H. Rose High School				X		
ECU Athletic Maintenance Building				X		
Greenville Square Shopping Center				X		
Pirates Pointe Shopping Center				X		
Greenville Mall				X		
University Commons Shopping Center				X		
Guy Smith Park				X		
S. Greenville Elementary School				X		
Carolina East Mall				X		
Hastings Ford Dealership				X		
Jiffy Lube				X		
Jaycee Park				X		
Andrew A. Best Freedom Park				X		
First Pentecostal Holiness Church				X		
Dream Park				X		
Eastern Elementary School				X		
Arlington Crossing Shopping Center				X		
Physicians East Medical Center				X		
Wahl Coates Elementary School				X		

8. Funding Opportunities

Many of the improvements set forth in the GMR WSMP present both design and construction challenges, and are costly to implement. To varying degrees, each requires acquisition and/or use of significant areas of land and implementation of substantive new infrastructure. Some of these approaches may require public funding resources beyond those available within the City of Greenville. For these improvements, assistance in the form of state and federal grant and loan funding may be available to assist with implementation. NCDEQ maintains a list of state and federal funding sources for water resource and related projects at:

http://www.ncstormwater.org/pages/financial.html

Table 8-1 shows selected specific funding sources which may apply to the projects identified as part of the GMR WSMP.

Table 8-1: Potential Funding Sources

	Section (319) Grant	Clean Water Management Trust Fund (CWMTF)	Clean Water State Revolving Fund (CWSRF)	Water Resources Development Grant	Environmental Education Grants	Flood Mitigation Assistance (HMGP)
Agency	NCDEQ (DWR)	NCDEQ	NCDEQ (DWI)	NCDEQ (DWR)	NCDOJ	NCDPS/FEMA
Project Type(s)	Water Quality Improvement	Water Quality Improvement	Water Quality Improvement	Water Quality Improvement	Water Quality Improvement	Flood Mitigation
Prior Year Awarded	$3,497,900	$19,320,806	Unknown	$3,211,054	$1,800,000	Unknown
Prior Year # of Projects	9	91	Unknown	47	8	Unknown
Match	40% of total request	Recommended, not required	20% of total request	50% of total request	Unknown	0-25%
Application Deadline	April 5, 2016	February 8, 2016	April 29, 2016	July 1 / January 1, 2016	December 11, 2016	Unknown
Guidelines / Criteria	http://portal.ncdenr.org/c/document_library/get_file?uuid=81694cd8-4f2f-49b7-81d7-1128ad65d15c&groupId=38364	http://www.cwmtf.net/Docs/Grant%20Criteria%20Guidelines.pdf	http://portal.ncdenr.org/c/document_library/get_file?uuid=dc38c95b-3a5d-49e9-94cd-0a88f7110648&groupId=14655572	http://www.ncwater.org/?page=7/	http://www.ncdoj.gov/EEG.aspx	https://www.ncdps.gov/div/EM/Documents/NCDisasterRecoveryGuide-2015.pdf

9. Preliminary Opinions of Probable Construction Cost

Preliminary opinions of probable construction cost were developed for each project presented in **Sections 4** and **5**. These estimates are provided to aid the City in planning and project prioritization, and do not reflect detailed design-level construction costs. The unit costs were obtained from recent bid tabulations from other municipalities and NCDOT projects, including administrative, easement acquisition, engineering, legal, and surveying costs. For projects with unique circumstances (such as RCBC installation beneath railroads), additional costs were developed with input from professional engineers, cost estimators, and contractors. The estimated construction costs presented in **Table 9-1** should be considered approximate and subject to change due to cost changes in general construction, materials, and transportation, among other factors. Detailed estimates for each project are provided in **Appendix G**.

Table 9-1: Primary System Preliminary Opinions of Probable Construction Cost

Project	Preliminary Project Cost	
	Alternative #1	Alternative #2
Greens Mill Run		
Rock Spring Road	$1,590,000	$2,100,000
College Hill Road	$920,000	*(N/A)*
South Elm Street	$2,810,000	$3,070,000
Reedy Branch		
Southeast Greenville Boulevard	$680,000	$680,000
South Wright Road	$620,000	$490,000
East 10th Street	$660,000	*(N/A)*
Fornes Run		
Crestwood Drive	$260,000	*(N/A)*
North Overlook Drive	$780,000	$780,000
Norfolk Southern Railway (FR)	$13,300,000	$12,650,000
East 14th Street	$1,200,000	*(N/A)*
North Fork Greens Mill Run		
Allen Road	$800,000	$800,000
Spring Forest Road (US)	$1,100,000	$620,000
Norfolk Southern Railway (NF)	$1,400,000	$1,190,000
Spring Forest Road (DS)	$2,330,000	$1,390,000
Ellsworth Drive	$1,870,000	$1,660,000
Total	**$30,320,000**	**$25,430,000**

Table 9-2: Secondary System Preliminary Opinions of Probable Construction Cost

Project	Preliminary Project Cost
Arlington Boulevard	$920,000
Bradley Street	$970,000
Brook Hollow Drive	$2,550,000
Brownlea Drive	$650,000
Cedar Lane	$650,000
Circle Drive	$1,680,000
Commerce Street	$430,000
Dellwood Drive	$750,000
Greenbriar Drive	$770,000
Lakewood Drive	$550,000
Jaycee Park	$480,000
Slay Drive	$1,640,000
Total	**$12,040,000**

Table 9-3: Stream Stabilization Preliminary Opinions of Probable Construction Cost

Project	Preliminary Project Cost
Dickinson Avenue	$500,000
South Elm Street	$440,000
Cedar Lane	$400,000
Forest Hill Drive	$820,000
South Evans Street	$1,110,000
St Andrews Drive	$3,430,000
Greenway at East 10th Street	$320,000
East 10th Street at Rock Spring Road	$240,000
Total	**$7,260,000**

Table 9-4: Stormwater BMP Preliminary Opinions of Probable Construction Cost

Project	Preliminary Project Cost
J.H. Rose High School	$170,000
ECU Athletic Maintenance Building	$150,000
Greenville Square Shopping Center	$440,000
Pirates Pointe Shopping Center	$76,000
Greenville Mall	$470,000
University Commons Shopping Center	$300,000
Guy Smith Park	$160,000
S. Greenville Elementary School	$170,000
Carolina East Mall	$340,000
Hastings Ford Dealership	$260,000
Jiffy Lube	$110,000
Jaycee Park	$180,000
Andrew A. Best Freedom Park	$99,000
First Pentecostal Holiness Church	$170,000
Dream Park	$140,000
Eastern Elementary School	$890,000
Arlington Crossing Shopping Center	$130,000
Physicians East Medical Center	$330,000
Wahl Coates Elementary School	$130,000
Total	**$4,720,000**

10. Prioritization and Recommendations

The projects identified in **Sections 4** and **5** are proposed to address flooding, roadway overtopping, erosion, and water quality concerns. In addition to project identification and preliminary cost estimating, a principal objective of the GMR WSMP is to prioritize the projects based upon several factors, including:

- Public health and safety
- Severity of street flooding
- Cost effectiveness
- Effect of improvements
- Water quality – Best Management Practice
- Open Channel – Stream Stabilization
- Implementation constraints
- Grant funding
- Constructability

Prioritization of the proposed projects was conducted on each of the four project types: Primary System flood control, Secondary System flood control, stream stabilization, and stormwater BMPs. Each project was assigned raw scores for the factors listed above; weighting factors were then applied to the raw scores. The weighted scores for each project were summed to calculate the total weighted scores. Projects were then ranked, in ascending order, from highest total weighted score to lowest. Tied rankings were resolved using the cost effectiveness benefit ratios, where a project with higher ratio was awarded the higher rank. Information pertaining to the benefit ratios is provided in **Appendix M**. Additionally, Primary System rankings were revised to reflect project dependency. Both sets of Primary System alternatives were scored and ranked among all primary system projects; however, only one alternative per stream may be selected in order to achieve the stated performances. Summaries of the project prioritizations are presented in **Table 10-1** through **Table 10-4**. Additional details regarding the prioritization process for both project types is provided in **Appendix M**.

Table 10-1: Primary System Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank
Allen Road - North Fork Greens Mill Run (Alternative #1 / #2)	187	1	1
Southeast Greenville Boulevard - Reedy Branch (Alternative #1 / #2)	181	2	2
Reedy Branch Project Group (Alternative #1)	169	3	3
South Wright Road - Reedy Branch (Alternative #1)			
East 10th Street - Reedy Branch (Alternative #1)			
Greens Mill Run Project Group (Alternative #2)	149	4	4
Rock Spring Road - Greens Mill Run (Alternative #2)			
South Elm Street - Greens Mill Run (Alternative #2)			
Greens Mill Run Project Group (Alternative #1)	149	4	5
Rock Spring Road - Greens Mill Run (Alternative #1)			
College Hill Road - Greens Mill Run (Alternative #1)			
South Elm Street - Greens Mill Run (Alternative #1)			
North Fork Project Group (Alternative #2)	141	6	6
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #2)			
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #2)			
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #2)			
Ellsworth Drive - North Fork Greens Mill Run (Alternative #2)			
Fornes Run Project Group (Alternative #1)	139	7	7
Crestwood Drive - Fornes Run (Alternative #1)			
North Overlook Drive - Fornes Run (Alternative #1)			
Norfolk Southern Railway (FR) - Fornes Run (Alternative #1)			
East 14th Street - Fornes Run (Alternative #1)			
South Wright Road - Reedy Branch (Alternative #2)	135	8	8
North Fork Project Group (Alternative #1)	131	9	9
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #1)			
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #1)			
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #1)			
Ellsworth Drive - North Fork Greens Mill Run (Alternative #1)			
Fornes Run Project Group (Alternative #2)	115	10	10
North Overlook Drive - Fornes Run (Alternative #2)			
Norfolk Southern Railway (FR) - Fornes Run (Alternative #2)			

*Project groups indicate project-dependency. Only one set of alternatives may be chosen per Primary System stream in order to achieve stated performance.
**Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table 10-2: Secondary System Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank
Greenbriar Drive System	151	1	1
Cedar Lane System	143	2	2
Dellwood Drive System	135	3	3
Circle Drive System	133	4	4
Jaycee Park System	125	5	5
Arlington Boulevard System	123	6	6
Slay Drive System	121	7	7
Commerce Street System	113	8	8
Brownlea Drive System	105	9	9
Bradley Street System	81	10	10
Lakewood Drive System	77	11	11
Brook Hollow System	69	12	12

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table 10-3: Stream Stabilization Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank
Forest Hill Drive	131	1	1
St Andrews Drive	119	2	2
East 10th Street at Rock Spring Road	119	2	3
Dickinson Avenue	91	4	4
South Evans Street	75	5	5
Cedar Lane	69	6	6
South Elm Street	69	6	7
Greenway at East 10th Street	63	8	8

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost per linear foot, with lower costs receiving a higher tie-breaking rank.

Table 10-4: Stormwater Best Management Practice Project Prioritization

Project	Total Weighted Score	Raw Rank	Tie-Break Rank
Jaycee Park	143	1	1
Eastern Elementary School	143	1	2
University Commons Shopping Center	131	3	3
ECU Athletic Maintenance Building	131	3	4
Greenville Square Shopping Center	131	3	5
Carolina East Mall	131	3	6
Pirates Pointe Shopping Center	131	3	7
First Pentecostal Holiness Church	131	3	8
Physicians East Medical Center	131	3	9
J.H. Rose High School	125	10	10
Jiffy Lube	125	10	11
Greenville Mall	119	12	12
Arlington Crossing Shopping Center	119	12	13
Guy Smith Park	111	14	14
Dream Park	111	14	15
Andrew A. Best Freedom Park	111	14	16
S. Greenville Elementary School	105	17	17
Hastings Ford Dealership	101	18	18
Wahl Coates Elementary School	75	19	19

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Maintenance Recommendations

The GIS inventory data were also examined to determine which Primary System crossings were in need of maintenance, denoted by either a “Poor” or “Repair” condition assessment during the inventory survey process. Crossings with proposed improvements due to LOS violations under existing land-use conditions were excluded from this analysis. This process determined that one of the two culverts at the East 14th Street crossing on Fornes Run was marked as repair in the inventory data. Upon a field inspection of the crossing, it was determined that both 72” CMP culverts should be replaced due to deformation and rust damage to both pipes. Note that this crossing included improvements in Fornes Runs Alternative #1, but no improvement was proposed for Alternative #2. Therefore, should Alternative #1 be selected, this maintenance project may be removed from this WSMP. However, if Alternative #2 is selected, replacement of the 72” CMPs is recommended. The estimated cost to replace the culverts in-kind is $260,000.

11. References

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A. Hydrologic Analysis

Per the SOP, the USACE HEC-HMS program was used as the basis for the hydrologic modeling of the Primary Systems, defined as the main stem of Greens Mill Run and its four major tributaries: Reedy Branch, Fornes Run, an Unnamed Tributary to Greens Mill Run, and Greens Mill Run North Fork. The HEC-HMS software was used to develop a surface runoff response to precipitation for the interconnected systems. Inputs included soils data, topographic data, land-uses, impervious area, and surveyed cross-sections. A NRCS Type III storm was used to develop the synthetic rainfall hydrographs for the 2-, 10-, 25-, 50-, and 100-year storm events. The SCS curve number approach was selected to develop runoff volume from subbasin areas. Times of concentration were translated to lag times to route the hydrographs through the system. Where attenuation behind major structures occurred, storage routing was incorporated into the model.

A.1 Watershed Subbasin Delineation and Connectivity

Subbasins were delineated for the Primary Systems using a combination of LIDAR data, aerial photographs, North Carolina Department of Transportation road layers, and the stormwater inventory obtained as part of the GMR WSMP development process. The preliminary subbasins were created using HEC-GeoHMS, then adjusted as needed based on available data. The subbasin boundaries were created at major roadway crossings, stream confluences, and known problem areas. In the urban portions of the watershed, the drainage area size was limited to 100 acres or less. In the rural portions of the watershed, the drainage area size was limited to approximately 400 acres. In all, eighty-nine subbasins were modeled.

A.2 Rainfall

Rainfall distributions for the City of Greenville were derived from the NRCS Type III storm. Cumulative rainfall depths, as specified in the City's SOP, are provided in **Table A-1**. These values were used to develop the design storm events for the 2-, 10-, 25-, 50-, and 100-year storm events. Five additional storm events were used to calibrate the hydrologic models. Tropical Storms (TS) Irene and Kyle were selected as high-flow calibration points, and Tropical Storm Andrea was selected as a low-flow calibration point. Two thunderstorms (occurring on 05/23/2012 and 07/02/2013) caused flash flooding within the watershed. The rainfall data for these five storm events was downloaded from the National Oceanic and Atmospheric Administration (NOAA) website for the City of Greenville Municipal airport. This data was input directly into the HEC-HMS model as a specified hyetograph.

Table A-1: Design Storm Rainfall Depths

Design Storm	Rainfall Depth (in)
2-Year, 24-Hour	3.76
10-Year, 24-Hour	5.81
25-Year, 24-Hour	7.23
50-Year, 24-Hour	8.47
100-Year, 24-Hour	9.84

A.3 Curve Number Development

A.3.1 Soils

The NRCS curve number method was utilized to develop runoff volumes for each subbasin. The curve number takes into account soil type, land-use, infiltration rates, and impervious area. The NRCS has developed soil types for Pitt County that identify the four primary hydrologic soil groups: A, B, C, and D. This data was overlain with the City's existing land-use layer to develop curve numbers for each subbasin. Originally to be conservative, combination soils (HSG A/D, B/D, and C/D soils) were assumed to fully saturated, therefore produced runoff similar to a HSG D soil. However, during the model validation/calibration phase, it was determined that this was overly conservative. The curve numbers were then adjusted to match the better drained soil condition. The **Table A-2** describes the hydraulic soil group conditions.

HSG A and A/D soils are the predominate hydrologic soil type within the Greens Mill Run watershed. The HSG A soils are located mostly in the eastern portion of the watershed; however, this is also where the majority of new development occurs, thus has a higher percentage of impervious area. The western portion of the watershed is dominated by combination soils, which could potentially cause a high amount of runoff when saturated. Refer to **Table A-3** and **Appendix C** for the hydrologic soil group information pertaining to the Greens Mill Run watershed.

A.3.2 Land-Use

The existing land-use was provided by the City of Greenville. These land-uses were intersected with the soils layer to develop curve numbers for the subbasins within the Greens Mill Run watershed. Land-use categories were outlined in Table 5 of the SOP. Of these, only ten land-uses were used for the Greens Mill Run watershed. **Table A-4** outlines the percentage of each existing land-use group.

Table A-2: Hydraulic Soil Groups (NRCS, 2011)

Hydraulic Soil Group	Description
A	Group A soils have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10% clay and more than 90% sand or gravel and have gravel or sand textures. The saturated hydraulic conductivity exceeds 0.3 inches per hour.
B	Group B soils have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10% - 20% clay and 50% - 90% sand and have loamy sand or sandy loam textures. The saturated hydraulic conductivity is between 0.15 – 0.3 inches per hour.
C	Group C soils have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20% - 40% clay and less than 50% sand and have loam, silt loam, sandy clay loam, clay loam and silty clay loam textures. The saturated hydraulic conductivity is between 0.05 – 0.15 inches per hour.
D	Group D Soils have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40% clay, less than 50% sand, and have clayey textures. The saturated hydraulic conductivity less than 0.05 inches per hour.
A/D	The first letter applies to the drained condition and the second to the undrained condition. For the purpose of the soil group, adequately drained means that the seasonal high water table is at least 60 centimeters (24 inches) below the surface.
B/D	The first letter applies to the drained condition and the second to the undrained condition. For the purpose of the soil group, adequately drained means that the seasonal high water table is at least 60 centimeters (24 inches) below the surface.
C/D	The first letter applies to the drained condition and the second to the undrained condition. For the purpose of the soil group, adequately drained means that the seasonal high water table is at least 60 centimeters (24 inches) below the surface.

Table A-3: Hydraulic Soil Group Distribution

HSG	Area (acres)	Total Area (%)
A	2,032	23%
B	1,022	12%
C	1,069	12%
D	426	5%
A/D	2,759	31%
B/D	1,171	13%
C/D	330	4%

Table A-4: GMR Land-Use

	Existing Conditions		Future Conditions	
Land-use Category	Area (acres)	Total Area (%)	Area (acres)	Total Area (%)
Industrial	154	1.8%	785	8.9%
Commercial	814	9.2%	1321	15.0%
Office/Institutional/Multi-Family	1611	18.3%	2070	23.5%
High Den Res	475	5.4%	844	9.6%
Med Den Res	454	5.1%	1427	16.2%
Low Den Res	773	8.8%	433	4.9%
Very Low Den Res	194	2.2%	27	0.3%
Open	3281	37.2%	1059	12.0%
Parking	65	0.7%	54	0.6%
ROW	990	11.2%	793	9.0%
Total	8,810	100%	8,810	100%

A.3.3 NRCS Curve Numbers

As stated in the City's SOP, the NRCS Curve Number approach was used to develop runoff volumes for the hydrologic modeling. The curve number methodology uses a combination of soils, land-use, and antecedent moisture conditions (AMC) to generate a unique curve number for each subbasin. The AMC is the total rainfall in a 5 day period preceding a storm event. The average antecedent moisture conditions (AMC-2) were used for the hydrologic calculations. Like the soils assumption, during validation/calibration, it was deemed too conservative to assume a fully saturated soil condition (AMC-3).

A weighted curve number was developed for each subbasin using the curve numbers outlined in the City's SOP. For each subbasin, the individual curve numbers were calculated by land-use and soil type. These were weighted against the total subbasin area to calculate the weighted curve number. A summary of the hydrologic inputs (including weighted curve numbers) are shown in **Table A-5**. Detailed calculations are included in **Appendices E** and **F**.

A.4 Lag Time

Lag time is defined by the NRCS as the delay, or lag, between the time runoff from a rainfall event over a watershed begins, until the runoff reaches its maximum peak (NRCS, 2010). Conceptually, lag may be thought of as a weighted time of concentration, where the centroids of the subbasin areas travel to the main watershed outlet. Based on the City's SOP, and standard HEC-HMS practice, the lag time was calculated per the following equation:

$$Lag\ Time = 0.6 * Total\ Time\ of\ Concentration$$

The time of concentration was calculated using the methodologies outlined in TR-55. The longest flow path was divided into three types of flow: overland flow, shallow concentrated flow, and channel flow. Overland flow was limited to a maximum of 300 feet in very flat areas with little to no slope. Generally, overland flow was limited to 100 feet. Shallow concentrated flow was calculated based on a paved or unpaved condition. Generally, shallow concentrated flow lengths were determined from available storm water inventory and aerial photographs. The flow lengths were taken until a defined channel or ditch was surveyed or visible from aerials. Channel flow was taken from the defined channel or ditch to the outlet of the subbasin. **Table A-5** outlines the calculated lag times for each subbasin modeled in HEC-HMS.

Table A-5: Subbasin Characteristics

Subbasin ID	Drainage Area (acres)	CN	Lag (min)	Subbasin ID	Drainage Area (acres)	CN	Lag (min)
W400	90.5	82	14.6	W800	222.7	59	63
W500	117.5	79	19.7	W810	76	65	14.9
W510	49.7	74	18.3	W820	34.8	54	15.3
W520	18.2	74	14.7	W830	16.8	59	11.6
W530	71.8	69	17.3	W840	101.1	86	14.4
W550	229.7	71	58.8	W850	102.3	79	8.3
W560	72	69	70.2	W860	80.3	63	15.2
W570	63.2	65	20.1	W870	9.8	82	14.2
W580	114.7	87	31.6	W880	244.4	53	28.2
W600	99	80	14.3	W890	72.4	85	22.6
W630	238.8	72	43.7	W900	82.8	79	24.3
W640	256.7	70	48.7	W910	75.3	58	55
W650	105.1	71	21.5	W920	294.8	66	101.1
W660	299.1	60	49.3	W930	116.6	67	56.5
W670	105.5	89	18.5	W940	201.2	54	36.1
W700	159.2	59	72.5	W950	69.1	60	21.9
W710	122	81	16.5	W960	52.8	79	21.5
W720	40.9	80	11.5	W970	120	80	34.3
W730	264.8	56	75.8	W980	164.4	72	84.2
W740	65.5	81	23	W990	226.5	74	46.7
W750	83	85	17.7	W1000	17.2	68	19.6
W760	104	69	38.8	W1100	94.8	57	14.3
W770	412.5	66	50.4	W1200	93.1	67	24.7
W780	157.9	65	27.8	W1300	98.5	65	17.6
W790	37.2	76	33.4	W1400	87.2	63	25.2
W1500	82.4	64	22.4	W3500	85.8	80	35.3
W1600	44.2	73	22	W3600	81.7	85	32.3
W1700	22.6	72	14.6	W3700	55	86	20.2
W1800	95.1	78	15.6	W3800	84.4	81	18.2
W1900	78.7	79	18.3	W3900	57.5	78	17.6
W2000	72.7	78	17.1	W4000	60.5	87	20
W2100	59.2	79	13.8	W4100	59.5	88	37.1
W2200	53.3	82	21	W4200	69	87	22.8
W2300	50.5	70	34.5	W4300	77.7	92	14.3
W2400	59.4	74	22.4	W4400	23.7	89	10.5
W2500	39.5	83	14.3	W4500	82.3	67	20.1
W2600	0.5	90	5.3	W4600	28.2	69	15.9
W2700	13.4	75	13.7	W4700	60.4	73	14
W2800	22.1	70	28.6	W4800	30.3	82	21.7
W2900	73.7	86	14.9	W4900	85.7	68	26.1
W3000	246.9	75	47.6	W5000	68.2	69	17.5
W3100	238.8	64	37.5	W5100	50	67	18.1
W3200	65.8	73	36.4	W5200	92.4	77	54.2
W3300	59.8	87	32.2	W5300	69.8	92	36.2
W3400	86	82	18.7				

A.5 Channel Elements

HEC-HMS allows for peak attenuation, or reduction, to occur within channels as the peak travels downstream due to the storage characteristics of the stream reach. The Muskingum-Cunge routing methodology was used in HEC-HMS to define the channel routing. The Muskingum-Cunge method is based on the stream reach's physical parameters, such as Manning's roughness, channel slope, and channel cross-section. Representative eight-point cross-sections were used to define the channel and floodplain cross-section for each reach. The cross-section used a combination of available surveyed channel data and LIDAR. In the upper headwaters, where survey cross-sections were unavailable, or no defined channel was present, trapezoidal cross-sections were used.

Reach lengths for each stream segment were calculated from a combination of surveys, NCDOT road layers, and available terrain data. Due to the combination of flat slopes and undersized structures, storage attenuation was significant during larger storm events. For this reason, two separate HEC-HMS models were developed: a low-flow model (2-year and below) and a high-flow model (10-year and above). To ensure that the model did not overestimate the attenuation that was occurring both behind crossing structures and within channels themselves, the reach lengths were adjusted for the high flow model to the beginning of the storage pool located behind the structure. A minimum of 10 feet was used, even though there were several instances where water pooled from one structure to the next.

A.6 Storage Attenuation

Reservoir routing was used to route hydrographs through storage areas located upstream of select structures. Per the SOP, these structures included those where fill heights were at least 50% of the structure height. Additional storage routing was added where significant impounding of water occurred behind structures, as noted by formation of level pools (flat water surface profiles) in the hydraulic model.

Storage routing was accomplished in HEC-HMS by utilizing the rating curve from HEC-RAS for the selected structures. Several iterations of both the hydrologic and hydraulic models were required to balance the peak flows between the two models. Balancing was required because flows generated from HEC-HMS that were input to HEC-RAS resulted in changes to the rating curves of the selected attenuation structures. The updated rating curves input to HEC-HMS from HEC-RAS then resulted in new flowrates. Thus, this process was repeated until flowrates stabilized between the two software programs. HEC-HMS used the Stage-Area-Discharge method to develop the storage routing.

For each structure, the reach length was cut off at the beginning of the backwater pool where the structure routing began. This was to ensure that the storage was not accounted for twice. A stage-area table was developed using the available topographic data. The stage-discharge table for each structure was taken from HEC-RAS output.

A.7 Model Calibration

The iterative process between HEC-RAS and HEC-HMS ensured that both models showed similar peak discharges and water surface elevations for the different storm events. However, the models also needed to be calibrated to actual field observations. A combination of questionnaire results, input from public meetings with residents, and results from interviews with City officials and NCDOT personnel were utilized to determine high water information throughout the watershed. NOAA rainfall data was obtained for the Pitt-Greenville Municipal airport. Several major storm events were selected from the data to calibrate the model. Hurricane Irene (2011) was selected as a high-flow event. The City experienced approximately 11 inches of rainfall during Hurricane Irene. Since it was a recent event, it was more likely that residents and City officials remembered specific high water levels. The City staff confirmed that aside from Hurricane Floyd, Irene was the largest storm event they had experienced in recent memory. Based on rainfall amounts and the watershed response, Hurricane Irene translates to between a 25-year to 50-year event.

Tropical Storms Kyle and Andrea were also selected, as they were fairly recent events. TS Kyle had approximately 5.5 inches of total rainfall. TS Andrea had approximately 1.7 inches of total rainfall. Two other flash flood events from 2012 and 2013 were also selected to incorporate a range of rainfall calibration data.

In the upper watershed, the land-use is typically rural agricultural fields with little to no slope. These fields have agricultural ditches that drain the field, but act as long, shallow ponds that do not drain. City officials confirmed that standing water was common in ditches and fields within the upper watershed.

The watersheds themselves provide additional storage due to a combination of very flat slopes and ditches which do not drain. This situation was difficult to model in the given parameters of HEC-HMS. Therefore, the time of concentration was lengthened for the basins located in the upper watershed to help account for the additional storage within the basins themselves. Also, the ponded areas for the storage reservoirs located in the upper watershed were increased by 20% to help account for the additional storage within the watershed. Curve numbers were adjusted in the upper watershed for open space to Pasture: Good Condition, as most of the land-use is agricultural in these areas.

Even with the changes made above, the models did not produce similar results to observed high water during Hurricane Irene, mostly in the upper watershed. As a final calibration technique, the original assumption of the combination soils (HSG A/D, B/D and C/D) performing as saturated HSG D soils was reversed. Based on rainfall data, the weeks leading up to Irene were very dry, therefore the soils probably responded under the better infiltration condition. Therefore, the soils were adjusted to the better condition as needed to achieve the level of performance historically seen by City staff. It should be noted that this is less conservative with regards to theoretical storms that may occur after heavy or prolonged rainfall. In this case, the models may be somewhat underestimating the amount of runoff produced in some areas, as the soils may potentially be at capacity, with little to no infiltration available.

A.8 Summary of Results

The HEC-HMS model was used to compute peak runoff for the 2-, 10-, 25-, 50-, and 100-year design storms, as well as five calibration storms. The results of the hydrologic model are summarized in the table below. **Table A-6** shows the computed discharges at major crossings throughout the watershed. The HEC-HMS input and output are included in **Appendix H**. Additionally, **Appendix J** contains the digital files of the HEC-HMS model.

A.9 Comparison of Peak Flows

Peak flows developed in HEC-HMS for this WSMP were compared to flows calculated by FEMA and current USGS regression equations to ensure that the HEC-HMS discharges were within reason. The FEMA discharges were developed using regression equations available at the time of the FEMA studies. Since these studies, the USGS released new regression equations in USGS SIR 2014-5030 (USGS, 2014).

Both FEMA and the USGS use regional river gage data to develop discharges based on empirical-based regression analysis. The discharges tend to be skewed based on flooding events over a larger area. In this case, the FEMA and USGS methodologies calculate discharges based on broad characteristics of eastern North Carolina and are not tailored to smaller drainage basins, such as the Greens Mill Run watershed. Such methods do not account for land use, soil types, rainfall, or other hydrologic and hydraulic factors. The regression equations also do not accurately predict discharges for drainage areas smaller than 0.1 square miles, or basins with impervious area greater than 34.8%. The heavily urbanized eastern portion of the GMR watershed, the Reedy Branch watershed, and the Fornes Run watershed all fall outside this impervious limit. In contrast, the HEC-HMS methodology used in this WSMP was tailored to the GMR watershed, by utilizing land-uses, soil types, and hydraulic features specifically within the watershed. Accounting for these watershed specific features results in discharges which are significantly higher than both the FEMA and regression based discharge values. **Table A-7** illustrates the differences between the peak flows of these three methods.

Table A-6: Summary of HEC-HMS Model Results – Existing Conditions

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-Use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run							
Reach-660	U/S Limit of GMR	40149	49	183	304	421	558
Reservoir-770	Allen Road	37950	125	455	748	1,019	1,139
Reach-770	D/S of Allen Road	37781	116	423	698	955	1,135
Reach-3100	U/S of Confluence with GMR North Fork	32869	164	544	923	1,277	1,577
Reservoir-2600	Dickinson Avenue	29957	303	825	1,295	1,737	2,054
Reach-780	D/S of Dickinson Avenue	29791	295	808	1,257	1,685	2,046
Reach-820	U/S of Confluence with Unnamed Tributary to GMR	27096	341	901	1,406	1,891	2,315
Reach-2500	D/S of Confluence with Unnamed Tributary to GMR	26096	670	1,666	2,455	3,188	4,045
Reservoir-860	Memorial Drive	25660	669	1,622	2,234	2,858	3,611
Reach-860	D/S of Memorial Drive	25462	641	1,567	2,177	2,799	3,559
Reach-810	U/S of Hooker Road	23596	704	1,679	2,323	2,971	3,765
Reservoir-2400	Hooker Road	22893	699	1,665	2,208	2,834	3,578
Reach-2400	D/S of Hooker Road	22704	690	1,655	2,205	2,831	3,572
Reach-790	U/S of CSX Railroad	21638	712	1,695	2,253	2,884	3,638
Reservoir-2300	CSX Railroad	21373	710	1,685	2,256	2,887	3,640
Reach-2300	D/S of CSX Railroad	21198	709	1,683	2,255	2,886	3,638
Reach-720	U/S of Arlington Boulevard	20096	736	1,735	2,313	2,951	3,721
Reservoir-2200	Arlington Boulevard	19396	736	1,730	2,312	2,947	3,722
Reach-2200	D/S of Arlington Boulevard	19096	736	1,730	2,311	2,947	3,722
Reach-600	U/S of Charles Boulevard	17596	974	2,108	2,882	3,559	4,272
Reservoir-3800	Charles Boulevard	15308	992	2,186	3,001	3,697	4,445
Reach-3800	D/S of Charles Boulevard	15023	992	2,177	2,990	3,686	4,431
Reservoir-2100	Norfolk Southern Railroad	14968	1,002	2,084	2,758	3,366	4,072
Reach-2100	D/S of Norfolk Southern Railroad	14807	1,001	2,082	2,755	3,361	4,063
Reach-4700	Near 11th Street	13604	996	2,084	2,755	3,351	4,044
Reach-2000	U/S of Rock Spring Road	12805	997	2,101	2,778	3,379	4,079
Reservoir-1900	Rock Spring Road	11822	1,006	2,108	2,783	3,410	4,122
Reach-1900	D/S of Rock Spring Road	11750	1,005	2,107	2,782	3,404	4,118
Reservoir-1800	College Hill Drive	10936	1,015	2,113	2,783	3,420	4,164
Reach-1800	D/S of College Hill Drive	10806	1,015	2,112	2,783	3,419	4,163
Reservoir-530	Elm Street	9856	1,027	2,098	2,746	3,355	4,178
Reach-530	D/S of Elm Street	9732	1,026	2,095	2,738	3,325	4,121
Reach-Fornescont	D/S of Confluence with Fornes Run	8229	1,137	2,374	3,193	3,877	4,779
Reservoir-510	10th Street	8019	1,131	2,367	3,184	3,871	4,739
Reach-510	D/S of 10th Street	7471	1,126	2,357	3,172	3,862	4,732

Table A-6 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-Use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run Continued							
Reach-500	D/S of Confluence with Reedy Branch	6500	1,112	2,542	3,282	4,114	5,072
Reservoir-400	5th Street	4008	1,113	2,516	3,307	4,111	5,100
Reach-400	D/S of 5th Street	3835	1,082	2,441	3,246	3,994	4,922
Outlet	D/S Limit of GMR	1890	1,060	2,412	3,198	3,941	4,813
Reedy Branch							
Reservoir-1700	Norfolk Southern Railroad	7801	36	75	95	116	139
Reach-1700	D/S of Norfolk Southern Railroad	6288	35	75	95	116	139
Reservoir-1200	14th Street	5356	50	99	117	135	158
Reach-1200	D/S of 14th Street	5241	49	99	117	135	158
Reservoir-1300	Wright Road	3208	92	224	297	362	443
Reach-1300	D/S of Wright Road	3113	91	223	297	362	442
Reach-4500	U/S of 10th Street	2002	125	355	495	612	752
Reservoir-520	10th Street	918	154	314	384	452	531
Reach-520	D/S Limit of Reedy Branch	734	154	314	384	452	531
Fornes Run							
Reservoir-1400	Charles Boulevard	8363	114	172	295	395	492
Reach-1400	D/S of Charles Boulevard	8188	114	172	279	361	461
Resevoir-1000	Greenville Boulevard	6071	134	226	296	334	361
Reach-1000	D/S of Greenville Boulevard	5636	134	226	296	334	361
Reach-1500	U/S of Norfolk Southern Railroad	4682	183	360	473	564	660
Reservoir-570	Norfolk Southern Railroad	3491	202	398	453	494	557
Reach-570	D/S of Railroad	3336	202	398	453	494	557
Reservoir-1100	Dalebrook Circle	2991	216	445	512	562	633
Reach-100	D/S of Dalebrook Circle	2884	215	443	509	558	624
Reach-FornesRun	D/S Limit of Fornes Run	723	224	475	565	643	737
Unnamed Tributary to Greens Mill Run							
Reservoir-930	Greenville Boulevard	13353	73	186	274	317	455
Reach-930	D/S of Greenville Boulevard	10471	67	160	227	283	340
Reservoir-940	Williams Road	8922	80	184	258	320	427
Reach-940	D/S of Williams Road	8762	80	184	258	320	425
Reach-950	Near Country Club Road	5403	149	410	634	831	1,054
Reach-880	D/S Limit of Unnamed Tributary to GMR	3804	388	889	1,290	1,646	2,050

Table A-6 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Existing Land-Use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run North Fork							
Reach-3000	U/S of Allen Road	8786	84	232	307	378	461
Reservoir-990	Allen Road	6966	122	308	435	692	950
Reach-990	D/S of Allen Road	6830	118	306	432	666	901
Reservoir-2800	Norfolk Southern Railroad	4027	125	285	329	364	395
Reach-2800	D/S of Norfolk Southern Railroad	3894	124	284	329	363	395
Reach-630	Ellsworth Pond	3086	125	287	332	367	400
Reservoir-2700	Ellsworth Drive	841	134	294	358	410	459
Reach-2700	D/S Limit of GMR North Fork	664	134	294	358	410	459

Table A-7: Existing Conditions Discharge Comparison

HEC-HMS Node	Location	Methodology	Return Period				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run							
Reservoir-770	Allen Rd	HEC-HMS	125	455	748	1,019	1,139
		USGS Regression Eq	121	304	420	514	615
		FEMA	N/A	166	N/A	327	418
Reach-3100	US Confluence with North Fork Greens Mill Run	HEC-HMS	164	544	923	1,277	1,577
		USGS Regression Eq	159	384	522	633	751
		FEMA	N/A	285	N/A	543	686
Reservoir-2600	Dickinson Ave	HEC-HMS	303	825	1,295	1,737	2,054
		USGS Regression Eq	284	663	893	1,076	1,271
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-820	US Confluence with Unnamed Tributary to Greens Mill Run	HEC-HMS	341	901	1,406	1,891	2,315
		USGS Regression Eq	342	771	1,027	1,228	1,441
		FEMA	N/A	320	N/A	605	762
Reservoir-860	Memorial Dr	HEC-HMS	669	1,622	2,234	2,858	3,611
		USGS Regression Eq	478	1,048	1,381	1,642	1,917
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-2400	Hooker Rd	HEC-HMS	699	1,665	2,208	2,834	3,578
		USGS Regression Eq	548	1,159	1,510	1,781	2,064
		FEMA	N/A	1,095	N/A	1,927	2,259
Reservoir-2300	Railroad	HEC-HMS	710	1,685	2,256	2,887	3,640
		USGS Regression Eq	570	1,199	1,558	1,835	2,124
		FEMA	N/A	N/A	N/A	N/A	N/A

Table A-7 Continued

HEC-HMS Node	Location	Methodology	Return Period				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run Continued							
Reservoir-2200	Arlington Blvd	HEC-HMS	736	1,730	2,312	2,947	3,722
		USGS Regression Eq	627	1,284	1,653	1,935	2,228
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-3800	Charles Blvd	HEC-HMS	992	2,186	3,001	3,697	4,445
		USGS Regression Eq	752	1,476	1,872	2,170	2,477
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-1900	Rock Spring Rd	HEC-HMS	1,006	2,108	2,783	3,410	4,122
		USGS Regression Eq	798	1,544	1,947	2,250	2,560
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-530	US Confluence with Fornes Run	HEC-HMS	1,026	2,095	2,738	3,325	4,121
		USGS Regression Eq	839	1,600	2,008	2,313	2,626
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-510	US Confluence with Reedy Branch	HEC-HMS	1,126	2,357	3,172	3,862	4,732
		USGS Regression Eq	927	1,733	2,161	2,477	2,800
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-400	5th St	HEC-HMS	1,113	2,516	3,307	4,111	5,100
		USGS Regression Eq	979	1,818	2,262	2,589	2,923
		FEMA	N/A	N/A	N/A	N/A	N/A
Outlet	Confluence with Tar River	HEC-HMS	1,060	2,412	3,198	3,941	4,813
		USGS Regression Eq	985	1,834	2,283	2,616	2,955
		FEMA	N/A	2,329	N/A	3,604	4,082
Reedy Branch							
Reservoir-1700	Railroad	HEC-HMS	36	75	95	116	139
		USGS Regression Eq	35	67	84	96	108
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-1300	Wright Rd	HEC-HMS	92	224	297	362	443
		USGS Regression Eq	120	192	224	246	267
		FEMA	N/A	147	N/A	306	365
Reach-1300	XS 2002	HEC-HMS	91	223	297	362	442
		USGS Regression Eq	125	197	229	250	270
		FEMA	N/A	300	N/A	571	667
Reservoir-520	10th St	HEC-HMS	154	314	384	452	531
		USGS Regression Eq	199	313	364	398	432
		FEMA	N/A	N/A	N/A	N/A	N/A

Table A-7 Continued

HEC-HMS Node	Location	Methodology	Return Period				
			2-year	10-year	25-year	50-year	100-year
Reedy Branch Continued							
Reach-520	Confluence with Greens Mill Run	HEC-HMS	154	314	384	452	531
		USGS Regression Eq	199	314	364	398	431
		FEMA	N/A	397	N/A	733	852
Fornes Run							
Reservoir-1400	Charles Blvd	HEC-HMS	114	172	295	395	492
		USGS Regression Eq	572	463	422	394	371
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-1000	Greenville Blvd	HEC-HMS	134	226	296	334	361
		USGS Regression Eq	433	446	444	439	435
		FEMA	N/A	440	N/A	778	889
Reservoir-570	Railroad	HEC-HMS	202	398	453	494	557
		USGS Regression Eq	370	479	519	542	564
		FEMA	N/A	509	N/A	898	1,030
Reservoir-1100	Dalebrook Cl	HEC-HMS	216	445	512	562	633
		USGS Regression Eq	364	491	540	570	598
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-FornesRun	Confluence with Greens Mill Run	HEC-HMS	224	475	565	643	737
		USGS Regression Eq	364	513	573	612	648
		FEMA	N/A	559	N/A	988	1,137
Unnamed Tributary to Greens Mill Run							
Reservoir-930	SW Greenville Blvd	HEC-HMS	73	186	274	317	455
		USGS Regression Eq	105	247	332	400	472
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-940	Williams Rd	HEC-HMS	80	184	258	320	427
		USGS Regression Eq	140	325	436	524	616
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-880	Confluence with Greens Mill Run	HEC-HMS	388	889	1,290	1,646	2,050
		USGS Regression Eq	264	539	690	805	923
		FEMA	N/A	N/A	N/A	N/A	N/A
Greens Mill Run North Fork							
Reservoir-990	Allen Rd	HEC-HMS	122	308	435	692	950
		USGS Regression Eq	118	275	367	441	518
		FEMA	N/A	N/A	N/A	N/A	N/A
Reservoir-2800	Railroad	HEC-HMS	125	285	329	364	395
		USGS Regression Eq	158	350	462	548	639
		FEMA	N/A	N/A	N/A	N/A	N/A

Table A-7 Continued

HEC-HMS Node	Location	Methodology	Return Period				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run North Fork Continued							
Reservoir-2700	Ellsworth Dr	HEC-HMS	134	294	358	410	459
		USGS Regression Eq	185	410	541	643	749
		FEMA	N/A	N/A	N/A	N/A	N/A
Reach-2700	Confluence with Greens Mill Run	HEC-HMS	134	294	358	410	459
		USGS Regression Eq	186	413	544	647	755
		FEMA	N/A	645	N/A	1,150	1,330

A.10 Future Conditions

The existing conditions HEC-HMS model was built upon to create the future conditions model. The future land-use layer was obtained from the City of Greenville planning department. Using the future land-use, new curve numbers were developed with similar methodology as described previously. As with the existing conditions, the higher infiltrating soil type was used for combination soils. Only the design discharges (2- to 100-year) were developed for the future conditions.

When comparing the existing and future curve numbers, there appeared to be some discrepancy regarding high, medium, low, and very low density residential classification. Table 2 of the SOP uses lot size to differentiate between the four classes of residential with the following dividing points: 1/8 acre, 1/4 acre, 1/2 acre and 2 acre lots. The lot sizing methodology was used to create the existing curve numbers; however, the future zoning classified areas as high, medium or low density residential with no details on lot sizing. It was often the case, especially in the lower end of the watershed, that the existing curve number had identified areas as high density residential, where the future layer showed the same area as medium density residential. Where discrepancies occurred, engineering judgment was used to determine the appropriate curve number. In most cases, the existing conditions were maintained if the area was already developed.

Curve numbers for the upper portion of the watershed increased significantly as the basins were rezoned from vacant or agricultural areas, to residential, commercial, or office space. When existing conditions showed a vacant area in a basin and a higher future curve number, then the future curve number was assumed to be correct. If a curve number changed by more than 10% from the existing condition, a new time of concentration was also developed. The new time of concentration was calculated using engineering judgment based on existing basin conditions that matched the future conditions of the new basin.

Attenuation was removed from the future conditions model, except in areas behind railroads, existing ponding structures, and where attenuation occurred on City-owned property. Attenuation remaining in the future conditions model was approved by city staff. Attenuation modeled at Ellsworth Drive Pond (Greens Mill Run North Fork) remained in the future conditions model, as the pond is unlikely to be removed and the surrounding area is already developed. The attenuation behind 5th Street (Greens Mill Run) also remained in future conditions, as the City-owned park adjacent to the greenway is not anticipated to have future development.

Attenuation was removed behind the Fornes Run railroad crossing. This was deemed conservative as the 72” CMP sleeve is considered a temporary measure. Eventually, the railroad will rehabilitate the pipe and impact the hydrology downstream. By removing the attenuation, it allows the full impact of the peak discharges to be accounted for developing alternatives downstream. Flows from HEC-HMS for future land-use conditions are provided in **Table A-8**. See **Section 4.1.1** for a complete listing of attenuation nodes in the future conditions model.

Table A-8: Summary of HEC-HMS Model Results – Future Conditions

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Future Land-Use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Greens Mill Run							
Reach-660	U/S Limit of Greens Mill Run	40149	315	597	798	975	1,170
Reservoir-770	Allen Road	37950	640	1,214	1,607	1,960	2,352
Reach-3100	U/S of Confluence with North Fork Greens Mill Run	32869	710	1,460	1,986	2,458	2,986
Reservoir-2600	Dickinson Avenue	29957	903	1,762	2,416	3,107	3,849
Reach-780	D/S of Dickinson Avenue	29791	856	1,670	2,298	2,956	3,663
Reach-820	U/S of Confluence with Unnamed Tributary to Greens Mill Run	27096	928	1,835	2,544	3,265	4,076
Reach-2500	D/S of Confluence with Unnamed Tributary to Greens Mill Run	26096	1,279	2,624	3,689	4,731	5,989
Reach-860	D/S of Memorial Drive	25462	1,263	2,599	3,665	4,703	5,943
Reach-810	U/S of Hooker Road	23596	1,311	2,695	3,802	4,879	6,169
Reach-2400	D/S of Hooker Road	22704	1,311	2,701	3,812	4,891	6,182
Reach-790	U/S of Railroad	21638	1,330	2,740	3,868	4,963	6,271
Reservoir-2300	Railroad	21373	1,326	2,733	3,852	4,921	6,229
Reach-2300	D/S of Railroad	21198	1,325	2,731	3,849	4,917	6,223
Reach-720	U/S of Arlington Boulevard	20096	1,348	2,780	3,917	5,002	6,329
Reservoir-2200	Arlington Boulevard	19396	1,352	2,788	3,929	5,017	6,346
Reach-600	U/S of Charles Boulevard	17596	1,413	2,912	4,093	5,235	6,604
Reach-3800	D/S of Charles Boulevard	15023	1,418	2,929	4,117	5,265	6,642
Reservoir-2100	Railroad	14968	1,419	2,914	4,058	5,206	6,603
Reach-2100	D/S of Railroad / 14th Street	14807	1,419	2,912	4,058	5,206	6,601
Reach-4700	Near 11th Street	13604	1,420	2,908	4,068	5,217	6,604
Reach-2000	U/S of Rock Spring Road	12805	1,421	2,910	4,078	5,231	6,615
Reach-1900	D/S of Rock Spring Road	11750	1,425	2,915	4,091	5,248	6,635
Reach-1800	D/S of College Hill Drive	10806	1,430	2,923	4,106	5,267	6,658
Reach-530	D/S of Elm Street	9732	1,437	2,920	4,117	5,275	6,646
Reach-Fornescont	D/S of Confluence with Fornes Run	8229	1,476	3,001	4,240	5,436	6,858
Reach-510	D/S of 10th Street	7471	1,475	2,998	4,237	5,431	6,849
Reach-500	D/S of Confluence with Reedy Branch	6500	1,490	3,031	4,292	5,499	6,931
Reservoir-400	5th Street	4008	1,492	3,033	4,301	5,508	6,376
Reach-400	D/S of 5th Street	3835	1,480	3,004	4,257	5,435	6,339
Outlet	D/S Limit of Greens Mill Run	1890	1,474	2,987	4,228	5,383	6,331

Table A-8 Continued

HEC-HMS Node	Location	HEC-RAS Station	Flowrates Under Future Land-Use Conditions (cfs)				
			2-year	10-year	25-year	50-year	100-year
Reedy Branch							
Reservoir-1700	Railroad	7801	36	75	95	116	139
Reach-1700	D/S of Railroad	6288	35	75	95	115	139
Reservoir-1200	14th Street	5356	49	110	140	167	200
Reach-1200	D/S of 14th Street	5241	96	235	328	412	509
Reservoir-1300	Wright Road	3208	138	355	509	640	788
Reach-4500	U/S of 10th Street	2002	177	467	677	855	1,054
Reservoir-520	10th Street	918	36	75	95	116	139
Fornes Run							
Reservoir-1400	Charles Boulevard	8363	160	265	342	410	486
Resevoir-1000	Greenville Boulevard	6071	192	345	462	569	691
Reach-1500	U/S of Railroad	4682	245	479	651	810	997
Reservoir-570	Railroad	3491	274	551	751	939	1,165
Reservoir-1100	Dalebrook Circle	2991	293	600	824	1,032	1,282
Reach-FornesRun	D/S Limit of Fornes Run	723	306	632	876	1,102	1,371
Unnamed Tributary to Greens Mill Run							
Reservoir-930	Greenville Boulevard	13353	171	320	430	529	639
Reach-940	D/S of Williams Road	8762	226	452	632	795	978
Reach-950	Near Country Club Road	5403	399	833	1,128	1,404	1,760
Reach-880	D/S Limit of Unnamed Tributary to Greens Mill Run	3804	639	1,336	1,808	2,234	2,732
Greens Mill Run North Fork							
Reach-3000	U/S of Allen Road	8786	163	297	384	464	554
Reservoir-990	Allen Road	6966	321	607	796	960	1,144
Reservoir-2800	Railroad	4027	263	349	402	428	500
Reach-2800	D/S of Railroad	3894	261	349	401	426	491
Reach-630	Ellsworth Pond	3086	263	353	406	431	496
Reservoir-2700	Ellsworth Drive	841	214	373	472	550	651
Reach-2700	D/S Limit of North Fork Greens Mill Run	664	214	373	472	549	651

B. Hydraulic Analysis

The purpose of the hydraulic modeling analysis was to determine an existing level of flooding and to develop proposed alternatives to help mitigate flooding on both the Primary and Secondary Systems. For the Primary System, the USACE HEC-RAS program was used for the hydraulic modeling. Peak flows developed from the HEC-HMS program were used to develop a backwater analysis for the five Primary System streams. The Storm Water Management Model developed by the EPA was selected to analyze the selected fourteen Secondary Systems. EPA SWMM is a dynamic model that integrates the precipitation/runoff hydrology model with stormwater network routing.

B.1 Primary System Models

The HEC-RAS model performs one-dimensional steady- and unsteady-state hydraulics calculations. The model calculates water surface elevations, energy losses, flow velocities, and effects of bridges and culvert crossings. A steady-state, sub-critical flow model was created for each of the five Primary System streams: Greens Mill Run, Reedy Branch, Fornes Run, an Unnamed Tributary to Greens Mill Run, and Greens Mill Run North Fork.

FEMA had HEC-RAS models for four of the Primary System streams; the Unnamed Tributary to Greens Mill Run is not a FEMA regulated stream, thus no model was available. The hydraulic models developed for this WSMP, except for the Unnamed Tributary to GMR, were built upon the FEMA models, using data obtained from the inventory process. The model for the Unnamed Tributary to Greens Mill Run was developed using available LIDAR, survey, and inventory data.

The HEC-RAS models calculated flood elevations at each of the modeled cross-sections for the Primary System. The analysis was based only on the existing condition of the structures as they were surveyed as part of the stormwater inventory collection. Where noted, debris and sediment deposits were included in the model. However, flood elevations produced by the model may be considered valid only if the hydraulic structure conditions remain as the time of survey. Additional sediment and / or debris can raise flood elevations. A hard copy of the HEC-RAS outputs for all the Primary System streams is included in **Appendix H**. A digital copy of all HEC-RAS models is also provided in **Appendix J**.

B.1.1 Existing Conditions

B.1.1.1 Greens Mill Run

FEMA had two models for Greens Mill Run. The older model extents started from the confluence of the Tar River to just upstream of Dickinson Avenue. The model appeared to be a HEC-2 model that was imported into HEC-RAS. There was no geospatial data associated with the cross-sections, and the stationing did not match the GIS database received from the North Carolina Floodplain Mapping Program (NCFMP, 2015).

The newer HEC-RAS model extended from the last cross-section of the downstream model at Dickinson Avenue to approximately 2,000 feet upstream of Allen Road. The two models were merged together to create the basis for the existing conditions on Greens Mill Run. The following additional steps were also taken to build the existing conditions model:

- Manning's n-values were updated from the FEMA model based on photos taken during the field inventory and aerial photography. Channel n-values were determined to be between 0.04 and 0.044 as the channel is fairly straight with some pools and shoals. For the overbanks, the n-values ranged from 0.035 in areas of grass or fields to 0.1 in areas of heavy trees (USACE, 2010).
- The structures were updated with data provided from the inventory and channel survey data, where provided. The bounding cross-sections at the structures were not coordinately correct based on the GIS data in the downstream effective FEMA model. Therefore, all bounding cross-sections at the structures were added to the model. Topography used a combination of LIDAR and structure survey data. The ineffective areas were revised around the structures based on the distance of the bounding cross-sections from the structure. Contraction/Expansion coefficients were revised to 0.3/0.5 around the structures for two cross-sections upstream and one downstream.
- The 14th Street Bridge data (XS 14329) was taken from the NCDOT Bridge Inspection Report. The internal cross-section channel data used the downstream soundings reported in the Bridge Inspection Report (**Appendix L**).
- The channel bottoms for cross-sections 30467, 30096, 29540, 29096, 28576, 28096, 25735, 25096, 24096, 23596, 22990, 22383, and 22096 were raised based on surrounding channel survey data provided in the inventory.
- Cross-sections 32350, 28321, and 9101 were added based on channel survey data provided from the inventory.
- Channel data were changed based on survey data at cross-sections 18614 (FEMA XS 18521), 16457 (FEMA XS 16364), 15393 (FEMA XS 15301), 13066 (FEMA XS 13004), 11048 (FEMA XS 11048), 10529 (FEMA XS 10529), 10000 (FEMA XS 10000), 7885 (FEMA XS 7883), 7471 (FEMA XS 7470), 5500 (FEMA XS 5498), and 1890 (FEMA XS 1891).
- Footbridges at XS 10970 and XS 9081 were added to the model. LIDAR data was used to determine the top of road elevations. These structures were not surveyed as part of the structure inventory; however, basic structure measurements were taken during a hydraulic field visit in August 2014.
- The starting boundary condition was set to a normal depth value of 0.0008.

B.1.1.2 Reedy Branch

The FEMA model was used to develop the existing conditions model for Reedy Branch. There was associated geospatial data within the FEMA model that corresponded to the FEMA geodatabase. The FEMA model reached from the confluence with Greens Mill Run to upstream of the Norfolk Southern Railway crossing. The model was extended to the downstream side of

Red Banks Road. The following steps were taken to update the FEMA model to create the existing conditions model:

- New cross-sections 6622 - 7801 were added to the model. The topography was taken from available LIDAR data.
- New road crossings for Dellwood Drive (XS 7399) and SE Greenville Blvd (XS 6771) were added; structure data was taken from the LIDAR data for top of road and the stormwater inventory data.
- FEMA cross-sections were re-stationed based on GIS data. FEMA cross-section stations were labeled in the description for each cross-section; reach lengths were also revised based on GIS data.
- New cross-sections 5381, 4182, 3284, 3074, and 2076 were added. Topography was taken from LIDAR and channel survey.
- The bounding cross-sections for 14th Street (FEMA XS 5335 and 5235) were replaced with XS 5356 & XS 5241 based on survey data.
- Manning's n-values were updated based on photographs and aerial imagery.
- Structures were updated with survey and channel data, where provided.
- Contraction/Expansion coefficients were revised to 0.3/0.5 around the structures for two cross-sections upstream and one downstream.
- Ineffective areas were revised around structures based on available survey data and distances from structures.

B.1.1.3 Fornes Run

The FEMA model was used to develop the existing conditions model for Fornes Run. The FEMA model had geospatial data within the HEC-RAS model that matched the associated FEMA geodatabase. The model was extended from the confluence with Greens Mill Run to just downstream of the Greenville Mall parking lot. The following steps were taken to update the FEMA model to create the existing conditions HEC-RAS model:

- The FEMA model was extended to downstream of Mall parking lot.
- New cross-sections 6632 - 8363 were added to the model. The topography was taken from available LIDAR data.
- New road crossing at Charles Blvd (XS 8290) was added; structure data was obtained from LIDAR and stormwater inventory data for the top of road.
- FEMA XS 5683 was replaced with XS 5636 based on survey data.
- Cross-sections 4597 and 4362 were added to the model. Topography was taken from LIDAR and channel survey.
- The channel for FEMA XS 3819 was revised based on channel survey.
- FEMA XS 3579 was replaced with XS 3534 based on channel survey.
- FEMA XS 3377 was replaced with XS 3336 based on structure survey.
- FEMA XS 3295 was replaced with XS 3266 based on channel survey.
- Cross- section 3049 was added to the model. Topography was taken from LIDAR and channel survey.

- FEMA XS 2632 was replaced with XS 2718. Topography was taken from LIDAR and channel survey.
- Cross-sections 2475 & 1121 were added to the model. Topography was taken from LIDAR and channel survey.
- Manning's n-values were updated based on photographs and aerial imagery.
- Structures were updated with survey and channel data where provided.
- Contraction/Expansion coefficients were revised to 0.3/0.5 around the structures for two cross-sections upstream and one downstream.
- Ineffective areas were revised around structures based on available survey data and distances from structures.
- The inventory data indicated that there are two 48" floodplain pipes beside the 72" (sleeved) CMP under the Norfolk Southern Railway. The inventory was unable to pick up the downstream invert elevation on the eastern-most floodplain pipe, therefore an invert of 29.05' was assumed to maintain positive slope.
- The inventory data indicated that there was a blind junction at the crossing with US 264 Alt (XS 5876). There is a 36" PVC and a 60" CMP pipe inlet. These pipes cross under US 264 Alt and outlet to a 9'x6.5' pipe arch. The junction box was listed under the Difficult Access structures (DA). The model shows that the culvert is under "outlet control". Due to the unique conditions, the structure was modeled two different ways:
    - The inlet condition (36" PVC & 60" CMP)
    - The outlet condition (8.6' x 6.4' CMPA)
    - To be conservative, the inlet condition was modeled. However, due to the unique structure conditions, the model was over-estimating the water surface elevations based on resident and City staff knowledge. Therefore the 36" pipe was revised to a 42" to allow for more water to pass through the system and calibrate the model to known storm events.

B.1.1.4 Unnamed Tributary to Greens Mill Run

There was no FEMA model available for the Unnamed Tributary to Greens Mill Run. The tributary is located in the upper southeastern portion of the watershed and runs through the Greenville Country Club golf course. Available LIDAR data and channel inventory data were used to build the geometry for the modeled cross-sections. The model extended from the confluence with Greens Mill Run to just upstream of Allen Road. The following steps were taken to create the existing conditions model:

- The boundary conditions for the 2-year storm event were set to normal depth, as the peak event is not affected by Greens Mill Run. The boundary condition for the 10-, 25-, 50-, and 100-year storm events were set to a known water surface elevation, which was the calculated tailwater from, Greens Mill Run during the same storm.
- Cross-sections were based on LIDAR, inventory data, and available aerial photography.

- Road Crossings for Allen Rd (XS 13134), Dickinson Ave (XS 12262), Railroad (XS 11857), SW Greenville Blvd (XS 10681), and Williams Rd (XS 8827) were added to the model. Structure data was taken from LIDAR for top of road and inventory data.
- Structures 4480, 3767, 3152, 2201, 1937, 1738, and 1080 were located on the Greenville Country Club golf course. Structure 4480 was included in the inventory database. All the other structures had basic dimensions measured during the hydraulic field reconnaissance in August 2014. Top of road elevations were taken from LIDAR and channel elevations were taken from the field measurements.
- Manning's n-values were selected based on photographs and aerial imagery.
- Contraction/Expansion coefficients were revised to 0.3/0.5 around the structures for two cross-sections upstream and one downstream. The structures located within the Greenville Country Club (Structures 3767 – 1080) are on-grade structures that do not constrict the floodplain flow, so the coefficients were left as 0.1/0.3.
- Ineffective areas were calculated around structures based on available survey data and distances from structures.

B.1.1.5 Greens Mill Run North Fork

The FEMA model was used as the basis for the Greens Mill Run North Fork existing conditions model. The FEMA model extended from the confluence with Greens Mill Run to the downstream side of Allen Road. The FEMA model appeared to be a HEC-2 model that was imported into HEC-RAS. There was no associated geospatial data for the cross-sections within the FEMA model. Geospatial data was added to the model based on the FEMA geodatabase provided. The existing model was extended to just upstream of Radio Station Road. Additional changes were made to the FEMA model to create the existing conditions model in HEC-RAS:

- The boundary conditions for the 2-year storm were set to normal depth, as the event was not affected by Greens Mill Run. However, during larger storm events (10-year and above) tailwater effects from Greens Mill Run influenced the North Fork. Therefore the 10-year, 25-year, 50-year, and 100-year boundary conditions were set to the correlating backwater elevations from Greens Mill Run, based on the North Fork discharges for these storm events.
- New cross-sections 8786 through 6830 were added to the model. Topography was a combination of LIDAR and channel survey data, where available.
- New road crossings were added at Radio Station Road (XS 8740) and Allen Road (6917). Top of road elevation data was taken from LIDAR data and structure inventory data was used for the culvert information and inverts.
- Effective cross-section 6796 was deleted. Based on GIS data, this cross-section was actually on a tributary of the North Fork and not on the main stem.
- Reach lengths were revised to account for new cross-sections.
- The bounding cross-sections at structures were not coordinately correct based on GIS data in the effective FEMA model. This error was potentially due to the HEC-2 method of modeling structures, where the bounding cross-sections were set to

the deck width of the structure. The error did not appear to have been revised in the effective HEC-RAS model. Therefore, all bounding cross-sections around structures were added from LIDAR and channel survey data. Stationing was based on GIS data. All structures were updated based on provided inventory data. Ineffective areas were revised based on new distances from structures.

- New cross-sections 1500 and 902 were added in Ellsworth Lake. Topography was taken from LIDAR and the lake bottom was assumed from bank elevation and structure invert depth at the riser.
- Structure 723.4 is a 10' riser structure with a 42" outlet pipe. There are three 30" overflow pipes. The main constriction was due to the 42" outlet pipe, therefore the model reflected the outlet pipe and overflow pipes, and ignored the 10' riser to be conservative.
- Manning's n-values from the effective model were revised. Manning's n-values for the channel ranged from 0.025 in the lake to 0.045 in the winding channel with shoals. Overbank values ranged from 0.015 for large parking lot areas, 0.035 for areas of grass or fields, to 0.1 in heavily forested areas.
- Contraction/Expansion coefficients were revised to 0.3/0.5 around the structures for two cross-sections upstream and one downstream.

B.1.2 Model Calibration

A combination of questionnaire results, input from public meetings with residents, and interviews with City officials and NCDOT personnel were utilized to determine high water information throughout the watershed. Based on conversations with NCDOT personnel and City staff, the lower portion of the watershed experiences major structure overtopping during frequent, flash flood events. The upper watershed does not experience localized flooding to the same extent. Interviews with the City staff illustrated the following flooding problems throughout the watershed:

- Greens Mill Run
    - From Allen Road to Dickinson Avenue, the water frequently overflows the banks by 1 - 2 feet. City staff does not recall seeing water overtop Allen Road or Dickinson Avenue; however, City staff reports that they do not usually have reports in the upper watershed, so it may overtop the road during a large storm event and they may not be aware.
    - City staff does not recall Memorial Drive overtopping, but water has risen to the bottom of the deck during large storm events. City staff states that the country club golf course does get inundated. Homes along Millbrook Road also have frequent reports of flooding, to the point where the City has looked to use the FEMA buy-out program for repetitive-loss properties. The resident surveys confirm this.
    - Hooker Road has not been overtopped according to City staff. City maintenance staff have seen water out of the banks by 2 - 3 feet.

- Along Arlington Road and Evans Road, City staff has not seen Arlington overtop; however, Evans overtops frequently. The maintenance staff reported having to close Deck Street due to flooding 1 - 2 times per year.
- Charles Boulevard overtops during similar storm events as Evans Street. City staff remembered a flash flood where 3” of rain fell in two hours; Charles was very close to overtopping, but it did not overtop at that time.
- Along 14th Street, the stream will surcharge to the south side inlets and the staff indicated that this may be a result of the poor condition of the outlet pipe for the roadway drainage system. They had seen the road overtop, but not the bridge itself.
- College Hill and Rock Springs Roads frequently overtop. City staff mention that during a good rainfall, they close the intersections with 10th Street due to flooding. The east-bound lanes of 10th Street also experience flooding.
- City staff has not seen Elm Street overtop. The 10th Street crossing was overtopped during Floyd, but they have not seen it since.
- City staff has not seen the 5th Street crossing overtop.

- Reedy Branch
  - Along Reedy Branch, City staff has not seen the road crossings overtop. Wright Road has failing drainage infrastructure that is causing maintenance issues.
- Fornes Run
  - Along Fornes Run, City staff has not seen the road crossings overtop. However, the City was unsure when the railroad had rehabilitated the crossing in this area. They believe it was 5+ years ago.
- Unnamed Tributary
  - City staff stated they have seen flooding on Allen Road and the intersection of Dickinson Avenue and Greenville Boulevard. They believed it may be caused by surface flooding and not necessarily the creek overtopping the road.
  - City staff has also seen Greenville Boulevard overtop, but again they thought it may have been caused by a drainage problem and not necessarily caused by the stream itself.
  - The City staff had never seen Williams Road overtop.
- Greens Mill Run North Fork
  - City staff has no knowledge of Radio Station or Allen Roads overtopping; however, it is a sparsely populated area and they have not had reports about the area.
  - The City has not seen either crossing of Spring Forest Road overtop; however, they said it has gotten close on the downstream crossing when the lake backs up.
  - The lake at Ellsworth Drive has had debris problems in the past, which has caused some flooding issues. The City has never seen the road overtop, but it has come close when the outlet was clogged with debris.

Based on these observations, the HEC-RAS models were calibrated with a combination of revising the discharges (see **Appendix A**) and adjusting Manning's n-values. Top of road elevations were adjusted based on the available surveyed rim elevations plus a 6" curb. In the instance of Greenville Boulevard along Fornes Run, the blind junction box configuration was over-estimating the flooding. The structure was adjusted to allow for more flow through the inlet condition to maintain consistency with City staff observations.

B.1.3 Future Conditions

All of the Primary System models were developed utilizing the future conditions discharges described in **Appendix A**. Since the lower portion of the watershed is almost at full build-out, Manning's n-values were assumed to remain as existing conditions. The upper watershed is mostly undeveloped. Based on the City's future zoning plans, the Manning's n-values were adjusted to account for future development of the floodplain. The City's zoning shows that a wooded buffer will be maintained to protect the streams from future development. A combination of aerial photography, the City's future zoning layer, and engineering judgment was used to assign Manning's n-values to the future conditions. If a certain area already had development, it was assumed that this remained unchanged in the future.

The existing conditions of the structure crossings remained unchanged for future conditions. If current conditions showed sediment blockage, it is assumed that this is an on-going condition and was modeled as such. Until the overlying issues of sediment and erosion are addressed upstream, the structure will continue to fill in; therefore it was deemed more conservative to show the existing blockages in the future conditions models. The City may choose an active maintenance plan to clean out the culverts, which may help future performance.

B.1.4 Summary of Results

Thirty-three major road crossings were analyzed for flooding hazards in the Greens Mill Run watershed. **Tables B-1** through **B-5** illustrate the hydraulic performance of the major structure crossings for each of the Primary System models, for each of the design storm events, in the following scenarios:

- Existing land-use conditions with existing infrastructure
- Future land-use conditions with existing infrastructure
- Future land-use conditions with Alternative #1 infrastructure
- Future land-use conditions with Alternative #2 infrastructure

For the streams with proposed infrastructure improvements, flows based upon future land-use conditions were revised to reflect balancing of the hydrologic and hydraulic models due dimensional improvements to culverts at or downstream of modeled attenuation nodes.

Table B-1: Summary of Primary System HEC-RAS Results - Greens Mill Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Existing Infrastructure - Existing Land-Use Conditions						
Allen Road	70.5	59.2	62.6	64.9	67.4	68.8
Dickinson Avenue Extension	56.0	46.5	49.4	51.6	53.5	55.2
South Memorial Drive	47.6	41.2	43.9	45.6	47.1	**48.2**
Hooker Road	43.8	38.6	41.0	42.2	43.6	**45.0**
CSX Railroad	50.1	37.2	39.3	40.3	41.2	42.4
West Arlington Boulevard	39.8	33.4	35.6	36.5	37.5	39.1
Evans Street	33.9	32.3	**34.5**	**35.1**	**35.5**	**35.9**
Charles Boulevard	31.0	29.1	**31.9**	**32.7**	**33.5**	**34.5**
Norfolk Southern Railway	47.3	28.8	31.4	32.5	33.4	34.4
East 14th Street	28.0	27.3	**29.2**	**30.4**	**31.1**	**31.7**
Rock Spring Road	28.0	23.0	27.6	**29.4**	**30.0**	**30.4**
College Hill Drive	25.8	20.4	23.7	**26.5**	**27.4**	**27.9**
South Elm Street	24.2	18.3	22.0	23.9	**25.3**	**26.0**
East 10th Street	23.0	14.2	16.1	17.5	19.0	20.6
East 5th Street	21.2	9.7	12.5	13.9	15.2	16.7
Existing Infrastructure - Future Land-Use Conditions						
Allen Road	70.5	64.2	69.5	**71.4**	**71.9**	**72.2**
Dickinson Avenue Extension	56.0	49.8	53.6	**56.5**	**56.9**	**57.3**
South Memorial Drive	47.6	43.1	47.0	**48.4**	**49.0**	**49.6**
Hooker Road	43.8	40.2	43.2	**45.4**	**46.5**	**47.3**
CSX Railroad	50.1	38.6	41.0	42.7	43.9	45.2
West Arlington Boulevard	39.8	34.7	37.2	39.3	**40.4**	**41.0**
Evans Street	33.9	33.3	**35.3**	**35.9**	**36.6**	**37.9**
Charles Boulevard	31.0	30.4	**32.9**	**34.5**	**35.8**	**37.4**
Norfolk Southern Railway	47.3	30.0	32.7	34.4	35.7	37.2
East 14th Street	28.0	**28.1**	**30.5**	**31.5**	**32.4**	**33.3**
Rock Spring Road	28.0	24.8	**29.6**	**30.4**	**31.0**	**31.6**
College Hill Drive	25.8	21.7	**26.9**	**27.8**	**28.3**	**28.8**
South Elm Street	24.2	19.8	**24.5**	**25.8**	**26.5**	**27.2**
East 10th Street	23.0	14.9	17.1	19.6	21.6	**24.6**
East 5th Street	21.2	10.6	13.5	15.5	17.3	**21.0**

Table B-1 Continued

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Alternative #1 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Allen Road	70.5	64.2	69.5	**71.4**	**71.8**	**72.2**
Dickinson Avenue Extension	56.0	50.5	54.7	**56.7**	**57.0**	**57.3**
South Memorial Drive	47.6	43.7	47.4	**48.5**	**49.1**	**49.6**
Hooker Road	43.8	40.2	43.5	**45.6**	**46.5**	**47.3**
CSX Railroad	50.1	38.6	41.1	42.8	44.0	45.3
West Arlington Boulevard	39.8	35.4	38.2	**40.2**	**40.9**	**41.5**
Evans Street	33.9	33.6	**35.3**	**35.9**	**36.6**	**37.8**
Charles Boulevard	31.0	30.4	**32.9**	**34.4**	**35.6**	**36.9**
Norfolk Southern Railway	47.3	29.9	32.8	34.4	35.6	36.9
East 14th Street	28.0	**28.1**	**29.8**	**31.2**	**32.1**	**33.0**
Rock Spring Road	28.0	23.8	27.3	**30.2**	**31.0**	**31.8**
College Hill Drive	25.8	22.1	24.5	**27.0**	**28.0**	**28.5**
South Elm Street	24.2	19.2	22.1	24.1	**25.7**	**26.6**
East 10th Street	23.0	14.9	17.6	20.0	21.7	**23.8**
East 5th Street	21.2	10.6	13.5	15.3	16.9	18.3
Alternative #2 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Allen Road	70.5	64.2	69.5	**71.4**	**71.8**	**72.2**
Dickinson Avenue Extension	56.0	50.5	54.7	**56.7**	**57.0**	**57.3**
South Memorial Drive	47.6	43.7	47.4	**48.5**	**49.1**	**49.6**
Hooker Road	43.8	40.2	43.5	**45.6**	**46.5**	**47.3**
CSX Railroad	50.1	38.6	41.1	42.8	44.0	45.3
West Arlington Boulevard	39.8	35.4	38.2	**40.2**	**40.9**	**41.5**
Evans Street	33.9	33.6	**35.3**	**35.9**	**36.6**	**37.8**
Charles Boulevard	31.0	30.4	**32.9**	**34.4**	**35.6**	**36.9**
Norfolk Southern Railway	47.3	29.9	32.8	34.4	35.6	36.9
East 14th Street	28.0	**28.1**	**29.7**	**30.9**	**32.0**	**32.9**
Rock Spring Road	28.0	23.7	26.6	**29.7**	**30.8**	**31.7**
College Hill Drive	25.8	22.2	25.1	**27.1**	**28.1**	**28.6**
South Elm Street	24.2	19.2	22.1	24.1	**25.7**	**26.6**
East 10th Street	23.0	14.9	17.6	20.0	21.7	**23.8**
East 5th Street	21.2	10.6	13.5	15.3	16.9	18.3

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.

Table B-2: Summary of Primary System HEC-RAS Results - Reedy Branch

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Existing Infrastructure - Existing Land-Use Conditions						
Southeast Greenville Boulevard	66.4	62.3	**66.8**	**66.9**	**67.0**	**67.1**
Norfolk Southern Railway	66.4	57.8	59.2	59.9	60.6	61.7
East 14th Street	56.5	51.7	53.8	54.8	55.9	**56.7**
South Wright Road	33.5	32.2	**34.3**	**34.5**	**34.7**	**34.8**
East 10th Street	34.3	17.4	20.4	22.6	24.2	27.6
Existing Infrastructure - Future Land-Use Conditions						
Southeast Greenville Boulevard	66.4	62.3	**66.8**	**66.9**	**67.0**	**67.1**
Norfolk Southern Railway	66.4	57.8	59.2	59.9	60.6	61.7
East 14th Street	56.5	51.7	54.3	**56.5**	**56.8**	**56.9**
South Wright Road	33.5	32.6	**34.3**	**34.9**	**35.3**	**35.5**
East 10th Street	34.3	17.8	24.8	**34.6**	**35.3**	**35.6**
Alternative #1 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Southeast Greenville Boulevard	66.4	60.5	61.9	62.7	64.0	**66.5**
Norfolk Southern Railway	66.4	57.8	59.2	59.9	60.6	61.7
East 14th Street	56.5	51.7	54.3	56.5	**56.8**	**56.9**
South Wright Road	33.5	30.5	32.4	33.3	**34.8**	**35.6**
East 10th Street	34.3	17.8	23.7	28.1	33.6	**35.3**
Alternative #2 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Southeast Greenville Boulevard	66.4	60.5	61.9	62.7	64.0	**66.5**
Norfolk Southern Railway	66.4	57.8	59.2	59.9	60.6	61.7
East 14th Street	56.5	51.7	54.3	56.5	**56.8**	**56.9**
South Wright Road	33.5	30.5	33.4	**35.0**	**35.5**	**35.9**
East 10th Street	34.3	17.8	24.8	**34.6**	**35.3**	**35.6**

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.

Table B-3: Summary of Primary System HEC-RAS Results - Fornes Run

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Existing Infrastructure - Existing Land-Use Conditions						
Southeast Greenville Boulevard	58.8	50.4	51.9	54.4	56.3	58.2
Crestwood Drive	42.7	38.4	40.4	**42.8**	**43.6**	**44.2**
North Overlook Drive	39.3	34.9	37.9	**40.2**	**41.2**	**42.8**
Norfolk Southern Railway	51.9	33.3	36.1	38.8	41.1	42.7
14th Street	37.3	29.4	33.5	35.5	37.2	**37.8**
Dalebrook Drive	34.1	27.6	31.4	32.9	34.1	**34.7**
Existing Infrastructure - Future Land-Use Conditions						
Southeast Greenville Boulevard	58.8	51.3	57.1	**59.3**	**59.6**	**59.7**
Crestwood Drive	42.7	39.1	**43.8**	**47.3**	**52.0**	**52.3**
North Overlook Drive	39.3	35.7	**42.6**	**47.2**	**52.0**	**52.3**
Norfolk Southern Railway	51.9	34.1	42.6	47.2	**52.0**	**52.3**
14th Street	37.3	30.5	**37.7**	**38.2**	**38.5**	**38.8**
Dalebrook Drive	34.1	28.9	**34.6**	**35.3**	**35.8**	**36.2**
Alternative #1 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Southeast Greenville Boulevard	58.8	52.0	57.1	**59.3**	**59.5**	**59.7**
Crestwood Drive	42.7	39.1	40.9	42.5	**43.7**	**44.2**
North Overlook Drive	39.3	34.6	36.6	38.6	**40.1**	**40.9**
Norfolk Southern Railway	51.8	32.7	35.6	37.3	38.8	40.4
East 14th Street	37.3	29.3	35.0	36.2	37.1	**37.8**
Dalebrook Circle	34.1	28.9	**34.5**	**35.4**	**35.8**	**36.2**
Alternative #2 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Southeast Greenville Boulevard	58.8	51.3	57.1	**59.2**	**59.5**	**59.6**
Crestwood Drive	42.7	39.1	42.2	**43.6**	**44.1**	**44.6**
North Overlook Drive	39.3	34.3	39.2	**40.4**	**41.1**	**42.6**
Norfolk Southern Railway	51.8	32.3	38.5	39.7	40.8	42.4
East 14th Street	37.3	30.5	**37.7**	**38.3**	**38.5**	**38.8**
Dalebrook Circle	34.1	28.9	**34.5**	**35.4**	**35.8**	**36.2**

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.

Table B-4: Summary of Primary System HEC-RAS Results - Unnamed Tributary

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Existing Infrastructure - Existing Land-Use Conditions						
Southwest Greenville Boulevard	68.5	62.7	64.3	65.4	66.2	67.4
Williams Road	65.0	58.7	61.1	62.9	64.6	**65.6**
Existing Infrastructure - Future Land-Use Conditions						
Southwest Greenville Boulevard	68.5	64.3	66.4	67.5	68.2	**68.9**
Williams Road	65.0	60.8	64.7	**65.6**	**65.8**	**66.0**
Alternative #1 Infrastructure - Future Land-Use Conditions (Revised Flows)						
(None)						
Alternative #2 Infrastructure - Future Land-Use Conditions (Revised Flows)						
(None)						

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.

Table B-5: Summary of Primary System HEC-RAS Results - North Fork

Location	Minimum Elevation at Top of Road (ft, NAVD)	Calculated Water Surface Elevations (ft, NAVD)				
		2-year	10-year	25-year	50-year	100-year
Existing Infrastructure - Existing Land-Use Conditions						
Allen Road	70.3	64.9	68.0	70.0	**71.2**	**71.5**
Spring Forest Road	64.3	59.8	63.1	**64.7**	**65.2**	**65.7**
Norfolk Southern Railway	67.9	58.3	62.0	63.3	64.4	65.5
Spring Forest Road	64.3	54.3	57.3	57.6	57.7	57.8
Ellsworth Drive	56.0	54.2	**56.9**	**57.3**	**57.5**	**57.6**
Existing Infrastructure - Future Land-Use Conditions						
Allen Road	70.3	68.2	**71.1**	**71.4**	**71.6**	**71.8**
Spring Forest Road	64.3	62.7	**65.1**	**65.9**	**67.0**	**68.1**
Norfolk Southern Railway	67.9	61.3	64.0	65.9	67.0	**68.1**
Spring Forest Road	56.8	56.7	**57.7**	**57.9**	**57.9**	**58.1**
Ellsworth Drive	56.0	56.0	**57.4**	**57.7**	**57.8**	**57.8**
Alternative #1 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Allen Road	70.3	65.2	66.8	68.3	70.0	**71.0**
Spring Forest Road	64.3	61.2	64.2	**65.2**	**65.9**	**67.0**
Norfolk Southern Railway	67.9	60.8	63.3	64.8	65.9	66.9
Spring Forest Road	64.3	61.2	64.2	**65.2**	**65.9**	**67.0**
Ellsworth Drive	56.0	54.5	55.8	**57.4**	**57.6**	**57.8**
Alternative #2 Infrastructure - Future Land-Use Conditions (Revised Flows)						
Allen Road	70.3	65.2	66.8	68.4	69.9	**71.0**
Spring Forest Road	64.3	61.2	64.1	**65.2**	**65.9**	**67.0**
Norfolk Southern Railway	67.9	60.8	63.3	64.8	65.9	66.9
Spring Forest Road	64.3	61.2	64.1	**65.2**	**65.9**	**67.0**
Ellsworth Drive	56.0	54.5	55.8	**57.4**	**57.6**	**57.8**

*Bold text indicates the existing water surface has exceeded the minimum elevation at the road, thereby causing flooding.

B.2 Secondary System Models

The EPA Storm Water Management Model is a dynamic rainfall-runoff simulation model that calculates the runoff and hydraulic capacity for stormwater conveyance systems. EPA SWMM includes both a hydrologic and hydraulic component for an integrated simulation. The program was used to determine the Secondary System capacities, including the effect of backwater, flat or negative slopes, energy losses, minor headlosses associated with bends, and entrances and exits. The dynamic wave routing model was utilized with a one-second time-step due to backwater effects, pressurized flow, and flow reversal present in the models. The simulation duration was 29 hours to allow all of the water to exit the system after the 24-hour storm event. Other general model setup options included: allowing ponding at sag nodes, one minute reporting time steps, and using curve number infiltration. The following input data was used to create the existing conditions models.

B.2.1 Nodes

The stormwater inventory included information gathered for catch basins, drop inlets, yard inlets, junction boxes, slab top inlets, difficult access (DA) structures, and underground pipe junctions. Inputs into SWMM included: X & Y coordinates, invert elevations, box depth, and surcharge depth (for locked or buried structures). The naming convention for the nodes in SWMM mimicked the stormwater inventory, using the last seven characters of the *Unique ID* field. If a node was not picked up as part of the inventory, an arbitrary name was assigned.

Inverts were taken from the stormwater inventory field *Out1_Inver*. For difficult access and underground junctions, an invert was assumed based on surrounding inverts to maintain positive drainage. The box depth was taken from the inventory field *Out1_Dpth*. As a check, the invert elevation was subtracted from the rim elevation. In the cases of underground junctions, the maximum depth based on SWMM calculations is not the ground surface, but the top of the highest connecting link. Therefore the maximum depth was set to zero and allowed the program to select the highest connecting link as the depth calculation. For catch basins, the maximum depth included the back of the curb, which was assumed to be a standard 6 inch concrete curb.

Surcharge depth was left as the default of zero, except for the underground junctions. To simulate pressurized flow at these junctions, the surcharge depth was set to 100 feet. This high value was used to ensure that the nodes pressurized, preventing volumetric loss of water until this additional depth was exceeded.

B.2.2 Links

B.2.2.1 Channels and Pipe Links

The stormwater inventory included data for open channel ditches, culverts, and pipes. Inputs into SWMM included: inlet and outlet nodes, shape, depth, length, roughness, inlet and outlet offsets, and losses, where applicable. The naming convention for the links was similar to the nodes, where the last five characters were assigned. Overland links were designated with *ST-*.

For circular pipes, the depth was determined as the diameter collected in the stormwater inventory. For open channels, either a trapezoidal or irregular shape was assumed. The dimensions were taken from the stormwater inventory. The length was taken from the stormwater inventory, were available. Otherwise it was measured in GIS from upstream to downstream node. The inlet and outlet offsets were calculated using the invert information gathered from the inventory database. The Manning's roughness coefficients (**Table B-6**) were selected from SOP.

Table B-6: Manning's Roughness Coefficients for Pipes

Material	Manning's Roughness Coefficients
Clay	0.014
CMP	0.024
CPE	0.020
DIP	0.011
PVC	0.010
RCP	0.013

The entry and exit loss coefficients were determined based on Tables 9 and 10 of the SOP. Pipes contracting from a manhole/inlet were assigned an entry loss coefficient of 0.5. For pipes expanding into a manhole/inlet, the exit loss coefficient was 0.7. As described in the SOP, bend loss coefficients were divided between the two joining pipes and added to the exit loss coefficient. The bend losses were divided based on the angle of the bend and applied to the pipes accordingly. For channels, entrance and exit loss coefficients did not apply. If a pipe was discharging into a channel, the exit loss of 1.0 was applied. If a channel was entering into a pipe, a coefficient of 0.5 or 0.9 entrance loss was applied depending on the entrance condition.

B.2.2.2 Overland Links

Secondary links were used to model overland flow along street gutters or parking lots, where overland flow could be determined to connect between two inlets. This allowed the model to bypass surcharging nodes to the next available inlet. The overland links were modeled as irregular cross-sections, with the full road section and overbanks behind the curb line. This ensured that all runoff volume is accounted for, and not lost from the system. A standard curb height of 6 inches was used. Roads were assumed to have a normal crown with flow available down both sides of the road, unless otherwise indicated from aerial photography. The road width was measured from GIS aerials.

B.2.3 Subcatchments

Subcatchments were drawn in GIS for junctions that accept incoming runoff, which included: catch basins, drop inlets, yard inlets, and pipe ends. Subcatchment boundaries were estimated using a combination of available terrain data and aerial photography.

As stated in the SOP, the subcatchment width was determined by calculating the watershed area divided by the longest flow path as measured in GIS. To calibrate the models, the width was adjusted accordingly to match calculated discharges developed using the rational method. The percent slope was calculated using the difference in elevation from the upper portion of the subcatchment to the rim elevation of the input node divided by the longest flow path.

Depression storage for impervious and pervious areas represent the depth of depression storage on impervious and pervious portions of the subcatchment area. The default values described in the EPA SWMM Manual were used.

The percent impervious represented the amount of impervious land area that was directly connected to the inlet node. Directly connected areas included: roads, driveways, parking lots and buildings surrounded by impervious area. These areas were separated from the pervious areas when calculating a curve number for the subcatchment. The remaining impervious areas, namely residential buildings, were accounted for in the curve number calculation. The pervious and indirectly connected impervious surfaces were calculated using the City's building layer, soils, and aerial photography to develop a weighted curve number for each subcatchment area. The subcatchment routing method was set to Outlet, allowing runoff from both pervious and impervious areas to flow directly to the inlet node.

B.2.4 Rain Gage

Rain gage data for the 2-, 10-, 25-, 50-, and 100-year storm events utilized the SCS Type III synthetic storm, with a 6-minute cumulative time interval. The rainfall depth for each storm event was outlined in the City's SOP.

B.2.5 Model Calibration

It was generally assumed that the stormwater networks were designed for the 10-yr storm event. The rational method peak discharges were used as a basis of comparison for all of the subcatchment area peak discharges. Rational C-values were assumed for the pervious areas of the basins. Time of concentration was calculated via the Kirpich method. Any time of concentration less than 5 minutes was rounded up to 5 minutes for the comparison of discharges. All calculated times of concentration were rounded up to the nearest whole minute for the flow comparison. Subcatchment widths were adjusted to calibrate the peak flows to the calculated peak flows developed using the Rational Method. Other methods of calibrate included reducing the Manning's n-value for the pervious surfaces from the default value of 0.15. These calibrations were done on a case-by-case basis to produce realistic flows for the alternatives analysis.

B.2.6 Existing Conditions

Fourteen Secondary Systems within the Greens Mill Run watershed were analyzed under existing land-use conditions. These analyses were used to identify systems, or portions of systems, failing to provide at least a 10-year level of service. Descriptions and brief summaries of the modeling results are provided below. Full model results can be found in **Appendices H** and **J**.

B.2.6.1 Arlington Boulevard

The Arlington Boulevard system stretches from West Arlington Boulevard, from the CSX Railroad crossing beside Marvin Jarman Road to the outlet across the street from Greenville Middle School. Due to the size of the upstream portions of the watershed, portions of the stormwater network were simplified into larger subcatchments, with calculated time of concentrations. The neighborhood through Hooker Road that outlets into the stormwater detention pond was one of these areas. Exiting the detention pond, the network continues to Greens Mill Run. The network consists of curb inlets, drop inlets and slab top inlets. The City has reported road flooding along Arlington Boulevard at the railroad crossing. The following steps were taken to create the existing conditions model:

- Junction B055845 is listed as an underground pipe junction in the Stormwater Inventory. The pipe invert was assumed to be 48.8 feet.
- A 65 acre subcatchment was drawn to encompass the area draining to the detention pond. The rational method and the Kirpich method were applied to get an understanding of expected peak flows and time of concentrations. EPA SWMM was then used to generate an outflow hydrograph for the 65 acre subcatchment. The hydrograph produced a reasonable time of concentration, but the peak was much lower than the rational method. The resulting hydrograph was used as an inflow for the detention pond and a scale factor was applied to make the peak flows match the rational method. A corresponding hydrograph and scale factor was applied for each design storm.
- The detention pond beside the school was assumed to have an invert elevation of 46 feet and a maximum depth of 18 feet. This depth is to ensure no water volume was lost in the model. A table was created that illustrates the surface area verses elevation to model storage.
- A weir, orifice, and emergency spillway were routed for the combination outlet of the detention pond.
- Three school parking lot links/nodes (PK001, PK002, PK003) were added with assumed inverts, depths, 15” diameter pipes and material (RCP). Street links were added where appropriate.

Six overland links we added on West Arlington Boulevard. Curb height was assumed to be 6 inches. Cross-section overbanks outside of the curb line were set high enough to prevent ponded water from leaving the system during analysis.

Some notable observations about the results from this model:

- During the 2-year storm:
    - The upper junctions near the railroad are flooding.
    - Most of the pipes along Arlington Boulevard are flowing full.
- During the 10-year storm:
    - All but two pipes in the system surcharge during the 10-year storm.

B.2.6.2 Bradley Street

The Bradley Street system is located north of Greenville Middle School, which is off West Arlington Boulevard. The stormwater network collects drainage from the housing development on Kennedy Circle and Bradley Street and directs it into a channel and is piped under the railroad. The network continues through a residential neighborhood and eventually discharges into another channel off South Green Street, which flows directly into Greens Mill Run. The City of Greenville reports flooding at the end of Bradley Street, stating that the railroad ditch frequently has standing water that floods the yard of the house at the end of Bradley Street. The following assumptions were made to create the existing conditions model:

- Two curb and gutter links ST45690 and ST45691 were added to account for flow on McClellan Street.
- The invert for UGPJ B045689, was assumed to be 42.8 feet
- The invert for UGPJ B045695, was assumed to be 31.7 feet
- The maximum depth was increased for Nodes B045685, B045686, B045690, and B045691; the program was allowed to select the highest connected conduit depth. This fixed a warning message due to the overland link elevations were higher than the depth of the inlet box.

Some notable observations were as follows:

- During the 2-year storm:
  - Nodes B045682 and B045683 are flooding.
  - Water overflows the railroad ditch at B045683 due to the limiting capacity of the existing 36” CMP.
- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, node B045684 is flooding.

B.2.6.3 Brook Hollow Drive

The Brook Hollow Drive system is located just north of the intersection of Brook Hollow Drive and Dickinson Avenue. The model encompasses approximately 39 acres of residential subdivision drainage. The area is primarily multi-family residential lots with 1/8-1/4 acre lot sizes. The 48” RCP outfall discharges to a swale just outside of the stream buffer for Greens Mill Run. The inlets are primarily catch basins in the roads and yard inlets in the drainage easement between the houses. The storm system predominately drains from south to north.

There is one flooding report from a resident of the Brook Hollow subdivision. The report addresses observed flooding on Brook Hollow Drive and erosion along the rear of the property, adjacent to the fence line.

The erosion is believed to be caused by current construction in the immediate area. The subdivision is still undergoing construction and the temporary drainage is diverting more offsite drainage than the surrounding drainage infrastructure (ditches and yard inlets) are designed to handle. Thus, the storm system adjacent to the flooding report at the rear fence was not modeled.

The following assumptions were made to create the existing conditions model:

- Five curb and gutter links were added to the model and assumed to be a full street cross-section (normal crown). The links were added between junctions that are connected with curb and gutter. Curb height was assumed to be 6 inches. Cross-section overbanks outside of the curb line were set high enough to prevent ponded water from leaving the system during analysis.
- Contour data does not appear to account for recent grading as part of the subdivision development. Therefore, assumptions of street sag versus on grade inlets were made based on inlet proximity and the difference in inlet elevation. When the calculated slope between an inlet and its adjacent inlets was less than the 0.3%, it was assumed the inlet was in a sag condition. If the calculated slope between inlets was greater than 0.3%, engineering judgement was used to determine whether or not flows bypassed to another inlet.
- Based on the surveyed storm system layout (combination of street catch basins and yard inlets between the backs of the units), it was assumed that drainage break lines were at road centerlines and at the location of the highest roofline. Longitudinal roadway crest locations were assumed using available terrain and aerial photography. Location of inlets, intersections factored into this design assumption.
- Difficult access junction, B086113, contains no survey information for rim or invert. For Link 086114, the downstream invert is unknown and for link 086113, the upstream invert is unknown. The rim elevation from the adjacent junction B086114 (yard inlet) was assumed to be the rim elevation for DA structure B086113. Using the invert elevations of structures B086112 & B086114, the invert for structure B086113 was linearly interpolated from the two known points.
- Tailwater for the system outlet was taken from the Greens Mill Run HEC-RAS model from the cross-section just upstream of the outfall (RS 35432.5). Tailwater elevations are 59.3, 60.2, 60.5, 61.0, and 61.6 feet for the 2-, 10-, 25-, 50-, and 100-year flood events, respectively.
- All models were run with *Normal* set as the outfall condition. All models but the 2-yr were run with “Fixed Tailwater” condition, to simulate backwater effects from Greens Mill Run. The Greens Mill Run 2-year tailwater is below the invert of the outfall pipe.
- Subcatchment basin slopes could not be calculated due to lack of accurate topographic data. All initial model runs were made assuming 1.00% basin slopes. Subcatchment basin slopes were altered during subsequent model runs to calibrate the model.
- Subcatchment slopes were adjusted from 1% up to 4% and/or sub-catchment widths were doubled from initial calculated values to calibrate peak SWMM discharges to the rational method peak discharges. Based on available terrain

data, 4% was assumed to be the maximum watercourse slope for the sub-catchment areas.
- Links B086107, B086111, B086112, B086128, B086129 and B086146 were surveyed to have negative slopes. Slopes were not adjusted to achieve positive drainage in the network.

Some notable observations about the results from this model:

- During the 2-year storm:
  - The pipe system along Cambria Drive is surcharging.
  - Flooding is shown at Nodes B086121, B086122, B086146, B086155, B086156, B086117, B086118 and B086120.
- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, ponding is shown at Nodes B086149, B086119 and B086113.
  - Curb and gutter link ST86146 is flooded.
- During the 25-year storm:
  - In addition to the flooded nodes during the 10-year event, ponding is shown at Nodes B086144 and B086145.
  - Curb and gutter 'ST-' link ST86145 is flooded.

B.2.6.4 Brownlea Drive

The Brownlea Drive system is along Brownlea Drive north of Maplewood Court to East 10th Street. The system then ties into the system that runs along East 10th Street to the culverts across Greens Mill Run to the west. The areas along Browlea Drive are primarily residential lots between 1/4 - 1/2 acres. Along East 10th Street, there is primarily commercial development and multi-family apartment complexes. The 24" RCP carries stormwater from Brownlea Drive and East 10th Street directly to Greens Mill Run. The outlet appears to be located inside the box culvert under East 10th Street.

There is one flooding report registered from the property owner located at 1305 East 10th Street. The owner reported that 2 - 3 times per year, water runs from the street into the parking lot and is a few inches deep. The property is not part of the Brownlea network; however, bypass flooding from inlet B025448 could potentially impact this property. The following steps were taken to create the existing conditions model:

- The invert of the outfall is unknown, as it is located inside the box culvert. An invert of 15.0 feet was assumed to maintain positive drainage in the system.
- Six street links were added to the model. The street links assumed the full roadway (from gutter line to gutter line) could potentially convey flow. Curb heights were assumed to be 6 inches. Cross-section overbanks outside of the curb line were set high enough to prevent ponded water from leaving the system during analysis.
- Assumptions of sag versus on grade (catch basin) inlets were made based on available LIDAR data, surveyed rim elevations and engineering judgement. Inlets

B015171, B015180, B015181 and B015182 were set as sag inlets. All other catch basin inlets were assumed to be on grade and were connected via overland (ST-) links.

- Subcatchment widths were adjusted from initial calculated values to adjust peak SWMM discharges more closely to the rational method peak discharges. The N-PERV values of the subcatchments were also adjusted to 0.06 from the default value of 0.15.

Some notable observations were as follows:

- During the 2-year storm
  - No nodes are flooded.
  - The 18" RCP between B025445 and B025448 is flowing full.
- During the 10-year storm
  - Nodes B025446, B025447 and B025448 show flooding.
  - There is street flooding between Inlets B025446 & B025448 and between inlets B025447 & B025450.
- During the 25-year storm
  - In addition to the flooded nodes during the 10-year event, inlets B025443 and B025445 show flooding.
  - In addition to the flooded street links during the 10-year event, there is street flooding between Inlets B025445 and B0245446.

B.2.6.5 Cedar Lane

The Cedar Lane system is located along Cedar Lane between the Jaycee Park and Tryon Drive. The model encompasses the parking lots for the Jaycee Park and Eastern Elementary School. The area is primarily single family residential lots with less than 1/2 acre lot size. The outfall ditch is located between Eastern Elementary School and South Wright Road. The ditch joins another drainage system and continues until the outfall with Reedy Branch. The modeled outfall is located at the pipe end east of Jefferson Drive. The inlets are primarily catch basins with the central drainage pipe running underneath Cedar Lane. The following assumptions were made to create the existing conditions model:

- Ten (curb and gutter links were added to the model and assumed to be half the road width (normal crown) and were linked between junctions that are connected with curb and gutter. Curb height was assumed to be 6 inches.
- Junction 1 does not appear in the Stormwater Inventory. This junction appears to be a catch basin located at the southern portion of the intersection of Cedar Lane and Golden Road. The rim elevation was assumed to be elevation 41 feet and a standard box depth was used to set the invert. A 15" RCP was assumed to connect Junction 1 to B010181.
- Junction 2 and Junction 3 do not appear in the Stormwater Inventory. These junctions indicate the endpoints of a concrete swale out of the northern end of the elementary school parking lot. Junction 2's invert elevation was set equal to the

ground elevation of 39 feet and Junction 3's invert elevation was 38.9 feet. The swale was modeled as an open rectangle with a maximum depth of 0.5 feet, bottom width 5 feet, and an overall length of 26.9 feet.

Some notable observations were as follows:

- During the 2-year storm:
  - Curb and gutter links are flooded due to node B010179.
- During the 10-year storm:
  - Seven additional nodes near the Wright Road intersection show flooding.
- During the 25-year storm:
  - Two additional nodes are flooded.

B.2.6.6 Circle Drive

The Circle Drive model is located southeast of the Dowdy-Ficklen Stadium between Charles Boulevard and South Elm Street. The network runs through a residential neighborhood. It begins on East Berkley Road and flows down Forest Hill Drive. The network then cuts across Circle Drive, down Birch Street and Rosewood Drive. It outlets into a stormwater detention pond behind the stadium.

Four resident interviews reported street flooding and non-hurricane related flooding in this area 2 - 3 times per year, with water up to 6 inches in the street. There are additional reports of slow and possibly clogged drains. The following steps were used to create the existing conditions model:

- The Stormwater Inventory indicated that the junction, B040905, on E Berkley Road at the beginning of the system could not be found. An invert elevation of 66.4 feet and a maximum depth of 3 feet were assumed.
- The invert for the UGPJ B040886 was assumed to be 54.7 feet.
- Four curb and gutter links, ST40894, ST40896, ST40906, ST40904, were added to account for flow running down Forest Hill Drive.
- Two models were developed. The first model used a normal depth outfall condition, which assumed that the ECU BMP is functioning properly. The second model used known information to route the dry detention pond behind ECU.

A summary of the results for the model which accounted for proper function of the ECU BMP is below:

- During the 2-year storm:
  - Eight nodes show flooding: B040893, B040894, B040895, B040896 and B044202 (Forest Hill Drive), B040889 and B040891 (Circle Drive), B040885 (Rosewood Drive).
  - Two curb and gutter links, ST40894 and ST40896, along Forest Drive are flowing due to junctions surcharging.
  - The 15" pipe connecting junctions B040899 to B040886 is flowing full.

- The 18" pipes connecting junctions B040886 to B040887and B040887 to B040888 are flowing full.
- The 24" pipes connecting junctions B040888 to B042886 and B042886 to B040915 are flowing full.

- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, one junction on Circle Drive, B040890; and one on Rosewood Drive, B040887, are flooded.
- During the 25-year storm:
  - One additional junction on Rosewood Drive, B040886, is flooded.
  - In addition to the links above, the 15" pipes connection junctions B040903 to B040900 and B040900 to B040907 are flowing full.

B.2.6.7 Commerce Street

The portion of concern for Commerce Street model starts at a drop inlet on Commerce Street and flow behind several residential properties before discharging into a ditch. The ditch flows into a tributary which is picked up as part of the Lakewood Drive model. The entire model includes the drainage network along Greenville Boulevard, East Arlington Boulevard, and the BMP behind the Greenville Square Shopping Center. The upper portion of the Commerce system did not have reported flooding and was not considered a priority area. This area was simplified to create larger drainage areas where there were pipe size changes.

The flooding report came from a business owner along Commerce Street. The owner specified that during heavy rains, the storm drains clog and street flooding is a concern. The owner also reported parking lot flooding in his business. The following steps were taken to create the existing conditions model:

- Junctions T021552 and T025965 are listed as underground junctions in the Stormwater Inventory. Inverts were assumed to be 61.0 and 58.2 feet based on surrounding inverts.
- The Stormwater Inventory did not report an invert for difficult access structure T025962 the outlet structure for the BMP; an invert was assumed at 60.7 feet.
- The detention pond behind the shopping center was assumed to have an invert elevation of 60.7 feet and a maximum depth of 3.3 feet. A table was created that illustrated the surface area verses elevation to model storage. To prevent any water volume being lost in the model the depth of the pond was increased to 10 feet.
- For the simplified sections of the Commerce model entry and exit loss coefficients were additive along the pipe for each omitted junction.
- Two street links were added on Southeast Greenville Boulevard and one on East Arlington Boulevard. Curb height was assumed to be 6 inches. Cross-section overbanks outside of the curb line were set high enough to prevent ponded water from leaving the system during analysis.

Some notable observations were as follows:

- During the 2-year storm:
  - In the area of interest, two nodes are flooded: T025964 and T025967.
- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, the catch basin, T025968, on Commerce Street shows flooding.

B.2.6.8 Dellwood Drive

The Dellwood Drive model is between Southeast Greenville Boulevard and Red Banks Road. The network drains the residential neighborhood between the E.B. Aycock Middle School and the Memorial Baptist Church. The system is primarily curb inlets with one yard inlet. The model discharges into a series of channel and pipes that leads to Reedy Branch.

A resident in the area reported street flooding 2 – 3 feet deep and water has reached over the hoods of cars. In addition, residents report of yard flooding 2 - 3 times per year. The following assumptions were made to create the existing conditions model:

- A small drainage area was drawn between houses for yard inlet B010263 because terrain data was not detailed enough to delineate a drainage area.
- The width was adjusted on subcatchment B10253 to 400 feet and N-Perv to 0.06 to calibrate to the rational method discharges.
- An irregular channel was assumed that modeled a cross-section of the street (overbank, curb, gutter, and normal crown) to carry excess flow from curb inlet B010251 to curb inlet B010254. Inlet and outlet offsets were assumed so that the elevation at the inlet and outlet were that of the gutter at each curb inlet.
- A triangular channel cross-section was assumed that modeled a low spot of the street to carry excess flow from curb inlet B010254 to curb inlet B010253. Inlet and outlet offsets were assumed so that the elevation at the inlet and outlet were that of the gutter at each curb inlet. Note that this flow is in the opposite direction of pipe flow due to inlet elevations.

Some notable observations were as follows:

- During the 2-year storm:
  - Almost the entire system is undersized. All but two nodes (B010252 and B010262) flood during the 2-year storm.
- During the 10-year storm:
  - In addition to the nodes above, junction B010252 also floods.

B.2.6.9 Greenbriar Drive

The priority area of the Greenbriar Drive network was the area between Fairlane Road and Greenbriar Drive. This network connects to the system flowing down Club Drive before discharging into Greens Mill Run. To accurately model the network, it was necessary to encompass the larger system that flows directly into the area of interest. The larger network included systems from Hooker Road, Fairlane Road and Greenville Boulevard. The larger network was simplified to a series of larger subcatchments to focus on the area of concern.

The Hooker Road and parallel networks area primarily commercial, multi-family and single family residential areas. The City of Greenville staff reports that the main channel is incised and there are erosion problems along the entire reach. A resident on Fairlane Road reports yard flooding 2 - 3 times per year. The following steps were taken to create the existing conditions model:

- Three curb and gutter links were added ST31273, ST31289, and ST31346 were added to account for flow down Hooker Road.
- The Hooker Road system was divided into 13 drainage areas.
- The channel from Greenville Boulevard to Fairlane Road was divided into 9 drainage areas.

Some notable observations were as follows:

- During the 2-year storm:
  - T031214, T031229 and T031233 all show flooding.
- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, junctions T031232, T031235, T031282m T031283 and T031284 show flooding.
  - All of the curb and gutter links are flooded.
- During the 25-year storm:
  - Additionally, junction T031281 shows flooding.

B.2.6.10 Lakewood Drive

The Lakewood Drive model is located between the railroad and Greenville Boulevard. The model encompasses approximately 152 acres, which includes drainage from the University Commons Shopping Center as it flows into the channel that passes through the residential neighborhood that ends at Lakewood Drive. The area is primarily commercial lots with some residential. The modeled outfall is located at the end of Lakewood Drive where it discharges into Greens Mill Run. The inlets that line Greenville Boulevard and Evans Street are primarily catch basins. The shopping center is comprised mostly of drop inlets. Downstream of the shopping center, there are a series of open channels that cross under Poplar Drive and Evans Street twice before discharging to Greens Mill Run.

The existing model also contains two detention ponds. One is located behind the University Commons Shopping Center and serves the majority or the parking lot. The other pond is located at the intersection of Greenville Boulevard and Evans Street at the Jiffy Lube.

The area of concern is the Lakewood subdivision. The residents of the subdivision have reported frequent flooding. Residents state that water frequently backs up into the yards along Greens Mill Run. There have been reports of crawl space and residential building flooding as well. There are three reports of residential building flooding along Lindell Drive. The reports state every time it rains, water will back up into the yard and crawl space. Lakewood residents report that the detention basin located behind the shopping center never has water in it. The flooding has gotten worse over time as the headwaters of the system have become more developed. The main channel shows signs of erosion and several large trees have been uprooted due to bank erosion. The following steps were taken to create the existing conditions model:

- Junctions MN002 and MN003 do not appear in the Stormwater Inventory. These yard inlets appear on either side of Lakewood Drive near the intersection of Evans Street. MN002 was assumed to have an invert elevation of 53.0 feet. MN003 was assumed to have an invert elevation 52.7 feet. A 15” RCP was assumed to connect MN002 to MN003. Another 15” RCP was assumed to connect MN003 to T025833.
- Junction WG1 does not appear in the Stormwater Inventory. This catch basin is located on Evans Street in the Walgreens entrance. WG1 was assumed to have an invert elevation of 69.0 feet. It was assumed to connect with Junction T025932 by a 15” RCP pipe.
- Junction VW1 does not appear in the Stormwater Inventory. This junction marks the end of a riprap ditch that runs through the Volkswagen Auto Lot. This junction was assumed to connect with T025926 by an irregular cross-section channel with a maximum depth of 3.5 feet, a bottom width of 6 feet, and 1H:4V side slopes.
- The junctions and pipes for the University Commons Shopping Center do not appear in the Stormwater Inventory. All associated rim, invert, pipe size, and material information was taken from plans provided by the City of Greenville. The plans are not included in this report.
- Junction 18 in the University Commons Shopping Center is the North Basin Control Structure (as detailed in the plans). A weir link was added to model flow in this structure.
- The detention pond behind the shopping center was assumed to have an invert elevation of 61.0 feet and a maximum depth of 10 feet. A table was created that illustrated the surface area verses elevation to model storage.
- The detention pond at the intersection of Southeast Greenville Boulevard and Evans Street was assumed to have an invert elevation of 68.2 feet and a maximum depth of 4 feet. A table was created that illustrates the surface area verses elevation to model storage.
- Forty-four curb and gutter links were added throughout the model to carry bypass flow from one junction to another.
- In an attempt to model the channel as it curves to cross under Evans Street a second time, a 60 acre subcatchment was drawn to encompass the three smaller pipe systems that output into the channel. These areas were taken from aerial photos.
- The Commerce Street model discharges into the channel that crosses under Evans Street a second time. A junction was added at the outlet of the Commerce Street model. The outflow hydrograph from the Commerce Street model was input directly into the Lakewood model to accurately model this portion of inflow.

- In order to ensure no water volume was lost in the model many of the trapezoidal channel cross-sections provided in the Stormwater Inventory were modified to show an overbank to contain the water.
- The University Commons plans show flat pipes with little to no slopes. EPA SWMM requires a minimum 0.001 elevation drop to calculate slope for these pipes.
- Pipe 25876 has a slope of 25%. This is due to the large drop from the invert of the pipe to the channel downstream. The large slope causes minor instability within the model at this location.

Some notable observations were as follows:

- During the 2-year storm:
  - Pipes T025806 and T025807 are surcharging due to water backing up in the outlet channel.
- During the 10-year storm:
  - In addition to the flooded nodes during the 2-year event, node T025804 and T025805 along Lindell Drive are flooded.

B.2.6.11 Jaycee Park

The Jaycee Park system is located off East 14th Street before the intersection with Greenville Boulevard. The model encompasses Laura Lane, David Drive and portions of Fletcher Place. The system is mainly comprised of curb and gutter with catch basins along Laura Lane and drop inlets located within a private parking lot. There is a drainage easement located between the multi-family residential lots along David Drive. The system discharges to Reedy Branch above the 100-year water surface elevation. The drainage area is comprised mainly of multi-family residential with small commercial lots along Greenville Boulevard and single family residential with 1/8 acre lots.

The City of Greenville has noticed frequent street flooding along Laura Lane in the sag, just past the intersection with Fletcher Place. The street flooding occurs 2 - 3 times per year. The following steps were taken to create the existing conditions model:

- The underground junction box, B010231, invert was assumed to be 45.0 feet to maintain connectivity.
- Subcatchments 010219, 010220, 010222, 010223, and 010224 widths were adjusted to calibrate to rational method discharges.
- Street links were added along Laura Lane. The surface link located within the parking lot between B010222 and B010223 was removed due to instability caused within the model. The surface link had a negative slope, which appeared to be causing model instability due to the positive slope on the pipe.
- A ditch was added as a surface link between B010224 and B010225.
- A surface link was added between B010226 and B010227 due to flooding in this area. The surface link is shown as a V-ditch which models the road profile for Laura Lane.

- Subcatchments 010226 and 010224 assumed the Manning's N-value for the indirect pervious area is 0.05 due to a combination of parking lots and grassed areas. Widths were adjusted to calibrate to observed flooding.
- Subcatchment 010226 was calculated to have a time of concentration of 11 minutes. Using a Manning's N-value of 0.15, the modeled peak flow occurred at 12:18, which is 6 minutes later than the rest of the subcatchments with 5-minute time of concentrations. However, the calculated 2-year peak flow of 11.4 cfs appeared to be too low when compared to the rational method discharge. Therefore, the Manning's N-value was changed to 0.05 due to the combination of grass and parking lots. The model adjusted the time of concentration to 5 minutes, which is over-estimating the time; however, the calculated 2-year peak flow of 18.4 cfs is closer to the rational method peak discharge of 29.6 cfs. It was deemed more realistic to use the high discharge as this appears to be more consistent with the City's observations.

Some notable observations were as follows:

- During the 2-year storm:
  - Between Nodes B010226 and B010227, Laura Lane is flooded with water pooling approximately 6" on the road during the 2-year storm. This is consistent with the City's observations of frequent flooding in this area. No other street links show flooding during the 2-year event.

B.2.6.12 Slay Drive

The Slay Drive model is located approximately 0.5 miles west of the US 64 Alt East, midway between East 10th Street and East 14th Street. The area is primarily single-family residential lots with 1/4 - 1/3 acre lots. The Slay model encompasses approximately 25 acres of the residential subdivision. Discharge is conveyed by a stormwater network that drains west to east along Slay Drive from West Ragsdale Road to East Wright Road. The 36" RCP outfall pipe discharges directly to Reedy Branch. The system consists mainly of catch basins and RCP pipes.

There is one existing flooding report lodged by the resident of 2405 Slay Drive. The resident reported yard flooding, but did not give a specific frequency. The following assumptions were made to create the existing conditions model:

- Six street curb and gutter (ST-) links were added to the model and assumed to be a full street cross-section (normal crown). The street links were between junctions that are connected with curb and gutter. Curb height was assumed to be 6 inches. Cross-section overbanks outside of the curb line were set high enough to prevent ponded water from leaving the system during analysis.
- Assumptions of sag versus on grade (catch basin) inlets were made based on available LIDAR data, surveyed rim elevations and engineering judgement. Inlets B015171, B015180, B015181 and B015182 were set as sag inlets. All other catch basin inlets were assumed to be on grade and were connected via (ST-) links.

- Difficult access junction B015175 contains no survey information invert elevations. Links 15174, 15176 & 15177 contain no survey information for downstream invert elevations. Link 15175 contains no survey information for upstream invert elevation. Link 15176 was assumed to have a 0.5% slope. Resulting downstream invert elevation for link 15176 was assumed to be the downstream invert for links 15174 and 15177. The upstream invert for 15175 was assumed to be approximately 0.1 feet lower than the inverts of the upstream links.
- Tailwater for the system outlet was taken from the project Reedy Branch HEC-RAS model from the cross-section just upstream of the outfall (XS 035). Tailwater elevations are 34.0, 34.7, 34.9, 35.2, and 35.4 feet for the flow adjusted 2-, 10-, 25-, 50- & 100-yr flood events, respectively.
- All models were run with *Normal* set as the outfall condition. All models were also run with “Fixed Tailwater” condition, to simulate backwater effects from Reedy Branch.
- Sub-catchment widths were tripled from initial calculated values to adjust peak SWMM discharges more closely to the rational method peak discharges. The N-PERV values of the sub-catchments were also adjusted to 0.08 from the default value of 0.15.
- Link 15181 was surveyed with elevations that represented a 0.7% negative slope. It was assumed that the invert elevations were reversed in the survey data. The inverts were thus reversed in the model to represent a 0.7% positive slope.

Some notable observations were as follows:

- During the 2-year storm:
  - Nodes B015171, B015173 along Ragsdale Road and B015177 along Slay Drive are flooded.
  - The curb and gutter link ST15173 is flooded. The node upstream of this link is surcharged above the rim.
- During the 10-year storm:
  - In addition to the nodes above, nodes B015172, B015176 and B015181 are flooded.
  - In addition to the flooded curb and gutter links above, curb and gutter links ST15176 and ST ST15177 are flooded. Nodes upstream of these links are surcharged above the rim.

B.2.6.13 Stratford Road

The Stratford Road model is located off of Charles Boulevard. Stratford Road is a small cul-de-sac neighborhood. The area of concern is the neighborhood along Stratford Road. The entrance to the neighborhood has two 36” elliptical culverts that run perpendicular to the road. These culverts are downstream of the Circle Drive model. The total drainage area for the culverts under Stratford Road is 86 acres.

The City of Greenville has noted flooding 2 - 3 times at the culverts over a 10-year span. The culverts discharge into the same channel as the stormwater network and flow to Greens Mill Run. The following assumptions were made to create the existing conditions model:

- Six curb and gutter links were added to account for flow down Stratford Road.
- The 15” elliptical pipes were modeled as 23” x 14” horizontal elliptical pipes.
- The two elliptical culvert pipes were modeled as 30” x 44” horizontal elliptical pipes.
- A 28.4 acre drainage area was drawn upstream of the culverts running under Stratford Road to encompass the system that drains into the channel.
- A storage node was added to account for the BMP and the outflow at the end of Circle Drive which is upstream of the channel that runs under Stratford. The outflow hydrograph from the Circle Drive model was directly input into the Stratford model at this location to account for flows from the Circle Drive system.

Some notable observations were as follows:

- During the 2-year storm:
  - There are no nodes within the area of concern that are flooding during the 2-year storm.
- During the 10-year storm:
  - Junction B040938 is flooded.
- During the 25-year storm:
  - Two nodes (B040939 and B040940) are flooding in addition to the junction above.

B.2.6.14 Sulgrave Road

The Sulgrave Road model is located across from the Dowdy-Ficklen Stadium. It encompasses the system along Charles Boulevard and Sulgrave Road. The modeled outfall is located inside the triple box culvert under Charles Boulevard that carries Greens Mill Run.

The City of Greenville staff reports that the box culvert overtops the road 2 - 3 times per year. There appears to be approximately 3 - 4 feet of sediment in the box culverts. Field photos (A1079, A1078 and A1124) confirm the height of the floodplain bench has not been maintained and sediment is blocking a portion of the culvert.

The stormwater network drains a residential community through a series of pipe, which discharge into an open ditch, before it re-enters a pipe network to discharge ultimately to Greens Mill Run. The following assumptions were made to create this existing conditions model:

- The Stormwater Inventory did not indicate the invert of the outfall inside the box culvert. Assuming a 9.6 feet box culvert where the 30” diameter pipe invert falls 6.3 feet from the top of the inside of the box (measured in field). This put the invert elevation of outfall B030789 at 22.3 feet. It is noted that this assumed outfall invert is slightly above the preceding upstream junction B030790 at 22.3 feet thus creating a flat slope.

- There was one curb and gutter link, ST30791, to carry excess flow from junction B030791 to B030790.
- The channel connecting junctions B030800 and B030796 assumed an irregular cross-section. The defined part of the channel is 2 feet wide, 2 feet deep, with 3H:1V side slopes, with a 25 foot wide floodplain on either side of the defined channel, then the channel joins up to road elevation at 35.0 feet on either side.
- Two scenarios were run for each design storm; one where the outfall was allowed to fall freely and one where the outfall had a fixed elevation to account for the water level in Greens Mill Run. The fixed elevation was set to the top of the 30" diameter pipe at 24.8 feet.

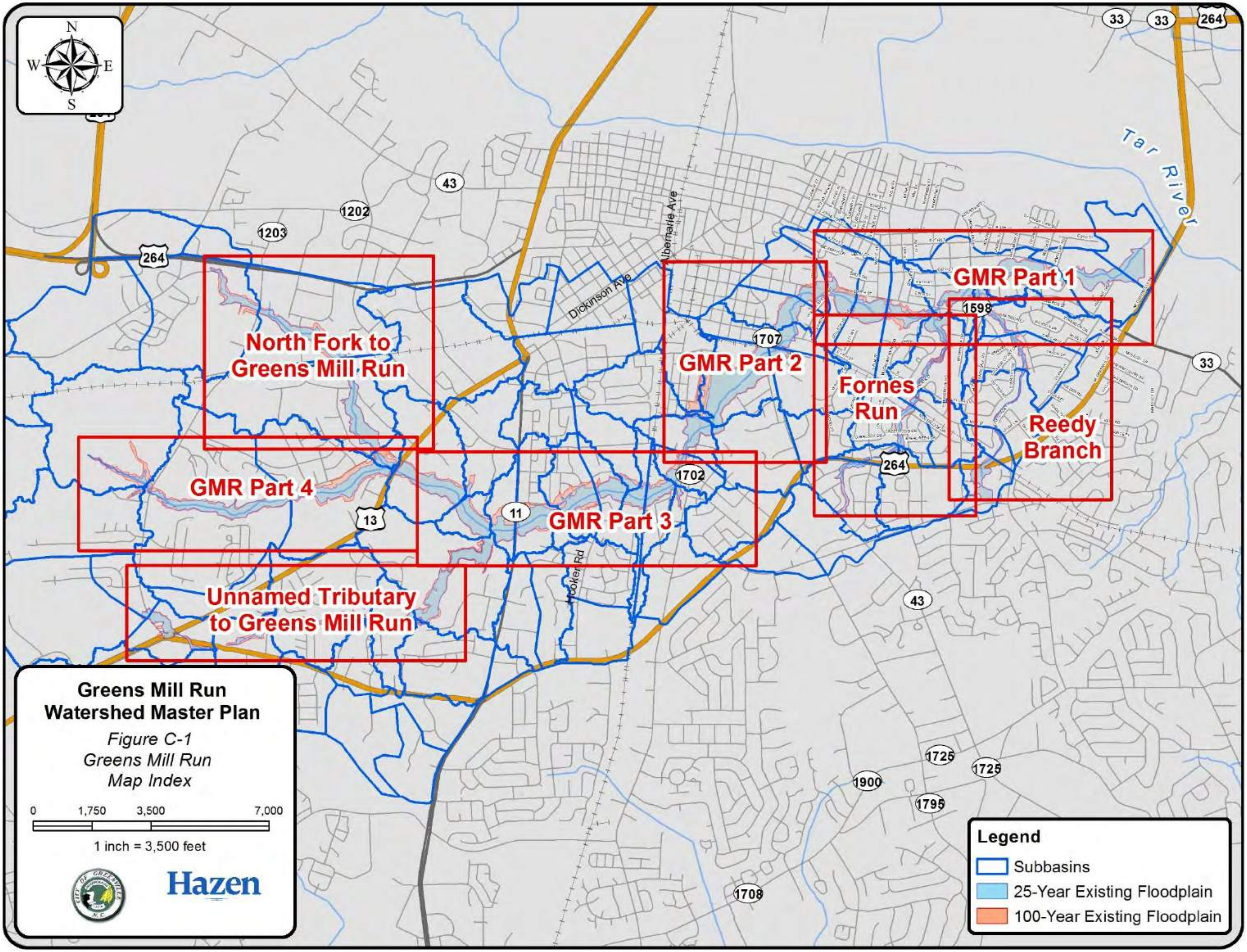
Some notable observations were as follows:

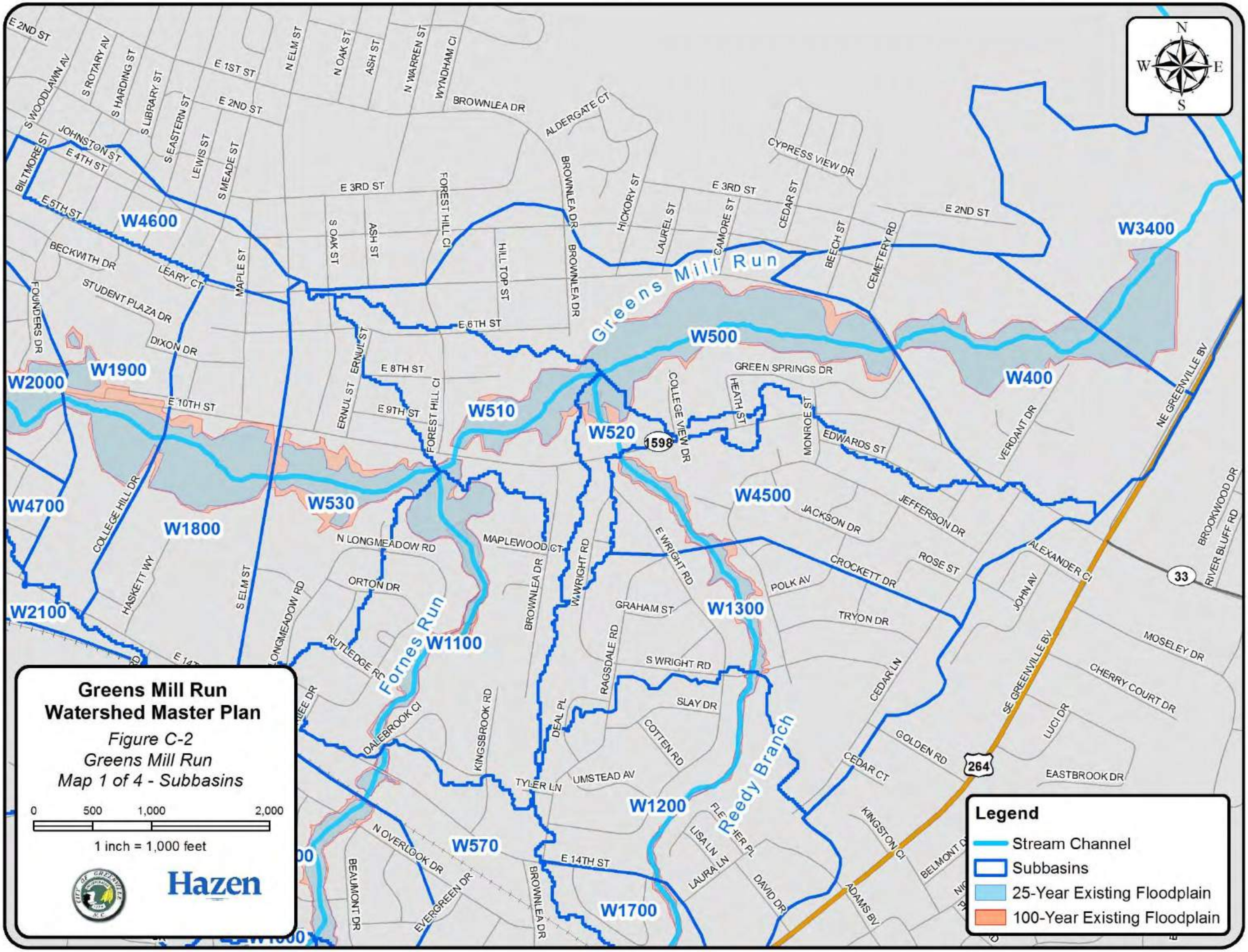
- During the 2-year storm:
  - There are no nodes flooded during the 2-year storm.
  - The 15" pipe connecting junctions B030798 and B030799 is flowing full.
- During the 10-year storm:
  - Node B030796 is flooded.
  - The 18" pipe connecting junctions B030799 to B030800 is flowing full, in addition to the pipe above.
- During the 25-year storm:
  - The most upstream junction in the system, B030798, shows flooding, in addition to the flooded node above.

B.2.6.15 Future Conditions

The Secondary Systems that were selected for closer examination were all in established neighborhoods or developed commercial properties. There was assumed to be very little redevelopment in these areas and as such, the future conditions were not anticipated to vary from existing conditions. For this reason, no future conditions were modeled for the Secondary Systems.

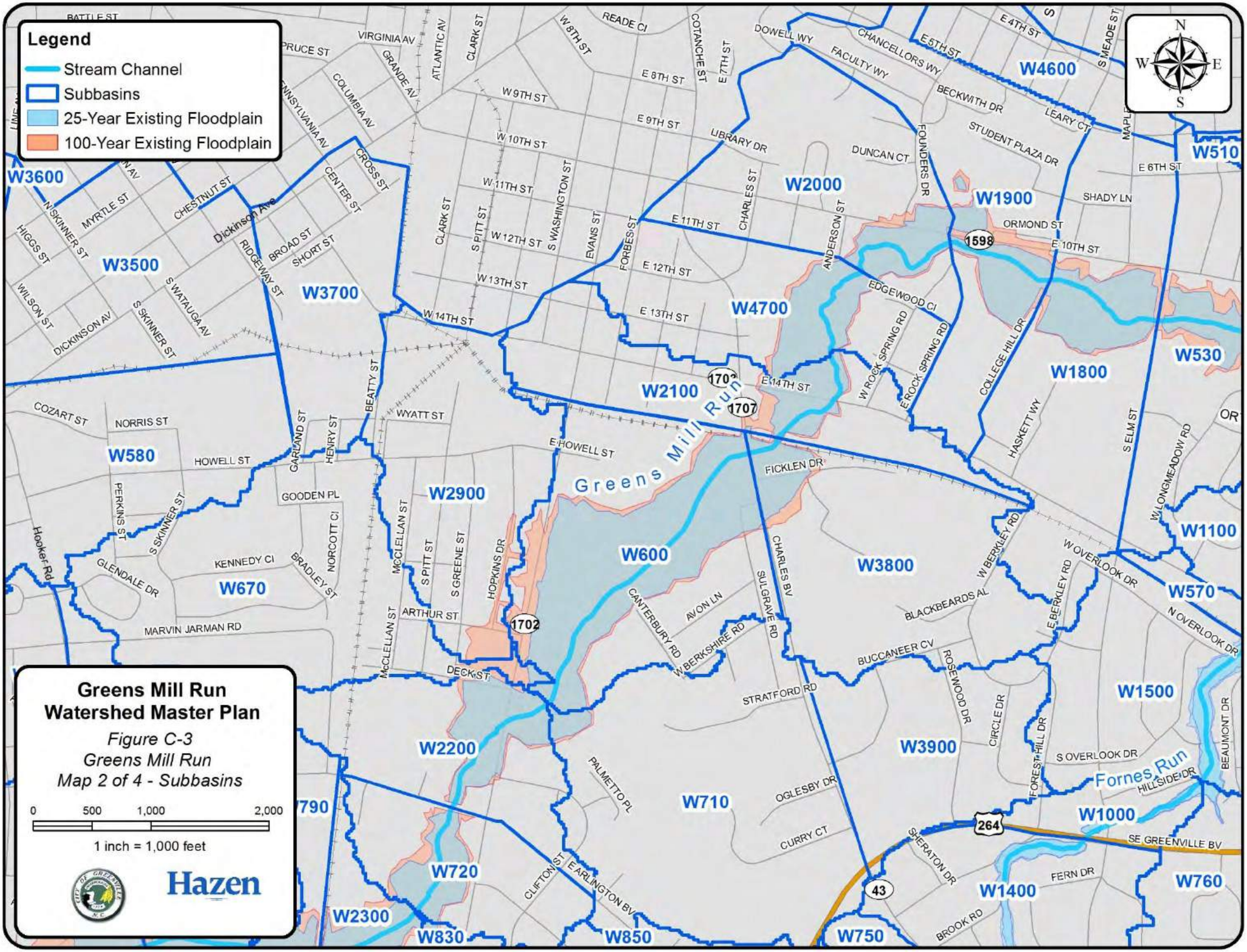
C. Watershed Maps, Land-Use Maps, and Soils Maps


N
S
W
E
Tar River
North Fork to Greens Mill Run
GMR Part 1
GMR Part 2
GMR Part 3
GMR Part 4
Fornes Run
Reedy Branch
Unnamed Tributary to Greens Mill Run
Dickinson Ave
Albemarle Ave
Hooker Rd
33
264
43
1202
1203
1598
1707
1702
11
13
1725
1900
1795
1708
Greens Mill Run
Watershed Master Plan
Figure C-1
Greens Mill Run
Map Index
0
1,750
3,500
7,000
1 inch = 3,500 feet
Hazen
Legend
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain



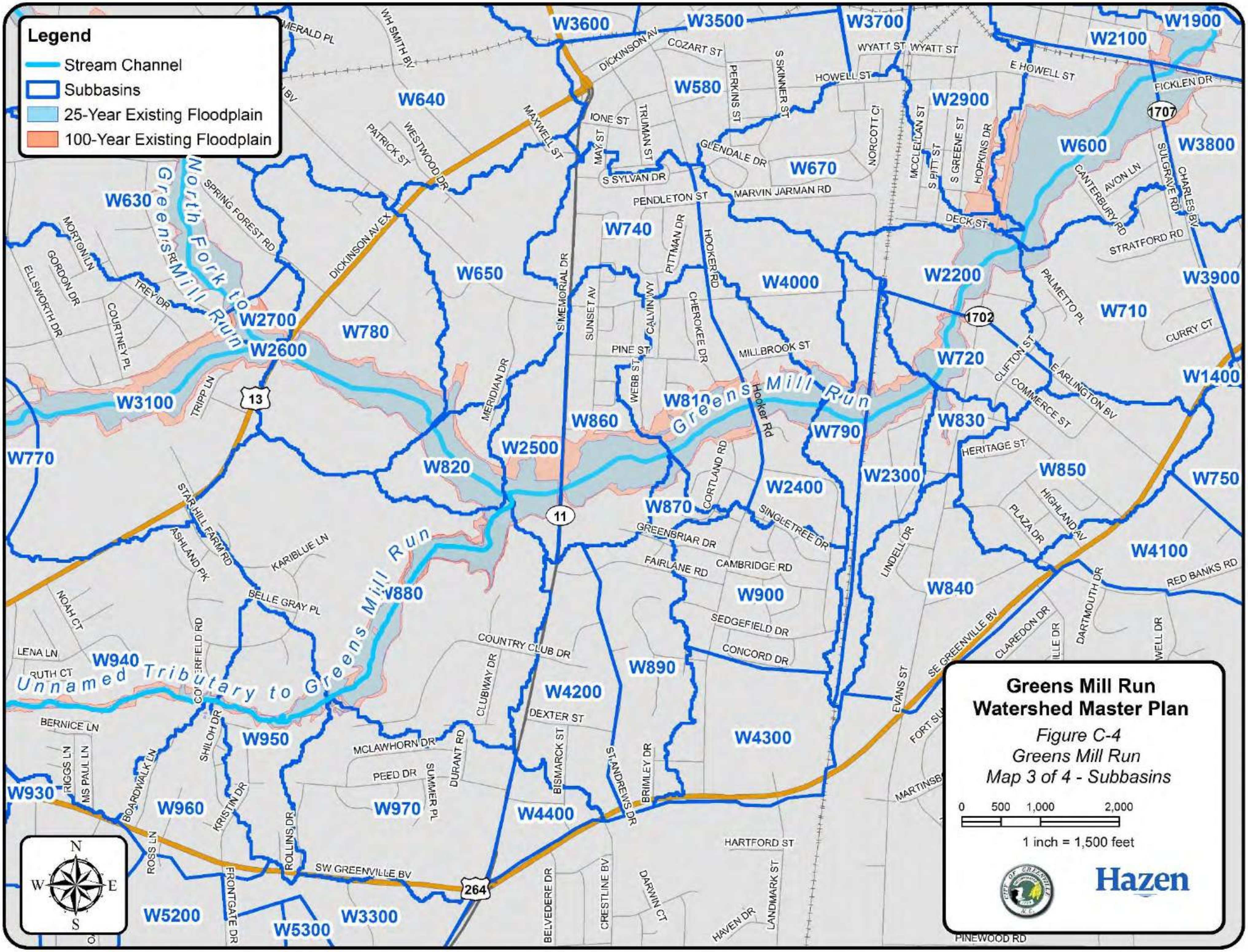
Greens Mill Run Watershed Master Plan

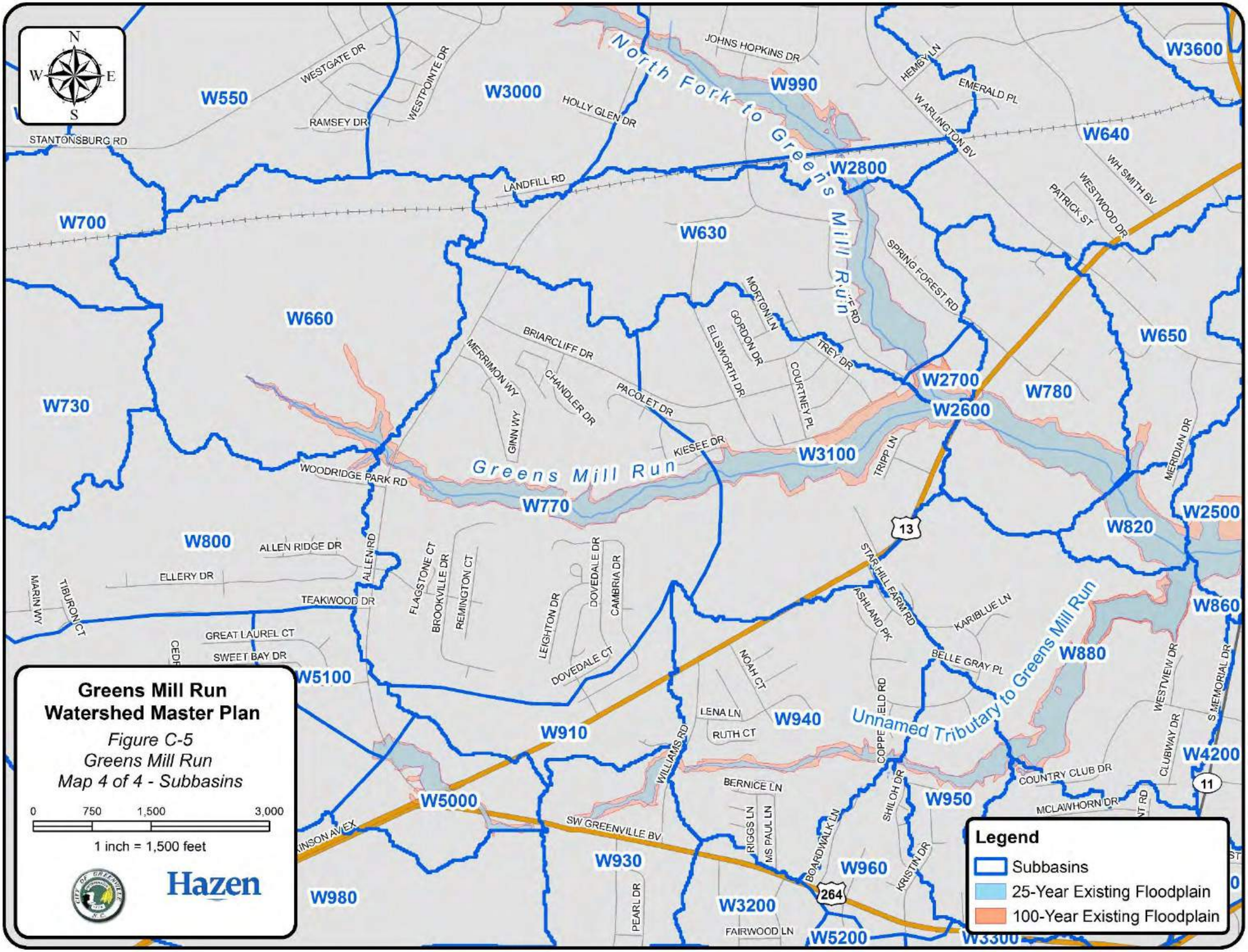
Figure C-2
Greens Mill Run
Map 1 of 4 - Subbasins



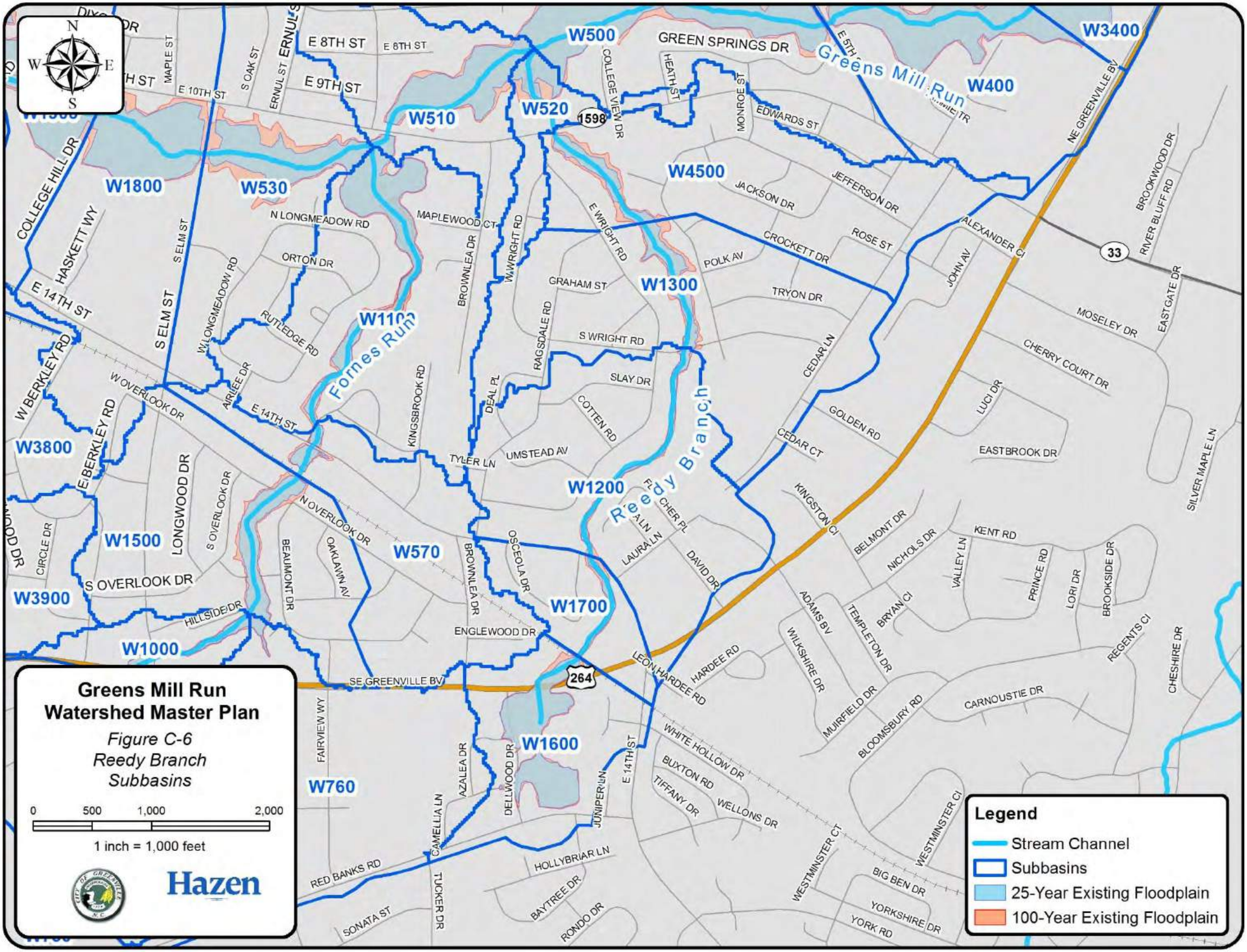
Greens Mill Run Watershed Master Plan

Figure C-3
Greens Mill Run
Map 2 of 4 - Subbasins

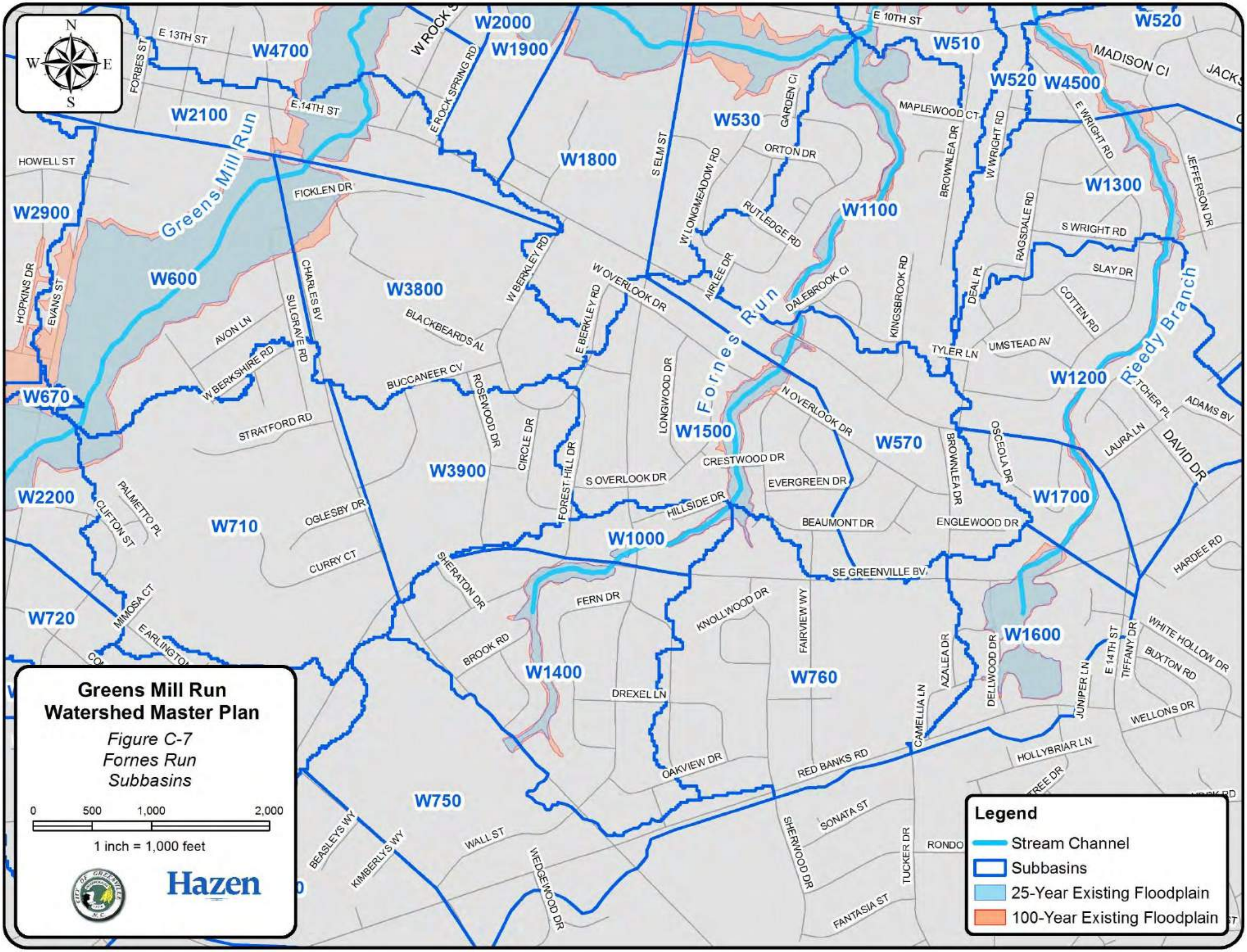

Legend
Stream Channel
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain
Greens Mill Run
Watershed Master Plan
Figure C-4
Greens Mill Run
Map 3 of 4 - Subbasins
0 500 1,000 2,000
1 inch = 1,500 feet
Hazen
North Fork to Greens Mill Run
Greens Mill Run
Unnamed Tributary to Greens Mill Run
W3600
W3500
W3700
W1900
W2100
W640
W580
W2900
W600
W3800
W670
W630
W740
W650
W4000
W2200
W3900
W2700
W780
W710
W2600
W720
W1400
W3100
W810
W860
W790
W830
W770
W2500
W820
W2300
W850
W750
W2400
W870
W4100
W880
W900
W840
W940
W890
W4200
W950
W4300
W930
W960
W970
W4400
W5200
W5300
W3300
DICKINSON AV
COZART ST
WYATT ST
HOWELL ST
E HOWELL ST
FICKLEN DR
SW GREENVILLE BV
SE GREENVILLE BV
COUNTRY CLUB DR
MEMORIAL DR
HOOKER RD
ARLINGTON BV
RED BANKS RD
PINEWOOD RD
HARTFORD ST
13
11
264
1702
1707

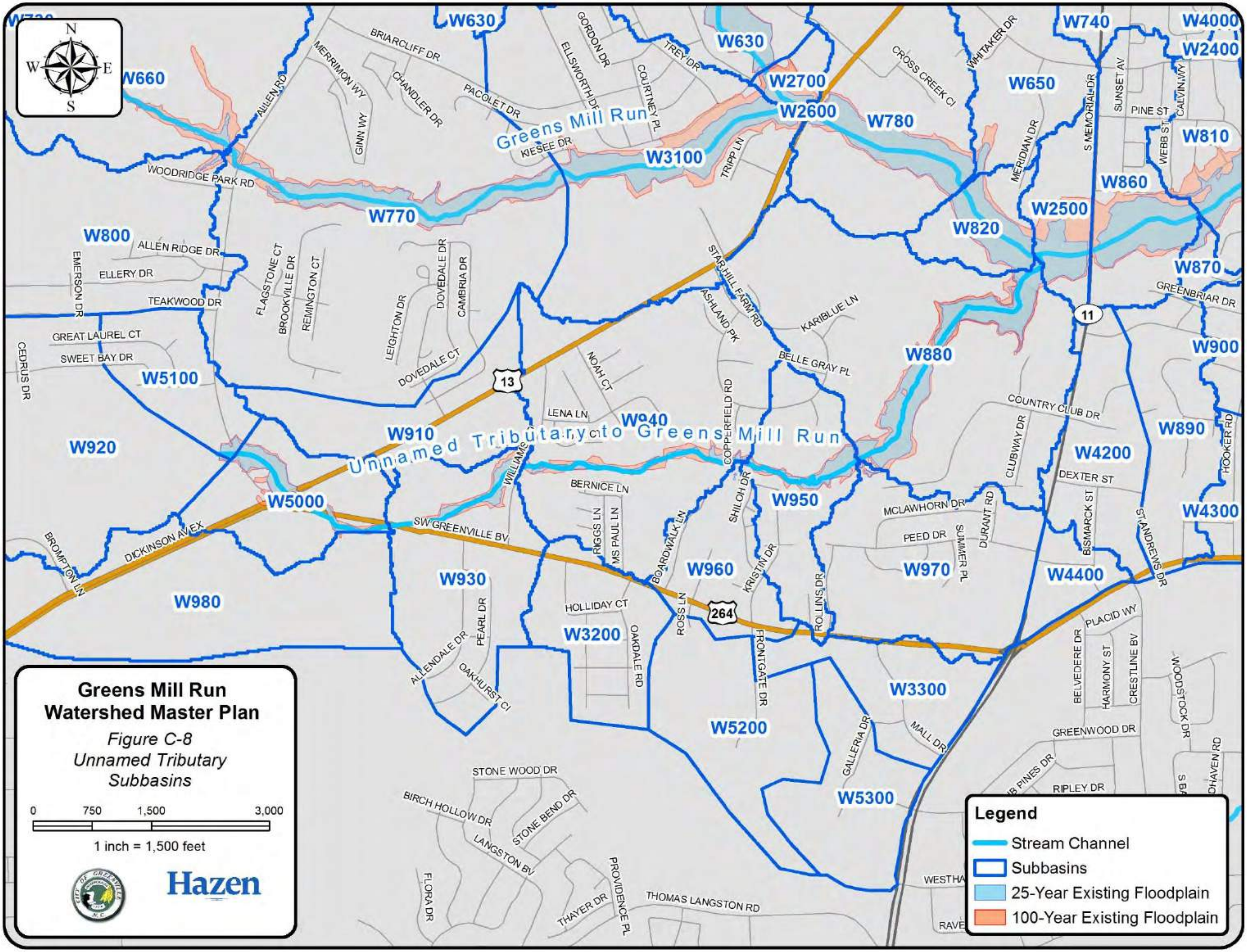


Greens Mill Run
Watershed Master Plan
Figure C-5
Greens Mill Run
Map 4 of 4 - Subbasins
0 750 1,500 3,000
1 inch = 1,500 feet
Hazen
Legend
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain
North Fork to Greens Mill Run
Greens Mill Run
Unnamed Tributary to Greens Mill Run
W550
W3000
W990
W3600
W640
W2800
W700
W630
W660
W650
W2700
W780
W2600
W730
W3100
W770
W800
W2500
W820
W860
W880
W5100
W940
W910
W4200
W5000
W950
W930
W960
W980
W3200
W5200
W3300
WESTGATE DR
WESTPOINTE DR
HOLLY GLEN DR
RAMSEY DR
STANTONSBURG RD
JOHNS HOPKINS DR
HEMBY LN
EMERALD PL
W ARLINGTON BV
LANDFILL RD
WH SMITH BV
PATRICK ST
WESTWOOD DR
SPRING FOREST RD
MORTON LN
GORDON DR
ELLSWORTH DR
TREY DR
COURTNEY PL
BRIARCLIFF DR
MERRIMON WY
CHANDLER DR
PACOLET DR
GINN WY
KIESEE DR
TRIPP LN
MERIDIAN DR
WOODRIDGE PARK RD
ALLEN RIDGE DR
ALLEN RD
ELLERY DR
FLAGSTONE CT
BROOKVILLE DR
REMINGTON CT
DOVEDALE DR
CAMBRIA DR
LEIGHTON DR
DOVEDALE CT
MARIN WY
TIBURON CT
TEAKWOOD DR
GREAT LAUREL CT
SWEET BAY DR
STAR HILL FARM RD
ASHLAND PK
KARIBLUE LN
NOAH CT
BELLE GRAY PL
WESTVIEW DR
S MEMORIAL DR
LENA LN
RUTH CT
WILLIAMS RD
COUNTRY CLUB DR
CLUBWAY DR
BERNICE LN
SHILOH DR
MCLAWHORN DR
SW GREENVILLE BV
RIGGS LN
MS PAUL LN
BOARDWALK LN
KRISTIN DR
PEARL DR
FAIRWOOD LN
13
264
11



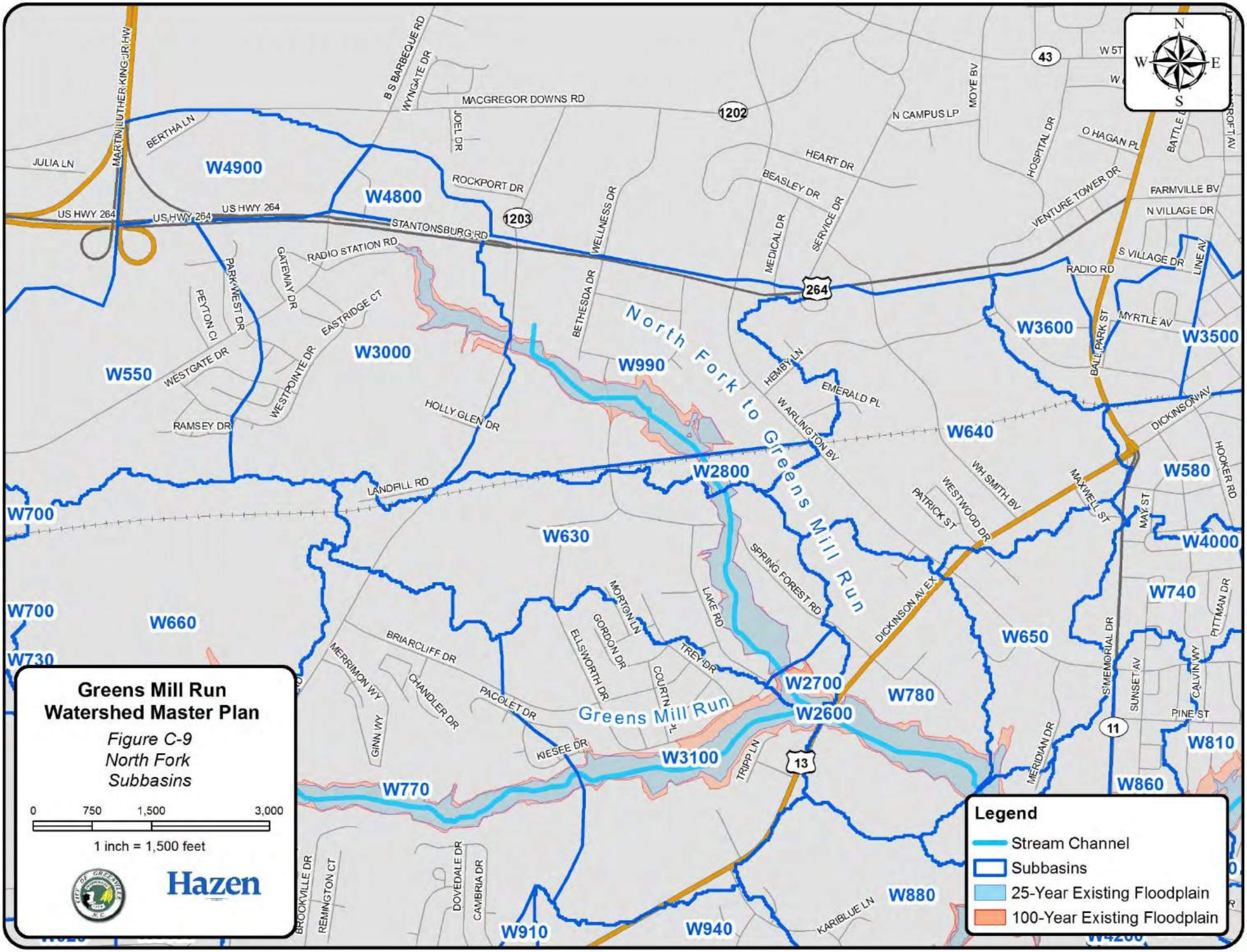
Greens Mill Run
Watershed Master Plan
Figure C-6
Reedy Branch
Subbasins
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain
Greens Mill Run
Fornes Run
Reedy Branch
W500
W510
W520
W530
W400
W3400
W4500
W1800
W1100
W1300
W1200
W1500
W570
W1700
W3800
W3900
W1000
W1600
W760
E 8TH ST
E 9TH ST
E 10TH ST
GREEN SPRINGS DR
COLLEGE VIEW DR
EDWARDS ST
JACKSON DR
JEFFERSON DR
NE GREENVILLE BV
COLLEGE HILL DR
HASKETT WY
E 14TH ST
S ELM ST
N LONGMEADOW RD
MAPLEWOOD CT
ORTON DR
E WRIGHT RD
W WRIGHT RD
GRAHAM ST
CROCKETT DR
ROSE ST
POLK AV
TRYON DR
ALEXANDER CI
MOSELEY DR
RUTLEDGE RD
S WRIGHT RD
SLAY DR
CEDAR LN
CHERRY COURT DR
W BERKLEY RD
E BERKLEY RD
W OVERLOOK DR
AIRLEE DR
KINGSBROOK RD
DEAL PL
COTTEN RD
GOLDEN RD
CEDAR CT
TYLER LN
UMSTEAD AV
EASTBROOK DR
LONGWOOD DR
S OVERLOOK DR
N OVERLOOK DR
BEAUMONT DR
OAKLAWN AV
BROWNLEA DR
OSCEOLA DR
LAURA LN
DAVID DR
KINGSTON CI
BELMONT DR
NICHOLS DR
VALLEY LN
KENT RD
PRINCE RD
LORI DR
BROOKSIDE DR
HILLSIDE DR
ENGLEWOOD DR
LEON HARDEE RD
HARDEE RD
ADAMS BV
WILKSHIRE DR
TEMPLETON DR
BRYAN CI
REGENTS CI
CHESHIRE DR
SE GREENVILLE BV
FAIRVIEW WY
AZALEA DR
DELLWOOD DR
JUNIPER LN
E 14TH ST
WHITE HOLLOW DR
BUXTON RD
TIFFANY DR
WELLONS DR
MUIRFIELD DR
BLOOMSBURY RD
CARNOUSTIE DR
WESTMINSTER CI
WESTMINSTER CT
CAMELLIA LN
RED BANKS RD
TUCKER DR
HOLLYBRIAR LN
BAYTREE DR
RONDO DR
SONATA ST
BIG BEN DR
YORKSHIRE DR
YORK RD
SILVER MAPLE LN
EASTGATE DR
BROOKWOOD DR
RIVER BLUFF RD
264
33
1598


Greens Mill Run
Watershed Master Plan
Figure C-7
Fornes Run
Subbasins
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain
N
S
E
W
Greens Mill Run
Fornes Run
Reedy Branch
W2000
W1900
W4700
W2100
W1800
W530
W510
W520
W4500
W1300
W1100
W2900
W600
W3800
W670
W1500
W570
W1200
W1700
W3900
W2200
W710
W1000
W720
W1400
W760
W1600
W750
E 13TH ST
E 14TH ST
E 10TH ST
FORBES ST
W ROCK S
E ROCK SPRING RD
HOWELL ST
FICKLEN DR
S ELM ST
GARDEN CI
ORTON DR
MAPLEWOOD CT
BROWNLEA DR
W WRIGHT RD
E WRIGHT RD
MADISON CI
JEFFERSON DR
W LONGMEADOW RD
RUTLEDGE RD
RAGSDALE RD
S WRIGHT RD
SLAY DR
HOPKINS DR
EVANS ST
CHARLES BV
SULGRAVE RD
W BERKLEY RD
W OVERLOOK DR
AIRLEE DR
DALEBROOK CI
KINGSBROOK RD
DEAL PL
COTTEN RD
AVON LN
BLACKBEARDS AL
E BERKLEY RD
TYLER LN
UMSTEAD AV
W BERKSHIRE RD
BUCCANEER CV
ROSEWOOD DR
LONGWOOD DR
N OVERLOOK DR
ADAMS BV
STRATFORD RD
CIRCLE DR
FOREST HILL DR
OSCEOLA DR
LAURA LN
DAVID DR
CRESTWOOD DR
S OVERLOOK DR
EVERGREEN DR
PALMETTO PL
CLIFTON ST
OGLESBY DR
HILLSIDE DR
BEAUMONT DR
ENGLEWOOD DR
HARDEE RD
CURRY CT
SHERATON DR
SE GREENVILLE BV
MIMOSA CT
FERN DR
KNOLLWOOD DR
FAIRVIEW WY
E ARLINGTON
BROOK RD
AZALEA DR
DELLWOOD DR
E 14TH ST
TIFFANY DR
WHITE HOLLOW DR
BUXTON RD
DREXEL LN
CAMELLIA LN
JUNIPER LN
WELLONS DR
HOLLYBRIAR LN
OAKVIEW DR
RED BANKS RD
SONATA ST
SHERWOOD DR
BEASLEYS WY
KIMBERLYS WY
WALL ST
WEDGEWOOD DR
TUCKER DR
RONDO
FANTASIA ST

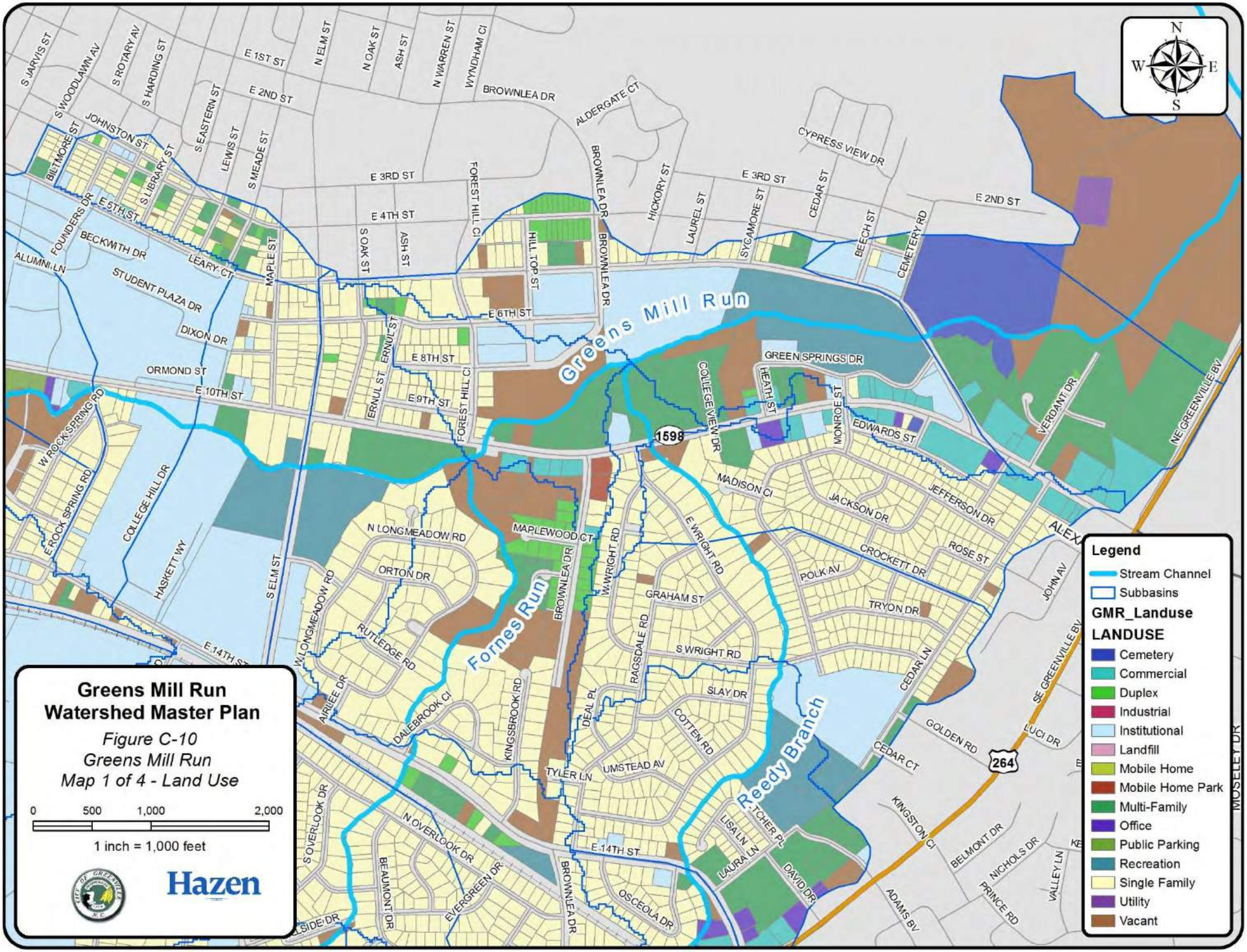


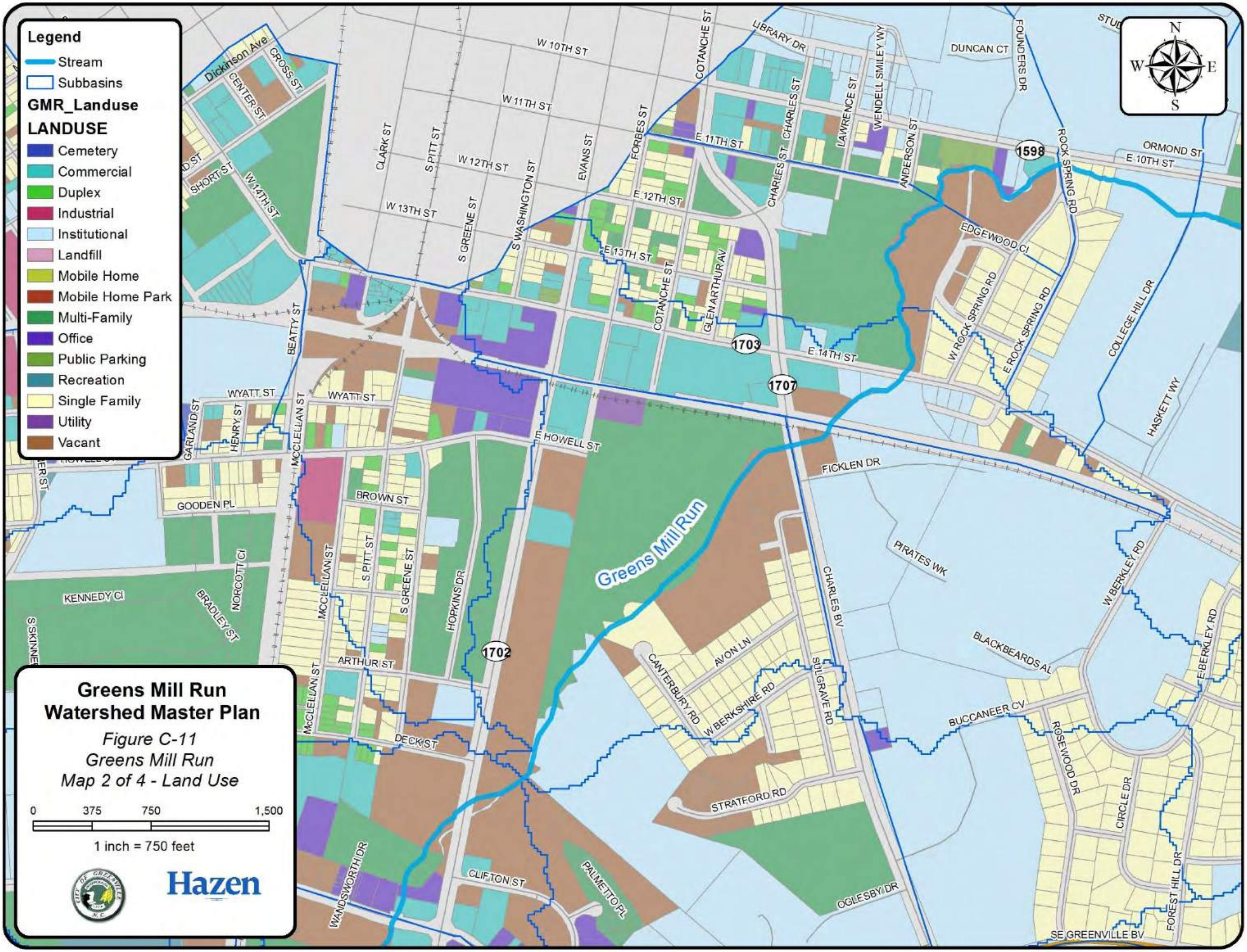
Greens Mill Run Watershed Master Plan

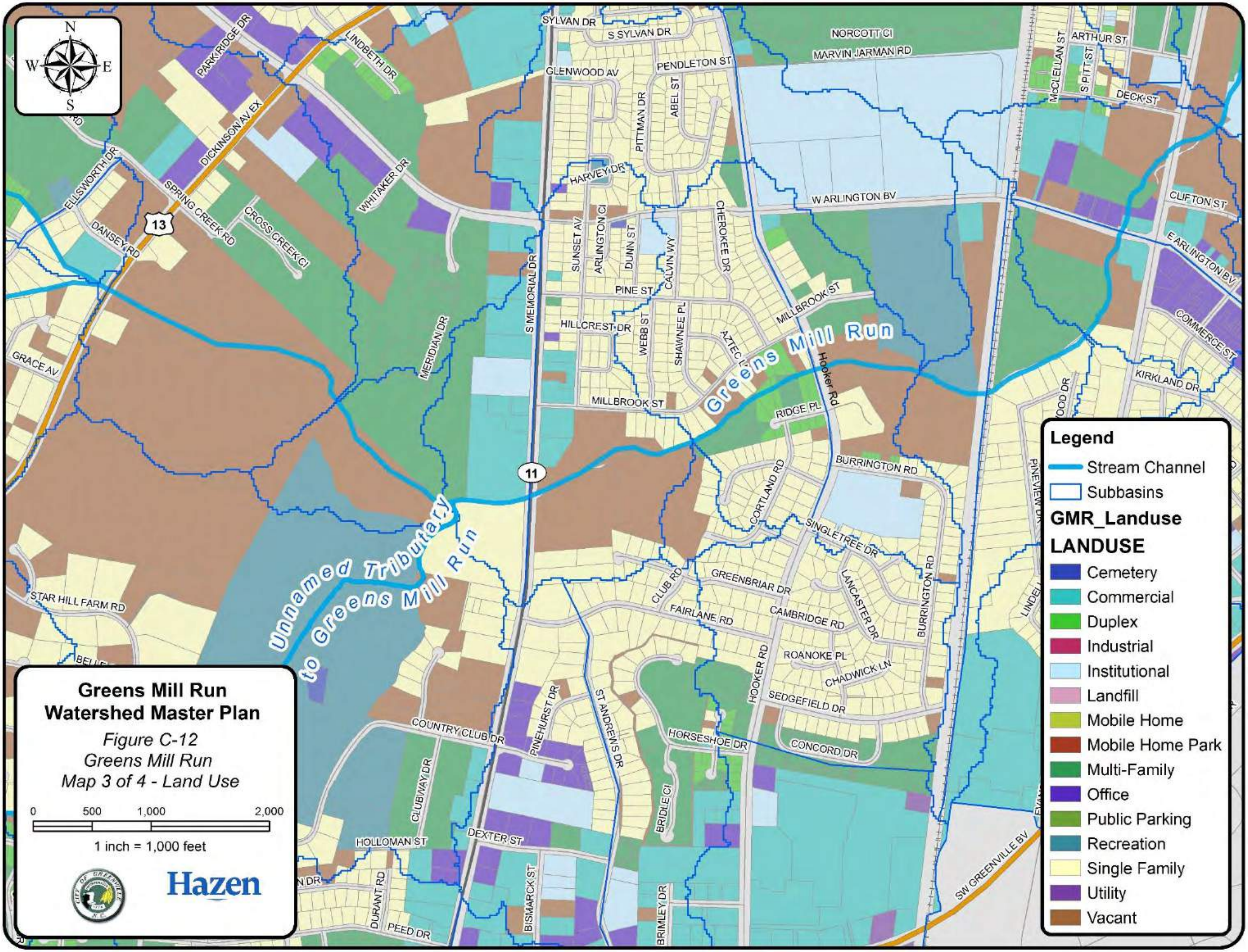
Figure C-8
Unnamed Tributary Subbasins

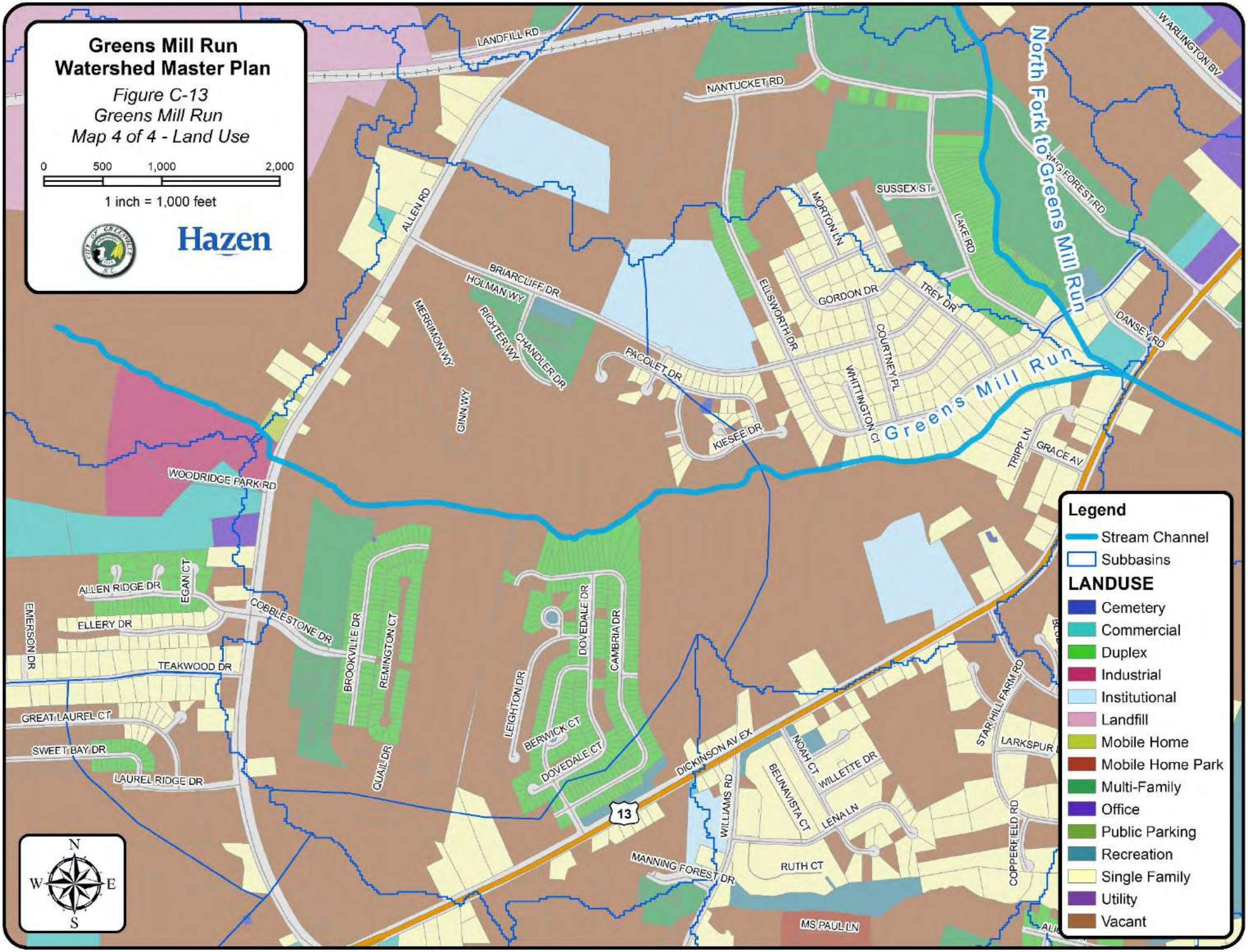


Greens Mill Run
Watershed Master Plan
Figure C-9
North Fork
Subbasins
0
750
1,500
3,000
1 inch = 1,500 feet
Hazen
Legend
Stream Channel
Subbasins
25-Year Existing Floodplain
100-Year Existing Floodplain
North Fork to Greens Mill Run
Greens Mill Run
W4900
W4800
W3000
W550
W990
W3600
W3500
W640
W2800
W580
W700
W630
W4000
W740
W660
W650
W730
W2700
W780
W2600
W3100
W770
W810
W860
W880
W910
W940

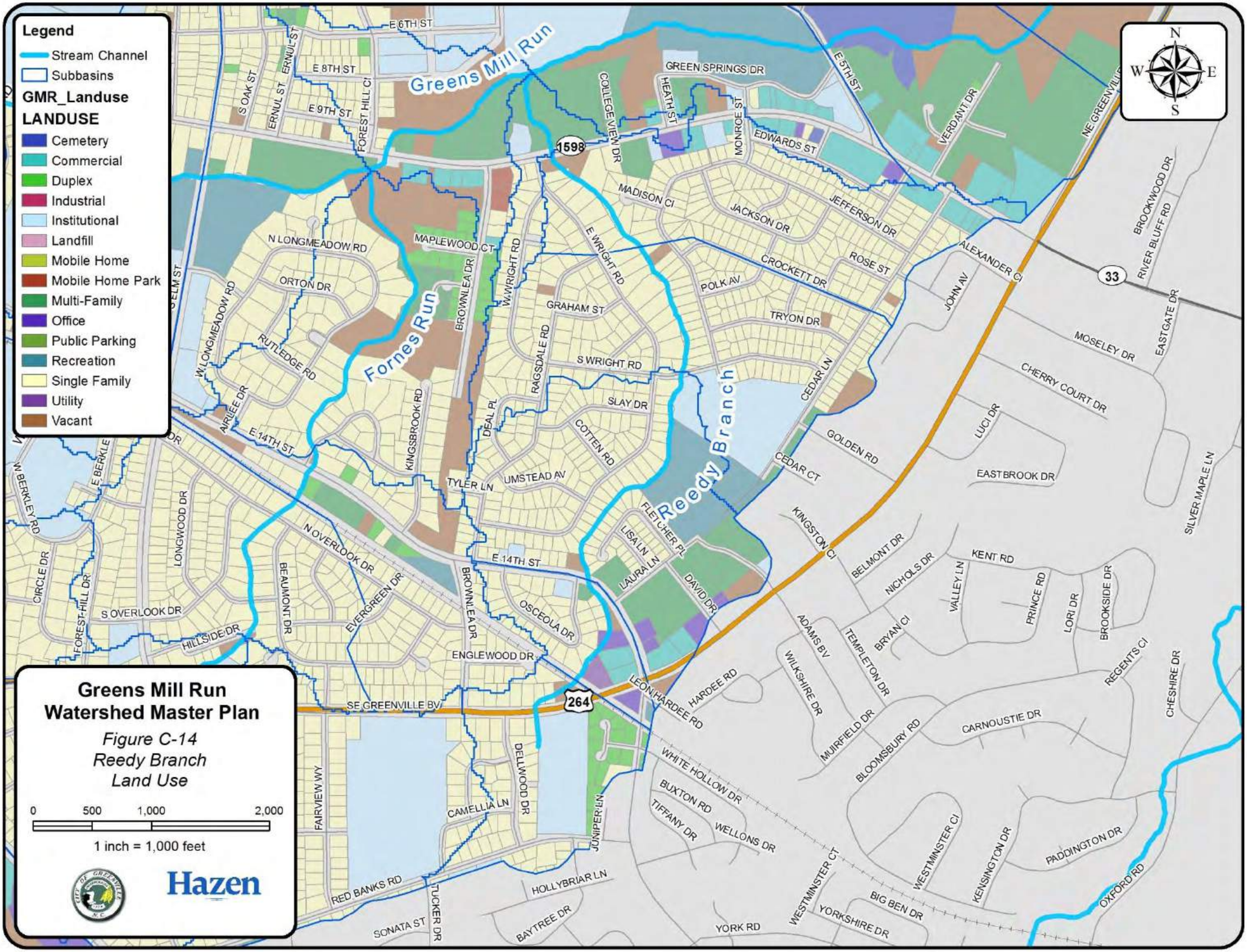

Greens Mill Run
Watershed Master Plan
Figure C-10
Greens Mill Run
Map 1 of 4 - Land Use
0 500 1,000 2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
GMR_Landuse
LANDUSE
Cemetery
Commercial
Duplex
Industrial
Institutional
Landfill
Mobile Home
Mobile Home Park
Multi-Family
Office
Public Parking
Recreation
Single Family
Utility
Vacant
N
W
E
S
Greens Mill Run
Fornes Run
Reedy Branch
1598
264
S JARVIS ST
S WOODLAWN AV
S ROTARY AV
S HARDING ST
E 1ST ST
N ELM ST
N OAK ST
ASH ST
N WARREN ST
WYNDHAM CI
E 2ND ST
BROWNLEA DR
ALDERGATE CT
JOHNSTON ST
BILTMORE ST
S EASTERN ST
S LIBRARY ST
LEWIS ST
S MEADE ST
E 3RD ST
FOREST HILL CI
CYPRESS VIEW DR
HICKORY ST
LAUREL ST
SYCAMORE ST
CEDAR ST
BEECH ST
CEMETERY RD
FOUNDERS DR
E 5TH ST
E 4TH ST
S OAK ST
HILL TOP ST
BECKWITH DR
LEARY CT
MAPLE ST
ALUMNI LN
STUDENT PLAZA DR
E 6TH ST
DIXON DR
ERNUL ST
E 8TH ST
GREEN SPRINGS DR
COLLEGE VIEW DR
HEATH ST
ORMOND ST
E 10TH ST
E 9TH ST
MONROE ST
EDWARDS ST
VERDANT DR
NE GREENVILLE BV
W ROCK SPRING RD
E ROCK SPRING RD
COLLEGE HILL DR
MADISON CI
JACKSON DR
JEFFERSON DR
N LONGMEADOW RD
MAPLEWOOD CT
W WRIGHT RD
E WRIGHT RD
CROCKETT DR
ROSE ST
ALEXA
HASKETT WY
S ELM ST
ORTON DR
GRAHAM ST
POLK AV
TRYON DR
JOHN AV
W LONGMEADOW RD
RUTLEDGE RD
RAGSDALE RD
S WRIGHT RD
CEDAR LN
SE GREENVILLE BV
E 14TH ST
AIRLEE DR
DALEBROOK CI
KINGSBROOK RD
DEAL PL
SLAY DR
COTTEN RD
GOLDEN RD
LUCI DR
CEDAR CT
TYLER LN
UMSTEAD AV
KINGSTON CI
MOSELEY DR
S OVERLOOK DR
N OVERLOOK DR
BEAUMONT DR
EVERGREEN DR
LISA LN
LAURA LN
TCHER PL
DAVID DR
BELMONT DR
NICHOLS DR
VALLEY LN
OSCEOLA DR
ADAMS BV
PRINCE RD
LSIDE DR


Legend
Stream
Subbasins
GMR_Landuse
LANDUSE
Cemetery
Commercial
Duplex
Industrial
Institutional
Landfill
Mobile Home
Mobile Home Park
Multi-Family
Office
Public Parking
Recreation
Single Family
Utility
Vacant
N
W
E
S
Greens Mill Run
Watershed Master Plan
Figure C-11
Greens Mill Run
Map 2 of 4 - Land Use
0
375
750
1,500
1 inch = 750 feet
Hazen
Greens Mill Run
1598
1703
1707
1702
W 10TH ST
W 11TH ST
W 12TH ST
W 13TH ST
E 10TH ST
E 11TH ST
E 12TH ST
E 13TH ST
E 14TH ST
W 14TH ST
Dickinson Ave
CENTER ST
CROSS ST
SHORT ST
CLARK ST
S PITT ST
S GREENE ST
S WASHINGTON ST
EVANS ST
FORBES ST
COTANCHE ST
LIBRARY DR
CHARLES ST
LAWRENCE ST
WENDELL SMILEY WY
ANDERSON ST
DUNCAN CT
FOUNDERS DR
ROCK SPRING RD
ORMOND ST
EDGEWOOD CI
W ROCK SPRING RD
E ROCK SPRING RD
COLLEGE HILL DR
HASKETT WY
GLEN ARTHUR AV
BEATTY ST
WYATT ST
GARLAND ST
HENRY ST
MCCLELLAN ST
E HOWELL ST
FICKLEN DR
BROWN ST
GOODEN PL
KENNEDY CI
BRADLEY ST
NORCOTT CI
S SKINNER
HOPKINS DR
ARTHUR ST
DECK ST
CHARLES BV
PIRATES WK
W BERKLEY RD
E BERKLEY RD
BLACKBEARDS AL
BUCCANEER CV
ROSEWOOD DR
CIRCLE DR
FOREST HILL DR
CANTERBURY RD
AVON LN
W BERKSHIRE RD
SULGRAVE RD
STRATFORD RD
OGLESBY DR
CLIFTON ST
PALMETTO PL
WANDSWORTH DR
SE GREENVILLE BV


Greens Mill Run
Watershed Master Plan
Figure C-12
Greens Mill Run
Map 3 of 4 - Land Use
0 500 1,000 2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
GMR_Landuse
LANDUSE
Cemetery
Commercial
Duplex
Industrial
Institutional
Landfill
Mobile Home
Mobile Home Park
Multi-Family
Office
Public Parking
Recreation
Single Family
Utility
Vacant
N
S
E
W
Greens Mill Run
Unnamed Tributary to Greens Mill Run
13
11
SYLVAN DR
S SYLVAN DR
NORCOTT CI
MARVIN JARMAN RD
PENDLETON ST
GLENWOOD AV
PARK RIDGE DR
LINDBETH DR
DICKINSON AV EX
PITTMAN DR
ABEL ST
MCCLELLAN ST
S PITT ST
ARTHUR ST
DECK ST
ELLSWORTH DR
SPRING CREEK RD
CROSS CREEK CI
WHITAKER DR
HARVEY DR
W ARLINGTON BV
CLIFTON ST
E ARLINGTON BV
DANSEY RD
SUNSET AV
ARLINGTON CI
DUNN ST
CALVIN WY
CHEROKEE DR
PINE ST
S MEMORIAL DR
MILLBROOK ST
COMMERCE ST
HILLCREST DR
WEBB ST
SHAWNEE PL
AZTEC
MERIDIAN DR
GRACE AV
KIRKLAND DR
Hooker Rd
RIDGE PL
MILLBROOK ST
BURRINGTON RD
CORTLAND RD
PINEVIEW DR
SINGLETREE DR
STAR HILL FARM RD
GREENBRIAR DR
CLUB RD
FAIRLANE RD
CAMBRIDGE RD
LANCASTER DR
BURRINGTON RD
ROANOKE PL
CHADWICK LN
HOOKER RD
SEDGEFIELD DR
COUNTRY CLUB DR
PINEHURST DR
ST ANDREWS DR
HORSESHOE DR
CONCORD DR
CLUBWAY DR
BRIDLE CI
HOLLOMAN ST
DEXTER ST
SW GREENVILLE BV
DURANT RD
BISMARCK ST
BRIMLEY DR
PEED DR

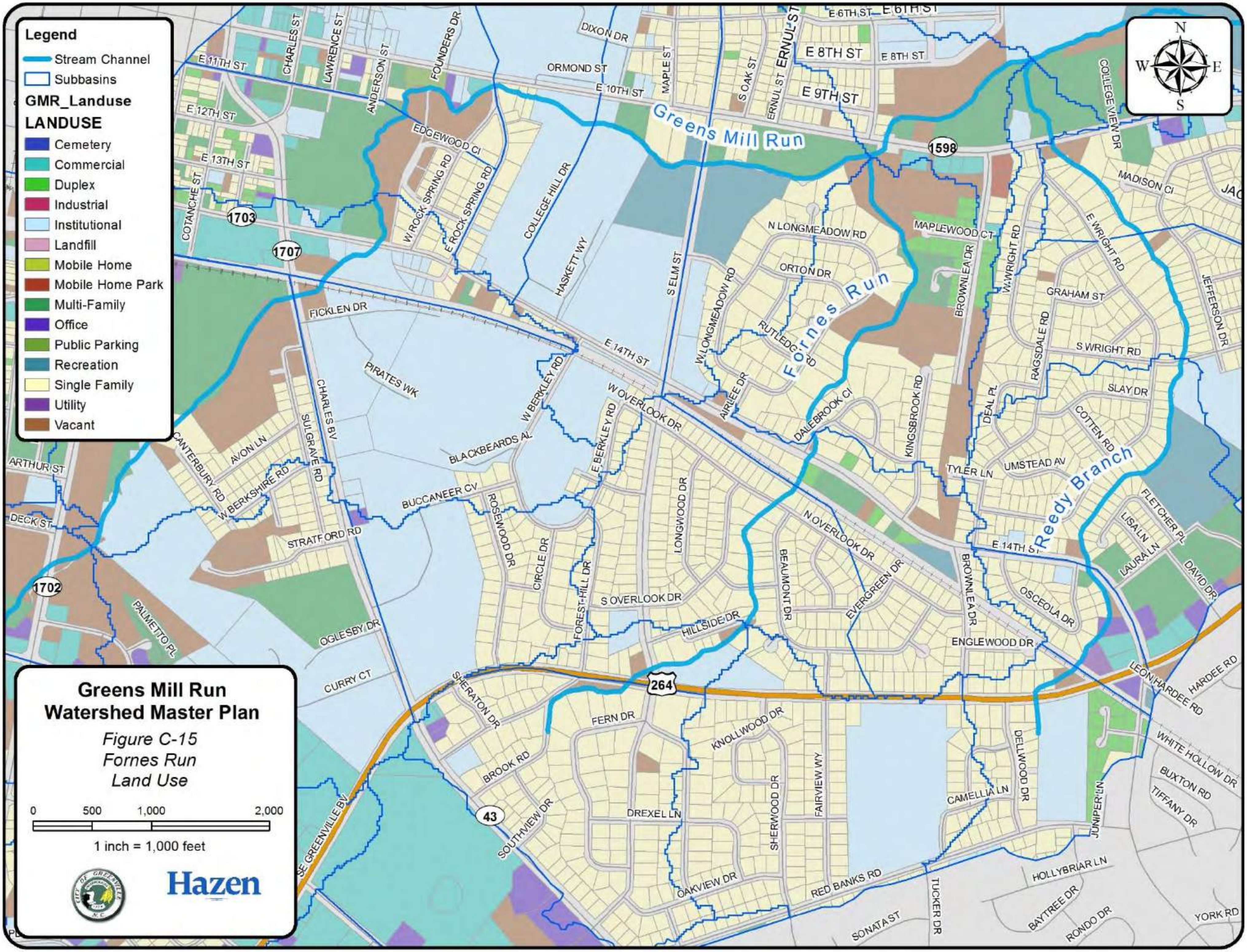


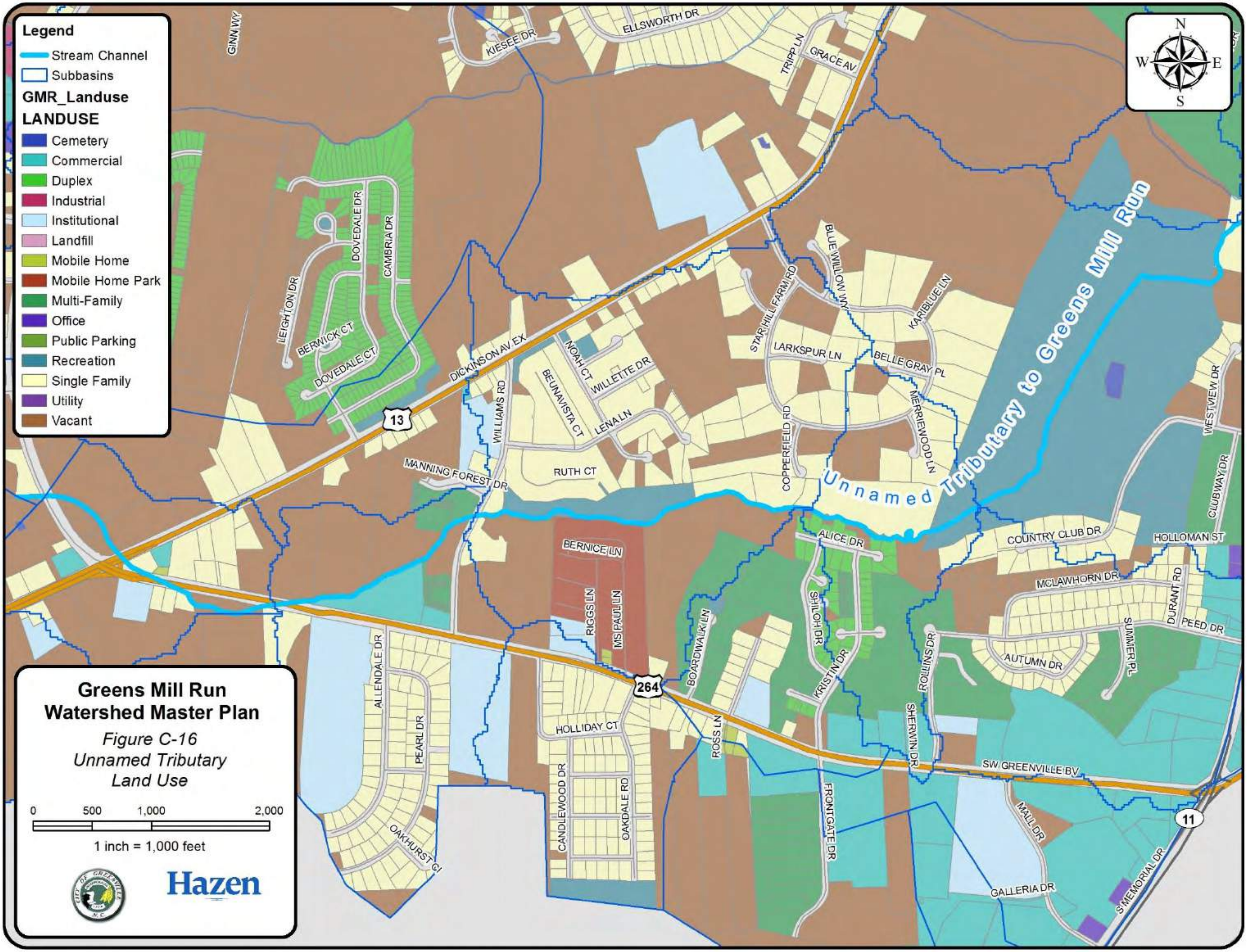
Greens Mill Run
Watershed Master Plan
Figure C-13
Greens Mill Run
Map 4 of 4 - Land Use
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
LANDUSE
Cemetery
Commercial
Duplex
Industrial
Institutional
Landfill
Mobile Home
Mobile Home Park
Multi-Family
Office
Public Parking
Recreation
Single Family
Utility
Vacant
N
E
S
W
North Fork to Greens Mill Run
Greens Mill Run
LANDFILL RD
NANTUCKET RD
W ARLINGTON BV
SUSSEX ST
MORTON LN
LAKE RD
ALLEN RD
BRIARCLIFF DR
HOLMAN WY
MERRIMON WY
RICHTER WY
CHANDLER DR
GINN WY
PACOLET DR
KIESEE DR
ELLSWORTH DR
GORDON DR
TREY DR
COURTNEY PL
WHITTINGTON CI
DANSEY RD
TRIPP LN
GRACE AV
WOODRIDGE PARK RD
ALLEN RIDGE DR
EGAN CT
COBBLESTONE DR
EMERSON DR
ELLERY DR
TEAKWOOD DR
GREAT LAUREL CT
SWEET BAY DR
LAUREL RIDGE DR
BROOKVILLE DR
REMINGTON CT
QUAIL DR
DOVEDALE DR
CAMBRIA DR
LEIGHTON DR
BERWICK CT
DOVEDALE CT
DICKINSON AV EX
13
WILLIAMS RD
BEUNAVISTA CT
NOAH CT
WILLETTE DR
LENA LN
RUTH CT
MANNING FOREST DR
MS PAUL LN
STAR HILL FARM RD
LARKSPUR
COPPERFIELD RD



Greens Mill Run Watershed Master Plan

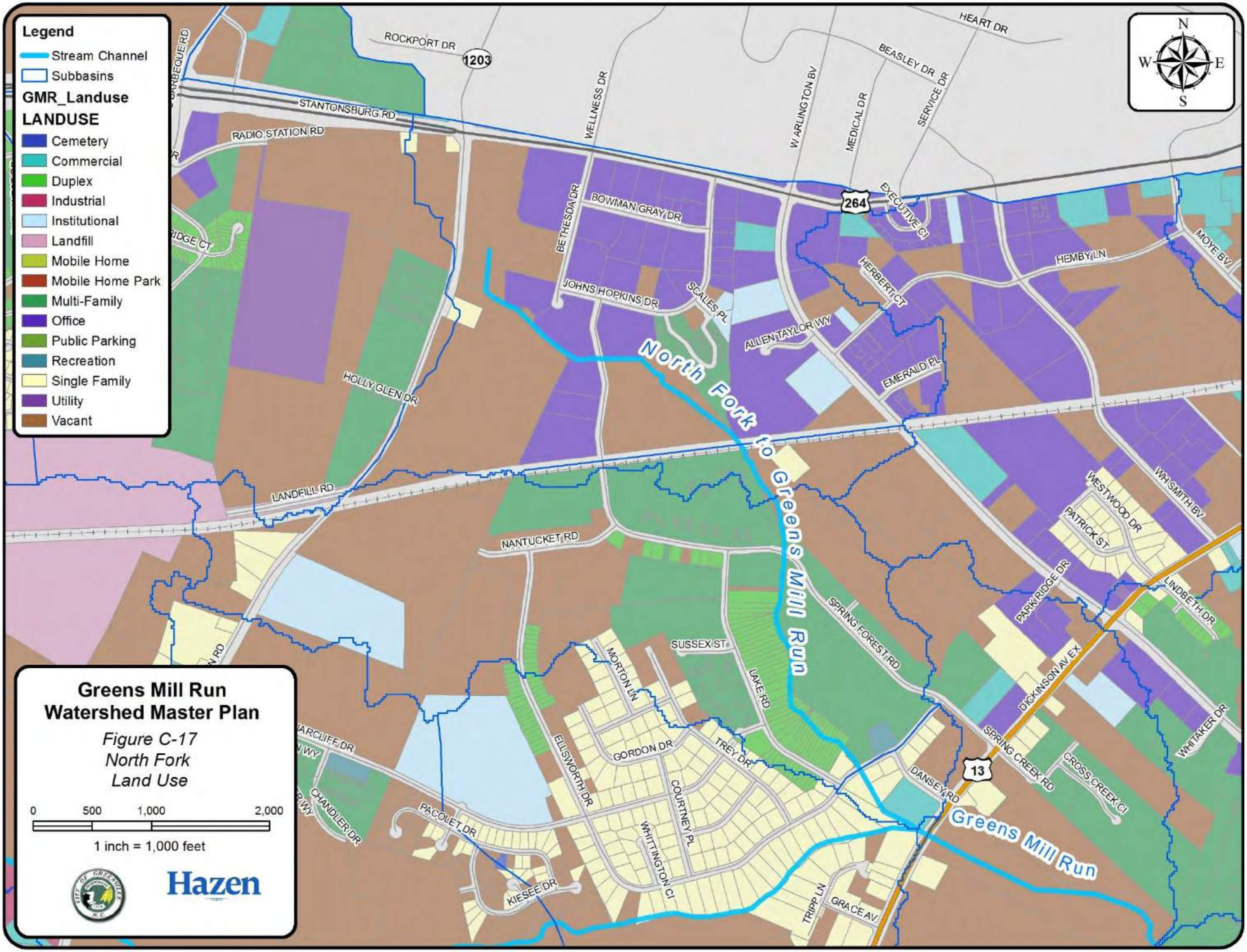
Figure C-14
Reedy Branch
Land Use


Legend
Stream Channel
Subbasins
GMR_Landuse
LANDUSE
Cemetery
Commercial
Duplex
Industrial
Institutional
Landfill
Mobile Home
Mobile Home Park
Multi-Family
Office
Public Parking
Recreation
Single Family
Utility
Vacant
Greens Mill Run
Watershed Master Plan
Figure C-15
Fornes Run
Land Use
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
N
S
E
W
Greens Mill Run
Fornes Run
Reedy Branch
E 6TH ST
E 8TH ST
E 9TH ST
E 10TH ST
E 11TH ST
E 12TH ST
E 13TH ST
E 14TH ST
ORMOND ST
DIXON DR
MAPLE ST
S OAK ST
ERNUL ST
CHARLES ST
LAWRENCE ST
ANDERSON ST
FOUNDERS DR
EDGEWOOD CI
W ROCK SPRING RD
E ROCK SPRING RD
COLLEGE HILL DR
HASKETT WY
S ELM ST
COTANCHE ST
FICKLEN DR
PIRATES WK
W BERKLEY RD
E BERKLEY RD
W OVERLOOK DR
N OVERLOOK DR
S OVERLOOK DR
AIRLEE DR
RUTLEDGE RD
W LONGMEADOW RD
N LONGMEADOW RD
ORTON DR
DALEBROOK CI
KINGSBROOK RD
MAPLEWOOD CT
BROWNLEA DR
W WRIGHT RD
E WRIGHT RD
S WRIGHT RD
MADISON CI
COLLEGE VIEW DR
JEFFERSON DR
GRAHAM ST
RAGSDALE RD
DEAL PL
SLAY DR
COTTEN RD
UMSTEAD AV
TYLER LN
FLETCHER PL
LISA LN
LAURA LN
DAVID DR
OSCEOLA DR
ENGLEWOOD DR
EVERGREEN DR
BEAUMONT DR
LONGWOOD DR
HILLSIDE DR
FOREST HILL DR
CIRCLE DR
ROSEWOOD DR
BUCCANEER CV
BLACKBEARDS AL
CHARLES BV
SULGRAVE RD
AVON LN
CANTERBURY RD
W BERKSHIRE RD
STRATFORD RD
ARTHUR ST
DECK ST
PALMETTO PL
OGLESBY DR
CURRY CT
SHERATON DR
FERN DR
KNOLLWOOD DR
BROOK RD
SOUTHVIEW DR
DREXEL LN
SHERWOOD DR
FAIRVIEW WY
CAMELLIA LN
DELLWOOD DR
JUNIPER LN
LEON HARDEE RD
HARDEE RD
WHITE HOLLOW DR
BUXTON RD
TIFFANY DR
HOLLYBRIAR LN
BAYTREE DR
RONDO DR
YORK RD
TUCKER DR
SONATA ST
RED BANKS RD
OAKVIEW DR
SE GREENVILLE BV
1598
1703
1707
1702
264
43



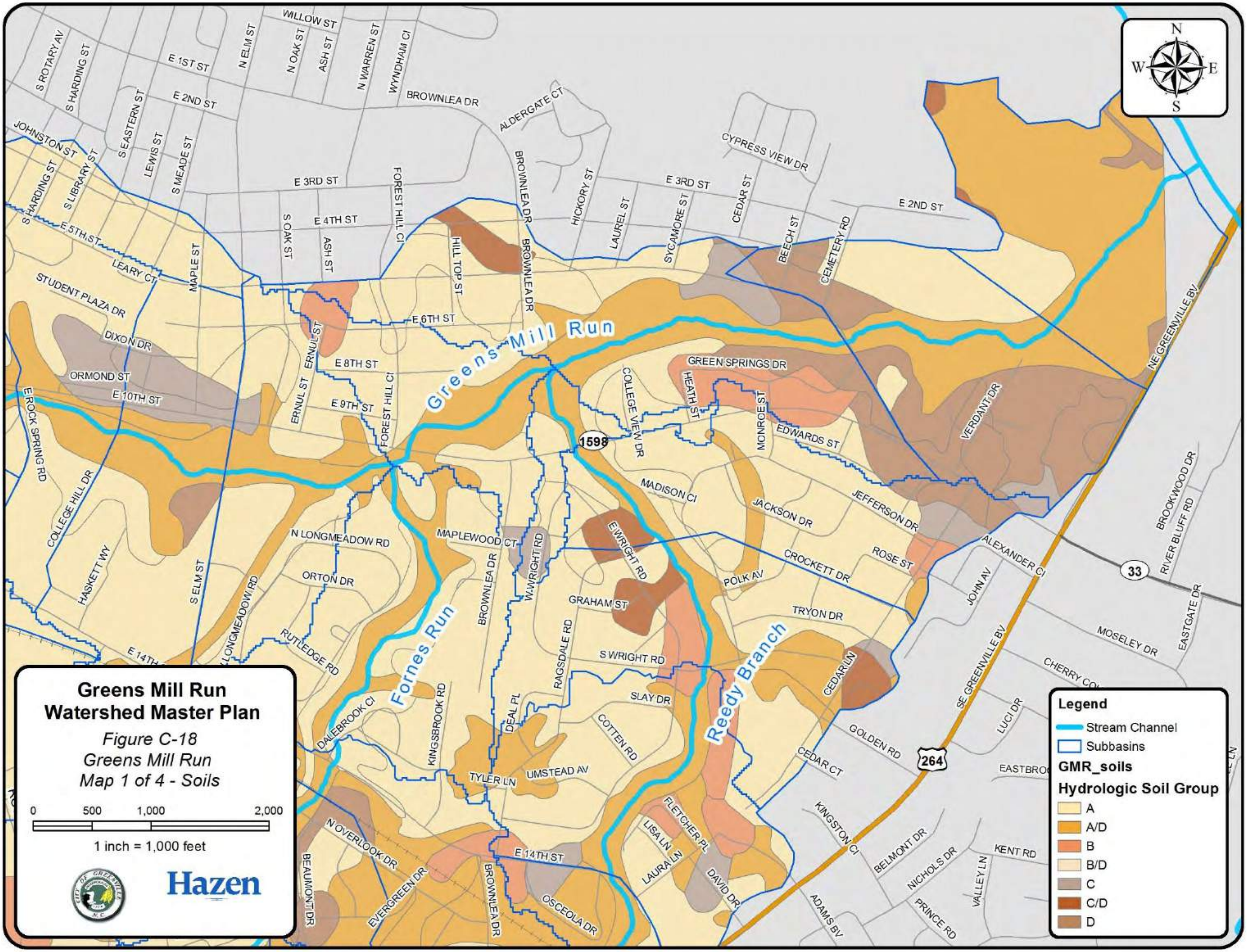
Greens Mill Run Watershed Master Plan

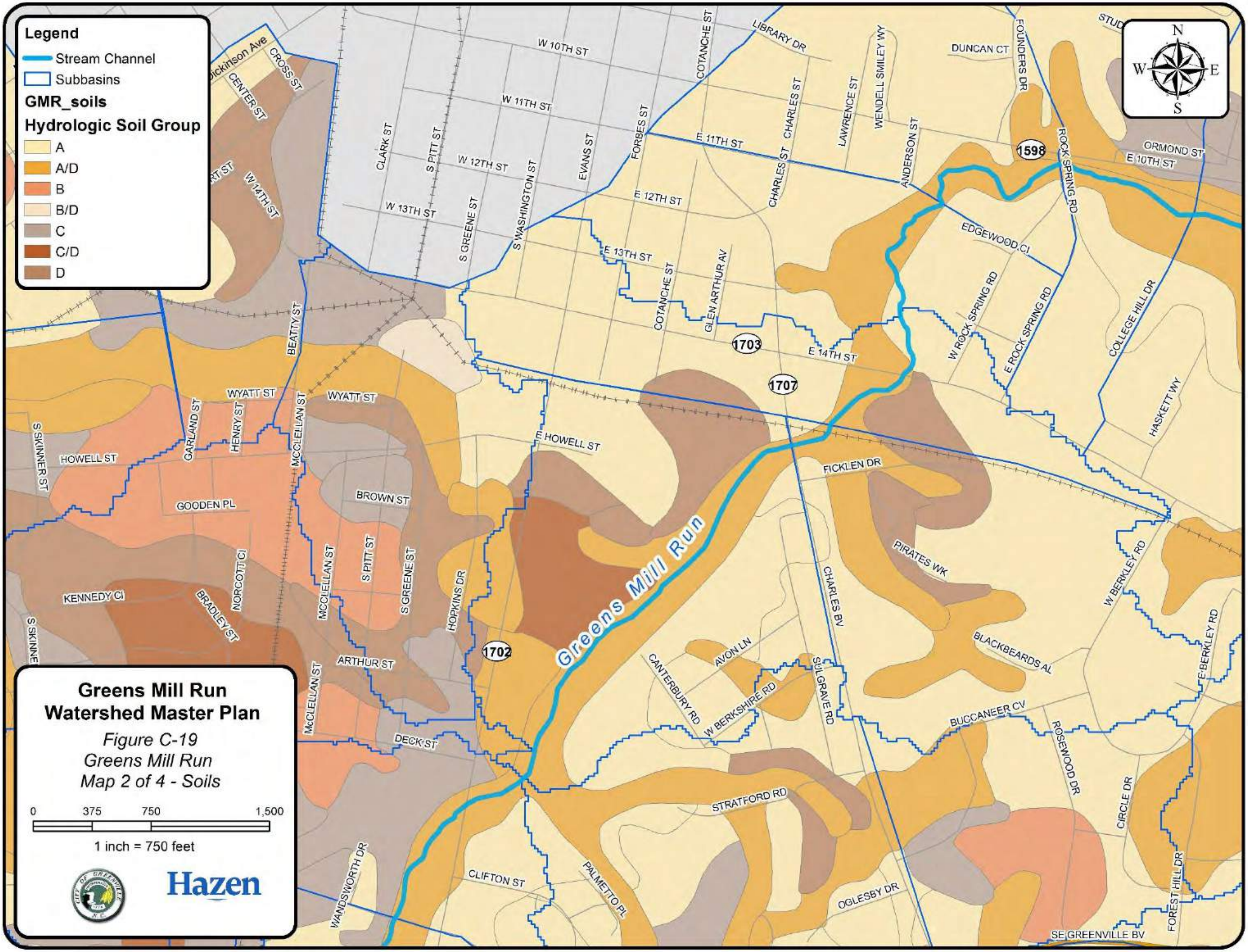
Figure C-16
Unnamed Tributary
Land Use



Greens Mill Run Watershed Master Plan

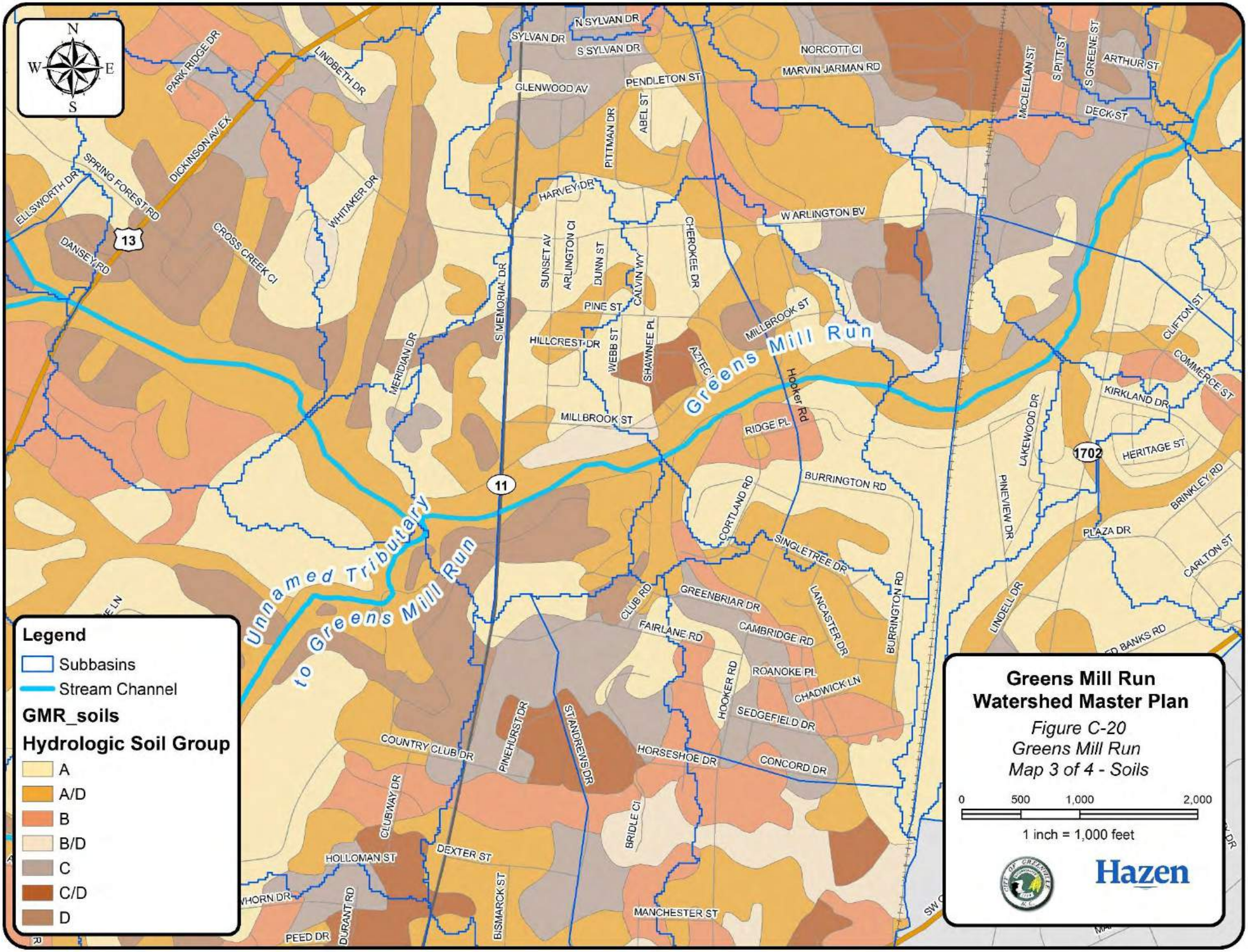
Figure C-17
North Fork
Land Use


Greens Mill Run
Watershed Master Plan
Figure C-18
Greens Mill Run
Map 1 of 4 - Soils
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
GMR_soils
Hydrologic Soil Group
A
A/D
B
B/D
C
C/D
D
N
S
E
W
Greens Mill Run
Fornes Run
Reedy Branch
1598
33
264
WILLOW ST
S ROTARY AV
S HARDING ST
E 1ST ST
N ELM ST
N OAK ST
ASH ST
N WARREN ST
WYNDHAM CI
E 2ND ST
BROWNLEA DR
ALDERGATE CT
JOHNSTON ST
S EASTERN ST
LEWIS ST
S MEADE ST
S LIBRARY ST
E 3RD ST
FOREST HILL CI
HICKORY ST
LAUREL ST
SYCAMORE ST
CEDAR ST
CYPRESS VIEW DR
BEECH ST
CEMETERY RD
E 4TH ST
S OAK ST
E 5TH ST
LEARY CT
MAPLE ST
HILL TOP ST
STUDENT PLAZA DR
DIXON DR
E 6TH ST
ERNUL ST
E 8TH ST
ORMOND ST
E 10TH ST
E 9TH ST
GREEN SPRINGS DR
COLLEGE VIEW DR
HEATH ST
MONROE ST
EDWARDS ST
VERDANT DR
NE GREENVILLE BV
E ROCK SPRING RD
COLLEGE HILL DR
MADISON CI
JACKSON DR
JEFFERSON DR
BROOKWOOD DR
RIVER BLUFF DR
N LONGMEADOW RD
MAPLEWOOD CT
W WRIGHT RD
E WRIGHT RD
ALEXANDER CI
ROSE ST
CROCKETT DR
HASKETT WY
ORTON DR
S ELM ST
LONGMEADOW RD
GRAHAM ST
POLK AV
JOHN AV
TRYON DR
EASTGATE DR
MOSELEY DR
RUTLEDGE RD
E 14TH ST
RAGSDALE RD
S WRIGHT RD
SE GREENVILLE BV
CHERRY CO
CEDAR LN
SLAY DR
DALEBROOK CI
KINGSBROOK RD
DEAL PL
COTTEN RD
LUCI DR
GOLDEN RD
CEDAR CT
EASTBRO
TYLER LN
UMSTEAD AV
FLETCHER PL
KINGSTON CI
LISA LN
LAURA LN
BELMONT DR
KENT RD
N OVERLOOK DR
BEAUMONT DR
EVERGREEN DR
OSCEOLA DR
DAVID DR
ADAMS BV
NICHOLS DR
VALLEY LN
PRINCE RD

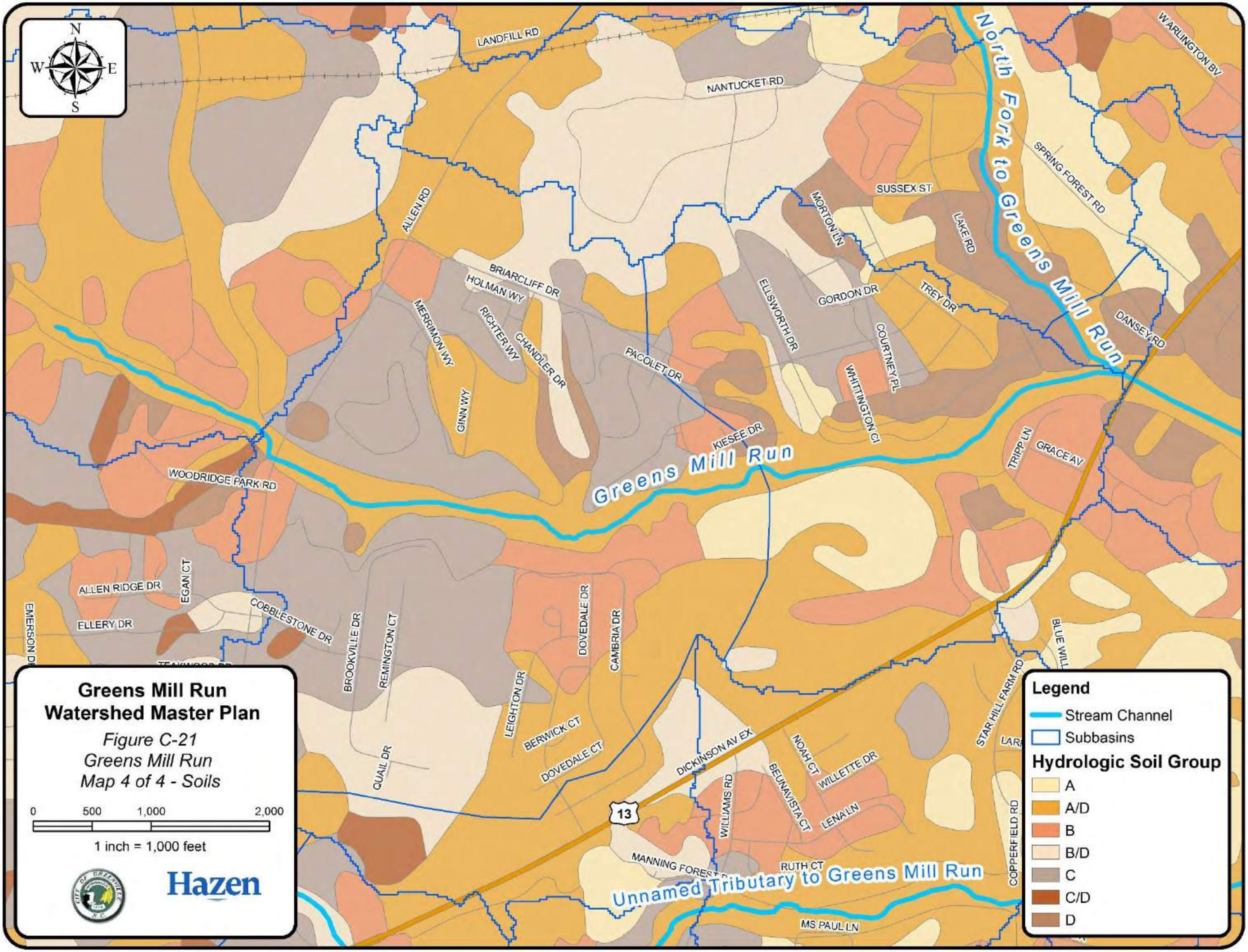


Greens Mill Run
Watershed Master Plan

Figure C-19
Greens Mill Run
Map 2 of 4 - Soils

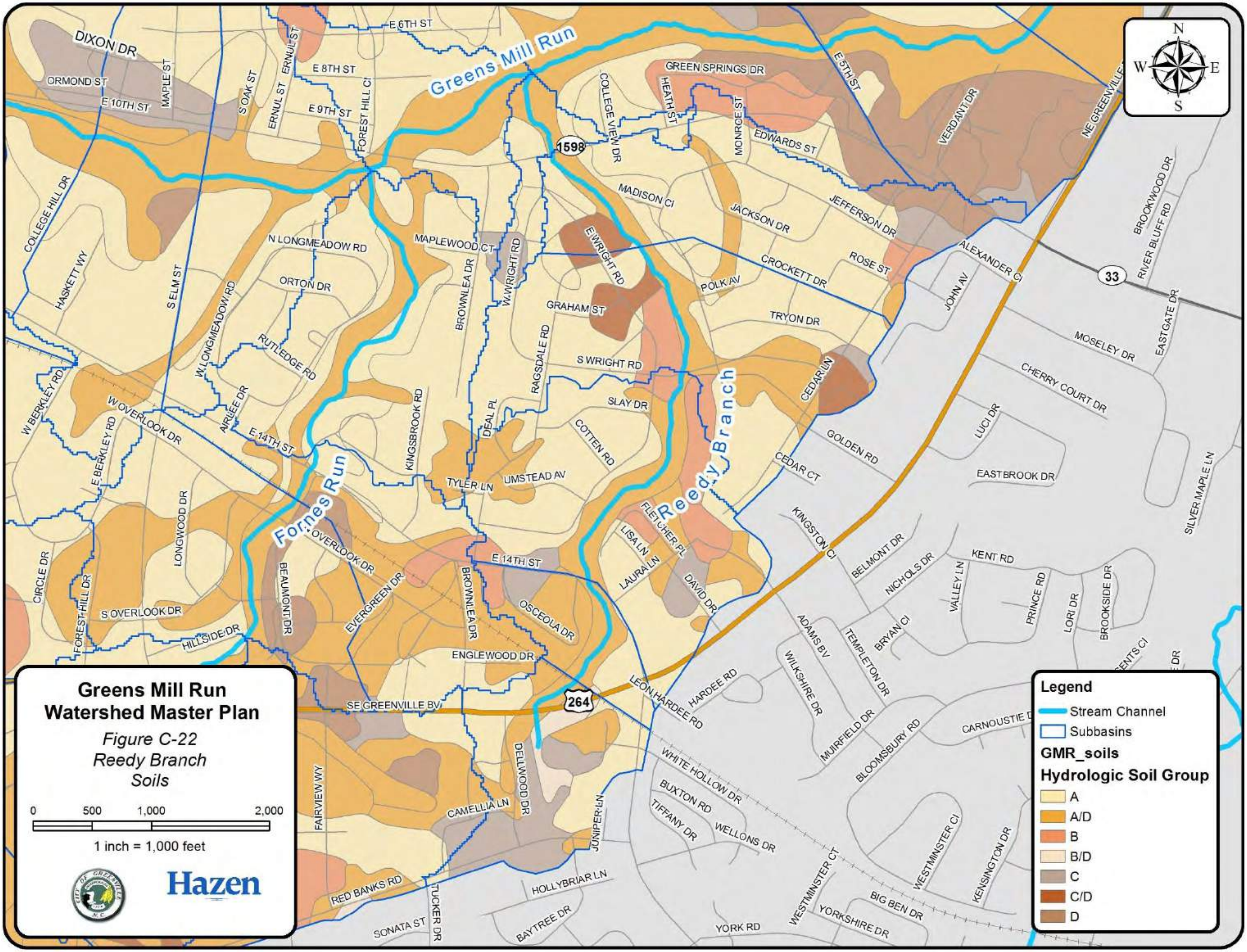


N
E
S
W
Legend
Subbasins
Stream Channel
GMR_soils
Hydrologic Soil Group
A
A/D
B
B/D
C
C/D
D
Greens Mill Run
Watershed Master Plan
Figure C-20
Greens Mill Run
Map 3 of 4 - Soils
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Greens Mill Run
Unnamed Tributary
to Greens Mill Run
13
11
1702
N SYLVAN DR
SYLVAN DR
S SYLVAN DR
GLENWOOD AV
PENDLETON ST
NORCOTT CI
MARVIN JARMAN RD
MCCLELLAN ST
S PITT ST
S GREENE ST
ARTHUR ST
DECK ST
PARK RIDGE DR
LINDBETH DR
DICKINSON AV EX
SPRING FOREST RD
ELLSWORTH DR
DANSEY RD
CROSS CREEK CI
WHITAKER DR
PITTMAN DR
ABEL ST
HARVEY DR
W ARLINGTON BV
SUNSET AV
ARLINGTON CI
DUNN ST
CALVIN WY
CHEROKEE DR
PINE ST
HILLCREST DR
WEBB ST
SHAWNEE PL
AZTEC
MILLBROOK ST
S MEMORIAL DR
MERIDIAN DR
Hooker Rd
RIDGE PL
BURRINGTON RD
CORTLAND RD
SINGLETREE DR
CLIFTON ST
COMMERCE ST
KIRKLAND DR
LAKEWOOD DR
HERITAGE ST
BRINKLEY RD
PINEVIEW DR
PLAZA DR
CARLTON ST
LINDELL DR
CLUB RD
GREENBRIAR DR
FAIRLANE RD
CAMBRIDGE RD
LANCASTER DR
ROANOKE PL
CHADWICK LN
HOOKER RD
SEDGEFIELD DR
HORSESHOE DR
CONCORD DR
COUNTRY CLUB DR
PINEHURST DR
ST ANDREWS DR
CLUBWAY DR
BRIDLE CI
HOLLOMAN ST
DEXTER ST
BISMARCK ST
MANCHESTER ST
DURANT RD
PEED DR

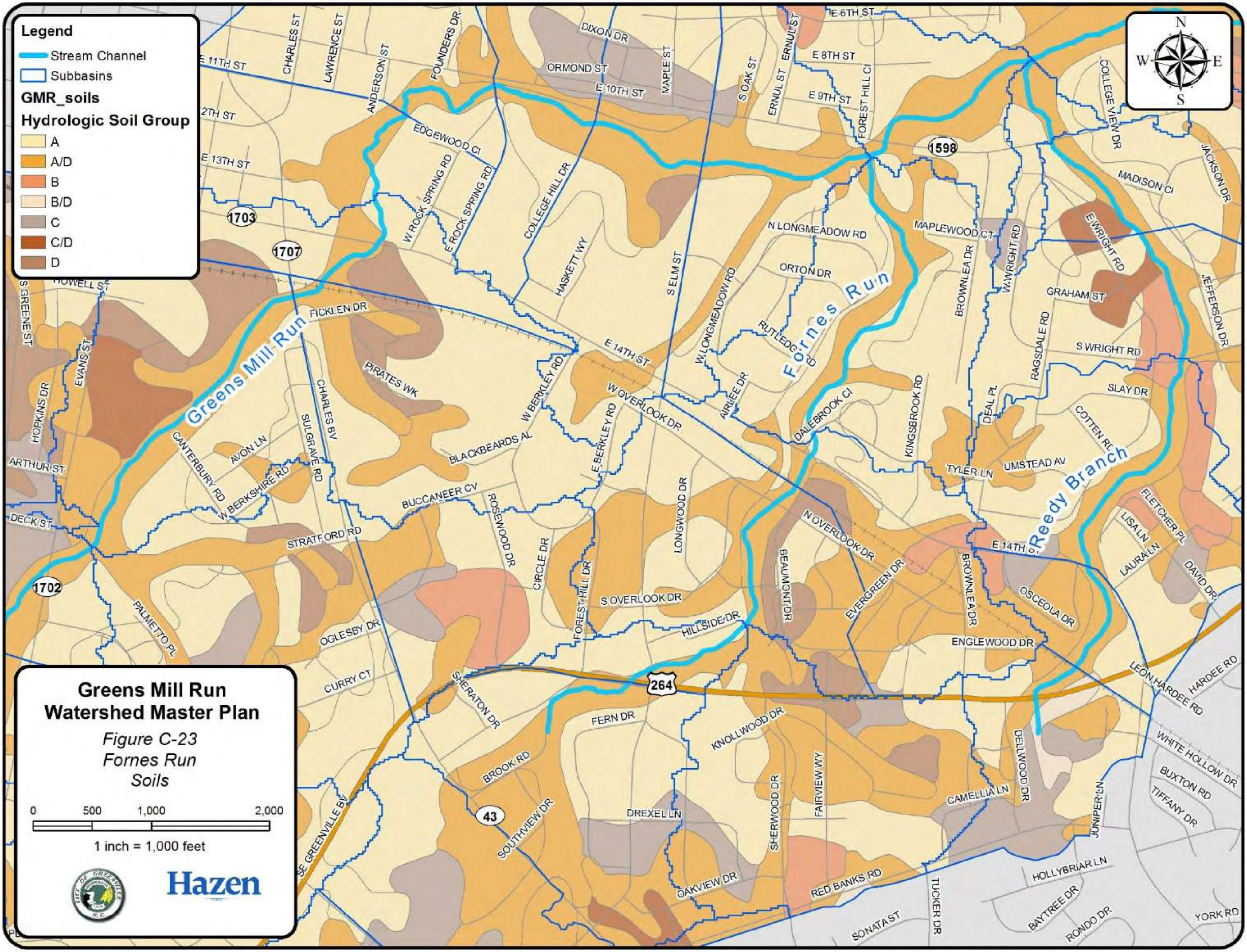


Greens Mill Run
Watershed Master Plan

Figure C-21
Greens Mill Run
Map 4 of 4 - Soils

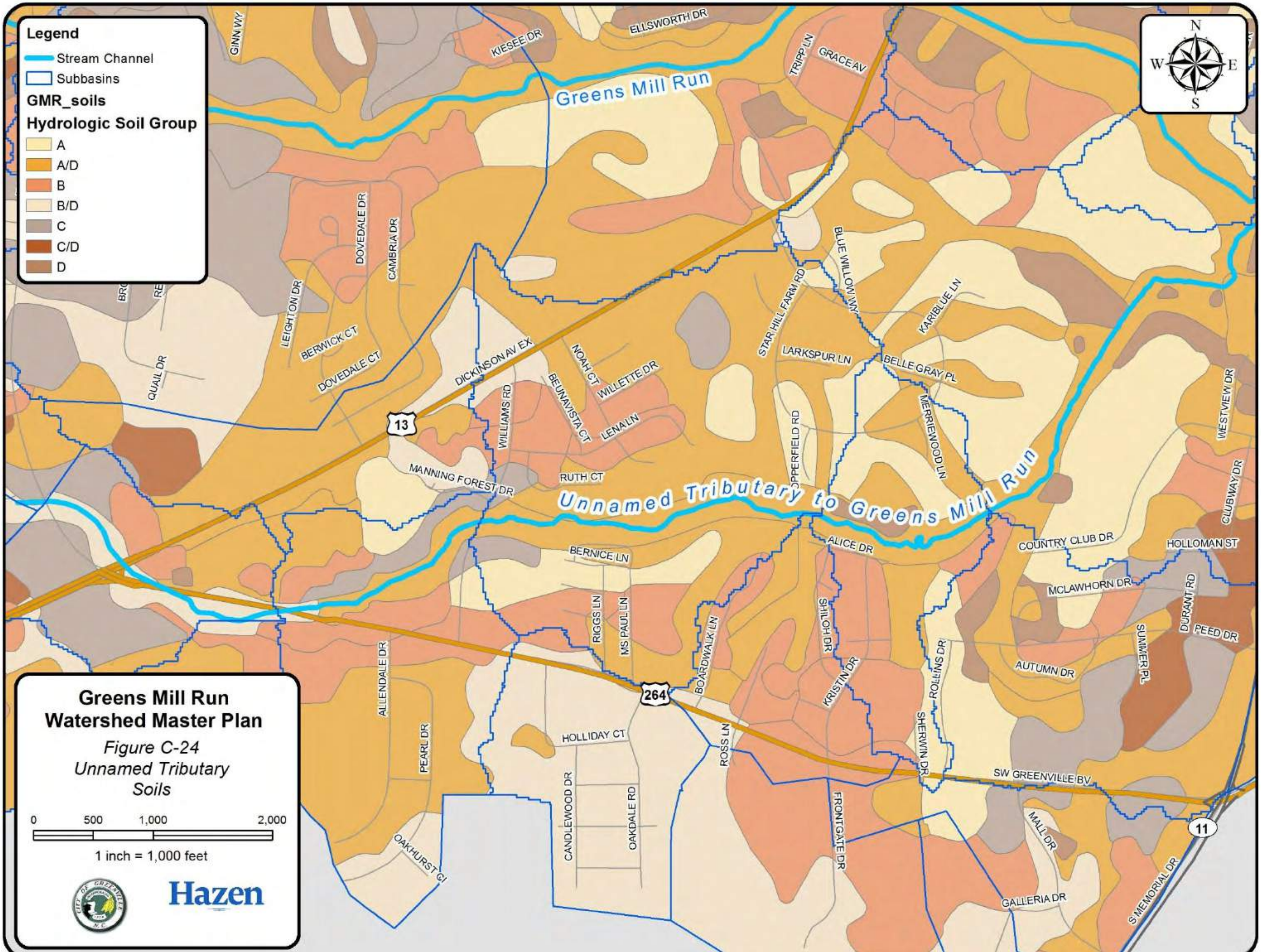


Greens Mill Run
Watershed Master Plan
Figure C-22
Reedy Branch
Soils
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
Legend
Stream Channel
Subbasins
GMR_soils
Hydrologic Soil Group
A
A/D
B
B/D
C
C/D
D
N
S
E
W
Greens Mill Run
Fornes Run
Reedy Branch
1598
33
264
DIXON DR
ORMOND ST
E 10TH ST
MAPLE ST
S OAK ST
ERNUL ST
E 8TH ST
E 9TH ST
E 6TH ST
FOREST HILL CI
GREEN SPRINGS DR
COLLEGE VIEW DR
HEATH ST
MONROE ST
E 5TH ST
EDWARDS ST
VERDANT DR
NE GREENVILLE
MADISON CI
JACKSON DR
JEFFERSON DR
ALEXANDER CI
BROOKWOOD DR
RIVER BLUFF RD
COLLEGE HILL DR
HASKETT WY
S ELM ST
N LONGMEADOW RD
ORTON DR
MAPLEWOOD CT
BROWNLEA DR
W WRIGHT RD
E WRIGHT RD
GRAHAM ST
POLK AV
CROCKETT DR
ROSE ST
JOHN AV
TRYON DR
EASTGATE DR
MOSELEY DR
W LONGMEADOW RD
RUTLEDGE RD
RAGSDALE RD
S WRIGHT RD
CEDAR LN
CHERRY COURT DR
W BERKLEY RD
W OVERLOOK DR
AIRLEE DR
E 14TH ST
KINGSBROOK RD
DEAL PL
SLAY DR
COTTEN RD
LUCI DR
GOLDEN RD
CEDAR CT
EASTBROOK DR
SILVER MAPLE LN
E BERKLEY RD
TYLER LN
UMSTEAD AV
LONGWOOD DR
KINGSTON CI
BELMONT DR
FLETCHER PL
LISA LN
LAURA LN
DAVID DR
CIRCLE DR
FOREST HILL DR
OVERLOOK DR
BEAUMONT DR
EVERGREEN DR
NICHOLS DR
KENT RD
VALLEY LN
PRINCE RD
LORI DR
BROOKSIDE DR
S OVERLOOK DR
HILLSIDE DR
OSCEOLA DR
ADAMS BV
TEMPLETON DR
BRYAN CI
WILKSHIRE DR
ENGLEWOOD DR
HARDEE RD
LEON HARDEE RD
SE GREENVILLE BV
MUIRFIELD DR
BLOOMSBURY RD
CARNOUSTIE D
WHITE HOLLOW DR
BUXTON RD
TIFFANY DR
WELLONS DR
FAIRVIEW WY
CAMELLIA LN
DELLWOOD DR
JUNIPER LN
WESTMINSTER CI
KENSINGTON DR
RED BANKS RD
HOLLYBRIAR LN
WESTMINSTER CT
BIG BEN DR
TUCKER DR
SONATA ST
BAYTREE DR
YORK RD
YORKSHIRE DR



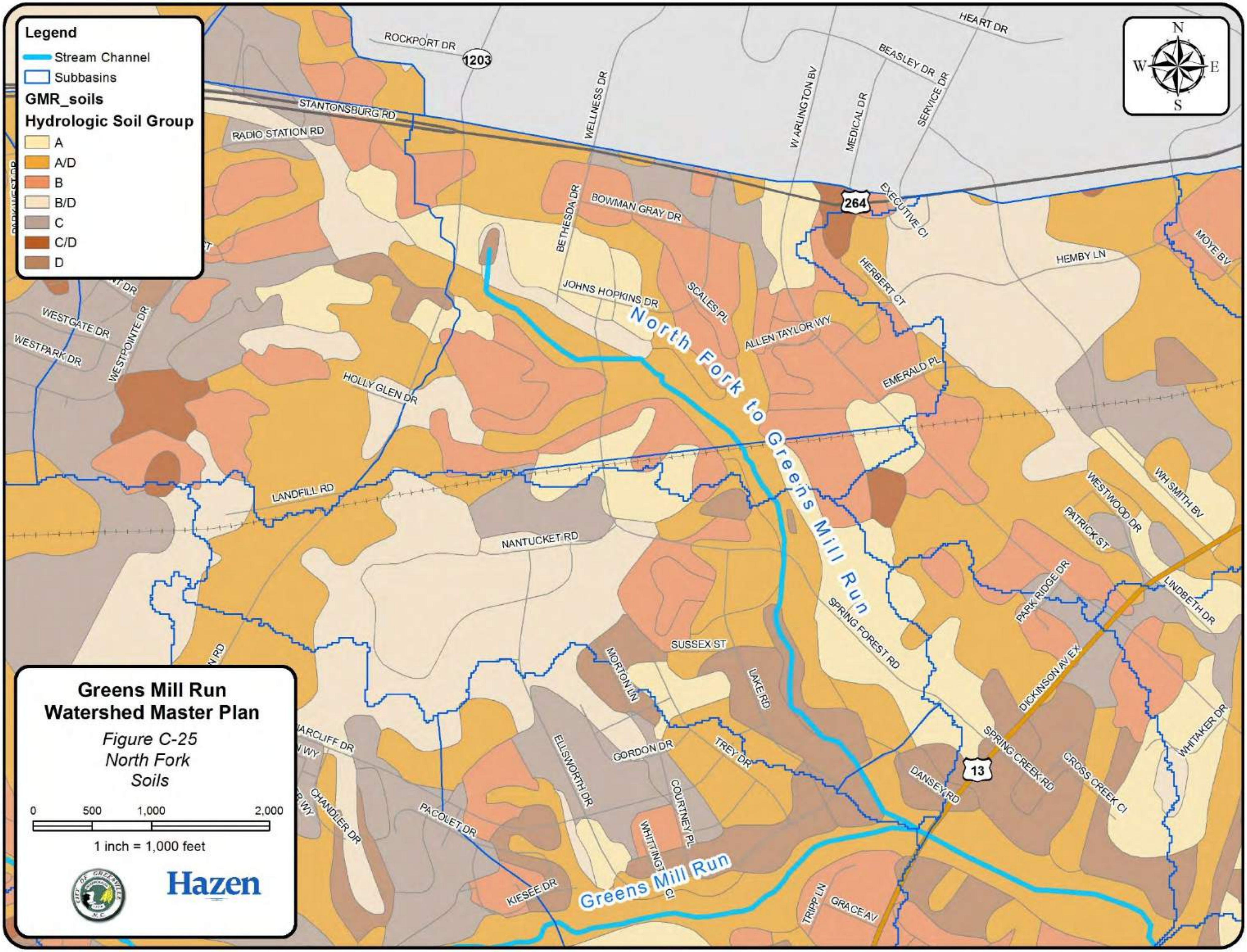
Greens Mill Run Watershed Master Plan

Figure C-23
Fornes Run
Soils



Greens Mill Run Watershed Master Plan

Figure C-24
Unnamed Tributary Soils



Legend
Stream Channel
Subbasins
GMR_soils
Hydrologic Soil Group
A
A/D
B
B/D
C
C/D
D
Greens Mill Run
Watershed Master Plan
Figure C-25
North Fork
Soils
0
500
1,000
2,000
1 inch = 1,000 feet
Hazen
North Fork to Greens Mill Run
Greens Mill Run
N
S
E
W
ROCKPORT DR
1203
HEART DR
BEASLEY DR
SERVICE DR
MEDICAL DR
W ARLINGTON BV
WELLNESS DR
STANTONSBURG RD
RADIO STATION RD
264
EXECUTIVE CI
BOWMAN GRAY DR
BETHESDA DR
HEMBY LN
MOYE BV
HERBERT CT
JOHNS HOPKINS DR
SCALES PL
ALLEN TAYLOR WY
EMERALD PL
WESTGATE DR
WESTPARK DR
WESTPOINTE DR
HOLLY GLEN DR
LANDFILL RD
NANTUCKET RD
WESTWOOD DR
WH SMITH BV
PATRICK ST
PARK RIDGE DR
LINDBETH DR
SPRING FOREST RD
SUSSEX ST
MORTON LN
LAKE RD
DICKINSON AV EX
WHITAKER DR
SPRING CREEK RD
CROSS CREEK CI
13
DANSEY RD
TREY DR
GORDON DR
ELLSWORTH DR
COURTNEY PL
WHITTINGTON CI
CHANDLER DR
PACOLET DR
KIESEE DR
TRIPP LN
GRACE AV

D. Citizen Input

Table D-1: General Survey Results

Survey Question #	Survey Question	Yes	No	Maybe
2	Have you ever experienced flooding on your property during a (non-Hurricane) storm?	18	29	------
3	Have you ever noticed flooded streets in your neighborhood?	22	20	------
4	Has flooding increased on your property due to any changes on nearby properties or drainage systems?	11	33	------
5	Have you had any erosion on your property associated with a stream or drainage ditch?	12	31	------
6	If a cost-sharing program was made available along with training, would you be willing to install a project such as a rain garden, cistern, backyard wetland, etc. to help improve water quality in your area?	21	6	17
7	Are you aware that the City of Greenville is currently analyzing and looking for possible solutions to erosion, flooding and water quality issues throughout the City with a watershed master planning process?	30	14	------
8	Are you aware of how the City of Greenville currently spends or utilizes its stormwater utility fee?	3	42	------

Table D-2: Frequency and Location of Flooding Question Responses (Question 2)

	Flooding Location						
Frequency of Flooding	Storage Building	Air Condition Units	Crawl Space	Living Space	Yard from Stream / Ditch	Yard from Street	Yard from Adjacent Property
Less than once per year	1	0	1	0	2	0	0
Once per year	1	0	0	0	1	0	0
2 - 3 times per year	0	0	1	0	2	3	2
More than 3 times per year	4	0	2	1	3	1	4
Every time it rains	1	1	1	2	3	4	3

Table D-3: Areas Impacted or Threatened by Erosion (Question 5)

Location	Responses
Street	0
Yard	8
Building/House	1
Fence	0

Table D-4: How Should Funding be Utilized?

Spending Category	Responses
Develop cost-sharing program for installation of projects to reduce/manage stormwater flows	22
Develop incentives for replanting areas adjacent to streams	23
Develop a program to address erosion on private property	21
Construct and maintain water quality control practices on public properties	25
Stream restoration	24
Buyout of floodprone properties	19
Other	5

Greenville
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City of Greenville

Watershed Master Plan

Public Involvement Plan

August 2014

Contents

City of Greenville Watershed Master Plan
Public Involvement Plan

1.0 Project Background

The City of Greenville is developing Watershed Master Plans (WMPs) as part of its comprehensive stormwater management program. The goals of the WMP projects include:

1) evaluating the watershed for existing flooding, water quality, and erosion,
2) recommending and prioritizing capital improvements to control existing flooding by reducing the frequency and severity of flooding for property owners, and
3) identifying stream stabilization projects to reduce the risk of property loss along streams and to reduce sediment loads as a result of erosion.

Seven (7) watersheds have been identified in the City of Greenville. The Master Plan will be developed for six of the seven (one watershed, Meetinghouse Branch, was completed in a pilot project). Figure 1 includes an illustration of the geographical boundaries of each watershed.

The six watersheds to be included in the WMP are:

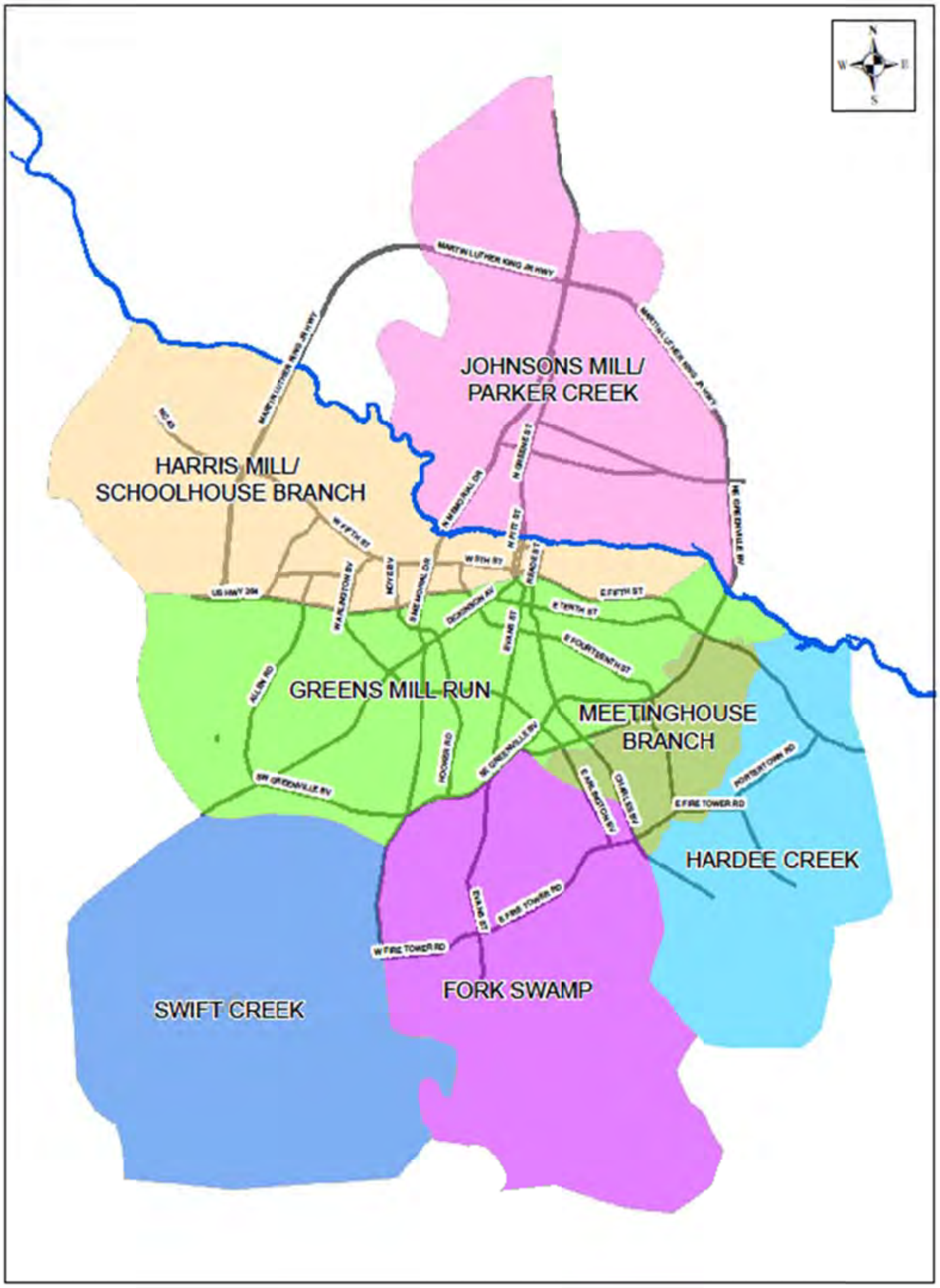
- Fork Swamp
- Greens Mill Run
- Hardee Creek
- Harris Mill Run/Schoolhouse Branch
- Johnsons Mill/Parker Creek
- Swift Creek

The City is committed to a comprehensive public involvement program to educate, inform and engage citizens and businesses about stormwater-related issues and the benefits of watershed master planning to the quality of life in and around the City of Greenville. This Public Involvement Plan (PIP) includes general approaches for public outreach as well as activities appropriately tailored to each watershed's unique characteristics.

2.0 Public Involvement Overview

The City of Greenville will provide the public with meaningful involvement throughout the WMP development, in order to ensure that the public is invested in the process, can support the recommendations, and that recommendations clearly reflect that the needs and expectations of the public have been heard, meaningfully evaluated and incorporated in final recommendations. Key to the success of the process will be an inclusive public involvement program that utilizes a variety of communications tools to engage and solicit input from a wide range of stakeholders. To achieve the

Figure 1
Greenville Watersheds



goal of educating and informing the general public, public involvement activities will be focused on activities that will yield maximum exposure and provide maximum opportunities for participation.

In summary, the City of Greenville Watershed Master Plan public involvement plan will:

- Reflect the City's commitment to an environment in which decisions are based on an objective, transparent, and inclusive planning process that actively seeks input from a variety of stakeholders.
- Use creative ways to ensure that the input of the public and specific stakeholder groups is gathered for use in the project's decision-making process. The City of Greenville will consider all public information and technical input and will ultimately make decisions about the stormwater management program.
- Facilitate open and clear communications. This project will involve multiple face-to-face and Internet-based opportunities for stakeholders to ask questions and receive timely feedback. Questions and concerns will be gathered and recorded, responses developed, and updated information disseminated throughout the WMP.

2.1 Purpose of Public Involvement

The public involvement program is structured to engage multiple audiences including residents, agency partners, community organizations and homeowner associations, elected officials, institutions, local businesses and business organizations, faith-based organizations and the public at large. Public participation opportunities will be designed to:

- provide information on the approach to the study
- gather input from stakeholders early and at key milestones, and
- share preliminary recommendations for watershed improvements.

Activities will include education of the Greenville general public, as well as participation by stakeholders via open house/public meetings, online surveys, and multiple opportunities and mechanisms for giving input.

2.2 Public Involvement Strategy & Activities

The public involvement strategy for the WMP is primarily designed to provide a structure and a forum for City of Greenville stakeholders – including residents, the business and academic communities – and the general public to provide input and comment on major issues, problems, and solutions throughout the study.

The major stakeholder groups that have been identified thus far include, but are not limited to:

- Greenville residents
- Greenville businesses
- Community Leaders
- Faith community
- Environmental and Civic Groups
- Homeowner's associations
- Local Elected Officials (City, County)
- Chamber of Commerce
- Area Colleges & Universities
- Local School Systems
- Major Employers

In addition, communications materials will be provided in languages other, as needed to reach populations with limited English proficiency.

2.2.1 Early Education and Coordination

Effective public involvement for watershed master planning begins with education because the WMP process involves complex regulatory issues, along with technical and scientific concepts. In addition, local constituencies may represent a broad range of interests and concerns, including private property and development rights, recreational use, and resource conservation. The Public Involvement Plan will actively engage all interested members of the public and provide multiple outlets for learning about and delivering feedback to the project.

The education process for the Greenville WMP will begin with distribution of educational collateral (fact sheets, etc.) in hard copy, via electronic media (website, social media), and in educational videos. In addition, educational materials will be provided to local media outlets.

Educational materials will help reinforce ongoing efforts to help the general public understand concepts such as:

- What is a watershed
- Why is watershed master planning important
- What is involved in the watershed inventory/planning process
- What is the role of the public in watershed master planning

2.2.2 Questionnaire

A questionnaire will be distributed citywide to assess the watersheds' conditions from the perspective of residents and property owners (historical flooding, drainage issues, erosion, etc.). Methods to distribute the questionnaire will include an online survey instrument, direct and e-mail, coordination with homeowner associations, community and faith-based organizations and hard copy distribution at public locations.

2.2.3 Public Meetings

Two rounds of public meetings will be held in each of the six watersheds. The first round of public meetings will be held early in the process during the watershed inventory phase. The second round of public meetings will be held following the completion of the draft master plan when the modelling is completed and draft recommendations are available.

Meetings will allow participants to provide direct and specific input on areas of concerns and reactions to proposals. The meeting format will allow for participation in a collaborative, informal atmosphere. Various maps and graphics depicting important project elements will be on display. Informational packets and comment cards will be distributed to receive additional input. Meetings will be held in convenient locations throughout the study area to maximize participation by various stakeholder groups.

Advertising for all public meetings will include a variety of techniques such as media, flyer distribution by hand and e-mail, direct mailings and coordination with participating municipalities. All advertising will occur at least two weeks in advance. Where opportunities are available, participation in events within the study area such as festivals, homeowner association meetings, etc. will be utilized to notify the community.

2.2.4 One-on-One On-Site Interviews

Data from the questionnaires will be used to help identify properties requiring on site resident interviews. The purpose of the interviews is to collect additional information that cannot necessarily be conveyed in a public meeting or questionnaire format, such as high water marks, extent of flooding, property damage, etc. The need for specific interviews will occur on a case by case basis and will be coordinated in advance with property owners and affected stakeholders.

2.2.5 Media Outreach

Project activities, updates, public meeting announcements, and educational materials (or links thereto), will be provided to local media outlets. Media outlets will include The Daily Reflector, G-Vegas Magazine, The Greenville Times, The East Carolinian, Her Magazine, The Minority Voice and Viva Greenville and other local print publications, public access television, and local radio stations. Advertisements will be placed in African American, Hispanic and Asian media outlets to ensure broader minority inclusion in the outreach process.

2.2.6 Website and Social Media

The project will take full advantage of the broad reach offered by the Internet and social media to ensure the public is informed and has meaningful opportunities to be involved in the WMP projects. A dedicated project web portal, linked to the City of Greenville website, will be used to post public notices, maps, reports, and other relevant documents for public review. A project email address will be established to enhance two-way communication with the community. Feature articles will be distributed via internet, email and post to provide updates and opportunities for public input. The website will remain under the control of the Public Information Officer for the City of Greenville; the project team and consulting staff will coordinate all updates with the PIO. The public will be alerted to website and social media updates.

3.0 Watershed-Specific Plans

To meet plan objectives and ensure stakeholder needs are met in a meaningful way, the remainder of this document will address public involvement activities specific to each unique watershed. This section will be the most fluid in the watershed plan. While goals and commitments will be standard across watersheds, and the public will have access to identical types and quantities of information, this section of the plan will be used to reflect any changes, at the watershed level, to project schedules, outreach activities, etc., identified as necessary in order to meet the specific needs of the watershed. Thus, we expect it to be updated frequently.

This section addresses the following:

- Distinguishing watershed characteristics found in watersheds (e.g., urbanized, rural, agricultural, etc.)
- Stakeholders (e.g., proportion of businesses to residents, contains campuses, rural vs. urban, proportion of non-English speaking population, etc.)
- Public outreach phases
- Scheduling of public outreach activities

Watershed	Total Area	Area in City Limits (Developed)	Area in ETJ&City Limits
Meetinghouse Branch	3.03	3.03	3.03
Greens Mill Run	14.36	10.85	12.79
Harris Mill Run / Schoolhouse Branch	12.58	5.86	11.89
Johnsons Mill Run / Parker Creek	14.48	4.91	12.88
Hardee Creek	9.03	1.72	4.34
Swift Creek		2.05	4.54
Fork Swamp		5.58	7.25
		34.00	**56.72**

- Greens Mill Run and Harris Mill Run/Schoolhouse Branch are the least developed watersheds; Meetinghouse Branch is 100% developed, and Johnsons Mill Run/Parker Creek is 60% developed.

- Johnsons Mill/Parkers Creek - These watersheds are located north of the Tar River and extend beyond the City Limits and ETJ, draining the majority of the corporate limits north of the Tar River.
- Harris Mill Run/Schoolhouse Branch – These watersheds are directly south of the Tar River and drain Medical District.
- Hardee Creek – This watershed is located on the east side of the City and south of the Tar River. It drains outlying portions of the southeastern corporate limits.

4.0 Schedule of Public Outreach Activities

Development of educational materials, reporting and presentation templates, media and website documents has already begun, and most elements will continue throughout the project.

- The public will begin to receive information about the project in July 2014.
- The watershed questionnaire will be distributed beginning in early August 2014.
- Survey technicians will conduct field sampling within the watersheds beginning in August 2014. Homeowner notification will be provided in advance of any field work.
- The first round of public meetings is estimated to begin in mid-to-late September 2014.
- The second round of public meetings is estimated to be conducted in May 2015.

5.0 Evaluation of Public Outreach Activities

Performance of outreach methods will be monitored continually to evaluate the effectiveness of the public involvement program and adjust, as needed, to respond to the communications needs of the public.

Greenville
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PUBLIC WORKS

Greenville Watershed Master Plan

You Are Invited!

Please join the City of Greenville at a public meeting to receive an update on the Greenville Watershed Master Plan (WSMP) project. There is a lot of important new information to share. The systemwide inventory of stormwater drainage infrastructure has been completed, feedback from meetings with property owners and other members of the community has been compiled, and potential projects have been identified.

We will share inventory data and findings, along with displays of associated impacts and other information. We will also discuss possible projects and their benefits and any issues addressed during the field work, including maintenance.

Your involvement is an essential part of this project, and we encourage you to not only attend but to let your neighbors and colleagues know about the meeting too! Details for attending the public meeting are as follows:

Tuesday, November 17, 2015

4:00 pm -7:00 pm*

City Hall - Third Floor Gallery

*The meeting will follow an Open House format, with display stations and roving project team members to answer questions. Therefore, attendees may arrive **at any time between 4 pm and 7 pm.**

Find project details at greenvillewsmp.com

Contact Us: wsmp@greenvillenc.gov or (252) 329-4467

City of Greenville, Dept. of Public Works — Greens Mill Run Watershed

Division of Stormwater Management — November 5, 2014

Watershed Master Plan Public Meeting — Sheppard Memorial Library

City of Greenville and Consultant Attendees

Lisa Kirby, Project Manager, City of Greenville	Travis Crissman, Hazen and Sawyer
Amanda Boone, City of Greenville	Leah Young, Hazen and Sawyer
Victor Long, City of Greenville	Jason Doll, Moffatt & Nichol
Eban Bean, ECU	Inga Kennedy, PEQ
	Marla Hill, PEQ

Meeting Summary

1. Welcome and Purpose of Meeting

   - Residents of Greenville's Greens Mill Run watershed were invited to learn more about the Watershed Master Plan process and to give their input on stormwater issues and challenges they have experienced.
   - The meeting began with an open house where attendees could view watershed maps to mark the location of their property, identify areas of flooding and other stormwater issues, and speak with staff and consultants of the City's Stormwater Division about their problems and observations.
   - Attendees were then invited to hear a short presentation on the Watershed Master Plan. Project manager Lisa Kirby explained the overall purpose of the master planning process and then invited consultant Travis Crissman of Hazen and Sawyer to describe the findings to date from the field assessment of the watershed. Inga Kennedy of PEQ shared information about the City's public involvement commitment and activities. Lisa Kirby ended the presentation with a description of next steps and then the open house resumed.

2. Questions/Comments by Participants
   - Will the Corps of Engineers approve the plans for working with streams? Or will that be a problem?
     - We can't know at this stage, but projects will be prioritized by factors such as cost estimate and permitting requirements. If a project seems not feasible because of permitting requirements, that will lower its score.
   - What timeframe are you looking at for getting permits?
     - In our experience, it can take anywhere from 2-12 months.

- There is a stream behind my house and I'm getting a lot of water from Evans Street and from the Harris Teeter parking lot where there is a bulkhead. What I get in my yard, which contains a ditch right now, has a little of everything in it – bottles, trash, etc., and doesn't get cleaned out any more. We have cleaned it out a couple of times ourselves. Once about 15 years ago, oil got in it and people from Washington came down and took samples and did something to it. Now there is oil getting into it again. My yard is totally caving in. I wonder when I'm stepping in my backyard now, where it's so deep in the center, whether I could go down in it. I've already stepped on the edge and it took me in with it resulting in bruises and a fractured shoulder. My yard is worse 15 years later. It starts at the first houses. The house next to me never got water in the yard, but now he's having problems. That tells you that this situation is not being looked after; it is going from house to house. My neighbor told me about a big ditch hole that water is making bigger and bigger. Ms. Kirby has walked it with me.

- One of the things that you didn't mention but that may be part of the plan, we would like assurance that something will be accomplished. We've had this conversation plenty of times with consultants we probably paid with taxpayer dollars. We want to know what you are going to do, when you're going to do it, how it will be monitored and evaluated. If the solution isn't working and there's no one going back to see if it was successful, it's a waste. We would like to know of strategies that have worked elsewhere. How do we deal with issues where companies come in and do what they want with the land but it affects the surrounding properties? What will the City do to enforce and ensure that these solutions are effective? Who will follow up? There may have been mitigating strategies, but they did not work and there's been no plan to ensure they work as they are supposed to.

- There's a proposal to widen Evans Street – how does this all work together? Are you factoring that into the Master Plan because that's going to add more water coming in our ditch, going down Evans Street feeding into Greens Mill Run and other areas.

- Concerns about developments causing damage to these properties date back to 1972. Council was told back then that this was urgent and that residents need help. I served on a flood task force to address these issues. The need was to come up with a comprehensive plan for land use, residential, recreational, etc. Seems now you're looking for places where there's a crisis, instead of pouring concrete or building a dam; what is needed is a plan to control development. Greenville is growing but it doesn't have to be like this. None of this growth has been developed with a mandate for efficient control of stormwater. Housing shouldn't be cheap when it affects quality of life for people downstream; Harris Teeter shouldn't be allowed to build and affect others, such as the lady falling in her yard. We'd like to see some political will and for developers to have to pay for the effects that they've caused. I have been on several task forces but the proposed fixes are Band-Aids.

- The house George Hamilton lived in was bulldozed and the property is not marketable because of its location and flooding. The person who owns it now can't sell it.

- I just received a chart from someone modeling for USGS – Greenville is discharging high concentrations of nitrogen and phosphorus into the Tar River.
    - Our first attempt to address water quality was 1994. This is part of the shift to a holistic approach – we realized that we were putting Band-Aids on problems and shifting the problems downstream. That is not in the best interest of our stormwater utility or our residents and is why we decided to do a citywide master plan to look at the problems in all the watersheds and say, if I address this problem, I will solve many problems. This is why we're doing this with several firms and expediting the process. The CIP is more of a holistic approach – it may involve regional approaches. We've engaged Aden, Winterville, etc. because the problem is bigger than Greenville. We can't fix the past but we believe we are moving in the right direction. As a result of last year's pilot project, we have increased the detention requirements (2004). Before then, there were no requirements for residential development, only commercial. Now we've increased the volume of storm developers have to design for and increased regulations, and that is the goal we are trying to realize.

- What is the solution to what we already have in place? What do you do? Dig your creek deeper?
    - A: Digging the creek deeper isn't always the solution. Other solutions might include planned storage, replacing floodplains, regional facilities that reduce storm release.
- How does that help in already developed areas?
    - It helps them by reducing the volume of stormwater that is coming to them.

- When the master plan is done, how will it be paid for? Will funding be available?
    - Part of the process will be identifying potential sources – grants, etc. – plus revenue from the stormwater utility.
- I just want to mention that this seems like a good opportunity to integrate stormwater goals with transportation goals. One problem is too many parking lots. Seems like a good opportunity to limit the amount of parking that goes in. Can we overall think of this as a way of controlling

the amount of car-oriented development we have? Seems like a good chance to rethink all those giant parking lots. Would like to see this have some teeth so we don't end up with more. Any way that we can support some change in policy and development patterns?

- One reason we're doing this is to get those kinds of ideas. Please note your ideas on our survey.

- One thing I think people would like to know is what kind of timeline will we have and what's to keep more of us from losing our property to this ditch that feeds into Green Mill Run, down Lindell road, to Lake -----? Your plan is not going to be fully developed until December 2015 – a year from now; that's a lot of water down the ditch. And that's not even when you'll be starting to implement. So we're looking at 2-4 years. People started asking for help in 1972.
    - We don't know what temporary solutions we can provide for local problems, plus this takes away from resources that could be used for the holistic approach. We have discussed with developers retaining more voluntarily to help with this problem.

3. Participant Feedback at Stations
    - We spoke to a gentleman at the first meeting whose house is on Fairlane Rd. He said that during a heavy rainfall event he has seen water in the road get up to knee high (~24"). He says water frequently backs up into his yard, but not into the house yet.
    - We spoke at length with a man who lives at 296 Millbrook Street. His house backs up to the main stem of GMR just upstream of the Hooker Road crossing. He said anytime there is a high intensity storm (he estimated 2-3 inches of rain), the creek rises up into his back yard and impacts his detached garage, as is the case with his neighbor's. He explained his house is on a high spot, so he has not ever had flooding above finished floor grade, even during Hurricane Floyd, but many of his neighbors were not so lucky.
    - We spoke with a group from Lakewood Pines and Sherwood Acres; both receive runoff from the Target parking lot and other areas, including discharges from the other side of Evans Road. The drainage ditch receiving runoff from the Target parking lot has, over the years, grown from a foot or so deep to anywhere from 6-12 feet deep and it continues to deteriorate. It is causing property loss and is threatening structures. Residents have fallen in. Several houses have been condemned. Past studies have been done that suggested piping the drainage feature but that would require cutting of "old growth forest" and a 30' easement and the residents don't care for that scenario. Large quantities of water end up in the ditch even during small summer showers. Residents state the ponds at Target do not function. They also state that the underground system in University Suites does not function properly. Streets get flooded starting 2 years ago.

City of Greenville, Dept. of Public Works	Greens Mill Run Watershed
Division of Stormwater Management	**November 5, 2014**
Watershed Master Plan Public Meeting	**ECU Murphy Center, Harvey Hall**

City of Greenville and Consultant Attendees

Lisa Kirby, Project Manager, City of Greenville	Travis Crissman, Hazen and Sawyer
Amanda Boone, City of Greenville	Leah Young, Hazen and Sawyer
Victor Long, City of Greenville	Jason Doll, Moffatt & Nichol
Eban Bean, ECU	Inga Kennedy, PEQ
Mike O'Driscoll, ECU	Marla Hill, PEQ

Meeting Summary

1. Welcome and Purpose of Meeting

- Residents of Greenville's Greens Mill Run watershed were invited to learn more about the Watershed Master Plan process and to give their input on stormwater issues and challenges they have experienced. Only two attendees were present, so the formal presentation was not offered.
- Attendees viewed watershed maps to mark the location of their property, identify areas of flooding and other stormwater issues, and speak with staff and consultants of the City's Stormwater Division about their problems and observations.
- Lisa Kirby gave the two attendees a brief summary of the presentation on the Watershed Master Plan, and consultant Travis Crissman of Hazen and Sawyer described the findings to date from the field assessment of the watershed. Inga Kennedy of PEQ shared information about the City's public involvement commitment and activities. Lisa Kirby discussed next steps and the meeting was adjourned.

2. Questions/Comments by Participants
   - None.

3. Participant Feedback at Stations

- Two individuals (Possibly mother/son?) are tenants in a rental property on Alice Drive along the South Fork of GMR just north of Greenville Blvd. They explained that during even the slightest rain, water backs up in the street all along their street and around some of the houses, including theirs. This occurs with very little rain, less than an inch by their account. They also explained that the stream is severely eroded through that reach and gave us pictures showing blown out banks and downed trees.

Name	PropertyAd	Fld_NonHur	NonHurAdd	Bldg_flood	Bldg_Freq	AC_fld	AC_Freq	Crawl_Fld	Crawl_Freq
Linda Wolfe	1007 E WRIGHT RD	No		No		No		No	
Spencer Grant	102 DELLWOOD DR	Yes	102 Dellwood Dr, Greenville 27858	No		No		No	
Robert Ellis	104 FAIRLANE RD	Yes							
Jack Fisher	1043 EAST ROCK SPRING ROAD	No							
George Hamilton	1044 E ROCK SPRING RD	No							
Donna Edwards	1104 EAST 10TH ST	Yes	1104 E. 10th st. Greenville NC 27858						
Willaim & Karen Dalzell	119 HERITAGE ST	No							
marsha	1305 COTTEN RD	No							
Jesse Dixon	1305 EAST 10TH ST	Yes	1305 East 10th Street, Greenville NC 27858					Yes	2-3 times a year
Pat and Marlena Long	1309 PRESIDIO LN GREENVILLE 27834	Yes	1309 Presidio LN 27834						
Brian Glover	1407 N OVERLOOK DR GREENVILLE 27858	Yes	1407 N. Overlook Dr.						
Jennie Bryan	15 MANNING FOREST DR A3 GREENVILLE	No							
Robert Boudreaux	1502 GREENVILLE BLVD S E	Yes	1502 Greenville Blvd. S.E.						
Ann Maxwell	1506 EAST FIFTH ST	No							
Bill Jackson	1517 WESTPOINTE DR 27834	No							
zachary woodmansee	1600 E 5TH ST	No							
Mrs. Faye B. Adams	1621 E BERKLEY RD GREENVILLE NC 27838	No							
Bernard Kane	1706 CANTERBURY RD	No							
Barney	1706 CANTERBURY ROAD	No							
Ruth Leggett	1706 FORREST HILL DR GREENVILLE NC 27858	Yes						Yes	Less than once a year

Name	PropertyAd	Livin_Fld	Livin_Freq	Yd_Fld_dit	Yd_dit_Frq	Yd_Fld_st	Yd_st_Frq	Yd_Fld_adj	Yd_adj_Frq	St_Flood	St_Info
Linda Wolfe	1007 E WRIGHT RD	No		No		No		No		Yes	Along side the roads where the drains are full of pine needles
Spencer Grant	102 DELLWOOD DR	No		No		Yes	2-3 times a year	No		Yes	See above. When this happens it it about 2-3 feet deep at the most. I've watched cars drive through it and the water goes over their hoods.
Robert Ellis	104 FAIRLANE RD			Yes	2-3 times a year	Yes	2-3 times a year	Yes	2-3 times a year		
Jack Fisher	1043 EAST ROCK SPRING ROAD									Yes	14th street near Charles Blvd.
George Hamilton	1044 E ROCK SPRING RD										Intersection of E. Rockspring Rd and Edgewood Circle. drain clogs with leaves on occasion. 2-3 inches near the drain area.
Donna Edwards	1104 EAST 10TH ST			Yes	Less than once a year						
Willaim & Karen Dalzell	119 HERITAGE ST									No	
marsha	1305 COTTEN RD									No	
Jesse Dixon	1305 EAST 10TH ST			Yes	Once a year	Yes	Every time it rains	Yes	Every time it rains	Yes	Any time it rains for more than a few minutes hard. Few inches deep, eventually runs down my driveway and across my parking lot from the street.
Pat and Marlena Long	1309 PRESIDIO LN GREENVILLE 27834			Yes				Yes		Yes	Presidio Ln., Tiberon, Teakwood Dr.
Brian Glover	1407 N OVERLOOK DR GREENVILLE 27858			Yes	More than 3 times a year			No	More than 3 times a year	No	
Jennie Bryan	15 MANNING FOREST DR A3 GREENVILLE									Yes	Williams Road
Robert Boudreaux	1502 GREENVILLE BLVD S E					Yes		Yes		Yes	See above
Ann Maxwell	1506 EAST FIFTH ST									Yes	I have observed flooding on Maple Street between 5th St. and 10th St.as well as flooding on 10th Street next to the University. The worst flooding was during and after Hurricane Floyd.
Bill Jackson	1517 WESTPOINTE DR 27834									No	
zachary woodmansee	1600 E 5TH ST									No	
Mrs. Faye B. Adams	1621 E BERKLEY RD GREENVILLE NC 27838									No	No flooded streets but in front of my house water does stand in the gutter by my mailbox. The curve is not high enough for the water to run off.
Bernard Kane	1706 CANTERBURY RD									Yes	North end of Sulgrave. Following very heavy rains it may have a few inches of water
Barney	1706 CANTERBURY ROAD									No	
Ruth Leggett	1706 FORREST HILL DR GREENVILLE NC 27858									No	

Name	PropertyAd	Inc_Fld_ch	Incr_Info	Drn_ero	Areas_Impc	Drain_Info
Linda Wolfe	1007 E WRIGHT RD	No		Yes		This is a maybe. There is a tree that is sort of up holding the bank.
Spencer Grant	102 DELLWOOD DR	No		No		
Robert Ellis	104 FAIRLANE RD	No		Yes		
Jack Fisher	1043 EAST ROCK SPRING ROAD					
George Hamilton	1044 E ROCK SPRING RD	No		No		
Donna Edwards	1104 EAST 10TH ST	Yes	During heavy rain fall the mill ran cuts into the back yard	Yes		
Willaim & Karen Dalzell	119 HERITAGE ST	No		Yes		Drainage ditch/stream behind house _119 Heritage St_: Since the Pentecostal Church built on their new building _~2003-2005_, we have had progressive increase in runoff. With this, we have had progressive erosion downstream from where that stream hits our
marsha	1305 COTTEN RD	No		No	Building/house	
Jesse Dixon	1305 EAST 10TH ST	No		No		
Pat and Marlena Long	1309 PRESIDIO LN GREENVILLE 27834	Yes	Last 8-12 months as development has been built on.	No		
Brian Glover	1407 N OVERLOOK DR GREENVILLE 27858	Yes	About two years ago, the culvert that carries a small stream under the Carolina Coastal Railway _behind 1405 N. Overlook Dr,_ becomes blocked with logs. This causes flooding.	Yes	Yard	
Jennie Bryan	15 MANNING FOREST DR A3 GREENVILLE	No		No		
Robert Boudreaux	1502 GREENVILLE BLVD S E	Yes	Memorial Baptist church putting in front parking lots and changing direction of flow of water.	No	Yard	
Ann Maxwell	1506 EAST FIFTH ST	No		No	Yard	
Bill Jackson	1517 WESTPOINTE DR 27834	No		No	Yard	
zachary woodmansee	1600 E 5TH ST	No		No		
Mrs. Faye B. Adams	1621 E BERKLEY RD GREENVILLE NC 27838	No		No		None
Bernard Kane	1706 CANTERBURY RD	No		No		
Barney	1706 CANTERBURY ROAD	No		No		
Ruth Leggett	1706 FORREST HILL DR GREENVILLE NC 27858	Yes	Not flooding but sturdy water because large storage building on property line.			

Name	PropertyAd	Shd_aware	BMP_prj	Fee_spend	Cost_share	Inct_plant	Eros_prop	Pub_prop	Stm_rest	Buy_prop	Other	Other_info	Email	Ph_num	Loc_live
Linda Wolfe	1007 E WRIGHT RD	Yes	Maybe	No						Yes			wolfel@suddenlink.net	Greenville	since about 1995
Spencer Grant	102 DELLWOOD DR	Yes	No	No		Yes	Yes	Yes	Yes	Yes	Yes	Visit www.lakegreenvillenc.com - maybe this can be incorporated in the plan? Thanks	spencergrant12@yahoo.com	919-612-5123	4.5 years
Robert Ellis	104 FAIRLANE RD	Yes	Yes	No					Yes					252-378-1510	1 year 6 months
Jack Fisher	1043 EAST ROCK SPRING ROAD	Yes	Maybe	No				Yes		Yes	Yes	keep street and storm drains clear of leaves and other litter	jackrfisher@gmail.com	252-364-2928	4 yrs
George Hamilton	1044 E ROCK SPRING RD	Yes	Yes	Yes	Yes						Yes	Prohibit filling of and buildin within the flood plaines		252-757-4084	10 Years
Donna Edwards	1104 EAST 10TH ST													_252_752-6165	55 years
Willaim & Karen Dalzell	119 HERITAGE ST	No	Maybe	No	Yes		Yes	Yes					akdazzle@gamil.com	756-4713	10 years _Fall 2004_
marsha	1305 COTTEN RD	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes			hallm@ecu.edu	2528148859	9 years
Jesse Dixon	1305 EAST 10TH ST	Yes	Maybe	No		Yes	Yes		Yes			Get the state to do its share of repairing streets and curbing as well as re-doing my Drive ways.	j2dix@suddenlink.net	2527529884	5 years
Pat and Marlena Long	1309 PRESIDIO LN GREENVILLE 27834	Yes	Yes	No		Yes	Yes	Yes						_303_601-8323	4 years
Brian Glover	1407 N OVERLOOK DR GREENVILLE 27858	Yes	Yes	No	Yes	Yes		Yes	Yes	Yes	Yes	Limit further construction of impermeble surfaces -change minimum parking ordinances.		434-979-7033	Since August, 2006.
Jennie Bryan	15 MANNING FOREST DR A3 GREENVILLE	No	Yes	No	Yes	Yes		Yes	Yes						18 Months
Robert Boudreaux	1502 GREENVILLE BLVD S E	Yes	Yes	No				Yes						252-756-2678	Since August 1968
Ann Maxwell	1506 EAST FIFTH ST	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes		fines need to be charged to individuals and businesses who do not stop erosion.	annmax63@gmail.com	252-758-7832	32 years
Bill Jackson	1517 WESTPOINTE DR 27834	Yes	Maybe	No	Yes		Yes		Yes					_252_ 917-1359	5 Years
zachary woodmansee	1600 E 5TH ST	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes			zach.woodmansee@gmail.com	8432972072	7 years
Mrs. Faye B. Adams	1621 E BERKLEY RD GREENVILLE NC 27838	No	No	No								Keep leaves, tree limbs and other items out of the streets in order for the water to runn into the gutters.		_252_756-3568	Since 1959 - Jan
Bernard Kane	1706 CANTERBURY RD	Yes	Maybe	Yes	Yes	Yes	Yes	Yes		Yes		Strong regulatory authority over development location and required water control measures is needed.	microbemanager@gmail.com	2523556789	36 years
Barney	1706 CANTERBURY ROAD	Yes	Yes	No				Yes	Yes			Stop bad development in the first place. People buy homes assuming the city approved the developers plans to prevent flooding. Then when it floods they ask the city to help them. But it is the developer, or other developers who	microbemanager@gmail.com	2523556789	36 years
Ruth Leggett	1706 FORREST HILL DR GREENVILLE NC 27858	Yes	Maybe	No		Yes				Yes				252*717-9237	26 Years

Name	PropertyAd	Fld_NonHur	NonHurAdd	Bldg_flood	Bldg_Freq	AC_fld	AC_Freq	Crawl_Fld	Crawl_Freq
Tom Chambliss	1706 ROSEWOOD DR GREENVILLE NC 27858	No							
Walter Taylor	1711 FOREST HILL DR GREENVILLE NC	Yes	1711 Forest hill Dr.	Yes	more than 3 times a year				
Caroline Doherty	1712 FOREST HILL DR GREENVILLE NC 27858	No							
George L Broussard	1713 S ELM ST GREENVILLE NC 27836	No							
David Pearsall	1721 CIRCLE DR GREENVILLE 27858-4439	No							
Edith Rand	1730 CIRCLE DR GREENVILL NC 27858	No							
Rita Khazanie	1755 BEAUMONT DR	No						Yes	More than 3 times a year
Jeffrey Ward	1802 E 6TH ST	No							
Judy Bernhardt	1803 FOREST HILL DR GREENVILLE NC 27858	No							
Carl Hartsfield	1903 FAIRVIEW WAY	Yes	1903 Fairview Way		Less than once a year				
Derald and Gloria Heckel	1914 FOREST HILL DR	Yes	1914 Forest Hill dr Greenville nc	Yes	more than 3 times a year	No		No	
Ginger Grimes	2005 CROYDEN CIRCLE	Yes	2005 A Croyden Circle	No		No		No	
Sheresa Blanchard	202 COMMERCE ST	No	202 Commerce St						
Merry Sandra Kennedy	204 KIRKLAND DR	No							
James E. Holloway	209 FAIRLANE ROAD	No							
Bill Fleming	235 COMMERCE ST	No							
Katherine Jones	2405 SLAY DR	Yes	2405 Slay Drive						
eugene langford	2805 JACKSON DR	Yes	2805 Jackson Drive	Yes	Once a year				
Shirly and Clinton Smith	294 MILLBROOK ST	Yes	294 Millbrook St.	Yes	more than 3 times a year			Yes	More than 3 times a year
Philbert Watson	3003 BRUNSWICK LN	No							

Name	PropertyAd	Livin_Fld	Livin_Freq	Yd_Fld_dit	Yd_dit_Frq	Yd_Fld_st	Yd_st_Frq	Yd_Fld_adj	Yd_adj_Frq	St_Flood	St_Info
Tom Chambliss	1706 ROSEWOOD DR GREENVILLE NC 27858									Yes	Yes -storm drain corner Rosewood and beech gets clogged. Not observed recently.
Walter Taylor	1711 FOREST HILL DR GREENVILLE NC					Yes	More than 3 times a year	Yes	More than 3 times a year		
Caroline Doherty	1712 FOREST HILL DR GREENVILLE NC 27858									No	
George L Broussard	1713 S ELM ST GREENVILLE NC 27836					Yes	2-3 times a year			Yes	never extensive _simply slow drain_
David Pearsall	1721 CIRCLE DR GREENVILLE 27858-4439									Yes	Lowest part of Circle Dr. Occurs after sudden hard rains 2-3 times a summer. Water in street is 6" deep and drains off in less than 1 hr.
Edith Rand	1730 CIRCLE DR GREENVILL NC 27858									Yes	14th 1 St. near Charles Blvd
Rita Khazanie	1755 BEAUMONT DR							Yes		Yes	Beaumont Drive, Greenville, NC
Jeffrey Ward	1802 E 6TH ST									No	
Judy Bernhardt	1803 FOREST HILL DR GREENVILLE NC 27858									No	
Carl Hartsfield	1903 FAIRVIEW WAY	Yes		Yes	Less than once a year			Yes	2-3 times a year	Yes	The drainage grates on the street are not cleaned before big rain and often floods the street 4 to 6 inches.
Derald and Gloria Heckel	1914 FOREST HILL DR	No		Yes	Every time it rains	Yes	Every time it rains	Yes	More than 3 times a year	No	everything runs down into our ditch or down our driveway flooding the carport and shed
Ginger Grimes	2005 CROYDEN CIRCLE	No		Yes	More than 3 times a year	No		Yes	More than 3 times a year	Yes	Brook Hollow Subdivision. Brook Hollow Drive on both sides of the road. Depth unknown.
Sheresa Blanchard	202 COMMERCE ST									No	
Merry Sandra Kennedy	204 KIRKLAND DR									No	
James E. Holloway	209 FAIRLANE ROAD									No	
Bill Fleming	235 COMMERCE ST									Yes	235 Commerce Street. During a heavy rain the storm water drain in the street clogs up and the street gets flooded. At least once the water was so high it came into my parking lot.
Katherine Jones	2405 SLAY DR									No	
eugene langford	2805 JACKSON DR			No	2-3 times a year			No		Yes	
Shirly and Clinton Smith	294 MILLBROOK ST	Yes	More than 3 times a year	Yes	More than 3 times a year					Yes	Millbrook street -high enough that it took a rough boat to get people out.
Philbert Watson	3003 BRUNSWICK LN										

Name	PropertyAd	Inc_Fld_ch	Incr_Info	Drn_ero	Areas_Impc	Drain_Info
Tom Chambliss	1706 ROSEWOOD DR GREENVILLE NC 27858	No		No		
Walter Taylor	1711 FOREST HILL DR GREENVILLE NC	Yes		No		
Caroline Doherty	1712 FOREST HILL DR GREENVILLE NC 27858	No		No		
George L Broussard	1713 S ELM ST GREENVILLE NC 27836	No		No		
David Pearsall	1721 CIRCLE DR GREENVILLE 27858-4439	No		No		
Edith Rand	1730 CIRCLE DR GREENVILL NC 27858	No		No	Yard	
Rita Khazanie	1755 BEAUMONT DR	Yes	Neighbor built a shed which changed the direction of the water draining from his yard into our backyard. 10-12 yrs I think.	No	Yard	
Jeffrey Ward	1802 E 6TH ST	No		No		
Judy Bernhardt	1803 FOREST HILL DR GREENVILLE NC 27858	No		No		
Carl Hartsfield	1903 FAIRVIEW WAY	No		Yes		
Derald and Gloria Heckel	1914 FOREST HILL DR	Yes	Their is a drain at the end of our driveway on the left but got cover up when the road was paved	No		
Ginger Grimes	2005 CROYDEN CIRCLE			Yes		Due to drainage behind our fence our yard has eroded underneath fence compromising its integrity.
Sheresa Blanchard	202 COMMERCE ST	No		Yes		
Merry Sandra Kennedy	204 KIRKLAND DR	No		No		
James E. Holloway	209 FAIRLANE ROAD	No		No		
Bill Fleming	235 COMMERCE ST	No		No		
Katherine Jones	2405 SLAY DR	No		No	Yard	
eugene langford	2805 JACKSON DR	No		No		
Shirly and Clinton Smith	294 MILLBROOK ST	Yes	My yard has been flooding over since 1996 - each year it kept getting higher and higher.	Yes		
Philbert Watson	3003 BRUNSWICK LN					

Name	PropertyAd	Shd_aware	BMP_prj	Fee_spend	Cost_share	Inct_plant	Eros_prop	Pub_prop	Stm_rest	Buy_prop	Other	Other_info	Email	Ph_num	Loc_live
Tom Chambliss	1706 ROSEWOOD DR GREENVILLE NC 27858	Yes		No	Yes	Yes		Yes	Yes			Why would one buy in these areas? There should be a limit to any amount spent on such property.		_252_355-6572	51 years
Walter Taylor	1711 FOREST HILL DR GREENVILLE NC	No	Maybe	No							Yes	Fis drainage of of streets		_252_902-6772	10 years
Caroline Doherty	1712 FOREST HILL DR GREENVILLE NC 27858	Yes	Yes	Yes	Yes	Yes			Yes	Yes				_252_227-4770	Since 2005
George L Broussard	1713 S ELM ST GREENVILLE NC 27836	Yes	No	No	Yes	Yes								_252_756-0411	36 years
David Pearsall	1721 CIRCLE DR GREENVILLE 27858-4439	No	Maybe	No	Yes							all of above	mbpearsall@gmail.com	252-355-0137	20 yrs
Edith Rand	1730 CIRCLE DR GREENVILL NC 27858	No	Yes	No	Yes	Yes		Yes	Yes					_252_756-1781	44 yrs
Rita Khazanie	1755 BEAUMONT DR	No	Yes	No	Yes		Yes					Free survey of improving the water collection in the crawl space of the house	khazanier@ecu.edu	252 355 2540	31 years
Jeffrey Ward	1802 E 6TH ST	Yes	No	No									wardj@ecu.edu		8 years
Judy Bernhardt	1803 FOREST HILL DR GREENVILLE NC 27858	Yes	Maybe	No	Yes	Yes		Yes	Yes					_252_756-8069	31 years
Carl Hartsfield	1903 FAIRVIEW WAY	Yes	Yes	No		Yes	Yes	Yes		Yes			carlhartsfield@hotmail.com	355-6593	since 1992
Derald and Gloria Heckel	1914 FOREST HILL DR	No	Maybe	No								not sure or all of the above	schwartzg@ecu.edu	2527565328	13 years
Ginger Grimes	2005 CROYDEN CIRCLE	No	Maybe	No								not sure		7042223245	4 years
Sheresa Blanchard	202 COMMERCE ST	No	Yes	No	Yes	Yes	Yes			Yes			blanchardsh@ecu.edu	252-689-1269	2 months
Merry Sandra Kennedy	204 KIRKLAND DR	Yes	Maybe	No	Yes	Yes	Yes	Yes	Yes	Yes			merrysandra@gmail.com	252-367-2038	7 years
James E. Holloway	209 FAIRLANE ROAD		Maybe	No				Yes	Yes	Yes			jehs0626@aol.com	252-756-2048	2.5 years
Bill Fleming	235 COMMERCE ST	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes				Williamhfleming@yahoo.com	252-531-1600	30 years
Katherine Jones	2405 SLAY DR	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes			joneska@ecu.edu	252-758-6571	15 years
eugene langford	2805 JACKSON DR	No	Yes	No	Yes	Yes	Yes			Yes			e_langford@hotmail.com	252-717-6078	approximately 25 years
Shirly and Clinton Smith	294 MILLBROOK ST	No	Yes	No	Yes	Yes		Yes	Yes	Yes		.		252-321-3449	Since 1992
Philbert Watson	3003 BRUNSWICK LN												pphwnt@yahoo.com	252 321 6827	8 years, 10 months

Name	PropertyAd	Fld_NonHur	NonHurAdd	Bldg_flood	Bldg_Freq	AC_fld	AC_Freq	Crawl_Fld	Crawl_Freq
Brenda Hughes	308 LINDELL ROAD	Yes	308 Lindell Road	Yes	every time it rains	No	Every time it rains	No	Every time it rains
Patrick Herring	310 LINDELL RD	Yes	310 Lindell Rd. Greenville, NC 27834	Yes	more than 3 times a year	No		No	
Bonnie Tapscott	314 LINDELL RD 27834	Yes	Everytime it rains	Yes					
Clara Pitt	3533 LENA LN GREENVILLE NC 27834	No							
Kaki McLeod	521 W LONGMEADOW RD	No							
Glen	805 COLLEGE VIEW DR	No		No		No		No	
Scott Below	901 FOREST HILL CIRCLE	No							

Name	PropertyAd	Livin_Fld	Livin_Freq	Yd_Fld_dit	Yd_dit_Frq	Yd_Fld_st	Yd_st_Frq	Yd_Fld_adj	Yd_adj_Frq	St_Flood	St_Info
Brenda Hughes	308 LINDELL ROAD	Yes	Every time it rains	Yes	Every time it rains	Yes	Every time it rains	Yes	Every time it rains	Yes	It is unsafe to pass through the street at my house due to water depth that lends to both houses on each side of me.
Patrick Herring	310 LINDELL RD	Yes	Every time it rains	Yes	Every time it rains	Yes	Every time it rains	Yes	Every time it rains	Yes	311 Lindell Rd. Greenville, NC 27834 2 ft
Bonnie Tapscott	314 LINDELL RD 27834			Yes		Yes		Yes		Yes	
Clara Pitt	3533 LENA LN GREENVILLE NC 27834									No	
Kaki McLeod	521 W LONGMEADOW RD									No	
Glen	805 COLLEGE VIEW DR	No		No		No		No		No	
Scott Below	901 FOREST HILL CIRCLE									No	

Name	PropertyAd	Inc_Fld_ch	Incr_Info	Drn_ero	Areas_Impc	Drain_Info
Brenda Hughes	308 LINDELL ROAD	Yes	It has gotten worse over the last 11 years that I have owned this house. I have previously provided photos at every water event at my home. This is not news to you.			The ditch continues to collapse, the foundation is eroding underneath my outside storage building, neighbors have laid marble down to prevent water washing up on their property which pushes it back to mine because there is no where for it to go.
Patrick Herring	310 LINDELL RD	No		Yes		
Bonnie Tapscott	314 LINDELL RD 27834	Yes		Yes	Yard	
Clara Pitt	3533 LENA LN GREENVILLE NC 27834	No		No		
Kaki McLeod	521 W LONGMEADOW RD	No		No		
Glen	805 COLLEGE VIEW DR	No		Yes		The entire 804/805 College View Drive building along with the cul-de-sac is sliding down the embankment created by the creek running through Green Mill Greenway. Every good rain changes the slope of the back yard and flexes the structure even more. A r
Scott Below	901 FOREST HILL CIRCLE	No		No		

Name	PropertyAd	Shd_aware	BMP_prj	Fee_spend	Cost_share	Inct_plant	Eros_prop	Pub_prop	Stm_rest	Buy_prop	Other	Other_info	Email	Ph_num	Loc_live
Brenda Hughes	308 LINDELL ROAD	Yes	No	No			Yes	Yes	Yes			Make the existing watersheds behind Target work. Why did the city have the builder create those if the city wasn't going to enforce that they work correctly? How ever did that pass inspection and continue to be allowed not to	brendaehughes@gmail.com	252-714-6906	over 11 years
Patrick Herring	310 LINDELL RD	No	Maybe	No			Yes	Yes	Yes				pherringiv@yahoo.com	2522272555	1 year
Bonnie Tapscott	314 LINDELL RD 27834	Yes	Maybe	No		Yes		Yes	Yes	Yes				252-717-4577	39 yrs.
Clara Pitt	3533 LENA LN GREENVILLE NC 27834	Yes	Yes	No					Yes					_252_364-2493	7 years
Kaki McLeod	521 W LONGMEADOW RD	Yes	No	No			Yes	Yes		Yes			kakimcleod@aol.com		13 years
Glen	805 COLLEGE VIEW DR	Yes	Maybe	No			Yes						gthenry@bellsouth.net		12+ years off and on _rental_
Scott Below	901 FOREST HILL CIRCLE	Yes	Yes	No			Yes		Yes				belows@ecu.edu	252-717-8117	10 years

E. SCS Hydrologic Input Data

E.1 Existing Conditions

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.37	0.001	32.69
	B	92	0.00	--	--
	C	94	1.62	0.003	152.62
	D	95	7.08	0.011	673.01
Office/Institutional/Multi-Family	A	77	1.26	0.002	97.18
	B	85	0.00	--	--
	C	90	0.68	0.001	60.96
	D	92	34.50	0.054	3173.68
High Desity Residential	A	61	0.31	0.000	18.87
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	1.19	0.002	103.16
Medium Desity Residential	A	54	0.23	0.000	12.56
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.31	0.000	26.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	17.01	0.027	833.31
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	17.28	0.027	1451.33
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.73	0.001	60.98
	B	89	0.00	--	--
	C	92	0.15	0.000	14.21
	D	93	7.76	0.012	721.46
		Total	90.48	0.141	7432.39
	Weighted CN		**82.14**		

W600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.07	0.003	183.81
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.42	0.002	134.64
Office/Institutional/Multi-Family	A	77	12.06	0.019	928.87
	B	85	0.00	--	--
	C	90	0.05	0.000	4.33
	D	92	30.31	0.047	2788.72
High Desity Residential	A	61	3.45	0.005	210.43
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.77	0.001	66.59
Medium Desity Residential	A	54	6.95	0.011	375.31
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.72	0.001	61.38
Low Desity Residential	A	51	1.80	0.003	91.64
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	1.74	0.003	146.04
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	8.31	0.013	407.03
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	16.50	0.026	1385.82
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	8.05	0.013	668.34
	B	89	0.00	--	--
	C	92	0.02	0.000	1.73
	D	93	4.82	0.008	448.07
		Total	99.02	0.155	7902.74
	Weighted CN		**79.81**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.30	0.002	116.10
	B	92	2.95	0.005	271.59
	C	94	0.00	--	--
	D	95	2.50	0.004	237.51
Office/Institutional/Multi-Family	A	77	19.82	0.031	1525.99
	B	85	2.95	0.005	250.70
	C	90	1.33	0.002	119.39
	D	92	14.30	0.022	1315.44
High Desity Residential	A	61	7.25	0.011	441.95
	B	75	0.40	0.001	29.64
	C	83	0.03	0.000	2.45
	D	87	1.56	0.002	135.95
Medium Desity Residential	A	54	2.61	0.004	140.69
	B	70	0.26	0.000	18.48
	C	80	0.00	--	--
	D	85	0.72	0.001	60.93
Low Desity Residential	A	51	4.88	0.008	249.05
	B	68	0.91	0.001	61.60
	C	79	0.00	--	--
	D	84	0.31	0.000	26.16
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.75	0.007	232.72
	B	69	1.74	0.003	119.89
	C	79	3.46	0.005	273.23
	D	84	19.24	0.030	1616.08
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	15.69	0.025	1302.44
	B	89	3.27	0.005	291.19
	C	92	0.86	0.001	79.04
	D	93	4.42	0.007	411.48
		Total	117.50	0.184	9329.67
	Weighted CN		**79.40**		

W630

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	44.62	0.070	3435.87
	B	85	16.21	0.025	1377.56
	C	90	6.71	0.010	604.00
	D	92	9.55	0.015	878.67
High Desity Residential	A	61	2.59	0.004	157.89
	B	75	1.83	0.003	137.57
	C	83	0.00	--	--
	D	87	6.15	0.010	534.86
Medium Desity Residential	A	54	4.00	0.006	215.89
	B	70	0.92	0.001	64.45
	C	80	0.00	--	--
	D	85	5.06	0.008	429.74
Low Desity Residential	A	51	5.71	0.009	291.10
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	1.79	0.003	149.95
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	36.81	0.058	1803.46
	B	69	72.99	0.114	5036.16
	C	79	3.63	0.006	286.59
	D	84	1.22	0.002	102.28
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	13.08	0.020	1085.29
	B	89	3.23	0.005	287.77
	C	92	0.21	0.000	19.04
	D	93	2.52	0.004	234.18
		Total	238.80	0.373	17132.31
	Weighted CN		**71.74**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W510

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.08	0.002	96.36
	B	92	0.00	--	--
	C	94	0.23	0.000	22.03
	D	95	0.79	0.001	74.94
Office/Institutional/Multi-Family	A	77	5.48	0.009	421.87
	B	85	0.50	0.001	42.74
	C	90	0.00	--	--
	D	92	6.62	0.010	608.86
High Desity Residential	A	61	2.51	0.004	152.84
	B	75	1.09	0.002	81.93
	C	83	0.22	0.000	18.53
	D	87	0.08	0.000	6.70
Medium Desity Residential	A	54	6.42	0.010	346.94
	B	70	0.32	0.001	22.73
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	2.63	0.004	134.20
	B	68	0.70	0.001	47.86
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.50	0.007	220.70
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	6.03	0.009	506.76
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	8.92	0.014	740.45
	B	89	0.68	0.001	60.92
	C	92	0.12	0.000	11.22
	D	93	0.70	0.001	65.18
		Total	49.65	0.08	3683.77
	Weighted CN		**74.19**		

W640

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	11.83	0.018	1052.59
	B	92	11.45	0.018	1053.76
	C	94	3.15	0.005	295.88
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	23.85	0.037	1836.62
	B	85	48.65	0.076	4135.32
	C	90	11.54	0.018	1038.82
	D	92	0.00	--	--
High Desity Residential	A	61	1.19	0.002	72.67
	B	75	0.74	0.001	55.55
	C	83	0.72	0.001	59.78
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.96	0.001	51.58
	B	70	0.00	--	--
	C	80	1.75	0.003	139.75
	D	85	0.00	--	--
Low Desity Residential	A	51	6.70	0.010	341.54
	B	68	0.33	0.001	22.20
	C	79	2.44	0.004	192.46
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	64.51	0.101	2515.87
	B	61	26.50	0.041	1616.42
	C	74	7.29	0.011	539.48
	D	80	3.28	0.005	262.77
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	12.35	0.019	1025.10
	B	89	11.46	0.018	1020.36
	C	92	6.01	0.009	553.20
	D	93	0.00	--	--
		Total	256.70	0.401	17881.71
	Weighted CN		**69.66**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W520

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.61	0.001	54.22
	B	92	0.00	--	--
	C	94	0.04	0.000	3.85
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	8.84	0.014	680.91
	B	85	0.06	0.000	4.92
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	1.37	0.002	83.84
	B	75	0.00	--	--
	C	83	0.27	0.000	22.74
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.72	0.001	38.81
	B	70	0.00	--	--
	C	80	0.24	0.000	19.03
	D	85	0.00	--	--
Low Desity Residential	A	51	1.69	0.003	86.10
	B	68	0.00	--	--
	C	79	1.23	0.002	97.05
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	0.000	0.02
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.65	0.004	220.12
	B	89	0.00	--	--
	C	92	0.42	0.001	38.75
	D	93	0.00	--	--
		Total	18.15	0.03	1350.34
	Weighted CN		**74.42**		

W650

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	17.46	0.027	1553.63
	B	92	0.52	0.001	48.04
	C	94	0.90	0.001	84.43
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	29.89	0.047	2301.78
	B	85	5.49	0.009	466.55
	C	90	2.83	0.004	254.66
	D	92	10.30	0.016	947.24
High Desity Residential	A	61	1.71	0.003	104.20
	B	75	0.24	0.000	18.19
	C	83	0.98	0.002	81.51
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	1.29	0.002	102.83
	D	85	0.00	--	--
Low Desity Residential	A	51	1.44	0.002	73.68
	B	68	0.00	--	--
	C	79	0.55	0.001	43.34
	D	84	0.97	0.002	81.23
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	26.47	0.041	1032.20
	B	61	0.43	0.001	26.10
	C	74	0.75	0.001	55.73
	D	80	2.64	0.004	211.31
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.19	0.000	15.65
	B	89	0.06	0.000	4.90
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	105.10	0.164	7507.20
	Weighted CN		**71.43**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W530

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	6.78	0.011	522.02
	B	85	0.09	0.000	7.58
	C	90	0.00	--	--
	D	92	5.88	0.009	541.18
High Desity Residential	A	61	6.06	0.009	369.75
	B	75	0.16	0.000	12.36
	C	83	0.29	0.000	23.95
	D	87	0.70	0.001	60.64
Medium Desity Residential	A	54	7.16	0.011	386.70
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.27	0.000	23.11
Low Desity Residential	A	51	13.66	0.021	696.56
	B	68	0.00	--	--
	C	79	0.42	0.001	33.47
	D	84	5.49	0.009	461.21
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	7.60	0.012	372.42
	B	69	0.00	--	--
	C	79	0.20	0.000	16.19
	D	84	2.47	0.004	207.81
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	12.25	0.019	1016.87
	B	89	0.09	0.000	8.28
	C	92	0.52	0.001	48.25
	D	93	1.66	0.003	154.69
		Total	71.78	0.11	4963.06
	Weighted CN		**69.14**		

W660

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	5.36	0.008	471.94
	C	91	0.00	0.000	0.13
	D	93	6.54	0.010	607.85
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.30	0.000	28.32
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.18	0.000	11.04
	B	75	0.10	0.000	7.13
	C	83	0.28	0.000	23.09
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.21	0.000	16.52
	D	85	0.00	--	--
Low Desity Residential	A	51	0.76	0.001	38.72
	B	68	1.13	0.002	77.12
	C	79	1.42	0.002	112.35
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.56	0.004	214.80
Open Space	A	39	100.98	0.158	3938.37
	B	61	84.21	0.132	5137.08
	C	74	77.18	0.121	5711.05
	D	80	8.57	0.013	685.91
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.37	0.005	280.12
	B	89	2.53	0.004	224.86
	C	92	3.42	0.005	314.95
	D	93	0.00	--	--
		Total	299.11	0.47	17901.34
	Weighted CN		**59.85**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W550

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Agriculture	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.97	0.006	305.50
	B	85	1.92	0.003	163.31
	C	90	2.47	0.004	222.05
	D	92	0.00	--	--
High Desity Residential	A	61	4.29	0.007	261.88
	B	75	9.34	0.015	700.42
	C	83	10.82	0.017	897.70
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.42	0.004	130.69
	B	70	2.15	0.003	150.65
	C	80	0.22	0.000	17.34
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.32	0.001	21.90
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	21.14	0.033	1036.02
	B	69	125.95	0.197	8690.60
	C	79	7.47	0.012	590.05
	D	84	25.05	0.039	2104.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.36	0.001	29.62
	B	89	0.04	0.000	3.68
	C	92	0.00	--	--
	D	93	11.78	0.018	1095.54
		Total	229.71	0.36	16421.14
	Weighted CN		**71.49**		

W670

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.08	0.000	7.19
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.83	0.001	75.95
	C	94	0.75	0.001	70.71
	D	95	0.71	0.001	67.67
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	8.07	0.013	686.28
	C	90	9.39	0.015	845.37
	D	92	53.42	0.083	4914.59
High Desity Residential	A	61	0.00	--	--
	B	75	4.05	0.006	303.66
	C	83	1.11	0.002	92.47
	D	87	3.62	0.006	315.34
Medium Desity Residential	A	54	0.00	--	--
	B	70	1.88	0.003	131.68
	C	80	0.26	0.000	20.49
	D	85	1.95	0.003	165.93
Low Desity Residential	A	51	0.00	--	--
	B	68	1.68	0.003	114.13
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	2.06	0.003	142.14
	C	79	1.15	0.002	90.74
	D	84	1.59	0.002	133.25
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	5.69	0.009	506.07
	C	92	1.21	0.002	110.86
	D	93	6.00	0.009	558.32
		Total	105.50	0.16	9352.85
	Weighted CN		**88.65**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W560

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.16	0.002	89.65
	B	85	0.10	0.000	8.74
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.07	0.000	4.38
	B	75	0.21	0.000	15.95
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.48	0.001	25.95
	B	70	0.50	0.001	34.65
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	2.56	0.004	130.54
	B	68	12.96	0.020	881.00
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.67	0.007	228.81
	B	69	39.06	0.061	2695.32
	C	79	8.41	0.013	664.25
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.81	0.003	168.04
		Total	71.99	0.11	4947.29
	Weighted CN		**68.72**		

W700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.33	0.001	25.29
	B	85	0.00	--	--
	C	90	0.34	0.001	30.93
	D	92	0.00	--	--
High Desity Residential	A	61	0.09	0.000	5.23
	B	75	0.28	0.000	20.91
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.57	0.002	80.00
	B	68	0.37	0.001	25.48
	C	79	0.54	0.001	42.43
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	52.11	0.081	2032.20
	B	61	59.87	0.094	3652.19
	C	74	28.93	0.045	2140.97
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.04	0.008	417.96
	B	89	6.75	0.011	600.37
	C	92	2.98	0.005	274.62
	D	93	0.00	--	--
		Total	159.20	0.25	9348.57
	Weighted CN		**58.72**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W570

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.42	0.002	109.62
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.91	0.001	83.26
High Desity Residential	A	61	8.71	0.014	531.01
	B	75	0.47	0.001	35.18
	C	83	0.14	0.000	11.39
	D	87	0.36	0.001	30.97
Medium Desity Residential	A	54	11.17	0.017	603.40
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	14.55	0.023	742.12
	B	68	0.32	0.000	21.43
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.51	0.007	221.20
	B	69	0.99	0.002	67.99
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	16.51	0.026	1370.37
	B	89	1.38	0.002	123.20
	C	92	0.21	0.000	18.89
	D	93	1.53	0.002	141.96
		Total	63.16	0.10	4112.00
	Weighted CN		**65.10**		

W710

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	10.19	0.016	906.66
	B	92	0.00	--	--
	C	94	1.70	0.003	159.82
	D	95	6.41	0.010	609.33
Office/Institutional/Multi-Family	A	77	36.28	0.057	2793.31
	B	85	0.00	--	--
	C	90	8.25	0.013	742.72
	D	92	20.41	0.032	1877.85
High Desity Residential	A	61	2.62	0.004	159.59
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	1.94	0.003	168.91
Medium Desity Residential	A	54	2.96	0.005	160.06
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	1.72	0.003	146.26
Low Desity Residential	A	51	0.36	0.001	18.58
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	1.43	0.002	120.32
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	10.40	0.016	509.52
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	5.92	0.009	497.63
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	8.59	0.013	713.16
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	2.80	0.004	260.76
		Total	122.00	0.19	9844.48
	Weighted CN		**80.69**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W580

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	6.84	0.011	553.99
	B	88	0.75	0.001	65.60
	C	91	3.73	0.006	339.18
	D	93	7.10	0.011	660.44
Commerical	A	89	2.55	0.004	227.19
	B	92	2.72	0.004	250.50
	C	94	22.24	0.035	2090.90
	D	95	2.46	0.004	233.91
Office/Institutional/Multi-Family	A	77	0.52	0.001	39.90
	B	85	2.99	0.005	254.18
	C	90	2.96	0.005	266.49
	D	92	2.90	0.005	267.10
High Desity Residential	A	61	0.00	0.000	0.12
	B	75	0.38	0.001	28.43
	C	83	3.95	0.006	327.55
	D	87	2.44	0.004	211.94
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.24	0.000	16.62
	C	80	3.08	0.005	246.13
	D	85	0.97	0.002	82.52
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.42	0.001	33.34
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.03	0.006	197.39
	B	69	5.85	0.009	403.96
	C	79	6.85	0.011	541.13
	D	84	3.70	0.006	311.21
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.06	0.005	254.06
	B	89	2.02	0.003	179.70
	C	92	16.91	0.026	1555.42
	D	93	3.04	0.005	282.51
		Total	114.70	0.18	9921.39
	Weighted CN		**86.50**		

W720

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.33	0.001	28.98
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.17	0.002	111.56
Office/Institutional/Multi-Family	A	77	11.17	0.017	860.10
	B	85	0.24	0.000	20.46
	C	90	3.10	0.005	279.17
	D	92	4.30	0.007	395.26
High Desity Residential	A	61	1.06	0.002	64.75
	B	75	0.56	0.001	42.30
	C	83	0.00	--	--
	D	87	0.10	0.000	8.89
Medium Desity Residential	A	54	0.26	0.000	13.99
	B	70	0.82	0.001	57.11
	C	80	0.00	--	--
	D	85	0.29	0.000	25.04
Low Desity Residential	A	51	0.85	0.001	43.57
	B	68	0.71	0.001	48.28
	C	79	0.00	--	--
	D	84	1.71	0.003	143.22
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.13	0.003	104.16
	B	69	0.00	--	--
	C	79	2.57	0.004	202.98
	D	84	3.01	0.005	252.83
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.82	0.006	317.47
	B	89	0.61	0.001	54.09
	C	92	0.85	0.001	77.83
	D	93	1.19	0.002	111.11
		Total	40.85	0.06	3263.16
	Weighted CN		**79.87**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W730

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	93.87	0.147	3660.87
	B	61	107.77	0.168	6574.25
	C	74	62.90	0.098	4654.74
	D	80	0.25	0.000	20.22
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	264.80	0.41	14910.08
	Weighted CN		**56.31**		

W820

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	10.72	0.017	825.11
	B	85	0.00	--	--
	C	90	0.54	0.001	48.44
	D	92	1.26	0.002	116.10
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.47	0.001	23.87
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	21.83	0.034	851.22
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	34.81	0.05	1864.73
	Weighted CN		53.57		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W740

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.57	0.002	139.77
	B	92	0.03	0.000	2.69
	C	94	2.11	0.003	198.66
	D	95	4.29	0.007	407.15
Office/Institutional/Multi-Family	A	77	0.40	0.001	30.67
	B	85	0.41	0.001	34.50
	C	90	0.09	0.000	7.73
	D	92	0.14	0.000	12.90
High Desity Residential	A	61	4.63	0.007	282.22
	B	75	0.70	0.001	52.85
	C	83	4.13	0.006	343.10
	D	87	4.46	0.007	387.61
Medium Desity Residential	A	54	2.86	0.004	154.62
	B	70	0.00	--	--
	C	80	5.44	0.009	435.58
	D	85	8.63	0.013	733.53
Low Desity Residential	A	51	1.31	0.002	66.97
	B	68	0.00	--	--
	C	79	2.84	0.004	224.38
	D	84	2.35	0.004	197.01
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.29	0.004	112.42
	B	69	0.69	0.001	47.66
	C	79	0.37	0.001	29.25
	D	84	1.02	0.002	85.38
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	2.77	0.004	229.55
	B	89	0.73	0.001	65.20
	C	92	4.55	0.007	418.75
	D	93	6.71	0.010	624.07
		Total	65.52	0.10	5324.23
	Weighted CN		**81.26**		

W830

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	1.24	0.002	75.54
	B	75	0.32	0.000	23.93
	C	83	0.00	--	--
	D	87	0.48	0.001	41.46
Medium Desity Residential	A	54	1.04	0.002	56.09
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.50	0.001	42.85
Low Desity Residential	A	51	6.63	0.010	337.97
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.65	0.001	54.74
Very Low Desity Residential	A	49	3.87	0.006	189.48
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.12	0.003	178.24
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	16.84	0.03	1000.32
	Weighted CN		59.39		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W750

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	33.40	0.052	2972.67
	B	92	0.00	--	--
	C	94	12.07	0.019	1134.55
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	14.45	0.023	1112.33
	B	85	1.25	0.002	106.11
	C	90	5.67	0.009	510.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.96	0.001	58.31
	B	75	0.02	0.000	1.82
	C	83	0.35	0.001	29.11
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.75	0.001	40.30
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	3.61	0.006	176.72
	B	69	0.00	--	--
	C	79	0.99	0.002	78.48
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	6.12	0.010	507.57
	B	89	1.02	0.002	90.34
	C	92	2.35	0.004	215.97
	D	93	0.00	--	--
		Total	82.99	0.13	7034.39
	Weighted CN		**84.76**		

W840

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	30.90	0.048	2749.99
	B	92	0.00	--	--
	C	94	11.42	0.018	1073.26
	D	95	12.71	0.020	1207.28
Office/Institutional/Multi-Family	A	77	1.24	0.002	95.55
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	1.22	0.002	112.49
High Desity Residential	A	61	0.73	0.001	44.65
	B	75	0.00	--	--
	C	83	0.08	0.000	6.41
	D	87	0.69	0.001	60.27
Medium Desity Residential	A	54	2.39	0.004	129.28
	B	70	0.00	--	--
	C	80	0.21	0.000	16.81
	D	85	1.14	0.002	97.11
Low Desity Residential	A	51	4.30	0.007	219.08
	B	68	0.00	--	--
	C	79	1.25	0.002	98.85
	D	84	3.35	0.005	281.01
Very Low Desity Residential	A	49	2.33	0.004	114.11
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.69	0.001	34.03
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.32	0.001	27.26
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	8.43	0.013	699.37
	B	89	0.00	--	--
	C	92	2.17	0.003	200.06
	D	93	6.59	0.010	613.14
		Total	92.17	0.14	7880.01
	Weighted CN		85.49		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W760

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	23.79	0.037	1832.21
	B	85	0.16	0.000	13.71
	C	90	2.17	0.003	195.52
	D	92	3.10	0.005	285.46
High Desity Residential	A	61	8.15	0.013	497.44
	B	75	0.49	0.001	36.38
	C	83	1.19	0.002	99.05
	D	87	0.60	0.001	52.42
Medium Desity Residential	A	54	7.84	0.012	423.54
	B	70	1.57	0.002	109.64
	C	80	1.37	0.002	109.94
	D	85	0.46	0.001	39.09
Low Desity Residential	A	51	29.14	0.046	1486.30
	B	68	2.75	0.004	187.17
	C	79	2.51	0.004	198.48
	D	84	0.92	0.001	77.11
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.03	0.000	1.38
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	12.24	0.019	1016.05
	B	89	1.42	0.002	126.53
	C	92	2.53	0.004	232.41
	D	93	1.55	0.002	143.73
		Total	104.00	0.16	7163.56
	Weighted CN		**68.88**		

W850

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	22.00	0.034	1958.06
	B	92	0.00	--	--
	C	94	8.87	0.014	833.89
	D	95	4.56	0.007	433.16
Office/Institutional/Multi-Family	A	77	9.63	0.015	741.22
	B	85	2.19	0.003	186.23
	C	90	3.67	0.006	330.60
	D	92	1.46	0.002	134.01
High Desity Residential	A	61	3.72	0.006	226.79
	B	75	0.43	0.001	31.92
	C	83	0.33	0.001	27.55
	D	87	0.66	0.001	57.46
Medium Desity Residential	A	54	9.07	0.014	489.83
	B	70	0.78	0.001	54.30
	C	80	0.00	--	--
	D	85	1.14	0.002	96.58
Low Desity Residential	A	51	10.82	0.017	552.01
	B	68	0.00	--	--
	C	79	0.73	0.001	58.02
	D	84	2.33	0.004	195.35
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.68	0.001	33.29
	B	69	0.00	--	--
	C	79	0.85	0.001	67.01
	D	84	1.31	0.002	110.39
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	14.39	0.022	1194.05
	B	89	0.44	0.001	39.07
	C	92	1.88	0.003	172.63
	D	93	0.38	0.001	35.21
		Total	102.30	0.16	8058.61
	Weighted CN		78.77		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W770

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.53	0.001	43.23
	B	88	0.56	0.001	49.41
	C	91	0.06	0.000	5.42
	D	93	0.61	0.001	56.91
Commerical	A	89	0.44	0.001	39.37
	B	92	0.76	0.001	69.56
	C	94	0.00	--	--
	D	95	0.07	0.000	7.04
Office/Institutional/Multi-Family	A	77	4.81	0.008	370.38
	B	85	8.39	0.013	713.09
	C	90	18.21	0.028	1639.24
	D	92	1.67	0.003	153.35
High Desity Residential	A	61	15.49	0.024	945.10
	B	75	14.28	0.022	1071.21
	C	83	15.32	0.024	1271.23
	D	87	0.25	0.000	21.94
Medium Desity Residential	A	54	1.17	0.002	63.32
	B	70	5.14	0.008	359.87
	C	80	3.39	0.005	271.11
	D	85	0.00	--	--
Low Desity Residential	A	51	2.97	0.005	151.33
	B	68	3.05	0.005	207.41
	C	79	3.91	0.006	308.61
	D	84	0.00	--	--
Very Low Desity Residential	A	49	2.92	0.005	142.99
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	97.68	0.153	3809.63
	B	61	64.15	0.100	3913.38
	C	74	107.82	0.168	7979.03
	D	80	6.68	0.010	534.18
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	32.15	0.050	2990.30
		Total	412.50	0.64	27187.64
	Weighted CN		**65.91**		

W860

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	5.29	0.008	470.73
	B	92	0.54	0.001	49.59
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.89	0.003	145.84
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.10	0.000	9.39
High Desity Residential	A	61	8.67	0.014	528.60
	B	75	0.27	0.000	20.17
	C	83	0.00	--	--
	D	87	0.37	0.001	31.94
Medium Desity Residential	A	54	12.60	0.020	680.24
	B	70	0.26	0.000	18.19
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	9.66	0.015	492.53
	B	68	1.14	0.002	77.27
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	15.38	0.024	599.64
	B	61	2.64	0.004	161.06
	C	74	0.00	--	--
	D	80	9.50	0.015	759.60
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	11.07	0.017	918.74
	B	89	0.06	0.000	5.64
	C	92	0.00	--	--
	D	93	0.87	0.001	80.95
		Total	80.29	0.13	5050.11
	Weighted CN		62.90		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W780

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.15	0.002	102.46
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.07	0.002	101.67
Office/Institutional/Multi-Family	A	77	15.66	0.024	1205.49
	B	85	7.01	0.011	595.61
	C	90	2.82	0.004	253.90
	D	92	13.21	0.021	1215.69
High Desity Residential	A	61	0.23	0.000	14.02
	B	75	0.21	0.000	15.43
	C	83	0.03	0.000	2.33
	D	87	0.33	0.001	28.44
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.61	0.001	31.29
	B	68	0.64	0.001	43.22
	C	79	1.44	0.002	114.05
	D	84	4.80	0.008	403.23
Very Low Desity Residential	A	49	4.43	0.007	216.89
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	49.14	0.077	1916.27
	B	61	24.21	0.038	1477.10
	C	74	3.29	0.005	243.11
	D	80	19.87	0.031	1589.75
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	2.59	0.004	215.25
	B	89	0.22	0.000	19.84
	C	92	0.84	0.001	77.31
	D	93	4.11	0.006	382.22
		Total	157.90	0.25	10264.58
	Weighted CN		**65.01**		

W870

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.12	0.000	11.19
High Desity Residential	A	61	0.56	0.001	34.03
	B	75	0.53	0.001	39.43
	C	83	0.00	--	--
	D	87	0.90	0.001	78.06
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.42	0.001	29.52
	C	80	0.00	--	--
	D	85	0.75	0.001	63.80
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.74	0.001	62.42
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.12	0.000	8.61
	C	79	0.00	--	--
	D	84	5.65	0.009	474.83
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	9.80	0.02	801.90
	Weighted CN		81.86		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W790

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.10	0.000	8.89
	B	92	0.00	--	--
	C	94	1.61	0.003	151.68
	D	95	0.10	0.000	9.76
Office/Institutional/Multi-Family	A	77	1.48	0.002	113.80
	B	85	0.00	--	--
	C	90	0.03	0.000	2.62
	D	92	1.71	0.003	156.94
High Desity Residential	A	61	0.84	0.001	51.18
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.23	0.000	12.27
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.28	0.002	65.16
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	6.46	0.010	316.77
	B	69	0.00	--	--
	C	79	4.70	0.007	371.63
	D	84	6.87	0.011	577.13
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	8.77	0.014	728.32
	B	89	0.00	--	--
	C	92	1.86	0.003	170.76
	D	93	1.15	0.002	107.02
		Total	37.19	0.06	2843.93
	Weighted CN		**76.46**		

W880

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.88	0.001	78.27
	B	92	0.61	0.001	56.09
	C	94	1.87	0.003	175.52
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.72	0.003	132.07
	B	85	5.25	0.008	446.37
	C	90	4.95	0.008	445.69
	D	92	0.00	--	--
High Desity Residential	A	61	1.32	0.002	80.72
	B	75	0.00	--	--
	C	83	0.42	0.001	34.48
	D	87	0.75	0.001	65.58
Medium Desity Residential	A	54	0.76	0.001	41.17
	B	70	0.00	--	--
	C	80	0.47	0.001	37.81
	D	85	0.00	--	--
Low Desity Residential	A	51	23.16	0.036	1181.29
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	7.12	0.011	597.83
Very Low Desity Residential	A	49	10.50	0.016	514.71
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	135.68	0.212	5291.61
	B	61	14.94	0.023	911.53
	C	74	2.00	0.003	147.80
	D	80	22.35	0.035	1787.71
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	7.08	0.011	587.76
	B	89	0.60	0.001	53.71
	C	92	1.24	0.002	113.74
	D	93	0.73	0.001	67.64
		Total	244.40	0.38	12849.10
	Weighted CN		52.57		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	1.90	0.003	154.11
	B	88	8.50	0.013	747.96
	C	91	1.48	0.002	134.99
	D	93	0.09	0.000	8.17
Commerical	A	89	3.52	0.006	313.61
	B	92	2.07	0.003	190.56
	C	94	14.22	0.022	1336.41
	D	95	2.77	0.004	263.02
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	1.17	0.002	99.15
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.37	0.001	22.62
	B	75	1.53	0.002	115.12
	C	83	4.70	0.007	390.12
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.22	0.000	11.62
	B	70	1.67	0.003	117.17
	C	80	4.17	0.007	333.20
	D	85	0.00	--	--
Low Desity Residential	A	51	2.06	0.003	104.93
	B	68	2.69	0.004	182.68
	C	79	3.44	0.005	271.95
	D	84	0.00	--	--
Very Low Desity Residential	A	49	7.27	0.011	356.39
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	104.41	0.163	4071.98
	B	61	13.20	0.021	805.14
	C	74	33.47	0.052	2476.58
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	1.45	0.002	120.05
	B	89	3.69	0.006	328.80
	C	92	2.65	0.004	243.96
	D	93	0.00	--	--
		Total	222.71	0.35	13200.28
	Weighted CN		**59.27**		

W890

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	6.26	0.010	575.70
	C	94	1.42	0.002	133.71
	D	95	4.83	0.008	458.43
Office/Institutional/Multi-Family	A	77	1.24	0.002	95.58
	B	85	3.29	0.005	279.96
	C	90	7.71	0.012	693.78
	D	92	7.69	0.012	707.29
High Desity Residential	A	61	1.37	0.002	83.45
	B	75	1.88	0.003	140.69
	C	83	0.87	0.001	71.97
	D	87	1.75	0.003	152.37
Medium Desity Residential	A	54	0.96	0.001	51.83
	B	70	0.25	0.000	17.43
	C	80	1.54	0.002	123.42
	D	85	1.29	0.002	109.75
Low Desity Residential	A	51	3.39	0.005	172.76
	B	68	0.91	0.001	61.90
	C	79	5.79	0.009	457.18
	D	84	5.99	0.009	502.94
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.10	0.000	4.86
	B	69	0.65	0.001	44.51
	C	79	0.59	0.001	46.78
	D	84	1.45	0.002	121.90
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.05	0.002	87.04
	B	89	2.81	0.004	249.71
	C	92	3.05	0.005	280.29
	D	93	4.28	0.007	397.74
		Total	72.38	0.11	6122.95
	Weighted CN		84.59		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W810

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	4.69	0.007	361.48
	B	85	2.33	0.004	198.46
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	6.89	0.011	420.44
	B	75	1.52	0.002	113.96
	C	83	1.07	0.002	88.49
	D	87	0.27	0.000	23.79
Medium Desity Residential	A	54	20.95	0.033	1131.07
	B	70	2.00	0.003	140.22
	C	80	3.04	0.005	243.06
	D	85	1.74	0.003	147.62
Low Desity Residential	A	51	12.44	0.019	634.23
	B	68	0.00	--	--
	C	79	0.61	0.001	48.47
	D	84	0.36	0.001	29.85
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	4.00	0.006	155.95
	B	61	0.40	0.001	24.67
	C	74	0.11	0.000	8.21
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	10.92	0.017	906.74
	B	89	1.09	0.002	97.32
	C	92	1.13	0.002	103.59
	D	93	0.40	0.001	37.65
		Total	75.97	0.12	4915.29
	Weighted CN		**64.70**		

W900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.62	0.006	278.91
	B	85	4.07	0.006	346.33
	C	90	2.76	0.004	248.06
	D	92	0.43	0.001	39.41
High Desity Residential	A	61	1.26	0.002	76.90
	B	75	3.96	0.006	296.91
	C	83	1.69	0.003	140.04
	D	87	2.61	0.004	227.13
Medium Desity Residential	A	54	3.28	0.005	177.25
	B	70	3.78	0.006	264.50
	C	80	2.89	0.005	230.96
	D	85	5.81	0.009	493.60
Low Desity Residential	A	51	5.25	0.008	267.89
	B	68	5.25	0.008	356.69
	C	79	4.83	0.008	381.77
	D	84	11.51	0.018	966.46
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.64	0.001	31.23
	B	69	0.08	0.000	5.35
	C	79	0.43	0.001	33.78
	D	84	0.01	0.000	0.76
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.96	0.005	245.28
	B	89	4.60	0.007	409.24
	C	92	5.15	0.008	473.50
	D	93	5.97	0.009	555.04
		Total	82.81	0.13	6547.01
	Weighted CN		79.06		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W910

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.10	0.000	8.81
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.85	0.001	65.43
	B	85	1.90	0.003	161.80
	C	90	0.32	0.001	29.23
	D	92	0.00	--	--
High Desity Residential	A	61	5.54	0.009	337.81
	B	75	0.50	0.001	37.68
	C	83	0.29	0.000	23.97
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.34	0.001	18.37
	B	70	0.24	0.000	16.81
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	3.56	0.006	181.46
	B	68	1.22	0.002	83.17
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	5.73	0.009	280.78
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	24.79	0.039	966.93
	B	61	13.99	0.022	853.50
	C	74	7.84	0.012	580.19
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	8.11	0.013	754.25
		Total	75.33	0.12	4400.19
	Weighted CN		**58.41**		

W1000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	4.02	0.006	309.68
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	2.39	0.004	145.96
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	1.73	0.003	93.51
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	3.13	0.005	159.77
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.05	0.002	51.65
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.88	0.008	405.29
	B	89	0.02	0.000	1.91
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	17.24	0.03	1167.77
	Weighted CN		**67.75**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W920

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	13.12	0.021	1167.90
	B	92	17.74	0.028	1631.78
	C	94	18.08	0.028	1699.20
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.26	0.005	250.80
	B	85	3.51	0.005	298.08
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.11	0.000	6.42
	B	75	0.02	0.000	1.60
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	2.63	0.004	134.15
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	7.55	0.012	634.33
Open Space	A	39	71.61	0.112	2792.88
	B	61	95.83	0.150	5845.78
	C	74	38.45	0.060	2845.21
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	6.17	0.010	511.90
	B	89	12.31	0.019	1095.75
	C	92	4.40	0.007	404.34
	D	93	0.02	0.000	1.90
		Total	294.80	0.46	19322.02
	Weighted CN		**65.54**		

W1100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.34	0.001	30.09
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.07	0.011	544.44
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	6.38	0.010	389.13
	B	75	0.00	--	--
	C	83	0.22	0.000	18.15
	D	87	0.00	--	--
Medium Desity Residential	A	54	11.24	0.018	606.85
	B	70	0.00	--	--
	C	80	0.23	0.000	18.06
	D	85	0.00	--	--
Low Desity Residential	A	51	43.31	0.068	2208.64
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	15.52	0.024	760.40
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	10.47	0.016	869.20
	B	89	0.00	--	--
	C	92	0.00	0.000	0.07
	D	93	0.00	--	--
		Total	94.77	0.15	5445.04
	Weighted CN		**57.46**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W930

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.84	0.004	253.13
	B	92	3.70	0.006	340.80
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	18.23	0.028	1403.99
	B	85	11.60	0.018	985.77
	C	90	1.55	0.002	139.41
	D	92	0.00	--	--
High Desity Residential	A	61	1.34	0.002	81.97
	B	75	1.45	0.002	109.09
	C	83	0.00	0.000	0.38
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.91	0.005	157.29
	B	70	1.96	0.003	137.00
	C	80	0.24	0.000	19.47
	D	85	0.00	--	--
Low Desity Residential	A	51	16.70	0.026	851.48
	B	68	8.65	0.014	588.37
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	17.94	0.028	699.82
	B	61	11.05	0.017	674.27
	C	74	4.34	0.007	321.17
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.44	0.008	451.20
	B	89	6.11	0.010	543.71
	C	92	0.52	0.001	48.09
	D	93	0.00	--	--
		Total	116.60	0.18	7806.39
	Weighted CN		**66.95**		

W1200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.83	0.003	162.77
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	12.52	0.020	963.86
	B	85	2.84	0.004	241.10
	C	90	3.27	0.005	294.07
	D	92	0.00	--	--
High Desity Residential	A	61	11.20	0.017	683.00
	B	75	2.13	0.003	159.45
	C	83	0.10	0.000	7.93
	D	87	0.00	--	--
Medium Desity Residential	A	54	19.31	0.030	1042.63
	B	70	0.42	0.001	29.45
	C	80	0.44	0.001	35.31
	D	85	0.00	--	--
Low Desity Residential	A	51	10.39	0.016	529.77
	B	68	0.62	0.001	42.29
	C	79	0.31	0.000	24.56
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	8.15	0.013	399.52
	B	69	4.42	0.007	304.71
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	12.46	0.019	1034.21
	B	89	1.81	0.003	161.21
	C	92	0.86	0.001	79.06
	D	93	0.00	--	--
		Total	93.06	0.15	6194.91
	Weighted CN		**66.57**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W940

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.33	0.001	30.41
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	4.78	0.007	368.44
	B	85	4.21	0.007	357.75
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	2.89	0.005	176.26
	B	75	1.23	0.002	92.51
	C	83	0.19	0.000	15.88
	D	87	0.00	--	--
Medium Desity Residential	A	54	3.02	0.005	163.19
	B	70	1.24	0.002	87.07
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	54.64	0.085	2786.62
	B	68	18.19	0.028	1237.23
	C	79	2.55	0.004	201.16
	D	84	0.00	--	--
Very Low Desity Residential	A	49	11.81	0.018	578.86
	B	69	4.87	0.008	335.76
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	65.08	0.102	2538.04
	B	61	9.61	0.015	586.35
	C	74	5.96	0.009	440.91
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	7.43	0.012	617.10
	B	89	2.59	0.004	230.14
	C	92	0.57	0.001	52.52
	D	93	0.00	--	--
		Total	201.20	0.31	10896.20
	Weighted CN		**54.15**		

W1300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	12.11	0.019	932.49
	B	85	1.52	0.002	129.54
	C	90	0.04	0.000	3.87
	D	92	0.00	--	--
High Desity Residential	A	61	11.66	0.018	711.51
	B	75	0.48	0.001	35.73
	C	83	2.66	0.004	220.82
	D	87	0.00	--	--
Medium Desity Residential	A	54	20.67	0.032	1116.04
	B	70	0.67	0.001	46.72
	C	80	1.88	0.003	150.36
	D	85	0.00	--	--
Low Desity Residential	A	51	19.65	0.031	1002.11
	B	68	2.94	0.005	200.00
	C	79	2.40	0.004	189.81
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	3.97	0.006	194.76
	B	69	0.00	--	--
	C	79	1.48	0.002	116.92
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	14.13	0.022	1172.84
	B	89	0.66	0.001	58.56
	C	92	1.59	0.002	146.28
	D	93	0.00	--	--
		Total	98.52	0.15	6428.35
	Weighted CN		**65.25**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W950

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.34	0.004	208.51
	B	92	2.22	0.003	204.59
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	5.97	0.009	459.35
	B	85	7.43	0.012	631.70
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.90	0.001	55.01
	B	75	3.06	0.005	229.77
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	3.25	0.005	175.30
	B	70	2.58	0.004	180.64
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	11.94	0.019	609.17
	B	68	0.95	0.001	64.72
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	10.54	0.016	516.35
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.30	0.004	193.57
Open Space	A	39	14.96	0.023	583.38
	B	61	0.60	0.001	36.87
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	69.06	0.11	4148.94
	Weighted CN		**60.08**		

W1400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.40	0.002	124.64
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.66	0.004	204.84
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	4.10	0.006	249.85
	B	75	0.00	--	--
	C	83	1.59	0.002	132.11
	D	87	0.00	--	--
Medium Desity Residential	A	54	6.11	0.010	329.69
	B	70	0.00	--	--
	C	80	1.85	0.003	147.75
	D	85	0.00	--	--
Low Desity Residential	A	51	41.40	0.065	2111.37
	B	68	0.00	--	--
	C	79	4.85	0.008	383.29
	D	84	0.00	--	--
Very Low Desity Residential	A	49	2.30	0.004	112.82
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.44	0.002	70.56
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	16.68	0.026	1384.79
	B	89	0.00	--	--
	C	92	2.78	0.004	255.60
	D	93	0.00	--	--
		Total	87.16	0.14	5507.31
	Weighted CN		**63.19**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W960

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	6.09	0.010	560.20
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	9.74	0.015	749.79
	B	85	12.05	0.019	1023.97
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	1.32	0.002	80.24
	B	75	3.78	0.006	283.21
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.75	0.001	40.70
	B	70	1.20	0.002	84.34
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.80	0.001	40.74
	B	68	3.15	0.005	214.40
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	2.11	0.003	82.22
	B	61	2.16	0.003	131.98
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.94	0.001	77.99
	B	89	8.67	0.014	771.84
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	52.76	0.08	4141.60
	Weighted CN		**78.50**		

W1500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.06	0.002	81.65
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	9.17	0.014	559.39
	B	75	0.00	--	--
	C	83	0.08	0.000	6.46
	D	87	2.82	0.004	245.21
Medium Desity Residential	A	54	28.36	0.044	1531.17
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	3.65	0.006	310.03
Low Desity Residential	A	51	17.70	0.028	902.76
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	1.17	0.002	98.14
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.07	0.000	3.27
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	15.51	0.024	1287.51
	B	89	0.00	--	--
	C	92	0.13	0.000	12.22
	D	93	2.68	0.004	249.12
		Total	82.39	0.13	5286.94
	Weighted CN		**64.17**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W970

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	18.28	0.029	1626.72
	B	92	0.00	--	--
	C	94	21.51	0.034	2021.82
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	11.71	0.018	901.32
	B	85	0.05	0.000	3.97
	C	90	12.00	0.019	1079.81
	D	92	1.31	0.002	120.87
High Desity Residential	A	61	3.97	0.006	242.11
	B	75	1.94	0.003	145.57
	C	83	2.24	0.004	186.15
	D	87	0.35	0.001	30.23
Medium Desity Residential	A	54	2.68	0.004	144.92
	B	70	1.66	0.003	116.52
	C	80	1.25	0.002	99.89
	D	85	0.52	0.001	44.33
Low Desity Residential	A	51	5.63	0.009	287.19
	B	68	2.63	0.004	178.94
	C	79	3.75	0.006	296.13
	D	84	0.96	0.001	80.43
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	6.90	0.011	269.18
	B	61	1.94	0.003	118.19
	C	74	0.92	0.001	67.74
	D	80	2.67	0.004	213.94
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	8.44	0.013	700.84
	B	89	1.31	0.002	116.61
	C	92	4.47	0.007	411.08
	D	93	0.91	0.001	84.71
		Total	120.00	0.19	9589.21
	Weighted CN		**79.91**		

W1600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.54	0.006	272.85
	B	85	2.83	0.004	240.96
	C	90	4.00	0.006	360.42
	D	92	0.00	--	--
High Desity Residential	A	61	4.22	0.007	257.18
	B	75	0.51	0.001	38.04
	C	83	1.38	0.002	114.39
	D	87	0.00	--	--
Medium Desity Residential	A	54	5.14	0.008	277.77
	B	70	0.00	--	--
	C	80	2.87	0.004	229.99
	D	85	0.00	--	--
Low Desity Residential	A	51	5.35	0.008	272.99
	B	68	0.00	--	--
	C	79	4.14	0.006	326.81
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.63	0.001	30.82
	B	69	0.05	0.000	3.32
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	6.46	0.010	536.10
	B	89	0.89	0.001	79.29
	C	92	2.20	0.003	202.42
	D	93	0.00	--	--
		Total	44.22	0.07	3243.35
	Weighted CN		**73.35**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W980

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.89	0.005	257.06
	B	92	10.46	0.016	962.09
	C	94	8.73	0.014	820.81
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.09	0.000	7.09
	B	85	1.25	0.002	106.21
	C	90	0.07	0.000	6.52
	D	92	0.00	--	--
High Desity Residential	A	61	0.06	0.000	3.42
	B	75	0.28	0.000	20.85
	C	83	0.27	0.000	22.00
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.40	0.001	20.62
	B	68	1.88	0.003	127.64
	C	79	1.69	0.003	133.25
	D	84	0.00	--	--
Very Low Desity Residential	A	49	2.15	0.003	105.37
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.00	--	--
	B	61	78.01	0.122	4758.47
	C	74	16.94	0.026	1253.55
	D	80	32.26	0.050	2580.67
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.46	0.001	38.27
	B	89	2.79	0.004	247.95
	C	92	3.74	0.006	343.63
	D	93	0.00	--	--
		Total	164.40	0.26	11815.47
	Weighted CN		**71.87**		

W1700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.74	0.003	154.49
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.35	0.004	181.10
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	1.34	0.002	82.04
	B	75	0.22	0.000	16.21
	C	83	0.16	0.000	12.92
	D	87	0.00	--	--
Medium Desity Residential	A	54	3.42	0.005	184.43
	B	70	0.22	0.000	15.28
	C	80	1.00	0.002	80.01
	D	85	0.00	--	--
Low Desity Residential	A	51	3.05	0.005	155.41
	B	68	0.70	0.001	47.74
	C	79	0.31	0.000	24.72
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.55	0.001	27.04
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	6.24	0.010	517.75
	B	89	0.51	0.001	45.04
	C	92	0.75	0.001	69.33
	D	93	0.00	--	--
		Total	22.55	0.04	1613.51
	Weighted CN		**71.55**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W990

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.60	0.001	52.96
	B	92	0.07	0.000	6.01
	C	94	1.08	0.002	101.45
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	43.96	0.069	3385.10
	B	85	52.64	0.082	4474.62
	C	90	8.35	0.013	751.39
	D	92	0.00	--	--
High Desity Residential	A	61	0.08	0.000	4.94
	B	75	0.03	0.000	2.21
	C	83	0.00	--	--
	D	87	0.01	0.000	1.01
Medium Desity Residential	A	54	0.28	0.000	14.89
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.21	0.002	61.61
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	41.99	0.066	2057.71
	B	69	39.03	0.061	2693.25
	C	79	0.00	--	--
	D	84	0.82	0.001	69.25
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	18.46	0.029	1531.84
	B	89	13.86	0.022	1233.11
	C	92	3.99	0.006	367.03
	D	93	0.05	0.000	4.57
		Total	226.50	0.35	16812.95
	Weighted CN		**74.23**		

W1800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	38.86	0.061	2992.31
	B	85	0.00	--	--
	C	90	4.01	0.006	361.16
	D	92	11.73	0.018	1078.82
High Desity Residential	A	61	3.08	0.005	187.74
	B	75	0.00	--	--
	C	83	1.01	0.002	84.13
	D	87	0.14	0.000	12.56
Medium Desity Residential	A	54	4.22	0.007	228.11
	B	70	0.00	--	--
	C	80	1.29	0.002	103.20
	D	85	0.27	0.000	23.12
Low Desity Residential	A	51	4.14	0.006	211.26
	B	68	0.00	--	--
	C	79	2.16	0.003	170.95
	D	84	3.07	0.005	258.27
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.59	0.002	77.76
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	7.17	0.011	602.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	7.90	0.012	655.66
	B	89	0.00	--	--
	C	92	2.16	0.003	198.81
	D	93	2.27	0.004	211.13
		Total	95.09	0.15	7457.20
	Weighted CN		**78.42**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W1900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.04	0.000	3.39
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	47.86	0.075	3685.18
	B	85	0.00	--	--
	C	90	7.32	0.011	658.79
	D	92	8.75	0.014	804.66
High Desity Residential	A	61	1.94	0.003	118.57
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.31	0.000	26.67
Medium Desity Residential	A	54	1.27	0.002	68.69
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.54	0.001	45.66
Low Desity Residential	A	51	4.02	0.006	204.77
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.53	0.001	44.45
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	0.000	0.15
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.60	0.007	382.13
	B	89	0.00	--	--
	C	92	0.69	0.001	63.66
	D	93	0.85	0.001	79.38
		Total	78.72	0.12	6186.14
	Weighted CN		**78.58**		

W2800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	5.52	0.009	424.96
	B	85	1.97	0.003	167.56
	C	90	0.13	0.000	11.57
	D	92	0.03	0.000	2.82
High Desity Residential	A	61	0.05	0.000	2.84
	B	75	0.15	0.000	11.07
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.10	0.002	55.92
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.78	0.007	234.16
	B	69	4.81	0.008	332.21
	C	79	0.00	0.000	0.12
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.25	0.004	186.66
	B	89	1.20	0.002	107.23
	C	92	0.10	0.000	8.83
	D	93	0.00	--	--
		Total	22.08	0.03	1545.95
	Weighted CN		**70.00**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	6.16	0.010	548.49
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.44	0.001	41.48
Office/Institutional/Multi-Family	A	77	40.75	0.064	3137.40
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	3.65	0.006	335.96
High Desity Residential	A	61	0.79	0.001	47.92
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.09	0.000	8.14
Medium Desity Residential	A	54	1.46	0.002	78.59
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.56	0.002	79.39
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.13	0.006	202.61
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.74	0.003	146.58
Parking	A	98	0.63	0.001	61.41
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.89	0.001	87.09
ROW	A	83	9.28	0.014	770.21
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.09	0.002	101.13
		Total	72.65	0.11	5646.40
	Weighted CN		**77.72**		

W2900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	1.25	0.002	110.28
	C	91	1.12	0.002	101.87
	D	93	0.00	--	--
Commerical	A	89	0.35	0.001	31.39
	B	92	0.14	0.000	12.51
	C	94	2.00	0.003	187.91
	D	95	0.28	0.000	26.45
Office/Institutional/Multi-Family	A	77	5.91	0.009	454.77
	B	85	0.14	0.000	11.71
	C	90	4.08	0.006	367.53
	D	92	12.27	0.019	1128.52
High Desity Residential	A	61	0.01	0.000	0.32
	B	75	3.78	0.006	283.22
	C	83	2.43	0.004	202.03
	D	87	5.65	0.009	491.21
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.94	0.001	65.71
	C	80	1.37	0.002	109.27
	D	85	0.97	0.002	82.47
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.62	0.001	51.88
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	0.000	0.03
	B	69	1.43	0.002	98.59
	C	79	3.61	0.006	284.86
	D	84	6.17	0.010	518.05
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.73	0.003	143.26
	B	89	2.57	0.004	228.37
	C	92	6.26	0.010	575.89
	D	93	8.68	0.014	807.12
		Total	73.72	0.12	6375.23
	Weighted CN		**86.48**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	14.84	0.023	1320.84
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.91	0.003	181.20
Office/Institutional/Multi-Family	A	77	5.51	0.009	424.23
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	6.17	0.010	567.48
High Desity Residential	A	61	4.56	0.007	278.23
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	0.000	0.05
Medium Desity Residential	A	54	2.06	0.003	111.16
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	3.01	0.005	153.68
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.10	0.006	200.91
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.32	0.000	26.66
Parking	A	98	0.35	0.001	33.95
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	13.97	0.022	1159.42
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	2.37	0.004	220.18
		Total	59.16	0.09	4677.99
	Weighted CN		**79.07**		

W3000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	20.03	0.031	1542.41
	B	85	12.36	0.019	1050.74
	C	90	23.49	0.037	2113.78
	D	92	3.89	0.006	357.58
High Desity Residential	A	61	2.68	0.004	163.69
	B	75	5.44	0.009	408.11
	C	83	12.81	0.020	1063.33
	D	87	0.05	0.000	4.65
Medium Desity Residential	A	54	1.67	0.003	90.32
	B	70	1.03	0.002	72.06
	C	80	1.37	0.002	109.60
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	48.17	0.075	2360.45
	B	69	35.57	0.056	2454.10
	C	79	14.04	0.022	1109.51
	D	84	1.84	0.003	154.58
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	20.58	0.032	1707.86
	B	89	25.09	0.039	2233.42
	C	92	16.12	0.025	1482.90
	D	93	0.66	0.001	61.26
		Total	246.90	0.39	18540.36
	Weighted CN		**75.09**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	3.05	0.005	271.08
	B	92	2.59	0.004	238.03
	C	94	3.89	0.006	365.35
	D	95	0.72	0.001	68.57
Office/Institutional/Multi-Family	A	77	2.19	0.003	168.49
	B	85	0.17	0.000	14.76
	C	90	6.18	0.010	555.89
	D	92	6.51	0.010	598.90
High Desity Residential	A	61	0.00	--	--
	B	75	0.69	0.001	51.89
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	6.59	0.010	322.72
	B	69	0.78	0.001	53.85
	C	79	8.18	0.013	646.03
	D	84	3.57	0.006	300.05
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.67	0.004	221.74
	B	89	0.01	0.000	0.77
	C	92	1.45	0.002	133.14
	D	93	4.09	0.006	380.36
		Total	53.32	0.08	4391.62
	Weighted CN		**82.37**		

W3100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	15.20	0.024	1170.27
	B	85	12.94	0.020	1100.22
	C	90	1.49	0.002	133.77
	D	92	1.02	0.002	94.04
High Desity Residential	A	61	4.77	0.007	291.24
	B	75	6.00	0.009	450.19
	C	83	3.54	0.006	294.17
	D	87	3.80	0.006	330.48
Medium Desity Residential	A	54	4.44	0.007	239.55
	B	70	1.21	0.002	84.38
	C	80	2.48	0.004	198.46
	D	85	3.73	0.006	316.81
Low Desity Residential	A	51	28.64	0.045	1460.66
	B	68	17.64	0.028	1199.47
	C	79	9.46	0.015	747.08
	D	84	10.21	0.016	857.68
Very Low Desity Residential	A	49	2.14	0.003	104.73
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	58.17	0.091	2268.59
	B	61	20.71	0.032	1263.32
	C	74	4.19	0.007	310.04
	D	80	5.24	0.008	419.38
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	9.02	0.014	748.69
	B	89	4.86	0.008	432.68
	C	92	4.08	0.006	375.74
	D	93	3.82	0.006	355.55
		Total	238.80	0.37	15247.17
	Weighted CN		**63.85**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	7.56	0.012	672.55
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	0.000	0.36
Office/Institutional/Multi-Family	A	77	2.11	0.003	162.14
	B	85	0.00	--	--
	C	90	1.40	0.002	125.81
	D	92	5.31	0.008	488.78
High Desity Residential	A	61	1.67	0.003	101.90
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.24	0.000	20.96
Medium Desity Residential	A	54	1.48	0.002	79.94
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	16.02	0.025	816.94
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	2.89	0.005	242.67
Very Low Desity Residential	A	49	4.37	0.007	214.14
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.48	0.001	23.56
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.01	0.000	0.58
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.04	0.008	418.24
	B	89	0.00	--	--
	C	92	1.00	0.002	92.06
	D	93	0.91	0.001	84.21
		Total	50.48	0.08	3544.86
	Weighted CN		**70.22**		

W3200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.03	0.000	2.78
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.31	0.000	24.03
	B	85	5.70	0.009	484.49
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.21	0.000	13.08
	B	75	0.02	0.000	1.39
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	9.17	0.014	641.58
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	22.82	0.036	1551.86
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.00	0.002	49.00
	B	69	16.84	0.026	1161.68
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	9.68	0.015	861.52
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	65.78	0.10	4791.43
	Weighted CN		**72.84**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.04	0.000	3.89
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.41	0.001	38.84
Office/Institutional/Multi-Family	A	77	6.69	0.010	515.13
	B	85	1.25	0.002	106.05
	C	90	0.41	0.001	36.56
	D	92	10.24	0.016	942.54
High Desity Residential	A	61	1.96	0.003	119.42
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.96	0.001	83.38
Medium Desity Residential	A	54	4.20	0.007	226.62
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	2.17	0.003	184.57
Low Desity Residential	A	51	4.34	0.007	221.47
	B	68	0.98	0.002	66.58
	C	79	0.00	--	--
	D	84	1.16	0.002	97.53
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	10.20	0.016	499.57
	B	69	0.10	0.000	7.08
	C	79	0.00	--	--
	D	84	6.77	0.011	568.50
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.71	0.004	224.87
	B	89	1.11	0.002	99.16
	C	92	0.00	--	--
	D	93	3.70	0.006	344.49
		Total	59.40	0.09	4386.23
	Weighted CN		**73.84**		

W3300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	15.53	0.024	1382.45
	B	92	16.34	0.026	1502.91
	C	94	4.16	0.006	390.74
	D	95	0.28	0.000	26.54
Office/Institutional/Multi-Family	A	77	1.70	0.003	130.57
	B	85	7.75	0.012	659.08
	C	90	3.62	0.006	325.66
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.28	0.004	111.69
	B	69	1.01	0.002	69.91
	C	79	0.04	0.000	3.41
	D	84	0.64	0.001	54.13
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	6.47	0.010	575.83
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	59.82	0.09	5232.93
	Weighted CN		**87.47**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	11.29	0.018	1005.10
	B	92	0.00	--	--
	C	94	0.02	0.000	2.17
	D	95	4.46	0.007	424.02
Office/Institutional/Multi-Family	A	77	8.93	0.014	687.77
	B	85	0.00	--	--
	C	90	2.00	0.003	179.70
	D	92	2.12	0.003	194.77
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.14	0.000	12.21
Medium Desity Residential	A	54	0.25	0.000	13.44
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.73	0.001	37.38
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	2.38	0.004	200.16
Very Low Desity Residential	A	49	2.16	0.003	105.92
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.03	0.003	170.50
Open Space	A	39	0.39	0.001	15.08
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.05	0.003	170.23
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.58	0.001	53.99
		Total	39.54	0.06	3272.44
	Weighted CN		**82.76**		

W3400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	3.37	0.005	309.64
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	8.26	0.013	404.81
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	68.20	0.107	5728.92
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	0.000	0.03
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	6.18	0.010	574.85
		Total	86.01	0.13	7018.25
	Weighted CN		**81.60**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.15	0.000	13.93
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.07	0.000	6.29
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.14	0.000	11.84
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.17	0.000	15.95
		Total	0.53	0.00	48.00
	Weighted CN		**90.35**		

W3500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	4.10	0.006	331.84
	B	88	4.08	0.006	359.13
	C	91	1.15	0.002	104.32
	D	93	0.00	--	--
Commerical	A	89	9.16	0.014	815.03
	B	92	7.03	0.011	646.76
	C	94	1.55	0.002	146.12
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.29	0.005	253.30
	B	85	4.42	0.007	376.07
	C	90	0.20	0.000	17.78
	D	92	0.05	0.000	4.78
High Desity Residential	A	61	7.37	0.012	449.28
	B	75	6.02	0.009	451.17
	C	83	0.09	0.000	7.58
	D	87	0.64	0.001	55.78
Medium Desity Residential	A	54	1.40	0.002	75.72
	B	70	2.37	0.004	165.89
	C	80	0.43	0.001	34.79
	D	85	0.22	0.000	18.75
Low Desity Residential	A	51	0.34	0.001	17.30
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.44	0.004	119.55
	B	69	6.42	0.010	442.97
	C	79	0.51	0.001	40.41
	D	84	0.24	0.000	20.14
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	9.26	0.014	768.57
	B	89	10.55	0.016	938.65
	C	92	2.03	0.003	187.00
	D	93	0.47	0.001	43.72
		Total	85.83	0.13	6892.40
	Weighted CN		**80.30**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W2700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.49	0.002	132.90
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.20	0.002	113.56
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.46	0.001	27.93
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.33	0.001	28.44
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	2.58	0.004	131.58
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	2.10	0.003	176.04
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	1.14	0.002	44.49
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	2.43	0.004	194.49
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.69	0.001	57.06
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.01	0.002	94.10
		Total	13.42	0.02	1000.58
	Weighted CN		**74.56**		

W3600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.86	0.001	75.97
	C	91	1.38	0.002	125.84
	D	93	0.00	--	--
Commerical	A	89	3.91	0.006	348.20
	B	92	10.77	0.017	990.84
	C	94	0.36	0.001	33.89
	D	95	13.03	0.020	1238.24
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.89	0.001	75.56
	C	90	0.66	0.001	59.04
	D	92	0.79	0.001	72.36
High Desity Residential	A	61	0.00	--	--
	B	75	4.36	0.007	327.18
	C	83	2.56	0.004	212.40
	D	87	1.41	0.002	122.63
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.89	0.001	62.30
	C	80	0.88	0.001	70.16
	D	85	0.47	0.001	40.10
Low Desity Residential	A	51	0.00	--	--
	B	68	0.33	0.001	22.54
	C	79	0.32	0.000	25.20
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.30	0.000	14.67
	B	69	15.85	0.025	1093.50
	C	79	2.17	0.003	171.30
	D	84	5.50	0.009	462.09
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.03	0.000	2.30
	B	89	6.33	0.010	563.13
	C	92	3.63	0.006	334.06
	D	93	4.03	0.006	375.00
		Total	81.71	0.13	6918.51
	Weighted CN		**84.67**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W3700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	6.26	0.010	557.50
	B	92	0.24	0.000	21.99
	C	94	2.13	0.003	199.93
	D	95	4.84	0.008	459.70
Office/Institutional/Multi-Family	A	77	1.73	0.003	133.32
	B	85	0.26	0.000	22.37
	C	90	7.85	0.012	706.81
	D	92	9.28	0.015	854.14
High Desity Residential	A	61	3.19	0.005	194.44
	B	75	1.13	0.002	84.77
	C	83	0.00	--	--
	D	87	0.25	0.000	21.82
Medium Desity Residential	A	54	0.28	0.000	15.33
	B	70	0.27	0.000	18.58
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.69	0.003	82.90
	B	69	1.03	0.002	71.21
	C	79	0.00	--	--
	D	84	1.31	0.002	109.65
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.46	0.005	286.97
	B	89	0.86	0.001	76.22
	C	92	6.28	0.010	578.13
	D	93	2.69	0.004	250.54
		Total	55.04	0.09	4746.30
	Weighted CN		**86.23**		

W4600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.29	0.000	26.00
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	4.20	0.007	323.32
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	11.27	0.018	687.21
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.25	0.004	121.52
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.53	0.002	77.92
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.17	0.000	8.47
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.41	0.001	40.53
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	8.11	0.013	673.01
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	28.23	0.04	1957.98
	Weighted CN		**69.36**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W3800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	46.17	0.072	3554.80
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	24.87	0.039	2288.06
High Desity Residential	A	61	0.98	0.002	59.73
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.20	0.000	17.13
Medium Desity Residential	A	54	0.98	0.002	52.74
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	1.94	0.003	98.88
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.33	0.001	16.26
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.00	0.002	84.05
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	6.58	0.010	546.20
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.31	0.002	121.74
		Total	84.35	0.13	6839.58
	Weighted CN		**81.09**		

W4700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.95	0.003	173.71
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.02	0.000	2.07
Office/Institutional/Multi-Family	A	77	13.67	0.021	1052.84
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	7.23	0.011	664.76
High Desity Residential	A	61	10.54	0.016	642.97
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	4.07	0.006	220.03
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	3.02	0.005	153.99
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	5.05	0.008	247.42
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.49	0.002	124.93
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	13.05	0.020	1083.21
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.26	0.000	23.77
		Total	60.35	0.09	4389.70
	Weighted CN		**72.74**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W3900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.08	0.000	7.13
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.02	0.000	1.81
Office/Institutional/Multi-Family	A	77	10.34	0.016	796.17
	B	85	4.49	0.007	381.46
	C	90	5.07	0.008	456.43
	D	92	10.65	0.017	979.83
High Desity Residential	A	61	1.02	0.002	62.29
	B	75	0.27	0.000	20.42
	C	83	0.00	--	--
	D	87	0.57	0.001	49.76
Medium Desity Residential	A	54	1.32	0.002	71.05
	B	70	0.24	0.000	16.51
	C	80	0.00	--	--
	D	85	0.93	0.001	79.08
Low Desity Residential	A	51	8.47	0.013	432.12
	B	68	5.25	0.008	356.96
	C	79	0.00	--	--
	D	84	3.00	0.005	252.29
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.62	0.006	300.44
	B	89	1.12	0.002	100.07
	C	92	0.00	--	--
	D	93	1.05	0.002	98.02
		Total	57.52	0.09	4461.85
	Weighted CN		**77.57**		

W4800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.61	0.001	54.27
	B	92	0.00	--	--
	C	94	1.36	0.002	128.09
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.81	0.012	601.18
	B	85	6.26	0.010	531.90
	C	90	3.24	0.005	291.67
	D	92	0.00	--	--
High Desity Residential	A	61	0.03	0.000	2.04
	B	75	0.01	0.000	0.49
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.77	0.001	39.52
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.51	0.001	25.14
	B	69	0.00	--	--
	C	79	6.25	0.010	493.43
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.13	0.002	93.91
	B	89	0.57	0.001	50.35
	C	92	1.70	0.003	156.29
	D	93	0.00	--	--
		Total	30.25	0.05	2468.28
	Weighted CN		**81.60**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.03	0.000	2.55
	D	95	0.49	0.001	46.64
Office/Institutional/Multi-Family	A	77	5.00	0.008	385.07
	B	85	5.66	0.009	480.68
	C	90	2.10	0.003	188.70
	D	92	24.94	0.039	2294.36
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.50	0.001	24.39
	B	69	0.01	0.000	0.62
	C	79	3.81	0.006	300.98
	D	84	14.61	0.023	1227.26
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.45	0.002	120.43
	B	89	0.49	0.001	43.96
	C	92	0.71	0.001	65.04
	D	93	0.68	0.001	63.43
		Total	60.47	0.09	5244.10
	Weighted CN		**86.72**		

W4900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.15	0.000	9.30
	B	75	0.17	0.000	12.66
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	1.75	0.003	94.44
	B	70	1.15	0.002	80.68
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	6.76	0.011	344.78
	B	68	0.94	0.001	64.09
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	3.04	0.005	148.79
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	15.63	0.024	765.71
	B	69	31.84	0.050	2196.79
	C	79	0.53	0.001	41.53
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	11.71	0.018	972.33
	B	89	12.02	0.019	1070.06
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	85.69	0.13	5801.16
	Weighted CN		**67.70**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	18.82	0.029	1674.91
	B	92	0.94	0.001	86.39
	C	94	13.83	0.022	1300.11
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.59	0.012	584.22
	B	85	0.63	0.001	53.71
	C	90	6.06	0.009	545.29
	D	92	0.00	--	--
High Desity Residential	A	61	0.35	0.001	21.53
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.34	0.001	23.62
	C	79	2.24	0.004	177.03
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.91	0.006	324.92
	B	89	1.05	0.002	93.52
	C	92	3.76	0.006	346.04
	D	93	0.00	--	--
		Total	59.53	0.09	5231.28
	Weighted CN		**87.88**		

W5000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	0.000	0.00
	B	92	0.62	0.001	56.72
	C	94	1.05	0.002	98.35
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	1.27	0.002	107.99
	C	90	1.33	0.002	119.81
	D	92	0.00	--	--
High Desity Residential	A	61	0.33	0.001	19.90
	B	75	1.15	0.002	86.36
	C	83	0.14	0.000	11.66
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.71	0.001	38.29
	B	70	0.42	0.001	29.65
	C	80	0.54	0.001	43.03
	D	85	0.00	--	--
Low Desity Residential	A	51	5.27	0.008	268.82
	B	68	1.80	0.003	122.11
	C	79	1.66	0.003	131.17
	D	84	0.52	0.001	43.96
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	7.14	0.011	278.57
	B	61	13.78	0.022	840.67
	C	74	20.39	0.032	1508.66
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.52	0.001	43.16
	B	89	5.56	0.009	495.00
	C	92	4.02	0.006	370.12
	D	93	0.00	--	--
		Total	68.22	0.11	4714.01
	Weighted CN		**69.10**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.02	0.000	1.68
	C	94	4.58	0.007	430.11
	D	95	7.62	0.012	724.13
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	7.38	0.012	627.33
	C	90	6.01	0.009	540.85
	D	92	11.27	0.018	1037.19
High Desity Residential	A	61	0.34	0.001	20.57
	B	75	0.11	0.000	8.05
	C	83	0.29	0.000	24.28
	D	87	1.32	0.002	114.52
Medium Desity Residential	A	54	0.26	0.000	14.12
	B	70	0.21	0.000	14.68
	C	80	0.27	0.000	21.81
	D	85	1.01	0.002	86.15
Low Desity Residential	A	51	1.48	0.002	75.57
	B	68	1.08	0.002	73.27
	C	79	7.51	0.012	593.50
	D	84	3.50	0.005	294.15
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.73	0.001	57.84
	D	84	1.97	0.003	165.09
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.58	0.001	47.83
	B	89	0.93	0.001	82.39
	C	92	3.52	0.006	324.10
	D	93	6.97	0.011	648.53
		Total	68.96	0.11	6027.72
	Weighted CN		**87.41**		

W5100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	0.000	0.05
	B	75	4.07	0.006	305.61
	C	83	0.51	0.001	42.51
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.21	0.000	11.56
	B	70	0.67	0.001	47.17
	C	80	0.46	0.001	36.68
	D	85	0.00	--	--
Low Desity Residential	A	51	0.44	0.001	22.20
	B	68	4.87	0.008	331.10
	C	79	3.31	0.005	261.60
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	8.42	0.013	328.47
	B	61	12.76	0.020	778.41
	C	74	7.27	0.011	537.92
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	2.26	0.004	200.76
	C	92	4.22	0.007	388.53
	D	93	0.56	0.001	51.95
		Total	50.04	0.08	3344.53
	Weighted CN		**66.84**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.61	0.001	54.56
	B	92	10.81	0.017	994.81
	C	94	0.31	0.000	29.33
	D	95	41.25	0.064	3918.49
Office/Institutional/Multi-Family	A	77	1.37	0.002	105.43
	B	85	3.93	0.006	334.00
	C	90	1.11	0.002	100.30
	D	92	1.98	0.003	182.29
High Desity Residential	A	61	0.00	--	--
	B	75	1.03	0.002	77.14
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.39	0.002	115.48
	B	89	7.02	0.011	624.72
	C	92	0.22	0.000	20.02
	D	93	6.67	0.010	620.62
		Total	77.71	0.12	7177.18
	Weighted CN		**92.36**		

W5200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	10.90	0.017	1003.26
	C	94	0.22	0.000	20.40
	D	95	9.03	0.014	857.97
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	8.42	0.013	715.74
	C	90	0.00	--	--
	D	92	5.99	0.009	550.95
High Desity Residential	A	61	0.00	--	--
	B	75	0.47	0.001	35.24
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.25	0.000	17.77
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.90	0.001	43.94
	B	69	54.86	0.086	3785.01
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	1.39	0.002	128.16
	D	93	0.00	--	--
		Total	92.43	0.14	7158.43
	Weighted CN		**77.45**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	9.99	0.016	889.29
	B	92	0.06	0.000	5.08
	C	94	7.20	0.011	677.25
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.54	0.002	118.94
	B	85	0.00	--	--
	C	90	0.44	0.001	40.04
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.04	0.000	1.92
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.10	0.005	257.56
	B	89	0.00	--	--
	C	92	1.33	0.002	122.00
	D	93	0.00	--	--
		Total	23.71	0.04	2112.08
	Weighted CN		**89.08**		

W5300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.17	0.002	104.36
	B	92	17.38	0.027	1599.21
	C	94	0.02	0.000	1.75
	D	95	43.06	0.067	4090.40
Office/Institutional/Multi-Family	A	77	0.00	0.000	0.10
	B	85	2.50	0.004	212.79
	C	90	0.00	--	--
	D	92	0.43	0.001	39.74
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.07	0.002	52.30
	B	69	2.65	0.004	183.00
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	1.54	0.002	137.06
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	69.83	0.11	6420.71
	Weighted CN		**91.95**		

Sub-Catchment Weighted Curve Number Calculation - Existing Conditions

W4500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.21	0.002	107.79
	B	92	0.18	0.000	16.28
	C	94	0.95	0.001	88.85
	D	95	2.69	0.004	255.77
Office/Institutional/Multi-Family	A	77	3.56	0.006	273.91
	B	85	0.80	0.001	68.23
	C	90	0.00	--	--
	D	92	0.03	0.000	2.60
High Desity Residential	A	61	9.23	0.014	562.76
	B	75	0.78	0.001	58.58
	C	83	0.77	0.001	64.26
	D	87	0.68	0.001	59.56
Medium Desity Residential	A	54	27.77	0.043	1499.61
	B	70	0.75	0.001	52.27
	C	80	2.05	0.003	164.04
	D	85	0.23	0.000	19.73
Low Desity Residential	A	51	9.99	0.016	509.30
	B	68	0.00	--	--
	C	79	3.40	0.005	268.81
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.46	0.002	71.31
	B	69	0.69	0.001	47.86
	C	79	0.00	--	--
	D	84	0.00	0.000	0.23
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	11.35	0.018	941.95
	B	89	1.17	0.002	104.11
	C	92	0.92	0.001	84.87
	D	93	1.66	0.003	154.30
		Total	82.32	0.13	5476.97
	Weighted CN		**66.53**		

E.2 Future Conditions

W400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.37	0.001	32.93
	B	92	0.00	--	--
	C	94	1.65	0.003	155.10
	D	95	14.91	0.023	1416.45
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	5.45	0.009	501.40
High Desity Residential	A	61	0.97	0.002	59.17
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	20.10	0.031	1748.70
Medium Desity Residential	A	54	1.09	0.002	58.86
	B	70	0.00	--	--
	C	80	0.73	0.001	58.40
	D	85	5.39	0.008	458.15
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	17.02	0.027	833.98
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	18.06	0.028	1517.04
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.09	0.000	7.47
	B	89	0.00	--	--
	C	92	0.11	0.000	10.12
	D	93	4.54	0.007	422.22
		Total	90.48	0.141	7279.99
	Weighted CN		80.46		

W600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	3.35	0.005	298.15
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	9.64	0.015	915.80
Office/Institutional/Multi-Family	A	77	3.99	0.006	307.23
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	1.92	0.003	176.64
High Desity Residential	A	61	8.05	0.013	491.05
	B	75	0.00	--	--
	C	83	0.07	0.000	5.81
	D	87	14.77	0.023	1284.99
Medium Desity Residential	A	54	17.21	0.027	929.34
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	4.04	0.006	343.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	7.74	0.012	379.26
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	21.48	0.034	1804.32
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.39	0.004	198.37
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	4.55	0.007	423.15
		Total	99.20	0.155	7557.51
	Weighted CN		76.18		

W500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.09	0.003	186.01
	B	92	7.04	0.011	647.68
	C	94	0.00	--	--
	D	95	5.31	0.008	504.45
Office/Institutional/Multi-Family	A	77	11.57	0.018	890.89
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	5.67	0.009	521.64
High Desity Residential	A	61	9.55	0.015	582.55
	B	75	1.53	0.002	114.75
	C	83	0.00	--	--
	D	87	3.90	0.006	339.30
Medium Desity Residential	A	54	24.75	0.039	1336.50
	B	70	1.19	0.002	83.30
	C	80	1.41	0.002	112.80
	D	85	4.51	0.007	383.35
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.24	0.002	60.76
	B	69	1.96	0.003	135.24
	C	79	3.43	0.005	270.97
	D	84	21.08	0.033	1770.72
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	6.20	0.010	514.60
	B	89	1.45	0.002	129.05
	C	92	0.80	0.001	73.60
	D	93	2.92	0.005	271.56
		Total	117.60	0.184	8929.72
	Weighted CN		75.93		

W630

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.04	0.000	3.52
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	14.25	0.022	1268.25
	B	92	4.14	0.006	380.88
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	5.37	0.008	413.49
	B	85	2.17	0.003	184.45
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	56.93	0.089	3472.73
	B	75	72.04	0.113	5403.00
	C	83	10.65	0.017	883.95
	D	87	0.01	0.000	0.87
Medium Desity Residential	A	54	15.06	0.024	813.24
	B	70	12.83	0.020	898.10
	C	80	0.00	--	--
	D	85	15.78	0.025	1341.30
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	7.93	0.012	388.57
	B	69	3.20	0.005	220.80
	C	79	0.00	--	--
	D	84	10.57	0.017	887.88
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.79	0.009	480.57
	B	89	1.99	0.003	177.11
	C	92	0.04	0.000	3.68
	D	93	0.00	--	--
		Total	238.79	0.373	17222.39
	Weighted CN		72.12		

W510

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.69	0.003	150.41
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.87	0.001	82.65
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	4.48	0.007	273.28
	B	75	0.00	--	--
	C	83	0.47	0.001	39.01
	D	87	6.71	0.010	583.77
Medium Desity Residential	A	54	18.92	0.030	1021.68
	B	70	3.29	0.005	230.30
	C	80	0.00	--	--
	D	85	0.04	0.000	3.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	3.12	0.005	152.88
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	5.99	0.009	503.16
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.94	0.005	244.02
	B	89	0.00	--	--
	C	92	0.13	0.000	11.96
	D	93	1.00	0.002	93.00
		Total	49.65	0.08	3389.52
	Weighted CN		68.27		

W640

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	37.27	0.058	3317.03
	B	92	9.83	0.015	904.36
	C	94	12.23	0.019	1149.62
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	62.85	0.098	4839.45
	B	85	81.57	0.127	6933.45
	C	90	11.77	0.018	1059.30
	D	92	0.01	0.000	0.92
High Desity Residential	A	61	1.56	0.002	95.16
	B	75	0.15	0.000	11.25
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	9.64	0.015	520.56
	B	70	0.62	0.001	43.40
	C	80	3.89	0.006	311.20
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.52	0.001	20.28
	B	61	0.00	--	--
	C	74	0.09	0.000	6.66
	D	80	3.27	0.005	261.60
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	9.96	0.016	826.68
	B	89	6.55	0.010	582.95
	C	92	4.92	0.008	452.64
	D	93	0.00	--	--
		Total	256.70	0.401	21336.51
	Weighted CN		83.12		

Weighted Curve Number Calculation - Future Conditions

W520

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.19	0.002	105.91
	B	92	0.05	0.000	4.60
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	8.30	0.013	506.30
	B	75	0.00	--	--
	C	83	0.19	0.000	15.77
	D	87	0.00	--	--
Medium Desity Residential	A	54	4.64	0.007	250.56
	B	70	0.00	--	--
	C	80	2.00	0.003	160.00
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.78	0.003	147.74
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	18.15	0.03	1190.88
	Weighted CN		65.61		

W650

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	30.78	0.048	2739.42
	B	92	0.55	0.001	50.60
	C	94	0.95	0.001	89.30
	D	95	2.44	0.004	231.80
Office/Institutional/Multi-Family	A	77	34.40	0.054	2648.80
	B	85	6.09	0.010	517.65
	C	90	5.51	0.009	495.90
	D	92	10.02	0.016	921.84
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.39	0.001	21.06
	B	70	0.11	0.000	7.70
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	4.05	0.006	157.95
	B	61	0.00	--	--
	C	74	0.52	0.001	38.48
	D	80	1.97	0.003	157.60
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.92	0.006	325.36
	B	89	1.59	0.002	141.51
	C	92	1.26	0.002	115.92
	D	93	0.55	0.001	51.15
		Total	105.10	0.164	8712.04
	Weighted CN		82.89		

W530

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	2.31	0.004	140.91
	B	75	0.00	--	--
	C	83	0.16	0.000	13.28
	D	87	7.07	0.011	615.09
Medium Desity Residential	A	54	37.64	0.059	2032.56
	B	70	0.34	0.001	23.80
	C	80	0.76	0.001	60.80
	D	85	5.21	0.008	442.85
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	7.85	0.012	384.65
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	3.77	0.006	316.68
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.91	0.008	407.53
	B	89	0.00	--	--
	C	92	0.52	0.001	47.84
	D	93	1.24	0.002	115.32
		Total	71.78	0.11	4601.31
	Weighted CN		64.10		

W660

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	80.89	0.126	6552.09
	B	88	59.03	0.092	5194.64
	C	91	74.34	0.116	6764.94
	D	93	9.42	0.015	876.06
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	11.36	0.018	874.72
	B	85	21.86	0.034	1858.10
	C	90	2.80	0.004	252.00
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	15.56	0.024	606.84
	B	61	9.92	0.016	605.12
	C	74	3.32	0.005	245.68
	D	80	0.99	0.002	79.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.47	0.005	288.01
	B	89	2.59	0.004	230.51
	C	92	3.55	0.006	326.60
	D	93	0.00	--	--
		Total	299.10	0.47	24754.51
	Weighted CN		82.76		

W550

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Agriculture	A	67	4.56	0.007	305.52
	B	78	11.61	0.018	905.58
	C	85	1.71	0.003	145.35
	D	89	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	48.13	0.075	4427.96
	C	94	0.43	0.001	40.42
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	8.37	0.013	644.49
	B	85	10.49	0.016	891.65
	C	90	2.12	0.003	190.80
	D	92	0.00	--	--
High Desity Residential	A	61	17.28	0.027	1054.08
	B	75	39.68	0.062	2976.00
	C	83	16.18	0.025	1342.94
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	3.52	0.006	172.48
	B	69	32.08	0.050	2213.52
	C	79	3.72	0.006	293.88
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.44	0.004	202.52
	B	89	26.81	0.042	2386.09
	C	92	0.58	0.001	53.36
	D	93	0.00	--	--
		Total	229.71	0.36	18246.64
	Weighted CN		79.43		

W670

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	1.11	0.002	104.34
	D	95	0.69	0.001	65.55
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	1.07	0.002	90.95
	C	90	5.44	0.009	489.60
	D	92	23.96	0.037	2204.32
High Desity Residential	A	61	0.00	--	--
	B	75	17.55	0.027	1316.25
	C	83	7.04	0.011	584.32
	D	87	32.69	0.051	2844.03
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	4.13	0.006	284.97
	C	79	0.04	0.000	3.16
	D	84	5.52	0.009	463.68
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	2.44	0.004	217.16
	C	92	0.20	0.000	18.40
	D	93	3.62	0.006	336.66
		Total	105.50	0.16	9023.39
	Weighted CN		85.53		

W560

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.25	0.000	22.25
	B	92	5.38	0.008	494.96
	C	94	0.26	0.000	24.44
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.12	0.011	548.24
	B	85	19.77	0.031	1680.45
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.66	0.003	81.34
	B	69	27.68	0.043	1909.92
	C	79	8.10	0.013	639.90
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.93	0.001	77.19
	B	89	0.83	0.001	73.87
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	71.98	0.11	5552.56
	Weighted CN		77.14		

W700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	8.41	0.013	681.21
	B	88	1.78	0.003	156.64
	C	91	15.41	0.024	1402.31
	D	93	0.00	--	--
Commerical	A	89	8.63	0.013	768.07
	B	92	6.56	0.010	603.52
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	30.81	0.048	2372.37
	B	85	19.85	0.031	1687.25
	C	90	7.69	0.012	692.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	5.19	0.008	280.26
	B	70	1.98	0.003	138.60
	C	80	1.56	0.002	124.80
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	3.00	0.005	117.00
	B	61	31.61	0.049	1928.21
	C	74	6.14	0.010	454.36
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.91	0.006	324.53
	B	89	3.88	0.006	345.32
	C	92	2.79	0.004	256.68
	D	93	0.00	--	--
		Total	159.20	0.25	12333.23
	Weighted CN		77.47		

W570

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	43.25	0.068	2335.50
	B	70	1.15	0.002	80.50
	C	80	0.15	0.000	12.00
	D	85	1.28	0.002	108.80
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.66	0.003	81.34
	B	69	0.69	0.001	47.61
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	12.61	0.020	1046.63
	B	89	1.35	0.002	120.15
	C	92	0.21	0.000	19.32
	D	93	0.83	0.001	77.19
		Total	63.18	0.10	3929.04
	Weighted CN		62.19		

W710

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	22.04	0.034	1961.56
	B	92	0.00	--	--
	C	94	6.68	0.010	627.92
	D	95	10.20	0.016	969.00
Office/Institutional/Multi-Family	A	77	33.74	0.053	2597.98
	B	85	0.00	--	--
	C	90	3.28	0.005	295.20
	D	92	18.27	0.029	1680.84
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	9.17	0.014	495.18
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	8.96	0.014	761.60
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.29	0.002	63.21
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.05	0.003	172.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.15	0.008	427.45
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.17	0.002	108.81
		Total	122.00	0.19	10160.95
	Weighted CN		83.29		

W580

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	8.78	0.014	781.42
	B	92	3.49	0.005	321.08
	C	94	31.03	0.048	2916.82
	D	95	1.51	0.002	143.45
Office/Institutional/Multi-Family	A	77	6.68	0.010	514.36
	B	85	1.78	0.003	151.30
	C	90	8.77	0.014	789.30
	D	92	13.03	0.020	1198.76
High Desity Residential	A	61	0.00	--	--
	B	75	4.45	0.007	333.75
	C	83	8.79	0.014	729.57
	D	87	6.36	0.010	553.32
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.76	0.001	53.20
	C	80	2.30	0.004	184.00
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	3.26	0.005	224.94
	C	79	0.99	0.002	78.21
	D	84	0.41	0.001	34.44
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.48	0.002	122.84
	B	89	1.16	0.002	103.24
	C	92	8.36	0.013	769.12
	D	93	1.31	0.002	121.83
		Total	114.70	0.18	10124.95
	Weighted CN		88.27		

W720

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	6.23	0.010	554.47
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	1.32	0.002	125.40
Office/Institutional/Multi-Family	A	77	8.12	0.013	625.24
	B	85	1.74	0.003	147.90
	C	90	5.36	0.008	482.40
	D	92	3.40	0.005	312.80
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	1.79	0.003	96.66
	B	70	1.21	0.002	84.70
	C	80	0.00	--	--
	D	85	1.29	0.002	109.65
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.42	0.001	20.58
	B	69	0.00	--	--
	C	79	0.28	0.000	22.12
	D	84	5.08	0.008	426.72
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.09	0.005	256.47
	B	89	0.00	--	--
	C	92	0.84	0.001	77.28
	D	93	0.68	0.001	63.24
		Total	40.85	0.06	3405.63
	Weighted CN		83.37		

W730

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	92.69	0.145	7507.89
	B	88	102.13	0.160	8987.44
	C	91	41.53	0.065	3779.23
	D	93	0.25	0.000	23.25
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.00	--	--
	B	61	5.67	0.009	345.87
	C	74	21.29	0.033	1575.46
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	1.24	0.002	114.08
	D	93	0.00	--	--
		Total	264.80	0.41	22333.22
	Weighted CN		84.34		

W820

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	9.26	0.014	713.02
	B	85	0.00	--	--
	C	90	0.55	0.001	49.50
	D	92	1.32	0.002	121.44
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	3.45	0.005	186.30
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	20.23	0.032	788.97
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	34.81	0.05	1859.23
	Weighted CN		53.41		

W740

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	3.26	0.005	290.14
	B	92	0.03	0.000	2.76
	C	94	3.20	0.005	300.80
	D	95	5.01	0.008	475.95
Office/Institutional/Multi-Family	A	77	1.16	0.002	89.32
	B	85	0.01	0.000	0.85
	C	90	1.72	0.003	154.80
	D	92	3.55	0.006	326.60
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	10.74	0.017	579.96
	B	70	1.97	0.003	137.90
	C	80	12.95	0.020	1036.00
	D	85	15.33	0.024	1303.05
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.13	0.000	6.37
	B	69	0.00	--	--
	C	79	0.24	0.000	18.96
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.97	0.002	80.51
	B	89	0.55	0.001	48.95
	C	92	1.39	0.002	127.88
	D	93	3.13	0.005	291.09
		Total	65.34	0.10	5271.89
	Weighted CN		80.68		

W830

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	10.73	0.017	579.42
	B	70	0.31	0.000	21.70
	C	80	0.00	--	--
	D	85	2.15	0.003	182.75
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.60	0.003	134.40
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	1.57	0.002	130.31
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.48	0.001	44.64
		Total	16.84	0.03	1093.22
	Weighted CN		64.92		

W750

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	31.14	0.049	2771.46
	B	92	0.73	0.001	67.16
	C	94	15.53	0.024	1459.82
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	19.84	0.031	1527.68
	B	85	0.53	0.001	45.05
	C	90	3.27	0.005	294.30
	D	92	0.00	--	--
High Desity Residential	A	61	0.33	0.001	20.13
	B	75	0.00	--	--
	C	83	0.14	0.000	11.62
	D	87	0.00	--	--
Medium Desity Residential	A	54	1.71	0.003	92.34
	B	70	0.07	0.000	4.90
	C	80	0.41	0.001	32.80
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	6.44	0.010	534.52
	B	89	1.16	0.002	103.24
	C	92	1.69	0.003	155.48
	D	93	0.00	--	--
		Total	82.99	0.13	7120.50
	Weighted CN		85.80		

W840

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	32.83	0.051	2921.87
	B	92	0.00	--	--
	C	94	8.44	0.013	793.36
	D	95	11.43	0.018	1085.85
Office/Institutional/Multi-Family	A	77	0.72	0.001	55.44
	B	85	0.00	--	--
	C	90	2.98	0.005	268.20
	D	92	1.55	0.002	142.60
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	11.14	0.017	601.56
	B	70	0.00	--	--
	C	80	1.92	0.003	153.60
	D	85	5.91	0.009	502.35
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.12	0.000	5.88
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.09	0.000	7.56
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	7.51	0.012	623.33
	B	89	0.00	--	--
	C	92	1.97	0.003	181.24
	D	93	5.60	0.009	520.80
		Total	92.21	0.14	7863.64
	Weighted CN		85.28		

W760

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	77.88	0.122	4205.52
	B	70	5.74	0.009	401.80
	C	80	9.33	0.015	746.40
	D	85	5.25	0.008	446.25
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	3.23	0.005	268.09
	B	89	0.63	0.001	56.07
	C	92	0.53	0.001	48.76
	D	93	1.41	0.002	131.13
		Total	104.00	0.16	6304.02
	Weighted CN		60.62		

W850

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	25.11	0.039	2234.79
	B	92	0.52	0.001	47.84
	C	94	12.25	0.019	1151.50
	D	95	4.54	0.007	431.30
Office/Institutional/Multi-Family	A	77	10.11	0.016	778.47
	B	85	3.11	0.005	264.35
	C	90	2.84	0.004	255.60
	D	92	1.97	0.003	181.24
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	29.47	0.046	1591.38
	B	70	0.21	0.000	14.70
	C	80	0.18	0.000	14.40
	D	85	4.52	0.007	384.20
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.07	0.000	3.43
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.74	0.001	62.16
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	5.43	0.008	450.69
	B	89	0.00	--	--
	C	92	1.21	0.002	111.32
	D	93	0.02	0.000	1.86
		Total	102.30	0.16	7979.23
	Weighted CN		78.00		

W770

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	15.94	0.025	1227.38
	B	85	13.67	0.021	1161.95
	C	90	40.54	0.063	3648.60
	D	92	2.85	0.004	262.20
High Desity Residential	A	61	25.38	0.040	1548.18
	B	75	19.02	0.030	1426.50
	C	83	36.68	0.057	3044.44
	D	87	6.17	0.010	536.79
Medium Desity Residential	A	54	61.64	0.096	3328.56
	B	70	52.86	0.083	3700.20
	C	80	68.46	0.107	5476.80
	D	85	0.49	0.001	41.65
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	29.82	0.047	1461.18
	B	69	17.38	0.027	1199.22
	C	79	9.87	0.015	779.73
	D	84	0.04	0.000	3.36
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	2.32	0.004	192.56
	B	89	3.21	0.005	285.69
	C	92	5.45	0.009	501.40
	D	93	0.71	0.001	66.03
		Total	412.50	0.64	29892.42
	Weighted CN		72.47		

W860

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.44	0.004	217.16
	B	92	0.54	0.001	49.68
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.05	0.011	542.85
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.32	0.001	29.44
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	41.91	0.065	2263.14
	B	70	3.21	0.005	224.70
	C	80	0.00	--	--
	D	85	6.15	0.010	522.75
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	8.09	0.013	315.51
	B	61	1.14	0.002	69.54
	C	74	0.00	--	--
	D	80	3.61	0.006	288.80
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	4.96	0.008	411.68
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.87	0.001	80.91
		Total	80.29	0.13	5016.16
	Weighted CN		62.48		

W780

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.24	0.004	199.36
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	2.45	0.004	232.75
Office/Institutional/Multi-Family	A	77	34.30	0.054	2641.10
	B	85	11.54	0.018	980.90
	C	90	6.08	0.010	547.20
	D	92	29.56	0.046	2719.52
High Desity Residential	A	61	6.56	0.010	400.16
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	9.99	0.016	539.46
	B	70	20.39	0.032	1427.30
	C	80	0.00	--	--
	D	85	6.59	0.010	560.15
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	20.83	0.033	812.37
	B	61	0.05	0.000	3.05
	C	74	0.00	--	--
	D	80	2.19	0.003	175.20
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	1.33	0.002	110.39
	B	89	0.22	0.000	19.58
	C	92	0.88	0.001	80.96
	D	93	2.70	0.004	251.10
		Total	157.90	0.25	11700.55
	Weighted CN		74.10		

W870

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.08	0.000	6.96
Medium Desity Residential	A	54	0.66	0.001	35.64
	B	70	1.45	0.002	101.50
	C	80	0.00	--	--
	D	85	7.53	0.012	640.05
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.07	0.000	5.88
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	9.79	0.02	790.03
	Weighted CN		80.70		

W790

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.04	0.000	3.56
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.08	0.002	83.16
	B	85	0.00	--	--
	C	90	6.00	0.009	540.00
	D	92	2.16	0.003	198.72
High Desity Residential	A	61	6.94	0.011	423.34
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.78	0.001	67.86
Medium Desity Residential	A	54	2.34	0.004	126.36
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.01	0.000	0.49
	B	69	0.00	--	--
	C	79	0.36	0.001	28.44
	D	84	5.70	0.009	478.80
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	7.95	0.012	659.85
	B	89	0.00	--	--
	C	92	2.33	0.004	214.36
	D	93	1.50	0.002	139.50
		Total	37.19	0.06	2964.44
	Weighted CN		79.71		

W880

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.03	0.002	91.67
	B	92	1.12	0.002	103.04
	C	94	2.67	0.004	250.98
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.49	0.001	37.73
	B	85	0.00	--	--
	C	90	0.66	0.001	59.40
	D	92	2.65	0.004	243.80
High Desity Residential	A	61	2.00	0.003	122.00
	B	75	5.31	0.008	398.25
	C	83	5.34	0.008	443.22
	D	87	0.00	--	--
Medium Desity Residential	A	54	97.11	0.152	5243.94
	B	70	14.74	0.023	1031.80
	C	80	2.10	0.003	168.00
	D	85	15.18	0.024	1290.30
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	79.74	0.125	3109.86
	B	61	0.16	0.000	9.76
	C	74	0.00	--	--
	D	80	12.65	0.020	1012.00
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.70	0.001	58.10
	B	89	0.02	0.000	1.78
	C	92	0.24	0.000	22.08
	D	93	0.49	0.001	45.57
		Total	244.40	0.38	13743.28
	Weighted CN		56.23		

W800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	66.40	0.104	5378.40
	B	88	15.84	0.025	1393.92
	C	91	36.27	0.057	3300.57
	D	93	0.57	0.001	53.01
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	41.59	0.065	3202.43
	B	85	14.45	0.023	1228.25
	C	90	22.21	0.035	1998.90
	D	92	2.30	0.004	211.60
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	11.97	0.019	646.38
	B	70	3.78	0.006	264.60
	C	80	4.87	0.008	389.60
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	1.39	0.002	54.21
	B	61	0.00	--	--
	C	74	0.01	0.000	0.74
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.73	0.001	64.97
	C	92	0.32	0.001	29.44
	D	93	0.00	--	--
		Total	222.70	0.35	18217.02
	Weighted CN		81.80		

W890

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	4.51	0.007	414.92
	C	94	2.29	0.004	215.26
	D	95	5.97	0.009	567.15
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	1.77	0.003	150.45
	C	90	2.95	0.005	265.50
	D	92	0.65	0.001	59.80
High Desity Residential	A	61	1.46	0.002	89.06
	B	75	7.12	0.011	534.00
	C	83	4.96	0.008	411.68
	D	87	7.84	0.012	682.08
Medium Desity Residential	A	54	6.64	0.010	358.56
	B	70	2.12	0.003	148.40
	C	80	10.73	0.017	858.40
	D	85	12.10	0.019	1028.50
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.58	0.001	51.62
	C	92	0.00	--	--
	D	93	0.63	0.001	58.59
		Total	72.32	0.11	5893.97
	Weighted CN		81.50		

W810

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	2.45	0.004	149.45
	B	75	4.55	0.007	341.25
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	51.22	0.080	2765.88
	B	70	2.31	0.004	161.70
	C	80	5.95	0.009	476.00
	D	85	2.46	0.004	209.10
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	3.40	0.005	132.60
	B	61	0.09	0.000	5.49
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	2.75	0.004	228.25
	B	89	0.46	0.001	40.94
	C	92	0.00	--	--
	D	93	0.33	0.001	30.69
		Total	75.97	0.12	4541.35
	Weighted CN		59.78		

W900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	3.62	0.006	220.82
	B	75	5.15	0.008	386.25
	C	83	3.88	0.006	322.04
	D	87	0.68	0.001	59.16
Medium Desity Residential	A	54	12.13	0.019	655.02
	B	70	16.14	0.025	1129.80
	C	80	11.99	0.019	959.20
	D	85	24.26	0.038	2062.10
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.52	0.002	126.16
	B	89	0.50	0.001	44.50
	C	92	1.76	0.003	161.92
	D	93	1.18	0.002	109.74
		Total	82.81	0.13	6236.71
	Weighted CN		75.31		

Weighted Curve Number Calculation - Future Conditions

W910

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.86	0.006	297.22
	B	85	0.20	0.000	17.00
	C	90	5.56	0.009	500.40
	D	92	0.00	--	--
High Desity Residential	A	61	15.32	0.024	934.52
	B	75	8.31	0.013	623.25
	C	83	1.08	0.002	89.64
	D	87	0.00	--	--
Medium Desity Residential	A	54	19.55	0.031	1055.70
	B	70	6.23	0.010	436.10
	C	80	0.08	0.000	6.40
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.01	0.006	196.49
	B	69	3.62	0.006	249.78
	C	79	2.22	0.003	175.38
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.38	0.005	280.54
	B	89	1.91	0.003	169.99
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	75.33	0.12	5032.41
	Weighted CN		66.80		

W1000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	13.59	0.021	733.86
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.63	0.006	301.29
	B	89	0.02	0.000	1.78
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	17.24	0.03	1036.93
	Weighted CN		60.15		

W920

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	43.72	0.068	3541.32
	B	88	10.99	0.017	967.12
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	21.97	0.034	1955.33
	B	92	26.17	0.041	2407.64
	C	94	19.42	0.030	1825.48
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	12.63	0.020	972.51
	B	85	37.10	0.058	3153.50
	C	90	30.29	0.047	2726.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	24.77	0.039	1337.58
	B	70	54.73	0.086	3831.10
	C	80	7.67	0.012	613.60
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	2.71	0.004	105.69
	B	61	2.63	0.004	160.43
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	294.80	0.46	23597.40
	Weighted CN		80.05		

W1100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.41	0.001	36.49
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	17.68	0.028	1078.48
	B	75	0.00	--	--
	C	83	0.44	0.001	36.52
	D	87	0.00	--	--
Medium Desity Residential	A	54	69.41	0.108	3748.14
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	5.35	0.008	262.15
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.48	0.002	122.84
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	94.77	0.15	5284.62
	Weighted CN		55.76		

W930

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	4.40	0.007	391.60
	B	92	10.42	0.016	958.64
	C	94	0.66	0.001	62.04
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.83	0.006	294.91
	B	85	13.89	0.022	1180.65
	C	90	0.53	0.001	47.70
	D	92	0.00	--	--
High Desity Residential	A	61	8.99	0.014	548.39
	B	75	1.66	0.003	124.50
	C	83	4.39	0.007	364.37
	D	87	0.00	--	--
Medium Desity Residential	A	54	42.21	0.066	2279.34
	B	70	14.14	0.022	989.80
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	5.49	0.009	214.11
	B	61	0.15	0.000	9.15
	C	74	1.23	0.002	91.02
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.36	0.001	29.88
	B	89	4.25	0.007	378.25
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	116.60	0.18	7964.35
	Weighted CN		68.30		

W1200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	3.72	0.006	331.08
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.15	0.003	165.55
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	10.56	0.017	644.16
	B	75	1.77	0.003	132.75
	C	83	3.50	0.005	290.50
	D	87	0.00	--	--
Medium Desity Residential	A	54	51.14	0.080	2761.56
	B	70	5.78	0.009	404.60
	C	80	1.05	0.002	84.00
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	5.86	0.009	287.14
	B	69	4.43	0.007	305.67
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.42	0.004	200.86
	B	89	0.24	0.000	21.36
	C	92	0.44	0.001	40.48
	D	93	0.00	--	--
		Total	93.06	0.15	5669.71
	Weighted CN		60.93		

W940

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	6.49	0.010	577.61
	B	92	2.77	0.004	254.84
	C	94	2.41	0.004	226.54
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.45	0.004	188.65
	B	85	0.89	0.001	75.65
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	22.45	0.035	1369.45
	B	75	15.05	0.024	1128.75
	C	83	0.40	0.001	33.20
	D	87	0.00	--	--
Medium Desity Residential	A	54	93.62	0.146	5055.48
	B	70	25.08	0.039	1755.60
	C	80	6.39	0.010	511.20
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	19.10	0.030	744.90
	B	61	0.00	--	--
	C	74	0.06	0.000	4.44
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.59	0.004	214.97
	B	89	1.45	0.002	129.05
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	201.20	0.31	12270.33
	Weighted CN		60.99		

W1300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.12	0.000	9.24
	B	85	0.00	--	--
	C	90	1.48	0.002	133.20
	D	92	0.00	--	--
High Desity Residential	A	61	1.62	0.003	98.82
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	77.80	0.122	4201.20
	B	70	6.29	0.010	440.30
	C	80	8.57	0.013	685.60
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.64	0.004	129.36
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	98.52	0.15	5697.72
	Weighted CN		57.83		

W950

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	2.71	0.004	241.19
	B	92	2.22	0.003	204.24
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	9.83	0.015	599.63
	B	75	15.60	0.024	1170.00
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	25.76	0.040	1391.04
	B	70	1.37	0.002	95.90
	C	80	0.00	--	--
	D	85	0.01	0.000	0.85
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	8.59	0.013	335.01
	B	61	0.23	0.000	14.03
	C	74	0.00	--	--
	D	80	2.29	0.004	183.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.41	0.001	34.03
	B	89	0.04	0.000	3.56
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	69.06	0.11	4272.68
	Weighted CN		61.87		

W1400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.43	0.002	127.27
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.92	0.003	147.84
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	61.59	0.096	3325.86
	B	70	0.00	--	--
	C	80	10.21	0.016	816.80
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.70	0.003	83.30
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	9.43	0.015	782.69
	B	89	0.00	--	--
	C	92	0.88	0.001	80.96
	D	93	0.00	--	--
		Total	87.16	0.14	5364.72
	Weighted CN		61.55		

W960

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	8.23	0.013	757.16
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.99	0.002	76.23
	B	85	6.08	0.010	516.80
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	14.40	0.023	878.40
	B	75	18.44	0.029	1383.00
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.21	0.000	8.19
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	4.41	0.007	392.49
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	52.76	0.08	4012.27
	Weighted CN		76.05		

W1500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	66.15	0.103	3572.10
	B	70	0.00	--	--
	C	80	0.08	0.000	6.40
	D	85	9.62	0.015	817.70
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.19	0.000	9.31
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.56	0.009	461.48
	B	89	0.00	--	--
	C	92	0.13	0.000	11.96
	D	93	0.66	0.001	61.38
		Total	82.39	0.13	4940.33
	Weighted CN		59.96		

W970

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	21.32	0.033	1897.48
	B	92	0.00	--	--
	C	94	14.66	0.023	1378.04
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	18.80	0.029	1146.80
	B	75	2.71	0.004	203.25
	C	83	23.06	0.036	1913.98
	D	87	1.56	0.002	135.72
Medium Desity Residential	A	54	14.05	0.022	758.70
	B	70	6.24	0.010	436.80
	C	80	6.55	0.010	524.00
	D	85	4.98	0.008	423.30
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.26	0.000	10.14
	B	61	0.55	0.001	33.55
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.39	0.005	281.37
	B	89	0.00	--	--
	C	92	1.87	0.003	172.04
	D	93	0.00	--	--
		Total	120.00	0.19	9315.17
	Weighted CN		77.63		

W1600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.31	0.000	18.91
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	21.02	0.033	1135.08
	B	70	3.37	0.005	235.90
	C	80	13.02	0.020	1041.60
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.05	0.006	336.15
	B	89	0.92	0.001	81.88
	C	92	1.53	0.002	140.76
	D	93	0.00	--	--
		Total	44.22	0.07	2990.28
	Weighted CN		67.62		

W980

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	37.10	0.058	3301.90
	B	92	42.55	0.066	3914.60
	C	94	46.45	0.073	4366.30
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.38	0.012	568.26
	B	85	3.08	0.005	261.80
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	18.46	0.029	996.84
	B	70	1.74	0.003	121.80
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.84	0.001	32.76
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	0.52	0.001	43.16
	B	89	2.82	0.004	250.98
	C	92	3.46	0.005	318.32
	D	93	0.00	--	--
		Total	164.40	0.26	14176.72
	Weighted CN		86.23		

W1700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	3.66	0.006	325.74
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.78	0.003	137.06
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	9.15	0.014	494.10
	B	70	1.17	0.002	81.90
	C	80	1.73	0.003	138.40
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.25	0.000	12.25
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.81	0.006	316.23
	B	89	0.48	0.001	42.72
	C	92	0.52	0.001	47.84
	D	93	0.00	--	--
		Total	22.55	0.04	1596.24
	Weighted CN		70.79		

W990

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.31	0.000	27.59
	B	92	0.01	0.000	0.92
	C	94	0.02	0.000	1.88
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	87.16	0.136	6711.32
	B	85	96.84	0.151	8231.40
	C	90	11.21	0.018	1008.90
	D	92	0.83	0.001	76.36
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	6.70	0.010	328.30
	B	69	0.29	0.000	20.01
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	67	0.00	--	--
	B	78	0.00	--	--
	C	85	0.00	--	--
	D	89	0.00	--	--
ROW	A	83	13.98	0.022	1160.34
	B	89	6.67	0.010	593.63
	C	92	2.40	0.004	220.80
	D	93	0.08	0.000	7.44
		Total	226.50	0.35	18388.89
	Weighted CN		81.19		

W1800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	36.29	0.057	2794.33
	B	85	0.00	--	--
	C	90	2.53	0.004	227.70
	D	92	5.89	0.009	541.88
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.77	0.001	63.91
	D	87	4.91	0.008	427.17
Medium Desity Residential	A	54	18.03	0.028	973.62
	B	70	0.00	--	--
	C	80	5.68	0.009	454.40
	D	85	3.46	0.005	294.10
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.95	0.001	46.55
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	7.91	0.012	664.44
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.67	0.007	387.61
	B	89	0.00	--	--
	C	92	1.64	0.003	150.88
	D	93	2.36	0.004	219.48
		Total	95.09	0.15	7246.07
	Weighted CN		76.20		

W1900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	46.78	0.073	3602.06
	B	85	0.00	--	--
	C	90	7.34	0.011	660.60
	D	92	8.75	0.014	805.00
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	10.10	0.016	545.40
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.32	0.001	27.20
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.03	0.000	1.47
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.17	0.002	98.28
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.75	0.004	228.25
	B	89	0.00	--	--
	C	92	0.69	0.001	63.48
	D	93	0.79	0.001	73.47
		Total	78.72	0.12	6105.21
	Weighted CN		77.56		

W2800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.38	0.004	183.26
	B	85	4.82	0.008	409.70
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	6.68	0.010	407.48
	B	75	1.98	0.003	148.50
	C	83	0.14	0.000	11.62
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.17	0.003	106.33
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.03	0.000	2.52
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.59	0.004	214.97
	B	89	1.20	0.002	106.80
	C	92	0.09	0.000	8.28
	D	93	0.00	--	--
		Total	22.08	0.03	1599.46
	Weighted CN		72.44		

W2000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	54.60	0.085	4204.20
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	5.21	0.008	479.32
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	5.29	0.008	285.66
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.54	0.001	45.90
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.58	0.001	28.42
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.51	0.002	126.84
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.42	0.007	366.86
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.50	0.001	46.50
		Total	72.65	0.11	5583.70
	Weighted CN		76.86		

W2900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	4.54	0.007	404.06
	B	92	0.00	--	--
	C	94	4.96	0.008	466.24
	D	95	3.52	0.006	334.40
Office/Institutional/Multi-Family	A	77	0.03	0.000	2.31
	B	85	0.06	0.000	5.10
	C	90	0.26	0.000	23.40
	D	92	0.02	0.000	1.84
High Desity Residential	A	61	2.67	0.004	162.87
	B	75	9.43	0.015	707.25
	C	83	12.86	0.020	1067.38
	D	87	27.46	0.043	2389.02
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.72	0.001	59.76
	B	89	0.89	0.001	79.21
	C	92	3.21	0.005	295.32
	D	93	3.09	0.005	287.37
		Total	73.72	0.12	6285.53
	Weighted CN		85.26		

W2100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	17.73	0.028	1577.97
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	3.41	0.005	323.95
Office/Institutional/Multi-Family	A	77	11.94	0.019	919.38
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	4.84	0.008	445.28
High Desity Residential	A	61	3.80	0.006	231.80
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	3.20	0.005	172.80
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.26	0.002	61.74
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.49	0.001	41.16
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	10.20	0.016	846.60
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	2.29	0.004	212.97
		Total	59.16	0.09	4833.65
	Weighted CN		81.70		

W3000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.63	0.001	51.03
	B	88	1.95	0.003	171.60
	C	91	2.30	0.004	209.30
	D	93	0.00	--	--
Commerical	A	89	25.18	0.039	2241.02
	B	92	6.14	0.010	564.88
	C	94	0.67	0.001	62.98
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	55.94	0.087	4307.38
	B	85	50.90	0.080	4326.50
	C	90	13.29	0.021	1196.10
	D	92	4.19	0.007	385.48
High Desity Residential	A	61	0.55	0.001	33.55
	B	75	6.40	0.010	480.00
	C	83	41.06	0.064	3407.98
	D	87	2.05	0.003	178.35
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.17	0.000	8.33
	B	69	5.19	0.008	358.11
	C	79	6.95	0.011	549.05
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	11.06	0.017	917.98
	B	89	8.43	0.013	750.27
	C	92	3.59	0.006	330.28
	D	93	0.26	0.000	24.18
		Total	246.90	0.39	20554.35
	Weighted CN		83.25		

W2200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	11.44	0.018	1018.16
	B	92	2.63	0.004	241.96
	C	94	11.77	0.018	1106.38
	D	95	2.21	0.003	209.95
Office/Institutional/Multi-Family	A	77	1.26	0.002	97.02
	B	85	0.00	--	--
	C	90	6.24	0.010	561.60
	D	92	4.74	0.007	436.08
High Desity Residential	A	61	0.00	--	--
	B	75	1.56	0.002	117.00
	C	83	0.08	0.000	6.64
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.58	0.001	45.82
	D	84	4.05	0.006	340.20
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.87	0.003	155.21
	B	89	0.05	0.000	4.45
	C	92	1.21	0.002	111.32
	D	93	3.63	0.006	337.59
		Total	53.32	0.08	4789.38
	Weighted CN		89.82		

W3100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	5.12	0.008	384.00
	C	83	0.90	0.001	74.70
	D	87	0.00	--	--
Medium Desity Residential	A	54	99.12	0.155	5352.48
	B	70	53.75	0.084	3762.50
	C	80	26.00	0.041	2080.00
	D	85	28.63	0.045	2433.55
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	17.19	0.027	670.41
	B	61	1.27	0.002	77.47
	C	74	0.00	--	--
	D	80	0.16	0.000	12.80
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.48	0.007	371.84
	B	89	1.96	0.003	174.44
	C	92	0.00	--	--
	D	93	0.22	0.000	20.46
		Total	238.80	0.37	15414.65
	Weighted CN		64.55		

W2300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	7.02	0.011	624.78
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.54	0.004	195.58
	B	85	0.00	--	--
	C	90	1.19	0.002	107.10
	D	92	1.85	0.003	170.20
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	26.44	0.041	1427.76
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	2.84	0.004	241.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.20	0.000	15.80
	D	84	4.13	0.006	346.92
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.93	0.003	160.19
	B	89	0.00	--	--
	C	92	1.15	0.002	105.80
	D	93	1.09	0.002	101.37
		Total	50.38	0.08	3496.90
	Weighted CN		69.41		

W3200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	1.39	0.002	127.88
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.05	0.002	80.85
	B	85	16.91	0.026	1437.35
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.61	0.001	32.94
	B	70	37.88	0.059	2651.60
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	5.04	0.008	347.76
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.55	0.001	45.65
	B	89	2.34	0.004	208.26
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	65.77	0.10	4932.29
	Weighted CN		74.99		

W2400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.03	0.000	2.31
	B	85	1.23	0.002	104.55
	C	90	0.00	--	--
	D	92	0.28	0.000	25.76
High Desity Residential	A	61	11.93	0.019	727.73
	B	75	1.08	0.002	81.00
	C	83	0.40	0.001	33.20
	D	87	10.14	0.016	882.18
Medium Desity Residential	A	54	15.01	0.023	810.54
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	6.08	0.010	516.80
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.41	0.002	69.09
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	5.94	0.009	498.96
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.64	0.003	136.12
	B	89	1.11	0.002	98.79
	C	92	0.00	--	--
	D	93	3.12	0.005	290.16
		Total	59.40	0.09	4277.19
	Weighted CN		72.01		

W3300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	19.90	0.031	1771.10
	B	92	26.71	0.042	2457.32
	C	94	8.04	0.013	755.76
	D	95	0.92	0.001	87.40
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.04	0.000	3.40
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.76	0.003	146.08
	B	89	1.78	0.003	158.42
	C	92	0.67	0.001	61.64
	D	93	0.00	--	--
		Total	59.82	0.09	5441.12
	Weighted CN		90.96		

W2500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	12.93	0.020	1150.77
	B	92	0.00	--	--
	C	94	0.02	0.000	1.88
	D	95	4.78	0.007	454.10
Office/Institutional/Multi-Family	A	77	5.14	0.008	395.78
	B	85	0.00	--	--
	C	90	1.99	0.003	179.10
	D	92	1.78	0.003	163.76
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	1.27	0.002	68.58
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	2.54	0.004	215.90
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	4.37	0.007	214.13
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	2.04	0.003	171.36
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.09	0.003	173.47
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.59	0.001	54.87
		Total	39.54	0.06	3243.70
	Weighted CN		82.04		

W3400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	3.56	0.006	327.52
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	8.27	0.013	405.23
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	72.99	0.114	6131.16
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.19	0.002	110.67
		Total	86.01	0.13	6974.58
	Weighted CN		81.09		

W2600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.05	0.000	4.60
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.16	0.000	13.44
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.31	0.000	28.83
		Total	0.52	0.00	46.87
	Weighted CN		90.13		

W3500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	13.22	0.021	1176.58
	B	92	16.08	0.025	1479.36
	C	94	2.89	0.005	271.66
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	18.62	0.029	1433.74
	B	85	7.54	0.012	640.90
	C	90	0.39	0.001	35.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.07	0.003	111.78
	B	70	11.98	0.019	838.60
	C	80	1.61	0.003	128.80
	D	85	1.61	0.003	136.85
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	3.46	0.005	238.74
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.24	0.005	268.92
	B	89	2.00	0.003	178.00
	C	92	1.12	0.002	103.04
	D	93	0.00	--	--
		Total	85.83	0.13	7042.07
	Weighted CN		82.05		

W2700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	1.46	0.002	112.42
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	4.21	0.007	387.32
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.79	0.004	150.66
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	2.11	0.003	179.35
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.98	0.003	97.02
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.74	0.001	62.16
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.08	0.000	6.64
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.05	0.000	4.65
		Total	13.42	0.02	1000.22
	Weighted CN		74.53		

W3600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	4.20	0.007	373.80
	B	92	14.80	0.023	1361.60
	C	94	1.60	0.003	150.40
	D	95	19.09	0.030	1813.55
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	3.00	0.005	255.00
	C	90	0.00	--	--
	D	92	1.06	0.002	97.52
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	7.09	0.011	496.30
	C	80	6.39	0.010	511.20
	D	85	2.64	0.004	224.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	10.76	0.017	742.44
	C	79	2.52	0.004	199.08
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	4.80	0.008	427.20
	C	92	1.53	0.002	140.76
	D	93	2.24	0.004	208.32
		Total	81.72	0.13	7001.57
	Weighted CN		85.68		

W3700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	7.48	0.012	665.72
	B	92	0.00	--	--
	C	94	1.61	0.003	151.34
	D	95	5.12	0.008	486.40
Office/Institutional/Multi-Family	A	77	8.14	0.013	626.78
	B	85	0.45	0.001	38.25
	C	90	3.43	0.005	308.70
	D	92	9.54	0.015	877.68
High Desity Residential	A	61	0.00	--	--
	B	75	3.09	0.005	231.75
	C	83	5.34	0.008	443.22
	D	87	2.81	0.004	244.47
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.72	0.003	142.76
	B	89	0.00	--	--
	C	92	5.04	0.008	463.68
	D	93	1.27	0.002	118.11
		Total	55.04	0.09	4798.86
	Weighted CN		87.19		

W4600

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	27.56	0.043	1488.24
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.67	0.001	55.61
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	28.23	0.04	1543.85
	Weighted CN		54.69		

W3800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	39.18	0.061	3016.86
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	25.37	0.040	2334.04
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	10.87	0.017	586.98
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.19	0.000	16.15
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.64	0.004	129.36
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.46	0.001	38.64
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	4.32	0.007	358.56
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	1.32	0.002	122.76
		Total	84.35	0.13	6603.35
	Weighted CN		78.29		

W4700

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.13	0.002	100.57
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.02	0.000	1.90
Office/Institutional/Multi-Family	A	77	21.64	0.034	1666.28
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	7.08	0.011	651.36
High Desity Residential	A	61	11.76	0.018	717.36
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	10.12	0.016	546.48
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	3.89	0.006	190.61
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	1.63	0.003	136.92
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.99	0.005	248.17
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.09	0.000	8.37
		Total	60.35	0.09	4268.02
	Weighted CN		70.72		

W3900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.07	0.000	6.23
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.01	0.000	0.95
Office/Institutional/Multi-Family	A	77	8.63	0.013	664.51
	B	85	4.50	0.007	382.50
	C	90	5.07	0.008	456.30
	D	92	10.65	0.017	979.80
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	13.03	0.020	703.62
	B	70	6.84	0.011	478.80
	C	80	0.00	--	--
	D	85	5.07	0.008	430.95
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.04	0.003	99.96
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.05	0.002	87.15
	B	89	0.05	0.000	4.45
	C	92	0.00	--	--
	D	93	0.51	0.001	47.43
		Total	57.52	0.09	4342.65
	Weighted CN		75.50		

W4800

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.91	0.003	169.99
	B	92	0.00	--	--
	C	94	8.58	0.013	806.52
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	7.78	0.012	599.06
	B	85	6.30	0.010	535.50
	C	90	3.11	0.005	279.90
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.13	0.000	10.79
	B	89	0.42	0.001	37.38
	C	92	2.02	0.003	185.84
	D	93	0.00	--	--
		Total	30.25	0.05	2624.98
	Weighted CN		86.78		

W4000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	3.19	0.005	245.63
	B	85	5.67	0.009	481.95
	C	90	0.29	0.000	26.10
	D	92	25.72	0.040	2366.24
High Desity Residential	A	61	1.86	0.003	113.46
	B	75	0.00	--	--
	C	83	1.88	0.003	156.04
	D	87	0.03	0.000	2.61
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.47	0.001	23.03
	B	69	0.00	--	--
	C	79	3.76	0.006	297.04
	D	84	14.28	0.022	1199.52
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.45	0.002	120.35
	B	89	0.47	0.001	41.83
	C	92	0.68	0.001	62.56
	D	93	0.72	0.001	66.96
		Total	60.47	0.09	5203.32
	Weighted CN		86.05		

W4900

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	10.81	0.017	962.09
	B	92	7.13	0.011	655.96
	C	94	0.55	0.001	51.70
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	15.89	0.025	1223.53
	B	85	3.68	0.006	312.80
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	1.85	0.003	90.65
	B	69	23.39	0.037	1613.91
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	5.93	0.009	492.19
	B	89	15.93	0.025	1417.77
	C	92	0.53	0.001	48.76
	D	93	0.00	--	--
		Total	85.69	0.13	6869.36
	Weighted CN		80.17		

W4100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	23.94	0.037	2130.66
	B	92	1.07	0.002	98.44
	C	94	22.21	0.035	2087.74
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	2.75	0.004	211.75
	B	85	0.84	0.001	71.40
	C	90	0.79	0.001	71.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.06	0.000	3.66
	B	75	0.00	--	--
	C	83	0.05	0.000	4.15
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.20	0.000	10.80
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	3.83	0.006	317.89
	B	89	1.16	0.002	103.24
	C	92	2.63	0.004	241.96
	D	93	0.00	--	--
		Total	59.53	0.09	5352.79
	Weighted CN		89.92		

W5000

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	7.07	0.011	629.23
	B	92	17.82	0.028	1639.44
	C	94	21.64	0.034	2034.16
	D	95	0.53	0.001	50.35
Office/Institutional/Multi-Family	A	77	5.39	0.008	415.03
	B	85	1.24	0.002	105.40
	C	90	3.23	0.005	290.70
	D	92	0.00	--	--
High Desity Residential	A	61	0.86	0.001	52.46
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.15	0.000	8.10
	B	70	0.00	--	--
	C	80	0.08	0.000	6.40
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	39	0.00	--	--
	B	61	0.00	--	--
	C	74	0.00	--	--
	D	80	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.14	0.003	177.62
	B	89	5.55	0.009	493.95
	C	92	2.51	0.004	230.92
	D	93	0.01	0.000	0.93
		Total	68.22	0.11	6134.69
	Weighted CN		89.93		

W4200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.02	0.000	1.84
	C	94	6.67	0.010	626.98
	D	95	17.95	0.028	1705.25
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	7.45	0.012	633.25
	C	90	5.79	0.009	521.10
	D	92	5.24	0.008	482.08
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	2.15	0.003	116.10
	B	70	1.58	0.002	110.60
	C	80	9.33	0.015	746.40
	D	85	7.09	0.011	602.65
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.51	0.001	42.33
	B	89	0.48	0.001	42.72
	C	92	1.02	0.002	93.84
	D	93	3.68	0.006	342.24
		Total	68.96	0.11	6067.38
	Weighted CN		87.98		

W5100

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	0.00	--	--
	B	92	0.00	--	--
	C	94	0.00	--	--
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.42	0.001	32.34
	B	85	0.38	0.001	32.30
	C	90	3.59	0.006	323.10
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	8.99	0.014	485.46
	B	70	24.60	0.038	1722.00
	C	80	9.41	0.015	752.80
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.17	0.002	97.11
	B	89	0.65	0.001	57.85
	C	92	0.83	0.001	76.36
	D	93	0.00	--	--
		Total	50.04	0.08	3579.32
	Weighted CN		71.53		

W4300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.28	0.002	113.92
	B	92	11.48	0.018	1056.16
	C	94	0.32	0.001	30.08
	D	95	40.80	0.064	3876.00
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	2.51	0.004	213.35
	C	90	0.00	--	--
	D	92	1.69	0.003	155.48
High Desity Residential	A	61	1.37	0.002	83.57
	B	75	3.75	0.006	281.25
	C	83	1.10	0.002	91.30
	D	87	1.68	0.003	146.16
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.35	0.001	29.05
	B	89	5.02	0.008	446.78
	C	92	0.38	0.001	34.96
	D	93	5.98	0.009	556.14
		Total	77.71	0.12	7114.20
	Weighted CN		91.55		

W5200

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	1.43	0.002	127.27
	B	92	49.60	0.078	4563.20
	C	94	0.23	0.000	21.62
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	18.21	0.028	1547.85
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	12.15	0.019	850.50
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	10.81	0.017	745.89
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	0.00	--	--
	B	89	0.00	--	--
	C	92	0.00	--	--
	D	93	0.00	--	--
		Total	92.43	0.14	7856.33
	Weighted CN		85.00		

W4400

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	11.99	0.019	1067.11
	B	92	0.06	0.000	5.52
	C	94	8.92	0.014	838.48
	D	95	0.00	--	--
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	2.59	0.004	214.97
	B	89	0.00	--	--
	C	92	0.15	0.000	13.80
	D	93	0.00	--	--
		Total	23.71	0.04	2139.88
	Weighted CN		90.25		

W5300

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	17.09	0.027	1521.01
	B	92	40.70	0.064	3744.40
	C	94	8.60	0.013	808.40
	D	95	1.90	0.003	180.50
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	0.00	--	--
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	0.00	--	--
	B	70	0.00	--	--
	C	80	0.00	--	--
	D	85	0.00	--	--
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.15	0.002	95.45
	B	89	0.17	0.000	15.13
	C	92	0.22	0.000	20.24
	D	93	0.00	--	--
		Total	69.83	0.11	6385.13
	Weighted CN		91.44		

W4500

LandUse	Soil Group	CN	Area (ac)	Area (sq mi)	CN*A
Industrial	A	81	0.00	--	--
	B	88	0.00	--	--
	C	91	0.00	--	--
	D	93	0.00	--	--
Commerical	A	89	4.16	0.007	370.24
	B	92	1.74	0.003	160.08
	C	94	0.97	0.002	91.18
	D	95	3.57	0.006	339.15
Office/Institutional/Multi-Family	A	77	0.00	--	--
	B	85	0.00	--	--
	C	90	0.00	--	--
	D	92	0.00	--	--
High Desity Residential	A	61	1.89	0.003	115.29
	B	75	0.00	--	--
	C	83	0.00	--	--
	D	87	0.00	--	--
Medium Desity Residential	A	54	54.40	0.085	2937.60
	B	70	2.27	0.004	158.90
	C	80	7.03	0.011	562.40
	D	85	0.84	0.001	71.40
Low Desity Residential	A	51	0.00	--	--
	B	68	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Very Low Desity Residential	A	49	0.00	--	--
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Open Space	A	49	2.17	0.003	106.33
	B	69	0.00	--	--
	C	79	0.00	--	--
	D	84	0.00	--	--
Parking	A	98	0.00	--	--
	B	98	0.00	--	--
	C	98	0.00	--	--
	D	98	0.00	--	--
ROW	A	83	1.83	0.003	151.89
	B	89	0.37	0.001	32.93
	C	92	0.13	0.000	11.96
	D	93	0.95	0.001	88.35
		Total	82.32	0.128625	5197.7
	Weighted CN		63.14		

F. Time of Concentration Calculations

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W400	W500	W510	W520	W530	W550	W560	W570	W580
Watershed ID	**40**	**50**	**51**	**52**	**53**	**55**	**56**	**57**	**58**
Sheet Flow Characteristics									
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	200	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.01	0.02	0.02	0.02	0.021	0.001	0.001	0.02	0.01
Sheet Flow Travel Time (hr)	0.29	0.22	0.22	0.22	0.22	0.73	0.73	0.38	0.29
Shallow Concentrated Flow Characteristics									
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1	1
Flow Length (ft)	1000	1967	1800	1400	2000	1900	2000	621	2000
Watercourse Slope (ft/ft)	0.038	0.015	0.016	0.02	0.021	0.002	0.0009	0.013	0.005
Average Velocity - computed (ft/s)	3.15	1.98	2.04	2.28	2.34	0.72	0.48	1.84	1.14
Shallow Concentrated Flow Travel Time (hr)	0.09	0.28	0.24	0.17	0.24	0.73	1.15	0.09	0.49
Channel Flow Characterisitics									
Cross-sectional Flow Area (ft2)	240.68	358.36	174.87	98.76	191.09	51.75	51.75	19.06	63
Wetted Perimeter (ft)	46.75	45.62	40.75	23.74	41.88	14	14	12.25	28.3
Hydraulic Radius - computed (ft)	5.15	7.86	4.29	4.16	4.56	3.70	3.70	1.56	2.23
Channel Slope (ft/ft)	0.01	0.0024	0.0107	0.014	0.0089	0.002	0.00125	0.025	0.013
Manning's Roughness Coefficient	0.044	0.044	0.044	0.045	0.044	0.035	0.035	0.043	0.035
Average Velocity - computed (ft/s)	10.10	6.56	9.25	10.13	8.79	4.55	3.60	7.36	8.28
Flow Length (ft)	1000	1198	1500	700	900	2844	965	2173	3000
Channel Flow Travel Time (hr)	0.03	0.05	0.05	0.02	0.03	0.17	0.07	0.08	0.10
Totals									
Watershed Time of travel (hr)	**0.41**	**0.55**	**0.51**	**0.41**	**0.48**	**1.63**	**1.95**	**0.56**	**0.88**
Watershed Time of travel (min)	**24.32**	**32.80**	**30.57**	**24.54**	**28.87**	**97.93**	**116.97**	**33.47**	**52.63**
Lag Time - Existing Condtions (min)	**14.59**	**19.68**	**18.34**	**14.73**	**17.32**	**58.76**	**70.18**	**20.08**	**31.58**
Lag Time - Future Conditions (min)	**14.59**	**19.68**	**18.34**	**14.73**	**17.32**	**51.12**	**56.15**	**20.08**	**31.58**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W600	W630	W640	W650	W660	W670	W700	W710	W720
Watershed ID	**60**	**63**	**64**	**65**	**66**	**67**	**70**	**71**	**72**
Sheet Flow Characteristics									
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.011	0.24
Flow Length (ft)	100	100	200	100	200	100	200	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.01	0.01	0.01	0.01	0.005	0.01	0.005	0.02	0.02
Sheet Flow Travel Time (hr)	0.29	0.29	0.50	0.29	0.67	0.29	0.67	0.02	0.22
Shallow Concentrated Flow Characteristics									
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1	1
Flow Length (ft)	480	2673	1628	1000	1400	700	1936	2100	727
Watercourse Slope (ft/ft)	0.03	0.005	0.0026	0.008	0.005	0.01	0.0012	0.0098	0.036
Average Velocity - computed (ft/s)	2.79	1.14	0.82	1.44	1.14	1.61	0.56	1.60	3.06
Shallow Concentrated Flow Travel Time (hr)	0.05	0.65	0.55	0.19	0.34	0.12	0.96	0.37	0.07
Channel Flow Characterisitics									
Cross-sectional Flow Area (ft2)	61.8	65.9	41.27	34.22	75.46	46.5	20.16	11	198.7
Wetted Perimeter (ft)	25.2	24.85	13.8	12.85	19.22	11.78	12.67	9	38.85
Hydraulic Radius - computed (ft)	2.45	2.65	2.99	2.66	3.93	3.95	1.59	1.22	5.11
Channel Slope (ft/ft)	0.0126	0.0056	0.001	0.0054	0.002	0.008	0.002	0.01	0.007
Manning's Roughness Coefficient	0.044	0.045	0.035	0.035	0.044	0.035	0.035	0.035	0.044
Average Velocity - computed (ft/s)	6.91	4.75	2.79	6.01	3.77	9.51	2.59	4.87	8.41
Flow Length (ft)	1500	4685	3000	2500	4944	3552	3600	1300	1000
Channel Flow Travel Time (hr)	0.06	0.27	0.30	0.12	0.36	0.10	0.39	0.07	0.03
Totals									
Watershed Time of travel (hr)	**0.40**	**1.21**	**1.35**	**0.60**	**1.37**	**0.51**	**2.01**	**0.46**	**0.32**
Watershed Time of travel (min)	**23.85**	**72.87**	**81.12**	**35.85**	**82.22**	**30.83**	**120.76**	**27.48**	**19.10**
Lag Time - Existing Condtions (min)	**14.31**	**43.72**	**48.67**	**21.51**	**49.33**	**18.50**	**72.46**	**16.49**	**11.46**
Lag Time - Future Conditions (min)	**14.31**	**43.72**	**48.67**	**18.50**	**39.96**	**18.50**	**57.97**	**16.49**	**11.46**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W730	W740	W750	W760	W770	W780	W790	W800	W810
Watershed ID	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**	**81**
Sheet Flow Characteristics									
Manning's Roughness Coefficient	0.24	0.24	0.011	0.24	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	200	100	200	100	200	100	100	200	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.01	0.01	0.005	0.01	0.005	0.01	0.02	0.005	0.02
Sheet Flow Travel Time (hr)	0.50	0.29	0.06	0.29	0.67	0.29	0.22	0.67	0.22
Shallow Concentrated Flow Characteristics									
Surface Description (1 - unpaved, 2 - paved)	1	1	2	1	1	1	1	1	1
Flow Length (ft)	2400	1000	1500	2100	1500	2300	2030	2129	1000
Watercourse Slope (ft/ft)	0.001	0.004	0.005	0.003	0.0026	0.019	0.003	0.0022	0.019
Average Velocity - computed (ft/s)	0.51	1.02	1.44	0.88	0.82	2.22	0.88	0.76	2.22
Shallow Concentrated Flow Travel Time (hr)	1.31	0.27	0.29	0.66	0.51	0.29	0.64	0.78	0.12
Channel Flow Characterisitics									
Cross-sectional Flow Area (ft2)	20.16	179.8	12.2	11.5	65.9	51.2	24	67.8	20.78
Wetted Perimeter (ft)	12.67	31.74	11.18	7.5	18.95	16.45	15.66	22.4	14.09
Hydraulic Radius - computed (ft)	1.59	5.66	1.09	1.53	3.48	3.11	1.53	3.03	1.47
Channel Slope (ft/ft)	0.0014	0.001	0.005	0.005	0.005	0.0014	0.017	0.002	0.012
Manning's Roughness Coefficient	0.035	0.035	0.045	0.043	0.044	0.044	0.044	0.035	0.044
Average Velocity - computed (ft/s)	2.17	4.28	2.48	3.26	5.50	2.70	5.87	3.98	4.81
Flow Length (ft)	2299	1200	1300	1500	4500	1900	1460	4349	1200
Channel Flow Travel Time (hr)	0.29	0.08	0.15	0.13	0.23	0.20	0.07	0.30	0.07
Totals									
Watershed Time of travel (hr)	**2.10**	**0.64**	**0.49**	**1.08**	**1.40**	**0.77**	**0.93**	**1.75**	**0.41**
Watershed Time of travel (min)	**126.29**	**38.38**	**29.51**	**64.65**	**83.94**	**46.33**	**55.60**	**104.99**	**24.82**
Lag Time - Existing Condtions (min)	**75.78**	**23.03**	**17.71**	**38.79**	**50.36**	**27.80**	**33.36**	**62.99**	**14.89**
Lag Time - Future Conditions (min)	**53.04**	**23.03**	**17.71**	**38.79**	**50.36**	**27.80**	**33.36**	**56.06**	**14.89**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W820	W830	W840	W850	W860	W870	W880	W890	W900
Watershed ID	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
Sheet Flow Characteristics									
Manning's Roughness Coefficient	0.24	0.24	0.011	0.011	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sheet Flow Travel Time (hr)	0.22	0.22	0.02	0.02	0.29	0.29	0.29	0.29	0.29
Shallow Concentrated Flow Characteristics									
Surface Description (1 - unpaved, 2 - paved)	1	1	2	2	1	1	1	1	1
Flow Length (ft)	1000	600	1500	281	300	800	1500	1000	1400
Watercourse Slope (ft/ft)	0.022	0.027	0.0057	0.007	0.0067	0.04	0.0053	0.0043	0.005
Average Velocity - computed (ft/s)	2.39	2.65	1.53	1.70	1.32	3.23	1.17	1.06	1.14
Shallow Concentrated Flow Travel Time (hr)	0.12	0.06	0.27	0.05	0.06	0.07	0.35	0.26	0.34
Channel Flow Characterisitics									
Cross-sectional Flow Area (ft2)	51.2	28.5	31.5	31.5	51.2	91	55.62	78	91
Wetted Perimeter (ft)	16.45	12	14	14	16.45	24	16.81	23.42	24
Hydraulic Radius - computed (ft)	3.11	2.38	2.25	2.25	3.11	3.79	3.31	3.33	3.79
Channel Slope (ft/ft)	0.0031	0.0067	0.0085	0.008	0.015	0.006	0.0071	0.0092	0.003
Manning's Roughness Coefficient	0.044	0.035	0.035	0.035	0.044	0.035	0.035	0.035	0.035
Average Velocity - computed (ft/s)	4.02	6.20	6.74	6.54	8.84	8.02	7.97	9.11	5.67
Flow Length (ft)	1300	900	2500	3756	2181	1000	4000	2500	900
Channel Flow Travel Time (hr)	0.09	0.04	0.10	0.16	0.07	0.03	0.14	0.08	0.04
Totals									
Watershed Time of travel (hr)	**0.43**	**0.32**	**0.40**	**0.23**	**0.42**	**0.39**	**0.78**	**0.63**	**0.67**
Watershed Time of travel (min)	**25.52**	**19.35**	**23.95**	**13.80**	**25.27**	**23.58**	**47.02**	**37.70**	**40.47**
Lag Time - Existing Condtions (min)	**15.31**	**11.61**	**14.37**	**8.28**	**15.16**	**14.15**	**28.21**	**22.62**	**24.28**
Lag Time - Future Conditions (min)	**15.31**	**11.61**	**14.37**	**8.28**	**15.16**	**14.15**	**28.21**	**22.62**	**24.28**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W910	W920	W930	W940	W950	W960	W970	W980	W990
Watershed ID	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**
Sheet Flow Characteristics									
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.011	0.24	0.24
Flow Length (ft)	200	300	200	100	100	100	100	300	200
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.005	0.005	0.005	0.005	0.02	0.01	0.005	0.005	0.005
Sheet Flow Travel Time (hr)	0.67	0.92	0.67	0.38	0.22	0.29	0.03	0.92	0.67
Shallow Concentrated Flow Characteristics									
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1	1
Flow Length (ft)	1700	3450	1400	1800	2100	843	1670	3266	2182
Watercourse Slope (ft/ft)	0.0016	0.002	0.0013	0.0048	0.011	0.004	0.0018	0.002	0.005
Average Velocity - computed (ft/s)	0.65	0.72	0.58	1.12	1.69	1.02	0.68	0.72	1.14
Shallow Concentrated Flow Travel Time (hr)	0.73	1.33	0.67	0.45	0.34	0.23	0.68	1.26	0.53
Channel Flow Characterisitics									
Cross-sectional Flow Area (ft2)	20.2	50.4	27.5	73.38	48.98	61.8	74.65	20.08	59.62
Wetted Perimeter (ft)	12	18.6	16	21.64	13.667	21.4	31.2	10.5	21.41
Hydraulic Radius - computed (ft)	1.68	2.71	1.72	3.39	3.58	2.89	2.39	1.91	2.78
Channel Slope (ft/ft)	0.005	0.001	0.0052	0.004	0.0025	0.007	0.002	0.001	0.005
Manning's Roughness Coefficient	0.035	0.047	0.045	0.035	0.035	0.035	0.045	0.047	0.045
Average Velocity - computed (ft/s)	4.26	1.95	3.43	6.08	4.98	7.22	2.65	1.54	4.63
Flow Length (ft)	2000	3937	2900	3769	800	2022	2312	900	1700
Channel Flow Travel Time (hr)	0.13	0.56	0.24	0.17	0.04	0.08	0.24	0.16	0.10
Totals									
Watershed Time of travel (hr)	**1.53**	**2.81**	**1.57**	**1.00**	**0.61**	**0.60**	**0.95**	**2.34**	**1.30**
Watershed Time of travel (min)	**91.64**	**168.56**	**94.13**	**60.10**	**36.52**	**35.81**	**57.15**	**140.35**	**77.90**
Lag Time - Existing Condtions (min)	**54.98**	**101.14**	**56.48**	**36.06**	**21.91**	**21.48**	**34.29**	**84.21**	**46.74**
Lag Time - Future Conditions (min)	**54.98**	**76.86**	**56.48**	**36.06**	**21.91**	**21.48**	**34.29**	**54.74**	**40.20**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W1000	W1100	W1200	W1300	W1400	W1500	W1600	W1700
Watershed ID	**100**	**110**	**120**	**130**	**140**	**150**	**160**	**170**
Sheet Flow Characteristics								
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.02	0.02	0.01	0.02	0.01	0.01	0.01	0.01
Sheet Flow Travel Time (hr)	0.22	0.22	0.29	0.22	0.29	0.29	0.29	0.29
Shallow Concentrated Flow Characteristics								
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1
Flow Length (ft)	1700	1300	1900	1200	1200	1000	900	600
Watercourse Slope (ft/ft)	0.015	0.029	0.012	0.012	0.005	0.005	0.0047	0.017
Average Velocity - computed (ft/s)	1.98	2.75	1.77	1.77	1.14	1.14	1.11	2.10
Shallow Concentrated Flow Travel Time (hr)	0.24	0.13	0.30	0.19	0.29	0.24	0.23	0.08
Channel Flow Characterisitics								
Cross-sectional Flow Area (ft2)	8.82	93.92	12.03	67.23	57.21	54.34	25.57	33.06
Wetted Perimeter (ft)	10.67	21.86	13.88	19.13	17.35	19.32	10.1	12.15
Hydraulic Radius - computed (ft)	0.83	4.30	0.87	3.51	3.30	2.81	2.53	2.72
Channel Slope (ft/ft)	0.0089	0.0078	0.013	0.01	0.003	0.006	0.005	0.0075
Manning's Roughness Coefficient	0.043	0.044	0.045	0.045	0.043	0.043	0.045	0.04
Average Velocity - computed (ft/s)	2.88	7.90	3.43	7.65	4.20	5.35	4.35	6.29
Flow Length (ft)	900	1300	1200	2200	1800	1691	1512	800
Channel Flow Travel Time (hr)	0.09	0.05	0.10	0.08	0.12	0.09	0.10	0.04
Totals								
Watershed Time of travel (hr)	**0.55**	**0.40**	**0.69**	**0.49**	**0.70**	**0.62**	**0.61**	**0.40**
Watershed Time of travel (min)	**32.71**	**23.79**	**41.12**	**29.27**	**42.04**	**37.25**	**36.73**	**24.25**
Lag Time - Existing Condtions (min)	**19.63**	**14.27**	**24.67**	**17.56**	**25.22**	**22.35**	**22.04**	**14.55**
Lag Time - Future Conditions (min)	**19.63**	**14.27**	**24.67**	**17.56**	**25.22**	**22.35**	**22.04**	**14.55**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W1800	W1900	W2000	W2100	W2200	W2300	W2400	W2500
Watershed ID	**180**	**190**	**200**	**210**	**220**	**230**	**240**	**250**
Sheet Flow Characteristics								
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.02
Sheet Flow Travel Time (hr)	0.22	0.22	0.22	0.22	0.29	0.22	0.29	0.22
Shallow Concentrated Flow Characteristics								
Surface Description (1 - unpaved, 2 - paved)	1	2	2	2	1	1	1	2
Flow Length (ft)	900	430	600	570	1835	2200	1150	1500
Watercourse Slope (ft/ft)	0.01	0.016	0.003	0.019	0.014	0.0035	0.006	0.017
Average Velocity - computed (ft/s)	1.61	2.57	1.11	2.80	1.91	0.95	1.25	2.65
Shallow Concentrated Flow Travel Time (hr)	0.15	0.05	0.15	0.06	0.27	0.64	0.26	0.16
Channel Flow Characterisitics								
Cross-sectional Flow Area (ft2)	61.56	106.93	42.52	94.29	202.4	32.12	32.12	51.2
Wetted Perimeter (ft)	34.35	36.82	25.14	33.12	39.4	19.56	19.56	16.45
Hydraulic Radius - computed (ft)	1.79	2.90	1.69	2.85	5.14	1.64	1.64	3.11
Channel Slope (ft/ft)	0.011	0.002	0.0145	0.0098	0.0026	0.016	0.014	0.008
Manning's Roughness Coefficient	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
Average Velocity - computed (ft/s)	5.24	3.08	5.79	6.73	5.14	5.96	5.58	6.46
Flow Length (ft)	1100	2688	2213	2590	500	2145	1530	500
Channel Flow Travel Time (hr)	0.06	0.24	0.11	0.11	0.03	0.10	0.08	0.02
Totals								
Watershed Time of travel (hr)	**0.43**	**0.51**	**0.48**	**0.38**	**0.58**	**0.96**	**0.62**	**0.40**
Watershed Time of travel (min)	**25.96**	**30.48**	**28.52**	**22.97**	**35.01**	**57.57**	**37.28**	**23.89**
Lag Time - Existing Condtions (min)	**15.58**	**18.29**	**17.11**	**13.78**	**21.01**	**34.54**	**22.37**	**14.33**
Lag Time - Future Conditions (min)	**15.58**	**18.29**	**17.11**	**13.78**	**20.85**	**34.54**	**22.37**	**14.33**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W2600	W2700	W2800	W2900	W3000	W3100	W3200	W3300
Watershed ID	**260**	**270**	**280**	**290**	**300**	**310**	**320**	**330**
Sheet Flow Characteristics								
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.06	0.01	0.005	0.02	0.002	0.005	0.005	0.01
Sheet Flow Travel Time (hr)	0.14	0.29	0.38	0.22	0.55	0.38	0.38	0.29
Shallow Concentrated Flow Characteristics								
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1
Flow Length (ft)	50	590	1600	900	1698	2800	1000	2180
Watercourse Slope (ft/ft)	0.04	0.021	0.005	0.0175	0.002	0.0086	0.002	0.004
Average Velocity - computed (ft/s)	3.23	2.34	1.14	2.13	0.72	1.50	0.72	1.02
Shallow Concentrated Flow Travel Time (hr)	0.00	0.07	0.39	0.12	0.65	0.52	0.38	0.59
Channel Flow Characterisitics								
Cross-sectional Flow Area (ft2)	51.2	65.9	59.62	40	74.69	65.9	12.5	49.8
Wetted Perimeter (ft)	16.45	18.95	16.05	23.87	19.87	18.95	8	19.4
Hydraulic Radius - computed (ft)	3.11	3.48	3.71	1.68	3.76	3.48	1.56	2.57
Channel Slope (ft/ft)	0.0075	0.015	0.008	0.007	0.002	0.0035	0.0022	0.003
Manning's Roughness Coefficient	0.035	0.045	0.045	0.035	0.045	0.044	0.035	0.035
Average Velocity - computed (ft/s)	7.86	9.31	7.10	5.03	3.58	4.60	2.69	4.37
Flow Length (ft)	70	735	550	1400	1500	2300	2374	172
Channel Flow Travel Time (hr)	0.00	0.02	0.02	0.08	0.12	0.14	0.25	0.01
Totals								
Watershed Time of travel (hr)	**0.15**	**0.38**	**0.79**	**0.41**	**1.32**	**1.04**	**1.01**	**0.89**
Watershed Time of travel (min)	**8.89**	**22.89**	**47.59**	**24.84**	**79.27**	**62.45**	**60.74**	**53.63**
Lag Time - Existing Condtions (min)	**5.33**	**13.74**	**28.55**	**14.90**	**47.56**	**37.47**	**36.44**	**32.18**
Lag Time - Future Conditions (min)	**5.33**	**13.74**	**28.55**	**14.90**	**47.56**	**37.47**	**36.44**	**32.18**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W3400	W3500	W3600	W3700	W3800	W3900	W4000	W4100
Watershed ID	**340**	**350**	**360**	**370**	**380**	**390**	**400**	**410**
Sheet Flow Characteristics								
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.011
Flow Length (ft)	100	100	100	100	100	100	100	200
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.005
Sheet Flow Travel Time (hr)	0.29	0.29	0.29	0.29	0.29	0.22	0.29	0.06
Shallow Concentrated Flow Characteristics								
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	2	1	1	2
Flow Length (ft)	1400	1600	1400	1500	480	914	1305	1700
Watercourse Slope (ft/ft)	0.018	0.0019	0.0021	0.012	0.02	0.011	0.013	0.0018
Average Velocity - computed (ft/s)	2.16	0.70	0.74	1.77	2.87	1.69	1.84	0.86
Shallow Concentrated Flow Travel Time (hr)	0.18	0.63	0.53	0.24	0.05	0.15	0.20	0.55
Channel Flow Characterisitics								
Cross-sectional Flow Area (ft2)	240.68	63	53.75	46.25	8.64	4.9	37	1.23
Wetted Perimeter (ft)	46.75	28.3	22.3	12.8	7.79	7.8	15	3.93
Hydraulic Radius - computed (ft)	5.15	2.23	2.41	3.61	1.11	0.63	2.47	0.31
Channel Slope (ft/ft)	0.0036	0.0086	0.002	0.003	0.014	0.002	0.0045	0.005
Manning's Roughness Coefficient	0.044	0.035	0.035	0.035	0.044	0.013	0.035	0.035
Average Velocity - computed (ft/s)	6.06	6.73	3.42	5.49	4.29	3.76	5.21	1.39
Flow Length (ft)	1100	1400	1000	700	2600	1607	1300	2133
Channel Flow Travel Time (hr)	0.05	0.06	0.08	0.04	0.17	0.12	0.07	0.43
Totals								
Watershed Time of travel (hr)	**0.52**	**0.98**	**0.90**	**0.56**	**0.50**	**0.49**	**0.56**	**1.03**
Watershed Time of travel (min)	**31.18**	**58.75**	**53.80**	**33.64**	**30.25**	**29.29**	**33.35**	**61.86**
Lag Time - Existing Condtions (min)	**18.71**	**35.25**	**32.28**	**20.18**	**18.15**	**17.57**	**20.01**	**37.12**
Lag Time - Future Conditions (min)	**18.71**	**35.25**	**32.28**	**20.18**	**18.15**	**17.57**	**20.01**	**37.12**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W4200	W4300	W4400	W4500	W4600	W4700	W4800	W4900
Watershed ID	**420**	**430**	**440**	**450**	**460**	**470**	**480**	**490**
Sheet Flow Characteristics								
Manning's Roughness Coefficient	0.24	0.011	0.011	0.24	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.01	0.01	0.01	0.02	0.01	0.02	0.005	0.005
Sheet Flow Travel Time (hr)	0.29	0.02	0.02	0.22	0.29	0.22	0.38	0.38
Shallow Concentrated Flow Characteristics								
Surface Description (1 - unpaved, 2 - paved)	1	2	2	1	1	1	1	1
Flow Length (ft)	1654	550	800	1116	500	400	900	1451
Watercourse Slope (ft/ft)	0.007	0.001	0.0025	0.006	0.0086	0.015	0.008	0.008
Average Velocity - computed (ft/s)	1.35	0.64	1.02	1.25	1.50	1.98	1.44	1.44
Shallow Concentrated Flow Travel Time (hr)	0.34	0.24	0.22	0.25	0.09	0.06	0.17	0.28
Channel Flow Characterisitics								
Cross-sectional Flow Area (ft2)	1.76	7.07	35	62.96	4.71	42.52	28	30
Wetted Perimeter (ft)	4.7	9.42	15.66	23.14	1.77	25.14	20.6	16.7
Hydraulic Radius - computed (ft)	0.37	0.75	2.23	2.72	2.66	1.69	1.36	1.80
Channel Slope (ft/ft)	0.008	0.0025	0.0029	0.01	0.0074	0.014	0.0067	0.003
Manning's Roughness Coefficient	0.013	0.013	0.035	0.035	0.035	0.044	0.035	0.035
Average Velocity - computed (ft/s)	5.33	4.73	3.92	8.30	7.03	5.69	4.28	3.45
Flow Length (ft)	50	2300	700	2678	1500	2300	711	779
Channel Flow Travel Time (hr)	0.00	0.13	0.05	0.09	0.06	0.11	0.05	0.06
Totals								
Watershed Time of travel (hr)	**0.63**	**0.40**	**0.29**	**0.56**	**0.44**	**0.39**	**0.60**	**0.72**
Watershed Time of travel (min)	**37.95**	**23.83**	**17.57**	**33.43**	**26.50**	**23.28**	**36.09**	**43.45**
Lag Time - Existing Condtions (min)	**22.77**	**14.30**	**10.54**	**20.06**	**15.90**	**13.97**	**21.65**	**26.07**
Lag Time - Future Conditions (min)	**22.77**	**14.30**	**10.54**	**20.06**	**15.90**	**13.97**	**21.65**	**11.99**

Computation of Sub-Watershed Travel Time according to TR-55 Methodology

Watershed Name	W5000	W5100	W5200	W5300
Watershed ID	**500**	**510**	**520**	**530**
Sheet Flow Characteristics				
Manning's Roughness Coefficient	0.24	0.24	0.24	0.24
Flow Length (ft)	100	100	100	100
Two-Year 24-hour Rainfall (in)	3.76	3.76	3.76	3.76
Land Slope (ft/ft)	0.02	0.02	0.01	0.005
Sheet Flow Travel Time (hr)	0.22	0.22	0.29	0.38
Shallow Concentrated Flow Characteristics				
Surface Description (1 - unpaved, 2 - paved)	1	1	1	2
Flow Length (ft)	700	500	200	1500
Watercourse Slope (ft/ft)	0.008	0.0057	0.005	0.005
Average Velocity - computed (ft/s)	1.44	1.22	1.14	1.44
Shallow Concentrated Flow Travel Time (hr)	0.13	0.11	0.05	0.29
Channel Flow Characterisitics				
Cross-sectional Flow Area (ft2)	30	36	5	5
Wetted Perimeter (ft)	16.7	16	11.5	16
Hydraulic Radius - computed (ft)	1.80	2.25	0.43	0.31
Channel Slope (ft/ft)	0.0065	0.002	0.001	0.001
Manning's Roughness Coefficient	0.035	0.035	0.035	0.013
Average Velocity - computed (ft/s)	5.07	3.27	0.77	1.67
Flow Length (ft)	2421.7	2000	3250	2000
Channel Flow Travel Time (hr)	0.13	0.17	1.17	0.33
Totals				
Watershed Time of travel (hr)	**0.49**	**0.50**	**1.51**	**1.00**
Watershed Time of travel (min)	**29.21**	**30.20**	**90.40**	**60.28**
Lag Time - Existing Condtions (min)	**17.52**	**18.12**	**54.24**	**36.17**
Lag Time - Future Conditions (min)	**15.95**	**18.12**	**30.37**	**36.17**

G. Preliminary Opinion of Probable Construction Costs

	Item Description	Unit	Unit Price
1	Mobilization	LS	(10%)
2	Excavation	CY	$25.00
3	Hauling	CY	$4.00
4	Clearing & Grubbing	AC	$5,000.00
5	Channel Grading including seeding	SY	$15.00
6	Comprehensive Grading*	LS	(20%)
7	Construction Staking ($0-$300,000)	LS	$3,000.00
8	Construction Staking ($300,000-$800,000)	LS	$6,000.00
9	Construction Staking (Greater than $800,000)	LS	$10,000.00
10	Select Material	CY	$25.00
11	Flowable Fill	CY	$500.00
12	12" R.C. Pipe Culvert, Class III	LF	$45.00
13	15" R.C. Pipe Culvert, Class III	LF	$50.00
14	18" R.C. Pipe Culvert, Class III	LF	$55.00
15	18" R.C. Pipe Culvert, Class IV	LF	$60.00
16	24" R.C. Pipe Culvert, Class III	LF	$70.00
17	24" R.C. Pipe Culvert, Class IV	LF	$75.00
18	30" R.C. Pipe Culvert, Class III	LF	$90.00
19	30" R.C. Pipe Culvert, Class IV, 0' - 6' depth	LF	$100.00
20	36" R.C. Pipe Culvert, Class III	LF	$120.00
21	36" R.C. Pipe Culvert, Class IV	LF	$130.00
22	36" Steel Pipe Culvert (Tunnel Installation)	LF	$800.00
23	42" R.C. Pipe Culvert, Class III	LF	$150.00
24	42" R.C. Pipe Culvert, Class IV	LF	$165.00
25	48" R.C. Pipe Culvert, Class III	LF	$180.00
26	48" R.C. Pipe Culvert, Class IV	LF	$195.00
27	48" Steel Pipe Culvert (Tunnel Installation)	LF	$1,100.00
28	54" R.C. Pipe Culvert, Class III	LF	$200.00
29	60" R.C. Pipe Culvert, Class III	LF	$225.00
30	60" Steel Pipe Culvert (Tunnel Installation)	LF	$1,500.00
31	66" R.C. Pipe Culverts, Class III	LF	$260.00
32	72" R.C. Pipe Culvert, Class III	LF	$320.00
33	72" R.C. Pipe Culvert, Class IV	LF	$370.00
34	72" Steel Pipe Culvert (Tunnel Installation)	LF	$1,800.00
35	4' x 4' Precast R.C. Box Culvert	LF	$400.00
36	5' x 3' Precast R.C. Box Culvert	LF	$450.00
37	5' x 4' Precast R.C. Box Culvert	LF	$500.00
38	6' x 3' Precast R.C. Box Culvert	LF	$600.00
39	6' x 4' Precast R.C. Box Culvert	LF	$650.00
40	6' x 5' Precast R.C. Box Culvert	LF	$700.00
41	7' x 5' Precast R.C. Box Culvert	LF	$750.00
42	7' x 6' Precast R.C. Box Culvert	LF	$850.00

	Item Description	Unit	Unit Price
43	7' x 7' Precast R.C. Box Culvert	LF	$1,200.00
44	8' x 2.5' Precast R.C. Box Culvert	LF	$490.00
45	8’ x 4’ Precast R.C. Box Culvert	LF	$750.00
46	8' x 6' Precast R.C. Box Culvert	LF	$1,200.00
47	8' x 8' Precast R.C. Box Culvert	LF	$1,600.00
48	9' x 5' Precast R.C. Box Culvert	LF	$1,100.00
49	9' x 6' Precast R.C. Box Culvert	LF	$1,400.00
50	10' x 7' Precast R.C. Box Culvert	LF	$1,700.00
51	10' x 8' Precast R.C. Box Culvert	LF	$2,000.00
52	11' x 6' Precast R.C. Box Culvert	LF	$1,500.00
53	11’ x 7’ Precast R.C. Box Culvert	LF	$1,800.00
54	11' x 10' Precast R.C. Box Culvert	LF	$2,700.00
55	11' x 11' Precast R.C. Box Culvert	LF	$3,000.00
56	R.C. Box Culvert Trenchless Installation	EA	*Varies*
57	Drainage Structures, Manhole	EA	$3,500.00
58	Drainage Structures, Inlet	EA	$3,000.00
59	Drainage Structures, DOT Standard Endwall	EA	$6,000.00
60	Drainage Structures, Box Culvert Custom Endwall	EA	$15,000.00
61	Flared End Section, 18 inch	EA	$1,000.00
62	Flared End Section, 36 inch	EA	$2,500.00
63	Flared End Section, 42 inch	EA	$2,500.00
64	Custom Junction Box	EA	$15,000.00
65	Concrete Curb and Gutter	LF	$35.00
66	6" Concrete Driveway Replacement	EA	$1,500.00
67	4" Concrete Sidewalk	LF	$40.00
68	Concrete Pipe Plug	EA	$450.00
69	Asphalt Milling/Overlay	SY	$30.00
70	Asphalt Replacement (Surface, Base Course, & Milling)	SY	$55.00
71	ABC Stone	TN	$35.00
72	Rip Rap Stone, Class B	TN	$65.00
73	Rip Rap Stone, Class 1	TN	$70.00
74	Rip Rap Stone, Class A	TN	$65.00
75	#5 stone	TN	$50.00
76	#57 stone (Bedding)	TN	$65.00
77	Gravel Walkway #78 stone	TN	$65.00
78	Stone Boulder	TN	$200.00
79	Sand 2S	CY	$60.00
80	Rock Grade Control	EA	$10,000.00
81	Traffic Control (Single 2-lane road)	LS	$10,000.00
82	Traffic Control (4+ lane road or multiple 2-lane roads)	LS	$20,000.00
83	Erosion Control (1-2 acre LOD)	LS	$15,000.00
84	Erosion Control (2-5 acre LOD)	LS	$30,000.00

	Item Description	Unit	Unit Price
85	Erosion Control (Greater than 5 acre LOD)	LS	$50,000.00
86	Erosion Control Matting	SY	$10.00
87	Fence Removal / Replacement	LF	$50.00
88	Soil Media	CY	$50.00
89	BMP Plantings	SF	$2.00
90	Riparian Seed Mix	SY	$1.50
91	Live Staking	SY	$15.00
92	Seeding and Mulching	AC	$7,500.00
93	Wood Retaining Wall (4' high)	LF	$100.00
94	Log Grade Control Structure	EA	$2,000.00
95	Vegetated Soil Lift	SFF	$40.00
96	Permanent Coir Matting	SY	$4.00
97	Shrubs (1 gallon)	EA	$55.00
98	Tree (1.5" caliper)	EA	$150.00
99	Gabion Wall	LF	$300.00
100	Foundation Protection	EA	$15,000.00
101	Utility Relocations (Minor Water line adjustments)**	LS	$5,000.00
102	Utility Relocations (Substantial Water line adjustements)**	LS	$15,000.00
103	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	LS	$30,000.00
104	Utility Relocations (Other Utility conflicts)**	LS	$20,000.00
105	8” Perforated PVC Underdrain	LF	$10.00
106	8" PVC Pipe, SDR 35	LF	$10.00
107	Removal of Chain Link Fence	LF	$3.73
108	6' Chain Link Fence w/ Barbed Wire	LF	$15.45
109	Demolition	LS	-
110	Pipe removal (15" - 18" dia)	LF	$20.00
111	4' Personnel Gates	EA	$375.00
112	20' Roadway Gates	EA	$400.00
113	15" PVC Pipe, SDR 35	LF	$17.60
114	BMP Outlet Structure	EA	$4,000.00
115	Dewatering during Construction	LS	$20,000.00
116	Convert Yard Inlet to Junction Box	EA	$1,500.00
117	Curb Cut	EA	$400.00
118	Porous Asphalt	SF	$1.50
119	Interlocking Pavers	SF	$15.00
120	Porous Concrete	SF	$10.00
121	Pipe removal (24" - 36" dia)	LF	$30.00
122	Pipe removal (42" - 60" dia)	LF	$35.00
123	Pipe removal (60" dia +)	LF	$40.00
124	Up to 8" DIP Water Line (incl. removal and replacement)	LF	$135.00
125	Up to 8" DIP Sewer Line (incl. removal and replacement)	LF	$135.00
126	Sewer Structures, Manhole	EA	$3,000.00

	Item Description	Unit	Unit Price
127	Sewer Structures, Manhole	LS	$7,500.00
128	Top Soil	CY	$80.00
129	Mulch (placed and tilled into topsoil)	CY	$150.00
130	Floodplain Benching Allocation	LS	*Varies*

G.1 Primary Systems

Rock Spring Road (Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 85,506.53	$ 85,506.53
2	Comprehensive Grading*	1	LS	$ 142,510.88	$ 142,510.88
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,781	CY	$ 4.00	$ 7,124.05
5	Select Material	1,781	CY	$ 25.00	$ 44,525.33
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	11' x 10' Precast R.C. Box Culvert	114	LF	$ 2,700.00	$ 307,800.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	303	SY	$ 55.00	$ 16,651.56
10	#57 Stone (Bedding)	88	TN	$ 65.00	$ 5,705.70
11	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
12	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
13	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
14	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
15	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
16	Floodplain Benching Allocation	1	LS	$ 188,747.77	$ 188,747.77
				Subtotal	$ 940,571.82
				30% Contingency	$ 282,171.55
				Total	$ 1,222,743.37
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 366,823.01
				Total Opinion of Project Cost	$ 1,589,566.37

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Rock Spring Road (Greens Mill Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 112,930.46	$ 112,930.46
2	Comprehensive Grading*	1	LS	$ 188,217.43	$ 188,217.43
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	2,012	CY	$ 4.00	$ 8,048.85
5	Select Material	2,012	CY	$ 25.00	$ 50,305.33
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	11' x 10' Precast R.C. Box Culvert	152	LF	$ 2,700.00	$ 410,400.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	337	SY	$ 55.00	$ 18,558.22
10	#57 Stone (Bedding)	117	TN	$ 65.00	$ 7,607.60
11	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
12	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
13	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
14	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
15	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
16	Floodplain Benching Allocation	1	LS	$ 304,167.14	$ 304,167.14
				Subtotal	$ 1,242,235.03
				30% Contingency	$ 372,670.51
				Total	$ 1,614,905.54
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 484,471.66
				Total Opinion of Project Cost	$ 2,099,377.20

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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College Hill Road (Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 49,608.27	$ 49,608.27
2	Comprehensive Grading*	1	LS	$ 82,680.45	$ 82,680.45
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	898	CY	$ 4.00	$ 3,590.93
5	Select Material	898	CY	$ 25.00	$ 22,443.31
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	8' x 4' Precast R.C. Box Culvert	89	LF	$ 750.00	$ 66,750.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	324	SY	$ 55.00	$ 17,834.67
10	#57 Stone (Bedding)	50	TN	$ 65.00	$ 3,239.60
11	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
12	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
13	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
14	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
15	Concrete Curb and Gutter	97	LF	$ 35.00	$ 3,404.80
16	4" Concrete Sidewalk	97	LF	$ 40.00	$ 3,891.20
17	Floodplain Benching Allocation	1	LS	$ 188,747.77	$ 188,747.77
				Subtotal	$ 545,690.99
				30% Contingency	$ 163,707.30
				Total	$ 709,398.29
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 212,819.49
				Total Opinion of Project Cost	$ 922,217.78

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

South Elm (Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 151,187.36	$ 151,187.36
2	Comprehensive Grading*	1	LS	$ 251,978.94	$ 251,978.94
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	2796	CY	$ 4.00	$ 11,185.49
5	Select Material	2796	CY	$ 25.00	$ 69,909.30
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	11' x 11' Precast R.C. Box Culvert	256	LF	$ 3,000.00	$ 768,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	784	SY	$ 55.00	$ 43,105.33
10	#57 Stone (Bedding)	197	TN	$ 65.00	$ 12,812.80
11	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
12	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
13	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
14	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
15	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
16	Concrete Curb and Gutter	235	LF	$ 35.00	$ 8,229.20
17	4" Concrete Sidewalk	235	LF	$ 40.00	$ 9,404.80
18	Floodplain Benching Allocation	1	LS	$ 188,747.77	$ 188,747.77
				Subtotal	$ 1,663,060.99
				30% Contingency	$ 498,918.30
				Total	$ 2,161,979.29
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 648,593.79
				Total Opinion of Project Cost	$ 2,810,573.07

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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South Elm (Greens Mill Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 165,037.69	$ 165,037.69
2	Comprehensive Grading*	1	LS	$ 275,062.81	$ 275,062.81
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	2796	CY	$ 4.00	$ 11,185.49
5	Select Material	2796	CY	$ 25.00	$ 69,909.30
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	11' x 11' Precast R.C. Box Culvert	256	LF	$ 3,000.00	$ 768,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	784	SY	$ 55.00	$ 43,105.33
10	#57 Stone (Bedding)	197	TN	$ 65.00	$ 12,812.80
11	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
12	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
13	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
14	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
15	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
16	Concrete Curb and Gutter	235	LF	$ 35.00	$ 8,229.20
17	4" Concrete Sidewalk	235	LF	$ 40.00	$ 9,404.80
18	Floodplain Benching Allocation	1	LS	$ 304,167.14	$ 304,167.14
				Subtotal	$ 1,815,414.56
				30% Contingency	$ 544,624.37
				Total	$ 2,360,038.92
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 708,011.68
				Total Opinion of Project Cost	$ 3,068,050.60

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Greens Mill Run - Floodplain Benching - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Excavation	13,399	CY	$ 25.00	$ 334,975.00
2	Hauling	13,399	CY	$ 4.00	$ 53,596.00
3	Erosion Control (2-5 acre LOD)	1	LS	$ 30,000.00	$ 30,000.00
4	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
5	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
6	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
7	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
8	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
9	Clearing & Grubbing	5	AC	$ 5,000.00	$ 23,520.51
10	Riparian Seed Mix	22,768	SY	$ 1.50	$ 34,151.79
				Total	$ 566,243.30

* Cost estimate for construction of floodplain benching only. Cost of floodplain benching distributed among crossing improvements on Greens Mill Run. See cost estimates for alternatives for full cost estimate information.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

*** Mobilization, Comprehensive Grading, Contingency, and Design/Administrative/Fiscal/Legal, and Construction Staking costs not calculated for floodplain benching; these costs are applied to crossing improvements, which include the distributed floodplain benching cost.

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Greens Mill Run - Floodplain Benching - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Excavation	13,880	CY	$ 25.00	$ 347,000.00
2	Hauling	13,880	CY	$ 4.00	$ 55,520.00
3	Erosion Control (Greater than 5 acre LOD)	1	LS	$ 50,000.00	$ 50,000.00
4	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
5	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
6	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
7	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
8	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
9	Clearing & Grubbing	5	AC	$ 5,000.00	$ 26,841.06
10	Riparian Seed Mix	25,982	SY	$ 1.50	$ 38,973.21
				Total	$ 608,334.27

* Cost estimate for construction of floodplain benching only. Cost of floodplain benching distributed among crossing improvements on Greens Mill Run. See cost estimates for alternatives for full cost estimate information.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

*** Mobilization, Comprehensive Grading, Contingency, and Design/Administrative/Fiscal/Legal, and Construction Staking costs not calculated for floodplain benching; these costs are applied to crossing improvements, which include the distributed floodplain benching cost.

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Southest Greenville Boulevard (Reedy Branch) - Alternative #1 / #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 36,556.58	$ 36,556.58
2	Comprehensive Grading*	1	LS	$ 60,927.64	$ 60,927.64
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	2,954	CY	$ 4.00	$ 11,816.49
5	Select Material	2,954	CY	$ 25.00	$ 73,853.09
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	60" R.C. Pipe Culvert, Class III	262	LF	$ 225.00	$ 58,950.00
8	Drainage Structures, DOT Standard Endwall	2	EA	$ 6,000.00	$ 12,000.00
9	Concrete Curb and Gutter	101	LF	$ 35.00	$ 3,525.20
10	4" Concrete Sidewalk	101	LF	$ 40.00	$ 4,028.80
11	Asphalt Replacement (Surface, Base Course, & Milling)	364	SY	$ 55.00	$ 20,004.11
12	#57 Stone (Bedding)	92	TN	$ 65.00	$ 5,960.50
13	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
14	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 402,122.42
				30% Contingency	$ 120,636.73
				Total	$ 522,759.15
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 156,827.74
				Total Opinion of Project Cost	$ 679,586.89

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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South Wright Road (Reedy Branch) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 33,189.64	$ 33,189.64
2	Comprehensive Grading*	1	LS	$ 55,316.07	$ 55,316.07
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	880	CY	$ 4.00	$ 3,519.29
5	Select Material	880	CY	$ 25.00	$ 21,995.54
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	6' x 5' Precast R.C. Box Culvert	152	LF	$ 700.00	$ 106,400.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	108	LF	$ 35.00	$ 3,785.60
10	4" Concrete Sidewalk	54	LF	$ 40.00	$ 2,163.20
11	Asphalt Replacement (Surface, Base Course, & Milling)	210	SY	$ 55.00	$ 11,567.11
12	#57 Stone (Bedding)	64	TN	$ 65.00	$ 4,149.60
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 365,086.05
				30% Contingency	$ 109,525.81
				Total	$ 474,611.86
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 142,383.56
	Total Opinion of Project Cost				$ 616,995.42

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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South Wright Road (Reedy Branch) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 26,274.60	$ 26,274.60
2	Comprehensive Grading*	1	LS	$ 43,790.99	$ 43,790.99
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	815	CY	$ 4.00	$ 3,260.40
5	Select Material	815	CY	$ 25.00	$ 20,377.50
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	7' x 5' Precast R.C. Box Culvert	76	LF	$ 750.00	$ 57,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	98	LF	$ 35.00	$ 3,435.60
10	4" Concrete Sidewalk	49	LF	$ 40.00	$ 1,963.20
11	Asphalt Replacement (Surface, Base Course, & Milling)	191	SY	$ 55.00	$ 10,497.67
12	#57 Stone (Bedding)	37	TN	$ 65.00	$ 2,420.60
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 289,020.56
				30% Contingency	$ 86,706.17
				Total	$ 375,726.72
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 112,718.02
				Total Opinion of Project Cost	$ 488,444.74

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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East 10th Street (Reedy Branch) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 35,630.13	$ 35,630.13
2	Comprehensive Grading*	1	LS	$ 59,383.56	$ 59,383.56
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	3,643	CY	$ 4.00	$ 14,572.26
5	Select Material	3,643	CY	$ 25.00	$ 91,076.61
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	48" R.C. Pipe Culvert, Class III	150	LF	$ 180.00	$ 27,000.00
8	Drainage Structures, DOT Standard Endwall	2	EA	$ 6,000.00	$ 12,000.00
9	Concrete Curb and Gutter	138	LF	$ 35.00	$ 4,835.60
10	4" Concrete Sidewalk	69	LF	$ 40.00	$ 2,763.20
11	Asphalt Replacement (Surface, Base Course, & Milling)	499	SY	$ 55.00	$ 27,440.11
12	#57 Stone (Bedding)	42	TN	$ 65.00	$ 2,730.00
13	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
14	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 391,931.46
				30% Contingency	$ 117,579.44
				Total	$ 509,510.90
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 152,853.27
	Total Opinion of Project Cost				$ 662,364.17

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Crestwood Drive (Fornes Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 13,747.06	$ 13,747.06
2	Comprehensive Grading*	1	LS	$ 22,911.77	$ 22,911.77
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	754	CY	$ 4.00	$ 3,015.19
5	Select Material	754	CY	$ 25.00	$ 18,844.91
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	60" R.C. Pipe Culvert, Class III	61	LF	$ 225.00	$ 13,725.00
8	Drainage Structures, DOT Standard Endwall	2	EA	$ 6,000.00	$ 12,000.00
9	Asphalt Replacement (Surface, Base Course, & Milling)	165	SY	$ 55.00	$ 9,086.00
10	#57 Stone (Bedding)	21	TN	$ 65.00	$ 1,387.75
11	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
12	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
13	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
14	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 151,217.68
				30% Contingency	$ 45,365.31
				Total	$ 196,582.99
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 58,974.90
	Total Opinion of Project Cost				$ 255,557.88

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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North Overlook Drive (Fornes Run) - Alternative #1 / #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 41,858.95	$ 41,858.95
2	Comprehensive Grading*	1	LS	$ 69,764.91	$ 69,764.91
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,017	CY	$ 4.00	$ 4,066.51
5	Select Material	1,017	CY	$ 25.00	$ 25,415.72
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	7' x 7' Precast R.C. Box Culvert	132	LF	$ 1,200.00	$ 158,400.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	128	LF	$ 35.00	$ 4,471.60
10	4" Concrete Sidewalk	64	LF	$ 40.00	$ 2,555.20
11	Asphalt Replacement (Surface, Base Course, & Milling)	213	SY	$ 55.00	$ 11,711.33
12	#57 Stone (Bedding)	65	TN	$ 65.00	$ 4,204.20
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 460,448.42
				30% Contingency	$ 138,134.53
				Total	$ 598,582.95
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 179,574.89
				Total Opinion of Project Cost	$ 778,157.84

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Norfolk Southern Railway (Fornes Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 715,355.80	$ 715,355.80
2	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
3	Hauling	15,680	CY	$ 4.00	$ 62,720.00
4	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
5	10' x 8' Precast R.C. Box Culvert	196	LF	$ 2,000.00	$ 392,000.00
6	R.C. Box Culvert Trenchless Installation	1	EA	$ 6,627,920.00	$ 6,627,920.00
7	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
8	#57 Stone (Bedding)	137	TN	$ 65.00	$ 8,918.00
9	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
				Subtotal	$ 7,868,913.80
				30% Contingency	$ 2,360,674.14
				Total	$ 10,229,587.94
	Design, Administraion, Fiscal, and Legal (30% of Construction Costs)				$ 3,068,876.38
	Total Opinion of Project Cost				$ 13,298,464.32

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Norfolk Southern Railway (Fornes Run) - Alternative #1 - R.C. Box Culvert Trenchless Installation

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Encroachment/Occupancy Permitting, Flag Man & other R/R Inspection Fees/Costs	1	LS	$ 50,000.00	$ 50,000.00
2	Environmental Permitting Fees	1	LS	$ 5,000.00	$ 5,000.00
3	Steam Bank Protection	1	LS	$ 60,000.00	$ 60,000.00
4	10'x8' Tunnel Jacking	196	LF	$ 15,000.00	$ 2,940,000.00
5	Tunnel Jacking Pit	40	VF	$ 8,500.00	$ 340,000.00
6	Pit Dewatering	24	WK	$ 10,000.00	$ 240,000.00
7	Tunnel Preparation Jet Grout	196	LF	$ 2,000.00	$ 392,000.00
8	Additional Excavation Face Support	2	EA	$ 65,000.00	$ 130,000.00
9	Controlled Stream Bank Excavation and Stream Flow Reroutiing	1	LS	$ 225,000.00	$ 225,000.00
10	24" Steel Casing Line and Grade Control Rail System	392	LF	$ 600.00	$ 235,200.00
11	Furnish, Install, and Grout Culvert Annular Space	196	LF	$ 2,200.00	$ 431,200.00
12	Site Restoration (Streambank)	1	AC	$ 50,000.00	$ 50,000.00
				Subtotal	$ 5,098,400.00
				25% Contingency*	$ 1,529,520.00
				Total	$ 6,627,920.00

*Contingency for trenchless installation is in addition to the overall project contingency, due to the basis for this evaluation and estimate being without geotechnical information, and typical of several potential site locations.

Norfolk Southern Railway (Fornes Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 680,591.04	$ 680,591.04
2	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
3	Hauling	12,544	CY	$ 4.00	$ 50,176.00
4	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
5	8' x 8' Precast R.C. Box Culvert	196	LF	$ 1,600.00	$ 313,600.00
6	R.C. Box Culvert Trenchless Installation	1	EA	$ 6,373,000.00	$ 6,373,000.00
7	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
8	#57 Stone (Bedding)	110	TN	$ 65.00	$ 7,134.40
9	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
				Subtotal	$ 7,486,501.44
				30% Contingency	$ 2,245,950.43
				Total	$ 9,732,451.87
				Design, Administraion, Fiscal, and Legal (30% of Construction Costs)	$ 2,919,735.56
				Total Opinion of Project Cost	$ 12,652,187.43

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Norfolk Southern Railway (Fornes Run) - Alternative #2 - R.C. Box Culvert Trenchless Installation

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Encroachment/Occupancy Permitting, Flag Man & other R/R Inspection Fees/Costs	1	LS	$ 50,000.00	$ 50,000.00
2	Environmental Permitting Fees	1	LS	$ 5,000.00	$ 5,000.00
3	Steam Bank Protection	1	LS	$ 60,000.00	$ 60,000.00
4	8'x8' Tunnel Jacking	196	LF	$ 15,000.00	$ 2,940,000.00
5	Tunnel Jacking Pit	40	VF	$ 8,500.00	$ 340,000.00
6	Pit Dewatering	24	WK	$ 10,000.00	$ 240,000.00
7	Tunnel Preparation Jet Grout	196	LF	$ 2,000.00	$ 392,000.00
8	Additional Excavation Face Support	2	EA	$ 65,000.00	$ 130,000.00
9	Controlled Stream Bank Excavation and Stream Flow Reroutiing	1	LS	$ 225,000.00	$ 225,000.00
10	24" Steel Casing Line and Grade Control Rail System	392	LF	$ 600.00	$ 235,200.00
11	Furnish, Install, and Grout Culvert Annular Space	196	LF	$ 2,200.00	$ 431,200.00
12	Site Restoration (Streambank)	1	AC	$ 50,000.00	$ 50,000.00
				Subtotal	$ 5,098,400.00
				25% Contingency*	$ 1,274,600.00
				Total	$ 6,373,000.00

*Contingency for trenchless installation is in addition to the overall project contingency, due to the basis for this evaluation and estimate being without geotechnical information, and typical of several potential site locations.

East 14th Street (Fornes Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 64,380.73	$ 64,380.73
2	Comprehensive Grading*	1	LS	$ 107,301.21	$ 107,301.21
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	2,702	CY	$ 4.00	$ 10,808.18
5	Select Material	2,702	CY	$ 25.00	$ 67,551.09
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	10' x 8' Precast R.C. Box Culvert	146	LF	$ 2,000.00	$ 292,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	185	LF	$ 35.00	$ 6,482.00
10	4" Concrete Sidewalk	93	LF	$ 40.00	$ 3,704.00
11	Asphalt Replacement (Surface, Base Course, & Milling)	206	SY	$ 55.00	$ 11,317.78
12	#57 Stone (Bedding)	102	TN	$ 65.00	$ 6,643.00
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 708,187.98
				30% Contingency	$ 212,456.39
				Total	$ 920,644.38
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 276,193.31
				Total Opinion of Project Cost	$ 1,196,837.69

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Allen Road (North Fork Greens Mill Run) - Alternative #1 / #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 43,211.29	$ 43,211.29
2	Comprehensive Grading*	1	LS	$ 72,018.81	$ 72,018.81
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,429	CY	$ 4.00	$ 5,716.33
5	Select Material	1,429	CY	$ 25.00	$ 35,727.05
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	7' x 7' Precast R.C. Box Culvert	120	LF	$ 1,200.00	$ 144,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	145	LF	$ 35.00	$ 5,082.00
10	Asphalt Replacement (Surface, Base Course, & Milling)	323	SY	$ 55.00	$ 17,746.67
11	#57 Stone (Bedding)	59	TN	$ 65.00	$ 3,822.00
12	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
13	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
14	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
15	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
16	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 475,324.14
				30% Contingency	$ 142,597.24
				Total	$ 617,921.38
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 185,376.41
				Total Opinion of Project Cost	$ 803,297.79

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Spring Forest Road (North Fork Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 59,333.26	$ 59,333.26
2	Comprehensive Grading*	1	LS	$ 98,888.77	$ 98,888.77
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,415	CY	$ 4.00	$ 5,661.00
5	Select Material	1,415	CY	$ 25.00	$ 35,381.24
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	8' x 6' Precast R.C. Box Culvert	240	LF	$ 1,200.00	$ 288,000.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	147	LF	$ 35.00	$ 5,157.60
10	Asphalt Replacement (Surface, Base Course, & Milling)	246	SY	$ 55.00	$ 13,508.00
11	#57 Stone (Bedding)	134	TN	$ 65.00	$ 8,736.00
12	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
13	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
14	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
15	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
16	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 652,665.86
				30% Contingency	$ 195,799.76
				Total	$ 848,465.62
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 254,539.69
				Total Opinion of Project Cost	$ 1,103,005.31

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Spring Forest Road (North Fork Greens Mill Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 33,439.72	$ 33,439.72
2	Comprehensive Grading*	1	LS	$ 55,732.87	$ 55,732.87
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,210	CY	$ 4.00	$ 4,841.24
5	Select Material	1,210	CY	$ 25.00	$ 30,257.78
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	72" R.C. Pipe Culvert, Class III	240	LF	$ 320.00	$ 76,800.00
8	Drainage Structures, DOT Standard Endwall	6	EA	$ 6,000.00	$ 36,000.00
9	Concrete Curb and Gutter	128	LF	$ 35.00	$ 4,480.00
10	Asphalt Replacement (Surface, Base Course, & Milling)	213	SY	$ 55.00	$ 11,733.33
11	#57 Stone (Bedding)	101	TN	$ 65.00	$ 6,552.00
12	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
13	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
14	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
15	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
16	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 367,836.95
				30% Contingency	$ 110,351.08
				Total	$ 478,188.03
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 143,456.41
				Total Opinion of Project Cost	$ 621,644.44

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Norfolk Southern Railway (Greens Mill Run North Fork) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 75,327.19	$ 75,327.19
2	Comprehensive Grading*	1	LS	$ 125,545.31	$ 125,545.31
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,178	CY	$ 4.00	$ 4,712.39
5	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
6	60" Steel Pipe Culvert (Tunnel Installation)	60	LF	$ 1,500.00	$ 90,000.00
7	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
8	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
9	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
10	Floodplain Benching Allocation	1	LS	$ 454,514.16	$ 454,514.16
				Subtotal	$ 828,599.04
				30% Contingency	$ 248,579.71
				Total	$ 1,077,178.75
				Design, Administraion, Fiscal, and Legal (30% of Construction Costs)	$ 323,153.63
				Total Opinion of Project Cost	$ 1,400,332.38

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Norfolk Southern Railway (Greens Mill Run North Fork) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 63,957.70	$ 63,957.70
2	Comprehensive Grading*	1	LS	$ 106,596.17	$ 106,596.17
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,178	CY	$ 4.00	$ 4,712.39
5	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
6	60" Steel Pipe Culvert (Tunnel Installation)	60	LF	$ 1,500.00	$ 90,000.00
7	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
8	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
9	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
10	Floodplain Benching Allocation	1	LS	$ 359,768.44	$ 359,768.44
				Subtotal	$ 703,534.69
				30% Contingency	$ 211,060.41
				Total	$ 914,595.10
				Design, Administraion, Fiscal, and Legal (30% of Construction Costs)	$ 274,378.53
				Total Opinion of Project Cost	$ 1,188,973.63

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Spring Forest Road (North Fork Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 125,103.19	$ 125,103.19
2	Comprehensive Grading*	1	LS	$ 208,505.32	$ 208,505.32
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,496	CY	$ 4.00	$ 5,984.08
5	Select Material	1,496	CY	$ 25.00	$ 37,400.48
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	8' x 6' Precast R.C. Box Culvert	309	LF	$ 1,200.00	$ 370,800.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	140	LF	$ 35.00	$ 4,911.20
10	4" Concrete Sidewalk	70	LF	$ 40.00	$ 2,806.40
11	Asphalt Replacement (Surface, Base Course, & Milling)	234	SY	$ 55.00	$ 12,862.67
12	#57 Stone (Bedding)	173	TN	$ 65.00	$ 11,247.60
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
18	Floodplain Benching Allocation	1	LS	$ 454,514.16	$ 454,514.16
				Subtotal	$ 1,376,135.08
				30% Contingency	$ 412,840.53
				Total	$ 1,788,975.61
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 536,692.68
				Total Opinion of Project Cost	$ 2,325,668.29

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Spring Forest Road (North Fork Greens Mill Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 74,818.95	$ 74,818.95
2	Comprehensive Grading*	1	LS	$ 124,698.24	$ 124,698.24
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	1,300	CY	$ 4.00	$ 5,199.12
5	Select Material	1,300	CY	$ 25.00	$ 32,494.53
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	72" R.C. Pipe Culvert, Class III	206	LF	$ 320.00	$ 65,920.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	112	LF	$ 35.00	$ 3,934.00
10	4" Concrete Sidewalk	56	LF	$ 40.00	$ 2,248.00
11	Asphalt Replacement (Surface, Base Course, & Milling)	187	SY	$ 55.00	$ 10,303.33
12	#57 Stone (Bedding)	87	TN	$ 65.00	$ 5,623.80
13	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
14	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
15	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
17	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
18	Floodplain Benching Allocation	1	LS	$ 359,768.44	$ 359,768.44
				Subtotal	$ 823,008.42
				30% Contingency	$ 246,902.52
				Total	$ 1,069,910.94
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 320,973.28
	Total Opinion of Project Cost				$ 1,390,884.22

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Ellsworth Drive (North Fork Greens Mill Run) - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 100,648.82	$ 100,648.82
2	Comprehensive Grading*	1	LS	$ 167,748.03	$ 167,748.03
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	630	CY	$ 4.00	$ 2,521.06
5	Select Material	630	CY	$ 25.00	$ 15,756.65
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	8' x 2.5' Precast R.C. Box Culvert	396	LF	$ 490.00	$ 194,040.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	122	LF	$ 35.00	$ 4,281.20
10	Asphalt Replacement (Surface, Base Course, & Milling)	204	SY	$ 55.00	$ 11,212.67
11	#57 Stone (Bedding)	222	TN	$ 65.00	$ 14,414.40
12	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
13	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
14	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
15	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
16	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
17	Floodplain Benching Allocation	1	LS	$ 454,514.16	$ 454,514.16
				Subtotal	$ 1,107,136.98
				30% Contingency	$ 332,141.09
				Total	$ 1,439,278.07
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 431,783.42
				Total Opinion of Project Cost	$ 1,871,061.49

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Ellsworth Drive (North Fork Greens Mill Run) - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 89,279.33	$ 89,279.33
2	Comprehensive Grading*	1	LS	$ 148,798.88	$ 148,798.88
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Hauling	630	CY	$ 4.00	$ 2,521.06
5	Select Material	630	CY	$ 25.00	$ 15,756.65
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	8' x 2.5' Precast R.C. Box Culvert	396	LF	$ 490.00	$ 194,040.00
8	Drainage Structures, Box Culvert Custom Endwall	2	EA	$ 15,000.00	$ 30,000.00
9	Concrete Curb and Gutter	122	LF	$ 35.00	$ 4,281.20
10	Asphalt Replacement (Surface, Base Course, & Milling)	204	SY	$ 55.00	$ 11,212.67
11	#57 Stone (Bedding)	222	TN	$ 65.00	$ 14,414.40
12	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
13	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
14	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
15	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
16	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
17	Floodplain Benching Allocation	1	LS	$ 359,768.44	$ 359,768.44
				Subtotal	$ 982,072.63
				30% Contingency	$ 294,621.79
				Total	$ 1,276,694.41
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 383,008.32
				Total Opinion of Project Cost	$ 1,659,702.74

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Greens Mill Run North Fork - Floodplain Benching - Alternative #1

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Excavation	27,631	CY	$ 25.00	$ 690,775.00
2	Hauling	27,631	CY	$ 4.00	$ 110,524.00
3	Erosion Control (Greater than 5 acre LOD)	1	LS	$ 50,000.00	$ 50,000.00
4	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
5	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
6	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
7	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
8	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
9	Clearing & Grubbing	34	AC	$ 5,000.00	$ 172,203.70
10	Riparian Seed Mix	166,693	SY	$ 1.50	$ 250,039.77
				Total	$ 1,363,542.47

* Cost estimate for construction of floodplain benching only. Cost of floodplain benching distributed among crossing improvements on Greens Mill Run North Fork. See cost estimates for alternatives for full cost estimate information.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

*** Mobilization, Comprehensive Grading, Contingency, and Design/Administrative/Fiscal/Legal, and Construction Staking costs not calculated for floodplain benching; these costs are applied to crossing improvements, which include the distributed floodplain benching cost.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Greens Mill Run North Fork - Floodplain Benching - Alternative #2

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Excavation	18,223	CY	$ 25.00	$ 455,575.00
2	Hauling	18,223	CY	$ 4.00	$ 72,892.00
3	Erosion Control (Greater than 5 acre LOD)	1	LS	$ 50,000.00	$ 50,000.00
4	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
5	Utility Relocations (Substantial Water line adjustements)**	1	LS	$ 15,000.00	$ 15,000.00
6	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
7	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
8	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
9	Clearing & Grubbing	34	AC	$ 5,000.00	$ 167,552.33
10	Riparian Seed Mix	162,191	SY	$ 1.50	$ 243,285.98
				Total	$ 1,079,305.32

* Cost estimate for construction of floodplain benching only. Cost of floodplain benching distributed among crossing improvements on Greens Mill Run North Fork. See cost estimates for alternatives for full cost estimate information.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

*** Mobilization, Comprehensive Grading, Contingency, and Design/Administrative/Fiscal/Legal, and Construction Staking costs not calculated for floodplain benching; these costs are applied to crossing improvements, which include the distributed floodplain benching cost.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

G.2 Secondary Systems

Arlington Boulevard Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 49,227.00	$ 49,227.00
2	Comprehensive Grading*	1	LS	$ 82,043.40	$ 82,043.40
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	15" R.C. Pipe Culvert, Class III	444	LF	$ 50.00	$ 22,200.00
9	24" R.C. Pipe Culvert, Class III	148	LF	$ 70.00	$ 10,360.00
10	30" R.C. Pipe Culvert, Class III	197	LF	$ 90.00	$ 17,730.00
11	36" R.C. Pipe Culvert, Class III	498	LF	$ 120.00	$ 59,760.00
12	48" R.C. Pipe Culvert, Class III	161	LF	$ 180.00	$ 28,980.00
13	Drainage Structures, Manhole	5	EA	$ 3,500.00	$ 17,500.00
14	Drainage Structures, Inlet	12	EA	$ 3,000.00	$ 36,000.00
15	Drainage Structures, Box Culvert Custom Endwall	1	EA	$ 15,000.00	$ 15,000.00
16	Concrete Curb and Gutter	360	LF	$ 35.00	$ 12,600.00
17	Asphalt Replacement (Surface, Base Course, & Milling)	293	SY	$ 55.00	$ 16,137.00
18	#57 Stone (Bedding)	330	TN	$ 65.00	$ 21,450.00
19	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
20	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
21	Utility Relocations (Minor Water line adjustments)**	2	LS	$ 5,000.00	$ 10,000.00
22	Utility Relocations (Substantial Water line adjustements)**	2	LS	$ 15,000.00	$ 30,000.00
23	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
24	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 541,487.40
				30% Contingency	$ 162,446.22
				Total	$ 703,933.62
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 211,180.09
				Total Opinion of Project Cost	$ 915,113.71

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Bradley Street Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 52,094.00	$ 52,094.00
2	Comprehensive Grading*	1	LS	$ 86,823.13	$ 86,823.13
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	250	CY	$ 25.00	$ 6,250.00
5	Hauling	250	CY	$ 4.00	$ 1,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (42" - 60" dia)	1,030	LF	$ 35.00	$ 36,050.00
8	60" Steel Pipe Culvert (Tunnel Installation)	100	LF	$ 1,500.00	$ 150,000.00
9	60" R.C. Pipe Culvert, Class III	142	LF	$ 225.00	$ 31,950.00
10	Channel Grading including seeding	1,751	SY	$ 15.00	$ 26,266.67
11	Drainage Structures, DOT Standard Endwall	6	EA	$ 6,000.00	$ 36,000.00
12	Concrete Curb and Gutter	200	LF	$ 35.00	$ 7,000.00
13	Asphalt Replacement (Surface, Base Course, & Milling)	333	SY	$ 55.00	$ 18,337.00
14	4" Concrete Sidewalk	50	LF	$ 40.00	$ 2,000.00
15	#57 Stone (Bedding)	35	TN	$ 65.00	$ 2,262.00
16	Rip Rap Stone, Class 1	300	TN	$ 70.00	$ 21,000.00
17	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
18	Utility Relocations (Minor Water line adjustments)**	1	LS	$ 5,000.00	$ 5,000.00
19	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
20	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 573,032.80
				30% Contingency	$ 171,909.84
				Total	$ 744,942.64
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 223,482.79
				Total Opinion of Project Cost	$ 968,425.43

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Brook Hollow Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 137,257.00	$ 137,257.00
2	Comprehensive Grading*	1	LS	$ 228,761.00	$ 228,761.00
3	Erosion Control (2-5 acre LOD)	1	LS	$ 30,000.00	$ 30,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	Pipe removal (15" - 18" dia)	340	LF	$ 20.00	$ 6,800.00
8	Pipe removal (24" - 36" dia)	2,044	LF	$ 30.00	$ 61,320.00
9	Pipe removal (42" - 60" dia)	720	LF	$ 35.00	$ 25,200.00
10	18" R.C. Pipe Culvert, Class III	348	LF	$ 55.00	$ 19,140.00
11	30" R.C. Pipe Culvert, Class III	619	LF	$ 90.00	$ 55,710.00
12	42" R.C. Pipe Culvert, Class III	581	LF	$ 150.00	$ 87,150.00
13	48" R.C. Pipe Culvert, Class III	1,472	LF	$ 180.00	$ 264,960.00
14	54" R.C. Pipe Culvert, Class III	694	LF	$ 200.00	$ 138,800.00
15	Drainage Structures, Inlet	29	EA	$ 3,000.00	$ 87,000.00
16	Drainage Structures, Manhole	2	EA	$ 3,500.00	$ 7,000.00
17	Drainage Structures, DOT Standard Endwall	2	EA	$ 6,000.00	$ 12,000.00
18	Concrete Curb and Gutter	644	LF	$ 35.00	$ 22,540.00
19	6" Concrete Driveway Replacement	6	EA	$ 1,500.00	$ 9,000.00
20	Asphalt Replacement (Surface, Base Course, & Milling)	51	SY	$ 55.00	$ 2,805.00
21	4" Concrete Sidewalk	642	LF	$ 40.00	$ 25,680.00
22	#57 Stone (Bedding)	980	TN	$ 65.00	$ 63,700.00
23	Rip Rap Stone, Class 1	150	TN	$ 70.00	$ 10,500.00
24	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
25	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	5	LS	$ 30,000.00	$ 150,000.00
26	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 1,509,823.00
				30% Contingency	$ 452,946.90
				Total	$ 1,962,769.90
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 588,830.97
	Total Opinion of Project Cost				$ 2,551,600.87

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Brownlea Drive Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 35,012.00	$ 35,012.00
2	Comprehensive Grading*	1	LS	$ 58,352.00	$ 58,352.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	250	CY	$ 25.00	$ 6,250.00
5	Hauling	250	CY	$ 4.00	$ 1,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (15" - 18" dia)	163	LF	$ 20.00	$ 3,260.00
8	Pipe removal (24" - 36" dia)	447	LF	$ 30.00	$ 13,410.00
9	24" R.C. Pipe Culvert, Class III	163	LF	$ 70.00	$ 11,410.00
10	30" R.C. Pipe Culvert, Class III	447	LF	$ 90.00	$ 40,230.00
11	Drainage Structures, Inlet	3	EA	$ 3,000.00	$ 9,000.00
12	Drainage Structures, Manhole	2	EA	$ 3,500.00	$ 7,000.00
13	Concrete Curb and Gutter	610	LF	$ 35.00	$ 21,350.00
14	Asphalt Replacement (Surface, Base Course, & Milling)	1,130	SY	$ 55.00	$ 62,150.00
18	4" Concrete Sidewalk	165	LF	$ 40.00	$ 6,600.00
15	#57 Stone (Bedding)	140	TN	$ 65.00	$ 9,100.00
16	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
17	Utility Relocations (Minor Water line adjustments)**	2	LS	$ 5,000.00	$ 10,000.00
18	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
19	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 385,124.00
				30% Contingency	$ 115,537.20
				Total	$ 500,661.20
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 150,198.36
				Total Opinion of Project Cost	$ 650,859.56

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Cedar Lane Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 34,973.00	$ 34,973.00
2	Comprehensive Grading*	1	LS	$ 58,288.00	$ 58,288.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	250	CY	$ 25.00	$ 6,250.00
5	Hauling	250	CY	$ 4.00	$ 1,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (15" - 18" dia)	273	LF	$ 20.00	$ 5,460.00
8	Pipe removal (24" - 36" dia)	18	LF	$ 30.00	$ 540.00
9	15" R.C. Pipe Culvert, Class III	443	LF	$ 50.00	$ 22,150.00
	18" R.C. Pipe Culvert, Class III	392	LF	$ 55.00	$ 21,560.00
11	24" R.C. Pipe Culvert, Class III	18	LF	$ 70.00	$ 1,260.00
12	36" R.C. Pipe Culvert, Class III	21	LF	$ 120.00	$ 2,520.00
15	Drainage Structures, Inlet	6	EA	$ 3,000.00	$ 18,000.00
16	Drainage Structures, Manhole	2	EA	$ 3,500.00	$ 7,000.00
17	Drainage Structures, DOT Standard Endwall	2	EA	$ 6,000.00	$ 12,000.00
18	Concrete Curb and Gutter	280	LF	$ 35.00	$ 9,800.00
19	Asphalt Replacement (Surface, Base Course, & Milling)	780	SY	$ 55.00	$ 42,900.00
20	4" Concrete Sidewalk	500	LF	$ 40.00	$ 20,000.00
21	#57 Stone (Bedding)	200	TN	$ 65.00	$ 13,000.00
22	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
23	Up to 8" DIP Water Line (incl. removal and replacement)	200	LF	$ 135.00	$ 27,000.00
24	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
25	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 384,701.00
				30% Contingency	$ 115,410.30
				Total	$ 500,111.30
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 150,033.39
	Total Opinion of Project Cost				$ 650,144.69

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Circle Drive Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 90,350.00	$ 90,350.00
2	Comprehensive Grading*	1	LS	$ 150,582.00	$ 150,582.00
3	Erosion Control (2-5 acre LOD)	1	LS	$ 30,000.00	$ 30,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	Pipe removal (15" - 18" dia)	1,069	LF	$ 20.00	$ 21,380.00
8	Pipe removal (24" - 36" dia)	191	LF	$ 30.00	$ 5,730.00
10	24" R.C. Pipe Culvert, Class III	881	LF	$ 70.00	$ 61,670.00
11	36" R.C. Pipe Culvert, Class III	1,553	LF	$ 120.00	$ 186,360.00
13	48" R.C. Pipe Culvert, Class III	32	LF	$ 180.00	$ 5,760.00
14	Drainage Structures, Inlet	8	EA	$ 3,000.00	$ 24,000.00
15	Drainage Structures, Manhole	4	EA	$ 3,500.00	$ 14,000.00
16	Concrete Curb and Gutter	670	LF	$ 35.00	$ 23,450.00
17	6" Concrete Driveway Replacement	7	EA	$ 1,500.00	$ 10,500.00
18	Asphalt Replacement (Surface, Base Course, & Milling)	1,280	SY	$ 55.00	$ 70,400.00
19	#57 Stone (Bedding)	720	TN	$ 65.00	$ 46,800.00
20	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
21	Up to 8" DIP Sewer Line (incl. removal and replacement)	936	LF	$ 135.00	$ 126,360.00
22	Sewer Structures, Manhole	4	EA	$ 3,000.00	$ 12,000.00
23	Utility Relocations (Minor Water line adjustments)**	4	LS	$ 5,000.00	$ 20,000.00
24	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
25	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 993,842.00
				30% Contingency	$ 298,152.60
				Total	$ 1,291,994.60
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 387,598.38
				Total Opinion of Project Cost	$ 1,679,592.98

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Commerce Street Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 23,034.00	$ 23,034.00
2	Comprehensive Grading*	1	LS	$ 38,390.00	$ 38,390.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	250	CY	$ 25.00	$ 6,250.00
5	Hauling	250	CY	$ 4.00	$ 1,000.00
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
13	42" R.C. Pipe Culvert, Class III	381	LF	$ 150.00	$ 57,150.00
14	Drainage Structures, Inlet	1	EA	$ 3,000.00	$ 3,000.00
15	Drainage Structures, Manhole	3	EA	$ 3,500.00	$ 10,500.00
16	Concrete Curb and Gutter	120	LF	$ 35.00	$ 4,200.00
17	6" Concrete Driveway Replacement	1	EA	$ 1,500.00	$ 1,500.00
18	Asphalt Replacement (Surface, Base Course, & Milling)	240	SY	$ 55.00	$ 13,200.00
19	#57 Stone (Bedding)	110	TN	$ 65.00	$ 7,150.00
20	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
21	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
22	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 253,374.00
				30% Contingency	$ 76,012.20
				Total	$ 329,386.20
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 98,815.86
				Total Opinion of Project Cost	$ 428,202.06

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Dellwood Drive Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 40,588.00	$ 40,588.00
2	Comprehensive Grading*	1	LS	$ 67,645.44	$ 67,645.44
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	250	CY	$ 25.00	$ 6,250.00
5	Hauling	250	CY	$ 4.00	$ 1,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (15" - 18" dia)	247	LF	$ 20.00	$ 4,940.00
10	24" R.C. Pipe Culvert, Class III	34	LF	$ 70.00	$ 2,380.00
12	36" R.C. Pipe Culvert, Class III	600	LF	$ 120.00	$ 72,000.00
14	Drainage Structures, Inlet	7	EA	$ 3,000.00	$ 21,000.00
15	Drainage Structures, Manhole	2	EA	$ 3,500.00	$ 7,000.00
16	Concrete Curb and Gutter	641	LF	$ 35.00	$ 22,435.00
17	6" Concrete Driveway Replacement	4	EA	$ 1,500.00	$ 6,000.00
18	Asphalt Replacement (Surface, Base Course, & Milling)	1,222	SY	$ 55.00	$ 67,222.22
19	#57 Stone (Bedding)	190	TN	$ 65.00	$ 12,350.00
20	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
21	Up to 8" DIP Water Line (incl. removal and replacement)	190	LF	$ 135.00	$ 25,650.00
22	Sewer Structures, Manhole	3	EA	$ 3,000.00	$ 9,000.00
23	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
24	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 446,460.67
				30% Contingency	$ 133,938.20
				Total	$ 580,398.87
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 174,119.66
				Total Opinion of Project Cost	$ 754,518.53

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Greenbriar Drive Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 41,480.00	$ 41,480.00
2	Comprehensive Grading*	1	LS	$ 69,133.00	$ 69,133.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (42" - 60" dia)	192	LF	$ 35.00	$ 6,720.00
8	48" R.C. Pipe Culvert, Class III	98	LF	$ 180.00	$ 17,640.00
9	60" R.C. Pipe Culvert, Class III	248	LF	$ 225.00	$ 55,800.00
10	72" R.C. Pipe Culvert, Class III	192	LF	$ 320.00	$ 61,440.00
11	Channel Grading including seeding	820	SY	$ 15.00	$ 12,305.00
12	Drainage Structures, Inlet	1	EA	$ 3,000.00	$ 3,000.00
13	Drainage Structures, Manhole	4	EA	$ 3,500.00	$ 14,000.00
14	Drainage Structures, DOT Standard Endwall	4	EA	$ 6,000.00	$ 24,000.00
15	Concrete Curb and Gutter	96	LF	$ 35.00	$ 3,360.00
16	6" Concrete Driveway Replacement	3	EA	$ 1,500.00	$ 4,500.00
17	Asphalt Replacement (Surface, Base Course, & Milling)	230	SY	$ 55.00	$ 12,650.00
18	#57 Stone (Bedding)	150	TN	$ 65.00	$ 9,750.00
19	Traffic Control (4+ lane road or multiple 2-lane roads)	1	LS	$ 20,000.00	$ 20,000.00
20	Utility Relocations (Minor Water line adjustments)**	3	LS	$ 5,000.00	$ 15,000.00
21	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
22	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 456,278.00
				30% Contingency	$ 136,883.40
				Total	$ 593,161.40
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 177,948.42
				Total Opinion of Project Cost	$ 771,109.82

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Lakewood Subdivision Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 29,716.00	$ 29,716.00
2	Comprehensive Grading*	1	LS	$ 49,526.00	$ 49,526.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	24" R.C. Pipe Culvert, Class III	2,079	LF	$ 70.00	$ 145,530.00
11	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
12	Drainage Structures, Manhole	6	EA	$ 3,500.00	$ 21,000.00
13	Drainage Structures, DOT Standard Endwall	1	EA	$ 6,000.00	$ 6,000.00
17	#57 Stone (Bedding)	440	TN	$ 65.00	$ 28,600.00
18	Rip Rap Stone, Class 1	100	TN	$ 70.00	$ 7,000.00
				Subtotal	$ 326,872.00
				30% Contingency	$ 98,061.60
				Total	$ 424,933.60
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 127,480.08
				Total Opinion of Project Cost	$ 552,413.68

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Jaycee Park Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 25,648.00	$ 25,648.00
2	Comprehensive Grading*	1	LS	$ 42,746.00	$ 42,746.00
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	Pipe removal (24" - 36" dia)	554	LF	$ 30.00	$ 16,620.00
8	30" R.C. Pipe Culvert, Class III	34	LF	$ 90.00	$ 3,060.00
9	36" R.C. Pipe Culvert, Class III	520	LF	$ 120.00	$ 62,400.00
10	Drainage Structures, Inlet	2	EA	$ 3,000.00	$ 6,000.00
11	Drainage Structures, DOT Standard Endwall	1	EA	$ 6,000.00	$ 6,000.00
12	Drainage Structures, Manhole	1	EA	$ 3,500.00	$ 3,500.00
13	Concrete Curb and Gutter	60	LF	$ 35.00	$ 2,100.00
14	Asphalt Replacement (Surface, Base Course, & Milling)	120	SY	$ 55.00	$ 6,600.00
15	#57 Stone (Bedding)	130	TN	$ 65.00	$ 8,450.00
16	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
17	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
18	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
19	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 282,124.00
				30% Contingency	$ 84,637.20
				Total	$ 366,761.20
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 110,028.36
				Total Opinion of Project Cost	$ 476,789.56

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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Slay Drive Secondary System

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 88,346.00	$ 88,346.00
2	Comprehensive Grading*	1	LS	$ 147,242.44	$ 147,242.44
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Select Material	500	CY	$ 25.00	$ 12,500.00
5	Hauling	500	CY	$ 4.00	$ 2,000.00
6	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
7	Pipe removal (15" - 18" dia)	497	LF	$ 20.00	$ 9,940.00
8	Pipe removal (24" - 36" dia)	732	LF	$ 30.00	$ 21,960.00
9	24" R.C. Pipe Culvert, Class III	466	LF	$ 70.00	$ 32,620.00
10	30" R.C. Pipe Culvert, Class III	580	LF	$ 90.00	$ 52,200.00
11	42" R.C. Pipe Culvert, Class III	183	LF	$ 150.00	$ 27,450.00
12	Drainage Structures, Inlet	7	EA	$ 3,000.00	$ 21,000.00
13	Drainage Structures, Manhole	2	EA	$ 3,500.00	$ 7,000.00
14	Drainage Structures, DOT Standard Endwall	1	EA	$ 6,000.00	$ 6,000.00
15	Concrete Curb and Gutter	2,090	LF	$ 35.00	$ 73,150.00
16	6" Concrete Driveway Replacement	19	EA	$ 1,500.00	$ 28,500.00
17	Asphalt Replacement (Surface, Base Course, & Milling)	3,086	SY	$ 55.00	$ 169,742.22
18	#57 Stone (Bedding)	430	TN	$ 65.00	$ 27,950.00
19	Rip Rap Stone, Class 1	50	TN	$ 70.00	$ 3,500.00
20	Traffic Control (Single 2-lane road)	1	LS	$ 10,000.00	$ 10,000.00
21	Up to 8" DIP Sewer Line (incl. removal and replacement)	1020	LF	$ 135.00	$ 137,700.00
22	Sewer Structures, Manhole	6	EA	$ 3,000.00	$ 18,000.00
23	Utility Relocations (Substantial sanitary sewer and water line adjustments)**	1	LS	$ 30,000.00	$ 30,000.00
24	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 971,800.67
				30% Contingency	$ 291,540.20
				Total	$ 1,263,340.87
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 379,002.26
				Total Opinion of Project Cost	$ 1,642,343.13

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

** Cost for utility conflicts include all utilities that need to be moved including sanitary sewer and potable water lines. Additional survey may be required to locate pressurized utilities.

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G.3 Stream Stabilization

Dickinson Avenue Stream Stabilization (Site 3)

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 48,954.14	$ 48,954.14
2	Comprehensive Grading*	1	LS	$ 40,795.12	$ 40,795.12
3	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.6	AC	$ 5,000.00	$ 3,170.91
7	Hauling	550	CY	$ 4.00	$ 2,200.00
8	Vegetated Soil Lift	750	SFF	$ 40.00	$ 30,000.00
9	Permanent Coir Matting	3,070	SY	$ 4.00	$ 12,280.00
10	Seeding and Mulching	0.2	AC	$ 7,500.00	$ 1,162.19
11	Riparian Seed Mix	2,153	SY	$ 1.50	$ 3,229.17
12	Live Staking	244	SY	$ 15.00	$ 3,666.67
13	Shrubs (1 gallon)	380	EA	$ 55.00	$ 20,900.00
14	Tree (1.5" caliper)	110	EA	$ 150.00	$ 16,500.00
15	Top Soil	240	CY	$ 80.00	$ 19,200.00
16	Mulch (placed and tilled into topsoil)	240	CY	$ 150.00	$ 36,000.00
17	Channel Grading including seeding	978	SY	$ 15.00	$ 14,666.67
				Subtotal	$ 293,724.87
				30% Contingency	$ 88,117.46
				Total	$ 381,842.33
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 114,552.70
	Total Opinion of Project Cost				$ 496,395.03

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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South Elm Street Stream Stabilization (Site 7)					
Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 43,597.11	$ 43,597.11
2	Comprehensive Grading*	1	LS	$ 36,330.92	$ 36,330.92
3	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.2	AC	$ 5,000.00	$ 1,033.06
7	Hauling	30	CY	$ 4.00	$ 120.00
8	Vegetated Soil Lift	1,500	SFF	$ 40.00	$ 60,000.00
9	Permanent Coir Matting	3,810	SY	$ 4.00	$ 15,240.00
10	Seeding and Mulching	0.2	AC	$ 7,500.00	$ 1,489.33
11	Riparian Seed Mix	833	SY	$ 1.50	$ 1,250.00
12	Live Staking	67	SY	$ 15.00	$ 1,000.00
13	Shrubs (1 gallon)	100	EA	$ 55.00	$ 5,500.00
14	Tree (1.5" caliper)	30	EA	$ 150.00	$ 4,500.00
15	Top Soil	160	CY	$ 80.00	$ 12,800.00
16	Mulch (placed and tilled into topsoil)	160	CY	$ 150.00	$ 24,000.00
17	Asphalt Replacement (Surface, Base Course, & Milling)	222	SY	$ 55.00	$ 12,222.22
18	Channel Grading including seeding	100	SY	$ 15.00	$ 1,500.00
				Subtotal	$ 261,582.63
				30% Contingency	$ 78,474.79
				Total	$ 340,057.42
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 102,017.23
				Total Opinion of Project Cost	$ 442,074.65

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Cedar Lane Stream Stabilization (Site 9)					
Item Number	**Item Description**	**Quantity**	**Unit**	**Unit Price**	**Amount**
1	Mobilization	1	LS	$ 39,466.86	$ 39,466.86
2	Comprehensive Grading*	1	LS	$ 32,889.05	$ 32,889.05
3	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.7	AC	$ 5,000.00	$ 3,409.09
7	Hauling	630	CY	$ 4.00	$ 2,520.00
8	Permanent Coir Matting	2,380	SY	$ 4.00	$ 9,520.00
9	Seeding and Mulching	0.4	AC	$ 7,500.00	$ 3,004.48
10	Riparian Seed Mix	1,361	SY	$ 1.50	$ 2,041.67
11	Live Staking	67	SY	$ 15.00	$ 1,000.00
12	Shrubs (1 gallon)	340	EA	$ 55.00	$ 18,700.00
13	Tree (1.5" caliper)	100	EA	$ 150.00	$ 15,000.00
14	Top Soil	275	CY	$ 80.00	$ 22,000.00
15	Mulch (placed and tilled into topsoil)	275	CY	$ 150.00	$ 41,250.00
16	Channel Grading including seeding	333	SY	$ 15.00	$ 5,000.00
				Subtotal	$ 236,801.14
				30% Contingency	$ 71,040.34
				Total	$ 307,841.48
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 92,352.44
				Total Opinion of Project Cost	$ 400,193.92

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Forest Hill Stream Stabilization Drive

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 81,077.07	$ 81,077.07
2	Comprehensive Grading*	1	LS	$ 67,564.23	$ 67,564.23
3	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.6	AC	$ 5,000.00	$ 3,000.00
7	Hauling	336	CY	$ 4.00	$ 1,344.00
8	Permanent Coir Matting	6,100	SY	$ 4.00	$ 24,400.00
9	Seeding and Mulching	0.3	AC	$ 7,500.00	$ 2,410.47
10	Riparian Seed Mix	2,722	SY	$ 1.50	$ 4,083.33
11	Live Staking	622	SY	$ 15.00	$ 9,333.33
12	Shrubs (1 gallon)	550	EA	$ 55.00	$ 30,250.00
13	Tree (1.5" caliper)	150	EA	$ 150.00	$ 22,500.00
14	Top Soil	350	CY	$ 80.00	$ 28,000.00
15	Mulch (placed and tilled into topsoil)	350	CY	$ 150.00	$ 52,500.00
16	Vegetated Soil Lift	2,800	SFF	$ 40.00	$ 112,000.00
17	Channel Grading including seeding	467	SY	$ 15.00	$ 7,000.00
				Subtotal	$ 486,462.43
				30% Contingency	$ 145,938.73
				Total	$ 632,401.16
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 189,720.35
	Total Opinion of Project Cost				$ 822,121.51

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Evans Street Stream Stabilization

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 109,505.09	$ 109,505.09
2	Comprehensive Grading*	1	LS	$ 91,254.24	$ 91,254.24
3	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.2	AC	$ 5,000.00	$ 1,000.00
7	Hauling	1,470	CY	$ 4.00	$ 5,880.00
8	Vegetated Soil Lift	3,300	SFF	$ 40.00	$ 132,000.00
9	Permanent Coir Matting	12,965	SY	$ 4.00	$ 51,860.00
10	Seeding and Mulching	0.2	AC	$ 7,500.00	$ 1,704.55
11	Riparian Seed Mix	5,007	SY	$ 1.50	$ 7,510.00
12	Live Staking	244	SY	$ 15.00	$ 3,666.67
13	Shrubs (1 gallon)	830	EA	$ 55.00	$ 45,650.00
14	Tree (1.5" caliper)	240	EA	$ 150.00	$ 36,000.00
15	Top Soil	500	CY	$ 80.00	$ 40,000.00
16	Mulch (placed and tilled into topsoil)	500	CY	$ 150.00	$ 75,000.00
17	Channel Grading including seeding	733	SY	$ 15.00	$ 11,000.00
				Subtotal	$ 657,030.55
				30% Contingency	$ 197,109.16
				Total	$ 854,139.71
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 256,241.91
				Total Opinion of Project Cost	$ 1,110,381.62

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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St. Andrews Drive Stream Stabilization

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 338,488.84	$ 338,488.84
2	Comprehensive Grading*	1	LS	$ 277,774.03	$ 277,774.03
3	Construction Staking (Greater than $800,000)	1	LS	$ 10,000.00	$ 10,000.00
4	Erosion Control (2-5 acre LOD)	1	LS	$ 30,000.00	$ 30,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	3.4	AC	$ 5,000.00	$ 17,000.00
7	Hauling	5,433	CY	$ 4.00	$ 21,732.00
8	Log Grade Control Structure	6	EA	$ 2,000.00	$ 12,000.00
9	Seeding and Mulching	2.1	AC	$ 7,500.00	$ 15,470.39
10	Riparian Seed Mix	14,333	SY	$ 1.50	$ 21,500.00
11	Shrubs (1 gallon)	2,560	EA	$ 55.00	$ 140,800.00
12	Tree (1.5" caliper)	730	EA	$ 150.00	$ 109,500.00
13	Top Soil	2,035	CY	$ 80.00	$ 162,800.00
14	Mulch (placed and tilled into topsoil)	2,035	CY	$ 150.00	$ 305,250.00
15	Gabion Wall	1,250	LF	$ 300.00	$ 375,000.00
16	Live Staking	1,647	SY	$ 15.00	$ 24,700.00
16	Asphalt Replacement (Surface, Base Course, & Milling)	278	SY	$ 55.00	$ 15,277.78
17	Permanent Coir Matting	26,960	SY	$ 4.00	$ 107,840.00
18	Channel Grading including seeding	1,720	SY	$ 15.00	$ 25,800.00
				Subtotal	$ 2,030,933.04
				30% Contingency	$ 609,279.91
				Total	$ 2,640,212.95
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 792,063.88
				Total Opinion of Project Cost	$ 3,432,276.83

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Greenway at East 10th Street Stream Stabilization

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 31,973.41	$ 31,973.41
2	Comprehensive Grading*	1	LS	$ 26,644.51	$ 26,644.51
3	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Vegetated Soil Lift	1,000	SFF	$ 40.00	$ 40,000.00
7	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 946.97
8	Riparian Seed Mix	111	SY	$ 1.50	$ 166.67
9	Live Staking	44	SY	$ 15.00	$ 666.67
10	Shrubs (1 gallon)	48	EA	$ 55.00	$ 2,640.00
11	Tree (1.5" caliper)	4	EA	$ 150.00	$ 600.00
12	Top Soil	130	CY	$ 80.00	$ 10,400.00
13	Mulch (placed and tilled into topsoil)	130	CY	$ 150.00	$ 19,500.00
14	Asphalt Replacement (Surface, Base Course, & Milling)	222	SY	$ 55.00	$ 12,222.22
15	Permanent Coir Matting	2,020	SY	$ 4.00	$ 8,080.00
				Subtotal	$ 191,840.44
				30% Contingency	$ 57,552.13
				Total	$ 249,392.57
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 74,817.77
				Total Opinion of Project Cost	$ 324,210.34

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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East 10th Street at Rock Spring Road Stream Stabilization

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 23,571.20	$ 23,571.20
2	Comprehensive Grading*	1	LS	$ 15,809.33	$ 15,809.33
3	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
4	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
5	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
6	Clearing & Grubbing	0.5	AC	$ 5,000.00	$ 2,500.00
7	Hauling	83	CY	$ 4.00	$ 333.33
8	Select Material	83	CY	$ 25.00	$ 2,083.33
9	18" R.C. Pipe Culvert, Class III	16	LF	$ 55.00	$ 880.00
10	Seeding and Mulching	0.5	AC	$ 7,500.00	$ 3,750.00
11	Gabion Wall	75	LF	$ 300.00	$ 22,500.00
12	Live Staking	100	SY	$ 15.00	$ 1,500.00
13	4" Concrete Sidewalk	100	LF	$ 40.00	$ 4,000.00
14	Concrete Curb and Gutter	100	LF	$ 35.00	$ 3,500.00
15	Channel Grading including seeding	200	SY	$ 15.00	$ 3,000.00
16	Utility Relocations (Other Utility conflicts)**	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 141,427.20
				30% Contingency	$ 42,428.16
				Total	$ 183,855.36
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 55,156.61
				Total Opinion of Project Cost	$ 239,011.97

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

G.4 Stormwater Best Management Practices

J.H. Rose High School - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 9,349.48	$ 9,349.48
2	Comprehensive Grading*	1	LS	$ 15,582.47	$ 15,582.47
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	1,354	CY	$ 25.00	$ 33,852.78
5	Hauling	1,354	CY	$ 4.00	$ 5,416.44
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	1,580	SF	$ 2.00	$ 3,159.50
8	Seeding and Mulching	0.4	AC	$ 7,500.00	$ 3,320.76
9	6' Chain Link Fence w/ Barbed Wire	632	LF	$ 15.45	$ 9,762.85
10	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
11	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
				Subtotal	$ 102,844.29
				30% Contingency	$ 30,853.29
				Total	$ 133,697.58
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 40,109.27
				Total Opinion of Project Cost	$ 173,806.85

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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ECU Athletic Maintenance Building - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 8,286.85	$ 8,286.85
2	Comprehensive Grading*	1	LS	$ 13,811.41	$ 13,811.41
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	1,255	CY	$ 25.00	$ 31,362.50
5	Hauling	1,255	CY	$ 4.00	$ 5,018.00
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	2,669	SF	$ 2.00	$ 5,338.00
8	Seeding and Mulching	0.7	AC	$ 7,500.00	$ 5,338.55
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
				Subtotal	$ 91,155.31
				30% Contingency	$ 27,346.59
				Total	$ 118,501.90
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 35,550.57
				Total Opinion of Project Cost	$ 154,052.47

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Greenville Square Shopping Center - Wetland

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 23,836.24	$ 23,836.24
2	Comprehensive Grading*	1	LS	$ 39,727.07	$ 39,727.07
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	2,753	CY	$ 25.00	$ 68,831.94
5	Hauling	2,753	CY	$ 4.00	$ 11,013.11
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	2,828	SF	$ 2.00	$ 5,656.50
8	Seeding and Mulching	1.2	AC	$ 7,500.00	$ 8,741.27
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	Clearing & Grubbing	1.2	AC	$ 5,000.00	$ 5,827.51
11	Fence Removal / Replacement	1,131	LF	$ 50.00	$ 56,565.00
12	Dewatering during Construction	1	LS	$ 20,000.00	$ 20,000.00
				Subtotal	$ 262,198.65
				30% Contingency	$ 78,659.59
				Total	$ 340,858.24
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 102,257.47
				Total Opinion of Project Cost	$ 443,115.72

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Pirates Pointe Shopping Center - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 4,107.14	$ 4,107.14
2	Comprehensive Grading*	1	LS	$ 6,845.23	$ 6,845.23
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	193	CY	$ 25.00	$ 4,827.78
5	Hauling	193	CY	$ 4.00	$ 772.44
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	631	SF	$ 2.00	$ 1,261.50
8	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 1,066.39
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	252	LF	$ 15.45	$ 3,898.04
11	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
				Subtotal	$ 45,178.52
				30% Contingency	$ 13,553.55
				Total	$ 58,732.07
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 17,619.62
				Total Opinion of Project Cost	$ 76,351.69

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Greenville Mall - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 25,036.08	$ 25,036.08
2	Comprehensive Grading*	1	LS	$ 41,726.80	$ 41,726.80
3	Erosion Control (2-5 acre LOD)	1	LS	$ 30,000.00	$ 30,000.00
4	Excavation	3,697	CY	$ 25.00	$ 92,416.67
5	Hauling	3,697	CY	$ 4.00	$ 14,786.67
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	3,981	SF	$ 2.00	$ 7,961.50
8	Seeding and Mulching	2.4	AC	$ 7,500.00	$ 18,190.89
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	1,592	LF	$ 15.45	$ 24,601.04
11	20' Roadway Gates	2	EA	$ 400.00	$ 800.00
12	4' Personnel Gates	2	EA	$ 375.00	$ 750.00
13	Clearing & Grubbing	2.4	AC	$ 5,000.00	$ 12,127.26
				Subtotal	$ 275,396.91
				30% Contingency	$ 82,619.07
				Total	$ 358,015.98
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 107,404.79
	Total Opinion of Project Cost				$ 465,420.78

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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University Commons Shopping Center - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 16,014.67	$ 16,014.67
2	Comprehensive Grading*	1	LS	$ 26,691.11	$ 26,691.11
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	2,400	CY	$ 25.00	$ 60,011.11
5	Hauling	2,400	CY	$ 4.00	$ 9,601.78
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	3,874	SF	$ 2.00	$ 7,747.00
8	Seeding and Mulching	1.3	AC	$ 7,500.00	$ 9,382.44
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	1,549	LF	$ 15.45	$ 23,938.23
11	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
12	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
				Subtotal	$ 176,161.34
				30% Contingency	$ 52,848.40
				Total	$ 229,009.74
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 68,702.92
	Total Opinion of Project Cost				$ 297,712.66

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Guy Smith Park - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 8,864.57	$ 8,864.57
2	Comprehensive Grading*	1	LS	$ 14,774.28	$ 14,774.28
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	518	CY	$ 25.00	$ 12,955.56
5	Hauling	518	CY	$ 4.00	$ 2,072.89
6	Soil Media	259	CY	$ 50.00	$ 12,955.56
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	875	SF	$ 2.00	$ 1,749.00
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 602.27
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 stone (Bedding)	9	TN	$ 65.00	$ 589.48
12	Sand 2S	65	CY	$ 60.00	$ 3,886.67
13	8” Perforated PVC Underdrain	70	LF	$ 10.00	$ 700.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
15	18" R.C. Pipe Culvert, Class III	143	LF	$ 55.00	$ 7,865.00
16	Drainage Structures, Manhole	1	EA	$ 3,500.00	$ 3,500.00
17	Asphalt Replacement (Surface, Base Course, & Milling)	89	SY	$ 55.00	$ 4,895.00
				Subtotal	$ 97,510.27
				30% Contingency	$ 29,253.08
				Total	$ 126,763.35
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 38,029.01
				Total Opinion of Project Cost	$ 164,792.36

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

S. Greenville Elementary School - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 9,386.17	$ 9,386.17
2	Comprehensive Grading*	1	LS	$ 15,643.62	$ 15,643.62
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	695	CY	$ 25.00	$ 17,377.78
5	Hauling	695	CY	$ 4.00	$ 2,780.44
6	Soil Media	348	CY	$ 50.00	$ 17,377.78
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	1,173	SF	$ 2.00	$ 2,346.00
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 1,062.07
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 stone (Bedding)	12	TN	$ 65.00	$ 790.69
12	Sand 2S	87	CY	$ 60.00	$ 5,213.33
13	8" Perforated PVC Underdrain	70	LF	$ 10.00	$ 700.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
15	18" R.C. Pipe Culvert, Class III	154	LF	$ 55.00	$ 8,470.00
				Subtotal	$ 103,247.88
				30% Contingency	$ 30,974.36
				Total	$ 134,222.25
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 40,266.67
	Total Opinion of Project Cost				$ 174,488.92

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Carolina East Mall - Stormwater Wetland

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 18,028.90	$ 18,028.90
2	Comprehensive Grading*	1	LS	$ 30,048.17	$ 30,048.17
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	1,885	CY	$ 25.00	$ 47,121.30
5	Hauling	1,885	CY	$ 4.00	$ 7,539.41
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	2,279	SF	$ 2.00	$ 4,557.50
8	Seeding and Mulching	1.8	AC	$ 7,500.00	$ 13,603.58
9	Fence Removal / Replacement	912	LF	$ 50.00	$ 45,575.00
10	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
11	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
12	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
13	Clearing & Grubbing	1.8	AC	$ 5,000.00	$ 9,069.05
				Subtotal	$ 198,317.91
				30% Contingency	$ 59,495.37
				Total	$ 257,813.28
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 77,343.98
				Total Opinion of Project Cost	$ 335,157.26

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Hastings Ford Dealership - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 14,154.95	$ 14,154.95
2	Comprehensive Grading*	1	LS	$ 23,591.59	$ 23,591.59
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	876	CY	$ 25.00	$ 21,908.33
5	Hauling	876	CY	$ 4.00	$ 3,505.33
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	1,972	SF	$ 2.00	$ 3,943.50
8	Seeding and Mulching	0.3	AC	$ 7,500.00	$ 2,011.67
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	#57 stone (Bedding)	20	TN	$ 65.00	$ 1,329.11
11	Sand 2S	146	CY	$ 60.00	$ 8,763.33
12	8” Perforated PVC Underdrain	640	LF	$ 10.00	$ 6,400.00
13	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
14	Soil Media	876	CY	$ 50.00	$ 43,816.67
15	18" R.C. Pipe Culvert, Class III	76	LF	$ 55.00	$ 4,180.00
				Subtotal	$ 155,704.49
				30% Contingency	$ 46,711.35
				Total	$ 202,415.83
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 60,724.75
	Total Opinion of Project Cost				$ 263,140.59

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Jiffy Lube - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 5,683.30	$ 5,683.30
2	Comprehensive Grading*	1	LS	$ 9,472.17	$ 9,472.17
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	228	CY	$ 25.00	$ 5,688.89
5	Hauling	228	CY	$ 4.00	$ 910.22
6	Soil Media	228	CY	$ 50.00	$ 11,377.78
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	768	SF	$ 2.00	$ 1,536.00
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 816.96
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 stone (Bedding)	8	TN	$ 65.00	$ 517.69
12	Sand 2S	57	CY	$ 60.00	$ 3,413.33
13	8” Perforated PVC Underdrain	100	LF	$ 10.00	$ 1,000.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
				Subtotal	$ 62,516.35
				30% Contingency	$ 18,754.90
				Total	$ 81,271.25
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 24,381.38
	Total Opinion of Project Cost				$ 105,652.63

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Jaycee Park - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 9,639.33	$ 9,639.33
2	Comprehensive Grading*	1	LS	$ 16,065.54	$ 16,065.54
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	1,489	CY	$ 25.00	$ 37,214.81
5	Hauling	1,489	CY	$ 4.00	$ 5,954.37
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	2,512	SF	$ 2.00	$ 5,024.00
8	Seeding and Mulching	0.3	AC	$ 7,500.00	$ 2,090.22
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	372	LF	$ 15.45	$ 5,744.31
11	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
12	Convert Yard Inlet to Junction Box	1	EA	$ 1,500.00	$ 1,500.00
13	Curb Cut	1	EA	$ 400.00	$ 400.00
				Subtotal	$ 106,032.58
				30% Contingency	$ 31,809.78
				Total	$ 137,842.36
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 41,352.71
				Total Opinion of Project Cost	$ 179,195.07

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Andrew A. Best Freedom Park - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 5,302.47	$ 5,302.47
2	Comprehensive Grading*	1	LS	$ 8,837.45	$ 8,837.45
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	177	CY	$ 25.00	$ 4,427.78
5	Hauling	177	CY	$ 4.00	$ 708.44
6	Soil Media	88	CY	$ 50.00	$ 4,411.11
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	298	SF	$ 2.00	$ 595.50
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 575.93
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 stone (Bedding)	3	TN	$ 65.00	$ 200.71
12	Sand 2S	22	CY	$ 60.00	$ 1,323.33
13	8” Perforated PVC Underdrain	100	LF	$ 10.00	$ 1,000.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
15	Concrete Curb and Gutter	30	LF	$ 35.00	$ 1,050.00
16	Asphalt Replacement (Surface, Base Course, & Milling)	44	SY	$ 55.00	$ 2,444.44
17	6" Concrete Driveway Replacement	1	EA	$ 1,500.00	$ 1,500.00
18	18" R.C. Pipe Culvert, Class III	70	LF	$ 55.00	$ 3,850.00
				Subtotal	$ 58,327.17
				30% Contingency	$ 17,498.15
				Total	$ 75,825.31
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 22,747.59
	Total Opinion of Project Cost				$ 98,572.91

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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First Pentecostal Holiness Church - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 9,134.18	$ 9,134.18
2	Comprehensive Grading*	1	LS	$ 15,223.64	$ 15,223.64
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	1,450	CY	$ 25.00	$ 36,248.15
5	Hauling	1,450	CY	$ 4.00	$ 5,799.70
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	1,099	SF	$ 2.00	$ 2,198.50
8	Seeding and Mulching	0.3	AC	$ 7,500.00	$ 2,303.46
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	440	LF	$ 15.45	$ 6,793.36
11	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
12	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
				Subtotal	$ 100,475.99
				30% Contingency	$ 30,142.80
				Total	$ 130,618.79
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 39,185.64
				Total Opinion of Project Cost	$ 169,804.43

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

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Dream Park - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 7,477.38	$ 7,477.38
2	Comprehensive Grading*	1	LS	$ 12,462.29	$ 12,462.29
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	397	CY	$ 25.00	$ 9,921.30
5	Hauling	397	CY	$ 4.00	$ 1,587.41
6	Soil Media	238	CY	$ 50.00	$ 11,905.56
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	536	SF	$ 2.00	$ 1,071.50
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 683.45
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 stone (Bedding)	6	TN	$ 65.00	$ 361.14
12	Sand 2S	40	CY	$ 60.00	$ 2,381.11
13	8” Perforated PVC Underdrain	130	LF	$ 10.00	$ 1,300.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
15	Convert Yard Inlet to Junction Box	2	EA	$ 1,500.00	$ 3,000.00
16	Curb Cut	2	EA	$ 400.00	$ 800.00
17	18" R.C. Pipe Culvert, Class IV	120	LF	$ 60.00	$ 7,200.00
				Subtotal	$ 82,251.13
				30% Contingency	$ 24,675.34
				Total	$ 106,926.46
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 32,077.94
				Total Opinion of Project Cost	$ 139,004.40

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Eastern Elementary School - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 48,067.65	$ 48,067.65
2	Comprehensive Grading*	1	LS	$ 80,112.74	$ 80,112.74
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	12,188	CY	$ 25.00	$ 304,694.44
5	Hauling	12,188	CY	$ 4.00	$ 48,751.11
6	Construction Staking ($300,000-$800,000)	1	LS	$ 6,000.00	$ 6,000.00
7	BMP Plantings	1,464	SF	$ 2.00	$ 2,928.00
8	Seeding and Mulching	0.7	AC	$ 7,500.00	$ 5,167.65
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	586	LF	$ 15.45	$ 9,047.52
11	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
12	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
13	24" R.C. Pipe Culvert, Class III	60	LF	$ 70.00	$ 4,200.00
				Subtotal	$ 528,744.12
				30% Contingency	$ 158,623.23
				Total	$ 687,367.35
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 206,210.20
				Total Opinion of Project Cost	$ 893,577.55

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Arlington Crossing Shopping Center - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 6,984.25	$ 6,984.25
2	Comprehensive Grading*	1	LS	$ 11,640.41	$ 11,640.41
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	758	CY	$ 25.00	$ 18,952.78
5	Hauling	758	CY	$ 4.00	$ 3,032.44
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	1,434	SF	$ 2.00	$ 2,868.00
8	Seeding and Mulching	0.2	AC	$ 7,500.00	$ 1,711.71
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	574	LF	$ 15.45	$ 8,862.12
11	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
12	20' Roadway Gates	1	EA	$ 400.00	$ 400.00
				Subtotal	$ 76,826.71
				30% Contingency	$ 23,048.01
				Total	$ 99,874.72
				Design, Administration, Fiscal, and Legal (30% of Construction Costs)	$ 29,962.42
				Total Opinion of Project Cost	$ 129,837.13

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Physicians East Medical Center - Wet Detention Basin

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 17,701.81	$ 17,701.81
2	Comprehensive Grading*	1	LS	$ 29,503.01	$ 29,503.01
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	3,191	CY	$ 25.00	$ 79,780.56
5	Hauling	3,191	CY	$ 4.00	$ 12,764.89
6	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
7	BMP Plantings	2,785	SF	$ 2.00	$ 5,569.50
8	Seeding and Mulching	0.8	AC	$ 7,500.00	$ 5,889.22
9	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
10	6' Chain Link Fence w/ Barbed Wire	1,114	LF	$ 15.45	$ 17,209.76
11	4' Personnel Gates	1	EA	$ 375.00	$ 375.00
12	Clearing & Grubbing	0.8	AC	$ 5,000.00	$ 3,926.15
				Subtotal	$ 194,719.89
				30% Contingency	$ 58,415.97
				Total	$ 253,135.86
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 75,940.76
	Total Opinion of Project Cost				$ 329,076.62

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

Wahl Coates Elementary School - Bioretention without IWS

Item Number	Item Description	Quantity	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 6,852.83	$ 6,852.83
2	Comprehensive Grading*	1	LS	$ 11,421.39	$ 11,421.39
3	Erosion Control (1-2 acre LOD)	1	LS	$ 15,000.00	$ 15,000.00
4	Excavation	461	CY	$ 25.00	$ 11,533.33
5	Hauling	461	CY	$ 4.00	$ 1,845.33
6	Soil Media	231	CY	$ 50.00	$ 11,533.33
7	Construction Staking ($0-$300,000)	1	LS	$ 3,000.00	$ 3,000.00
8	BMP Plantings	514	SF	$ 2.00	$ 1,027.00
9	Seeding and Mulching	0.1	AC	$ 7,500.00	$ 533.18
10	BMP Outlet Structure	1	EA	$ 4,000.00	$ 4,000.00
11	#57 Stone (Bedding)	8	TN	$ 65.00	$ 524.77
12	Sand 2S	58	CY	$ 60.00	$ 3,460.00
13	8” Perforated PVC Underdrain	70	LF	$ 10.00	$ 700.00
14	8" PVC Pipe, SDR 35	10	LF	$ 10.00	$ 100.00
15	18" R.C. Pipe Culvert, Class III	70	LF	$ 55.00	$ 3,850.00
				Subtotal	$ 75,381.17
				30% Contingency	$ 22,614.35
				Total	$ 97,995.52
	Design, Administration, Fiscal, and Legal (30% of Construction Costs)				$ 29,398.66
	Total Opinion of Project Cost				$ 127,394.17

* Cost for comprehensive grading includes roadway excavation, saw cutting, compaction of select material, geotechnical recommendations, home owner coordination, tree and structure protection, structure removal and disposal, shoring and culvert excavation.

The Engineer's opinions of probable construction costs are made on the basis of the Engineer's experience and qualifications and represent the Engineer's best judgement as a professional generally familiar with the construction industry. Since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, over the contractors methods of determining prices;or over competitive bidding or marketing conditions, the Engineer's cannot and does not guarantee that proposal, bids or actual construction costs will not vary from opinions of probable construction costs prepared by the Engineer.

H. Hydraulic and Hydrologic Input and Output

H.1 Primary System Structures – Existing Conditions

Picture H- 1. Greens Mill Run: Allen Road Upstream Face

Picture H- 2. Greens Mill Run: Dickinson Avenue Upstream Face

Picture H- 3. Greens Mill Run: Memorial Drive Upstream Face

Picture H- 4. Greens Mill Run: Hooker Road Downstream Face

Picture H- 5. Greens Mill Run: Arlington Boulevard Upstream Face

Picture H- 6. Greens Mill Run: Evans Street Downstream Face

Picture H- 7. Greens Mill Run: Charles Boulevard Upstream Face

Picture H- 8. Greens Mill Run: 14th Street Upstream Face

Picture H- 9. Greens Mill Run: Rock Spring Road Upstream Face

Picture H- 10. Greens Mill Run: College Hill Drive Downstream Face

Picture H- 11. Greens Mill Run: Elm Street Downstream Face

Picture H- 12. Greens Mill Run: 10th Street Upstream Face

Picture H- 13. Greens Mill Run: 5th Street Upstream Face

Picture H- 14. North Fork to Greens Mill Run: Radio Station Road Upstream Face

Picture H- 15. North Fork to Greens Mill Run: Allen Road Upstream Face

Picture H- 16. North Fork to Greens Mill Run: Spring Forest Road Upstream Face

Picture H- 17. North Fork to Greens Mill Run: Spring Forest Road Upstream Face

Picture H- 18. North Fork to Greens Mill Run: Ellsworth Drive Downstream Face

Picture H- 19. Unnamed Tributary to Greens Mill Run: Allen Road Upstream Face

Picture H- 20. Unnamed Tributary to Greens Mill Run: Dickinson Avenue Upstream Face

Picture H- 21. Unnamed Tributary to Greens Mill Run: Greenville Boulevard Upstream Face

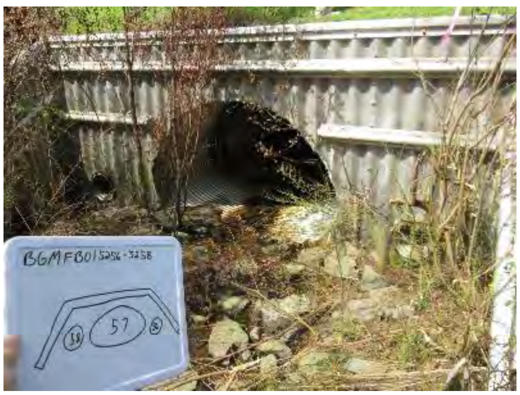
Picture H- 22. Unnamed Tributary to Greens Mill Run: Greenville Boulevard Upstream Face

Picture H- 23. Unnamed Tributary to Greens Mill Run: Williams Road Upstream Face

Picture H- 24. Unnamed Tributary to Greens Mill Run: Golf Cart Path Upstream Face

Picture H- 25. Fornes Run: Charles Boulevard Downstream Face

Picture H- 26. Fornes Run: Greenville Boulevard Upstream Face



Picture H- 27. Fornes Run: Greenville Boulevard Downstream Face

Picture H- 28. Fornes Run: Crestwood Drive Downstream Face

Picture H- 29. Fornes Run: Overlook Road Upstream Face

Picture H- 30. Fornes Run: Railroad Upstream Face

Picture H- 31. Fornes Run: Railroad Downstream Face

Picture H- 32. Fornes Run: 14th Street Upstream Face

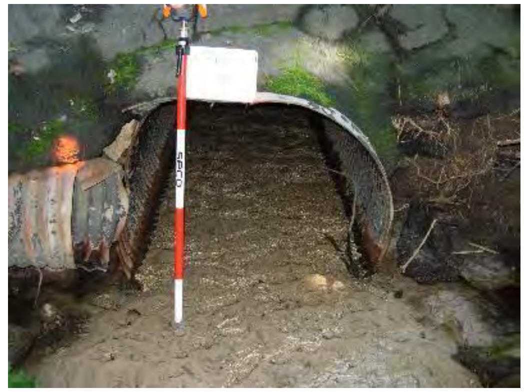
Picture H- 33. Fornes Run: Dalebrook Circle Upstream Face

Picture H- 34. Reedy Branch: Parking Lot off Dellwood Drive Upstream Face

Picture H- 35. Reedy Branch: Greenville Boulevard Upstream Face

Picture H- 36. Reedy Branch: Driveway off Greenville Boulevard Upstream Face

Picture H- 37. Reedy Branch: 14th Street Upstream Face



Picture H- 38. Reedy Branch: Wright Road Upstream Face

Picture H- 39. Reedy Branch: 10th Street Upstream Face

H.2 HEC-HMS Output – Existing Conditions

Project: EXGMR2YR_Rev Simulation Run: 2 yr

Start of Run:	02Nov2014, 00:00	Basin Model:	GMR Subbasins
End of Run:	03Nov2014, 00:06	Meteorologic Model:	2yr
Compute Time:	18Jul2016, 15:23:56	Control Specifications:	Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	27.0	02Nov2014, 13:47	0.47
W700	0.248681	21.7	02Nov2014, 13:38	0.57
Reach-660	0.662365	48.5	02Nov2014, 13:57	0.50
W660	0.467389	58.5	02Nov2014, 13:06	0.63
W800	0.347947	35.2	02Nov2014, 13:25	0.59
GMRTrib9	1.477701	124.7	02Nov2014, 13:28	0.56
Reservoir-770	1.477701	124.6	02Nov2014, 13:29	0.56
Reach-770	1.477701	115.7	02Nov2014, 14:43	0.54
W770	0.644502	134.9	02Nov2014, 13:02	0.92
Reach-3100	2.122203	164.1	02Nov2014, 14:46	0.64
W550	0.358867	80.6	02Nov2014, 13:31	1.22
W560	0.110000	18.9	02Nov2014, 13:47	1.06
Reach-550	0.110000	17.9	02Nov2014, 14:23	1.02
Reach-3000	0.468867	84.3	02Nov2014, 14:19	1.12
W3000	0.385817	147.9	02Nov2014, 12:55	1.47
W4900	0.133889	47.0	02Nov2014, 12:34	1.03
Reach-4800	0.133889	39.0	02Nov2014, 12:49	1.01
W4800	0.047262	37.7	02Nov2014, 12:25	1.96
Reach-3000(2)	0.181151	42.0	02Nov2014, 13:06	1.19
Reservoir-990	1.035835	122.0	02Nov2014, 15:02	1.20
Reach-990	1.035835	118.3	02Nov2014, 15:58	1.13
W990	0.353913	154.1	02Nov2014, 12:43	1.42
Reservoir-2800	1.389748	124.6	02Nov2014, 16:59	1.20
Reach-2800	1.389748	124.1	02Nov2014, 17:12	1.18
W2800	0.034493	13.4	02Nov2014, 12:36	1.16
Reach-630	1.424241	125.0	02Nov2014, 17:41	1.13
W630	0.373057	125.6	02Nov2014, 12:52	1.26

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	133.6	02Nov2014, 18:24	1.11
Reach-2700	1.797298	133.6	02Nov2014, 18:26	1.10
W3100	0.373146	80.1	02Nov2014, 12:49	0.82
NorthForkGMR	4.292647	301.9	02Nov2014, 14:46	0.85
W2700	0.020970	14.7	02Nov2014, 12:17	1.45
Reach-2600	4.313617	303.4	02Nov2014, 14:46	0.85
W2600	0.000825	1.4	02Nov2014, 12:07	2.72
Reservoir-2600	4.314442	303.2	02Nov2014, 14:49	0.85
Reach-780	4.314442	295.3	02Nov2014, 15:34	0.84
W640	0.401148	111.1	02Nov2014, 12:58	1.13
Reach-650	0.401148	110.1	02Nov2014, 13:10	1.12
W780	0.246680	73.6	02Nov2014, 12:33	0.88
W650	0.164286	80.0	02Nov2014, 12:27	1.25
GMRTrib8	5.126556	343.2	02Nov2014, 15:24	0.88
Reach-820	5.126556	341.4	02Nov2014, 15:41	0.86
W920	0.460578	58.4	02Nov2014, 14:06	0.88
W5100	0.078185	30.6	02Nov2014, 12:24	0.99
Laurel Ridge	0.538763	63.7	02Nov2014, 14:03	0.89
Reach-5000	0.538763	31.4	02Nov2014, 14:15	0.51
W980	0.256902	56.0	02Nov2014, 13:38	1.24
Reach-980	0.256902	47.9	02Nov2014, 14:05	1.19
W5000	0.106592	49.2	02Nov2014, 12:22	1.11
Reservoir-930	0.902257	73.3	02Nov2014, 14:52	0.75
Reach-930	0.902257	67.4	02Nov2014, 15:32	0.71
W930	0.182222	38.1	02Nov2014, 13:09	0.97
W910	0.117701	11.8	02Nov2014, 13:15	0.56
Reservoir-940	1.202180	80.4	02Nov2014, 15:54	0.71
Reach-940	1.202180	80.3	02Nov2014, 16:05	0.70
W940	0.314395	23.4	02Nov2014, 12:55	0.40
W5200	0.144430	57.2	02Nov2014, 13:02	1.63
Reach-5200	0.144430	57.1	02Nov2014, 13:10	1.62

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	41.1	02Nov2014, 12:44	1.33
Reach-3200	0.102774	40.9	02Nov2014, 12:55	1.32
W960	0.082432	57.6	02Nov2014, 12:26	1.72
Trib2GMRTrib7	1.846211	149.6	02Nov2014, 13:03	0.80
Reach-950	1.846211	149.2	02Nov2014, 13:11	0.80
W5300	0.109099	95.8	02Nov2014, 12:39	2.86
W3300	0.093470	76.2	02Nov2014, 12:36	2.44
Reach-970	0.202569	163.5	02Nov2014, 12:49	2.64
W970	0.187536	110.0	02Nov2014, 12:40	1.82
W950	0.107912	21.8	02Nov2014, 12:32	0.65
W4400	0.037039	51.9	02Nov2014, 12:12	2.60
Reach-4400	0.037039	44.0	02Nov2014, 12:36	2.57
Trib1GMRTrib7	2.381267	445.8	02Nov2014, 12:47	1.05
Reach-880	2.381267	387.7	02Nov2014, 13:30	1.04
W880	0.381917	27.6	02Nov2014, 12:40	0.34
W820	0.054394	5.4	02Nov2014, 12:30	0.38
GMRTrib7	7.944134	686.4	02Nov2014, 13:33	0.89
Reach-2500	7.944134	669.9	02Nov2014, 13:43	0.88
W2500	0.061783	61.7	02Nov2014, 12:17	2.05
Reservoir-860	8.005917	669.3	02Nov2014, 13:53	0.89
Reach-860	8.005917	641.3	02Nov2014, 14:20	0.88
W900	0.129395	87.6	02Nov2014, 12:29	1.76
W4300	0.118974	163.7	02Nov2014, 12:16	2.92
Reach-900	0.118974	157.6	02Nov2014, 12:22	2.90
W890	0.113096	99.3	02Nov2014, 12:26	2.20
W4200	0.107748	104.3	02Nov2014, 12:26	2.44
Reach-890	0.107748	103.9	02Nov2014, 12:29	2.44
TribGMRTrib6	0.469213	438.9	02Nov2014, 12:25	2.31
Reach-870	0.469213	396.4	02Nov2014, 12:28	2.29
W860	0.125460	38.5	02Nov2014, 12:21	0.78
W870	0.015309	14.8	02Nov2014, 12:16	1.98

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	704.6	02Nov2014, 14:17	0.96
Reach-810	8.615899	704.4	02Nov2014, 14:20	0.96
W810	0.118699	42.7	02Nov2014, 12:20	0.87
Reservoir-2400	8.734598	698.8	02Nov2014, 14:35	0.95
Reach-2400	8.734598	689.9	02Nov2014, 14:48	0.94
W740	0.102118	78.0	02Nov2014, 12:27	1.93
Reach-4000	0.102118	77.7	02Nov2014, 12:34	1.93
W4000	0.094479	94.8	02Nov2014, 12:23	2.38
W2400	0.092820	50.7	02Nov2014, 12:28	1.40
GMRTrib5	9.024015	714.9	02Nov2014, 14:47	0.97
Reach-790	9.024015	712.4	02Nov2014, 14:54	0.97
W790	0.058117	29.5	02Nov2014, 12:39	1.57
Reservoir-2300	9.082132	709.8	02Nov2014, 15:07	0.96
Reach-2300	9.082132	709.1	02Nov2014, 15:13	0.96
W850	0.159866	163.5	02Nov2014, 12:10	1.75
W840	0.144036	163.0	02Nov2014, 12:16	2.33
Reach-830	0.303902	311.7	02Nov2014, 12:14	2.03
W2300	0.078733	27.9	02Nov2014, 12:42	1.17
GMRTrib4	9.464767	736.8	02Nov2014, 15:11	1.00
W830	0.026314	6.3	02Nov2014, 12:18	0.62
Reach-720	9.491081	736.3	02Nov2014, 15:17	0.99
W720	0.063825	73.3	02Nov2014, 12:08	1.83
Reservoir-2200	9.554906	736.3	02Nov2014, 15:28	0.99
Reach-2200	9.554906	736.2	02Nov2014, 15:30	0.99
W2200	0.083314	69.4	02Nov2014, 12:24	2.02
Reach-2201	9.638220	741.8	02Nov2014, 15:31	1.00
W580	0.179172	142.6	02Nov2014, 12:35	2.36
W3500	0.134110	78.8	02Nov2014, 12:40	1.85
W3600	0.127673	93.9	02Nov2014, 12:36	2.20
Reach-580	0.127673	93.8	02Nov2014, 12:42	2.19
Reach-3700	0.440955	311.6	02Nov2014, 12:41	2.15

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	84.5	02Nov2014, 12:23	2.34
Reach-2900	0.526948	364.8	02Nov2014, 12:46	2.17
W2900	0.115190	130.1	02Nov2014, 12:17	2.37
Reach-670	0.642138	415.3	02Nov2014, 12:43	2.21
W670	0.164802	182.6	02Nov2014, 12:21	2.56
W3900	0.089883	65.9	02Nov2014, 12:21	1.66
Reach-710	0.089883	55.1	02Nov2014, 12:38	1.62
GMRTrib2	10.535043	1100.7	02Nov2014, 12:39	1.10
W710	0.190622	164.9	02Nov2014, 12:19	1.89
Reach-600	10.725665	973.5	02Nov2014, 13:35	1.09
W600	0.155003	137.0	02Nov2014, 12:17	1.83
Reservoir-3800	10.880668	991.9	02Nov2014, 13:36	1.10
Reach-3800	10.880668	991.7	02Nov2014, 13:37	1.10
W3800	0.131793	111.3	02Nov2014, 12:21	1.92
Reservoir-2100	11.012461	1001.5	02Nov2014, 13:47	1.07
Reach-2100	11.012461	1001.0	02Nov2014, 13:50	1.07
W2100	0.092432	80.2	02Nov2014, 12:16	1.77
Reach-4700	11.104893	996.3	02Nov2014, 14:02	1.07
W4700	0.094290	59.4	02Nov2014, 12:17	1.34
Reach-2000	11.199183	997.0	02Nov2014, 14:21	1.07
W2000	0.113520	84.7	02Nov2014, 12:20	1.67
Reservoir-1900	11.312703	1005.7	02Nov2014, 14:25	1.07
Reach-1900	11.312703	1004.8	02Nov2014, 14:28	1.07
W1900	0.122992	92.8	02Nov2014, 12:22	1.73
Reservoir-1800	11.435695	1015.0	02Nov2014, 14:31	1.08
Reach-1800	11.435695	1014.7	02Nov2014, 14:33	1.07
W1800	0.148583	119.1	02Nov2014, 12:18	1.72
W4600	0.044115	21.6	02Nov2014, 12:20	1.13
Reach-4600	0.044115	18.2	02Nov2014, 12:34	1.11
Reservoir-530	11.628393	1026.7	02Nov2014, 14:40	1.08
Reach-530	11.628393	1026.3	02Nov2014, 14:43	1.08

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	128.0	02Nov2014, 12:20	2.22
W4100	0.093017	71.0	02Nov2014, 12:41	2.47
Reach-750	0.093017	70.4	02Nov2014, 12:49	2.47
Reservoir-1400	0.222696	114.3	02Nov2014, 12:53	2.32
Reach-1400	0.222696	113.7	02Nov2014, 13:05	2.30
W1400	0.136188	34.5	02Nov2014, 12:34	0.79
Reservoir-1000	0.358884	134.2	02Nov2014, 13:00	1.72
Reach-1000	0.358884	133.9	02Nov2014, 13:05	1.72
W760	0.162490	49.4	02Nov2014, 12:48	1.09
W1000	0.026933	10.8	02Nov2014, 12:26	1.04
Reach-1500	0.548307	182.8	02Nov2014, 13:01	1.49
W1500	0.128740	37.5	02Nov2014, 12:30	0.84
Reservoir-570	0.677047	201.6	02Nov2014, 13:01	1.37
Reach-570	0.677047	201.5	02Nov2014, 13:02	1.37
W570	0.098691	32.4	02Nov2014, 12:27	0.89
Reservoir-1100	0.775738	215.7	02Nov2014, 13:00	1.31
Reach-1100	0.775738	214.9	02Nov2014, 13:08	1.30
W1100	0.148073	26.1	02Nov2014, 12:24	0.53
Reach-FornesRun	0.923811	224.0	02Nov2014, 13:07	1.18
W530	0.112161	52.2	02Nov2014, 12:22	1.12
FornesRun	12.664365	1136.8	02Nov2014, 14:33	1.09
Reach-Fornescont	12.664365	1136.8	02Nov2014, 14:33	1.09
Reservoir-510	12.664365	1130.5	02Nov2014, 14:43	1.08
Reach-510	12.664365	1125.5	02Nov2014, 14:54	1.08
W1200	0.145402	48.5	02Nov2014, 12:32	0.97
W1600	0.069092	37.0	02Nov2014, 12:27	1.37
Reservoir-1700	0.069092	35.5	02Nov2014, 12:33	1.37
Reach-1700	0.069092	35.4	02Nov2014, 12:36	1.37
W1700	0.035228	20.4	02Nov2014, 12:18	1.26
Reservoir-1200	0.104320	49.5	02Nov2014, 12:32	1.33
Reach-1200	0.104320	49.3	02Nov2014, 12:40	1.33

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	91.5	02Nov2014, 12:43	1.12
Reach-1300	0.249722	91.4	02Nov2014, 12:46	1.11
W1300	0.153935	54.2	02Nov2014, 12:24	0.90
Reach-4500	0.403657	125.3	02Nov2014, 12:45	1.03
W4500	0.128624	47.1	02Nov2014, 12:27	0.97
Reservoir-520	0.532281	154.0	02Nov2014, 12:48	1.01
Reach-520	0.532281	153.8	02Nov2014, 12:50	1.01
W510	0.077580	47.2	02Nov2014, 12:22	1.43
W520	0.028353	19.1	02Nov2014, 12:18	1.44
ReedyBch	13.302579	1166.5	02Nov2014, 14:52	1.08
Reach-500	13.302579	1112.0	02Nov2014, 15:26	1.06
W500	0.183659	139.2	02Nov2014, 12:23	1.79
Reservoir-400	13.486238	1113.0	02Nov2014, 15:43	1.06
Reach-400	13.486238	1082.2	02Nov2014, 16:10	1.04
W400	0.141370	136.7	02Nov2014, 12:17	2.00
Reach-3400	13.627608	1053.6	02Nov2014, 16:51	1.01
W3400	0.134392	114.4	02Nov2014, 12:22	1.96
Outlet	13.762000	1059.9	02Nov2014, 16:50	1.02

Project: EXGMR10-100_Rev Simulation Run: 10 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 10 yr
Compute Time: 18Jul2016, 15:34:12 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	106.6	02Nov2014, 13:33	1.46
W700	0.248681	76.6	02Nov2014, 13:27	1.65
Reach-660	0.662365	182.5	02Nov2014, 13:41	1.52
W660	0.467389	199.2	02Nov2014, 12:59	1.75
W800	0.347947	121.9	02Nov2014, 13:15	1.70
GMRTrib9	1.477701	455.0	02Nov2014, 13:16	1.63
Reservoir-770	1.477701	454.9	02Nov2014, 13:17	1.63
Reach-770	1.477701	422.7	02Nov2014, 14:07	1.58
W770	0.644502	364.8	02Nov2014, 12:58	2.25
Reach-3100	2.122203	543.9	02Nov2014, 14:47	1.77
W550	0.358867	228.8	02Nov2014, 13:06	2.74
W560	0.110000	56.0	02Nov2014, 13:19	2.48
Reach-550	0.110000	52.3	02Nov2014, 13:44	2.42
Reach-3000	0.468867	232.0	02Nov2014, 13:43	2.58
W3000	0.385817	318.7	02Nov2014, 12:53	3.09
W4900	0.133889	119.5	02Nov2014, 12:31	2.43
Reach-4800	0.133889	118.7	02Nov2014, 12:37	2.42
W4800	0.047262	72.0	02Nov2014, 12:24	3.75
Reach-3000(2)	0.181151	179.1	02Nov2014, 12:41	2.76
Reservoir-990	1.035835	308.1	02Nov2014, 14:21	2.68
Reach-990	1.035835	305.6	02Nov2014, 14:30	2.67
W990	0.353913	287.5	02Nov2014, 12:52	3.01
Reservoir-2800	1.389748	284.5	02Nov2014, 16:04	2.74
Reach-2800	1.389748	284.1	02Nov2014, 16:15	2.71
W2800	0.034493	32.1	02Nov2014, 12:34	2.63
Reach-630	1.424241	286.9	02Nov2014, 16:18	2.68
W630	0.373057	290.2	02Nov2014, 12:50	2.78

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	294.4	02Nov2014, 18:01	2.47
Reach-2700	1.797298	294.4	02Nov2014, 18:06	2.46
W3100	0.373146	231.4	02Nov2014, 12:45	2.09
NorthForkGMR	4.292647	825.7	02Nov2014, 14:49	2.09
W2700	0.020970	31.8	02Nov2014, 12:16	3.07
Reach-2600	4.313617	828.4	02Nov2014, 14:49	2.09
W2600	0.000825	2.4	02Nov2014, 12:07	4.70
Reservoir-2600	4.314442	824.6	02Nov2014, 14:57	2.09
Reach-780	4.314442	807.7	02Nov2014, 15:26	2.03
W640	0.401148	270.3	02Nov2014, 12:55	2.58
Reach-650	0.401148	267.6	02Nov2014, 13:05	2.57
W780	0.246680	190.4	02Nov2014, 12:34	2.20
W650	0.164286	185.0	02Nov2014, 12:25	2.77
GMRTrib8	5.126556	907.2	02Nov2014, 15:20	2.11
Reach-820	5.126556	901.1	02Nov2014, 15:33	2.07
W920	0.460578	158.7	02Nov2014, 13:56	2.17
W5100	0.078185	79.8	02Nov2014, 12:22	2.36
Laurel Ridge	0.538763	170.4	02Nov2014, 13:54	2.20
Reach-5000	0.538763	104.7	02Nov2014, 13:58	1.41
W980	0.256902	129.7	02Nov2014, 13:34	2.75
Reach-980	0.256902	112.3	02Nov2014, 13:52	2.66
W5000	0.106592	120.8	02Nov2014, 12:21	2.56
Reservoir-930	0.902257	186.0	02Nov2014, 14:45	1.86
Reach-930	0.902257	160.3	02Nov2014, 15:35	1.75
W930	0.182222	100.0	02Nov2014, 13:05	2.34
W910	0.117701	43.0	02Nov2014, 13:06	1.64
Reservoir-940	1.202180	183.5	02Nov2014, 16:13	1.79
Reach-940	1.202180	183.5	02Nov2014, 16:22	1.78
W940	0.314395	113.4	02Nov2014, 12:46	1.33
W5200	0.144430	118.0	02Nov2014, 13:00	3.31
Reach-5200	0.144430	117.7	02Nov2014, 13:06	3.30

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	92.6	02Nov2014, 12:42	2.89
Reach-3200	0.102774	92.0	02Nov2014, 12:51	2.87
W960	0.082432	116.1	02Nov2014, 12:25	3.44
Trib2GMRTrib7	1.846211	412.2	02Nov2014, 12:57	1.95
Reach-950	1.846211	410.4	02Nov2014, 13:05	1.94
W5300	0.109099	158.3	02Nov2014, 12:39	4.84
W3300	0.093470	133.6	02Nov2014, 12:35	4.36
Reach-970	0.202569	277.5	02Nov2014, 12:47	4.58
W970	0.187536	216.7	02Nov2014, 12:38	3.57
W950	0.107912	73.6	02Nov2014, 12:28	1.79
W4400	0.037039	88.8	02Nov2014, 12:12	4.55
Reach-4400	0.037039	75.4	02Nov2014, 12:32	4.50
Trib1GMRTrib7	2.381267	960.0	02Nov2014, 12:45	2.33
Reach-880	2.381267	889.4	02Nov2014, 13:16	2.33
W880	0.381917	140.3	02Nov2014, 12:38	1.22
W820	0.054394	28.4	02Nov2014, 12:21	1.30
GMRTrib7	7.944134	1710.7	02Nov2014, 13:22	2.10
Reach-2500	7.944134	1666.4	02Nov2014, 13:32	2.10
W2500	0.061783	115.8	02Nov2014, 12:16	3.88
Reservoir-860	8.005917	1621.7	02Nov2014, 13:51	2.10
Reach-860	8.005917	1566.8	02Nov2014, 14:14	2.08
W900	0.129395	174.7	02Nov2014, 12:28	3.50
W4300	0.118974	268.5	02Nov2014, 12:16	4.91
Reach-900	0.118974	258.1	02Nov2014, 12:21	4.90
W890	0.113096	181.3	02Nov2014, 12:25	4.06
W4200	0.107748	182.8	02Nov2014, 12:25	4.36
Reach-890	0.107748	182.1	02Nov2014, 12:28	4.36
TribGMRTrib6	0.469213	779.9	02Nov2014, 12:24	4.18
Reach-870	0.469213	715.2	02Nov2014, 12:27	4.15
W860	0.125460	115.8	02Nov2014, 12:19	2.03
W870	0.015309	28.2	02Nov2014, 12:16	3.79

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	1680.5	02Nov2014, 14:11	2.19
Reach-810	8.615899	1679.3	02Nov2014, 14:16	2.19
W810	0.118699	120.0	02Nov2014, 12:18	2.18
Reservoir-2400	8.734598	1665.3	02Nov2014, 14:32	2.17
Reach-2400	8.734598	1654.8	02Nov2014, 14:41	2.16
W740	0.102118	149.9	02Nov2014, 12:26	3.72
Reach-4000	0.102118	149.5	02Nov2014, 12:32	3.71
W4000	0.094479	167.8	02Nov2014, 12:22	4.29
W2400	0.092820	111.4	02Nov2014, 12:26	2.99
GMRTrib5	9.024015	1700.0	02Nov2014, 14:40	2.21
Reach-790	9.024015	1695.2	02Nov2014, 14:45	2.20
W790	0.058117	61.8	02Nov2014, 12:38	3.23
Reservoir-2300	9.082132	1684.6	02Nov2014, 14:59	2.19
Reach-2300	9.082132	1682.9	02Nov2014, 15:04	2.18
W850	0.159866	327.0	02Nov2014, 12:10	3.48
W840	0.144036	290.9	02Nov2014, 12:16	4.23
Reach-830	0.303902	588.9	02Nov2014, 12:13	3.84
W2300	0.078733	66.6	02Nov2014, 12:40	2.65
GMRTrib4	9.464767	1733.7	02Nov2014, 15:03	2.24
W830	0.026314	22.5	02Nov2014, 12:15	1.74
Reach-720	9.491081	1734.7	02Nov2014, 15:05	2.23
W720	0.063825	121.1	02Nov2014, 12:13	3.59
Reservoir-2200	9.554906	1730.4	02Nov2014, 15:16	2.23
Reach-2200	9.554906	1730.4	02Nov2014, 15:17	2.23
W2200	0.083314	131.2	02Nov2014, 12:24	3.83
Reach-2201	9.638220	1736.6	02Nov2014, 15:21	2.24
W580	0.179172	253.5	02Nov2014, 12:35	4.25
W3500	0.134110	154.2	02Nov2014, 12:39	3.61
W3600	0.127673	171.5	02Nov2014, 12:36	4.06
Reach-580	0.127673	171.4	02Nov2014, 12:41	4.05
Reach-3700	0.440955	573.8	02Nov2014, 12:40	4.00

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	150.5	02Nov2014, 12:22	4.24
Reach-2900	0.526948	671.2	02Nov2014, 12:43	4.02
W2900	0.115190	230.8	02Nov2014, 12:17	4.27
Reach-670	0.642138	769.3	02Nov2014, 12:40	4.06
W670	0.164802	314.5	02Nov2014, 12:20	4.50
W3900	0.089883	134.9	02Nov2014, 12:20	3.36
Reach-710	0.089883	113.4	02Nov2014, 12:34	3.30
GMRTrib2	10.535043	2174.0	02Nov2014, 12:37	2.39
W710	0.190622	320.1	02Nov2014, 12:19	3.67
Reach-600	10.725665	2107.6	02Nov2014, 12:51	2.39
W600	0.155003	269.7	02Nov2014, 12:16	3.58
Reservoir-3800	10.880668	2185.9	02Nov2014, 12:49	2.41
Reach-3800	10.880668	2176.8	02Nov2014, 12:54	2.40
W3800	0.131793	214.5	02Nov2014, 12:21	3.71
Reservoir-2100	11.012461	2083.6	02Nov2014, 13:21	2.38
Reach-2100	11.012461	2082.1	02Nov2014, 13:25	2.37
W2100	0.092432	160.0	02Nov2014, 12:16	3.51
Reach-4700	11.104893	2083.8	02Nov2014, 13:32	2.37
W4700	0.094290	133.8	02Nov2014, 12:16	2.90
Reach-2000	11.199183	2101.1	02Nov2014, 13:33	2.38
W2000	0.113520	173.0	02Nov2014, 12:20	3.37
Reservoir-1900	11.312703	2108.4	02Nov2014, 13:45	2.38
Reach-1900	11.312703	2107.4	02Nov2014, 13:46	2.38
W1900	0.122992	186.6	02Nov2014, 12:21	3.46
Reservoir-1800	11.435695	2112.5	02Nov2014, 14:00	2.39
Reach-1800	11.435695	2112.3	02Nov2014, 14:00	2.39
W1800	0.148583	240.4	02Nov2014, 12:18	3.44
W4600	0.044115	52.6	02Nov2014, 12:19	2.59
Reach-4600	0.044115	44.7	02Nov2014, 12:29	2.56
Reservoir-530	11.628393	2098.3	02Nov2014, 14:23	2.40
Reach-530	11.628393	2094.8	02Nov2014, 14:30	2.39

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	233.0	02Nov2014, 12:20	4.08
W4100	0.093017	123.9	02Nov2014, 12:40	4.39
Reach-750	0.093017	122.6	02Nov2014, 12:48	4.38
Reservoir-1400	0.222696	172.4	02Nov2014, 13:00	4.20
Reach-1400	0.222696	171.5	02Nov2014, 13:04	4.19
W1400	0.136188	101.6	02Nov2014, 12:31	2.04
Reservoir-1000	0.358884	225.9	02Nov2014, 12:58	3.37
Reach-1000	0.358884	225.9	02Nov2014, 12:58	3.37
W760	0.162490	122.2	02Nov2014, 12:45	2.52
W1000	0.026933	27.5	02Nov2014, 12:24	2.44
Reach-1500	0.548307	359.7	02Nov2014, 12:46	3.08
W1500	0.128740	106.5	02Nov2014, 12:28	2.13
Reservoir-570	0.677047	397.8	02Nov2014, 12:57	2.89
Reach-570	0.677047	397.8	02Nov2014, 12:58	2.89
W570	0.098691	89.4	02Nov2014, 12:25	2.21
Reservoir-1100	0.775738	444.6	02Nov2014, 12:49	2.81
Reach-1100	0.775738	442.9	02Nov2014, 13:00	2.80
W1100	0.148073	104.0	02Nov2014, 12:19	1.59
Reach-FornesRun	0.923811	474.9	02Nov2014, 12:52	2.60
W530	0.112161	127.9	02Nov2014, 12:21	2.57
FornesRun	12.664365	2374.4	02Nov2014, 13:37	2.41
Reach-Fornescont	12.664365	2374.3	02Nov2014, 13:37	2.41
Reservoir-510	12.664365	2366.6	02Nov2014, 13:42	2.40
Reach-510	12.664365	2357.3	02Nov2014, 13:51	2.39
W1200	0.145402	127.4	02Nov2014, 12:30	2.33
W1600	0.069092	82.2	02Nov2014, 12:26	2.95
Reservoir-1700	0.069092	75.2	02Nov2014, 12:34	2.94
Reach-1700	0.069092	75.2	02Nov2014, 12:34	2.94
W1700	0.035228	47.2	02Nov2014, 12:17	2.79
Reservoir-1200	0.104320	98.8	02Nov2014, 12:39	2.89
Reach-1200	0.104320	98.8	02Nov2014, 12:42	2.89

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	223.5	02Nov2014, 12:33	2.56
Reach-1300	0.249722	223.4	02Nov2014, 12:33	2.56
W1300	0.153935	148.8	02Nov2014, 12:21	2.23
Reach-4500	0.403657	354.8	02Nov2014, 12:28	2.43
W4500	0.128624	123.9	02Nov2014, 12:24	2.33
Reservoir-520	0.532281	314.4	02Nov2014, 12:50	2.40
Reach-520	0.532281	314.3	02Nov2014, 12:53	2.40
W510	0.077580	103.0	02Nov2014, 12:21	3.03
W520	0.028353	41.6	02Nov2014, 12:17	3.06
ReedyBch	13.302579	2616.2	02Nov2014, 13:31	2.40
Reach-500	13.302579	2541.7	02Nov2014, 13:32	2.38
W500	0.183659	275.9	02Nov2014, 12:22	3.54
Reservoir-400	13.486238	2516.4	02Nov2014, 13:56	2.37
Reach-400	13.486238	2440.8	02Nov2014, 14:50	2.33
W400	0.141370	259.0	02Nov2014, 12:16	3.82
Reach-3400	13.627608	2395.1	02Nov2014, 15:22	2.28
W3400	0.134392	218.8	02Nov2014, 12:21	3.76
Outlet	13.762000	2412.1	02Nov2014, 15:21	2.30

Project: EXGMR10-100_Rev Simulation Run: 25 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 25 yr
Compute Time: 18Jul2016, 15:35:35 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	180.1	02Nov2014, 13:29	2.33
W700	0.248681	125.1	02Nov2014, 13:24	2.57
Reach-660	0.662365	303.9	02Nov2014, 13:37	2.40
W660	0.467389	320.1	02Nov2014, 12:57	2.71
W800	0.347947	197.5	02Nov2014, 13:13	2.63
GMRTrib9	1.477701	749.2	02Nov2014, 13:13	2.55
Reservoir-770	1.477701	747.7	02Nov2014, 13:16	2.55
Reach-770	1.477701	697.9	02Nov2014, 13:58	2.48
W770	0.644502	548.5	02Nov2014, 12:57	3.32
Reach-3100	2.122203	922.8	02Nov2014, 14:23	2.72
W550	0.358867	328.4	02Nov2014, 13:05	3.90
W560	0.110000	82.2	02Nov2014, 13:18	3.59
Reach-550	0.110000	77.0	02Nov2014, 13:41	3.52
Reach-3000	0.468867	307.1	02Nov2014, 13:55	3.64
W3000	0.385817	445.3	02Nov2014, 12:52	4.31
W4900	0.133889	176.3	02Nov2014, 12:31	3.54
Reach-4800	0.133889	175.2	02Nov2014, 12:36	3.53
W4800	0.047262	96.4	02Nov2014, 12:24	5.06
Reach-3000(2)	0.181151	257.4	02Nov2014, 12:39	3.92
Reservoir-990	1.035835	434.6	02Nov2014, 14:25	3.78
Reach-990	1.035835	431.6	02Nov2014, 14:32	3.76
W990	0.353913	404.0	02Nov2014, 12:52	4.22
Reservoir-2800	1.389748	328.9	02Nov2014, 16:47	3.75
Reach-2800	1.389748	328.6	02Nov2014, 16:58	3.70
W2800	0.034493	46.5	02Nov2014, 12:33	3.78
Reach-630	1.424241	331.7	02Nov2014, 16:58	3.67
W630	0.373057	415.2	02Nov2014, 12:49	3.95

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	358.0	02Nov2014, 18:01	3.26
Reach-2700	1.797298	358.0	02Nov2014, 18:06	3.25
W3100	0.373146	354.4	02Nov2014, 12:44	3.13
NorthForkGMR	4.292647	1298.7	02Nov2014, 14:23	2.98
W2700	0.020970	44.5	02Nov2014, 12:16	4.29
Reach-2600	4.313617	1302.7	02Nov2014, 14:23	2.98
W2600	0.000825	3.0	02Nov2014, 12:07	6.09
Reservoir-2600	4.314442	1295.2	02Nov2014, 14:30	2.98
Reach-780	4.314442	1257.0	02Nov2014, 14:55	2.89
W640	0.401148	393.2	02Nov2014, 12:54	3.72
Reach-650	0.401148	389.3	02Nov2014, 13:03	3.70
W780	0.246680	287.8	02Nov2014, 12:33	3.26
W650	0.164286	264.8	02Nov2014, 12:25	3.94
GMRTrib8	5.126556	1421.0	02Nov2014, 14:50	3.01
Reach-820	5.126556	1405.6	02Nov2014, 15:03	2.96
W920	0.460578	239.9	02Nov2014, 13:54	3.22
W5100	0.078185	118.6	02Nov2014, 12:21	3.46
Laurel Ridge	0.538763	256.4	02Nov2014, 13:52	3.25
Reach-5000	0.538763	168.0	02Nov2014, 13:55	2.25
W980	0.256902	185.9	02Nov2014, 13:33	3.91
Reach-980	0.256902	147.9	02Nov2014, 13:50	3.69
W5000	0.106592	176.0	02Nov2014, 12:20	3.70
Reservoir-930	0.902257	274.4	02Nov2014, 14:42	2.77
Reach-930	0.902257	226.9	02Nov2014, 15:44	2.61
W930	0.182222	149.0	02Nov2014, 13:03	3.43
W910	0.117701	70.5	02Nov2014, 13:04	2.56
Reservoir-940	1.202180	258.4	02Nov2014, 16:21	2.68
Reach-940	1.202180	258.4	02Nov2014, 16:29	2.66
W940	0.314395	198.9	02Nov2014, 12:44	2.16
W5200	0.144430	162.4	02Nov2014, 12:59	4.56
Reach-5200	0.144430	162.1	02Nov2014, 13:05	4.54

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	131.3	02Nov2014, 12:41	4.08
Reach-3200	0.102774	130.5	02Nov2014, 12:49	4.06
W960	0.082432	158.3	02Nov2014, 12:24	4.72
Trib2GMRTrib7	1.846211	639.4	02Nov2014, 12:52	2.89
Reach-950	1.846211	634.2	02Nov2014, 12:58	2.88
W5300	0.109099	201.2	02Nov2014, 12:39	6.23
W3300	0.093470	173.3	02Nov2014, 12:35	5.72
Reach-970	0.202569	356.3	02Nov2014, 12:46	5.95
W970	0.187536	293.2	02Nov2014, 12:38	4.86
W950	0.107912	117.4	02Nov2014, 12:27	2.76
W4400	0.037039	114.1	02Nov2014, 12:12	5.93
Reach-4400	0.037039	96.9	02Nov2014, 12:31	5.87
Trib1GMRTrib7	2.381267	1373.8	02Nov2014, 12:45	3.33
Reach-880	2.381267	1289.6	02Nov2014, 13:10	3.33
W880	0.381917	253.8	02Nov2014, 12:36	2.02
W820	0.054394	50.5	02Nov2014, 12:20	2.12
GMRTrib7	7.944134	2538.1	02Nov2014, 13:14	3.02
Reach-2500	7.944134	2455.4	02Nov2014, 13:22	3.01
W2500	0.061783	153.9	02Nov2014, 12:16	5.21
Reservoir-860	8.005917	2234.2	02Nov2014, 13:51	3.01
Reach-860	8.005917	2177.0	02Nov2014, 14:15	2.97
W900	0.129395	237.4	02Nov2014, 12:27	4.78
W4300	0.118974	340.3	02Nov2014, 12:16	6.31
Reach-900	0.118974	326.7	02Nov2014, 12:20	6.29
W890	0.113096	238.7	02Nov2014, 12:25	5.40
W4200	0.107748	237.1	02Nov2014, 12:25	5.72
Reach-890	0.107748	236.2	02Nov2014, 12:28	5.72
TribGMRTrib6	0.469213	1018.4	02Nov2014, 12:24	5.53
Reach-870	0.469213	939.3	02Nov2014, 12:26	5.49
W860	0.125460	179.0	02Nov2014, 12:18	3.05
W870	0.015309	37.7	02Nov2014, 12:16	5.10

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	2324.1	02Nov2014, 14:10	3.11
Reach-810	8.615899	2322.6	02Nov2014, 14:16	3.10
W810	0.118699	182.1	02Nov2014, 12:18	3.24
Reservoir-2400	8.734598	2207.7	02Nov2014, 15:08	3.08
Reach-2400	8.734598	2205.0	02Nov2014, 15:16	3.07
W740	0.102118	201.0	02Nov2014, 12:26	5.02
Reach-4000	0.102118	200.5	02Nov2014, 12:31	5.02
W4000	0.094479	218.3	02Nov2014, 12:22	5.65
W2400	0.092820	156.6	02Nov2014, 12:26	4.20
GMRTrib5	9.024015	2254.8	02Nov2014, 15:12	3.13
Reach-790	9.024015	2252.6	02Nov2014, 15:19	3.12
W790	0.058117	85.4	02Nov2014, 12:37	4.48
Reservoir-2300	9.082132	2255.9	02Nov2014, 15:34	3.10
Reach-2300	9.082132	2255.2	02Nov2014, 15:39	3.09
W850	0.159866	444.3	02Nov2014, 12:10	4.76
W840	0.144036	379.5	02Nov2014, 12:16	5.59
Reach-830	0.303902	786.4	02Nov2014, 12:13	5.15
W2300	0.078733	96.3	02Nov2014, 12:39	3.80
GMRTrib4	9.464767	2311.0	02Nov2014, 15:35	3.16
W830	0.026314	36.2	02Nov2014, 12:14	2.70
Reach-720	9.491081	2313.3	02Nov2014, 15:36	3.15
W720	0.063825	163.6	02Nov2014, 12:13	4.88
Reservoir-2200	9.554906	2311.5	02Nov2014, 15:54	3.15
Reach-2200	9.554906	2311.4	02Nov2014, 15:56	3.14
W2200	0.083314	174.8	02Nov2014, 12:23	5.15
Reach-2201	9.638220	2321.0	02Nov2014, 15:59	3.16
W580	0.179172	330.5	02Nov2014, 12:34	5.61
W3500	0.134110	208.1	02Nov2014, 12:39	4.90
W3600	0.127673	225.9	02Nov2014, 12:35	5.40
Reach-580	0.127673	225.6	02Nov2014, 12:40	5.39
Reach-3700	0.440955	757.9	02Nov2014, 12:39	5.32

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	196.4	02Nov2014, 12:22	5.59
Reach-2900	0.526948	887.0	02Nov2014, 12:42	5.35
W2900	0.115190	300.7	02Nov2014, 12:16	5.63
Reach-670	0.642138	1019.6	02Nov2014, 12:39	5.40
W670	0.164802	405.4	02Nov2014, 12:20	5.87
W3900	0.089883	185.0	02Nov2014, 12:20	4.62
Reach-710	0.089883	156.0	02Nov2014, 12:32	4.55
GMRTrib2	10.535043	2953.8	02Nov2014, 12:37	3.35
W710	0.190622	430.6	02Nov2014, 12:18	4.97
Reach-600	10.725665	2882.3	02Nov2014, 12:47	3.34
W600	0.155003	364.8	02Nov2014, 12:16	4.87
Reservoir-3800	10.880668	3000.8	02Nov2014, 12:46	3.36
Reach-3800	10.880668	2990.2	02Nov2014, 12:50	3.36
W3800	0.131793	288.0	02Nov2014, 12:20	5.01
Reservoir-2100	11.012461	2757.5	02Nov2014, 13:25	3.33
Reach-2100	11.012461	2755.2	02Nov2014, 13:29	3.33
W2100	0.092432	217.3	02Nov2014, 12:16	4.79
Reach-4700	11.104893	2754.8	02Nov2014, 13:36	3.32
W4700	0.094290	189.7	02Nov2014, 12:16	4.09
Reach-2000	11.199183	2777.5	02Nov2014, 13:37	3.33
W2000	0.113520	237.1	02Nov2014, 12:19	4.64
Reservoir-1900	11.312703	2783.2	02Nov2014, 13:50	3.33
Reach-1900	11.312703	2781.7	02Nov2014, 13:51	3.33
W1900	0.122992	254.3	02Nov2014, 12:21	4.73
Reservoir-1800	11.435695	2783.2	02Nov2014, 14:06	3.34
Reach-1800	11.435695	2783.0	02Nov2014, 14:07	3.34
W1800	0.148583	327.7	02Nov2014, 12:18	4.72
W4600	0.044115	76.5	02Nov2014, 12:19	3.73
Reach-4600	0.044115	65.5	02Nov2014, 12:27	3.69
Reservoir-530	11.628393	2746.3	02Nov2014, 14:36	3.35
Reach-530	11.628393	2737.5	02Nov2014, 14:45	3.35

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	306.3	02Nov2014, 12:20	5.43
W4100	0.093017	160.4	02Nov2014, 12:40	5.76
Reach-750	0.093017	158.7	02Nov2014, 12:48	5.74
Reservoir-1400	0.222696	294.5	02Nov2014, 12:46	5.55
Reach-1400	0.222696	278.5	02Nov2014, 12:55	5.53
W1400	0.136188	156.4	02Nov2014, 12:30	3.07
Reservoir-1000	0.358884	296.0	02Nov2014, 13:12	4.59
Reach-1000	0.358884	296.0	02Nov2014, 13:12	4.59
W760	0.162490	178.7	02Nov2014, 12:44	3.65
W1000	0.026933	40.6	02Nov2014, 12:23	3.55
Reach-1500	0.548307	473.0	02Nov2014, 12:49	4.26
W1500	0.128740	162.3	02Nov2014, 12:27	3.18
Reservoir-570	0.677047	452.5	02Nov2014, 13:18	4.05
Reach-570	0.677047	452.5	02Nov2014, 13:19	4.05
W570	0.098691	135.0	02Nov2014, 12:24	3.28
Reservoir-1100	0.775738	511.6	02Nov2014, 12:44	3.95
Reach-1100	0.775738	508.7	02Nov2014, 12:59	3.94
W1100	0.148073	172.6	02Nov2014, 12:18	2.50
Reach-FornesRun	0.923811	564.7	02Nov2014, 12:39	3.71
W530	0.112161	186.4	02Nov2014, 12:20	3.70
FornesRun	12.664365	3193.1	02Nov2014, 14:29	3.38
Reach-Fornescont	12.664365	3193.1	02Nov2014, 14:29	3.38
Reservoir-510	12.664365	3183.5	02Nov2014, 14:36	3.36
Reach-510	12.664365	3172.2	02Nov2014, 14:42	3.35
W1200	0.145402	189.8	02Nov2014, 12:29	3.42
W1600	0.069092	115.9	02Nov2014, 12:25	4.15
Reservoir-1700	0.069092	95.3	02Nov2014, 12:37	4.15
Reach-1700	0.069092	95.3	02Nov2014, 12:37	4.15
W1700	0.035228	67.5	02Nov2014, 12:17	3.97
Reservoir-1200	0.104320	116.5	02Nov2014, 12:45	4.09
Reach-1200	0.104320	116.5	02Nov2014, 12:48	4.08

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	297.4	02Nov2014, 12:32	3.69
Reach-1300	0.249722	297.1	02Nov2014, 12:34	3.69
W1300	0.153935	224.5	02Nov2014, 12:21	3.29
Reach-4500	0.403657	494.7	02Nov2014, 12:26	3.54
W4500	0.128624	184.7	02Nov2014, 12:24	3.42
Reservoir-520	0.532281	383.8	02Nov2014, 12:55	3.51
Reach-520	0.532281	383.7	02Nov2014, 12:57	3.50
W510	0.077580	144.6	02Nov2014, 12:21	4.25
W520	0.028353	58.3	02Nov2014, 12:17	4.28
ReedyBch	13.302579	3322.6	02Nov2014, 14:11	3.36
Reach-500	13.302579	3281.9	02Nov2014, 14:11	3.34
W500	0.183659	374.2	02Nov2014, 12:22	4.82
Reservoir-400	13.486238	3306.5	02Nov2014, 14:48	3.33
Reach-400	13.486238	3245.5	02Nov2014, 14:59	3.27
W400	0.141370	345.6	02Nov2014, 12:16	5.13
Reach-3400	13.627608	3175.9	02Nov2014, 15:21	3.20
W3400	0.134392	292.8	02Nov2014, 12:21	5.07
Outlet	13.762000	3197.9	02Nov2014, 15:20	3.22

Project: EXGMR10-100_Rev Simulation Run: 50 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 50 yr
Compute Time: 18Jul2016, 15:36:29 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	251.6	02Nov2014, 13:27	3.17
W700	0.248681	171.6	02Nov2014, 13:22	3.45
Reach-660	0.662365	420.7	02Nov2014, 13:38	3.26
W660	0.467389	434.9	02Nov2014, 12:56	3.61
W800	0.347947	269.7	02Nov2014, 13:12	3.53
GMRTrib9	1.477701	1021.6	02Nov2014, 13:12	3.44
Reservoir-770	1.477701	1019.4	02Nov2014, 13:15	3.43
Reach-770	1.477701	955.0	02Nov2014, 13:54	3.34
W770	0.644502	718.0	02Nov2014, 12:56	4.32
Reach-3100	2.122203	1277.1	02Nov2014, 14:12	3.63
W550	0.358867	418.5	02Nov2014, 13:04	4.97
W560	0.110000	106.2	02Nov2014, 13:17	4.62
Reach-550	0.110000	99.6	02Nov2014, 13:38	4.54
Reach-3000	0.468867	378.4	02Nov2014, 14:00	4.63
W3000	0.385817	558.4	02Nov2014, 12:52	5.41
W4900	0.133889	228.2	02Nov2014, 12:30	4.57
Reach-4800	0.133889	226.7	02Nov2014, 12:35	4.56
W4800	0.047262	117.7	02Nov2014, 12:24	6.23
Reach-3000(2)	0.181151	328.1	02Nov2014, 12:38	4.98
Reservoir-990	1.035835	692.2	02Nov2014, 13:47	4.79
Reach-990	1.035835	665.6	02Nov2014, 13:57	4.77
W990	0.353913	508.4	02Nov2014, 12:51	5.31
Reservoir-2800	1.389748	363.6	02Nov2014, 16:57	4.46
Reach-2800	1.389748	363.4	02Nov2014, 17:08	4.39
W2800	0.034493	59.5	02Nov2014, 12:33	4.84
Reach-630	1.424241	367.2	02Nov2014, 17:02	4.35
W630	0.373057	527.9	02Nov2014, 12:48	5.02

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	410.1	02Nov2014, 17:21	3.86
Reach-2700	1.797298	410.1	02Nov2014, 17:26	3.84
W3100	0.373146	468.8	02Nov2014, 12:43	4.10
NorthForkGMR	4.292647	1741.5	02Nov2014, 14:11	3.76
W2700	0.020970	55.8	02Nov2014, 12:16	5.40
Reach-2600	4.313617	1746.6	02Nov2014, 14:11	3.77
W2600	0.000825	3.6	02Nov2014, 12:07	7.31
Reservoir-2600	4.314442	1736.6	02Nov2014, 14:18	3.76
Reach-780	4.314442	1685.4	02Nov2014, 14:41	3.65
W640	0.401148	505.1	02Nov2014, 12:54	4.77
Reach-650	0.401148	500.1	02Nov2014, 13:02	4.74
W780	0.246680	377.8	02Nov2014, 12:32	4.25
W650	0.164286	336.7	02Nov2014, 12:25	5.02
GMRTrib8	5.126556	1912.5	02Nov2014, 14:35	3.81
Reach-820	5.126556	1890.8	02Nov2014, 14:47	3.75
W920	0.460578	315.2	02Nov2014, 13:52	4.20
W5100	0.078185	154.2	02Nov2014, 12:21	4.48
Laurel Ridge	0.538763	336.0	02Nov2014, 13:51	4.24
Reach-5000	0.538763	232.1	02Nov2014, 13:53	3.15
W980	0.256902	236.7	02Nov2014, 13:32	4.97
Reach-980	0.256902	183.0	02Nov2014, 13:51	4.68
W5000	0.106592	226.4	02Nov2014, 12:20	4.75
Reservoir-930	0.902257	316.9	02Nov2014, 15:02	3.70
Reach-930	0.902257	283.4	02Nov2014, 16:35	3.50
W930	0.182222	194.0	02Nov2014, 13:03	4.43
W910	0.117701	96.8	02Nov2014, 13:03	3.44
Reservoir-940	1.202180	320.2	02Nov2014, 16:53	3.56
Reach-940	1.202180	320.0	02Nov2014, 17:12	3.54
W940	0.314395	282.8	02Nov2014, 12:43	2.98
W5200	0.144430	201.8	02Nov2014, 12:59	5.68
Reach-5200	0.144430	201.3	02Nov2014, 13:04	5.67

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	166.0	02Nov2014, 12:41	5.16
Reach-3200	0.102774	165.0	02Nov2014, 12:49	5.14
W960	0.082432	195.6	02Nov2014, 12:24	5.86
Trib2GMRTrib7	1.846211	840.7	02Nov2014, 12:48	3.80
Reach-950	1.846211	830.8	02Nov2014, 12:55	3.78
W5300	0.109099	238.4	02Nov2014, 12:38	7.45
W3300	0.093470	207.7	02Nov2014, 12:35	6.92
Reach-970	0.202569	424.5	02Nov2014, 12:45	7.16
W970	0.187536	360.5	02Nov2014, 12:38	6.01
W950	0.107912	158.8	02Nov2014, 12:26	3.68
W4400	0.037039	136.0	02Nov2014, 12:12	7.15
Reach-4400	0.037039	115.8	02Nov2014, 12:30	7.07
Trib1GMRTrib7	2.381267	1747.1	02Nov2014, 12:44	4.29
Reach-880	2.381267	1645.9	02Nov2014, 13:07	4.27
W880	0.381917	366.1	02Nov2014, 12:35	2.81
W820	0.054394	72.2	02Nov2014, 12:19	2.93
GMRTrib7	7.944134	3303.1	02Nov2014, 13:09	3.86
Reach-2500	7.944134	3188.3	02Nov2014, 13:17	3.84
W2500	0.061783	187.2	02Nov2014, 12:16	6.38
Reservoir-860	8.005917	2858.0	02Nov2014, 13:51	3.84
Reach-860	8.005917	2798.8	02Nov2014, 14:18	3.79
W900	0.129395	292.7	02Nov2014, 12:27	5.92
W4300	0.118974	402.5	02Nov2014, 12:16	7.54
Reach-900	0.118974	386.5	02Nov2014, 12:20	7.51
W890	0.113096	288.6	02Nov2014, 12:25	6.59
W4200	0.107748	284.2	02Nov2014, 12:25	6.93
Reach-890	0.107748	283.1	02Nov2014, 12:28	6.92
TribGMRTrib6	0.469213	1226.1	02Nov2014, 12:24	6.72
Reach-870	0.469213	1135.8	02Nov2014, 12:26	6.67
W860	0.125460	238.0	02Nov2014, 12:18	4.02
W870	0.015309	46.0	02Nov2014, 12:16	6.28

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	2972.0	02Nov2014, 14:11	3.95
Reach-810	8.615899	2970.5	02Nov2014, 14:17	3.94
W810	0.118699	239.4	02Nov2014, 12:17	4.23
Reservoir-2400	8.734598	2834.0	02Nov2014, 15:22	3.92
Reach-2400	8.734598	2830.7	02Nov2014, 15:29	3.90
W740	0.102118	245.8	02Nov2014, 12:26	6.19
Reach-4000	0.102118	245.2	02Nov2014, 12:30	6.18
W4000	0.094479	262.2	02Nov2014, 12:22	6.85
W2400	0.092820	197.1	02Nov2014, 12:25	5.30
GMRTrib5	9.024015	2886.7	02Nov2014, 15:26	3.97
Reach-790	9.024015	2884.3	02Nov2014, 15:31	3.95
W790	0.058117	106.4	02Nov2014, 12:37	5.60
Reservoir-2300	9.082132	2887.2	02Nov2014, 15:45	3.93
Reach-2300	9.082132	2886.0	02Nov2014, 15:50	3.92
W850	0.159866	547.5	02Nov2014, 12:10	5.91
W840	0.144036	456.6	02Nov2014, 12:16	6.79
Reach-830	0.303902	958.6	02Nov2014, 12:13	6.32
W2300	0.078733	123.3	02Nov2014, 12:39	4.85
GMRTrib4	9.464767	2948.5	02Nov2014, 15:46	4.00
W830	0.026314	49.3	02Nov2014, 12:14	3.61
Reach-720	9.491081	2951.1	02Nov2014, 15:48	4.00
W720	0.063825	201.0	02Nov2014, 12:13	6.04
Reservoir-2200	9.554906	2946.8	02Nov2014, 16:05	3.99
Reach-2200	9.554906	2946.7	02Nov2014, 16:06	3.98
W2200	0.083314	213.0	02Nov2014, 12:23	6.33
Reach-2201	9.638220	2956.8	02Nov2014, 16:10	4.00
W580	0.179172	397.5	02Nov2014, 12:34	6.80
W3500	0.134110	255.6	02Nov2014, 12:39	6.06
W3600	0.127673	273.2	02Nov2014, 12:35	6.58
Reach-580	0.127673	272.9	02Nov2014, 12:40	6.57
Reach-3700	0.440955	919.1	02Nov2014, 12:39	6.51

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	236.3	02Nov2014, 12:22	6.79
Reach-2900	0.526948	1075.5	02Nov2014, 12:42	6.53
W2900	0.115190	361.5	02Nov2014, 12:16	6.83
Reach-670	0.642138	1238.6	02Nov2014, 12:38	6.58
W670	0.164802	484.3	02Nov2014, 12:20	7.08
W3900	0.089883	229.3	02Nov2014, 12:20	5.76
Reach-710	0.089883	193.9	02Nov2014, 12:31	5.67
GMRTrib2	10.535043	3646.5	02Nov2014, 12:37	4.22
W710	0.190622	527.7	02Nov2014, 12:18	6.13
Reach-600	10.725665	3559.2	02Nov2014, 12:44	4.21
W600	0.155003	448.3	02Nov2014, 12:16	6.03
Reservoir-3800	10.880668	3697.4	02Nov2014, 12:47	4.23
Reach-3800	10.880668	3686.4	02Nov2014, 12:50	4.23
W3800	0.131793	352.5	02Nov2014, 12:20	6.18
Reservoir-2100	11.012461	3365.8	02Nov2014, 13:23	4.20
Reach-2100	11.012461	3361.1	02Nov2014, 13:28	4.19
W2100	0.092432	267.8	02Nov2014, 12:15	5.94
Reach-4700	11.104893	3351.2	02Nov2014, 13:34	4.19
W4700	0.094290	239.9	02Nov2014, 12:16	5.18
Reach-2000	11.199183	3379.1	02Nov2014, 13:34	4.19
W2000	0.113520	293.8	02Nov2014, 12:19	5.77
Reservoir-1900	11.312703	3409.6	02Nov2014, 13:40	4.20
Reach-1900	11.312703	3404.0	02Nov2014, 13:42	4.20
W1900	0.122992	314.0	02Nov2014, 12:20	5.88
Reservoir-1800	11.435695	3419.8	02Nov2014, 13:51	4.21
Reach-1800	11.435695	3418.8	02Nov2014, 13:52	4.21
W1800	0.148583	405.0	02Nov2014, 12:17	5.86
W4600	0.044115	98.3	02Nov2014, 12:18	4.78
Reach-4600	0.044115	84.5	02Nov2014, 12:26	4.73
Reservoir-530	11.628393	3354.7	02Nov2014, 14:17	4.22
Reach-530	11.628393	3324.6	02Nov2014, 14:32	4.21

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	370.1	02Nov2014, 12:19	6.62
W4100	0.093017	192.2	02Nov2014, 12:40	6.96
Reach-750	0.093017	189.9	02Nov2014, 12:48	6.94
Reservoir-1400	0.222696	395.2	02Nov2014, 12:39	6.74
Reach-1400	0.222696	360.8	02Nov2014, 12:50	6.72
W1400	0.136188	207.4	02Nov2014, 12:30	4.04
Reservoir-1000	0.358884	334.1	02Nov2014, 13:16	5.69
Reach-1000	0.358884	334.1	02Nov2014, 13:17	5.69
W760	0.162490	230.2	02Nov2014, 12:44	4.69
W1000	0.026933	52.5	02Nov2014, 12:23	4.58
Reach-1500	0.548307	563.8	02Nov2014, 12:46	5.34
W1500	0.128740	214.1	02Nov2014, 12:26	4.16
Reservoir-570	0.677047	493.9	02Nov2014, 13:28	5.11
Reach-570	0.677047	493.9	02Nov2014, 13:29	5.11
W570	0.098691	177.1	02Nov2014, 12:24	4.27
Reservoir-1100	0.775738	562.3	02Nov2014, 12:45	5.00
Reach-1100	0.775738	558.3	02Nov2014, 13:01	4.99
W1100	0.148073	238.3	02Nov2014, 12:17	3.38
Reach-FornesRun	0.923811	642.7	02Nov2014, 12:33	4.73
W530	0.112161	239.7	02Nov2014, 12:20	4.75
FornesRun	12.664365	3876.7	02Nov2014, 14:28	4.26
Reach-Fornescont	12.664365	3876.7	02Nov2014, 14:28	4.26
Reservoir-510	12.664365	3871.4	02Nov2014, 14:34	4.24
Reach-510	12.664365	3861.8	02Nov2014, 14:44	4.22
W1200	0.145402	247.0	02Nov2014, 12:29	4.44
W1600	0.069092	146.2	02Nov2014, 12:25	5.25
Reservoir-1700	0.069092	115.5	02Nov2014, 12:38	5.24
Reach-1700	0.069092	115.5	02Nov2014, 12:38	5.24
W1700	0.035228	85.8	02Nov2014, 12:17	5.04
Reservoir-1200	0.104320	134.8	02Nov2014, 12:49	5.17
Reach-1200	0.104320	134.8	02Nov2014, 12:52	5.16

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	362.2	02Nov2014, 12:34	4.73
Reach-1300	0.249722	361.8	02Nov2014, 12:36	4.73
W1300	0.153935	294.3	02Nov2014, 12:21	4.29
Reach-4500	0.403657	611.8	02Nov2014, 12:25	4.56
W4500	0.128624	240.4	02Nov2014, 12:23	4.44
Reservoir-520	0.532281	451.6	02Nov2014, 12:57	4.53
Reach-520	0.532281	451.5	02Nov2014, 13:00	4.52
W510	0.077580	181.6	02Nov2014, 12:21	5.35
W520	0.028353	73.2	02Nov2014, 12:17	5.38
ReedyBch	13.302579	4152.9	02Nov2014, 14:38	4.24
Reach-500	13.302579	4113.8	02Nov2014, 14:39	4.21
W500	0.183659	460.7	02Nov2014, 12:22	5.97
Reservoir-400	13.486238	4111.1	02Nov2014, 14:46	4.19
Reach-400	13.486238	3993.6	02Nov2014, 15:03	4.12
W400	0.141370	421.3	02Nov2014, 12:16	6.31
Reach-3400	13.627608	3915.1	02Nov2014, 15:28	4.04
W3400	0.134392	357.6	02Nov2014, 12:21	6.24
Outlet	13.762000	3940.6	02Nov2014, 15:27	4.06

Project: EXGMR10-100_Rev Simulation Run: 50 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 50 yr
Compute Time: 18Jul2016, 15:36:29 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	251.6	02Nov2014, 13:27	3.17
W700	0.248681	171.6	02Nov2014, 13:22	3.45
Reach-660	0.662365	420.7	02Nov2014, 13:38	3.26
W660	0.467389	434.9	02Nov2014, 12:56	3.61
W800	0.347947	269.7	02Nov2014, 13:12	3.53
GMRTrib9	1.477701	1021.6	02Nov2014, 13:12	3.44
Reservoir-770	1.477701	1019.4	02Nov2014, 13:15	3.43
Reach-770	1.477701	955.0	02Nov2014, 13:54	3.34
W770	0.644502	718.0	02Nov2014, 12:56	4.32
Reach-3100	2.122203	1277.1	02Nov2014, 14:12	3.63
W550	0.358867	418.5	02Nov2014, 13:04	4.97
W560	0.110000	106.2	02Nov2014, 13:17	4.62
Reach-550	0.110000	99.6	02Nov2014, 13:38	4.54
Reach-3000	0.468867	378.4	02Nov2014, 14:00	4.63
W3000	0.385817	558.4	02Nov2014, 12:52	5.41
W4900	0.133889	228.2	02Nov2014, 12:30	4.57
Reach-4800	0.133889	226.7	02Nov2014, 12:35	4.56
W4800	0.047262	117.7	02Nov2014, 12:24	6.23
Reach-3000(2)	0.181151	328.1	02Nov2014, 12:38	4.98
Reservoir-990	1.035835	692.2	02Nov2014, 13:47	4.79
Reach-990	1.035835	665.6	02Nov2014, 13:57	4.77
W990	0.353913	508.4	02Nov2014, 12:51	5.31
Reservoir-2800	1.389748	363.6	02Nov2014, 16:57	4.46
Reach-2800	1.389748	363.4	02Nov2014, 17:08	4.39
W2800	0.034493	59.5	02Nov2014, 12:33	4.84
Reach-630	1.424241	367.2	02Nov2014, 17:02	4.35
W630	0.373057	527.9	02Nov2014, 12:48	5.02

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	410.1	02Nov2014, 17:21	3.86
Reach-2700	1.797298	410.1	02Nov2014, 17:26	3.84
W3100	0.373146	468.8	02Nov2014, 12:43	4.10
NorthForkGMR	4.292647	1741.5	02Nov2014, 14:11	3.76
W2700	0.020970	55.8	02Nov2014, 12:16	5.40
Reach-2600	4.313617	1746.6	02Nov2014, 14:11	3.77
W2600	0.000825	3.6	02Nov2014, 12:07	7.31
Reservoir-2600	4.314442	1736.6	02Nov2014, 14:18	3.76
Reach-780	4.314442	1685.4	02Nov2014, 14:41	3.65
W640	0.401148	505.1	02Nov2014, 12:54	4.77
Reach-650	0.401148	500.1	02Nov2014, 13:02	4.74
W780	0.246680	377.8	02Nov2014, 12:32	4.25
W650	0.164286	336.7	02Nov2014, 12:25	5.02
GMRTrib8	5.126556	1912.5	02Nov2014, 14:35	3.81
Reach-820	5.126556	1890.8	02Nov2014, 14:47	3.75
W920	0.460578	315.2	02Nov2014, 13:52	4.20
W5100	0.078185	154.2	02Nov2014, 12:21	4.48
Laurel Ridge	0.538763	336.0	02Nov2014, 13:51	4.24
Reach-5000	0.538763	232.1	02Nov2014, 13:53	3.15
W980	0.256902	236.7	02Nov2014, 13:32	4.97
Reach-980	0.256902	183.0	02Nov2014, 13:51	4.68
W5000	0.106592	226.4	02Nov2014, 12:20	4.75
Reservoir-930	0.902257	316.9	02Nov2014, 15:02	3.70
Reach-930	0.902257	283.4	02Nov2014, 16:35	3.50
W930	0.182222	194.0	02Nov2014, 13:03	4.43
W910	0.117701	96.8	02Nov2014, 13:03	3.44
Reservoir-940	1.202180	320.2	02Nov2014, 16:53	3.56
Reach-940	1.202180	320.0	02Nov2014, 17:12	3.54
W940	0.314395	282.8	02Nov2014, 12:43	2.98
W5200	0.144430	201.8	02Nov2014, 12:59	5.68
Reach-5200	0.144430	201.3	02Nov2014, 13:04	5.67

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	166.0	02Nov2014, 12:41	5.16
Reach-3200	0.102774	165.0	02Nov2014, 12:49	5.14
W960	0.082432	195.6	02Nov2014, 12:24	5.86
Trib2GMRTrib7	1.846211	840.7	02Nov2014, 12:48	3.80
Reach-950	1.846211	830.8	02Nov2014, 12:55	3.78
W5300	0.109099	238.4	02Nov2014, 12:38	7.45
W3300	0.093470	207.7	02Nov2014, 12:35	6.92
Reach-970	0.202569	424.5	02Nov2014, 12:45	7.16
W970	0.187536	360.5	02Nov2014, 12:38	6.01
W950	0.107912	158.8	02Nov2014, 12:26	3.68
W4400	0.037039	136.0	02Nov2014, 12:12	7.15
Reach-4400	0.037039	115.8	02Nov2014, 12:30	7.07
Trib1GMRTrib7	2.381267	1747.1	02Nov2014, 12:44	4.29
Reach-880	2.381267	1645.9	02Nov2014, 13:07	4.27
W880	0.381917	366.1	02Nov2014, 12:35	2.81
W820	0.054394	72.2	02Nov2014, 12:19	2.93
GMRTrib7	7.944134	3303.1	02Nov2014, 13:09	3.86
Reach-2500	7.944134	3188.3	02Nov2014, 13:17	3.84
W2500	0.061783	187.2	02Nov2014, 12:16	6.38
Reservoir-860	8.005917	2858.0	02Nov2014, 13:51	3.84
Reach-860	8.005917	2798.8	02Nov2014, 14:18	3.79
W900	0.129395	292.7	02Nov2014, 12:27	5.92
W4300	0.118974	402.5	02Nov2014, 12:16	7.54
Reach-900	0.118974	386.5	02Nov2014, 12:20	7.51
W890	0.113096	288.6	02Nov2014, 12:25	6.59
W4200	0.107748	284.2	02Nov2014, 12:25	6.93
Reach-890	0.107748	283.1	02Nov2014, 12:28	6.92
TribGMRTrib6	0.469213	1226.1	02Nov2014, 12:24	6.72
Reach-870	0.469213	1135.8	02Nov2014, 12:26	6.67
W860	0.125460	238.0	02Nov2014, 12:18	4.02
W870	0.015309	46.0	02Nov2014, 12:16	6.28

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	2972.0	02Nov2014, 14:11	3.95
Reach-810	8.615899	2970.5	02Nov2014, 14:17	3.94
W810	0.118699	239.4	02Nov2014, 12:17	4.23
Reservoir-2400	8.734598	2834.0	02Nov2014, 15:22	3.92
Reach-2400	8.734598	2830.7	02Nov2014, 15:29	3.90
W740	0.102118	245.8	02Nov2014, 12:26	6.19
Reach-4000	0.102118	245.2	02Nov2014, 12:30	6.18
W4000	0.094479	262.2	02Nov2014, 12:22	6.85
W2400	0.092820	197.1	02Nov2014, 12:25	5.30
GMRTrib5	9.024015	2886.7	02Nov2014, 15:26	3.97
Reach-790	9.024015	2884.3	02Nov2014, 15:31	3.95
W790	0.058117	106.4	02Nov2014, 12:37	5.60
Reservoir-2300	9.082132	2887.2	02Nov2014, 15:45	3.93
Reach-2300	9.082132	2886.0	02Nov2014, 15:50	3.92
W850	0.159866	547.5	02Nov2014, 12:10	5.91
W840	0.144036	456.6	02Nov2014, 12:16	6.79
Reach-830	0.303902	958.6	02Nov2014, 12:13	6.32
W2300	0.078733	123.3	02Nov2014, 12:39	4.85
GMRTrib4	9.464767	2948.5	02Nov2014, 15:46	4.00
W830	0.026314	49.3	02Nov2014, 12:14	3.61
Reach-720	9.491081	2951.1	02Nov2014, 15:48	4.00
W720	0.063825	201.0	02Nov2014, 12:13	6.04
Reservoir-2200	9.554906	2946.8	02Nov2014, 16:05	3.99
Reach-2200	9.554906	2946.7	02Nov2014, 16:06	3.98
W2200	0.083314	213.0	02Nov2014, 12:23	6.33
Reach-2201	9.638220	2956.8	02Nov2014, 16:10	4.00
W580	0.179172	397.5	02Nov2014, 12:34	6.80
W3500	0.134110	255.6	02Nov2014, 12:39	6.06
W3600	0.127673	273.2	02Nov2014, 12:35	6.58
Reach-580	0.127673	272.9	02Nov2014, 12:40	6.57
Reach-3700	0.440955	919.1	02Nov2014, 12:39	6.51

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	236.3	02Nov2014, 12:22	6.79
Reach-2900	0.526948	1075.5	02Nov2014, 12:42	6.53
W2900	0.115190	361.5	02Nov2014, 12:16	6.83
Reach-670	0.642138	1238.6	02Nov2014, 12:38	6.58
W670	0.164802	484.3	02Nov2014, 12:20	7.08
W3900	0.089883	229.3	02Nov2014, 12:20	5.76
Reach-710	0.089883	193.9	02Nov2014, 12:31	5.67
GMRTrib2	10.535043	3646.5	02Nov2014, 12:37	4.22
W710	0.190622	527.7	02Nov2014, 12:18	6.13
Reach-600	10.725665	3559.2	02Nov2014, 12:44	4.21
W600	0.155003	448.3	02Nov2014, 12:16	6.03
Reservoir-3800	10.880668	3697.4	02Nov2014, 12:47	4.23
Reach-3800	10.880668	3686.4	02Nov2014, 12:50	4.23
W3800	0.131793	352.5	02Nov2014, 12:20	6.18
Reservoir-2100	11.012461	3365.8	02Nov2014, 13:23	4.20
Reach-2100	11.012461	3361.1	02Nov2014, 13:28	4.19
W2100	0.092432	267.8	02Nov2014, 12:15	5.94
Reach-4700	11.104893	3351.2	02Nov2014, 13:34	4.19
W4700	0.094290	239.9	02Nov2014, 12:16	5.18
Reach-2000	11.199183	3379.1	02Nov2014, 13:34	4.19
W2000	0.113520	293.8	02Nov2014, 12:19	5.77
Reservoir-1900	11.312703	3409.6	02Nov2014, 13:40	4.20
Reach-1900	11.312703	3404.0	02Nov2014, 13:42	4.20
W1900	0.122992	314.0	02Nov2014, 12:20	5.88
Reservoir-1800	11.435695	3419.8	02Nov2014, 13:51	4.21
Reach-1800	11.435695	3418.8	02Nov2014, 13:52	4.21
W1800	0.148583	405.0	02Nov2014, 12:17	5.86
W4600	0.044115	98.3	02Nov2014, 12:18	4.78
Reach-4600	0.044115	84.5	02Nov2014, 12:26	4.73
Reservoir-530	11.628393	3354.7	02Nov2014, 14:17	4.22
Reach-530	11.628393	3324.6	02Nov2014, 14:32	4.21

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	370.1	02Nov2014, 12:19	6.62
W4100	0.093017	192.2	02Nov2014, 12:40	6.96
Reach-750	0.093017	189.9	02Nov2014, 12:48	6.94
Reservoir-1400	0.222696	395.2	02Nov2014, 12:39	6.74
Reach-1400	0.222696	360.8	02Nov2014, 12:50	6.72
W1400	0.136188	207.4	02Nov2014, 12:30	4.04
Reservoir-1000	0.358884	334.1	02Nov2014, 13:16	5.69
Reach-1000	0.358884	334.1	02Nov2014, 13:17	5.69
W760	0.162490	230.2	02Nov2014, 12:44	4.69
W1000	0.026933	52.5	02Nov2014, 12:23	4.58
Reach-1500	0.548307	563.8	02Nov2014, 12:46	5.34
W1500	0.128740	214.1	02Nov2014, 12:26	4.16
Reservoir-570	0.677047	493.9	02Nov2014, 13:28	5.11
Reach-570	0.677047	493.9	02Nov2014, 13:29	5.11
W570	0.098691	177.1	02Nov2014, 12:24	4.27
Reservoir-1100	0.775738	562.3	02Nov2014, 12:45	5.00
Reach-1100	0.775738	558.3	02Nov2014, 13:01	4.99
W1100	0.148073	238.3	02Nov2014, 12:17	3.38
Reach-FornesRun	0.923811	642.7	02Nov2014, 12:33	4.73
W530	0.112161	239.7	02Nov2014, 12:20	4.75
FornesRun	12.664365	3876.7	02Nov2014, 14:28	4.26
Reach-Fornescont	12.664365	3876.7	02Nov2014, 14:28	4.26
Reservoir-510	12.664365	3871.4	02Nov2014, 14:34	4.24
Reach-510	12.664365	3861.8	02Nov2014, 14:44	4.22
W1200	0.145402	247.0	02Nov2014, 12:29	4.44
W1600	0.069092	146.2	02Nov2014, 12:25	5.25
Reservoir-1700	0.069092	115.5	02Nov2014, 12:38	5.24
Reach-1700	0.069092	115.5	02Nov2014, 12:38	5.24
W1700	0.035228	85.8	02Nov2014, 12:17	5.04
Reservoir-1200	0.104320	134.8	02Nov2014, 12:49	5.17
Reach-1200	0.104320	134.8	02Nov2014, 12:52	5.16

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	362.2	02Nov2014, 12:34	4.73
Reach-1300	0.249722	361.8	02Nov2014, 12:36	4.73
W1300	0.153935	294.3	02Nov2014, 12:21	4.29
Reach-4500	0.403657	611.8	02Nov2014, 12:25	4.56
W4500	0.128624	240.4	02Nov2014, 12:23	4.44
Reservoir-520	0.532281	451.6	02Nov2014, 12:57	4.53
Reach-520	0.532281	451.5	02Nov2014, 13:00	4.52
W510	0.077580	181.6	02Nov2014, 12:21	5.35
W520	0.028353	73.2	02Nov2014, 12:17	5.38
ReedyBch	13.302579	4152.9	02Nov2014, 14:38	4.24
Reach-500	13.302579	4113.8	02Nov2014, 14:39	4.21
W500	0.183659	460.7	02Nov2014, 12:22	5.97
Reservoir-400	13.486238	4111.1	02Nov2014, 14:46	4.19
Reach-400	13.486238	3993.6	02Nov2014, 15:03	4.12
W400	0.141370	421.3	02Nov2014, 12:16	6.31
Reach-3400	13.627608	3915.1	02Nov2014, 15:28	4.04
W3400	0.134392	357.6	02Nov2014, 12:21	6.24
Outlet	13.762000	3940.6	02Nov2014, 15:27	4.06

Project: EXGMR10-100_Rev Simulation Run: 100 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 100 yr
Compute Time: 18Jul2016, 15:34:52 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	336.3	02Nov2014, 13:26	4.17
W700	0.248681	226.0	02Nov2014, 13:21	4.49
Reach-660	0.662365	558.1	02Nov2014, 13:37	4.27
W660	0.467389	568.6	02Nov2014, 12:56	4.68
W800	0.347947	354.0	02Nov2014, 13:11	4.58
GMRTrib9	1.477701	1337.5	02Nov2014, 13:12	4.47
Reservoir-770	1.477701	1138.5	02Nov2014, 13:43	4.47
Reach-770	1.477701	1134.6	02Nov2014, 14:17	4.35
W770	0.644502	911.7	02Nov2014, 12:56	5.47
Reach-3100	2.122203	1576.7	02Nov2014, 14:00	4.68
W550	0.358867	519.9	02Nov2014, 13:04	6.18
W560	0.110000	133.4	02Nov2014, 13:17	5.80
Reach-550	0.110000	125.3	02Nov2014, 13:36	5.70
Reach-3000	0.468867	461.3	02Nov2014, 14:02	5.79
W3000	0.385817	684.6	02Nov2014, 12:52	6.66
W4900	0.133889	287.1	02Nov2014, 12:30	5.75
Reach-4800	0.133889	285.3	02Nov2014, 12:34	5.73
W4800	0.047262	141.3	02Nov2014, 12:24	7.54
Reach-3000(2)	0.181151	407.7	02Nov2014, 12:38	6.19
Reservoir-990	1.035835	950.2	02Nov2014, 13:28	5.96
Reach-990	1.035835	900.5	02Nov2014, 13:38	5.93
W990	0.353913	625.2	02Nov2014, 12:51	6.55
Reservoir-2800	1.389748	395.3	02Nov2014, 17:04	5.02
Reach-2800	1.389748	395.1	02Nov2014, 17:16	4.94
W2800	0.034493	74.2	02Nov2014, 12:32	6.04
Reach-630	1.424241	399.6	02Nov2014, 17:08	4.90
W630	0.373057	654.8	02Nov2014, 12:48	6.24

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	458.8	02Nov2014, 16:49	4.44
Reach-2700	1.797298	458.7	02Nov2014, 16:54	4.42
W3100	0.373146	600.2	02Nov2014, 12:42	5.22
NorthForkGMR	4.292647	2149.0	02Nov2014, 13:58	4.62
W2700	0.020970	68.4	02Nov2014, 12:15	6.66
Reach-2600	4.313617	2155.7	02Nov2014, 13:58	4.63
W2600	0.000825	4.2	02Nov2014, 12:07	8.66
Reservoir-2600	4.314442	2054.3	02Nov2014, 14:28	4.62
Reach-780	4.314442	2046.4	02Nov2014, 14:53	4.49
W640	0.401148	631.5	02Nov2014, 12:53	5.96
Reach-650	0.401148	625.4	02Nov2014, 13:01	5.93
W780	0.246680	480.9	02Nov2014, 12:32	5.39
W650	0.164286	417.6	02Nov2014, 12:24	6.24
GMRTrib8	5.126556	2326.9	02Nov2014, 14:22	4.70
Reach-820	5.126556	2315.4	02Nov2014, 14:37	4.64
W920	0.460578	401.7	02Nov2014, 13:51	5.32
W5100	0.078185	194.7	02Nov2014, 12:21	5.65
Laurel Ridge	0.538763	427.1	02Nov2014, 13:50	5.37
Reach-5000	0.538763	304.1	02Nov2014, 13:52	4.17
W980	0.256902	294.0	02Nov2014, 13:31	6.17
Reach-980	0.256902	222.4	02Nov2014, 13:52	5.83
W5000	0.106592	283.3	02Nov2014, 12:20	5.94
Reservoir-930	0.902257	455.3	02Nov2014, 14:43	4.76
Reach-930	0.902257	340.2	02Nov2014, 15:27	4.53
W930	0.182222	245.4	02Nov2014, 13:02	5.59
W910	0.117701	127.6	02Nov2014, 13:02	4.48
Reservoir-940	1.202180	427.2	02Nov2014, 15:01	4.55
Reach-940	1.202180	425.2	02Nov2014, 15:32	4.52
W940	0.314395	382.4	02Nov2014, 12:42	3.95
W5200	0.144430	245.6	02Nov2014, 12:58	6.95
Reach-5200	0.144430	244.9	02Nov2014, 13:04	6.93

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	205.0	02Nov2014, 12:40	6.39
Reach-3200	0.102774	203.8	02Nov2014, 12:48	6.37
W960	0.082432	236.8	02Nov2014, 12:24	7.15
Trib2GMRTrib7	1.846211	1063.6	02Nov2014, 12:46	4.83
Reach-950	1.846211	1053.9	02Nov2014, 12:52	4.80
W5300	0.109099	279.3	02Nov2014, 12:38	8.80
W3300	0.093470	245.6	02Nov2014, 12:35	8.26
Reach-970	0.202569	500.0	02Nov2014, 12:45	8.50
W970	0.187536	435.0	02Nov2014, 12:37	7.30
W950	0.107912	206.9	02Nov2014, 12:26	4.75
W4400	0.037039	160.1	02Nov2014, 12:12	8.50
Reach-4400	0.037039	136.5	02Nov2014, 12:29	8.41
Trib1GMRTrib7	2.381267	2176.4	02Nov2014, 12:43	5.37
Reach-880	2.381267	2050.0	02Nov2014, 13:04	5.34
W880	0.381917	500.6	02Nov2014, 12:34	3.75
W820	0.054394	98.0	02Nov2014, 12:19	3.90
GMRTrib7	7.944134	4192.0	02Nov2014, 13:05	4.80
Reach-2500	7.944134	4045.1	02Nov2014, 13:13	4.78
W2500	0.061783	223.9	02Nov2014, 12:16	7.70
Reservoir-860	8.005917	3610.5	02Nov2014, 13:53	4.78
Reach-860	8.005917	3558.9	02Nov2014, 14:16	4.71
W900	0.129395	353.9	02Nov2014, 12:27	7.21
W4300	0.118974	471.0	02Nov2014, 12:15	8.89
Reach-900	0.118974	452.0	02Nov2014, 12:20	8.87
W890	0.113096	343.6	02Nov2014, 12:25	7.91
W4200	0.107748	336.0	02Nov2014, 12:25	8.27
Reach-890	0.107748	334.7	02Nov2014, 12:28	8.26
TribGMRTrib6	0.469213	1454.9	02Nov2014, 12:24	8.04
Reach-870	0.469213	1351.9	02Nov2014, 12:25	7.99
W860	0.125460	305.7	02Nov2014, 12:18	5.14
W870	0.015309	55.1	02Nov2014, 12:16	7.59

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	3766.6	02Nov2014, 14:10	4.90
Reach-810	8.615899	3764.5	02Nov2014, 14:16	4.89
W810	0.118699	305.3	02Nov2014, 12:17	5.37
Reservoir-2400	8.734598	3577.9	02Nov2014, 15:09	4.86
Reach-2400	8.734598	3571.7	02Nov2014, 15:16	4.84
W740	0.102118	295.3	02Nov2014, 12:25	7.49
Reach-4000	0.102118	294.6	02Nov2014, 12:30	7.48
W4000	0.094479	310.5	02Nov2014, 12:22	8.19
W2400	0.092820	242.4	02Nov2014, 12:25	6.55
GMRTrib5	9.024015	3641.9	02Nov2014, 15:14	4.92
Reach-790	9.024015	3637.8	02Nov2014, 15:19	4.90
W790	0.058117	129.8	02Nov2014, 12:37	6.86
Reservoir-2300	9.082132	3639.9	02Nov2014, 15:32	4.87
Reach-2300	9.082132	3638.0	02Nov2014, 15:37	4.85
W850	0.159866	661.7	02Nov2014, 12:10	7.20
W840	0.144036	541.3	02Nov2014, 12:16	8.12
Reach-830	0.303902	1148.4	02Nov2014, 12:13	7.64
W2300	0.078733	153.7	02Nov2014, 12:39	6.06
GMRTrib4	9.464767	3717.7	02Nov2014, 15:34	4.95
W830	0.026314	64.5	02Nov2014, 12:14	4.68
Reach-720	9.491081	3720.9	02Nov2014, 15:36	4.95
W720	0.063825	242.3	02Nov2014, 12:13	7.34
Reservoir-2200	9.554906	3722.1	02Nov2014, 15:47	4.93
Reach-2200	9.554906	3722.0	02Nov2014, 15:49	4.93
W2200	0.083314	255.0	02Nov2014, 12:23	7.64
Reach-2201	9.638220	3733.6	02Nov2014, 15:53	4.95
W580	0.179172	471.1	02Nov2014, 12:34	8.14
W3500	0.134110	308.1	02Nov2014, 12:38	7.35
W3600	0.127673	325.3	02Nov2014, 12:35	7.91
Reach-580	0.127673	324.9	02Nov2014, 12:39	7.90
Reach-3700	0.440955	1096.4	02Nov2014, 12:39	7.82

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	280.2	02Nov2014, 12:22	8.12
Reach-2900	0.526948	1283.2	02Nov2014, 12:41	7.85
W2900	0.115190	428.2	02Nov2014, 12:16	8.17
Reach-670	0.642138	1480.9	02Nov2014, 12:38	7.90
W670	0.164802	570.9	02Nov2014, 12:20	8.43
W3900	0.089883	278.4	02Nov2014, 12:20	7.04
Reach-710	0.089883	236.2	02Nov2014, 12:31	6.94
GMRTrib2	10.535043	4349.9	02Nov2014, 12:36	5.20
W710	0.190622	635.0	02Nov2014, 12:18	7.43
Reach-600	10.725665	4272.4	02Nov2014, 12:43	5.19
W600	0.155003	540.7	02Nov2014, 12:16	7.33
Reservoir-3800	10.880668	4445.3	02Nov2014, 12:45	5.21
Reach-3800	10.880668	4431.2	02Nov2014, 12:48	5.21
W3800	0.131793	423.6	02Nov2014, 12:20	7.48
Reservoir-2100	11.012461	4071.6	02Nov2014, 13:20	5.18
Reach-2100	11.012461	4063.3	02Nov2014, 13:25	5.17
W2100	0.092432	323.7	02Nov2014, 12:15	7.23
Reach-4700	11.104893	4044.4	02Nov2014, 13:32	5.16
W4700	0.094290	296.0	02Nov2014, 12:16	6.42
Reach-2000	11.199183	4078.6	02Nov2014, 13:32	5.17
W2000	0.113520	356.6	02Nov2014, 12:19	7.06
Reservoir-1900	11.312703	4121.7	02Nov2014, 13:35	5.18
Reach-1900	11.312703	4118.3	02Nov2014, 13:37	5.18
W1900	0.122992	380.2	02Nov2014, 12:20	7.16
Reservoir-1800	11.435695	4163.5	02Nov2014, 13:40	5.19
Reach-1800	11.435695	4163.1	02Nov2014, 13:40	5.19
W1800	0.148583	490.6	02Nov2014, 12:17	7.15
W4600	0.044115	122.9	02Nov2014, 12:18	5.98
Reach-4600	0.044115	105.9	02Nov2014, 12:25	5.92
Reservoir-530	11.628393	4178.2	02Nov2014, 13:54	5.20
Reach-530	11.628393	4121.1	02Nov2014, 14:06	5.19

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	440.4	02Nov2014, 12:19	7.95
W4100	0.093017	227.1	02Nov2014, 12:40	8.30
Reach-750	0.093017	224.4	02Nov2014, 12:47	8.27
Reservoir-1400	0.222696	491.5	02Nov2014, 12:36	8.07
Reach-1400	0.222696	460.5	02Nov2014, 12:46	8.04
W1400	0.136188	266.1	02Nov2014, 12:29	5.16
Reservoir-1000	0.358884	360.8	02Nov2014, 13:21	6.94
Reach-1000	0.358884	360.8	02Nov2014, 13:21	6.94
W760	0.162490	288.6	02Nov2014, 12:43	5.88
W1000	0.026933	66.1	02Nov2014, 12:22	5.76
Reach-1500	0.548307	660.1	02Nov2014, 12:44	6.57
W1500	0.128740	273.4	02Nov2014, 12:26	5.29
Reservoir-570	0.677047	557.2	02Nov2014, 13:28	6.32
Reach-570	0.677047	557.2	02Nov2014, 13:29	6.32
W570	0.098691	225.3	02Nov2014, 12:23	5.42
Reservoir-1100	0.775738	632.6	02Nov2014, 12:39	6.20
Reach-1100	0.775738	623.5	02Nov2014, 12:57	6.18
W1100	0.148073	315.3	02Nov2014, 12:17	4.42
Reach-FornesRun	0.923811	736.5	02Nov2014, 12:24	5.90
W530	0.112161	299.8	02Nov2014, 12:20	5.95
FornesRun	12.664365	4779.2	02Nov2014, 14:04	5.25
Reach-Fornescont	12.664365	4779.2	02Nov2014, 14:04	5.25
Reservoir-510	12.664365	4738.7	02Nov2014, 14:16	5.23
Reach-510	12.664365	4731.5	02Nov2014, 14:24	5.21
W1200	0.145402	312.2	02Nov2014, 12:28	5.60
W1600	0.069092	180.1	02Nov2014, 12:25	6.49
Reservoir-1700	0.069092	138.9	02Nov2014, 12:39	6.48
Reach-1700	0.069092	138.9	02Nov2014, 12:39	6.48
W1700	0.035228	106.3	02Nov2014, 12:16	6.27
Reservoir-1200	0.104320	158.1	02Nov2014, 12:51	6.41
Reach-1200	0.104320	157.7	02Nov2014, 12:53	6.40

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	442.8	02Nov2014, 12:33	5.93
Reach-1300	0.249722	442.1	02Nov2014, 12:35	5.92
W1300	0.153935	374.3	02Nov2014, 12:20	5.44
Reach-4500	0.403657	752.0	02Nov2014, 12:28	5.74
W4500	0.128624	304.1	02Nov2014, 12:23	5.60
Reservoir-520	0.532281	530.7	02Nov2014, 13:00	5.70
Reach-520	0.532281	530.5	02Nov2014, 13:02	5.69
W510	0.077580	223.0	02Nov2014, 12:21	6.60
W520	0.028353	89.7	02Nov2014, 12:17	6.64
ReedyBch	13.302579	5137.3	02Nov2014, 14:15	5.24
Reach-500	13.302579	5072.2	02Nov2014, 14:26	5.21
W500	0.183659	556.4	02Nov2014, 12:22	7.26
Reservoir-400	13.486238	5099.7	02Nov2014, 14:35	5.18
Reach-400	13.486238	4921.7	02Nov2014, 14:49	5.09
W400	0.141370	504.8	02Nov2014, 12:16	7.62
Reach-3400	13.627608	4780.5	02Nov2014, 15:11	4.98
W3400	0.134392	429.0	02Nov2014, 12:21	7.55
Outlet	13.762000	4813.0	02Nov2014, 15:10	5.01

Project: EXGMR10-100_Rev Simulation Run: TS Irene

Start of Run:	26Aug2011, 19:00	Basin Model:	GMR Subbasins
End of Run:	28Aug2011, 00:00	Meteorologic Model:	TS Irene
Compute Time:	18Jul2016, 15:33:10	Control Specifications:	Aug27

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	191.3	27Aug2011, 11:29	5.42
W700	0.248681	122.4	27Aug2011, 11:26	5.78
Reach-660	0.662365	313.3	27Aug2011, 11:38	5.56
W660	0.467389	249.2	27Aug2011, 11:13	5.95
W800	0.347947	177.4	27Aug2011, 11:20	5.86
GMRTrib9	1.477701	731.5	27Aug2011, 11:21	5.75
Reservoir-770	1.477701	730.9	27Aug2011, 11:23	5.75
Reach-770	1.477701	715.6	27Aug2011, 11:55	5.73
W770	0.644502	379.9	27Aug2011, 11:13	6.83
Reach-3100	2.122203	1036.2	27Aug2011, 11:55	6.05
W550	0.358867	224.3	27Aug2011, 11:15	7.61
W560	0.110000	64.8	27Aug2011, 11:22	7.22
Reach-550	0.110000	63.9	27Aug2011, 11:38	7.20
Reach-3000	0.468867	274.5	27Aug2011, 11:44	7.46
W3000	0.385817	256.4	27Aug2011, 11:10	8.11
W4900	0.133889	84.9	27Aug2011, 11:03	7.08
Reach-4800	0.133889	84.8	27Aug2011, 11:08	7.08
W4800	0.047262	34.4	27Aug2011, 11:01	8.98
Reach-3000(2)	0.181151	118.6	27Aug2011, 11:12	7.58
Reservoir-990	1.035835	614.6	27Aug2011, 11:30	7.56
Reach-990	1.035835	600.2	27Aug2011, 11:35	7.55
W990	0.353913	233.5	27Aug2011, 11:10	7.99
Reservoir-2800	1.389748	372.7	27Aug2011, 15:51	6.86
Reach-2800	1.389748	372.5	27Aug2011, 16:01	6.78
W2800	0.034493	22.4	27Aug2011, 11:03	7.40
Reach-630	1.424241	381.0	27Aug2011, 15:14	6.74
W630	0.373057	240.8	27Aug2011, 11:09	7.65

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	460.7	27Aug2011, 18:42	6.25
Reach-2700	1.797298	460.7	27Aug2011, 18:47	6.23
W3100	0.373146	219.1	27Aug2011, 11:07	6.53
NorthForkGMR	4.292647	1604.5	27Aug2011, 11:33	6.17
W2700	0.020970	14.5	27Aug2011, 11:00	8.04
Reach-2600	4.313617	1609.0	27Aug2011, 11:32	6.18
W2600	0.000825	0.6	27Aug2011, 11:00	10.11
Reservoir-2600	4.314442	1605.7	27Aug2011, 11:40	6.17
Reach-780	4.314442	1588.6	27Aug2011, 12:04	6.06
W640	0.401148	250.0	27Aug2011, 11:11	7.36
Reach-650	0.401148	249.4	27Aug2011, 11:20	7.35
W780	0.246680	150.2	27Aug2011, 11:04	6.70
W650	0.164286	109.6	27Aug2011, 11:02	7.60
GMRTrib8	5.126556	1931.1	27Aug2011, 11:21	6.24
Reach-820	5.126556	1911.1	27Aug2011, 11:37	6.20
W920	0.460578	240.6	27Aug2011, 11:41	6.75
W5100	0.078185	49.6	27Aug2011, 11:01	6.96
Laurel Ridge	0.538763	278.2	27Aug2011, 11:08	6.78
Reach-5000	0.538763	210.7	27Aug2011, 11:09	5.66
W980	0.256902	153.3	27Aug2011, 11:28	7.66
Reach-980	0.256902	144.4	27Aug2011, 11:39	7.56
W5000	0.106592	69.6	27Aug2011, 11:01	7.28
Reservoir-930	0.902257	317.8	27Aug2011, 12:35	6.33
Reach-930	0.902257	298.3	27Aug2011, 13:55	6.18
W930	0.182222	107.6	27Aug2011, 11:15	6.97
W910	0.117701	60.1	27Aug2011, 11:17	5.74
Reservoir-940	1.202180	374.2	27Aug2011, 12:17	6.13
Reach-940	1.202180	369.9	27Aug2011, 12:46	6.09
W940	0.314395	153.7	27Aug2011, 11:08	5.11
W5200	0.144430	97.0	27Aug2011, 11:12	8.43
Reach-5200	0.144430	97.0	27Aug2011, 11:19	8.43

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	68.0	27Aug2011, 11:06	7.80
Reach-3200	0.102774	68.0	27Aug2011, 11:15	7.80
W960	0.082432	58.7	27Aug2011, 11:01	8.57
Trib2GMRTrib7	1.846211	660.4	27Aug2011, 11:11	6.31
Reach-950	1.846211	657.8	27Aug2011, 11:18	6.29
W5300	0.109099	82.1	27Aug2011, 11:04	10.31
W3300	0.093470	69.5	27Aug2011, 11:03	9.75
Reach-970	0.202569	150.8	27Aug2011, 11:11	10.04
W970	0.187536	132.8	27Aug2011, 11:04	8.76
W950	0.107912	61.4	27Aug2011, 11:02	5.98
W4400	0.037039	28.1	27Aug2011, 11:00	9.95
Reach-4400	0.037039	28.1	27Aug2011, 11:14	9.94
Trib1GMRTrib7	2.381267	1023.7	27Aug2011, 11:11	6.85
Reach-880	2.381267	1009.8	27Aug2011, 11:32	6.82
W880	0.381917	183.5	27Aug2011, 11:05	4.87
W820	0.054394	27.6	27Aug2011, 11:01	5.02
GMRTrib7	7.944134	3062.4	27Aug2011, 11:25	6.31
Reach-2500	7.944134	3038.6	27Aug2011, 11:31	6.30
W2500	0.061783	45.5	27Aug2011, 11:00	9.13
Reservoir-860	8.005917	2942.9	27Aug2011, 11:56	6.30
Reach-860	8.005917	2907.4	27Aug2011, 12:13	6.25
W900	0.129395	92.3	27Aug2011, 11:02	8.64
W4300	0.118974	91.2	27Aug2011, 11:00	10.36
Reach-900	0.118974	91.2	27Aug2011, 11:02	10.36
W890	0.113096	83.7	27Aug2011, 11:01	9.37
W4200	0.107748	80.9	27Aug2011, 11:01	9.74
Reach-890	0.107748	80.8	27Aug2011, 11:04	9.74
TribGMRTrib6	0.469213	347.9	27Aug2011, 11:02	9.51
Reach-870	0.469213	346.6	27Aug2011, 11:03	9.49
W860	0.125460	75.6	27Aug2011, 11:01	6.39
W870	0.015309	11.2	27Aug2011, 11:00	9.02

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	3031.7	27Aug2011, 12:11	6.43
Reach-810	8.615899	3031.0	27Aug2011, 12:17	6.43
W810	0.118699	73.4	27Aug2011, 11:01	6.65
Reservoir-2400	8.734598	2966.2	27Aug2011, 12:53	6.40
Reach-2400	8.734598	2962.5	27Aug2011, 13:00	6.38
W740	0.102118	74.1	27Aug2011, 11:01	8.94
Reach-4000	0.102118	74.0	27Aug2011, 11:08	8.94
W4000	0.094479	70.8	27Aug2011, 11:00	9.65
W2400	0.092820	63.4	27Aug2011, 11:02	7.94
GMRTrib5	9.024015	3032.1	27Aug2011, 13:00	6.46
Reach-790	9.024015	3029.5	27Aug2011, 13:05	6.44
W790	0.058117	40.1	27Aug2011, 11:04	8.29
Reservoir-2300	9.082132	3034.4	27Aug2011, 13:19	6.42
Reach-2300	9.082132	3033.2	27Aug2011, 13:24	6.41
W850	0.159866	115.0	27Aug2011, 11:00	8.61
W840	0.144036	108.0	27Aug2011, 11:00	9.57
Reach-830	0.303902	223.0	27Aug2011, 11:01	9.06
W2300	0.078733	50.8	27Aug2011, 11:05	7.43
GMRTrib4	9.464767	3126.0	27Aug2011, 13:24	6.50
W830	0.026314	15.0	27Aug2011, 11:00	5.88
Reach-720	9.491081	3130.6	27Aug2011, 13:26	6.49
W720	0.063825	46.2	27Aug2011, 11:00	8.75
Reservoir-2200	9.554906	3133.8	27Aug2011, 13:42	6.48
Reach-2200	9.554906	3133.8	27Aug2011, 13:44	6.48
W2200	0.083314	61.0	27Aug2011, 11:01	9.08
Reach-2201	9.638220	3151.9	27Aug2011, 13:47	6.49
W580	0.179172	132.7	27Aug2011, 11:03	9.62
W3500	0.134110	95.2	27Aug2011, 11:05	8.81
W3600	0.127673	93.6	27Aug2011, 11:03	9.38
Reach-580	0.127673	93.5	27Aug2011, 11:09	9.38
Reach-3700	0.440955	321.0	27Aug2011, 11:07	9.31

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	64.3	27Aug2011, 11:00	9.59
Reach-2900	0.526948	383.8	27Aug2011, 11:11	9.35
W2900	0.115190	86.5	27Aug2011, 11:00	9.62
Reach-670	0.642138	467.6	27Aug2011, 11:04	9.40
W670	0.164802	124.7	27Aug2011, 11:00	9.90
W3900	0.089883	63.8	27Aug2011, 11:00	8.44
Reach-710	0.089883	63.3	27Aug2011, 11:07	8.43
GMRTrib2	10.535043	3375.2	27Aug2011, 13:48	6.74
W710	0.190622	138.5	27Aug2011, 11:00	8.86
Reach-600	10.725665	3410.6	27Aug2011, 13:58	6.74
W600	0.155003	112.1	27Aug2011, 11:00	8.74
Reservoir-3800	10.880668	3472.1	27Aug2011, 11:15	6.76
Reach-3800	10.880668	3466.4	27Aug2011, 11:18	6.76
W3800	0.131793	95.9	27Aug2011, 11:00	8.91
Reservoir-2100	11.012461	3475.7	27Aug2011, 14:51	6.73
Reach-2100	11.012461	3475.3	27Aug2011, 14:55	6.72
W2100	0.092432	66.5	27Aug2011, 11:00	8.65
Reach-4700	11.104893	3501.0	27Aug2011, 15:00	6.71
W4700	0.094290	64.3	27Aug2011, 11:00	7.79
Reach-2000	11.199183	3528.6	27Aug2011, 15:01	6.72
W2000	0.113520	80.7	27Aug2011, 11:00	8.46
Reservoir-1900	11.312703	3562.6	27Aug2011, 15:03	6.73
Reach-1900	11.312703	3562.3	27Aug2011, 15:04	6.73
W1900	0.122992	87.9	27Aug2011, 11:00	8.58
Reservoir-1800	11.435695	3599.0	27Aug2011, 15:06	6.74
Reach-1800	11.435695	3598.9	27Aug2011, 15:06	6.74
W1800	0.148583	106.3	27Aug2011, 11:00	8.56
W4600	0.044115	28.9	27Aug2011, 11:01	7.31
Reach-4600	0.044115	28.7	27Aug2011, 11:04	7.30
Reservoir-530	11.628393	3651.0	27Aug2011, 15:11	6.75
Reach-530	11.628393	3644.8	27Aug2011, 15:16	6.74

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	96.4	27Aug2011, 11:00	9.40
W4100	0.093017	68.9	27Aug2011, 11:05	9.80
Reach-750	0.093017	68.8	27Aug2011, 11:12	9.80
Reservoir-1400	0.222696	146.8	27Aug2011, 11:15	9.56
Reach-1400	0.222696	146.7	27Aug2011, 11:18	9.56
W1400	0.136188	81.1	27Aug2011, 11:03	6.44
Reservoir-1000	0.358884	222.8	27Aug2011, 11:14	8.38
Reach-1000	0.358884	222.8	27Aug2011, 11:14	8.38
W760	0.162490	102.2	27Aug2011, 11:07	7.25
W1000	0.026933	17.3	27Aug2011, 11:02	7.09
Reach-1500	0.548307	341.0	27Aug2011, 11:09	7.98
W1500	0.128740	78.2	27Aug2011, 11:02	6.58
Reservoir-570	0.677047	399.6	27Aug2011, 11:18	7.71
Reach-570	0.677047	399.6	27Aug2011, 11:19	7.71
W570	0.098691	61.0	27Aug2011, 11:02	6.71
Reservoir-1100	0.775738	455.0	27Aug2011, 11:12	7.58
Reach-1100	0.775738	454.0	27Aug2011, 11:23	7.58
W1100	0.148073	81.4	27Aug2011, 11:01	5.60
Reach-FornesRun	0.923811	526.1	27Aug2011, 11:05	7.26
W530	0.112161	73.3	27Aug2011, 11:01	7.28
FornesRun	12.664365	3915.7	27Aug2011, 15:09	6.79
Reach-Fornescont	12.664365	3915.7	27Aug2011, 15:09	6.79
Reservoir-510	12.664365	3912.1	27Aug2011, 15:14	6.77
Reach-510	12.664365	3906.1	27Aug2011, 15:21	6.75
W1200	0.145402	91.0	27Aug2011, 11:03	6.92
W1600	0.069092	47.0	27Aug2011, 11:02	7.87
Reservoir-1700	0.069092	46.9	27Aug2011, 11:04	7.87
Reach-1700	0.069092	46.9	27Aug2011, 11:04	7.87
W1700	0.035228	23.7	27Aug2011, 11:00	7.62
Reservoir-1200	0.104320	70.5	27Aug2011, 11:02	7.79
Reach-1200	0.104320	70.4	27Aug2011, 11:05	7.78

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	160.7	27Aug2011, 11:07	7.28
Reach-1300	0.249722	160.7	27Aug2011, 11:08	7.28
W1300	0.153935	95.6	27Aug2011, 11:01	6.73
Reach-4500	0.403657	255.7	27Aug2011, 11:03	7.07
W4500	0.128624	81.0	27Aug2011, 11:02	6.91
Reservoir-520	0.532281	304.8	27Aug2011, 11:15	7.03
Reach-520	0.532281	304.7	27Aug2011, 11:17	7.03
W510	0.077580	53.4	27Aug2011, 11:01	7.98
W520	0.028353	19.6	27Aug2011, 11:00	8.02
ReedyBch	13.302579	4072.7	27Aug2011, 15:15	6.77
Reach-500	13.302579	4056.8	27Aug2011, 15:18	6.73
W500	0.183659	131.9	27Aug2011, 11:01	8.69
Reservoir-400	13.486238	4089.1	27Aug2011, 15:24	6.70
Reach-400	13.486238	4056.4	27Aug2011, 15:31	6.61
W400	0.141370	103.8	27Aug2011, 11:00	9.05
Reach-3400	13.627608	4053.1	27Aug2011, 15:37	6.51
W3400	0.134392	98.1	27Aug2011, 11:00	8.98
Outlet	13.762000	4074.0	27Aug2011, 15:32	6.53

Project: EXGMR10-100_Rev Simulation Run: TS Kyle

Start of Run: 11Oct2002, 00:00 Basin Model: GMR Subbasins
End of Run: 12Oct2002, 00:00 Meteorologic Model: TS Kyle
Compute Time: 18Jul2016, 15:33:41 Control Specifications: Oct11

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	97.2	11Oct2002, 19:48	1.33
W700	0.248681	65.3	11Oct2002, 19:45	1.50
Reach-660	0.662365	161.9	11Oct2002, 19:57	1.39
W660	0.467389	153.6	11Oct2002, 19:25	1.59
W800	0.347947	99.9	11Oct2002, 19:37	1.55
GMRTrib9	1.477701	389.6	11Oct2002, 19:36	1.49
Reservoir-770	1.477701	389.3	11Oct2002, 19:38	1.49
Reach-770	1.477701	363.6	11Oct2002, 20:24	1.47
W770	0.644502	248.8	11Oct2002, 19:25	2.07
Reach-3100	2.122203	463.8	11Oct2002, 20:42	1.63
W550	0.358867	166.3	11Oct2002, 16:58	2.54
W560	0.110000	41.5	11Oct2002, 17:16	2.30
Reach-550	0.110000	39.6	11Oct2002, 17:42	2.27
Reach-3000	0.468867	181.9	11Oct2002, 17:38	2.42
W3000	0.385817	231.3	11Oct2002, 16:38	2.87
W4900	0.133889	74.6	11Oct2002, 16:17	2.22
Reach-4800	0.133889	74.1	11Oct2002, 16:23	2.22
W4800	0.047262	49.6	11Oct2002, 16:09	3.49
Reach-3000(2)	0.181151	116.4	11Oct2002, 16:27	2.55
Reservoir-990	1.035835	300.4	11Oct2002, 20:00	2.38
Reach-990	1.035835	297.9	11Oct2002, 20:07	2.36
W990	0.353913	206.2	11Oct2002, 16:38	2.79
Reservoir-2800	1.389748	290.5	11Oct2002, 21:03	2.17
Reach-2800	1.389748	290.2	11Oct2002, 21:14	2.10
W2800	0.034493	20.7	11Oct2002, 16:19	2.41
Reach-630	1.424241	291.8	11Oct2002, 21:15	2.06
W630	0.373057	200.6	11Oct2002, 16:35	2.57

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	304.3	11Oct2002, 21:42	1.65
Reach-2700	1.797298	304.3	11Oct2002, 21:47	1.64
W3100	0.373146	153.6	11Oct2002, 19:15	1.90
NorthForkGMR	4.292647	791.8	11Oct2002, 19:27	1.66
W2700	0.020970	19.0	11Oct2002, 16:05	2.82
Reach-2600	4.313617	794.9	11Oct2002, 19:25	1.66
W2600	0.000825	1.2	11Oct2002, 16:00	4.40
Reservoir-2600	4.314442	791.9	11Oct2002, 19:33	1.66
Reach-780	4.314442	783.8	11Oct2002, 21:03	1.58
W640	0.401148	185.8	11Oct2002, 16:44	2.38
Reach-650	0.401148	184.8	11Oct2002, 16:54	2.38
W780	0.246680	115.7	11Oct2002, 16:19	2.00
W650	0.164286	117.4	11Oct2002, 16:12	2.54
GMRTrib8	5.126556	1029.0	11Oct2002, 19:20	1.69
Reach-820	5.126556	1006.8	11Oct2002, 19:37	1.65
W920	0.460578	127.6	11Oct2002, 20:05	2.01
W5100	0.078185	47.6	11Oct2002, 16:10	2.15
Laurel Ridge	0.538763	140.4	11Oct2002, 19:07	2.03
Reach-5000	0.538763	79.2	11Oct2002, 19:08	1.02
W980	0.256902	101.9	11Oct2002, 17:30	2.57
Reach-980	0.256902	89.2	11Oct2002, 17:49	2.48
W5000	0.106592	73.0	11Oct2002, 16:09	2.34
Reservoir-930	0.902257	168.9	11Oct2002, 19:26	1.55
Reach-930	0.902257	155.9	11Oct2002, 20:46	1.42
W930	0.182222	69.2	11Oct2002, 17:00	2.15
W910	0.117701	35.1	11Oct2002, 19:30	1.48
Reservoir-940	1.202180	192.5	11Oct2002, 20:35	1.44
Reach-940	1.202180	192.4	11Oct2002, 20:44	1.40
W940	0.314395	96.1	11Oct2002, 19:15	1.18
W5200	0.144430	89.6	11Oct2002, 16:46	3.09
Reach-5200	0.144430	89.5	11Oct2002, 16:53	3.09

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	63.3	11Oct2002, 16:26	2.66
Reach-3200	0.102774	63.1	11Oct2002, 16:36	2.66
W960	0.082432	78.0	11Oct2002, 16:10	3.19
Trib2GMRTrib7	1.846211	398.6	11Oct2002, 19:18	1.65
Reach-950	1.846211	396.3	11Oct2002, 19:25	1.63
W5300	0.109099	133.2	11Oct2002, 16:18	4.57
W3300	0.093470	104.9	11Oct2002, 16:16	4.09
Reach-970	0.202569	231.1	11Oct2002, 16:27	4.33
W970	0.187536	158.9	11Oct2002, 16:21	3.32
W950	0.107912	46.1	11Oct2002, 19:05	1.61
W4400	0.037039	52.4	11Oct2002, 16:01	4.26
Reach-4400	0.037039	50.8	11Oct2002, 16:18	4.21
Trib1GMRTrib7	2.381267	697.5	11Oct2002, 16:29	2.03
Reach-880	2.381267	651.2	11Oct2002, 17:09	2.01
W880	0.381917	118.6	11Oct2002, 19:10	1.07
W820	0.054394	19.5	11Oct2002, 19:02	1.14
GMRTrib7	7.944134	1678.0	11Oct2002, 19:44	1.73
Reach-2500	7.944134	1655.2	11Oct2002, 19:51	1.71
W2500	0.061783	72.8	11Oct2002, 16:04	3.61
Reservoir-860	8.005917	1621.8	11Oct2002, 20:05	1.72
Reach-860	8.005917	1582.5	11Oct2002, 20:23	1.67
W900	0.129395	120.6	11Oct2002, 16:12	3.24
W4300	0.118974	176.2	11Oct2002, 16:02	4.62
Reach-900	0.118974	175.0	11Oct2002, 16:06	4.61
W890	0.113096	129.1	11Oct2002, 16:09	3.79
W4200	0.107748	133.3	11Oct2002, 16:09	4.08
Reach-890	0.107748	133.1	11Oct2002, 16:12	4.08
TribGMRTrib6	0.469213	554.5	11Oct2002, 16:09	3.91
Reach-870	0.469213	530.3	11Oct2002, 16:11	3.88
W860	0.125460	65.3	11Oct2002, 16:08	1.83
W870	0.015309	17.6	11Oct2002, 16:04	3.52

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	1624.4	11Oct2002, 20:21	1.80
Reach-810	8.615899	1623.6	11Oct2002, 20:25	1.79
W810	0.118699	68.5	11Oct2002, 16:07	1.97
Reservoir-2400	8.734598	1622.8	11Oct2002, 19:19	1.76
Reach-2400	8.734598	1610.7	11Oct2002, 20:43	1.75
W740	0.102118	104.3	11Oct2002, 16:11	3.46
Reach-4000	0.102118	104.2	11Oct2002, 16:17	3.46
W4000	0.094479	117.8	11Oct2002, 16:07	4.01
W2400	0.092820	72.6	11Oct2002, 16:12	2.75
GMRTrib5	9.024015	1757.1	11Oct2002, 19:15	1.80
Reach-790	9.024015	1746.3	11Oct2002, 19:19	1.78
W790	0.058117	43.5	11Oct2002, 16:21	3.00
Reservoir-2300	9.082132	1740.5	11Oct2002, 19:31	1.76
Reach-2300	9.082132	1737.1	11Oct2002, 19:36	1.74
W850	0.159866	177.1	11Oct2002, 16:02	3.21
W840	0.144036	185.7	11Oct2002, 16:04	3.95
Reach-830	0.303902	361.6	11Oct2002, 16:03	3.56
W2300	0.078733	44.0	11Oct2002, 16:25	2.43
GMRTrib4	9.464767	1818.3	11Oct2002, 19:08	1.81
W830	0.026314	11.9	11Oct2002, 16:06	1.56
Reach-720	9.491081	1820.5	11Oct2002, 19:09	1.80
W720	0.063825	71.0	11Oct2002, 16:03	3.32
Reservoir-2200	9.554906	1808.9	11Oct2002, 19:23	1.79
Reach-2200	9.554906	1808.9	11Oct2002, 19:24	1.79
W2200	0.083314	90.4	11Oct2002, 16:09	3.57
Reach-2201	9.638220	1833.6	11Oct2002, 19:23	1.79
W580	0.179172	196.5	11Oct2002, 16:16	3.99
W3500	0.134110	114.0	11Oct2002, 16:22	3.36
W3600	0.127673	131.0	11Oct2002, 16:17	3.80
Reach-580	0.127673	130.9	11Oct2002, 16:23	3.80
Reach-3700	0.440955	437.7	11Oct2002, 16:22	3.74

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	105.6	11Oct2002, 16:07	3.96
Reach-2900	0.526948	519.7	11Oct2002, 16:25	3.77
W2900	0.115190	149.3	11Oct2002, 16:04	3.99
Reach-670	0.642138	608.6	11Oct2002, 16:20	3.81
W670	0.164802	219.1	11Oct2002, 16:05	4.21
W3900	0.089883	86.5	11Oct2002, 16:07	3.10
Reach-710	0.089883	78.8	11Oct2002, 16:19	3.05
GMRTrib2	10.535043	2351.2	11Oct2002, 19:13	1.97
W710	0.190622	206.3	11Oct2002, 16:06	3.40
Reach-600	10.725665	2316.8	11Oct2002, 19:19	1.95
W600	0.155003	167.0	11Oct2002, 16:05	3.31
Reservoir-3800	10.880668	2366.9	11Oct2002, 19:18	1.96
Reach-3800	10.880668	2355.6	11Oct2002, 19:23	1.96
W3800	0.131793	141.8	11Oct2002, 16:07	3.44
Reservoir-2100	11.012461	2215.7	11Oct2002, 19:50	1.93
Reach-2100	11.012461	2214.2	11Oct2002, 19:55	1.92
W2100	0.092432	97.8	11Oct2002, 16:04	3.24
Reach-4700	11.104893	2203.7	11Oct2002, 20:01	1.91
W4700	0.094290	79.5	11Oct2002, 16:05	2.66
Reach-2000	11.199183	2208.0	11Oct2002, 20:03	1.91
W2000	0.113520	110.5	11Oct2002, 16:07	3.11
Reservoir-1900	11.312703	2200.3	11Oct2002, 20:15	1.91
Reach-1900	11.312703	2199.4	11Oct2002, 20:16	1.91
W1900	0.122992	121.5	11Oct2002, 16:08	3.20
Reservoir-1800	11.435695	2190.6	11Oct2002, 20:30	1.92
Reach-1800	11.435695	2190.5	11Oct2002, 20:30	1.92
W1800	0.148583	150.9	11Oct2002, 16:06	3.18
W4600	0.044115	31.4	11Oct2002, 16:07	2.36
Reach-4600	0.044115	28.3	11Oct2002, 16:16	2.33
Reservoir-530	11.628393	2162.9	11Oct2002, 20:53	1.92
Reach-530	11.628393	2159.7	11Oct2002, 21:00	1.92

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	156.6	11Oct2002, 16:06	3.81
W4100	0.093017	100.1	11Oct2002, 16:21	4.13
Reach-750	0.093017	99.4	11Oct2002, 16:29	4.13
Reservoir-1400	0.222696	146.8	11Oct2002, 16:54	3.94
Reach-1400	0.222696	146.7	11Oct2002, 16:58	3.94
W1400	0.136188	61.8	11Oct2002, 19:07	1.85
Reservoir-1000	0.358884	189.3	11Oct2002, 16:46	3.15
Reach-1000	0.358884	189.3	11Oct2002, 16:46	3.15
W760	0.162490	80.5	11Oct2002, 16:31	2.32
W1000	0.026933	16.7	11Oct2002, 16:11	2.22
Reach-1500	0.548307	278.8	11Oct2002, 16:34	2.86
W1500	0.128740	63.0	11Oct2002, 16:14	1.93
Reservoir-570	0.677047	326.0	11Oct2002, 16:34	2.68
Reach-570	0.677047	326.0	11Oct2002, 16:34	2.68
W570	0.098691	53.0	11Oct2002, 16:12	2.00
Reservoir-1100	0.775738	362.6	11Oct2002, 16:32	2.59
Reach-1100	0.775738	362.0	11Oct2002, 16:40	2.59
W1100	0.148073	61.3	11Oct2002, 19:02	1.41
Reach-FornesRun	0.923811	395.4	11Oct2002, 16:41	2.40
W530	0.112161	77.2	11Oct2002, 16:09	2.34
FornesRun	12.664365	2301.6	11Oct2002, 19:19	1.96
Reach-Fornescont	12.664365	2301.6	11Oct2002, 19:19	1.96
Reservoir-510	12.664365	2293.5	11Oct2002, 19:30	1.94
Reach-510	12.664365	2284.4	11Oct2002, 19:43	1.92
W1200	0.145402	78.1	11Oct2002, 16:16	2.12
W1600	0.069092	53.2	11Oct2002, 16:12	2.71
Reservoir-1700	0.069092	51.7	11Oct2002, 16:16	2.71
Reach-1700	0.069092	51.7	11Oct2002, 16:16	2.71
W1700	0.035228	28.1	11Oct2002, 16:06	2.55
Reservoir-1200	0.104320	76.5	11Oct2002, 16:11	2.66
Reach-1200	0.104320	76.3	11Oct2002, 16:14	2.66

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	148.1	11Oct2002, 16:21	2.35
Reach-1300	0.249722	148.0	11Oct2002, 16:22	2.35
W1300	0.153935	87.1	11Oct2002, 16:09	2.02
Reach-4500	0.403657	223.0	11Oct2002, 16:16	2.22
W4500	0.128624	74.5	11Oct2002, 16:11	2.12
Reservoir-520	0.532281	269.5	11Oct2002, 16:25	2.20
Reach-520	0.532281	269.4	11Oct2002, 16:27	2.20
W510	0.077580	65.2	11Oct2002, 16:08	2.79
W520	0.028353	25.3	11Oct2002, 16:06	2.81
ReedyBch	13.302579	2519.4	11Oct2002, 19:19	1.94
Reach-500	13.302579	2482.8	11Oct2002, 19:23	1.91
W500	0.183659	183.5	11Oct2002, 16:08	3.28
Reservoir-400	13.486238	2523.7	11Oct2002, 19:29	1.87
Reach-400	13.486238	2460.9	11Oct2002, 19:42	1.80
W400	0.141370	163.1	11Oct2002, 16:04	3.54
Reach-3400	13.627608	2421.2	11Oct2002, 20:01	1.70
W3400	0.134392	146.0	11Oct2002, 16:07	3.49
Outlet	13.762000	2430.6	11Oct2002, 19:59	1.72

Project: EXGMR2YR_Rev Simulation Run: TS Andrea

Start of Run: 07Jun2013, 00:00 Basin Model: GMR Subbasins
End of Run: 08Jun2013, 00:00 Meteorologic Model: TS Andrea
Compute Time: 18Jul2016, 15:23:23 Control Specifications: Jun07

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	0.4	07Jun2013, 16:54	0.00
W700	0.248681	0.6	07Jun2013, 16:48	0.01
Reach-660	0.662365	0.9	07Jun2013, 17:38	0.01
W660	0.467389	1.9	07Jun2013, 16:26	0.02
W800	0.347947	1.1	07Jun2013, 16:39	0.01
GMRTrib9	1.477701	3.0	07Jun2013, 16:32	0.01
Reservoir-770	1.477701	2.9	07Jun2013, 16:33	0.01
Reach-770	1.477701	2.8	07Jun2013, 17:31	0.01
W770	0.644502	6.6	07Jun2013, 09:14	0.08
Reach-3100	2.122203	7.1	07Jun2013, 09:53	0.03
W550	0.358867	6.1	07Jun2013, 09:22	0.17
W560	0.110000	1.4	07Jun2013, 09:31	0.12
Reach-550	0.110000	1.4	07Jun2013, 10:29	0.12
Reach-3000	0.468867	7.0	07Jun2013, 10:24	0.15
W3000	0.385817	12.1	07Jun2013, 04:40	0.25
W4900	0.133889	1.9	07Jun2013, 16:07	0.10
Reach-4800	0.133889	1.7	07Jun2013, 09:26	0.10
W4800	0.047262	5.3	07Jun2013, 04:10	0.45
Reach-3000(2)	0.181151	3.1	07Jun2013, 09:31	0.17
Reservoir-990	1.035835	15.0	07Jun2013, 09:52	0.19
Reach-990	1.035835	14.6	07Jun2013, 11:03	0.18
W990	0.353913	11.5	07Jun2013, 04:28	0.23
Reservoir-2800	1.389748	19.2	07Jun2013, 09:20	0.19
Reach-2800	1.389748	18.8	07Jun2013, 09:32	0.19
W2800	0.034493	0.6	07Jun2013, 16:08	0.14
Reach-630	1.424241	18.7	07Jun2013, 10:28	0.18
W630	0.373057	6.9	07Jun2013, 09:08	0.17

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	20.3	07Jun2013, 10:06	0.18
Reach-2700	1.797298	20.3	07Jun2013, 10:10	0.18
W3100	0.373146	3.2	07Jun2013, 16:16	0.05
NorthForkGMR	4.292647	28.5	07Jun2013, 09:42	0.09
W2700	0.020970	1.2	07Jun2013, 04:07	0.23
Reach-2600	4.313617	28.5	07Jun2013, 09:42	0.09
W2600	0.000825	0.2	07Jun2013, 04:00	0.86
Reservoir-2600	4.314442	28.5	07Jun2013, 09:45	0.09
Reach-780	4.314442	28.4	07Jun2013, 10:02	0.09
W640	0.401148	6.2	07Jun2013, 09:11	0.13
Reach-650	0.401148	6.1	07Jun2013, 09:35	0.13
W780	0.246680	2.8	07Jun2013, 16:06	0.06
W650	0.164286	4.0	07Jun2013, 04:15	0.17
GMRTrib8	5.126556	35.9	07Jun2013, 09:16	0.10
Reach-820	5.126556	35.6	07Jun2013, 09:30	0.10
W920	0.460578	3.8	07Jun2013, 09:44	0.07
W5100	0.078185	1.1	07Jun2013, 16:03	0.09
Laurel Ridge	0.538763	4.5	07Jun2013, 09:08	0.07
Reach-5000	0.538763	1.9	07Jun2013, 10:34	0.04
W980	0.256902	4.4	07Jun2013, 09:24	0.17
Reach-980	0.256902	4.3	07Jun2013, 09:58	0.17
W5000	0.106592	1.9	07Jun2013, 16:02	0.12
Reservoir-930	0.902257	6.1	07Jun2013, 09:29	0.09
Reach-930	0.902257	6.0	07Jun2013, 11:11	0.08
W930	0.182222	2.1	07Jun2013, 09:16	0.09
W910	0.117701	0.3	07Jun2013, 16:32	0.01
Reservoir-940	1.202180	6.6	07Jun2013, 10:19	0.08
Reach-940	1.202180	6.6	07Jun2013, 10:44	0.08
W940	0.314395	0.0	07Jun2013, 16:35	0.00
W5200	0.144430	6.0	07Jun2013, 04:44	0.31
Reach-5200	0.144430	6.0	07Jun2013, 05:01	0.31

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	2.5	07Jun2013, 04:30	0.19
Reach-3200	0.102774	2.5	07Jun2013, 04:59	0.19
W960	0.082432	6.6	07Jun2013, 04:11	0.34
Trib2GMRTrib7	1.846211	12.1	07Jun2013, 09:11	0.10
Reach-950	1.846211	12.1	07Jun2013, 09:28	0.10
W5300	0.109099	24.7	07Jun2013, 04:16	0.97
W3300	0.093470	15.5	07Jun2013, 04:16	0.70
Reach-970	0.202569	38.9	07Jun2013, 04:30	0.84
W970	0.187536	14.3	07Jun2013, 04:21	0.39
W950	0.107912	0.6	07Jun2013, 16:06	0.02
W4400	0.037039	8.7	07Jun2013, 04:02	0.79
Reach-4400	0.037039	8.2	07Jun2013, 04:34	0.79
Trib1GMRTrib7	2.381267	67.2	07Jun2013, 04:29	0.19
Reach-880	2.381267	63.5	07Jun2013, 04:48	0.19
W880	0.381917	0.0	07Jun2013, 00:00	0.00
W820	0.054394	0.0	07Jun2013, 00:00	0.00
GMRTrib7	7.944134	67.4	07Jun2013, 04:48	0.12
Reach-2500	7.944134	66.5	07Jun2013, 04:53	0.12
W2500	0.061783	8.6	07Jun2013, 04:05	0.49
Reservoir-860	8.005917	67.9	07Jun2013, 04:57	0.12
Reach-860	8.005917	65.8	07Jun2013, 05:12	0.12
W900	0.129395	10.6	07Jun2013, 04:13	0.36
W4300	0.118974	33.4	07Jun2013, 04:03	1.00
Reach-900	0.118974	33.1	07Jun2013, 04:10	1.00
W890	0.113096	16.5	07Jun2013, 04:10	0.57
W4200	0.107748	19.8	07Jun2013, 04:09	0.70
Reach-890	0.107748	19.8	07Jun2013, 04:14	0.70
TribGMRTrib6	0.469213	79.6	07Jun2013, 04:11	0.65
Reach-870	0.469213	75.1	07Jun2013, 04:14	0.64
W860	0.125460	1.2	07Jun2013, 16:02	0.04
W870	0.015309	2.0	07Jun2013, 04:05	0.45

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	87.6	07Jun2013, 05:07	0.15
Reach-810	8.615899	87.5	07Jun2013, 05:13	0.15
W810	0.118699	1.4	07Jun2013, 16:02	0.06
Reservoir-2400	8.734598	85.4	07Jun2013, 05:23	0.15
Reach-2400	8.734598	84.7	07Jun2013, 05:31	0.15
W740	0.102118	10.8	07Jun2013, 04:11	0.43
Reach-4000	0.102118	10.8	07Jun2013, 04:22	0.43
W4000	0.094479	17.0	07Jun2013, 04:07	0.66
W2400	0.092820	3.7	07Jun2013, 04:14	0.22
GMRTrib5	9.024015	92.8	07Jun2013, 04:30	0.16
Reach-790	9.024015	92.5	07Jun2013, 05:35	0.16
W790	0.058117	2.9	07Jun2013, 04:23	0.28
Reservoir-2300	9.082132	91.6	07Jun2013, 05:47	0.16
Reach-2300	9.082132	91.5	07Jun2013, 05:52	0.16
W850	0.159866	16.8	07Jun2013, 04:02	0.35
W840	0.144036	26.3	07Jun2013, 04:04	0.63
Reach-830	0.303902	42.9	07Jun2013, 04:05	0.48
W2300	0.078733	1.3	07Jun2013, 09:06	0.14
GMRTrib4	9.464767	101.7	07Jun2013, 05:53	0.17
W830	0.026314	0.1	07Jun2013, 16:02	0.02
Reach-720	9.491081	101.6	07Jun2013, 05:59	0.17
W720	0.063825	7.7	07Jun2013, 04:01	0.38
Reservoir-2200	9.554906	102.9	07Jun2013, 06:06	0.17
Reach-2200	9.554906	102.9	07Jun2013, 06:08	0.17
W2200	0.083314	10.2	07Jun2013, 04:09	0.47
Reach-2201	9.638220	105.4	07Jun2013, 06:11	0.17
W580	0.179172	27.6	07Jun2013, 04:16	0.65
W3500	0.134110	10.6	07Jun2013, 04:22	0.40
W3600	0.127673	16.5	07Jun2013, 04:17	0.57
Reach-580	0.127673	16.5	07Jun2013, 04:27	0.57
Reach-3700	0.440955	53.4	07Jun2013, 04:24	0.55

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	14.8	07Jun2013, 04:07	0.64
Reach-2900	0.526948	63.3	07Jun2013, 04:31	0.57
W2900	0.115190	21.5	07Jun2013, 04:04	0.65
Reach-670	0.642138	70.4	07Jun2013, 04:28	0.58
W670	0.164802	34.9	07Jun2013, 04:06	0.77
W3900	0.089883	6.9	07Jun2013, 04:08	0.31
Reach-710	0.089883	5.8	07Jun2013, 04:38	0.31
GMRTrib2	10.535043	161.1	07Jun2013, 04:26	0.21
W710	0.190622	21.2	07Jun2013, 04:07	0.41
Reach-600	10.725665	151.3	07Jun2013, 05:37	0.21
W600	0.155003	16.3	07Jun2013, 04:06	0.38
Reservoir-3800	10.880668	155.2	07Jun2013, 05:40	0.21
Reach-3800	10.880668	155.2	07Jun2013, 05:42	0.21
W3800	0.131793	14.8	07Jun2013, 04:08	0.43
Reservoir-2100	11.012461	154.0	07Jun2013, 06:57	0.21
Reach-2100	11.012461	154.0	07Jun2013, 07:01	0.21
W2100	0.092432	9.1	07Jun2013, 04:05	0.36
Reach-4700	11.104893	156.4	07Jun2013, 07:05	0.21
W4700	0.094290	3.8	07Jun2013, 04:07	0.19
Reach-2000	11.199183	158.0	07Jun2013, 07:13	0.21
W2000	0.113520	9.0	07Jun2013, 04:08	0.32
Reservoir-1900	11.312703	160.9	07Jun2013, 07:15	0.21
Reach-1900	11.312703	160.9	07Jun2013, 07:19	0.21
W1900	0.122992	10.6	07Jun2013, 04:09	0.34
Reservoir-1800	11.435695	164.2	07Jun2013, 07:21	0.21
Reach-1800	11.435695	164.2	07Jun2013, 07:24	0.21
W1800	0.148583	13.2	07Jun2013, 04:07	0.34
W4600	0.044115	0.8	07Jun2013, 16:02	0.13
Reach-4600	0.044115	0.8	07Jun2013, 16:20	0.13
Reservoir-530	11.628393	168.7	07Jun2013, 07:26	0.21
Reach-530	11.628393	168.7	07Jun2013, 07:32	0.21

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	20.4	07Jun2013, 04:06	0.57
W4100	0.093017	15.1	07Jun2013, 04:19	0.72
Reach-750	0.093017	15.0	07Jun2013, 04:27	0.72
Reservoir-1400	0.222696	31.0	07Jun2013, 04:15	0.64
Reach-1400	0.222696	29.9	07Jun2013, 04:31	0.63
W1400	0.136188	1.2	07Jun2013, 16:07	0.04
Reservoir-1000	0.358884	28.7	07Jun2013, 04:39	0.41
Reach-1000	0.358884	28.5	07Jun2013, 04:46	0.41
W760	0.162490	2.4	07Jun2013, 09:08	0.12
W1000	0.026933	0.4	07Jun2013, 16:03	0.10
Reach-1500	0.548307	29.7	07Jun2013, 04:54	0.31
W1500	0.128740	1.4	07Jun2013, 16:05	0.06
Reservoir-570	0.677047	29.7	07Jun2013, 04:55	0.26
Reach-570	0.677047	29.7	07Jun2013, 04:57	0.26
W570	0.098691	1.2	07Jun2013, 16:04	0.07
Reservoir-1100	0.775738	29.9	07Jun2013, 04:58	0.24
Reach-1100	0.775738	29.7	07Jun2013, 05:12	0.24
W1100	0.148073	0.5	07Jun2013, 16:03	0.01
Reach-FornesRun	0.923811	29.7	07Jun2013, 05:12	0.20
W530	0.112161	2.0	07Jun2013, 16:02	0.12
FornesRun	12.664365	182.8	07Jun2013, 07:35	0.21
Reach-Fornescont	12.664365	182.8	07Jun2013, 07:36	0.21
Reservoir-510	12.664365	182.8	07Jun2013, 07:39	0.21
Reach-510	12.664365	182.8	07Jun2013, 07:46	0.21
W1200	0.145402	1.9	07Jun2013, 16:06	0.08
W1600	0.069092	2.5	07Jun2013, 04:14	0.21
Reservoir-1700	0.069092	2.4	07Jun2013, 04:19	0.21
Reach-1700	0.069092	2.4	07Jun2013, 04:26	0.21
W1700	0.035228	1.1	07Jun2013, 04:08	0.17
Reservoir-1200	0.104320	3.0	07Jun2013, 04:23	0.19
Reach-1200	0.104320	2.9	07Jun2013, 04:43	0.19

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	3.8	07Jun2013, 09:10	0.13
Reach-1300	0.249722	3.8	07Jun2013, 09:18	0.13
W1300	0.153935	1.9	07Jun2013, 16:02	0.07
Reach-4500	0.403657	5.3	07Jun2013, 09:17	0.11
W4500	0.128624	1.8	07Jun2013, 16:03	0.08
Reservoir-520	0.532281	6.7	07Jun2013, 09:12	0.10
Reach-520	0.532281	6.7	07Jun2013, 09:16	0.10
W510	0.077580	3.6	07Jun2013, 04:10	0.22
W520	0.028353	1.5	07Jun2013, 04:07	0.23
ReedyBch	13.302579	190.2	07Jun2013, 07:51	0.21
Reach-500	13.302579	189.7	07Jun2013, 08:05	0.20
W500	0.183659	16.9	07Jun2013, 04:09	0.37
Reservoir-400	13.486238	194.6	07Jun2013, 08:25	0.21
Reach-400	13.486238	194.1	07Jun2013, 08:39	0.20
W400	0.141370	18.5	07Jun2013, 04:05	0.47
Reach-3400	13.627608	198.2	07Jun2013, 09:02	0.20
W3400	0.134392	15.8	07Jun2013, 04:08	0.45
Outlet	13.762000	203.0	07Jun2013, 09:01	0.21

Project: EXGMR2YR_Rev Simulation Run: 2012 Thunder

Start of Run: 23May2012, 17:00 Basin Model: GMR Subbasins
End of Run: 24May2012, 02:00 Meteorologic Model: 2012 Thunder
Compute Time: 18Jul2016, 15:24:18 Control Specifications: May23

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	17.2	23May2012, 22:24	0.19
W700	0.248681	13.2	23May2012, 22:16	0.25
Reach-660	0.662365	30.3	23May2012, 22:37	0.20
W660	0.467389	29.8	23May2012, 21:42	0.29
W800	0.347947	20.1	23May2012, 22:06	0.27
GMRTrib9	1.477701	76.6	23May2012, 22:15	0.24
Reservoir-770	1.477701	76.6	23May2012, 22:16	0.24
Reach-770	1.477701	73.1	23May2012, 23:23	0.22
W770	0.644502	62.2	23May2012, 21:37	0.48
Reach-3100	2.122203	101.9	23May2012, 22:48	0.29
W550	0.358867	42.3	23May2012, 22:06	0.69
W560	0.110000	10.8	23May2012, 22:20	0.57
Reach-550	0.110000	10.5	23May2012, 22:55	0.53
Reach-3000	0.468867	49.8	23May2012, 22:49	0.60
W3000	0.385817	65.0	23May2012, 19:36	0.89
W4900	0.133889	16.3	23May2012, 19:18	0.56
Reach-4800	0.133889	15.5	23May2012, 21:28	0.54
W4800	0.047262	19.2	23May2012, 19:10	1.27
Reach-3000(2)	0.181151	21.6	23May2012, 21:50	0.66
Reservoir-990	1.035835	88.1	23May2012, 22:56	0.60
Reach-990	1.035835	84.6	23May2012, 23:50	0.50
W990	0.353913	66.7	23May2012, 19:24	0.85
Reservoir-2800	1.389748	86.9	23May2012, 22:54	0.57
Reach-2800	1.389748	86.5	23May2012, 23:21	0.54
W2800	0.034493	5.1	23May2012, 19:19	0.66
Reach-630	1.424241	86.6	23May2012, 23:48	0.46
W630	0.373057	50.5	23May2012, 21:26	0.73

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	95.8	23May2012, 23:12	0.43
Reach-2700	1.797298	95.8	23May2012, 23:15	0.43
W3100	0.373146	33.9	23May2012, 21:23	0.42
NorthForkGMR	4.292647	210.3	23May2012, 22:35	0.36
W2700	0.020970	6.3	23May2012, 19:06	0.87
Reach-2600	4.313617	210.4	23May2012, 22:35	0.36
W2600	0.000825	0.6	23May2012, 19:00	1.92
Reservoir-2600	4.314442	210.3	23May2012, 22:38	0.36
Reach-780	4.314442	202.6	23May2012, 23:34	0.34
W640	0.401148	47.9	23May2012, 21:32	0.63
Reach-650	0.401148	47.8	23May2012, 21:46	0.62
W780	0.246680	26.2	23May2012, 21:11	0.46
W650	0.164286	32.4	23May2012, 19:12	0.72
GMRTrib8	5.126556	236.2	23May2012, 22:13	0.38
Reach-820	5.126556	230.8	23May2012, 22:34	0.36
W920	0.460578	35.8	23May2012, 22:34	0.44
W5100	0.078185	10.6	23May2012, 19:11	0.53
Laurel Ridge	0.538763	40.4	23May2012, 22:09	0.45
Reach-5000	0.538763	22.0	23May2012, 22:12	0.22
W980	0.256902	30.3	23May2012, 22:11	0.71
Reach-980	0.256902	28.8	23May2012, 22:32	0.66
W5000	0.106592	18.7	23May2012, 19:10	0.62
Reservoir-930	0.902257	50.2	23May2012, 22:43	0.37
Reach-930	0.902257	47.2	23May2012, 23:26	0.32
W930	0.182222	18.2	23May2012, 21:43	0.52
W910	0.117701	6.5	23May2012, 21:57	0.25
Reservoir-940	1.202180	57.2	23May2012, 23:09	0.31
Reach-940	1.202180	57.1	23May2012, 23:22	0.30
W940	0.314395	12.2	23May2012, 21:31	0.15
W5200	0.144430	26.8	23May2012, 19:42	1.01
Reach-5200	0.144430	26.8	23May2012, 19:52	1.00

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	17.0	23May2012, 19:26	0.78
Reach-3200	0.102774	16.9	23May2012, 19:41	0.77
W960	0.082432	27.7	23May2012, 19:10	1.09
Trib2GMRTrib7	1.846211	97.9	23May2012, 22:12	0.39
Reach-950	1.846211	97.5	23May2012, 22:21	0.38
W5300	0.109099	64.0	23May2012, 19:17	2.05
W3300	0.093470	45.6	23May2012, 19:16	1.68
Reach-970	0.202569	105.3	23May2012, 19:28	1.86
W970	0.187536	55.7	23May2012, 19:21	1.17
W950	0.107912	8.3	23May2012, 21:11	0.30
W4400	0.037039	25.1	23May2012, 19:02	1.82
Reach-4400	0.037039	23.9	23May2012, 19:24	1.79
Trib1GMRTrib7	2.381267	226.0	23May2012, 19:28	0.58
Reach-880	2.381267	205.4	23May2012, 19:49	0.56
W880	0.381917	13.2	23May2012, 21:15	0.12
W820	0.054394	2.3	23May2012, 21:08	0.14
GMRTrib7	7.944134	414.3	23May2012, 22:17	0.41
Reach-2500	7.944134	409.1	23May2012, 22:25	0.40
W2500	0.061783	30.0	23May2012, 19:05	1.35
Reservoir-860	8.005917	410.2	23May2012, 22:28	0.41
Reach-860	8.005917	401.8	23May2012, 22:56	0.40
W900	0.129395	43.0	23May2012, 19:12	1.12
W4300	0.118974	89.2	23May2012, 19:03	2.10
Reach-900	0.118974	88.2	23May2012, 19:08	2.10
W890	0.113096	53.8	23May2012, 19:10	1.47
W4200	0.107748	59.4	23May2012, 19:09	1.68
Reach-890	0.107748	59.2	23May2012, 19:13	1.68
TribGMRTrib6	0.469213	242.8	23May2012, 19:10	1.58
Reach-870	0.469213	228.0	23May2012, 19:12	1.56
W860	0.125460	12.3	23May2012, 21:05	0.39
W870	0.015309	7.1	23May2012, 19:05	1.29

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	450.9	23May2012, 22:14	0.46
Reach-810	8.615899	450.7	23May2012, 22:18	0.46
W810	0.118699	13.7	23May2012, 19:09	0.45
Reservoir-2400	8.734598	449.0	23May2012, 22:26	0.45
Reach-2400	8.734598	448.0	23May2012, 22:30	0.44
W740	0.102118	39.8	23May2012, 19:11	1.25
Reach-4000	0.102118	39.7	23May2012, 19:19	1.25
W4000	0.094479	52.1	23May2012, 19:07	1.63
W2400	0.092820	22.0	23May2012, 19:12	0.84
GMRTrib5	9.024015	476.8	23May2012, 22:15	0.47
Reach-790	9.024015	474.6	23May2012, 22:22	0.46
W790	0.058117	13.7	23May2012, 19:21	0.97
Reservoir-2300	9.082132	478.6	23May2012, 22:28	0.46
Reach-2300	9.082132	478.1	23May2012, 22:35	0.45
W850	0.159866	68.6	23May2012, 19:02	1.10
W840	0.144036	82.7	23May2012, 19:04	1.59
Reach-830	0.303902	150.4	23May2012, 19:04	1.33
W2300	0.078733	10.5	23May2012, 19:25	0.67
GMRTrib4	9.464767	524.2	23May2012, 22:03	0.48
W830	0.026314	2.1	23May2012, 21:04	0.28
Reach-720	9.491081	524.7	23May2012, 22:06	0.48
W720	0.063825	29.8	23May2012, 19:01	1.17
Reservoir-2200	9.554906	528.9	23May2012, 22:08	0.47
Reach-2200	9.554906	528.9	23May2012, 22:09	0.47
W2200	0.083314	35.8	23May2012, 19:09	1.32
Reach-2201	9.638220	540.5	23May2012, 22:09	0.48
W580	0.179172	83.4	23May2012, 19:16	1.61
W3500	0.134110	40.3	23May2012, 19:21	1.19
W3600	0.127673	52.9	23May2012, 19:17	1.48
Reach-580	0.127673	52.9	23May2012, 19:24	1.47
Reach-3700	0.440955	173.8	23May2012, 19:23	1.44

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	46.2	23May2012, 19:08	1.59
Reach-2900	0.526948	205.3	23May2012, 19:27	1.45
W2900	0.115190	66.9	23May2012, 19:04	1.61
Reach-670	0.642138	231.3	23May2012, 19:22	1.48
W670	0.164802	101.7	23May2012, 19:06	1.78
W3900	0.089883	30.6	23May2012, 19:08	1.03
Reach-710	0.089883	26.2	23May2012, 19:25	1.00
GMRTrib2	10.535043	706.3	23May2012, 21:21	0.56
W710	0.190622	80.0	23May2012, 19:06	1.22
Reach-600	10.725665	713.2	23May2012, 22:13	0.54
W600	0.155003	64.1	23May2012, 19:05	1.16
Reservoir-3800	10.880668	732.0	23May2012, 22:08	0.54
Reach-3800	10.880668	731.8	23May2012, 22:09	0.54
W3800	0.131793	55.1	23May2012, 19:07	1.24
Reservoir-2100	11.012461	745.3	23May2012, 22:13	0.51
Reach-2100	11.012461	745.0	23May2012, 22:16	0.51
W2100	0.092432	36.9	23May2012, 19:05	1.12
Reach-4700	11.104893	744.7	23May2012, 22:18	0.51
W4700	0.094290	24.6	23May2012, 19:06	0.78
Reach-2000	11.199183	742.8	23May2012, 22:38	0.50
W2000	0.113520	39.3	23May2012, 19:07	1.04
Reservoir-1900	11.312703	743.9	23May2012, 22:40	0.51
Reach-1900	11.312703	743.7	23May2012, 22:42	0.50
W1900	0.122992	44.1	23May2012, 19:08	1.09
Reservoir-1800	11.435695	745.1	23May2012, 22:42	0.51
Reach-1800	11.435695	745.0	23May2012, 22:44	0.51
W1800	0.148583	55.3	23May2012, 19:06	1.08
W4600	0.044115	8.3	23May2012, 19:08	0.63
Reach-4600	0.044115	6.8	23May2012, 19:22	0.62
Reservoir-530	11.628393	747.4	23May2012, 22:44	0.51
Reach-530	11.628393	747.3	23May2012, 22:47	0.51

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	66.7	23May2012, 19:06	1.49
W4100	0.093017	43.4	23May2012, 19:20	1.71
Reach-750	0.093017	43.1	23May2012, 19:28	1.71
Reservoir-1400	0.222696	80.5	23May2012, 19:23	1.58
Reach-1400	0.222696	79.0	23May2012, 19:36	1.56
W1400	0.136188	12.8	23May2012, 21:12	0.40
Reservoir-1000	0.358884	84.8	23May2012, 19:39	1.11
Reach-1000	0.358884	84.4	23May2012, 19:44	1.11
W760	0.162490	19.6	23May2012, 21:23	0.61
W1000	0.026933	3.9	23May2012, 19:12	0.57
Reach-1500	0.548307	101.0	23May2012, 19:47	0.92
W1500	0.128740	13.1	23May2012, 21:10	0.43
Reservoir-570	0.677047	105.9	23May2012, 19:47	0.83
Reach-570	0.677047	105.9	23May2012, 19:48	0.83
W570	0.098691	10.8	23May2012, 21:08	0.46
Reservoir-1100	0.775738	109.7	23May2012, 19:49	0.78
Reach-1100	0.775738	109.3	23May2012, 19:59	0.77
W1100	0.148073	9.7	23May2012, 21:06	0.23
Reach-FornesRun	0.923811	111.4	23May2012, 19:59	0.68
W530	0.112161	19.8	23May2012, 19:09	0.62
FornesRun	12.664365	838.8	23May2012, 22:20	0.52
Reach-Fornescont	12.664365	838.8	23May2012, 22:20	0.52
Reservoir-510	12.664365	835.6	23May2012, 22:29	0.51
Reach-510	12.664365	834.6	23May2012, 22:35	0.51
W1200	0.145402	16.8	23May2012, 21:11	0.52
W1600	0.069092	15.8	23May2012, 19:12	0.81
Reservoir-1700	0.069092	15.1	23May2012, 19:17	0.81
Reach-1700	0.069092	15.1	23May2012, 19:21	0.81
W1700	0.035228	8.3	23May2012, 19:07	0.73
Reservoir-1200	0.104320	20.6	23May2012, 19:14	0.78
Reach-1200	0.104320	20.4	23May2012, 19:25	0.78

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	33.5	23May2012, 19:28	0.63
Reach-1300	0.249722	33.4	23May2012, 19:32	0.63
W1300	0.153935	17.5	23May2012, 19:11	0.47
Reach-4500	0.403657	47.3	23May2012, 21:21	0.56
W4500	0.128624	16.0	23May2012, 19:12	0.52
Reservoir-520	0.532281	60.4	23May2012, 21:23	0.55
Reach-520	0.532281	60.4	23May2012, 21:25	0.55
W510	0.077580	20.6	23May2012, 19:09	0.85
W520	0.028353	8.2	23May2012, 19:06	0.87
ReedyBch	13.302579	879.8	23May2012, 22:21	0.51
Reach-500	13.302579	837.4	23May2012, 23:02	0.49
W500	0.183659	67.6	23May2012, 19:09	1.14
Reservoir-400	13.486238	832.3	23May2012, 23:18	0.48
Reach-400	13.486238	811.2	23May2012, 23:47	0.45
W400	0.141370	66.2	23May2012, 19:05	1.31
Reach-3400	13.627608	784.4	24May2012, 00:32	0.41
W3400	0.134392	57.4	23May2012, 19:08	1.27
Outlet	13.762000	789.8	24May2012, 00:35	0.41

Project: EXGMR2YR_Rev Simulation Run: 2013 Thunder

Start of Run:	02Jul2013, 12:00	Basin Model:	GMR Subbasins
End of Run:	02Jul2013, 16:00	Meteorologic Model:	2013 Thunder
Compute Time:	18Jul2016, 15:24:32	Control Specifications:	Jul02

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	5.0	02Jul2013, 15:22	0.02
W700	0.248681	5.4	02Jul2013, 15:14	0.05
Reach-660	0.662365	10.3	02Jul2013, 15:40	0.02
W660	0.467389	17.2	02Jul2013, 14:46	0.07
W800	0.347947	9.4	02Jul2013, 15:03	0.06
GMRTrib9	1.477701	29.9	02Jul2013, 15:07	0.05
Reservoir-770	1.477701	29.9	02Jul2013, 15:08	0.05
Reach-770	1.477701	20.4	02Jul2013, 16:00	0.01
W770	0.644502	56.6	02Jul2013, 14:42	0.17
Reach-3100	2.122203	54.8	02Jul2013, 15:00	0.05
W550	0.358867	38.5	02Jul2013, 15:09	0.24
W560	0.110000	8.1	02Jul2013, 15:23	0.16
Reach-550	0.110000	7.4	02Jul2013, 16:00	0.07
Reach-3000	0.468867	36.8	02Jul2013, 16:00	0.08
W3000	0.385817	84.1	02Jul2013, 14:35	0.41
W4900	0.133889	23.8	02Jul2013, 14:17	0.22
Reach-4800	0.133889	18.0	02Jul2013, 14:35	0.20
W4800	0.047262	25.4	02Jul2013, 14:10	0.70
Reach-3000(2)	0.181151	19.5	02Jul2013, 14:53	0.24
Reservoir-990	1.035835	48.8	02Jul2013, 16:00	0.09
Reach-990	1.035835	29.2	02Jul2013, 16:00	0.02
W990	0.353913	89.0	02Jul2013, 14:24	0.40
Reservoir-2800	1.389748	77.3	02Jul2013, 14:36	0.11
Reach-2800	1.389748	68.7	02Jul2013, 14:46	0.09
W2800	0.034493	7.1	02Jul2013, 14:18	0.28
Reach-630	1.424241	58.9	02Jul2013, 15:34	0.04
W630	0.373057	66.1	02Jul2013, 14:32	0.31

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-2700	1.797298	57.6	02Jul2013, 15:56	0.06
Reach-2700	1.797298	57.6	02Jul2013, 16:00	0.06
W3100	0.373146	32.4	02Jul2013, 14:30	0.14
NorthForkGMR	4.292647	112.8	02Jul2013, 14:55	0.06
W2700	0.020970	8.8	02Jul2013, 14:06	0.42
Reach-2600	4.313617	113.5	02Jul2013, 14:55	0.06
W2600	0.000825	0.8	02Jul2013, 14:00	1.20
Reservoir-2600	4.314442	113.2	02Jul2013, 14:58	0.06
Reach-780	4.314442	97.9	02Jul2013, 16:00	0.05
W640	0.401148	53.9	02Jul2013, 14:38	0.25
Reach-650	0.401148	53.2	02Jul2013, 14:52	0.23
W780	0.246680	34.3	02Jul2013, 14:16	0.16
W650	0.164286	45.6	02Jul2013, 14:12	0.32
GMRTrib8	5.126556	145.9	02Jul2013, 14:55	0.08
Reach-820	5.126556	137.6	02Jul2013, 15:30	0.06
W920	0.460578	21.4	02Jul2013, 15:38	0.09
W5100	0.078185	15.9	02Jul2013, 14:10	0.20
Laurel Ridge	0.538763	21.7	02Jul2013, 15:34	0.11
Reach-5000	0.538763	3.2	02Jul2013, 16:00	0.01
W980	0.256902	26.7	02Jul2013, 15:15	0.23
Reach-980	0.256902	21.8	02Jul2013, 15:47	0.13
W5000	0.106592	27.1	02Jul2013, 14:09	0.26
Reservoir-930	0.902257	19.2	02Jul2013, 16:00	0.04
Reach-930	0.902257	12.0	02Jul2013, 16:00	0.01
W930	0.182222	16.4	02Jul2013, 14:48	0.18
W910	0.117701	3.0	02Jul2013, 14:54	0.05
Reservoir-940	1.202180	17.1	02Jul2013, 16:00	0.03
Reach-940	1.202180	16.8	02Jul2013, 16:00	0.02
W940	0.314395	3.2	02Jul2013, 14:37	0.02
W5200	0.144430	33.9	02Jul2013, 14:41	0.48
Reach-5200	0.144430	33.8	02Jul2013, 14:50	0.45

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3200	0.102774	22.9	02Jul2013, 14:25	0.35
Reach-3200	0.102774	22.7	02Jul2013, 14:38	0.34
W960	0.082432	37.2	02Jul2013, 14:10	0.56
Trib2GMRTrib7	1.846211	68.2	02Jul2013, 14:38	0.09
Reach-950	1.846211	67.7	02Jul2013, 14:48	0.09
W5300	0.109099	79.6	02Jul2013, 14:18	1.31
W3300	0.093470	57.6	02Jul2013, 14:16	1.01
Reach-970	0.202569	130.8	02Jul2013, 14:28	1.13
W970	0.187536	72.2	02Jul2013, 14:20	0.61
W950	0.107912	8.0	02Jul2013, 14:16	0.08
W4400	0.037039	33.2	02Jul2013, 14:02	1.12
Reach-4400	0.037039	31.2	02Jul2013, 14:22	1.09
Trib1GMRTrib7	2.381267	290.6	02Jul2013, 14:27	0.23
Reach-880	2.381267	250.2	02Jul2013, 14:54	0.21
W880	0.381917	2.3	02Jul2013, 14:24	0.01
W820	0.054394	0.8	02Jul2013, 14:13	0.01
GMRTrib7	7.944134	361.6	02Jul2013, 15:01	0.10
Reach-2500	7.944134	355.7	02Jul2013, 15:04	0.10
W2500	0.061783	40.2	02Jul2013, 14:05	0.75
Reservoir-860	8.005917	351.6	02Jul2013, 15:11	0.10
Reach-860	8.005917	317.6	02Jul2013, 15:35	0.09
W900	0.129395	57.1	02Jul2013, 14:12	0.58
W4300	0.118974	115.8	02Jul2013, 14:03	1.36
Reach-900	0.118974	114.4	02Jul2013, 14:08	1.35
W890	0.113096	70.2	02Jul2013, 14:10	0.85
W4200	0.107748	76.8	02Jul2013, 14:09	1.01
Reach-890	0.107748	76.5	02Jul2013, 14:13	1.01
TribGMRTrib6	0.469213	315.8	02Jul2013, 14:10	0.94
Reach-870	0.469213	293.5	02Jul2013, 14:12	0.91
W860	0.125460	18.2	02Jul2013, 14:09	0.12
W870	0.015309	9.6	02Jul2013, 14:05	0.71

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
GMRTrib6	8.615899	364.9	02Jul2013, 14:35	0.13
Reach-810	8.615899	364.2	02Jul2013, 14:39	0.13
W810	0.118699	21.5	02Jul2013, 14:08	0.16
Reservoir-2400	8.734598	357.0	02Jul2013, 14:48	0.12
Reach-2400	8.734598	355.4	02Jul2013, 14:53	0.11
W740	0.102118	52.6	02Jul2013, 14:11	0.68
Reach-4000	0.102118	52.4	02Jul2013, 14:18	0.68
W4000	0.094479	67.9	02Jul2013, 14:07	0.97
W2400	0.092820	30.3	02Jul2013, 14:12	0.39
GMRTrib5	9.024015	421.7	02Jul2013, 14:24	0.13
Reach-790	9.024015	400.7	02Jul2013, 14:38	0.13
W790	0.058117	18.1	02Jul2013, 14:21	0.48
Reservoir-2300	9.082132	393.8	02Jul2013, 14:58	0.12
Reach-2300	9.082132	393.5	02Jul2013, 15:02	0.11
W850	0.159866	94.6	02Jul2013, 14:02	0.57
W840	0.144036	109.4	02Jul2013, 14:04	0.93
Reach-830	0.303902	202.6	02Jul2013, 14:04	0.74
W2300	0.078733	14.6	02Jul2013, 14:24	0.28
GMRTrib4	9.464767	413.0	02Jul2013, 14:59	0.13
W830	0.026314	2.6	02Jul2013, 14:07	0.07
Reach-720	9.491081	412.5	02Jul2013, 15:04	0.13
W720	0.063825	41.0	02Jul2013, 14:01	0.62
Reservoir-2200	9.554906	406.6	02Jul2013, 15:14	0.12
Reach-2200	9.554906	406.6	02Jul2013, 15:15	0.12
W2200	0.083314	47.3	02Jul2013, 14:09	0.73
Reach-2201	9.638220	409.5	02Jul2013, 15:16	0.12
W580	0.179172	106.0	02Jul2013, 14:16	0.95
W3500	0.134110	52.0	02Jul2013, 14:21	0.63
W3600	0.127673	67.6	02Jul2013, 14:17	0.85
Reach-580	0.127673	67.5	02Jul2013, 14:24	0.84
Reach-3700	0.440955	221.7	02Jul2013, 14:22	0.82

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3700	0.085993	60.3	02Jul2013, 14:08	0.94
Reach-2900	0.526948	260.5	02Jul2013, 14:27	0.82
W2900	0.115190	88.2	02Jul2013, 14:04	0.95
Reach-670	0.642138	289.7	02Jul2013, 14:21	0.84
W670	0.164802	132.2	02Jul2013, 14:06	1.09
W3900	0.089883	41.6	02Jul2013, 14:08	0.52
Reach-710	0.089883	34.8	02Jul2013, 14:23	0.49
GMRTrib2	10.535043	737.1	02Jul2013, 14:17	0.19
W710	0.190622	107.5	02Jul2013, 14:06	0.65
Reach-600	10.725665	589.2	02Jul2013, 15:11	0.14
W600	0.155003	86.8	02Jul2013, 14:05	0.62
Reservoir-3800	10.880668	594.2	02Jul2013, 15:11	0.15
Reach-3800	10.880668	593.9	02Jul2013, 15:12	0.15
W3800	0.131793	73.6	02Jul2013, 14:07	0.67
Reservoir-2100	11.012461	584.7	02Jul2013, 15:25	0.11
Reach-2100	11.012461	584.4	02Jul2013, 15:28	0.11
W2100	0.092432	50.3	02Jul2013, 14:05	0.58
Reach-4700	11.104893	556.6	02Jul2013, 15:45	0.10
W4700	0.094290	34.8	02Jul2013, 14:06	0.36
Reach-2000	11.199183	554.3	02Jul2013, 15:53	0.10
W2000	0.113520	53.5	02Jul2013, 14:07	0.53
Reservoir-1900	11.312703	553.7	02Jul2013, 15:57	0.10
Reach-1900	11.312703	553.3	02Jul2013, 15:59	0.09
W1900	0.122992	59.6	02Jul2013, 14:08	0.56
Reservoir-1800	11.435695	552.9	02Jul2013, 16:00	0.10
Reach-1800	11.435695	551.9	02Jul2013, 16:00	0.09
W1800	0.148583	75.3	02Jul2013, 14:06	0.56
W4600	0.044115	12.0	02Jul2013, 14:08	0.26
Reach-4600	0.044115	9.6	02Jul2013, 14:20	0.25
Reservoir-530	11.628393	543.6	02Jul2013, 16:00	0.10
Reach-530	11.628393	537.4	02Jul2013, 16:00	0.09

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W750	0.129679	88.0	02Jul2013, 14:06	0.86
W4100	0.093017	54.3	02Jul2013, 14:20	1.02
Reach-750	0.093017	53.8	02Jul2013, 14:28	1.01
Reservoir-1400	0.222696	92.9	02Jul2013, 14:25	0.92
Reach-1400	0.222696	91.4	02Jul2013, 14:38	0.88
W1400	0.136188	14.7	02Jul2013, 14:18	0.13
Reservoir-1000	0.358884	99.1	02Jul2013, 14:38	0.59
Reach-1000	0.358884	98.7	02Jul2013, 14:43	0.57
W760	0.162490	24.3	02Jul2013, 14:29	0.24
W1000	0.026933	5.7	02Jul2013, 14:11	0.22
Reach-1500	0.548307	120.7	02Jul2013, 14:44	0.44
W1500	0.128740	17.2	02Jul2013, 14:15	0.15
Reservoir-570	0.677047	126.0	02Jul2013, 14:44	0.38
Reach-570	0.677047	125.9	02Jul2013, 14:45	0.38
W570	0.098691	15.7	02Jul2013, 14:12	0.17
Reservoir-1100	0.775738	129.5	02Jul2013, 14:45	0.35
Reach-1100	0.775738	129.0	02Jul2013, 14:54	0.33
W1100	0.148073	8.9	02Jul2013, 14:10	0.05
Reach-FornesRun	0.923811	130.4	02Jul2013, 14:54	0.28
W530	0.112161	28.8	02Jul2013, 14:09	0.26
FornesRun	12.664365	590.0	02Jul2013, 16:00	0.11
Reach-Fornescont	12.664365	589.8	02Jul2013, 16:00	0.10
Reservoir-510	12.664365	574.5	02Jul2013, 16:00	0.10
Reach-510	12.664365	563.2	02Jul2013, 16:00	0.09
W1200	0.145402	23.8	02Jul2013, 14:16	0.20
W1600	0.069092	21.9	02Jul2013, 14:12	0.38
Reservoir-1700	0.069092	20.8	02Jul2013, 14:16	0.38
Reach-1700	0.069092	20.7	02Jul2013, 14:20	0.38
W1700	0.035228	11.8	02Jul2013, 14:07	0.32
Reservoir-1200	0.104320	28.3	02Jul2013, 14:13	0.36
Reach-1200	0.104320	28.1	02Jul2013, 14:23	0.36

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reservoir-1300	0.249722	47.2	02Jul2013, 14:26	0.26
Reach-1300	0.249722	47.1	02Jul2013, 14:30	0.26
W1300	0.153935	27.1	02Jul2013, 14:10	0.17
Reach-4500	0.403657	58.2	02Jul2013, 14:30	0.22
W4500	0.128624	23.9	02Jul2013, 14:12	0.20
Reservoir-520	0.532281	68.4	02Jul2013, 14:31	0.21
Reach-520	0.532281	68.4	02Jul2013, 14:34	0.21
W510	0.077580	28.5	02Jul2013, 14:09	0.40
W520	0.028353	11.5	02Jul2013, 14:06	0.41
ReedyBch	13.302579	570.6	02Jul2013, 16:00	0.10
Reach-500	13.302579	495.6	02Jul2013, 16:00	0.08
W500	0.183659	90.7	02Jul2013, 14:09	0.60
Reservoir-400	13.486238	466.2	02Jul2013, 16:00	0.07
Reach-400	13.486238	410.7	02Jul2013, 16:00	0.05
W400	0.141370	88.8	02Jul2013, 14:05	0.72
Reach-3400	13.627608	309.4	02Jul2013, 16:00	0.04
W3400	0.134392	76.4	02Jul2013, 14:08	0.70
Outlet	13.762000	309.5	02Jul2013, 16:00	0.05

H.3 HEC-HMS Output – Future Conditions

Project: GMR_Future Simulation Run: 2 yr

Start of Run:	02Nov2014, 00:00	Basin Model:	GMR Subbasins
End of Run:	03Nov2014, 00:06	Meteorologic Model:	2 yr
Compute Time:	02Nov2015, 15:48:45	Control Specifications:	Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	223.5	02Nov2014, 12:58	2.16
W700	0.248681	94.3	02Nov2014, 13:06	1.63
Reach-660	0.662365	314.6	02Nov2014, 13:11	1.95
W660	0.467389	282.8	02Nov2014, 12:45	2.04
W800	0.347947	163.7	02Nov2014, 13:02	1.95
GMRTrib9	1.477701	711.0	02Nov2014, 12:58	1.98
Reach-770	1.477701	640.3	02Nov2014, 13:41	1.93
W770	0.644502	206.6	02Nov2014, 12:59	1.30
Reach-3100	2.122203	710.1	02Nov2014, 14:19	1.74
W550	0.358867	161.9	02Nov2014, 12:58	1.78
W560	0.110000	41.9	02Nov2014, 13:04	1.61
Reach-550	0.110000	37.9	02Nov2014, 13:31	1.57
Reach-3000	0.468867	162.8	02Nov2014, 13:33	1.67
W3000	0.385817	214.1	02Nov2014, 12:53	2.07
W4900	0.133889	128.8	02Nov2014, 12:14	1.85
Reach-4800	0.133889	125.7	02Nov2014, 12:20	1.85
W4800	0.047262	45.8	02Nov2014, 12:25	2.39
Reach-3000(2)	0.181151	165.6	02Nov2014, 12:29	1.98
Reach-990	1.035835	321.2	02Nov2014, 13:46	1.80
W990	0.353913	200.0	02Nov2014, 12:46	1.91
Reservoir-2800	1.389748	263.0	02Nov2014, 14:51	1.82
Reach-2800	1.389748	260.8	02Nov2014, 15:06	1.80
W2800	0.034493	15.5	02Nov2014, 12:35	1.31
Reach-630	1.424241	262.7	02Nov2014, 15:10	1.78
W630	0.373057	128.4	02Nov2014, 12:52	1.28
Reservoir-2700	1.797298	214.0	02Nov2014, 17:15	1.62
Reach-2700	1.797298	214.0	02Nov2014, 17:18	1.62

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3100	0.373146	84.8	02Nov2014, 12:48	0.86
NorthForkGMR	4.292647	901.6	02Nov2014, 14:19	1.61
W2700	0.020970	14.7	02Nov2014, 12:17	1.45
Reach-2600	4.313617	903.2	02Nov2014, 14:19	1.61
W2600	0.000825	1.4	02Nov2014, 12:07	2.72
Reach-780	4.314442	855.8	02Nov2014, 14:50	1.59
W640	0.401148	218.3	02Nov2014, 12:54	2.06
Reach-650	0.401148	216.1	02Nov2014, 13:04	2.05
W780	0.246680	122.8	02Nov2014, 12:34	1.42
W650	0.164286	148.0	02Nov2014, 12:21	2.06
GMRTrib8	5.126556	944.9	02Nov2014, 14:46	1.63
Reach-820	5.126556	927.5	02Nov2014, 15:02	1.62
W920	0.460578	162.3	02Nov2014, 13:26	1.80
W5100	0.078185	41.3	02Nov2014, 12:23	1.26
Laurel Ridge	0.538763	170.8	02Nov2014, 13:24	1.72
Reach-5000	0.538763	103.8	02Nov2014, 13:26	1.08
W980	0.256902	146.0	02Nov2014, 13:00	2.32
Reach-980	0.256902	114.8	02Nov2014, 13:12	2.22
W5000	0.106592	131.0	02Nov2014, 12:18	2.68
Reach-930	0.902257	170.5	02Nov2014, 13:47	1.45
W930	0.182222	41.9	02Nov2014, 13:08	1.05
W910	0.117701	24.8	02Nov2014, 13:07	0.97
Reach-940	1.202180	226.0	02Nov2014, 13:31	1.33
W940	0.314395	53.4	02Nov2014, 12:49	0.68
W5200	0.144430	111.2	02Nov2014, 12:34	2.23
Reach-5200	0.144430	110.7	02Nov2014, 12:41	2.22
W3200	0.102774	46.1	02Nov2014, 12:43	1.47
Reach-3200	0.102774	45.9	02Nov2014, 12:54	1.46
W960	0.082432	57.6	02Nov2014, 12:26	1.72
Trib2GMRTrib7	1.846211	401.7	02Nov2014, 12:51	1.31
Reach-950	1.846211	399.0	02Nov2014, 12:58	1.31

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W5300	0.109099	95.8	02Nov2014, 12:39	2.86
W3300	0.093470	85.1	02Nov2014, 12:35	2.77
Reach-970	0.202569	171.8	02Nov2014, 12:48	2.79
W970	0.187536	110.0	02Nov2014, 12:40	1.82
W950	0.107912	26.0	02Nov2014, 12:31	0.73
W4400	0.037039	53.8	02Nov2014, 12:12	2.71
Reach-4400	0.037039	45.5	02Nov2014, 12:35	2.67
Trib1GMRTrib7	2.381267	711.8	02Nov2014, 12:49	1.47
Reach-880	2.381267	639.0	02Nov2014, 13:27	1.46
W880	0.381917	43.5	02Nov2014, 12:43	0.48
W820	0.054394	5.4	02Nov2014, 12:30	0.38
GMRTrib7	7.944134	1288.8	02Nov2014, 14:51	1.51
Reach-2500	7.944134	1278.6	02Nov2014, 14:57	1.50
W2500	0.061783	61.7	02Nov2014, 12:17	2.05
Reach-860	8.005917	1263.3	02Nov2014, 15:14	1.50
W900	0.129395	87.6	02Nov2014, 12:29	1.76
W4300	0.118974	163.7	02Nov2014, 12:16	2.92
Reach-900	0.118974	157.6	02Nov2014, 12:22	2.90
W890	0.113096	99.3	02Nov2014, 12:26	2.20
W4200	0.107748	106.3	02Nov2014, 12:26	2.49
Reach-890	0.107748	105.9	02Nov2014, 12:29	2.49
TribGMRTrib6	0.469213	441.0	02Nov2014, 12:25	2.32
Reach-870	0.469213	398.3	02Nov2014, 12:28	2.30
W860	0.125460	38.5	02Nov2014, 12:21	0.78
W870	0.015309	14.8	02Nov2014, 12:16	1.98
GMRTrib6	8.615899	1311.1	02Nov2014, 15:13	1.53
Reach-810	8.615899	1310.8	02Nov2014, 15:17	1.53
W810	0.118699	42.7	02Nov2014, 12:20	0.87
Reach-2400	8.734598	1310.8	02Nov2014, 15:24	1.51
W740	0.102118	78.0	02Nov2014, 12:27	1.93
Reach-4000	0.102118	77.7	02Nov2014, 12:34	1.93

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W4000	0.094479	94.8	02Nov2014, 12:23	2.38
W2400	0.092820	50.7	02Nov2014, 12:28	1.40
GMRTrib5	9.024015	1332.1	02Nov2014, 15:23	1.52
Reach-790	9.024015	1329.9	02Nov2014, 15:28	1.52
W790	0.058117	34.3	02Nov2014, 12:39	1.81
Reservoir-2300	9.082132	1325.6	02Nov2014, 15:40	1.51
Reach-2300	9.082132	1324.8	02Nov2014, 15:45	1.51
W850	0.159866	163.5	02Nov2014, 12:10	1.75
W840	0.144036	163.0	02Nov2014, 12:16	2.33
Reach-830	0.303902	311.7	02Nov2014, 12:14	2.03
W2300	0.078733	27.9	02Nov2014, 12:42	1.17
GMRTrib4	9.464767	1348.4	02Nov2014, 15:43	1.52
W830	0.026314	10.6	02Nov2014, 12:16	0.89
Reach-720	9.491081	1347.8	02Nov2014, 15:49	1.51
W720	0.063825	71.1	02Nov2014, 12:13	2.10
Reach-2200	9.554906	1351.8	02Nov2014, 15:49	1.52
W2200	0.083314	90.8	02Nov2014, 12:23	2.66
Reach-2201	9.638220	1356.1	02Nov2014, 15:52	1.52
W580	0.179172	151.5	02Nov2014, 12:35	2.51
W3500	0.134110	85.9	02Nov2014, 12:40	2.01
W3600	0.127673	99.4	02Nov2014, 12:36	2.33
Reach-580	0.127673	99.3	02Nov2014, 12:42	2.32
Reach-3700	0.440955	332.9	02Nov2014, 12:41	2.30
W3700	0.085993	87.3	02Nov2014, 12:23	2.42
Reach-2900	0.526948	387.9	02Nov2014, 12:46	2.31
W2900	0.115190	130.1	02Nov2014, 12:17	2.37
Reach-670	0.642138	439.2	02Nov2014, 12:43	2.32
W670	0.164802	182.6	02Nov2014, 12:21	2.56
W3900	0.089883	65.9	02Nov2014, 12:21	1.66
Reach-710	0.089883	55.1	02Nov2014, 12:38	1.62
GMRTrib2	10.535043	1425.9	02Nov2014, 15:48	1.59

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W710	0.190622	164.9	02Nov2014, 12:19	1.89
Reach-600	10.725665	1413.2	02Nov2014, 16:12	1.56
W600	0.155003	137.0	02Nov2014, 12:17	1.83
Reach-3800	10.880668	1417.9	02Nov2014, 16:19	1.56
W3800	0.131793	111.3	02Nov2014, 12:21	1.92
Reservoir-2100	11.012461	1419.4	02Nov2014, 16:31	1.53
Reach-2100	11.012461	1419.1	02Nov2014, 16:35	1.52
W2100	0.092432	89.8	02Nov2014, 12:16	1.97
Reach-4700	11.104893	1419.8	02Nov2014, 16:41	1.52
W4700	0.094290	59.4	02Nov2014, 12:17	1.34
Reach-2000	11.199183	1421.4	02Nov2014, 16:54	1.51
W2000	0.113520	84.7	02Nov2014, 12:20	1.67
Reach-1900	11.312703	1425.0	02Nov2014, 17:00	1.51
W1900	0.122992	92.8	02Nov2014, 12:22	1.73
Reach-1800	11.435695	1430.1	02Nov2014, 17:02	1.51
W1800	0.148583	119.1	02Nov2014, 12:18	1.72
W4600	0.044115	21.6	02Nov2014, 12:20	1.13
Reach-4600	0.044115	18.2	02Nov2014, 12:34	1.11
Reach-530	11.628393	1437.2	02Nov2014, 17:07	1.51
W750	0.129679	128.0	02Nov2014, 12:20	2.22
W4100	0.093017	75.8	02Nov2014, 12:41	2.66
Reach-750	0.093017	75.2	02Nov2014, 12:49	2.65
Reach-1400	0.222696	160.3	02Nov2014, 12:37	2.38
W1400	0.136188	34.5	02Nov2014, 12:34	0.79
Reach-1000	0.358884	192.4	02Nov2014, 12:41	1.77
W760	0.162490	49.4	02Nov2014, 12:48	1.09
W1000	0.026933	10.8	02Nov2014, 12:26	1.04
Reach-1500	0.548307	244.9	02Nov2014, 12:47	1.53
W1500	0.128740	37.5	02Nov2014, 12:30	0.84
Reach-570	0.677047	273.5	02Nov2014, 12:46	1.40
W570	0.098691	32.4	02Nov2014, 12:27	0.89

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reach-1100	0.775738	293.2	02Nov2014, 12:52	1.33
W1100	0.148073	26.1	02Nov2014, 12:24	0.53
Reach-FornesRun	0.923811	305.8	02Nov2014, 12:52	1.20
W530	0.112161	52.2	02Nov2014, 12:22	1.12
FornesRun	12.664365	1476.4	02Nov2014, 17:04	1.48
Reach-Fornescont	12.664365	1476.4	02Nov2014, 17:04	1.48
Reach-510	12.664365	1474.5	02Nov2014, 17:14	1.47
W1200	0.145402	48.5	02Nov2014, 12:32	0.97
W1600	0.069092	37.0	02Nov2014, 12:27	1.37
Reservoir-1700	0.069092	35.5	02Nov2014, 12:33	1.37
Reach-1700	0.069092	35.4	02Nov2014, 12:36	1.37
W1700	0.035228	20.4	02Nov2014, 12:18	1.26
Reach-1200	0.104320	49.3	02Nov2014, 12:39	1.33
Reach-1300	0.249722	96.1	02Nov2014, 12:39	1.12
W1300	0.153935	54.2	02Nov2014, 12:24	0.90
Reach-4500	0.403657	137.5	02Nov2014, 12:39	1.03
W4500	0.128624	47.1	02Nov2014, 12:27	0.97
Reach-520	0.532281	176.7	02Nov2014, 12:39	1.01
W510	0.077580	47.2	02Nov2014, 12:22	1.43
W520	0.028353	19.1	02Nov2014, 12:18	1.44
ReedyBch	13.302579	1495.4	02Nov2014, 17:12	1.45
Reach-500	13.302579	1490.4	02Nov2014, 17:19	1.45
W500	0.183659	139.2	02Nov2014, 12:23	1.79
Reservoir-400	13.486238	1491.8	02Nov2014, 17:34	1.44
Reach-400	13.486238	1479.8	02Nov2014, 17:47	1.41
W400	0.141370	136.7	02Nov2014, 12:17	2.00
Reach-3400	13.627608	1468.9	02Nov2014, 18:04	1.38
W3400	0.134392	114.4	02Nov2014, 12:22	1.96
Outlet	13.762000	1473.6	02Nov2014, 18:03	1.38

Project: GMR_Future Simulation Run: 10 yr

Start of Run:	02Nov2014, 00:00	Basin Model:	GMR Subbasins
End of Run:	03Nov2014, 00:06	Meteorologic Model:	10 yr
Compute Time:	02Nov2015, 15:47:50	Control Specifications:	Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	411.8	02Nov2014, 12:57	4.00
W700	0.248681	194.6	02Nov2014, 13:04	3.31
Reach-660	0.662365	597.3	02Nov2014, 13:13	3.72
W660	0.467389	532.6	02Nov2014, 12:44	3.85
W800	0.347947	313.9	02Nov2014, 13:01	3.74
GMRTrib9	1.477701	1329.3	02Nov2014, 12:58	3.77
Reach-770	1.477701	1213.5	02Nov2014, 13:34	3.68
W770	0.644502	470.4	02Nov2014, 12:57	2.84
Reach-3100	2.122203	1459.7	02Nov2014, 13:57	3.42
W550	0.358867	322.5	02Nov2014, 12:56	3.51
W560	0.110000	87.0	02Nov2014, 13:02	3.28
Reach-550	0.110000	79.1	02Nov2014, 13:24	3.21
Reach-3000	0.468867	296.7	02Nov2014, 13:42	3.27
W3000	0.385817	400.6	02Nov2014, 12:52	3.90
W4900	0.133889	251.8	02Nov2014, 12:14	3.62
Reach-4800	0.133889	246.0	02Nov2014, 12:19	3.61
W4800	0.047262	81.1	02Nov2014, 12:24	4.29
Reach-3000(2)	0.181151	315.3	02Nov2014, 12:27	3.78
Reach-990	1.035835	607.4	02Nov2014, 13:36	3.48
W990	0.353913	386.2	02Nov2014, 12:44	3.69
Reservoir-2800	1.389748	348.9	02Nov2014, 15:25	3.52
Reach-2800	1.389748	348.8	02Nov2014, 15:49	3.49
W2800	0.034493	35.0	02Nov2014, 12:33	2.86
Reach-630	1.424241	352.6	02Nov2014, 15:25	3.45
W630	0.373057	294.1	02Nov2014, 12:50	2.81
Reservoir-2700	1.797298	373.3	02Nov2014, 17:21	2.98
Reach-2700	1.797298	373.2	02Nov2014, 17:26	2.97

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3100	0.373146	238.9	02Nov2014, 12:44	2.15
NorthForkGMR	4.292647	1758.0	02Nov2014, 13:57	3.12
W2700	0.020970	31.8	02Nov2014, 12:16	3.07
Reach-2600	4.313617	1761.5	02Nov2014, 13:57	3.12
W2600	0.000825	2.4	02Nov2014, 12:07	4.70
Reach-780	4.314442	1670.2	02Nov2014, 14:21	3.05
W640	0.401148	409.4	02Nov2014, 12:53	3.88
Reach-650	0.401148	405.3	02Nov2014, 13:01	3.86
W780	0.246680	268.4	02Nov2014, 12:32	3.01
W650	0.164286	277.4	02Nov2014, 12:21	3.89
GMRTrib8	5.126556	1874.2	02Nov2014, 14:17	3.14
Reach-820	5.126556	1835.3	02Nov2014, 14:30	3.10
W920	0.460578	321.0	02Nov2014, 13:23	3.54
W5100	0.078185	95.4	02Nov2014, 12:21	2.78
Laurel Ridge	0.538763	338.5	02Nov2014, 13:22	3.43
Reach-5000	0.538763	236.9	02Nov2014, 13:23	2.61
W980	0.256902	261.6	02Nov2014, 12:59	4.20
Reach-980	0.256902	185.2	02Nov2014, 13:10	3.92
W5000	0.106592	221.6	02Nov2014, 12:17	4.64
Reach-930	0.902257	319.9	02Nov2014, 13:51	3.02
W930	0.182222	105.7	02Nov2014, 13:04	2.46
W910	0.117701	65.3	02Nov2014, 13:03	2.33
Reach-940	1.202180	452.1	02Nov2014, 13:45	2.85
W940	0.314395	173.2	02Nov2014, 12:44	1.86
W5200	0.144430	201.9	02Nov2014, 12:34	4.10
Reach-5200	0.144430	201.0	02Nov2014, 12:39	4.09
W3200	0.102774	99.3	02Nov2014, 12:41	3.09
Reach-3200	0.102774	98.7	02Nov2014, 12:50	3.08
W960	0.082432	116.1	02Nov2014, 12:25	3.44
Trib2GMRTrib7	1.846211	842.3	02Nov2014, 12:43	2.82
Reach-950	1.846211	833.1	02Nov2014, 12:50	2.80

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W5300	0.109099	158.3	02Nov2014, 12:39	4.84
W3300	0.093470	142.3	02Nov2014, 12:35	4.74
Reach-970	0.202569	285.6	02Nov2014, 12:46	4.76
W970	0.187536	216.7	02Nov2014, 12:38	3.57
W950	0.107912	80.7	02Nov2014, 12:27	1.94
W4400	0.037039	90.5	02Nov2014, 12:12	4.68
Reach-4400	0.037039	76.9	02Nov2014, 12:32	4.63
Trib1GMRTrib7	2.381267	1431.2	02Nov2014, 12:45	3.02
Reach-880	2.381267	1336.2	02Nov2014, 13:10	3.02
W880	0.381917	182.8	02Nov2014, 12:36	1.49
W820	0.054394	28.4	02Nov2014, 12:21	1.30
GMRTrib7	7.944134	2640.8	02Nov2014, 14:20	2.99
Reach-2500	7.944134	2623.7	02Nov2014, 14:25	2.98
W2500	0.061783	115.8	02Nov2014, 12:16	3.88
Reach-860	8.005917	2598.9	02Nov2014, 14:37	2.95
W900	0.129395	174.7	02Nov2014, 12:28	3.50
W4300	0.118974	268.5	02Nov2014, 12:16	4.91
Reach-900	0.118974	258.1	02Nov2014, 12:21	4.90
W890	0.113096	181.3	02Nov2014, 12:25	4.06
W4200	0.107748	184.8	02Nov2014, 12:25	4.42
Reach-890	0.107748	184.2	02Nov2014, 12:28	4.42
TribGMRTrib6	0.469213	782.0	02Nov2014, 12:24	4.20
Reach-870	0.469213	717.2	02Nov2014, 12:27	4.17
W860	0.125460	115.8	02Nov2014, 12:19	2.03
W870	0.015309	28.2	02Nov2014, 12:16	3.79
GMRTrib6	8.615899	2696.7	02Nov2014, 14:35	3.01
Reach-810	8.615899	2695.2	02Nov2014, 14:41	3.00
W810	0.118699	120.0	02Nov2014, 12:18	2.18
Reach-2400	8.734598	2700.7	02Nov2014, 14:46	2.98
W740	0.102118	149.9	02Nov2014, 12:26	3.72
Reach-4000	0.102118	149.5	02Nov2014, 12:32	3.71

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W4000	0.094479	167.8	02Nov2014, 12:22	4.29
W2400	0.092820	111.4	02Nov2014, 12:26	2.99
GMRTrib5	9.024015	2744.6	02Nov2014, 14:45	3.00
Reach-790	9.024015	2739.7	02Nov2014, 14:49	2.99
W790	0.058117	67.8	02Nov2014, 12:37	3.55
Reservoir-2300	9.082132	2732.7	02Nov2014, 15:01	2.97
Reach-2300	9.082132	2730.5	02Nov2014, 15:06	2.96
W850	0.159866	327.0	02Nov2014, 12:10	3.48
W840	0.144036	290.9	02Nov2014, 12:16	4.23
Reach-830	0.303902	588.9	02Nov2014, 12:13	3.84
W2300	0.078733	66.6	02Nov2014, 12:40	2.65
GMRTrib4	9.464767	2780.8	02Nov2014, 15:05	2.99
W830	0.026314	29.6	02Nov2014, 12:14	2.20
Reach-720	9.491081	2779.5	02Nov2014, 15:10	2.98
W720	0.063825	132.2	02Nov2014, 12:13	3.95
Reach-2200	9.554906	2787.8	02Nov2014, 15:11	2.98
W2200	0.083314	153.9	02Nov2014, 12:23	4.62
Reach-2201	9.638220	2795.3	02Nov2014, 15:14	2.99
W580	0.179172	262.6	02Nov2014, 12:34	4.44
W3500	0.134110	162.6	02Nov2014, 12:39	3.82
W3600	0.127673	177.4	02Nov2014, 12:35	4.22
Reach-580	0.127673	177.3	02Nov2014, 12:41	4.21
Reach-3700	0.440955	597.1	02Nov2014, 12:40	4.18
W3700	0.085993	153.5	02Nov2014, 12:22	4.34
Reach-2900	0.526948	696.9	02Nov2014, 12:43	4.19
W2900	0.115190	230.8	02Nov2014, 12:17	4.27
Reach-670	0.642138	795.8	02Nov2014, 12:40	4.20
W670	0.164802	314.5	02Nov2014, 12:20	4.50
W3900	0.089883	134.9	02Nov2014, 12:20	3.36
Reach-710	0.089883	113.4	02Nov2014, 12:34	3.30
GMRTrib2	10.535043	2934.0	02Nov2014, 15:10	3.09

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W710	0.190622	320.1	02Nov2014, 12:19	3.67
Reach-600	10.725665	2912.2	02Nov2014, 15:31	3.03
W600	0.155003	269.7	02Nov2014, 12:16	3.58
Reach-3800	10.880668	2928.9	02Nov2014, 15:33	3.04
W3800	0.131793	214.5	02Nov2014, 12:21	3.71
Reservoir-2100	11.012461	2913.8	02Nov2014, 15:52	3.00
Reach-2100	11.012461	2912.0	02Nov2014, 15:57	3.00
W2100	0.092432	171.4	02Nov2014, 12:16	3.77
Reach-4700	11.104893	2908.1	02Nov2014, 16:01	2.99
W4700	0.094290	133.8	02Nov2014, 12:16	2.90
Reach-2000	11.199183	2909.7	02Nov2014, 16:12	2.97
W2000	0.113520	173.0	02Nov2014, 12:20	3.37
Reach-1900	11.312703	2914.6	02Nov2014, 16:18	2.97
W1900	0.122992	186.6	02Nov2014, 12:21	3.46
Reach-1800	11.435695	2922.9	02Nov2014, 16:24	2.97
W1800	0.148583	240.4	02Nov2014, 12:18	3.44
W4600	0.044115	52.6	02Nov2014, 12:19	2.59
Reach-4600	0.044115	44.7	02Nov2014, 12:29	2.56
Reach-530	11.628393	2919.6	02Nov2014, 16:43	2.96
W750	0.129679	233.0	02Nov2014, 12:20	4.08
W4100	0.093017	128.7	02Nov2014, 12:40	4.62
Reach-750	0.093017	127.3	02Nov2014, 12:48	4.60
Reach-1400	0.222696	264.7	02Nov2014, 12:49	4.25
W1400	0.136188	101.6	02Nov2014, 12:31	2.04
Reach-1000	0.358884	344.9	02Nov2014, 12:45	3.40
W760	0.162490	122.2	02Nov2014, 12:45	2.52
W1000	0.026933	27.5	02Nov2014, 12:24	2.44
Reach-1500	0.548307	479.1	02Nov2014, 12:49	3.09
W1500	0.128740	106.5	02Nov2014, 12:28	2.13
Reach-570	0.677047	551.0	02Nov2014, 12:45	2.90
W570	0.098691	89.4	02Nov2014, 12:25	2.21

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reach-1100	0.775738	599.6	02Nov2014, 12:56	2.80
W1100	0.148073	104.0	02Nov2014, 12:19	1.59
Reach-FornesRun	0.923811	632.1	02Nov2014, 12:55	2.61
W530	0.112161	127.9	02Nov2014, 12:21	2.57
FornesRun	12.664365	3001.4	02Nov2014, 16:40	2.93
Reach-Fornescont	12.664365	3001.4	02Nov2014, 16:40	2.93
Reach-510	12.664365	2997.5	02Nov2014, 16:49	2.92
W1200	0.145402	127.4	02Nov2014, 12:30	2.33
W1600	0.069092	82.2	02Nov2014, 12:26	2.95
Reservoir-1700	0.069092	75.2	02Nov2014, 12:34	2.94
Reach-1700	0.069092	75.2	02Nov2014, 12:36	2.94
W1700	0.035228	47.2	02Nov2014, 12:17	2.79
Reach-1200	0.104320	109.6	02Nov2014, 12:33	2.88
Reach-1300	0.249722	235.3	02Nov2014, 12:35	2.56
W1300	0.153935	148.8	02Nov2014, 12:21	2.23
Reach-4500	0.403657	354.7	02Nov2014, 12:34	2.42
W4500	0.128624	123.9	02Nov2014, 12:24	2.33
Reach-520	0.532281	466.5	02Nov2014, 12:33	2.40
W510	0.077580	103.0	02Nov2014, 12:21	3.03
W520	0.028353	41.6	02Nov2014, 12:17	3.06
ReedyBch	13.302579	3042.1	02Nov2014, 16:48	2.90
Reach-500	13.302579	3031.2	02Nov2014, 16:53	2.89
W500	0.183659	275.9	02Nov2014, 12:22	3.54
Reservoir-400	13.486238	3033.0	02Nov2014, 17:08	2.87
Reach-400	13.486238	3003.8	02Nov2014, 17:21	2.82
W400	0.141370	259.0	02Nov2014, 12:16	3.82
Reach-3400	13.627608	2978.3	02Nov2014, 17:37	2.77
W3400	0.134392	218.8	02Nov2014, 12:21	3.76
Outlet	13.762000	2987.3	02Nov2014, 17:37	2.77

Project: GMR_Future Simulation Run: 25 yr

Start of Run: 02Nov2014, 00:00 Basin Model: GMR Subbasins
End of Run: 03Nov2014, 00:06 Meteorologic Model: 25 yr
Compute Time: 02Nov2015, 15:49:08 Control Specifications: Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	543.9	02Nov2014, 12:57	5.33
W700	0.248681	267.9	02Nov2014, 13:03	4.55
Reach-660	0.662365	798.3	02Nov2014, 13:13	5.01
W660	0.467389	709.0	02Nov2014, 12:43	5.17
W800	0.347947	420.7	02Nov2014, 13:00	5.04
GMRTrib9	1.477701	1770.8	02Nov2014, 12:58	5.07
Reach-770	1.477701	1606.9	02Nov2014, 13:32	4.95
W770	0.644502	669.9	02Nov2014, 12:56	4.02
Reach-3100	2.122203	1986.0	02Nov2014, 13:50	4.66
W550	0.358867	438.2	02Nov2014, 12:55	4.78
W560	0.110000	120.1	02Nov2014, 13:01	4.52
Reach-550	0.110000	109.5	02Nov2014, 13:21	4.44
Reach-3000	0.468867	384.2	02Nov2014, 13:48	4.46
W3000	0.385817	532.2	02Nov2014, 12:51	5.22
W4900	0.133889	339.5	02Nov2014, 12:14	4.92
Reach-4800	0.133889	332.7	02Nov2014, 12:18	4.91
W4800	0.047262	105.4	02Nov2014, 12:24	5.65
Reach-3000(2)	0.181151	421.6	02Nov2014, 12:26	5.09
Reach-990	1.035835	795.7	02Nov2014, 13:32	4.71
W990	0.353913	518.9	02Nov2014, 12:44	4.99
Reservoir-2800	1.389748	401.6	02Nov2014, 15:42	4.62
Reach-2800	1.389748	401.0	02Nov2014, 15:57	4.58
W2800	0.034493	49.8	02Nov2014, 12:33	4.04
Reach-630	1.424241	405.6	02Nov2014, 15:55	4.52
W630	0.373057	419.5	02Nov2014, 12:49	3.99
Reservoir-2700	1.797298	472.3	02Nov2014, 15:09	3.86
Reach-2700	1.797298	472.2	02Nov2014, 15:14	3.85

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3100	0.373146	363.4	02Nov2014, 12:43	3.20
NorthForkGMR	4.292647	2411.1	02Nov2014, 13:51	4.19
W2700	0.020970	44.5	02Nov2014, 12:16	4.29
Reach-2600	4.313617	2416.0	02Nov2014, 13:51	4.19
W2600	0.000825	3.0	02Nov2014, 12:07	6.09
Reach-780	4.314442	2298.3	02Nov2014, 14:12	4.09
W640	0.401148	544.2	02Nov2014, 12:52	5.20
Reach-650	0.401148	538.8	02Nov2014, 13:00	5.18
W780	0.246680	376.9	02Nov2014, 12:32	4.23
W650	0.164286	368.4	02Nov2014, 12:21	5.21
GMRTrib8	5.126556	2595.3	02Nov2014, 14:07	4.22
Reach-820	5.126556	2543.6	02Nov2014, 14:18	4.17
W920	0.460578	435.2	02Nov2014, 13:23	4.81
W5100	0.078185	136.5	02Nov2014, 12:21	3.96
Laurel Ridge	0.538763	459.5	02Nov2014, 13:20	4.69
Reach-5000	0.538763	330.6	02Nov2014, 13:22	3.72
W980	0.256902	342.0	02Nov2014, 12:58	5.54
Reach-980	0.256902	236.4	02Nov2014, 13:10	5.19
W5000	0.106592	283.9	02Nov2014, 12:17	6.03
Reach-930	0.902257	430.4	02Nov2014, 13:49	4.22
W930	0.182222	155.6	02Nov2014, 13:03	3.57
W910	0.117701	97.5	02Nov2014, 13:02	3.41
Reach-940	1.202180	632.4	02Nov2014, 13:39	4.02
W940	0.314395	273.7	02Nov2014, 12:43	2.84
W5200	0.144430	265.4	02Nov2014, 12:33	5.44
Reach-5200	0.144430	263.5	02Nov2014, 12:39	5.42
W3200	0.102774	138.7	02Nov2014, 12:41	4.31
Reach-3200	0.102774	137.9	02Nov2014, 12:49	4.30
W960	0.082432	158.3	02Nov2014, 12:24	4.72
Trib2GMRTrib7	1.846211	1137.9	02Nov2014, 12:44	3.97
Reach-950	1.846211	1128.1	02Nov2014, 12:50	3.96

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W5300	0.109099	201.2	02Nov2014, 12:39	6.23
W3300	0.093470	181.5	02Nov2014, 12:35	6.12
Reach-970	0.202569	364.1	02Nov2014, 12:46	6.14
W970	0.187536	293.2	02Nov2014, 12:38	4.86
W950	0.107912	126.1	02Nov2014, 12:27	2.94
W4400	0.037039	115.7	02Nov2014, 12:12	6.07
Reach-4400	0.037039	98.3	02Nov2014, 12:31	6.00
Trib1GMRTrib7	2.381267	1918.0	02Nov2014, 12:44	4.20
Reach-880	2.381267	1808.3	02Nov2014, 13:06	4.19
W880	0.381917	308.6	02Nov2014, 12:35	2.37
W820	0.054394	50.5	02Nov2014, 12:20	2.12
GMRTrib7	7.944134	3709.4	02Nov2014, 14:06	4.07
Reach-2500	7.944134	3689.4	02Nov2014, 14:10	4.06
W2500	0.061783	153.9	02Nov2014, 12:16	5.21
Reach-860	8.005917	3664.6	02Nov2014, 14:21	4.02
W900	0.129395	237.4	02Nov2014, 12:27	4.78
W4300	0.118974	340.3	02Nov2014, 12:16	6.31
Reach-900	0.118974	326.7	02Nov2014, 12:20	6.29
W890	0.113096	238.7	02Nov2014, 12:25	5.40
W4200	0.107748	239.0	02Nov2014, 12:25	5.79
Reach-890	0.107748	238.2	02Nov2014, 12:28	5.78
TribGMRTrib6	0.469213	1020.4	02Nov2014, 12:24	5.54
Reach-870	0.469213	941.4	02Nov2014, 12:26	5.51
W860	0.125460	179.0	02Nov2014, 12:18	3.05
W870	0.015309	37.7	02Nov2014, 12:16	5.10
GMRTrib6	8.615899	3804.5	02Nov2014, 14:18	4.09
Reach-810	8.615899	3802.3	02Nov2014, 14:23	4.08
W810	0.118699	182.1	02Nov2014, 12:18	3.24
Reach-2400	8.734598	3811.9	02Nov2014, 14:28	4.06
W740	0.102118	201.0	02Nov2014, 12:26	5.02
Reach-4000	0.102118	200.5	02Nov2014, 12:31	5.02

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W4000	0.094479	218.3	02Nov2014, 12:22	5.65
W2400	0.092820	156.6	02Nov2014, 12:26	4.20
GMRTrib5	9.024015	3874.4	02Nov2014, 14:27	4.09
Reach-790	9.024015	3868.4	02Nov2014, 14:31	4.07
W790	0.058117	91.9	02Nov2014, 12:37	4.84
Reservoir-2300	9.082132	3852.1	02Nov2014, 14:44	4.05
Reach-2300	9.082132	3848.9	02Nov2014, 14:49	4.04
W850	0.159866	444.3	02Nov2014, 12:10	4.76
W840	0.144036	379.5	02Nov2014, 12:16	5.59
Reach-830	0.303902	786.4	02Nov2014, 12:13	5.15
W2300	0.078733	96.3	02Nov2014, 12:39	3.80
GMRTrib4	9.464767	3919.7	02Nov2014, 14:48	4.07
W830	0.026314	44.8	02Nov2014, 12:14	3.27
Reach-720	9.491081	3917.3	02Nov2014, 14:52	4.06
W720	0.063825	175.0	02Nov2014, 12:13	5.28
Reach-2200	9.554906	3928.8	02Nov2014, 14:54	4.06
W2200	0.083314	197.3	02Nov2014, 12:23	6.01
Reach-2201	9.638220	3937.9	02Nov2014, 14:57	4.07
W580	0.179172	339.4	02Nov2014, 12:34	5.81
W3500	0.134110	216.8	02Nov2014, 12:39	5.13
W3600	0.127673	231.7	02Nov2014, 12:35	5.57
Reach-580	0.127673	231.5	02Nov2014, 12:40	5.57
Reach-3700	0.440955	781.3	02Nov2014, 12:39	5.53
W3700	0.085993	199.3	02Nov2014, 12:22	5.70
Reach-2900	0.526948	912.7	02Nov2014, 12:42	5.54
W2900	0.115190	300.7	02Nov2014, 12:16	5.63
Reach-670	0.642138	1046.2	02Nov2014, 12:39	5.55
W670	0.164802	405.4	02Nov2014, 12:20	5.87
W3900	0.089883	185.0	02Nov2014, 12:20	4.62
Reach-710	0.089883	156.0	02Nov2014, 12:32	4.55
GMRTrib2	10.535043	4131.0	02Nov2014, 14:53	4.19

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W710	0.190622	430.6	02Nov2014, 12:18	4.97
Reach-600	10.725665	4093.2	02Nov2014, 15:13	4.12
W600	0.155003	364.8	02Nov2014, 12:16	4.87
Reach-3800	10.880668	4116.9	02Nov2014, 15:15	4.13
W3800	0.131793	288.0	02Nov2014, 12:20	5.01
Reservoir-2100	11.012461	4058.0	02Nov2014, 15:41	4.09
Reach-2100	11.012461	4057.8	02Nov2014, 15:45	4.08
W2100	0.092432	229.2	02Nov2014, 12:15	5.09
Reach-4700	11.104893	4067.6	02Nov2014, 15:52	4.07
W4700	0.094290	189.7	02Nov2014, 12:16	4.09
Reach-2000	11.199183	4078.1	02Nov2014, 16:00	4.05
W2000	0.113520	237.1	02Nov2014, 12:19	4.64
Reach-1900	11.312703	4091.4	02Nov2014, 16:04	4.05
W1900	0.122992	254.3	02Nov2014, 12:21	4.73
Reach-1800	11.435695	4106.3	02Nov2014, 16:07	4.05
W1800	0.148583	327.7	02Nov2014, 12:18	4.72
W4600	0.044115	76.5	02Nov2014, 12:19	3.73
Reach-4600	0.044115	65.5	02Nov2014, 12:27	3.69
Reach-530	11.628393	4117.1	02Nov2014, 16:21	4.04
W750	0.129679	306.3	02Nov2014, 12:20	5.43
W4100	0.093017	165.0	02Nov2014, 12:40	5.99
Reach-750	0.093017	163.2	02Nov2014, 12:48	5.98
Reach-1400	0.222696	341.7	02Nov2014, 12:49	5.59
W1400	0.136188	156.4	02Nov2014, 12:30	3.07
Reach-1000	0.358884	461.8	02Nov2014, 12:45	4.62
W760	0.162490	178.7	02Nov2014, 12:44	3.65
W1000	0.026933	40.6	02Nov2014, 12:23	3.55
Reach-1500	0.548307	650.8	02Nov2014, 12:51	4.27
W1500	0.128740	162.3	02Nov2014, 12:27	3.18
Reach-570	0.677047	750.7	02Nov2014, 12:47	4.06
W570	0.098691	135.0	02Nov2014, 12:24	3.28

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reach-1100	0.775738	824.4	02Nov2014, 12:55	3.94
W1100	0.148073	172.6	02Nov2014, 12:18	2.50
Reach-FornesRun	0.923811	876.2	02Nov2014, 12:52	3.71
W530	0.112161	186.4	02Nov2014, 12:20	3.70
FornesRun	12.664365	4239.5	02Nov2014, 16:16	4.01
Reach-Fornescont	12.664365	4239.5	02Nov2014, 16:16	4.01
Reach-510	12.664365	4236.7	02Nov2014, 16:24	4.00
W1200	0.145402	189.8	02Nov2014, 12:29	3.42
W1600	0.069092	115.9	02Nov2014, 12:25	4.15
Reservoir-1700	0.069092	95.3	02Nov2014, 12:37	4.15
Reach-1700	0.069092	95.2	02Nov2014, 12:40	4.14
W1700	0.035228	67.5	02Nov2014, 12:17	3.97
Reach-1200	0.104320	140.1	02Nov2014, 12:28	4.07
Reach-1300	0.249722	328.3	02Nov2014, 12:34	3.69
W1300	0.153935	224.5	02Nov2014, 12:21	3.29
Reach-4500	0.403657	508.7	02Nov2014, 12:33	3.53
W4500	0.128624	184.7	02Nov2014, 12:24	3.42
Reach-520	0.532281	676.5	02Nov2014, 12:32	3.50
W510	0.077580	144.6	02Nov2014, 12:21	4.25
W520	0.028353	58.3	02Nov2014, 12:17	4.28
ReedyBch	13.302579	4304.6	02Nov2014, 16:21	3.98
Reach-500	13.302579	4292.1	02Nov2014, 16:27	3.96
W500	0.183659	374.2	02Nov2014, 12:22	4.82
Reservoir-400	13.486238	4301.2	02Nov2014, 16:39	3.93
Reach-400	13.486238	4256.9	02Nov2014, 16:52	3.88
W400	0.141370	345.6	02Nov2014, 12:16	5.13
Reach-3400	13.627608	4214.7	02Nov2014, 17:06	3.80
W3400	0.134392	292.8	02Nov2014, 12:21	5.07
Outlet	13.762000	4227.9	02Nov2014, 17:05	3.82

Project: GMR_Future Simulation Run: 50 yr

Start of Run:	02Nov2014, 00:00	Basin Model:	GMR Subbasins
End of Run:	03Nov2014, 00:06	Meteorologic Model:	50 yr
Compute Time:	02Nov2015, 15:49:32	Control Specifications:	Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	659.1	02Nov2014, 12:56	6.51
W700	0.248681	332.9	02Nov2014, 13:03	5.68
Reach-660	0.662365	974.6	02Nov2014, 13:13	6.17
W660	0.467389	863.5	02Nov2014, 12:43	6.34
W800	0.347947	514.5	02Nov2014, 13:00	6.20
GMRTrib9	1.477701	2159.7	02Nov2014, 12:58	6.23
Reach-770	1.477701	1959.9	02Nov2014, 13:31	6.08
W770	0.644502	849.5	02Nov2014, 12:55	5.10
Reach-3100	2.122203	2458.3	02Nov2014, 13:47	5.77
W550	0.358867	540.3	02Nov2014, 12:55	5.93
W560	0.110000	149.4	02Nov2014, 13:01	5.64
Reach-550	0.110000	136.6	02Nov2014, 13:20	5.55
Reach-3000	0.468867	464.3	02Nov2014, 13:51	5.55
W3000	0.385817	647.3	02Nov2014, 12:51	6.39
W4900	0.133889	416.6	02Nov2014, 12:13	6.08
Reach-4800	0.133889	407.7	02Nov2014, 12:18	6.06
W4800	0.047262	126.6	02Nov2014, 12:24	6.85
Reach-3000(2)	0.181151	514.4	02Nov2014, 12:25	6.25
Reach-990	1.035835	960.2	02Nov2014, 13:29	5.83
W990	0.353913	635.3	02Nov2014, 12:44	6.15
Reservoir-2800	1.389748	427.7	02Nov2014, 15:59	5.36
Reach-2800	1.389748	426.1	02Nov2014, 16:20	5.28
W2800	0.034493	63.0	02Nov2014, 12:32	5.13
Reach-630	1.424241	431.0	02Nov2014, 16:14	5.22
W630	0.373057	532.6	02Nov2014, 12:48	5.07
Reservoir-2700	1.797298	549.5	02Nov2014, 14:13	4.53
Reach-2700	1.797298	549.4	02Nov2014, 14:18	4.51

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3100	0.373146	478.8	02Nov2014, 12:43	4.18
NorthForkGMR	4.292647	3101.4	02Nov2014, 13:51	5.10
W2700	0.020970	55.8	02Nov2014, 12:16	5.40
Reach-2600	4.313617	3107.3	02Nov2014, 13:51	5.11
W2600	0.000825	3.6	02Nov2014, 12:07	7.31
Reach-780	4.314442	2956.3	02Nov2014, 14:08	4.98
W640	0.401148	662.2	02Nov2014, 12:52	6.37
Reach-650	0.401148	655.8	02Nov2014, 12:59	6.35
W780	0.246680	473.8	02Nov2014, 12:31	5.33
W650	0.164286	448.0	02Nov2014, 12:20	6.39
GMRTrib8	5.126556	3330.0	02Nov2014, 14:03	5.15
Reach-820	5.126556	3265.2	02Nov2014, 14:13	5.09
W920	0.460578	536.0	02Nov2014, 13:22	5.95
W5100	0.078185	173.5	02Nov2014, 12:21	5.03
Laurel Ridge	0.538763	566.3	02Nov2014, 13:20	5.82
Reach-5000	0.538763	413.8	02Nov2014, 13:21	4.72
W980	0.256902	412.1	02Nov2014, 12:58	6.73
Reach-980	0.256902	281.8	02Nov2014, 13:10	6.34
W5000	0.106592	338.0	02Nov2014, 12:17	7.24
Reach-930	0.902257	528.6	02Nov2014, 13:48	5.29
W930	0.182222	201.3	02Nov2014, 13:02	4.59
W910	0.117701	127.0	02Nov2014, 13:01	4.42
Reach-940	1.202180	794.7	02Nov2014, 13:35	5.08
W940	0.314395	368.5	02Nov2014, 12:42	3.77
W5200	0.144430	320.6	02Nov2014, 12:33	6.63
Reach-5200	0.144430	317.9	02Nov2014, 12:40	6.61
W3200	0.102774	173.9	02Nov2014, 12:40	5.42
Reach-3200	0.102774	172.9	02Nov2014, 12:48	5.40
W960	0.082432	195.6	02Nov2014, 12:24	5.86
Trib2GMRTrib7	1.846211	1415.5	02Nov2014, 12:45	5.03
Reach-950	1.846211	1404.4	02Nov2014, 12:51	5.01

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W5300	0.109099	238.4	02Nov2014, 12:38	7.45
W3300	0.093470	215.6	02Nov2014, 12:34	7.34
Reach-970	0.202569	431.9	02Nov2014, 12:45	7.35
W970	0.187536	360.5	02Nov2014, 12:38	6.01
W950	0.107912	168.6	02Nov2014, 12:26	3.89
W4400	0.037039	137.6	02Nov2014, 12:12	7.29
Reach-4400	0.037039	117.2	02Nov2014, 12:30	7.21
Trib1GMRTrib7	2.381267	2356.4	02Nov2014, 12:44	5.27
Reach-880	2.381267	2233.8	02Nov2014, 13:05	5.25
W880	0.381917	429.9	02Nov2014, 12:34	3.22
W820	0.054394	72.2	02Nov2014, 12:19	2.93
GMRTrib7	7.944134	4751.0	02Nov2014, 13:59	5.04
Reach-2500	7.944134	4730.6	02Nov2014, 14:03	5.02
W2500	0.061783	187.2	02Nov2014, 12:16	6.38
Reach-860	8.005917	4703.1	02Nov2014, 14:12	4.97
W900	0.129395	292.7	02Nov2014, 12:27	5.92
W4300	0.118974	402.5	02Nov2014, 12:16	7.54
Reach-900	0.118974	386.5	02Nov2014, 12:20	7.51
W890	0.113096	288.6	02Nov2014, 12:25	6.59
W4200	0.107748	286.1	02Nov2014, 12:25	7.00
Reach-890	0.107748	285.0	02Nov2014, 12:28	6.99
TribGMRTrib6	0.469213	1228.1	02Nov2014, 12:24	6.73
Reach-870	0.469213	1137.3	02Nov2014, 12:26	6.69
W860	0.125460	238.0	02Nov2014, 12:18	4.02
W870	0.015309	46.0	02Nov2014, 12:16	6.28
GMRTrib6	8.615899	4881.4	02Nov2014, 14:09	5.06
Reach-810	8.615899	4878.5	02Nov2014, 14:15	5.05
W810	0.118699	239.4	02Nov2014, 12:17	4.23
Reach-2400	8.734598	4891.3	02Nov2014, 14:19	5.02
W740	0.102118	245.8	02Nov2014, 12:26	6.19
Reach-4000	0.102118	245.2	02Nov2014, 12:30	6.18

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W4000	0.094479	262.2	02Nov2014, 12:22	6.85
W2400	0.092820	197.1	02Nov2014, 12:25	5.30
GMRTrib5	9.024015	4970.5	02Nov2014, 14:18	5.05
Reach-790	9.024015	4963.1	02Nov2014, 14:21	5.04
W790	0.058117	113.0	02Nov2014, 12:37	5.99
Reservoir-2300	9.082132	4921.0	02Nov2014, 14:38	5.01
Reach-2300	9.082132	4917.4	02Nov2014, 14:42	4.99
W850	0.159866	547.5	02Nov2014, 12:10	5.91
W840	0.144036	456.6	02Nov2014, 12:16	6.79
Reach-830	0.303902	958.6	02Nov2014, 12:13	6.32
W2300	0.078733	123.3	02Nov2014, 12:39	4.85
GMRTrib4	9.464767	5005.1	02Nov2014, 14:41	5.04
W830	0.026314	58.9	02Nov2014, 12:14	4.26
Reach-720	9.491081	5002.4	02Nov2014, 14:45	5.02
W720	0.063825	212.3	02Nov2014, 12:13	6.46
Reach-2200	9.554906	5016.5	02Nov2014, 14:49	5.02
W2200	0.083314	234.9	02Nov2014, 12:23	7.22
Reach-2201	9.638220	5029.0	02Nov2014, 14:52	5.04
W580	0.179172	406.0	02Nov2014, 12:34	7.02
W3500	0.134110	264.3	02Nov2014, 12:38	6.30
W3600	0.127673	278.9	02Nov2014, 12:35	6.77
Reach-580	0.127673	278.6	02Nov2014, 12:39	6.76
Reach-3700	0.440955	942.0	02Nov2014, 12:39	6.72
W3700	0.085993	239.1	02Nov2014, 12:22	6.91
Reach-2900	0.526948	1100.7	02Nov2014, 12:42	6.73
W2900	0.115190	361.5	02Nov2014, 12:16	6.83
Reach-670	0.642138	1264.8	02Nov2014, 12:38	6.75
W670	0.164802	484.3	02Nov2014, 12:20	7.08
W3900	0.089883	229.3	02Nov2014, 12:20	5.76
Reach-710	0.089883	193.9	02Nov2014, 12:31	5.67
GMRTrib2	10.535043	5266.1	02Nov2014, 14:47	5.18

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W710	0.190622	527.7	02Nov2014, 12:18	6.13
Reach-600	10.725665	5234.9	02Nov2014, 15:04	5.09
W600	0.155003	448.3	02Nov2014, 12:16	6.03
Reach-3800	10.880668	5265.1	02Nov2014, 15:06	5.11
W3800	0.131793	352.5	02Nov2014, 12:20	6.18
Reservoir-2100	11.012461	5205.7	02Nov2014, 15:30	5.06
Reach-2100	11.012461	5205.5	02Nov2014, 15:35	5.06
W2100	0.092432	279.8	02Nov2014, 12:15	6.26
Reach-4700	11.104893	5217.0	02Nov2014, 15:43	5.04
W4700	0.094290	239.9	02Nov2014, 12:16	5.18
Reach-2000	11.199183	5230.5	02Nov2014, 15:49	5.01
W2000	0.113520	293.8	02Nov2014, 12:19	5.77
Reach-1900	11.312703	5247.6	02Nov2014, 15:51	5.01
W1900	0.122992	314.0	02Nov2014, 12:20	5.88
Reach-1800	11.435695	5266.6	02Nov2014, 15:54	5.01
W1800	0.148583	405.0	02Nov2014, 12:17	5.86
W4600	0.044115	98.3	02Nov2014, 12:18	4.78
Reach-4600	0.044115	84.5	02Nov2014, 12:26	4.73
Reach-530	11.628393	5275.2	02Nov2014, 16:06	5.01
W750	0.129679	370.1	02Nov2014, 12:19	6.62
W4100	0.093017	196.6	02Nov2014, 12:40	7.21
Reach-750	0.093017	194.3	02Nov2014, 12:47	7.19
Reach-1400	0.222696	410.0	02Nov2014, 12:49	6.78
W1400	0.136188	207.4	02Nov2014, 12:30	4.04
Reach-1000	0.358884	569.0	02Nov2014, 12:44	5.73
W760	0.162490	230.2	02Nov2014, 12:44	4.69
W1000	0.026933	52.5	02Nov2014, 12:23	4.58
Reach-1500	0.548307	809.9	02Nov2014, 12:51	5.34
W1500	0.128740	214.1	02Nov2014, 12:26	4.16
Reach-570	0.677047	938.7	02Nov2014, 12:47	5.12
W570	0.098691	177.1	02Nov2014, 12:24	4.27

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reach-1100	0.775738	1032.4	02Nov2014, 12:55	4.98
W1100	0.148073	238.3	02Nov2014, 12:17	3.38
Reach-FornesRun	0.923811	1101.8	02Nov2014, 12:52	4.73
W530	0.112161	239.7	02Nov2014, 12:20	4.75
FornesRun	12.664365	5436.1	02Nov2014, 16:02	4.98
Reach-Fornescont	12.664365	5436.1	02Nov2014, 16:03	4.98
Reach-510	12.664365	5431.2	02Nov2014, 16:09	4.97
W1200	0.145402	247.0	02Nov2014, 12:29	4.44
W1600	0.069092	146.2	02Nov2014, 12:25	5.25
Reservoir-1700	0.069092	115.5	02Nov2014, 12:38	5.24
Reach-1700	0.069092	115.4	02Nov2014, 12:41	5.23
W1700	0.035228	85.8	02Nov2014, 12:17	5.04
Reach-1200	0.104320	167.2	02Nov2014, 12:30	5.16
Reach-1300	0.249722	411.9	02Nov2014, 12:34	4.73
W1300	0.153935	294.3	02Nov2014, 12:21	4.29
Reach-4500	0.403657	640.3	02Nov2014, 12:34	4.55
W4500	0.128624	240.4	02Nov2014, 12:23	4.44
Reach-520	0.532281	854.5	02Nov2014, 12:32	4.52
W510	0.077580	181.6	02Nov2014, 12:21	5.35
W520	0.028353	73.2	02Nov2014, 12:17	5.38
ReedyBch	13.302579	5521.4	02Nov2014, 16:07	4.95
Reach-500	13.302579	5499.1	02Nov2014, 16:13	4.93
W500	0.183659	460.7	02Nov2014, 12:22	5.97
Reservoir-400	13.486238	5508.4	02Nov2014, 16:24	4.90
Reach-400	13.486238	5435.2	02Nov2014, 16:35	4.83
W400	0.141370	421.3	02Nov2014, 12:16	6.31
Reach-3400	13.627608	5366.4	02Nov2014, 16:48	4.74
W3400	0.134392	357.6	02Nov2014, 12:21	6.24
Outlet	13.762000	5383.1	02Nov2014, 16:48	4.75

Project: GMR_Future Simulation Run: 100 yr

Start of Run:	02Nov2014, 00:00	Basin Model:	GMR Subbasins
End of Run:	03Nov2014, 00:06	Meteorologic Model:	100 yr
Compute Time:	02Nov2015, 15:48:15	Control Specifications:	Nov14

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W730	0.413684	786.3	02Nov2014, 12:56	7.82
W700	0.248681	405.2	02Nov2014, 13:02	6.95
Reach-660	0.662365	1170.1	02Nov2014, 13:12	7.46
W660	0.467389	1033.8	02Nov2014, 12:43	7.65
W800	0.347947	618.0	02Nov2014, 13:00	7.50
GMRTrib9	1.477701	2591.3	02Nov2014, 12:58	7.53
Reach-770	1.477701	2351.7	02Nov2014, 13:29	7.36
W770	0.644502	1051.3	02Nov2014, 12:55	6.32
Reach-3100	2.122203	2986.3	02Nov2014, 13:44	7.02
W550	0.358867	653.4	02Nov2014, 12:55	7.21
W560	0.110000	182.0	02Nov2014, 13:00	6.91
Reach-550	0.110000	166.8	02Nov2014, 13:18	6.80
Reach-3000	0.468867	554.3	02Nov2014, 13:52	6.79
W3000	0.385817	774.2	02Nov2014, 12:51	7.70
W4900	0.133889	501.9	02Nov2014, 12:13	7.38
Reach-4800	0.133889	490.8	02Nov2014, 12:17	7.36
W4800	0.047262	149.9	02Nov2014, 12:24	8.19
Reach-3000(2)	0.181151	615.9	02Nov2014, 12:24	7.56
Reach-990	1.035835	1143.5	02Nov2014, 13:27	7.09
W990	0.353913	764.0	02Nov2014, 12:43	7.45
Reservoir-2800	1.389748	499.9	02Nov2014, 16:03	6.02
Reach-2800	1.389748	491.2	02Nov2014, 16:13	5.93
W2800	0.034493	77.9	02Nov2014, 12:32	6.36
Reach-630	1.424241	496.4	02Nov2014, 16:18	5.88
W630	0.373057	659.7	02Nov2014, 12:48	6.29
Reservoir-2700	1.797298	651.4	02Nov2014, 13:51	5.26
Reach-2700	1.797298	651.4	02Nov2014, 13:56	5.24

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W3100	0.373146	611.0	02Nov2014, 12:42	5.32
NorthForkGMR	4.292647	3841.6	02Nov2014, 13:41	6.13
W2700	0.020970	68.4	02Nov2014, 12:15	6.66
Reach-2600	4.313617	3849.0	02Nov2014, 13:41	6.13
W2600	0.000825	4.2	02Nov2014, 12:07	8.66
Reach-780	4.314442	3662.7	02Nov2014, 14:00	5.99
W640	0.401148	792.3	02Nov2014, 12:52	7.68
Reach-650	0.401148	784.8	02Nov2014, 12:59	7.65
W780	0.246680	582.3	02Nov2014, 12:31	6.57
W650	0.164286	535.8	02Nov2014, 12:20	7.71
GMRTrib8	5.126556	4158.0	02Nov2014, 13:54	6.20
Reach-820	5.126556	4076.3	02Nov2014, 14:04	6.14
W920	0.460578	647.7	02Nov2014, 13:22	7.23
W5100	0.078185	215.0	02Nov2014, 12:20	6.26
Laurel Ridge	0.538763	684.6	02Nov2014, 13:19	7.09
Reach-5000	0.538763	506.7	02Nov2014, 13:21	5.84
W980	0.256902	489.1	02Nov2014, 12:58	8.06
Reach-980	0.256902	332.5	02Nov2014, 13:10	7.64
W5000	0.106592	397.3	02Nov2014, 12:17	8.59
Reach-930	0.902257	638.8	02Nov2014, 13:46	6.49
W930	0.182222	253.1	02Nov2014, 13:02	5.77
W910	0.117701	160.7	02Nov2014, 13:01	5.58
Reach-940	1.202180	978.3	02Nov2014, 13:32	6.27
W940	0.314395	478.3	02Nov2014, 12:41	4.85
W5200	0.144430	381.4	02Nov2014, 12:33	7.95
Reach-5200	0.144430	374.8	02Nov2014, 12:42	7.93
W3200	0.102774	213.2	02Nov2014, 12:40	6.67
Reach-3200	0.102774	211.8	02Nov2014, 12:48	6.65
W960	0.082432	236.8	02Nov2014, 12:24	7.15
Trib2GMRTrib7	1.846211	1774.0	02Nov2014, 12:50	6.22
Reach-950	1.846211	1760.1	02Nov2014, 12:55	6.20

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W5300	0.109099	279.3	02Nov2014, 12:38	8.80
W3300	0.093470	253.1	02Nov2014, 12:34	8.69
Reach-970	0.202569	506.9	02Nov2014, 12:45	8.70
W970	0.187536	435.0	02Nov2014, 12:37	7.30
W950	0.107912	217.7	02Nov2014, 12:26	4.99
W4400	0.037039	161.6	02Nov2014, 12:12	8.64
Reach-4400	0.037039	137.8	02Nov2014, 12:29	8.55
Trib1GMRTrib7	2.381267	2855.7	02Nov2014, 12:45	6.48
Reach-880	2.381267	2732.3	02Nov2014, 13:04	6.45
W880	0.381917	572.7	02Nov2014, 12:34	4.24
W820	0.054394	98.0	02Nov2014, 12:19	3.90
GMRTrib7	7.944134	6018.1	02Nov2014, 13:48	6.12
Reach-2500	7.944134	5989.2	02Nov2014, 13:51	6.10
W2500	0.061783	223.9	02Nov2014, 12:16	7.70
Reach-860	8.005917	5942.5	02Nov2014, 14:02	6.05
W900	0.129395	353.9	02Nov2014, 12:27	7.21
W4300	0.118974	471.0	02Nov2014, 12:15	8.89
Reach-900	0.118974	452.0	02Nov2014, 12:20	8.87
W890	0.113096	343.6	02Nov2014, 12:25	7.91
W4200	0.107748	337.8	02Nov2014, 12:25	8.34
Reach-890	0.107748	336.5	02Nov2014, 12:27	8.33
TribGMRTrib6	0.469213	1456.8	02Nov2014, 12:24	8.06
Reach-870	0.469213	1354.0	02Nov2014, 12:26	8.01
W860	0.125460	305.7	02Nov2014, 12:18	5.14
W870	0.015309	55.1	02Nov2014, 12:16	7.59
GMRTrib6	8.615899	6173.0	02Nov2014, 13:59	6.15
Reach-810	8.615899	6169.1	02Nov2014, 14:04	6.14
W810	0.118699	305.3	02Nov2014, 12:17	5.37
Reach-2400	8.734598	6182.0	02Nov2014, 14:08	6.10
W740	0.102118	295.3	02Nov2014, 12:25	7.49
Reach-4000	0.102118	294.6	02Nov2014, 12:30	7.48

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W4000	0.094479	310.5	02Nov2014, 12:22	8.19
W2400	0.092820	242.4	02Nov2014, 12:25	6.55
GMRTrib5	9.024015	6283.4	02Nov2014, 14:07	6.15
Reach-790	9.024015	6271.3	02Nov2014, 14:10	6.13
W790	0.058117	136.4	02Nov2014, 12:36	7.28
Reservoir-2300	9.082132	6228.8	02Nov2014, 14:25	6.10
Reach-2300	9.082132	6223.2	02Nov2014, 14:29	6.08
W850	0.159866	661.7	02Nov2014, 12:10	7.20
W840	0.144036	541.3	02Nov2014, 12:16	8.12
Reach-830	0.303902	1148.4	02Nov2014, 12:13	7.64
W2300	0.078733	153.7	02Nov2014, 12:39	6.06
GMRTrib4	9.464767	6334.9	02Nov2014, 14:28	6.13
W830	0.026314	74.9	02Nov2014, 12:14	5.41
Reach-720	9.491081	6328.6	02Nov2014, 14:32	6.11
W720	0.063825	253.4	02Nov2014, 12:13	7.78
Reach-2200	9.554906	6346.2	02Nov2014, 14:35	6.12
W2200	0.083314	276.2	02Nov2014, 12:23	8.57
Reach-2201	9.638220	6360.2	02Nov2014, 14:38	6.13
W580	0.179172	479.2	02Nov2014, 12:34	8.36
W3500	0.134110	316.8	02Nov2014, 12:38	7.61
W3600	0.127673	330.8	02Nov2014, 12:35	8.10
Reach-580	0.127673	330.5	02Nov2014, 12:39	8.09
Reach-3700	0.440955	1118.5	02Nov2014, 12:39	8.05
W3700	0.085993	282.8	02Nov2014, 12:22	8.24
Reach-2900	0.526948	1307.8	02Nov2014, 12:41	8.05
W2900	0.115190	428.2	02Nov2014, 12:16	8.17
Reach-670	0.642138	1506.2	02Nov2014, 12:38	8.07
W670	0.164802	570.9	02Nov2014, 12:20	8.43
W3900	0.089883	278.4	02Nov2014, 12:20	7.04
Reach-710	0.089883	236.2	02Nov2014, 12:31	6.94
GMRTrib2	10.535043	6664.7	02Nov2014, 14:33	6.29

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
W710	0.190622	635.0	02Nov2014, 12:18	7.43
Reach-600	10.725665	6604.4	02Nov2014, 14:50	6.20
W600	0.155003	540.7	02Nov2014, 12:16	7.33
Reach-3800	10.880668	6642.1	02Nov2014, 14:52	6.21
W3800	0.131793	423.6	02Nov2014, 12:20	7.48
Reservoir-2100	11.012461	6603.2	02Nov2014, 15:10	6.17
Reach-2100	11.012461	6600.9	02Nov2014, 15:15	6.16
W2100	0.092432	335.6	02Nov2014, 12:15	7.57
Reach-4700	11.104893	6603.6	02Nov2014, 15:20	6.14
W4700	0.094290	296.0	02Nov2014, 12:16	6.42
Reach-2000	11.199183	6615.3	02Nov2014, 15:26	6.11
W2000	0.113520	356.6	02Nov2014, 12:19	7.06
Reach-1900	11.312703	6634.5	02Nov2014, 15:31	6.11
W1900	0.122992	380.2	02Nov2014, 12:20	7.16
Reach-1800	11.435695	6657.6	02Nov2014, 15:34	6.11
W1800	0.148583	490.6	02Nov2014, 12:17	7.15
W4600	0.044115	122.9	02Nov2014, 12:18	5.98
Reach-4600	0.044115	105.9	02Nov2014, 12:25	5.92
Reach-530	11.628393	6645.9	02Nov2014, 15:48	6.10
W750	0.129679	440.4	02Nov2014, 12:19	7.95
W4100	0.093017	231.2	02Nov2014, 12:39	8.55
Reach-750	0.093017	228.5	02Nov2014, 12:47	8.53
Reach-1400	0.222696	485.6	02Nov2014, 12:49	8.11
W1400	0.136188	266.1	02Nov2014, 12:29	5.16
Reach-1000	0.358884	690.9	02Nov2014, 12:43	6.98
W760	0.162490	288.6	02Nov2014, 12:43	5.88
W1000	0.026933	66.1	02Nov2014, 12:22	5.76
Reach-1500	0.548307	997.1	02Nov2014, 12:49	6.57
W1500	0.128740	273.4	02Nov2014, 12:26	5.29
Reach-570	0.677047	1165.1	02Nov2014, 12:46	6.32
W570	0.098691	225.3	02Nov2014, 12:23	5.42

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Reach-1100	0.775738	1281.5	02Nov2014, 12:54	6.18
W1100	0.148073	315.3	02Nov2014, 12:17	4.42
Reach-FornesRun	0.923811	1371.1	02Nov2014, 12:51	5.90
W530	0.112161	299.8	02Nov2014, 12:20	5.95
FornesRun	12.664365	6858.1	02Nov2014, 15:45	6.08
Reach-Fornescont	12.664365	6858.1	02Nov2014, 15:46	6.08
Reach-510	12.664365	6848.7	02Nov2014, 15:52	6.06
W1200	0.145402	312.2	02Nov2014, 12:28	5.60
W1600	0.069092	180.1	02Nov2014, 12:25	6.49
Reservoir-1700	0.069092	138.9	02Nov2014, 12:39	6.48
Reach-1700	0.069092	138.7	02Nov2014, 12:42	6.47
W1700	0.035228	106.3	02Nov2014, 12:16	6.27
Reach-1200	0.104320	199.8	02Nov2014, 12:32	6.39
Reach-1300	0.249722	508.5	02Nov2014, 12:35	5.92
W1300	0.153935	374.3	02Nov2014, 12:20	5.44
Reach-4500	0.403657	788.3	02Nov2014, 12:34	5.71
W4500	0.128624	304.1	02Nov2014, 12:23	5.60
Reach-520	0.532281	1053.6	02Nov2014, 12:32	5.68
W510	0.077580	223.0	02Nov2014, 12:21	6.60
W520	0.028353	89.7	02Nov2014, 12:17	6.64
ReedyBch	13.302579	6968.3	02Nov2014, 15:51	6.05
Reach-500	13.302579	6931.2	02Nov2014, 15:55	6.02
W500	0.183659	556.4	02Nov2014, 12:22	7.26
Reservoir-400	13.486238	6376.4	02Nov2014, 16:52	5.99
Reach-400	13.486238	6338.5	02Nov2014, 17:04	5.90
W400	0.141370	504.8	02Nov2014, 12:16	7.62
Reach-3400	13.627608	6312.9	02Nov2014, 17:17	5.80
W3400	0.134392	429.0	02Nov2014, 12:21	7.55
Outlet	13.762000	6330.6	02Nov2014, 17:16	5.82

H.4 HEC-HMS Output – Primary System Alternatives

HEC-HMS Output for Alternatives #1 and #2 (Future Land-Use Conditions)

Project:	GMR_Future_Revised_HS	**Simulation Run:**	2 yr
Start of Run:	02Nov2014, 00:00	**Basin Model:**	GMR Subbasins
End of Run:	03Nov2014, 00:06	**Meteorlogic Model:**	2 yr
Compue Time:	15Dec2015, 10:19:54	**Control Specifications:**	Nov14

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W730	0.41	224	02Nov2014, 12:58	2.16
W700	0.25	94	02Nov2014, 13:06	1.63
Reach-660	0.66	315	02Nov2014, 13:11	1.95
W660	0.47	283	02Nov2014, 12:45	2.04
W800	0.35	164	02Nov2014, 13:02	1.95
GMRTrib9	1.48	711	02Nov2014, 12:58	1.98
Reach-770	1.48	640	02Nov2014, 13:41	1.93
W770	0.64	207	02Nov2014, 12:59	1.30
Reach-3100	2.12	710	02Nov2014, 14:19	1.74
W550	0.36	162	02Nov2014, 12:58	1.78
W560	0.11	42	02Nov2014, 13:04	1.61
Reach-550	0.11	38	02Nov2014, 13:31	1.57
Reach-3000	0.47	163	02Nov2014, 13:33	1.67
W3000	0.39	214	02Nov2014, 12:53	2.07
W4900	0.13	129	02Nov2014, 12:14	1.85
Reach-4800	0.13	126	02Nov2014, 12:20	1.85
W4800	0.05	46	02Nov2014, 12:25	2.39
Reach-3000(2)	0.18	166	02Nov2014, 12:29	1.98
Reach-990	1.04	321	02Nov2014, 13:46	1.80
W990	0.35	200	02Nov2014, 12:46	1.91
Reservoir-2800	1.39	329	02Nov2014, 14:22	1.79
Reach-2800	1.39	324	02Nov2014, 14:34	1.77
W2800	0.03	16	02Nov2014, 12:35	1.31
Reach-630	1.42	325	02Nov2014, 14:40	1.75
W630	0.37	128	02Nov2014, 12:52	1.28
Reservoir-2700	1.80	308	02Nov2014, 15:34	1.61
Reach-2700	1.80	308	02Nov2014, 15:39	1.60
W3100	0.37	85	02Nov2014, 12:48	0.86
NorthForkGMR	4.29	977	02Nov2014, 14:23	1.60
W2700	0.02	15	02Nov2014, 12:17	1.45
Reach-2600	4.31	978	02Nov2014, 14:23	1.60
W2600	0.00	1	02Nov2014, 12:07	2.72
Reach-780	4.31	935	02Nov2014, 14:54	1.59
W640	0.40	218	02Nov2014, 12:54	2.06
Reach-650	0.40	216	02Nov2014, 13:04	2.05
W780	0.25	123	02Nov2014, 12:34	1.42

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W650	0.16	148	02Nov2014, 12:21	2.06
GMRTrib8	5.13	1021	02Nov2014, 14:51	1.64
Reach-820	5.13	1005	02Nov2014, 15:06	1.62
W920	0.46	162	02Nov2014, 13:26	1.80
W5100	0.08	41	02Nov2014, 12:23	1.26
Laurel Ridge	0.54	171	02Nov2014, 13:24	1.72
Reach-5000	0.54	104	02Nov2014, 13:26	1.08
W980	0.26	146	02Nov2014, 13:00	2.32
Reach-980	0.26	115	02Nov2014, 13:12	2.22
W5000	0.11	131	02Nov2014, 12:18	2.68
Reach-930	0.90	171	02Nov2014, 13:47	1.45
W930	0.18	42	02Nov2014, 13:08	1.05
W910	0.12	25	02Nov2014, 13:07	0.97
Reach-940	1.20	226	02Nov2014, 13:31	1.33
W940	0.31	53	02Nov2014, 12:49	0.68
W5200	0.14	111	02Nov2014, 12:34	2.23
Reach-5200	0.14	111	02Nov2014, 12:41	2.22
W3200	0.10	46	02Nov2014, 12:43	1.47
Reach-3200	0.10	46	02Nov2014, 12:54	1.46
W960	0.08	58	02Nov2014, 12:26	1.72
Trib2GMRTrib7	1.85	402	02Nov2014, 12:51	1.31
Reach-950	1.85	399	02Nov2014, 12:58	1.31
W5300	0.11	96	02Nov2014, 12:39	2.86
W3300	0.09	85	02Nov2014, 12:35	2.77
Reach-970	0.20	172	02Nov2014, 12:48	2.79
W970	0.19	110	02Nov2014, 12:40	1.82
W950	0.11	26	02Nov2014, 12:31	0.73
W4400	0.04	54	02Nov2014, 12:12	2.71
Reach-4400	0.04	46	02Nov2014, 12:35	2.67
Trib1GMRTrib7	2.38	712	02Nov2014, 12:49	1.47
Reach-880	2.38	639	02Nov2014, 13:27	1.46
W880	0.38	44	02Nov2014, 12:43	0.48
W820	0.05	5	02Nov2014, 12:30	0.38
GMRTrib7	7.94	1356	02Nov2014, 14:56	1.51
Reach-2500	7.94	1344	02Nov2014, 15:03	1.51
W2500	0.06	62	02Nov2014, 12:17	2.05
Reach-860	8.01	1325	02Nov2014, 15:21	1.50
W900	0.13	88	02Nov2014, 12:29	1.76
W4300	0.12	164	02Nov2014, 12:16	2.92
Reach-900	0.12	158	02Nov2014, 12:22	2.90
W890	0.11	99	02Nov2014, 12:26	2.20
W4200	0.11	106	02Nov2014, 12:26	2.49

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
Reach-890	0.11	106	02Nov2014, 12:29	2.49
TribGMRTrib6	0.47	441	02Nov2014, 12:25	2.32
Reach-870	0.47	398	02Nov2014, 12:28	2.30
W860	0.13	39	02Nov2014, 12:21	0.78
W870	0.02	15	02Nov2014, 12:16	1.98
GMRTrib6	8.62	1371	02Nov2014, 15:20	1.54
Reach-810	8.62	1371	02Nov2014, 15:24	1.53
W810	0.12	43	02Nov2014, 12:20	0.87
Reach-2400	8.73	1370	02Nov2014, 15:32	1.52
W740	0.10	78	02Nov2014, 12:27	1.93
Reach-4000	0.10	78	02Nov2014, 12:34	1.93
W4000	0.09	95	02Nov2014, 12:23	2.38
W2400	0.09	51	02Nov2014, 12:28	1.40
GMRTrib5	9.02	1390	02Nov2014, 15:31	1.53
Reach-790	9.02	1387	02Nov2014, 15:36	1.53
W790	0.06	34	02Nov2014, 12:39	1.81
Reservoir-2300	9.08	1381	02Nov2014, 15:49	1.52
Reach-2300	9.08	1380	02Nov2014, 15:54	1.52
W850	0.16	164	02Nov2014, 12:10	1.75
W840	0.14	163	02Nov2014, 12:16	2.33
Reach-830	0.30	312	02Nov2014, 12:14	2.03
W2300	0.08	28	02Nov2014, 12:42	1.17
GMRTrib4	9.46	1403	02Nov2014, 15:52	1.53
W830	0.03	11	02Nov2014, 12:16	0.89
Reach-720	9.49	1402	02Nov2014, 15:58	1.52
W720	0.06	71	02Nov2014, 12:13	2.10
Reach-2200	9.55	1405	02Nov2014, 15:58	1.53
W2200	0.08	91	02Nov2014, 12:23	2.66
Reach-2201	9.64	1409	02Nov2014, 16:01	1.53
W580	0.18	152	02Nov2014, 12:35	2.51
W3500	0.13	86	02Nov2014, 12:40	2.01
W3600	0.13	99	02Nov2014, 12:36	2.33
Reach-580	0.13	99	02Nov2014, 12:42	2.32
Reach-3700	0.44	333	02Nov2014, 12:41	2.30
W3700	0.09	87	02Nov2014, 12:23	2.42
Reach-2900	0.53	388	02Nov2014, 12:46	2.31
W2900	0.12	130	02Nov2014, 12:17	2.37
Reach-670	0.64	439	02Nov2014, 12:43	2.32
W670	0.16	183	02Nov2014, 12:21	2.56
W3900	0.09	66	02Nov2014, 12:21	1.66
Reach-710	0.09	55	02Nov2014, 12:38	1.62
GMRTrib2	10.54	1475	02Nov2014, 15:58	1.60

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W710	0.19	165	02Nov2014, 12:19	1.89
Reach-600	10.73	1456	02Nov2014, 16:23	1.57
W600	0.16	137	02Nov2014, 12:17	1.83
Reach-3800	10.88	1461	02Nov2014, 16:29	1.58
W3800	0.13	111	02Nov2014, 12:21	1.92
Reservoir-2100	11.01	1415	02Nov2014, 17:06	1.54
Reach-2100	11.01	1415	02Nov2014, 17:10	1.53
W2100	0.09	90	02Nov2014, 12:16	1.97
Reach-4700	11.10	1415	02Nov2014, 17:16	1.53
W4700	0.09	59	02Nov2014, 12:17	1.34
Reach-2000	11.20	1416	02Nov2014, 17:30	1.53
W2000	0.11	85	02Nov2014, 12:20	1.67
Reach-1900	11.31	1419	02Nov2014, 17:35	1.52
W1900	0.12	93	02Nov2014, 12:22	1.73
Reach-1800	11.44	1424	02Nov2014, 17:37	1.52
W1800	0.15	119	02Nov2014, 12:18	1.72
W4600	0.04	22	02Nov2014, 12:20	1.13
Reach-4600	0.04	18	02Nov2014, 12:34	1.11
Reach-530	11.63	1430	02Nov2014, 17:43	1.52
W750	0.13	128	02Nov2014, 12:20	2.22
W4100	0.09	76	02Nov2014, 12:41	2.66
Reach-750	0.09	75	02Nov2014, 12:49	2.65
Reach-1400	0.22	160	02Nov2014, 12:37	2.38
W1400	0.14	35	02Nov2014, 12:34	0.79
Reach-1000	0.36	192	02Nov2014, 12:41	1.77
W760	0.16	49	02Nov2014, 12:48	1.09
W1000	0.03	11	02Nov2014, 12:26	1.04
Reach-1500	0.55	245	02Nov2014, 12:47	1.53
W1500	0.13	38	02Nov2014, 12:30	0.84
Reach-570	0.68	274	02Nov2014, 12:46	1.40
W570	0.10	32	02Nov2014, 12:27	0.89
Reach-1100	0.78	293	02Nov2014, 12:52	1.33
W1100	0.15	26	02Nov2014, 12:24	0.53
Reach-FornesRun	0.92	306	02Nov2014, 12:52	1.20
W530	0.11	52	02Nov2014, 12:22	1.12
FornesRun	12.66	1464	02Nov2014, 17:40	1.49
Reach-Fornescont	12.66	1464	02Nov2014, 17:40	1.49
Reach-510	12.66	1462	02Nov2014, 17:50	1.48
W1200	0.15	49	02Nov2014, 12:32	0.97
W1600	0.07	37	02Nov2014, 12:27	1.37
Reservoir-1700	0.07	36	02Nov2014, 12:33	1.37
Reach-1700	0.07	35	02Nov2014, 12:36	1.37

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W1700	0.04	20	02Nov2014, 12:18	1.26
Reach-1200	0.10	49	02Nov2014, 12:39	1.33
Reach-1300	0.25	96	02Nov2014, 12:39	1.12
W1300	0.15	54	02Nov2014, 12:24	0.90
Reach-4500	0.40	138	02Nov2014, 12:39	1.03
W4500	0.13	47	02Nov2014, 12:27	0.97
Reach-520	0.53	177	02Nov2014, 12:39	1.01
W510	0.08	47	02Nov2014, 12:22	1.43
W520	0.03	19	02Nov2014, 12:18	1.44
ReedyBch	13.30	1480	02Nov2014, 17:49	1.47
Reach-500	13.30	1475	02Nov2014, 17:56	1.46
W500	0.18	139	02Nov2014, 12:23	1.79
Reservoir-400	13.49	1469	02Nov2014, 18:17	1.44
Reach-400	13.49	1455	02Nov2014, 18:33	1.41
W400	0.14	137	02Nov2014, 12:17	2.00
Reach-3400	13.63	1440	02Nov2014, 18:54	1.37
W3400	0.13	114	02Nov2014, 12:22	1.96
Outlet	13.76	1444	02Nov2014, 18:54	1.38

HEC-HMS Output for Alternatives #1 and #2 (Future Land-Use Conditions)

Project:	GMR_Future_Revised_HS	**Simulation Run:**	10 yr
Start of Run:	02Nov2014, 00:00	**Basin Model:**	GMR Subbasins
End of Run:	03Nov2014, 00:06	**Meteorlogic Model:**	10 yr
Compue Time:	15Dec2015, 10:19:06	**Control Specifications:**	Nov14

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W730	0.41	412	02Nov2014, 12:57	4.00
W700	0.25	195	02Nov2014, 13:04	3.31
Reach-660	0.66	597	02Nov2014, 13:13	3.72
W660	0.47	533	02Nov2014, 12:44	3.85
W800	0.35	314	02Nov2014, 13:01	3.74
GMRTrib9	1.48	1329	02Nov2014, 12:58	3.77
Reach-770	1.48	1214	02Nov2014, 13:34	3.68
W770	0.64	470	02Nov2014, 12:57	2.84
Reach-3100	2.12	1460	02Nov2014, 13:57	3.42
W550	0.36	323	02Nov2014, 12:56	3.51
W560	0.11	87	02Nov2014, 13:02	3.28
Reach-550	0.11	79	02Nov2014, 13:24	3.21
Reach-3000	0.47	297	02Nov2014, 13:42	3.27
W3000	0.39	401	02Nov2014, 12:52	3.90
W4900	0.13	252	02Nov2014, 12:14	3.62
Reach-4800	0.13	246	02Nov2014, 12:19	3.61
W4800	0.05	81	02Nov2014, 12:24	4.29
Reach-3000(2)	0.18	315	02Nov2014, 12:27	3.78
Reach-990	1.04	607	02Nov2014, 13:36	3.48
W990	0.35	386	02Nov2014, 12:44	3.69
Reservoir-2800	1.39	507	02Nov2014, 14:43	3.47
Reach-2800	1.39	497	02Nov2014, 15:01	3.44
W2800	0.03	35	02Nov2014, 12:33	2.86
Reach-630	1.42	501	02Nov2014, 15:05	3.41
W630	0.37	294	02Nov2014, 12:50	2.81
Reservoir-2700	1.80	525	02Nov2014, 15:49	3.20
Reach-2700	1.80	525	02Nov2014, 15:53	3.20
W3100	0.37	239	02Nov2014, 12:44	2.15
NorthForkGMR	4.29	1964	02Nov2014, 13:58	3.22
W2700	0.02	32	02Nov2014, 12:16	3.07
Reach-2600	4.31	1968	02Nov2014, 13:58	3.22
W2600	0.00	2	02Nov2014, 12:07	4.70
Reach-780	4.31	1873	02Nov2014, 14:22	3.18
W640	0.40	409	02Nov2014, 12:53	3.88
Reach-650	0.40	405	02Nov2014, 13:01	3.86
W780	0.25	268	02Nov2014, 12:32	3.01

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W650	0.16	277	02Nov2014, 12:21	3.89
GMRTrib8	5.13	2075	02Nov2014, 14:18	3.24
Reach-820	5.13	2033	02Nov2014, 14:31	3.22
W920	0.46	321	02Nov2014, 13:23	3.54
W5100	0.08	95	02Nov2014, 12:21	2.78
Laurel Ridge	0.54	339	02Nov2014, 13:22	3.43
Reach-5000	0.54	237	02Nov2014, 13:23	2.61
W980	0.26	262	02Nov2014, 12:59	4.20
Reach-980	0.26	185	02Nov2014, 13:10	3.92
W5000	0.11	222	02Nov2014, 12:17	4.64
Reach-930	0.90	320	02Nov2014, 13:51	3.02
W930	0.18	106	02Nov2014, 13:04	2.46
W910	0.12	65	02Nov2014, 13:03	2.33
Reach-940	1.20	452	02Nov2014, 13:45	2.85
W940	0.31	173	02Nov2014, 12:44	1.86
W5200	0.14	202	02Nov2014, 12:34	4.10
Reach-5200	0.14	201	02Nov2014, 12:39	4.09
W3200	0.10	99	02Nov2014, 12:41	3.09
Reach-3200	0.10	99	02Nov2014, 12:50	3.08
W960	0.08	116	02Nov2014, 12:25	3.44
Trib2GMRTrib7	1.85	842	02Nov2014, 12:43	2.82
Reach-950	1.85	833	02Nov2014, 12:50	2.80
W5300	0.11	158	02Nov2014, 12:39	4.84
W3300	0.09	142	02Nov2014, 12:35	4.74
Reach-970	0.20	286	02Nov2014, 12:46	4.76
W970	0.19	217	02Nov2014, 12:38	3.57
W950	0.11	81	02Nov2014, 12:27	1.94
W4400	0.04	91	02Nov2014, 12:12	4.68
Reach-4400	0.04	77	02Nov2014, 12:32	4.63
Trib1GMRTrib7	2.38	1431	02Nov2014, 12:45	3.02
Reach-880	2.38	1336	02Nov2014, 13:10	3.02
W880	0.38	183	02Nov2014, 12:36	1.49
W820	0.05	28	02Nov2014, 12:21	1.30
GMRTrib7	7.94	2832	02Nov2014, 14:22	3.06
Reach-2500	7.94	2810	02Nov2014, 14:27	3.06
W2500	0.06	116	02Nov2014, 12:16	3.88
Reach-860	8.01	2774	02Nov2014, 14:41	3.04
W900	0.13	175	02Nov2014, 12:28	3.50
W4300	0.12	269	02Nov2014, 12:16	4.91
Reach-900	0.12	258	02Nov2014, 12:21	4.90
W890	0.11	181	02Nov2014, 12:25	4.06
W4200	0.11	185	02Nov2014, 12:25	4.42

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
Reach-890	0.11	184	02Nov2014, 12:28	4.42
TribGMRTrib6	0.47	782	02Nov2014, 12:24	4.20
Reach-870	0.47	717	02Nov2014, 12:27	4.17
W860	0.13	116	02Nov2014, 12:19	2.03
W870	0.02	28	02Nov2014, 12:16	3.79
GMRTrib6	8.62	2869	02Nov2014, 14:40	3.09
Reach-810	8.62	2867	02Nov2014, 14:45	3.08
W810	0.12	120	02Nov2014, 12:18	2.18
Reach-2400	8.73	2869	02Nov2014, 14:51	3.06
W740	0.10	150	02Nov2014, 12:26	3.72
Reach-4000	0.10	150	02Nov2014, 12:32	3.71
W4000	0.09	168	02Nov2014, 12:22	4.29
W2400	0.09	111	02Nov2014, 12:26	2.99
GMRTrib5	9.02	2912	02Nov2014, 14:50	3.08
Reach-790	9.02	2905	02Nov2014, 14:55	3.08
W790	0.06	68	02Nov2014, 12:37	3.55
Reservoir-2300	9.08	2877	02Nov2014, 15:11	3.06
Reach-2300	9.08	2874	02Nov2014, 15:16	3.06
W850	0.16	327	02Nov2014, 12:10	3.48
W840	0.14	291	02Nov2014, 12:16	4.23
Reach-830	0.30	589	02Nov2014, 12:13	3.84
W2300	0.08	67	02Nov2014, 12:40	2.65
GMRTrib4	9.46	2921	02Nov2014, 15:15	3.08
W830	0.03	30	02Nov2014, 12:14	2.20
Reach-720	9.49	2919	02Nov2014, 15:20	3.07
W720	0.06	132	02Nov2014, 12:13	3.95
Reach-2200	9.55	2927	02Nov2014, 15:22	3.07
W2200	0.08	154	02Nov2014, 12:23	4.62
Reach-2201	9.64	2932	02Nov2014, 15:25	3.08
W580	0.18	263	02Nov2014, 12:34	4.44
W3500	0.13	163	02Nov2014, 12:39	3.82
W3600	0.13	177	02Nov2014, 12:35	4.22
Reach-580	0.13	177	02Nov2014, 12:41	4.21
Reach-3700	0.44	597	02Nov2014, 12:40	4.18
W3700	0.09	154	02Nov2014, 12:22	4.34
Reach-2900	0.53	697	02Nov2014, 12:43	4.19
W2900	0.12	231	02Nov2014, 12:17	4.27
Reach-670	0.64	796	02Nov2014, 12:40	4.20
W670	0.16	315	02Nov2014, 12:20	4.50
W3900	0.09	135	02Nov2014, 12:20	3.36
Reach-710	0.09	113	02Nov2014, 12:34	3.30
GMRTrib2	10.54	3063	02Nov2014, 15:22	3.17

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W710	0.19	320	02Nov2014, 12:19	3.67
Reach-600	10.73	3025	02Nov2014, 15:44	3.13
W600	0.16	270	02Nov2014, 12:16	3.58
Reach-3800	10.88	3040	02Nov2014, 15:46	3.13
W3800	0.13	215	02Nov2014, 12:21	3.71
Reservoir-2100	11.01	2901	02Nov2014, 16:27	3.06
Reach-2100	11.01	2901	02Nov2014, 16:31	3.06
W2100	0.09	171	02Nov2014, 12:16	3.77
Reach-4700	11.10	2901	02Nov2014, 16:37	3.05
W4700	0.09	134	02Nov2014, 12:16	2.90
Reach-2000	11.20	2904	02Nov2014, 16:47	3.03
W2000	0.11	173	02Nov2014, 12:20	3.37
Reach-1900	11.31	2910	02Nov2014, 16:53	3.03
W1900	0.12	187	02Nov2014, 12:21	3.46
Reach-1800	11.44	2918	02Nov2014, 16:59	3.03
W1800	0.15	240	02Nov2014, 12:18	3.44
W4600	0.04	53	02Nov2014, 12:19	2.59
Reach-4600	0.04	45	02Nov2014, 12:29	2.56
Reach-530	11.63	2916	02Nov2014, 17:17	3.02
W750	0.13	233	02Nov2014, 12:20	4.08
W4100	0.09	129	02Nov2014, 12:40	4.62
Reach-750	0.09	127	02Nov2014, 12:48	4.60
Reach-1400	0.22	265	02Nov2014, 12:49	4.25
W1400	0.14	102	02Nov2014, 12:31	2.04
Reach-1000	0.36	345	02Nov2014, 12:45	3.40
W760	0.16	122	02Nov2014, 12:45	2.52
W1000	0.03	28	02Nov2014, 12:24	2.44
Reach-1500	0.55	479	02Nov2014, 12:49	3.09
W1500	0.13	107	02Nov2014, 12:28	2.13
Reach-570	0.68	551	02Nov2014, 12:45	2.90
W570	0.10	89	02Nov2014, 12:25	2.21
Reach-1100	0.78	600	02Nov2014, 12:56	2.80
W1100	0.15	104	02Nov2014, 12:19	1.59
Reach-FornesRun	0.92	632	02Nov2014, 12:55	2.61
W530	0.11	128	02Nov2014, 12:21	2.57
FornesRun	12.66	2986	02Nov2014, 17:15	2.98
Reach-Fornescont	12.66	2986	02Nov2014, 17:15	2.98
Reach-510	12.66	2983	02Nov2014, 17:24	2.97
W1200	0.15	127	02Nov2014, 12:30	2.33
W1600	0.07	82	02Nov2014, 12:26	2.95
Reservoir-1700	0.07	75	02Nov2014, 12:34	2.94
Reach-1700	0.07	75	02Nov2014, 12:36	2.94

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W1700	0.04	47	02Nov2014, 12:17	2.79
Reach-1200	0.10	110	02Nov2014, 12:33	2.88
Reach-1300	0.25	235	02Nov2014, 12:35	2.56
W1300	0.15	149	02Nov2014, 12:21	2.23
Reach-4500	0.40	355	02Nov2014, 12:34	2.42
W4500	0.13	124	02Nov2014, 12:24	2.33
Reach-520	0.53	467	02Nov2014, 12:33	2.40
W510	0.08	103	02Nov2014, 12:21	3.03
W520	0.03	42	02Nov2014, 12:17	3.06
ReedyBch	13.30	3022	02Nov2014, 17:23	2.95
Reach-500	13.30	3011	02Nov2014, 17:29	2.93
W500	0.18	276	02Nov2014, 12:22	3.54
Reservoir-400	13.49	2995	02Nov2014, 17:52	2.90
Reach-400	13.49	2963	02Nov2014, 18:06	2.85
W400	0.14	259	02Nov2014, 12:16	3.82
Reach-3400	13.63	2933	02Nov2014, 18:24	2.78
W3400	0.13	219	02Nov2014, 12:21	3.76
Outlet	13.76	2940	02Nov2014, 18:23	2.79

HEC-HMS Output for Alternatives #1 and #2 (Future Land-Use Conditions)

Project:	GMR_Future_Revised_HS	**Simulation Run:**	25 yr
Start of Run:	02Nov2014, 00:00	**Basin Model:**	GMR Subbasins
End of Run:	03Nov2014, 00:06	**Meteorlogic Model:**	25 yr
Compue Time:	15Dec2015, 10:20:17	**Control Specifications:**	Nov14

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W730	0.41	544	02Nov2014, 12:57	5.33
W700	0.25	268	02Nov2014, 13:03	4.55
Reach-660	0.66	798	02Nov2014, 13:13	5.01
W660	0.47	709	02Nov2014, 12:43	5.17
W800	0.35	421	02Nov2014, 13:00	5.04
GMRTrib9	1.48	1771	02Nov2014, 12:58	5.07
Reach-770	1.48	1607	02Nov2014, 13:32	4.95
W770	0.64	670	02Nov2014, 12:56	4.02
Reach-3100	2.12	1986	02Nov2014, 13:50	4.66
W550	0.36	438	02Nov2014, 12:55	4.78
W560	0.11	120	02Nov2014, 13:01	4.52
Reach-550	0.11	110	02Nov2014, 13:21	4.44
Reach-3000	0.47	384	02Nov2014, 13:48	4.46
W3000	0.39	532	02Nov2014, 12:51	5.22
W4900	0.13	340	02Nov2014, 12:14	4.92
Reach-4800	0.13	333	02Nov2014, 12:18	4.91
W4800	0.05	105	02Nov2014, 12:24	5.65
Reach-3000(2)	0.18	422	02Nov2014, 12:26	5.09
Reach-990	1.04	796	02Nov2014, 13:32	4.71
W990	0.35	519	02Nov2014, 12:44	4.99
Reservoir-2800	1.39	584	02Nov2014, 15:01	4.71
Reach-2800	1.39	578	02Nov2014, 15:19	4.67
W2800	0.03	50	02Nov2014, 12:33	4.04
Reach-630	1.42	584	02Nov2014, 15:23	4.63
W630	0.37	420	02Nov2014, 12:49	3.99
Reservoir-2700	1.80	580	02Nov2014, 16:56	4.39
Reach-2700	1.80	580	02Nov2014, 17:00	4.38
W3100	0.37	363	02Nov2014, 12:43	3.20
NorthForkGMR	4.29	2634	02Nov2014, 13:49	4.41
W2700	0.02	45	02Nov2014, 12:16	4.29
Reach-2600	4.31	2639	02Nov2014, 13:49	4.41
W2600	0.00	3	02Nov2014, 12:07	6.09
Reach-780	4.31	2515	02Nov2014, 14:10	4.35
W640	0.40	544	02Nov2014, 12:52	5.20
Reach-650	0.40	539	02Nov2014, 13:00	5.18
W780	0.25	377	02Nov2014, 12:32	4.23

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W650	0.16	368	02Nov2014, 12:21	5.21
GMRTrib8	5.13	2818	02Nov2014, 14:05	4.44
Reach-820	5.13	2763	02Nov2014, 14:17	4.40
W920	0.46	435	02Nov2014, 13:23	4.81
W5100	0.08	137	02Nov2014, 12:21	3.96
Laurel Ridge	0.54	460	02Nov2014, 13:20	4.69
Reach-5000	0.54	331	02Nov2014, 13:22	3.72
W980	0.26	342	02Nov2014, 12:58	5.54
Reach-980	0.26	236	02Nov2014, 13:10	5.19
W5000	0.11	284	02Nov2014, 12:17	6.03
Reach-930	0.90	430	02Nov2014, 13:49	4.22
W930	0.18	156	02Nov2014, 13:03	3.57
W910	0.12	98	02Nov2014, 13:02	3.41
Reach-940	1.20	632	02Nov2014, 13:39	4.02
W940	0.31	274	02Nov2014, 12:43	2.84
W5200	0.14	265	02Nov2014, 12:33	5.44
Reach-5200	0.14	264	02Nov2014, 12:39	5.42
W3200	0.10	139	02Nov2014, 12:41	4.31
Reach-3200	0.10	138	02Nov2014, 12:49	4.30
W960	0.08	158	02Nov2014, 12:24	4.72
Trib2GMRTrib7	1.85	1138	02Nov2014, 12:44	3.97
Reach-950	1.85	1128	02Nov2014, 12:50	3.96
W5300	0.11	201	02Nov2014, 12:39	6.23
W3300	0.09	182	02Nov2014, 12:35	6.12
Reach-970	0.20	364	02Nov2014, 12:46	6.14
W970	0.19	293	02Nov2014, 12:38	4.86
W950	0.11	126	02Nov2014, 12:27	2.94
W4400	0.04	116	02Nov2014, 12:12	6.07
Reach-4400	0.04	98	02Nov2014, 12:31	6.00
Trib1GMRTrib7	2.38	1918	02Nov2014, 12:44	4.20
Reach-880	2.38	1808	02Nov2014, 13:06	4.19
W880	0.38	309	02Nov2014, 12:35	2.37
W820	0.05	51	02Nov2014, 12:20	2.12
GMRTrib7	7.94	3939	02Nov2014, 14:05	4.22
Reach-2500	7.94	3913	02Nov2014, 14:09	4.21
W2500	0.06	154	02Nov2014, 12:16	5.21
Reach-860	8.01	3877	02Nov2014, 14:21	4.19
W900	0.13	237	02Nov2014, 12:27	4.78
W4300	0.12	340	02Nov2014, 12:16	6.31
Reach-900	0.12	327	02Nov2014, 12:20	6.29
W890	0.11	239	02Nov2014, 12:25	5.40
W4200	0.11	239	02Nov2014, 12:25	5.79

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
Reach-890	0.11	238	02Nov2014, 12:28	5.78
TribGMRTrib6	0.47	1020	02Nov2014, 12:24	5.54
Reach-870	0.47	941	02Nov2014, 12:26	5.51
W860	0.13	179	02Nov2014, 12:18	3.05
W870	0.02	38	02Nov2014, 12:16	5.10
GMRTrib6	8.62	4016	02Nov2014, 14:19	4.24
Reach-810	8.62	4013	02Nov2014, 14:24	4.24
W810	0.12	182	02Nov2014, 12:18	3.24
Reach-2400	8.73	4019	02Nov2014, 14:30	4.21
W740	0.10	201	02Nov2014, 12:26	5.02
Reach-4000	0.10	201	02Nov2014, 12:31	5.02
W4000	0.09	218	02Nov2014, 12:22	5.65
W2400	0.09	157	02Nov2014, 12:26	4.20
GMRTrib5	9.02	4081	02Nov2014, 14:29	4.24
Reach-790	9.02	4072	02Nov2014, 14:33	4.23
W790	0.06	92	02Nov2014, 12:37	4.84
Reservoir-2300	9.08	4025	02Nov2014, 14:50	4.21
Reach-2300	9.08	4021	02Nov2014, 14:55	4.20
W850	0.16	444	02Nov2014, 12:10	4.76
W840	0.14	380	02Nov2014, 12:16	5.59
Reach-830	0.30	786	02Nov2014, 12:13	5.15
W2300	0.08	96	02Nov2014, 12:39	3.80
GMRTrib4	9.46	4089	02Nov2014, 14:54	4.23
W830	0.03	45	02Nov2014, 12:14	3.27
Reach-720	9.49	4085	02Nov2014, 14:59	4.21
W720	0.06	175	02Nov2014, 12:13	5.28
Reach-2200	9.55	4096	02Nov2014, 15:01	4.22
W2200	0.08	197	02Nov2014, 12:23	6.01
Reach-2201	9.64	4102	02Nov2014, 15:05	4.23
W580	0.18	339	02Nov2014, 12:34	5.81
W3500	0.13	217	02Nov2014, 12:39	5.13
W3600	0.13	232	02Nov2014, 12:35	5.57
Reach-580	0.13	232	02Nov2014, 12:40	5.57
Reach-3700	0.44	781	02Nov2014, 12:39	5.53
W3700	0.09	199	02Nov2014, 12:22	5.70
Reach-2900	0.53	913	02Nov2014, 12:42	5.54
W2900	0.12	301	02Nov2014, 12:16	5.63
Reach-670	0.64	1046	02Nov2014, 12:39	5.55
W670	0.16	405	02Nov2014, 12:20	5.87
W3900	0.09	185	02Nov2014, 12:20	4.62
Reach-710	0.09	156	02Nov2014, 12:32	4.55
GMRTrib2	10.54	4287	02Nov2014, 15:02	4.34

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W710	0.19	431	02Nov2014, 12:18	4.97
Reach-600	10.73	4226	02Nov2014, 15:22	4.27
W600	0.16	365	02Nov2014, 12:16	4.87
Reach-3800	10.88	4249	02Nov2014, 15:24	4.28
W3800	0.13	288	02Nov2014, 12:20	5.01
Reservoir-2100	11.01	4034	02Nov2014, 16:06	4.18
Reach-2100	11.01	4032	02Nov2014, 16:10	4.17
W2100	0.09	229	02Nov2014, 12:15	5.09
Reach-4700	11.10	4032	02Nov2014, 16:15	4.16
W4700	0.09	190	02Nov2014, 12:16	4.09
Reach-2000	11.20	4036	02Nov2014, 16:24	4.13
W2000	0.11	237	02Nov2014, 12:19	4.64
Reach-1900	11.31	4044	02Nov2014, 16:31	4.12
W1900	0.12	254	02Nov2014, 12:21	4.73
Reach-1800	11.44	4055	02Nov2014, 16:36	4.12
W1800	0.15	328	02Nov2014, 12:18	4.72
W4600	0.04	77	02Nov2014, 12:19	3.73
Reach-4600	0.04	66	02Nov2014, 12:27	3.69
Reach-530	11.63	4052	02Nov2014, 16:52	4.11
W750	0.13	306	02Nov2014, 12:20	5.43
W4100	0.09	165	02Nov2014, 12:40	5.99
Reach-750	0.09	163	02Nov2014, 12:48	5.98
Reach-1400	0.22	342	02Nov2014, 12:49	5.59
W1400	0.14	156	02Nov2014, 12:30	3.07
Reach-1000	0.36	462	02Nov2014, 12:45	4.62
W760	0.16	179	02Nov2014, 12:44	3.65
W1000	0.03	41	02Nov2014, 12:23	3.55
Reach-1500	0.55	651	02Nov2014, 12:51	4.27
W1500	0.13	162	02Nov2014, 12:27	3.18
Reach-570	0.68	751	02Nov2014, 12:47	4.06
W570	0.10	135	02Nov2014, 12:24	3.28
Reach-1100	0.78	824	02Nov2014, 12:55	3.94
W1100	0.15	173	02Nov2014, 12:18	2.50
Reach-FornesRun	0.92	876	02Nov2014, 12:52	3.71
W530	0.11	186	02Nov2014, 12:20	3.70
FornesRun	12.66	4156	02Nov2014, 16:50	4.08
Reach-Fornescont	12.66	4156	02Nov2014, 16:50	4.08
Reach-510	12.66	4151	02Nov2014, 16:58	4.06
W1200	0.15	190	02Nov2014, 12:29	3.42
W1600	0.07	116	02Nov2014, 12:25	4.15
Reservoir-1700	0.07	95	02Nov2014, 12:37	4.15
Reach-1700	0.07	95	02Nov2014, 12:40	4.14

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W1700	0.04	68	02Nov2014, 12:17	3.97
Reach-1200	0.10	140	02Nov2014, 12:28	4.07
Reach-1300	0.25	328	02Nov2014, 12:34	3.69
W1300	0.15	225	02Nov2014, 12:21	3.29
Reach-4500	0.40	509	02Nov2014, 12:33	3.53
W4500	0.13	185	02Nov2014, 12:24	3.42
Reach-520	0.53	677	02Nov2014, 12:32	3.50
W510	0.08	145	02Nov2014, 12:21	4.25
W520	0.03	58	02Nov2014, 12:17	4.28
ReedyBch	13.30	4209	02Nov2014, 16:57	4.04
Reach-500	13.30	4191	02Nov2014, 17:03	4.02
W500	0.18	374	02Nov2014, 12:22	4.82
Reservoir-400	13.49	4157	02Nov2014, 17:28	3.96
Reach-400	13.49	4106	02Nov2014, 17:42	3.90
W400	0.14	346	02Nov2014, 12:16	5.13
Reach-3400	13.63	4057	02Nov2014, 17:57	3.81
W3400	0.13	293	02Nov2014, 12:21	5.07
Outlet	13.76	4068	02Nov2014, 17:57	3.82

HEC-HMS Output for Alternatives #1 and #2 (Future Land-Use Conditions)

Project:	GMR_Future_Revised_HS	**Simulation Run:**	50 yr
Start of Run:	02Nov2014, 00:00	**Basin Model:**	GMR Subbasins
End of Run:	03Nov2014, 00:06	**Meteorlogic Model:**	50 yr
Compue Time:	15Dec2015, 10:20:42	**Control Specifications:**	Nov14

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W730	0.41	659	02Nov2014, 12:56	6.51
W700	0.25	333	02Nov2014, 13:03	5.68
Reach-660	0.66	975	02Nov2014, 13:13	6.17
W660	0.47	864	02Nov2014, 12:43	6.34
W800	0.35	515	02Nov2014, 13:00	6.20
GMRTrib9	1.48	2160	02Nov2014, 12:58	6.23
Reach-770	1.48	1960	02Nov2014, 13:31	6.08
W770	0.64	850	02Nov2014, 12:55	5.10
Reach-3100	2.12	2458	02Nov2014, 13:47	5.77
W550	0.36	540	02Nov2014, 12:55	5.93
W560	0.11	149	02Nov2014, 13:01	5.64
Reach-550	0.11	137	02Nov2014, 13:20	5.55
Reach-3000	0.47	464	02Nov2014, 13:51	5.55
W3000	0.39	647	02Nov2014, 12:51	6.39
W4900	0.13	417	02Nov2014, 12:13	6.08
Reach-4800	0.13	408	02Nov2014, 12:18	6.06
W4800	0.05	127	02Nov2014, 12:24	6.85
Reach-3000(2)	0.18	514	02Nov2014, 12:25	6.25
Reach-990	1.04	960	02Nov2014, 13:29	5.83
W990	0.35	635	02Nov2014, 12:44	6.15
Reservoir-2800	1.39	637	02Nov2014, 15:15	5.82
Reach-2800	1.39	633	02Nov2014, 15:33	5.78
W2800	0.03	63	02Nov2014, 12:32	5.13
Reach-630	1.42	639	02Nov2014, 15:35	5.74
W630	0.37	533	02Nov2014, 12:48	5.07
Reservoir-2700	1.80	714	02Nov2014, 15:34	5.44
Reach-2700	1.80	714	02Nov2014, 15:39	5.44
W3100	0.37	479	02Nov2014, 12:43	4.18
NorthForkGMR	4.29	3177	02Nov2014, 13:45	5.49
W2700	0.02	56	02Nov2014, 12:16	5.40
Reach-2600	4.31	3183	02Nov2014, 13:45	5.49
W2600	0.00	4	02Nov2014, 12:07	7.31
Reach-780	4.31	3043	02Nov2014, 14:04	5.40
W640	0.40	662	02Nov2014, 12:52	6.37
Reach-650	0.40	656	02Nov2014, 12:59	6.35
W780	0.25	474	02Nov2014, 12:31	5.33

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W650	0.16	448	02Nov2014, 12:20	6.39
GMRTrib8	5.13	3439	02Nov2014, 13:59	5.51
Reach-820	5.13	3377	02Nov2014, 14:09	5.46
W920	0.46	536	02Nov2014, 13:22	5.95
W5100	0.08	174	02Nov2014, 12:21	5.03
Laurel Ridge	0.54	566	02Nov2014, 13:20	5.82
Reach-5000	0.54	414	02Nov2014, 13:21	4.72
W980	0.26	412	02Nov2014, 12:58	6.73
Reach-980	0.26	282	02Nov2014, 13:10	6.34
W5000	0.11	338	02Nov2014, 12:17	7.24
Reach-930	0.90	529	02Nov2014, 13:48	5.29
W930	0.18	201	02Nov2014, 13:02	4.59
W910	0.12	127	02Nov2014, 13:01	4.42
Reach-940	1.20	795	02Nov2014, 13:35	5.08
W940	0.31	369	02Nov2014, 12:42	3.77
W5200	0.14	321	02Nov2014, 12:33	6.63
Reach-5200	0.14	318	02Nov2014, 12:40	6.61
W3200	0.10	174	02Nov2014, 12:40	5.42
Reach-3200	0.10	173	02Nov2014, 12:48	5.40
W960	0.08	196	02Nov2014, 12:24	5.86
Trib2GMRTrib7	1.85	1416	02Nov2014, 12:45	5.03
Reach-950	1.85	1404	02Nov2014, 12:51	5.01
W5300	0.11	238	02Nov2014, 12:38	7.45
W3300	0.09	216	02Nov2014, 12:34	7.34
Reach-970	0.20	432	02Nov2014, 12:45	7.35
W970	0.19	361	02Nov2014, 12:38	6.01
W950	0.11	169	02Nov2014, 12:26	3.89
W4400	0.04	138	02Nov2014, 12:12	7.29
Reach-4400	0.04	117	02Nov2014, 12:30	7.21
Trib1GMRTrib7	2.38	2356	02Nov2014, 12:44	5.27
Reach-880	2.38	2234	02Nov2014, 13:05	5.25
W880	0.38	430	02Nov2014, 12:34	3.22
W820	0.05	72	02Nov2014, 12:19	2.93
GMRTrib7	7.94	4927	02Nov2014, 13:53	5.27
Reach-2500	7.94	4904	02Nov2014, 13:56	5.26
W2500	0.06	187	02Nov2014, 12:16	6.38
Reach-860	8.01	4868	02Nov2014, 14:08	5.22
W900	0.13	293	02Nov2014, 12:27	5.92
W4300	0.12	403	02Nov2014, 12:16	7.54
Reach-900	0.12	387	02Nov2014, 12:20	7.51
W890	0.11	289	02Nov2014, 12:25	6.59
W4200	0.11	286	02Nov2014, 12:25	7.00

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
Reach-890	0.11	285	02Nov2014, 12:28	6.99
TribGMRTrib6	0.47	1228	02Nov2014, 12:24	6.73
Reach-870	0.47	1137	02Nov2014, 12:26	6.69
W860	0.13	238	02Nov2014, 12:18	4.02
W870	0.02	46	02Nov2014, 12:16	6.28
GMRTrib6	8.62	5054	02Nov2014, 14:05	5.29
Reach-810	8.62	5051	02Nov2014, 14:10	5.28
W810	0.12	239	02Nov2014, 12:17	4.23
Reach-2400	8.73	5060	02Nov2014, 14:15	5.25
W740	0.10	246	02Nov2014, 12:26	6.19
Reach-4000	0.10	245	02Nov2014, 12:30	6.18
W4000	0.09	262	02Nov2014, 12:22	6.85
W2400	0.09	197	02Nov2014, 12:25	5.30
GMRTrib5	9.02	5142	02Nov2014, 14:14	5.27
Reach-790	9.02	5132	02Nov2014, 14:17	5.26
W790	0.06	113	02Nov2014, 12:37	5.99
Reservoir-2300	9.08	5087	02Nov2014, 14:34	5.23
Reach-2300	9.08	5082	02Nov2014, 14:38	5.22
W850	0.16	548	02Nov2014, 12:10	5.91
W840	0.14	457	02Nov2014, 12:16	6.79
Reach-830	0.30	959	02Nov2014, 12:13	6.32
W2300	0.08	123	02Nov2014, 12:39	4.85
GMRTrib4	9.46	5172	02Nov2014, 14:37	5.25
W830	0.03	59	02Nov2014, 12:14	4.26
Reach-720	9.49	5164	02Nov2014, 14:42	5.24
W720	0.06	212	02Nov2014, 12:13	6.46
Reach-2200	9.55	5179	02Nov2014, 14:46	5.24
W2200	0.08	235	02Nov2014, 12:23	7.22
Reach-2201	9.64	5186	02Nov2014, 14:49	5.25
W580	0.18	406	02Nov2014, 12:34	7.02
W3500	0.13	264	02Nov2014, 12:38	6.30
W3600	0.13	279	02Nov2014, 12:35	6.77
Reach-580	0.13	279	02Nov2014, 12:39	6.76
Reach-3700	0.44	942	02Nov2014, 12:39	6.72
W3700	0.09	239	02Nov2014, 12:22	6.91
Reach-2900	0.53	1101	02Nov2014, 12:42	6.73
W2900	0.12	362	02Nov2014, 12:16	6.83
Reach-670	0.64	1265	02Nov2014, 12:38	6.75
W670	0.16	484	02Nov2014, 12:20	7.08
W3900	0.09	229	02Nov2014, 12:20	5.76
Reach-710	0.09	194	02Nov2014, 12:31	5.67
GMRTrib2	10.54	5426	02Nov2014, 14:46	5.38

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W710	0.19	528	02Nov2014, 12:18	6.13
Reach-600	10.73	5341	02Nov2014, 15:06	5.29
W600	0.16	448	02Nov2014, 12:16	6.03
Reach-3800	10.88	5370	02Nov2014, 15:08	5.30
W3800	0.13	353	02Nov2014, 12:20	6.18
Reservoir-2100	11.01	5043	02Nov2014, 15:53	5.17
Reach-2100	11.01	5040	02Nov2014, 15:58	5.16
W2100	0.09	280	02Nov2014, 12:15	6.26
Reach-4700	11.10	5040	02Nov2014, 16:02	5.14
W4700	0.09	240	02Nov2014, 12:16	5.18
Reach-2000	11.20	5047	02Nov2014, 16:11	5.11
W2000	0.11	294	02Nov2014, 12:19	5.77
Reach-1900	11.31	5059	02Nov2014, 16:16	5.10
W1900	0.12	314	02Nov2014, 12:20	5.88
Reach-1800	11.44	5073	02Nov2014, 16:20	5.10
W1800	0.15	405	02Nov2014, 12:17	5.86
W4600	0.04	98	02Nov2014, 12:18	4.78
Reach-4600	0.04	85	02Nov2014, 12:26	4.73
Reach-530	11.63	5068	02Nov2014, 16:37	5.09
W750	0.13	370	02Nov2014, 12:19	6.62
W4100	0.09	197	02Nov2014, 12:40	7.21
Reach-750	0.09	194	02Nov2014, 12:47	7.19
Reach-1400	0.22	410	02Nov2014, 12:49	6.78
W1400	0.14	207	02Nov2014, 12:30	4.04
Reach-1000	0.36	569	02Nov2014, 12:44	5.73
W760	0.16	230	02Nov2014, 12:44	4.69
W1000	0.03	53	02Nov2014, 12:23	4.58
Reach-1500	0.55	810	02Nov2014, 12:51	5.34
W1500	0.13	214	02Nov2014, 12:26	4.16
Reach-570	0.68	939	02Nov2014, 12:47	5.12
W570	0.10	177	02Nov2014, 12:24	4.27
Reach-1100	0.78	1032	02Nov2014, 12:55	4.98
W1100	0.15	238	02Nov2014, 12:17	3.38
Reach-FornesRun	0.92	1102	02Nov2014, 12:52	4.73
W530	0.11	240	02Nov2014, 12:20	4.75
FornesRun	12.66	5205	02Nov2014, 16:34	5.06
Reach-Fornescont	12.66	5204	02Nov2014, 16:34	5.06
Reach-510	12.66	5199	02Nov2014, 16:42	5.04
W1200	0.15	247	02Nov2014, 12:29	4.44
W1600	0.07	146	02Nov2014, 12:25	5.25
Reservoir-1700	0.07	116	02Nov2014, 12:38	5.24
Reach-1700	0.07	115	02Nov2014, 12:41	5.23

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W1700	0.04	86	02Nov2014, 12:17	5.04
Reach-1200	0.10	167	02Nov2014, 12:30	5.16
Reach-1300	0.25	412	02Nov2014, 12:34	4.73
W1300	0.15	294	02Nov2014, 12:21	4.29
Reach-4500	0.40	640	02Nov2014, 12:34	4.55
W4500	0.13	240	02Nov2014, 12:23	4.44
Reach-520	0.53	855	02Nov2014, 12:32	4.52
W510	0.08	182	02Nov2014, 12:21	5.35
W520	0.03	73	02Nov2014, 12:17	5.38
ReedyBch	13.30	5275	02Nov2014, 16:40	5.02
Reach-500	13.30	5251	02Nov2014, 16:46	4.99
W500	0.18	461	02Nov2014, 12:22	5.97
Reservoir-400	13.49	5195	02Nov2014, 17:13	4.93
Reach-400	13.49	5133	02Nov2014, 17:26	4.84
W400	0.14	421	02Nov2014, 12:16	6.31
Reach-3400	13.63	5071	02Nov2014, 17:42	4.74
W3400	0.13	358	02Nov2014, 12:21	6.24
Outlet	13.76	5084	02Nov2014, 17:41	4.76

HEC-HMS Output for Alternatives #1 and #2 (Future Land-Use Conditions)

Project:	GMR_Future_Revised_HS		**Simulation Run:**	100 yr
Start of Run:	02Nov2014, 00:00		**Basin Model:**	GMR Subbasins
End of Run:	03Nov2014, 00:06		**Meteorologic Model:**	100 yr
Compue Time:	15Dec2015, 10:19:31		**Control Specifications:**	Nov14
Hydrologic Element	**Drainage Area (mi^2)**	**Peak Discharge (cfs)**	**Time of Peak**	**Volume (in)**
W730	0.41	786	02Nov2014, 12:56	7.82
W700	0.25	405	02Nov2014, 13:02	6.95
Reach-660	0.66	1170	02Nov2014, 13:12	7.46
W660	0.47	1034	02Nov2014, 12:43	7.65
W800	0.35	618	02Nov2014, 13:00	7.50
GMRTrib9	1.48	2591	02Nov2014, 12:58	7.53
Reach-770	1.48	2352	02Nov2014, 13:29	7.36
W770	0.64	1051	02Nov2014, 12:55	6.32
Reach-3100	2.12	2986	02Nov2014, 13:44	7.02
W550	0.36	653	02Nov2014, 12:55	7.21
W560	0.11	182	02Nov2014, 13:00	6.91
Reach-550	0.11	167	02Nov2014, 13:18	6.80
Reach-3000	0.47	554	02Nov2014, 13:52	6.79
W3000	0.39	774	02Nov2014, 12:51	7.70
W4900	0.13	502	02Nov2014, 12:13	7.38
Reach-4800	0.13	491	02Nov2014, 12:17	7.36
W4800	0.05	150	02Nov2014, 12:24	8.19
Reach-3000(2)	0.18	616	02Nov2014, 12:24	7.56
Reach-990	1.04	1144	02Nov2014, 13:27	7.09
W990	0.35	764	02Nov2014, 12:43	7.45
Reservoir-2800	1.39	685	02Nov2014, 15:29	7.06
Reach-2800	1.39	682	02Nov2014, 15:46	7.02
W2800	0.03	78	02Nov2014, 12:32	6.36
Reach-630	1.42	689	02Nov2014, 15:47	6.97
W630	0.37	660	02Nov2014, 12:48	6.29
Reservoir-2700	1.80	819	02Nov2014, 14:12	6.58
Reach-2700	1.80	818	02Nov2014, 14:18	6.57
W3100	0.37	611	02Nov2014, 12:42	5.32
NorthForkGMR	4.29	3931	02Nov2014, 13:46	6.68
W2700	0.02	68	02Nov2014, 12:15	6.66
Reach-2600	4.31	3938	02Nov2014, 13:46	6.68
W2600	0.00	4	02Nov2014, 12:07	8.66
Reach-780	4.31	3768	02Nov2014, 14:03	6.56
W640	0.40	792	02Nov2014, 12:52	7.68
Reach-650	0.40	785	02Nov2014, 12:59	7.65
W780	0.25	582	02Nov2014, 12:31	6.57

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W650	0.16	536	02Nov2014, 12:20	7.71
GMRTrib8	5.13	4248	02Nov2014, 13:57	6.69
Reach-820	5.13	4176	02Nov2014, 14:06	6.62
W920	0.46	648	02Nov2014, 13:22	7.23
W5100	0.08	215	02Nov2014, 12:20	6.26
Laurel Ridge	0.54	685	02Nov2014, 13:19	7.09
Reach-5000	0.54	507	02Nov2014, 13:21	5.84
W980	0.26	489	02Nov2014, 12:58	8.06
Reach-980	0.26	333	02Nov2014, 13:10	7.64
W5000	0.11	397	02Nov2014, 12:17	8.59
Reach-930	0.90	639	02Nov2014, 13:46	6.49
W930	0.18	253	02Nov2014, 13:02	5.77
W910	0.12	161	02Nov2014, 13:01	5.58
Reach-940	1.20	978	02Nov2014, 13:32	6.27
W940	0.31	478	02Nov2014, 12:41	4.85
W5200	0.14	381	02Nov2014, 12:33	7.95
Reach-5200	0.14	375	02Nov2014, 12:42	7.93
W3200	0.10	213	02Nov2014, 12:40	6.67
Reach-3200	0.10	212	02Nov2014, 12:48	6.65
W960	0.08	237	02Nov2014, 12:24	7.15
Trib2GMRTrib7	1.85	1774	02Nov2014, 12:50	6.22
Reach-950	1.85	1760	02Nov2014, 12:55	6.20
W5300	0.11	279	02Nov2014, 12:38	8.80
W3300	0.09	253	02Nov2014, 12:34	8.69
Reach-970	0.20	507	02Nov2014, 12:45	8.70
W970	0.19	435	02Nov2014, 12:37	7.30
W950	0.11	218	02Nov2014, 12:26	4.99
W4400	0.04	162	02Nov2014, 12:12	8.64
Reach-4400	0.04	138	02Nov2014, 12:29	8.55
Trib1GMRTrib7	2.38	2856	02Nov2014, 12:45	6.48
Reach-880	2.38	2732	02Nov2014, 13:04	6.45
W880	0.38	573	02Nov2014, 12:34	4.24
W820	0.05	98	02Nov2014, 12:19	3.90
GMRTrib7	7.94	6104	02Nov2014, 13:46	6.44
Reach-2500	7.94	6084	02Nov2014, 13:50	6.42
W2500	0.06	224	02Nov2014, 12:16	7.70
Reach-860	8.01	6049	02Nov2014, 14:01	6.36
W900	0.13	354	02Nov2014, 12:27	7.21
W4300	0.12	471	02Nov2014, 12:15	8.89
Reach-900	0.12	452	02Nov2014, 12:20	8.87
W890	0.11	344	02Nov2014, 12:25	7.91
W4200	0.11	338	02Nov2014, 12:25	8.34

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
Reach-890	0.11	337	02Nov2014, 12:27	8.33
TribGMRTrib6	0.47	1457	02Nov2014, 12:24	8.06
Reach-870	0.47	1354	02Nov2014, 12:26	8.01
W860	0.13	306	02Nov2014, 12:18	5.14
W870	0.02	55	02Nov2014, 12:16	7.59
GMRTrib6	8.62	6282	02Nov2014, 13:57	6.44
Reach-810	8.62	6279	02Nov2014, 14:02	6.43
W810	0.12	305	02Nov2014, 12:17	5.37
Reach-2400	8.73	6294	02Nov2014, 14:07	6.39
W740	0.10	295	02Nov2014, 12:25	7.49
Reach-4000	0.10	295	02Nov2014, 12:30	7.48
W4000	0.09	311	02Nov2014, 12:22	8.19
W2400	0.09	242	02Nov2014, 12:25	6.55
GMRTrib5	9.02	6397	02Nov2014, 14:05	6.42
Reach-790	9.02	6386	02Nov2014, 14:09	6.40
W790	0.06	136	02Nov2014, 12:36	7.28
Reservoir-2300	9.08	6333	02Nov2014, 14:25	6.37
Reach-2300	9.08	6326	02Nov2014, 14:29	6.35
W850	0.16	662	02Nov2014, 12:10	7.20
W840	0.14	541	02Nov2014, 12:16	8.12
Reach-830	0.30	1148	02Nov2014, 12:13	7.64
W2300	0.08	154	02Nov2014, 12:39	6.06
GMRTrib4	9.46	6438	02Nov2014, 14:28	6.39
W830	0.03	75	02Nov2014, 12:14	5.41
Reach-720	9.49	6429	02Nov2014, 14:33	6.37
W720	0.06	253	02Nov2014, 12:13	7.78
Reach-2200	9.55	6447	02Nov2014, 14:37	6.37
W2200	0.08	276	02Nov2014, 12:23	8.57
Reach-2201	9.64	6458	02Nov2014, 14:40	6.38
W580	0.18	479	02Nov2014, 12:34	8.36
W3500	0.13	317	02Nov2014, 12:38	7.61
W3600	0.13	331	02Nov2014, 12:35	8.10
Reach-580	0.13	331	02Nov2014, 12:39	8.09
Reach-3700	0.44	1119	02Nov2014, 12:39	8.05
W3700	0.09	283	02Nov2014, 12:22	8.24
Reach-2900	0.53	1308	02Nov2014, 12:41	8.05
W2900	0.12	428	02Nov2014, 12:16	8.17
Reach-670	0.64	1506	02Nov2014, 12:38	8.07
W670	0.16	571	02Nov2014, 12:20	8.43
W3900	0.09	278	02Nov2014, 12:20	7.04
Reach-710	0.09	236	02Nov2014, 12:31	6.94
GMRTrib2	10.54	6758	02Nov2014, 14:36	6.52

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W710	0.19	635	02Nov2014, 12:18	7.43
Reach-600	10.73	6659	02Nov2014, 14:54	6.41
W600	0.16	541	02Nov2014, 12:16	7.33
Reach-3800	10.88	6695	02Nov2014, 14:56	6.42
W3800	0.13	424	02Nov2014, 12:20	7.48
Reservoir-2100	11.01	6204	02Nov2014, 15:46	6.27
Reach-2100	11.01	6200	02Nov2014, 15:50	6.26
W2100	0.09	336	02Nov2014, 12:15	7.57
Reach-4700	11.10	6200	02Nov2014, 15:55	6.24
W4700	0.09	296	02Nov2014, 12:16	6.42
Reach-2000	11.20	6209	02Nov2014, 16:03	6.20
W2000	0.11	357	02Nov2014, 12:19	7.06
Reach-1900	11.31	6224	02Nov2014, 16:07	6.19
W1900	0.12	380	02Nov2014, 12:20	7.16
Reach-1800	11.44	6243	02Nov2014, 16:12	6.20
W1800	0.15	491	02Nov2014, 12:17	7.15
W4600	0.04	123	02Nov2014, 12:18	5.98
Reach-4600	0.04	106	02Nov2014, 12:25	5.92
Reach-530	11.63	6237	02Nov2014, 16:27	6.18
W750	0.13	440	02Nov2014, 12:19	7.95
W4100	0.09	231	02Nov2014, 12:39	8.55
Reach-750	0.09	229	02Nov2014, 12:47	8.53
Reach-1400	0.22	486	02Nov2014, 12:49	8.11
W1400	0.14	266	02Nov2014, 12:29	5.16
Reach-1000	0.36	691	02Nov2014, 12:43	6.98
W760	0.16	289	02Nov2014, 12:43	5.88
W1000	0.03	66	02Nov2014, 12:22	5.76
Reach-1500	0.55	997	02Nov2014, 12:49	6.57
W1500	0.13	273	02Nov2014, 12:26	5.29
Reach-570	0.68	1165	02Nov2014, 12:46	6.32
W570	0.10	225	02Nov2014, 12:23	5.42
Reach-1100	0.78	1282	02Nov2014, 12:54	6.18
W1100	0.15	315	02Nov2014, 12:17	4.42
Reach-FornesRun	0.92	1371	02Nov2014, 12:51	5.90
W530	0.11	300	02Nov2014, 12:20	5.95
FornesRun	12.66	6410	02Nov2014, 16:24	6.16
Reach-Fornescont	12.66	6410	02Nov2014, 16:24	6.16
Reach-510	12.66	6403	02Nov2014, 16:31	6.13
W1200	0.15	312	02Nov2014, 12:28	5.60
W1600	0.07	180	02Nov2014, 12:25	6.49
Reservoir-1700	0.07	139	02Nov2014, 12:39	6.48
Reach-1700	0.07	139	02Nov2014, 12:42	6.47

Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (in)
W1700	0.04	106	02Nov2014, 12:16	6.27
Reach-1200	0.10	200	02Nov2014, 12:32	6.39
Reach-1300	0.25	509	02Nov2014, 12:35	5.92
W1300	0.15	374	02Nov2014, 12:20	5.44
Reach-4500	0.40	788	02Nov2014, 12:34	5.71
W4500	0.13	304	02Nov2014, 12:23	5.60
Reach-520	0.53	1054	02Nov2014, 12:32	5.68
W510	0.08	223	02Nov2014, 12:21	6.60
W520	0.03	90	02Nov2014, 12:17	6.64
ReedyBch	13.30	6499	02Nov2014, 16:29	6.12
Reach-500	13.30	6471	02Nov2014, 16:34	6.08
W500	0.18	556	02Nov2014, 12:22	7.26
Reservoir-400	13.49	6130	02Nov2014, 17:30	6.01
Reach-400	13.49	6079	02Nov2014, 17:42	5.91
W400	0.14	505	02Nov2014, 12:16	7.62
Reach-3400	13.63	6035	02Nov2014, 17:56	5.80
W3400	0.13	429	02Nov2014, 12:21	7.55
Outlet	13.76	6050	02Nov2014, 17:55	5.81

H.5 HEC-RAS Output – Existing and Future Conditions

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Greens Mill Run - Existing Conditions												
Reach-1	1000.00	2 year	1054.00	0.40	5.27	3.79	5.30	0.001	2.18	1441.02	983.09	0.19
Reach-1	1000.00	10 year	2404.00	0.40	6.52	4.47	6.54	0.001	2.49	2824.24	1231.32	0.19
Reach-1	1000.00	25 year	3175.00	0.40	7.01	4.71	7.03	0.001	2.63	3443.63	1280.82	0.20
Reach-1	1000.00	50 year	3952.00	0.40	7.42	4.91	7.45	0.001	2.76	3978.30	1287.69	0.20
Reach-1	1000.00	100 year	4823.00	0.40	7.85	5.15	7.88	0.001	2.89	4530.11	1294.74	0.20
Reach-1	1500.00	2 year	1054.00	0.50	5.81		5.89	0.002	3.25	886.07	540.00	0.27
Reach-1	1500.00	10 year	2404.00	0.50	7.07		7.16	0.002	3.90	1600.18	620.43	0.29
Reach-1	1500.00	25 year	3175.00	0.50	7.59		7.72	0.002	4.67	1959.98	776.49	0.33
Reach-1	1500.00	50 year	3952.00	0.50	8.01		8.14	0.002	4.87	2284.28	781.56	0.34
Reach-1	1500.00	100 year	4823.00	0.50	8.44		8.56	0.002	5.07	2617.30	786.68	0.34
Reach-1	1890.00	2 year	1054.00	0.64	6.33		6.41	0.001	3.03	822.45	436.61	0.24
Reach-1	1890.00	10 year	2404.00	0.64	7.66		7.78	0.002	3.95	1493.00	525.14	0.28
Reach-1	1890.00	25 year	3175.00	0.64	8.29		8.41	0.002	4.25	1822.82	531.55	0.28
Reach-1	1890.00	50 year	3952.00	0.64	8.73		8.87	0.002	4.65	2057.81	535.97	0.30
Reach-1	1890.00	100 year	4823.00	0.64	9.17		9.33	0.002	5.05	2297.51	539.92	0.32
Reach-1	2381.00	2 year	1074.00	0.98	7.06		7.48	0.004	5.45	303.76	218.13	0.42
Reach-1	2381.00	10 year	2433.00	0.98	8.56		9.15	0.005	7.31	692.59	281.08	0.50
Reach-1	2381.00	25 year	3217.00	0.98	9.19		9.84	0.005	7.99	874.11	294.32	0.52
Reach-1	2381.00	50 year	4023.00	0.98	9.72		10.43	0.005	8.62	1032.01	303.63	0.54
Reach-1	2381.00	100 year	4927.00	0.98	10.24		11.01	0.006	9.23	1192.15	309.76	0.56
Reach-1	2950.00	2 year	1074.00	1.26	8.60		8.80	0.002	3.92	1033.13	384.58	0.28
Reach-1	2950.00	10 year	2433.00	1.26	10.61		10.95	0.002	5.64	1843.13	413.60	0.35
Reach-1	2950.00	25 year	3217.00	1.26	11.41		11.82	0.002	6.41	2177.30	420.00	0.37
Reach-1	2950.00	50 year	4023.00	1.26	12.10		12.59	0.003	7.13	2470.20	425.53	0.40
Reach-1	2950.00	100 year	4927.00	1.26	12.78		13.35	0.003	7.86	2759.85	431.36	0.43
Reach-1	3391.00	2 year	1074.00	1.02	9.10		9.20	0.001	2.69	666.46	241.03	0.18
Reach-1	3391.00	10 year	2433.00	1.02	11.34		11.50	0.001	3.74	1296.86	320.12	0.22
Reach-1	3391.00	25 year	3217.00	1.02	12.26		12.43	0.001	4.14	1595.83	332.53	0.23
Reach-1	3391.00	50 year	4023.00	1.02	13.06		13.26	0.001	4.49	1866.13	340.86	0.24
Reach-1	3391.00	100 year	4927.00	1.02	13.85		14.07	0.001	4.85	2140.10	349.09	0.25
Reach-1	3835.00	2 year	1074.00	0.06	9.34	4.27	9.45	0.001	2.77	447.47	137.62	0.18
Reach-1	3835.00	10 year	2433.00	0.06	11.66	6.17	11.95	0.001	4.56	708.19	397.14	0.26
Reach-1	3835.00	25 year	3217.00	0.06	12.58	7.03	12.98	0.001	5.34	823.28	414.20	0.29
Reach-1	3835.00	50 year	4023.00	0.06	13.39	7.84	13.89	0.001	6.06	923.43	429.05	0.32
Reach-1	3835.00	100 year	4927.00	0.06	14.18	8.68	14.80	0.002	6.80	1021.76	443.63	0.34
Reach-1	3903.00		Bridge									
Reach-1	4008.00	2 year	1102.00	0.26	9.67	4.42	9.78	0.000	2.73	471.73	190.96	0.17
Reach-1	4008.00	10 year	2520.00	0.26	12.52	6.33	12.74	0.001	4.05	1021.72	412.31	0.22
Reach-1	4008.00	25 year	3295.00	0.26	13.86	7.18	14.09	0.001	4.32	1337.80	436.93	0.22
Reach-1	4008.00	50 year	4151.00	0.26	15.20	8.03	15.44	0.001	4.53	1655.37	454.15	0.22
Reach-1	4008.00	100 year	5103.00	0.26	16.65	8.89	16.89	0.001	4.70	1996.74	461.90	0.22
Reach-1	4137.00	2 year	1099.00	0.48	9.79		9.85	0.000	2.23	826.11	209.88	0.14
Reach-1	4137.00	10 year	2560.00	0.48	12.74		12.84	0.000	3.13	1630.13	322.22	0.17
Reach-1	4137.00	25 year	3291.00	0.48	14.09		14.19	0.000	3.27	2079.84	342.34	0.17
Reach-1	4137.00	50 year	4158.00	0.48	15.43		15.54	0.000	3.43	2548.09	353.46	0.17
Reach-1	4137.00	100 year	5075.00	0.48	16.88		16.98	0.000	3.53	3069.10	370.42	0.16
Reach-1	4500.00	2 year	1099.00	0.81	9.94		10.06	0.001	3.35	597.81	183.46	0.22
Reach-1	4500.00	10 year	2560.00	0.81	12.92		13.10	0.001	4.37	1222.54	254.69	0.24
Reach-1	4500.00	25 year	3291.00	0.81	14.25		14.42	0.001	4.48	1580.94	279.72	0.24
Reach-1	4500.00	50 year	4158.00	0.81	15.58		15.76	0.001	4.60	1966.10	296.92	0.23
Reach-1	4500.00	100 year	5075.00	0.81	17.01		17.18	0.001	4.64	2403.81	315.34	0.22
Reach-1	5088.00	2 year	1099.00	1.35	10.49		10.57	0.001	2.88	930.48	410.62	0.19
Reach-1	5088.00	10 year	2560.00	1.35	13.44		13.49	0.000	2.84	2262.50	476.27	0.16
Reach-1	5088.00	25 year	3291.00	1.35	14.72		14.77	0.000	2.83	2882.65	493.56	0.15
Reach-1	5088.00	50 year	4158.00	1.35	16.02		16.07	0.000	2.86	3532.21	505.03	0.14
Reach-1	5088.00	100 year	5075.00	1.35	17.41		17.45	0.000	2.86	4240.93	516.88	0.14
Reach-1	5500.00	2 year	1099.00	3.02	10.83		11.06	0.002	4.11	529.67	397.90	0.30
Reach-1	5500.00	10 year	2560.00	3.02	13.65		13.75	0.001	3.61	1682.41	424.50	0.22
Reach-1	5500.00	25 year	3291.00	3.02	14.89		14.98	0.001	3.49	2219.24	443.60	0.20
Reach-1	5500.00	50 year	4158.00	3.02	16.17		16.25	0.001	3.47	2806.48	476.25	0.18
Reach-1	5500.00	100 year	5075.00	3.02	17.53		17.61	0.000	3.41	3480.90	512.02	0.17
Reach-1	6000.00	2 year	1099.00	3.32	11.74		12.00	0.002	4.40	460.32	279.40	0.31
Reach-1	6000.00	10 year	2560.00	3.32	14.13		14.35	0.002	4.85	1211.11	346.25	0.29
Reach-1	6000.00	25 year	3291.00	3.32	15.27		15.45	0.001	4.74	1613.50	360.04	0.27
Reach-1	6000.00	50 year	4158.00	3.32	16.48		16.65	0.001	4.69	2058.82	373.27	0.25
Reach-1	6000.00	100 year	5075.00	3.32	17.79		17.94	0.001	4.60	2556.29	387.52	0.23

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6500.00	2 year	1099.00	3.91	12.67		12.93	0.002	4.33	464.59	363.06	0.30
Reach-1	6500.00	10 year	2560.00	3.91	14.89		15.06	0.001	4.51	1452.73	481.07	0.27
Reach-1	6500.00	25 year	3291.00	3.91	15.89		16.03	0.001	4.34	1939.87	497.09	0.24
Reach-1	6500.00	50 year	4158.00	3.91	17.00		17.12	0.001	4.16	2498.43	503.93	0.22
Reach-1	6500.00	100 year	5075.00	3.91	18.22		18.32	0.001	3.97	3117.19	511.40	0.20
Reach-1	7000.00	2 year	1108.00	4.42	13.51		13.73	0.001	4.03	485.42	237.31	0.27
Reach-1	7000.00	10 year	2343.00	4.42	15.54		15.80	0.002	4.98	1025.65	296.74	0.29
Reach-1	7000.00	25 year	3131.00	4.42	16.44		16.72	0.002	5.44	1300.24	317.46	0.31
Reach-1	7000.00	50 year	3905.00	4.42	17.45		17.72	0.002	5.56	1659.39	403.96	0.30
Reach-1	7000.00	100 year	4733.00	4.42	18.57		18.82	0.001	5.57	2132.55	438.29	0.28
Reach-1	7471.00	2 year	1108.00	5.10	14.04		14.15	0.001	2.82	731.53	302.52	0.18
Reach-1	7471.00	10 year	2343.00	5.10	16.14		16.27	0.001	3.59	1401.95	330.24	0.20
Reach-1	7471.00	25 year	3131.00	5.10	17.08		17.23	0.001	3.99	1715.35	339.66	0.21
Reach-1	7471.00	50 year	3905.00	5.10	18.05		18.20	0.001	4.21	2051.32	353.35	0.21
Reach-1	7471.00	100 year	4733.00	5.10	19.11		19.26	0.001	4.32	2430.98	362.92	0.21
Reach-1	7885.00	2 year	1112.00	7.49	14.33		14.58	0.002	4.00	284.21	61.61	0.30
Reach-1	7885.00	10 year	2355.00	7.49	16.36		16.90	0.003	6.00	449.18	104.91	0.39
Reach-1	7885.00	25 year	3154.00	7.49	17.24		17.97	0.003	7.01	549.85	123.52	0.43
Reach-1	7885.00	50 year	3921.00	7.49	18.14		18.98	0.003	7.66	668.34	139.72	0.45
Reach-1	7885.00	100 year	4740.00	7.49	19.12		20.03	0.003	8.08	811.90	151.49	0.45
Reach-1	8019.00	2 year	1112.00	5.86	14.55	9.67	14.79	0.001	3.92	283.29	40.31	0.26
Reach-1	8019.00	10 year	2355.00	5.86	16.69	11.92	17.30	0.003	6.28	387.95	85.81	0.38
Reach-1	8019.00	25 year	3154.00	5.86	17.62	13.11	18.49	0.004	7.52	443.64	95.21	0.43
Reach-1	8019.00	50 year	3921.00	5.86	18.51	14.13	19.60	0.004	8.47	497.22	104.17	0.47
Reach-1	8019.00	100 year	4740.00	5.86	19.42	15.11	20.73	0.005	9.31	555.51	128.60	0.49
Reach-1	8118.00		Culvert									
Reach-1	8229.00	2 year	1117.00	7.95	14.21	12.48	14.86	0.006	6.47	172.63	38.08	0.54
Reach-1	8229.00	10 year	2363.00	7.95	16.11	14.65	17.51	0.010	9.49	255.22	143.67	0.69
Reach-1	8229.00	25 year	3176.00	7.95	17.45	15.79	18.78	0.008	9.60	447.88	264.39	0.64
Reach-1	8229.00	50 year	3929.00	7.95	19.03	17.46	20.00	0.005	8.62	708.08	308.47	0.52
Reach-1	8229.00	100 year	4781.00	7.95	20.59	18.19	21.35	0.003	7.98	997.50	327.33	0.44
Reach-1	8500.00	2 year	1026.00	7.91	15.43		15.58	0.001	3.22	355.56	79.45	0.23
Reach-1	8500.00	10 year	2095.00	7.91	18.27		18.53	0.001	4.24	664.10	158.51	0.25
Reach-1	8500.00	25 year	2738.00	7.91	19.46		19.75	0.001	4.64	859.65	170.48	0.26
Reach-1	8500.00	50 year	3325.00	7.91	20.45		20.77	0.001	4.92	1035.30	181.58	0.26
Reach-1	8500.00	100 year	4121.00	7.91	21.63		21.98	0.001	5.27	1263.39	209.14	0.27
Reach-1	9000.00	2 year	1026.00	9.13	16.00	12.54	16.21	0.002	3.67	302.97	94.60	0.28
Reach-1	9000.00	10 year	2095.00	9.13	18.81	14.30	19.08	0.001	4.41	664.28	159.39	0.27
Reach-1	9000.00	25 year	2738.00	9.13	20.00	15.15	20.29	0.001	4.73	889.54	230.09	0.27
Reach-1	9000.00	50 year	3325.00	9.13	21.01	15.78	21.29	0.001	4.78	1137.91	259.92	0.26
Reach-1	9000.00	100 year	4121.00	9.13	22.22	16.89	22.48	0.001	4.76	1474.01	295.54	0.25
Reach-1	9081.00		Bridge									
Reach-1	9101.00	2 year	1026.00	10.36	16.37	13.49	16.66	0.002	4.30	241.81	58.40	0.34
Reach-1	9101.00	10 year	2095.00	10.36	19.20	15.19	19.51	0.002	4.86	743.70	497.99	0.31
Reach-1	9101.00	25 year	2738.00	10.36	20.08	16.05	20.33	0.001	4.71	1206.18	546.72	0.28
Reach-1	9101.00	50 year	3325.00	10.36	21.17	16.91	21.32	0.001	3.96	1839.67	594.33	0.22
Reach-1	9101.00	100 year	4121.00	10.36	22.63	18.64	22.71	0.000	3.22	2728.42	621.08	0.17
Reach-1	9375.00	2 year	1026.00	10.04	16.97		17.18	0.001	3.68	283.89	73.56	0.28
Reach-1	9375.00	10 year	2095.00	10.04	19.66		19.91	0.001	4.26	683.17	309.81	0.27
Reach-1	9375.00	25 year	2738.00	10.04	20.44		20.66	0.001	4.30	947.84	369.81	0.26
Reach-1	9375.00	50 year	3325.00	10.04	21.37		21.53	0.001	3.87	1320.31	430.14	0.22
Reach-1	9375.00	100 year	4121.00	10.04	22.74		22.85	0.000	3.41	2013.56	592.72	0.18
Reach-1	9732.00	2 year	1026.00	11.51	17.51	14.22	17.73	0.002	3.81	270.38	54.19	0.28
Reach-1	9732.00	10 year	2095.00	11.51	20.08	15.75	20.51	0.002	5.28	410.05	124.25	0.32
Reach-1	9732.00	25 year	2738.00	11.51	20.78	16.53	21.39	0.002	6.34	448.00	282.27	0.37
Reach-1	9732.00	50 year	3325.00	11.51	21.64	17.19	22.00	0.002	5.32	973.28	584.09	0.31
Reach-1	9732.00	100 year	4121.00	11.51	22.93	18.06	23.07	0.001	3.83	1897.66	766.69	0.21
Reach-1	9813.00		Culvert									
Reach-1	9856.00	2 year	1027.00	11.57	18.26	14.32	18.43	0.001	3.35	310.61	57.86	0.24
Reach-1	9856.00	10 year	2098.00	11.57	22.02	15.88	22.21	0.001	3.72	644.37	741.46	0.21
Reach-1	9856.00	25 year	2746.00	11.57	23.88	16.68	24.08	0.001	3.77	845.15	791.31	0.20
Reach-1	9856.00	50 year	3355.00	11.57	25.25	17.37	25.28	0.000	2.02	3849.73	830.82	0.10
Reach-1	9856.00	100 year	4178.00	11.57	25.98	18.25	26.01	0.000	2.16	4461.25	847.44	0.10
Reach-1	10000.00	2 year	1015.00	10.11	18.42		18.61	0.001	3.59	313.32	143.81	0.25
Reach-1	10000.00	10 year	2112.00	10.11	22.27		22.32	0.000	2.49	1832.24	575.33	0.14
Reach-1	10000.00	25 year	2783.00	10.11	24.14		24.17	0.000	1.98	3099.44	899.21	0.10
Reach-1	10000.00	50 year	3419.00	10.11	25.27		25.30	0.000	1.89	4291.68	1120.96	0.09
Reach-1	10000.00	100 year	4163.00	10.11	26.01		26.03	0.000	1.92	5122.98	1148.85	0.09

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	10529.00	2 year	1015.00	10.94	19.23		19.63	0.003	5.04	201.42	36.63	0.37
Reach-1	10529.00	10 year	2112.00	10.94	22.38		22.42	0.000	1.29	1361.86	492.40	0.08
Reach-1	10529.00	25 year	2783.00	10.94	24.18		24.20	0.000	0.84	2317.75	578.15	0.05
Reach-1	10529.00	50 year	3419.00	10.94	25.30		25.33	0.000	0.76	2973.41	587.60	0.04
Reach-1	10529.00	100 year	4163.00	10.94	26.03		26.06	0.000	0.78	3403.18	593.71	0.04
Reach-1	10806.00	2 year	1015.00	12.36	19.94	16.45	20.30	0.002	4.89	212.17	42.33	0.33
Reach-1	10806.00	10 year	2112.00	12.36	22.03	18.56	22.94	0.004	7.69	282.57	161.67	0.46
Reach-1	10806.00	25 year	2783.00	12.36	23.67	19.62	24.78	0.003	8.50	337.60	324.77	0.46
Reach-1	10806.00	50 year	3419.00	12.36	25.27	20.54	25.40	0.001	3.72	1520.58	548.25	0.19
Reach-1	10806.00	100 year	4163.00	12.36	26.01	21.52	26.11	0.000	3.48	1930.29	560.11	0.17
Reach-1	10885.00		Culvert									
Reach-1	10936.00	2 year	1015.00	12.45	20.44	16.20	20.67	0.001	3.91	282.34	62.81	0.26
Reach-1	10936.00	10 year	2113.00	12.45	23.67	18.15	23.98	0.001	4.73	536.93	346.22	0.26
Reach-1	10936.00	25 year	2783.00	12.45	26.50	19.16	26.53	0.000	1.79	2492.14	655.44	0.09
Reach-1	10936.00	50 year	3420.00	12.45	27.39	20.02	27.41	0.000	1.70	3080.60	671.90	0.08
Reach-1	10936.00	100 year	4164.00	12.45	27.87	21.59	27.90	0.000	1.83	3411.65	734.23	0.08
Reach-1	10970.00		Bridge									
Reach-1	11048.00	2 year	1005.00	13.72	20.90	17.17	21.14	0.002	4.04	260.90	65.01	0.29
Reach-1	11048.00	10 year	2107.00	13.72	23.90	19.13	24.01	0.001	3.22	1060.48	472.00	0.19
Reach-1	11048.00	25 year	2782.00	13.72	26.53	20.15	26.55	0.000	1.68	2549.45	626.32	0.09
Reach-1	11048.00	50 year	3404.00	13.72	27.41	22.56	27.43	0.000	1.63	3154.65	721.39	0.08
Reach-1	11048.00	100 year	4118.00	13.72	27.89	23.03	27.92	0.000	1.75	3507.25	731.24	0.09
Reach-1	11500.00	2 year	1005.00	14.51	21.71		22.10	0.002	5.28	261.45	65.31	0.35
Reach-1	11500.00	10 year	2107.00	14.51	24.14		24.84	0.003	7.43	461.49	97.32	0.43
Reach-1	11500.00	25 year	2782.00	14.51	26.36		27.00	0.002	7.35	732.34	173.95	0.38
Reach-1	11500.00	50 year	3404.00	14.51	27.17		27.93	0.002	8.14	903.67	241.58	0.41
Reach-1	11500.00	100 year	4118.00	14.51	27.60		28.51	0.003	9.11	1017.80	290.67	0.45
Reach-1	11750.00	2 year	1005.00	15.50	22.30	18.89	22.61	0.002	4.54	254.41	49.47	0.31
Reach-1	11750.00	10 year	2107.00	15.50	24.89	20.83	25.51	0.002	6.57	396.68	65.28	0.38
Reach-1	11750.00	25 year	2782.00	15.50	26.86	21.82	27.54	0.002	6.96	524.97	89.17	0.37
Reach-1	11750.00	50 year	3404.00	15.50	27.72	22.68	28.55	0.002	7.74	635.91	99.57	0.40
Reach-1	11750.00	100 year	4118.00	15.50	28.21	23.70	29.33	0.003	8.99	694.94	160.42	0.45
Reach-1	11812.00		Culvert									
Reach-1	11822.00	2 year	1006.00	14.88	23.02	18.55	23.23	0.001	3.76	297.80	53.43	0.24
Reach-1	11822.00	10 year	2108.00	14.88	27.58	20.46	27.91	0.001	4.72	513.67	97.18	0.24
Reach-1	11822.00	25 year	2783.00	14.88	29.41	21.44	29.78	0.001	5.17	849.82	288.44	0.24
Reach-1	11822.00	50 year	3410.00	14.88	29.98	22.34	30.43	0.001	5.79	1008.44	335.11	0.27
Reach-1	11822.00	100 year	4122.00	14.88	30.43	23.17	30.90	0.001	6.19	1316.70	371.69	0.28
Reach-1	11890.00	2 year	997.00	15.80	23.01	20.10	23.45	0.003	5.56	230.78	96.73	0.38
Reach-1	11890.00	10 year	2101.00	15.80	27.59	22.47	28.06	0.002	6.09	565.64	243.46	0.32
Reach-1	11890.00	25 year	2778.00	15.80	29.81	23.60	29.90	0.000	3.62	1878.70	436.43	0.17
Reach-1	11890.00	50 year	3379.00	15.80	30.48	24.50	30.58	0.000	3.79	2176.68	449.48	0.18
Reach-1	11890.00	100 year	4079.00	15.80	30.94	25.38	31.05	0.001	4.16	2386.13	458.76	0.19
Reach-1	12393.00	2 year	997.00	16.66	23.74		23.75	0.000	1.63	1360.21	289.38	0.11
Reach-1	12393.00	10 year	2101.00	16.66	28.23		28.24	0.000	1.68	2782.79	394.83	0.09
Reach-1	12393.00	25 year	2778.00	16.66	29.99		30.01	0.000	1.75	3529.15	440.93	0.09
Reach-1	12393.00	50 year	3379.00	16.66	30.67		30.69	0.000	1.96	3836.07	471.87	0.09
Reach-1	12393.00	100 year	4079.00	16.66	31.17		31.19	0.000	2.24	4090.92	547.02	0.10
Reach-1	12805.00	2 year	997.00	17.20	23.83		24.00	0.002	3.86	539.52	250.51	0.29
Reach-1	12805.00	10 year	2101.00	17.20	28.28		28.33	0.000	2.64	1775.76	304.25	0.15
Reach-1	12805.00	25 year	2778.00	17.20	30.04		30.09	0.000	2.67	2326.72	324.52	0.14
Reach-1	12805.00	50 year	3379.00	17.20	30.73		30.78	0.000	2.97	2553.16	332.49	0.15
Reach-1	12805.00	100 year	4079.00	17.20	31.23		31.31	0.000	3.36	2722.84	338.34	0.16
Reach-1	13066.00	2 year	996.00	18.12	24.34		24.63	0.003	4.91	421.14	333.22	0.39
Reach-1	13066.00	10 year	2084.00	18.12	28.39		28.44	0.000	2.60	1896.07	387.13	0.15
Reach-1	13066.00	25 year	2755.00	18.12	30.13		30.16	0.000	2.47	2582.84	404.42	0.13
Reach-1	13066.00	50 year	3351.00	18.12	30.83		30.87	0.000	2.69	2869.58	411.42	0.14
Reach-1	13066.00	100 year	4044.00	18.12	31.36		31.41	0.000	3.01	3088.70	416.69	0.15
Reach-1	13604.00	2 year	996.00	18.99	25.50		25.62	0.001	3.22	654.70	423.32	0.24
Reach-1	13604.00	10 year	2084.00	18.99	28.59		28.62	0.000	2.12	2145.34	534.37	0.13
Reach-1	13604.00	25 year	2755.00	18.99	30.27		30.29	0.000	1.87	3069.62	569.42	0.10
Reach-1	13604.00	50 year	3351.00	18.99	30.98		31.00	0.000	1.98	3481.02	584.34	0.10
Reach-1	13604.00	100 year	4044.00	18.99	31.53		31.56	0.000	2.15	3807.50	595.92	0.11
Reach-1	14157.00	2 year	1001.00	20.50	26.35	24.56	26.64	0.003	4.76	337.96	483.34	0.37
Reach-1	14157.00	10 year	2082.00	20.50	28.77	26.27	28.80	0.000	2.34	2042.72	605.86	0.15
Reach-1	14157.00	25 year	2755.00	20.50	30.37	26.88	30.39	0.000	1.91	3066.15	673.13	0.11
Reach-1	14157.00	50 year	3361.00	20.50	31.08	27.36	31.10	0.000	1.95	3556.07	701.36	0.11
Reach-1	14157.00	100 year	4063.00	20.50	31.65	27.70	31.67	0.000	2.08	3957.51	723.67	0.11

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	14329.00		Bridge									
Reach-1	14470.00	2 year	1001.00	20.60	27.28	24.08	27.52	0.002	4.11	330.80	122.30	0.30
Reach-1	14470.00	10 year	2082.00	20.60	29.18	26.18	29.58	0.002	5.63	630.43	193.20	0.36
Reach-1	14470.00	25 year	2755.00	20.60	30.41	27.20	30.74	0.002	5.53	969.32	348.59	0.32
Reach-1	14470.00	50 year	3361.00	20.60	31.08	27.93	31.39	0.002	5.55	1230.14	424.27	0.31
Reach-1	14470.00	100 year	4063.00	20.60	31.66	28.63	31.94	0.002	5.63	1492.86	488.80	0.31
Reach-1	14671.00	2 year	1001.00	20.76	27.68		27.78	0.001	2.93	606.07	195.88	0.21
Reach-1	14671.00	10 year	2082.00	20.76	29.77		29.91	0.001	3.72	1116.53	317.75	0.23
Reach-1	14671.00	25 year	2755.00	20.76	30.88		31.01	0.001	3.77	1524.76	420.10	0.22
Reach-1	14671.00	50 year	3361.00	20.76	31.50		31.64	0.001	3.95	1804.82	482.68	0.22
Reach-1	14671.00	100 year	4063.00	20.76	32.04		32.18	0.001	4.18	2080.34	538.06	0.23
Reach-1	14807.00	2 year	1001.00	21.04	27.78	24.51	27.90	0.001	3.12	490.00	238.42	0.23
Reach-1	14807.00	10 year	2082.00	21.04	29.86	26.20	30.07	0.001	4.30	833.20	451.31	0.27
Reach-1	14807.00	25 year	2755.00	21.04	30.95	26.79	31.18	0.001	4.65	1092.44	576.11	0.27
Reach-1	14807.00	50 year	3361.00	21.04	31.55	27.27	31.83	0.001	5.11	1237.61	603.30	0.29
Reach-1	14807.00	100 year	4063.00	21.04	32.08	27.77	32.41	0.001	5.68	1363.17	623.38	0.32
Reach-1	14903.00		Bridge									
Reach-1	14968.00	2 year	1002.00	20.40	28.79	26.00	28.85	0.001	2.60	723.25	313.83	0.20
Reach-1	14968.00	10 year	2084.00	20.40	31.39	26.96	31.45	0.001	2.80	1571.23	596.83	0.18
Reach-1	14968.00	25 year	2758.00	20.40	32.50	27.42	32.56	0.001	2.95	1971.55	637.25	0.18
Reach-1	14968.00	50 year	3366.00	20.40	33.38	27.77	33.44	0.000	3.07	2291.87	654.80	0.17
Reach-1	14968.00	100 year	4072.00	20.40	34.36	28.06	34.43	0.000	3.18	2648.95	676.96	0.17
Reach-1	15023.00	2 year	992.00	21.14	28.76	25.02	29.04	0.002	4.31	266.93	444.06	0.31
Reach-1	15023.00	10 year	2177.00	21.14	31.43	27.30	31.49	0.000	2.85	2300.88	786.60	0.17
Reach-1	15023.00	25 year	2990.00	21.14	32.55	29.25	32.59	0.000	2.75	3196.53	814.77	0.15
Reach-1	15023.00	50 year	3686.00	21.14	33.44	30.08	33.47	0.000	2.69	3925.49	824.67	0.14
Reach-1	15023.00	100 year	4431.00	21.14	34.42	30.50	34.46	0.000	2.61	4746.72	837.22	0.13
Reach-1	15236.00		Culvert									
Reach-1	15308.00	2 year	992.00	19.00	29.09	22.91	29.17	0.000	2.43	645.03	520.67	0.15
Reach-1	15308.00	10 year	2186.00	19.00	31.88	24.93	31.91	0.000	2.12	2945.21	799.56	0.11
Reach-1	15308.00	25 year	3001.00	19.00	32.66	26.18	32.70	0.000	2.34	3581.36	815.52	0.12
Reach-1	15308.00	50 year	3697.00	19.00	33.49	27.73	33.52	0.000	2.36	4259.69	824.72	0.11
Reach-1	15308.00	100 year	4445.00	19.00	34.47	28.45	34.50	0.000	2.30	5077.55	837.23	0.11
Reach-1	15393.00	2 year	974.00	21.18	29.13		29.23	0.001	3.26	835.41	551.61	0.23
Reach-1	15393.00	10 year	2108.00	21.18	31.91		31.93	0.000	2.19	2827.57	857.50	0.13
Reach-1	15393.00	25 year	2882.00	21.18	32.70		32.73	0.000	2.31	3514.87	881.30	0.13
Reach-1	15393.00	50 year	3559.00	21.18	33.53		33.55	0.000	2.26	4251.43	906.10	0.12
Reach-1	15393.00	100 year	4272.00	21.18	34.51		34.53	0.000	2.16	5157.03	945.29	0.11
Reach-1	16096.00	2 year	974.00	23.89	29.85		29.91	0.001	2.95	957.32	457.17	0.23
Reach-1	16096.00	10 year	2108.00	23.89	32.16		32.20	0.001	2.83	2192.68	609.34	0.18
Reach-1	16096.00	25 year	2882.00	23.89	32.96		33.00	0.001	3.14	2694.62	647.82	0.19
Reach-1	16096.00	50 year	3559.00	23.89	33.75		33.79	0.001	3.21	3216.88	669.15	0.19
Reach-1	16096.00	100 year	4272.00	23.89	34.69		34.73	0.000	3.17	3857.28	694.42	0.18
Reach-1	16457.00	2 year	974.00	23.40	30.18		30.25	0.001	3.19	872.88	423.09	0.22
Reach-1	16457.00	10 year	2108.00	23.40	32.36		32.41	0.001	3.14	2101.02	657.50	0.19
Reach-1	16457.00	25 year	2882.00	23.40	33.16		33.22	0.001	3.38	2648.12	699.42	0.20
Reach-1	16457.00	50 year	3559.00	23.40	33.94		33.99	0.001	3.42	3207.64	739.85	0.19
Reach-1	16457.00	100 year	4272.00	23.40	34.85		34.90	0.000	3.33	3902.14	782.29	0.18
Reach-1	16932.00	2 year	974.00	25.30	30.56		30.57	0.000	1.91	1378.46	528.49	0.16
Reach-1	16932.00	10 year	2108.00	25.30	32.60		32.62	0.000	2.04	2784.44	792.50	0.14
Reach-1	16932.00	25 year	2882.00	25.30	33.41		33.43	0.000	2.17	3436.62	827.37	0.14
Reach-1	16932.00	50 year	3559.00	25.30	34.16		34.18	0.000	2.18	4078.76	902.21	0.14
Reach-1	16932.00	100 year	4272.00	25.30	35.04		35.06	0.000	2.13	4927.53	1002.78	0.13
Reach-1	17596.00	2 year	974.00	25.12	30.96		31.01	0.001	2.83	919.01	387.27	0.23
Reach-1	17596.00	10 year	2108.00	25.12	32.88		32.93	0.001	3.08	1737.48	477.98	0.21
Reach-1	17596.00	25 year	2882.00	25.12	33.68		33.74	0.001	3.36	2153.00	563.03	0.21
Reach-1	17596.00	50 year	3559.00	25.12	34.40		34.46	0.001	3.36	2575.77	597.72	0.21
Reach-1	17596.00	100 year	4272.00	25.12	35.24		35.29	0.001	3.30	3105.75	681.97	0.19
Reach-1	18096.00	2 year	736.00	24.99	31.27		31.32	0.000	1.97	461.92	170.84	0.16
Reach-1	18096.00	10 year	1730.00	24.99	33.16		33.29	0.001	3.02	897.63	287.96	0.20
Reach-1	18096.00	25 year	2311.00	24.99	33.97		34.11	0.001	3.38	1186.62	431.85	0.22
Reach-1	18096.00	50 year	2947.00	24.99	34.66		34.82	0.001	3.63	1530.09	556.94	0.22
Reach-1	18096.00	100 year	3722.00	24.99	35.46		35.60	0.001	3.60	2197.00	1009.31	0.21
Reach-1	18283.00	2 year	736.00	26.30	30.80	30.73	32.28	0.021	9.77	75.37	24.16	0.97
Reach-1	18283.00	10 year	1730.00	26.30	33.36	32.69	33.51	0.002	4.52	795.37	469.92	0.36
Reach-1	18283.00	25 year	2311.00	26.30	34.21	32.96	34.30	0.001	3.67	1234.54	569.57	0.27
Reach-1	18283.00	50 year	2947.00	26.30	34.91	33.19	34.99	0.001	3.38	1670.46	682.61	0.23
Reach-1	18283.00	100 year	3722.00	26.30	35.67	33.40	35.74	0.001	3.18	2261.71	860.08	0.21

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18506.00		Culvert									
Reach-1	18538.00	2 year	736.00	25.74	32.33	27.97	32.42	0.000	2.42	331.04	417.35	0.17
Reach-1	18538.00	10 year	1730.00	25.74	34.54	29.57	34.56	0.000	1.61	2076.80	634.89	0.10
Reach-1	18538.00	25 year	2311.00	25.74	35.09	30.28	35.11	0.000	1.88	2458.96	765.78	0.11
Reach-1	18538.00	50 year	2947.00	25.74	35.47	30.99	35.50	0.000	2.13	2770.46	851.50	0.12
Reach-1	18538.00	100 year	3722.00	25.74	35.88	31.78	35.91	0.000	2.35	3128.00	910.77	0.13
Reach-1	18614.00	2 year	736.00	23.93	32.32		32.58	0.003	4.50	376.72	510.31	0.35
Reach-1	18614.00	10 year	1730.00	23.93	34.56		34.59	0.001	2.66	1937.01	749.72	0.17
Reach-1	18614.00	25 year	2311.00	23.93	35.11		35.15	0.001	2.80	2354.43	755.88	0.18
Reach-1	18614.00	50 year	2947.00	23.93	35.50		35.54	0.001	3.10	2648.72	760.42	0.19
Reach-1	18614.00	100 year	3722.00	23.93	35.91		35.96	0.001	3.41	2961.74	765.88	0.20
Reach-1	19096.00	2 year	736.00	27.02	33.16	29.72	33.27	0.001	2.59	301.45	83.47	0.21
Reach-1	19096.00	10 year	1730.00	27.02	34.87	31.32	35.14	0.001	4.33	468.70	112.86	0.30
Reach-1	19096.00	25 year	2311.00	27.02	35.41	32.05	35.81	0.002	5.23	532.70	122.25	0.35
Reach-1	19096.00	50 year	2947.00	27.02	35.82	32.72	36.38	0.002	6.21	584.21	129.31	0.40
Reach-1	19096.00	100 year	3722.00	27.02	36.24	33.48	37.00	0.003	7.30	640.35	138.25	0.46
Reach-1	19365.00		Culvert									
Reach-1	19396.00	2 year	736.00	27.56	33.43	30.77	33.59	0.002	3.30	225.53	63.20	0.29
Reach-1	19396.00	10 year	1730.00	27.56	35.58	32.38	35.95	0.002	4.91	385.90	101.37	0.35
Reach-1	19396.00	25 year	2312.00	27.56	36.51	33.14	36.98	0.002	5.59	459.43	133.89	0.38
Reach-1	19396.00	50 year	2947.00	27.56	37.53	33.91	38.08	0.002	6.08	561.18	217.55	0.39
Reach-1	19396.00	100 year	3722.00	27.56	39.05	34.75	39.61	0.002	6.25	719.61	309.78	0.36
Reach-1	19506.00	2 year	736.00	27.60	33.65		33.73	0.001	2.41	402.13	137.44	0.20
Reach-1	19506.00	10 year	1735.00	27.60	36.00		36.14	0.001	3.39	777.46	181.86	0.23
Reach-1	19506.00	25 year	2313.00	27.60	37.03		37.20	0.001	3.78	974.88	201.33	0.24
Reach-1	19506.00	50 year	2951.00	27.60	38.12		38.32	0.001	4.09	1206.99	225.13	0.24
Reach-1	19506.00	100 year	3721.00	27.60	39.63		39.84	0.001	4.23	1578.64	278.17	0.23
Reach-1	20096.00	2 year	736.00	28.00	34.00		34.04	0.000	1.94	674.29	386.81	0.16
Reach-1	20096.00	10 year	1735.00	28.00	36.38		36.43	0.000	2.16	1755.34	496.91	0.14
Reach-1	20096.00	25 year	2313.00	28.00	37.43		37.47	0.000	2.22	2287.68	518.30	0.14
Reach-1	20096.00	50 year	2951.00	28.00	38.52		38.56	0.000	2.24	2863.86	534.56	0.13
Reach-1	20096.00	100 year	3721.00	28.00	40.01		40.04	0.000	2.17	3671.24	555.01	0.12
Reach-1	20596.00	2 year	709.00	29.93	34.31		34.45	0.002	3.13	302.57	154.31	0.30
Reach-1	20596.00	10 year	1683.00	29.93	36.57		36.74	0.001	3.76	722.66	272.10	0.28
Reach-1	20596.00	25 year	2255.00	29.93	37.58		37.76	0.001	3.95	1031.30	323.00	0.27
Reach-1	20596.00	50 year	2886.00	29.93	38.64		38.82	0.001	4.08	1396.82	375.62	0.26
Reach-1	20596.00	100 year	3638.00	29.93	40.08		40.24	0.001	3.93	2006.36	463.78	0.23
Reach-1	20751.00	2 year	709.00	30.58	34.61		34.77	0.002	3.39	285.56	146.64	0.34
Reach-1	20751.00	10 year	1683.00	30.58	36.79		36.98	0.002	3.99	675.08	268.95	0.31
Reach-1	20751.00	25 year	2255.00	30.58	37.77		37.96	0.001	4.17	948.78	289.80	0.30
Reach-1	20751.00	50 year	2886.00	30.58	38.80		38.99	0.001	4.24	1259.07	309.31	0.28
Reach-1	20751.00	100 year	3638.00	30.58	40.19		40.38	0.001	4.30	1757.38	405.77	0.26
Reach-1	21198.00	2 year	709.00	32.74	36.12	35.26	36.44	0.006	4.67	184.76	284.88	0.53
Reach-1	21198.00	10 year	1683.00	32.74	37.82	36.67	38.21	0.004	5.53	432.65	373.01	0.49
Reach-1	21198.00	25 year	2255.00	32.74	38.64	37.14	39.07	0.004	5.85	555.35	431.13	0.47
Reach-1	21198.00	50 year	2886.00	32.74	39.51	37.60	39.95	0.003	6.00	751.90	619.12	0.45
Reach-1	21198.00	100 year	3638.00	32.74	40.74	38.07	41.12	0.002	5.79	1032.95	714.15	0.39
Reach-1	21303.00		Bridge									
Reach-1	21373.00	2 year	710.00	32.80	37.23	35.32	37.33	0.001	2.77	384.08	348.11	0.26
Reach-1	21373.00	10 year	1685.00	32.80	39.27	36.72	39.41	0.001	3.48	799.45	589.64	0.27
Reach-1	21373.00	25 year	2256.00	32.80	40.25	37.15	40.40	0.001	3.66	1080.14	673.21	0.26
Reach-1	21373.00	50 year	2887.00	32.80	41.22	37.57	41.37	0.001	3.82	1358.28	745.24	0.25
Reach-1	21373.00	100 year	3640.00	32.80	42.36	38.01	42.52	0.001	3.92	1687.69	801.02	0.24
Reach-1	21638.00	2 year	712.00	32.63	37.51		37.53	0.000	1.63	901.97	380.99	0.15
Reach-1	21638.00	10 year	1695.00	32.63	39.56		39.59	0.000	1.91	2019.77	631.70	0.14
Reach-1	21638.00	25 year	2253.00	32.63	40.53		40.56	0.000	1.97	2638.05	647.77	0.13
Reach-1	21638.00	50 year	2884.00	32.63	41.49		41.52	0.000	2.05	3268.00	667.40	0.13
Reach-1	21638.00	100 year	3638.00	32.63	42.63		42.66	0.000	2.15	4057.72	724.94	0.13
Reach-1	22096.00	2 year	690.00	32.71	37.75		37.88	0.001	2.94	309.05	346.94	0.28
Reach-1	22096.00	10 year	1655.00	32.71	39.74		39.82	0.001	2.79	1454.37	656.82	0.21
Reach-1	22096.00	25 year	2205.00	32.71	40.68		40.74	0.001	2.70	2123.70	761.57	0.19
Reach-1	22096.00	50 year	2831.00	32.71	41.62		41.67	0.000	2.59	2858.19	795.71	0.17
Reach-1	22096.00	100 year	3572.00	32.71	42.74		42.78	0.000	2.47	3770.46	836.18	0.15
Reach-1	22383.00	2 year	690.00	32.90	38.10		38.14	0.001	2.01	632.59	326.54	0.18
Reach-1	22383.00	10 year	1655.00	32.90	39.94		40.01	0.001	2.56	1316.65	388.62	0.19
Reach-1	22383.00	25 year	2205.00	32.90	40.84		40.90	0.001	2.73	1670.00	404.17	0.19
Reach-1	22383.00	50 year	2831.00	32.90	41.74		41.82	0.001	2.89	2044.47	420.02	0.19
Reach-1	22383.00	100 year	3572.00	32.90	42.83		42.90	0.000	3.01	2511.92	444.22	0.18

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	22704.00	2 year	690.00	33.39	38.31	35.62	38.42	0.001	2.66	275.03	204.75	0.24
Reach-1	22704.00	10 year	1655.00	33.39	40.13	37.04	40.40	0.002	4.26	432.21	307.24	0.31
Reach-1	22704.00	25 year	2205.00	33.39	40.98	37.71	41.33	0.002	4.89	505.85	344.14	0.33
Reach-1	22704.00	50 year	2831.00	33.39	41.87	38.34	42.22	0.002	5.04	842.11	393.35	0.32
Reach-1	22704.00	100 year	3572.00	33.39	42.93	38.97	43.29	0.001	5.31	1088.51	466.26	0.32
Reach-1	22812.00		Culvert									
Reach-1	22893.00	2 year	699.00	32.81	38.57	34.91	38.64	0.001	2.18	397.76	216.52	0.18
Reach-1	22893.00	10 year	1665.00	32.81	40.98	36.44	41.09	0.001	2.98	838.29	340.29	0.20
Reach-1	22893.00	25 year	2208.00	32.81	42.18	37.11	42.30	0.001	3.20	1063.52	408.08	0.20
Reach-1	22893.00	50 year	2834.00	32.81	43.59	38.01	43.71	0.000	3.21	1593.28	499.57	0.18
Reach-1	22893.00	100 year	3578.00	32.81	45.02	38.69	45.13	0.000	3.24	2079.46	568.71	0.17
Reach-1	22990.00	2 year	704.00	33.30	38.63		38.70	0.001	2.27	500.74	269.45	0.20
Reach-1	22990.00	10 year	1679.00	33.30	41.09		41.16	0.001	2.62	1310.65	436.85	0.18
Reach-1	22990.00	25 year	2323.00	33.30	42.30		42.37	0.000	2.65	1917.80	553.65	0.17
Reach-1	22990.00	50 year	2971.00	33.30	43.71		43.76	0.000	2.41	2765.35	632.87	0.14
Reach-1	22990.00	100 year	3765.00	33.30	45.14		45.18	0.000	2.34	3745.53	767.89	0.13
Reach-1	23596.00	2 year	704.00	33.57	39.10		39.19	0.001	2.49	402.13	218.79	0.22
Reach-1	23596.00	10 year	1679.00	33.57	41.42		41.53	0.001	3.03	1002.42	314.88	0.21
Reach-1	23596.00	25 year	2323.00	33.57	42.57		42.68	0.001	3.12	1473.54	463.91	0.20
Reach-1	23596.00	50 year	2971.00	33.57	43.90		43.97	0.000	2.86	2151.77	563.37	0.17
Reach-1	23596.00	100 year	3765.00	33.57	45.28		45.34	0.000	2.64	2989.72	635.57	0.15
Reach-1	24096.00	2 year	641.00	34.72	39.60		39.75	0.001	3.30	294.71	258.53	0.27
Reach-1	24096.00	10 year	1567.00	34.72	41.82		41.94	0.001	3.50	1062.10	384.72	0.23
Reach-1	24096.00	25 year	2177.00	34.72	42.91		43.01	0.001	3.49	1520.98	467.90	0.22
Reach-1	24096.00	50 year	2799.00	34.72	44.13		44.20	0.001	3.18	2137.35	535.75	0.19
Reach-1	24096.00	100 year	3559.00	34.72	45.44		45.50	0.000	2.94	2910.03	660.19	0.16
Reach-1	24596.00	2 year	641.00	35.80	40.21		40.27	0.001	2.31	619.76	424.64	0.20
Reach-1	24596.00	10 year	1567.00	35.80	42.22		42.25	0.000	2.26	1552.95	495.61	0.16
Reach-1	24596.00	25 year	2177.00	35.80	43.26		43.29	0.000	2.43	2144.99	668.90	0.16
Reach-1	24596.00	50 year	2799.00	35.80	44.37		44.40	0.000	2.27	2938.51	734.44	0.14
Reach-1	24596.00	100 year	3559.00	35.80	45.62		45.64	0.000	2.14	3884.13	779.04	0.12
Reach-1	25096.00	2 year	641.00	36.20	40.62		40.70	0.001	2.63	605.18	488.88	0.22
Reach-1	25096.00	10 year	1567.00	36.20	42.46		42.51	0.001	2.67	1541.20	527.99	0.19
Reach-1	25096.00	25 year	2177.00	36.20	43.48		43.52	0.001	2.70	2116.64	622.17	0.18
Reach-1	25096.00	50 year	2799.00	36.20	44.53		44.57	0.000	2.55	2800.53	665.99	0.16
Reach-1	25096.00	100 year	3559.00	36.20	45.74		45.77	0.000	2.42	3626.53	701.91	0.14
Reach-1	25462.00	2 year	641.00	36.52	41.07	39.07	41.33	0.003	4.10	170.74	96.09	0.36
Reach-1	25462.00	10 year	1567.00	36.52	42.62	40.85	43.34	0.005	7.00	260.28	208.59	0.52
Reach-1	25462.00	25 year	2177.00	36.52	43.44	41.79	44.45	0.006	8.34	308.30	272.13	0.58
Reach-1	25462.00	50 year	2799.00	36.52	44.28	42.56	45.53	0.006	9.34	357.55	395.28	0.61
Reach-1	25462.00	100 year	3559.00	36.52	45.84	43.40	46.07	0.001	5.18	1263.43	603.78	0.31
Reach-1	25570.00		Culvert									
Reach-1	25660.00	2 year	669.00	37.51	41.21	39.84	41.57	0.004	4.92	161.79	84.57	0.46
Reach-1	25660.00	10 year	1622.00	37.51	43.81	41.71	44.14	0.002	5.29	552.98	257.67	0.38
Reach-1	25660.00	25 year	2234.00	37.51	45.43	42.74	45.68	0.002	4.88	868.08	522.89	0.31
Reach-1	25660.00	50 year	2858.00	37.51	46.90	43.34	47.11	0.001	4.74	1152.53	658.55	0.28
Reach-1	25660.00	100 year	3611.00	37.51	48.14	43.94	48.20	0.000	3.14	2608.18	930.13	0.17
Reach-1	25735.00	2 year	670.00	37.20	41.66		41.83	0.002	3.48	349.95	317.96	0.30
Reach-1	25735.00	10 year	1666.00	37.20	44.24		44.31	0.001	2.99	1368.90	422.26	0.20
Reach-1	25735.00	25 year	2455.00	37.20	45.73		45.80	0.001	2.97	2018.26	444.34	0.18
Reach-1	25735.00	50 year	3188.00	37.20	47.15		47.21	0.000	2.90	2663.59	465.24	0.16
Reach-1	25735.00	100 year	4045.00	37.20	48.19		48.24	0.000	2.98	3419.88	1024.29	0.16
Reach-1	26096.00	2 year	670.00	37.70	42.19		42.22	0.001	2.24	755.01	340.89	0.20
Reach-1	26096.00	10 year	1666.00	37.70	44.48		44.52	0.000	2.56	1682.49	434.76	0.18
Reach-1	26096.00	25 year	2455.00	37.70	45.93		45.97	0.000	2.72	2323.21	459.74	0.17
Reach-1	26096.00	50 year	3188.00	37.70	47.31		47.35	0.000	2.82	3030.91	622.07	0.16
Reach-1	26096.00	100 year	4045.00	37.70	48.33		48.37	0.000	2.87	3797.54	862.39	0.16
Reach-1	26596.00	2 year	341.00	38.20	42.46		42.47	0.000	1.38	531.85	275.40	0.13
Reach-1	26596.00	10 year	901.00	38.20	44.68		44.70	0.000	1.57	1307.30	403.23	0.11
Reach-1	26596.00	25 year	1406.00	38.20	46.10		46.12	0.000	1.67	1921.86	462.29	0.11
Reach-1	26596.00	50 year	1891.00	38.20	47.46		47.47	0.000	1.69	2586.67	518.65	0.10
Reach-1	26596.00	100 year	2315.00	38.20	48.47		48.48	0.000	1.70	3126.08	550.13	0.10
Reach-1	27096.00	2 year	341.00	38.50	42.64		42.66	0.000	1.62	510.26	331.12	0.15
Reach-1	27096.00	10 year	901.00	38.50	44.80		44.81	0.000	1.65	1330.23	427.72	0.12
Reach-1	27096.00	25 year	1406.00	38.50	46.20		46.21	0.000	1.72	1957.74	467.76	0.11
Reach-1	27096.00	50 year	1891.00	38.50	47.53		47.55	0.000	1.72	2608.69	505.96	0.10
Reach-1	27096.00	100 year	2315.00	38.50	48.53		48.55	0.000	1.75	3127.53	534.46	0.10

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	27712.00	2 year	295.00	39.40	43.07		43.14	0.002	2.89	265.47	237.62	0.29
Reach-1	27712.00	10 year	808.00	39.40	45.01		45.04	0.001	2.43	875.51	359.09	0.19
Reach-1	27712.00	25 year	1257.00	39.40	46.36		46.39	0.000	2.32	1412.74	471.19	0.16
Reach-1	27712.00	50 year	1685.00	39.40	47.65		47.67	0.000	1.97	2156.50	622.38	0.13
Reach-1	27712.00	100 year	2046.00	39.40	48.63		48.64	0.000	1.75	2784.10	662.92	0.11
Reach-1	28096.00	2 year	295.00	40.57	44.17	43.56	44.64	0.010	5.95	94.45	161.73	0.63
Reach-1	28096.00	10 year	808.00	40.57	45.46		45.61	0.004	4.75	515.74	396.71	0.43
Reach-1	28096.00	25 year	1257.00	40.57	46.64		46.70	0.002	3.57	1008.65	443.86	0.28
Reach-1	28096.00	50 year	1685.00	40.57	47.80		47.84	0.001	2.98	1551.13	482.74	0.21
Reach-1	28096.00	100 year	2046.00	40.57	48.73		48.76	0.001	2.72	2011.01	509.42	0.18
Reach-1	28320.00	2 year	295.00	40.42	45.04		45.06	0.001	1.72	513.42	405.38	0.16
Reach-1	28320.00	10 year	808.00	40.42	45.99		46.02	0.001	2.51	919.54	450.05	0.21
Reach-1	28320.00	25 year	1257.00	40.42	46.92		46.95	0.001	2.54	1361.45	490.96	0.20
Reach-1	28320.00	50 year	1685.00	40.42	47.97		47.99	0.001	2.35	1889.67	514.25	0.16
Reach-1	28320.00	100 year	2046.00	40.42	48.85		48.87	0.000	2.23	2349.35	529.58	0.15
Reach-1	28576.00	2 year	295.00	40.70	45.25		45.32	0.002	2.79	323.13	368.93	0.26
Reach-1	28576.00	10 year	808.00	40.70	46.29		46.36	0.002	3.36	729.04	408.17	0.28
Reach-1	28576.00	25 year	1257.00	40.70	47.16		47.21	0.001	3.33	1094.64	436.52	0.25
Reach-1	28576.00	50 year	1685.00	40.70	48.13		48.17	0.001	3.08	1533.57	466.65	0.21
Reach-1	28576.00	100 year	2046.00	40.70	48.97		49.00	0.001	2.90	1937.24	492.74	0.19
Reach-1	29096.00	2 year	295.00	40.50	45.45		45.46	0.000	0.84	863.92	354.19	0.07
Reach-1	29096.00	10 year	808.00	40.50	46.60		46.62	0.000	1.53	1281.71	373.67	0.12
Reach-1	29096.00	25 year	1257.00	40.50	47.47		47.49	0.000	1.88	1611.60	388.36	0.13
Reach-1	29096.00	50 year	1685.00	40.50	48.39		48.41	0.000	2.05	1975.97	403.96	0.14
Reach-1	29096.00	100 year	2046.00	40.50	49.19		49.21	0.000	2.14	2304.68	417.54	0.14
Reach-1	29540.00	2 year	295.00	41.90	45.48		45.61	0.002	2.88	102.52	31.78	0.28
Reach-1	29540.00	10 year	808.00	41.90	46.52		47.06	0.006	5.91	136.74	34.40	0.52
Reach-1	29540.00	25 year	1257.00	41.90	47.21	45.92	48.12	0.009	7.68	185.00	163.93	0.66
Reach-1	29540.00	50 year	1685.00	41.90	48.43		48.86	0.005	5.97	593.21	407.60	0.49
Reach-1	29540.00	100 year	2046.00	41.90	49.31		49.54	0.003	4.87	980.26	473.63	0.37
Reach-1	29791.00	2 year	295.00	42.61	45.97	44.21	46.11	0.002	3.00	98.41	33.42	0.31
Reach-1	29791.00	10 year	808.00	42.61	47.92	45.63	48.25	0.004	4.63	174.38	45.70	0.42
Reach-1	29791.00	25 year	1257.00	42.61	49.14	46.64	49.59	0.003	5.44	238.20	60.73	0.43
Reach-1	29791.00	50 year	1685.00	42.61	49.49	47.49	50.20	0.005	6.77	260.29	69.43	0.52
Reach-1	29791.00	100 year	2046.00	42.61	49.88	48.08	50.78	0.006	7.63	284.66	78.85	0.56
Reach-1	29893.00		Culvert									
Reach-1	29957.00	2 year	303.00	42.45	46.46	44.06	46.56	0.001	2.58	117.48	33.58	0.24
Reach-1	29957.00	10 year	825.00	42.45	49.42	45.53	49.60	0.001	3.41	247.26	57.52	0.26
Reach-1	29957.00	25 year	1295.00	42.45	51.64	46.55	51.84	0.001	3.63	412.33	281.99	0.23
Reach-1	29957.00	50 year	1737.00	42.45	53.48	47.49	53.68	0.001	3.74	569.14	407.28	0.22
Reach-1	29957.00	100 year	2054.00	42.45	55.16	48.06	55.35	0.001	3.63	711.81	553.08	0.19
Reach-1	30096.00	2 year	164.00	42.60	46.64		46.74	0.001	2.60	89.44	89.99	0.25
Reach-1	30096.00	10 year	544.00	42.60	49.72		49.73	0.000	1.43	1172.93	438.64	0.10
Reach-1	30096.00	25 year	923.00	42.60	51.93		51.93	0.000	1.19	2428.00	644.74	0.07
Reach-1	30096.00	50 year	1277.00	42.60	53.76		53.77	0.000	1.06	3647.18	682.68	0.06
Reach-1	30096.00	100 year	1577.00	42.60	55.41		55.42	0.000	0.95	4796.41	700.00	0.05
Reach-1	30467.00	2 year	164.00	42.80	47.12		47.21	0.001	2.53	89.79	112.83	0.24
Reach-1	30467.00	10 year	544.00	42.80	49.79		49.84	0.001	2.50	572.60	235.23	0.18
Reach-1	30467.00	25 year	923.00	42.80	51.96		51.99	0.000	2.19	1164.26	307.99	0.13
Reach-1	30467.00	50 year	1277.00	42.80	53.78		53.80	0.000	2.03	1825.78	395.00	0.11
Reach-1	30467.00	100 year	1577.00	42.80	55.43		55.44	0.000	1.75	2531.45	475.90	0.09
Reach-1	30960.00	2 year	164.00	43.11	47.79		47.91	0.002	2.72	60.23	16.52	0.25
Reach-1	30960.00	10 year	544.00	43.11	50.16		50.31	0.002	3.77	338.37	213.45	0.27
Reach-1	30960.00	25 year	923.00	43.11	52.14		52.21	0.001	3.01	842.41	301.52	0.19
Reach-1	30960.00	50 year	1277.00	43.11	53.90		53.94	0.000	2.57	1454.17	404.87	0.15
Reach-1	30960.00	100 year	1577.00	43.11	55.50		55.52	0.000	2.05	2179.71	468.49	0.11
Reach-1	31511.00	2 year	164.00	43.55	48.59		48.68	0.001	2.48	66.18	17.05	0.22
Reach-1	31511.00	10 year	544.00	43.55	50.90		50.98	0.001	2.87	511.64	299.17	0.20
Reach-1	31511.00	25 year	923.00	43.55	52.50		52.54	0.000	2.49	1128.92	475.81	0.16
Reach-1	31511.00	50 year	1277.00	43.55	54.09		54.11	0.000	1.94	1958.71	562.20	0.11
Reach-1	31511.00	100 year	1577.00	43.55	55.60		55.61	0.000	1.60	2840.67	602.59	0.09
Reach-1	31977.00	2 year	164.00	46.91	49.62		49.99	0.009	4.88	33.61	16.12	0.60
Reach-1	31977.00	10 year	544.00	46.91	51.16	50.82	52.44	0.016	9.09	60.17	17.87	0.86
Reach-1	31977.00	25 year	923.00	46.91	52.76	52.76	53.43	0.007	7.70	315.11	285.64	0.60
Reach-1	31977.00	50 year	1277.00	46.91	54.23		54.40	0.002	4.90	790.06	344.17	0.34
Reach-1	31977.00	100 year	1577.00	46.91	55.68		55.75	0.001	3.57	1370.62	428.53	0.22
Reach-1	32350.00	2 year	164.00	47.01	51.13		51.24	0.002	2.61	81.72	113.07	0.27
Reach-1	32350.00	10 year	544.00	47.01	53.28		53.32	0.001	2.34	643.50	375.43	0.19
Reach-1	32350.00	25 year	923.00	47.01	54.10		54.15	0.001	2.67	970.18	414.54	0.20
Reach-1	32350.00	50 year	1277.00	47.01	54.79		54.84	0.001	2.81	1267.52	444.62	0.20
Reach-1	32350.00	100 year	1577.00	47.01	55.94		55.97	0.000	2.47	1819.40	530.43	0.16

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	32724.00	2 year	164.00	47.24	51.72		51.80	0.001	2.48	127.11	173.67	0.23
Reach-1	32724.00	10 year	544.00	47.24	53.58		53.62	0.001	2.55	550.75	267.52	0.20
Reach-1	32724.00	25 year	923.00	47.24	54.42		54.48	0.001	3.02	787.93	293.77	0.22
Reach-1	32724.00	50 year	1277.00	47.24	55.11		55.17	0.001	3.31	997.29	317.63	0.23
Reach-1	32724.00	100 year	1577.00	47.24	56.14		56.19	0.001	3.04	1344.58	351.24	0.19
Reach-1	32869.00	2 year	164.00	47.75	51.93		52.05	0.002	2.87	96.74	175.62	0.28
Reach-1	32869.00	10 year	544.00	47.75	53.71		53.77	0.001	2.70	526.88	262.76	0.22
Reach-1	32869.00	25 year	923.00	47.75	54.58		54.64	0.001	3.09	761.29	279.35	0.23
Reach-1	32869.00	50 year	1277.00	47.75	55.27		55.33	0.001	3.35	958.99	292.91	0.23
Reach-1	32869.00	100 year	1577.00	47.75	56.26		56.31	0.001	3.09	1255.47	308.14	0.20
Reach-1	33371.00	2 year	116.00	47.87	52.63		52.69	0.001	1.88	61.53	17.35	0.17
Reach-1	33371.00	10 year	423.00	47.87	54.25		54.34	0.001	2.95	365.13	256.93	0.23
Reach-1	33371.00	25 year	698.00	47.87	55.12		55.20	0.001	3.11	606.69	290.60	0.22
Reach-1	33371.00	50 year	955.00	47.87	55.80		55.87	0.001	3.18	806.71	301.58	0.22
Reach-1	33371.00	100 year	1135.00	47.87	56.63		56.67	0.001	2.82	1061.17	313.27	0.18
Reach-1	33851.00	2 year	116.00	49.12	53.09		53.18	0.001	2.37	48.85	15.46	0.23
Reach-1	33851.00	10 year	423.00	49.12	54.99		55.20	0.003	4.18	213.73	202.45	0.34
Reach-1	33851.00	25 year	698.00	49.12	55.79		55.98	0.003	4.45	401.25	262.75	0.33
Reach-1	33851.00	50 year	955.00	49.12	56.41		56.57	0.002	4.48	571.53	285.86	0.32
Reach-1	33851.00	100 year	1135.00	49.12	57.05		57.16	0.002	4.07	758.81	303.83	0.28
Reach-1	34229.00	2 year	116.00	50.64	53.93		54.37	0.009	5.36	24.33	14.42	0.60
Reach-1	34229.00	10 year	423.00	50.64	56.18		56.43	0.004	5.48	248.89	198.73	0.44
Reach-1	34229.00	25 year	698.00	50.64	56.89		57.10	0.003	5.73	394.65	211.14	0.43
Reach-1	34229.00	50 year	955.00	50.64	57.40		57.60	0.003	6.02	506.01	220.16	0.43
Reach-1	34229.00	100 year	1135.00	50.64	57.81		57.99	0.003	5.98	597.27	227.28	0.42
Reach-1	34653.00	2 year	116.00	51.50	55.85		56.01	0.002	3.37	52.44	34.75	0.32
Reach-1	34653.00	10 year	423.00	51.50	57.54		57.71	0.002	4.67	331.61	283.60	0.36
Reach-1	34653.00	25 year	698.00	51.50	58.15		58.30	0.002	4.97	510.58	298.70	0.36
Reach-1	34653.00	50 year	955.00	51.50	58.64		58.77	0.002	5.13	659.62	309.86	0.36
Reach-1	34653.00	100 year	1135.00	51.50	58.96		59.09	0.002	5.20	759.88	317.21	0.36
Reach-1	35029.00	2 year	116.00	52.36	56.52		56.56	0.001	2.27	134.04	112.51	0.22
Reach-1	35029.00	10 year	423.00	52.36	58.25		58.30	0.001	3.06	451.37	239.48	0.24
Reach-1	35029.00	25 year	698.00	52.36	58.89		58.96	0.001	3.66	610.73	259.35	0.27
Reach-1	35029.00	50 year	955.00	52.36	59.38		59.46	0.001	4.08	741.93	274.64	0.29
Reach-1	35029.00	100 year	1135.00	52.36	59.70		59.77	0.002	4.31	828.97	284.33	0.30
Reach-1	35433.00	2 year	116.00	52.37	56.92		56.99	0.001	2.44	122.32	119.21	0.22
Reach-1	35433.00	10 year	423.00	52.37	58.68		58.75	0.001	3.27	412.62	220.90	0.25
Reach-1	35433.00	25 year	698.00	52.37	59.42		59.50	0.001	3.88	591.19	265.54	0.27
Reach-1	35433.00	50 year	955.00	52.37	59.96		60.04	0.001	4.25	742.32	290.15	0.29
Reach-1	35433.00	100 year	1135.00	52.37	60.29		60.38	0.001	4.42	839.89	299.55	0.29
Reach-1	35806.00	2 year	116.00	52.98	57.39		57.57	0.002	3.49	41.15	15.64	0.32
Reach-1	35806.00	10 year	423.00	52.98	59.18		59.53	0.004	5.93	203.89	190.33	0.45
Reach-1	35806.00	25 year	698.00	52.98	60.01		60.28	0.003	5.99	384.41	228.62	0.42
Reach-1	35806.00	50 year	955.00	52.98	60.59		60.83	0.003	6.14	521.37	245.40	0.41
Reach-1	35806.00	100 year	1135.00	52.98	60.93		61.16	0.003	6.28	606.00	255.09	0.41
Reach-1	36428.00	2 year	116.00	53.28	58.25		58.30	0.001	2.15	126.85	87.84	0.19
Reach-1	36428.00	10 year	423.00	53.28	60.46		60.53	0.001	3.15	384.28	179.71	0.22
Reach-1	36428.00	25 year	698.00	53.28	61.29		61.38	0.001	3.93	555.34	220.49	0.26
Reach-1	36428.00	50 year	955.00	53.28	61.89		61.99	0.001	4.42	693.45	250.99	0.28
Reach-1	36428.00	100 year	1135.00	53.28	62.24		62.36	0.001	4.72	788.16	276.84	0.29
Reach-1	37026.00	2 year	116.00	53.42	58.60		58.64	0.000	1.51	84.81	38.00	0.15
Reach-1	37026.00	10 year	423.00	53.42	60.93		61.04	0.001	2.90	211.49	72.93	0.22
Reach-1	37026.00	25 year	698.00	53.42	61.90		62.09	0.001	3.81	361.21	241.97	0.26
Reach-1	37026.00	50 year	955.00	53.42	62.57		62.78	0.001	4.26	533.63	285.75	0.28
Reach-1	37026.00	100 year	1135.00	53.42	62.96		63.17	0.001	4.41	647.59	297.29	0.28
Reach-1	37629.00	2 year	116.00	54.33	58.95		59.00	0.001	1.80	66.86	28.88	0.19
Reach-1	37629.00	10 year	423.00	54.33	61.47		61.63	0.001	3.26	165.13	67.21	0.25
Reach-1	37629.00	25 year	698.00	54.33	62.62		62.84	0.001	4.09	280.46	137.30	0.28
Reach-1	37629.00	50 year	955.00	54.33	63.35		63.62	0.002	4.67	415.71	227.02	0.31
Reach-1	37629.00	100 year	1135.00	54.33	63.74		64.03	0.002	4.91	506.41	234.33	0.32
Reach-1	37781.00	2 year	116.00	55.55	59.13	57.85	59.26	0.003	2.81	41.23	22.35	0.36
Reach-1	37781.00	10 year	423.00	55.55	61.67	59.59	61.86	0.002	3.62	138.95	46.05	0.32
Reach-1	37781.00	25 year	698.00	55.55	62.85	60.51	63.12	0.002	4.44	195.27	49.92	0.34
Reach-1	37781.00	50 year	955.00	55.55	63.58	61.09	63.99	0.003	5.46	235.51	133.80	0.39
Reach-1	37781.00	100 year	1135.00	55.55	63.96	61.46	64.45	0.003	5.97	268.25	179.58	0.42
Reach-1	37906.00		Culvert									
Reach-1	37950.00	2 year	125.00	55.91	59.23	58.03	59.36	0.004	2.91	42.81	23.43	0.38
Reach-1	37950.00	10 year	455.00	55.91	62.56	59.80	62.69	0.001	3.07	183.51	49.31	0.24
Reach-1	37950.00	25 year	748.00	55.91	64.89	60.61	65.02	0.001	3.14	345.37	206.75	0.21
Reach-1	37950.00	50 year	1019.00	55.91	67.43	61.20	67.52	0.000	2.79	551.28	262.35	0.16
Reach-1	37950.00	100 year	1139.00	55.91	68.80	61.44	68.87	0.000	2.60	666.57	269.08	0.14

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	38205.00	2 year	49.00	57.08	60.06		60.11	0.002	1.78	27.34	19.15	0.25
Reach-1	38205.00	10 year	183.00	57.08	62.87		62.91	0.000	1.74	148.44	63.14	0.16
Reach-1	38205.00	25 year	304.00	57.08	65.13		65.15	0.000	1.49	351.15	129.84	0.11
Reach-1	38205.00	50 year	421.00	57.08	67.57		67.58	0.000	1.05	838.61	283.21	0.06
Reach-1	38205.00	100 year	558.00	57.08	68.91		68.92	0.000	0.95	1358.61	465.35	0.05
Reach-1	38564.00	2 year	49.00	57.32	60.50		60.52	0.001	1.28	38.60	28.96	0.18
Reach-1	38564.00	10 year	183.00	57.32	63.03		63.07	0.000	1.71	139.58	51.15	0.15
Reach-1	38564.00	25 year	304.00	57.32	65.19		65.23	0.000	1.70	294.58	97.89	0.12
Reach-1	38564.00	50 year	421.00	57.32	67.59		67.62	0.000	1.45	579.72	143.26	0.09
Reach-1	38564.00	100 year	558.00	57.32	68.92		68.95	0.000	1.57	815.06	208.77	0.09
Reach-1	39079.00	2 year	49.00	57.80	60.87	58.86	60.90	0.001	1.35	36.03	15.95	0.16
Reach-1	39079.00	10 year	183.00	57.80	63.29	60.08	63.35	0.001	2.11	113.41	42.73	0.18
Reach-1	39079.00	25 year	304.00	57.80	65.34	60.86	65.40	0.000	2.15	208.72	49.80	0.15
Reach-1	39079.00	50 year	421.00	57.80	67.66	61.48	67.71	0.000	2.07	369.17	104.77	0.12
Reach-1	39079.00	100 year	558.00	57.80	68.98	62.20	69.04	0.000	2.17	530.81	135.31	0.12
Reach-1	39582.00	2 year	49.00	59.93	61.60	61.59	62.03	0.033	5.23	9.27	10.89	1.00
Reach-1	39582.00	10 year	183.00	59.93	63.89		64.07	0.004	3.43	54.66	27.21	0.40
Reach-1	39582.00	25 year	304.00	59.93	65.64		65.79	0.001	3.13	108.99	34.80	0.28
Reach-1	39582.00	50 year	421.00	59.93	67.81		67.92	0.001	2.68	202.13	52.75	0.19
Reach-1	39582.00	100 year	558.00	59.93	69.11		69.23	0.001	2.82	278.68	64.94	0.18
Reach-1	40149.00	2 year	49.00	63.69	65.93		66.02	0.003	2.42	20.06	11.39	0.32
Reach-1	40149.00	10 year	183.00	63.69	67.00		67.45	0.010	5.36	35.39	19.94	0.63
Reach-1	40149.00	25 year	304.00	63.69	67.17	67.17	68.22	0.023	8.26	38.87	22.00	0.96
Reach-1	40149.00	50 year	421.00	63.69	68.20		69.05	0.012	7.54	64.51	26.79	0.73
Reach-1	40149.00	100 year	558.00	63.69	69.42		70.12	0.007	6.98	100.94	34.23	0.58

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Greens Mill Run - Future Conditions												
Reach-1	1000.00	2 year	1474.00	0.40	5.72	4.11	5.75	0.001	2.29	1904.00	1062.12	0.19
Reach-1	1000.00	10 year	2987.00	0.40	6.90	4.65	6.93	0.001	2.60	3305.42	1279.04	0.20
Reach-1	1000.00	25 year	4228.00	0.40	7.56	4.97	7.59	0.001	2.80	4158.18	1289.99	0.20
Reach-1	1000.00	50 year	5383.00	0.40	8.11	5.30	8.14	0.001	2.97	4863.43	1298.98	0.20
Reach-1	1000.00	100 year	6331.00	0.40	8.52	5.48	8.55	0.001	3.09	5397.30	1305.74	0.20
Reach-1	1500.00	2 year	1474.00	0.50	6.27		6.35	0.002	3.47	1138.45	559.07	0.28
Reach-1	1500.00	10 year	2987.00	0.50	7.46		7.56	0.002	4.17	1858.75	704.25	0.30
Reach-1	1500.00	25 year	4228.00	0.50	8.15		8.27	0.002	4.94	2392.48	783.25	0.34
Reach-1	1500.00	50 year	5383.00	0.50	8.69		8.82	0.002	5.19	2818.69	789.40	0.34
Reach-1	1500.00	100 year	6331.00	0.50	9.10		9.23	0.002	5.38	3141.16	793.74	0.35
Reach-1	1890.00	2 year	1474.00	0.64	6.82		6.91	0.001	3.38	1053.65	501.71	0.25
Reach-1	1890.00	10 year	2987.00	0.64	8.09		8.21	0.002	4.26	1715.23	529.47	0.29
Reach-1	1890.00	25 year	4228.00	0.64	8.87		9.02	0.002	4.78	2136.01	537.26	0.31
Reach-1	1890.00	50 year	5383.00	0.64	9.44		9.61	0.002	5.28	2441.47	542.27	0.33
Reach-1	1890.00	100 year	6331.00	0.64	9.86		10.05	0.002	5.63	2670.93	546.01	0.34
Reach-1	2381.00	2 year	1480.00	0.98	7.62		8.11	0.004	6.15	437.66	252.73	0.45
Reach-1	2381.00	10 year	3004.00	0.98	9.03		9.66	0.005	7.81	826.66	289.53	0.52
Reach-1	2381.00	25 year	4257.00	0.98	9.89		10.60	0.005	8.73	1082.93	305.59	0.55
Reach-1	2381.00	50 year	5435.00	0.98	10.54		11.33	0.006	9.47	1286.08	313.31	0.57
Reach-1	2381.00	100 year	6339.00	0.98	11.02		11.85	0.006	9.93	1436.49	318.90	0.58
Reach-1	2950.00	2 year	1480.00	1.26	9.35		9.59	0.002	4.51	1329.04	403.56	0.30
Reach-1	2950.00	10 year	3004.00	1.26	11.20		11.59	0.002	6.22	2089.87	418.34	0.37
Reach-1	2950.00	25 year	4257.00	1.26	12.28		12.80	0.003	7.33	2547.16	426.97	0.41
Reach-1	2950.00	50 year	5435.00	1.26	13.12		13.75	0.003	8.24	2908.72	434.60	0.44
Reach-1	2950.00	100 year	6339.00	1.26	13.69		14.40	0.003	8.88	3157.57	439.96	0.46
Reach-1	3391.00	2 year	1480.00	1.02	9.93		10.04	0.001	3.06	874.70	264.79	0.20
Reach-1	3391.00	10 year	3004.00	1.02	12.02		12.19	0.001	4.04	1517.40	330.08	0.23
Reach-1	3391.00	25 year	4257.00	1.02	13.27		13.48	0.001	4.59	1938.88	343.06	0.25
Reach-1	3391.00	50 year	5435.00	1.02	14.26		14.49	0.001	5.03	2283.49	353.33	0.26
Reach-1	3391.00	100 year	6339.00	1.02	14.94		15.19	0.001	5.34	2525.48	360.36	0.27
Reach-1	3835.00	2 year	1480.00	0.06	10.19	4.96	10.37	0.001	3.42	527.68	325.42	0.21
Reach-1	3835.00	10 year	3004.00	0.06	12.35	6.81	12.71	0.001	5.14	793.70	409.82	0.28
Reach-1	3835.00	25 year	4257.00	0.06	13.61	8.06	14.13	0.001	6.26	949.89	432.97	0.32
Reach-1	3835.00	50 year	5435.00	0.06	14.59	9.12	15.27	0.002	7.18	1072.01	451.08	0.36
Reach-1	3835.00	100 year	6339.00	0.06	15.26	9.77	16.06	0.002	7.84	1154.91	454.67	0.38
Reach-1	3903.00		Bridge									
Reach-1	4008.00	2 year	1492.00	0.26	10.60	5.06	10.76	0.001	3.28	610.24	358.72	0.20
Reach-1	4008.00	10 year	3033.00	0.26	13.47	6.90	13.69	0.001	4.21	1244.52	429.68	0.22
Reach-1	4008.00	25 year	4301.00	0.26	15.48	8.16	15.72	0.001	4.54	1721.26	455.65	0.22
Reach-1	4008.00	50 year	5508.00	0.26	17.30	9.23	17.54	0.001	4.72	2151.70	465.42	0.21
Reach-1	4008.00	100 year	6376.00	0.26	21.00	9.81	21.15	0.000	3.92	3026.57	485.28	0.16
Reach-1	4137.00	2 year	1490.00	0.48	10.77		10.85	0.000	2.55	1052.05	254.29	0.15
Reach-1	4137.00	10 year	3031.00	0.48	13.69		13.79	0.000	3.20	1943.92	337.83	0.17
Reach-1	4137.00	25 year	4292.00	0.48	15.71		15.82	0.000	3.41	2645.95	355.73	0.16
Reach-1	4137.00	50 year	5499.00	0.48	17.53		17.63	0.000	3.57	3312.74	379.36	0.16
Reach-1	4137.00	100 year	6931.00	0.48	21.12		21.20	0.000	3.23	4765.97	428.83	0.13
Reach-1	4500.00	2 year	1490.00	0.81	10.93		11.07	0.001	3.60	788.02	198.41	0.22
Reach-1	4500.00	10 year	3031.00	0.81	13.85		14.02	0.001	4.40	1470.60	273.51	0.24
Reach-1	4500.00	25 year	4292.00	0.81	15.85		16.02	0.001	4.57	2046.86	300.41	0.22
Reach-1	4500.00	50 year	5499.00	0.81	17.65		17.83	0.001	4.81	2664.28	477.34	0.22
Reach-1	4500.00	100 year	6931.00	0.81	21.21		21.30	0.000	3.83	4637.40	621.47	0.16
Reach-1	5088.00	2 year	1490.00	1.35	11.44		11.51	0.001	2.82	1340.04	444.02	0.18
Reach-1	5088.00	10 year	3031.00	1.35	14.33		14.37	0.000	2.80	2689.94	488.25	0.15
Reach-1	5088.00	25 year	4292.00	1.35	16.27		16.32	0.000	2.84	3661.29	507.21	0.14
Reach-1	5088.00	50 year	5499.00	1.35	18.05		18.09	0.000	2.86	4575.56	522.38	0.13
Reach-1	5088.00	100 year	6931.00	1.35	21.42		21.46	0.000	2.72	6554.96	677.37	0.11
Reach-1	5500.00	2 year	1490.00	3.02	11.73		11.89	0.001	3.84	889.17	402.70	0.26
Reach-1	5500.00	10 year	3031.00	3.02	14.51		14.60	0.001	3.49	2049.85	434.43	0.20
Reach-1	5500.00	25 year	4292.00	3.02	16.42		16.50	0.001	3.43	2925.58	482.76	0.18
Reach-1	5500.00	50 year	5499.00	3.02	18.17		18.24	0.000	3.37	3811.29	528.65	0.16
Reach-1	5500.00	100 year	6931.00	3.02	21.50		21.54	0.000	2.82	5677.96	586.46	0.12
Reach-1	6000.00	2 year	1490.00	3.32	12.45		12.70	0.002	4.65	667.31	301.54	0.31
Reach-1	6000.00	10 year	3031.00	3.32	14.90		15.09	0.001	4.74	1482.72	356.06	0.27
Reach-1	6000.00	25 year	4292.00	3.32	16.72		16.87	0.001	4.65	2145.91	375.80	0.24
Reach-1	6000.00	50 year	5499.00	3.32	18.40		18.54	0.001	4.55	2795.55	394.19	0.22
Reach-1	6000.00	100 year	6931.00	3.32	21.62		21.71	0.000	3.88	4122.64	433.16	0.17

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6500.00	2 year	1490.00	3.91	13.36		13.61	0.002	4.55	738.10	428.42	0.30
Reach-1	6500.00	10 year	3031.00	3.91	15.55		15.70	0.001	4.36	1775.53	485.45	0.25
Reach-1	6500.00	25 year	4292.00	3.91	17.21		17.32	0.001	4.11	2603.83	505.21	0.22
Reach-1	6500.00	50 year	5499.00	3.91	18.80		18.89	0.001	3.88	3413.30	514.94	0.19
Reach-1	6500.00	100 year	6931.00	3.91	21.83		21.89	0.000	3.16	5004.04	534.40	0.14
Reach-1	7000.00	2 year	1475.00	4.42	14.18		14.42	0.002	4.42	649.01	251.51	0.28
Reach-1	7000.00	10 year	2998.00	4.42	16.15		16.44	0.002	5.54	1207.55	308.99	0.32
Reach-1	7000.00	25 year	4237.00	4.42	17.64		17.95	0.002	5.98	1736.68	410.38	0.32
Reach-1	7000.00	50 year	5431.00	4.42	19.12		19.37	0.001	5.76	2374.89	449.13	0.29
Reach-1	7000.00	100 year	6849.00	4.42	21.99		22.13	0.001	4.64	3744.99	510.43	0.21
Reach-1	7471.00	2 year	1475.00	5.10	14.75		14.87	0.001	3.12	952.49	316.30	0.19
Reach-1	7471.00	10 year	2998.00	5.10	16.83		16.98	0.001	4.00	1630.24	337.10	0.22
Reach-1	7471.00	25 year	4237.00	5.10	18.31		18.48	0.001	4.38	2145.26	355.74	0.22
Reach-1	7471.00	50 year	5431.00	5.10	19.66		19.83	0.001	4.59	2633.17	367.91	0.22
Reach-1	7471.00	100 year	6849.00	5.10	22.26		22.39	0.000	4.21	3620.45	391.39	0.18
Reach-1	7885.00	2 year	1476.00	7.49	15.03		15.37	0.002	4.68	330.53	72.37	0.33
Reach-1	7885.00	10 year	3001.00	7.49	17.02		17.73	0.003	6.90	523.09	118.86	0.43
Reach-1	7885.00	25 year	4240.00	7.49	18.39		19.30	0.003	7.99	703.90	143.10	0.46
Reach-1	7885.00	50 year	5436.00	7.49	19.64		20.67	0.003	8.66	891.71	157.41	0.47
Reach-1	7885.00	100 year	6858.00	7.49	22.16		22.99	0.002	8.08	1326.50	193.96	0.39
Reach-1	8019.00	2 year	1476.00	5.86	15.29	10.41	15.64	0.002	4.70	313.84	50.14	0.30
Reach-1	8019.00	10 year	3001.00	5.86	17.41	12.89	18.23	0.004	7.34	430.69	93.03	0.43
Reach-1	8019.00	25 year	4240.00	5.86	18.76	14.52	19.97	0.004	8.91	513.15	109.49	0.49
Reach-1	8019.00	50 year	5436.00	5.86	19.93	15.98	21.48	0.005	10.16	587.74	162.27	0.53
Reach-1	8019.00	100 year	6858.00	5.86	22.81	17.57	23.33	0.002	6.80	1490.05	330.83	0.32
Reach-1	8118.00		Culvert									
Reach-1	8229.00	2 year	1476.00	7.95	14.89	13.17	15.74	0.007	7.43	198.80	39.59	0.58
Reach-1	8229.00	10 year	3001.00	7.95	17.06	15.56	18.50	0.009	9.86	392.20	261.99	0.67
Reach-1	8229.00	25 year	4240.00	7.95	19.56	17.74	20.45	0.004	8.44	803.19	314.79	0.50
Reach-1	8229.00	50 year	5436.00	7.95	21.59	18.67	22.28	0.003	7.80	1190.76	339.36	0.41
Reach-1	8229.00	100 year	6858.00	7.95	24.55	19.52	24.70	0.001	4.40	3024.23	506.72	0.21
Reach-1	8500.00	2 year	1437.00	7.91	16.37		16.58	0.001	3.83	432.65	84.80	0.26
Reach-1	8500.00	10 year	2920.00	7.91	19.22		19.58	0.001	5.12	819.79	167.89	0.29
Reach-1	8500.00	25 year	4117.00	7.91	20.79		21.24	0.001	5.83	1097.37	187.54	0.31
Reach-1	8500.00	50 year	5275.00	7.91	22.41		22.88	0.001	6.15	1434.44	229.28	0.30
Reach-1	8500.00	100 year	6646.00	7.91	24.67		25.04	0.001	5.81	2206.59	466.22	0.26
Reach-1	9000.00	2 year	1437.00	9.13	17.00	13.29	17.27	0.002	4.20	416.50	122.50	0.30
Reach-1	9000.00	10 year	2920.00	9.13	19.90	15.36	20.25	0.001	5.13	867.53	227.25	0.30
Reach-1	9000.00	25 year	4117.00	9.13	21.56	16.90	21.90	0.001	5.35	1286.40	276.23	0.29
Reach-1	9000.00	50 year	5275.00	9.13	23.18	17.84	23.47	0.001	5.16	1772.00	323.01	0.26
Reach-1	9000.00	100 year	6646.00	9.13	25.26	18.87	25.46	0.001	4.69	2748.15	608.40	0.22
Reach-1	9081.00		Bridge									
Reach-1	9101.00	2 year	1437.00	10.36	17.73	14.20	18.05	0.002	4.60	374.42	140.24	0.32
Reach-1	9101.00	10 year	2920.00	10.36	19.99	16.29	20.30	0.002	5.17	1159.74	539.04	0.31
Reach-1	9101.00	25 year	4117.00	10.36	21.77	18.64	21.93	0.001	4.06	2202.73	605.40	0.22
Reach-1	9101.00	50 year	5275.00	10.36	23.61	19.88	23.69	0.000	3.40	3418.02	758.79	0.17
Reach-1	9101.00	100 year	6646.00	10.36	25.55	20.34	25.60	0.000	2.75	4993.23	853.76	0.13
Reach-1	9375.00	2 year	1437.00	10.04	18.25		18.50	0.001	4.06	393.29	102.27	0.28
Reach-1	9375.00	10 year	2920.00	10.04	20.44		20.69	0.001	4.58	949.04	370.02	0.27
Reach-1	9375.00	25 year	4117.00	10.04	21.97		22.14	0.001	4.10	1594.47	491.23	0.23
Reach-1	9375.00	50 year	5275.00	10.04	23.72		23.81	0.000	3.37	2638.31	682.06	0.17
Reach-1	9375.00	100 year	6646.00	10.04	25.61		25.67	0.000	2.74	4068.46	817.23	0.13
Reach-1	9732.00	2 year	1437.00	11.51	18.75	14.87	19.05	0.002	4.36	336.96	61.31	0.29
Reach-1	9732.00	10 year	2920.00	11.51	20.82	16.74	21.51	0.003	6.73	450.62	294.70	0.40
Reach-1	9732.00	25 year	4117.00	11.51	22.26	18.04	22.55	0.001	5.17	1391.71	750.25	0.29
Reach-1	9732.00	50 year	5275.00	11.51	23.88	21.13	23.98	0.000	3.39	2639.98	794.92	0.18
Reach-1	9732.00	100 year	6646.00	11.51	25.70	22.02	25.75	0.000	2.49	4136.98	843.74	0.12
Reach-1	9813.00		Culvert									
Reach-1	9856.00	2 year	1430.00	11.57	19.84	14.96	20.04	0.001	3.59	424.79	108.34	0.23
Reach-1	9856.00	10 year	2923.00	11.57	24.47	16.88	24.53	0.000	2.43	2920.27	811.71	0.12
Reach-1	9856.00	25 year	4106.00	11.57	25.81	18.18	25.85	0.000	2.20	4320.73	843.65	0.11
Reach-1	9856.00	50 year	5267.00	11.57	26.53	19.78	26.58	0.000	2.45	4935.41	860.12	0.12
Reach-1	9856.00	100 year	6658.00	11.57	27.20	20.95	27.25	0.000	2.76	5511.54	875.26	0.13
Reach-1	10000.00	2 year	1430.00	10.11	20.01		20.18	0.001	3.52	709.89	347.12	0.22
Reach-1	10000.00	10 year	2923.00	10.11	24.53		24.56	0.000	1.97	3481.96	1040.39	0.10
Reach-1	10000.00	25 year	4106.00	10.11	25.84		25.87	0.000	1.97	4933.89	1142.56	0.09
Reach-1	10000.00	50 year	5267.00	10.11	26.57		26.60	0.000	2.14	5774.95	1170.25	0.10
Reach-1	10000.00	100 year	6658.00	10.11	27.24		27.28	0.000	2.35	6568.97	1195.81	0.11

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	10529.00	2 year	1430.00	10.94	20.56		20.71	0.001	3.50	493.26	449.59	0.24
Reach-1	10529.00	10 year	2923.00	10.94	24.57		24.59	0.000	0.79	2544.73	581.44	0.04
Reach-1	10529.00	25 year	4106.00	10.94	25.87		25.90	0.000	0.80	3306.89	592.35	0.04
Reach-1	10529.00	50 year	5267.00	10.94	26.60		26.63	0.000	0.89	3739.85	598.46	0.04
Reach-1	10529.00	100 year	6658.00	10.94	27.27		27.32	0.000	0.99	4144.24	604.11	0.05
Reach-1	10806.00	2 year	1430.00	12.36	20.81	17.32	21.37	0.003	6.08	241.37	74.87	0.39
Reach-1	10806.00	10 year	2923.00	12.36	24.52	19.83	24.70	0.001	4.26	1109.94	522.74	0.22
Reach-1	10806.00	25 year	4106.00	12.36	25.85	21.45	25.96	0.000	3.63	1837.67	557.45	0.18
Reach-1	10806.00	50 year	5267.00	12.36	26.58	22.88	26.69	0.000	3.66	2251.12	569.23	0.18
Reach-1	10806.00	100 year	6658.00	12.36	27.26	24.23	27.38	0.000	3.81	2640.04	580.08	0.18
Reach-1	10885.00		Culvert									
Reach-1	10936.00	2 year	1425.00	12.45	21.68	17.00	21.96	0.001	4.42	375.68	165.66	0.27
Reach-1	10936.00	10 year	2915.00	12.45	26.90	19.34	26.93	0.000	1.66	2758.24	662.93	0.08
Reach-1	10936.00	25 year	4091.00	12.45	27.82	21.51	27.84	0.000	1.82	3371.79	710.74	0.08
Reach-1	10936.00	50 year	5248.00	12.45	28.34	22.57	28.38	0.000	2.27	3794.15	866.01	0.10
Reach-1	10936.00	100 year	6635.00	12.45	28.78	23.65	28.83	0.000	2.62	4188.91	959.63	0.12
Reach-1	10970.00		Bridge									
Reach-1	11048.00	2 year	1425.00	13.72	22.28	18.00	22.53	0.001	4.18	454.10	255.44	0.27
Reach-1	11048.00	10 year	2915.00	13.72	26.92	20.37	26.95	0.000	1.58	2811.36	687.14	0.08
Reach-1	11048.00	25 year	4091.00	13.72	27.84	23.02	27.87	0.000	1.76	3467.33	730.13	0.09
Reach-1	11048.00	50 year	5248.00	13.72	28.37	23.57	28.41	0.000	2.00	3860.05	740.95	0.10
Reach-1	11048.00	100 year	6635.00	13.72	28.81	23.95	28.86	0.000	2.31	4187.54	749.86	0.11
Reach-1	11500.00	2 year	1425.00	14.51	22.96		23.45	0.002	6.05	355.81	83.09	0.37
Reach-1	11500.00	10 year	2915.00	14.51	26.73		27.40	0.002	7.51	804.94	212.14	0.38
Reach-1	11500.00	25 year	4091.00	14.51	27.54		28.46	0.003	9.15	1000.94	285.01	0.45
Reach-1	11500.00	50 year	5248.00	14.51	27.95	25.03	29.20	0.004	10.85	1129.33	362.19	0.53
Reach-1	11500.00	100 year	6635.00	14.51	28.21	26.19	29.94	0.006	13.00	1235.12	460.64	0.62
Reach-1	11750.00	2 year	1425.00	15.50	23.58	19.69	23.99	0.002	5.30	322.55	57.20	0.33
Reach-1	11750.00	10 year	2915.00	15.50	27.23	21.96	27.92	0.002	7.02	552.21	93.65	0.37
Reach-1	11750.00	25 year	4091.00	15.50	28.17	23.68	29.28	0.003	8.97	688.12	150.44	0.45
Reach-1	11750.00	50 year	5248.00	15.50	28.76	24.86	30.36	0.004	10.85	809.53	240.54	0.53
Reach-1	11750.00	100 year	6635.00	15.50	29.36	26.39	31.40	0.005	12.53	967.70	289.01	0.60
Reach-1	11812.00		Culvert									
Reach-1	11822.00	2 year	1421.00	14.88	24.78	19.32	25.05	0.001	4.23	381.33	64.08	0.25
Reach-1	11822.00	10 year	2910.00	14.88	29.59	21.61	29.97	0.001	5.26	897.93	303.40	0.25
Reach-1	11822.00	25 year	4078.00	14.88	30.42	23.12	30.88	0.001	6.14	1311.76	370.60	0.28
Reach-1	11822.00	50 year	5231.00	14.88	30.96	24.36	31.53	0.001	7.09	1522.36	403.67	0.32
Reach-1	11822.00	100 year	6615.00	14.88	31.60	25.73	32.25	0.002	7.87	1787.95	430.92	0.35
Reach-1	11890.00	2 year	1421.00	15.80	24.77	21.12	25.25	0.002	5.94	338.71	165.94	0.36
Reach-1	11890.00	10 year	2910.00	15.80	30.00	23.81	30.10	0.000	3.63	1965.00	440.25	0.17
Reach-1	11890.00	25 year	4078.00	15.80	30.92	25.38	31.03	0.001	4.18	2375.16	457.97	0.19
Reach-1	11890.00	50 year	5231.00	15.80	31.58	26.81	31.73	0.001	4.78	2690.96	489.39	0.22
Reach-1	11890.00	100 year	6615.00	15.80	32.30	27.57	32.47	0.001	5.33	3052.75	519.85	0.23
Reach-1	12393.00	2 year	1421.00	16.66	25.48		25.50	0.000	1.66	1878.64	303.46	0.10
Reach-1	12393.00	10 year	2910.00	16.66	30.18		30.20	0.000	1.79	3615.56	444.41	0.09
Reach-1	12393.00	25 year	4078.00	16.66	31.14		31.17	0.000	2.24	4079.12	543.63	0.11
Reach-1	12393.00	50 year	5231.00	16.66	31.87		31.90	0.000	2.61	4482.99	567.76	0.12
Reach-1	12393.00	100 year	6615.00	16.66	32.63		32.68	0.000	2.98	4925.36	583.91	0.13
Reach-1	12805.00	2 year	1421.00	17.20	25.57		25.65	0.001	3.16	992.80	271.90	0.21
Reach-1	12805.00	10 year	2910.00	17.20	30.23		30.28	0.000	2.73	2390.55	326.78	0.14
Reach-1	12805.00	25 year	4078.00	17.20	31.21		31.29	0.000	3.37	2715.71	338.09	0.16
Reach-1	12805.00	50 year	5231.00	17.20	31.95		32.05	0.001	3.96	2967.93	346.82	0.19
Reach-1	12805.00	100 year	6615.00	17.20	32.73		32.86	0.001	4.61	3243.37	358.43	0.21
Reach-1	13066.00	2 year	1420.00	18.12	25.80		25.92	0.001	3.58	929.33	357.37	0.25
Reach-1	13066.00	10 year	2908.00	18.12	30.32		30.36	0.000	2.32	2662.74	406.38	0.12
Reach-1	13066.00	25 year	4068.00	18.12	31.34		31.38	0.000	2.75	3079.68	416.48	0.14
Reach-1	13066.00	50 year	5217.00	18.12	32.11		32.17	0.000	3.17	3406.01	428.79	0.16
Reach-1	13066.00	100 year	6604.00	18.12	32.94		33.01	0.000	3.62	3767.41	446.48	0.17
Reach-1	13604.00	2 year	1420.00	18.99	26.31		26.37	0.001	2.52	1010.87	454.91	0.17
Reach-1	13604.00	10 year	2908.00	18.99	30.42		30.44	0.000	1.35	3157.35	572.63	0.07
Reach-1	13604.00	25 year	4068.00	18.99	31.45		31.48	0.000	1.54	3761.28	594.29	0.08
Reach-1	13604.00	50 year	5217.00	18.99	32.25		32.28	0.000	1.72	4242.26	611.00	0.09
Reach-1	13604.00	100 year	6604.00	18.99	33.11		33.14	0.000	1.93	4774.08	637.85	0.09
Reach-1	14157.00	2 year	1419.00	20.50	26.79	25.49	27.22	0.004	5.91	398.79	516.37	0.45
Reach-1	14157.00	10 year	2912.00	20.50	30.49	27.01	30.51	0.000	1.96	3145.80	677.80	0.11
Reach-1	14157.00	25 year	4058.00	20.50	31.53	27.70	31.56	0.000	2.13	3874.35	719.11	0.12
Reach-1	14157.00	50 year	5206.00	20.50	32.34	27.70	32.37	0.000	2.31	4468.03	751.08	0.12
Reach-1	14157.00	100 year	6601.00	20.50	33.20	27.70	33.24	0.000	2.48	5133.17	785.37	0.13

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	14329.00		Bridge									
Reach-1	14470.00	2 year	1419.00	20.60	28.09	24.89	28.41	0.002	4.85	441.39	152.36	0.33
Reach-1	14470.00	10 year	2912.00	20.60	30.51	27.41	30.86	0.002	5.67	1007.89	360.78	0.33
Reach-1	14470.00	25 year	4058.00	20.60	31.54	28.62	31.85	0.002	5.84	1435.51	475.47	0.32
Reach-1	14470.00	50 year	5206.00	20.60	32.38	30.03	32.65	0.002	5.78	1875.93	569.95	0.31
Reach-1	14470.00	100 year	6601.00	20.60	33.28	30.90	33.51	0.001	5.58	2437.72	673.02	0.29
Reach-1	14671.00	2 year	1419.00	20.76	28.58		28.71	0.001	3.33	789.73	222.88	0.22
Reach-1	14671.00	10 year	2912.00	20.76	31.01		31.14	0.001	3.86	1577.63	432.12	0.22
Reach-1	14671.00	25 year	4058.00	20.76	31.96		32.11	0.001	4.26	2038.02	529.93	0.23
Reach-1	14671.00	50 year	5206.00	20.76	32.73		32.88	0.001	4.53	2473.55	611.19	0.24
Reach-1	14671.00	100 year	6601.00	20.76	33.55		33.71	0.001	4.70	3016.99	696.55	0.24
Reach-1	14807.00	2 year	1419.00	21.04	28.68	25.47	28.84	0.001	3.66	601.55	272.81	0.25
Reach-1	14807.00	10 year	2912.00	21.04	31.07	26.92	31.32	0.001	4.81	1121.95	580.99	0.28
Reach-1	14807.00	25 year	4058.00	21.04	32.01	27.77	32.34	0.001	5.74	1345.34	621.05	0.32
Reach-1	14807.00	50 year	5206.00	21.04	32.74	28.52	33.17	0.002	6.59	1520.74	643.65	0.35
Reach-1	14807.00	100 year	6601.00	21.04	33.52	29.76	34.06	0.002	7.51	1706.15	656.67	0.39
Reach-1	14903.00		Bridge									
Reach-1	14968.00	2 year	1419.00	20.40	29.98	26.43	30.04	0.001	2.70	1061.08	480.88	0.19
Reach-1	14968.00	10 year	2914.00	20.40	32.73	27.51	32.79	0.001	2.98	2056.17	643.94	0.18
Reach-1	14968.00	25 year	4058.00	20.40	34.36	28.05	34.43	0.000	3.17	2650.19	676.98	0.17
Reach-1	14968.00	50 year	5206.00	20.40	35.74	28.71	35.81	0.000	3.38	3149.61	685.76	0.17
Reach-1	14968.00	100 year	6603.00	20.40	37.23	29.41	37.31	0.000	3.61	3691.42	718.72	0.17
Reach-1	15023.00	2 year	1418.00	21.14	29.91	25.93	30.24	0.002	4.81	418.58	682.15	0.32
Reach-1	15023.00	10 year	2929.00	21.14	32.79	29.15	32.82	0.000	2.52	3393.30	817.46	0.14
Reach-1	15023.00	25 year	4117.00	21.14	34.43	30.50	34.46	0.000	2.42	4752.55	837.35	0.12
Reach-1	15023.00	50 year	5265.00	21.14	35.81	30.50	35.84	0.000	2.41	5929.31	864.37	0.12
Reach-1	15023.00	100 year	6642.00	21.14	37.32	30.62	37.34	0.000	2.43	7248.77	893.38	0.11
Reach-1	15236.00		Culvert									
Reach-1	15308.00	2 year	1413.00	19.00	30.38	23.69	30.47	0.000	2.76	867.31	687.92	0.15
Reach-1	15308.00	10 year	2912.00	19.00	32.86	26.04	32.89	0.000	2.16	3745.74	817.76	0.11
Reach-1	15308.00	25 year	4093.00	19.00	34.45	28.14	34.48	0.000	2.13	5057.90	836.77	0.10
Reach-1	15308.00	50 year	5235.00	19.00	35.84	29.03	35.86	0.000	2.12	6236.80	863.85	0.10
Reach-1	15308.00	100 year	6604.00	19.00	37.35	29.90	37.38	0.000	2.13	7567.12	893.12	0.09
Reach-1	15393.00	2 year	1413.00	21.18	30.50		30.52	0.000	2.03	1703.89	688.11	0.13
Reach-1	15393.00	10 year	2912.00	21.18	32.90		32.91	0.000	1.58	3691.23	887.30	0.09
Reach-1	15393.00	25 year	4093.00	21.18	34.48		34.49	0.000	1.42	5132.80	944.11	0.07
Reach-1	15393.00	50 year	5235.00	21.18	35.86		35.87	0.000	1.35	6482.85	1008.22	0.07
Reach-1	15393.00	100 year	6604.00	21.18	37.38		37.39	0.000	1.30	8060.53	1078.31	0.06
Reach-1	16096.00	2 year	1413.00	23.89	30.80		30.84	0.001	2.91	1420.24	521.59	0.21
Reach-1	16096.00	10 year	2912.00	23.89	33.04		33.08	0.001	3.10	2749.88	650.11	0.19
Reach-1	16096.00	25 year	4093.00	23.89	34.58		34.61	0.000	3.11	3779.06	691.38	0.18
Reach-1	16096.00	50 year	5235.00	23.89	35.94		35.97	0.000	3.10	4753.21	745.75	0.16
Reach-1	16096.00	100 year	6604.00	23.89	37.43		37.47	0.000	3.06	5986.87	874.78	0.15
Reach-1	16457.00	2 year	1413.00	23.40	31.07		31.13	0.001	3.31	1303.52	549.77	0.22
Reach-1	16457.00	10 year	2912.00	23.40	33.24		33.29	0.001	3.35	2702.82	703.48	0.19
Reach-1	16457.00	25 year	4093.00	23.40	34.74		34.78	0.000	3.27	3810.89	777.09	0.18
Reach-1	16457.00	50 year	5235.00	23.40	36.07		36.11	0.000	3.15	4886.30	836.20	0.16
Reach-1	16457.00	100 year	6604.00	23.40	37.54		37.57	0.000	3.04	6166.21	901.50	0.15
Reach-1	16932.00	2 year	1413.00	25.30	31.38		31.40	0.000	1.91	1867.99	679.05	0.15
Reach-1	16932.00	10 year	2912.00	25.30	33.46		33.47	0.000	1.91	3474.99	829.38	0.13
Reach-1	16932.00	25 year	4093.00	25.30	34.90		34.92	0.000	1.87	4789.07	995.86	0.11
Reach-1	16932.00	50 year	5235.00	25.30	36.20		36.21	0.000	1.79	6238.04	1204.91	0.10
Reach-1	16932.00	100 year	6604.00	25.30	37.64		37.65	0.000	1.63	8025.49	1260.62	0.09
Reach-1	17596.00	2 year	1413.00	25.12	31.70		31.75	0.001	2.78	1217.87	415.91	0.21
Reach-1	17596.00	10 year	2912.00	25.12	33.67		33.72	0.001	3.00	2144.01	561.32	0.19
Reach-1	17596.00	25 year	4093.00	25.12	35.06		35.10	0.000	2.88	2982.82	661.40	0.17
Reach-1	17596.00	50 year	5235.00	25.12	36.31		36.35	0.000	2.71	4042.47	935.90	0.15
Reach-1	17596.00	100 year	6604.00	25.12	37.72		37.75	0.000	2.37	5422.85	1029.38	0.12
Reach-1	18096.00	2 year	1352.00	24.99	32.02		32.14	0.001	2.92	605.80	216.98	0.22
Reach-1	18096.00	10 year	2788.00	24.99	33.92		34.08	0.001	3.60	1167.85	423.96	0.23
Reach-1	18096.00	25 year	3929.00	24.99	35.25		35.36	0.001	3.42	1981.36	979.35	0.20
Reach-1	18096.00	50 year	5017.00	24.99	36.45		36.51	0.000	2.70	3260.24	1145.64	0.15
Reach-1	18096.00	100 year	6346.00	24.99	37.80		37.84	0.000	2.15	4916.27	1281.29	0.11
Reach-1	18283.00	2 year	1352.00	26.30	32.48	32.48	32.96	0.007	6.94	421.83	368.88	0.59
Reach-1	18283.00	10 year	2788.00	26.30	34.16	33.15	34.30	0.002	4.54	1207.47	563.64	0.33
Reach-1	18283.00	25 year	3929.00	26.30	35.42	33.45	35.51	0.001	3.76	2049.17	823.19	0.25
Reach-1	18283.00	50 year	5017.00	26.30	36.52	33.72	36.59	0.001	3.02	3042.89	963.52	0.19
Reach-1	18283.00	100 year	6346.00	26.30	37.83	34.03	37.88	0.000	2.42	4357.43	1023.57	0.14

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	18506.00		Culvert									
Reach-1	18538.00	2 year	1352.00	25.74	33.33	29.05	33.55	0.001	3.82	386.99	480.80	0.25
Reach-1	18538.00	10 year	2788.00	25.74	35.25	30.81	35.28	0.000	2.17	2585.33	815.87	0.13
Reach-1	18538.00	25 year	3929.00	25.74	35.83	31.98	35.87	0.000	2.52	3086.63	904.11	0.14
Reach-1	18538.00	50 year	5017.00	25.74	36.58	32.98	36.62	0.000	2.51	3799.91	982.88	0.14
Reach-1	18538.00	100 year	6346.00	25.74	37.87	33.90	37.90	0.000	2.16	5093.68	1029.53	0.11
Reach-1	18614.00	2 year	1352.00	23.93	33.59		33.68	0.001	3.47	1225.06	720.61	0.24
Reach-1	18614.00	10 year	2788.00	23.93	35.28		35.33	0.001	3.17	2481.79	757.74	0.20
Reach-1	18614.00	25 year	3929.00	23.93	35.87		35.93	0.001	3.65	2930.63	765.34	0.22
Reach-1	18614.00	50 year	5017.00	23.93	36.62		36.68	0.001	3.73	3506.97	775.28	0.21
Reach-1	18614.00	100 year	6346.00	23.93	37.89		37.94	0.001	3.54	4543.71	918.98	0.19
Reach-1	19096.00	2 year	1352.00	27.02	34.15	30.81	34.37	0.001	3.88	391.91	100.44	0.29
Reach-1	19096.00	10 year	2788.00	27.02	35.64	32.55	36.18	0.002	6.06	561.44	126.24	0.40
Reach-1	19096.00	25 year	3929.00	27.02	36.26	33.70	37.10	0.003	7.69	642.41	138.59	0.48
Reach-1	19096.00	50 year	5017.00	27.02	36.89	34.71	37.98	0.004	8.84	735.59	155.42	0.54
Reach-1	19096.00	100 year	6346.00	27.02	37.98	35.78	39.12	0.004	9.29	932.05	205.40	0.53
Reach-1	19365.00		Culvert									
Reach-1	19396.00	2 year	1348.00	27.56	34.72	31.81	35.03	0.002	4.52	318.46	82.32	0.35
Reach-1	19396.00	10 year	2780.00	27.56	37.20	33.71	37.74	0.002	6.03	526.57	210.01	0.39
Reach-1	19396.00	25 year	3917.00	27.56	39.33	34.94	39.91	0.002	6.35	749.17	341.88	0.36
Reach-1	19396.00	50 year	5002.00	27.56	40.40	35.87	40.88	0.002	6.24	1593.42	509.81	0.34
Reach-1	19396.00	100 year	6329.00	27.56	41.02	36.92	41.63	0.002	7.18	1946.94	607.68	0.38
Reach-1	19506.00	2 year	1348.00	27.60	35.09		35.22	0.001	3.15	620.06	164.70	0.22
Reach-1	19506.00	10 year	2780.00	27.60	37.79		37.98	0.001	4.04	1133.40	217.53	0.24
Reach-1	19506.00	25 year	3917.00	27.60	39.93		40.14	0.001	4.30	1663.92	297.99	0.23
Reach-1	19506.00	50 year	5002.00	27.60	40.71		41.06	0.001	5.42	1951.61	473.26	0.28
Reach-1	19506.00	100 year	6329.00	27.60	41.42		41.85	0.001	6.16	2304.35	548.50	0.31
Reach-1	20096.00	2 year	1348.00	28.00	35.49		35.54	0.000	2.17	1320.91	474.73	0.15
Reach-1	20096.00	10 year	2780.00	28.00	38.20		38.24	0.000	2.25	2690.55	529.72	0.13
Reach-1	20096.00	25 year	3917.00	28.00	40.30		40.34	0.000	2.18	3838.07	559.60	0.11
Reach-1	20096.00	50 year	5002.00	28.00	41.27		41.31	0.000	2.41	4384.00	574.37	0.12
Reach-1	20096.00	100 year	6329.00	28.00	42.09		42.15	0.000	2.73	4864.29	587.07	0.13
Reach-1	20596.00	2 year	1325.00	29.93	35.73		35.91	0.002	3.67	537.05	176.42	0.30
Reach-1	20596.00	10 year	2731.00	29.93	38.32		38.51	0.001	4.09	1281.91	355.51	0.27
Reach-1	20596.00	25 year	3849.00	29.93	40.38		40.53	0.001	3.91	2145.91	475.13	0.23
Reach-1	20596.00	50 year	4917.00	29.93	41.35		41.51	0.001	4.15	2624.99	507.81	0.23
Reach-1	20596.00	100 year	6223.00	29.93	42.19		42.37	0.001	4.53	3059.92	524.29	0.24
Reach-1	20751.00	2 year	1325.00	30.58	36.00		36.19	0.002	3.91	498.52	160.54	0.33
Reach-1	20751.00	10 year	2731.00	30.58	38.50		38.70	0.001	4.28	1165.95	303.59	0.29
Reach-1	20751.00	25 year	3849.00	30.58	40.48		40.67	0.001	4.30	1876.40	416.29	0.26
Reach-1	20751.00	50 year	4917.00	30.58	41.44		41.65	0.001	4.65	2294.13	451.26	0.26
Reach-1	20751.00	100 year	6223.00	30.58	42.29		42.52	0.001	5.11	2688.25	481.95	0.28
Reach-1	21198.00	2 year	1325.00	32.74	37.22	36.32	37.61	0.005	5.34	345.31	350.01	0.51
Reach-1	21198.00	10 year	2731.00	32.74	39.27	37.49	39.71	0.004	6.03	696.01	595.06	0.46
Reach-1	21198.00	25 year	3849.00	32.74	41.00	38.21	41.38	0.002	5.82	1093.38	733.93	0.39
Reach-1	21198.00	50 year	4917.00	32.74	41.95	38.90	42.38	0.002	6.29	1311.72	783.67	0.39
Reach-1	21198.00	100 year	6223.00	32.74	42.81	39.62	43.33	0.002	6.96	1510.47	841.81	0.41
Reach-1	21303.00		Bridge									
Reach-1	21373.00	2 year	1326.00	32.80	38.59	36.39	38.72	0.001	3.29	622.69	400.48	0.27
Reach-1	21373.00	10 year	2733.00	32.80	40.98	37.47	41.13	0.001	3.79	1289.84	728.09	0.25
Reach-1	21373.00	25 year	3852.00	32.80	42.65	38.12	42.80	0.001	3.96	1770.05	814.97	0.24
Reach-1	21373.00	50 year	4921.00	32.80	43.90	38.64	44.07	0.001	4.23	2128.12	992.42	0.24
Reach-1	21373.00	100 year	6229.00	32.80	45.23	39.43	45.42	0.001	4.53	2510.50	1042.30	0.24
Reach-1	21638.00	2 year	1330.00	32.63	38.88		38.91	0.000	1.85	1591.97	616.83	0.14
Reach-1	21638.00	10 year	2740.00	32.63	41.26		41.28	0.000	2.03	3111.92	658.47	0.13
Reach-1	21638.00	25 year	3868.00	32.63	42.91		42.94	0.000	2.19	4267.65	740.41	0.13
Reach-1	21638.00	50 year	4963.00	32.63	44.17		44.21	0.000	2.39	5284.60	858.08	0.13
Reach-1	21638.00	100 year	6271.00	32.63	45.52		45.56	0.000	2.51	6499.28	941.55	0.13
Reach-1	22096.00	2 year	1311.00	32.71	39.08		39.18	0.001	2.94	1032.43	621.12	0.24
Reach-1	22096.00	10 year	2701.00	32.71	41.39		41.45	0.000	2.64	2675.57	787.36	0.17
Reach-1	22096.00	25 year	3812.00	32.71	43.03		43.07	0.000	2.48	4010.16	846.49	0.15
Reach-1	22096.00	50 year	4891.00	32.71	44.28		44.32	0.000	2.48	5097.25	883.53	0.14
Reach-1	22096.00	100 year	6182.00	32.71	45.62		45.66	0.000	2.52	6304.47	917.13	0.13
Reach-1	22383.00	2 year	1311.00	32.90	39.34		39.40	0.001	2.42	1084.70	378.39	0.19
Reach-1	22383.00	10 year	2701.00	32.90	41.52		41.60	0.001	2.88	1952.20	416.17	0.19
Reach-1	22383.00	25 year	3812.00	32.90	43.11		43.19	0.000	3.07	2637.39	449.98	0.18
Reach-1	22383.00	50 year	4891.00	32.90	44.35		44.43	0.000	3.28	3206.88	471.92	0.18
Reach-1	22383.00	100 year	6182.00	32.90	45.67		45.76	0.000	3.49	3848.07	495.47	0.18

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	22704.00	2 year	1311.00	33.39	39.54	36.59	39.76	0.001	3.78	381.74	282.05	0.29
Reach-1	22704.00	10 year	2701.00	33.39	41.63	38.21	42.06	0.002	5.42	562.64	376.72	0.35
Reach-1	22704.00	25 year	3812.00	33.39	43.26	39.16	43.42	0.001	4.06	2051.23	487.20	0.24
Reach-1	22704.00	50 year	4891.00	33.39	44.49	39.96	44.64	0.001	4.12	2682.59	538.62	0.23
Reach-1	22704.00	100 year	6182.00	33.39	45.80	40.83	45.96	0.001	4.30	3517.75	744.69	0.22
Reach-1	22812.00		Culvert									
Reach-1	22893.00	2 year	1311.00	32.81	40.16	35.93	40.27	0.001	2.78	685.26	304.98	0.19
Reach-1	22893.00	10 year	2695.00	32.81	43.21	37.86	43.35	0.001	3.34	1258.72	479.72	0.19
Reach-1	22893.00	25 year	3802.00	32.81	45.43	38.87	45.50	0.000	2.77	3221.84	697.52	0.14
Reach-1	22893.00	50 year	4879.00	32.81	46.48	39.67	46.56	0.000	3.03	4008.06	798.59	0.15
Reach-1	22893.00	100 year	6169.00	32.81	47.26	40.37	47.35	0.000	3.36	4650.91	854.25	0.16
Reach-1	22990.00	2 year	1311.00	33.30	40.28		40.33	0.000	2.05	996.35	346.35	0.15
Reach-1	22990.00	10 year	2695.00	33.30	43.37		43.40	0.000	1.43	2549.39	618.18	0.08
Reach-1	22990.00	25 year	3802.00	33.30	45.50		45.52	0.000	1.21	4023.58	782.38	0.06
Reach-1	22990.00	50 year	4879.00	33.30	46.55		46.58	0.000	1.18	4868.42	824.85	0.06
Reach-1	22990.00	100 year	6169.00	33.30	47.34		47.37	0.000	1.26	5531.42	867.75	0.06
Reach-1	23596.00	2 year	1311.00	33.57	40.56		40.66	0.001	2.84	755.68	265.61	0.21
Reach-1	23596.00	10 year	2695.00	33.57	43.45		43.52	0.000	2.71	1908.03	529.50	0.17
Reach-1	23596.00	25 year	3802.00	33.57	45.55		45.58	0.000	2.24	3160.36	646.05	0.12
Reach-1	23596.00	50 year	4879.00	33.57	46.59		46.63	0.000	2.27	3858.17	687.27	0.12
Reach-1	23596.00	100 year	6169.00	33.57	47.38		47.43	0.000	2.47	4417.60	731.74	0.12
Reach-1	24096.00	2 year	1263.00	34.72	40.95		41.04	0.001	2.87	740.96	358.45	0.21
Reach-1	24096.00	10 year	2599.00	34.72	43.63		43.67	0.000	2.10	1876.45	513.01	0.13
Reach-1	24096.00	25 year	3665.00	34.72	45.63		45.67	0.000	1.77	3037.01	676.93	0.10
Reach-1	24096.00	50 year	4703.00	34.72	46.67		46.70	0.000	1.80	3786.10	766.64	0.09
Reach-1	24096.00	100 year	5943.00	34.72	47.47		47.50	0.000	1.94	4422.18	835.06	0.10
Reach-1	24596.00	2 year	1263.00	35.80	41.32		41.36	0.001	2.31	1119.95	472.46	0.18
Reach-1	24596.00	10 year	2599.00	35.80	43.78		43.81	0.000	2.06	2511.42	713.39	0.13
Reach-1	24596.00	25 year	3665.00	35.80	45.72		45.73	0.000	1.66	3959.72	782.49	0.09
Reach-1	24596.00	50 year	4703.00	35.80	46.75		46.77	0.000	1.70	4787.90	824.66	0.09
Reach-1	24596.00	100 year	5943.00	35.80	47.55		47.57	0.000	1.84	5459.17	855.56	0.10
Reach-1	25096.00	2 year	1263.00	36.20	41.61		41.65	0.001	2.38	1097.22	509.82	0.18
Reach-1	25096.00	10 year	2599.00	36.20	43.91		43.95	0.000	2.14	2396.13	647.68	0.14
Reach-1	25096.00	25 year	3665.00	36.20	45.78		45.81	0.000	1.88	3659.00	703.28	0.11
Reach-1	25096.00	50 year	4703.00	36.20	46.81		46.84	0.000	1.96	4396.67	733.82	0.11
Reach-1	25096.00	100 year	5943.00	36.20	47.61		47.65	0.000	2.15	4996.08	768.74	0.11
Reach-1	25462.00	2 year	1263.00	36.52	41.79	40.35	42.47	0.006	6.76	211.78	145.28	0.54
Reach-1	25462.00	10 year	2599.00	36.52	43.55	42.32	44.93	0.008	9.77	314.65	281.53	0.67
Reach-1	25462.00	25 year	3665.00	36.52	45.81	43.51	46.06	0.002	5.37	1253.84	601.67	0.32
Reach-1	25462.00	50 year	4703.00	36.52	46.85	44.53	47.04	0.001	4.88	1727.97	696.33	0.27
Reach-1	25462.00	100 year	5943.00	36.52	47.69	45.21	47.81	0.001	4.32	3096.40	930.73	0.23
Reach-1	25570.00		Culvert									
Reach-1	25660.00	2 year	1279.00	37.51	42.71	41.16	43.16	0.004	5.81	348.95	180.23	0.46
Reach-1	25660.00	10 year	2624.00	37.51	46.37	43.12	46.59	0.001	4.77	1049.29	609.47	0.29
Reach-1	25660.00	25 year	3689.00	37.51	48.18	43.98	48.25	0.000	3.16	2640.01	931.36	0.17
Reach-1	25660.00	50 year	4731.00	37.51	48.89	44.59	48.95	0.000	3.16	3191.26	952.61	0.17
Reach-1	25660.00	100 year	5989.00	37.51	49.49	45.23	49.54	0.000	3.09	4342.38	970.59	0.16
Reach-1	25735.00	2 year	1279.00	37.20	43.30		43.40	0.001	3.16	982.02	407.63	0.23
Reach-1	25735.00	10 year	2624.00	37.20	46.64		46.69	0.000	2.62	2428.09	457.73	0.15
Reach-1	25735.00	25 year	3689.00	37.20	48.24		48.28	0.000	2.68	3473.04	1027.12	0.14
Reach-1	25735.00	50 year	4731.00	37.20	48.94		48.98	0.000	2.82	4206.64	1065.33	0.15
Reach-1	25735.00	100 year	5989.00	37.20	49.52		49.57	0.000	3.03	4838.64	1097.72	0.15
Reach-1	26096.00	2 year	1279.00	37.70	43.63		43.67	0.001	2.54	1314.28	425.59	0.19
Reach-1	26096.00	10 year	2624.00	37.70	46.78		46.81	0.000	2.40	2734.18	511.03	0.14
Reach-1	26096.00	25 year	3689.00	37.70	48.35		48.38	0.000	2.46	3815.99	862.81	0.14
Reach-1	26096.00	50 year	4731.00	37.70	49.05		49.08	0.000	2.66	4427.06	876.72	0.14
Reach-1	26096.00	100 year	5989.00	37.70	49.65		49.68	0.000	2.93	4950.38	888.45	0.15
Reach-1	26596.00	2 year	928.00	38.20	43.90		43.93	0.000	2.10	1005.24	370.77	0.16
Reach-1	26596.00	10 year	1835.00	38.20	46.91		46.93	0.000	1.83	2307.37	495.75	0.11
Reach-1	26596.00	25 year	2544.00	38.20	48.46		48.48	0.000	1.87	3124.05	550.04	0.11
Reach-1	26596.00	50 year	3265.00	38.20	49.18		49.20	0.000	2.12	3522.71	568.43	0.12
Reach-1	26596.00	100 year	4076.00	38.20	49.79		49.81	0.000	2.40	3874.97	584.20	0.13
Reach-1	27096.00	2 year	928.00	38.50	44.13		44.15	0.000	2.02	1053.90	397.96	0.16
Reach-1	27096.00	10 year	1835.00	38.50	47.00		47.01	0.000	1.64	2340.84	490.60	0.10
Reach-1	27096.00	25 year	2544.00	38.50	48.53		48.55	0.000	1.64	3128.50	534.51	0.09
Reach-1	27096.00	50 year	3265.00	38.50	49.26		49.28	0.000	1.84	3522.07	551.57	0.10
Reach-1	27096.00	100 year	4076.00	38.50	49.88		49.91	0.000	2.06	3871.55	565.22	0.11

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	27712.00	2 year	856.00	39.40	44.52		44.57	0.001	3.11	704.03	336.77	0.26
Reach-1	27712.00	10 year	1670.00	39.40	47.13		47.15	0.000	2.19	1834.99	600.55	0.14
Reach-1	27712.00	25 year	2298.00	39.40	48.62		48.64	0.000	1.80	2780.35	662.69	0.11
Reach-1	27712.00	50 year	2956.00	39.40	49.36		49.37	0.000	1.89	3276.70	693.08	0.11
Reach-1	27712.00	100 year	3663.00	39.40	49.99		50.01	0.000	2.00	3726.81	719.54	0.11
Reach-1	28096.00	2 year	856.00	40.57	45.33		45.55	0.006	5.61	464.24	391.45	0.52
Reach-1	28096.00	10 year	1670.00	40.57	47.34		47.39	0.001	3.49	1329.97	469.37	0.26
Reach-1	28096.00	25 year	2298.00	40.57	48.73		48.77	0.001	2.98	2012.71	509.51	0.20
Reach-1	28096.00	50 year	2956.00	40.57	49.46		49.50	0.001	3.14	2391.94	530.50	0.20
Reach-1	28096.00	100 year	3663.00	40.57	50.10		50.14	0.001	3.34	2736.58	548.88	0.20
Reach-1	28320.00	2 year	856.00	40.42	45.90		45.93	0.001	2.12	879.82	443.27	0.18
Reach-1	28320.00	10 year	1670.00	40.42	47.52		47.54	0.000	1.92	1660.11	505.71	0.14
Reach-1	28320.00	25 year	2298.00	40.42	48.84		48.86	0.000	1.72	2342.51	529.32	0.11
Reach-1	28320.00	50 year	2956.00	40.42	49.57		49.59	0.000	1.84	2734.10	547.09	0.12
Reach-1	28320.00	100 year	3663.00	40.42	50.21		50.24	0.000	1.99	3089.75	562.78	0.12
Reach-1	28576.00	2 year	856.00	40.70	46.16		46.25	0.002	3.85	677.20	403.80	0.32
Reach-1	28576.00	10 year	1670.00	40.70	47.66		47.72	0.001	3.53	1318.97	452.17	0.26
Reach-1	28576.00	25 year	2298.00	40.70	48.92		48.97	0.001	3.15	1914.66	491.32	0.21
Reach-1	28576.00	50 year	2956.00	40.70	49.65		49.70	0.001	3.30	2280.92	513.92	0.21
Reach-1	28576.00	100 year	3663.00	40.70	50.30		50.35	0.001	3.48	2618.51	533.89	0.21
Reach-1	29096.00	2 year	856.00	40.50	46.55		46.56	0.000	1.60	1260.36	372.70	0.12
Reach-1	29096.00	10 year	1670.00	40.50	47.99		48.02	0.000	2.10	1817.51	397.25	0.14
Reach-1	29096.00	25 year	2298.00	40.50	49.17		49.20	0.000	2.24	2299.06	417.31	0.14
Reach-1	29096.00	50 year	2956.00	40.50	49.91		49.95	0.000	2.51	2611.39	429.82	0.15
Reach-1	29096.00	100 year	3663.00	40.50	50.57		50.61	0.000	2.78	2897.55	440.97	0.16
Reach-1	29540.00	2 year	856.00	41.90	46.44		47.07	0.007	6.39	133.91	33.98	0.57
Reach-1	29540.00	10 year	1670.00	41.90	47.62	46.78	48.78	0.012	8.86	281.69	324.95	0.76
Reach-1	29540.00	25 year	2298.00	41.90	49.29		49.59	0.003	5.51	971.48	472.23	0.41
Reach-1	29540.00	50 year	2956.00	41.90	50.08		50.32	0.002	5.26	1364.63	516.09	0.37
Reach-1	29540.00	100 year	3663.00	41.90	50.77		50.98	0.002	5.21	1727.27	535.65	0.35
Reach-1	29791.00	2 year	856.00	42.61	48.04	45.74	48.39	0.004	4.76	179.80	47.14	0.42
Reach-1	29791.00	10 year	1670.00	42.61	49.89	47.47	50.48	0.004	6.22	284.98	78.98	0.46
Reach-1	29791.00	25 year	2298.00	42.61	50.02	48.42	51.09	0.007	8.36	293.45	82.22	0.61
Reach-1	29791.00	50 year	2956.00	42.61	50.49	49.28	51.96	0.008	9.85	345.74	128.66	0.69
Reach-1	29791.00	100 year	3663.00	42.61	50.89	50.17	52.84	0.010	11.38	414.07	200.00	0.77
Reach-1	29893.00		Culvert									
Reach-1	29957.00	2 year	903.00	42.45	49.77	45.71	49.96	0.001	3.50	268.64	65.94	0.26
Reach-1	29957.00	10 year	1762.00	42.45	53.67	47.54	53.87	0.001	3.70	584.98	417.93	0.21
Reach-1	29957.00	25 year	2416.00	42.45	56.53	48.61	56.57	0.000	2.04	2793.57	676.43	0.10
Reach-1	29957.00	50 year	3107.00	42.45	56.92	49.43	56.97	0.000	2.42	3067.43	731.93	0.12
Reach-1	29957.00	100 year	3849.00	42.45	57.22	50.44	57.28	0.000	2.81	3291.71	769.47	0.14
Reach-1	30096.00	2 year	710.00	42.60	50.07		50.09	0.000	1.59	1340.30	511.15	0.11
Reach-1	30096.00	10 year	1460.00	42.60	53.94		53.95	0.000	1.09	3769.95	687.06	0.06
Reach-1	30096.00	25 year	1986.00	42.60	56.58		56.59	0.000	0.93	5615.73	700.00	0.04
Reach-1	30096.00	50 year	2458.00	42.60	56.99		57.00	0.000	1.09	5900.11	700.00	0.05
Reach-1	30096.00	100 year	2986.00	42.60	57.31		57.32	0.000	1.27	6123.88	700.00	0.06
Reach-1	30467.00	2 year	710.00	42.80	50.16		50.22	0.001	2.86	661.06	247.80	0.20
Reach-1	30467.00	10 year	1460.00	42.80	53.96		53.99	0.000	2.22	1896.69	395.00	0.12
Reach-1	30467.00	25 year	1986.00	42.80	56.59		56.61	0.000	1.78	3099.13	494.91	0.09
Reach-1	30467.00	50 year	2458.00	42.80	57.00		57.02	0.000	2.06	3303.41	504.49	0.10
Reach-1	30467.00	100 year	2986.00	42.80	57.33		57.35	0.000	2.37	3468.38	515.70	0.11
Reach-1	30960.00	2 year	710.00	43.11	50.59		50.75	0.002	3.98	435.01	229.39	0.28
Reach-1	30960.00	10 year	1460.00	43.11	54.09		54.13	0.000	2.47	1533.49	426.16	0.14
Reach-1	30960.00	25 year	1986.00	43.11	56.65		56.67	0.000	1.73	2728.00	480.95	0.09
Reach-1	30960.00	50 year	2458.00	43.11	57.08		57.09	0.000	1.97	2933.57	488.59	0.10
Reach-1	30960.00	100 year	2986.00	43.11	57.42		57.44	0.000	2.24	3102.47	495.15	0.11
Reach-1	31511.00	2 year	710.00	43.55	51.35		51.42	0.001	3.04	648.59	338.29	0.21
Reach-1	31511.00	10 year	1460.00	43.55	54.28		54.30	0.000	2.10	2064.23	569.69	0.12
Reach-1	31511.00	25 year	1986.00	43.55	56.72		56.73	0.000	1.58	3537.72	635.71	0.08
Reach-1	31511.00	50 year	2458.00	43.55	57.16		57.17	0.000	1.79	3819.63	642.76	0.09
Reach-1	31511.00	100 year	2986.00	43.55	57.53		57.54	0.000	2.03	4055.32	648.21	0.10
Reach-1	31977.00	2 year	710.00	46.91	51.45	51.45	53.31	0.021	10.96	65.32	18.04	1.00
Reach-1	31977.00	10 year	1460.00	46.91	54.44		54.63	0.002	5.24	865.20	375.56	0.36
Reach-1	31977.00	25 year	1986.00	46.91	56.79		56.84	0.001	3.19	1859.83	489.99	0.19
Reach-1	31977.00	50 year	2458.00	46.91	57.25		57.31	0.001	3.50	2098.46	539.63	0.20
Reach-1	31977.00	100 year	2986.00	46.91	57.64		57.70	0.001	3.85	2309.32	553.52	0.22

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	32350.00	2 year	710.00	47.01	54.02		54.05	0.001	2.12	938.70	411.22	0.16
Reach-1	32350.00	10 year	1460.00	47.01	55.04		55.09	0.001	2.95	1380.67	455.54	0.20
Reach-1	32350.00	25 year	1986.00	47.01	56.98		57.01	0.000	2.38	2416.17	611.56	0.14
Reach-1	32350.00	50 year	2458.00	47.01	57.46		57.49	0.000	2.60	2714.02	629.82	0.15
Reach-1	32350.00	100 year	2986.00	47.01	57.88		57.91	0.000	2.87	2979.70	645.67	0.17
Reach-1	32724.00	2 year	710.00	47.24	54.24		54.28	0.001	2.49	734.49	287.36	0.18
Reach-1	32724.00	10 year	1460.00	47.24	55.37		55.44	0.001	3.49	1082.74	326.87	0.23
Reach-1	32724.00	25 year	1986.00	47.24	57.14		57.18	0.001	2.95	1717.02	398.54	0.18
Reach-1	32724.00	50 year	2458.00	47.24	57.63		57.68	0.001	3.24	1926.58	462.16	0.19
Reach-1	32724.00	100 year	2986.00	47.24	58.07		58.13	0.001	3.54	2138.78	487.67	0.20
Reach-1	32869.00	2 year	710.00	47.75	54.35		54.40	0.001	2.61	698.31	274.30	0.20
Reach-1	32869.00	10 year	1460.00	47.75	55.54		55.61	0.001	3.51	1039.55	297.40	0.24
Reach-1	32869.00	25 year	1986.00	47.75	57.22		57.27	0.001	3.08	1561.24	322.60	0.19
Reach-1	32869.00	50 year	2458.00	47.75	57.73		57.79	0.001	3.42	1726.33	328.62	0.20
Reach-1	32869.00	100 year	2986.00	47.75	58.18		58.25	0.001	3.83	1876.07	336.89	0.22
Reach-1	33371.00	2 year	640.00	47.87	54.78		54.84	0.001	2.77	508.97	283.25	0.20
Reach-1	33371.00	10 year	1214.00	47.87	56.04		56.10	0.001	2.90	879.81	304.98	0.19
Reach-1	33371.00	25 year	1607.00	47.87	57.50		57.54	0.000	2.37	1340.66	324.85	0.14
Reach-1	33371.00	50 year	1960.00	47.87	58.04		58.08	0.000	2.51	1516.55	331.08	0.15
Reach-1	33371.00	100 year	2352.00	47.87	58.53		58.58	0.000	2.68	1680.85	336.80	0.15
Reach-1	33851.00	2 year	640.00	49.12	55.41		55.65	0.003	4.83	305.20	233.66	0.38
Reach-1	33851.00	10 year	1214.00	49.12	56.57		56.74	0.003	4.85	617.96	289.74	0.34
Reach-1	33851.00	25 year	1607.00	49.12	57.78		57.87	0.001	3.87	988.47	323.30	0.25
Reach-1	33851.00	50 year	1960.00	49.12	58.32		58.41	0.001	3.92	1167.00	339.23	0.24
Reach-1	33851.00	100 year	2352.00	49.12	58.82		58.91	0.001	4.03	1342.41	358.41	0.24
Reach-1	34229.00	2 year	640.00	50.64	56.73		56.95	0.004	5.75	361.90	208.42	0.44
Reach-1	34229.00	10 year	1214.00	50.64	57.70		57.93	0.004	6.71	571.20	225.27	0.47
Reach-1	34229.00	25 year	1607.00	50.64	58.43		58.64	0.003	6.71	740.46	238.03	0.45
Reach-1	34229.00	50 year	1960.00	50.64	58.93		59.14	0.003	6.94	861.62	246.75	0.45
Reach-1	34229.00	100 year	2352.00	50.64	59.41		59.64	0.003	7.25	984.33	257.84	0.45
Reach-1	34653.00	2 year	640.00	51.50	58.04		58.19	0.002	4.91	476.78	296.11	0.36
Reach-1	34653.00	10 year	1214.00	51.50	59.05		59.18	0.002	5.34	787.68	319.37	0.36
Reach-1	34653.00	25 year	1607.00	51.50	59.65		59.77	0.002	5.49	982.96	331.39	0.36
Reach-1	34653.00	50 year	1960.00	51.50	60.12		60.24	0.002	5.64	1142.03	340.74	0.36
Reach-1	34653.00	100 year	2352.00	51.50	60.61		60.73	0.002	5.80	1309.28	350.30	0.35
Reach-1	35029.00	2 year	640.00	52.36	58.77		58.83	0.001	3.55	579.83	255.62	0.26
Reach-1	35029.00	10 year	1214.00	52.36	59.81		59.89	0.002	4.42	861.07	287.82	0.30
Reach-1	35029.00	25 year	1607.00	52.36	60.40		60.49	0.002	4.84	1037.38	320.07	0.32
Reach-1	35029.00	50 year	1960.00	52.36	60.88		60.98	0.002	5.27	1202.09	357.31	0.33
Reach-1	35029.00	100 year	2352.00	52.36	61.34		61.44	0.002	5.41	1373.32	378.71	0.33
Reach-1	35433.00	2 year	640.00	52.37	59.28		59.36	0.001	3.77	555.51	258.29	0.27
Reach-1	35433.00	10 year	1214.00	52.37	60.42		60.50	0.001	4.50	878.19	303.12	0.29
Reach-1	35433.00	25 year	1607.00	52.37	61.04		61.13	0.001	4.80	1071.49	319.94	0.30
Reach-1	35433.00	50 year	1960.00	52.37	61.55		61.64	0.001	4.99	1238.26	330.71	0.30
Reach-1	35433.00	100 year	2352.00	52.37	62.01		62.11	0.002	5.27	1393.47	340.42	0.31
Reach-1	35806.00	2 year	640.00	52.98	59.86		60.14	0.003	5.97	350.20	224.24	0.43
Reach-1	35806.00	10 year	1214.00	52.98	61.06		61.29	0.003	6.35	640.65	259.12	0.41
Reach-1	35806.00	25 year	1607.00	52.98	61.69		61.91	0.003	6.64	810.12	280.67	0.42
Reach-1	35806.00	50 year	1960.00	52.98	62.20		62.41	0.003	6.83	957.12	298.11	0.42
Reach-1	35806.00	100 year	2352.00	52.98	62.68		62.90	0.003	7.09	1103.69	314.53	0.42
Reach-1	36428.00	2 year	640.00	53.28	61.15		61.24	0.001	3.80	524.00	216.84	0.25
Reach-1	36428.00	10 year	1214.00	53.28	62.39		62.50	0.001	4.81	827.47	281.00	0.29
Reach-1	36428.00	25 year	1607.00	53.28	63.05		63.18	0.002	5.29	1022.86	310.94	0.31
Reach-1	36428.00	50 year	1960.00	53.28	63.57		63.71	0.002	5.63	1191.04	337.82	0.32
Reach-1	36428.00	100 year	2352.00	53.28	64.07		64.21	0.002	5.93	1365.60	359.64	0.33
Reach-1	37026.00	2 year	640.00	53.42	61.74		61.91	0.001	3.67	321.83	236.47	0.26
Reach-1	37026.00	10 year	1214.00	53.42	63.10		63.28	0.001	4.32	688.28	301.68	0.27
Reach-1	37026.00	25 year	1607.00	53.42	63.79		63.96	0.001	4.46	904.38	321.05	0.27
Reach-1	37026.00	50 year	1960.00	53.42	64.32		64.49	0.001	4.56	1078.85	335.20	0.27
Reach-1	37026.00	100 year	2352.00	53.42	64.83		64.99	0.001	4.68	1253.13	348.76	0.27
Reach-1	37629.00	2 year	640.00	54.33	62.43		62.64	0.001	3.93	256.02	122.90	0.28
Reach-1	37629.00	10 year	1214.00	54.33	63.83		64.08	0.001	4.78	527.45	235.90	0.31
Reach-1	37629.00	25 year	1607.00	54.33	64.49		64.74	0.001	5.03	689.75	261.44	0.31
Reach-1	37629.00	50 year	1960.00	54.33	65.00		65.24	0.001	5.17	830.44	286.30	0.31
Reach-1	37629.00	100 year	2352.00	54.33	65.49		65.72	0.001	5.27	975.16	301.40	0.31
Reach-1	37781.00	2 year	640.00	55.55	62.65	60.36	62.90	0.002	4.26	185.56	49.28	0.33
Reach-1	37781.00	10 year	1214.00	55.55	64.00	61.61	64.55	0.003	6.32	272.35	180.92	0.44
Reach-1	37781.00	25 year	1607.00	55.55	64.66	62.30	65.22	0.003	6.78	441.61	199.06	0.45
Reach-1	37781.00	50 year	1960.00	55.55	65.15	62.87	65.72	0.003	7.10	542.94	209.05	0.46
Reach-1	37781.00	100 year	2352.00	55.55	65.63	63.33	66.21	0.003	7.42	644.76	218.64	0.46

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	37906.00		Culvert									
Reach-1	37950.00	2 year	640.00	55.91	64.16	60.36	64.29	0.001	3.15	287.68	189.61	0.22
Reach-1	37950.00	10 year	1214.00	55.91	69.51	61.59	69.59	0.000	2.57	730.53	291.23	0.13
Reach-1	37950.00	25 year	1607.00	55.91	71.38	62.27	71.40	0.000	1.70	2428.79	519.51	0.08
Reach-1	37950.00	50 year	1960.00	55.91	71.85	62.84	71.87	0.000	1.89	2679.53	556.05	0.09
Reach-1	37950.00	100 year	2352.00	55.91	72.17	63.17	72.20	0.000	2.13	2862.74	578.10	0.10
Reach-1	38205.00	2 year	315.00	57.08	64.42		64.46	0.000	1.87	273.30	96.07	0.14
Reach-1	38205.00	10 year	597.00	57.08	69.62		69.63	0.000	0.71	1698.06	493.26	0.04
Reach-1	38205.00	25 year	798.00	57.08	71.41		71.41	0.000	0.55	2643.95	560.19	0.03
Reach-1	38205.00	50 year	975.00	57.08	71.88		71.88	0.000	0.60	2911.49	576.98	0.03
Reach-1	38205.00	100 year	1170.00	57.08	72.21		72.22	0.000	0.67	3104.49	590.13	0.03
Reach-1	38564.00	2 year	315.00	57.32	64.54		64.60	0.000	2.02	234.85	82.70	0.15
Reach-1	38564.00	10 year	597.00	57.32	69.63		69.64	0.000	1.26	970.26	231.88	0.07
Reach-1	38564.00	25 year	798.00	57.32	71.41		71.42	0.000	1.18	1453.66	317.78	0.06
Reach-1	38564.00	50 year	975.00	57.32	71.88		71.89	0.000	1.30	1609.27	344.39	0.06
Reach-1	38564.00	100 year	1170.00	57.32	72.21		72.23	0.000	1.44	1726.00	361.14	0.07
Reach-1	39079.00	2 year	315.00	57.80	64.78	60.91	64.86	0.001	2.50	181.25	48.01	0.18
Reach-1	39079.00	10 year	597.00	57.80	69.66	62.36	69.70	0.000	1.93	626.09	146.16	0.10
Reach-1	39079.00	25 year	798.00	57.80	71.43	62.99	71.46	0.000	1.85	928.21	216.99	0.09
Reach-1	39079.00	50 year	975.00	57.80	71.91	63.45	71.94	0.000	2.04	1037.96	288.53	0.10
Reach-1	39079.00	100 year	1170.00	57.80	72.25	63.93	72.29	0.000	2.26	1124.54	497.25	0.11
Reach-1	39582.00	2 year	315.00	59.93	65.25		65.45	0.002	3.62	95.80	33.12	0.33
Reach-1	39582.00	10 year	597.00	59.93	69.75		69.85	0.000	2.75	325.42	80.66	0.17
Reach-1	39582.00	25 year	798.00	59.93	71.50		71.57	0.000	2.52	537.46	152.65	0.14
Reach-1	39582.00	50 year	975.00	59.93	71.98		72.06	0.000	2.73	620.60	189.91	0.15
Reach-1	39582.00	100 year	1170.00	59.93	72.33		72.43	0.000	2.96	693.16	226.55	0.16
Reach-1	40149.00	2 year	315.00	63.69	67.49	67.24	68.33	0.016	7.41	46.33	24.15	0.82
Reach-1	40149.00	10 year	597.00	63.69	69.99		70.59	0.005	6.55	121.70	41.05	0.51
Reach-1	40149.00	25 year	798.00	63.69	71.69		71.97	0.002	4.90	228.42	83.44	0.33
Reach-1	40149.00	50 year	975.00	63.69	72.20		72.47	0.002	4.90	277.45	114.06	0.32
Reach-1	40149.00	100 year	1170.00	63.69	72.57		72.84	0.002	4.80	322.80	129.92	0.31

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
North Fork to Greens Mill Run - Existing Conditions												
Reach-1	415.00	2 YR	134.00	42.21	44.77	43.69	44.89	0.003	2.74	49.99	31.48	0.34
Reach-1	415.00	10 YR	294.00	42.21	49.43	44.43	49.45	0.000	1.19	522.53	191.29	0.08
Reach-1	415.00	25 YR	358.00	42.21	51.63	44.68	51.64	0.000	0.85	1033.58	274.03	0.05
Reach-1	415.00	50 YR	410.00	42.21	53.48	44.88	53.48	0.000	0.69	1626.59	369.77	0.04
Reach-1	415.00	100 YR	459.00	42.21	55.16	45.05	55.16	0.000	0.59	2452.89	585.85	0.03
Reach-1	664.00	2 YR	134.00	43.18	46.06	45.70	46.76	0.022	6.73	19.87	8.91	0.79
Reach-1	664.00	10 YR	294.00	43.18	49.38	47.15	49.67	0.004	4.61	98.40	59.90	0.37
Reach-1	664.00	25 YR	358.00	43.18	51.62	47.61	51.69	0.001	2.66	280.17	102.10	0.18
Reach-1	664.00	50 YR	410.00	43.18	53.48	48.00	53.51	0.000	1.74	546.35	192.40	0.10
Reach-1	664.00	100 YR	459.00	43.18	55.16	48.72	55.17	0.000	1.07	977.06	302.05	0.06
Reach-1	723.40		Culvert									
Reach-1	841.00	2 YR	134.00	47.80	54.16	48.03	54.17	0.000	0.10	1378.07	250.14	0.01
Reach-1	841.00	10 YR	294.00	47.80	56.89	48.20	56.89	0.000	0.14	2132.26	294.30	0.01
Reach-1	841.00	25 YR	358.00	47.80	57.32	48.26	57.32	0.000	0.16	2257.58	297.75	0.01
Reach-1	841.00	50 YR	410.00	47.80	57.45	48.29	57.45	0.000	0.18	2297.81	298.85	0.01
Reach-1	841.00	100 YR	459.00	47.80	57.57	48.33	57.57	0.000	0.20	2331.84	300.19	0.01
Reach-1	902.00	2 YR	125.00	47.80	54.16		54.17	0.000	0.11	1096.01	196.22	0.01
Reach-1	902.00	10 YR	287.00	47.80	56.89		56.89	0.000	0.16	1749.65	253.75	0.01
Reach-1	902.00	25 YR	332.00	47.80	57.32		57.32	0.000	0.18	1858.06	258.75	0.01
Reach-1	902.00	50 YR	367.00	47.80	57.45		57.45	0.000	0.19	1893.08	260.54	0.01
Reach-1	902.00	100 YR	400.00	47.80	57.57		57.57	0.000	0.21	1922.78	262.04	0.01
Reach-1	1500.00	2 YR	125.00	48.00	54.17		54.17	0.000	0.12	1066.40	200.73	0.01
Reach-1	1500.00	10 YR	287.00	48.00	56.89		56.90	0.000	0.18	2101.05	460.29	0.01
Reach-1	1500.00	25 YR	332.00	48.00	57.32		57.32	0.000	0.20	2298.30	473.76	0.01
Reach-1	1500.00	50 YR	367.00	48.00	57.45		57.45	0.000	0.22	2363.08	483.49	0.01
Reach-1	1500.00	100 YR	400.00	48.00	57.57		57.57	0.000	0.23	2418.24	486.79	0.01
Reach-1	1998.00	2 YR	125.00	48.28	54.16		54.17	0.000	0.56	357.93	160.08	0.04
Reach-1	1998.00	10 YR	287.00	48.28	56.89		56.90	0.000	0.64	952.93	266.43	0.04
Reach-1	1998.00	25 YR	332.00	48.28	57.32		57.32	0.000	0.68	1068.70	280.53	0.04
Reach-1	1998.00	50 YR	367.00	48.28	57.45		57.46	0.000	0.73	1106.79	285.01	0.04
Reach-1	1998.00	100 YR	400.00	48.28	57.56		57.57	0.000	0.77	1139.35	288.79	0.05
Reach-1	2497.00	2 YR	125.00	48.70	54.18		54.18	0.000	0.63	337.25	176.62	0.05
Reach-1	2497.00	10 YR	287.00	48.70	56.90		56.91	0.000	0.69	1018.35	321.85	0.04
Reach-1	2497.00	25 YR	332.00	48.70	57.33		57.33	0.000	0.71	1158.13	336.44	0.04
Reach-1	2497.00	50 YR	367.00	48.70	57.46		57.47	0.000	0.76	1204.12	339.33	0.05
Reach-1	2497.00	100 YR	400.00	48.70	57.58		57.58	0.000	0.80	1243.20	341.76	0.05
Reach-1	2837.00	2 YR	125.00	49.18	54.18	50.95	54.23	0.000	1.80	69.51	37.52	0.16
Reach-1	2837.00	10 YR	287.00	49.18	56.90	52.03	56.94	0.000	1.76	343.05	198.21	0.12
Reach-1	2837.00	25 YR	332.00	49.18	57.33	52.29	57.36	0.000	1.74	436.95	234.81	0.12
Reach-1	2837.00	50 YR	367.00	49.18	57.46	52.47	57.50	0.000	1.83	469.49	241.10	0.12
Reach-1	2837.00	100 YR	400.00	49.18	57.58	52.64	57.62	0.000	1.91	497.66	249.81	0.13
Reach-1	2918.70		Culvert									
Reach-1	2963.00	2 YR	125.00	49.39	54.30	51.06	54.33	0.000	1.56	88.64	54.21	0.14
Reach-1	2963.00	10 YR	287.00	49.39	57.33	52.06	57.35	0.000	1.28	453.85	206.90	0.09
Reach-1	2963.00	25 YR	332.00	49.39	57.61	52.28	57.63	0.000	1.32	515.10	227.17	0.09
Reach-1	2963.00	50 YR	367.00	49.39	57.72	52.43	57.74	0.000	1.40	540.61	231.93	0.09
Reach-1	2963.00	100 YR	400.00	49.39	57.81	52.59	57.83	0.000	1.47	560.50	236.62	0.09
Reach-1	3086.00	2 YR	125.00	50.43	54.32		54.43	0.001	2.80	79.74	80.86	0.28
Reach-1	3086.00	10 YR	287.00	50.43	57.34		57.37	0.000	1.76	483.65	169.71	0.13
Reach-1	3086.00	25 YR	332.00	50.43	57.62		57.65	0.000	1.88	532.23	176.22	0.13
Reach-1	3086.00	50 YR	367.00	50.43	57.74		57.77	0.000	2.01	552.07	179.01	0.14
Reach-1	3086.00	100 YR	400.00	50.43	57.82		57.85	0.000	2.14	567.53	182.25	0.15
Reach-1	3582.00	2 YR	124.00	52.39	55.19		55.55	0.006	4.85	26.66	17.27	0.60
Reach-1	3582.00	10 YR	284.00	52.39	57.46		57.55	0.001	3.01	312.67	236.94	0.26
Reach-1	3582.00	25 YR	329.00	52.39	57.75		57.82	0.001	2.91	382.51	244.30	0.24
Reach-1	3582.00	50 YR	363.00	52.39	57.88		57.95	0.001	3.00	413.82	247.54	0.24
Reach-1	3582.00	100 YR	395.00	52.39	57.98		58.05	0.001	3.08	439.06	250.11	0.25
Reach-1	3894.00	2 YR	124.00	52.81	56.36	54.87	56.50	0.002	3.06	40.59	17.04	0.33
Reach-1	3894.00	10 YR	284.00	52.81	57.74	55.90	58.06	0.002	4.51	63.13	22.75	0.41
Reach-1	3894.00	25 YR	329.00	52.81	57.97	56.13	58.35	0.003	4.91	67.32	24.71	0.43
Reach-1	3894.00	50 YR	363.00	52.81	58.09	56.31	58.52	0.003	5.27	69.57	25.71	0.46
Reach-1	3894.00	100 YR	395.00	52.81	58.18	56.46	58.67	0.003	5.60	71.43	26.52	0.48
Reach-1	3919.20		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4027.00	2 YR	125.00	53.79	58.29	55.82	58.32	0.000	1.70	136.23	165.64	0.16
Reach-1	4027.00	10 YR	285.00	53.79	61.95	56.82	61.96	0.000	1.10	600.34	364.14	0.07
Reach-1	4027.00	25 YR	329.00	53.79	63.27	57.05	63.28	0.000	0.99	768.30	426.23	0.06
Reach-1	4027.00	50 YR	364.00	53.79	64.40	57.36	64.41	0.000	0.91	910.78	468.89	0.05
Reach-1	4027.00	100 YR	395.00	53.79	65.54	57.48	65.55	0.000	0.85	1055.55	528.72	0.05
Reach-1	4074.00	2 YR	118.00	53.69	58.31		58.34	0.000	1.68	185.72	205.79	0.15
Reach-1	4074.00	10 YR	306.00	53.69	61.96		61.96	0.000	0.49	1837.39	562.01	0.03
Reach-1	4074.00	25 YR	432.00	53.69	63.28		63.29	0.000	0.45	2592.97	580.15	0.03
Reach-1	4074.00	50 YR	666.00	53.69	64.41		64.41	0.000	0.52	3264.39	636.68	0.03
Reach-1	4074.00	100 YR	901.00	53.69	65.55		65.55	0.000	0.54	4015.44	679.58	0.03
Reach-1	4497.00	2 YR	118.00	54.69	58.46		58.51	0.001	1.85	122.55	158.24	0.20
Reach-1	4497.00	10 YR	306.00	54.69	61.97		61.97	0.000	0.95	859.40	271.67	0.07
Reach-1	4497.00	25 YR	432.00	54.69	63.29		63.29	0.000	0.96	1260.95	330.11	0.06
Reach-1	4497.00	50 YR	666.00	54.69	64.41		64.42	0.000	1.14	1655.67	394.87	0.07
Reach-1	4497.00	100 YR	901.00	54.69	65.55		65.56	0.000	1.19	2160.20	478.15	0.07
Reach-1	5149.00	2 YR	118.00	56.02	58.92		59.01	0.001	2.35	50.24	21.13	0.27
Reach-1	5149.00	10 YR	306.00	56.02	62.01		62.03	0.000	1.67	453.65	279.72	0.13
Reach-1	5149.00	25 YR	432.00	56.02	63.32		63.33	0.000	1.37	850.31	322.97	0.09
Reach-1	5149.00	50 YR	666.00	56.02	64.44		64.46	0.000	1.48	1234.90	395.12	0.09
Reach-1	5149.00	100 YR	901.00	56.02	65.58		65.59	0.000	1.42	1864.36	585.67	0.08
Reach-1	5333.00	2 YR	118.00	56.33	59.14	57.63	59.20	0.001	1.96	60.45	31.04	0.24
Reach-1	5333.00	10 YR	306.00	56.33	62.04	58.52	62.08	0.000	1.85	211.99	219.85	0.15
Reach-1	5333.00	25 YR	432.00	56.33	63.33	58.97	63.35	0.000	1.42	757.87	322.77	0.10
Reach-1	5333.00	50 YR	666.00	56.33	64.46	59.66	64.48	0.000	1.55	1187.51	428.64	0.10
Reach-1	5333.00	100 YR	901.00	56.33	65.59	60.31	65.61	0.000	1.50	1692.94	464.71	0.09
Reach-1	5399.60		Culvert									
Reach-1	5469.00	2 YR	118.00	57.01	59.80	58.15	59.85	0.001	1.75	73.28	62.61	0.21
Reach-1	5469.00	10 YR	306.00	57.01	63.13	59.00	63.16	0.000	1.61	236.44	185.94	0.12
Reach-1	5469.00	25 YR	432.00	57.01	64.74	59.45	64.76	0.000	1.32	764.31	282.15	0.09
Reach-1	5469.00	50 YR	666.00	57.01	65.21	60.14	65.24	0.000	1.76	907.20	320.90	0.11
Reach-1	5469.00	100 YR	901.00	57.01	65.63	60.64	65.67	0.000	2.11	1046.57	346.35	0.13
Reach-1	5499.00	2 YR	118.00	56.76	59.81		59.89	0.001	2.21	53.42	21.55	0.25
Reach-1	5499.00	10 YR	306.00	56.76	63.15		63.17	0.000	1.52	488.58	243.06	0.11
Reach-1	5499.00	25 YR	432.00	56.76	64.75		64.76	0.000	1.22	917.07	291.29	0.08
Reach-1	5499.00	50 YR	666.00	56.76	65.23		65.25	0.000	1.64	1059.49	308.85	0.10
Reach-1	5499.00	100 YR	901.00	56.76	65.66		65.68	0.000	1.96	1195.17	323.59	0.12
Reach-1	5998.00	2 YR	118.00	58.16	60.62		60.81	0.004	3.51	33.66	22.80	0.51
Reach-1	5998.00	10 YR	306.00	58.16	63.22		63.35	0.001	2.89	131.04	59.23	0.26
Reach-1	5998.00	25 YR	432.00	58.16	64.77		64.85	0.000	2.47	383.86	291.55	0.19
Reach-1	5998.00	50 YR	666.00	58.16	65.27		65.38	0.001	3.05	532.30	302.31	0.22
Reach-1	5998.00	100 YR	901.00	58.16	65.73		65.84	0.001	3.43	670.93	312.01	0.24
Reach-1	6499.00	2 YR	118.00	59.58	62.31		62.44	0.003	2.95	40.35	29.83	0.40
Reach-1	6499.00	10 YR	306.00	59.58	63.75		63.91	0.002	3.43	143.72	115.37	0.35
Reach-1	6499.00	25 YR	432.00	59.58	65.01		65.09	0.001	2.70	331.21	179.94	0.23
Reach-1	6499.00	50 YR	666.00	59.58	65.58		65.69	0.001	3.26	437.45	192.15	0.26
Reach-1	6499.00	100 YR	901.00	59.58	66.07		66.19	0.001	3.67	534.00	202.62	0.28
Reach-1	6830.00	2 YR	118.00	59.86	63.17	61.89	63.37	0.003	3.62	32.71	14.10	0.42
Reach-1	6830.00	10 YR	306.00	59.86	64.45	63.31	64.97	0.005	5.78	52.84	17.31	0.58
Reach-1	6830.00	25 YR	432.00	59.86	65.18	64.01	65.81	0.005	6.43	76.71	51.11	0.59
Reach-1	6830.00	50 YR	666.00	59.86	65.71	65.32	66.71	0.007	8.29	121.28	142.43	0.71
Reach-1	6830.00	100 YR	901.00	59.86	66.40	66.40	67.20	0.005	8.06	234.52	176.39	0.64
Reach-1	6917.00		Culvert									
Reach-1	6966.00	2 YR	122.00	59.80	64.87	61.50	64.91	0.000	1.60	80.04	26.71	0.15
Reach-1	6966.00	10 YR	308.00	59.80	67.96	62.74	68.02	0.000	2.00	182.67	93.90	0.14
Reach-1	6966.00	25 YR	435.00	59.80	70.03	63.39	70.09	0.000	2.04	263.29	155.18	0.12
Reach-1	6966.00	50 YR	692.00	59.80	71.20	64.45	71.25	0.000	2.02	725.37	321.43	0.11
Reach-1	6966.00	100 YR	950.00	59.80	71.54	65.32	71.60	0.000	2.54	809.25	353.68	0.14
Reach-1	7348.00	2 YR	84.00	61.03	65.00	62.41	65.04	0.000	1.62	51.96	17.84	0.17
Reach-1	7348.00	10 YR	232.00	61.03	68.06	63.58	68.12	0.000	1.92	157.45	86.73	0.15
Reach-1	7348.00	25 YR	307.00	61.03	70.12	64.02	70.15	0.000	1.41	440.74	184.69	0.09
Reach-1	7348.00	50 YR	378.00	61.03	71.28	64.40	71.29	0.000	1.25	671.22	295.68	0.08
Reach-1	7348.00	100 YR	461.00	61.03	71.65	64.81	71.66	0.000	1.38	753.08	331.92	0.08

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7868.00	2 YR	84.00	65.21	66.55	66.55	67.13	0.019	6.09	13.83	12.12	1.01
Reach-1	7868.00	10 YR	232.00	65.21	68.06		68.73	0.010	6.60	35.15	16.19	0.79
Reach-1	7868.00	25 YR	307.00	65.21	70.13		70.34	0.002	3.81	114.17	130.32	0.36
Reach-1	7868.00	50 YR	378.00	65.21	71.33		71.37	0.000	2.06	349.78	262.68	0.17
Reach-1	7868.00	100 YR	461.00	65.21	71.70		71.74	0.000	1.96	451.96	277.54	0.16
Reach-1	8272.00	2 YR	84.00	67.10	70.26	69.41	70.46	0.004	4.15	33.53	68.78	0.43
Reach-1	8272.00	10 YR	232.00	67.10	70.94	70.69	71.07	0.004	4.27	102.86	143.06	0.40
Reach-1	8272.00	25 YR	307.00	67.10	71.18		71.29	0.003	4.05	138.34	161.31	0.37
Reach-1	8272.00	50 YR	378.00	67.10	71.59		71.65	0.001	3.10	212.49	198.25	0.27
Reach-1	8272.00	100 YR	461.00	67.10	71.91		71.96	0.001	2.75	279.74	223.55	0.23
Reach-1	8687.00	2 YR	84.00	67.66	71.66	69.98	71.85	0.003	3.82	28.38	24.79	0.35
Reach-1	8687.00	10 YR	232.00	67.66	72.52	72.10	72.89	0.005	5.94	57.52	53.34	0.49
Reach-1	8687.00	25 YR	307.00	67.66	72.74	72.58	73.27	0.007	7.33	74.03	94.76	0.59
Reach-1	8687.00	50 YR	378.00	67.66	73.04	73.04	73.40	0.005	6.65	110.56	133.87	0.52
Reach-1	8687.00	100 YR	461.00	67.66	73.15	73.15	73.57	0.006	7.28	127.86	158.20	0.56
Reach-1	8740.00		Culvert									
Reach-1	8786.00	2 YR	84.00	68.89	74.19	71.20	74.23	0.000	2.09	97.38	102.72	0.16
Reach-1	8786.00	10 YR	232.00	68.89	74.93	73.38	75.00	0.001	3.28	226.16	323.60	0.24
Reach-1	8786.00	25 YR	307.00	68.89	75.01	73.62	75.11	0.001	3.84	253.76	334.97	0.28
Reach-1	8786.00	50 YR	378.00	68.89	75.14	74.50	75.23	0.001	3.96	296.03	349.91	0.28
Reach-1	8786.00	100 YR	461.00	68.89	75.12	74.64	75.26	0.002	4.93	290.76	348.59	0.36

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
North Fork to Greens Mill Run - Future Conditions												
Reach-1	415.00	2 YR	214.00	42.21	45.41	44.08	45.57	0.003	3.24	73.68	42.64	0.36
Reach-1	415.00	10 YR	373.00	42.21	53.82	44.74	53.82	0.000	0.60	1756.81	404.46	0.03
Reach-1	415.00	25 YR	472.00	42.21	56.56	45.10	56.56	0.000	0.45	3304.52	633.63	0.02
Reach-1	415.00	50 YR	549.00	42.21	56.89	45.36	56.89	0.000	0.50	3517.18	655.20	0.02
Reach-1	415.00	100 YR	651.00	42.21	57.14	45.67	57.14	0.000	0.57	3683.38	683.24	0.03
Reach-1	664.00	2 YR	214.00	43.18	46.64	46.49	47.76	0.029	8.47	25.28	9.73	0.93
Reach-1	664.00	10 YR	373.00	43.18	53.82	47.71	53.84	0.000	1.42	615.28	216.84	0.08
Reach-1	664.00	25 YR	472.00	43.18	56.56	48.81	56.56	0.000	0.70	1439.84	370.79	0.04
Reach-1	664.00	50 YR	549.00	43.18	56.89	49.26	56.90	0.000	0.81	1593.13	510.76	0.04
Reach-1	664.00	100 YR	651.00	43.18	57.14	49.63	57.15	0.000	0.87	1722.34	521.63	0.04
Reach-1	723.40		Culvert									
Reach-1	841.00	2 YR	214.00	47.80	56.00	48.12	56.00	0.000	0.11	1871.63	287.00	0.01
Reach-1	841.00	10 YR	373.00	47.80	57.44	48.26	57.44	0.000	0.16	2293.72	298.74	0.01
Reach-1	841.00	25 YR	472.00	47.80	57.69	48.35	57.69	0.000	0.20	2368.48	301.84	0.01
Reach-1	841.00	50 YR	550.00	47.80	57.75	48.40	57.75	0.000	0.23	2387.99	302.72	0.01
Reach-1	841.00	100 YR	651.00	47.80	57.84	48.48	57.84	0.000	0.27	2413.63	303.86	0.02
Reach-1	902.00	2 YR	263.00	47.80	56.00		56.00	0.000	0.17	1525.88	245.64	0.01
Reach-1	902.00	10 YR	353.00	47.80	57.44		57.44	0.000	0.19	1889.51	260.36	0.01
Reach-1	902.00	25 YR	406.00	47.80	57.69		57.69	0.000	0.21	1954.78	263.65	0.01
Reach-1	902.00	50 YR	431.00	47.80	57.75		57.75	0.000	0.22	1971.86	264.45	0.01
Reach-1	902.00	100 YR	496.00	47.80	57.84		57.84	0.000	0.25	1994.29	265.44	0.02
Reach-1	1500.00	2 YR	263.00	48.00	56.00		56.00	0.000	0.19	1699.35	424.26	0.01
Reach-1	1500.00	10 YR	353.00	48.00	57.44		57.44	0.000	0.21	2356.43	483.09	0.01
Reach-1	1500.00	25 YR	406.00	48.00	57.69		57.69	0.000	0.23	2477.82	493.26	0.01
Reach-1	1500.00	50 YR	431.00	48.00	57.75		57.75	0.000	0.24	2509.90	497.46	0.01
Reach-1	1500.00	100 YR	496.00	48.00	57.84		57.84	0.000	0.28	2552.30	502.97	0.02
Reach-1	1998.00	2 YR	263.00	48.28	56.00		56.00	0.000	0.73	726.96	237.43	0.05
Reach-1	1998.00	10 YR	353.00	48.28	57.44		57.44	0.000	0.70	1102.92	284.56	0.04
Reach-1	1998.00	25 YR	406.00	48.28	57.69		57.69	0.000	0.76	1174.77	292.85	0.05
Reach-1	1998.00	50 YR	431.00	48.28	57.75		57.76	0.000	0.80	1193.75	295.00	0.05
Reach-1	1998.00	100 YR	496.00	48.28	57.83		57.84	0.000	0.91	1218.69	297.80	0.05
Reach-1	2497.00	2 YR	263.00	48.70	56.02		56.02	0.000	0.75	746.32	270.63	0.05
Reach-1	2497.00	10 YR	353.00	48.70	57.45		57.46	0.000	0.66	1200.29	339.09	0.04
Reach-1	2497.00	25 YR	406.00	48.70	57.70		57.71	0.000	0.71	1286.05	344.41	0.04
Reach-1	2497.00	50 YR	431.00	48.70	57.77		57.77	0.000	0.74	1308.83	345.81	0.04
Reach-1	2497.00	100 YR	496.00	48.70	57.86		57.86	0.000	0.83	1339.63	347.70	0.05
Reach-1	2837.00	2 YR	263.00	49.18	56.02	51.89	56.08	0.000	2.16	203.81	117.67	0.16
Reach-1	2837.00	10 YR	353.00	49.18	57.46	52.39	57.49	0.000	1.76	467.47	240.71	0.12
Reach-1	2837.00	25 YR	406.00	49.18	57.71	52.66	57.74	0.000	1.86	530.77	266.83	0.12
Reach-1	2837.00	50 YR	431.00	49.18	57.77	52.79	57.81	0.000	1.93	548.82	275.66	0.13
Reach-1	2837.00	100 YR	496.00	49.18	57.86	53.09	57.91	0.000	2.16	574.31	287.09	0.14
Reach-1	2918.70		Culvert									
Reach-1	2963.00	2 YR	263.00	49.39	56.65	51.93	56.70	0.000	1.91	169.65	150.10	0.13
Reach-1	2963.00	10 YR	353.00	49.39	57.70	52.37	57.72	0.000	1.35	535.20	231.00	0.09
Reach-1	2963.00	25 YR	406.00	49.39	57.87	52.61	57.89	0.000	1.45	575.92	244.83	0.09
Reach-1	2963.00	50 YR	431.00	49.39	57.94	52.72	57.96	0.000	1.50	592.64	254.72	0.10
Reach-1	2963.00	100 YR	496.00	49.39	58.05	53.00	58.07	0.000	1.65	620.10	270.19	0.10
Reach-1	3086.00	2 YR	263.00	50.43	56.72		56.74	0.000	1.74	381.95	155.20	0.13
Reach-1	3086.00	10 YR	353.00	50.43	57.72		57.74	0.000	1.68	548.84	178.56	0.12
Reach-1	3086.00	25 YR	406.00	50.43	57.89		57.91	0.000	1.85	580.44	185.10	0.13
Reach-1	3086.00	50 YR	431.00	50.43	57.96		57.98	0.000	1.92	593.07	187.83	0.13
Reach-1	3086.00	100 YR	496.00	50.43	58.07		58.10	0.000	2.14	613.59	192.14	0.14
Reach-1	3582.00	2 YR	261.00	52.39	56.98		57.11	0.002	3.63	199.94	225.92	0.33
Reach-1	3582.00	10 YR	349.00	52.39	57.90		57.94	0.001	2.48	418.49	248.01	0.20
Reach-1	3582.00	25 YR	401.00	52.39	58.10		58.14	0.001	2.55	467.84	253.01	0.20
Reach-1	3582.00	50 YR	426.00	52.39	58.18		58.22	0.001	2.59	488.07	255.04	0.20
Reach-1	3582.00	100 YR	491.00	52.39	58.32		58.37	0.001	2.77	525.78	258.76	0.22
Reach-1	3894.00	2 YR	261.00	52.81	57.60	55.76	57.89	0.002	4.30	60.62	21.51	0.40
Reach-1	3894.00	10 YR	349.00	52.81	58.13	56.23	58.52	0.002	5.01	70.39	26.07	0.43
Reach-1	3894.00	25 YR	401.00	52.81	58.31	56.50	58.78	0.003	5.52	73.92	27.57	0.47
Reach-1	3894.00	50 YR	426.00	52.81	58.38	56.62	58.89	0.003	5.77	75.42	28.18	0.48
Reach-1	3894.00	100 YR	491.00	52.81	58.52	56.91	59.16	0.004	6.43	78.47	29.40	0.53
Reach-1	3919.20		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4027.00	2 YR	263.00	53.79	61.34	56.70	61.36	0.000	1.16	523.66	349.24	0.08
Reach-1	4027.00	10 YR	349.00	53.79	63.95	57.20	63.96	0.000	0.94	854.41	450.38	0.06
Reach-1	4027.00	25 YR	402.00	53.79	65.90	57.52	65.91	0.000	0.83	1101.15	553.13	0.04
Reach-1	4027.00	50 YR	428.00	53.79	66.99	57.82	67.00	0.000	0.78	1239.58	621.06	0.04
Reach-1	4027.00	100 YR	500.00	53.79	68.04	57.99	68.04	0.000	0.38	4295.61	711.98	0.02
Reach-1	4074.00	2 YR	321.00	53.69	61.36		61.36	0.000	0.60	1501.41	551.96	0.04
Reach-1	4074.00	10 YR	607.00	53.69	63.96		63.96	0.000	0.46	2989.96	594.64	0.03
Reach-1	4074.00	25 YR	796.00	53.69	65.91		65.91	0.000	0.40	4262.41	693.11	0.02
Reach-1	4074.00	50 YR	960.00	53.69	67.00		67.00	0.000	0.39	5041.79	734.79	0.02
Reach-1	4074.00	100 YR	1144.00	53.69	68.04		68.04	0.000	0.39	5829.00	774.64	0.02
Reach-1	4497.00	2 YR	321.00	54.69	61.37		61.38	0.000	0.95	707.45	238.86	0.07
Reach-1	4497.00	10 YR	607.00	54.69	63.97		63.97	0.000	0.86	1491.15	349.01	0.05
Reach-1	4497.00	25 YR	796.00	54.69	65.91		65.91	0.000	0.76	2336.17	501.42	0.04
Reach-1	4497.00	50 YR	960.00	54.69	67.00		67.00	0.000	0.71	2926.12	570.20	0.04
Reach-1	4497.00	100 YR	1144.00	54.69	68.04		68.05	0.000	0.69	3562.82	638.71	0.03
Reach-1	5149.00	2 YR	321.00	56.02	61.43		61.48	0.000	2.12	315.52	214.30	0.17
Reach-1	5149.00	10 YR	607.00	56.02	64.00		64.01	0.000	1.31	1077.58	344.34	0.09
Reach-1	5149.00	25 YR	796.00	56.02	65.93		65.93	0.000	0.86	2068.82	600.33	0.05
Reach-1	5149.00	50 YR	960.00	56.02	67.01		67.02	0.000	0.73	2744.58	641.10	0.04
Reach-1	5149.00	100 YR	1144.00	56.02	68.05		68.06	0.000	0.67	3445.73	711.98	0.04
Reach-1	5333.00	2 YR	321.00	56.33	61.51	58.57	61.58	0.000	2.22	182.06	205.41	0.19
Reach-1	5333.00	10 YR	607.00	56.33	64.01	59.49	64.04	0.000	1.60	1001.47	397.75	0.11
Reach-1	5333.00	25 YR	796.00	56.33	65.93	60.02	65.94	0.000	1.22	1851.74	482.76	0.07
Reach-1	5333.00	50 YR	960.00	56.33	67.02	60.43	67.02	0.000	1.14	2417.51	571.71	0.06
Reach-1	5333.00	100 YR	1144.00	56.33	68.06	60.78	68.06	0.000	1.09	3065.72	688.46	0.06
Reach-1	5399.60		Culvert									
Reach-1	5469.00	2 YR	321.00	57.01	62.68	59.07	62.73	0.000	1.86	214.47	143.10	0.14
Reach-1	5469.00	10 YR	607.00	57.01	65.09	60.00	65.12	0.000	1.67	868.85	315.67	0.11
Reach-1	5469.00	25 YR	796.00	57.01	65.93	60.43	65.96	0.000	1.71	1162.56	414.04	0.10
Reach-1	5469.00	50 YR	960.00	57.01	67.01	60.76	67.03	0.000	1.48	1827.56	715.63	0.08
Reach-1	5469.00	100 YR	1144.00	57.01	68.06	61.09	68.07	0.000	1.19	2618.39	811.24	0.06
Reach-1	5499.00	2 YR	321.00	56.76	62.71		62.74	0.000	1.81	386.40	214.33	0.14
Reach-1	5499.00	10 YR	607.00	56.76	65.11		65.12	0.000	1.44	1023.40	304.17	0.09
Reach-1	5499.00	25 YR	796.00	56.76	65.95		65.97	0.000	1.46	1293.22	333.84	0.09
Reach-1	5499.00	50 YR	960.00	56.76	67.02		67.03	0.000	1.34	1662.49	358.62	0.08
Reach-1	5499.00	100 YR	1144.00	56.76	68.06		68.07	0.000	1.26	2048.27	382.43	0.07
Reach-1	5998.00	2 YR	321.00	58.16	62.91		63.08	0.002	3.34	113.32	53.44	0.31
Reach-1	5998.00	10 YR	607.00	58.16	65.17		65.26	0.001	2.80	501.05	300.07	0.21
Reach-1	5998.00	25 YR	796.00	58.16	66.01		66.07	0.000	2.57	762.03	318.23	0.18
Reach-1	5998.00	50 YR	960.00	58.16	67.06		67.10	0.000	2.16	1107.93	340.82	0.14
Reach-1	5998.00	100 YR	1144.00	58.16	68.10		68.12	0.000	1.89	1485.41	390.00	0.11
Reach-1	6499.00	2 YR	321.00	59.58	63.81		63.97	0.002	3.42	150.84	118.75	0.35
Reach-1	6499.00	10 YR	607.00	59.58	65.51		65.59	0.001	2.85	424.24	190.68	0.23
Reach-1	6499.00	25 YR	796.00	59.58	66.25		66.31	0.001	2.71	571.19	206.19	0.20
Reach-1	6499.00	50 YR	960.00	59.58	67.20		67.24	0.000	2.28	774.02	222.28	0.16
Reach-1	6499.00	100 YR	1144.00	59.58	68.18		68.21	0.000	1.99	1000.05	238.93	0.13
Reach-1	6830.00	2 YR	321.00	59.86	64.63	63.41	65.14	0.005	5.74	56.51	24.60	0.57
Reach-1	6830.00	10 YR	607.00	59.86	65.68	64.92	66.54	0.006	7.65	117.76	139.39	0.66
Reach-1	6830.00	25 YR	796.00	59.86	66.37	66.18	67.02	0.004	7.23	229.29	175.73	0.58
Reach-1	6830.00	50 YR	960.00	59.86	67.28	66.49	67.62	0.002	5.81	403.14	207.81	0.43
Reach-1	6830.00	100 YR	1144.00	59.86	68.24	66.67	68.43	0.001	4.81	614.96	236.29	0.33
Reach-1	6917.00		Culvert									
Reach-1	6966.00	2 YR	321.00	59.80	68.16	62.81	68.22	0.000	2.02	190.54	101.83	0.14
Reach-1	6966.00	10 YR	607.00	59.80	71.05	64.13	71.08	0.000	1.85	688.15	301.91	0.11
Reach-1	6966.00	25 YR	796.00	59.80	71.33	64.82	71.38	0.000	2.24	757.21	331.33	0.13
Reach-1	6966.00	50 YR	960.00	59.80	71.55	65.34	71.62	0.000	2.55	814.07	354.91	0.14
Reach-1	6966.00	100 YR	1144.00	59.80	71.78	65.92	71.86	0.000	2.85	876.14	370.49	0.16
Reach-1	7348.00	2 YR	163.00	61.03	68.29	63.09	68.31	0.000	1.24	178.69	97.18	0.09
Reach-1	7348.00	10 YR	297.00	61.03	71.12	63.97	71.12	0.000	0.79	637.02	281.50	0.05
Reach-1	7348.00	25 YR	384.00	61.03	71.43	64.44	71.44	0.000	0.89	704.72	310.11	0.05
Reach-1	7348.00	50 YR	464.00	61.03	71.67	64.83	71.68	0.000	0.98	759.25	335.41	0.06
Reach-1	7348.00	100 YR	554.00	61.03	71.93	65.22	71.94	0.000	1.09	819.18	378.78	0.06

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7868.00	2 YR	163.00	65.21	68.40		68.64	0.004	3.99	40.81	17.11	0.46
Reach-1	7868.00	10 YR	297.00	65.21	71.15		71.16	0.000	1.05	304.21	231.82	0.09
Reach-1	7868.00	25 YR	384.00	65.21	71.46		71.48	0.000	0.99	385.66	267.26	0.08
Reach-1	7868.00	50 YR	464.00	65.21	71.71		71.72	0.000	0.96	452.20	277.59	0.08
Reach-1	7868.00	100 YR	554.00	65.21	71.96		71.98	0.000	0.96	525.77	300.97	0.07
Reach-1	8272.00	2 YR	163.00	67.10	70.48	70.48	70.73	0.006	5.19	50.65	86.10	0.52
Reach-1	8272.00	10 YR	297.00	67.10	71.23		71.30	0.001	2.41	147.00	166.52	0.22
Reach-1	8272.00	25 YR	384.00	67.10	71.52		71.59	0.001	2.06	198.80	191.76	0.18
Reach-1	8272.00	50 YR	464.00	67.10	71.75		71.82	0.001	1.85	245.68	209.98	0.16
Reach-1	8272.00	100 YR	554.00	67.10	72.00		72.06	0.000	1.69	300.59	232.94	0.14
Reach-1	8687.00	2 YR	163.00	67.66	72.32	71.75	72.57	0.003	4.78	49.03	37.85	0.40
Reach-1	8687.00	10 YR	297.00	67.66	72.35	72.35	73.15	0.011	8.54	50.14	38.43	0.72
Reach-1	8687.00	25 YR	384.00	67.66	73.04	73.04	73.41	0.005	6.73	110.85	134.06	0.53
Reach-1	8687.00	50 YR	464.00	67.66	73.16	73.16	73.58	0.006	7.29	128.70	159.31	0.56
Reach-1	8687.00	100 YR	554.00	67.66	73.35	73.35	73.70	0.005	7.03	161.23	180.75	0.53
Reach-1	8740.00		Culvert									
Reach-1	8786.00	2 YR	163.00	68.89	74.79	72.66	74.85	0.001	2.85	159.59	223.12	0.21
Reach-1	8786.00	10 YR	297.00	68.89	74.98	73.90	75.10	0.002	4.19	218.59	329.77	0.31
Reach-1	8786.00	25 YR	384.00	68.89	75.06	74.76	75.20	0.002	4.74	246.51	341.62	0.34
Reach-1	8786.00	50 YR	464.00	68.89	75.07	75.03	75.27	0.003	5.67	248.89	342.61	0.41
Reach-1	8786.00	100 YR	554.00	68.89	75.20	75.12	75.37	0.002	5.46	295.75	355.58	0.39

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Unnamed Tributary to Greens Mill Run - Existing Conditions												
Main	471.00	2 yr	388.00	37.60	42.22	41.67	42.66	0.003	5.89	123.65	97.86	0.53
Main	471.00	10 yr	889.00	37.60	44.74	43.24	44.77	0.000	2.28	784.28	331.35	0.16
Main	471.00	25 yr	1290.00	37.60	46.36	43.49	46.38	0.000	1.64	1346.73	361.67	0.10
Main	471.00	50 yr	1646.00	37.60	47.80	43.72	47.82	0.000	1.38	1884.75	388.76	0.08
Main	471.00	100 yr	2050.00	37.60	48.48	43.87	48.50	0.000	1.46	2151.97	397.78	0.08
Main	1040.00	2 yr	388.00	39.20	43.36		43.39	0.001	2.16	270.02	184.87	0.23
Main	1040.00	10 yr	889.00	39.20	44.90		44.94	0.000	2.09	576.45	222.20	0.18
Main	1040.00	25 yr	1290.00	39.20	46.42		46.45	0.000	1.78	982.05	284.33	0.13
Main	1040.00	50 yr	1646.00	39.20	47.83		47.86	0.000	1.59	1423.76	347.43	0.10
Main	1040.00	100 yr	2050.00	39.20	48.51		48.54	0.000	1.68	1663.95	357.22	0.11
Main	1080.00		Bridge									
Main	1108.00	2 yr	388.00	38.90	43.91	43.53	44.82	0.006	7.85	55.88	37.61	0.75
Main	1108.00	10 yr	889.00	38.90	45.34	45.27	45.75	0.003	6.84	259.38	219.36	0.55
Main	1108.00	25 yr	1290.00	38.90	46.37	45.57	46.53	0.001	4.78	506.96	253.02	0.35
Main	1108.00	50 yr	1646.00	38.90	47.83	45.75	47.89	0.000	3.23	917.05	332.95	0.21
Main	1108.00	100 yr	2050.00	38.90	48.51	45.97	48.57	0.000	3.13	1149.38	351.96	0.20
Main	1700.00	2 yr	388.00	40.50	46.11	45.59	46.24	0.001	3.66	199.44	218.85	0.33
Main	1700.00	10 yr	889.00	40.50	46.81		46.97	0.001	4.57	373.18	263.83	0.37
Main	1700.00	25 yr	1290.00	40.50	47.16		47.35	0.002	5.15	469.05	278.31	0.41
Main	1700.00	50 yr	1646.00	40.50	48.12		48.22	0.001	3.86	748.44	308.93	0.28
Main	1700.00	100 yr	2050.00	40.50	48.74		48.83	0.001	3.65	947.24	324.84	0.25
Main	1738.00		Bridge									
Main	1758.00	2 yr	388.00	40.40	46.16	44.81	46.26	0.001	3.08	222.10	174.40	0.27
Main	1758.00	10 yr	889.00	40.40	46.85	46.07	47.01	0.001	4.41	350.28	195.61	0.36
Main	1758.00	25 yr	1290.00	40.40	47.20	46.40	47.41	0.002	5.24	419.50	203.13	0.41
Main	1758.00	50 yr	1646.00	40.40	48.12	46.67	48.27	0.001	4.37	621.55	234.13	0.31
Main	1758.00	100 yr	2050.00	40.40	48.75	46.92	48.89	0.001	4.29	772.83	249.72	0.29
Main	1903.00	2 yr	388.00	37.40	46.24		46.30	0.000	2.13	283.99	164.32	0.14
Main	1903.00	10 yr	889.00	37.40	46.96		47.11	0.000	3.70	415.61	193.63	0.23
Main	1903.00	25 yr	1290.00	37.40	47.33		47.55	0.001	4.64	489.87	203.93	0.28
Main	1903.00	50 yr	1646.00	37.40	48.19		48.37	0.001	4.39	678.24	236.47	0.25
Main	1903.00	100 yr	2050.00	37.40	48.81		48.98	0.000	4.51	832.66	262.52	0.25
Main	1937.00		Bridge									
Main	1957.00	2 yr	388.00	37.50	46.29	40.88	46.32	0.000	1.78	343.21	150.42	0.12
Main	1957.00	10 yr	889.00	37.50	47.04	42.87	47.15	0.000	3.12	462.25	163.70	0.19
Main	1957.00	25 yr	1290.00	37.50	47.45	44.04	47.60	0.000	3.97	530.15	171.60	0.24
Main	1957.00	50 yr	1646.00	37.50	48.26	45.52	48.42	0.000	4.17	682.71	210.10	0.24
Main	1957.00	100 yr	2050.00	37.50	48.86	46.14	49.03	0.000	4.43	818.15	234.23	0.25
Main	2169.00	2 yr	388.00	39.90	46.23		46.42	0.001	3.53	109.95	28.18	0.31
Main	2169.00	10 yr	889.00	39.90	46.72	45.28	47.51	0.004	7.14	129.78	65.54	0.61
Main	2169.00	25 yr	1290.00	39.90	46.55	46.36	48.37	0.008	10.83	120.08	45.83	0.94
Main	2169.00	50 yr	1646.00	39.90	48.01	48.01	48.93	0.004	8.40	288.36	182.20	0.64
Main	2169.00	100 yr	2050.00	39.90	48.70		49.38	0.003	7.72	423.06	204.40	0.55
Main	2201.00		Bridge									
Main	2231.00	2 yr	388.00	38.63	46.35	42.25	46.47	0.000	2.81	138.95	36.58	0.22
Main	2231.00	10 yr	889.00	38.63	47.27	44.16	47.69	0.001	5.27	182.91	56.89	0.39
Main	2231.00	25 yr	1290.00	38.63	48.83	45.29	49.21	0.001	5.26	320.14	124.15	0.35
Main	2231.00	50 yr	1646.00	38.63	49.04	46.16	49.58	0.002	6.37	346.33	132.66	0.42
Main	2231.00	100 yr	2050.00	38.63	49.35	47.47	50.04	0.002	7.33	389.44	146.37	0.47
Main	3133.00	2 yr	388.00	39.86	46.88		47.09	0.001	3.84	129.99	105.25	0.30
Main	3133.00	10 yr	889.00	39.86	48.44		48.58	0.001	3.93	432.68	248.29	0.27
Main	3133.00	25 yr	1290.00	39.86	49.66		49.73	0.000	3.08	828.03	353.64	0.19
Main	3133.00	50 yr	1646.00	39.86	50.11		50.19	0.000	3.27	995.59	393.29	0.20
Main	3133.00	100 yr	2050.00	39.86	50.62		50.69	0.000	3.35	1203.00	434.46	0.20
Main	3152.00		Bridge									
Main	3177.00	2 yr	388.00	39.20	47.33	42.99	47.42	0.000	2.68	198.54	103.82	0.18
Main	3177.00	10 yr	889.00	39.20	48.48	45.41	48.66	0.001	4.15	415.01	257.71	0.26
Main	3177.00	25 yr	1290.00	39.20	49.66	46.49	49.76	0.000	3.46	765.63	336.15	0.20
Main	3177.00	50 yr	1646.00	39.20	50.11	47.45	50.22	0.000	3.68	926.40	375.11	0.21
Main	3177.00	100 yr	2050.00	39.20	50.62	48.59	50.72	0.000	3.81	1141.47	448.92	0.21

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	3293.00	2 yr	388.00	42.54	46.83	46.28	47.78	0.007	7.82	49.55	15.94	0.78
Main	3293.00	10 yr	889.00	42.54	48.91	48.91	49.41	0.003	6.89	242.06	231.53	0.55
Main	3293.00	25 yr	1290.00	42.54	49.60		49.89	0.002	5.97	424.74	314.17	0.45
Main	3293.00	50 yr	1646.00	42.54	50.10		50.32	0.002	5.62	621.52	420.55	0.40
Main	3293.00	100 yr	2050.00	42.54	50.65		50.80	0.001	4.87	863.03	454.17	0.33
Main	3737.00	2 yr	388.00	39.50	47.98		48.02	0.000	1.75	281.30	75.74	0.11
Main	3737.00	10 yr	889.00	39.50	49.61		49.72	0.000	3.05	488.60	228.13	0.18
Main	3737.00	25 yr	1290.00	39.50	50.06		50.22	0.000	3.80	606.31	296.31	0.22
Main	3737.00	50 yr	1646.00	39.50	50.47		50.66	0.000	4.23	738.29	348.50	0.24
Main	3737.00	100 yr	2050.00	39.50	50.92		51.11	0.000	4.56	910.38	418.03	0.25
Main	3767.00		Bridge									
Main	3804.00	2 yr	388.00	40.38	48.00	43.12	48.04	0.000	1.78	315.05	135.61	0.12
Main	3804.00	10 yr	889.00	40.38	49.68	44.92	49.73	0.000	2.32	690.29	302.31	0.14
Main	3804.00	25 yr	1290.00	40.38	50.17	46.62	50.24	0.000	2.87	855.82	382.63	0.17
Main	3804.00	50 yr	1646.00	40.38	50.59	47.37	50.67	0.000	3.29	1037.80	478.40	0.19
Main	3804.00	100 yr	2050.00	40.38	51.05	47.85	51.13	0.000	3.33	1267.53	505.27	0.19
Main	4203.00	2 yr	149.00	43.38	48.06		48.11	0.000	1.81	83.23	26.32	0.16
Main	4203.00	10 yr	410.00	43.38	49.75		49.82	0.000	2.36	287.62	184.98	0.18
Main	4203.00	25 yr	634.00	43.38	50.27		50.35	0.000	2.80	391.60	231.92	0.20
Main	4203.00	50 yr	831.00	43.38	50.72		50.80	0.000	2.92	515.92	308.98	0.20
Main	4203.00	100 yr	1054.00	43.38	51.18		51.25	0.000	3.00	665.20	344.05	0.20
Main	4456.00	2 yr	149.00	44.74	48.14	46.24	48.24	0.001	2.54	58.76	21.16	0.27
Main	4456.00	10 yr	410.00	44.74	49.80	47.58	50.04	0.001	4.05	137.89	128.57	0.34
Main	4456.00	25 yr	634.00	44.74	50.31	48.43	50.64	0.002	5.04	211.37	159.44	0.41
Main	4456.00	50 yr	831.00	44.74	50.75	49.18	51.11	0.002	5.49	291.73	222.24	0.42
Main	4456.00	100 yr	1054.00	44.74	51.22	50.33	51.53	0.001	5.45	398.53	233.56	0.40
Main	4480.00		Culvert									
Main	4520.00	2 yr	149.00	44.77	48.81	46.26	48.87	0.000	1.96	77.17	27.81	0.19
Main	4520.00	10 yr	410.00	44.77	50.94	47.56	51.03	0.000	2.67	267.54	157.09	0.20
Main	4520.00	25 yr	634.00	44.77	51.31	48.39	51.46	0.001	3.60	328.47	176.82	0.27
Main	4520.00	50 yr	831.00	44.77	51.55	49.06	51.77	0.001	4.31	374.05	189.73	0.31
Main	4520.00	100 yr	1054.00	44.77	51.77	49.87	52.06	0.001	5.05	416.75	199.99	0.36
Main	5403.00	2 yr	149.00	45.49	49.26		49.35	0.001	2.32	64.28	20.70	0.23
Main	5403.00	10 yr	410.00	45.49	51.40		51.60	0.001	3.62	125.25	40.66	0.29
Main	5403.00	25 yr	634.00	45.49	52.03		52.39	0.002	4.87	153.49	48.40	0.36
Main	5403.00	50 yr	831.00	45.49	52.50		52.99	0.002	5.78	177.45	54.10	0.41
Main	5403.00	100 yr	1054.00	45.49	52.96		53.59	0.002	6.65	209.69	87.11	0.46
Main	6160.00	2 yr	80.00	49.23	50.30	50.30	50.78	0.020	5.54	14.50	15.41	1.01
Main	6160.00	10 yr	184.00	49.23	52.39		52.59	0.002	3.58	51.19	19.76	0.39
Main	6160.00	25 yr	258.00	49.23	53.45		53.63	0.002	3.42	92.81	83.21	0.33
Main	6160.00	50 yr	320.00	49.23	54.14		54.26	0.001	3.05	184.10	162.97	0.27
Main	6160.00	100 yr	425.00	49.23	54.77		54.86	0.001	2.90	299.99	198.03	0.24
Main	6719.00	2 yr	80.00	45.56	50.94		50.95	0.000	0.83	102.97	34.70	0.07
Main	6719.00	10 yr	184.00	45.56	52.73		52.76	0.000	1.27	185.68	57.75	0.09
Main	6719.00	25 yr	258.00	45.56	53.76		53.79	0.000	1.47	253.14	76.77	0.10
Main	6719.00	50 yr	320.00	45.56	54.38		54.42	0.000	1.63	309.37	105.87	0.10
Main	6719.00	100 yr	425.00	45.56	54.98		55.03	0.000	1.92	397.80	169.04	0.12
Main	7442.00	2 yr	80.00	51.65	52.68	52.68	53.17	0.020	5.64	14.24	14.57	1.01
Main	7442.00	10 yr	184.00	51.65	53.41	53.41	54.23	0.018	7.26	25.29	15.65	1.01
Main	7442.00	25 yr	258.00	51.65	53.84	53.84	54.84	0.017	8.02	32.20	16.28	1.01
Main	7442.00	50 yr	320.00	51.65	54.17	54.17	55.30	0.017	8.54	37.49	16.75	1.01
Main	7442.00	100 yr	425.00	51.65	54.66	54.66	55.99	0.016	9.25	45.96	17.48	1.01
Main	7858.00	2 yr	80.00	52.83	55.21	54.20	55.33	0.002	2.80	28.71	15.10	0.36
Main	7858.00	10 yr	184.00	52.83	56.39	54.95	56.62	0.003	3.88	47.28	16.30	0.40
Main	7858.00	25 yr	258.00	52.83	57.05	55.39	57.36	0.003	4.43	58.44	21.01	0.42
Main	7858.00	50 yr	320.00	52.83	57.52	55.72	57.86	0.003	4.76	76.79	66.35	0.43
Main	7858.00	100 yr	425.00	52.83	58.12	56.23	58.45	0.003	4.90	137.12	120.20	0.42
Main	8366.00	2 yr	80.00	53.66	55.90		55.95	0.001	1.78	45.08	21.18	0.22
Main	8366.00	10 yr	184.00	53.66	57.26		57.35	0.001	2.46	74.69	22.50	0.24
Main	8366.00	25 yr	258.00	53.66	58.02		58.14	0.001	2.81	92.11	23.24	0.25
Main	8366.00	50 yr	320.00	53.66	58.55		58.69	0.001	3.06	104.45	23.75	0.26
Main	8366.00	100 yr	425.00	53.66	59.16		59.35	0.001	3.57	120.81	46.46	0.28
Main	8762.00	2 yr	80.00	53.98	56.25	54.96	56.31	0.001	2.02	39.81	19.82	0.25
Main	8762.00	10 yr	184.00	53.98	57.63	55.59	57.74	0.001	2.68	68.48	21.62	0.27
Main	8762.00	25 yr	258.00	53.98	58.41	55.96	58.55	0.001	3.01	85.75	22.64	0.27
Main	8762.00	50 yr	320.00	53.98	58.96	56.25	59.12	0.001	3.26	98.29	23.35	0.28
Main	8762.00	100 yr	425.00	53.98	59.64	56.68	59.85	0.001	3.71	114.56	24.24	0.30
Main	8827.00		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	8922.00	2 yr	80.00	56.58	58.70	58.27	59.10	0.012	5.06	15.90	9.39	0.68
Main	8922.00	10 yr	184.00	56.58	61.13	59.34	61.34	0.003	3.90	65.54	56.49	0.36
Main	8922.00	25 yr	258.00	56.58	62.86	59.94	62.90	0.001	2.18	275.23	189.79	0.17
Main	8922.00	50 yr	320.00	56.58	64.61	60.75	64.62	0.000	1.07	736.00	318.36	0.07
Main	8922.00	100 yr	427.00	56.58	65.58	61.43	65.59	0.000	1.01	1091.36	386.76	0.06
Main	9372.00	2 yr	67.00	58.21	60.67		60.74	0.001	2.04	33.09	16.61	0.25
Main	9372.00	10 yr	160.00	58.21	62.14		62.25	0.001	2.67	61.98	37.26	0.27
Main	9372.00	25 yr	227.00	58.21	63.13		63.21	0.001	2.51	135.22	96.46	0.22
Main	9372.00	50 yr	283.00	58.21	64.66		64.68	0.000	1.55	349.91	168.96	0.12
Main	9372.00	100 yr	340.00	58.21	65.61		65.63	0.000	1.28	526.61	201.51	0.09
Main	9769.00	2 yr	67.00	57.80	61.10		61.14	0.001	1.70	39.69	15.24	0.19
Main	9769.00	10 yr	160.00	57.80	62.64		62.74	0.001	2.46	65.17	17.65	0.23
Main	9769.00	25 yr	227.00	57.80	63.51		63.64	0.001	2.80	81.10	19.01	0.24
Main	9769.00	50 yr	283.00	57.80	64.77		64.86	0.001	2.47	140.69	83.62	0.19
Main	9769.00	100 yr	340.00	57.80	65.67		65.73	0.000	2.10	241.94	134.60	0.15
Main	10471.00	2 yr	67.00	58.47	61.86	60.23	61.95	0.002	2.43	27.72	12.24	0.28
Main	10471.00	10 yr	160.00	58.47	63.59	61.24	63.74	0.002	3.07	52.20	16.03	0.30
Main	10471.00	25 yr	227.00	58.47	64.51	61.79	64.69	0.002	3.34	67.86	18.04	0.30
Main	10471.00	50 yr	283.00	58.47	65.43	62.19	65.60	0.002	3.32	85.45	20.83	0.28
Main	10471.00	100 yr	340.00	58.47	66.09	62.56	66.27	0.001	3.44	101.42	27.92	0.27
Main	10681.00		Culvert									
Main	10912.00	2 yr	73.00	58.55	62.69	61.23	62.84	0.003	3.07	23.88	9.88	0.35
Main	10912.00	10 yr	186.00	58.55	64.26	62.48	64.58	0.005	4.52	41.14	12.08	0.43
Main	10912.00	25 yr	274.00	58.55	65.36	63.21	65.75	0.005	4.96	55.84	21.33	0.43
Main	10912.00	50 yr	317.00	58.55	66.17	63.51	66.50	0.003	4.67	72.79	33.64	0.37
Main	10912.00	100 yr	455.00	58.55	67.44	64.41	67.80	0.003	5.00	103.35	313.29	0.36
Main	11214.00	2 yr	73.00	61.69	63.74		63.86	0.003	2.77	26.46	16.85	0.39
Main	11214.00	10 yr	186.00	61.69	65.43		65.57	0.002	3.08	60.43	23.34	0.34
Main	11214.00	25 yr	274.00	61.69	66.46		66.62	0.002	3.17	86.75	28.22	0.31
Main	11214.00	50 yr	317.00	61.69	67.01		67.16	0.001	3.10	106.32	49.87	0.28
Main	11214.00	100 yr	455.00	61.69	68.18		68.33	0.001	3.18	171.47	65.19	0.25
Main	11673.00	2 yr	73.00	63.20	65.00	64.28	65.15	0.002	3.07	23.85	15.59	0.44
Main	11673.00	10 yr	186.00	63.20	66.36	65.12	66.60	0.002	3.91	47.53	19.16	0.44
Main	11673.00	25 yr	274.00	63.20	67.23	65.64	67.51	0.002	4.22	65.07	21.43	0.43
Main	11673.00	50 yr	317.00	63.20	67.65	65.86	67.93	0.002	4.26	74.37	22.53	0.41
Main	11673.00	100 yr	455.00	63.20	68.67	66.50	69.00	0.002	4.62	98.66	25.20	0.41
Main	11857.00		Culvert									
Main	12142.00	2 yr	73.00	63.50	68.30	64.76	68.32	0.000	1.02	71.83	21.77	0.10
Main	12142.00	10 yr	186.00	63.50	71.48	65.71	71.50	0.000	1.16	174.27	57.17	0.08
Main	12142.00	25 yr	274.00	63.50	72.33	66.27	72.36	0.000	1.26	273.08	133.12	0.09
Main	12142.00	50 yr	317.00	63.50	72.45	66.51	72.48	0.000	1.40	290.22	159.43	0.09
Main	12142.00	100 yr	455.00	63.50	72.73	67.18	72.77	0.000	1.75	342.94	221.92	0.12
Main	12178.00	2 yr	73.00	64.80	68.28	66.02	68.35	0.000	2.17	33.78	19.27	0.21
Main	12178.00	10 yr	186.00	64.80	71.43	67.06	71.56	0.000	2.88	64.51	37.92	0.20
Main	12178.00	25 yr	274.00	64.80	72.33	67.72	72.37	0.000	1.61	211.33	192.21	0.12
Main	12178.00	50 yr	317.00	64.80	72.45	68.01	72.49	0.000	1.72	236.26	238.44	0.13
Main	12178.00	100 yr	455.00	64.80	72.73	68.89	72.78	0.000	1.95	307.41	261.32	0.14
Main	12262.00		Culvert									
Main	12316.00	2 yr	73.00	65.90	69.01	67.31	69.10	0.002	2.39	30.64	12.70	0.27
Main	12316.00	10 yr	186.00	65.90	72.76	68.39	72.78	0.000	1.33	223.79	279.42	0.10
Main	12316.00	25 yr	274.00	65.90	73.01	69.04	73.03	0.000	1.45	300.01	338.83	0.11
Main	12316.00	50 yr	317.00	65.90	73.08	69.31	73.10	0.000	1.55	325.55	371.40	0.11
Main	12316.00	100 yr	455.00	65.90	73.25	70.10	73.28	0.000	1.80	392.79	396.42	0.13
Main	12724.00	2 yr	73.00	65.98	69.58		69.65	0.001	2.07	35.45	12.68	0.22
Main	12724.00	10 yr	186.00	65.98	72.84		72.86	0.000	1.31	250.03	182.30	0.10
Main	12724.00	25 yr	274.00	65.98	73.10		73.13	0.000	1.63	301.05	212.00	0.12
Main	12724.00	50 yr	317.00	65.98	73.19		73.22	0.000	1.78	320.14	242.45	0.13
Main	12724.00	100 yr	455.00	65.98	73.40		73.44	0.000	2.23	377.67	292.48	0.16

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	13101.00	2 yr	73.00	63.90	69.77	65.47	69.83	0.000	1.86	39.49	28.18	0.14
Main	13101.00	10 yr	186.00	63.90	72.88	66.80	72.88	0.000	0.62	549.59	391.72	0.04
Main	13101.00	25 yr	274.00	63.90	73.16	67.64	73.16	0.000	0.75	663.76	426.83	0.05
Main	13101.00	50 yr	317.00	63.90	73.25	68.02	73.26	0.000	0.82	704.47	437.26	0.05
Main	13101.00	100 yr	455.00	63.90	73.50	69.14	73.50	0.000	1.00	812.63	450.88	0.06
Main	13134.00		Culvert									
Main	13173.00	2 yr	73.00	68.21	71.79	69.19	71.81	0.000	1.20	61.25	88.95	0.12
Main	13173.00	10 yr	186.00	68.21	72.99	69.96	73.00	0.000	1.01	283.82	222.50	0.09
Main	13173.00	25 yr	274.00	68.21	73.18	70.40	73.19	0.000	1.29	326.59	231.70	0.11
Main	13173.00	50 yr	317.00	68.21	73.26	70.60	73.28	0.000	1.40	347.43	236.06	0.12
Main	13173.00	100 yr	455.00	68.21	73.52	71.16	73.55	0.000	1.71	413.41	279.67	0.14
Main	13353.00	2 yr	73.00	69.00	71.84		71.88	0.001	1.44	51.21	36.57	0.17
Main	13353.00	10 yr	186.00	69.00	73.01		73.04	0.000	1.50	189.24	183.07	0.14
Main	13353.00	25 yr	274.00	69.00	73.22		73.25	0.000	1.86	227.78	197.75	0.17
Main	13353.00	50 yr	317.00	69.00	73.31		73.35	0.001	1.98	246.82	204.73	0.18
Main	13353.00	100 yr	455.00	69.00	73.59		73.63	0.001	2.31	306.49	228.69	0.21

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Unnamed Tributary to Greens Mill Run - Future Conditions												
Main	471.00	2 yr	639.00	37.60	42.98	42.52	43.45	0.003	6.65	234.38	281.08	0.55
Main	471.00	10 yr	1336.00	37.60	47.39	43.57	47.40	0.000	1.27	1727.81	378.29	0.08
Main	471.00	25 yr	1808.00	37.60	48.51	43.81	48.52	0.000	1.31	2163.92	398.36	0.07
Main	471.00	50 yr	2234.00	37.60	49.13	44.02	49.15	0.000	1.43	2414.90	413.27	0.08
Main	471.00	100 yr	2732.00	37.60	49.67	44.18	49.69	0.000	1.58	2642.95	431.34	0.08
Main	1040.00	2 yr	639.00	39.20	44.04		44.09	0.001	2.25	401.02	196.88	0.21
Main	1040.00	10 yr	1336.00	39.20	47.42		47.44	0.000	1.42	1284.30	322.42	0.10
Main	1040.00	25 yr	1808.00	39.20	48.54		48.56	0.000	1.48	1672.29	357.49	0.09
Main	1040.00	50 yr	2234.00	39.20	49.16		49.18	0.000	1.59	1896.84	364.60	0.10
Main	1040.00	100 yr	2732.00	39.20	49.70		49.73	0.000	1.75	2096.56	370.17	0.10
Main	1080.00		Bridge									
Main	1108.00	2 yr	639.00	38.90	45.20	44.97	45.48	0.002	5.50	229.68	210.44	0.45
Main	1108.00	10 yr	1336.00	38.90	47.41	45.58	47.47	0.000	3.05	786.91	296.75	0.21
Main	1108.00	25 yr	1808.00	38.90	48.53	45.86	48.58	0.000	2.74	1158.06	352.89	0.17
Main	1108.00	50 yr	2234.00	38.90	49.16	46.10	49.20	0.000	2.77	1385.51	376.89	0.17
Main	1108.00	100 yr	2732.00	38.90	49.70	46.25	49.75	0.000	2.86	1595.02	399.25	0.17
Main	1700.00	2 yr	639.00	40.50	46.40		46.59	0.002	4.64	267.68	245.06	0.40
Main	1700.00	10 yr	1336.00	40.50	47.70		47.80	0.001	3.86	623.24	295.44	0.29
Main	1700.00	25 yr	1808.00	40.50	48.71		48.79	0.000	3.26	937.81	324.11	0.22
Main	1700.00	50 yr	2234.00	40.50	49.32		49.39	0.000	3.22	1138.72	339.49	0.21
Main	1700.00	100 yr	2732.00	40.50	49.86		49.93	0.000	3.31	1325.04	351.02	0.21
Main	1738.00		Bridge									
Main	1758.00	2 yr	639.00	40.40	46.47	45.83	46.61	0.001	4.04	277.98	184.62	0.34
Main	1758.00	10 yr	1336.00	40.40	47.71	46.46	47.85	0.001	4.24	527.69	222.48	0.31
Main	1758.00	25 yr	1808.00	40.40	48.72	46.76	48.83	0.001	3.82	766.06	249.04	0.26
Main	1758.00	50 yr	2234.00	40.40	49.33	46.98	49.44	0.001	3.87	921.50	264.14	0.25
Main	1758.00	100 yr	2732.00	40.40	49.86	47.25	49.99	0.001	4.05	1067.69	278.95	0.26
Main	1903.00	2 yr	639.00	37.40	46.58		46.70	0.000	3.10	344.66	184.39	0.20
Main	1903.00	10 yr	1336.00	37.40	47.79		47.94	0.000	4.08	585.84	217.42	0.24
Main	1903.00	25 yr	1808.00	37.40	48.77		48.90	0.000	4.03	822.09	261.01	0.23
Main	1903.00	50 yr	2234.00	37.40	49.37		49.51	0.000	4.16	987.84	284.74	0.23
Main	1903.00	100 yr	2732.00	37.40	49.91		50.06	0.000	4.36	1146.17	299.92	0.23
Main	1937.00		Bridge									
Main	1957.00	2 yr	639.00	37.50	46.66	41.97	46.73	0.000	2.56	400.40	156.93	0.16
Main	1957.00	10 yr	1336.00	37.50	47.85	44.14	47.99	0.000	3.72	602.12	188.20	0.22
Main	1957.00	25 yr	1808.00	37.50	48.82	45.73	48.95	0.000	3.96	807.37	233.29	0.22
Main	1957.00	50 yr	2234.00	37.50	49.42	46.29	49.56	0.000	4.13	951.40	246.90	0.22
Main	1957.00	100 yr	2732.00	37.50	49.95	46.71	50.11	0.000	4.46	1089.56	269.33	0.24
Main	2169.00	2 yr	639.00	39.90	46.49		46.95	0.002	5.44	117.88	38.62	0.48
Main	2169.00	10 yr	1336.00	39.90	47.38	47.31	48.46	0.004	8.64	193.93	121.83	0.70
Main	2169.00	25 yr	1808.00	39.90	48.70		49.22	0.002	6.83	421.58	204.17	0.49
Main	2169.00	50 yr	2234.00	39.90	49.36		49.79	0.002	6.50	564.32	225.07	0.44
Main	2169.00	100 yr	2732.00	39.90	49.93		50.33	0.001	6.48	697.42	241.06	0.42
Main	2201.00		Bridge									
Main	2231.00	2 yr	639.00	38.63	46.80	43.29	47.07	0.001	4.21	157.98	47.71	0.33
Main	2231.00	10 yr	1336.00	38.63	48.86	45.39	49.26	0.001	5.41	323.55	125.27	0.36
Main	2231.00	25 yr	1808.00	38.63	49.28	46.86	49.85	0.002	6.57	380.39	143.60	0.42
Main	2231.00	50 yr	2234.00	38.63	49.80	47.93	50.43	0.002	7.16	473.61	236.68	0.45
Main	2231.00	100 yr	2732.00	38.63	50.30	48.91	50.94	0.002	7.42	601.80	271.47	0.45
Main	3133.00	2 yr	639.00	39.86	47.73		47.92	0.001	4.16	273.24	203.63	0.30
Main	3133.00	10 yr	1336.00	39.86	49.72		49.79	0.000	3.10	849.20	356.42	0.19
Main	3133.00	25 yr	1808.00	39.86	50.37		50.43	0.000	3.23	1096.64	407.12	0.19
Main	3133.00	50 yr	2234.00	39.86	50.94		51.01	0.000	3.20	1345.74	445.16	0.19
Main	3133.00	100 yr	2732.00	39.86	51.43		51.49	0.000	3.27	1562.35	453.23	0.19
Main	3152.00		Bridge									
Main	3177.00	2 yr	639.00	39.20	48.02	44.14	48.17	0.000	3.53	310.11	195.44	0.23
Main	3177.00	10 yr	1336.00	39.20	49.72	46.63	49.82	0.000	3.50	785.61	340.32	0.21
Main	3177.00	25 yr	1808.00	39.20	50.36	48.08	50.46	0.000	3.71	1025.27	437.13	0.21
Main	3177.00	50 yr	2234.00	39.20	50.95	48.72	51.04	0.000	3.61	1292.24	459.43	0.20
Main	3177.00	100 yr	2732.00	39.20	51.43	49.04	51.52	0.000	3.69	1518.78	480.58	0.20

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	3293.00	2 yr	639.00	42.54	48.39	48.39	48.99	0.004	6.84	144.17	152.76	0.58
Main	3293.00	10 yr	1336.00	42.54	49.67		49.95	0.002	5.92	446.88	353.65	0.44
Main	3293.00	25 yr	1808.00	42.54	50.38		50.55	0.001	5.10	740.27	437.93	0.36
Main	3293.00	50 yr	2234.00	42.54	50.98		51.10	0.001	4.38	1016.90	470.29	0.29
Main	3293.00	100 yr	2732.00	42.54	51.47		51.57	0.001	4.20	1250.97	492.86	0.27
Main	3737.00	2 yr	639.00	39.50	49.16		49.23	0.000	2.26	393.07	174.30	0.14
Main	3737.00	10 yr	1336.00	39.50	50.12		50.28	0.000	3.87	622.23	303.29	0.22
Main	3737.00	25 yr	1808.00	39.50	50.67		50.86	0.000	4.37	811.16	382.36	0.24
Main	3737.00	50 yr	2234.00	39.50	51.20		51.38	0.000	4.55	1031.94	454.49	0.25
Main	3737.00	100 yr	2732.00	39.50	51.66		51.83	0.000	4.63	1248.57	477.40	0.25
Main	3767.00		Bridge									
Main	3804.00	2 yr	639.00	40.38	49.20	44.10	49.24	0.000	1.98	558.49	253.05	0.13
Main	3804.00	10 yr	1336.00	40.38	50.22	46.67	50.30	0.000	2.91	877.77	392.00	0.17
Main	3804.00	25 yr	1808.00	40.38	50.79	47.55	50.88	0.000	3.29	1139.89	495.74	0.19
Main	3804.00	50 yr	2234.00	40.38	51.32	48.02	51.40	0.000	3.23	1407.64	513.11	0.18
Main	3804.00	100 yr	2732.00	40.38	51.78	48.28	51.85	0.000	3.32	1643.55	526.28	0.18
Main	4203.00	2 yr	399.00	43.38	49.22		49.35	0.001	3.07	196.09	158.90	0.25
Main	4203.00	10 yr	833.00	43.38	50.32		50.44	0.001	3.59	402.60	237.73	0.26
Main	4203.00	25 yr	1128.00	43.38	50.92		51.03	0.001	3.61	577.20	323.31	0.25
Main	4203.00	50 yr	1404.00	43.38	51.43		51.53	0.000	3.51	753.95	351.19	0.23
Main	4203.00	100 yr	1760.00	43.38	51.89		51.98	0.000	3.58	916.74	368.22	0.23
Main	4456.00	2 yr	399.00	44.74	49.36	47.53	49.68	0.002	4.61	90.47	37.36	0.41
Main	4456.00	10 yr	833.00	44.74	50.38	49.18	50.92	0.002	6.41	223.49	165.32	0.51
Main	4456.00	25 yr	1128.00	44.74	50.96	50.46	51.46	0.002	6.65	340.69	227.50	0.50
Main	4456.00	50 yr	1404.00	44.74	51.49	51.00	51.88	0.002	6.36	462.87	240.12	0.46
Main	4456.00	100 yr	1760.00	44.74	51.94	51.29	52.31	0.002	6.44	590.36	338.11	0.45
Main	4480.00		Culvert									
Main	4520.00	2 yr	399.00	44.77	50.85	47.51	50.95	0.000	2.68	254.06	152.38	0.21
Main	4520.00	10 yr	833.00	44.77	51.54	49.07	51.76	0.001	4.35	371.10	188.94	0.32
Main	4520.00	25 yr	1128.00	44.77	51.78	50.10	52.11	0.001	5.39	418.46	200.34	0.38
Main	4520.00	50 yr	1404.00	44.77	52.00	50.92	52.41	0.002	6.20	462.75	209.32	0.43
Main	4520.00	100 yr	1760.00	44.77	52.15	51.41	52.72	0.002	7.37	494.72	215.64	0.51
Main	5403.00	2 yr	399.00	45.49	51.32		51.52	0.001	3.59	122.28	39.76	0.28
Main	5403.00	10 yr	833.00	45.49	52.50		53.00	0.002	5.83	177.60	54.14	0.42
Main	5403.00	25 yr	1128.00	45.49	53.11		53.80	0.003	6.95	223.14	95.79	0.47
Main	5403.00	50 yr	1404.00	45.49	53.60	51.58	54.40	0.003	7.66	273.59	109.40	0.50
Main	5403.00	100 yr	1760.00	45.49	54.19	52.44	55.12	0.003	8.45	354.36	217.61	0.53
Main	6160.00	2 yr	226.00	49.23	52.40		52.70	0.004	4.40	51.34	19.78	0.48
Main	6160.00	10 yr	452.00	49.23	54.29		54.50	0.002	4.08	208.54	173.98	0.35
Main	6160.00	25 yr	632.00	49.23	55.12		55.28	0.001	3.83	370.84	209.58	0.30
Main	6160.00	50 yr	795.00	49.23	55.71		55.84	0.001	3.76	500.56	228.44	0.28
Main	6160.00	100 yr	978.00	49.23	56.38		56.49	0.001	3.63	659.46	248.26	0.26
Main	6719.00	2 yr	226.00	45.56	52.90		52.94	0.000	1.53	195.63	59.93	0.11
Main	6719.00	10 yr	452.00	45.56	54.71		54.77	0.000	2.21	352.63	156.51	0.14
Main	6719.00	25 yr	632.00	45.56	55.46		55.55	0.000	2.62	483.73	186.67	0.15
Main	6719.00	50 yr	795.00	45.56	56.02		56.12	0.000	2.90	597.64	224.55	0.16
Main	6719.00	100 yr	978.00	45.56	56.65		56.74	0.000	3.03	751.63	267.49	0.17
Main	7442.00	2 yr	226.00	51.65	53.67	53.67	54.59	0.017	7.70	29.34	16.02	1.00
Main	7442.00	10 yr	452.00	51.65	54.78	54.78	56.15	0.016	9.42	48.02	17.65	1.01
Main	7442.00	25 yr	632.00	51.65	55.51	55.51	57.16	0.016	10.32	61.29	18.72	1.01
Main	7442.00	50 yr	795.00	51.65	56.09	56.09	57.96	0.015	10.97	72.44	19.58	1.01
Main	7442.00	100 yr	978.00	51.65	57.87	57.87	58.52	0.004	7.19	310.52	313.48	0.56
Main	7858.00	2 yr	226.00	52.83	56.78	55.21	57.05	0.003	4.21	53.68	16.70	0.41
Main	7858.00	10 yr	452.00	52.83	58.26	56.36	58.59	0.003	4.94	154.87	124.79	0.42
Main	7858.00	25 yr	632.00	52.83	59.06	57.20	59.32	0.002	4.78	266.70	173.15	0.38
Main	7858.00	50 yr	795.00	52.83	59.65	58.40	59.86	0.002	4.64	373.33	189.30	0.35
Main	7858.00	100 yr	978.00	52.83	59.68		59.99	0.003	5.65	378.94	190.51	0.42
Main	8366.00	2 yr	226.00	53.66	57.70		57.81	0.001	2.67	84.79	22.93	0.24
Main	8366.00	10 yr	452.00	53.66	59.30		59.51	0.001	3.68	129.51	76.05	0.29
Main	8366.00	25 yr	632.00	53.66	59.96		60.22	0.001	4.26	224.66	183.49	0.32
Main	8366.00	50 yr	795.00	53.66	60.43		60.71	0.001	4.52	317.34	206.85	0.32
Main	8366.00	100 yr	978.00	53.66	60.74		61.05	0.002	4.98	381.54	215.89	0.35

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	8762.00	2 yr	226.00	53.98	58.09	55.81	58.22	0.001	2.88	78.48	22.22	0.27
Main	8762.00	10 yr	452.00	53.98	59.79	56.79	60.02	0.001	3.82	118.42	29.69	0.31
Main	8762.00	25 yr	632.00	53.98	60.53	57.43	60.86	0.002	4.59	148.49	48.52	0.34
Main	8762.00	50 yr	795.00	53.98	61.02	57.96	61.43	0.002	5.22	175.29	67.17	0.38
Main	8762.00	100 yr	978.00	53.98	61.39	58.50	61.91	0.002	5.93	204.99	94.08	0.41
Main	8827.00		Culvert									
Main	8922.00	2 yr	171.00	56.58	60.82	59.22	61.08	0.004	4.18	49.94	44.79	0.41
Main	8922.00	10 yr	320.00	56.58	64.65	60.75	64.66	0.000	1.05	747.39	320.51	0.07
Main	8922.00	25 yr	430.00	56.58	65.63	61.44	65.63	0.000	1.00	1110.27	388.97	0.06
Main	8922.00	50 yr	529.00	56.58	65.81	61.91	65.81	0.000	1.15	1180.10	398.32	0.07
Main	8922.00	100 yr	639.00	56.58	65.95	62.08	65.96	0.000	1.32	1238.87	408.51	0.08
Main	9372.00	2 yr	171.00	58.21	62.17		62.29	0.002	2.82	62.79	41.09	0.28
Main	9372.00	10 yr	320.00	58.21	64.71		64.74	0.000	1.72	357.78	170.50	0.13
Main	9372.00	25 yr	430.00	58.21	65.67		65.69	0.000	1.60	537.94	203.40	0.11
Main	9372.00	50 yr	529.00	58.21	65.86		65.89	0.000	1.83	576.93	209.61	0.12
Main	9372.00	100 yr	639.00	58.21	66.02		66.05	0.000	2.08	611.02	214.76	0.14
Main	9769.00	2 yr	171.00	57.80	62.83		62.93	0.001	2.49	68.47	17.94	0.22
Main	9769.00	10 yr	320.00	57.80	64.89		64.99	0.001	2.64	151.40	93.70	0.20
Main	9769.00	25 yr	430.00	57.80	65.80		65.87	0.001	2.46	259.02	139.86	0.17
Main	9769.00	50 yr	529.00	57.80	66.02		66.11	0.001	2.76	291.09	149.26	0.19
Main	9769.00	100 yr	639.00	57.80	66.22		66.33	0.001	3.08	321.97	157.79	0.21
Main	10471.00	2 yr	171.00	58.47	63.86	61.33	64.00	0.002	3.01	56.59	16.62	0.29
Main	10471.00	10 yr	320.00	58.47	65.71	62.43	65.90	0.002	3.51	91.67	23.77	0.29
Main	10471.00	25 yr	430.00	58.47	66.44	63.07	66.69	0.002	4.05	111.76	31.74	0.31
Main	10471.00	50 yr	529.00	58.47	66.78	63.57	67.11	0.002	4.64	123.31	36.31	0.34
Main	10471.00	100 yr	639.00	58.47	67.11	64.06	67.53	0.003	5.24	136.39	41.54	0.38
Main	10681.00		Culvert									
Main	10912.00	2 yr	171.00	58.55	64.28	62.33	64.55	0.004	4.12	41.37	12.11	0.39
Main	10912.00	10 yr	320.00	58.55	66.38	63.54	66.69	0.003	4.48	77.61	36.54	0.35
Main	10912.00	25 yr	430.00	58.55	67.47	64.26	67.79	0.002	4.69	104.18	314.11	0.33
Main	10912.00	50 yr	529.00	58.55	68.20	64.82	68.55	0.002	4.95	122.50	449.56	0.33
Main	10912.00	100 yr	639.00	58.55	68.86	65.55	68.88	0.000	1.74	737.26	500.61	0.11
Main	11214.00	2 yr	171.00	61.69	65.39		65.51	0.002	2.87	59.47	23.18	0.32
Main	11214.00	10 yr	320.00	61.69	67.20		67.34	0.001	2.96	115.80	51.40	0.26
Main	11214.00	25 yr	430.00	61.69	68.19		68.32	0.001	2.99	171.97	65.38	0.24
Main	11214.00	50 yr	529.00	61.69	68.91		69.04	0.001	3.01	230.75	101.07	0.22
Main	11214.00	100 yr	639.00	61.69	68.95		69.12	0.001	3.59	234.26	101.79	0.27
Main	11673.00	2 yr	171.00	63.20	66.32	65.02	66.53	0.002	3.65	46.66	19.04	0.41
Main	11673.00	10 yr	320.00	63.20	67.83	65.87	68.09	0.002	4.08	78.40	23.00	0.39
Main	11673.00	25 yr	430.00	63.20	68.69	66.39	68.98	0.001	4.34	99.20	25.26	0.39
Main	11673.00	50 yr	529.00	63.20	69.34	66.80	69.66	0.001	4.55	116.12	26.95	0.39
Main	11673.00	100 yr	639.00	63.20	69.53	67.21	69.96	0.002	5.26	121.43	27.46	0.44
Main	11857.00		Culvert									
Main	12142.00	2 yr	171.00	63.50	70.92	65.60	70.94	0.000	1.19	152.54	49.46	0.09
Main	12142.00	10 yr	320.00	63.50	72.46	66.52	72.48	0.000	1.41	291.39	161.06	0.09
Main	12142.00	25 yr	430.00	63.50	72.65	67.07	72.69	0.000	1.73	326.55	198.27	0.11
Main	12142.00	50 yr	529.00	63.50	72.85	67.50	72.89	0.000	1.91	371.33	250.41	0.12
Main	12142.00	100 yr	639.00	63.50	72.97	67.93	73.02	0.000	2.16	401.88	264.19	0.14
Main	12178.00	2 yr	171.00	64.80	70.87	66.93	71.00	0.000	2.89	59.06	31.68	0.21
Main	12178.00	10 yr	320.00	64.80	72.46	68.03	72.50	0.000	1.73	238.03	239.03	0.13
Main	12178.00	25 yr	430.00	64.80	72.65	68.74	72.70	0.000	1.97	286.95	254.95	0.15
Main	12178.00	50 yr	529.00	64.80	72.85	69.31	72.90	0.000	2.05	338.91	270.84	0.15
Main	12178.00	100 yr	639.00	64.80	72.97	69.92	73.03	0.000	2.24	372.33	280.58	0.16
Main	12262.00		Culvert									
Main	12316.00	2 yr	171.00	65.90	72.62	68.27	72.66	0.000	1.68	127.50	253.80	0.13
Main	12316.00	10 yr	320.00	65.90	73.10	69.33	73.12	0.000	1.52	335.06	376.47	0.11
Main	12316.00	25 yr	430.00	65.90	73.24	69.97	73.27	0.000	1.72	388.54	395.71	0.12
Main	12316.00	50 yr	529.00	65.90	73.31	70.47	73.34	0.000	1.95	415.63	400.20	0.14
Main	12316.00	100 yr	639.00	65.90	73.39	71.09	73.43	0.000	2.15	449.59	414.32	0.15

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	12724.00	2 yr	171.00	65.98	72.72		72.73	0.000	0.84	229.53	172.03	0.06
Main	12724.00	10 yr	320.00	65.98	73.18		73.20	0.000	1.03	317.66	238.66	0.08
Main	12724.00	25 yr	430.00	65.98	73.33		73.36	0.000	1.22	358.68	279.98	0.09
Main	12724.00	50 yr	529.00	65.98	73.43		73.46	0.000	1.39	385.31	297.15	0.10
Main	12724.00	100 yr	639.00	65.98	73.53		73.58	0.000	1.54	417.05	313.46	0.11
Main	13101.00	2 yr	171.00	63.90	72.75	66.63	72.75	0.000	0.62	499.83	378.13	0.04
Main	13101.00	10 yr	320.00	63.90	73.22	68.05	73.23	0.000	0.84	691.53	434.56	0.05
Main	13101.00	25 yr	430.00	63.90	73.40	68.94	73.41	0.000	1.00	769.61	445.76	0.06
Main	13101.00	50 yr	529.00	63.90	73.51	69.68	73.52	0.000	1.15	820.54	451.82	0.07
Main	13101.00	100 yr	639.00	63.90	73.64	70.40	73.65	0.000	1.28	878.02	458.57	0.08
Main	13134.00		Culvert									
Main	13173.00	2 yr	171.00	68.21	72.91	69.86	72.92	0.000	0.99	267.02	218.78	0.09
Main	13173.00	10 yr	320.00	68.21	73.26	70.61	73.27	0.000	1.42	345.52	235.66	0.12
Main	13173.00	25 yr	430.00	68.21	73.45	71.06	73.47	0.000	1.68	392.69	263.97	0.14
Main	13173.00	50 yr	529.00	68.21	73.55	71.44	73.58	0.000	1.96	421.47	284.72	0.16
Main	13173.00	100 yr	639.00	68.21	73.72	72.21	73.76	0.000	2.11	471.05	304.00	0.17
Main	13353.00	2 yr	171.00	69.00	72.94		72.96	0.000	1.25	175.72	177.63	0.12
Main	13353.00	10 yr	320.00	69.00	73.30		73.33	0.000	1.53	245.09	204.00	0.14
Main	13353.00	25 yr	430.00	69.00	73.50		73.54	0.000	1.66	287.84	221.62	0.15
Main	13353.00	50 yr	529.00	69.00	73.62		73.67	0.001	1.81	314.76	231.70	0.16
Main	13353.00	100 yr	639.00	69.00	73.79		73.85	0.001	1.84	354.99	240.92	0.16

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Fornes Run - Existing Conditions												
Reach-1	157.00	2 YR	262.00	6.57	11.61	9.60	11.77	0.002	3.33	108.80	65.61	0.31
Reach-1	157.00	10 YR	541.00	6.57	13.07	11.04	13.28	0.002	4.18	230.97	105.24	0.33
Reach-1	157.00	25 YR	643.00	6.57	13.47	11.41	13.70	0.002	4.40	275.62	117.75	0.33
Reach-1	157.00	50 YR	714.00	6.57	13.72	11.61	13.96	0.002	4.53	306.45	125.66	0.33
Reach-1	157.00	100 YR	808.00	6.57	14.03	11.88	14.27	0.002	4.69	346.69	135.30	0.34
Reach-1	426.00	2 YR	262.00	7.17	12.20		12.39	0.002	3.53	87.49	47.78	0.33
Reach-1	426.00	10 YR	541.00	7.17	13.66		13.90	0.002	4.35	245.51	178.50	0.34
Reach-1	426.00	25 YR	643.00	7.17	14.06		14.28	0.002	4.36	321.62	205.48	0.33
Reach-1	426.00	50 YR	714.00	7.17	14.31		14.54	0.002	4.47	379.48	249.76	0.33
Reach-1	426.00	100 YR	808.00	7.17	14.63		14.83	0.002	4.40	460.81	268.13	0.32
Reach-1	723.00	2 YR	262.00	7.79	12.89		13.08	0.002	3.51	80.49	31.63	0.32
Reach-1	723.00	10 YR	541.00	7.79	14.32		14.67	0.003	4.90	136.34	46.47	0.38
Reach-1	723.00	25 YR	643.00	7.79	14.65		15.06	0.003	5.38	152.23	49.89	0.41
Reach-1	723.00	50 YR	714.00	7.79	14.89		15.33	0.003	5.64	164.44	52.84	0.42
Reach-1	723.00	100 YR	808.00	7.79	15.12		15.63	0.004	6.06	178.96	70.24	0.44
Reach-1	1031.00	2 YR	252.00	10.07	13.92		14.34	0.008	5.20	49.56	25.95	0.58
Reach-1	1031.00	10 YR	495.00	10.07	15.41		15.88	0.006	5.76	114.20	64.31	0.51
Reach-1	1031.00	25 YR	551.00	10.07	15.79		16.22	0.005	5.60	141.45	77.35	0.48
Reach-1	1031.00	50 YR	559.00	10.07	16.05		16.41	0.004	5.17	163.32	90.05	0.43
Reach-1	1031.00	100 YR	644.00	10.07	16.39		16.73	0.003	5.25	193.52	91.95	0.42
Reach-1	1121.00	2 YR	252.00	12.55	15.28	15.28	16.36	0.029	8.33	30.28	14.27	1.01
Reach-1	1121.00	10 YR	495.00	12.55	16.55	16.55	18.10	0.027	9.98	49.63	16.27	1.01
Reach-1	1121.00	25 YR	551.00	12.55	16.80	16.80	18.43	0.027	10.25	53.77	16.66	1.01
Reach-1	1121.00	50 YR	559.00	12.55	16.85	16.85	18.48	0.026	10.25	54.56	16.74	1.00
Reach-1	1121.00	100 YR	644.00	12.55	17.20	17.20	18.96	0.026	10.63	60.61	17.30	1.00
Reach-1	1274.00	2 YR	252.00	12.60	17.27		17.47	0.003	3.67	80.93	41.80	0.36
Reach-1	1274.00	10 YR	495.00	12.60	18.84		19.07	0.002	4.26	165.21	64.69	0.34
Reach-1	1274.00	25 YR	551.00	12.60	19.14		19.38	0.002	4.33	185.45	67.38	0.34
Reach-1	1274.00	50 YR	559.00	12.60	19.18		19.42	0.002	4.34	188.34	67.75	0.34
Reach-1	1274.00	100 YR	644.00	12.60	19.63		19.87	0.002	4.43	219.38	71.66	0.33
Reach-1	1515.00	2 YR	252.00	14.33	18.23		18.63	0.008	5.12	49.56	21.41	0.57
Reach-1	1515.00	10 YR	495.00	14.33	19.49		20.13	0.008	6.50	83.34	33.58	0.59
Reach-1	1515.00	25 YR	551.00	14.33	19.73		20.42	0.008	6.73	92.03	37.63	0.60
Reach-1	1515.00	50 YR	559.00	14.33	19.77		20.46	0.008	6.76	93.35	38.22	0.60
Reach-1	1515.00	100 YR	644.00	14.33	20.13	19.02	20.87	0.007	7.06	109.54	57.64	0.60
Reach-1	1780.00	2 YR	252.00	16.24	20.02		20.23	0.005	4.27	100.86	111.67	0.46
Reach-1	1780.00	10 YR	495.00	16.24	21.18		21.32	0.003	4.10	236.01	121.38	0.37
Reach-1	1780.00	25 YR	551.00	16.24	21.41		21.55	0.003	4.08	264.50	123.29	0.35
Reach-1	1780.00	50 YR	559.00	16.24	21.44		21.58	0.003	4.08	268.63	123.56	0.35
Reach-1	1780.00	100 YR	644.00	16.24	21.78		21.92	0.002	4.05	311.45	126.37	0.34
Reach-1	2008.00	2 YR	252.00	20.00	22.96	22.96	23.93	0.027	7.91	31.89	16.86	1.01
Reach-1	2008.00	10 YR	495.00	20.00	24.16	24.16	24.92	0.016	7.57	93.88	65.48	0.81
Reach-1	2008.00	25 YR	551.00	20.00	24.28	24.28	25.08	0.016	7.87	101.80	66.40	0.82
Reach-1	2008.00	50 YR	559.00	20.00	24.30	24.30	25.10	0.016	7.91	102.99	66.54	0.83
Reach-1	2008.00	100 YR	644.00	20.00	24.47	24.47	25.34	0.016	8.32	114.83	70.96	0.84
Reach-1	2190.00	2 YR	252.00	20.06	24.74		24.86	0.002	3.04	133.06	97.24	0.29
Reach-1	2190.00	10 YR	495.00	20.06	25.65		25.81	0.002	3.87	228.91	114.11	0.33
Reach-1	2190.00	25 YR	551.00	20.06	25.83		25.99	0.002	4.00	249.46	117.27	0.33
Reach-1	2190.00	50 YR	559.00	20.06	25.85		26.02	0.002	4.01	252.45	117.72	0.33
Reach-1	2190.00	100 YR	644.00	20.06	26.10		26.28	0.002	4.19	281.70	120.33	0.34
Reach-1	2475.00	2 YR	252.00	20.31	25.35		25.62	0.004	4.15	62.25	19.03	0.37
Reach-1	2475.00	10 YR	495.00	20.31	26.31		26.93	0.006	6.38	87.18	33.02	0.52
Reach-1	2475.00	25 YR	551.00	20.31	26.48		27.18	0.007	6.83	92.72	35.47	0.54
Reach-1	2475.00	50 YR	559.00	20.31	26.50		27.21	0.007	6.89	93.52	35.81	0.55
Reach-1	2475.00	100 YR	644.00	20.31	26.71		27.56	0.008	7.54	101.47	39.03	0.59
Reach-1	2718.00	2 YR	252.00	21.25	26.19		26.39	0.003	3.60	70.05	19.21	0.33
Reach-1	2718.00	10 YR	495.00	21.25	27.72		28.05	0.003	4.70	118.95	51.62	0.38
Reach-1	2718.00	25 YR	551.00	21.25	27.99		28.33	0.003	4.82	133.82	57.91	0.38
Reach-1	2718.00	50 YR	559.00	21.25	28.03		28.37	0.003	4.83	136.07	58.81	0.37
Reach-1	2718.00	100 YR	644.00	21.25	28.41		28.75	0.003	4.95	160.06	67.60	0.37
Reach-1	2884.00	2 YR	252.00	21.91	26.72	25.09	27.04	0.005	4.48	56.53	19.09	0.44
Reach-1	2884.00	10 YR	495.00	21.91	28.32	26.41	28.81	0.005	5.67	92.27	25.77	0.48
Reach-1	2884.00	25 YR	551.00	21.91	28.57	26.66	29.11	0.005	5.94	99.13	29.22	0.49
Reach-1	2884.00	50 YR	559.00	21.91	28.61	26.70	29.15	0.005	5.98	100.17	29.87	0.49
Reach-1	2884.00	100 YR	644.00	21.91	28.95	27.05	29.56	0.005	6.37	111.52	38.81	0.51
Reach-1	2946.00		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2991.00	2 YR	254.00	23.30	28.23	26.36	28.51	0.004	4.22	60.34	19.11	0.41
Reach-1	2991.00	10 YR	509.00	23.30	32.82	27.75	32.95	0.001	3.03	220.57	103.28	0.20
Reach-1	2991.00	25 YR	554.00	23.30	33.90	27.94	34.00	0.001	2.77	270.00	120.73	0.17
Reach-1	2991.00	50 YR	559.00	23.30	34.08	27.97	34.15	0.000	2.36	430.03	123.59	0.14
Reach-1	2991.00	100 YR	653.00	23.30	34.84	28.36	34.90	0.000	2.37	546.52	135.27	0.14
Reach-1	3049.00	2 YR	238.00	23.69	28.59		28.67	0.001	2.27	104.78	28.27	0.21
Reach-1	3049.00	10 YR	429.00	23.69	32.96		33.00	0.000	1.68	329.26	85.02	0.11
Reach-1	3049.00	25 YR	478.00	23.69	34.00		34.04	0.000	1.58	426.34	101.20	0.09
Reach-1	3049.00	50 YR	521.00	23.69	34.13		34.17	0.000	1.68	439.37	103.23	0.10
Reach-1	3049.00	100 YR	567.00	23.69	34.88		34.92	0.000	1.63	521.66	115.23	0.09
Reach-1	3114.00	2 YR	238.00	24.09	28.61	26.59	28.87	0.004	4.11	57.91	15.67	0.38
Reach-1	3114.00	10 YR	429.00	24.09	32.92	27.67	33.09	0.001	3.34	128.95	78.63	0.21
Reach-1	3114.00	25 YR	478.00	24.09	33.95	27.91	34.12	0.001	3.28	146.30	109.52	0.19
Reach-1	3114.00	50 YR	521.00	24.09	34.07	28.11	34.27	0.001	3.52	148.29	112.34	0.21
Reach-1	3114.00	100 YR	567.00	24.09	34.82	28.33	35.01	0.001	3.54	160.78	131.96	0.20
Reach-1	3156.00		Culvert									
Reach-1	3200.00	2 YR	238.00	24.19	29.17	26.67	29.35	0.002	3.40	69.89	18.29	0.31
Reach-1	3200.00	10 YR	429.00	24.19	34.06	27.71	34.15	0.000	2.42	204.92	86.43	0.15
Reach-1	3200.00	25 YR	478.00	24.19	35.41	27.94	35.48	0.000	2.26	250.36	114.40	0.13
Reach-1	3200.00	50 YR	521.00	24.19	35.81	28.13	35.89	0.000	2.34	263.69	118.19	0.13
Reach-1	3200.00	100 YR	567.00	24.19	36.90	28.34	36.97	0.000	2.26	300.34	191.67	0.12
Reach-1	3266.00	2 YR	238.00	26.28	29.19	28.96	30.03	0.021	7.39	32.17	14.48	0.87
Reach-1	3266.00	10 YR	429.00	26.28	34.10		34.18	0.001	2.64	255.02	95.39	0.19
Reach-1	3266.00	25 YR	478.00	26.28	35.48		35.52	0.000	1.88	402.61	116.32	0.12
Reach-1	3266.00	50 YR	521.00	26.28	35.89		35.92	0.000	1.81	453.04	135.95	0.12
Reach-1	3266.00	100 YR	567.00	26.28	36.98		37.00	0.000	1.46	632.61	180.24	0.09
Reach-1	3336.00	2 YR	238.00	28.37	30.84	30.84	31.72	0.027	7.54	31.53	17.89	1.00
Reach-1	3336.00	10 YR	429.00	28.37	34.12	31.76	34.34	0.003	3.79	123.51	124.94	0.34
Reach-1	3336.00	25 YR	478.00	28.37	35.47	31.96	35.60	0.001	2.98	182.46	155.40	0.23
Reach-1	3336.00	50 YR	521.00	28.37	35.87	32.13	36.00	0.001	2.98	200.02	162.49	0.22
Reach-1	3336.00	100 YR	567.00	28.37	36.96	32.30	37.06	0.001	2.64	247.50	180.25	0.18
Reach-1	3423.00		Culvert									
Reach-1	3491.00	2 YR	238.00	28.37	33.72	30.96	33.88	0.002	3.17	77.41	26.35	0.27
Reach-1	3491.00	10 YR	429.00	28.37	36.96	32.00	37.07	0.001	2.79	201.51	121.48	0.18
Reach-1	3491.00	25 YR	478.00	28.37	39.07	32.24	39.13	0.000	2.22	290.50	150.33	0.13
Reach-1	3491.00	50 YR	521.00	28.37	40.15	32.44	40.21	0.000	2.10	336.42	171.65	0.11
Reach-1	3491.00	100 YR	567.00	28.37	42.05	32.64	42.09	0.000	1.85	416.74	217.67	0.09
Reach-1	3534.00	2 YR	217.00	28.83	33.87		33.96	0.001	2.39	118.86	79.09	0.22
Reach-1	3534.00	10 YR	384.00	28.83	37.08		37.10	0.000	1.58	469.02	137.97	0.11
Reach-1	3534.00	25 YR	524.00	28.83	39.13		39.15	0.000	1.39	790.90	175.97	0.08
Reach-1	3534.00	50 YR	583.00	28.83	40.21		40.22	0.000	1.27	991.88	196.12	0.07
Reach-1	3534.00	100 YR	650.00	28.83	42.10		42.11	0.000	1.08	1413.93	255.68	0.06
Reach-1	3631.00	2 YR	217.00	30.31	33.89	33.32	34.36	0.009	5.52	39.80	20.56	0.64
Reach-1	3631.00	10 YR	384.00	30.31	37.01	34.12	37.26	0.002	4.07	98.55	57.45	0.31
Reach-1	3631.00	25 YR	524.00	30.31	39.11	34.69	39.21	0.001	2.90	309.81	113.73	0.19
Reach-1	3631.00	50 YR	583.00	30.31	40.19	34.92	40.27	0.000	2.52	457.86	156.89	0.16
Reach-1	3631.00	100 YR	650.00	30.31	42.09	35.15	42.13	0.000	1.84	807.76	213.29	0.10
Reach-1	3670.00		Culvert									
Reach-1	3713.00	2 YR	217.00	31.05	35.30	33.06	35.44	0.001	3.00	73.74	23.85	0.28
Reach-1	3713.00	10 YR	384.00	31.05	39.09	33.89	39.15	0.000	2.12	231.06	144.27	0.14
Reach-1	3713.00	25 YR	524.00	31.05	40.36	34.47	40.39	0.000	1.69	638.56	179.85	0.10
Reach-1	3713.00	50 YR	583.00	31.05	40.71	34.70	40.74	0.000	1.74	703.73	191.88	0.10
Reach-1	3713.00	100 YR	650.00	31.05	42.12	34.96	42.14	0.000	1.38	1001.87	233.25	0.08
Reach-1	3819.00	2 YR	217.00	30.63	35.42		35.58	0.002	3.26	81.78	58.44	0.29
Reach-1	3819.00	10 YR	384.00	30.63	39.16		39.18	0.000	1.58	511.66	149.09	0.10
Reach-1	3819.00	25 YR	524.00	30.63	40.38		40.40	0.000	1.60	702.90	162.04	0.09
Reach-1	3819.00	50 YR	583.00	30.63	40.73		40.76	0.000	1.65	760.22	165.61	0.10
Reach-1	3819.00	100 YR	650.00	30.63	42.13		42.15	0.000	1.42	1003.16	181.95	0.08
Reach-1	4027.00	2 YR	217.00	30.79	35.80		35.89	0.001	2.49	124.08	74.61	0.24
Reach-1	4027.00	10 YR	384.00	30.79	39.19		39.22	0.000	1.62	435.17	109.11	0.11
Reach-1	4027.00	25 YR	524.00	30.79	40.41		40.44	0.000	1.73	575.97	122.33	0.11
Reach-1	4027.00	50 YR	583.00	30.79	40.76		40.79	0.000	1.82	619.70	127.08	0.11
Reach-1	4027.00	100 YR	650.00	30.79	42.15		42.17	0.000	1.62	805.97	141.75	0.09
Reach-1	4249.00	2 YR	217.00	31.37	36.12		36.43	0.005	4.62	61.52	47.73	0.45
Reach-1	4249.00	10 YR	384.00	31.37	39.25		39.27	0.000	1.68	362.49	137.72	0.12
Reach-1	4249.00	25 YR	524.00	31.37	40.46		40.48	0.000	1.50	548.82	168.50	0.10
Reach-1	4249.00	50 YR	583.00	31.37	40.82		40.84	0.000	1.51	609.66	177.39	0.10
Reach-1	4249.00	100 YR	650.00	31.37	42.18		42.20	0.000	1.14	872.58	204.93	0.07

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4362.00	2 YR	217.00	31.60	36.61		36.72	0.001	2.68	80.70	21.08	0.24
Reach-1	4362.00	10 YR	384.00	31.60	39.25		39.34	0.001	2.54	198.50	87.50	0.18
Reach-1	4362.00	25 YR	524.00	31.60	40.45		40.54	0.001	2.54	319.60	112.05	0.17
Reach-1	4362.00	50 YR	583.00	31.60	40.80		40.89	0.001	2.59	359.72	117.26	0.17
Reach-1	4362.00	100 YR	650.00	31.60	42.17		42.22	0.000	2.12	532.65	134.83	0.12
Reach-1	4469.00	2 YR	217.00	32.55	36.69	35.41	37.04	0.003	4.80	45.94	17.64	0.49
Reach-1	4469.00	10 YR	384.00	32.55	39.27	36.47	39.49	0.001	3.91	109.54	68.18	0.30
Reach-1	4469.00	25 YR	524.00	32.55	40.45	37.03	40.68	0.001	4.07	146.07	91.72	0.28
Reach-1	4469.00	50 YR	583.00	32.55	40.79	37.55	41.03	0.001	4.23	156.66	98.55	0.29
Reach-1	4469.00	100 YR	650.00	32.55	42.19	37.80	42.25	0.000	2.34	433.98	128.03	0.14
Reach-1	4506.00		Culvert									
Reach-1	4545.00	2 YR	217.00	35.01	38.75	37.50	39.11	0.006	4.81	45.27	15.96	0.48
Reach-1	4545.00	10 YR	384.00	35.01	41.05	38.45	41.32	0.003	4.35	98.73	45.13	0.34
Reach-1	4545.00	25 YR	524.00	35.01	43.20	39.15	43.28	0.001	2.67	261.19	93.73	0.17
Reach-1	4545.00	50 YR	583.00	35.01	43.51	39.43	43.59	0.001	2.68	291.07	99.97	0.17
Reach-1	4545.00	100 YR	650.00	35.01	43.99	39.79	44.07	0.001	2.57	341.99	110.13	0.16
Reach-1	4597.00	2 YR	217.00	33.77	39.15		39.37	0.003	3.75	57.79	13.90	0.32
Reach-1	4597.00	10 YR	384.00	33.77	41.33		41.46	0.001	3.29	187.30	85.21	0.23
Reach-1	4597.00	25 YR	524.00	33.77	43.26		43.32	0.001	2.50	396.71	131.72	0.16
Reach-1	4597.00	50 YR	583.00	33.77	43.57		43.63	0.001	2.56	438.33	139.12	0.16
Reach-1	4597.00	100 YR	650.00	33.77	44.04		44.10	0.000	2.51	507.54	149.18	0.15
Reach-1	4682.00	2 YR	217.00	34.00	39.46		39.58	0.002	3.11	107.70	61.03	0.28
Reach-1	4682.00	10 YR	384.00	34.00	41.49		41.55	0.001	2.46	314.93	144.75	0.18
Reach-1	4682.00	25 YR	524.00	34.00	43.33		43.35	0.000	1.83	619.55	184.46	0.12
Reach-1	4682.00	50 YR	583.00	34.00	43.64		43.66	0.000	1.87	677.21	190.30	0.12
Reach-1	4682.00	100 YR	650.00	34.00	44.11		44.13	0.000	1.84	769.03	199.25	0.11
Reach-1	4919.00	2 YR	165.00	35.89	39.99		40.15	0.003	3.40	69.69	57.11	0.35
Reach-1	4919.00	10 YR	245.00	35.89	41.66		41.72	0.001	2.28	189.53	84.34	0.19
Reach-1	4919.00	25 YR	319.00	35.89	43.39		43.42	0.000	1.70	356.96	109.45	0.12
Reach-1	4919.00	50 YR	319.00	35.89	43.70		43.72	0.000	1.57	391.24	113.91	0.11
Reach-1	4919.00	100 YR	320.00	35.89	44.16		44.18	0.000	1.39	445.82	120.67	0.09
Reach-1	5288.00	2 YR	165.00	37.92	41.43		41.73	0.006	4.41	37.35	14.89	0.49
Reach-1	5288.00	10 YR	245.00	37.92	42.02		42.45	0.007	5.29	46.57	16.14	0.54
Reach-1	5288.00	25 YR	319.00	37.92	43.43		43.74	0.003	4.58	78.84	33.50	0.39
Reach-1	5288.00	50 YR	319.00	37.92	43.71		43.98	0.002	4.23	89.20	38.10	0.34
Reach-1	5288.00	100 YR	320.00	37.92	44.17		44.37	0.002	3.74	108.09	45.30	0.29
Reach-1	5493.00	2 YR	165.00	39.45	42.63		42.86	0.005	3.88	43.99	25.71	0.48
Reach-1	5493.00	10 YR	245.00	39.45	43.33		43.59	0.004	4.17	63.89	31.50	0.46
Reach-1	5493.00	25 YR	319.00	39.45	44.15		44.38	0.003	3.94	92.65	38.54	0.39
Reach-1	5493.00	50 YR	319.00	39.45	44.29		44.50	0.003	3.75	98.37	39.87	0.36
Reach-1	5493.00	100 YR	320.00	39.45	44.57		44.74	0.002	3.42	109.77	42.30	0.32
Reach-1	5636.00	2 YR	165.00	41.02	43.36	43.06	43.86	0.007	5.67	29.04	17.58	0.78
Reach-1	5636.00	10 YR	245.00	41.02	43.93	43.55	44.52	0.007	6.14	39.90	20.05	0.77
Reach-1	5636.00	25 YR	319.00	41.02	44.53	43.93	45.10	0.005	6.07	52.63	22.60	0.70
Reach-1	5636.00	50 YR	319.00	41.02	44.62	43.93	45.15	0.005	5.85	54.56	22.96	0.67
Reach-1	5636.00	100 YR	320.00	41.02	44.80	43.93	45.26	0.004	5.42	58.95	23.77	0.61
Reach-1	5876.00		Culvert									
Reach-1	6071.00	2 YR	167.00	46.10	50.89	48.47	51.01	0.002	2.83	66.15	126.32	0.26
Reach-1	6071.00	10 YR	245.00	46.10	52.28	49.04	52.40	0.001	2.83	111.07	220.79	0.22
Reach-1	6071.00	25 YR	319.00	46.10	55.68	49.51	55.73	0.000	1.98	223.59	282.69	0.12
Reach-1	6071.00	50 YR	319.00	46.10	55.68	49.51	55.73	0.000	1.98	223.59	282.69	0.12
Reach-1	6071.00	100 YR	320.00	46.10	55.68	49.51	55.73	0.000	1.98	223.77	282.79	0.12
Reach-1	6343.00	2 YR	139.00	46.73	51.28		51.36	0.001	2.36	84.64	57.67	0.22
Reach-1	6343.00	10 YR	151.00	46.73	52.55		52.59	0.000	1.63	170.99	76.65	0.13
Reach-1	6343.00	25 YR	255.00	46.73	55.77		55.78	0.000	1.24	485.59	120.15	0.08
Reach-1	6343.00	50 YR	342.00	46.73	55.76		55.79	0.000	1.66	485.35	120.12	0.10
Reach-1	6343.00	100 YR	442.00	46.73	55.76		55.81	0.000	2.15	485.33	120.12	0.13

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	6632.00	2 YR	139.00	46.73	51.65		51.77	0.002	2.73	50.90	13.83	0.25
Reach-1	6632.00	10 YR	151.00	46.73	52.67		52.75	0.001	2.24	80.67	54.03	0.19
Reach-1	6632.00	25 YR	255.00	46.73	55.80		55.82	0.000	1.37	327.44	116.39	0.09
Reach-1	6632.00	50 YR	342.00	46.73	55.82		55.86	0.000	1.82	330.41	117.01	0.12
Reach-1	6632.00	100 YR	442.00	46.73	55.87		55.92	0.001	2.32	335.18	118.05	0.15
Reach-1	7189.00	2 YR	139.00	51.20	53.62		54.08	0.014	5.49	26.57	18.88	0.72
Reach-1	7189.00	10 YR	151.00	51.20	53.75		54.22	0.013	5.55	29.03	19.85	0.71
Reach-1	7189.00	25 YR	255.00	51.20	55.90		56.13	0.002	3.99	93.72	55.91	0.35
Reach-1	7189.00	50 YR	342.00	51.20	56.02		56.39	0.004	5.16	100.34	58.82	0.44
Reach-1	7189.00	100 YR	442.00	51.20	56.20		56.73	0.005	6.27	111.19	63.32	0.53
Reach-1	7703.00	2 YR	139.00	56.00	58.60		58.85	0.007	4.14	43.88	46.04	0.51
Reach-1	7703.00	10 YR	151.00	56.00	58.67		58.94	0.007	4.31	47.07	48.91	0.53
Reach-1	7703.00	25 YR	255.00	56.00	58.70	58.70	59.44	0.018	7.13	48.79	50.43	0.86
Reach-1	7703.00	50 YR	342.00	56.00	59.20	59.11	59.87	0.014	7.09	78.83	69.44	0.77
Reach-1	7703.00	100 YR	442.00	56.00	59.78	59.46	60.31	0.009	6.67	125.05	89.89	0.66
Reach-1	8188.00	2 YR	139.00	57.22	60.99	59.66	61.15	0.003	3.15	44.34	22.91	0.37
Reach-1	8188.00	10 YR	151.00	57.22	61.11	59.76	61.27	0.003	3.24	47.11	24.61	0.38
Reach-1	8188.00	25 YR	255.00	57.22	62.14	60.44	62.35	0.003	3.68	81.62	48.09	0.35
Reach-1	8188.00	50 YR	342.00	57.22	62.53	60.88	62.81	0.003	4.31	103.34	62.02	0.39
Reach-1	8188.00	100 YR	442.00	57.22	62.81	61.31	63.18	0.004	5.04	121.73	69.06	0.44
Reach-1	8290.00		Culvert									
Reach-1	8363.00	2 YR	151.00	58.09	65.32	60.27	65.34	0.000	1.23	257.78	83.26	0.08
Reach-1	8363.00	10 YR	151.00	58.09	65.39	60.28	65.40	0.000	1.21	262.23	84.08	0.08
Reach-1	8363.00	25 YR	263.00	58.09	66.12	61.18	66.15	0.000	1.90	344.20	113.64	0.12
Reach-1	8363.00	50 YR	364.00	58.09	66.45	61.80	66.50	0.000	2.50	386.27	140.74	0.15
Reach-1	8363.00	100 YR	479.00	58.09	66.61	62.36	66.70	0.001	3.16	410.34	154.57	0.19

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Fornes Run - Future Conditions												
Reach-1	157.00	2 YR	306.00	6.57	11.89	9.84	12.06	0.002	3.50	128.09	72.31	0.31
Reach-1	157.00	10 YR	632.00	6.57	13.43	11.38	13.65	0.002	4.38	270.97	116.51	0.33
Reach-1	157.00	25 YR	876.00	6.57	14.25	12.05	14.50	0.002	4.81	376.84	144.78	0.34
Reach-1	157.00	50 YR	1102.00	6.57	14.98	12.54	15.26	0.002	5.18	521.48	275.00	0.35
Reach-1	157.00	100 YR	1371.00	6.57	15.47	13.07	15.75	0.002	5.42	664.87	294.68	0.35
Reach-1	426.00	2 YR	306.00	7.17	12.48		12.69	0.002	3.76	104.09	70.64	0.34
Reach-1	426.00	10 YR	632.00	7.17	14.02		14.24	0.002	4.36	313.35	201.41	0.33
Reach-1	426.00	25 YR	876.00	7.17	14.85		15.04	0.002	4.34	522.88	284.16	0.31
Reach-1	426.00	50 YR	1102.00	7.17	15.59		15.73	0.001	4.05	744.99	314.51	0.27
Reach-1	426.00	100 YR	1371.00	7.17	16.09		16.23	0.001	4.22	906.16	334.69	0.27
Reach-1	723.00	2 YR	306.00	7.79	13.18		13.40	0.002	3.75	90.32	34.71	0.33
Reach-1	723.00	10 YR	632.00	7.79	14.62		15.02	0.003	5.33	150.64	49.56	0.41
Reach-1	723.00	25 YR	876.00	7.79	15.28		15.84	0.004	6.34	191.24	80.96	0.45
Reach-1	723.00	50 YR	1102.00	7.79	15.81		16.48	0.004	7.08	239.39	95.17	0.49
Reach-1	723.00	100 YR	1371.00	7.79	16.24		17.03	0.005	7.88	281.27	100.66	0.52
Reach-1	1031.00	2 YR	293.00	10.07	14.22		14.66	0.008	5.35	58.02	31.30	0.57
Reach-1	1031.00	10 YR	600.00	10.07	15.79		16.30	0.006	6.09	141.55	77.38	0.52
Reach-1	1031.00	25 YR	824.00	10.07	16.64		17.10	0.004	6.13	217.04	93.40	0.48
Reach-1	1031.00	50 YR	1032.00	10.07	17.31		17.74	0.004	6.17	280.66	97.22	0.45
Reach-1	1031.00	100 YR	1282.00	10.07	17.91		18.35	0.004	6.45	339.91	100.65	0.45
Reach-1	1121.00	2 YR	293.00	12.55	15.52	15.52	16.69	0.028	8.68	33.78	14.65	1.01
Reach-1	1121.00	10 YR	600.00	12.55	17.02	17.02	18.71	0.026	10.43	57.47	17.01	1.00
Reach-1	1121.00	25 YR	824.00	12.55	17.89	17.89	19.88	0.026	11.31	72.88	18.38	1.00
Reach-1	1121.00	50 YR	1032.00	12.55	19.06	19.06	20.78	0.017	10.64	110.40	57.82	0.85
Reach-1	1121.00	100 YR	1282.00	12.55	20.01	20.01	21.39	0.012	9.98	181.65	83.16	0.73
Reach-1	1274.00	2 YR	293.00	12.60	17.57		17.78	0.003	3.82	94.16	46.51	0.36
Reach-1	1274.00	10 YR	600.00	12.60	19.40		19.64	0.002	4.39	203.00	69.63	0.33
Reach-1	1274.00	25 YR	824.00	12.60	20.50		20.74	0.002	4.59	284.83	80.88	0.32
Reach-1	1274.00	50 YR	1032.00	12.60	21.28		21.54	0.002	4.85	352.60	91.68	0.32
Reach-1	1274.00	100 YR	1282.00	12.60	21.78		22.10	0.002	5.43	400.29	97.71	0.34
Reach-1	1515.00	2 YR	293.00	14.33	18.48		18.93	0.008	5.40	55.10	22.89	0.58
Reach-1	1515.00	10 YR	600.00	14.33	19.94		20.66	0.007	6.91	100.25	42.83	0.60
Reach-1	1515.00	25 YR	824.00	14.33	20.91		21.60	0.006	7.04	170.22	85.04	0.55
Reach-1	1515.00	50 YR	1032.00	14.33	21.69		22.29	0.005	6.92	240.36	95.78	0.50
Reach-1	1515.00	100 YR	1282.00	14.33	22.27		22.89	0.005	7.28	297.88	103.76	0.50
Reach-1	1780.00	2 YR	293.00	16.24	20.24		20.44	0.004	4.24	125.97	113.68	0.43
Reach-1	1780.00	10 YR	600.00	16.24	21.61		21.74	0.002	4.07	288.99	124.90	0.34
Reach-1	1780.00	25 YR	824.00	16.24	22.37		22.50	0.002	4.16	386.95	131.18	0.33
Reach-1	1780.00	50 YR	1032.00	16.24	22.95		23.09	0.002	4.33	464.84	135.96	0.32
Reach-1	1780.00	100 YR	1282.00	16.24	23.53		23.68	0.002	4.57	544.41	140.26	0.32
Reach-1	2008.00	2 YR	293.00	20.00	23.53	23.53	24.19	0.016	6.69	53.72	60.55	0.79
Reach-1	2008.00	10 YR	600.00	20.00	24.39	24.39	25.22	0.016	8.09	108.89	68.71	0.83
Reach-1	2008.00	25 YR	824.00	20.00	24.83	24.83	25.78	0.016	8.96	141.60	80.31	0.86
Reach-1	2008.00	50 YR	1032.00	20.00	25.17	25.17	26.23	0.017	9.62	170.79	89.39	0.88
Reach-1	2008.00	100 YR	1282.00	20.00	25.57	25.57	26.69	0.016	10.15	208.54	99.93	0.88
Reach-1	2190.00	2 YR	293.00	20.06	24.90		25.04	0.002	3.25	148.93	100.68	0.30
Reach-1	2190.00	10 YR	600.00	20.06	25.97		26.15	0.002	4.10	266.67	119.03	0.34
Reach-1	2190.00	25 YR	824.00	20.06	26.55		26.75	0.002	4.53	337.39	125.04	0.35
Reach-1	2190.00	50 YR	1032.00	20.06	27.01		27.23	0.002	4.87	395.84	129.80	0.36
Reach-1	2190.00	100 YR	1282.00	20.06	27.48		27.72	0.003	5.27	457.56	134.64	0.38
Reach-1	2475.00	2 YR	293.00	20.31	25.56		25.88	0.004	4.58	66.20	19.71	0.40
Reach-1	2475.00	10 YR	600.00	20.31	26.60		27.38	0.008	7.20	97.34	37.39	0.57
Reach-1	2475.00	25 YR	824.00	20.31	27.08	26.16	28.22	0.010	8.82	117.01	44.88	0.66
Reach-1	2475.00	50 YR	1032.00	20.31	27.41	27.00	28.92	0.013	10.23	133.08	52.88	0.75
Reach-1	2475.00	100 YR	1282.00	20.31	28.06	28.06	29.69	0.012	10.89	177.60	78.66	0.75
Reach-1	2718.00	2 YR	293.00	21.25	26.51		26.74	0.003	3.85	76.24	19.85	0.35
Reach-1	2718.00	10 YR	600.00	21.25	28.22		28.56	0.003	4.90	147.31	63.08	0.37
Reach-1	2718.00	25 YR	824.00	21.25	29.12		29.46	0.003	5.08	214.14	84.65	0.36
Reach-1	2718.00	50 YR	1032.00	21.25	29.85		30.16	0.002	5.07	280.73	98.76	0.34
Reach-1	2718.00	100 YR	1282.00	21.25	30.55		30.86	0.002	5.13	355.13	112.47	0.33
Reach-1	2884.00	2 YR	293.00	21.91	27.06	25.37	27.40	0.005	4.70	63.24	20.51	0.45
Reach-1	2884.00	10 YR	600.00	21.91	28.77	26.86	29.35	0.005	6.17	105.42	32.92	0.50
Reach-1	2884.00	25 YR	824.00	21.91	29.57	27.74	30.32	0.006	7.08	148.74	76.42	0.53
Reach-1	2884.00	50 YR	1032.00	21.91	30.20	28.42	31.01	0.006	7.56	200.31	86.67	0.54
Reach-1	2884.00	100 YR	1282.00	21.91	30.84	29.19	31.70	0.006	8.01	259.17	97.06	0.54
Reach-1	2946.00		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2991.00	2 YR	293.00	23.30	28.86	26.61	29.12	0.003	4.08	73.29	21.71	0.37
Reach-1	2991.00	10 YR	600.00	23.30	34.56	28.13	34.62	0.000	2.31	483.71	131.02	0.13
Reach-1	2991.00	25 YR	824.00	23.30	35.35	29.01	35.43	0.000	2.73	617.60	143.17	0.15
Reach-1	2991.00	50 YR	1032.00	23.30	35.80	29.71	35.90	0.001	3.15	683.58	150.13	0.17
Reach-1	2991.00	100 YR	1282.00	23.30	36.19	30.43	36.32	0.001	3.66	743.17	155.90	0.20
Reach-1	3049.00	2 YR	274.00	23.69	29.18		29.26	0.001	2.24	122.15	30.76	0.19
Reach-1	3049.00	10 YR	551.00	23.69	34.60		34.64	0.000	1.65	490.26	110.80	0.09
Reach-1	3049.00	25 YR	751.00	23.69	35.40		35.45	0.000	1.99	582.92	122.67	0.11
Reach-1	3049.00	50 YR	939.00	23.69	35.86		35.93	0.000	2.33	641.20	129.94	0.13
Reach-1	3049.00	100 YR	1165.00	23.69	36.26		36.36	0.000	2.73	695.07	136.31	0.14
Reach-1	3114.00	2 YR	274.00	24.09	29.19	26.81	29.44	0.003	4.08	67.06	16.33	0.35
Reach-1	3114.00	10 YR	551.00	24.09	34.54	28.25	34.74	0.001	3.54	156.17	123.52	0.20
Reach-1	3114.00	25 YR	751.00	24.09	35.40	29.08	35.48	0.001	2.83	490.97	139.16	0.16
Reach-1	3114.00	50 YR	939.00	24.09	35.87	29.77	35.97	0.001	3.15	557.03	143.47	0.17
Reach-1	3114.00	100 YR	1165.00	24.09	36.28	30.51	36.40	0.001	3.54	616.98	147.27	0.19
Reach-1	3156.00		Culvert									
Reach-1	3200.00	2 YR	274.00	24.19	29.76	26.89	29.94	0.002	3.38	81.31	20.86	0.29
Reach-1	3200.00	10 YR	551.00	24.19	36.50	28.27	36.58	0.000	2.29	286.98	125.98	0.12
Reach-1	3200.00	25 YR	751.00	24.19	37.97	29.08	38.00	0.000	1.76	826.07	259.89	0.09
Reach-1	3200.00	50 YR	939.00	24.19	38.33	29.74	38.37	0.000	2.02	925.28	281.20	0.10
Reach-1	3200.00	100 YR	1165.00	24.19	38.63	30.50	38.67	0.000	2.31	1008.80	286.56	0.11
Reach-1	3266.00	2 YR	274.00	26.28	29.79		30.47	0.014	6.61	41.37	15.85	0.72
Reach-1	3266.00	10 YR	551.00	26.28	36.58		36.61	0.000	1.58	562.28	173.90	0.10
Reach-1	3266.00	25 YR	751.00	26.28	37.99		38.01	0.000	1.48	823.22	194.62	0.08
Reach-1	3266.00	50 YR	939.00	26.28	38.36		38.38	0.000	1.69	895.10	199.38	0.09
Reach-1	3266.00	100 YR	1165.00	26.28	38.66		38.69	0.000	1.96	955.26	203.27	0.11
Reach-1	3336.00	2 YR	274.00	28.37	31.03	31.03	31.98	0.027	7.79	35.11	18.63	1.00
Reach-1	3336.00	10 YR	551.00	28.37	36.56	32.24	36.67	0.001	2.75	230.20	174.46	0.19
Reach-1	3336.00	25 YR	751.00	28.37	37.96	32.91	38.08	0.001	2.98	291.30	192.12	0.19
Reach-1	3336.00	50 YR	939.00	28.37	38.31	33.61	38.48	0.001	3.55	306.48	194.65	0.22
Reach-1	3336.00	100 YR	1165.00	28.37	38.58	34.14	38.83	0.001	4.24	318.40	196.56	0.26
Reach-1	3423.00		Culvert									
Reach-1	3491.00	2 YR	274.00	28.37	34.09	31.17	34.26	0.002	3.33	87.84	31.20	0.28
Reach-1	3491.00	10 YR	551.00	28.37	41.37	32.57	41.41	0.000	1.93	387.84	201.48	0.10
Reach-1	3491.00	25 YR	751.00	28.37	46.93	33.37	46.96	0.000	1.63	623.06	334.72	0.07
Reach-1	3491.00	50 YR	939.00	28.37	52.00	34.13	52.00	0.000	0.53	4565.48	457.29	0.02
Reach-1	3491.00	100 YR	1165.00	28.37	52.30	34.94	52.30	0.000	0.64	4705.88	476.36	0.02
Reach-1	3534.00	2 YR	245.00	28.83	34.26		34.34	0.001	2.35	150.85	88.86	0.20
Reach-1	3534.00	10 YR	479.00	28.83	41.42		41.43	0.000	0.88	1249.52	231.93	0.05
Reach-1	3534.00	25 YR	651.00	28.83	46.97		46.97	0.000	0.56	2949.05	369.70	0.02
Reach-1	3534.00	50 YR	810.00	28.83	52.00		52.00	0.000	0.42	5097.72	495.62	0.02
Reach-1	3534.00	100 YR	997.00	28.83	52.30		52.30	0.000	0.51	5249.41	506.68	0.02
Reach-1	3631.00	2 YR	245.00	30.31	34.26	33.47	34.70	0.007	5.37	46.65	22.40	0.58
Reach-1	3631.00	10 YR	479.00	30.31	41.42	34.52	41.44	0.000	1.56	671.11	191.98	0.09
Reach-1	3631.00	25 YR	651.00	30.31	46.97	35.16	46.98	0.000	0.77	2065.51	291.08	0.04
Reach-1	3631.00	50 YR	810.00	30.31	52.00	35.70	52.00	0.000	0.54	3922.01	430.62	0.02
Reach-1	3631.00	100 YR	997.00	30.31	52.30	36.29	52.31	0.000	0.64	4053.42	437.79	0.03
Reach-1	3670.00		Culvert									
Reach-1	3713.00	2 YR	245.00	31.05	35.69	33.22	35.83	0.001	3.03	83.35	25.42	0.27
Reach-1	3713.00	10 YR	479.00	31.05	41.46	34.29	41.47	0.000	1.19	854.06	211.26	0.07
Reach-1	3713.00	25 YR	651.00	31.05	46.98	34.97	46.98	0.000	0.57	2337.62	310.37	0.03
Reach-1	3713.00	50 YR	810.00	31.05	52.00	35.52	52.00	0.000	0.40	4276.04	436.99	0.02
Reach-1	3713.00	100 YR	997.00	31.05	52.30	36.19	52.31	0.000	0.47	4408.91	440.76	0.02
Reach-1	3819.00	2 YR	245.00	30.63	35.80		35.95	0.002	3.20	111.40	86.12	0.27
Reach-1	3819.00	10 YR	479.00	30.63	41.46		41.47	0.000	1.18	884.10	174.13	0.07
Reach-1	3819.00	25 YR	651.00	30.63	46.98		46.98	0.000	0.74	2028.79	243.75	0.03
Reach-1	3819.00	50 YR	810.00	30.63	52.00		52.00	0.000	0.58	3472.51	348.80	0.02
Reach-1	3819.00	100 YR	997.00	30.63	52.30		52.31	0.000	0.70	3579.32	356.98	0.03
Reach-1	4027.00	2 YR	245.00	30.79	36.14		36.22	0.001	2.46	149.39	77.97	0.22
Reach-1	4027.00	10 YR	479.00	30.79	41.48		41.49	0.000	1.32	713.11	134.64	0.08
Reach-1	4027.00	25 YR	651.00	30.79	46.98		46.99	0.000	0.90	1622.40	199.34	0.04
Reach-1	4027.00	50 YR	810.00	30.79	52.00		52.01	0.000	0.68	2739.14	229.00	0.03
Reach-1	4027.00	100 YR	997.00	30.79	52.30		52.31	0.000	0.82	2808.50	229.00	0.03
Reach-1	4249.00	2 YR	245.00	31.37	36.41		36.70	0.005	4.54	76.69	57.81	0.43
Reach-1	4249.00	10 YR	479.00	31.37	41.50		41.51	0.000	1.02	737.00	193.00	0.06
Reach-1	4249.00	25 YR	651.00	31.37	46.99		46.99	0.000	0.46	1953.01	236.75	0.02
Reach-1	4249.00	50 YR	810.00	31.37	52.01		52.01	0.000	0.33	3477.12	362.70	0.01
Reach-1	4249.00	100 YR	997.00	31.37	52.31		52.31	0.000	0.39	3588.06	366.57	0.02

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	4362.00	2 YR	245.00	31.60	36.86		36.98	0.001	2.85	85.93	21.55	0.25
Reach-1	4362.00	10 YR	479.00	31.60	41.49		41.53	0.000	1.81	444.02	126.68	0.11
Reach-1	4362.00	25 YR	651.00	31.60	46.98		46.99	0.000	0.96	1357.28	210.44	0.05
Reach-1	4362.00	50 YR	810.00	31.60	52.00		52.01	0.000	0.66	2589.49	278.23	0.03
Reach-1	4362.00	100 YR	997.00	31.60	52.31		52.31	0.000	0.78	2674.69	283.00	0.03
Reach-1	4469.00	2 YR	245.00	32.55	36.94	35.62	37.32	0.003	4.98	50.44	18.61	0.50
Reach-1	4469.00	10 YR	479.00	32.55	41.51	36.96	41.56	0.000	2.09	351.49	113.72	0.13
Reach-1	4469.00	25 YR	651.00	32.55	46.99	37.79	46.99	0.000	0.86	1232.96	204.61	0.04
Reach-1	4469.00	50 YR	810.00	32.55	52.01	38.32	52.01	0.000	0.51	2611.75	332.33	0.02
Reach-1	4469.00	100 YR	997.00	32.55	52.31	38.87	52.31	0.000	0.61	2713.47	335.13	0.02
Reach-1	4506.00		Culvert									
Reach-1	4545.00	2 YR	245.00	35.01	39.06	37.67	39.44	0.006	4.93	50.38	17.14	0.48
Reach-1	4545.00	10 YR	479.00	35.01	43.42	38.93	43.48	0.000	2.27	282.61	98.18	0.15
Reach-1	4545.00	25 YR	651.00	35.01	46.99	39.79	47.01	0.000	1.23	756.36	163.17	0.07
Reach-1	4545.00	50 YR	810.00	35.01	52.01	40.66	52.01	0.000	0.71	1791.47	257.99	0.03
Reach-1	4545.00	100 YR	997.00	35.01	52.31	41.19	52.32	0.000	0.84	1869.62	263.71	0.04
Reach-1	4597.00	2 YR	245.00	33.77	39.46		39.70	0.003	3.93	65.76	45.10	0.33
Reach-1	4597.00	10 YR	479.00	33.77	43.46		43.51	0.000	2.16	424.20	136.65	0.13
Reach-1	4597.00	25 YR	651.00	33.77	47.00		47.01	0.000	1.31	998.08	182.59	0.07
Reach-1	4597.00	50 YR	810.00	33.77	52.01		52.02	0.000	0.81	2095.61	259.87	0.03
Reach-1	4597.00	100 YR	997.00	33.77	52.31		52.32	0.000	0.97	2174.58	266.02	0.04
Reach-1	4682.00	2 YR	245.00	34.00	39.79		39.90	0.002	3.05	129.19	71.69	0.27
Reach-1	4682.00	10 YR	479.00	34.00	43.51		43.53	0.000	1.59	654.12	187.98	0.10
Reach-1	4682.00	25 YR	651.00	34.00	47.01		47.02	0.000	1.00	1412.84	244.50	0.05
Reach-1	4682.00	50 YR	810.00	34.00	52.01		52.02	0.000	0.61	2784.21	299.39	0.03
Reach-1	4682.00	100 YR	997.00	34.00	52.32		52.32	0.000	0.73	2874.86	301.98	0.03
Reach-1	4919.00	2 YR	192.00	35.89	40.26		40.41	0.003	3.43	85.39	62.40	0.34
Reach-1	4919.00	10 YR	345.00	35.89	43.56		43.59	0.000	1.75	375.79	111.92	0.12
Reach-1	4919.00	25 YR	462.00	35.89	47.02		47.03	0.000	1.12	850.42	162.23	0.06
Reach-1	4919.00	50 YR	569.00	35.89	52.02		52.02	0.000	0.67	1813.74	221.13	0.03
Reach-1	4919.00	100 YR	691.00	35.89	52.32		52.32	0.000	0.79	1881.11	224.50	0.04
Reach-1	5288.00	2 YR	192.00	37.92	41.61		41.97	0.006	4.79	40.18	15.28	0.52
Reach-1	5288.00	10 YR	345.00	37.92	43.59		43.93	0.003	4.73	84.53	36.10	0.39
Reach-1	5288.00	25 YR	462.00	37.92	47.04		47.09	0.000	2.35	316.45	102.13	0.15
Reach-1	5288.00	50 YR	569.00	37.92	52.02		52.03	0.000	0.85	1077.54	187.97	0.04
Reach-1	5288.00	100 YR	691.00	37.92	52.33		52.33	0.000	0.97	1134.96	189.73	0.05
Reach-1	5493.00	2 YR	192.00	39.45	42.88		43.13	0.005	4.00	50.70	27.80	0.47
Reach-1	5493.00	10 YR	345.00	39.45	44.32		44.55	0.003	4.01	99.36	40.10	0.39
Reach-1	5493.00	25 YR	462.00	39.45	47.11		47.19	0.001	2.59	244.44	63.98	0.18
Reach-1	5493.00	50 YR	569.00	39.45	52.02		52.04	0.000	1.38	733.04	152.22	0.07
Reach-1	5493.00	100 YR	691.00	39.45	52.32		52.35	0.000	1.60	780.04	158.24	0.08
Reach-1	5636.00	2 YR	192.00	41.02	43.57	43.24	44.10	0.007	5.87	32.80	18.47	0.78
Reach-1	5636.00	10 YR	345.00	41.02	44.68	44.06	45.27	0.005	6.15	56.11	23.25	0.70
Reach-1	5636.00	25 YR	462.00	41.02	47.15	44.56	47.36	0.001	3.66	126.32	33.56	0.33
Reach-1	5636.00	50 YR	569.00	41.02	52.02	44.96	52.06	0.000	1.69	401.45	79.14	0.10
Reach-1	5636.00	100 YR	691.00	41.02	52.32	45.36	52.38	0.000	1.96	425.81	81.93	0.12
Reach-1	5876.00		Culvert									
Reach-1	6071.00	2 YR	192.00	46.10	51.30	48.68	51.43	0.001	2.88	78.58	189.36	0.25
Reach-1	6071.00	10 YR	345.00	46.10	57.05	49.67	57.09	0.000	1.79	269.12	309.29	0.10
Reach-1	6071.00	25 YR	462.00	46.10	59.31	50.32	59.31	0.000	0.43	2432.00	379.85	0.02
Reach-1	6071.00	50 YR	569.00	46.10	59.60	50.77	59.60	0.000	0.51	2542.89	387.90	0.03
Reach-1	6071.00	100 YR	691.00	46.10	59.79	51.27	59.79	0.000	0.60	2616.26	390.99	0.03
Reach-1	6343.00	2 YR	160.00	46.73	51.67		51.74	0.001	2.35	108.28	64.68	0.21
Reach-1	6343.00	10 YR	265.00	46.73	57.12		57.13	0.000	1.00	660.92	139.39	0.06
Reach-1	6343.00	25 YR	342.00	46.73	59.31		59.32	0.000	0.93	1001.29	173.46	0.05
Reach-1	6343.00	50 YR	410.00	46.73	59.60		59.61	0.000	1.07	1051.95	177.90	0.05
Reach-1	6343.00	100 YR	486.00	46.73	59.79		59.80	0.000	1.23	1085.80	181.38	0.06
Reach-1	6632.00	2 YR	160.00	46.73	52.00		52.13	0.002	2.87	55.82	14.32	0.26
Reach-1	6632.00	10 YR	265.00	46.73	57.13		57.14	0.000	0.93	501.29	145.29	0.05
Reach-1	6632.00	25 YR	342.00	46.73	59.32		59.33	0.000	0.65	912.47	215.34	0.03
Reach-1	6632.00	50 YR	410.00	46.73	59.61		59.62	0.000	0.72	976.16	221.45	0.04
Reach-1	6632.00	100 YR	486.00	46.73	59.81		59.81	0.000	0.81	1019.35	226.04	0.04

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7189.00	2 YR	160.00	51.20	53.90		54.35	0.011	5.42	32.24	21.04	0.66
Reach-1	7189.00	10 YR	265.00	51.20	57.17		57.26	0.001	2.71	182.71	82.09	0.21
Reach-1	7189.00	25 YR	342.00	51.20	59.34		59.36	0.000	1.72	427.18	140.46	0.11
Reach-1	7189.00	50 YR	410.00	51.20	59.63		59.66	0.000	1.88	469.31	145.28	0.12
Reach-1	7189.00	100 YR	486.00	51.20	59.83		59.87	0.000	2.09	498.63	156.55	0.13
Reach-1	7703.00	2 YR	160.00	56.00	58.69		58.98	0.008	4.53	47.98	49.72	0.55
Reach-1	7703.00	10 YR	265.00	56.00	58.76	58.76	59.49	0.018	7.14	51.97	53.11	0.85
Reach-1	7703.00	25 YR	342.00	56.00	59.23	59.11	59.87	0.013	6.94	81.22	70.65	0.75
Reach-1	7703.00	50 YR	410.00	56.00	59.60	59.37	60.17	0.010	6.79	109.75	83.75	0.69
Reach-1	7703.00	100 YR	486.00	56.00	59.85	59.59	60.44	0.010	7.07	131.50	92.04	0.69
Reach-1	8188.00	2 YR	160.00	57.22	61.21	59.83	61.38	0.003	3.30	49.66	26.07	0.37
Reach-1	8188.00	10 YR	265.00	57.22	62.19	60.50	62.41	0.003	3.76	84.14	50.31	0.36
Reach-1	8188.00	25 YR	342.00	57.22	62.51	60.89	62.79	0.003	4.34	101.94	61.27	0.40
Reach-1	8188.00	50 YR	410.00	57.22	62.73	61.17	63.07	0.004	4.82	116.26	67.40	0.43
Reach-1	8188.00	100 YR	486.00	57.22	63.01	61.49	63.39	0.004	5.17	135.84	72.89	0.44
Reach-1	8290.00		Culvert									
Reach-1	8363.00	2 YR	160.00	58.09	65.62	60.36	65.63	0.000	1.23	295.15	87.05	0.08
Reach-1	8363.00	10 YR	265.00	58.09	66.15	61.19	66.18	0.000	1.90	348.23	116.35	0.12
Reach-1	8363.00	25 YR	342.00	58.09	66.38	61.67	66.43	0.000	2.36	377.03	134.18	0.15
Reach-1	8363.00	50 YR	410.00	58.09	66.50	62.05	66.57	0.001	2.78	393.57	144.95	0.17
Reach-1	8363.00	100 YR	486.00	58.09	66.63	62.39	66.72	0.001	3.19	413.07	155.40	0.19

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reedy Branch - Existing Conditions												
Reach-1	338.00	2 yr	154.00	7.07	10.59	9.71	10.89	0.006	4.68	46.04	27.81	0.48
Reach-1	338.00	10 YR	314.00	7.07	11.84	10.77	12.28	0.006	5.95	95.32	56.45	0.51
Reach-1	338.00	25 YR	384.00	7.07	12.21	10.92	12.67	0.006	6.29	118.41	67.40	0.52
Reach-1	338.00	50 YR	452.00	7.07	12.50	11.50	12.98	0.006	6.56	138.43	71.30	0.53
Reach-1	338.00	100 YR	531.00	7.07	12.81	11.94	13.30	0.006	6.83	160.78	75.43	0.53
Reach-1	546.00	2 yr	154.00	7.65	11.41	10.04	11.68	0.003	4.10	37.50	14.39	0.45
Reach-1	546.00	10 YR	314.00	7.65	12.73	11.24	13.17	0.003	5.37	58.56	17.72	0.52
Reach-1	546.00	25 YR	384.00	7.65	13.12	11.65	13.65	0.004	5.84	65.68	18.71	0.55
Reach-1	546.00	50 YR	452.00	7.65	13.42	12.01	14.04	0.004	6.32	71.46	19.64	0.58
Reach-1	546.00	100 YR	531.00	7.65	13.73	12.40	14.45	0.004	6.84	77.72	21.10	0.61
Reach-1	564.00		Bridge									
Reach-1	592.00	2 yr	154.00	7.70	11.66	9.85	11.89	0.002	3.91	39.30	11.77	0.38
Reach-1	592.00	10 YR	314.00	7.70	13.12	11.07	13.59	0.003	5.46	57.63	13.73	0.46
Reach-1	592.00	25 YR	384.00	7.70	13.59	11.51	14.15	0.003	6.00	64.71	16.90	0.48
Reach-1	592.00	50 YR	452.00	7.70	13.98	11.91	14.63	0.003	6.49	71.86	19.96	0.50
Reach-1	592.00	100 YR	531.00	7.70	14.42	12.35	15.14	0.003	6.92	81.36	37.10	0.51
Reach-1	636.00	2 yr	154.00	9.55	12.26	12.26	13.29	0.014	8.13	18.92	9.33	1.01
Reach-1	636.00	10 YR	314.00	9.55	13.72	13.72	14.98	0.011	9.08	36.72	17.12	0.91
Reach-1	636.00	25 YR	384.00	9.55	14.17	14.17	15.49	0.010	9.42	44.94	20.48	0.88
Reach-1	636.00	50 YR	452.00	9.55	14.61	14.61	15.91	0.009	9.51	55.07	25.79	0.84
Reach-1	636.00	100 YR	531.00	9.55	15.02	15.02	16.33	0.008	9.69	66.89	30.85	0.82
Reach-1	734.00	2 yr	154.00	11.71	13.89	13.35	14.24	0.005	4.76	32.33	18.13	0.63
Reach-1	734.00	10 YR	314.00	11.71	15.35	14.24	15.75	0.003	5.08	61.89	22.45	0.53
Reach-1	734.00	25 YR	384.00	11.71	15.77	14.56	16.22	0.003	5.38	71.30	23.48	0.53
Reach-1	734.00	50 YR	452.00	11.71	16.09	14.85	16.61	0.003	5.77	78.26	24.24	0.54
Reach-1	734.00	100 YR	531.00	11.71	16.39	15.16	17.00	0.003	6.25	84.93	24.96	0.56
Reach-1	813.00		Culvert									
Reach-1	918.00	2 yr	154.00	13.48	17.39	15.29	17.50	0.002	2.72	56.59	18.42	0.27
Reach-1	918.00	10 YR	314.00	13.48	20.42	16.25	20.52	0.001	2.61	126.12	34.57	0.20
Reach-1	918.00	25 YR	384.00	13.48	22.55	16.59	22.62	0.000	2.14	227.66	99.01	0.14
Reach-1	918.00	50 YR	452.00	13.48	24.22	16.91	24.27	0.000	1.93	317.46	133.39	0.11
Reach-1	918.00	100 YR	531.00	13.48	27.56	17.26	27.59	0.000	1.51	511.97	164.39	0.07
Reach-1	1058.00	2 yr	125.00	12.30	17.60		17.64	0.000	1.55	126.34	70.58	0.13
Reach-1	1058.00	10 YR	355.00	12.30	20.57		20.61	0.000	1.83	419.29	130.13	0.12
Reach-1	1058.00	25 YR	495.00	12.30	22.64		22.66	0.000	1.59	707.54	149.02	0.09
Reach-1	1058.00	50 YR	612.00	12.30	24.28		24.30	0.000	1.47	965.03	164.06	0.08
Reach-1	1058.00	100 YR	752.00	12.30	27.60		27.61	0.000	1.16	1559.71	196.44	0.05
Reach-1	1502.00	2 yr	125.00	12.83	17.80		17.85	0.001	1.86	79.66	31.94	0.16
Reach-1	1502.00	10 YR	355.00	12.83	20.71		20.79	0.001	2.50	246.75	79.78	0.17
Reach-1	1502.00	25 YR	495.00	12.83	22.71		22.76	0.000	2.27	456.53	122.89	0.13
Reach-1	1502.00	50 YR	612.00	12.83	24.33		24.37	0.000	2.03	672.72	144.55	0.11
Reach-1	1502.00	100 YR	752.00	12.83	27.62		27.63	0.000	1.47	1213.61	182.98	0.07
Reach-1	2002.00	2 yr	125.00	15.34	18.39		18.80	0.010	5.21	26.93	15.22	0.61
Reach-1	2002.00	10 YR	355.00	15.34	21.13		21.56	0.005	5.63	82.54	28.11	0.47
Reach-1	2002.00	25 YR	495.00	15.34	22.91		23.22	0.003	5.01	164.27	62.50	0.36
Reach-1	2002.00	50 YR	612.00	15.34	24.45		24.65	0.001	4.30	281.91	90.13	0.27
Reach-1	2002.00	100 YR	752.00	15.34	27.67		27.72	0.000	2.58	665.92	156.05	0.14
Reach-1	2076.00	2 yr	91.00	17.78	19.57	19.57	20.18	0.032	6.30	14.50	11.98	1.01
Reach-1	2076.00	10 YR	223.00	17.78	21.60		22.03	0.008	5.27	42.42	15.44	0.56
Reach-1	2076.00	25 YR	297.00	17.78	23.16		23.45	0.004	4.34	68.49	18.09	0.39
Reach-1	2076.00	50 YR	362.00	17.78	24.66		24.76	0.001	2.89	244.20	146.58	0.22
Reach-1	2076.00	100 YR	442.00	17.78	27.73		27.74	0.000	1.25	776.75	204.62	0.08
Reach-1	2509.00	2 yr	91.00	18.50	22.44		22.55	0.002	2.63	37.89	20.28	0.28
Reach-1	2509.00	10 YR	223.00	18.50	23.79		24.00	0.003	3.91	80.81	40.32	0.34
Reach-1	2509.00	25 YR	297.00	18.50	24.55		24.77	0.002	4.08	114.83	48.75	0.33
Reach-1	2509.00	50 YR	362.00	18.50	25.24		25.44	0.002	4.07	151.10	56.37	0.30
Reach-1	2509.00	100 YR	442.00	18.50	27.78		27.85	0.001	2.72	329.61	84.59	0.17
Reach-1	3007.00	2 yr	91.00	21.82	24.40		24.81	0.014	5.13	17.82	9.64	0.66
Reach-1	3007.00	10 YR	223.00	21.82	26.04		26.64	0.012	6.24	35.84	13.07	0.64
Reach-1	3007.00	25 YR	297.00	21.82	26.49	25.70	27.27	0.013	7.12	44.73	24.06	0.68
Reach-1	3007.00	50 YR	362.00	21.82	26.82	26.13	27.74	0.014	7.76	53.26	26.98	0.71
Reach-1	3007.00	100 YR	442.00	21.82	28.07		28.66	0.007	6.51	93.65	37.88	0.52

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3074.00	2 yr	91.00	25.84	27.57	27.57	28.18	0.031	6.25	14.63	12.25	1.01
Reach-1	3074.00	10 YR	223.00	25.84	28.62	28.62	29.50	0.024	7.52	30.78	24.83	0.96
Reach-1	3074.00	25 YR	297.00	25.84	29.16	29.16	29.98	0.018	7.43	49.63	45.98	0.86
Reach-1	3074.00	50 YR	362.00	25.84	29.44	29.44	30.30	0.017	7.73	64.30	56.08	0.85
Reach-1	3074.00	100 YR	442.00	25.84	29.90	29.90	30.62	0.013	7.40	100.71	93.44	0.75
Reach-1	3113.00	2 yr	91.00	25.96	28.57	27.96	28.87	0.009	4.36	20.96	22.92	0.57
Reach-1	3113.00	10 YR	223.00	25.96	29.75	29.07	30.12	0.008	5.31	62.98	41.86	0.55
Reach-1	3113.00	25 YR	297.00	25.96	30.06	29.48	30.54	0.009	6.11	76.99	47.21	0.60
Reach-1	3113.00	50 YR	362.00	25.96	30.29	29.79	30.86	0.010	6.75	88.25	51.53	0.64
Reach-1	3113.00	100 YR	442.00	25.96	30.35	30.12	31.15	0.013	8.05	91.25	52.69	0.76
Reach-1	3163.00		Culvert									
Reach-1	3208.00	2 yr	92.00	26.97	32.22	29.07	32.28	0.001	2.02	45.77	13.64	0.18
Reach-1	3208.00	10 YR	224.00	26.97	34.29	30.39	34.39	0.001	2.71	134.12	71.99	0.20
Reach-1	3208.00	25 YR	297.00	26.97	34.54	30.97	34.68	0.001	3.33	152.44	75.33	0.24
Reach-1	3208.00	50 YR	362.00	26.97	34.65	31.42	34.84	0.002	3.92	160.59	76.79	0.28
Reach-1	3208.00	100 YR	443.00	26.97	34.79	31.92	35.05	0.003	4.56	172.21	78.82	0.32
Reach-1	3284.00	2 yr	49.00	27.75	32.32		32.33	0.000	0.78	65.40	26.28	0.08
Reach-1	3284.00	10 YR	99.00	27.75	34.43		34.44	0.000	0.83	182.76	74.13	0.06
Reach-1	3284.00	25 YR	117.00	27.75	34.74		34.75	0.000	0.90	206.55	78.90	0.07
Reach-1	3284.00	50 YR	135.00	27.75	34.93		34.94	0.000	1.00	221.09	81.72	0.07
Reach-1	3284.00	100 YR	158.00	27.75	35.17		35.18	0.000	1.10	241.16	85.48	0.08
Reach-1	3523.00	2 yr	49.00	27.24	32.36		32.38	0.000	1.03	58.40	25.11	0.09
Reach-1	3523.00	10 YR	99.00	27.24	34.46		34.47	0.000	1.14	129.50	45.11	0.08
Reach-1	3523.00	25 YR	117.00	27.24	34.77		34.79	0.000	1.25	144.14	48.56	0.09
Reach-1	3523.00	50 YR	135.00	27.24	34.95		34.98	0.000	1.38	153.31	50.59	0.10
Reach-1	3523.00	100 YR	158.00	27.24	35.20		35.23	0.000	1.53	165.97	53.28	0.11
Reach-1	3761.00	2 yr	49.00	27.45	32.41		32.42	0.000	0.79	63.08	19.67	0.08
Reach-1	3761.00	10 YR	99.00	27.45	34.49		34.51	0.000	0.94	116.96	32.93	0.07
Reach-1	3761.00	25 YR	117.00	27.45	34.81		34.82	0.000	1.04	127.71	35.03	0.08
Reach-1	3761.00	50 YR	135.00	27.45	35.00		35.02	0.000	1.15	134.55	36.30	0.08
Reach-1	3761.00	100 YR	158.00	27.45	35.25		35.28	0.000	1.29	143.87	37.96	0.09
Reach-1	4044.00	2 yr	49.00	30.62	32.46		32.56	0.004	2.54	19.43	14.18	0.38
Reach-1	4044.00	10 YR	99.00	30.62	34.53		34.58	0.001	1.82	54.53	19.96	0.19
Reach-1	4044.00	25 YR	117.00	30.62	34.85		34.91	0.001	1.92	61.22	21.81	0.19
Reach-1	4044.00	50 YR	135.00	30.62	35.05		35.12	0.001	2.09	65.69	22.97	0.20
Reach-1	4044.00	100 YR	158.00	30.62	35.31		35.39	0.001	2.26	71.83	24.47	0.21
Reach-1	4182.00	2 yr	49.00	32.22	33.37		33.59	0.015	3.77	13.07	13.72	0.68
Reach-1	4182.00	10 YR	99.00	32.22	34.70		34.83	0.004	2.90	34.05	17.93	0.37
Reach-1	4182.00	25 YR	117.00	32.22	35.01		35.14	0.003	2.92	39.87	18.94	0.35
Reach-1	4182.00	50 YR	135.00	32.22	35.22		35.37	0.003	3.07	43.98	19.61	0.36
Reach-1	4182.00	100 YR	158.00	32.22	35.49		35.65	0.003	3.19	49.37	20.47	0.36
Reach-1	4291.00	2 yr	49.00	33.47	34.98	34.71	35.25	0.015	4.15	11.87	10.53	0.69
Reach-1	4291.00	10 YR	99.00	33.47	35.27	35.27	35.95	0.031	6.61	14.95	11.20	1.01
Reach-1	4291.00	25 YR	117.00	33.47	35.44	35.44	36.18	0.031	6.90	16.88	11.60	1.01
Reach-1	4291.00	50 YR	135.00	33.47	35.60	35.60	36.40	0.030	7.16	18.83	11.99	1.01
Reach-1	4291.00	100 YR	158.00	33.47	35.81	35.79	36.66	0.029	7.36	21.41	12.49	0.99
Reach-1	4494.00	2 yr	49.00	35.80	37.85		38.14	0.013	4.35	11.33	7.55	0.63
Reach-1	4494.00	10 YR	99.00	35.80	38.93	38.11	39.30	0.010	4.85	20.51	9.85	0.56
Reach-1	4494.00	25 YR	117.00	35.80	39.15	38.33	39.57	0.010	5.22	22.71	10.64	0.58
Reach-1	4494.00	50 YR	135.00	35.80	39.35	38.53	39.83	0.011	5.58	24.93	11.38	0.60
Reach-1	4494.00	100 YR	158.00	35.80	39.57	38.76	40.12	0.011	6.02	27.49	12.17	0.62
Reach-1	4624.00	2 yr	49.00	39.14	40.72	40.72	41.32	0.036	6.19	7.96	6.80	1.01
Reach-1	4624.00	10 YR	99.00	39.14	41.45	41.45	42.31	0.034	7.41	13.33	7.92	1.01
Reach-1	4624.00	25 YR	117.00	39.14	41.67	41.67	42.60	0.034	7.71	15.11	8.26	1.00
Reach-1	4624.00	50 YR	135.00	39.14	41.88	41.88	42.87	0.034	8.01	16.83	8.57	1.01
Reach-1	4624.00	100 YR	158.00	39.14	42.11	42.11	43.20	0.033	8.36	18.96	9.75	1.00
Reach-1	4798.00	2 yr	49.00	42.16	44.81	44.25	45.14	0.015	4.59	10.74	6.42	0.63
Reach-1	4798.00	10 YR	99.00	42.16	45.61	45.16	46.11	0.015	5.83	20.42	19.00	0.67
Reach-1	4798.00	25 YR	117.00	42.16	45.82	45.53	46.35	0.015	6.10	24.64	21.93	0.67
Reach-1	4798.00	50 YR	135.00	42.16	46.01	45.76	46.56	0.014	6.32	29.14	24.66	0.67
Reach-1	4798.00	100 YR	158.00	42.16	46.22	46.00	46.79	0.014	6.55	34.79	27.71	0.67
Reach-1	4994.00	2 yr	49.00	43.38	46.90		47.09	0.007	3.50	14.10	6.19	0.41
Reach-1	4994.00	10 YR	99.00	43.38	47.97		48.30	0.009	4.62	22.02	9.38	0.46
Reach-1	4994.00	25 YR	117.00	43.38	48.21		48.60	0.009	5.02	24.41	10.81	0.49
Reach-1	4994.00	50 YR	135.00	43.38	48.43		48.88	0.010	5.42	27.62	19.11	0.51
Reach-1	4994.00	100 YR	158.00	43.38	48.65	47.39	49.16	0.010	5.85	32.75	27.65	0.53

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5241.00	2 yr	49.00	46.32	48.25	47.52	48.33	0.004	2.25	21.91	16.97	0.35
Reach-1	5241.00	10 YR	99.00	46.32	49.27	47.95	49.36	0.002	2.42	40.76	20.07	0.30
Reach-1	5241.00	25 YR	117.00	46.32	49.56	48.08	49.66	0.002	2.49	46.76	20.97	0.29
Reach-1	5241.00	50 YR	135.00	46.32	49.84	48.20	49.94	0.002	2.56	52.72	21.82	0.29
Reach-1	5241.00	100 YR	158.00	46.32	50.13	48.35	50.24	0.002	2.66	59.33	22.72	0.29
Reach-1	5301.00		Culvert									
Reach-1	5356.00	2 yr	50.00	47.99	51.66	49.30	51.70	0.001	1.70	32.48	23.09	0.17
Reach-1	5356.00	10 YR	99.00	47.99	53.76	50.00	53.80	0.001	1.76	71.86	61.75	0.14
Reach-1	5356.00	25 YR	117.00	47.99	54.83	50.21	54.86	0.000	1.64	92.16	81.60	0.12
Reach-1	5356.00	50 YR	135.00	47.99	55.92	50.42	55.95	0.000	1.56	112.75	197.55	0.10
Reach-1	5356.00	100 YR	158.00	47.99	56.68	50.69	56.68	0.000	0.91	361.70	225.46	0.06
Reach-1	5381.00	2 yr	35.00	48.86	51.68		51.74	0.002	2.07	17.21	9.48	0.26
Reach-1	5381.00	10 YR	75.00	48.86	53.78		53.81	0.001	1.61	62.63	36.66	0.14
Reach-1	5381.00	25 YR	95.00	48.86	54.86		54.88	0.000	1.27	113.01	59.26	0.10
Reach-1	5381.00	50 YR	116.00	48.86	55.95		55.96	0.000	0.93	206.55	106.97	0.07
Reach-1	5381.00	100 YR	139.00	48.86	56.68		56.69	0.000	0.79	291.84	128.45	0.05
Reach-1	5438.00	2 yr	35.00	48.66	51.82		51.97	0.007	3.13	11.29	5.00	0.37
Reach-1	5438.00	10 YR	75.00	48.66	53.77		53.91	0.004	3.04	28.19	19.96	0.31
Reach-1	5438.00	25 YR	95.00	48.66	54.85		54.92	0.002	2.38	63.24	45.56	0.21
Reach-1	5438.00	50 YR	116.00	48.66	55.95		55.98	0.001	1.79	129.44	81.34	0.14
Reach-1	5438.00	100 YR	139.00	48.66	56.68		56.70	0.000	1.56	195.22	100.35	0.11
Reach-1	5466.00	2 yr	35.00	48.92	52.02	50.45	52.11	0.003	2.33	15.22	6.77	0.27
Reach-1	5466.00	10 YR	75.00	48.92	53.91	51.23	54.00	0.002	2.41	37.15	16.31	0.22
Reach-1	5466.00	25 YR	95.00	48.92	54.89	51.54	54.96	0.001	2.24	55.36	24.19	0.19
Reach-1	5466.00	50 YR	116.00	48.92	55.96	51.83	56.00	0.001	1.92	110.97	68.60	0.14
Reach-1	5466.00	100 YR	139.00	48.92	56.68	52.14	56.71	0.000	1.71	168.74	89.63	0.12
Reach-1	5515.00		Culvert									
Reach-1	5571.00	2 yr	35.00	51.43	54.83	52.67	54.86	0.001	1.37	25.85	12.18	0.16
Reach-1	5571.00	10 YR	75.00	51.43	56.84	53.33	56.86	0.000	1.22	107.23	71.59	0.11
Reach-1	5571.00	25 YR	95.00	51.43	57.02	53.61	57.05	0.000	1.43	120.21	75.34	0.12
Reach-1	5571.00	50 YR	116.00	51.43	57.17	53.84	57.20	0.000	1.63	131.52	78.46	0.14
Reach-1	5571.00	100 YR	139.00	51.43	57.30	54.10	57.34	0.001	1.85	142.31	81.33	0.15
Reach-1	5862.00	2 yr	35.00	49.18	55.03		55.05	0.001	1.21	31.86	15.56	0.11
Reach-1	5862.00	10 YR	75.00	49.18	56.94		56.96	0.000	1.40	76.80	32.98	0.11
Reach-1	5862.00	25 YR	95.00	49.18	57.15		57.18	0.001	1.67	83.80	34.91	0.13
Reach-1	5862.00	50 YR	116.00	49.18	57.32		57.37	0.001	1.93	90.13	36.56	0.14
Reach-1	5862.00	100 YR	139.00	49.18	57.50		57.56	0.001	2.21	96.59	38.31	0.16
Reach-1	6288.00	2 yr	35.00	54.92	56.11	56.11	56.54	0.027	5.29	6.70	7.68	1.00
Reach-1	6288.00	10 YR	75.00	54.92	57.29	56.74	57.53	0.006	4.04	19.72	20.13	0.54
Reach-1	6288.00	25 YR	95.00	54.92	57.60	56.95	57.86	0.006	4.24	23.75	22.49	0.53
Reach-1	6288.00	50 YR	116.00	54.92	57.88	57.14	58.17	0.006	4.43	27.43	24.58	0.53
Reach-1	6288.00	100 YR	139.00	54.92	58.16	57.34	58.48	0.006	4.66	31.30	26.86	0.53
Reach-1	6317.00		Culvert									
Reach-1	6351.00	2 yr	36.00	55.23	57.78	56.38	57.81	0.001	1.56	26.68	21.84	0.20
Reach-1	6351.00	10 YR	75.00	55.23	59.23	56.91	59.27	0.000	1.61	71.14	66.16	0.15
Reach-1	6351.00	25 YR	95.00	55.23	59.90	57.11	59.93	0.000	1.60	93.61	90.27	0.14
Reach-1	6351.00	50 YR	116.00	55.23	60.61	57.32	60.64	0.000	1.56	117.60	145.38	0.13
Reach-1	6351.00	100 YR	139.00	55.23	61.72	57.53	61.74	0.000	1.43	154.88	195.05	0.10
Reach-1	6504.00	2 yr	36.00	55.52	57.99		58.05	0.003	2.32	29.01	34.89	0.27
Reach-1	6504.00	10 YR	75.00	55.52	59.34		59.38	0.001	2.08	93.94	78.60	0.19
Reach-1	6504.00	25 YR	95.00	55.52	59.99		60.01	0.001	1.71	156.18	106.66	0.15
Reach-1	6504.00	50 YR	116.00	55.52	60.68		60.69	0.000	1.36	235.59	122.31	0.11
Reach-1	6504.00	100 YR	139.00	55.52	61.77		61.77	0.000	1.00	384.57	154.02	0.07
Reach-1	6622.00	2 yr	36.00	55.38	58.23		58.27	0.001	1.74	20.45	10.84	0.22
Reach-1	6622.00	10 YR	75.00	55.38	59.45		59.52	0.001	2.12	38.59	24.63	0.22
Reach-1	6622.00	25 YR	95.00	55.38	60.04		60.11	0.001	2.10	62.29	53.02	0.20
Reach-1	6622.00	50 YR	116.00	55.38	60.71		60.75	0.001	1.87	99.59	59.42	0.16
Reach-1	6622.00	100 YR	139.00	55.38	61.77		61.80	0.000	1.47	176.01	86.18	0.11
Reach-1	6708.00	2 yr	36.00	56.92	58.37	58.17	58.69	0.016	4.57	7.77	7.23	0.78
Reach-1	6708.00	10 YR	75.00	56.92	59.56	58.83	59.82	0.007	4.14	18.17	10.29	0.55
Reach-1	6708.00	25 YR	95.00	56.92	60.11	59.09	60.35	0.005	3.93	24.24	11.71	0.48
Reach-1	6708.00	50 YR	116.00	56.92	60.72	59.33	60.92	0.003	3.63	33.42	19.27	0.39
Reach-1	6708.00	100 YR	139.00	56.92	61.77	59.57	61.88	0.001	2.78	71.89	53.20	0.26
Reach-1	6771.00		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7004.00	2 yr	36.00	58.56	62.28	59.86	62.31	0.001	1.54	23.00	8.68	0.17
Reach-1	7004.00	10 YR	75.00	58.56	66.82	60.61	66.82	0.000	0.38	428.49	357.97	0.03
Reach-1	7004.00	25 YR	95.00	58.56	66.97	60.92	66.97	0.000	0.42	481.58	367.16	0.03
Reach-1	7004.00	50 YR	116.00	58.56	67.04	61.20	67.04	0.000	0.47	507.64	371.31	0.03
Reach-1	7004.00	100 YR	139.00	58.56	67.13	61.49	67.13	0.000	0.53	540.33	376.17	0.03
Reach-1	7222.00	2 yr	36.00	62.60	63.89	63.89	64.43	0.030	5.90	6.01	5.61	1.00
Reach-1	7222.00	10 YR	75.00	62.60	66.83		66.83	0.000	1.02	139.00	261.03	0.10
Reach-1	7222.00	25 YR	95.00	62.60	66.97		66.98	0.000	0.95	177.94	264.71	0.10
Reach-1	7222.00	50 YR	116.00	62.60	67.05		67.05	0.000	1.01	197.19	266.50	0.10
Reach-1	7222.00	100 YR	139.00	62.60	67.14		67.14	0.000	1.04	221.08	268.72	0.10
Reach-1	7371.00	2 yr	36.00	65.23	67.03	66.65	67.33	0.013	4.38	8.11	6.05	0.66
Reach-1	7371.00	10 YR	75.00	65.23	67.57	67.57	68.09	0.016	6.05	16.37	21.41	0.78
Reach-1	7371.00	25 YR	95.00	65.23	67.81	67.81	68.34	0.014	6.27	22.34	26.87	0.76
Reach-1	7371.00	50 YR	116.00	65.23	68.00	68.00	68.54	0.014	6.55	27.79	31.02	0.76
Reach-1	7371.00	100 YR	139.00	65.23	68.18	68.18	68.74	0.014	6.85	33.77	35.02	0.76
Reach-1	7399.00		Culvert									
Reach-1	7428.00	2 yr	36.00	65.56	68.55	66.98	68.56	0.000	1.14	76.17	149.88	0.13
Reach-1	7428.00	10 YR	75.00	65.56	68.83	67.89	68.84	0.001	1.43	143.65	191.54	0.15
Reach-1	7428.00	25 YR	95.00	65.56	68.90	68.07	68.92	0.001	1.64	157.31	203.14	0.17
Reach-1	7428.00	50 YR	116.00	65.56	68.99	68.23	69.01	0.001	1.75	177.08	234.23	0.18
Reach-1	7428.00	100 YR	139.00	65.56	69.04	68.39	69.06	0.001	1.95	189.56	238.80	0.20
Reach-1	7545.00	2 yr	36.00	66.69	68.58	68.11	68.58	0.000	0.31	104.75	108.12	0.05
Reach-1	7545.00	10 YR	75.00	66.69	68.87	68.51	68.87	0.000	0.51	136.74	113.56	0.07
Reach-1	7545.00	25 YR	95.00	66.69	68.95	68.51	68.95	0.000	0.61	145.85	116.04	0.08
Reach-1	7545.00	50 YR	116.00	66.69	69.04	68.51	69.05	0.000	0.70	157.07	119.03	0.09
Reach-1	7545.00	100 YR	139.00	66.69	69.11	68.51	69.12	0.000	0.81	164.76	121.03	0.10
Reach-1	7801.00	2 yr	36.00	69.60	71.02	71.02	71.57	0.030	5.94	5.98	5.41	1.00
Reach-1	7801.00	10 YR	75.00	69.60	71.78	71.78	71.87	0.005	3.29	52.77	350.46	0.44
Reach-1	7801.00	25 YR	95.00	69.60	71.81	71.81	71.91	0.006	3.70	58.57	357.84	0.49
Reach-1	7801.00	50 YR	116.00	69.60	71.84	71.84	71.96	0.008	4.09	64.74	377.98	0.54
Reach-1	7801.00	100 YR	139.00	69.60	71.90	71.90	71.93	0.003	2.65	125.24	411.58	0.34

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reedy Branch - Future Conditions												
Reach-1	338.00	2 yr	177.00	7.07	10.80	9.89	11.13	0.006	4.90	52.10	29.62	0.49
Reach-1	338.00	10 YR	467.00	7.07	12.56	11.59	13.04	0.006	6.61	142.75	72.12	0.53
Reach-1	338.00	25 YR	677.00	7.07	13.31	12.54	13.82	0.006	7.27	199.94	82.15	0.54
Reach-1	338.00	50 YR	855.00	7.07	13.84	12.91	14.38	0.006	7.72	245.39	89.32	0.55
Reach-1	338.00	100 YR	1054.00	7.07	14.35	13.32	14.92	0.006	8.15	293.63	96.35	0.56
Reach-1	546.00	2 yr	177.00	7.65	11.64	10.24	11.93	0.003	4.33	40.82	14.96	0.46
Reach-1	546.00	10 YR	467.00	7.65	13.48	12.09	14.12	0.004	6.42	72.67	19.93	0.59
Reach-1	546.00	25 YR	677.00	7.65	14.22	13.03	15.14	0.005	7.71	88.60	23.40	0.67
Reach-1	546.00	50 YR	855.00	7.65	14.72	13.71	15.87	0.005	8.64	100.91	25.77	0.72
Reach-1	546.00	100 YR	1054.00	7.65	15.17	14.40	16.59	0.006	9.62	113.00	27.80	0.76
Reach-1	564.00		Bridge									
Reach-1	592.00	2 yr	177.00	7.70	11.90	10.04	12.18	0.002	4.18	42.26	12.00	0.39
Reach-1	592.00	10 YR	467.00	7.70	14.06	12.00	14.73	0.003	6.58	73.61	20.64	0.50
Reach-1	592.00	25 YR	677.00	7.70	15.23	13.09	16.01	0.003	7.32	102.97	96.39	0.51
Reach-1	592.00	50 YR	855.00	7.70	16.04	14.16	16.85	0.003	7.64	129.37	145.27	0.50
Reach-1	592.00	100 YR	1054.00	7.70	16.58	15.25	17.52	0.003	8.35	149.04	168.65	0.53
Reach-1	636.00	2 yr	177.00	9.55	12.48	12.48	13.58	0.014	8.41	21.00	9.68	1.01
Reach-1	636.00	10 YR	467.00	9.55	14.69	14.69	16.00	0.008	9.55	57.29	26.81	0.84
Reach-1	636.00	25 YR	677.00	9.55	15.64	15.64	16.96	0.007	10.04	88.18	38.07	0.79
Reach-1	636.00	50 YR	855.00	9.55	16.22	16.22	17.59	0.007	10.51	112.32	44.87	0.78
Reach-1	636.00	100 YR	1054.00	9.55	16.72	16.72	18.17	0.007	11.10	136.22	50.70	0.79
Reach-1	734.00	2 yr	177.00	11.71	14.15	13.50	14.50	0.004	4.77	37.06	18.91	0.60
Reach-1	734.00	10 YR	467.00	11.71	16.15	14.91	16.68	0.003	5.86	79.67	24.39	0.54
Reach-1	734.00	25 YR	677.00	11.71	16.79	15.62	17.60	0.004	7.22	93.72	25.92	0.62
Reach-1	734.00	50 YR	855.00	11.71	17.06	16.14	18.20	0.005	8.56	99.78	26.58	0.71
Reach-1	734.00	100 YR	1054.00	11.71	17.28	16.68	18.86	0.006	10.07	104.58	27.10	0.82
Reach-1	813.00		Culvert									
Reach-1	918.00	2 yr	177.00	13.48	17.77	15.44	17.89	0.002	2.77	63.73	19.13	0.27
Reach-1	918.00	10 YR	467.00	13.48	24.80	16.98	24.84	0.000	1.84	349.64	139.76	0.10
Reach-1	918.00	25 YR	677.00	13.48	34.62	17.83	34.63	0.000	1.05	1136.29	287.16	0.04
Reach-1	918.00	50 YR	855.00	13.48	35.30	18.46	35.32	0.000	1.26	1245.10	328.30	0.05
Reach-1	918.00	100 YR	1054.00	13.48	35.64	19.08	35.64	0.000	0.91	2805.93	333.88	0.04
Reach-1	1058.00	2 yr	138.00	12.30	17.98		18.01	0.000	1.49	155.23	79.38	0.12
Reach-1	1058.00	10 YR	355.00	12.30	24.86		24.86	0.000	0.78	1060.83	169.32	0.04
Reach-1	1058.00	25 YR	509.00	12.30	34.63		34.63	0.000	0.40	3573.29	385.85	0.02
Reach-1	1058.00	50 YR	640.00	12.30	35.32		35.33	0.000	0.47	3844.02	395.96	0.02
Reach-1	1058.00	100 YR	788.00	12.30	35.65		35.65	0.000	0.55	3972.14	400.73	0.02
Reach-1	1502.00	2 yr	138.00	12.83	18.15		18.20	0.001	1.86	92.10	39.72	0.15
Reach-1	1502.00	10 YR	355.00	12.83	24.87		24.88	0.000	1.07	752.65	152.13	0.06
Reach-1	1502.00	25 YR	509.00	12.83	34.63		34.63	0.000	0.45	3047.65	325.74	0.02
Reach-1	1502.00	50 YR	640.00	12.83	35.33		35.33	0.000	0.52	3275.28	331.23	0.02
Reach-1	1502.00	100 YR	788.00	12.83	35.65		35.65	0.000	0.62	3382.47	333.78	0.02
Reach-1	2002.00	2 yr	138.00	15.34	18.66		19.04	0.009	5.05	31.12	16.20	0.56
Reach-1	2002.00	10 YR	355.00	15.34	24.90		24.95	0.000	2.25	324.28	98.19	0.14
Reach-1	2002.00	25 YR	509.00	15.34	34.64		34.64	0.000	0.45	2186.79	262.51	0.02
Reach-1	2002.00	50 YR	640.00	15.34	35.33		35.33	0.000	0.53	2381.79	298.92	0.02
Reach-1	2002.00	100 YR	788.00	15.34	35.65		35.66	0.000	0.63	2479.58	305.59	0.03
Reach-1	2076.00	2 yr	96.00	17.78	19.61	19.61	20.25	0.032	6.39	15.04	12.06	1.01
Reach-1	2076.00	10 YR	235.00	17.78	24.95		24.98	0.000	1.66	287.60	150.23	0.13
Reach-1	2076.00	25 YR	328.00	17.78	34.64		34.64	0.000	0.23	2543.33	272.70	0.01
Reach-1	2076.00	50 YR	412.00	17.78	35.33		35.33	0.000	0.27	2733.23	274.47	0.01
Reach-1	2076.00	100 YR	509.00	17.78	35.66		35.66	0.000	0.32	2822.33	275.30	0.01
Reach-1	2509.00	2 yr	96.00	18.50	22.52		22.62	0.002	2.68	39.41	21.79	0.28
Reach-1	2509.00	10 YR	235.00	18.50	25.15		25.24	0.001	2.72	145.70	55.31	0.20
Reach-1	2509.00	25 YR	328.00	18.50	34.64		34.64	0.000	0.65	1175.64	160.23	0.03
Reach-1	2509.00	50 YR	412.00	18.50	35.33		35.33	0.000	0.75	1289.64	168.47	0.03
Reach-1	2509.00	100 YR	509.00	18.50	35.65		35.66	0.000	0.89	1346.98	188.21	0.04
Reach-1	3007.00	2 yr	96.00	21.82	24.48		24.89	0.014	5.18	18.57	9.77	0.66
Reach-1	3007.00	10 YR	235.00	21.82	25.86		26.62	0.016	6.99	33.68	12.08	0.74
Reach-1	3007.00	25 YR	328.00	21.82	34.65		34.65	0.000	1.00	793.26	156.91	0.05
Reach-1	3007.00	50 YR	412.00	21.82	35.34		35.35	0.000	1.11	905.21	164.37	0.06
Reach-1	3007.00	100 YR	509.00	21.82	35.67		35.68	0.000	1.30	959.62	167.43	0.06
Reach-1	3074.00	2 yr	96.00	25.84	27.62	27.62	28.24	0.030	6.32	15.20	12.43	1.01
Reach-1	3074.00	10 YR	235.00	25.84	28.72	28.72	29.59	0.023	7.49	33.45	28.78	0.94
Reach-1	3074.00	25 YR	328.00	25.84	34.65		34.66	0.000	0.85	919.42	209.91	0.05
Reach-1	3074.00	50 YR	412.00	25.84	35.35		35.35	0.000	0.91	1068.19	216.84	0.06
Reach-1	3074.00	100 YR	509.00	25.84	35.68		35.69	0.000	1.06	1140.40	220.12	0.06

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	3113.00	2 yr	96.00	25.96	28.62	28.01	28.93	0.009	4.46	21.55	23.67	0.57
Reach-1	3113.00	10 YR	235.00	25.96	29.81	29.14	30.20	0.008	5.43	65.61	42.92	0.56
Reach-1	3113.00	25 YR	328.00	25.96	34.65	29.63	34.66	0.000	1.07	795.06	225.51	0.07
Reach-1	3113.00	50 YR	412.00	25.96	35.35	30.00	35.36	0.000	1.10	956.02	236.03	0.07
Reach-1	3113.00	100 YR	509.00	25.96	35.68	30.36	35.69	0.000	1.25	1034.95	241.02	0.07
Reach-1	3163.00		Culvert									
Reach-1	3208.00	2 yr	96.00	26.97	32.56	29.12	32.62	0.001	1.94	50.54	14.70	0.17
Reach-1	3208.00	10 YR	235.00	26.97	34.31	30.48	34.42	0.001	2.84	135.43	72.19	0.21
Reach-1	3208.00	25 YR	328.00	26.97	34.84	31.19	34.98	0.001	3.33	175.84	79.45	0.23
Reach-1	3208.00	50 YR	412.00	26.97	35.31	31.74	35.46	0.002	3.64	214.57	88.36	0.25
Reach-1	3208.00	100 YR	509.00	26.97	35.57	32.32	35.77	0.002	4.19	239.27	98.84	0.28
Reach-1	3284.00	2 yr	49.00	27.75	32.65		32.66	0.000	0.71	76.43	41.21	0.07
Reach-1	3284.00	10 YR	110.00	27.75	34.46		34.47	0.000	0.92	184.90	74.57	0.07
Reach-1	3284.00	25 YR	140.00	27.75	35.04		35.05	0.000	1.01	230.27	83.46	0.07
Reach-1	3284.00	50 YR	167.00	27.75	35.53		35.54	0.000	1.06	272.82	90.68	0.07
Reach-1	3284.00	100 YR	200.00	27.75	35.85		35.87	0.000	1.17	303.66	97.74	0.08
Reach-1	3523.00	2 yr	49.00	27.24	32.68		32.69	0.000	0.93	66.60	26.64	0.08
Reach-1	3523.00	10 YR	110.00	27.24	34.49		34.51	0.000	1.26	131.01	45.48	0.09
Reach-1	3523.00	25 YR	140.00	27.24	35.06		35.09	0.000	1.40	158.98	51.81	0.10
Reach-1	3523.00	50 YR	167.00	27.24	35.55		35.58	0.000	1.49	185.59	57.20	0.10
Reach-1	3523.00	100 YR	200.00	27.24	35.88		35.91	0.000	1.66	205.10	60.84	0.11
Reach-1	3761.00	2 yr	49.00	27.45	32.72		32.72	0.000	0.72	69.21	20.56	0.07
Reach-1	3761.00	10 YR	110.00	27.45	34.53		34.55	0.000	1.03	118.29	33.20	0.08
Reach-1	3761.00	25 YR	140.00	27.45	35.11		35.13	0.000	1.17	138.61	37.03	0.09
Reach-1	3761.00	50 YR	167.00	27.45	35.60		35.62	0.000	1.28	157.52	40.27	0.09
Reach-1	3761.00	100 YR	200.00	27.45	35.94		35.97	0.000	1.44	171.48	42.50	0.10
Reach-1	4044.00	2 yr	49.00	30.62	32.76		32.82	0.002	2.07	23.76	15.05	0.29
Reach-1	4044.00	10 YR	110.00	30.62	34.58		34.64	0.001	1.98	55.50	20.24	0.20
Reach-1	4044.00	25 YR	140.00	30.62	35.16		35.23	0.001	2.10	68.27	23.61	0.20
Reach-1	4044.00	50 YR	167.00	30.62	35.65		35.73	0.001	2.17	80.55	26.45	0.20
Reach-1	4044.00	100 YR	200.00	30.62	36.00		36.09	0.001	2.36	89.92	27.58	0.21
Reach-1	4182.00	2 yr	49.00	32.22	33.33		33.57	0.017	3.93	12.56	13.60	0.72
Reach-1	4182.00	10 YR	110.00	32.22	34.77		34.92	0.004	3.10	35.40	18.17	0.39
Reach-1	4182.00	25 YR	140.00	32.22	35.33		35.47	0.003	3.04	46.05	19.95	0.35
Reach-1	4182.00	50 YR	167.00	32.22	35.80		35.94	0.003	2.99	55.86	21.45	0.33
Reach-1	4182.00	100 YR	200.00	32.22	36.16		36.31	0.003	3.14	63.67	22.58	0.33
Reach-1	4291.00	2 yr	49.00	33.47	35.01	34.71	35.27	0.014	4.07	12.12	10.59	0.67
Reach-1	4291.00	10 YR	110.00	33.47	35.38	35.38	36.09	0.031	6.78	16.17	11.45	1.01
Reach-1	4291.00	25 YR	140.00	33.47	35.66	35.65	36.46	0.030	7.19	19.48	12.12	1.00
Reach-1	4291.00	50 YR	167.00	33.47	36.01	35.87	36.77	0.024	6.99	23.93	12.95	0.91
Reach-1	4291.00	100 YR	200.00	33.47	36.35	36.12	37.12	0.021	7.04	28.40	14.12	0.86
Reach-1	4494.00	2 yr	49.00	35.80	37.83		38.13	0.014	4.41	11.17	7.52	0.64
Reach-1	4494.00	10 YR	110.00	35.80	39.06	38.24	39.46	0.010	5.09	21.84	10.33	0.57
Reach-1	4494.00	25 YR	140.00	35.80	39.40	38.59	39.90	0.011	5.69	25.50	11.56	0.60
Reach-1	4494.00	50 YR	167.00	35.80	39.57	38.85	40.19	0.013	6.38	27.49	12.17	0.65
Reach-1	4494.00	100 YR	200.00	35.80	39.78	39.16	40.54	0.014	7.07	30.16	12.95	0.70
Reach-1	4624.00	2 yr	49.00	39.14	40.72	40.72	41.32	0.036	6.19	7.96	6.80	1.01
Reach-1	4624.00	10 YR	110.00	39.14	41.59	41.59	42.49	0.034	7.61	14.41	8.12	1.01
Reach-1	4624.00	25 YR	140.00	39.14	41.93	41.93	42.95	0.034	8.09	17.32	8.68	1.01
Reach-1	4624.00	50 YR	167.00	39.14	42.22	42.22	43.32	0.032	8.42	20.07	10.42	0.99
Reach-1	4624.00	100 YR	200.00	39.14	42.56	42.56	43.73	0.028	8.69	24.23	14.65	0.95
Reach-1	4798.00	2 yr	49.00	42.16	44.81		45.14	0.015	4.59	10.75	6.43	0.63
Reach-1	4798.00	10 YR	110.00	42.16	45.74	45.44	46.26	0.015	5.99	23.03	20.87	0.67
Reach-1	4798.00	25 YR	140.00	42.16	46.06	45.82	46.62	0.014	6.37	30.48	25.41	0.67
Reach-1	4798.00	50 YR	167.00	42.16	46.30	46.09	46.88	0.014	6.67	36.86	28.74	0.67
Reach-1	4798.00	100 YR	200.00	42.16	46.53	46.34	47.15	0.014	7.04	43.88	32.01	0.68
Reach-1	4994.00	2 yr	49.00	43.38	46.90		47.09	0.007	3.50	14.10	6.19	0.41
Reach-1	4994.00	10 YR	110.00	43.38	48.12		48.49	0.009	4.87	23.48	9.99	0.48
Reach-1	4994.00	25 YR	140.00	43.38	48.48		48.95	0.010	5.53	28.72	21.21	0.51
Reach-1	4994.00	50 YR	167.00	43.38	48.74	47.51	49.26	0.011	5.97	35.45	31.46	0.54
Reach-1	4994.00	100 YR	200.00	43.38	49.01	47.93	49.56	0.011	6.27	45.87	44.91	0.54
Reach-1	5241.00	2 yr	49.00	46.32	48.25	47.52	48.33	0.004	2.25	21.91	16.97	0.35
Reach-1	5241.00	10 YR	110.00	46.32	49.45	48.03	49.54	0.002	2.47	44.44	20.63	0.30
Reach-1	5241.00	25 YR	140.00	46.32	49.91	48.24	50.01	0.002	2.58	54.32	22.04	0.29
Reach-1	5241.00	50 YR	167.00	46.32	50.24	48.42	50.36	0.002	2.70	61.84	23.05	0.29
Reach-1	5241.00	100 YR	200.00	46.32	50.55	48.60	50.68	0.002	2.89	69.22	26.79	0.30
Reach-1	5301.00		Culvert									

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	5356.00	2 yr	49.00	47.99	51.65	49.29	51.69	0.001	1.69	32.34	22.92	0.17
Reach-1	5356.00	10 YR	110.00	47.99	54.28	50.13	54.32	0.000	1.73	81.75	67.25	0.13
Reach-1	5356.00	25 YR	140.00	47.99	56.45	50.47	56.46	0.000	0.81	329.79	217.89	0.05
Reach-1	5356.00	50 YR	167.00	47.99	56.74	50.83	56.75	0.000	0.83	371.16	227.16	0.05
Reach-1	5356.00	100 YR	200.00	47.99	56.89	51.13	56.90	0.000	0.93	392.26	284.37	0.06
Reach-1	5381.00	2 yr	35.00	48.86	51.67		51.73	0.002	2.08	17.12	9.44	0.26
Reach-1	5381.00	10 YR	75.00	48.86	54.31		54.33	0.000	1.26	84.37	45.93	0.10
Reach-1	5381.00	25 YR	95.00	48.86	56.45		56.46	0.000	0.60	264.04	120.46	0.04
Reach-1	5381.00	50 YR	115.00	48.86	56.75		56.75	0.000	0.64	300.61	132.88	0.04
Reach-1	5381.00	100 YR	139.00	48.86	56.89		56.90	0.000	0.72	320.92	142.62	0.05
Reach-1	5438.00	2 yr	35.00	48.66	51.81		51.96	0.007	3.14	11.26	4.99	0.37
Reach-1	5438.00	10 YR	75.00	48.66	54.30		54.38	0.002	2.40	42.02	32.37	0.23
Reach-1	5438.00	25 YR	95.00	48.66	56.45		56.47	0.000	1.18	173.58	93.23	0.09
Reach-1	5438.00	50 YR	115.00	48.66	56.74		56.76	0.000	1.25	202.18	102.59	0.09
Reach-1	5438.00	100 YR	139.00	48.66	56.89		56.91	0.000	1.41	217.62	107.55	0.10
Reach-1	5466.00	2 yr	35.00	48.92	52.02	50.45	52.10	0.003	2.33	15.19	6.76	0.27
Reach-1	5466.00	10 YR	75.00	48.92	54.37	51.23	54.43	0.001	2.07	45.13	18.35	0.18
Reach-1	5466.00	25 YR	95.00	48.92	56.46	51.54	56.48	0.000	1.30	148.89	85.36	0.09
Reach-1	5466.00	50 YR	115.00	48.92	56.75	51.83	56.77	0.000	1.38	174.67	91.23	0.10
Reach-1	5466.00	100 YR	139.00	48.92	56.90	52.14	56.92	0.000	1.55	188.48	94.86	0.11
Reach-1	5515.00		Culvert									
Reach-1	5571.00	2 yr	35.00	51.43	54.83	52.67	54.86	0.001	1.37	25.85	12.18	0.16
Reach-1	5571.00	10 YR	75.00	51.43	56.83	53.33	56.85	0.000	1.23	106.50	71.37	0.11
Reach-1	5571.00	25 YR	95.00	51.43	57.15	53.60	57.18	0.000	1.35	130.46	78.18	0.11
Reach-1	5571.00	50 YR	115.00	51.43	57.21	53.84	57.24	0.000	1.60	135.00	79.40	0.13
Reach-1	5571.00	100 YR	139.00	51.43	57.33	54.09	57.37	0.001	1.83	144.30	81.85	0.15
Reach-1	5862.00	2 yr	35.00	49.18	55.03		55.05	0.001	1.21	31.86	15.56	0.11
Reach-1	5862.00	10 YR	75.00	49.18	56.93		56.96	0.000	1.41	76.50	32.90	0.11
Reach-1	5862.00	25 YR	95.00	49.18	57.26		57.30	0.001	1.62	87.97	36.00	0.12
Reach-1	5862.00	50 YR	115.00	49.18	57.36		57.41	0.001	1.90	91.50	36.91	0.14
Reach-1	5862.00	100 YR	139.00	49.18	57.51		57.57	0.001	2.19	97.34	38.54	0.16
Reach-1	6288.00	2 yr	35.00	54.92	56.11	56.11	56.54	0.027	5.29	6.70	7.68	1.00
Reach-1	6288.00	10 YR	75.00	54.92	57.28	56.74	57.52	0.007	4.05	19.64	20.08	0.54
Reach-1	6288.00	25 YR	95.00	54.92	57.67	56.95	57.92	0.005	4.07	24.69	23.03	0.50
Reach-1	6288.00	50 YR	115.00	54.92	57.90	57.13	58.18	0.006	4.38	27.69	24.72	0.52
Reach-1	6288.00	100 YR	139.00	54.92	58.17	57.34	58.48	0.006	4.64	31.40	26.91	0.52
Reach-1	6317.00		Culvert									
Reach-1	6351.00	2 yr	36.00	55.23	57.78	56.38	57.81	0.001	1.56	26.68	21.84	0.20
Reach-1	6351.00	10 YR	75.00	55.23	59.23	56.91	59.27	0.000	1.61	71.14	66.16	0.15
Reach-1	6351.00	25 YR	95.00	55.23	59.90	57.11	59.93	0.000	1.60	93.61	90.27	0.14
Reach-1	6351.00	50 YR	116.00	55.23	60.61	57.32	60.64	0.000	1.56	117.60	145.38	0.13
Reach-1	6351.00	100 YR	139.00	55.23	61.72	57.53	61.74	0.000	1.43	154.88	195.05	0.10
Reach-1	6504.00	2 yr	36.00	55.52	57.99		58.05	0.003	2.32	29.01	34.89	0.27
Reach-1	6504.00	10 YR	75.00	55.52	59.34		59.38	0.001	2.08	93.94	78.60	0.19
Reach-1	6504.00	25 YR	95.00	55.52	59.99		60.01	0.001	1.71	156.18	106.66	0.15
Reach-1	6504.00	50 YR	116.00	55.52	60.68		60.69	0.000	1.36	235.59	122.31	0.11
Reach-1	6504.00	100 YR	139.00	55.52	61.77		61.77	0.000	1.00	384.57	154.02	0.07
Reach-1	6622.00	2 yr	36.00	55.38	58.23		58.27	0.001	1.74	20.45	10.84	0.22
Reach-1	6622.00	10 YR	75.00	55.38	59.45		59.52	0.001	2.12	38.59	24.63	0.22
Reach-1	6622.00	25 YR	95.00	55.38	60.04		60.11	0.001	2.10	62.29	53.02	0.20
Reach-1	6622.00	50 YR	116.00	55.38	60.71		60.75	0.001	1.87	99.59	59.42	0.16
Reach-1	6622.00	100 YR	139.00	55.38	61.77		61.80	0.000	1.47	176.01	86.18	0.11
Reach-1	6708.00	2 yr	36.00	56.92	58.37	58.17	58.69	0.016	4.57	7.77	7.23	0.78
Reach-1	6708.00	10 YR	75.00	56.92	59.56	58.83	59.82	0.007	4.14	18.17	10.29	0.55
Reach-1	6708.00	25 YR	95.00	56.92	60.11	59.09	60.35	0.005	3.93	24.24	11.71	0.48
Reach-1	6708.00	50 YR	116.00	56.92	60.72	59.33	60.92	0.003	3.63	33.42	19.27	0.39
Reach-1	6708.00	100 YR	139.00	56.92	61.77	59.57	61.88	0.001	2.78	71.89	53.20	0.26
Reach-1	6771.00		Culvert									
Reach-1	7004.00	2 yr	36.00	58.56	62.28	59.86	62.31	0.001	1.54	23.00	8.68	0.17
Reach-1	7004.00	10 YR	75.00	58.56	66.82	60.61	66.82	0.000	0.38	428.49	357.97	0.03
Reach-1	7004.00	25 YR	95.00	58.56	66.97	60.92	66.97	0.000	0.42	481.58	367.16	0.03
Reach-1	7004.00	50 YR	116.00	58.56	67.04	61.20	67.04	0.000	0.47	507.64	371.31	0.03
Reach-1	7004.00	100 YR	139.00	58.56	67.13	61.49	67.13	0.000	0.53	540.33	376.17	0.03

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	7222.00	2 yr	36.00	62.60	63.89	63.89	64.43	0.030	5.90	6.01	5.61	1.00
Reach-1	7222.00	10 YR	75.00	62.60	66.83		66.83	0.000	1.02	139.00	261.03	0.10
Reach-1	7222.00	25 YR	95.00	62.60	66.97		66.98	0.000	0.95	177.94	264.71	0.10
Reach-1	7222.00	50 YR	116.00	62.60	67.05		67.05	0.000	1.01	197.19	266.50	0.10
Reach-1	7222.00	100 YR	139.00	62.60	67.14		67.14	0.000	1.04	221.08	268.72	0.10
Reach-1	7371.00	2 yr	36.00	65.23	67.03	66.65	67.33	0.013	4.38	8.11	6.05	0.66
Reach-1	7371.00	10 YR	75.00	65.23	67.57	67.57	68.09	0.016	6.05	16.37	21.41	0.78
Reach-1	7371.00	25 YR	95.00	65.23	67.81	67.81	68.34	0.014	6.27	22.34	26.87	0.76
Reach-1	7371.00	50 YR	116.00	65.23	68.00	68.00	68.54	0.014	6.55	27.79	31.02	0.76
Reach-1	7371.00	100 YR	139.00	65.23	68.18	68.18	68.74	0.014	6.85	33.77	35.02	0.76
Reach-1	7399.00		Culvert									
Reach-1	7428.00	2 yr	36.00	65.56	68.55	66.98	68.56	0.000	1.14	76.17	149.88	0.13
Reach-1	7428.00	10 YR	75.00	65.56	68.83	67.89	68.84	0.001	1.43	143.65	191.54	0.15
Reach-1	7428.00	25 YR	95.00	65.56	68.90	68.07	68.92	0.001	1.64	157.31	203.14	0.17
Reach-1	7428.00	50 YR	116.00	65.56	68.99	68.23	69.01	0.001	1.75	177.08	234.23	0.18
Reach-1	7428.00	100 YR	139.00	65.56	69.04	68.39	69.06	0.001	1.95	189.56	238.80	0.20
Reach-1	7545.00	2 yr	36.00	66.69	68.58	68.11	68.58	0.000	0.31	104.75	108.12	0.05
Reach-1	7545.00	10 YR	75.00	66.69	68.87	68.51	68.87	0.000	0.51	136.74	113.56	0.07
Reach-1	7545.00	25 YR	95.00	66.69	68.95	68.51	68.95	0.000	0.61	145.85	116.04	0.08
Reach-1	7545.00	50 YR	116.00	66.69	69.04	68.51	69.05	0.000	0.70	157.07	119.03	0.09
Reach-1	7545.00	100 YR	139.00	66.69	69.11	68.51	69.12	0.000	0.81	164.76	121.03	0.10
Reach-1	7801.00	2 yr	36.00	69.60	71.02	71.02	71.57	0.030	5.94	5.98	5.41	1.00
Reach-1	7801.00	10 YR	75.00	69.60	71.78	71.78	71.87	0.005	3.29	52.77	350.46	0.44
Reach-1	7801.00	25 YR	95.00	69.60	71.81	71.81	71.91	0.006	3.70	58.57	357.84	0.49
Reach-1	7801.00	50 YR	116.00	69.60	71.84	71.84	71.96	0.008	4.09	64.74	377.98	0.54
Reach-1	7801.00	100 YR	139.00	69.60	71.90	71.90	71.93	0.003	2.65	125.24	411.58	0.34

H.6 HEC-RAS Output – Refined Future Conditions

As part of the Primary System improvement modeling effort, certain modifications were made to the *Future Conditions Model* to allow for more stable modeling of culvert improvements *(*referred to as the *Refined Future Conditions Model*). These revisions were largely focused on stabilizing the water surface profiles upstream and downstream of culverts. These changes resulted in mostly small water surface elevation variances from the *Future Conditions Model* presented elsewhere in this WSMP. The *Refined Future Conditions Model* was then used as the basis for developing the Primary System improvements. Additionally, comparison of pre- and post-improvement water surface elevations was conducted between the *Refined Future Conditions Model* and the *Future Conditions Model with Alternatives* so as to have a common starting point between the models.

HEC-RAS Output for Greens Mill Run Refined Future Land-Use Conditions

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	40149	2 year	314.60	63.69	67.48		68.32	0.01671	7.44	46.07	24.11	0.82
Reach-1	40149	10 year	597.30	63.69	70.00		70.61	0.00514	6.54	122.34	41.48	0.51
Reach-1	40149	25 year	798.30	63.69	71.70		71.98	0.00195	4.88	229.24	83.67	0.33
Reach-1	40149	50 year	974.60	63.69	72.20		72.47	0.00178	4.88	278.13	114.21	0.32
Reach-1	40149	100 year	1170.10	63.69	72.57		72.84	0.00161	4.80	322.66	129.86	0.31
Reach-1	39582	2 year	314.60	59.93	65.27	63.41	65.46	0.00218	3.60	96.36	33.19	0.33
Reach-1	39582	10 year	597.30	59.93	69.77	64.37	69.87	0.00043	2.74	326.99	81.06	0.17
Reach-1	39582	25 year	798.30	59.93	71.51	64.96	71.58	0.00028	2.52	538.78	153.95	0.14
Reach-1	39582	50 year	974.60	59.93	71.99	65.41	72.07	0.00031	2.72	621.94	190.52	0.15
Reach-1	39582	100 year	1170.10	59.93	72.33	65.90	72.42	0.00035	2.96	692.86	226.38	0.16
Reach-1	39079	2 year	314.60	57.80	64.80	60.91	64.88	0.00065	2.48	182.46	48.09	0.18
Reach-1	39079	10 year	597.30	57.80	69.68	62.36	69.72	0.00017	1.92	629.09	146.56	0.10
Reach-1	39079	25 year	798.30	57.80	71.45	62.99	71.48	0.00013	1.84	930.63	217.66	0.09
Reach-1	39079	50 year	974.60	57.80	71.92	63.45	71.95	0.00015	2.03	1039.76	290.64	0.10
Reach-1	39079	100 year	1170.10	57.80	72.24	63.93	72.29	0.00018	2.26	1124.16	496.31	0.11
Reach-1	38564	2 year	314.60	57.32	64.57	60.70	64.63	0.00037	2.01	237.34	84.68	0.15
Reach-1	38564	10 year	597.30	57.32	69.65	61.64	69.66	0.00006	1.26	975.11	232.64	0.07
Reach-1	38564	25 year	798.30	57.32	71.42	62.18	71.43	0.00005	1.18	1457.25	318.27	0.06
Reach-1	38564	50 year	974.60	57.32	71.89	62.61	71.90	0.00005	1.30	1611.83	344.71	0.06
Reach-1	38564	100 year	1170.10	57.32	72.21	63.02	72.23	0.00006	1.44	1725.48	361.04	0.07
Reach-1	38205	2 year	314.60	57.08	64.45		64.49	0.00035	1.85	276.48	96.60	0.14
Reach-1	38205	10 year	597.30	57.08	69.64		69.65	0.00002	0.71	1708.42	494.22	0.04
Reach-1	38205	25 year	798.30	57.08	71.42		71.42	0.00001	0.55	2650.30	560.56	0.03
Reach-1	38205	50 year	974.60	57.08	71.89		71.89	0.00001	0.60	2915.77	577.20	0.03
Reach-1	38205	100 year	1170.10	57.08	72.21		72.21	0.00001	0.67	3103.64	589.99	0.03
Reach-1	37950	2 year	640.30	55.91	64.20	60.36	64.33	0.00075	3.12	290.73	190.73	0.21
Reach-1	37950	10 year	1213.50	55.91	69.54	61.59	69.61	0.00023	2.57	732.67	293.12	0.13
Reach-1	37950	25 year	1606.90	55.91	71.39	62.27	71.41	0.00008	1.70	2434.77	520.45	0.08
Reach-1	37950	50 year	1959.90	55.91	71.85	62.83	71.88	0.00010	1.89	2683.73	556.49	0.09
Reach-1	37950	100 year	2351.70	55.91	72.17	63.17	72.20	0.00012	2.13	2861.90	577.98	0.10
Reach-1	37906		Culvert									
Reach-1	37781	2 year	640.30	55.55	62.70	60.36	62.94	0.00194	4.21	187.89	49.43	0.33
Reach-1	37781	10 year	1213.50	55.55	64.03	61.61	64.56	0.00317	6.28	274.22	181.53	0.44
Reach-1	37781	25 year	1606.90	55.55	64.70	62.30	65.24	0.00314	6.69	450.38	199.94	0.44
Reach-1	37781	50 year	1959.90	55.55	65.22	62.87	65.76	0.00309	6.96	557.16	210.42	0.44
Reach-1	37781	100 year	2351.70	55.55	65.75	63.33	66.29	0.00302	7.19	670.74	221.02	0.44
Reach-1	37629	2 year	640.30	54.33	62.43		62.64	0.00129	3.93	256.02	122.90	0.28
Reach-1	37629	10 year	1213.50	54.33	63.83		64.08	0.00145	4.78	527.46	235.91	0.31
Reach-1	37629	25 year	1606.90	54.33	64.49		64.74	0.00144	5.03	689.77	261.45	0.31
Reach-1	37629	50 year	1959.90	54.33	65.00		65.24	0.00140	5.17	830.51	286.31	0.31
Reach-1	37629	100 year	2351.70	54.33	65.49		65.72	0.00135	5.27	975.30	301.41	0.30

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	37026	2 year	640.30	53.42	61.74		61.91	0.00110	3.67	321.83	236.47	0.26
Reach-1	37026	10 year	1213.50	53.42	63.10		63.28	0.00117	4.32	688.29	301.69	0.27
Reach-1	37026	25 year	1606.90	53.42	63.79		63.96	0.00111	4.46	904.44	321.06	0.27
Reach-1	37026	50 year	1959.90	53.42	64.32		64.49	0.00107	4.56	1078.99	335.21	0.27
Reach-1	37026	100 year	2351.70	53.42	64.83		64.99	0.00105	4.68	1253.42	348.78	0.27
Reach-1	36428	2 year	640.30	53.28	61.15		61.24	0.00108	3.80	524.00	216.84	0.25
Reach-1	36428	10 year	1213.50	53.28	62.39		62.50	0.00139	4.81	827.49	281.01	0.29
Reach-1	36428	25 year	1606.90	53.28	63.05		63.18	0.00152	5.29	1022.96	310.95	0.31
Reach-1	36428	50 year	1959.90	53.28	63.57		63.71	0.00159	5.63	1191.29	337.85	0.32
Reach-1	36428	100 year	2351.70	53.28	64.07		64.21	0.00165	5.93	1366.11	359.70	0.33
Reach-1	35806	2 year	640.30	52.98	59.86		60.14	0.00325	5.97	350.25	224.24	0.43
Reach-1	35806	10 year	1213.50	52.98	61.06		61.29	0.00288	6.35	640.78	259.14	0.41
Reach-1	35806	25 year	1606.90	52.98	61.69		61.91	0.00282	6.63	810.51	280.72	0.42
Reach-1	35806	50 year	1959.90	52.98	62.20		62.42	0.00275	6.83	957.89	298.19	0.41
Reach-1	35806	100 year	2351.70	52.98	62.68		62.90	0.00274	7.08	1105.10	314.68	0.42
Reach-1	35433	2 year	640.30	52.37	59.28		59.36	0.00129	3.77	555.64	258.32	0.27
Reach-1	35433	10 year	1213.50	52.37	60.42		60.51	0.00146	4.50	878.52	303.15	0.29
Reach-1	35433	25 year	1606.90	52.37	61.04		61.13	0.00148	4.80	1072.34	320.00	0.30
Reach-1	35433	50 year	1959.90	52.37	61.55		61.65	0.00147	4.99	1239.77	330.80	0.30
Reach-1	35433	100 year	2351.70	52.37	62.02		62.12	0.00152	5.25	1396.06	340.58	0.31
Reach-1	35029	2 year	640.30	52.36	58.77	57.00	58.83	0.00128	3.55	580.08	255.65	0.26
Reach-1	35029	10 year	1213.50	52.36	59.81	57.97	59.89	0.00158	4.42	861.64	287.88	0.30
Reach-1	35029	25 year	1606.90	52.36	60.40	58.26	60.49	0.00169	4.84	1037.99	320.58	0.32
Reach-1	35029	50 year	1959.90	52.36	60.88	58.49	60.99	0.00182	5.25	1205.14	357.56	0.33
Reach-1	35029	100 year	2351.70	52.36	61.35	58.72	61.46	0.00177	5.39	1378.43	379.30	0.33
Reach-1	34653	2 year	640.30	51.50	58.04		58.19	0.00235	4.89	478.08	296.21	0.36
Reach-1	34653	10 year	1213.50	51.50	59.05		59.18	0.00225	5.33	789.35	319.50	0.36
Reach-1	34653	25 year	1606.90	51.50	59.66		59.78	0.00211	5.47	987.07	331.63	0.36
Reach-1	34653	50 year	1959.90	51.50	60.14		60.26	0.00204	5.61	1148.09	341.09	0.35
Reach-1	34653	100 year	2351.70	51.50	60.63		60.75	0.00198	5.76	1318.15	350.81	0.35
Reach-1	34229	2 year	640.30	50.64	56.71		56.94	0.00373	5.82	357.62	208.06	0.45
Reach-1	34229	10 year	1213.50	50.64	57.71		57.95	0.00387	6.66	575.23	225.58	0.47
Reach-1	34229	25 year	1606.90	50.64	58.47		58.68	0.00326	6.60	751.82	238.86	0.44
Reach-1	34229	50 year	1959.90	50.64	58.98		59.18	0.00319	6.84	873.81	247.61	0.44
Reach-1	34229	100 year	2351.70	50.64	59.48		59.69	0.00318	7.13	1001.06	259.71	0.44
Reach-1	33851	2 year	640.30	49.12	55.54		55.74	0.00271	4.47	335.95	243.25	0.34
Reach-1	33851	10 year	1213.50	49.12	56.74		56.88	0.00206	4.47	666.86	293.77	0.31
Reach-1	33851	25 year	1606.90	49.12	57.87		57.96	0.00115	3.73	1019.91	325.96	0.24
Reach-1	33851	50 year	1959.90	49.12	58.40		58.49	0.00110	3.81	1196.88	342.39	0.24
Reach-1	33851	100 year	2351.70	49.12	58.93		59.01	0.00106	3.90	1381.07	362.54	0.23
Reach-1	33371	2 year	640.30	47.87	55.12		55.16	0.00060	2.33	604.53	290.44	0.17
Reach-1	33371	10 year	1213.50	47.87	56.33		56.37	0.00059	2.60	968.06	309.05	0.17

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	33371	25 year	1606.90	47.87	57.62		57.65	0.00037	2.29	1379.48	326.24	0.14
Reach-1	33371	50 year	1959.90	47.87	58.14		58.18	0.00039	2.45	1551.77	332.32	0.14
Reach-1	33371	100 year	2351.70	47.87	58.66		58.70	0.00041	2.60	1724.29	338.29	0.15
Reach-1	32869	2 year	710.10	47.75	54.35		54.39	0.00084	2.61	696.80	274.20	0.20
Reach-1	32869	10 year	1459.70	47.75	55.54		55.61	0.00116	3.50	1040.20	297.44	0.24
Reach-1	32869	25 year	1986.00	47.75	57.25		57.29	0.00065	3.06	1568.38	322.96	0.19
Reach-1	32869	50 year	2458.30	47.75	57.76		57.81	0.00075	3.41	1734.37	328.90	0.20
Reach-1	32869	100 year	2986.30	47.75	58.26		58.33	0.00086	3.78	1901.12	338.97	0.22
Reach-1	32724	2 year	710.10	47.24	54.23		54.27	0.00074	2.50	732.71	287.14	0.18
Reach-1	32724	10 year	1459.70	47.24	55.38		55.44	0.00113	3.49	1083.56	326.96	0.23
Reach-1	32724	25 year	1986.00	47.24	57.16		57.20	0.00059	2.93	1726.40	399.98	0.17
Reach-1	32724	50 year	2458.30	47.24	57.66		57.71	0.00066	3.22	1938.68	467.45	0.19
Reach-1	32724	100 year	2986.30	47.24	58.15		58.21	0.00072	3.48	2177.48	488.60	0.20
Reach-1	32350	2 year	710.10	47.01	54.02		54.05	0.00050	2.13	935.72	410.91	0.16
Reach-1	32350	10 year	1459.70	47.01	55.05		55.10	0.00077	2.95	1382.21	455.69	0.20
Reach-1	32350	25 year	1986.00	47.01	57.01		57.03	0.00035	2.36	2432.21	612.56	0.14
Reach-1	32350	50 year	2458.30	47.01	57.49		57.52	0.00039	2.58	2732.38	630.93	0.15
Reach-1	32350	100 year	2986.30	47.01	57.97		58.00	0.00042	2.81	3037.26	649.05	0.16
Reach-1	31977	2 year	710.10	46.91	51.44	51.44	53.31	0.02110	10.99	65.15	18.03	1.00
Reach-1	31977	10 year	1459.70	46.91	54.28	53.35	54.49	0.00247	5.47	807.56	345.18	0.38
Reach-1	31977	25 year	1986.00	46.91	56.79	53.74	56.84	0.00055	3.20	1850.06	489.59	0.19
Reach-1	31977	50 year	2458.30	46.91	57.25	54.00	57.31	0.00062	3.51	2051.97	539.58	0.20
Reach-1	31977	100 year	2986.30	46.91	57.70	54.26	57.77	0.00069	3.83	2252.08	556.33	0.21
Reach-1	31511	2 year	710.10	43.55	51.32	48.47	51.40	0.00094	3.07	640.94	325.83	0.21
Reach-1	31511	10 year	1459.70	43.55	54.09	50.61	54.12	0.00031	2.22	1908.11	562.33	0.13
Reach-1	31511	25 year	1986.00	43.55	56.71	51.07	56.72	0.00012	1.64	3266.30	635.51	0.08
Reach-1	31511	50 year	2458.30	43.55	57.15	51.36	57.17	0.00015	1.88	3505.04	642.59	0.09
Reach-1	31511	100 year	2986.30	43.55	57.59	51.66	57.60	0.00018	2.12	3742.22	651.42	0.10
Reach-1	30960	2 year	710.10	43.11	50.53		50.70	0.00180	4.09	420.55	227.08	0.29
Reach-1	30960	10 year	1459.70	43.11	53.88		53.92	0.00041	2.61	1446.72	402.98	0.15
Reach-1	30960	25 year	1986.00	43.11	56.64		56.65	0.00013	1.74	2721.11	480.80	0.09
Reach-1	30960	50 year	2458.30	43.11	57.06		57.08	0.00016	1.98	2927.17	488.34	0.10
Reach-1	30960	100 year	2986.30	43.11	57.48		57.50	0.00020	2.22	3131.81	496.28	0.11
Reach-1	30467	2 year	710.10	42.80	50.05	47.78	50.12	0.00077	2.96	635.94	243.89	0.20
Reach-1	30467	10 year	1459.70	42.80	53.73	48.96	53.76	0.00027	2.35	1805.86	395.00	0.13
Reach-1	30467	25 year	1986.00	42.80	56.58	49.41	56.59	0.00011	1.82	2929.87	494.65	0.09
Reach-1	30467	50 year	2458.30	42.80	56.99	49.76	57.01	0.00015	2.11	3091.33	504.07	0.10
Reach-1	30467	100 year	2986.30	42.80	57.38	50.07	57.41	0.00019	2.42	3247.95	517.66	0.11
Reach-1	30096	2 year	710.10	42.60	49.92		49.94	0.00022	1.67	1266.26	472.32	0.11
Reach-1	30096	10 year	1459.70	42.60	53.70		53.71	0.00006	1.15	3606.33	681.21	0.06
Reach-1	30096	25 year	1986.00	42.60	56.57		56.57	0.00003	0.94	5602.85	700.00	0.05
Reach-1	30096	50 year	2458.30	42.60	56.97		56.98	0.00004	1.09	5886.91	700.00	0.05
Reach-1	30096	100 year	2986.30	42.60	57.37		57.37	0.00005	1.26	6162.22	700.00	0.06

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	29957	2 year	856.40	42.45	49.63	45.60	49.81	0.00123	3.40	259.57	62.51	0.26
Reach-1	29957	10 year	1749.60	42.45	53.41	47.52	53.62	0.00076	3.80	563.19	403.28	0.22
Reach-1	29957	25 year	2417.30	42.45	56.51	48.61	56.55	0.00015	2.04	2780.81	673.52	0.10
Reach-1	29957	50 year	3068.60	42.45	56.90	49.42	56.95	0.00020	2.40	3054.40	729.69	0.12
Reach-1	29957	100 year	3947.30	42.45	57.27	50.55	57.34	0.00027	2.84	3332.57	776.12	0.14
Reach-1	29893		Culvert									
Reach-1	29791	2 year	811.20	42.61	48.34	45.64	48.61	0.00258	4.19	194.39	50.39	0.36
Reach-1	29791	10 year	1658.70	42.61	50.02	47.44	50.58	0.00340	6.03	293.64	82.29	0.44
Reach-1	29791	25 year	2299.40	42.61	50.79	48.42	51.59	0.00421	7.28	395.00	191.08	0.50
Reach-1	29791	50 year	2935.60	42.61	51.08	49.26	52.23	0.00580	8.79	454.77	240.49	0.59
Reach-1	29791	100 year	3718.30	42.61	51.64	50.23	52.99	0.00648	9.78	615.83	312.20	0.63
Reach-1	29540	2 year	811.20	41.90	47.20	44.94	47.59	0.00395	5.01	161.87	160.39	0.43
Reach-1	29540	10 year	1658.70	41.90	48.52	46.77	48.89	0.00409	5.62	629.80	414.29	0.46
Reach-1	29540	25 year	2299.40	41.90	49.56	47.97	49.79	0.00244	4.95	1101.66	492.52	0.36
Reach-1	29540	50 year	2935.60	41.90	50.26	48.77	50.46	0.00206	4.91	1457.09	521.15	0.34
Reach-1	29540	100 year	3718.30	41.90	50.97	49.11	51.16	0.00185	4.99	1833.60	541.26	0.33
Reach-1	29096	2 year	811.20	40.50	46.70		46.71	0.00020	1.45	1318.58	375.34	0.11
Reach-1	29096	10 year	1658.70	40.50	48.23		48.26	0.00027	1.98	1914.12	401.36	0.13
Reach-1	29096	25 year	2299.40	40.50	49.34		49.37	0.00027	2.17	2368.93	420.14	0.14
Reach-1	29096	50 year	2935.60	40.50	50.03		50.07	0.00030	2.44	2664.26	431.90	0.15
Reach-1	29096	100 year	3718.30	40.50	50.73		50.77	0.00035	2.75	2969.77	443.74	0.16
Reach-1	28576	2 year	811.20	40.70	46.32		46.38	0.00158	3.32	739.22	409.02	0.27
Reach-1	28576	10 year	1658.70	40.70	47.89		47.94	0.00100	3.21	1423.46	459.28	0.23
Reach-1	28576	25 year	2299.40	40.70	49.07		49.10	0.00070	3.02	1984.38	495.70	0.20
Reach-1	28576	50 year	2935.60	40.70	49.75		49.79	0.00070	3.19	2331.16	516.94	0.20
Reach-1	28576	100 year	3718.30	40.70	50.43		50.48	0.00072	3.42	2690.45	538.06	0.20
Reach-1	28320	2 year	811.20	40.42	46.05		46.07	0.00055	1.86	944.45	454.77	0.16
Reach-1	28320	10 year	1658.70	40.42	47.73		47.75	0.00032	1.76	1768.24	510.13	0.13
Reach-1	28320	25 year	2299.40	40.42	48.96		48.98	0.00022	1.66	2405.81	531.79	0.11
Reach-1	28320	50 year	2935.60	40.42	49.64		49.66	0.00023	1.80	2775.97	548.71	0.11
Reach-1	28320	100 year	3718.30	40.42	50.32		50.35	0.00025	1.97	3153.33	566.23	0.12
Reach-1	28096	2 year	811.20	40.57	45.61		45.72	0.00328	4.27	573.20	402.49	0.38
Reach-1	28096	10 year	1658.70	40.57	47.55		47.59	0.00107	3.18	1430.62	475.50	0.23
Reach-1	28096	25 year	2299.40	40.57	48.84		48.87	0.00068	2.89	2066.45	512.54	0.19
Reach-1	28096	50 year	2935.60	40.57	49.52		49.56	0.00068	3.07	2424.59	532.27	0.19
Reach-1	28096	100 year	3718.30	40.57	50.20		50.24	0.00071	3.31	2789.04	551.62	0.20
Reach-1	27712	2 year	811.20	39.40	44.49		44.54	0.00118	3.00	693.05	335.29	0.25
Reach-1	27712	10 year	1658.70	39.40	47.33		47.35	0.00028	2.01	1958.95	609.06	0.13
Reach-1	27712	25 year	2299.40	39.40	48.70		48.72	0.00017	1.76	2832.85	665.97	0.11
Reach-1	27712	50 year	2935.60	39.40	49.39		49.40	0.00017	1.86	3299.05	694.42	0.11
Reach-1	27712	100 year	3718.30	39.40	50.05		50.07	0.00018	2.00	3771.03	722.08	0.11

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	27096	2 year	881.20	38.50	44.13		44.15	0.00039	1.92	1054.97	398.08	0.15
Reach-1	27096	10 year	1820.80	38.50	47.22		47.24	0.00013	1.55	2452.23	497.05	0.10
Reach-1	27096	25 year	2542.00	38.50	48.62		48.63	0.00012	1.62	3173.12	536.89	0.09
Reach-1	27096	50 year	3247.50	38.50	49.29		49.31	0.00014	1.82	3541.46	552.33	0.10
Reach-1	27096	100 year	4127.60	38.50	49.95		49.97	0.00016	2.07	3906.53	566.57	0.11
Reach-1	26596	2 year	881.20	38.20	43.93		43.96	0.00040	1.98	1015.63	371.94	0.15
Reach-1	26596	10 year	1820.80	38.20	47.15		47.16	0.00016	1.73	2426.61	505.66	0.11
Reach-1	26596	25 year	2542.00	38.20	48.55		48.57	0.00015	1.84	3171.67	552.27	0.10
Reach-1	26596	50 year	3247.50	38.20	49.21		49.23	0.00018	2.10	3544.00	569.40	0.11
Reach-1	26596	100 year	4127.60	38.20	49.85		49.88	0.00021	2.41	3911.26	585.80	0.13
Reach-1	26096	2 year	1222.60	37.70	43.69		43.73	0.00051	2.37	1341.70	426.28	0.18
Reach-1	26096	10 year	2600.50	37.70	47.03		47.06	0.00025	2.27	2868.68	550.86	0.13
Reach-1	26096	25 year	3679.80	37.70	48.44		48.47	0.00023	2.40	3896.10	864.65	0.13
Reach-1	26096	50 year	4715.70	37.70	49.09		49.12	0.00025	2.62	4463.03	877.53	0.14
Reach-1	26096	100 year	6030.40	37.70	49.71		49.75	0.00029	2.90	5007.81	889.73	0.15
Reach-1	25735	2 year	1222.60	37.20	43.42		43.50	0.00076	2.89	1030.92	410.26	0.21
Reach-1	25735	10 year	2600.50	37.20	46.92		46.96	0.00030	2.47	2554.84	461.79	0.14
Reach-1	25735	25 year	3679.80	37.20	48.34		48.38	0.00028	2.60	3576.72	1032.60	0.14
Reach-1	25735	50 year	4715.70	37.20	48.98		49.03	0.00029	2.78	4254.84	1067.79	0.14
Reach-1	25735	100 year	6030.40	37.20	49.59		49.64	0.00032	3.00	4913.86	1101.61	0.15
Reach-1	25660	2 year	1222.60	37.51	42.96	41.05	43.32	0.00292	5.20	399.38	198.97	0.40
Reach-1	25660	10 year	2600.50	37.51	46.84	43.20	46.92	0.00055	3.27	1805.70	652.95	0.19
Reach-1	25660	25 year	3679.80	37.51	48.30	44.08	48.35	0.00035	2.88	2970.85	934.91	0.16
Reach-1	25660	50 year	4715.70	37.51	48.95	45.20	49.00	0.00034	2.95	3510.64	954.35	0.15
Reach-1	25660	100 year	6030.40	37.51	49.56	45.67	49.61	0.00034	3.05	4409.39	972.66	0.16
Reach-1	25570		Culvert									
Reach-1	25462	2 year	1206.50	36.52	42.20	40.31	42.59	0.00312	5.37	350.56	176.35	0.42
Reach-1	25462	10 year	2571.30	36.52	44.11	42.61	44.50	0.00267	6.12	825.14	350.12	0.40
Reach-1	25462	25 year	3650.60	36.52	45.79	43.51	46.04	0.00154	5.35	1329.04	600.02	0.32
Reach-1	25462	50 year	4686.10	36.52	46.84	44.18	47.09	0.00136	5.43	1643.30	695.22	0.30
Reach-1	25462	100 year	5975.20	36.52	47.73	44.66	47.84	0.00075	4.27	3133.16	931.92	0.23
Reach-1	25096	2 year	1206.50	36.20	41.52		41.57	0.00061	2.38	1053.09	507.97	0.18
Reach-1	25096	10 year	2571.30	36.20	43.83		43.86	0.00031	2.17	2339.17	645.05	0.14
Reach-1	25096	25 year	3650.60	36.20	45.67		45.70	0.00018	1.92	3578.19	699.86	0.11
Reach-1	25096	50 year	4686.10	36.20	46.75		46.78	0.00017	1.97	4355.41	732.14	0.11
Reach-1	25096	100 year	5975.20	36.20	47.60		47.63	0.00018	2.16	4986.25	764.27	0.11
Reach-1	24596	2 year	1206.50	35.80	41.23		41.27	0.00056	2.31	1076.49	470.08	0.18
Reach-1	24596	10 year	2571.30	35.80	43.68		43.71	0.00028	2.11	2442.98	709.96	0.13
Reach-1	24596	25 year	3650.60	35.80	45.60		45.61	0.00014	1.70	3866.22	778.22	0.10
Reach-1	24596	50 year	4686.10	35.80	46.69		46.71	0.00012	1.72	4740.33	822.42	0.09
Reach-1	24596	100 year	5975.20	35.80	47.53		47.56	0.00013	1.86	5447.20	855.02	0.10
Reach-1	24096	2 year	1206.50	34.72	40.85		40.93	0.00079	2.90	703.52	355.26	0.21

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	24096	10 year	2571.30	34.72	43.53		43.57	0.00026	2.15	1822.93	508.21	0.13
Reach-1	24096	25 year	3650.60	34.72	45.51		45.54	0.00014	1.82	2952.89	665.89	0.10
Reach-1	24096	50 year	4686.10	34.72	46.61		46.65	0.00013	1.82	3740.54	761.50	0.09
Reach-1	24096	100 year	5975.20	34.72	47.45		47.49	0.00013	1.95	4409.24	833.73	0.10
Reach-1	23596	2 year	1252.90	33.57	40.45		40.55	0.00077	2.81	727.10	262.14	0.21
Reach-1	23596	10 year	2665.90	33.57	43.33		43.40	0.00042	2.77	1846.89	520.77	0.17
Reach-1	23596	25 year	3786.30	33.57	45.41		45.45	0.00021	2.30	3075.46	640.85	0.13
Reach-1	23596	50 year	4861.40	33.57	46.53		46.57	0.00019	2.30	3815.80	684.80	0.12
Reach-1	23596	100 year	6198.20	33.57	47.36		47.41	0.00020	2.48	4405.16	730.78	0.13
Reach-1	22990	2 year	1252.90	33.30	40.09		40.13	0.00040	2.09	929.80	328.18	0.16
Reach-1	22990	10 year	2665.90	33.30	43.20		43.23	0.00011	1.49	2444.16	610.93	0.09
Reach-1	22990	25 year	3786.30	33.30	45.34		45.37	0.00006	1.26	3901.85	776.07	0.07
Reach-1	22990	50 year	4861.40	33.30	46.47		46.50	0.00005	1.20	4799.29	821.46	0.06
Reach-1	22990	100 year	6198.20	33.30	47.29		47.33	0.00005	1.27	5495.61	865.31	0.06
Reach-1	22893	2 year	1252.90	32.81	39.96	35.84	40.07	0.00062	2.77	647.75	296.36	0.20
Reach-1	22893	10 year	2665.90	32.81	43.04	37.82	43.18	0.00054	3.39	1225.48	467.66	0.20
Reach-1	22893	25 year	3786.30	32.81	45.27	38.85	45.34	0.00028	2.82	3114.26	635.33	0.15
Reach-1	22893	50 year	4861.40	32.81	46.39	39.66	46.47	0.00029	3.06	3939.12	791.75	0.15
Reach-1	22893	100 year	6198.20	32.81	47.21	40.38	47.30	0.00033	3.40	4613.58	851.12	0.16
Reach-1	22812		Culvert									
Reach-1	22704	2 year	1252.60	33.39	39.40	36.51	39.54	0.00109	3.25	607.81	275.87	0.25
Reach-1	22704	10 year	2670.20	33.39	41.55	38.41	41.73	0.00106	4.05	1143.88	371.32	0.27
Reach-1	22704	25 year	3794.40	33.39	43.11	39.25	43.28	0.00086	4.16	1978.97	478.82	0.25
Reach-1	22704	50 year	4873.30	33.39	44.34	39.87	44.50	0.00074	4.21	2604.27	532.83	0.23
Reach-1	22704	100 year	6208.40	33.39	45.68	40.46	45.85	0.00069	4.42	3425.58	732.90	0.23
Reach-1	22383	2 year	1252.60	32.90	39.18		39.24	0.00063	2.43	1024.40	375.78	0.19
Reach-1	22383	10 year	2670.20	32.90	41.36		41.43	0.00057	2.95	1883.82	413.30	0.19
Reach-1	22383	25 year	3794.40	32.90	42.95		43.03	0.00049	3.14	2565.60	447.14	0.19
Reach-1	22383	50 year	4873.30	32.90	44.19		44.28	0.00047	3.34	3134.28	469.18	0.19
Reach-1	22383	100 year	6208.40	32.90	45.54		45.64	0.00045	3.56	3782.74	493.12	0.19
Reach-1	22096	2 year	1252.60	32.71	38.89		39.00	0.00111	3.08	911.77	608.29	0.25
Reach-1	22096	10 year	2670.20	32.71	41.21		41.27	0.00052	2.75	2533.59	780.81	0.18
Reach-1	22096	25 year	3794.40	32.71	42.86		42.90	0.00034	2.56	3867.92	840.39	0.15
Reach-1	22096	50 year	4873.30	32.71	44.12		44.16	0.00028	2.55	4956.16	879.51	0.14
Reach-1	22096	100 year	6208.40	32.71	45.49		45.52	0.00024	2.58	6179.65	913.72	0.14
Reach-1	21638	2 year	1271.10	32.63	38.64	36.03	38.67	0.00044	1.99	1316.86	611.54	0.16
Reach-1	21638	10 year	2707.80	32.63	41.04	36.78	41.08	0.00032	2.23	2668.52	655.34	0.15
Reach-1	21638	25 year	3849.40	32.63	42.73	37.24	42.76	0.00027	2.32	3633.02	730.37	0.14
Reach-1	21638	50 year	4944.40	32.63	44.00	37.61	44.04	0.00025	2.47	4374.55	847.47	0.14
Reach-1	21638	100 year	6295.30	32.63	45.37	38.04	45.41	0.00024	2.64	5185.77	932.05	0.14
Reach-1	21373	2 year	1266.90	32.80	38.39	36.31	38.48	0.00104	2.89	757.43	393.04	0.24
Reach-1	21373	10 year	2687.50	32.80	40.85	37.26	40.94	0.00072	3.21	1660.83	718.15	0.22

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Reach-1	21373	25 year	3811.40	32.80	42.56	37.81	42.65	0.00055	3.26	2346.13	810.60	0.20
Reach-1	21373	50 year	4910.20	32.80	43.84	38.29	43.93	0.00051	3.45	2855.93	985.35	0.19
Reach-1	21373	100 year	6236.40	32.80	45.20	38.80	45.31	0.00049	3.67	3402.16	1040.84	0.19
Reach-1	21303		Bridge									
Reach-1	21198	2 year	1266.20	32.74	37.10	36.25	37.35	0.00379	4.57	470.23	345.24	0.44
Reach-1	21198	10 year	2685.00	32.74	39.26	37.19	39.48	0.00216	4.70	1049.39	594.14	0.36
Reach-1	21198	25 year	3807.80	32.74	41.06	37.75	41.22	0.00122	4.28	1769.16	738.52	0.28
Reach-1	21198	50 year	4905.70	32.74	42.01	38.22	42.19	0.00118	4.58	2149.27	786.65	0.28
Reach-1	21198	100 year	6229.40	32.74	42.85	38.74	43.06	0.00125	5.04	2484.84	876.56	0.30
Reach-1	20751	2 year	1266.20	30.58	36.04		36.22	0.00174	3.68	506.43	161.03	0.31
Reach-1	20751	10 year	2685.00	30.58	38.59		38.77	0.00120	4.13	1193.57	305.30	0.28
Reach-1	20751	25 year	3807.80	30.58	40.60		40.77	0.00087	4.17	1925.77	420.57	0.25
Reach-1	20751	50 year	4905.70	30.58	41.53		41.73	0.00091	4.57	2333.69	454.43	0.26
Reach-1	20751	100 year	6229.40	30.58	42.32		42.56	0.00102	5.08	2704.81	483.20	0.28
Reach-1	20596	2 year	1266.20	29.93	35.82		35.97	0.00135	3.43	552.81	184.13	0.28
Reach-1	20596	10 year	2685.00	29.93	38.43		38.60	0.00100	3.95	1320.03	362.31	0.26
Reach-1	20596	25 year	3807.80	29.93	40.51		40.64	0.00065	3.77	2206.93	480.01	0.22
Reach-1	20596	50 year	4905.70	29.93	41.44		41.59	0.00067	4.07	2672.19	509.62	0.22
Reach-1	20596	100 year	6229.40	29.93	42.23		42.40	0.00075	4.51	3078.70	524.99	0.24
Reach-1	20096	2 year	1288.70	28.00	35.52		35.57	0.00033	2.06	1337.17	475.58	0.14
Reach-1	20096	10 year	2731.90	28.00	38.26		38.30	0.00023	2.19	2721.63	530.59	0.13
Reach-1	20096	25 year	3873.50	28.00	40.41		40.44	0.00016	2.12	3898.38	561.25	0.11
Reach-1	20096	50 year	4988.60	28.00	41.34		41.38	0.00019	2.38	4425.59	575.48	0.12
Reach-1	20096	100 year	6329.40	28.00	42.11		42.16	0.00022	2.73	4871.57	587.26	0.13
Reach-1	19506	2 year	1288.70	27.60	35.17	31.29	35.29	0.00070	2.96	633.74	166.26	0.21
Reach-1	19506	10 year	2731.90	27.60	37.87	33.13	38.06	0.00076	3.92	1151.98	219.47	0.23
Reach-1	19506	25 year	3873.50	27.60	40.06	34.02	40.26	0.00064	4.19	1703.35	303.87	0.22
Reach-1	19506	50 year	4988.60	27.60	40.81	34.77	41.14	0.00095	5.32	1997.15	478.40	0.27
Reach-1	19506	100 year	6329.40	27.60	41.44	35.57	41.87	0.00119	6.15	2310.98	552.84	0.31
Reach-1	19396	2 year	1288.70	27.56	34.85	31.71	35.13	0.00180	4.21	329.10	84.36	0.32
Reach-1	19396	10 year	2731.90	27.56	37.33	33.66	37.83	0.00220	5.81	540.41	214.14	0.37
Reach-1	19396	25 year	3873.50	27.56	39.51	34.90	40.05	0.00176	6.15	767.12	357.07	0.35
Reach-1	19396	50 year	4988.60	27.56	40.51	35.86	40.97	0.00154	6.14	1649.71	545.08	0.33
Reach-1	19396	100 year	6329.40	27.56	41.04	36.92	41.65	0.00195	7.15	1960.16	610.13	0.38
Reach-1	19365		Culvert									
Reach-1	19096	2 year	1292.60	27.02	34.42	30.72	34.60	0.00103	3.52	419.87	105.13	0.25
Reach-1	19096	10 year	2739.90	27.02	36.00	32.51	36.45	0.00190	5.60	607.98	132.75	0.36
Reach-1	19096	25 year	3884.60	27.02	36.68	33.66	37.38	0.00272	7.09	703.09	148.33	0.43
Reach-1	19096	50 year	5002.60	27.02	37.34	34.70	38.25	0.00327	8.18	808.96	175.76	0.48
Reach-1	19096	100 year	6346.70	27.02	38.12	35.79	39.20	0.00359	9.07	961.67	211.92	0.51
Reach-1	18614	2 year	1292.60	25.92	33.62		33.70	0.00115	3.33	1238.11	722.08	0.24

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Reach-1	18614	10 year	2739.90	25.92	35.23		35.28	0.00080	3.23	2441.39	757.25	0.20
Reach-1	18614	25 year	3884.60	25.92	35.85		35.92	0.00094	3.69	2913.83	765.16	0.22
Reach-1	18614	50 year	5002.60	25.92	36.60		36.66	0.00089	3.81	3488.24	775.07	0.22
Reach-1	18614	100 year	6346.70	25.92	37.66		37.72	0.00077	3.80	4335.34	878.90	0.21
Reach-1	18538	2 year	1292.60	25.74	33.39	28.97	33.58	0.00087	3.62	389.98	486.82	0.24
Reach-1	18538	10 year	2739.90	25.74	35.21	30.77	35.24	0.00023	2.16	2549.98	795.47	0.13
Reach-1	18538	25 year	3884.60	25.74	35.82	31.93	35.86	0.00028	2.50	3075.46	902.31	0.14
Reach-1	18538	50 year	5002.60	25.74	36.57	32.96	36.61	0.00026	2.52	3784.82	980.57	0.14
Reach-1	18538	100 year	6346.70	25.74	37.64	33.90	37.67	0.00019	2.30	4862.00	1021.73	0.12
Reach-1	18506		Culvert									
Reach-1	18283	2 year	1292.60	26.30	32.40	32.40	33.20	0.01018	8.24	313.44	358.58	0.71
Reach-1	18283	10 year	2739.90	26.30	34.14	33.27	34.28	0.00202	4.51	1196.50	561.22	0.33
Reach-1	18283	25 year	3884.60	26.30	35.38	33.44	35.47	0.00109	3.77	2015.58	809.71	0.25
Reach-1	18283	50 year	5002.60	26.30	36.44	33.72	36.51	0.00061	3.11	2970.46	958.75	0.19
Reach-1	18283	100 year	6346.70	26.30	37.58	34.03	37.64	0.00036	2.60	4098.53	1012.03	0.15
Reach-1	18096	2 year	1292.60	24.99	31.95	28.24	32.06	0.00075	2.85	589.22	211.05	0.21
Reach-1	18096	10 year	2739.90	24.99	33.87	29.97	34.04	0.00085	3.70	1040.56	415.04	0.24
Reach-1	18096	25 year	3884.60	24.99	35.13	31.14	35.29	0.00073	3.80	1551.63	928.60	0.23
Reach-1	18096	50 year	5002.60	24.99	36.26	32.08	36.39	0.00055	3.57	2118.56	1120.20	0.20
Reach-1	18096	100 year	6346.70	24.99	37.44	32.71	37.55	0.00043	3.41	2706.20	1255.59	0.18
Reach-1	17596	2 year	1357.10	25.12	31.63		31.68	0.00072	2.75	1187.83	413.12	0.21
Reach-1	17596	10 year	2855.80	25.12	33.62		33.67	0.00056	2.98	2117.82	556.33	0.19
Reach-1	17596	25 year	4035.50	25.12	34.94		34.98	0.00043	2.92	2906.23	648.26	0.17
Reach-1	17596	50 year	5180.40	25.12	36.11		36.15	0.00035	2.84	3855.75	922.48	0.16
Reach-1	17596	100 year	6549.50	25.12	37.33		37.37	0.00025	2.59	5033.62	1004.12	0.14
Reach-1	16932	2 year	1357.10	25.30	31.27		31.28	0.00041	1.93	1789.95	662.51	0.15
Reach-1	16932	10 year	2855.80	25.30	33.36		33.37	0.00025	1.93	3393.45	825.11	0.13
Reach-1	16932	25 year	4035.50	25.30	34.74		34.76	0.00020	1.92	4630.07	987.85	0.12
Reach-1	16932	50 year	5180.40	25.30	35.96		35.98	0.00016	1.87	5956.34	1189.87	0.11
Reach-1	16932	100 year	6549.50	25.30	37.22		37.24	0.00012	1.77	7504.74	1249.88	0.09
Reach-1	16457	2 year	1357.10	23.40	30.90		30.98	0.00092	3.37	1217.06	526.79	0.22
Reach-1	16457	10 year	2855.80	23.40	33.12		33.17	0.00064	3.39	2617.51	697.15	0.20
Reach-1	16457	25 year	4035.50	23.40	34.55		34.60	0.00052	3.36	3667.52	768.86	0.18
Reach-1	16457	50 year	5180.40	23.40	35.80		35.84	0.00043	3.28	4666.46	824.46	0.17
Reach-1	16457	100 year	6549.50	23.40	37.09		37.13	0.00037	3.26	5762.20	881.41	0.16
Reach-1	16096	2 year	1357.10	23.89	30.61		30.66	0.00081	3.00	1324.91	509.72	0.22
Reach-1	16096	10 year	2855.80	23.89	32.91		32.95	0.00057	3.15	2664.56	646.57	0.20
Reach-1	16096	25 year	4035.50	23.89	34.38		34.42	0.00047	3.19	3642.53	686.05	0.18
Reach-1	16096	50 year	5180.40	23.89	35.66		35.70	0.00040	3.22	4545.98	732.95	0.17
Reach-1	16096	100 year	6549.50	23.89	36.96		37.00	0.00036	3.28	5575.52	854.22	0.17
Reach-1	15393	2 year	1357.10	21.18	30.25	27.55	30.28	0.00038	2.21	1519.21	668.58	0.14
Reach-1	15393	10 year	2855.80	21.18	32.69	29.15	32.71	0.00016	1.75	3201.03	881.06	0.10

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Reach-1	15393	25 year	4035.50	21.18	34.21	29.61	34.22	0.00012	1.67	4259.57	931.38	0.09
Reach-1	15393	50 year	5180.40	21.18	35.51	29.87	35.53	0.00010	1.66	5173.76	991.92	0.08
Reach-1	15393	100 year	6549.50	21.18	36.83	30.13	36.85	0.00010	1.69	6096.53	1053.02	0.08
Reach-1	15308	2 year	1357.10	19.00	30.13	23.59	30.22	0.00041	2.76	823.05	684.42	0.16
Reach-1	15308	10 year	2855.80	19.00	32.66	25.96	32.69	0.00020	2.24	3575.11	815.43	0.11
Reach-1	15308	25 year	4035.50	19.00	34.18	28.08	34.21	0.00016	2.22	4828.92	832.36	0.11
Reach-1	15308	50 year	5180.40	19.00	35.49	29.00	35.51	0.00015	2.23	5935.51	857.01	0.10
Reach-1	15308	100 year	6549.50	19.00	36.81	29.87	36.84	0.00014	2.28	7084.64	882.81	0.10
Reach-1	15236		Culvert									
Reach-1	15023	2 year	1362.70	21.14	29.70	25.82	30.03	0.00188	4.85	389.21	677.84	0.32
Reach-1	15023	10 year	2871.70	21.14	32.56	29.04	32.60	0.00035	2.64	3204.11	814.88	0.15
Reach-1	15023	25 year	4058.50	21.14	34.15	30.50	34.19	0.00027	2.52	4521.65	832.67	0.13
Reach-1	15023	50 year	5209.60	21.14	35.47	30.50	35.50	0.00023	2.53	5632.42	857.63	0.12
Reach-1	15023	100 year	6585.50	21.14	36.79	30.66	36.82	0.00021	2.60	6781.96	883.42	0.12
Reach-1	14968	2 year	1329.60	20.40	29.77	26.35	29.83	0.00070	2.67	988.83	439.45	0.19
Reach-1	14968	10 year	2758.80	20.40	32.50	27.42	32.56	0.00052	2.95	1973.73	637.43	0.18
Reach-1	14968	25 year	3877.80	20.40	34.09	27.98	34.15	0.00048	3.16	2550.53	675.23	0.17
Reach-1	14968	50 year	4910.00	20.40	35.40	28.55	35.47	0.00045	3.33	3026.00	683.59	0.17
Reach-1	14968	100 year	6099.10	20.40	36.71	29.19	36.79	0.00044	3.52	3503.15	705.60	0.17
Reach-1	14903		Bridge									
Reach-1	14807	2 year	1329.40	21.04	28.59	25.32	28.73	0.00090	3.49	588.81	257.93	0.24
Reach-1	14807	10 year	2758.10	21.04	30.99	26.80	31.22	0.00104	4.62	1102.99	577.85	0.27
Reach-1	14807	25 year	3876.10	21.04	31.95	27.65	32.26	0.00130	5.53	1331.50	619.24	0.31
Reach-1	14807	50 year	4907.60	21.04	32.64	28.33	33.03	0.00155	6.31	1496.14	640.74	0.34
Reach-1	14807	100 year	6095.80	21.04	33.38	29.26	33.86	0.00178	7.06	1673.09	654.35	0.37
Reach-1	14671	2 year	1329.40	20.76	28.39	24.79	28.58	0.00108	3.85	495.20	204.85	0.26
Reach-1	14671	10 year	2758.10	20.76	30.82	26.84	31.07	0.00108	4.74	997.32	413.88	0.28
Reach-1	14671	25 year	3876.10	20.76	31.82	27.81	32.07	0.00108	5.08	1314.68	514.66	0.28
Reach-1	14671	50 year	4907.60	20.76	32.53	28.73	32.79	0.00110	5.35	1541.56	587.39	0.29
Reach-1	14671	100 year	6095.80	20.76	33.29	30.02	33.57	0.00108	5.56	1787.66	677.46	0.29
Reach-1	14470	2 year	1329.40	20.60	27.97	24.72	28.27	0.00197	4.67	423.45	147.90	0.32
Reach-1	14470	10 year	2758.10	20.60	30.45	27.19	30.78	0.00176	5.47	984.93	353.57	0.32
Reach-1	14470	25 year	3876.10	20.60	31.52	28.46	31.81	0.00159	5.60	1427.41	473.55	0.31
Reach-1	14470	50 year	4907.60	20.60	32.30	29.73	32.55	0.00143	5.59	1829.11	560.66	0.30
Reach-1	14470	100 year	6095.80	20.60	33.11	30.65	33.33	0.00123	5.42	2325.13	653.44	0.28
Reach-1	14329		Bridge									
Reach-1	14157	2 year	1329.40	20.50	26.78	25.29	27.16	0.00348	5.56	396.80	515.70	0.42
Reach-1	14157	10 year	2758.10	20.50	30.42	26.88	30.44	0.00020	1.89	3101.19	675.19	0.11
Reach-1	14157	25 year	3876.10	20.50	31.52	27.70	31.54	0.00020	2.04	3862.81	718.47	0.11
Reach-1	14157	50 year	4907.60	20.50	32.26	27.70	32.29	0.00022	2.21	4411.21	748.08	0.12
Reach-1	14157	100 year	6095.80	20.50	33.05	27.70	33.08	0.00023	2.36	5009.23	779.09	0.12

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Reach-1	13604	2 year	1330.50	18.99	26.40		26.45	0.00046	2.26	1052.40	458.45	0.15
Reach-1	13604	10 year	2759.30	18.99	30.36		30.37	0.00008	1.30	3122.32	571.35	0.07
Reach-1	13604	25 year	3876.90	18.99	31.44		31.46	0.00009	1.47	3755.64	594.09	0.08
Reach-1	13604	50 year	4907.70	18.99	32.18		32.21	0.00010	1.64	4200.49	609.56	0.08
Reach-1	13604	100 year	6094.90	18.99	32.96		32.99	0.00012	1.82	4679.66	632.57	0.09
Reach-1	13066	2 year	1330.50	18.12	25.85		25.94	0.00105	3.31	944.28	358.02	0.23
Reach-1	13066	10 year	2759.30	18.12	30.23		30.26	0.00024	2.24	2625.73	405.47	0.12
Reach-1	13066	25 year	3876.90	18.12	31.30		31.34	0.00030	2.64	3062.84	416.07	0.13
Reach-1	13066	50 year	4907.70	18.12	32.01		32.06	0.00036	3.02	3362.53	426.61	0.15
Reach-1	13066	100 year	6094.90	18.12	32.76		32.83	0.00043	3.42	3687.38	442.63	0.16
Reach-1	12805	2 year	1332.10	17.20	25.65		25.72	0.00066	2.90	1015.05	272.88	0.19
Reach-1	12805	10 year	2763.20	17.20	30.15		30.19	0.00028	2.62	2362.84	325.80	0.13
Reach-1	12805	25 year	3882.50	17.20	31.18		31.25	0.00039	3.22	2705.63	337.75	0.16
Reach-1	12805	50 year	4914.60	17.20	31.86		31.95	0.00049	3.76	2938.02	345.61	0.18
Reach-1	12805	100 year	6103.40	17.20	32.57		32.69	0.00061	4.33	3187.20	356.15	0.20
Reach-1	12393	2 year	1335.60	16.66	25.53	19.97	25.55	0.00015	1.55	1893.73	303.76	0.09
Reach-1	12393	10 year	2769.40	16.66	30.09	20.89	30.11	0.00010	1.72	3575.34	442.80	0.08
Reach-1	12393	25 year	3890.80	16.66	31.11	21.37	31.13	0.00014	2.15	4059.69	538.17	0.10
Reach-1	12393	50 year	4924.80	16.66	31.77	21.75	31.80	0.00018	2.49	4430.00	565.80	0.11
Reach-1	12393	100 year	6118.80	16.66	32.47	22.16	32.50	0.00022	2.82	4827.37	580.37	0.13
Reach-1	11890	2 year	1335.60	15.80	24.47	20.92	24.94	0.00228	5.84	318.87	156.13	0.36
Reach-1	11890	10 year	2769.40	15.80	29.81	23.59	29.90	0.00045	3.61	1878.83	436.43	0.17
Reach-1	11890	25 year	3890.80	15.80	30.81	25.12	30.92	0.00052	4.08	2324.30	455.81	0.19
Reach-1	11890	50 year	4924.80	15.80	31.41	26.46	31.55	0.00063	4.63	2608.83	482.20	0.21
Reach-1	11890	100 year	6118.80	15.80	32.06	27.57	32.22	0.00074	5.14	2927.47	509.55	0.23
Reach-1	11822	2 year	1335.60	14.88	24.49	19.17	24.74	0.00095	4.12	367.22	62.28	0.24
Reach-1	11822	10 year	2769.40	14.88	29.42	21.42	29.78	0.00083	5.14	851.25	288.90	0.24
Reach-1	11822	25 year	3890.80	14.88	30.34	22.90	30.77	0.00102	5.94	1281.31	363.87	0.27
Reach-1	11822	50 year	4924.80	14.88	30.82	24.05	31.37	0.00130	6.87	1465.61	397.60	0.31
Reach-1	11822	100 year	6118.80	14.88	31.38	25.26	32.01	0.00152	7.62	1694.62	421.54	0.34
Reach-1	11812		Culvert									
Reach-1	11750	2 year	1335.60	15.50	23.41	19.53	23.79	0.00175	5.09	313.04	56.16	0.32
Reach-1	11750	10 year	2769.40	15.50	26.90	21.80	27.56	0.00192	6.85	516.92	89.69	0.36
Reach-1	11750	25 year	3890.80	15.50	28.18	23.44	29.18	0.00257	8.52	687.15	152.06	0.43
Reach-1	11750	50 year	4924.80	15.50	28.77	24.59	30.18	0.00344	10.16	812.18	241.43	0.50
Reach-1	11750	100 year	6118.80	15.50	29.24	25.91	31.06	0.00440	11.77	935.38	279.79	0.57
Reach-1	11500	2 year	1335.60	14.51	22.83		23.28	0.00219	5.80	344.82	81.45	0.36
Reach-1	11500	10 year	2769.40	14.51	26.41		27.05	0.00216	7.34	739.89	180.70	0.38
Reach-1	11500	25 year	3890.80	14.51	27.66		28.43	0.00249	8.44	1036.91	296.96	0.41
Reach-1	11500	50 year	4924.80	14.51	28.19		29.14	0.00307	9.62	1227.77	454.49	0.46
Reach-1	11500	100 year	6118.80	14.51	28.65		29.70	0.00353	10.56	1457.32	517.58	0.50

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Reach-1	11048	2 year	1335.60	13.72	22.06	17.83	22.32	0.00149	4.20	401.80	226.49	0.28
Reach-1	11048	10 year	2769.40	13.72	26.37	20.14	26.40	0.00014	1.75	2453.14	618.48	0.09
Reach-1	11048	25 year	3890.80	13.72	27.67	22.91	27.70	0.00012	1.74	3342.66	726.66	0.09
Reach-1	11048	50 year	4924.80	13.72	28.20	23.49	28.24	0.00014	1.95	3734.97	737.52	0.09
Reach-1	11048	100 year	6118.80	13.72	28.64	23.82	28.69	0.00017	2.20	4061.28	746.44	0.11
Reach-1	10970		Bridge									
Reach-1	10936	2 year	1335.60	12.45	21.45	16.84	21.72	0.00121	4.32	357.62	142.43	0.27
Reach-1	10936	10 year	2769.40	12.45	26.34	19.14	26.37	0.00012	1.87	2388.55	652.50	0.09
Reach-1	10936	25 year	3890.80	12.45	27.64	21.26	27.67	0.00010	1.81	3254.34	676.68	0.08
Reach-1	10936	50 year	4924.80	12.45	28.18	22.31	28.21	0.00014	2.21	3651.33	829.54	0.10
Reach-1	10936	100 year	6118.80	12.45	28.61	23.23	28.65	0.00018	2.51	4032.03	923.56	0.11
Reach-1	10885		Culvert									
Reach-1	10806	2 year	1335.60	12.36	20.85	17.13	21.34	0.00231	5.64	242.85	78.71	0.36
Reach-1	10806	10 year	2769.40	12.36	23.75	19.60	24.83	0.00332	8.39	340.36	348.25	0.46
Reach-1	10806	25 year	3890.80	12.36	25.72	21.16	25.83	0.00049	3.60	1763.90	555.33	0.18
Reach-1	10806	50 year	4924.80	12.36	26.47	22.47	26.58	0.00044	3.54	2188.81	567.47	0.17
Reach-1	10806	100 year	6118.80	12.36	27.14	23.86	27.24	0.00043	3.62	2568.61	578.11	0.17
Reach-1	10529	2 year	1340.40	10.94	20.77	16.71	20.85	0.00058	2.58	588.98	460.63	0.17
Reach-1	10529	10 year	2777.50	10.94	24.25	19.34	24.28	0.00003	0.78	2337.58	578.76	0.04
Reach-1	10529	25 year	3902.60	10.94	25.74	20.86	25.77	0.00002	0.75	3183.67	591.25	0.04
Reach-1	10529	50 year	4939.60	10.94	26.49	21.05	26.52	0.00003	0.81	3614.12	597.54	0.04
Reach-1	10529	100 year	6137.40	10.94	27.15	21.26	27.19	0.00003	0.89	3995.09	603.07	0.04
Reach-1	10000	2 year	1340.40	10.11	19.67	14.72	19.85	0.00098	3.60	602.73	284.92	0.23
Reach-1	10000	10 year	2777.50	10.11	24.16	16.96	24.19	0.00016	1.97	3068.22	906.05	0.10
Reach-1	10000	25 year	3902.60	10.11	25.67	19.53	25.70	0.00013	1.95	4736.75	1135.98	0.09
Reach-1	10000	50 year	4939.60	10.11	26.41	20.38	26.44	0.00014	2.07	5588.92	1164.19	0.10
Reach-1	10000	100 year	6137.40	10.11	27.06	21.29	27.10	0.00016	2.25	6351.75	1188.87	0.10
Reach-1	9856	2 year	1340.40	11.57	19.51	14.81	19.71	0.00103	3.56	394.89	92.12	0.24
Reach-1	9856	10 year	2777.50	11.57	23.90	16.71	24.10	0.00062	3.81	846.56	791.59	0.20
Reach-1	9856	25 year	3902.60	11.57	25.64	17.96	25.67	0.00017	2.17	4175.58	839.72	0.11
Reach-1	9856	50 year	4939.60	11.57	26.37	19.05	26.42	0.00018	2.37	4800.49	856.53	0.11
Reach-1	9856	100 year	6137.40	11.57	27.02	20.57	27.07	0.00021	2.62	5355.74	871.19	0.12
Reach-1	9813		Culvert									
Reach-1	9732	2 year	1347.20	11.51	18.51	14.72	18.79	0.00155	4.24	323.84	59.95	0.29
Reach-1	9732	10 year	2779.10	11.51	20.68	16.58	21.33	0.00251	6.51	443.03	258.71	0.39
Reach-1	9732	25 year	3901.70	11.51	21.89	17.81	22.54	0.00240	6.93	693.18	655.22	0.39
Reach-1	9732	50 year	4936.20	11.51	23.49	18.89	23.60	0.00060	3.66	2327.19	788.01	0.19
Reach-1	9732	100 year	6130.50	11.51	25.35	21.23	25.40	0.00023	2.52	3837.89	835.61	0.12
Reach-1	9375	2 year	1347.20	10.04	18.01		18.25	0.00137	3.98	368.91	98.11	0.28
Reach-1	9375	10 year	2779.10	10.04	20.27		20.53	0.00123	4.62	887.22	358.97	0.28
Reach-1	9375	25 year	3901.70	10.04	21.65		21.83	0.00083	4.20	1445.49	454.81	0.23

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	9375	50 year	4936.20	10.04	23.30		23.41	0.00048	3.52	2361.19	647.85	0.18
Reach-1	9375	100 year	6130.50	10.04	25.25		25.31	0.00024	2.74	3775.48	814.37	0.13
Reach-1	9101	2 year	1347.20	10.36	17.48	14.05	17.78	0.00194	4.54	341.80	119.93	0.32
Reach-1	9101	10 year	2779.10	10.36	19.77	16.10	20.11	0.00175	5.32	1038.85	531.01	0.32
Reach-1	9101	25 year	3901.70	10.36	21.43	17.93	21.59	0.00089	4.28	1994.30	599.06	0.24
Reach-1	9101	50 year	4936.20	10.36	23.19	19.74	23.27	0.00045	3.39	3100.10	739.49	0.17
Reach-1	9101	100 year	6130.50	10.36	25.19	20.11	25.24	0.00024	2.75	4685.41	849.01	0.13
Reach-1	9081		Bridge									
Reach-1	9000	2 year	1347.20	9.13	16.79	13.13	17.04	0.00156	4.11	390.26	119.48	0.30
Reach-1	9000	10 year	2779.10	9.13	19.68	15.20	20.02	0.00141	5.08	817.93	211.77	0.30
Reach-1	9000	25 year	3901.70	9.13	21.21	16.68	21.57	0.00129	5.40	1191.30	265.90	0.29
Reach-1	9000	50 year	4936.20	9.13	22.72	17.58	23.02	0.00101	5.23	1626.09	310.32	0.27
Reach-1	9000	100 year	6130.50	9.13	24.88	18.39	25.09	0.00066	4.73	2517.09	594.69	0.22
Reach-1	8500	2 year	1347.20	7.91	16.15		16.36	0.00113	3.72	414.76	83.59	0.25
Reach-1	8500	10 year	2779.10	7.91	19.00		19.35	0.00128	5.03	782.52	165.69	0.29
Reach-1	8500	25 year	3901.70	7.91	20.43		20.87	0.00141	5.79	1030.24	181.27	0.31
Reach-1	8500	50 year	4936.20	7.91	21.94		22.41	0.00131	6.08	1329.53	217.15	0.30
Reach-1	8500	100 year	6130.50	7.91	24.31		24.67	0.00089	5.63	2044.63	425.20	0.26
Reach-1	8229	2 year	1383.10	7.95	14.78	13.00	15.56	0.00667	7.11	194.43	39.34	0.56
Reach-1	8229	10 year	2851.50	7.95	17.20	15.35	18.40	0.00724	9.05	448.71	262.85	0.61
Reach-1	8229	25 year	4007.30	7.95	19.72	17.79	20.28	0.00298	7.01	1063.01	316.78	0.41
Reach-1	8229	50 year	5071.90	7.95	21.52	18.52	21.93	0.00193	6.36	1544.92	338.55	0.34
Reach-1	8229	100 year	6303.50	7.95	24.20	19.15	24.34	0.00065	4.28	2851.83	480.87	0.20
Reach-1	8118		Culvert									
Reach-1	8019	2 year	1383.10	5.86	15.15	10.22	15.47	0.00171	4.49	307.95	45.13	0.29
Reach-1	8019	10 year	2851.50	5.86	17.40	12.68	18.15	0.00319	6.98	430.47	93.00	0.40
Reach-1	8019	25 year	4007.30	5.86	18.77	14.23	19.84	0.00399	8.42	513.48	109.64	0.46
Reach-1	8019	50 year	5071.90	5.86	19.86	15.50	21.23	0.00449	9.54	583.67	146.22	0.50
Reach-1	8019	100 year	6303.50	5.86	22.36	17.04	22.89	0.00175	6.79	1353.50	287.27	0.32
Reach-1	7885	2 year	1383.10	5.67	15.05	9.69	15.24	0.00091	3.49	411.53	72.93	0.22
Reach-1	7885	10 year	2851.50	5.67	17.27	11.73	17.70	0.00156	5.38	633.49	124.19	0.30
Reach-1	7885	25 year	4007.30	5.67	18.66	13.05	19.25	0.00183	6.38	823.80	146.28	0.34
Reach-1	7885	50 year	5071.90	5.67	19.82	14.13	20.52	0.00197	7.07	999.91	159.46	0.35
Reach-1	7885	100 year	6303.50	5.67	22.02	15.36	22.65	0.00153	6.94	1380.43	188.20	0.32
Reach-1	7471	2 year	1381.70	5.10	14.77	9.18	14.90	0.00067	3.22	651.45	316.43	0.19
Reach-1	7471	10 year	2848.40	5.10	16.84	12.05	17.11	0.00112	4.81	948.96	337.18	0.26
Reach-1	7471	25 year	4003.10	5.10	18.17	13.30	18.54	0.00134	5.70	1146.09	354.42	0.29
Reach-1	7471	50 year	5066.60	5.10	19.28	14.14	19.73	0.00149	6.36	1315.73	364.49	0.31
Reach-1	7471	100 year	6296.80	5.10	21.87	15.00	22.10	0.00074	5.05	2346.35	387.86	0.22
Reach-1	7000	2 year	1381.70	4.42	14.26	10.04	14.45	0.00128	4.06	667.16	253.04	0.26
Reach-1	7000	10 year	2848.40	4.42	16.29	13.58	16.54	0.00147	5.10	1253.74	313.08	0.29

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7000	25 year	4003.10	4.42	17.65	14.41	17.93	0.00151	5.64	1742.59	410.82	0.30
Reach-1	7000	50 year	5066.60	4.42	18.89	15.12	19.13	0.00129	5.60	2272.86	444.60	0.28
Reach-1	7000	100 year	6296.80	4.42	21.66	15.69	21.79	0.00062	4.45	3580.37	499.64	0.20
Reach-1	6500	2 year	1396.60	3.91	13.43	9.56	13.66	0.00157	4.38	644.50	434.36	0.28
Reach-1	6500	10 year	2878.80	3.91	15.64	13.18	15.80	0.00112	4.41	1612.51	486.02	0.25
Reach-1	6500	25 year	4046.30	3.91	17.13	14.01	17.27	0.00092	4.39	2255.53	504.72	0.23
Reach-1	6500	50 year	5120.70	3.91	18.45	14.46	18.57	0.00077	4.35	2826.15	512.76	0.22
Reach-1	6500	100 year	6364.70	3.91	21.43	14.89	21.51	0.00039	3.55	4141.82	531.77	0.16
Reach-1	6000	2 year	1396.60	3.32	12.44		12.66	0.00169	4.38	663.16	301.17	0.29
Reach-1	6000	10 year	2878.80	3.32	14.91		15.08	0.00119	4.50	1484.73	356.12	0.26
Reach-1	6000	25 year	4046.30	3.32	16.56		16.71	0.00096	4.51	2087.43	374.10	0.24
Reach-1	6000	50 year	5120.70	3.32	17.96		18.10	0.00083	4.52	2622.90	389.39	0.23
Reach-1	6000	100 year	6364.70	3.32	21.21		21.29	0.00041	3.72	3946.49	428.05	0.17
Reach-1	5500	2 year	1396.60	3.02	11.80		11.93	0.00109	3.51	915.79	403.02	0.24
Reach-1	5500	10 year	2878.80	3.02	14.52		14.60	0.00062	3.30	2055.63	434.58	0.19
Reach-1	5500	25 year	4046.30	3.02	16.25		16.33	0.00050	3.33	2845.76	478.40	0.17
Reach-1	5500	50 year	5120.70	3.02	17.70		17.77	0.00043	3.36	3567.39	516.42	0.17
Reach-1	5500	100 year	6364.70	3.02	21.09		21.13	0.00021	2.71	5438.01	580.27	0.12
Reach-1	5088	2 year	1396.60	1.35	11.48		11.54	0.00050	2.62	1355.16	445.20	0.16
Reach-1	5088	10 year	2878.80	1.35	14.31		14.36	0.00035	2.67	2682.82	488.05	0.14
Reach-1	5088	25 year	4046.30	1.35	16.09		16.13	0.00030	2.75	3568.21	505.64	0.14
Reach-1	5088	50 year	5120.70	1.35	17.56		17.61	0.00028	2.83	4321.93	518.22	0.13
Reach-1	5088	100 year	6364.70	1.35	21.01		21.05	0.00018	2.61	6279.63	672.77	0.11
Reach-1	4500	2 year	1396.60	0.81	10.86		10.98	0.00088	3.43	772.82	197.25	0.22
Reach-1	4500	10 year	2878.80	0.81	13.74		13.90	0.00089	4.26	1440.07	271.59	0.23
Reach-1	4500	25 year	4046.30	0.81	15.58		15.75	0.00080	4.48	1965.77	296.91	0.22
Reach-1	4500	50 year	5120.70	0.81	17.11		17.28	0.00073	4.63	2435.01	318.60	0.22
Reach-1	4500	100 year	6364.70	0.81	20.80		20.89	0.00034	3.70	4383.13	612.74	0.15
Reach-1	4137	2 year	1396.60	0.48	10.58		10.66	0.00036	2.47	1005.51	245.15	0.15
Reach-1	4137	10 year	2878.80	0.48	13.46		13.56	0.00040	3.14	1867.32	334.63	0.16
Reach-1	4137	25 year	4046.30	0.48	15.32		15.43	0.00038	3.38	2509.23	352.55	0.16
Reach-1	4137	50 year	5120.70	0.48	16.90		17.01	0.00036	3.55	3076.37	370.69	0.16
Reach-1	4137	100 year	6364.70	0.48	20.70		20.77	0.00020	3.07	4586.16	423.02	0.13
Reach-1	4008	2 year	1394.10	0.26	10.43	4.91	10.57	0.00058	3.15	578.00	342.95	0.19
Reach-1	4008	10 year	2867.50	0.26	13.25	6.73	13.46	0.00067	4.12	1192.30	425.62	0.22
Reach-1	4008	25 year	4018.60	0.26	15.10	7.90	15.33	0.00064	4.45	1631.43	453.61	0.22
Reach-1	4008	50 year	5054.50	0.26	16.68	8.85	16.91	0.00059	4.64	2003.82	462.06	0.21
Reach-1	4008	100 year	5950.40	0.26	20.58	9.60	20.72	0.00029	3.78	2927.86	483.04	0.15
Reach-1	3903		Bridge									
Reach-1	3835	2 year	1382.60	0.06	10.06	4.80	10.22	0.00065	3.26	512.48	313.27	0.20
Reach-1	3835	10 year	2839.40	0.06	12.23	6.63	12.57	0.00108	4.93	779.16	407.66	0.27
Reach-1	3835	25 year	3972.40	0.06	13.43	7.80	13.91	0.00136	5.96	928.10	429.74	0.31

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3835	50 year	5009.90	0.06	14.35	8.75	14.97	0.00159	6.79	1042.64	446.72	0.34
Reach-1	3835	100 year	5904.20	0.06	15.06	9.51	15.79	0.00177	7.44	1130.87	453.62	0.36
Reach-1	3391	2 year	1382.60	1.02	9.81		9.91	0.00061	2.93	843.29	261.35	0.19
Reach-1	3391	10 year	2839.40	1.02	11.92		12.08	0.00076	3.90	1484.53	328.91	0.22
Reach-1	3391	25 year	3972.40	1.02	13.12		13.30	0.00083	4.40	1884.87	341.43	0.24
Reach-1	3391	50 year	5009.90	1.02	14.04		14.26	0.00088	4.79	2205.97	351.04	0.25
Reach-1	3391	100 year	5904.20	1.02	14.76		15.00	0.00092	5.09	2461.90	358.52	0.26
Reach-1	2950	2 year	1382.60	1.26	9.20		9.43	0.00165	4.37	1269.06	402.37	0.29
Reach-1	2950	10 year	2839.40	1.26	11.04		11.42	0.00231	6.05	2022.26	417.04	0.36
Reach-1	2950	25 year	3972.40	1.26	12.05		12.54	0.00274	7.10	2448.44	425.12	0.40
Reach-1	2950	50 year	5009.90	1.26	12.83		13.41	0.00309	7.93	2780.92	431.82	0.43
Reach-1	2950	100 year	5904.20	1.26	13.43		14.10	0.00335	8.57	3043.08	437.50	0.45
Reach-1	2381	2 year	1382.60	0.98	7.75		8.13	0.00323	5.47	472.07	259.60	0.40
Reach-1	2381	10 year	2839.40	0.98	9.25		9.74	0.00383	6.94	890.46	295.95	0.45
Reach-1	2381	25 year	3972.40	0.98	10.11		10.65	0.00407	7.70	1149.82	308.15	0.47
Reach-1	2381	50 year	5009.90	0.98	10.75		11.35	0.00429	8.32	1352.47	315.79	0.49
Reach-1	2381	100 year	5904.20	0.98	11.26		11.90	0.00443	8.78	1514.90	321.78	0.51
Reach-1	1890	2 year	1375.10	0.64	6.81	4.75	6.95	0.00166	3.77	757.02	500.54	0.28
Reach-1	1890	10 year	2820.40	0.64	8.10	6.27	8.28	0.00208	4.85	1327.42	529.58	0.33
Reach-1	1890	25 year	3940.00	0.64	8.85	6.94	9.07	0.00230	5.48	1638.10	537.01	0.35
Reach-1	1890	50 year	4969.80	0.64	9.37	7.27	9.63	0.00258	6.07	1857.60	541.66	0.38
Reach-1	1890	100 year	5881.20	0.64	9.79	7.58	10.08	0.00279	6.53	2033.80	545.37	0.40
Reach-1	1500	2 year	1375.10	0.50	6.27		6.34	0.00146	3.23	1140.68	559.20	0.26
Reach-1	1500	10 year	2820.40	0.50	7.48		7.57	0.00161	3.90	1876.04	709.50	0.28
Reach-1	1500	25 year	3940.00	0.50	8.11		8.23	0.00202	4.66	2364.26	782.81	0.32
Reach-1	1500	50 year	4969.80	0.50	8.61		8.73	0.00204	4.92	2756.57	788.56	0.33
Reach-1	1500	100 year	5881.20	0.50	9.02		9.14	0.00205	5.12	3076.38	792.87	0.33
Reach-1	1000	2 year	1375.10	0.40	5.63	3.89	5.65	0.00080	2.27	1800.59	1049.13	0.19
Reach-1	1000	10 year	2820.40	0.40	6.80	4.60	6.82	0.00080	2.56	3174.49	1272.93	0.20
Reach-1	1000	25 year	3940.00	0.40	7.42	4.89	7.45	0.00080	2.76	3970.38	1287.59	0.20
Reach-1	1000	50 year	4969.80	0.40	7.92	5.19	7.95	0.00080	2.91	4618.92	1295.87	0.20
Reach-1	1000	100 year	5881.20	0.40	8.33	5.40	8.36	0.00080	3.03	5147.39	1302.58	0.20

HEC-RAS Output for Reedy Branch Refined Future Land-Use Conditions

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7801	2 YR	35.50	69.60	71.42	71.01	71.70	0.01213	4.30	8.37	9.77	0.65
Reach-1	7801	10 YR	75.20	69.60	71.85	71.85	71.98	0.00650	3.78	40.01	388.85	0.50
Reach-1	7801	25 YR	95.30	69.6	71.90	71.90	72.05	0.00747	4.13	46.01	411.80	0.53
Reach-1	7801	50 YR	115.50	69.60	71.94	71.94	72.10	0.00839	4.45	51.12	414.38	0.57
Reach-1	7801	100 YR	138.90	69.60	71.99	71.99	72.17	0.00919	4.73	56.80	417.21	0.60
Reach-1	7545	2 YR	35.50	66.69	68.57	68.12	68.83	0.01044	4.09	9.54	108.02	0.60
Reach-1	7545	10 YR	75.20	66.69	68.88	68.80	68.88	0.00012	0.51	138.12	113.94	0.07
Reach-1	7545	25 YR	95.30	66.69	68.98	68.80	68.99	0.00016	0.60	149.94	117.14	0.08
Reach-1	7545	50 YR	115.50	66.69	69.04	68.80	69.05	0.00021	0.70	156.59	118.90	0.09
Reach-1	7545	100 YR	138.90	66.69	69.12	68.80	69.13	0.00026	0.80	166.19	121.40	0.10
Reach-1	7428	2 YR	35.50	65.56	68.58	66.98	68.59	0.00035	1.10	79.19	153.38	0.12
Reach-1	7428	10 YR	75.20	65.56	68.83	67.89	68.85	0.00074	1.71	110.15	191.34	0.18
Reach-1	7428	25 YR	95.30	65.56	68.92	68.07	68.95	0.00090	1.93	123.31	208.94	0.20
Reach-1	7428	50 YR	115.50	65.56	68.96	68.23	68.99	0.00118	2.23	129.13	223.29	0.23
Reach-1	7428	100 YR	138.90	65.56	69.02	68.36	69.06	0.00140	2.46	140.71	237.14	0.25
Reach-1	7399		Culvert									
Reach-1	7371	2 YR	35.50	65.23	67.03	66.65	67.33	0.01291	4.38	8.11	6.12	0.66
Reach-1	7371	10 YR	75.20	65.23	67.48	67.48	68.15	0.02070	6.70	12.59	18.36	0.88
Reach-1	7371	25 YR	95.30	65.23	67.73	67.73	68.49	0.02023	7.22	15.23	24.92	0.89
Reach-1	7371	50 YR	115.50	65.23	68.00	68.00	68.54	0.01414	6.56	27.69	30.96	0.76
Reach-1	7371	100 YR	138.90	65.23	68.18	68.18	68.74	0.01390	6.85	33.80	35.04	0.76
Reach-1	7222	2 YR	35.50	62.60	63.89	63.89	64.43	0.03054	5.91	6.01	5.61	1.01
Reach-1	7222	10 YR	75.20	62.60	66.85	64.63	66.86	0.00053	1.40	97.08	261.53	0.14
Reach-1	7222	25 YR	95.30	62.60	66.95	64.93	66.97	0.00054	1.43	117.17	264.15	0.14
Reach-1	7222	50 YR	115.50	62.60	67.07	65.20	67.09	0.00049	1.40	139.50	267.07	0.14
Reach-1	7222	100 YR	138.90	62.60	67.17	65.49	67.18	0.00050	1.44	158.13	269.51	0.14
Reach-1	7004	2 YR	35.50	58.56	62.28	59.86	62.31	0.00078	1.54	23.00	8.68	0.17
Reach-1	7004	10 YR	75.20	58.56	66.85	60.62	66.85	0.00001	0.37	437.28	359.51	0.02
Reach-1	7004	25 YR	95.30	58.56	66.95	60.92	66.95	0.00002	0.42	474.77	366.02	0.03
Reach-1	7004	50 YR	115.50	58.56	67.07	61.20	67.07	0.00002	0.46	517.42	372.86	0.03
Reach-1	7004	100 YR	138.90	58.56	67.16	61.49	67.16	0.00002	0.51	553.54	377.65	0.03
Reach-1	6771		Culvert									
Reach-1	6708	2 YR	35.50	56.92	58.37	58.17	58.69	0.01630	4.57	7.77	7.23	0.78
Reach-1	6708	10 YR	75.20	56.92	59.56	58.83	59.82	0.00721	4.14	18.17	10.29	0.55
Reach-1	6708	25 YR	95.30	56.92	60.11	59.09	60.35	0.00533	3.93	24.24	11.71	0.48
Reach-1	6708	50 YR	115.50	56.92	60.72	59.33	60.92	0.00330	3.63	33.42	19.27	0.39
Reach-1	6708	100 YR	138.90	56.92	61.77	59.57	61.88	0.00124	2.78	71.89	53.20	0.26
Reach-1	6622	2 YR	35.50	55.38	58.23		58.27	0.00135	1.74	20.45	10.84	0.22
Reach-1	6622	10 YR	75.20	55.38	59.45		59.52	0.00115	2.12	38.59	24.63	0.22
Reach-1	6622	25 YR	95.30	55.38	60.04		60.11	0.00088	2.10	62.29	53.02	0.20

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6622	50 YR	115.50	55.38	60.71		60.75	0.00055	1.87	99.59	59.42	0.16
Reach-1	6622	100 YR	138.90	55.38	61.77		61.80	0.00025	1.47	176.01	86.18	0.11
Reach-1	6504	2 YR	35.50	55.52	57.99		58.05	0.00261	2.32	29.01	34.89	0.27
Reach-1	6504	10 YR	75.20	55.52	59.34		59.38	0.00112	2.08	93.94	78.60	0.19
Reach-1	6504	25 YR	95.30	55.52	59.99		60.01	0.00060	1.71	156.18	106.66	0.15
Reach-1	6504	50 YR	115.50	55.52	60.68		60.69	0.00031	1.36	235.59	122.31	0.11
Reach-1	6504	100 YR	138.90	55.52	61.77		61.77	0.00013	1.00	384.57	154.02	0.07
Reach-1	6351	2 YR	35.50	55.23	57.78	56.38	57.81	0.00096	1.56	26.68	21.84	0.20
Reach-1	6351	10 YR	75.20	55.23	59.23	56.91	59.27	0.00049	1.61	71.14	66.16	0.15
Reach-1	6351	25 YR	95.30	55.23	59.90	57.11	59.93	0.00038	1.60	93.61	90.27	0.14
Reach-1	6351	50 YR	115.50	55.23	60.61	57.32	60.64	0.00030	1.56	117.60	145.38	0.13
Reach-1	6351	100 YR	138.90	55.23	61.72	57.53	61.74	0.00019	1.43	154.88	195.05	0.10
Reach-1	6317		Culvert									
Reach-1	6288	2 YR	35.40	54.92	56.38	56.11	56.62	0.01229	3.97	8.92	8.62	0.69
Reach-1	6288	10 YR	75.20	54.92	57.40	56.74	57.61	0.00529	3.76	21.14	20.97	0.49
Reach-1	6288	25 YR	95.20	54.92	57.70	56.95	57.93	0.00520	4.01	25.01	23.21	0.49
Reach-1	6288	50 YR	115.40	54.92	57.92	57.13	58.20	0.00549	4.33	28.01	24.90	0.51
Reach-1	6288	100 YR	138.70	54.92	58.14	57.34	58.46	0.00576	4.69	31.05	26.74	0.53
Reach-1	5862	2 YR	35.40	49.18	55.03		55.05	0.00053	1.21	31.86	15.56	0.11
Reach-1	5862	10 YR	75.20	49.18	56.93		56.96	0.00043	1.41	76.48	32.89	0.11
Reach-1	5862	25 YR	95.20	49.18	57.19		57.23	0.00055	1.65	85.42	35.34	0.12
Reach-1	5862	50 YR	115.40	49.18	57.35		57.40	0.00071	1.91	91.29	36.86	0.14
Reach-1	5862	100 YR	138.70	49.18	57.50		57.56	0.00091	2.20	96.69	38.34	0.16
Reach-1	5571	2 YR	35.40	51.43	54.83	52.67	54.86	0.00076	1.37	25.85	12.18	0.16
Reach-1	5571	10 YR	75.20	51.43	56.83	53.33	56.85	0.00028	1.23	106.45	71.36	0.11
Reach-1	5571	25 YR	95.20	51.43	57.07	53.60	57.10	0.00034	1.40	124.25	76.47	0.12
Reach-1	5571	50 YR	115.40	51.43	57.21	53.84	57.24	0.00043	1.60	134.48	79.26	0.13
Reach-1	5571	100 YR	138.70	51.43	57.31	54.09	57.35	0.00055	1.85	142.62	81.41	0.15
Reach-1	5515		Culvert									
Reach-1	5466	2 YR	35.40	48.92	52.02	50.46	52.10	0.00299	2.33	15.19	6.76	0.27
Reach-1	5466	10 YR	75.20	48.92	54.37	51.23	54.43	0.00121	2.07	45.13	18.35	0.18
Reach-1	5466	25 YR	95.20	48.92	56.46	51.55	56.48	0.00029	1.30	148.89	85.49	0.09
Reach-1	5466	50 YR	115.40	48.92	56.76	51.84	56.78	0.00031	1.39	176.73	98.47	0.10
Reach-1	5466	100 YR	138.70	48.92	56.89	52.14	56.92	0.00039	1.58	190.13	104.23	0.11
Reach-1	5438	2 YR	35.40	48.66	51.81		51.96	0.00659	3.14	11.26	4.99	0.37
Reach-1	5438	10 YR	75.20	48.66	54.30		54.38	0.00199	2.40	42.02	32.37	0.23
Reach-1	5438	25 YR	95.20	48.66	56.45		56.47	0.00025	1.18	173.58	93.23	0.09
Reach-1	5438	50 YR	115.40	48.66	56.75		56.77	0.00026	1.25	203.25	102.92	0.09
Reach-1	5438	100 YR	138.70	48.66	56.89		56.90	0.00033	1.42	217.00	107.34	0.10
Reach-1	5381	2 YR	35.40	48.86	51.67		51.73	0.00227	2.08	17.12	9.44	0.26
Reach-1	5381	10 YR	75.20	48.86	54.31		54.33	0.00028	1.26	84.37	45.93	0.10

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Reach-1	5381	25 YR	95.20	48.86	56.45		56.46	0.00004	0.60	264.04	120.46	0.04
Reach-1	5381	50 YR	115.40	48.86	56.76		56.76	0.00004	0.64	301.99	133.57	0.04
Reach-1	5381	100 YR	138.70	48.86	56.89		56.89	0.00005	0.72	320.10	142.24	0.05
Reach-1	5356	2 YR	49.30	47.99	51.65	49.29	51.69	0.00094	1.69	32.34	22.92	0.17
Reach-1	5356	10 YR	109.60	47.99	54.28	50.13	54.32	0.00043	1.73	81.75	67.25	0.13
Reach-1	5356	25 YR	140.10	47.99	56.45	50.47	56.46	0.00006	0.81	329.79	217.89	0.05
Reach-1	5356	50 YR	167.20	47.99	56.75	50.83	56.76	0.00006	0.83	372.65	228.23	0.05
Reach-1	5356	100 YR	199.80	47.99	56.88	51.13	56.89	0.00008	0.93	391.42	281.43	0.06
Reach-1	5301		Culvert									
Reach-1	5241	2 YR	49.30	46.32	48.25	47.52	48.33	0.00353	2.24	21.98	16.99	0.35
Reach-1	5241	10 YR	109.60	46.32	49.46	48.03	49.56	0.00219	2.45	44.75	20.67	0.29
Reach-1	5241	25 YR	140.10	46.32	49.92	48.24	50.02	0.00204	2.57	54.53	22.07	0.29
Reach-1	5241	50 YR	167.20	46.32	50.24	48.41	50.35	0.00204	2.71	61.76	23.04	0.29
Reach-1	5241	100 YR	199.80	46.32	50.54	48.61	50.68	0.00212	2.90	69.07	26.64	0.30
Reach-1	4994	2 YR	49.30	43.38	46.94		47.12	0.00677	3.44	14.35	6.24	0.40
Reach-1	4994	10 YR	109.60	43.38	48.20		48.54	0.00817	4.74	24.27	10.31	0.46
Reach-1	4994	25 YR	140.10	43.38	48.57		49.00	0.00908	5.36	30.63	24.45	0.49
Reach-1	4994	50 YR	167.20	43.38	48.81		49.29	0.00974	5.79	37.67	34.77	0.52
Reach-1	4994	100 YR	199.80	43.38	49.05		49.57	0.01020	6.17	47.42	46.58	0.53
Reach-1	4798	2 YR	49.30	42.16	44.70		45.07	0.01769	4.93	10.00	6.22	0.69
Reach-1	4798	10 YR	109.60	42.16	45.62	45.43	46.23	0.01801	6.41	20.67	19.19	0.73
Reach-1	4798	25 YR	140.10	42.16	45.95		46.59	0.01700	6.79	27.71	23.83	0.73
Reach-1	4798	50 YR	167.20	42.16	46.21		46.86	0.01604	7.01	34.35	27.48	0.72
Reach-1	4798	100 YR	199.80	42.16	46.48		47.14	0.01509	7.21	42.43	31.36	0.71
Reach-1	4624	2 YR	49.30	39.14	40.85	40.72	41.33	0.02676	5.57	8.85	6.99	0.87
Reach-1	4624	10 YR	109.60	39.14	41.78	41.59	42.51	0.02586	6.87	15.96	8.41	0.88
Reach-1	4624	25 YR	140.10	39.14	42.11	41.93	42.97	0.02595	7.42	18.97	9.76	0.89
Reach-1	4624	50 YR	167.20	39.14	42.37	42.22	43.33	0.02605	7.91	21.64	11.70	0.90
Reach-1	4624	100 YR	199.80	39.14	42.63	42.56	43.73	0.02593	8.45	25.24	15.64	0.91
Reach-1	4494	2 YR	49.30	35.80	37.74		38.08	0.01663	4.70	10.50	7.38	0.69
Reach-1	4494	10 YR	109.60	35.80	38.74		39.28	0.01645	5.87	18.70	9.18	0.71
Reach-1	4494	25 YR	140.10	35.80	39.07		39.72	0.01658	6.47	21.96	10.38	0.73
Reach-1	4494	50 YR	167.20	35.80	39.31	38.86	40.07	0.01738	7.03	24.46	11.22	0.76
Reach-1	4494	100 YR	199.80	35.80	39.54	39.17	40.45	0.01852	7.68	27.23	12.09	0.79
Reach-1	4291	2 YR	49.30	33.47	35.11		35.33	0.01110	3.73	13.22	10.83	0.59
Reach-1	4291	10 YR	109.60	33.47	35.83		36.23	0.01354	5.07	21.60	12.52	0.68
Reach-1	4291	25 YR	140.10	33.47	36.13		36.60	0.01399	5.51	25.44	13.22	0.70
Reach-1	4291	50 YR	167.20	33.47	36.39		36.91	0.01353	5.77	29.05	14.43	0.70
Reach-1	4291	100 YR	199.80	33.47	36.68		37.25	0.01288	6.05	33.54	16.43	0.69
Reach-1	4182	2 YR	49.30	32.22	33.33		33.57	0.01670	3.93	12.56	13.60	0.72
Reach-1	4182	10 YR	109.60	32.22	34.77		34.92	0.00403	3.10	35.35	18.16	0.39
Reach-1	4182	25 YR	140.10	32.22	35.34		35.48	0.00310	3.03	46.21	19.97	0.35

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Reach-1	4182	50 YR	167.20	32.22	35.77		35.91	0.00271	3.04	55.09	21.34	0.33
Reach-1	4182	100 YR	199.80	32.22	36.16		36.32	0.00257	3.13	63.82	22.60	0.33
Reach-1	4044	2 YR	49.30	30.62	32.76		32.82	0.00240	2.07	23.77	15.05	0.29
Reach-1	4044	10 YR	109.60	30.62	34.58		34.64	0.00104	1.98	55.43	20.22	0.20
Reach-1	4044	25 YR	140.10	30.62	35.17		35.24	0.00095	2.09	68.49	23.67	0.20
Reach-1	4044	50 YR	167.20	30.62	35.61		35.69	0.00093	2.19	79.45	26.21	0.20
Reach-1	4044	100 YR	199.80	30.62	36.01		36.09	0.00096	2.35	90.14	27.60	0.21
Reach-1	3761	2 YR	49.30	27.45	32.72		32.72	0.00011	0.72	69.22	20.56	0.07
Reach-1	3761	10 YR	109.60	27.45	34.53		34.54	0.00013	1.03	118.18	33.18	0.08
Reach-1	3761	25 YR	140.10	27.45	35.12		35.14	0.00015	1.17	138.97	37.10	0.09
Reach-1	3761	50 YR	167.20	27.45	35.56		35.58	0.00016	1.29	155.78	39.98	0.09
Reach-1	3761	100 YR	199.80	27.45	35.95		35.98	0.00018	1.43	171.83	42.56	0.10
Reach-1	3523	2 YR	49.30	27.24	32.68		32.69	0.00019	0.93	66.60	26.64	0.08
Reach-1	3523	10 YR	109.60	27.24	34.49		34.51	0.00021	1.26	130.84	45.44	0.09
Reach-1	3523	25 YR	140.10	27.24	35.07		35.10	0.00023	1.39	159.50	51.93	0.10
Reach-1	3523	50 YR	167.20	27.24	35.51		35.53	0.00024	1.51	183.04	56.70	0.10
Reach-1	3523	100 YR	199.80	27.24	35.89		35.92	0.00027	1.65	205.62	60.93	0.11
Reach-1	3284	2 YR	49.30	27.75	32.65	28.79	32.66	0.00010	0.71	73.86	41.21	0.07
Reach-1	3284	10 YR	109.60	27.75	34.46	29.43	34.47	0.00010	0.92	184.62	74.52	0.07
Reach-1	3284	25 YR	140.10	27.75	35.05	29.69	35.06	0.00010	1.00	231.12	83.62	0.07
Reach-1	3284	50 YR	167.20	27.75	35.48	29.90	35.49	0.00011	1.07	268.70	89.70	0.07
Reach-1	3284	100 YR	199.80	27.75	35.86	30.14	35.88	0.00012	1.16	304.51	97.93	0.08
Reach-1	3208	2 YR	96.10	26.97	32.56	29.12	32.62	0.00086	1.94	50.54	14.70	0.17
Reach-1	3208	10 YR	235.30	26.97	34.30	30.48	34.41	0.00115	2.85	135.12	72.13	0.21
Reach-1	3208	25 YR	328.30	26.97	34.85	31.19	34.99	0.00138	3.32	176.80	79.61	0.23
Reach-1	3208	50 YR	411.90	26.97	35.25	31.73	35.41	0.00157	3.69	209.87	86.85	0.25
Reach-1	3208	100 YR	508.50	26.97	35.58	32.32	35.78	0.00189	4.18	240.33	99.28	0.28
Reach-1	3163		Culvert									
Reach-1	3113	2 YR	96.10	25.96	28.62	28.01	28.93	0.00936	4.47	21.49	23.58	0.57
Reach-1	3113	10 YR	235.30	25.96	29.54	29.11	30.37	0.01510	7.28	32.49	38.41	0.77
Reach-1	3113	25 YR	328.30	25.96	34.66	29.70	34.67	0.00008	1.07	796.89	225.63	0.07
Reach-1	3113	50 YR	411.90	25.96	35.35	30.17	35.36	0.00008	1.10	956.06	236.03	0.07
Reach-1	3113	100 YR	508.50	25.96	35.68	30.67	35.69	0.00009	1.25	1034.89	241.01	0.07
Reach-1	3074	2 YR	96.10	25.84	27.62	27.62	28.24	0.02986	6.27	15.32	12.46	1.00
Reach-1	3074	10 YR	235.30	25.84	28.68	28.68	29.60	0.02476	7.68	31.39	27.15	0.97
Reach-1	3074	25 YR	328.30	25.84	34.66	29.33	34.66	0.00005	0.85	921.13	209.99	0.05
Reach-1	3074	50 YR	411.90	25.84	35.35	29.53	35.35	0.00005	0.91	1068.24	216.84	0.06
Reach-1	3074	100 YR	508.50	25.84	35.68	30.09	35.69	0.00006	1.06	1140.34	220.12	0.06
Reach-1	3007	2 YR	96.10	21.82	24.48		24.89	0.01375	5.17	18.58	9.77	0.66
Reach-1	3007	10 YR	235.30	21.82	25.86		26.62	0.01619	6.99	33.68	12.08	0.74
Reach-1	3007	25 YR	328.30	21.82	34.65		34.66	0.00005	1.00	794.54	157.00	0.05
Reach-1	3007	50 YR	411.90	21.82	35.34		35.35	0.00006	1.11	905.24	164.37	0.06

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Reach-1	3007	100 YR	508.50	21.82	35.67		35.68	0.00008	1.30	959.58	167.43	0.06
Reach-1	2509	2 YR	96.10	18.50	22.51	20.61	22.62	0.00213	2.69	39.37	21.76	0.28
Reach-1	2509	10 YR	235.30	18.50	25.15	21.93	25.24	0.00091	2.72	145.70	55.31	0.20
Reach-1	2509	25 YR	328.30	18.50	34.64	22.57	34.65	0.00001	0.65	1176.95	160.31	0.03
Reach-1	2509	50 YR	411.90	18.50	35.33	23.12	35.33	0.00002	0.75	1289.67	168.47	0.03
Reach-1	2509	100 YR	508.50	18.50	35.65	23.59	35.66	0.00002	0.89	1344.93	188.19	0.04
Reach-1	2076	2 YR	96.10	17.78	19.62	19.62	20.25	0.03157	6.37	15.09	12.07	1.00
Reach-1	2076	10 YR	235.30	17.78	24.95	20.68	24.98	0.00036	1.66	287.60	150.23	0.13
Reach-1	2076	25 YR	328.30	17.78	34.64	21.23	34.65	0.00000	0.23	2565.68	289.30	0.01
Reach-1	2076	50 YR	411.90	17.78	35.33	21.67	35.33	0.00000	0.28	2776.91	325.34	0.01
Reach-1	2076	100 YR	508.50	17.78	35.65	22.14	35.66	0.00000	0.33	2883.25	331.88	0.01
Reach-1	2002	2 YR	137.50	15.34	18.66	17.89	19.04	0.00867	5.05	31.12	16.20	0.56
Reach-1	2002	10 YR	354.70	15.34	24.90	19.45	24.95	0.00038	2.25	324.28	98.19	0.14
Reach-1	2002	25 YR	508.70	15.34	34.64	20.24	34.65	0.00001	0.45	2188.92	262.61	0.02
Reach-1	2002	50 YR	640.30	15.34	35.33	20.82	35.33	0.00001	0.53	2381.79	298.92	0.02
Reach-1	2002	100 YR	788.30	15.34	35.65	21.40	35.65	0.00001	0.63	2479.42	305.58	0.03
Reach-1	1502	2 YR	137.50	12.83	18.15		18.20	0.00059	1.86	92.10	39.72	0.15
Reach-1	1502	10 YR	354.70	12.83	24.87		24.88	0.00006	1.07	752.65	152.13	0.06
Reach-1	1502	25 YR	508.70	12.83	34.64		34.64	0.00000	0.45	3050.30	325.80	0.02
Reach-1	1502	50 YR	640.30	12.83	35.33		35.33	0.00001	0.52	3275.28	331.23	0.02
Reach-1	1502	100 YR	788.30	12.83	35.65		35.65	0.00001	0.62	3382.30	333.78	0.02
Reach-1	1058	2 YR	137.50	12.30	17.98	14.26	18.01	0.00031	1.49	155.23	79.38	0.12
Reach-1	1058	10 YR	354.70	12.30	24.86	15.56	24.86	0.00003	0.78	1060.83	169.32	0.04
Reach-1	1058	25 YR	508.70	12.30	34.64	16.47	34.64	0.00000	0.40	3576.43	385.97	0.02
Reach-1	1058	50 YR	640.30	12.30	35.32	17.09	35.33	0.00000	0.47	3844.02	395.96	0.02
Reach-1	1058	100 YR	788.30	12.30	35.65	17.62	35.65	0.00001	0.55	3971.94	400.73	0.02
Reach-1	918	2 YR	176.70	13.48	17.77	15.45	17.89	0.00185	2.77	63.74	19.13	0.27
Reach-1	918	10 YR	466.50	13.48	24.80	16.98	24.84	0.00020	1.84	349.64	139.76	0.10
Reach-1	918	25 YR	676.50	13.48	34.62	17.83	34.64	0.00003	1.05	1136.23	287.56	0.04
Reach-1	918	50 YR	854.50	13.48	35.30	18.46	35.32	0.00004	1.26	1245.10	328.30	0.05
Reach-1	918	100 YR	1053.60	13.48	35.64	19.08	35.64	0.00002	0.91	2805.76	333.85	0.04
Reach-1	813		Culvert									
Reach-1	734	2 YR	176.70	11.71	14.15	13.50	14.50	0.00430	4.77	37.07	18.91	0.60
Reach-1	734	10 YR	466.50	11.71	16.15	14.91	16.68	0.00296	5.86	79.67	24.39	0.54
Reach-1	734	25 YR	676.50	11.71	16.79	15.62	17.60	0.00362	7.22	93.72	25.92	0.62
Reach-1	734	50 YR	854.50	11.71	17.06	16.14	18.20	0.00468	8.56	99.78	26.58	0.71
Reach-1	734	100 YR	1053.60	11.71	17.28	16.68	18.86	0.00609	10.07	104.58	27.10	0.82
Reach-1	636	2 YR	176.70	9.55	12.48	12.48	13.58	0.01415	8.42	21.00	9.68	1.01
Reach-1	636	10 YR	466.50	9.55	14.69	14.69	16.00	0.00846	9.55	57.29	26.81	0.84
Reach-1	636	25 YR	676.50	9.55	15.64	15.64	16.96	0.00706	10.04	88.18	38.07	0.79
Reach-1	636	50 YR	854.50	9.55	16.22	16.22	17.59	0.00668	10.51	112.32	44.87	0.78
Reach-1	636	100 YR	1053.60	9.55	16.72	16.72	18.17	0.00665	11.10	136.22	50.71	0.79

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	592	2 YR	176.70	7.70	11.90	10.04	12.18	0.00218	4.18	42.26	12.00	0.39
Reach-1	592	10 YR	466.50	7.70	14.06	12.00	14.73	0.00336	6.58	73.60	20.64	0.50
Reach-1	592	25 YR	676.50	7.70	15.23	13.10	16.01	0.00320	7.32	102.97	96.39	0.51
Reach-1	592	50 YR	854.50	7.70	16.04	14.16	16.85	0.00297	7.64	129.36	145.27	0.50
Reach-1	592	100 YR	1053.60	7.70	16.58	15.26	17.52	0.00322	8.35	149.03	168.65	0.53
Reach-1	564		Bridge									
Reach-1	546	2 YR	176.70	7.65	11.64	10.24	11.93	0.00265	4.33	40.82	14.96	0.46
Reach-1	546	10 YR	466.50	7.65	13.48	12.09	14.12	0.00395	6.42	72.65	19.93	0.59
Reach-1	546	25 YR	676.50	7.65	14.22	13.03	15.14	0.00484	7.71	88.60	23.40	0.67
Reach-1	546	50 YR	854.50	7.65	14.72	13.71	15.87	0.00549	8.64	100.91	25.77	0.72
Reach-1	546	100 YR	1053.60	7.65	15.17	14.40	16.59	0.00599	9.62	113.00	27.80	0.76
Reach-1	338	2 YR	176.70	7.07	10.80	9.89	11.13	0.00600	4.90	52.10	29.62	0.49
Reach-1	338	10 YR	466.50	7.07	12.56	11.59	13.04	0.00600	6.61	142.75	72.12	0.53
Reach-1	338	25 YR	676.50	7.07	13.31	12.54	13.82	0.00601	7.27	199.94	82.15	0.54
Reach-1	338	50 YR	854.50	7.07	13.84	12.91	14.38	0.00600	7.72	245.39	89.32	0.55
Reach-1	338	100 YR	1053.60	7.07	14.35	13.31	14.92	0.00600	8.15	293.63	96.35	0.56

HEC-RAS Output for Fornes Run Refined Future Land-Use Conditions

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8363	2 YR	160.30	58.09	65.63	60.36	65.64	0.00012	1.23	295.99	87.19	0.08
Reach-1	8363	10 YR	264.70	58.09	66.15	61.19	66.18	0.00026	1.91	347.70	116.00	0.12
Reach-1	8363	25 YR	341.70	58.09	66.38	61.67	66.43	0.00038	2.36	377.17	134.26	0.15
Reach-1	8363	50 YR	410.00	58.09	66.53	62.05	66.60	0.00051	2.76	398.53	148.65	0.17
Reach-1	8363	100 YR	485.60	58.09	66.62	62.39	66.71	0.00067	3.20	411.50	154.92	0.19
Reach-1	8290		Culvert									
Reach-1	8188	2 YR	160.30	57.22	61.26	59.83	61.42	0.00316	3.23	50.96	26.79	0.36
Reach-1	8188	10 YR	264.70	57.22	61.99	60.50	62.24	0.00348	4.04	74.77	41.52	0.40
Reach-1	8188	25 YR	341.70	57.22	62.26	60.89	62.59	0.00432	4.75	87.35	52.92	0.45
Reach-1	8188	50 YR	410.00	57.22	62.50	61.17	62.90	0.00480	5.23	101.13	60.84	0.48
Reach-1	8188	100 YR	485.60	57.22	62.79	61.49	63.24	0.00494	5.59	120.19	68.60	0.49
Reach-1	7703	2 YR	160.30	56.00	58.58	58.12	58.93	0.00924	4.85	42.92	45.15	0.61
Reach-1	7703	10 YR	264.70	56.00	59.11	58.76	59.56	0.00958	5.78	72.73	66.25	0.64
Reach-1	7703	25 YR	341.70	56.00	59.67		60.03	0.00659	5.47	115.08	85.98	0.55
Reach-1	7703	50 YR	410.00	56.00	60.05		60.38	0.00549	5.40	150.31	97.99	0.51
Reach-1	7703	100 YR	485.60	56.00	60.27		60.63	0.00571	5.74	172.43	102.78	0.53
Reach-1	7189	2 YR	160.30	51.20	53.90	53.45	54.35	0.01089	5.42	32.24	21.04	0.66
Reach-1	7189	10 YR	264.70	51.20	57.17	54.11	57.26	0.00077	2.71	182.71	82.09	0.21
Reach-1	7189	25 YR	341.70	51.20	59.30	54.51	59.32	0.00020	1.74	421.41	139.78	0.11
Reach-1	7189	50 YR	410.00	51.20	59.67	54.84	59.70	0.00021	1.85	475.15	145.94	0.12
Reach-1	7189	100 YR	485.60	51.20	59.80	55.17	59.83	0.00027	2.11	493.76	151.39	0.13
Reach-1	6632	2 YR	160.30	46.73	52.00	49.10	52.13	0.00194	2.87	55.82	14.32	0.26
Reach-1	6632	10 YR	264.70	46.73	57.13	49.93	57.14	0.00007	0.93	501.29	145.29	0.05
Reach-1	6632	25 YR	341.70	46.73	59.28	50.44	59.28	0.00003	0.65	903.56	214.48	0.03
Reach-1	6632	50 YR	410.00	46.73	59.65	50.87	59.66	0.00003	0.71	985.13	222.29	0.04
Reach-1	6632	100 YR	485.60	46.73	59.77	51.29	59.78	0.00004	0.82	1012.17	225.15	0.04
Reach-1	6343	2 YR	160.30	46.73	51.67		51.74	0.00090	2.35	108.28	64.68	0.21
Reach-1	6343	10 YR	264.70	46.73	57.12		57.13	0.00005	1.00	660.92	139.39	0.06
Reach-1	6343	25 YR	341.70	46.73	59.27		59.28	0.00003	0.93	994.08	172.81	0.05
Reach-1	6343	50 YR	410.00	46.73	59.64		59.65	0.00004	1.06	1059.20	178.53	0.05
Reach-1	6343	100 YR	485.60	46.73	59.76		59.77	0.00006	1.24	1080.00	180.50	0.06
Reach-1	6071	2 YR	192.40	46.10	51.30	48.68	51.43	0.00136	2.88	78.58	189.36	0.25
Reach-1	6071	10 YR	344.90	46.10	57.05	49.67	57.09	0.00016	1.79	269.12	309.29	0.10
Reach-1	6071	25 YR	461.80	46.10	59.27	50.32	59.27	0.00001	0.44	2415.99	378.18	0.02
Reach-1	6071	50 YR	569.00	46.10	59.64	50.77	59.64	0.00001	0.51	2558.70	388.57	0.03
Reach-1	6071	100 YR	690.90	46.10	59.75	51.27	59.76	0.00001	0.60	2603.73	390.47	0.03
Reach-1	5876		Culvert									
Reach-1	5636	2 YR	192.40	41.02	43.57	43.24	44.10	0.00706	5.87	32.80	18.47	0.78
Reach-1	5636	10 YR	344.90	41.02	44.78	44.06	45.32	0.00469	5.91	58.33	23.65	0.66
Reach-1	5636	25 YR	461.80	41.02	47.42	44.56	47.60	0.00081	3.42	135.47	34.58	0.30
Reach-1	5636	50 YR	569.00	41.02	52.03	44.96	52.07	0.00008	1.69	402.32	79.24	0.10

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	5636	100 YR	690.90	41.02	52.37	45.36	52.42	0.00009	1.94	429.89	82.39	0.12
Reach-1	5493	2 YR	192.40	39.45	42.88		43.13	0.00487	4.00	50.70	27.80	0.47
Reach-1	5493	10 YR	344.90	39.45	44.47		44.69	0.00245	3.81	105.68	41.46	0.36
Reach-1	5493	25 YR	461.80	39.45	47.38		47.46	0.00045	2.45	262.57	66.36	0.17
Reach-1	5493	50 YR	569.00	39.45	52.03		52.05	0.00007	1.38	734.71	152.44	0.07
Reach-1	5493	100 YR	690.90	39.45	52.37		52.40	0.00009	1.58	787.93	159.23	0.08
Reach-1	5288	2 YR	192.40	37.92	41.61		41.97	0.00645	4.79	40.18	15.28	0.52
Reach-1	5288	10 YR	344.90	37.92	43.89		44.17	0.00247	4.36	96.26	40.94	0.35
Reach-1	5288	25 YR	461.80	37.92	47.33		47.38	0.00030	2.16	347.43	108.41	0.13
Reach-1	5288	50 YR	569.00	37.92	52.03		52.04	0.00003	0.85	1079.60	188.06	0.04
Reach-1	5288	100 YR	690.90	37.92	52.37		52.38	0.00003	0.96	1144.39	189.91	0.05
Reach-1	4919	2 YR	192.40	35.89	40.26	38.77	40.41	0.00279	3.43	85.43	62.41	0.34
Reach-1	4919	10 YR	344.90	35.89	43.88	39.94	43.90	0.00022	1.61	412.41	116.58	0.11
Reach-1	4919	25 YR	461.80	35.89	47.32	40.33	47.33	0.00006	1.06	898.86	166.51	0.06
Reach-1	4919	50 YR	569.00	35.89	52.03	40.63	52.03	0.00001	0.67	1816.17	221.25	0.03
Reach-1	4919	100 YR	690.90	35.89	52.37	40.90	52.37	0.00002	0.78	1892.30	225.06	0.04
Reach-1	4682	2 YR	244.90	34.00	39.79		39.90	0.00171	3.05	129.29	71.75	0.27
Reach-1	4682	10 YR	479.10	34.00	43.84		43.86	0.00015	1.45	717.33	194.26	0.09
Reach-1	4682	25 YR	650.80	34.00	47.31		47.31	0.00004	0.95	1485.82	248.20	0.05
Reach-1	4682	50 YR	809.90	34.00	52.03		52.03	0.00001	0.61	2787.50	299.49	0.03
Reach-1	4682	100 YR	997.10	34.00	52.37		52.37	0.00001	0.73	2889.92	302.47	0.03
Reach-1	4597	2 YR	244.90	33.77	39.45	36.75	39.70	0.00304	3.95	62.06	44.75	0.33
Reach-1	4597	10 YR	479.10	33.77	43.80	38.20	43.84	0.00031	1.97	472.22	144.87	0.12
Reach-1	4597	25 YR	650.80	33.77	47.30	39.07	47.31	0.00008	1.24	1052.93	185.95	0.06
Reach-1	4597	50 YR	809.90	33.77	52.02	40.44	52.03	0.00002	0.81	2098.47	260.13	0.03
Reach-1	4597	100 YR	997.10	33.77	52.36	40.93	52.37	0.00003	0.96	2187.88	266.96	0.04
Reach-1	4545	2 YR	244.90	35.01	39.06	37.67	39.44	0.00597	4.93	50.38	17.14	0.48
Reach-1	4545	10 YR	479.10	35.01	43.77	38.93	43.82	0.00033	2.03	318.37	105.54	0.13
Reach-1	4545	25 YR	650.80	35.01	47.29	39.79	47.30	0.00007	1.17	805.91	168.22	0.06
Reach-1	4545	50 YR	809.90	35.01	52.02	40.66	52.03	0.00002	0.71	1794.31	258.20	0.03
Reach-1	4545	100 YR	997.10	35.01	52.36	41.19	52.37	0.00002	0.83	1882.81	264.67	0.04
Reach-1	4506		Culvert									
Reach-1	4469	2 YR	244.90	32.55	36.93	35.62	37.32	0.00275	4.98	50.39	18.60	0.50
Reach-1	4469	10 YR	479.10	32.55	42.65	36.96	42.67	0.00007	1.53	494.70	136.49	0.09
Reach-1	4469	25 YR	650.80	32.55	47.28	37.79	47.28	0.00001	0.82	1293.01	209.65	0.04
Reach-1	4469	50 YR	809.90	32.55	52.02	38.32	52.02	0.00000	0.51	2615.75	332.44	0.02
Reach-1	4469	100 YR	997.10	32.55	52.36	38.87	52.36	0.00000	0.60	2728.21	335.54	0.02
Reach-1	4362	2 YR	244.90	31.60	36.85		36.98	0.00145	2.85	85.86	21.54	0.25
Reach-1	4362	10 YR	479.10	31.60	42.64		42.66	0.00012	1.42	597.36	140.48	0.08
Reach-1	4362	25 YR	650.80	31.60	47.27		47.28	0.00003	0.92	1419.01	214.71	0.04
Reach-1	4362	50 YR	809.90	31.60	52.02		52.02	0.00001	0.65	2592.84	278.36	0.03
Reach-1	4362	100 YR	997.10	31.60	52.35		52.36	0.00001	0.78	2687.15	283.81	0.03

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4249	2 YR	244.90	31.37	36.40	34.80	36.69	0.00466	4.56	76.30	57.57	0.43
Reach-1	4249	10 YR	479.10	31.37	42.65	36.72	42.65	0.00003	0.75	969.61	213.05	0.04
Reach-1	4249	25 YR	650.80	31.37	47.28	37.20	47.28	0.00001	0.45	2021.89	238.08	0.02
Reach-1	4249	50 YR	809.90	31.37	52.02	37.46	52.02	0.00000	0.34	3199.72	362.85	0.01
Reach-1	4249	100 YR	997.10	31.37	52.35	37.72	52.36	0.00000	0.41	3286.75	367.13	0.02
Reach-1	4027	2 YR	244.90	30.79	36.13	33.43	36.21	0.00102	2.47	148.61	77.86	0.23
Reach-1	4027	10 YR	479.10	30.79	42.63	34.64	42.64	0.00005	1.11	875.83	146.87	0.06
Reach-1	4027	25 YR	650.80	30.79	47.27	35.46	47.28	0.00002	0.87	1680.89	203.18	0.04
Reach-1	4027	50 YR	809.90	30.79	52.01	35.94	52.02	0.00001	0.68	2741.90	229.00	0.03
Reach-1	4027	100 YR	997.10	30.79	52.35	36.31	52.35	0.00001	0.81	2818.58	229.00	0.03
Reach-1	3819	2 YR	244.90	30.63	35.79	33.26	35.94	0.00166	3.23	110.07	85.89	0.27
Reach-1	3819	10 YR	479.10	30.63	42.63	34.48	42.63	0.00004	0.96	1094.28	187.71	0.05
Reach-1	3819	25 YR	650.80	30.63	47.27	35.86	47.27	0.00001	0.71	2100.25	247.69	0.03
Reach-1	3819	50 YR	809.90	30.63	52.01	36.27	52.02	0.00001	0.58	3476.73	349.09	0.02
Reach-1	3819	100 YR	997.10	30.63	52.35	36.64	52.35	0.00001	0.69	3595.06	357.50	0.03
Reach-1	3713	2 YR	244.90	31.05	35.67	33.22	35.82	0.00079	3.04	82.93	25.36	0.28
Reach-1	3713	10 YR	479.10	31.05	42.62	34.29	42.63	0.00002	0.92	1120.29	241.99	0.05
Reach-1	3713	25 YR	650.80	31.05	47.27	34.97	47.27	0.00000	0.54	2428.49	314.43	0.02
Reach-1	3713	50 YR	809.90	31.05	52.01	35.52	52.01	0.00000	0.39	4281.33	437.14	0.02
Reach-1	3713	100 YR	997.10	31.05	52.35	36.19	52.35	0.00000	0.47	4428.34	441.31	0.02
Reach-1	3670		Culvert									
Reach-1	3631	2 YR	244.90	30.31	34.17	33.47	34.65	0.00802	5.56	44.98	21.95	0.61
Reach-1	3631	10 YR	479.10	30.31	42.60	34.52	42.62	0.00006	1.23	923.90	233.77	0.07
Reach-1	3631	25 YR	650.80	30.31	47.26	35.16	47.27	0.00001	0.74	2151.37	295.76	0.03
Reach-1	3631	50 YR	809.90	30.31	52.01	35.70	52.01	0.00000	0.54	3927.30	430.89	0.02
Reach-1	3631	100 YR	997.10	30.31	52.33	36.29	52.33	0.00001	0.64	4065.97	438.50	0.03
Reach-1	3534	2 YR	244.90	28.83	34.16	31.22	34.25	0.00092	2.43	142.67	84.51	0.21
Reach-1	3534	10 YR	479.10	28.83	42.61	32.30	42.61	0.00002	0.74	1547.04	268.01	0.04
Reach-1	3534	25 YR	650.80	28.83	47.26	32.96	47.27	0.00001	0.54	3058.10	375.76	0.02
Reach-1	3534	50 YR	809.90	28.83	52.01	33.89	52.01	0.00000	0.42	5103.81	496.07	0.02
Reach-1	3534	100 YR	997.10	28.83	52.33	34.36	52.33	0.00000	0.51	5263.94	507.72	0.02
Reach-1	3491	2 YR	273.50	28.37	33.98	31.17	34.16	0.00192	3.42	84.71	29.83	0.29
Reach-1	3491	10 YR	551.00	28.37	42.56	32.57	42.60	0.00011	1.71	438.34	229.77	0.08
Reach-1	3491	25 YR	750.70	28.37	47.23	33.37	47.26	0.00007	1.60	635.49	337.99	0.07
Reach-1	3491	50 YR	938.70	28.37	52.01	34.13	52.01	0.00001	0.53	4570.65	457.75	0.02
Reach-1	3491	100 YR	1165.10	28.37	52.33	34.94	52.33	0.00001	0.64	4716.88	477.88	0.02
Reach-1	3423		Culvert									
Reach-1	3336	2 YR	273.50	28.37	31.75	31.03	32.23	0.01024	5.53	49.50	21.32	0.64
Reach-1	3336	10 YR	551.00	28.37	37.75	32.24	37.82	0.00037	2.26	282.01	189.75	0.15
Reach-1	3336	25 YR	750.70	28.37	38.25	32.91	38.37	0.00054	2.86	304.11	194.26	0.18
Reach-1	3336	50 YR	938.70	28.37	38.49	33.61	38.66	0.00076	3.46	314.71	195.97	0.21
Reach-1	3336	100 YR	1165.10	28.37	38.76	34.14	38.99	0.00105	4.15	326.13	197.80	0.25

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3266	2 YR	273.50	26.28	30.48		30.89	0.00687	5.19	53.64	21.71	0.52
Reach-1	3266	10 YR	551.00	26.28	37.77		37.78	0.00009	1.15	779.53	191.67	0.07
Reach-1	3266	25 YR	750.70	26.28	38.29		38.31	0.00012	1.38	881.04	198.45	0.08
Reach-1	3266	50 YR	938.70	26.28	38.55		38.57	0.00016	1.62	933.24	201.86	0.09
Reach-1	3266	100 YR	1165.10	26.28	38.84		38.87	0.00020	1.89	991.82	205.60	0.10
Reach-1	3200	2 YR	273.50	24.19	30.46	26.89	30.59	0.00125	2.89	97.47	25.53	0.23
Reach-1	3200	10 YR	551.00	24.19	37.72	28.27	37.76	0.00016	1.90	442.34	230.15	0.10
Reach-1	3200	25 YR	750.70	24.19	38.27	29.08	38.30	0.00011	1.65	907.98	280.08	0.08
Reach-1	3200	50 YR	938.70	24.19	38.53	29.74	38.56	0.00015	1.92	980.42	284.75	0.09
Reach-1	3200	100 YR	1165.10	24.19	38.81	30.50	38.85	0.00019	2.20	1061.91	289.91	0.11
Reach-1	3156		Culvert									
Reach-1	3114	2 YR	273.50	24.09	29.19	26.81	29.45	0.00327	4.08	67.08	16.34	0.35
Reach-1	3114	10 YR	551.00	24.09	34.52	28.25	34.71	0.00086	3.55	155.73	122.86	0.20
Reach-1	3114	25 YR	750.70	24.09	35.41	29.08	35.50	0.00050	2.82	492.79	139.28	0.16
Reach-1	3114	50 YR	938.70	24.09	35.86	29.77	35.96	0.00059	3.16	555.44	143.37	0.17
Reach-1	3114	100 YR	1165.10	24.09	36.29	30.51	36.41	0.00070	3.53	618.71	147.38	0.19
Reach-1	3049	2 YR	273.50	23.69	29.18		29.26	0.00081	2.24	122.20	30.77	0.19
Reach-1	3049	10 YR	551.00	23.69	34.58		34.62	0.00015	1.66	487.36	110.39	0.10
Reach-1	3049	25 YR	750.70	23.69	35.41		35.46	0.00019	1.99	584.51	122.88	0.11
Reach-1	3049	50 YR	938.70	23.69	35.85		35.92	0.00025	2.33	639.78	129.77	0.13
Reach-1	3049	100 YR	1165.10	23.69	36.27		36.37	0.00033	2.72	696.66	136.49	0.14
Reach-1	2991	2 YR	293.20	23.30	28.87	26.61	29.12	0.00318	4.08	73.34	21.72	0.37
Reach-1	2991	10 YR	599.60	23.30	34.54	28.13	34.60	0.00032	2.32	480.65	130.61	0.13
Reach-1	2991	25 YR	824.40	23.30	35.36	29.01	35.44	0.00039	2.72	619.51	143.37	0.15
Reach-1	2991	50 YR	1032.40	23.30	35.79	29.71	35.89	0.00050	3.16	681.88	149.95	0.17
Reach-1	2991	100 YR	1281.50	23.30	36.20	30.43	36.33	0.00064	3.65	745.08	155.97	0.20
Reach-1	2946		Culvert									
Reach-1	2884	2 YR	293.20	21.91	27.07	25.37	27.41	0.00478	4.69	63.35	20.53	0.45
Reach-1	2884	10 YR	599.60	21.91	28.73	26.86	29.32	0.00557	6.23	103.94	32.09	0.51
Reach-1	2884	25 YR	824.40	21.91	29.49	27.74	30.27	0.00612	7.22	142.59	75.11	0.54
Reach-1	2884	50 YR	1032.40	21.91	30.10	28.42	30.96	0.00615	7.77	191.32	84.97	0.56
Reach-1	2884	100 YR	1281.50	21.91	30.72	29.19	31.64	0.00609	8.25	247.65	95.11	0.56
Reach-1	2718	2 YR	293.20	21.25	26.51		26.74	0.00293	3.84	76.41	19.86	0.34
Reach-1	2718	10 YR	599.60	21.25	28.20		28.52	0.00293	4.73	146.50	62.78	0.36
Reach-1	2718	25 YR	824.40	21.25	29.09		29.39	0.00250	4.83	211.48	84.05	0.34
Reach-1	2718	50 YR	1032.40	21.25	29.80		30.09	0.00212	4.79	276.04	97.83	0.32
Reach-1	2718	100 YR	1281.50	21.25	30.49		30.77	0.00189	4.82	348.49	111.32	0.31
Reach-1	2475	2 YR	293.20	20.31	25.58	23.57	25.90	0.00411	4.55	66.63	19.78	0.40
Reach-1	2475	10 YR	599.60	20.31	26.60	25.10	27.38	0.00764	7.20	97.35	37.39	0.57
Reach-1	2475	25 YR	824.40	20.31	27.08	26.17	28.22	0.01015	8.82	117.01	44.88	0.66
Reach-1	2475	50 YR	1032.40	20.31	27.41	27.01	28.92	0.01265	10.23	133.03	52.85	0.75
Reach-1	2475	100 YR	1281.50	20.31	28.08	28.08	29.69	0.01228	10.83	179.17	79.06	0.75

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	2190	2 YR	293.20	20.06	25.00		25.11	0.00174	3.10	158.37	102.47	0.29
Reach-1	2190	10 YR	599.60	20.06	25.97		26.15	0.00221	4.09	266.75	119.04	0.34
Reach-1	2190	25 YR	824.40	20.06	26.55		26.75	0.00231	4.53	337.28	125.03	0.35
Reach-1	2190	50 YR	1032.40	20.06	27.00		27.22	0.00240	4.88	394.88	129.72	0.36
Reach-1	2190	100 YR	1281.50	20.06	27.48		27.72	0.00251	5.27	457.55	134.64	0.38
Reach-1	2008	2 YR	293.20	20.00	23.22	23.22	24.23	0.02602	8.07	36.34	36.24	1.00
Reach-1	2008	10 YR	599.60	20.00	24.39	24.39	25.22	0.01624	8.10	108.76	68.66	0.83
Reach-1	2008	25 YR	824.40	20.00	24.83	24.83	25.78	0.01642	8.94	141.85	80.39	0.86
Reach-1	2008	50 YR	1032.40	20.00	25.20	25.20	26.23	0.01624	9.53	172.96	90.03	0.87
Reach-1	2008	100 YR	1281.50	20.00	25.57	25.57	26.69	0.01624	10.15	208.56	99.93	0.88
Reach-1	1780	2 YR	293.20	16.24	20.24		20.44	0.00432	4.24	125.97	113.68	0.43
Reach-1	1780	10 YR	599.60	16.24	21.61		21.74	0.00239	4.07	289.01	124.90	0.34
Reach-1	1780	25 YR	824.40	16.24	22.37		22.50	0.00202	4.16	386.95	131.18	0.33
Reach-1	1780	50 YR	1032.40	16.24	22.95		23.09	0.00189	4.33	464.84	135.96	0.32
Reach-1	1780	100 YR	1281.50	16.24	23.53		23.68	0.00185	4.57	544.41	140.26	0.32
Reach-1	1515	2 YR	293.20	14.33	18.48		18.93	0.00798	5.40	55.10	22.89	0.58
Reach-1	1515	10 YR	599.60	14.33	19.94		20.66	0.00743	6.91	100.31	42.88	0.60
Reach-1	1515	25 YR	824.40	14.33	20.91		21.60	0.00583	7.04	170.23	85.04	0.55
Reach-1	1515	50 YR	1032.40	14.33	21.69		22.29	0.00467	6.92	240.37	95.78	0.50
Reach-1	1515	100 YR	1281.50	14.33	22.27		22.89	0.00456	7.28	297.88	103.76	0.50
Reach-1	1274	2 YR	293.20	12.60	17.57		17.78	0.00283	3.82	94.17	46.51	0.36
Reach-1	1274	10 YR	599.60	12.60	19.40		19.64	0.00214	4.38	203.19	69.65	0.33
Reach-1	1274	25 YR	824.40	12.60	20.50		20.74	0.00183	4.59	284.84	80.88	0.32
Reach-1	1274	50 YR	1032.40	12.60	21.28		21.54	0.00175	4.85	352.61	91.69	0.32
Reach-1	1274	100 YR	1281.50	12.60	21.78		22.10	0.00201	5.43	400.29	97.71	0.34
Reach-1	1121	2 YR	293.20	12.55	15.52	15.52	16.69	0.02826	8.68	33.78	14.65	1.01
Reach-1	1121	10 YR	599.60	12.55	17.01	17.01	18.71	0.02653	10.48	57.23	16.99	1.01
Reach-1	1121	25 YR	824.40	12.55	17.89	17.89	19.88	0.02566	11.31	72.88	18.38	1.00
Reach-1	1121	50 YR	1032.40	12.55	19.06	19.06	20.78	0.01746	10.64	110.40	57.82	0.85
Reach-1	1121	100 YR	1281.50	12.55	20.01	20.01	21.39	0.01212	9.98	181.65	83.16	0.73
Reach-1	1031	2 YR	293.20	10.07	14.22		14.66	0.00782	5.35	58.02	31.30	0.57
Reach-1	1031	10 YR	599.60	10.07	15.81		16.31	0.00545	6.04	143.13	77.85	0.51
Reach-1	1031	25 YR	824.40	10.07	16.73		17.15	0.00406	5.94	225.55	93.92	0.46
Reach-1	1031	50 YR	1032.40	10.07	17.34		17.76	0.00370	6.10	284.07	97.42	0.45
Reach-1	1031	100 YR	1281.50	10.07	18.03		18.44	0.00333	6.24	352.69	101.37	0.43
Reach-1	723	2 YR	305.80	7.79	13.18	11.07	13.40	0.00235	3.75	90.32	34.71	0.33
Reach-1	723	10 YR	632.10	7.79	14.69	12.43	15.08	0.00297	5.23	154.39	50.33	0.40
Reach-1	723	25 YR	876.20	7.79	15.49	13.27	16.01	0.00341	6.14	209.27	91.26	0.43
Reach-1	723	50 YR	1101.80	7.79	16.10	13.94	16.65	0.00345	6.57	266.77	98.88	0.44
Reach-1	723	100 YR	1371.10	7.79	16.57	14.62	17.28	0.00411	7.49	319.37	143.63	0.49
Reach-1	426	2 YR	305.80	7.17	12.48	10.46	12.69	0.00243	3.76	104.09	70.64	0.34
Reach-1	426	10 YR	632.10	7.17	14.02	11.88	14.29	0.00235	4.62	232.75	201.63	0.35
Reach-1	426	25 YR	876.20	7.17	14.84	12.92	15.14	0.00238	5.11	351.39	283.51	0.36
Reach-1	426	50 YR	1101.80	7.17	15.58	13.42	15.84	0.00201	5.06	489.04	313.69	0.34

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	426	100 YR	1371.10	7.17	16.07	13.88	16.35	0.00211	5.44	590.70	333.72	0.35
Reach-1	157	2 YR	305.80	6.57	11.89	9.85	12.06	0.00210	3.50	128.09	72.31	0.31
Reach-1	157	10 YR	632.10	6.57	13.43	11.38	13.65	0.00210	4.38	270.97	116.51	0.33
Reach-1	157	25 YR	876.20	6.57	14.25	12.06	14.50	0.00210	4.81	376.76	144.71	0.34
Reach-1	157	50 YR	1101.80	6.57	14.98	12.52	15.26	0.00210	5.18	521.14	275.02	0.35
Reach-1	157	100 YR	1371.10	6.57	15.47	13.08	15.75	0.00210	5.42	664.86	294.68	0.35

HEC-RAS Output for Greens Mill Run North Fork Refined Future Land-Use Conditions

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8786	2 YR	162.80	68.89	74.83	72.66	74.91	0.00086	3.10	153.45	305.11	0.23
Reach-1	8786	10 YR	296.70	68.89	74.82	73.90	75.10	0.00284	5.64	152.80	299.16	0.42
Reach-1	8786	25 YR	384.20	68.89	74.17	74.17	75.37	0.01130	10.37	72.66	57.22	0.81
Reach-1	8786	50 YR	464.30	68.89	74.18	74.18	75.91	0.01639	12.51	72.93	62.10	0.98
Reach-1	8786	100 YR	554.30	68.89	74.78	74.78	75.60	0.00887	9.92	144.61	208.58	0.74
Reach-1	8740		Culvert									
Reach-1	8687	2 YR	162.80	67.66	72.31	71.74	72.56	0.00323	4.70	47.87	37.75	0.40
Reach-1	8687	10 YR	296.70	67.66	72.45	72.45	73.12	0.00859	7.83	52.39	40.42	0.65
Reach-1	8687	25 YR	384.20	67.66	72.75	72.75	73.47	0.00883	8.29	62.86	98.24	0.67
Reach-1	8687	50 YR	464.30	67.66	72.94	72.94	73.77	0.00961	8.87	69.58	128.86	0.70
Reach-1	8687	100 YR	554.30	67.66	73.15	73.15	74.08	0.01019	9.39	76.82	156.87	0.73
Reach-1	8272	2 YR	162.80	67.10	70.48	70.48	70.73	0.00643	5.24	50.20	85.67	0.53
Reach-1	8272	10 YR	296.70	67.10	71.26		71.32	0.00093	2.32	151.12	168.94	0.21
Reach-1	8272	25 YR	384.20	67.10	71.51		71.58	0.00068	2.08	197.20	190.78	0.18
Reach-1	8272	50 YR	464.30	67.10	71.76		71.83	0.00049	1.83	247.78	210.64	0.15
Reach-1	8272	100 YR	554.30	67.10	72.02		72.08	0.00037	1.65	305.25	234.73	0.14
Reach-1	7868	2 YR	162.80	65.21	68.68		68.88	0.00307	3.55	45.81	17.88	0.39
Reach-1	7868	10 YR	296.70	65.21	71.18		71.19	0.00013	1.02	311.85	244.71	0.09
Reach-1	7868	25 YR	384.20	65.21	71.45		71.47	0.00011	0.99	383.03	266.93	0.08
Reach-1	7868	50 YR	464.30	65.21	71.72		71.74	0.00009	0.95	455.31	278.13	0.08
Reach-1	7868	100 YR	554.30	65.21	71.98		72.00	0.00009	0.95	532.24	303.50	0.07
Reach-1	7348	2 YR	162.80	61.03	68.29	63.09	68.31	0.00019	1.24	178.69	97.18	0.09
Reach-1	7348	10 YR	296.70	61.03	71.12	63.97	71.12	0.00004	0.79	637.20	281.58	0.05
Reach-1	7348	25 YR	384.20	61.03	71.39	64.44	71.40	0.00006	0.91	695.67	306.46	0.05
Reach-1	7348	50 YR	464.30	61.03	71.66	64.83	71.67	0.00006	0.99	755.87	333.37	0.06
Reach-1	7348	100 YR	554.30	61.03	71.93	65.22	71.94	0.00007	1.09	820.18	379.44	0.06
Reach-1	6966	2 YR	321.20	59.80	68.16	62.81	68.22	0.00023	2.02	190.54	101.83	0.14
Reach-1	6966	10 YR	607.40	59.80	71.05	64.13	71.08	0.00012	1.85	688.35	302.01	0.11
Reach-1	6966	25 YR	795.70	59.80	71.29	64.82	71.34	0.00017	2.27	746.24	327.95	0.13
Reach-1	6966	50 YR	960.20	59.80	71.54	65.34	71.60	0.00021	2.56	809.73	353.80	0.14
Reach-1	6966	100 YR	1143.50	59.80	71.79	65.91	71.86	0.00025	2.85	877.36	370.79	0.16
Reach-1	6917		Culvert									
Reach-1	6830	2 YR	321.20	59.86	64.63	63.41	65.14	0.00487	5.73	56.63	24.82	0.57
Reach-1	6830	10 YR	607.40	59.86	65.69	64.97	66.55	0.00608	7.67	102.24	140.34	0.66
Reach-1	6830	25 YR	795.70	59.86	66.10	65.88	67.17	0.00694	8.72	129.83	165.00	0.72
Reach-1	6830	50 YR	960.20	59.86	66.85	66.32	67.75	0.00515	8.31	179.89	194.55	0.63
Reach-1	6830	100 YR	1143.50	59.86	68.21	66.70	68.41	0.00130	4.86	608.58	235.38	0.33
Reach-1	6499	2 YR	321.20	59.58	63.92		64.06	0.00174	3.24	163.87	124.50	0.32
Reach-1	6499	10 YR	607.40	59.58	65.54		65.61	0.00076	2.82	428.84	191.19	0.23
Reach-1	6499	25 YR	795.70	59.58	66.06		66.13	0.00071	2.94	531.58	202.36	0.23

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6499	50 YR	960.20	59.58	66.94		66.99	0.00042	2.50	717.30	217.90	0.18
Reach-1	6499	100 YR	1143.50	59.58	68.15		68.18	0.00021	2.00	993.32	238.45	0.13
Reach-1	5998	2 YR	321.20	58.16	63.22		63.36	0.00114	3.01	131.00	59.21	0.27
Reach-1	5998	10 YR	607.40	58.16	65.21		65.29	0.00055	2.75	512.51	300.90	0.20
Reach-1	5998	25 YR	795.70	58.16	65.75		65.83	0.00052	2.85	679.38	312.60	0.20
Reach-1	5998	50 YR	960.20	58.16	66.77		66.81	0.00030	2.38	1008.05	334.45	0.15
Reach-1	5998	100 YR	1143.50	58.16	68.06		68.09	0.00015	1.91	1473.67	388.79	0.11
Reach-1	5499	2 YR	321.20	56.76	63.10		63.12	0.00021	1.55	476.56	240.58	0.11
Reach-1	5499	10 YR	607.40	56.76	65.15		65.16	0.00011	1.42	1035.45	305.78	0.09
Reach-1	5499	25 YR	795.70	56.76	65.68		65.70	0.00013	1.58	1202.93	324.41	0.10
Reach-1	5499	50 YR	960.20	56.76	66.72		66.73	0.00009	1.44	1554.16	351.65	0.08
Reach-1	5499	100 YR	1143.50	56.76	68.03		68.04	0.00006	1.27	2036.53	381.73	0.07
Reach-1	5469	2 YR	321.20	57.01	63.07	59.07	63.11	0.00017	1.71	233.67	182.36	0.13
Reach-1	5469	10 YR	607.40	57.01	65.13	60.00	65.16	0.00011	1.65	881.80	317.45	0.11
Reach-1	5469	25 YR	795.70	57.01	65.66	60.43	65.69	0.00012	1.85	1055.27	354.64	0.11
Reach-1	5469	50 YR	960.20	57.01	66.70	60.76	66.72	0.00008	1.66	1611.59	685.80	0.10
Reach-1	5469	100 YR	1143.50	57.01	68.03	61.09	68.04	0.00004	1.20	2594.04	800.64	0.07
Reach-1	5400		Culvert									
Reach-1	5333	2 YR	321.20	56.33	61.87	58.57	61.92	0.00030	2.02	202.41	214.23	0.16
Reach-1	5333	10 YR	607.40	56.33	64.22	59.49	64.24	0.00010	1.53	1084.58	418.22	0.10
Reach-1	5333	25 YR	795.70	56.33	65.62	60.02	65.64	0.00006	1.31	1707.14	465.41	0.08
Reach-1	5333	50 YR	960.20	56.33	66.71	60.43	66.71	0.00004	1.23	2247.27	534.92	0.07
Reach-1	5333	100 YR	1143.50	56.33	68.02	60.78	68.03	0.00003	1.10	3040.56	681.81	0.06
Reach-1	5149	2 YR	321.20	56.02	61.82		61.85	0.00030	1.76	405.72	249.38	0.14
Reach-1	5149	10 YR	607.40	56.02	64.20		64.21	0.00009	1.23	1148.92	350.78	0.08
Reach-1	5149	25 YR	795.70	56.02	65.62		65.62	0.00004	0.96	1885.65	587.21	0.06
Reach-1	5149	50 YR	960.20	56.02	66.70		66.71	0.00003	0.81	2547.02	630.40	0.04
Reach-1	5149	100 YR	1143.50	56.02	68.02		68.02	0.00002	0.68	3419.58	710.02	0.04
Reach-1	4497	2 YR	321.20	54.69	61.78		61.78	0.00005	0.84	808.96	262.05	0.06
Reach-1	4497	10 YR	607.40	54.69	64.18		64.18	0.00003	0.84	1566.15	370.62	0.05
Reach-1	4497	25 YR	795.70	54.69	65.60		65.60	0.00002	0.82	2183.12	480.84	0.05
Reach-1	4497	50 YR	960.20	54.69	66.69		66.69	0.00002	0.77	2749.35	558.27	0.04
Reach-1	4497	100 YR	1143.50	54.69	68.01		68.01	0.00001	0.69	3539.26	636.31	0.03
Reach-1	4074	2 YR	321.20	53.69	61.77	57.34	61.77	0.00001	0.50	1727.02	559.01	0.03
Reach-1	4074	10 YR	607.40	53.69	64.17	58.48	64.17	0.00001	0.44	3113.87	617.66	0.02
Reach-1	4074	25 YR	795.70	53.69	65.59	58.72	65.60	0.00001	0.42	4046.81	681.32	0.02
Reach-1	4074	50 YR	960.20	53.69	66.69	58.90	66.69	0.00001	0.41	4812.74	722.79	0.02
Reach-1	4074	100 YR	1143.50	53.69	68.01	59.36	68.01	0.00000	0.40	5800.13	773.22	0.02
Reach-1	4027	2 YR	284.40	53.79	61.75	56.82	61.76	0.00006	1.14	575.20	359.95	0.08
Reach-1	4027	10 YR	375.00	53.79	64.16	57.44	64.17	0.00003	0.98	880.50	458.95	0.06
Reach-1	4027	25 YR	413.50	53.79	65.59	57.76	65.59	0.00002	0.89	1061.28	531.12	0.05
Reach-1	4027	50 YR	441.40	53.79	66.68	57.86	66.68	0.00002	0.83	1199.66	596.60	0.04

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4027	100 YR	501.40	53.79	68.01	57.98	68.01	0.00000	0.39	4269.08	710.01	0.02
Reach-1	3919		Culvert									
Reach-1	3894	2 YR	282.60	52.81	57.69	55.88	58.01	0.00238	4.55	62.16	22.28	0.42
Reach-1	3894	10 YR	374.10	52.81	58.19	56.37	58.62	0.00273	5.30	71.51	26.55	0.45
Reach-1	3894	25 YR	412.00	52.81	58.32	56.55	58.82	0.00298	5.65	74.24	27.70	0.48
Reach-1	3894	50 YR	439.60	52.81	58.40	56.68	58.94	0.00319	5.92	75.85	28.36	0.50
Reach-1	3894	100 YR	498.70	52.81	58.55	56.95	59.20	0.00366	6.48	79.09	29.65	0.53
Reach-1	3582	2 YR	282.60	52.39	57.07		57.20	0.00223	3.63	221.12	228.25	0.32
Reach-1	3582	10 YR	374.10	52.39	57.94		57.99	0.00087	2.60	428.88	249.08	0.21
Reach-1	3582	25 YR	412.00	52.39	58.10		58.15	0.00084	2.61	469.39	253.17	0.21
Reach-1	3582	50 YR	439.60	52.39	58.19		58.23	0.00085	2.66	491.28	255.36	0.21
Reach-1	3582	100 YR	498.70	52.39	58.36		58.41	0.00088	2.76	536.06	259.77	0.21
Reach-1	3086	2 YR	284.60	50.43	56.78		56.81	0.00036	1.85	392.16	156.72	0.14
Reach-1	3086	10 YR	377.80	50.43	57.74		57.76	0.00027	1.79	552.42	179.06	0.12
Reach-1	3086	25 YR	416.60	50.43	57.89		57.91	0.00030	1.90	579.45	184.88	0.13
Reach-1	3086	50 YR	444.50	50.43	57.96		57.99	0.00032	1.99	593.01	187.82	0.13
Reach-1	3086	100 YR	504.20	50.43	58.11		58.14	0.00036	2.14	621.66	193.81	0.14
Reach-1	2963	2 YR	284.60	49.39	56.70	52.05	56.76	0.00025	2.04	172.38	153.43	0.14
Reach-1	2963	10 YR	377.80	49.39	57.72	52.49	57.74	0.00010	1.44	539.36	231.71	0.09
Reach-1	2963	25 YR	416.60	49.39	57.87	52.66	57.89	0.00011	1.49	574.12	243.87	0.10
Reach-1	2963	50 YR	444.50	49.39	57.94	52.78	57.96	0.00012	1.55	591.29	254.49	0.10
Reach-1	2963	100 YR	504.20	49.39	58.09	53.04	58.11	0.00013	1.65	627.36	276.41	0.10
Reach-1	2919		Culvert									
Reach-1	2837	2 YR	284.60	49.18	56.03	52.02	56.11	0.00045	2.34	202.46	118.65	0.18
Reach-1	2837	10 YR	377.80	49.18	57.46	52.52	57.50	0.00021	1.88	469.64	241.13	0.13
Reach-1	2837	25 YR	416.60	49.18	57.69	52.71	57.73	0.00021	1.92	526.00	264.44	0.13
Reach-1	2837	50 YR	444.50	49.18	57.78	52.85	57.82	0.00023	1.99	549.75	276.11	0.13
Reach-1	2837	100 YR	504.20	49.18	57.95	53.12	57.99	0.00025	2.12	598.13	297.03	0.14
Reach-1	2497	2 YR	284.60	48.70	56.03		56.04	0.00005	0.80	749.74	271.33	0.05
Reach-1	2497	10 YR	377.80	48.70	57.46		57.46	0.00003	0.70	1203.14	339.26	0.04
Reach-1	2497	25 YR	416.60	48.70	57.68		57.69	0.00003	0.73	1279.76	344.03	0.04
Reach-1	2497	50 YR	444.50	48.70	57.77		57.78	0.00003	0.76	1309.87	345.88	0.05
Reach-1	2497	100 YR	504.20	48.70	57.94		57.94	0.00004	0.82	1367.99	349.43	0.05
Reach-1	1998	2 YR	284.60	48.28	56.00		56.01	0.00004	0.79	729.17	237.72	0.05
Reach-1	1998	10 YR	377.80	48.28	57.44		57.45	0.00003	0.75	1104.72	284.77	0.05
Reach-1	1998	25 YR	416.60	48.28	57.67		57.67	0.00003	0.79	1169.11	292.20	0.05
Reach-1	1998	50 YR	444.50	48.28	57.75		57.76	0.00004	0.83	1194.31	295.06	0.05
Reach-1	1998	100 YR	504.20	48.28	57.92		57.92	0.00004	0.91	1243.13	300.52	0.05
Reach-1	1500	2 YR	284.60	48.00	56.00		56.01	0.00000	0.20	1702.21	424.62	0.01
Reach-1	1500	10 YR	377.80	48.00	57.44		57.44	0.00000	0.22	2358.55	483.21	0.01
Reach-1	1500	25 YR	416.60	48.00	57.67		57.67	0.00000	0.24	2467.17	491.22	0.01

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1500	50 YR	444.50	48.00	57.75		57.75	0.00000	0.25	2509.62	497.43	0.01
Reach-1	1500	100 YR	504.20	48.00	57.92		57.92	0.00000	0.28	2592.06	508.97	0.02
Reach-1	902	2 YR	284.60	47.80	56.00		56.00	0.00000	0.19	1527.52	245.69	0.01
Reach-1	902	10 YR	377.80	47.80	57.44		57.44	0.00000	0.20	1890.64	260.41	0.01
Reach-1	902	25 YR	416.60	47.80	57.67		57.67	0.00000	0.21	1949.07	263.36	0.01
Reach-1	902	50 YR	444.50	47.80	57.75		57.75	0.00000	0.23	1971.71	264.45	0.01
Reach-1	902	100 YR	504.20	47.80	57.92		57.92	0.00000	0.25	2015.18	266.35	0.02
Reach-1	841	2 YR	214.30	47.80	56.00	48.12	56.00	0.00000	0.11	1873.55	287.05	0.01
Reach-1	841	10 YR	377.50	47.80	57.44	48.27	57.44	0.00000	0.17	2295.02	298.77	0.01
Reach-1	841	25 YR	473.40	47.80	57.67	48.34	57.67	0.00000	0.20	2361.95	301.55	0.01
Reach-1	841	50 YR	550.30	47.80	57.75	48.41	57.75	0.00000	0.23	2387.83	302.71	0.01
Reach-1	841	100 YR	758.90	47.80	57.92	48.55	57.92	0.00000	0.31	2437.39	305.06	0.02
Reach-1	723		Culvert									
Reach-1	664	2 YR	214.30	43.18	46.64	46.50	47.76	0.02920	8.47	25.29	9.73	0.93
Reach-1	664	10 YR	377.50	43.18	53.41	47.74	53.43	0.00023	1.64	532.94	188.75	0.10
Reach-1	664	25 YR	473.40	43.18	56.51	48.82	56.51	0.00003	0.71	1421.48	365.71	0.04
Reach-1	664	50 YR	550.00	43.18	56.90	49.26	56.91	0.00004	0.81	1598.24	511.10	0.04
Reach-1	664	100 YR	753.90	43.18	57.27	49.94	57.28	0.00005	0.96	1791.09	529.54	0.05
Reach-1	415	2 YR	214.30	42.21	45.41	44.08	45.57	0.00300	3.24	73.77	42.69	0.36
Reach-1	415	10 YR	377.50	42.21	53.41	44.76	53.41	0.00002	0.64	1600.80	366.89	0.03
Reach-1	415	25 YR	473.40	42.21	56.51	45.11	56.51	0.00001	0.46	3272.92	630.37	0.02
Reach-1	415	50 YR	550.00	42.21	56.90	45.36	56.90	0.00001	0.50	3523.74	655.86	0.02
Reach-1	415	100 YR	753.90	42.21	57.27	45.97	57.27	0.00001	0.64	3773.95	704.42	0.03

H.7 HEC-RAS Output – Primary System Alternative #1

HEC-RAS Output for Greens Mill Run Alternative #1 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	40149	2 year	314.60	63.69	67.48		68.32	0.01671	7.44	46.07	24.11	0.82
Reach-1	40149	10 year	597.30	63.69	70.00		70.61	0.00514	6.54	122.34	41.48	0.51
Reach-1	40149	25 year	798.30	63.69	71.70		71.98	0.00195	4.88	229.26	83.68	0.33
Reach-1	40149	50 year	974.60	63.69	72.20		72.47	0.00179	4.90	277.54	114.08	0.32
Reach-1	40149	100 year	1170.10	63.69	72.54		72.82	0.00168	4.89	318.22	127.80	0.31
Reach-1	39582	2 year	314.60	59.93	65.27	63.41	65.46	0.00218	3.60	96.36	33.19	0.33
Reach-1	39582	10 year	597.30	59.93	69.77	64.37	69.87	0.00043	2.74	326.99	81.06	0.17
Reach-1	39582	25 year	798.30	59.93	71.51	64.96	71.58	0.00028	2.51	538.82	153.99	0.14
Reach-1	39582	50 year	974.60	59.93	71.98	65.41	72.07	0.00031	2.73	620.78	189.99	0.15
Reach-1	39582	100 year	1170.10	59.93	72.29	65.90	72.38	0.00036	3.00	683.21	220.90	0.16
Reach-1	39079	2 year	314.60	57.80	64.80	60.91	64.88	0.00065	2.48	182.46	48.09	0.18
Reach-1	39079	10 year	597.30	57.80	69.68	62.36	69.72	0.00017	1.92	629.09	146.56	0.10
Reach-1	39079	25 year	798.30	57.80	71.45	62.99	71.48	0.00013	1.84	930.71	217.68	0.09
Reach-1	39079	50 year	974.60	57.80	71.91	63.45	71.94	0.00015	2.04	1038.20	288.81	0.10
Reach-1	39079	100 year	1170.10	57.80	72.20	63.93	72.24	0.00019	2.29	1112.03	466.01	0.11
Reach-1	38564	2 year	314.60	57.32	64.57	60.70	64.63	0.00037	2.01	237.34	84.68	0.15
Reach-1	38564	10 year	597.30	57.32	69.65	61.64	69.66	0.00006	1.26	975.11	232.64	0.07
Reach-1	38564	25 year	798.30	57.32	71.42	62.18	71.43	0.00005	1.18	1457.36	318.28	0.06
Reach-1	38564	50 year	974.60	57.32	71.88	62.61	71.90	0.00005	1.30	1609.62	344.43	0.06
Reach-1	38564	100 year	1170.10	57.32	72.17	63.02	72.18	0.00006	1.46	1708.89	357.84	0.07
Reach-1	38205	2 year	314.60	57.08	64.45		64.49	0.00035	1.85	276.48	96.60	0.14
Reach-1	38205	10 year	597.30	57.08	69.64		69.65	0.00002	0.71	1708.42	494.22	0.04
Reach-1	38205	25 year	798.30	57.08	71.42		71.42	0.00001	0.55	2650.49	560.57	0.03
Reach-1	38205	50 year	974.60	57.08	71.88		71.89	0.00001	0.60	2912.06	577.01	0.03
Reach-1	38205	100 year	1170.10	57.08	72.17		72.17	0.00001	0.67	3076.52	585.52	0.03
Reach-1	37950	2 year	640.30	55.91	64.20	60.36	64.33	0.00075	3.12	290.73	190.73	0.21
Reach-1	37950	10 year	1213.50	55.91	69.54	61.59	69.61	0.00023	2.57	732.67	293.12	0.13
Reach-1	37950	25 year	1606.90	55.91	71.39	62.27	71.41	0.00008	1.70	2434.96	520.48	0.08
Reach-1	37950	50 year	1959.90	55.91	71.85	62.83	71.87	0.00010	1.89	2680.09	556.11	0.09
Reach-1	37950	100 year	2351.70	55.91	72.12	63.17	72.15	0.00012	2.15	2834.80	574.09	0.10
Reach-1	37906		Culvert									
Reach-1	37781	2 year	640.30	55.55	62.70	60.36	62.94	0.00194	4.21	187.89	49.43	0.33
Reach-1	37781	10 year	1213.50	55.55	64.03	61.61	64.56	0.00317	6.28	274.22	181.53	0.44
Reach-1	37781	25 year	1606.90	55.55	64.70	62.30	65.24	0.00314	6.69	450.39	199.94	0.44
Reach-1	37781	50 year	1959.90	55.55	65.22	62.87	65.76	0.00309	6.96	557.17	210.42	0.44
Reach-1	37781	100 year	2351.70	55.55	65.75	63.33	66.29	0.00302	7.19	670.73	221.02	0.44
Reach-1	37629	2 year	640.30	54.33	62.43		62.64	0.00129	3.93	256.02	122.90	0.28
Reach-1	37629	10 year	1213.50	54.33	63.83		64.08	0.00145	4.78	527.46	235.91	0.31
Reach-1	37629	25 year	1606.90	54.33	64.49		64.74	0.00144	5.03	689.80	261.45	0.31
Reach-1	37629	50 year	1959.90	54.33	65.00		65.24	0.00140	5.17	830.52	286.31	0.31
Reach-1	37629	100 year	2351.70	54.33	65.49		65.72	0.00135	5.27	975.29	301.41	0.30

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	37026	2 year	640.30	53.42	61.74		61.91	0.00110	3.67	321.83	236.47	0.26
Reach-1	37026	10 year	1213.50	53.42	63.10		63.28	0.00117	4.32	688.30	301.69	0.27
Reach-1	37026	25 year	1606.90	53.42	63.79		63.96	0.00111	4.46	904.50	321.06	0.27
Reach-1	37026	50 year	1959.90	53.42	64.32		64.49	0.00107	4.56	1079.01	335.21	0.27
Reach-1	37026	100 year	2351.70	53.42	64.83		64.99	0.00105	4.68	1253.40	348.78	0.27
Reach-1	36428	2 year	640.30	53.28	61.15		61.24	0.00108	3.80	524.00	216.84	0.25
Reach-1	36428	10 year	1213.50	53.28	62.39		62.50	0.00139	4.81	827.50	281.01	0.29
Reach-1	36428	25 year	1606.90	53.28	63.05		63.18	0.00152	5.29	1023.07	310.97	0.31
Reach-1	36428	50 year	1959.90	53.28	63.57		63.71	0.00159	5.63	1191.34	337.86	0.32
Reach-1	36428	100 year	2351.70	53.28	64.07		64.21	0.00165	5.93	1366.08	359.70	0.33
Reach-1	35806	2 year	640.30	52.98	59.86		60.14	0.00325	5.97	350.25	224.24	0.43
Reach-1	35806	10 year	1213.50	52.98	61.06		61.29	0.00288	6.35	640.82	259.14	0.41
Reach-1	35806	25 year	1606.90	52.98	61.69		61.91	0.00281	6.63	810.91	280.77	0.42
Reach-1	35806	50 year	1959.90	52.98	62.20		62.42	0.00274	6.83	958.06	298.21	0.41
Reach-1	35806	100 year	2351.70	52.98	62.68		62.90	0.00274	7.08	1105.02	314.67	0.42
Reach-1	35433	2 year	640.30	52.37	59.28		59.36	0.00129	3.77	555.64	258.32	0.27
Reach-1	35433	10 year	1213.50	52.37	60.42		60.51	0.00146	4.50	878.62	303.16	0.29
Reach-1	35433	25 year	1606.90	52.37	61.04		61.13	0.00148	4.79	1073.21	320.05	0.30
Reach-1	35433	50 year	1959.90	52.37	61.55		61.65	0.00147	4.99	1240.09	330.82	0.30
Reach-1	35433	100 year	2351.70	52.37	62.02		62.12	0.00152	5.26	1395.92	340.57	0.31
Reach-1	35029	2 year	640.30	52.36	58.77	57.00	58.83	0.00128	3.55	580.08	255.65	0.26
Reach-1	35029	10 year	1213.50	52.36	59.81	57.97	59.89	0.00158	4.42	861.82	287.90	0.30
Reach-1	35029	25 year	1606.90	52.36	60.41	58.26	60.50	0.00168	4.83	1039.43	321.10	0.32
Reach-1	35029	50 year	1959.90	52.36	60.89	58.49	60.99	0.00182	5.25	1205.79	357.61	0.33
Reach-1	35029	100 year	2351.70	52.36	61.35	58.72	61.46	0.00177	5.39	1378.14	379.28	0.33
Reach-1	34653	2 year	640.30	51.50	58.04		58.19	0.00235	4.89	478.08	296.21	0.36
Reach-1	34653	10 year	1213.50	51.50	59.06		59.18	0.00224	5.32	789.87	319.54	0.36
Reach-1	34653	25 year	1606.90	51.50	59.67		59.79	0.00209	5.44	990.42	331.83	0.35
Reach-1	34653	50 year	1959.90	51.50	60.14		60.26	0.00203	5.60	1149.38	341.17	0.35
Reach-1	34653	100 year	2351.70	51.50	60.63		60.75	0.00198	5.76	1317.66	350.78	0.35
Reach-1	34229	2 year	640.30	50.64	56.71		56.94	0.00373	5.82	357.62	208.06	0.45
Reach-1	34229	10 year	1213.50	50.64	57.73		57.96	0.00381	6.62	578.75	225.86	0.47
Reach-1	34229	25 year	1606.90	50.64	58.51		58.71	0.00316	6.51	760.58	239.50	0.43
Reach-1	34229	50 year	1959.90	50.64	58.99		59.19	0.00317	6.82	876.40	247.80	0.44
Reach-1	34229	100 year	2351.70	50.64	59.48		59.69	0.00319	7.13	1000.15	259.61	0.44
Reach-1	33851	2 year	640.30	49.12	55.54		55.74	0.00271	4.47	335.95	243.25	0.34
Reach-1	33851	10 year	1213.50	49.12	56.82		56.95	0.00187	4.30	691.99	295.96	0.30
Reach-1	33851	25 year	1606.90	49.12	57.94		58.02	0.00108	3.64	1042.66	327.87	0.23
Reach-1	33851	50 year	1959.90	49.12	58.42		58.50	0.00108	3.79	1203.03	343.08	0.23
Reach-1	33851	100 year	2351.70	49.12	58.92		59.01	0.00106	3.91	1379.01	362.33	0.23
Reach-1	33371	2 year	640.30	47.87	55.12		55.16	0.00060	2.33	604.54	290.44	0.17
Reach-1	33371	10 year	1213.50	47.87	56.46		56.50	0.00053	2.49	1007.86	310.86	0.16

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	33371	25 year	1606.90	47.87	57.71		57.74	0.00035	2.24	1406.93	327.22	0.13
Reach-1	33371	50 year	1959.90	47.87	58.17		58.20	0.00038	2.43	1558.92	332.57	0.14
Reach-1	33371	100 year	2351.70	47.87	58.65		58.70	0.00041	2.61	1722.00	338.21	0.15
Reach-1	32869	2 year	710.10	47.75	54.35		54.39	0.00084	2.61	696.81	274.20	0.20
Reach-1	32869	10 year	1459.70	47.75	55.82		55.88	0.00093	3.22	1123.24	301.68	0.22
Reach-1	32869	25 year	1986.00	47.75	57.36		57.40	0.00061	2.99	1604.11	324.26	0.18
Reach-1	32869	50 year	2458.30	47.75	57.78		57.84	0.00074	3.39	1743.66	329.25	0.20
Reach-1	32869	100 year	2986.30	47.75	58.25		58.32	0.00086	3.79	1898.13	338.72	0.22
Reach-1	32724	2 year	710.10	47.24	54.23		54.27	0.00074	2.50	732.72	287.14	0.18
Reach-1	32724	10 year	1459.70	47.24	55.69		55.74	0.00089	3.19	1187.48	337.85	0.21
Reach-1	32724	25 year	1986.00	47.24	57.28		57.32	0.00055	2.85	1773.54	407.12	0.17
Reach-1	32724	50 year	2458.30	47.24	57.69		57.74	0.00065	3.19	1952.84	474.35	0.18
Reach-1	32724	100 year	2986.30	47.24	58.14		58.20	0.00072	3.48	2172.88	488.49	0.20
Reach-1	32350	2 year	710.10	47.01	54.02		54.05	0.00050	2.13	935.73	410.91	0.16
Reach-1	32350	10 year	1459.70	47.01	55.45		55.48	0.00055	2.60	1567.87	476.72	0.17
Reach-1	32350	25 year	1986.00	47.01	57.14		57.16	0.00032	2.28	2511.84	617.49	0.14
Reach-1	32350	50 year	2458.30	47.01	57.52		57.55	0.00038	2.56	2753.57	632.21	0.15
Reach-1	32350	100 year	2986.30	47.01	57.95		57.99	0.00043	2.82	3030.40	648.65	0.16
Reach-1	31977	2 year	710.10	46.91	51.44	51.44	53.31	0.02110	10.99	65.15	18.03	1.00
Reach-1	31977	10 year	1459.70	46.91	55.00	53.35	55.11	0.00128	4.22	1083.87	407.83	0.28
Reach-1	31977	25 year	1986.00	46.91	56.94	53.74	56.98	0.00049	3.07	1916.04	523.56	0.18
Reach-1	31977	50 year	2458.30	46.91	57.29	54.00	57.35	0.00060	3.48	2069.35	541.00	0.20
Reach-1	31977	100 year	2986.30	46.91	57.69	54.26	57.76	0.00070	3.85	2246.55	555.49	0.21
Reach-1	31511	2 year	710.10	43.55	51.45	48.47	51.52	0.00081	2.89	687.37	367.80	0.20
Reach-1	31511	10 year	1459.70	43.55	54.89	50.61	54.90	0.00018	1.80	2311.63	588.20	0.10
Reach-1	31511	25 year	1986.00	43.55	56.87	51.07	56.88	0.00011	1.60	3350.60	638.02	0.08
Reach-1	31511	50 year	2458.30	43.55	57.19	51.36	57.21	0.00015	1.87	3527.57	643.26	0.09
Reach-1	31511	100 year	2986.30	43.55	57.57	51.66	57.59	0.00018	2.12	3734.97	650.70	0.10
Reach-1	30960	2 year	710.10	43.11	50.85		50.96	0.00128	3.57	494.02	237.84	0.25
Reach-1	30960	10 year	1459.70	43.11	54.77		54.79	0.00022	2.03	1841.98	461.32	0.11
Reach-1	30960	25 year	1986.00	43.11	56.80		56.81	0.00012	1.68	2799.47	483.31	0.08
Reach-1	30960	50 year	2458.30	43.11	57.11		57.12	0.00016	1.96	2948.33	489.16	0.10
Reach-1	30960	100 year	2986.30	43.11	57.46		57.49	0.00020	2.23	3124.90	496.02	0.11
Reach-1	30467	2 year	710.10	42.80	50.52	47.78	50.57	0.00052	2.55	754.14	263.68	0.17
Reach-1	30467	10 year	1459.70	42.80	54.68	48.96	54.70	0.00015	1.89	2182.17	433.14	0.10
Reach-1	30467	25 year	1986.00	42.80	56.74	49.41	56.76	0.00011	1.77	2995.74	497.67	0.09
Reach-1	30467	50 year	2458.30	42.80	57.03	49.76	57.05	0.00015	2.10	3108.98	505.28	0.10
Reach-1	30467	100 year	2986.30	42.80	57.37	50.07	57.39	0.00019	2.43	3242.24	517.15	0.11
Reach-1	30096	2 year	710.10	42.60	50.44	47.50	50.45	0.00014	1.39	1530.60	527.73	0.09
Reach-1	30096	10 year	1459.70	42.60	54.67	48.12	54.67	0.00004	0.95	4274.54	700.00	0.05
Reach-1	30096	25 year	1986.00	42.60	56.73	48.42	56.74	0.00003	0.91	5720.04	700.00	0.04
Reach-1	30096	50 year	2458.30	42.60	57.02	48.64	57.02	0.00004	1.09	5918.11	700.00	0.05
Reach-1	30096	100 year	2986.30	42.60	57.35	48.87	57.36	0.00005	1.26	6151.50	700.00	0.06

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Reach-1	29957	2 year	972.60	42.45	50.14	45.87	50.33	0.00116	3.51	295.04	75.03	0.25
Reach-1	29957	10 year	1954.50	42.45	54.39	47.89	54.59	0.00065	3.76	646.47	499.01	0.21
Reach-1	29957	25 year	2631.60	42.45	56.68	48.88	56.72	0.00016	2.16	2892.43	698.59	0.11
Reach-1	29957	50 year	3189.30	42.45	56.95	49.55	56.99	0.00021	2.47	3084.30	734.82	0.12
Reach-1	29957	100 year	3959.10	42.45	57.26	50.56	57.32	0.00027	2.86	3319.63	774.02	0.14
Reach-1	29893		Culvert									
Reach-1	29791	2 year	929.50	42.61	48.62	45.91	48.93	0.00272	4.50	209.03	53.39	0.37
Reach-1	29791	10 year	1860.00	42.61	50.31	47.79	50.94	0.00360	6.40	326.44	89.68	0.45
Reach-1	29791	25 year	2508.10	42.61	51.13	48.69	51.95	0.00413	7.45	466.43	258.64	0.50
Reach-1	29791	50 year	3049.10	42.61	51.16	49.39	52.36	0.00600	9.00	474.20	270.06	0.60
Reach-1	29791	100 year	3783.90	42.61	51.63	50.31	53.04	0.00677	9.99	612.16	311.26	0.64
Reach-1	29540	2 year	929.50	41.90	47.31	45.23	47.78	0.00480	5.50	169.10	376.72	0.48
Reach-1	29540	10 year	1860.00	41.90	48.81	47.18	49.01	0.00250	4.65	917.34	435.98	0.36
Reach-1	29540	25 year	2508.10	41.90	49.72	48.17	49.88	0.00184	4.44	1346.56	504.59	0.32
Reach-1	29540	50 year	3049.10	41.90	50.32	48.40	50.48	0.00162	4.44	1656.74	523.04	0.30
Reach-1	29540	100 year	3783.90	41.90	50.96	48.71	51.11	0.00154	4.61	1993.28	540.98	0.30
Reach-1	29096	2 year	929.50	40.50	46.75		46.76	0.00022	1.53	1444.09	386.64	0.11
Reach-1	29096	10 year	1860.00	40.50	48.49		48.51	0.00025	1.99	2141.96	412.79	0.13
Reach-1	29096	25 year	2508.10	40.50	49.47		49.49	0.00027	2.22	2551.62	427.39	0.14
Reach-1	29096	50 year	3049.10	40.50	50.08		50.11	0.00029	2.42	2816.74	436.58	0.14
Reach-1	29096	100 year	3783.90	40.50	50.71		50.74	0.00033	2.71	3091.96	445.92	0.16
Reach-1	28576	2 year	929.50	40.70	46.34		46.41	0.00168	3.51	787.81	409.94	0.28
Reach-1	28576	10 year	1860.00	40.70	48.20		48.24	0.00086	3.12	1603.79	468.83	0.21
Reach-1	28576	25 year	2508.10	40.70	49.20		49.24	0.00070	3.09	2090.77	500.00	0.20
Reach-1	28576	50 year	3049.10	40.70	49.82		49.86	0.00067	3.19	2403.15	519.01	0.20
Reach-1	28576	100 year	3783.90	40.70	50.42		50.47	0.00070	3.43	2721.86	537.71	0.20
Reach-1	28320	2 year	929.50	40.42	46.08		46.10	0.00052	2.04	1065.57	457.33	0.16
Reach-1	28320	10 year	1860.00	40.42	48.07		48.09	0.00026	1.81	2048.46	515.98	0.12
Reach-1	28320	25 year	2508.10	40.42	49.10		49.12	0.00022	1.83	2589.11	534.75	0.12
Reach-1	28320	50 year	3049.10	40.42	49.72		49.74	0.00022	1.93	2923.70	550.27	0.12
Reach-1	28320	100 year	3783.90	40.42	50.31		50.34	0.00024	2.12	3257.01	566.01	0.12
Reach-1	28096	2 year	929.50	40.57	45.71		45.78	0.00225	3.84	725.88	406.54	0.32
Reach-1	28096	10 year	1860.00	40.57	47.93		47.96	0.00076	2.92	1723.04	486.30	0.20
Reach-1	28096	25 year	2508.10	40.57	48.98		49.02	0.00061	2.90	2253.05	516.72	0.18
Reach-1	28096	50 year	3049.10	40.57	49.60		49.64	0.00060	3.03	2578.72	534.55	0.19
Reach-1	28096	100 year	3783.90	40.57	50.19		50.23	0.00065	3.29	2898.97	551.52	0.19
Reach-1	27712	2 year	929.50	39.40	44.65		44.71	0.00125	3.16	748.76	342.73	0.26
Reach-1	27712	10 year	1860.00	39.40	47.74		47.76	0.00024	1.95	2211.08	626.01	0.12
Reach-1	27712	25 year	2508.10	39.40	48.84		48.86	0.00018	1.85	2925.05	671.69	0.11
Reach-1	27712	50 year	3049.10	39.40	49.47		49.48	0.00017	1.90	3353.19	697.65	0.11
Reach-1	27712	100 year	3783.90	39.40	50.05		50.07	0.00019	2.04	3765.49	721.77	0.11

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Reach-1	27096	2 year	998.90	38.50	44.32		44.34	0.00035	1.89	1174.88	406.40	0.14
Reach-1	27096	10 year	2020.40	38.50	47.64		47.66	0.00012	1.52	2709.29	509.07	0.09
Reach-1	27096	25 year	2754.20	38.50	48.75		48.77	0.00012	1.67	3290.57	540.50	0.09
Reach-1	27096	50 year	3380.20	38.50	49.37		49.39	0.00014	1.83	3629.88	554.03	0.10
Reach-1	27096	100 year	4190.10	38.50	49.94		49.96	0.00016	2.07	3947.52	566.40	0.11
Reach-1	26596	2 year	998.90	38.20	44.14		44.16	0.00035	1.92	1137.88	380.55	0.15
Reach-1	26596	10 year	2020.40	38.20	47.58		47.59	0.00014	1.67	2692.47	523.56	0.10
Reach-1	26596	25 year	2754.20	38.20	48.68		48.70	0.00015	1.86	3289.89	555.71	0.10
Reach-1	26596	50 year	3380.20	38.20	49.29		49.31	0.00017	2.07	3634.38	571.48	0.11
Reach-1	26596	100 year	4190.10	38.20	49.84		49.87	0.00020	2.36	3953.38	585.71	0.12
Reach-1	26096	2 year	1338.10	37.70	43.94		43.96	0.00043	2.24	1487.99	428.90	0.16
Reach-1	26096	10 year	2797.30	37.70	47.48		47.50	0.00022	2.19	3182.41	665.92	0.13
Reach-1	26096	25 year	3901.60	37.70	48.58		48.60	0.00023	2.41	4055.37	867.33	0.13
Reach-1	26096	50 year	4901.00	37.70	49.18		49.21	0.00025	2.63	4578.66	879.19	0.14
Reach-1	26096	100 year	6092.30	37.70	49.71		49.75	0.00028	2.89	5049.97	889.74	0.15
Reach-1	25735	2 year	1338.10	37.20	43.71		43.77	0.00065	2.76	1178.80	414.50	0.19
Reach-1	25735	10 year	2797.30	37.20	47.38		47.41	0.00027	2.40	2805.56	574.82	0.13
Reach-1	25735	25 year	3901.60	37.20	48.47		48.51	0.00028	2.62	3748.51	1040.04	0.14
Reach-1	25735	50 year	4901.00	37.20	49.07		49.11	0.00029	2.78	4375.96	1072.41	0.14
Reach-1	25735	100 year	6092.30	37.20	49.59		49.64	0.00032	3.00	4944.74	1101.63	0.15
Reach-1	25660	2 year	1338.10	37.51	43.26	41.27	43.60	0.00271	5.20	461.85	219.12	0.39
Reach-1	25660	10 year	2797.30	37.51	47.31	43.38	47.38	0.00046	3.08	2019.90	695.14	0.17
Reach-1	25660	25 year	3901.60	37.51	48.44	44.23	48.49	0.00035	2.90	3083.49	938.98	0.16
Reach-1	25660	50 year	4901.00	37.51	49.03	45.27	49.08	0.00035	2.98	3579.99	956.84	0.16
Reach-1	25660	100 year	6092.30	37.51	49.56	45.70	49.61	0.00035	3.09	4408.05	972.62	0.16
Reach-1	25570		Culvert									
Reach-1	25462	2 year	1319.00	36.52	42.27	40.54	42.71	0.00349	5.73	364.27	182.18	0.44
Reach-1	25462	10 year	2761.10	36.52	44.30	42.81	44.68	0.00264	6.19	879.55	403.29	0.40
Reach-1	25462	25 year	3865.20	36.52	45.96	43.73	46.22	0.00155	5.44	1379.25	615.55	0.32
Reach-1	25462	50 year	4865.00	36.52	46.91	44.24	47.16	0.00141	5.56	1663.61	701.22	0.31
Reach-1	25462	100 year	6056.00	36.52	47.73	44.70	47.85	0.00077	4.33	3132.09	931.88	0.23
Reach-1	25096	2 year	1319.00	36.20	41.67		41.71	0.00061	2.42	1127.55	511.08	0.19
Reach-1	25096	10 year	2761.10	36.20	44.04		44.08	0.00031	2.19	2478.76	651.46	0.14
Reach-1	25096	25 year	3865.20	36.20	45.84		45.87	0.00019	1.96	3701.57	705.08	0.11
Reach-1	25096	50 year	4865.00	36.20	46.82		46.85	0.00017	2.02	4406.03	734.20	0.11
Reach-1	25096	100 year	6056.00	36.20	47.60		47.63	0.00019	2.19	4983.78	763.14	0.12
Reach-1	24596	2 year	1319.00	35.80	41.38		41.42	0.00056	2.35	1145.58	473.87	0.18
Reach-1	24596	10 year	2761.10	35.80	43.90		43.93	0.00027	2.10	2600.81	717.85	0.13
Reach-1	24596	25 year	3865.20	35.80	45.77		45.79	0.00014	1.73	4003.05	784.47	0.10
Reach-1	24596	50 year	4865.00	35.80	46.76		46.78	0.00013	1.76	4795.05	824.99	0.09
Reach-1	24596	100 year	6056.00	35.80	47.53		47.55	0.00013	1.88	5442.69	854.82	0.10
Reach-1	24096	2 year	1319.00	34.72	41.00		41.08	0.00078	2.93	756.63	359.77	0.21

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	24096	10 year	2761.10	34.72	43.75		43.80	0.00026	2.16	1938.56	518.51	0.13
Reach-1	24096	25 year	3865.20	34.72	45.68		45.72	0.00015	1.85	3070.08	681.22	0.10
Reach-1	24096	50 year	4865.00	34.72	46.68		46.71	0.00013	1.86	3788.81	766.94	0.10
Reach-1	24096	100 year	6056.00	34.72	47.44		47.48	0.00014	1.98	4402.72	833.05	0.10
Reach-1	23596	2 year	1364.90	33.57	40.58		40.68	0.00082	2.94	761.27	266.29	0.22
Reach-1	23596	10 year	2854.70	33.57	43.56		43.63	0.00041	2.78	1969.28	538.11	0.17
Reach-1	23596	25 year	4001.20	33.57	45.59		45.63	0.00022	2.33	3187.37	647.69	0.13
Reach-1	23596	50 year	5046.10	33.57	46.59		46.63	0.00019	2.35	3856.75	687.15	0.12
Reach-1	23596	100 year	6284.50	33.57	47.35		47.40	0.00021	2.52	4397.34	730.17	0.13
Reach-1	22990	2 year	1364.90	33.30	40.19		40.24	0.00039	2.19	1019.46	336.88	0.16
Reach-1	22990	10 year	2854.70	33.30	43.43		43.46	0.00011	1.51	2643.06	620.93	0.09
Reach-1	22990	25 year	4001.20	33.30	45.52		45.54	0.00006	1.29	4090.45	783.08	0.07
Reach-1	22990	50 year	5046.10	33.30	46.52		46.55	0.00005	1.25	4899.92	823.78	0.06
Reach-1	22990	100 year	6284.50	33.30	47.28		47.32	0.00005	1.32	5538.36	864.58	0.06
Reach-1	22893	2 year	1364.90	32.81	40.07	36.01	40.18	0.00064	2.87	704.93	300.94	0.20
Reach-1	22893	10 year	2854.70	32.81	43.27	38.06	43.41	0.00054	3.46	1306.86	482.95	0.20
Reach-1	22893	25 year	4001.20	32.81	45.45	38.93	45.52	0.00028	2.86	3262.70	700.72	0.15
Reach-1	22893	50 year	5046.10	32.81	46.45	39.60	46.53	0.00029	3.10	4023.30	796.61	0.15
Reach-1	22893	100 year	6284.50	32.81	47.20	40.26	47.29	0.00033	3.40	4642.47	850.42	0.16
Reach-1	22812		Culvert									
Reach-1	22704	2 year	1363.80	33.39	39.38	36.67	39.53	0.00121	3.44	640.49	275.07	0.27
Reach-1	22704	10 year	2857.10	33.39	41.54	38.52	41.74	0.00115	4.25	1179.99	371.08	0.28
Reach-1	22704	25 year	4007.00	33.39	43.13	39.25	43.30	0.00089	4.27	2024.90	479.86	0.25
Reach-1	22704	50 year	5055.80	33.39	44.29	39.80	44.46	0.00077	4.32	2617.61	531.05	0.24
Reach-1	22704	100 year	6299.40	33.39	45.55	40.35	45.72	0.00072	4.50	3368.00	720.57	0.24
Reach-1	22383	2 year	1363.80	32.90	39.16		39.22	0.00061	2.51	1057.25	375.46	0.19
Reach-1	22383	10 year	2857.10	32.90	41.37		41.44	0.00052	2.93	1927.69	413.45	0.19
Reach-1	22383	25 year	4007.00	32.90	42.99		43.06	0.00044	3.05	2621.67	447.76	0.18
Reach-1	22383	50 year	5055.80	32.90	44.16		44.24	0.00041	3.21	3161.66	468.69	0.18
Reach-1	22383	100 year	6299.40	32.90	45.43		45.51	0.00039	3.38	3768.32	491.15	0.18
Reach-1	22096	2 year	1363.80	32.71	38.89		38.99	0.00104	3.04	950.14	608.44	0.24
Reach-1	22096	10 year	2857.10	32.71	41.23		41.29	0.00047	2.67	2587.70	781.59	0.18
Reach-1	22096	25 year	4007.00	32.71	42.90		42.94	0.00030	2.46	3942.34	841.99	0.15
Reach-1	22096	50 year	5055.80	32.71	44.10		44.13	0.00025	2.45	4973.49	878.95	0.14
Reach-1	22096	100 year	6299.40	32.71	45.38		45.41	0.00022	2.47	6117.33	910.98	0.13
Reach-1	21638	2 year	1381.50	32.63	38.68	36.13	38.70	0.00036	1.89	1494.45	612.41	0.15
Reach-1	21638	10 year	2893.20	32.63	41.09	36.82	41.12	0.00027	2.08	2851.31	656.04	0.13
Reach-1	21638	25 year	4060.50	32.63	42.79	37.21	42.82	0.00022	2.15	3826.55	733.91	0.12
Reach-1	21638	50 year	5127.40	32.63	44.00	37.52	44.03	0.00021	2.29	4528.00	847.24	0.12
Reach-1	21638	100 year	6390.40	32.63	45.28	37.86	45.31	0.00020	2.43	5288.16	926.54	0.13
Reach-1	21373	2 year	1371.30	32.80	38.50	36.45	38.56	0.00075	2.59	935.02	460.39	0.21
Reach-1	21373	10 year	2863.10	32.80	40.95	37.26	41.02	0.00051	2.80	1870.71	726.04	0.18

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	21373	25 year	4020.90	32.80	42.67	37.71	42.74	0.00040	2.86	2558.99	816.07	0.17
Reach-1	21373	50 year	5083.30	32.80	43.88	38.09	43.95	0.00038	3.03	3040.30	990.11	0.17
Reach-1	21373	100 year	6343.90	32.80	45.16	38.49	45.23	0.00036	3.21	3552.15	1038.32	0.17
Reach-1	21303		Bridge									
Reach-1	21198	2 year	1370.40	32.74	37.20	36.36	37.44	0.00350	4.57	551.68	395.93	0.43
Reach-1	21198	10 year	2860.10	32.74	39.40	37.25	39.59	0.00185	4.58	1230.75	607.78	0.34
Reach-1	21198	25 year	4016.50	32.74	41.16	37.77	41.31	0.00112	4.26	1935.07	745.23	0.27
Reach-1	21198	50 year	5078.10	32.74	42.04	38.18	42.20	0.00111	4.57	2286.49	787.98	0.28
Reach-1	21198	100 year	6337.50	32.74	42.81	38.63	43.01	0.00119	5.02	2595.18	836.04	0.29
Reach-1	20751	2 year	1370.40	30.58	36.15	34.09	36.35	0.00178	3.91	529.62	210.39	0.32
Reach-1	20751	10 year	2860.10	30.58	38.83	35.38	38.99	0.00099	3.96	1390.09	309.95	0.26
Reach-1	20751	25 year	4016.50	30.58	40.74	36.12	40.90	0.00079	4.11	2106.53	425.74	0.24
Reach-1	20751	50 year	5078.10	30.58	41.59	36.60	41.77	0.00085	4.52	2482.83	456.71	0.25
Reach-1	20751	100 year	6337.50	30.58	42.32	37.16	42.53	0.00095	5.02	2822.71	483.00	0.27
Reach-1	20596	2 year	1370.40	29.93	35.98		36.11	0.00111	3.30	712.89	229.03	0.26
Reach-1	20596	10 year	2860.10	29.93	38.70		38.85	0.00082	3.76	1554.77	380.02	0.24
Reach-1	20596	25 year	4016.50	29.93	40.66		40.78	0.00059	3.70	2412.39	485.83	0.21
Reach-1	20596	50 year	5078.10	29.93	41.51		41.65	0.00062	4.02	2839.65	510.98	0.22
Reach-1	20596	100 year	6337.50	29.93	42.23		42.39	0.00070	4.45	3210.75	524.99	0.23
Reach-1	20096	2 year	1391.70	28.00	35.74		35.78	0.00027	1.97	1560.41	481.05	0.13
Reach-1	20096	10 year	2905.40	28.00	38.56		38.60	0.00020	2.14	3001.05	535.10	0.12
Reach-1	20096	25 year	4080.10	28.00	40.57		40.60	0.00016	2.15	4102.07	563.60	0.11
Reach-1	20096	50 year	5160.50	28.00	41.41		41.45	0.00018	2.42	4583.13	576.54	0.12
Reach-1	20096	100 year	6439.40	28.00	42.11		42.16	0.00022	2.75	4989.26	587.25	0.13
Reach-1	19506	2 year	1391.70	27.60	35.41	31.45	35.53	0.00070	3.04	673.22	170.69	0.21
Reach-1	19506	10 year	2905.40	27.60	38.18	33.27	38.37	0.00075	3.99	1221.95	226.64	0.23
Reach-1	19506	25 year	4080.10	27.60	40.20	34.17	40.41	0.00068	4.34	1745.51	320.80	0.23
Reach-1	19506	50 year	5160.50	27.60	40.86	34.88	41.21	0.00100	5.46	2021.15	481.09	0.28
Reach-1	19506	100 year	6439.40	27.60	41.42	35.63	41.86	0.00124	6.28	2300.04	546.94	0.31
Reach-1	19396	2 year	1391.70	27.56	35.07	31.88	35.36	0.00184	4.35	345.93	87.57	0.33
Reach-1	19396	10 year	2905.40	27.56	37.63	33.85	38.15	0.00216	5.91	571.95	219.31	0.37
Reach-1	19396	25 year	4080.10	27.56	39.89	35.09	40.26	0.00131	5.46	1368.56	390.62	0.30
Reach-1	19396	50 year	5160.50	27.56	40.54	36.00	41.03	0.00163	6.33	1664.68	552.80	0.34
Reach-1	19396	100 year	6439.40	27.56	40.99	37.01	41.63	0.00207	7.34	1928.93	604.33	0.39
Reach-1	19365		Culvert									
Reach-1	19096	2 year	1395.40	27.02	34.58	30.88	34.78	0.00108	3.68	437.09	107.92	0.26
Reach-1	19096	10 year	2913.20	27.02	36.11	32.68	36.60	0.00203	5.84	622.57	135.26	0.37
Reach-1	19096	25 year	4091.20	27.02	36.76	33.86	37.52	0.00290	7.37	714.99	150.17	0.45
Reach-1	19096	50 year	5174.70	27.02	37.26	34.85	38.27	0.00362	8.56	796.03	172.35	0.51
Reach-1	19096	100 year	6456.90	27.02	37.84	35.86	39.09	0.00427	9.69	902.74	198.75	0.56
Reach-1	18614	2 year	1395.40	25.92	33.83		33.89	0.00101	3.19	1388.52	733.24	0.22

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	18614	10 year	2913.20	25.92	35.31		35.36	0.00084	3.34	2496.51	758.05	0.21
Reach-1	18614	25 year	4091.20	25.92	35.85		35.92	0.00105	3.90	2908.51	765.06	0.24
Reach-1	18614	50 year	5174.70	25.92	36.30		36.38	0.00118	4.29	3255.79	771.07	0.25
Reach-1	18614	100 year	6456.90	25.92	37.02		37.10	0.00113	4.41	3811.76	780.60	0.25
Reach-1	18538	2 year	1395.40	25.74	33.55	29.12	33.77	0.00094	3.82	399.17	505.32	0.25
Reach-1	18538	10 year	2913.20	25.74	35.28	30.95	35.31	0.00025	2.25	2606.89	822.97	0.13
Reach-1	18538	25 year	4091.20	25.74	35.81	32.13	35.85	0.00032	2.65	3065.35	900.67	0.15
Reach-1	18538	50 year	5174.70	25.74	36.26	33.12	36.31	0.00035	2.89	3482.45	955.65	0.16
Reach-1	18538	100 year	6456.90	25.74	36.98	33.90	37.03	0.00031	2.85	4193.30	1002.38	0.15
Reach-1	18506		Culvert									
Reach-1	18283	2 year	1395.40	26.30	32.50	32.50	33.33	0.01044	8.45	333.95	371.89	0.72
Reach-1	18283	10 year	2913.20	26.30	34.14	33.27	34.30	0.00228	4.80	1196.01	561.11	0.35
Reach-1	18283	25 year	4091.20	26.30	35.13	33.49	35.26	0.00151	4.34	1827.78	750.54	0.29
Reach-1	18283	50 year	5174.70	26.30	35.99	33.76	36.09	0.00103	3.88	2540.34	906.16	0.25
Reach-1	18283	100 year	6456.90	26.30	36.90	34.05	36.99	0.00066	3.36	3417.78	997.78	0.20
Reach-1	18096	2 year	1395.40	24.99	32.01	28.38	32.14	0.00083	3.02	602.08	215.84	0.22
Reach-1	18096	10 year	2913.20	24.99	33.83	30.22	34.02	0.00099	3.98	1025.62	406.50	0.26
Reach-1	18096	25 year	4091.20	24.99	34.79	31.30	35.01	0.00101	4.37	1392.79	637.99	0.27
Reach-1	18096	50 year	5174.70	24.99	35.70	32.17	35.89	0.00086	4.31	1834.37	1041.77	0.25
Reach-1	18096	100 year	6456.90	24.99	36.67	32.76	36.84	0.00070	4.15	2323.09	1176.65	0.23
Reach-1	17596	2 year	1449.20	25.12	31.66		31.71	0.00079	2.91	1199.40	414.20	0.22
Reach-1	17596	10 year	3013.20	25.12	33.52		33.58	0.00067	3.24	2063.99	545.92	0.21
Reach-1	17596	25 year	4217.00	25.12	34.52		34.58	0.00062	3.38	2642.85	601.17	0.21
Reach-1	17596	50 year	5337.50	25.12	35.43		35.50	0.00059	3.55	3254.31	831.08	0.20
Reach-1	17596	100 year	6663.00	25.12	36.48		36.53	0.00044	3.29	4199.46	947.03	0.18
Reach-1	16932	2 year	1449.20	25.30	31.24		31.26	0.00047	2.08	1774.95	659.29	0.16
Reach-1	16932	10 year	3013.20	25.30	33.20		33.22	0.00032	2.13	3262.24	818.21	0.14
Reach-1	16932	25 year	4217.00	25.30	34.22		34.24	0.00030	2.26	4128.84	913.75	0.14
Reach-1	16932	50 year	5337.50	25.30	35.18		35.20	0.00026	2.28	5068.19	1009.77	0.13
Reach-1	16932	100 year	6663.00	25.30	36.28		36.30	0.00021	2.23	6339.06	1210.25	0.12
Reach-1	16457	2 year	1449.20	23.40	30.80		30.89	0.00115	3.73	1164.95	512.44	0.25
Reach-1	16457	10 year	3013.20	23.40	32.89		32.96	0.00084	3.82	2459.64	685.27	0.22
Reach-1	16457	25 year	4217.00	23.40	33.92		33.99	0.00083	4.07	3194.16	738.90	0.23
Reach-1	16457	50 year	5337.50	23.40	34.91		34.98	0.00074	4.10	3949.93	784.99	0.22
Reach-1	16457	100 year	6663.00	23.40	36.05		36.11	0.00062	4.02	4873.42	835.52	0.20
Reach-1	16096	2 year	1449.20	23.89	30.41		30.48	0.00113	3.46	1223.65	496.79	0.26
Reach-1	16096	10 year	3013.20	23.89	32.61		32.66	0.00078	3.60	2470.22	637.93	0.23
Reach-1	16096	25 year	4217.00	23.89	33.64		33.70	0.00078	3.89	3144.05	666.22	0.23
Reach-1	16096	50 year	5337.50	23.89	34.66		34.72	0.00070	3.99	3835.42	693.57	0.22
Reach-1	16096	100 year	6663.00	23.89	35.83		35.89	0.00062	4.02	4673.80	740.87	0.21
Reach-1	15393	2 year	1449.20	21.18	29.81	28.08	29.87	0.00075	2.99	1242.32	637.61	0.20
Reach-1	15393	10 year	3013.20	21.18	32.30	29.22	32.32	0.00024	2.09	2926.79	869.26	0.12

APPENDIX H
HYDRAULIC AND HYDROLOGIC INPUT AND OUTPUT

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	15393	25 year	4217.00	21.18	33.34	29.66	33.36	0.00023	2.16	3651.83	900.44	0.12
Reach-1	15393	50 year	5337.50	21.18	34.39	29.90	34.42	0.00019	2.12	4389.58	939.99	0.11
Reach-1	15393	100 year	6663.00	21.18	35.60	30.16	35.63	0.00017	2.10	5239.00	996.24	0.10
Reach-1	15308	2 year	1449.20	19.00	29.66	23.75	29.79	0.00058	3.20	741.69	676.03	0.19
Reach-1	15308	10 year	3013.20	19.00	32.24	26.20	32.29	0.00028	2.64	3240.71	810.86	0.13
Reach-1	15308	25 year	4217.00	19.00	33.28	28.25	33.33	0.00029	2.82	4089.21	822.41	0.14
Reach-1	15308	50 year	5337.50	19.00	34.35	29.11	34.39	0.00026	2.83	4969.47	834.70	0.13
Reach-1	15308	100 year	6663.00	19.00	35.57	29.94	35.61	0.00023	2.83	6003.19	858.55	0.13
Reach-1	15236		Culvert									
Reach-1	15023	2 year	1453.90	21.14	29.03	26.00	29.56	0.00327	5.97	299.92	516.81	0.42
Reach-1	15023	10 year	3028.40	21.14	31.75	29.30	31.84	0.00072	3.55	2556.91	797.18	0.21
Reach-1	15023	25 year	4239.40	21.14	33.18	30.50	33.24	0.00051	3.30	3711.37	821.77	0.18
Reach-1	15023	50 year	5366.80	21.14	34.30	30.50	34.36	0.00043	3.24	4645.01	834.84	0.17
Reach-1	15023	100 year	6699.50	21.14	35.54	30.73	35.59	0.00037	3.22	5689.92	858.94	0.16
Reach-1	14968	2 year	1409.70	20.40	29.22	25.68	29.26	0.00036	2.22	1076.87	346.17	0.15
Reach-1	14968	10 year	2897.80	20.40	31.74	26.56	31.79	0.00036	2.72	1943.06	613.61	0.16
Reach-1	14968	25 year	4021.10	20.40	33.15	27.08	33.21	0.00036	2.99	2455.07	650.93	0.16
Reach-1	14968	50 year	5029.40	20.40	34.26	27.49	34.32	0.00036	3.20	2858.73	676.30	0.16
Reach-1	14968	100 year	6194.50	20.40	35.48	27.92	35.55	0.00035	3.39	3302.70	684.11	0.16
Reach-1	14903		Bridge									
Reach-1	14807	2 year	1409.40	21.04	28.73	25.46	28.89	0.00093	3.60	607.94	279.77	0.24
Reach-1	14807	10 year	2897.00	21.04	30.76	26.91	31.04	0.00129	5.05	1047.67	568.71	0.30
Reach-1	14807	25 year	4019.10	21.04	31.78	27.74	32.14	0.00151	5.89	1292.24	614.11	0.33
Reach-1	14807	50 year	5026.80	21.04	32.51	28.40	32.94	0.00172	6.58	1465.34	636.72	0.36
Reach-1	14807	100 year	6191.40	21.04	33.30	29.33	33.81	0.00189	7.25	1654.48	653.04	0.38
Reach-1	14671	2 year	1409.40	20.76	28.52	24.93	28.73	0.00113	3.98	510.81	216.16	0.27
Reach-1	14671	10 year	2897.00	20.76	30.50	26.97	30.83	0.00146	5.38	905.59	383.09	0.32
Reach-1	14671	25 year	4019.10	20.76	31.61	27.93	31.92	0.00133	5.56	1249.81	493.86	0.31
Reach-1	14671	50 year	5026.80	20.76	32.37	28.85	32.68	0.00126	5.70	1492.75	571.74	0.31
Reach-1	14671	100 year	6191.40	20.76	33.21	30.12	33.51	0.00117	5.76	1759.22	669.09	0.30
Reach-1	14470	2 year	1409.40	20.60	28.08	24.87	28.40	0.00205	4.82	440.78	152.21	0.33
Reach-1	14470	10 year	2897.00	20.60	29.82	27.39	30.37	0.00298	6.79	783.66	282.62	0.41
Reach-1	14470	25 year	4019.10	20.60	31.15	28.58	31.57	0.00225	6.50	1260.04	432.11	0.37
Reach-1	14470	50 year	5026.80	20.60	32.08	29.86	32.40	0.00177	6.12	1708.74	536.05	0.33
Reach-1	14470	100 year	6191.40	20.60	33.00	30.70	33.25	0.00137	5.69	2252.23	640.44	0.29
Reach-1	14329		Bridge									
Reach-1	14157	2 year	1409.40	20.50	26.82	25.49	27.23	0.00378	5.83	402.23	517.51	0.44
Reach-1	14157	10 year	2897.00	20.50	29.58	26.99	29.61	0.00041	2.51	2543.64	640.95	0.15
Reach-1	14157	25 year	4019.10	20.50	31.14	27.70	31.17	0.00027	2.30	3598.38	703.75	0.13
Reach-1	14157	50 year	5026.80	20.50	32.05	27.70	32.08	0.00026	2.36	4251.79	739.60	0.13
Reach-1	14157	100 year	6191.40	20.50	32.93	27.70	32.96	0.00025	2.45	4920.03	774.55	0.13

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	13604	2 year	1409.90	18.99	26.39		26.44	0.00052	2.42	1044.84	457.81	0.17
Reach-1	13604	10 year	2897.20	18.99	29.45		29.47	0.00015	1.69	2612.74	552.37	0.10
Reach-1	13604	25 year	4018.60	18.99	31.05		31.08	0.00012	1.65	3523.20	585.85	0.09
Reach-1	13604	50 year	5026.20	18.99	31.96		31.99	0.00012	1.75	4062.46	604.81	0.09
Reach-1	13604	100 year	6191.20	18.99	32.83		32.87	0.00013	1.88	4602.72	628.23	0.09
Reach-1	13066	2 year	1409.90	18.12	25.70		25.82	0.00137	3.71	891.00	355.70	0.26
Reach-1	13066	10 year	2897.20	18.12	29.22		29.27	0.00045	2.84	2219.17	395.36	0.16
Reach-1	13066	25 year	4018.60	18.12	30.86		30.91	0.00039	2.93	2881.00	411.70	0.15
Reach-1	13066	50 year	5026.20	18.12	31.76		31.82	0.00042	3.20	3254.50	421.15	0.16
Reach-1	13066	100 year	6191.20	18.12	32.62		32.69	0.00047	3.53	3625.95	439.64	0.17
Reach-1	12805	2 year	1411.10	17.20	25.44		25.53	0.00085	3.25	958.50	270.39	0.21
Reach-1	12805	10 year	2900.60	17.20	29.07		29.15	0.00048	3.21	2019.64	313.38	0.17
Reach-1	12805	25 year	4023.60	17.20	30.71		30.79	0.00049	3.54	2548.26	332.32	0.18
Reach-1	12805	50 year	5033.00	17.20	31.59		31.69	0.00056	3.98	2843.00	342.42	0.19
Reach-1	12805	100 year	6199.90	17.20	32.42		32.54	0.00066	4.47	3132.58	353.92	0.21
Reach-1	12393	2 year	1411.10	16.66	25.29	20.03	25.31	0.00018	1.70	1820.31	302.27	0.10
Reach-1	12393	10 year	2900.60	16.66	28.98	20.95	29.00	0.00017	2.09	3093.23	422.92	0.11
Reach-1	12393	25 year	4023.60	16.66	30.62	21.42	30.65	0.00018	2.35	3811.32	463.50	0.11
Reach-1	12393	50 year	5033.00	16.66	31.48	21.79	31.52	0.00021	2.65	4265.98	559.67	0.12
Reach-1	12393	100 year	6199.90	16.66	32.30	22.18	32.34	0.00024	2.92	4732.80	576.94	0.13
Reach-1	11890	2 year	1411.10	15.80	23.78	21.10	24.44	0.00358	6.90	275.12	127.89	0.44
Reach-1	11890	10 year	2900.60	15.80	27.30	23.80	28.26	0.00338	8.68	537.97	230.71	0.46
Reach-1	11890	25 year	4023.60	15.80	30.16	25.30	30.33	0.00077	4.84	2035.66	443.35	0.23
Reach-1	11890	50 year	5033.00	15.80	31.04	26.58	31.20	0.00078	5.05	2430.35	463.55	0.23
Reach-1	11890	100 year	6199.90	15.80	31.84	27.57	32.02	0.00083	5.41	2819.11	500.42	0.24
Reach-1	11822	2 year	1411.10	15.60	23.77	19.60	24.13	0.00158	4.92	326.82	57.99	0.31
Reach-1	11822	10 year	2900.60	15.60	27.28	21.88	27.94	0.00185	6.79	500.64	93.49	0.35
Reach-1	11822	25 year	4023.60	15.60	29.19	23.37	30.04	0.00199	7.81	793.77	270.65	0.38
Reach-1	11822	50 year	5033.00	15.60	29.77	24.45	30.84	0.00248	8.96	944.14	317.54	0.42
Reach-1	11822	100 year	6199.90	15.60	30.26	25.60	31.58	0.00304	10.15	1093.64	357.81	0.47
Reach-1	11812		Culvert									
Reach-1	11750	2 year	1414.20	15.50	23.55	19.67	23.96	0.00185	5.29	320.92	57.00	0.33
Reach-1	11750	10 year	2906.20	15.50	25.95	21.94	26.86	0.00294	7.98	462.50	78.13	0.44
Reach-1	11750	25 year	4031.30	15.50	27.81	23.63	28.95	0.00305	9.10	645.18	102.82	0.46
Reach-1	11750	50 year	5044.90	15.50	28.69	24.74	30.21	0.00372	10.52	793.89	235.20	0.52
Reach-1	11750	100 year	6215.30	15.50	29.24	26.04	31.12	0.00454	11.96	934.14	279.43	0.57
Reach-1	11500	2 year	1414.20	14.51	22.93		23.42	0.00234	6.04	353.14	82.69	0.37
Reach-1	11500	10 year	2906.20	14.51	24.97		25.98	0.00391	9.06	547.16	107.41	0.50
Reach-1	11500	25 year	4031.30	14.51	26.98		28.12	0.00368	9.90	859.63	224.07	0.50
Reach-1	11500	50 year	5044.90	14.51	27.99		29.10	0.00358	10.29	1142.58	375.95	0.50
Reach-1	11500	100 year	6215.30	14.51	28.52		29.72	0.00397	11.13	1393.77	514.25	0.53

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	11048	2 year	1414.20	13.72	22.10	17.97	22.38	0.00161	4.38	411.76	232.28	0.29
Reach-1	11048	10 year	2906.20	13.72	24.54	20.36	24.66	0.00067	3.46	1380.79	526.97	0.20
Reach-1	11048	25 year	4031.30	13.72	26.97	22.99	27.01	0.00019	2.16	2839.70	693.40	0.11
Reach-1	11048	50 year	5044.90	13.72	28.00	23.53	28.04	0.00016	2.09	3586.31	733.42	0.10
Reach-1	11048	100 year	6215.30	13.72	28.53	23.85	28.58	0.00019	2.29	3974.97	744.09	0.11
Reach-1	10970		Bridge									
Reach-1	10936	2 year	1418.60	12.45	21.40	16.99	21.72	0.00139	4.62	360.87	137.61	0.29
Reach-1	10936	10 year	2914.10	12.45	24.24	19.34	24.63	0.00134	5.55	653.87	497.35	0.30
Reach-1	10936	25 year	4042.70	12.45	26.93	21.77	26.97	0.00017	2.28	2772.93	663.34	0.11
Reach-1	10936	50 year	5059.70	12.45	27.97	22.62	28.01	0.00014	2.17	3475.64	771.31	0.10
Reach-1	10936	100 year	6234.00	12.45	28.49	23.38	28.54	0.00019	2.62	3923.32	897.72	0.12
Reach-1	10885		Culvert									
Reach-1	10806	2 year	1418.60	12.36	20.86	17.30	21.37	0.00246	5.83	266.83	79.69	0.37
Reach-1	10806	10 year	2914.10	12.36	22.06	19.86	23.48	0.00583	9.89	330.07	162.35	0.59
Reach-1	10806	25 year	4042.70	12.36	23.51	21.81	25.27	0.00609	11.19	406.35	277.11	0.62
Reach-1	10806	50 year	5059.70	12.36	25.77	22.85	25.95	0.00079	4.60	1793.95	556.19	0.23
Reach-1	10806	100 year	6234.00	12.36	26.68	23.89	26.83	0.00060	4.20	2309.07	570.86	0.20
Reach-1	10529	2 year	1418.60	10.94	20.74	16.88	20.84	0.00070	2.82	574.91	459.14	0.19
Reach-1	10529	10 year	2914.10	10.94	22.62	20.65	22.68	0.00015	1.51	1475.13	494.29	0.09
Reach-1	10529	25 year	4042.70	10.94	24.30	20.88	24.36	0.00006	1.12	2366.61	579.19	0.06
Reach-1	10529	50 year	5059.70	10.94	25.81	21.07	25.85	0.00004	0.95	3223.06	591.83	0.05
Reach-1	10529	100 year	6234.00	10.94	26.70	21.28	26.76	0.00004	0.98	3738.41	599.35	0.05
Reach-1	10000	2 year	1418.60	10.11	19.18	14.86	19.45	0.00153	4.29	469.78	253.45	0.28
Reach-1	10000	10 year	2914.10	10.11	22.11	17.14	22.23	0.00069	3.62	1739.67	565.78	0.20
Reach-1	10000	25 year	4042.70	10.11	24.09	19.67	24.16	0.00035	2.91	3022.19	883.15	0.15
Reach-1	10000	50 year	5059.70	10.11	25.69	20.46	25.74	0.00022	2.51	4761.71	1136.81	0.12
Reach-1	10000	100 year	6234.00	10.11	26.59	21.32	26.64	0.00020	2.52	5798.74	1171.03	0.12
Reach-1	9856	2 year	1418.60	11.57	18.96	14.94	19.22	0.00153	4.11	352.88	61.89	0.28
Reach-1	9856	10 year	2914.10	11.57	21.53	16.88	21.98	0.00180	5.56	595.40	659.60	0.32
Reach-1	9856	25 year	4042.70	11.57	23.49	18.11	23.95	0.00150	5.78	832.59	777.95	0.31
Reach-1	9856	50 year	5059.70	11.57	25.64	19.25	25.70	0.00028	2.81	4176.07	839.73	0.14
Reach-1	9856	100 year	6234.00	11.57	26.54	20.65	26.60	0.00027	2.90	4940.25	860.24	0.14
Reach-1	9813		Culvert									
Reach-1	9732	2 year	1424.80	11.51	18.75	14.84	19.03	0.00163	4.20	346.48	61.32	0.29
Reach-1	9732	10 year	2912.60	11.51	20.84	16.76	21.44	0.00253	6.31	509.99	298.59	0.38
Reach-1	9732	25 year	4039.30	11.51	22.00	18.00	22.83	0.00305	7.53	615.80	686.67	0.43
Reach-1	9732	50 year	5054.30	11.51	23.63	18.87	23.74	0.00055	3.54	2444.08	789.89	0.19
Reach-1	9732	100 year	6228.40	11.51	25.15	20.21	25.20	0.00027	2.71	3669.68	831.00	0.13
Reach-1	9375	2 year	1424.80	10.04	18.24		18.49	0.00134	4.03	391.71	102.00	0.28
Reach-1	9375	10 year	2912.60	10.04	20.41		20.66	0.00120	4.62	936.94	367.90	0.28
Reach-1	9375	25 year	4039.30	10.04	21.83		22.00	0.00079	4.15	1528.25	473.21	0.23

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	9375	50 year	5054.30	10.04	23.46		23.56	0.00045	3.46	2464.96	660.87	0.18
Reach-1	9375	100 year	6228.40	10.04	25.03		25.10	0.00027	2.93	3603.46	770.88	0.14
Reach-1	9101	2 year	1424.80	10.36	17.72	14.18	18.03	0.00187	4.57	372.75	139.12	0.32
Reach-1	9101	10 year	2912.60	10.36	19.94	16.28	20.26	0.00166	5.26	1129.52	537.05	0.32
Reach-1	9101	25 year	4039.30	10.36	21.62	18.55	21.78	0.00082	4.17	2111.29	602.63	0.23
Reach-1	9101	50 year	5054.30	10.36	23.34	19.79	23.43	0.00047	3.50	3215.95	748.45	0.18
Reach-1	9101	100 year	6228.40	10.36	24.96	20.15	25.02	0.00028	2.95	4492.06	846.02	0.14
Reach-1	9081		Bridge									
Reach-1	9000	2 year	1424.80	9.13	16.98	13.27	17.24	0.00155	4.18	413.24	122.13	0.30
Reach-1	9000	10 year	2912.60	9.13	19.84	15.35	20.20	0.00143	5.17	854.72	225.59	0.30
Reach-1	9000	25 year	4039.30	9.13	21.40	16.81	21.75	0.00127	5.40	1241.69	271.42	0.29
Reach-1	9000	50 year	5054.30	9.13	22.90	17.67	23.19	0.00098	5.20	1680.21	315.41	0.26
Reach-1	9000	100 year	6228.40	9.13	24.58	18.39	24.84	0.00081	5.14	2342.59	573.49	0.24
Reach-1	8500	2 year	1424.80	7.91	16.34	12.05	16.56	0.00114	3.81	430.57	84.66	0.26
Reach-1	8500	10 year	2912.60	7.91	19.14	14.17	19.52	0.00132	5.16	807.26	167.15	0.29
Reach-1	8500	25 year	4039.30	7.91	20.61	15.31	21.06	0.00141	5.85	1064.27	183.34	0.31
Reach-1	8500	50 year	5054.30	7.91	22.12	16.18	22.59	0.00129	6.09	1369.89	221.89	0.30
Reach-1	8500	100 year	6228.40	7.91	23.92	17.05	24.34	0.00106	6.04	1886.71	372.51	0.28
Reach-1	8229	2 year	1458.70	7.95	14.90	13.15	15.73	0.00690	7.32	199.38	39.62	0.57
Reach-1	8229	10 year	2983.10	7.95	17.54	15.53	18.61	0.00632	8.69	524.25	264.98	0.57
Reach-1	8229	25 year	4143.00	7.95	19.94	17.90	20.48	0.00282	6.93	1121.32	319.47	0.40
Reach-1	8229	50 year	5190.20	7.95	21.71	18.59	22.10	0.00186	6.32	1595.11	340.77	0.33
Reach-1	8229	100 year	6400.40	7.95	23.77	19.18	23.94	0.00081	4.65	2651.55	450.33	0.23
Reach-1	8118		Culvert									
Reach-1	8019	2 year	1458.70	5.86	15.29	10.37	15.63	0.00180	4.65	313.82	50.13	0.30
Reach-1	8019	10 year	2983.10	5.86	17.55	12.87	18.34	0.00331	7.17	439.55	94.52	0.41
Reach-1	8019	25 year	4143.00	5.86	18.89	14.40	20.01	0.00409	8.59	521.59	113.30	0.47
Reach-1	8019	50 year	5190.20	5.86	19.97	15.65	21.37	0.00455	9.66	590.49	173.14	0.50
Reach-1	8019	100 year	6400.40	5.86	21.39	17.13	22.24	0.00287	8.28	1092.74	251.19	0.40
Reach-1	7885	2 year	1458.70	5.67	15.19	9.81	15.39	0.00096	3.62	421.80	76.52	0.23
Reach-1	7885	10 year	2983.10	5.67	17.42	11.89	17.88	0.00161	5.53	652.39	127.36	0.31
Reach-1	7885	25 year	4143.00	5.67	18.80	13.18	19.40	0.00187	6.50	843.02	147.78	0.34
Reach-1	7885	50 year	5190.20	5.67	19.93	14.25	20.64	0.00199	7.15	1018.03	160.76	0.36
Reach-1	7885	100 year	6400.40	5.67	21.09	15.46	21.91	0.00210	7.78	1212.27	174.04	0.37
Reach-1	7471	2 year	1456.90	5.10	14.89	9.31	15.04	0.00070	3.32	669.34	317.70	0.20
Reach-1	7471	10 year	2979.60	5.10	16.97	12.23	17.26	0.00116	4.94	969.05	338.55	0.26
Reach-1	7471	25 year	4138.50	5.10	18.29	13.42	18.67	0.00138	5.81	1164.14	355.51	0.29
Reach-1	7471	50 year	5184.60	5.10	19.39	14.23	19.85	0.00150	6.43	1332.35	365.46	0.31
Reach-1	7471	100 year	6394.00	5.10	20.52	15.04	21.06	0.00163	7.07	1508.44	375.63	0.33
Reach-1	7000	2 year	1456.90	4.42	14.37	10.20	14.58	0.00130	4.14	697.54	255.58	0.26
Reach-1	7000	10 year	2979.60	4.42	16.43	13.69	16.68	0.00149	5.19	1295.66	317.03	0.29

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7000	25 year	4138.50	4.42	17.78	14.48	18.05	0.00151	5.68	1793.91	414.57	0.30
Reach-1	7000	50 year	5184.60	4.42	19.01	15.17	19.25	0.00128	5.61	2325.34	446.94	0.28
Reach-1	7000	100 year	6394.00	4.42	20.24	15.72	20.46	0.00112	5.58	2893.51	471.10	0.27
Reach-1	6500	2 year	1469.50	3.91	13.54	9.71	13.78	0.00158	4.44	679.69	444.64	0.29
Reach-1	6500	10 year	3007.70	3.91	15.77	13.28	15.94	0.00113	4.46	1669.37	492.61	0.25
Reach-1	6500	25 year	4179.00	3.91	17.26	14.07	17.40	0.00092	4.43	2309.38	505.48	0.23
Reach-1	6500	50 year	5237.30	3.91	18.57	14.50	18.69	0.00077	4.36	2878.90	513.50	0.22
Reach-1	6500	100 year	6462.00	3.91	19.84	14.93	19.96	0.00069	4.42	3437.22	521.31	0.21
Reach-1	6000	2 year	1469.50	3.32	12.54		12.77	0.00171	4.45	693.76	303.86	0.30
Reach-1	6000	10 year	3007.70	3.32	15.04		15.21	0.00120	4.56	1532.34	357.57	0.26
Reach-1	6000	25 year	4179.00	3.32	16.68		16.83	0.00097	4.55	2133.66	375.45	0.24
Reach-1	6000	50 year	5237.30	3.32	18.09		18.23	0.00082	4.54	2671.65	390.75	0.23
Reach-1	6000	100 year	6462.00	3.32	19.41		19.55	0.00076	4.66	3197.67	405.63	0.22
Reach-1	5500	2 year	1469.50	3.02	11.89		12.02	0.00111	3.57	952.11	404.05	0.24
Reach-1	5500	10 year	3007.70	3.02	14.65		14.73	0.00063	3.36	2111.90	437.53	0.19
Reach-1	5500	25 year	4179.00	3.02	16.37		16.45	0.00051	3.37	2904.06	481.59	0.18
Reach-1	5500	50 year	5237.30	3.02	17.83		17.90	0.00043	3.37	3633.04	519.74	0.17
Reach-1	5500	100 year	6462.00	3.02	19.18		19.25	0.00040	3.46	4355.95	551.47	0.16
Reach-1	5088	2 year	1469.50	1.35	11.56		11.62	0.00053	2.69	1389.86	447.91	0.17
Reach-1	5088	10 year	3007.70	1.35	14.44		14.48	0.00036	2.72	2744.57	489.76	0.15
Reach-1	5088	25 year	4179.00	1.35	16.21		16.25	0.00031	2.79	3628.84	506.66	0.14
Reach-1	5088	50 year	5237.30	1.35	17.69		17.73	0.00028	2.85	4388.07	519.31	0.13
Reach-1	5088	100 year	6462.00	1.35	19.05		19.09	0.00027	2.99	5100.15	531.02	0.13
Reach-1	4500	2 year	1469.50	0.81	10.88	7.08	11.02	0.00095	3.58	778.51	197.69	0.22
Reach-1	4500	10 year	3007.70	0.81	13.84	9.27	14.02	0.00093	4.37	1469.04	273.41	0.23
Reach-1	4500	25 year	4179.00	0.81	15.70	10.08	15.86	0.00082	4.55	1999.10	298.35	0.23
Reach-1	4500	50 year	5237.30	0.81	17.24	10.70	17.41	0.00074	4.67	2475.62	335.21	0.22
Reach-1	4500	100 year	6462.00	0.81	18.61	11.35	18.79	0.00074	4.96	3133.83	513.54	0.22
Reach-1	4137	2 year	1469.50	0.48	10.58		10.66	0.00040	2.60	1005.23	245.10	0.16
Reach-1	4137	10 year	3007.70	0.48	13.55		13.66	0.00042	3.24	1897.89	335.91	0.17
Reach-1	4137	25 year	4179.00	0.48	15.43		15.54	0.00039	3.45	2547.08	353.43	0.17
Reach-1	4137	50 year	5237.30	0.48	17.02		17.14	0.00036	3.58	3124.05	372.45	0.16
Reach-1	4137	100 year	6462.00	0.48	18.41		18.54	0.00037	3.84	3654.74	391.57	0.17
Reach-1	4008	2 year	1464.10	0.26	10.41	5.02	10.57	0.00064	3.32	574.67	341.29	0.20
Reach-1	4008	10 year	2992.30	0.26	13.32	6.86	13.55	0.00070	4.25	1211.06	427.08	0.22
Reach-1	4008	25 year	4145.90	0.26	15.20	8.02	15.44	0.00065	4.53	1655.20	454.15	0.22
Reach-1	4008	50 year	5185.70	0.26	16.80	8.96	17.04	0.00060	4.69	2033.06	462.73	0.22
Reach-1	4008	100 year	6103.50	0.26	18.21	9.73	18.44	0.00055	4.78	2365.78	470.28	0.21
Reach-1	3903		Bridge									
Reach-1	3835	2 year	1450.00	0.06	9.99	4.91	10.17	0.00073	3.45	505.32	307.33	0.21
Reach-1	3835	10 year	2960.60	0.06	12.20	6.76	12.57	0.00118	5.16	775.92	407.18	0.28
Reach-1	3835	25 year	4095.90	0.06	13.40	7.91	13.91	0.00146	6.16	924.26	429.17	0.32

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3835	50 year	5120.60	0.06	14.31	8.85	14.95	0.00169	6.97	1036.99	445.88	0.35
Reach-1	3835	100 year	6061.70	0.06	15.05	9.64	15.82	0.00188	7.65	1129.25	453.55	0.37
Reach-1	3391	2 year	1450.00	1.02	9.70		9.82	0.00071	3.15	815.18	258.22	0.21
Reach-1	3391	10 year	2960.60	1.02	11.86		12.04	0.00086	4.11	1463.48	327.93	0.24
Reach-1	3391	25 year	4095.90	1.02	13.05		13.26	0.00091	4.58	1863.93	340.79	0.25
Reach-1	3391	50 year	5120.60	1.02	13.97		14.20	0.00095	4.95	2180.98	350.30	0.26
Reach-1	3391	100 year	6061.70	1.02	14.73		14.98	0.00098	5.26	2449.32	358.16	0.26
Reach-1	2950	2 year	1450.00	1.26	8.97		9.24	0.00191	4.80	1285.71	395.69	0.32
Reach-1	2950	10 year	2960.60	1.26	10.82		11.27	0.00265	6.62	2041.00	415.32	0.39
Reach-1	2950	25 year	4095.90	1.26	11.84		12.40	0.00307	7.67	2468.27	423.45	0.43
Reach-1	2950	50 year	5120.60	1.26	12.62		13.27	0.00341	8.50	2797.53	429.81	0.46
Reach-1	2950	100 year	6061.70	1.26	13.25		13.99	0.00369	9.18	3071.54	435.77	0.48
Reach-1	2381	2 year	1450.00	0.98	7.65	6.05	7.96	0.00267	5.25	553.40	254.30	0.37
Reach-1	2381	10 year	2960.60	0.98	9.08	7.71	9.52	0.00355	6.95	948.30	290.90	0.45
Reach-1	2381	25 year	4095.90	0.98	9.92	8.42	10.43	0.00385	7.77	1200.50	305.96	0.47
Reach-1	2381	50 year	5120.60	0.98	10.55	8.92	11.12	0.00409	8.40	1396.79	313.41	0.49
Reach-1	2381	100 year	6061.70	0.98	11.09	9.29	11.70	0.00424	8.90	1566.38	319.70	0.51
Reach-1	1890	2 year	1439.30	0.64	6.74	5.20	6.89	0.00164	3.96	783.18	515.66	0.29
Reach-1	1890	10 year	2937.40	0.64	7.98	6.19	8.16	0.00198	4.95	1406.73	528.38	0.33
Reach-1	1890	25 year	4059.20	0.64	8.70	6.72	8.92	0.00223	5.61	1706.00	535.75	0.36
Reach-1	1890	50 year	5074.00	0.64	9.22	7.07	9.48	0.00248	6.18	1921.69	540.33	0.38
Reach-1	1890	100 year	6042.10	0.64	9.67	7.38	9.95	0.00269	6.67	2108.52	544.26	0.40
Reach-1	1500	2 year	1439.30	0.50	6.24		6.31	0.00135	3.25	1262.26	622.53	0.25
Reach-1	1500	10 year	2937.40	0.50	7.39		7.48	0.00155	3.99	2005.49	690.32	0.28
Reach-1	1500	25 year	4059.20	0.50	8.02		8.13	0.00186	4.66	2483.86	781.69	0.31
Reach-1	1500	50 year	5074.00	0.50	8.51		8.63	0.00189	4.92	2870.07	787.51	0.32
Reach-1	1500	100 year	6042.10	0.50	8.94		9.06	0.00191	5.14	3208.96	792.08	0.33
Reach-1	1000	2 year	1439.30	0.40	5.62	4.10	5.65	0.00080	2.35	1897.63	1111.70	0.19
Reach-1	1000	10 year	2937.40	0.40	6.74	4.64	6.76	0.00080	2.69	3240.54	1267.69	0.20
Reach-1	1000	25 year	4059.20	0.40	7.35	4.93	7.38	0.00080	2.89	4032.17	1286.55	0.20
Reach-1	1000	50 year	5074.00	0.40	7.85	5.19	7.88	0.00080	3.03	4667.51	1294.67	0.21
Reach-1	1000	100 year	6042.10	0.40	8.28	5.40	8.31	0.00080	3.16	5224.77	1301.75	0.21

HEC-RAS Output for Reedy Branch Alternative #1 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7801	2 YR	35.50	69.60	71.42	71.01	71.70	0.01213	4.30	8.37	9.77	0.65
Reach-1	7801	10 YR	75.20	69.60	71.85	71.85	71.98	0.00650	3.78	40.01	388.85	0.50
Reach-1	7801	25 YR	95.30	69.6	71.90	71.90	72.05	0.00747	4.13	46.01	411.80	0.53
Reach-1	7801	50 YR	115.50	69.60	71.94	71.94	72.10	0.00839	4.45	51.12	414.38	0.57
Reach-1	7801	100 YR	138.90	69.60	71.99	71.99	72.17	0.00919	4.73	56.80	417.21	0.60
Reach-1	7545	2 YR	35.50	66.69	68.57	68.12	68.83	0.01044	4.09	9.54	108.02	0.60
Reach-1	7545	10 YR	75.20	66.69	68.88	68.80	68.89	0.00012	0.51	138.68	114.09	0.07
Reach-1	7545	25 YR	95.30	66.69	69.02	68.80	69.03	0.00015	0.58	155.02	118.49	0.07
Reach-1	7545	50 YR	115.50	66.69	69.04	68.80	69.04	0.00021	0.70	156.45	118.86	0.09
Reach-1	7545	100 YR	138.90	66.69	69.12	68.80	69.13	0.00026	0.80	166.19	121.40	0.10
Reach-1	7428	2 YR	35.50	65.56	68.58	66.98	68.59	0.00035	1.10	79.19	153.38	0.12
Reach-1	7428	10 YR	75.20	65.56	68.84	67.89	68.86	0.00073	1.70	110.93	192.30	0.18
Reach-1	7428	25 YR	95.30	65.56	68.97	68.07	68.99	0.00078	1.81	131.52	232.46	0.19
Reach-1	7428	50 YR	115.50	65.56	68.96	68.23	68.99	0.00119	2.23	128.89	222.73	0.23
Reach-1	7428	100 YR	138.90	65.56	69.02	68.36	69.06	0.00140	2.46	140.71	237.14	0.25
Reach-1	7399		Culvert									
Reach-1	7371	2 YR	35.50	65.23	67.03	66.65	67.33	0.01291	4.38	8.11	6.12	0.66
Reach-1	7371	10 YR	75.20	65.23	67.73	67.48	68.20	0.01249	5.68	15.28	25.02	0.70
Reach-1	7371	25 YR	95.30	65.23	68.05	67.73	68.38	0.00872	5.22	29.16	31.99	0.60
Reach-1	7371	50 YR	115.50	65.23	68.20	68.00	68.57	0.00940	5.65	34.17	35.28	0.63
Reach-1	7371	100 YR	138.90	65.23	68.18	68.18	68.74	0.01390	6.85	33.80	35.04	0.76
Reach-1	7222	2 YR	35.50	62.60	63.89	63.89	64.43	0.03054	5.91	6.01	5.61	1.01
Reach-1	7222	10 YR	75.20	62.60	64.63	64.63	65.42	0.02874	7.13	10.54	6.70	1.00
Reach-1	7222	25 YR	95.30	62.60	64.93	64.93	65.81	0.02810	7.53	12.65	7.15	1.00
Reach-1	7222	50 YR	115.50	62.60	65.20	65.20	66.17	0.02786	7.90	14.63	7.54	1.00
Reach-1	7222	100 YR	138.90	62.60	66.48	65.49	66.86	0.00804	5.12	34.87	158.37	0.55
Reach-1	7004	2 YR	35.50	58.56	60.54	59.87	60.74	0.00742	3.57	9.96	6.35	0.50
Reach-1	7004	10 YR	75.20	58.56	61.91	60.61	62.13	0.00511	3.77	19.94	8.19	0.43
Reach-1	7004	25 YR	95.30	58.56	62.65	60.92	62.85	0.00391	3.62	26.34	9.18	0.38
Reach-1	7004	50 YR	115.50	58.56	63.99	61.20	64.11	0.00160	2.83	47.08	31.30	0.25
Reach-1	7004	100 YR	138.90	58.56	66.52	61.49	66.54	0.00022	1.44	158.14	338.31	0.10
Reach-1	6771		Culvert									
Reach-1	6708	2 YR	35.50	56.92	58.37	58.17	58.69	0.01630	4.57	7.77	7.23	0.78
Reach-1	6708	10 YR	75.20	56.92	59.56	58.83	59.82	0.00721	4.14	18.17	10.29	0.55
Reach-1	6708	25 YR	95.30	56.92	60.11	59.09	60.35	0.00533	3.93	24.24	11.71	0.48
Reach-1	6708	50 YR	115.50	56.92	60.72	59.33	60.92	0.00330	3.63	33.42	19.27	0.39
Reach-1	6708	100 YR	138.90	56.92	61.77	59.57	61.88	0.00124	2.78	67.85	53.20	0.26
Reach-1	6622	2 YR	35.50	55.38	58.23		58.27	0.00135	1.74	20.45	10.84	0.22
Reach-1	6622	10 YR	75.20	55.38	59.45		59.52	0.00115	2.12	38.59	24.63	0.22
Reach-1	6622	25 YR	95.30	55.38	60.04		60.11	0.00088	2.10	62.29	53.02	0.20

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6622	50 YR	115.50	55.38	60.71		60.75	0.00055	1.87	99.59	59.42	0.16
Reach-1	6622	100 YR	138.90	55.38	61.77		61.80	0.00025	1.47	176.01	86.18	0.11
Reach-1	6504	2 YR	35.50	55.52	57.99		58.05	0.00261	2.32	29.01	34.89	0.27
Reach-1	6504	10 YR	75.20	55.52	59.34		59.38	0.00112	2.08	93.94	78.60	0.19
Reach-1	6504	25 YR	95.30	55.52	59.99		60.01	0.00060	1.71	156.18	106.66	0.15
Reach-1	6504	50 YR	115.50	55.52	60.68		60.69	0.00031	1.36	235.59	122.31	0.11
Reach-1	6504	100 YR	138.90	55.52	61.77		61.77	0.00013	1.00	384.57	154.02	0.07
Reach-1	6351	2 YR	35.50	55.23	57.78	56.38	57.81	0.00096	1.56	26.68	21.84	0.20
Reach-1	6351	10 YR	75.20	55.23	59.23	56.91	59.27	0.00049	1.61	71.14	66.16	0.15
Reach-1	6351	25 YR	95.30	55.23	59.90	57.11	59.93	0.00038	1.60	93.61	90.27	0.14
Reach-1	6351	50 YR	115.50	55.23	60.61	57.32	60.64	0.00030	1.56	117.60	145.38	0.13
Reach-1	6351	100 YR	138.90	55.23	61.72	57.53	61.74	0.00019	1.43	154.88	195.05	0.10
Reach-1	6317		Culvert									
Reach-1	6288	2 YR	35.40	54.92	56.38	56.11	56.62	0.01229	3.97	8.92	8.62	0.69
Reach-1	6288	10 YR	75.20	54.92	57.40	56.74	57.61	0.00529	3.76	21.14	20.97	0.49
Reach-1	6288	25 YR	95.20	54.92	57.70	56.95	57.93	0.00520	4.01	25.01	23.21	0.49
Reach-1	6288	50 YR	115.40	54.92	57.92	57.13	58.20	0.00546	4.32	28.06	24.93	0.51
Reach-1	6288	100 YR	138.70	54.92	58.15	57.34	58.47	0.00565	4.67	31.23	26.83	0.53
Reach-1	5862	2 YR	35.40	49.18	55.03		55.05	0.00053	1.21	31.86	15.56	0.11
Reach-1	5862	10 YR	75.20	49.18	56.93		56.96	0.00043	1.41	76.48	32.89	0.11
Reach-1	5862	25 YR	95.20	49.18	57.19		57.23	0.00055	1.65	85.42	35.34	0.12
Reach-1	5862	50 YR	115.40	49.18	57.36		57.41	0.00070	1.90	91.59	36.93	0.14
Reach-1	5862	100 YR	138.70	49.18	57.53		57.59	0.00089	2.19	97.83	38.69	0.16
Reach-1	5571	2 YR	35.40	51.43	54.83	52.67	54.86	0.00076	1.37	25.85	12.18	0.16
Reach-1	5571	10 YR	75.20	51.43	56.83	53.33	56.85	0.00028	1.23	106.45	71.36	0.11
Reach-1	5571	25 YR	95.20	51.43	57.07	53.60	57.10	0.00034	1.40	124.25	76.47	0.12
Reach-1	5571	50 YR	115.40	51.43	57.22	53.84	57.25	0.00042	1.60	135.22	79.46	0.13
Reach-1	5571	100 YR	138.70	51.43	57.34	54.09	57.38	0.00053	1.82	145.59	82.18	0.15
Reach-1	5515		Culvert									
Reach-1	5466	2 YR	35.40	48.92	52.02	50.46	52.10	0.00299	2.33	15.19	6.76	0.27
Reach-1	5466	10 YR	75.20	48.92	54.37	51.23	54.43	0.00121	2.07	45.13	18.35	0.18
Reach-1	5466	25 YR	95.20	48.92	56.46	51.55	56.48	0.00029	1.30	148.89	85.49	0.09
Reach-1	5466	50 YR	115.40	48.92	56.76	51.84	56.78	0.00031	1.39	176.56	98.39	0.10
Reach-1	5466	100 YR	138.70	48.92	56.90	52.14	56.93	0.00038	1.57	191.12	104.65	0.11
Reach-1	5438	2 YR	35.40	48.66	51.81		51.96	0.00659	3.14	11.26	4.99	0.37
Reach-1	5438	10 YR	75.20	48.66	54.30		54.38	0.00199	2.40	42.02	32.37	0.23
Reach-1	5438	25 YR	95.20	48.66	56.45		56.47	0.00025	1.18	173.58	93.23	0.09
Reach-1	5438	50 YR	115.40	48.66	56.75		56.77	0.00026	1.25	203.07	102.87	0.09
Reach-1	5438	100 YR	138.70	48.66	56.90		56.91	0.00032	1.41	218.02	107.69	0.10
Reach-1	5381	2 YR	35.40	48.86	51.67		51.73	0.00227	2.08	17.12	9.44	0.26
Reach-1	5381	10 YR	75.20	48.86	54.31		54.33	0.00028	1.26	84.37	45.93	0.10

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	5381	25 YR	95.20	48.86	56.45		56.46	0.00004	0.60	264.04	120.46	0.04
Reach-1	5381	50 YR	115.40	48.86	56.76		56.76	0.00004	0.64	301.75	133.45	0.04
Reach-1	5381	100 YR	138.70	48.86	56.90		56.90	0.00005	0.72	321.45	142.87	0.05
Reach-1	5356	2 YR	49.30	47.99	51.65	49.29	51.69	0.00094	1.69	32.34	22.92	0.17
Reach-1	5356	10 YR	109.60	47.99	54.28	50.13	54.32	0.00043	1.73	81.75	67.25	0.13
Reach-1	5356	25 YR	140.10	47.99	56.45	50.47	56.46	0.00006	0.81	329.79	217.89	0.05
Reach-1	5356	50 YR	167.20	47.99	56.75	50.83	56.76	0.00006	0.83	372.40	227.89	0.05
Reach-1	5356	100 YR	199.80	47.99	56.89	51.13	56.90	0.00007	0.93	392.79	286.26	0.06
Reach-1	5301		Culvert									
Reach-1	5241	2 YR	49.30	46.32	48.25	47.52	48.33	0.00353	2.24	21.98	16.99	0.35
Reach-1	5241	10 YR	109.60	46.32	49.46	48.03	49.56	0.00219	2.45	44.75	20.67	0.29
Reach-1	5241	25 YR	140.10	46.32	49.92	48.24	50.02	0.00204	2.57	54.53	22.07	0.29
Reach-1	5241	50 YR	167.20	46.32	50.24	48.41	50.35	0.00204	2.71	61.76	23.04	0.29
Reach-1	5241	100 YR	199.80	46.32	50.54	48.61	50.68	0.00212	2.90	69.06	26.63	0.30
Reach-1	4994	2 YR	49.30	43.38	46.94		47.12	0.00677	3.44	14.34	6.24	0.40
Reach-1	4994	10 YR	109.60	43.38	48.20		48.54	0.00817	4.74	24.27	10.31	0.46
Reach-1	4994	25 YR	140.10	43.38	48.57		49.00	0.00908	5.36	30.63	24.45	0.49
Reach-1	4994	50 YR	167.20	43.38	48.80		49.29	0.00974	5.79	37.65	34.75	0.52
Reach-1	4994	100 YR	199.80	43.38	49.05		49.57	0.01020	6.17	47.44	46.60	0.53
Reach-1	4798	2 YR	49.30	42.16	44.70		45.07	0.01768	4.93	10.00	6.22	0.68
Reach-1	4798	10 YR	109.60	42.16	45.62	45.43	46.23	0.01801	6.41	20.67	19.19	0.73
Reach-1	4798	25 YR	140.10	42.16	45.95		46.59	0.01700	6.79	27.72	23.83	0.73
Reach-1	4798	50 YR	167.20	42.16	46.21		46.86	0.01602	7.01	34.36	27.49	0.72
Reach-1	4798	100 YR	199.80	42.16	46.48		47.14	0.01510	7.21	42.41	31.35	0.71
Reach-1	4624	2 YR	49.30	39.14	40.85	40.72	41.33	0.02676	5.57	8.85	6.99	0.87
Reach-1	4624	10 YR	109.60	39.14	41.78	41.59	42.51	0.02585	6.87	15.96	8.41	0.88
Reach-1	4624	25 YR	140.10	39.14	42.11	41.93	42.97	0.02596	7.42	18.97	9.76	0.89
Reach-1	4624	50 YR	167.20	39.14	42.37	42.22	43.33	0.02608	7.91	21.63	11.69	0.90
Reach-1	4624	100 YR	199.80	39.14	42.63	42.56	43.73	0.02597	8.46	25.22	15.62	0.91
Reach-1	4494	2 YR	49.30	35.80	37.74		38.08	0.01661	4.70	10.50	7.38	0.69
Reach-1	4494	10 YR	109.60	35.80	38.74		39.27	0.01650	5.87	18.68	9.17	0.71
Reach-1	4494	25 YR	140.10	35.80	39.09		39.73	0.01631	6.44	22.08	10.42	0.72
Reach-1	4494	50 YR	167.20	35.80	39.35		40.09	0.01642	6.91	24.96	11.39	0.74
Reach-1	4494	100 YR	199.80	35.80	39.58	39.17	40.46	0.01765	7.57	27.72	12.24	0.77
Reach-1	4291	2 YR	49.30	33.47	35.11		35.33	0.01111	3.73	13.22	10.83	0.59
Reach-1	4291	10 YR	109.60	33.47	35.83		36.23	0.01350	5.07	21.62	12.52	0.68
Reach-1	4291	25 YR	140.10	33.47	36.11		36.59	0.01433	5.56	25.22	13.18	0.71
Reach-1	4291	50 YR	167.20	33.47	36.33		36.88	0.01491	5.95	28.12	13.99	0.73
Reach-1	4291	100 YR	199.80	33.47	36.62		37.22	0.01408	6.22	32.46	15.97	0.72
Reach-1	4182	2 YR	49.30	32.22	33.69		33.81	0.00610	2.80	17.62	14.74	0.45
Reach-1	4182	10 YR	109.60	32.22	34.20		34.49	0.01018	4.29	25.57	16.36	0.60
Reach-1	4182	25 YR	140.10	32.22	34.52		34.84	0.00959	4.52	30.99	17.38	0.60

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Reach-1	4182	50 YR	167.20	32.22	35.27		35.49	0.00477	3.72	44.95	19.77	0.43
Reach-1	4182	100 YR	199.80	32.22	35.94		36.12	0.00323	3.40	58.79	21.88	0.37
Reach-1	4044	2 YR	49.30	30.62	31.71	31.71	32.12	0.03428	5.13	9.62	12.00	1.01
Reach-1	4044	10 YR	109.60	30.62	32.98		33.23	0.00809	4.03	27.20	15.70	0.54
Reach-1	4044	25 YR	140.10	30.62	33.77		33.96	0.00423	3.46	40.49	17.64	0.40
Reach-1	4044	50 YR	167.20	30.62	35.00		35.10	0.00160	2.63	64.40	22.64	0.26
Reach-1	4044	100 YR	199.80	30.62	35.74		35.84	0.00119	2.53	82.88	26.87	0.23
Reach-1	3761	2 YR	49.30	27.45	30.99		31.02	0.00057	1.29	38.15	15.54	0.15
Reach-1	3761	10 YR	109.60	27.45	32.76		32.79	0.00052	1.58	70.05	20.68	0.15
Reach-1	3761	25 YR	140.10	27.45	33.60		33.64	0.00042	1.62	90.25	27.04	0.14
Reach-1	3761	50 YR	167.20	27.45	34.91		34.94	0.00024	1.46	131.29	35.70	0.11
Reach-1	3761	100 YR	199.80	27.45	35.67		35.70	0.00021	1.51	160.24	40.71	0.10
Reach-1	3523	2 YR	49.30	27.24	30.76		30.82	0.00132	1.86	26.51	10.46	0.21
Reach-1	3523	10 YR	109.60	27.24	32.56		32.62	0.00104	2.15	63.41	26.05	0.19
Reach-1	3523	25 YR	140.10	27.24	33.45		33.51	0.00078	2.11	89.61	33.99	0.17
Reach-1	3523	50 YR	167.20	27.24	34.83		34.87	0.00039	1.76	147.22	49.25	0.13
Reach-1	3523	100 YR	199.80	27.24	35.60		35.64	0.00033	1.76	188.42	57.74	0.12
Reach-1	3284	2 YR	49.30	27.75	30.50	28.79	30.54	0.00101	1.58	31.25	15.09	0.19
Reach-1	3284	10 YR	109.60	27.75	32.38	29.43	32.42	0.00063	1.71	66.83	28.95	0.16
Reach-1	3284	25 YR	140.10	27.75	33.33	29.69	33.37	0.00042	1.63	110.16	57.07	0.14
Reach-1	3284	50 YR	167.20	27.75	34.78	29.90	34.80	0.00018	1.28	209.64	79.49	0.09
Reach-1	3284	100 YR	199.80	27.75	35.56	30.14	35.58	0.00014	1.25	276.36	91.52	0.09
Reach-1	3208	2 YR	96.10	26.97	29.12	29.12	29.93	0.03374	7.22	13.32	8.31	1.00
Reach-1	3208	10 YR	235.30	26.97	30.48	30.48	31.77	0.03218	9.11	25.83	10.06	1.00
Reach-1	3208	25 YR	328.30	26.97	31.19	31.19	32.70	0.03157	9.87	33.26	10.98	1.00
Reach-1	3208	50 YR	411.90	26.97	34.31	31.73	34.64	0.00349	4.97	135.84	72.27	0.36
Reach-1	3208	100 YR	508.50	26.97	35.21	32.32	35.46	0.00248	4.61	206.04	85.60	0.32
Reach-1	3163		Culvert									
Reach-1	3113	2 YR	96.10	25.96	28.64	28.03	28.90	0.00847	4.19	26.24	23.91	0.54
Reach-1	3113	10 YR	235.30	25.96	29.79	29.08	30.26	0.00867	5.77	50.33	42.61	0.59
Reach-1	3113	25 YR	328.30	25.96	29.92	29.56	30.74	0.01436	7.64	53.36	44.87	0.77
Reach-1	3113	50 YR	411.90	25.96	33.69	29.95	33.71	0.00029	1.86	584.85	210.98	0.13
Reach-1	3113	100 YR	508.50	25.96	35.34	30.35	35.35	0.00012	1.36	953.61	235.87	0.08
Reach-1	3074	2 YR	96.10	25.84	27.62	27.62	28.24	0.02986	6.27	15.32	12.46	1.00
Reach-1	3074	10 YR	235.30	25.84	28.68	28.68	29.60	0.02476	7.68	31.39	27.15	0.97
Reach-1	3074	25 YR	328.30	25.84	29.33	29.33	30.14	0.01697	7.47	58.08	52.11	0.84
Reach-1	3074	50 YR	411.90	25.84	33.69	29.53	33.70	0.00015	1.37	721.69	200.34	0.09
Reach-1	3074	100 YR	508.50	25.84	35.34	30.09	35.35	0.00008	1.13	1065.84	216.73	0.07
Reach-1	3007	2 YR	96.10	21.82	24.48		24.89	0.01375	5.17	18.58	9.77	0.66
Reach-1	3007	10 YR	235.30	21.82	25.88		26.63	0.01591	6.94	33.89	12.11	0.73
Reach-1	3007	25 YR	328.30	21.82	28.36		28.64	0.00285	4.46	105.24	40.47	0.34
Reach-1	3007	50 YR	411.90	21.82	33.67		33.69	0.00013	1.53	645.85	146.40	0.08

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Reach-1	3007	100 YR	508.50	21.82	35.33		35.34	0.00009	1.38	902.74	164.23	0.07
Reach-1	2509	2 YR	96.10	18.50	22.51	20.61	22.62	0.00213	2.69	39.37	21.76	0.28
Reach-1	2509	10 YR	235.30	18.50	24.50	21.93	24.64	0.00157	3.28	112.20	48.15	0.26
Reach-1	2509	25 YR	328.30	18.50	28.25	22.57	28.29	0.00023	1.85	371.17	91.04	0.11
Reach-1	2509	50 YR	411.90	18.50	33.65	23.12	33.66	0.00003	0.94	1023.07	149.70	0.04
Reach-1	2509	100 YR	508.50	18.50	35.31	23.59	35.32	0.00003	0.93	1286.15	168.17	0.04
Reach-1	2076	2 YR	96.10	17.78	19.62	19.62	20.25	0.03157	6.37	15.09	12.07	1.00
Reach-1	2076	10 YR	235.30	17.78	23.95	20.68	24.04	0.00116	2.60	142.68	138.38	0.22
Reach-1	2076	25 YR	328.30	17.78	28.23	21.23	28.24	0.00005	0.81	883.57	221.00	0.05
Reach-1	2076	50 YR	411.90	17.78	33.65	21.67	33.65	0.00000	0.33	2284.31	277.58	0.02
Reach-1	2076	100 YR	508.50	17.78	35.31	22.14	35.31	0.00000	0.35	2770.10	324.91	0.02
Reach-1	2002	2 YR	137.50	15.34	18.66	17.89	19.04	0.00867	5.05	31.12	16.20	0.56
Reach-1	2002	10 YR	354.70	15.34	23.89	19.45	23.98	0.00072	2.84	233.87	80.01	0.19
Reach-1	2002	25 YR	508.70	15.34	28.21	20.24	28.23	0.00011	1.54	754.92	175.63	0.08
Reach-1	2002	50 YR	640.30	15.34	33.65	20.82	33.65	0.00001	0.65	1933.91	250.45	0.03
Reach-1	2002	100 YR	788.30	15.34	35.31	21.40	35.31	0.00001	0.66	2375.28	298.47	0.03
Reach-1	1502	2 YR	137.50	12.83	18.15		18.20	0.00059	1.86	92.10	39.72	0.15
Reach-1	1502	10 YR	354.70	12.83	23.84		23.85	0.00010	1.29	602.76	137.56	0.07
Reach-1	1502	25 YR	508.70	12.83	28.20		28.20	0.00003	0.92	1320.92	189.38	0.04
Reach-1	1502	50 YR	640.30	12.83	33.64		33.65	0.00001	0.64	2729.22	318.42	0.03
Reach-1	1502	100 YR	788.30	12.83	35.30		35.31	0.00001	0.65	3267.52	331.04	0.02
Reach-1	1058	2 YR	137.50	12.30	17.98	14.26	18.01	0.00031	1.49	155.23	79.38	0.12
Reach-1	1058	10 YR	354.70	12.30	23.82	15.56	23.82	0.00004	0.92	889.30	159.78	0.05
Reach-1	1058	25 YR	508.70	12.30	28.19	16.47	28.19	0.00002	0.74	1677.58	205.40	0.03
Reach-1	1058	50 YR	640.30	12.30	33.64	17.09	33.64	0.00001	0.56	3209.15	351.97	0.02
Reach-1	1058	100 YR	788.30	12.30	35.30	17.62	35.30	0.00001	0.58	3834.36	395.60	0.02
Reach-1	918	2 YR	176.70	13.48	17.77	15.45	17.89	0.00185	2.77	63.74	19.13	0.27
Reach-1	918	10 YR	466.50	13.48	23.73	16.98	23.79	0.00030	2.10	315.72	125.04	0.12
Reach-1	918	25 YR	676.50	13.48	28.14	17.83	28.18	0.00011	1.70	621.01	170.83	0.08
Reach-1	918	50 YR	854.50	13.48	33.62	18.46	33.64	0.00004	1.32	1055.25	266.16	0.05
Reach-1	918	100 YR	1053.60	13.48	35.29	19.08	35.30	0.00002	0.95	2691.27	328.16	0.04
Reach-1	813		Culvert									
Reach-1	734	2 YR	176.70	11.71	14.15	13.50	14.50	0.00430	4.77	37.07	18.91	0.60
Reach-1	734	10 YR	466.50	11.71	16.16	14.91	16.68	0.00293	5.83	80.63	24.40	0.54
Reach-1	734	25 YR	676.50	11.71	16.81	15.64	17.60	0.00352	7.14	96.14	25.97	0.61
Reach-1	734	50 YR	854.50	11.71	17.11	16.16	18.20	0.00445	8.41	103.44	26.69	0.69
Reach-1	734	100 YR	1053.60	11.71	17.30	16.70	18.82	0.00591	9.95	107.97	27.14	0.80
Reach-1	636	2 YR	176.70	9.55	12.48	12.48	13.58	0.01415	8.42	21.00	9.68	1.01
Reach-1	636	10 YR	466.50	9.55	14.69	14.69	16.00	0.00846	9.55	57.29	26.81	0.84
Reach-1	636	25 YR	676.50	9.55	15.64	15.64	16.96	0.00706	10.04	88.18	38.07	0.79
Reach-1	636	50 YR	854.50	9.55	16.22	16.22	17.59	0.00668	10.51	112.32	44.87	0.78
Reach-1	636	100 YR	1053.60	9.55	16.72	16.72	18.17	0.00665	11.10	136.22	50.71	0.79

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	592	2 YR	176.70	7.70	11.90	10.04	12.18	0.00218	4.18	42.26	12.00	0.39
Reach-1	592	10 YR	466.50	7.70	14.06	12.00	14.73	0.00336	6.58	73.60	20.64	0.50
Reach-1	592	25 YR	676.50	7.70	15.23	13.10	16.01	0.00320	7.32	102.97	96.39	0.51
Reach-1	592	50 YR	854.50	7.70	16.04	14.16	16.85	0.00297	7.64	129.36	145.27	0.50
Reach-1	592	100 YR	1053.60	7.70	16.58	15.26	17.52	0.00322	8.35	149.03	168.65	0.53
Reach-1	564		Bridge									
Reach-1	546	2 YR	176.70	7.65	11.64	10.24	11.93	0.00265	4.33	40.82	14.96	0.46
Reach-1	546	10 YR	466.50	7.65	13.48	12.09	14.12	0.00395	6.42	72.65	19.93	0.59
Reach-1	546	25 YR	676.50	7.65	14.22	13.03	15.14	0.00484	7.71	88.60	23.40	0.67
Reach-1	546	50 YR	854.50	7.65	14.72	13.71	15.87	0.00549	8.64	100.91	25.77	0.72
Reach-1	546	100 YR	1053.60	7.65	15.17	14.40	16.59	0.00599	9.62	113.00	27.80	0.76
Reach-1	338	2 YR	176.70	7.07	10.80	9.89	11.13	0.00600	4.90	52.10	29.62	0.49
Reach-1	338	10 YR	466.50	7.07	12.56	11.59	13.04	0.00600	6.61	142.75	72.12	0.53
Reach-1	338	25 YR	676.50	7.07	13.31	12.54	13.82	0.00601	7.27	199.94	82.15	0.54
Reach-1	338	50 YR	854.50	7.07	13.84	12.91	14.38	0.00600	7.72	245.39	89.32	0.55
Reach-1	338	100 YR	1053.60	7.07	14.35	13.31	14.92	0.00600	8.15	293.63	96.35	0.56

HEC-RAS Output for Fornes Run Alternative #1 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8363	2 YR	160.30	58.09	65.63	60.36	65.64	0.00012	1.23	295.54	87.11	0.08
Reach-1	8363	10 YR	264.70	58.09	66.15	61.19	66.18	0.00026	1.91	348.05	116.23	0.12
Reach-1	8363	25 YR	341.70	58.09	66.36	61.67	66.41	0.00039	2.37	374.53	132.73	0.15
Reach-1	8363	50 YR	410.00	58.09	66.51	62.05	66.58	0.00051	2.77	395.76	146.59	0.17
Reach-1	8363	100 YR	485.60	58.09	66.62	62.39	66.71	0.00067	3.20	411.80	155.02	0.19
Reach-1	8290		Culvert									
Reach-1	8188	2 YR	160.30	57.22	61.26	59.83	61.42	0.00316	3.23	50.96	26.79	0.36
Reach-1	8188	10 YR	264.70	57.22	61.99	60.50	62.24	0.00348	4.04	74.77	41.52	0.40
Reach-1	8188	25 YR	341.70	57.22	62.26	60.88	62.60	0.00429	4.74	87.75	53.16	0.45
Reach-1	8188	50 YR	410.00	57.22	62.54	61.17	62.93	0.00461	5.16	103.50	62.10	0.47
Reach-1	8188	100 YR	485.60	57.22	62.82	61.49	63.26	0.00482	5.54	121.89	69.11	0.49
Reach-1	7703	2 YR	160.30	56.00	58.58		58.93	0.00924	4.85	42.92	45.15	0.61
Reach-1	7703	10 YR	264.70	56.00	59.11		59.56	0.00958	5.78	72.73	66.25	0.64
Reach-1	7703	25 YR	341.70	56.00	59.65		60.02	0.00672	5.51	113.95	85.51	0.55
Reach-1	7703	50 YR	410.00	56.00	59.94		60.31	0.00640	5.71	139.68	94.69	0.55
Reach-1	7703	100 YR	485.60	56.00	60.21		60.59	0.00620	5.92	166.15	101.56	0.55
Reach-1	7189	2 YR	160.30	51.20	53.90	53.45	54.35	0.01089	5.42	32.24	21.04	0.66
Reach-1	7189	10 YR	264.70	51.20	57.17	54.11	57.26	0.00077	2.71	182.71	82.09	0.21
Reach-1	7189	25 YR	341.70	51.20	59.27	54.51	59.30	0.00021	1.76	418.40	139.43	0.11
Reach-1	7189	50 YR	410.00	51.20	59.49	54.84	59.53	0.00025	1.96	449.67	143.05	0.12
Reach-1	7189	100 YR	485.60	51.20	59.68	55.17	59.72	0.00030	2.19	476.87	146.13	0.14
Reach-1	6632	2 YR	160.30	46.73	52.00	49.10	52.13	0.00194	2.87	55.82	14.32	0.26
Reach-1	6632	10 YR	264.70	46.73	57.13	49.93	57.14	0.00007	0.93	501.29	145.29	0.05
Reach-1	6632	25 YR	341.70	46.73	59.26	50.44	59.26	0.00003	0.66	898.90	214.02	0.03
Reach-1	6632	50 YR	410.00	46.73	59.48	50.87	59.48	0.00003	0.74	945.88	218.57	0.04
Reach-1	6632	100 YR	485.60	46.73	59.66	51.29	59.67	0.00004	0.84	986.22	222.40	0.04
Reach-1	6343	2 YR	160.30	46.73	51.67		51.74	0.00090	2.35	108.28	64.68	0.21
Reach-1	6343	10 YR	264.70	46.73	57.12		57.13	0.00005	1.00	660.92	139.39	0.06
Reach-1	6343	25 YR	341.70	46.73	59.25		59.25	0.00003	0.93	990.30	172.48	0.05
Reach-1	6343	50 YR	410.00	46.73	59.46		59.47	0.00005	1.09	1027.46	175.77	0.06
Reach-1	6343	100 YR	485.60	46.73	59.64		59.65	0.00006	1.26	1059.01	178.51	0.06
Reach-1	6071	2 YR	192.40	46.10	51.30	48.68	51.43	0.00136	2.88	78.58	189.36	0.25
Reach-1	6071	10 YR	344.90	46.10	57.05	49.67	57.09	0.00016	1.79	269.12	309.29	0.10
Reach-1	6071	25 YR	461.80	46.10	59.25	50.32	59.25	0.00001	0.44	2407.83	377.30	0.02
Reach-1	6071	50 YR	569.00	46.10	59.46	50.77	59.46	0.00001	0.52	2489.28	385.62	0.03
Reach-1	6071	100 YR	690.90	46.10	59.64	51.27	59.64	0.00001	0.61	2558.13	388.54	0.03
Reach-1	5876		Culvert									
Reach-1	5636	2 YR	192.40	41.02	43.57	43.24	44.10	0.00705	5.86	32.81	18.47	0.78
Reach-1	5636	10 YR	344.90	41.02	44.53	44.06	45.20	0.00618	6.54	52.70	22.61	0.76
Reach-1	5636	25 YR	461.80	41.02	45.12	44.56	45.87	0.00584	6.92	66.71	25.12	0.75

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	5636	50 YR	569.00	41.02	45.63	44.96	46.42	0.00540	7.11	80.08	27.30	0.73
Reach-1	5636	100 YR	690.90	41.02	46.10	45.36	46.95	0.00525	7.39	93.46	29.32	0.73
Reach-1	5493	2 YR	192.40	39.45	42.88		43.13	0.00486	3.99	50.78	27.82	0.47
Reach-1	5493	10 YR	344.90	39.45	44.02		44.31	0.00403	4.46	87.69	37.35	0.45
Reach-1	5493	25 YR	461.80	39.45	44.70		45.02	0.00351	4.76	115.07	43.36	0.43
Reach-1	5493	50 YR	569.00	39.45	45.27		45.62	0.00315	4.96	141.57	48.31	0.42
Reach-1	5493	100 YR	690.90	39.45	45.77		46.16	0.00309	5.28	166.71	52.57	0.42
Reach-1	5288	2 YR	192.40	37.92	41.65		42.00	0.00617	4.72	40.78	15.37	0.51
Reach-1	5288	10 YR	344.90	37.92	42.38		43.07	0.00940	6.64	52.55	16.95	0.64
Reach-1	5288	25 YR	461.80	37.92	43.08		43.89	0.00875	7.27	68.33	28.08	0.64
Reach-1	5288	50 YR	569.00	37.92	43.95		44.69	0.00642	7.08	98.61	41.83	0.56
Reach-1	5288	100 YR	690.90	37.92	44.48		45.26	0.00611	7.40	123.20	50.33	0.56
Reach-1	4919	2 YR	192.40	35.89	40.14	38.77	40.32	0.00334	3.66	78.30	60.07	0.37
Reach-1	4919	10 YR	344.90	35.89	41.60	39.94	41.71	0.00160	3.29	184.36	83.44	0.27
Reach-1	4919	25 YR	461.80	35.89	42.85	40.33	42.93	0.00087	2.87	300.40	101.66	0.21
Reach-1	4919	50 YR	569.00	35.89	43.91	40.63	43.97	0.00059	2.64	416.24	117.05	0.18
Reach-1	4919	100 YR	690.90	35.89	44.47	40.90	44.53	0.00060	2.80	483.22	125.09	0.18
Reach-1	4682	2 YR	244.90	34.00	39.52		39.66	0.00236	3.43	111.16	61.98	0.31
Reach-1	4682	10 YR	479.10	34.00	41.26		41.37	0.00135	3.33	282.86	136.55	0.25
Reach-1	4682	25 YR	650.80	34.00	42.69		42.75	0.00067	2.75	505.60	172.33	0.18
Reach-1	4682	50 YR	809.90	34.00	43.81		43.85	0.00045	2.48	710.09	193.55	0.15
Reach-1	4682	100 YR	997.10	34.00	44.36		44.40	0.00047	2.65	819.32	203.98	0.16
Reach-1	4597	2 YR	244.90	33.77	39.11	36.75	39.40	0.00378	4.28	57.24	13.85	0.37
Reach-1	4597	10 YR	479.10	33.77	40.89	38.20	41.18	0.00313	4.73	152.65	74.77	0.35
Reach-1	4597	25 YR	650.80	33.77	42.50	39.08	42.66	0.00149	3.85	303.98	113.50	0.25
Reach-1	4597	50 YR	809.90	33.77	43.68	40.44	43.79	0.00097	3.45	454.54	141.90	0.21
Reach-1	4597	100 YR	997.10	33.77	44.22	40.93	44.34	0.00102	3.68	534.53	151.21	0.22
Reach-1	4545	2 YR	244.90	35.01	37.67	37.67	38.74	0.02845	8.29	29.54	13.83	1.00
Reach-1	4545	10 YR	479.10	35.01	39.15	38.93	40.52	0.02115	9.40	51.84	17.46	0.90
Reach-1	4545	25 YR	650.80	35.01	42.14	39.80	42.49	0.00288	5.13	149.94	72.64	0.36
Reach-1	4545	50 YR	809.90	35.01	43.57	40.89	43.72	0.00111	3.66	297.14	101.23	0.23
Reach-1	4545	100 YR	997.10	35.01	44.10	41.35	44.27	0.00111	3.82	354.30	112.45	0.24
Reach-1	4506		Culvert									
Reach-1	4469	2 YR	244.90	32.55	36.83	35.62	37.24	0.00305	5.17	48.46	18.19	0.52
Reach-1	4469	10 YR	479.10	32.55	38.07	36.96	38.73	0.00351	6.71	77.72	38.67	0.59
Reach-1	4469	25 YR	650.80	32.55	39.26	37.83	39.87	0.00236	6.54	112.33	68.08	0.50
Reach-1	4469	50 YR	809.90	32.55	40.55	38.34	40.80	0.00092	4.73	252.24	93.88	0.33
Reach-1	4469	100 YR	997.10	32.55	41.33	38.87	41.54	0.00074	4.58	330.93	109.86	0.30
Reach-1	4362	2 YR	244.90	31.60	36.74		36.87	0.00157	2.94	83.44	21.32	0.26
Reach-1	4362	10 YR	479.10	31.60	37.92		38.21	0.00282	4.36	109.92	24.06	0.36
Reach-1	4362	25 YR	650.80	31.60	39.19		39.47	0.00205	4.36	193.44	86.52	0.32
Reach-1	4362	50 YR	809.90	31.60	40.46		40.66	0.00128	3.92	320.69	112.20	0.26

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4362	100 YR	997.10	31.60	41.24		41.43	0.00116	3.99	412.43	123.24	0.25
Reach-1	4249	2 YR	244.90	31.37	36.13	34.80	36.53	0.00654	5.21	61.90	48.02	0.51
Reach-1	4249	10 YR	479.10	31.37	37.65	36.72	37.85	0.00303	4.38	174.97	97.37	0.36
Reach-1	4249	25 YR	650.80	31.37	39.18	37.20	39.26	0.00091	2.93	353.49	136.06	0.21
Reach-1	4249	50 YR	809.90	31.37	40.49	37.46	40.54	0.00044	2.31	553.17	169.15	0.15
Reach-1	4249	100 YR	997.10	31.37	41.28	37.72	41.32	0.00037	2.26	693.90	189.02	0.14
Reach-1	4027	2 YR	244.90	30.79	35.62	33.43	35.75	0.00184	3.06	110.16	73.07	0.30
Reach-1	4027	10 YR	479.10	30.79	37.30	34.64	37.43	0.00122	3.25	246.79	89.81	0.26
Reach-1	4027	25 YR	650.80	30.79	39.00	35.46	39.09	0.00063	2.85	414.65	107.17	0.20
Reach-1	4027	50 YR	809.90	30.79	40.36	35.94	40.44	0.00044	2.71	569.91	121.40	0.17
Reach-1	4027	100 YR	997.10	30.79	41.14	36.31	41.23	0.00045	2.91	669.08	131.13	0.17
Reach-1	3819	2 YR	244.90	30.63	34.86	33.26	35.17	0.00439	4.46	56.87	31.02	0.43
Reach-1	3819	10 YR	479.10	30.63	36.92	34.48	37.11	0.00188	4.01	217.02	105.38	0.30
Reach-1	3819	25 YR	650.80	30.63	38.88	35.86	38.95	0.00065	2.90	470.46	146.01	0.19
Reach-1	3819	50 YR	809.90	30.63	40.29	36.27	40.34	0.00039	2.53	687.95	161.10	0.15
Reach-1	3819	100 YR	997.10	30.63	41.08	36.64	41.13	0.00038	2.64	817.99	169.64	0.15
Reach-1	3713	2 YR	244.90	31.05	34.55	33.22	34.84	0.00226	4.33	56.88	20.80	0.45
Reach-1	3713	10 YR	479.10	31.05	36.57	34.29	36.89	0.00142	4.67	115.75	85.88	0.38
Reach-1	3713	25 YR	650.80	31.05	38.63	34.97	38.85	0.00062	3.93	211.52	134.09	0.27
Reach-1	3713	50 YR	809.90	31.05	40.14	35.52	40.28	0.00036	3.42	363.57	172.14	0.21
Reach-1	3713	100 YR	997.10	31.05	40.93	36.20	41.07	0.00034	3.54	456.88	199.26	0.21
Reach-1	3670		Culvert									
Reach-1	3631	2 YR	244.90	30.31	33.48	33.48	34.38	0.02364	7.61	32.29	18.49	0.99
Reach-1	3631	10 YR	479.10	30.31	35.55	34.57	36.19	0.00693	6.47	78.47	29.83	0.60
Reach-1	3631	25 YR	650.80	30.31	37.16	35.15	37.70	0.00362	5.99	116.56	62.61	0.46
Reach-1	3631	50 YR	809.90	30.31	38.70	35.62	39.01	0.00175	4.88	267.63	95.41	0.33
Reach-1	3631	100 YR	997.10	30.31	40.30	36.15	40.51	0.00097	4.21	474.96	159.93	0.26
Reach-1	3534	2 YR	244.90	28.83	32.66	31.22	32.93	0.00410	4.11	59.54	20.83	0.43
Reach-1	3534	10 YR	479.10	28.83	35.63	32.30	35.73	0.00087	2.89	289.38	110.44	0.22
Reach-1	3534	25 YR	650.80	28.83	37.30	32.96	37.37	0.00047	2.53	500.28	142.04	0.17
Reach-1	3534	50 YR	809.90	28.83	38.77	33.89	38.82	0.00030	2.30	729.13	169.10	0.14
Reach-1	3534	100 YR	997.10	28.83	40.35	34.36	40.39	0.00020	2.12	1018.82	198.19	0.12
Reach-1	3491	2 YR	273.50	28.37	31.94	31.17	32.54	0.01138	6.22	44.00	15.87	0.66
Reach-1	3491	10 YR	551.00	28.37	35.21	32.57	35.58	0.00308	5.09	137.12	100.02	0.38
Reach-1	3491	25 YR	750.70	28.37	36.98	33.37	37.27	0.00181	4.68	232.05	121.64	0.30
Reach-1	3491	50 YR	938.70	28.37	38.51	34.13	38.74	0.00124	4.39	319.99	138.77	0.26
Reach-1	3491	100 YR	1165.10	28.37	40.11	35.08	40.32	0.00095	4.28	411.66	170.80	0.23
Reach-1	3423		Culvert									
Reach-1	3336	2 YR	273.50	28.37	31.73	31.03	32.21	0.01057	5.59	48.94	21.22	0.65
Reach-1	3336	10 YR	551.00	28.37	35.04	32.24	35.20	0.00159	3.46	209.83	145.70	0.28
Reach-1	3336	25 YR	750.70	28.37	36.30	32.91	36.45	0.00111	3.39	304.07	169.90	0.24

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3336	50 YR	938.70	28.37	37.24	33.83	37.39	0.00096	3.47	378.14	183.90	0.23
Reach-1	3336	100 YR	1165.10	28.37	38.00	34.28	38.16	0.00098	3.75	439.38	192.46	0.24
Reach-1	3266	2 YR	273.50	26.28	29.37	29.18	30.33	0.02244	7.83	34.92	14.90	0.90
Reach-1	3266	10 YR	551.00	26.28	35.03		35.10	0.00062	2.50	351.70	110.66	0.17
Reach-1	3266	25 YR	750.70	26.28	36.31		36.36	0.00044	2.32	515.69	162.38	0.14
Reach-1	3266	50 YR	938.70	26.28	37.26		37.31	0.00035	2.24	684.04	184.74	0.13
Reach-1	3266	100 YR	1165.10	26.28	38.03		38.07	0.00033	2.28	829.12	195.01	0.13
Reach-1	3200	2 YR	273.50	24.19	29.34	26.89	29.55	0.00280	3.75	73.03	18.57	0.33
Reach-1	3200	10 YR	551.00	24.19	34.95	28.27	35.05	0.00046	2.70	249.75	103.35	0.15
Reach-1	3200	25 YR	750.70	24.19	36.17	29.08	36.30	0.00053	3.14	298.71	121.25	0.17
Reach-1	3200	50 YR	938.70	24.19	37.07	29.74	37.24	0.00060	3.52	335.11	202.50	0.18
Reach-1	3200	100 YR	1165.10	24.19	37.82	30.50	38.00	0.00064	3.78	484.06	241.99	0.19
Reach-1	3156		Culvert									
Reach-1	3114	2 YR	273.50	24.09	29.19	26.81	29.45	0.00340	4.07	67.22	16.34	0.35
Reach-1	3114	10 YR	551.00	24.09	34.57	28.25	34.65	0.00046	2.57	380.49	124.40	0.15
Reach-1	3114	25 YR	750.70	24.09	35.41	29.09	35.50	0.00050	2.82	493.08	139.30	0.16
Reach-1	3114	50 YR	938.70	24.09	35.85	29.84	35.95	0.00059	3.16	554.86	143.33	0.17
Reach-1	3114	100 YR	1165.10	24.09	36.29	30.79	36.41	0.00070	3.53	618.52	147.37	0.19
Reach-1	3049	2 YR	273.50	23.69	29.18		29.26	0.00081	2.24	122.20	30.77	0.19
Reach-1	3049	10 YR	551.00	23.69	34.58		34.62	0.00015	1.66	487.36	110.39	0.10
Reach-1	3049	25 YR	750.70	23.69	35.41		35.46	0.00019	1.99	584.77	122.91	0.11
Reach-1	3049	50 YR	938.70	23.69	35.84		35.91	0.00025	2.33	639.25	129.70	0.13
Reach-1	3049	100 YR	1165.10	23.69	36.27		36.37	0.00033	2.72	696.48	136.47	0.14
Reach-1	2991	2 YR	293.20	23.30	28.87	26.61	29.12	0.00318	4.08	73.34	21.72	0.37
Reach-1	2991	10 YR	599.60	23.30	34.54	28.14	34.60	0.00032	2.32	480.65	130.61	0.13
Reach-1	2991	25 YR	824.40	23.30	35.36	29.01	35.44	0.00039	2.72	619.82	143.41	0.15
Reach-1	2991	50 YR	1032.40	23.30	35.78	29.71	35.88	0.00050	3.16	681.25	149.89	0.17
Reach-1	2991	100 YR	1281.50	23.30	36.20	30.43	36.33	0.00064	3.65	744.87	155.96	0.20
Reach-1	2946		Culvert									
Reach-1	2884	2 YR	293.20	21.91	27.07	25.37	27.41	0.00478	4.69	63.35	20.53	0.45
Reach-1	2884	10 YR	599.60	21.91	28.73	26.87	29.32	0.00557	6.23	103.94	32.09	0.51
Reach-1	2884	25 YR	824.40	21.91	29.49	27.73	30.27	0.00612	7.22	142.59	75.11	0.54
Reach-1	2884	50 YR	1032.40	21.91	30.10	28.42	30.96	0.00615	7.77	191.32	84.97	0.56
Reach-1	2884	100 YR	1281.50	21.91	30.72	29.19	31.64	0.00609	8.25	247.65	95.11	0.56
Reach-1	2718	2 YR	293.20	21.25	26.51		26.74	0.00293	3.84	76.41	19.86	0.34
Reach-1	2718	10 YR	599.60	21.25	28.20		28.52	0.00293	4.73	146.50	62.78	0.36
Reach-1	2718	25 YR	824.40	21.25	29.09		29.39	0.00250	4.83	211.48	84.05	0.34
Reach-1	2718	50 YR	1032.40	21.25	29.80		30.09	0.00212	4.79	276.04	97.83	0.32
Reach-1	2718	100 YR	1281.50	21.25	30.49		30.77	0.00189	4.82	348.49	111.32	0.31
Reach-1	2475	2 YR	293.20	20.31	25.58	23.57	25.90	0.00411	4.55	66.63	19.78	0.40
Reach-1	2475	10 YR	599.60	20.31	26.60	25.10	27.38	0.00765	7.20	97.35	37.39	0.57

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	2475	25 YR	824.40	20.31	27.08	26.16	28.22	0.01015	8.82	117.01	44.88	0.66
Reach-1	2475	50 YR	1032.40	20.31	27.41	27.01	28.92	0.01266	10.23	133.03	52.85	0.75
Reach-1	2475	100 YR	1281.50	20.31	28.08	28.08	29.69	0.01227	10.83	179.18	79.06	0.75
Reach-1	2190	2 YR	293.20	20.06	25.00		25.11	0.00174	3.10	158.37	102.47	0.29
Reach-1	2190	10 YR	599.60	20.06	25.97		26.15	0.00221	4.09	266.75	119.04	0.34
Reach-1	2190	25 YR	824.40	20.06	26.55		26.75	0.00231	4.53	337.28	125.03	0.35
Reach-1	2190	50 YR	1032.40	20.06	27.00		27.22	0.00240	4.88	394.89	129.72	0.36
Reach-1	2190	100 YR	1281.50	20.06	27.48		27.72	0.00251	5.27	457.56	134.64	0.38
Reach-1	2008	2 YR	293.20	20.00	23.22	23.22	24.23	0.02602	8.07	36.34	36.24	1.00
Reach-1	2008	10 YR	599.60	20.00	24.39	24.39	25.22	0.01625	8.10	108.76	68.66	0.83
Reach-1	2008	25 YR	824.40	20.00	24.83	24.83	25.78	0.01642	8.94	141.85	80.39	0.86
Reach-1	2008	50 YR	1032.40	20.00	25.20	25.20	26.23	0.01625	9.53	172.96	90.03	0.87
Reach-1	2008	100 YR	1281.50	20.00	25.57	25.57	26.69	0.01624	10.15	208.56	99.93	0.88
Reach-1	1780	2 YR	293.20	16.24	20.24		20.44	0.00432	4.24	125.97	113.68	0.43
Reach-1	1780	10 YR	599.60	16.24	21.61		21.74	0.00240	4.07	289.01	124.90	0.34
Reach-1	1780	25 YR	824.40	16.24	22.37		22.50	0.00202	4.16	386.95	131.18	0.33
Reach-1	1780	50 YR	1032.40	16.24	22.95		23.09	0.00189	4.33	464.84	135.96	0.32
Reach-1	1780	100 YR	1281.50	16.24	23.53		23.68	0.00185	4.57	544.41	140.26	0.32
Reach-1	1515	2 YR	293.20	14.33	18.48		18.93	0.00798	5.40	55.10	22.89	0.58
Reach-1	1515	10 YR	599.60	14.33	19.94		20.66	0.00743	6.91	100.31	42.88	0.60
Reach-1	1515	25 YR	824.40	14.33	20.91		21.60	0.00584	7.04	170.23	85.04	0.55
Reach-1	1515	50 YR	1032.40	14.33	21.69		22.29	0.00467	6.92	240.37	95.78	0.50
Reach-1	1515	100 YR	1281.50	14.33	22.27		22.89	0.00456	7.28	297.88	103.76	0.50
Reach-1	1274	2 YR	293.20	12.60	17.57		17.78	0.00284	3.82	94.17	46.51	0.36
Reach-1	1274	10 YR	599.60	12.60	19.40		19.64	0.00214	4.38	203.19	69.65	0.33
Reach-1	1274	25 YR	824.40	12.60	20.50		20.74	0.00183	4.59	284.84	80.88	0.32
Reach-1	1274	50 YR	1032.40	12.60	21.28		21.54	0.00176	4.85	352.61	91.68	0.32
Reach-1	1274	100 YR	1281.50	12.60	21.78		22.10	0.00201	5.43	400.29	97.71	0.34
Reach-1	1121	2 YR	293.20	12.55	15.52	15.52	16.69	0.02826	8.68	33.78	14.65	1.01
Reach-1	1121	10 YR	599.60	12.55	17.01	17.01	18.71	0.02653	10.48	57.23	16.99	1.01
Reach-1	1121	25 YR	824.40	12.55	17.89	17.89	19.88	0.02566	11.31	72.88	18.38	1.00
Reach-1	1121	50 YR	1032.40	12.55	19.06	19.06	20.78	0.01746	10.64	110.41	57.83	0.85
Reach-1	1121	100 YR	1281.50	12.55	20.01	20.01	21.39	0.01212	9.98	181.65	83.16	0.73
Reach-1	1031	2 YR	293.20	10.07	14.22		14.66	0.00782	5.35	58.02	31.30	0.57
Reach-1	1031	10 YR	599.60	10.07	15.81		16.31	0.00545	6.04	143.13	77.85	0.51
Reach-1	1031	25 YR	824.40	10.07	16.73		17.15	0.00406	5.94	225.55	93.92	0.46
Reach-1	1031	50 YR	1032.40	10.07	17.34		17.76	0.00370	6.10	284.07	97.42	0.45
Reach-1	1031	100 YR	1281.50	10.07	18.03		18.44	0.00333	6.24	352.69	101.37	0.43
Reach-1	723	2 YR	305.80	7.79	13.18	11.07	13.40	0.00235	3.75	90.32	34.71	0.33
Reach-1	723	10 YR	632.10	7.79	14.69	12.43	15.08	0.00297	5.23	154.39	50.33	0.40
Reach-1	723	25 YR	876.20	7.79	15.49	13.28	16.01	0.00341	6.14	209.27	91.26	0.43
Reach-1	723	50 YR	1101.80	7.79	16.10	13.94	16.65	0.00345	6.57	266.77	98.88	0.44
Reach-1	723	100 YR	1371.10	7.79	16.57	14.63	17.28	0.00411	7.49	319.37	143.63	0.49

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	426	2 YR	305.80	7.17	12.48	10.45	12.69	0.00243	3.76	104.09	70.64	0.34
Reach-1	426	10 YR	632.10	7.17	14.02	11.88	14.29	0.00235	4.62	232.75	201.63	0.35
Reach-1	426	25 YR	876.20	7.17	14.84	12.92	15.14	0.00238	5.11	351.39	283.51	0.36
Reach-1	426	50 YR	1101.80	7.17	15.58	13.42	15.84	0.00201	5.06	489.04	313.69	0.34
Reach-1	426	100 YR	1371.10	7.17	16.07	13.88	16.35	0.00212	5.44	590.68	333.71	0.35
Reach-1	157	2 YR	305.80	6.57	11.89	9.86	12.06	0.00210	3.50	128.09	72.31	0.31
Reach-1	157	10 YR	632.10	6.57	13.43	11.38	13.65	0.00210	4.38	270.97	116.51	0.33
Reach-1	157	25 YR	876.20	6.57	14.25	12.06	14.50	0.00210	4.81	376.76	144.70	0.34
Reach-1	157	50 YR	1101.80	6.57	14.98	12.52	15.26	0.00210	5.18	521.13	275.02	0.35
Reach-1	157	100 YR	1371.10	6.57	15.47	13.08	15.75	0.00210	5.42	664.86	294.68	0.35

HEC-RAS Output for Greens Mill Run North Fork Alternative #1 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8786	2 YR	162.80	68.89	74.85	72.66	74.92	0.00071	2.83	178.81	315.03	0.21
Reach-1	8786	10 YR	296.70	68.89	74.82	73.90	75.10	0.00284	5.64	152.80	299.16	0.42
Reach-1	8786	25 YR	384.20	68.89	74.17	74.17	75.37	0.01130	10.37	72.66	57.22	0.81
Reach-1	8786	50 YR	464.30	68.89	74.18	74.18	75.91	0.01639	12.51	72.93	62.10	0.98
Reach-1	8786	100 YR	554.30	68.89	74.78	74.78	75.60	0.00887	9.92	144.61	208.58	0.74
Reach-1	8740		Culvert									
Reach-1	8687	2 YR	162.80	67.66	72.24	71.74	72.52	0.00365	4.94	45.56	36.35	0.42
Reach-1	8687	10 YR	296.70	67.66	72.45	72.45	73.12	0.00859	7.83	52.39	40.42	0.65
Reach-1	8687	25 YR	384.20	67.66	72.75	72.75	73.47	0.00883	8.29	62.86	98.24	0.67
Reach-1	8687	50 YR	464.30	67.66	72.94	72.94	73.77	0.00961	8.87	69.58	128.86	0.70
Reach-1	8687	100 YR	554.30	67.66	73.15	73.15	74.08	0.01019	9.39	76.82	156.87	0.73
Reach-1	8272	2 YR	162.80	67.10	70.54	70.48	70.73	0.00497	4.67	55.60	91.18	0.47
Reach-1	8272	10 YR	296.70	67.10	71.01		71.13	0.00230	3.49	113.03	147.41	0.32
Reach-1	8272	25 YR	384.20	67.10	71.24		71.36	0.00164	3.07	148.73	167.54	0.28
Reach-1	8272	50 YR	464.30	67.10	71.26		71.42	0.00224	3.61	151.92	169.41	0.32
Reach-1	8272	100 YR	554.30	67.10	71.56		71.68	0.00125	2.83	206.19	195.52	0.24
Reach-1	7868	2 YR	162.80	65.21	68.02		68.36	0.00675	4.72	34.50	16.08	0.57
Reach-1	7868	10 YR	296.70	65.21	69.20	68.07	69.64	0.00605	5.36	55.35	19.26	0.56
Reach-1	7868	25 YR	384.20	65.21	69.97		70.31	0.00413	4.91	95.10	110.45	0.47
Reach-1	7868	50 YR	464.30	65.21	70.81		70.88	0.00076	2.37	232.11	193.97	0.21
Reach-1	7868	100 YR	554.30	65.21	71.42		71.46	0.00025	1.48	374.72	265.87	0.12
Reach-1	7348	2 YR	162.80	61.03	65.92	63.09	66.01	0.00120	2.35	69.31	20.01	0.22
Reach-1	7348	10 YR	296.70	61.03	67.71	63.97	67.82	0.00101	2.68	122.47	64.50	0.21
Reach-1	7348	25 YR	384.20	61.03	69.02	64.44	69.09	0.00057	2.36	260.59	130.48	0.17
Reach-1	7348	50 YR	464.30	61.03	70.42	64.83	70.45	0.00021	1.66	497.15	209.45	0.11
Reach-1	7348	100 YR	554.30	61.03	71.27	65.23	71.29	0.00013	1.38	669.56	294.98	0.08
Reach-1	6966	2 YR	321.20	59.80	65.18	62.81	65.41	0.00161	3.86	88.45	28.08	0.34
Reach-1	6966	10 YR	607.40	59.80	66.83	64.13	67.19	0.00182	4.93	138.98	43.42	0.38
Reach-1	6966	25 YR	795.70	59.80	68.32	64.82	68.66	0.00126	4.84	201.03	115.27	0.33
Reach-1	6966	50 YR	960.20	59.80	69.90	65.34	70.19	0.00084	4.54	269.02	152.55	0.28
Reach-1	6966	100 YR	1143.50	59.80	71.03	65.91	71.15	0.00042	3.50	683.19	298.54	0.20
Reach-1	6917		Culvert									
Reach-1	6830	2 YR	321.20	59.86	64.63	63.41	65.14	0.00488	5.74	56.56	24.69	0.57
Reach-1	6830	10 YR	607.40	59.86	65.52	64.96	66.49	0.00710	8.07	96.97	80.45	0.71
Reach-1	6830	25 YR	795.70	59.86	66.05	66.05	67.06	0.00687	8.61	148.79	163.18	0.71
Reach-1	6830	50 YR	960.20	59.86	66.39	66.39	67.45	0.00687	9.04	184.34	176.20	0.72
Reach-1	6830	100 YR	1143.50	59.86	67.16	66.71	67.92	0.00461	8.16	262.70	204.44	0.60
Reach-1	6499	2 YR	321.20	59.58	63.73		63.90	0.00230	3.57	141.22	114.11	0.37
Reach-1	6499	10 YR	607.40	59.58	65.10		65.22	0.00130	3.47	347.55	181.87	0.30
Reach-1	6499	25 YR	795.70	59.58	65.75		65.85	0.00101	3.36	470.55	195.81	0.27

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6499	50 YR	960.20	59.58	66.26		66.35	0.00083	3.26	572.82	206.33	0.25
Reach-1	6499	100 YR	1143.50	59.58	67.14		67.20	0.00049	2.77	760.96	221.28	0.19
Reach-1	5998	2 YR	321.20	58.16	62.27		62.54	0.00320	4.18	83.04	41.74	0.43
Reach-1	5998	10 YR	607.40	58.16	64.16		64.44	0.00185	4.44	219.27	235.29	0.36
Reach-1	5998	25 YR	795.70	58.16	65.23		65.37	0.00091	3.57	520.23	301.45	0.26
Reach-1	5998	50 YR	960.20	58.16	65.88		65.98	0.00067	3.28	718.35	315.27	0.23
Reach-1	5998	100 YR	1143.50	58.16	66.93		66.99	0.00037	2.69	1062.41	337.93	0.17
Reach-1	5499	2 YR	321.20	56.76	61.15		61.32	0.00184	3.52	132.92	95.62	0.32
Reach-1	5499	10 YR	607.40	56.76	64.04		64.07	0.00028	2.02	717.85	268.70	0.14
Reach-1	5499	25 YR	795.70	56.76	65.13		65.15	0.00020	1.87	1029.33	304.97	0.12
Reach-1	5499	50 YR	960.20	56.76	65.78		65.80	0.00018	1.85	1234.64	327.75	0.11
Reach-1	5499	100 YR	1143.50	56.76	66.86		66.88	0.00012	1.65	1605.76	354.99	0.09
Reach-1	5469	2 YR	321.20	57.01	61.15	59.07	61.25	0.00076	2.69	154.02	83.63	0.25
Reach-1	5469	10 YR	607.40	57.01	63.96	60.03	64.05	0.00032	2.57	318.75	218.25	0.18
Reach-1	5469	25 YR	795.70	57.01	65.09	60.45	65.14	0.00019	2.18	870.56	315.91	0.14
Reach-1	5469	50 YR	960.20	57.01	65.74	60.76	65.79	0.00017	2.18	1085.48	370.82	0.13
Reach-1	5469	100 YR	1143.50	57.01	66.84	61.08	66.87	0.00010	1.87	1710.77	690.76	0.11
Reach-1	5400		Culvert									
Reach-1	5333	2 YR	321.20	56.33	61.00	58.57	61.09	0.00061	2.53	178.23	169.17	0.23
Reach-1	5333	10 YR	607.40	56.33	63.22	59.49	63.26	0.00022	2.07	721.83	311.60	0.15
Reach-1	5333	25 YR	795.70	56.33	64.65	60.03	64.67	0.00012	1.74	1269.22	434.08	0.11
Reach-1	5333	50 YR	960.20	56.33	65.74	60.49	65.76	0.00008	1.54	1761.57	468.09	0.09
Reach-1	5333	100 YR	1143.50	56.33	66.85	60.94	66.86	0.00006	1.41	2324.53	544.43	0.08
Reach-1	5149	2 YR	321.20	56.02	60.85		60.94	0.00100	2.80	204.91	158.30	0.24
Reach-1	5149	10 YR	607.40	56.02	63.19		63.21	0.00023	1.79	808.53	318.89	0.12
Reach-1	5149	25 YR	795.70	56.02	64.63		64.65	0.00011	1.39	1326.55	552.12	0.09
Reach-1	5149	50 YR	960.20	56.02	65.73		65.74	0.00006	1.11	1953.34	592.09	0.07
Reach-1	5149	100 YR	1143.50	56.02	66.84		66.85	0.00003	0.92	2636.96	635.29	0.05
Reach-1	4497	2 YR	321.20	54.69	60.72		60.73	0.00013	1.22	557.74	222.12	0.10
Reach-1	4497	10 YR	607.40	54.69	63.13		63.14	0.00006	1.08	1209.18	326.23	0.07
Reach-1	4497	25 YR	795.70	54.69	64.60		64.60	0.00004	1.03	1730.94	414.16	0.06
Reach-1	4497	50 YR	960.20	54.69	65.71		65.71	0.00003	0.96	2235.31	486.89	0.05
Reach-1	4497	100 YR	1143.50	54.69	66.83		66.83	0.00002	0.89	2826.76	563.53	0.05
Reach-1	4074	2 YR	321.20	53.69	60.68	57.34	60.69	0.00005	0.86	1132.45	539.23	0.06
Reach-1	4074	10 YR	607.40	53.69	63.12	58.48	63.12	0.00002	0.58	2495.34	577.96	0.04
Reach-1	4074	25 YR	795.70	53.69	64.59	58.72	64.59	0.00001	0.52	3380.28	643.48	0.03
Reach-1	4074	50 YR	960.20	53.69	65.70	58.90	65.70	0.00001	0.50	4119.63	685.32	0.03
Reach-1	4074	100 YR	1143.50	53.69	66.82	59.36	66.82	0.00001	0.48	4912.23	728.03	0.02
Reach-1	4027	2 YR	330.70	53.79	60.66	57.13	60.68	0.00014	1.53	586.15	306.46	0.11
Reach-1	4027	10 YR	517.80	53.79	63.10	58.04	63.11	0.00006	1.28	1060.93	416.18	0.08
Reach-1	4027	25 YR	596.90	53.79	64.58	58.27	64.59	0.00004	1.15	1347.69	479.94	0.07
Reach-1	4027	50 YR	649.90	53.79	65.69	58.42	65.70	0.00003	1.06	1564.27	536.72	0.06

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4027	100 YR	700.10	53.79	66.82	58.50	66.82	0.00002	1.00	1782.48	605.79	0.05
Reach-1	3919		Culvert									
Reach-1	3894	2 YR	326.90	52.81	57.51	56.15	57.93	0.00377	5.24	62.92	20.86	0.51
Reach-1	3894	10 YR	510.10	52.81	58.02	57.00	58.78	0.00560	7.02	74.79	25.14	0.63
Reach-1	3894	25 YR	592.30	52.81	58.30	57.34	59.18	0.00591	7.56	82.07	27.50	0.66
Reach-1	3894	50 YR	646.50	52.81	58.43	57.55	59.40	0.00629	7.97	85.75	28.62	0.68
Reach-1	3894	100 YR	697.30	52.81	58.53	57.74	59.60	0.00676	8.38	88.53	29.44	0.71
Reach-1	3582	2 YR	326.90	52.39	56.09		56.34	0.00647	5.09	133.80	116.95	0.53
Reach-1	3582	10 YR	510.10	52.39	57.11		57.24	0.00295	4.21	316.15	229.14	0.37
Reach-1	3582	25 YR	592.30	52.39	58.05		58.10	0.00110	2.96	540.56	251.78	0.24
Reach-1	3582	50 YR	646.50	52.39	58.23		58.28	0.00106	2.97	587.78	256.50	0.23
Reach-1	3582	100 YR	697.30	52.39	58.36		58.41	0.00107	3.04	620.52	259.72	0.24
Reach-1	3086	2 YR	328.60	50.43	55.08		55.13	0.00118	2.62	291.29	144.36	0.24
Reach-1	3086	10 YR	514.10	50.43	56.64		56.67	0.00056	2.27	540.96	176.71	0.17
Reach-1	3086	25 YR	597.50	50.43	57.81		57.83	0.00031	1.91	761.83	201.93	0.13
Reach-1	3086	50 YR	652.60	50.43	57.99		58.01	0.00032	2.00	798.38	208.35	0.14
Reach-1	3086	100 YR	704.30	50.43	58.10		58.12	0.00035	2.10	822.33	212.40	0.14
Reach-1	2963	2 YR	328.60	49.39	54.91	52.35	55.01	0.00064	2.86	178.88	109.32	0.23
Reach-1	2963	10 YR	514.10	49.39	56.45	53.07	56.57	0.00054	3.18	258.63	157.17	0.22
Reach-1	2963	25 YR	597.50	49.39	57.73	53.30	57.78	0.00024	2.42	506.20	232.01	0.16
Reach-1	2963	50 YR	652.60	49.39	57.90	53.45	57.96	0.00027	2.56	525.48	248.19	0.16
Reach-1	2963	100 YR	704.30	49.39	58.06	53.58	58.09	0.00017	2.05	832.26	272.53	0.13
Reach-1	2919		Culvert									
Reach-1	2837	2 YR	328.60	49.18	54.62	52.26	54.89	0.00209	4.18	80.91	51.52	0.37
Reach-1	2837	10 YR	514.10	49.18	55.94	53.17	56.20	0.00160	4.35	192.46	111.52	0.33
Reach-1	2837	25 YR	597.50	49.18	57.44	53.53	57.53	0.00055	3.01	462.79	239.82	0.20
Reach-1	2837	50 YR	652.60	49.18	57.66	53.75	57.76	0.00054	3.04	519.10	260.96	0.20
Reach-1	2837	100 YR	704.30	49.18	57.82	53.95	57.92	0.00054	3.11	562.63	282.08	0.20
Reach-1	2497	2 YR	328.60	48.70	54.58		54.60	0.00021	1.41	410.72	193.15	0.11
Reach-1	2497	10 YR	514.10	48.70	55.92		55.94	0.00018	1.50	720.39	265.48	0.10
Reach-1	2497	25 YR	597.50	48.70	57.42		57.44	0.00008	1.12	1191.06	338.51	0.07
Reach-1	2497	50 YR	652.60	48.70	57.65		57.66	0.00008	1.15	1268.00	343.30	0.07
Reach-1	2497	100 YR	704.30	48.70	57.81		57.82	0.00008	1.19	1322.72	346.67	0.07
Reach-1	1998	2 YR	328.60	48.28	54.48		54.50	0.00018	1.36	411.09	174.74	0.10
Reach-1	1998	10 YR	514.10	48.28	55.83		55.86	0.00016	1.49	688.89	232.32	0.10
Reach-1	1998	25 YR	597.50	48.28	57.38		57.40	0.00008	1.20	1087.22	282.72	0.07
Reach-1	1998	50 YR	652.60	48.28	57.61		57.62	0.00009	1.25	1151.33	290.17	0.07
Reach-1	1998	100 YR	704.30	48.28	57.76		57.78	0.00009	1.31	1196.94	295.36	0.08
Reach-1	1500	2 YR	328.60	48.00	54.48		54.48	0.00000	0.30	1147.99	301.88	0.02
Reach-1	1500	10 YR	514.10	48.00	55.83		55.84	0.00000	0.38	1630.52	415.43	0.02
Reach-1	1500	25 YR	597.50	48.00	57.38		57.38	0.00000	0.35	2328.81	480.78	0.02

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1500	50 YR	652.60	48.00	57.61		57.61	0.00000	0.37	2437.25	488.49	0.02
Reach-1	1500	100 YR	704.30	48.00	57.76		57.76	0.00000	0.40	2514.01	498.00	0.02
Reach-1	902	2 YR	328.60	47.80	54.48		54.48	0.00000	0.28	1162.69	227.02	0.02
Reach-1	902	10 YR	514.10	47.80	55.83		55.83	0.00000	0.35	1485.43	244.30	0.02
Reach-1	902	25 YR	597.50	47.80	57.38		57.38	0.00000	0.32	1874.45	259.59	0.02
Reach-1	902	50 YR	652.60	47.80	57.60		57.61	0.00000	0.34	1932.84	262.55	0.02
Reach-1	902	100 YR	704.30	47.80	57.76		57.76	0.00000	0.36	1973.86	264.54	0.02
Reach-1	841	2 YR	311.90	47.80	54.48	48.22	54.48	0.00000	0.21	1458.01	257.07	0.02
Reach-1	841	10 YR	529.60	47.80	55.83	48.39	55.83	0.00000	0.29	1824.43	284.33	0.02
Reach-1	841	25 YR	608.30	47.80	57.38	48.44	57.38	0.00000	0.27	2276.46	298.27	0.02
Reach-1	841	50 YR	732.10	47.80	57.60	48.53	57.61	0.00000	0.31	2343.36	300.71	0.02
Reach-1	841	100 YR	840.50	47.80	57.76	48.60	57.76	0.00000	0.35	2390.29	302.82	0.02
Reach-1	723		Culvert									
Reach-1	664	2 YR	311.80	43.18	47.28	47.28	48.78	0.03346	9.80	31.81	10.63	1.00
Reach-1	664	10 YR	529.60	43.18	54.41	49.17	54.42	0.00020	1.65	760.04	268.86	0.09
Reach-1	664	25 YR	608.10	43.18	56.65	49.48	56.66	0.00004	0.88	1473.90	433.49	0.04
Reach-1	664	50 YR	732.00	43.18	56.96	49.87	56.97	0.00006	1.05	1629.84	513.14	0.05
Reach-1	664	100 YR	839.70	43.18	57.25	50.16	57.26	0.00006	1.07	1781.01	528.38	0.05
Reach-1	415	2 YR	311.80	42.21	46.00	44.50	46.20	0.00300	3.72	102.82	56.65	0.37
Reach-1	415	10 YR	529.60	42.21	54.40	45.30	54.40	0.00003	0.81	2019.87	538.05	0.04
Reach-1	415	25 YR	608.10	42.21	56.65	45.54	56.65	0.00001	0.57	3361.82	639.52	0.03
Reach-1	415	50 YR	732.00	42.21	56.96	45.91	56.96	0.00001	0.66	3563.21	659.78	0.03
Reach-1	415	100 YR	839.70	42.21	57.25	46.19	57.25	0.00002	0.72	3759.88	702.83	0.03

H.8 HEC-RAS Output – Primary System Alternative #2

HEC-RAS Output for Greens Mill Run Alternative #2 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	40149	2 year	314.60	63.69	67.48		68.32	0.01671	7.44	46.07	24.11	0.82
Reach-1	40149	10 year	597.30	63.69	70.00		70.61	0.00514	6.54	122.34	41.48	0.51
Reach-1	40149	25 year	798.30	63.69	71.70		71.98	0.00195	4.88	229.26	83.68	0.33
Reach-1	40149	50 year	974.60	63.69	72.20		72.47	0.00177	4.88	278.30	114.24	0.32
Reach-1	40149	100 year	1170.10	63.69	72.57		72.84	0.00161	4.80	322.66	129.86	0.31
Reach-1	39582	2 year	314.60	59.93	65.27	63.41	65.46	0.00218	3.60	96.36	33.19	0.33
Reach-1	39582	10 year	597.30	59.93	69.77	64.37	69.87	0.00043	2.74	326.99	81.06	0.17
Reach-1	39582	25 year	798.30	59.93	71.51	64.96	71.58	0.00028	2.51	538.82	153.99	0.14
Reach-1	39582	50 year	974.60	59.93	71.99	65.41	72.07	0.00031	2.72	622.27	190.67	0.15
Reach-1	39582	100 year	1170.10	59.93	72.33	65.90	72.42	0.00035	2.96	692.86	226.38	0.16
Reach-1	39079	2 year	314.60	57.80	64.80	60.91	64.88	0.00065	2.48	182.46	48.09	0.18
Reach-1	39079	10 year	597.30	57.80	69.68	62.36	69.72	0.00017	1.92	629.09	146.56	0.10
Reach-1	39079	25 year	798.30	57.80	71.45	62.99	71.48	0.00013	1.84	930.71	217.68	0.09
Reach-1	39079	50 year	974.60	57.80	71.92	63.45	71.95	0.00015	2.03	1040.21	291.17	0.10
Reach-1	39079	100 year	1170.10	57.80	72.24	63.93	72.29	0.00018	2.26	1124.16	496.31	0.11
Reach-1	38564	2 year	314.60	57.32	64.57	60.70	64.63	0.00037	2.01	237.35	84.68	0.15
Reach-1	38564	10 year	597.30	57.32	69.65	61.64	69.66	0.00006	1.26	975.11	232.64	0.07
Reach-1	38564	25 year	798.30	57.32	71.42	62.18	71.43	0.00005	1.18	1457.36	318.28	0.06
Reach-1	38564	50 year	974.60	57.32	71.89	62.61	71.90	0.00005	1.30	1612.47	344.79	0.06
Reach-1	38564	100 year	1170.10	57.32	72.21	63.02	72.23	0.00006	1.44	1725.48	361.04	0.07
Reach-1	38205	2 year	314.60	57.08	64.45		64.49	0.00035	1.85	276.49	96.60	0.14
Reach-1	38205	10 year	597.30	57.08	69.64		69.65	0.00002	0.71	1708.42	494.22	0.04
Reach-1	38205	25 year	798.30	57.08	71.42		71.42	0.00001	0.55	2650.49	560.57	0.03
Reach-1	38205	50 year	974.60	57.08	71.89		71.89	0.00001	0.60	2916.85	577.25	0.03
Reach-1	38205	100 year	1170.10	57.08	72.21		72.21	0.00001	0.67	3103.64	589.99	0.03
Reach-1	37950	2 year	640.30	55.91	64.20	60.36	64.33	0.00075	3.12	290.73	190.73	0.21
Reach-1	37950	10 year	1213.50	55.91	69.54	61.59	69.61	0.00023	2.57	732.67	293.12	0.13
Reach-1	37950	25 year	1606.90	55.91	71.39	62.27	71.41	0.00008	1.70	2434.96	520.48	0.08
Reach-1	37950	50 year	1959.90	55.91	71.86	62.83	71.88	0.00010	1.89	2684.79	556.60	0.09
Reach-1	37950	100 year	2351.70	55.91	72.17	63.17	72.20	0.00012	2.13	2861.90	577.98	0.10
Reach-1	37906		Culvert									
Reach-1	37781	2 year	640.30	55.55	62.70	60.36	62.94	0.00194	4.21	187.89	49.43	0.33
Reach-1	37781	10 year	1213.50	55.55	64.03	61.61	64.56	0.00317	6.28	274.22	181.53	0.44
Reach-1	37781	25 year	1606.90	55.55	64.70	62.30	65.24	0.00314	6.69	450.39	199.94	0.44
Reach-1	37781	50 year	1959.90	55.55	65.22	62.87	65.76	0.00309	6.96	557.17	210.42	0.44
Reach-1	37781	100 year	2351.70	55.55	65.75	63.33	66.29	0.00302	7.19	670.74	221.02	0.44
Reach-1	37629	2 year	640.30	54.33	62.43		62.64	0.00129	3.93	256.02	122.90	0.28
Reach-1	37629	10 year	1213.50	54.33	63.83		64.08	0.00145	4.78	527.46	235.91	0.31
Reach-1	37629	25 year	1606.90	54.33	64.49		64.74	0.00144	5.03	689.80	261.45	0.31
Reach-1	37629	50 year	1959.90	54.33	65.00		65.24	0.00140	5.17	830.53	286.31	0.31
Reach-1	37629	100 year	2351.70	54.33	65.49		65.72	0.00135	5.27	975.30	301.41	0.30

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	37026	2 year	640.30	53.42	61.74		61.91	0.00110	3.67	321.83	236.47	0.26
Reach-1	37026	10 year	1213.50	53.42	63.10		63.28	0.00117	4.32	688.30	301.69	0.27
Reach-1	37026	25 year	1606.90	53.42	63.79		63.96	0.00111	4.46	904.50	321.06	0.27
Reach-1	37026	50 year	1959.90	53.42	64.32		64.49	0.00107	4.56	1079.03	335.21	0.27
Reach-1	37026	100 year	2351.70	53.42	64.83		64.99	0.00105	4.68	1253.42	348.78	0.27
Reach-1	36428	2 year	640.30	53.28	61.15		61.24	0.00108	3.80	524.00	216.84	0.25
Reach-1	36428	10 year	1213.50	53.28	62.39		62.50	0.00139	4.81	827.50	281.01	0.29
Reach-1	36428	25 year	1606.90	53.28	63.05		63.18	0.00152	5.29	1023.07	310.97	0.31
Reach-1	36428	50 year	1959.90	53.28	63.57		63.71	0.00159	5.63	1191.37	337.86	0.32
Reach-1	36428	100 year	2351.70	53.28	64.07		64.21	0.00165	5.93	1366.11	359.70	0.33
Reach-1	35806	2 year	640.30	52.98	59.86		60.14	0.00325	5.97	350.25	224.24	0.43
Reach-1	35806	10 year	1213.50	52.98	61.06		61.29	0.00288	6.35	640.82	259.14	0.41
Reach-1	35806	25 year	1606.90	52.98	61.69		61.91	0.00281	6.63	810.91	280.77	0.42
Reach-1	35806	50 year	1959.90	52.98	62.20		62.42	0.00274	6.83	958.13	298.22	0.41
Reach-1	35806	100 year	2351.70	52.98	62.68		62.90	0.00274	7.08	1105.10	314.68	0.42
Reach-1	35433	2 year	640.30	52.37	59.28		59.36	0.00129	3.77	555.64	258.32	0.27
Reach-1	35433	10 year	1213.50	52.37	60.42		60.51	0.00146	4.50	878.62	303.16	0.29
Reach-1	35433	25 year	1606.90	52.37	61.04		61.13	0.00148	4.79	1073.20	320.05	0.30
Reach-1	35433	50 year	1959.90	52.37	61.55		61.65	0.00147	4.99	1240.22	330.83	0.30
Reach-1	35433	100 year	2351.70	52.37	62.02		62.12	0.00152	5.25	1396.07	340.58	0.31
Reach-1	35029	2 year	640.30	52.36	58.77	57.00	58.83	0.00128	3.55	580.08	255.65	0.26
Reach-1	35029	10 year	1213.50	52.36	59.81	57.97	59.89	0.00158	4.42	861.81	287.90	0.30
Reach-1	35029	25 year	1606.90	52.36	60.41	58.26	60.50	0.00168	4.83	1039.42	321.10	0.32
Reach-1	35029	50 year	1959.90	52.36	60.89	58.49	60.99	0.00182	5.25	1206.06	357.63	0.33
Reach-1	35029	100 year	2351.70	52.36	61.35	58.72	61.46	0.00177	5.39	1378.43	379.30	0.33
Reach-1	34653	2 year	640.30	51.50	58.04		58.19	0.00235	4.89	478.08	296.21	0.36
Reach-1	34653	10 year	1213.50	51.50	59.06		59.18	0.00224	5.32	789.86	319.54	0.36
Reach-1	34653	25 year	1606.90	51.50	59.67		59.79	0.00209	5.45	990.40	331.83	0.35
Reach-1	34653	50 year	1959.90	51.50	60.14		60.26	0.00203	5.60	1149.91	341.20	0.35
Reach-1	34653	100 year	2351.70	51.50	60.63		60.75	0.00198	5.76	1318.16	350.81	0.35
Reach-1	34229	2 year	640.30	50.64	56.71		56.94	0.00373	5.82	357.62	208.06	0.45
Reach-1	34229	10 year	1213.50	50.64	57.73		57.96	0.00381	6.62	578.73	225.85	0.47
Reach-1	34229	25 year	1606.90	50.64	58.51		58.71	0.00316	6.51	760.52	239.49	0.43
Reach-1	34229	50 year	1959.90	50.64	58.99		59.19	0.00316	6.81	877.46	247.87	0.44
Reach-1	34229	100 year	2351.70	50.64	59.48		59.69	0.00318	7.13	1001.08	259.72	0.44
Reach-1	33851	2 year	640.30	49.12	55.54		55.74	0.00271	4.47	335.95	243.25	0.34
Reach-1	33851	10 year	1213.50	49.12	56.82		56.95	0.00187	4.30	691.86	295.95	0.30
Reach-1	33851	25 year	1606.90	49.12	57.94		58.02	0.00108	3.64	1042.52	327.86	0.23
Reach-1	33851	50 year	1959.90	49.12	58.43		58.51	0.00108	3.78	1205.53	343.36	0.23
Reach-1	33851	100 year	2351.70	49.12	58.93		59.01	0.00106	3.90	1381.12	362.55	0.23
Reach-1	33371	2 year	640.30	47.87	55.12		55.16	0.00060	2.33	604.54	290.44	0.17
Reach-1	33371	10 year	1213.50	47.87	56.46		56.49	0.00053	2.49	1007.67	310.85	0.16

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	33371	25 year	1606.90	47.87	57.70		57.74	0.00035	2.24	1406.77	327.21	0.13
Reach-1	33371	50 year	1959.90	47.87	58.17		58.21	0.00038	2.43	1561.81	332.67	0.14
Reach-1	33371	100 year	2351.70	47.87	58.66		58.70	0.00041	2.60	1724.34	338.29	0.15
Reach-1	32869	2 year	710.10	47.75	54.35		54.39	0.00084	2.61	696.81	274.20	0.20
Reach-1	32869	10 year	1459.70	47.75	55.82		55.88	0.00093	3.23	1122.87	301.66	0.22
Reach-1	32869	25 year	1986.00	47.75	57.36		57.40	0.00061	2.99	1603.89	324.25	0.18
Reach-1	32869	50 year	2458.30	47.75	57.80		57.85	0.00073	3.38	1747.40	329.38	0.20
Reach-1	32869	100 year	2986.30	47.75	58.26		58.33	0.00086	3.78	1901.19	338.98	0.22
Reach-1	32724	2 year	710.10	47.24	54.23		54.27	0.00074	2.50	732.72	287.14	0.18
Reach-1	32724	10 year	1459.70	47.24	55.69		55.74	0.00089	3.19	1187.03	337.81	0.21
Reach-1	32724	25 year	1986.00	47.24	57.28		57.31	0.00055	2.85	1773.26	407.08	0.17
Reach-1	32724	50 year	2458.30	47.24	57.70		57.75	0.00064	3.18	1958.58	477.12	0.18
Reach-1	32724	100 year	2986.30	47.24	58.15		58.21	0.00072	3.48	2177.59	488.61	0.20
Reach-1	32350	2 year	710.10	47.01	54.02		54.05	0.00050	2.13	935.73	410.91	0.16
Reach-1	32350	10 year	1459.70	47.01	55.44		55.48	0.00055	2.60	1567.09	476.62	0.17
Reach-1	32350	25 year	1986.00	47.01	57.13		57.16	0.00032	2.28	2511.37	617.46	0.14
Reach-1	32350	50 year	2458.30	47.01	57.54		57.56	0.00037	2.56	2762.08	632.72	0.15
Reach-1	32350	100 year	2986.30	47.01	57.97		58.00	0.00042	2.81	3037.42	649.06	0.16
Reach-1	31977	2 year	710.10	46.91	51.44	51.44	53.31	0.02110	10.99	65.15	18.03	1.00
Reach-1	31977	10 year	1459.70	46.91	55.00	53.35	55.11	0.00128	4.23	1082.85	407.63	0.28
Reach-1	31977	25 year	1986.00	46.91	56.94	53.74	56.98	0.00049	3.07	1915.66	523.54	0.18
Reach-1	31977	50 year	2458.30	46.91	57.31	54.00	57.36	0.00060	3.47	2076.29	541.57	0.20
Reach-1	31977	100 year	2986.30	46.91	57.70	54.26	57.77	0.00069	3.83	2252.21	556.37	0.21
Reach-1	31511	2 year	710.10	43.55	51.45	48.47	51.52	0.00081	2.89	687.40	367.81	0.20
Reach-1	31511	10 year	1459.70	43.55	54.88	50.61	54.90	0.00018	1.80	2310.25	588.14	0.10
Reach-1	31511	25 year	1986.00	43.55	56.87	51.07	56.88	0.00011	1.60	3350.11	638.01	0.08
Reach-1	31511	50 year	2458.30	43.55	57.21	51.36	57.22	0.00015	1.86	3536.56	643.52	0.09
Reach-1	31511	100 year	2986.30	43.55	57.59	51.66	57.60	0.00018	2.12	3742.40	651.43	0.10
Reach-1	30960	2 year	710.10	43.11	50.85		50.96	0.00128	3.57	494.06	237.84	0.25
Reach-1	30960	10 year	1459.70	43.11	54.77		54.79	0.00022	2.03	1840.64	461.30	0.11
Reach-1	30960	25 year	1986.00	43.11	56.80		56.81	0.00012	1.68	2799.01	483.29	0.08
Reach-1	30960	50 year	2458.30	43.11	57.12		57.14	0.00016	1.95	2956.76	489.49	0.10
Reach-1	30960	100 year	2986.30	43.11	57.48		57.50	0.00020	2.22	3131.97	496.29	0.11
Reach-1	30467	2 year	710.10	42.80	50.52	47.78	50.57	0.00052	2.55	754.20	263.69	0.17
Reach-1	30467	10 year	1459.70	42.80	54.68	48.96	54.70	0.00015	1.89	2180.96	432.84	0.10
Reach-1	30467	25 year	1986.00	42.80	56.74	49.41	56.76	0.00011	1.77	2995.36	497.64	0.09
Reach-1	30467	50 year	2458.30	42.80	57.05	49.76	57.07	0.00015	2.09	3116.00	505.90	0.10
Reach-1	30467	100 year	2986.30	42.80	57.38	50.07	57.41	0.00019	2.42	3248.09	517.68	0.11
Reach-1	30096	2 year	710.10	42.60	50.44	47.50	50.45	0.00014	1.39	1530.74	527.74	0.09
Reach-1	30096	10 year	1459.70	42.60	54.67	48.12	54.67	0.00004	0.95	4272.38	700.00	0.05
Reach-1	30096	25 year	1986.00	42.60	56.73	48.42	56.74	0.00003	0.91	5719.36	700.00	0.04
Reach-1	30096	50 year	2458.30	42.60	57.03	48.64	57.04	0.00004	1.08	5930.64	700.00	0.05
Reach-1	30096	100 year	2986.30	42.60	57.37	48.87	57.37	0.00005	1.26	6161.95	700.00	0.06

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	29957	2 year	972.60	42.45	50.14	45.87	50.33	0.00116	3.51	295.07	75.04	0.25
Reach-1	29957	10 year	1954.50	42.45	54.39	47.89	54.59	0.00065	3.77	646.18	498.80	0.21
Reach-1	29957	25 year	2631.60	42.45	56.68	48.88	56.71	0.00016	2.16	2891.72	698.44	0.11
Reach-1	29957	50 year	3189.30	42.45	56.96	49.55	57.01	0.00021	2.46	3097.99	737.16	0.12
Reach-1	29957	100 year	3959.10	42.45	57.27	50.56	57.33	0.00027	2.85	3331.82	776.00	0.14
Reach-1	29893		Culvert									
Reach-1	29791	2 year	929.50	42.61	48.62	45.91	48.93	0.00272	4.49	209.07	53.39	0.37
Reach-1	29791	10 year	1860.00	42.61	50.30	47.79	50.93	0.00362	6.41	325.71	89.10	0.46
Reach-1	29791	25 year	2508.10	42.61	51.08	48.69	51.92	0.00423	7.51	455.61	241.84	0.50
Reach-1	29791	50 year	3049.10	42.61	51.15	49.39	52.36	0.00602	9.02	472.26	267.26	0.60
Reach-1	29791	100 year	3783.90	42.61	51.62	50.31	53.04	0.00679	10.00	610.50	310.83	0.64
Reach-1	29540	2 year	929.50	41.90	47.31	45.23	47.78	0.00479	5.49	169.18	376.76	0.48
Reach-1	29540	10 year	1860.00	41.90	48.83	47.18	49.03	0.00242	4.58	925.32	437.36	0.36
Reach-1	29540	25 year	2508.10	41.90	49.74	48.17	49.89	0.00177	4.37	1354.53	505.77	0.31
Reach-1	29540	50 year	3049.10	41.90	50.33	48.40	50.48	0.00157	4.38	1659.56	523.19	0.30
Reach-1	29540	100 year	3783.90	41.90	50.97	48.70	51.12	0.00148	4.52	2000.48	541.36	0.30
Reach-1	29096	2 year	929.50	40.50	46.76		46.77	0.00021	1.52	1448.45	386.81	0.11
Reach-1	29096	10 year	1860.00	40.50	48.52		48.54	0.00025	1.98	2151.84	413.14	0.13
Reach-1	29096	25 year	2508.10	40.50	49.49		49.51	0.00026	2.21	2559.18	427.66	0.14
Reach-1	29096	50 year	3049.10	40.50	50.09		50.12	0.00029	2.42	2818.81	436.65	0.14
Reach-1	29096	100 year	3783.90	40.50	50.72		50.76	0.00033	2.70	3098.06	446.13	0.15
Reach-1	28576	2 year	929.50	40.70	46.35		46.42	0.00174	3.57	790.03	410.13	0.29
Reach-1	28576	10 year	1860.00	40.70	48.21		48.25	0.00087	3.15	1608.77	469.16	0.22
Reach-1	28576	25 year	2508.10	40.70	49.21		49.25	0.00071	3.12	2094.19	500.21	0.20
Reach-1	28576	50 year	3049.10	40.70	49.81		49.85	0.00069	3.24	2399.61	518.80	0.20
Reach-1	28576	100 year	3783.90	40.70	50.43		50.47	0.00072	3.46	2724.12	537.84	0.21
Reach-1	28320	2 year	929.50	40.42	46.08		46.10	0.00051	2.04	1068.18	457.82	0.16
Reach-1	28320	10 year	1860.00	40.42	48.08		48.10	0.00026	1.81	2054.04	516.16	0.12
Reach-1	28320	25 year	2508.10	40.42	49.11		49.12	0.00022	1.83	2592.56	534.88	0.12
Reach-1	28320	50 year	3049.10	40.42	49.71		49.73	0.00022	1.94	2919.15	550.09	0.12
Reach-1	28320	100 year	3783.90	40.42	50.32		50.34	0.00024	2.12	3258.96	566.12	0.12
Reach-1	28096	2 year	929.50	40.57	45.71		45.79	0.00228	3.87	727.72	406.72	0.32
Reach-1	28096	10 year	1860.00	40.57	47.94		47.97	0.00077	2.95	1727.84	486.59	0.20
Reach-1	28096	25 year	2508.10	40.57	48.99		49.02	0.00062	2.93	2255.83	516.87	0.19
Reach-1	28096	50 year	3049.10	40.57	49.59		49.63	0.00061	3.06	2573.17	534.25	0.19
Reach-1	28096	100 year	3783.90	40.57	50.20		50.24	0.00066	3.31	2900.18	551.58	0.20
Reach-1	27712	2 year	929.50	39.40	44.68		44.73	0.00121	3.12	757.12	343.84	0.25
Reach-1	27712	10 year	1860.00	39.40	47.75		47.77	0.00024	1.94	2218.00	626.47	0.12
Reach-1	27712	25 year	2508.10	39.40	48.85		48.86	0.00018	1.85	2928.84	671.92	0.11
Reach-1	27712	50 year	3049.10	39.40	49.45		49.47	0.00018	1.90	3345.05	697.16	0.11
Reach-1	27712	100 year	3783.90	39.40	50.05		50.07	0.00019	2.04	3767.03	721.85	0.11

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	27096	2 year	998.90	38.50	44.33		44.35	0.00037	1.93	1181.52	407.13	0.15
Reach-1	27096	10 year	2020.40	38.50	47.65		47.67	0.00012	1.54	2714.46	509.36	0.09
Reach-1	27096	25 year	2754.20	38.50	48.76		48.77	0.00012	1.69	3293.13	540.61	0.10
Reach-1	27096	50 year	3380.20	38.50	49.36		49.38	0.00014	1.86	3622.37	553.74	0.10
Reach-1	27096	100 year	4190.10	38.50	49.94		49.96	0.00016	2.08	3948.02	566.42	0.11
Reach-1	26596	2 year	998.90	38.20	44.15		44.17	0.00037	1.99	1140.05	380.79	0.15
Reach-1	26596	10 year	2020.40	38.20	47.58		47.60	0.00015	1.74	2695.81	523.83	0.10
Reach-1	26596	25 year	2754.20	38.20	48.68		48.70	0.00016	1.93	3290.54	555.74	0.11
Reach-1	26596	50 year	3380.20	38.20	49.28		49.30	0.00018	2.14	3624.12	571.02	0.12
Reach-1	26596	100 year	4190.10	38.20	49.84		49.87	0.00021	2.43	3951.36	585.62	0.13
Reach-1	26096	2 year	1338.10	37.70	43.92		43.95	0.00047	2.36	1482.03	428.75	0.17
Reach-1	26096	10 year	2797.30	37.70	47.48		47.50	0.00022	2.23	3183.46	666.32	0.13
Reach-1	26096	25 year	3901.60	37.70	48.58		48.60	0.00023	2.45	4052.60	867.27	0.13
Reach-1	26096	50 year	4901.00	37.70	49.15		49.18	0.00026	2.67	4557.93	878.73	0.14
Reach-1	26096	100 year	6092.30	37.70	49.70		49.74	0.00029	2.93	5042.56	889.57	0.15
Reach-1	25735	2 year	1338.10	37.20	43.68		43.75	0.00068	2.81	1167.48	414.10	0.20
Reach-1	25735	10 year	2797.30	37.20	47.38		47.42	0.00027	2.41	2805.60	574.84	0.13
Reach-1	25735	25 year	3901.60	37.20	48.47		48.51	0.00028	2.63	3743.64	1039.78	0.14
Reach-1	25735	50 year	4901.00	37.20	49.04		49.08	0.00030	2.81	4347.46	1070.96	0.15
Reach-1	25735	100 year	6092.30	37.20	49.58		49.63	0.00032	3.01	4933.74	1101.07	0.15
Reach-1	25660	2 year	1338.10	37.51	43.22	41.27	43.57	0.00280	5.26	452.92	216.70	0.39
Reach-1	25660	10 year	2797.30	37.51	47.31	43.38	47.38	0.00046	3.08	2020.08	695.17	0.17
Reach-1	25660	25 year	3901.60	37.51	48.43	44.23	48.48	0.00035	2.91	3079.43	938.83	0.16
Reach-1	25660	50 year	4901.00	37.51	49.00	45.27	49.06	0.00035	3.01	3557.11	956.02	0.16
Reach-1	25660	100 year	6092.30	37.51	49.55	45.70	49.60	0.00035	3.09	4398.31	972.31	0.16
Reach-1	25570		Culvert									
Reach-1	25462	2 year	1319.00	36.52	42.13	40.54	42.62	0.00397	6.00	338.69	171.13	0.47
Reach-1	25462	10 year	2761.10	36.52	44.15	42.81	44.59	0.00299	6.50	836.03	353.31	0.43
Reach-1	25462	25 year	3865.20	36.52	45.84	43.73	46.12	0.00167	5.59	1344.06	604.67	0.33
Reach-1	25462	50 year	4865.00	36.52	46.81	44.24	47.08	0.00149	5.67	1633.97	692.47	0.32
Reach-1	25462	100 year	6056.00	36.52	47.65	44.70	47.77	0.00083	4.47	3055.41	929.41	0.24
Reach-1	25096	2 year	1319.00	36.20	41.66		41.71	0.00062	2.43	1123.68	510.92	0.19
Reach-1	25096	10 year	2761.10	36.20	43.99		44.02	0.00032	2.23	2443.10	649.83	0.14
Reach-1	25096	25 year	3865.20	36.20	45.77		45.80	0.00019	1.99	3648.73	702.85	0.11
Reach-1	25096	50 year	4865.00	36.20	46.76		46.79	0.00018	2.05	4359.37	732.30	0.11
Reach-1	25096	100 year	6056.00	36.20	47.54		47.58	0.00019	2.21	4941.80	755.59	0.12
Reach-1	24596	2 year	1319.00	35.80	41.37		41.41	0.00057	2.36	1140.43	473.58	0.18
Reach-1	24596	10 year	2761.10	35.80	43.84		43.87	0.00028	2.14	2556.57	715.65	0.13
Reach-1	24596	25 year	3865.20	35.80	45.69		45.71	0.00015	1.76	3941.49	781.66	0.10
Reach-1	24596	50 year	4865.00	35.80	46.69		46.71	0.00013	1.78	4740.68	822.44	0.10
Reach-1	24596	100 year	6056.00	35.80	47.47		47.50	0.00014	1.90	5393.75	852.60	0.10
Reach-1	24096	2 year	1319.00	34.72	40.98		41.07	0.00080	2.95	750.10	359.22	0.21

APPENDIX H
HYDRAULIC AND HYDROLOGIC INPUT AND OUTPUT

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	24096	10 year	2761.10	34.72	43.68		43.73	0.00027	2.20	1902.59	515.33	0.13
Reach-1	24096	25 year	3865.20	34.72	45.60		45.64	0.00015	1.88	3013.91	673.91	0.10
Reach-1	24096	50 year	4865.00	34.72	46.61		46.64	0.00014	1.89	3736.08	760.99	0.10
Reach-1	24096	100 year	6056.00	34.72	47.38		47.42	0.00014	2.01	4352.98	827.89	0.10
Reach-1	23596	2 year	1364.90	33.57	40.55		40.66	0.00084	2.97	753.94	265.40	0.22
Reach-1	23596	10 year	2854.70	33.57	43.48		43.56	0.00043	2.84	1926.21	532.07	0.17
Reach-1	23596	25 year	4001.20	33.57	45.50		45.54	0.00023	2.38	3130.41	644.22	0.13
Reach-1	23596	50 year	5046.10	33.57	46.52		46.56	0.00020	2.39	3807.09	684.30	0.12
Reach-1	23596	100 year	6284.50	33.57	47.29		47.34	0.00021	2.55	4351.71	726.64	0.13
Reach-1	22990	2 year	1364.90	33.30	40.17		40.21	0.00033	1.99	1011.19	334.92	0.14
Reach-1	22990	10 year	2854.70	33.30	43.35		43.38	0.00010	1.43	2590.27	617.32	0.08
Reach-1	22990	25 year	4001.20	33.30	45.43		45.45	0.00005	1.24	4020.01	779.43	0.07
Reach-1	22990	50 year	5046.10	33.30	46.45		46.48	0.00005	1.20	4839.52	820.81	0.06
Reach-1	22990	100 year	6284.50	33.30	47.22		47.25	0.00005	1.27	5483.82	860.84	0.06
Reach-1	22893	2 year	1364.90	32.81	40.08	36.01	40.16	0.00052	2.60	706.03	301.20	0.18
Reach-1	22893	10 year	2854.70	32.81	43.24	38.13	43.34	0.00041	3.00	1300.74	481.14	0.17
Reach-1	22893	25 year	4001.20	32.81	45.38	38.89	45.43	0.00022	2.54	3219.61	666.49	0.13
Reach-1	22893	50 year	5046.10	32.81	46.40	39.46	46.46	0.00023	2.75	3985.67	792.86	0.14
Reach-1	22893	100 year	6284.50	32.81	47.17	40.02	47.24	0.00026	3.03	4613.25	847.96	0.15
Reach-1	22812		Culvert									
Reach-1	22704	2 year	1363.80	33.39	39.35	36.67	39.47	0.00103	3.16	633.84	273.89	0.25
Reach-1	22704	10 year	2857.10	33.39	41.44	38.44	41.59	0.00095	3.82	1153.80	365.48	0.25
Reach-1	22704	25 year	4007.00	33.39	42.97	39.10	43.12	0.00078	3.94	1713.94	469.40	0.24
Reach-1	22704	50 year	5055.80	33.39	44.09	39.59	44.22	0.00065	3.92	2512.36	523.14	0.22
Reach-1	22704	100 year	6299.40	33.39	45.29	40.07	45.42	0.00060	4.04	3183.82	665.71	0.21
Reach-1	22383	2 year	1363.80	32.90	39.13		39.19	0.00063	2.54	1046.37	374.99	0.19
Reach-1	22383	10 year	2857.10	32.90	41.25		41.32	0.00056	3.01	1878.02	411.35	0.20
Reach-1	22383	25 year	4007.00	32.90	42.82		42.89	0.00047	3.13	2546.76	443.84	0.18
Reach-1	22383	50 year	5055.80	32.90	43.95		44.03	0.00045	3.31	3060.63	464.85	0.18
Reach-1	22383	100 year	6299.40	32.90	45.15		45.23	0.00043	3.50	3631.35	486.17	0.18
Reach-1	22096	2 year	1363.80	32.71	38.85		38.95	0.00109	3.11	924.66	605.00	0.25
Reach-1	22096	10 year	2857.10	32.71	41.10		41.16	0.00052	2.78	2482.50	776.71	0.19
Reach-1	22096	25 year	4007.00	32.71	42.72		42.77	0.00033	2.56	3793.28	835.56	0.15
Reach-1	22096	50 year	5055.80	32.71	43.87		43.91	0.00028	2.55	4776.03	873.30	0.14
Reach-1	22096	100 year	6299.40	32.71	45.09		45.13	0.00025	2.58	5855.48	903.75	0.14
Reach-1	21638	2 year	1381.50	32.63	38.62	36.13	38.65	0.00038	1.92	1465.39	611.26	0.15
Reach-1	21638	10 year	2893.20	32.63	40.94	36.82	40.97	0.00029	2.15	2766.66	653.85	0.14
Reach-1	21638	25 year	4060.50	32.63	42.60	37.21	42.64	0.00024	2.22	3717.95	723.75	0.13
Reach-1	21638	50 year	5127.40	32.63	43.76	37.52	43.79	0.00023	2.36	4389.59	832.66	0.13
Reach-1	21638	100 year	6390.40	32.63	44.98	37.86	45.02	0.00022	2.52	5109.58	908.04	0.13
Reach-1	21373	2 year	1371.30	32.80	38.43	36.45	38.50	0.00080	2.64	916.47	457.89	0.21
Reach-1	21373	10 year	2863.10	32.80	40.79	37.26	40.86	0.00056	2.90	1805.96	713.86	0.19

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Reach-1	21373	25 year	4020.90	32.80	42.48	37.71	42.54	0.00044	2.96	2479.57	806.40	0.18
Reach-1	21373	50 year	5083.30	32.80	43.63	38.09	43.71	0.00042	3.13	2941.51	961.32	0.18
Reach-1	21373	100 year	6343.90	32.80	44.85	38.49	44.93	0.00040	3.33	3427.54	1023.92	0.18
Reach-1	21303		Bridge									
Reach-1	21198	2 year	1370.40	32.74	37.16	36.37	37.38	0.00340	4.47	540.70	394.35	0.42
Reach-1	21198	10 year	2860.10	32.74	39.28	37.22	39.45	0.00173	4.38	1182.07	595.73	0.33
Reach-1	21198	25 year	4016.50	32.74	41.06	37.69	41.19	0.00099	3.97	1896.09	738.65	0.26
Reach-1	21198	50 year	5078.10	32.74	41.93	38.09	42.07	0.00097	4.24	2242.77	782.67	0.26
Reach-1	21198	100 year	6337.50	32.74	42.69	38.50	42.86	0.00104	4.65	2547.87	819.79	0.27
Reach-1	20751	2 year	1370.40	30.58	36.10	34.10	36.30	0.00182	3.93	521.21	209.80	0.32
Reach-1	20751	10 year	2860.10	30.58	38.80	35.38	38.92	0.00081	3.56	1378.27	309.23	0.23
Reach-1	20751	25 year	4016.50	30.58	40.72	36.11	40.84	0.00062	3.65	2099.04	425.10	0.21
Reach-1	20751	50 year	5078.10	30.58	41.57	36.45	41.72	0.00067	4.01	2474.57	456.05	0.22
Reach-1	20751	100 year	6337.50	30.58	42.30	36.94	42.47	0.00075	4.46	2815.12	482.43	0.24
Reach-1	20596	2 year	1370.40	29.93	35.97		36.07	0.00094	3.03	708.78	228.67	0.24
Reach-1	20596	10 year	2860.10	29.93	38.69		38.80	0.00065	3.34	1550.50	379.30	0.21
Reach-1	20596	25 year	4016.50	29.93	40.66		40.75	0.00046	3.28	2412.07	485.80	0.18
Reach-1	20596	50 year	5078.10	29.93	41.51		41.62	0.00049	3.57	2838.61	510.94	0.19
Reach-1	20596	100 year	6337.50	29.93	42.23		42.36	0.00055	3.96	3211.53	525.02	0.21
Reach-1	20096	2 year	1391.70	28.00	35.74		35.78	0.00027	1.97	1560.41	481.05	0.13
Reach-1	20096	10 year	2905.40	28.00	38.56		38.59	0.00020	2.14	2998.30	535.02	0.12
Reach-1	20096	25 year	4080.10	28.00	40.57		40.60	0.00016	2.15	4102.04	563.60	0.11
Reach-1	20096	50 year	5160.50	28.00	41.41		41.45	0.00018	2.42	4582.07	576.52	0.12
Reach-1	20096	100 year	6439.40	28.00	42.11		42.16	0.00022	2.75	4990.26	587.28	0.13
Reach-1	19506	2 year	1391.70	27.60	35.41	31.45	35.53	0.00070	3.04	673.22	170.69	0.21
Reach-1	19506	10 year	2905.40	27.60	38.18	33.27	38.37	0.00075	3.99	1220.59	226.50	0.23
Reach-1	19506	25 year	4080.10	27.60	40.20	34.17	40.41	0.00068	4.34	1745.50	320.79	0.23
Reach-1	19506	50 year	5160.50	27.60	40.86	34.88	41.21	0.00100	5.47	2020.03	480.96	0.28
Reach-1	19506	100 year	6439.40	27.60	41.42	35.63	41.86	0.00124	6.27	2301.17	547.55	0.31
Reach-1	19396	2 year	1391.70	27.56	35.07	31.88	35.36	0.00184	4.35	345.93	87.57	0.33
Reach-1	19396	10 year	2905.40	27.56	37.63	33.85	38.14	0.00217	5.92	571.17	219.19	0.37
Reach-1	19396	25 year	4080.10	27.56	39.89	35.09	40.26	0.00131	5.46	1368.54	390.61	0.30
Reach-1	19396	50 year	5160.50	27.56	40.53	36.00	41.02	0.00163	6.34	1663.20	552.50	0.34
Reach-1	19396	100 year	6439.40	27.56	41.00	37.01	41.63	0.00207	7.34	1930.75	604.67	0.39
Reach-1	19365		Culvert									
Reach-1	19096	2 year	1395.40	27.02	34.58	30.88	34.78	0.00108	3.68	437.09	107.92	0.26
Reach-1	19096	10 year	2913.20	27.02	36.11	32.68	36.60	0.00203	5.84	622.29	135.21	0.37
Reach-1	19096	25 year	4091.20	27.02	36.76	33.86	37.52	0.00290	7.37	714.97	150.17	0.45
Reach-1	19096	50 year	5174.70	27.02	37.26	34.85	38.26	0.00363	8.57	795.71	172.27	0.51
Reach-1	19096	100 year	6456.90	27.02	37.84	35.86	39.09	0.00427	9.69	902.52	198.70	0.56
Reach-1	18614	2 year	1395.40	25.92	33.83		33.89	0.00101	3.19	1388.52	733.24	0.22

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Reach-1	18614	10 year	2913.20	25.92	35.30		35.35	0.00085	3.35	2491.73	757.98	0.21
Reach-1	18614	25 year	4091.20	25.92	35.85		35.91	0.00105	3.90	2907.74	765.05	0.24
Reach-1	18614	50 year	5174.70	25.92	36.29		36.37	0.00119	4.30	3251.41	771.00	0.25
Reach-1	18614	100 year	6456.90	25.92	37.01		37.10	0.00113	4.42	3809.17	780.55	0.25
Reach-1	18538	2 year	1395.40	25.74	33.55	29.12	33.77	0.00094	3.82	399.17	505.32	0.25
Reach-1	18538	10 year	2913.20	25.74	35.27	30.95	35.30	0.00025	2.26	2601.58	822.02	0.13
Reach-1	18538	25 year	4091.20	25.74	35.81	32.13	35.85	0.00032	2.65	3064.41	900.52	0.15
Reach-1	18538	50 year	5174.70	25.74	36.25	33.12	36.30	0.00036	2.89	3476.80	955.27	0.16
Reach-1	18538	100 year	6456.90	25.74	36.98	33.90	37.03	0.00032	2.85	4189.86	1002.30	0.15
Reach-1	18506		Culvert									
Reach-1	18283	2 year	1395.40	26.30	32.50	32.50	33.33	0.01044	8.45	333.95	371.89	0.72
Reach-1	18283	10 year	2913.20	26.30	34.14	33.27	34.30	0.00229	4.81	1194.03	560.67	0.35
Reach-1	18283	25 year	4091.20	26.30	35.12	33.49	35.24	0.00151	4.32	1814.77	745.03	0.29
Reach-1	18283	50 year	5174.70	26.30	35.98	33.76	36.08	0.00104	3.89	2532.34	904.87	0.25
Reach-1	18283	100 year	6456.90	26.30	36.89	34.05	36.98	0.00067	3.37	3409.56	997.61	0.20
Reach-1	18096	2 year	1395.40	24.99	32.01	28.38	32.14	0.00083	3.02	602.06	215.83	0.22
Reach-1	18096	10 year	2913.20	24.99	33.82	30.22	34.02	0.00099	3.98	1024.29	405.74	0.26
Reach-1	18096	25 year	4091.20	24.99	34.77	31.30	34.99	0.00103	4.41	1380.87	614.93	0.27
Reach-1	18096	50 year	5174.70	24.99	35.69	32.17	35.88	0.00087	4.32	1828.75	1040.22	0.25
Reach-1	18096	100 year	6456.90	24.99	36.66	32.76	36.83	0.00070	4.16	2318.26	1175.32	0.23
Reach-1	17596	2 year	1449.20	25.12	31.66		31.71	0.00080	2.91	1199.33	414.19	0.22
Reach-1	17596	10 year	3013.20	25.12	33.52		33.57	0.00067	3.24	2060.97	545.34	0.21
Reach-1	17596	25 year	4217.00	25.12	34.48		34.54	0.00063	3.41	2622.73	600.14	0.21
Reach-1	17596	50 year	5337.50	25.12	35.42		35.49	0.00060	3.55	3243.84	821.39	0.20
Reach-1	17596	100 year	6663.00	25.12	36.47		36.52	0.00045	3.30	4188.88	946.29	0.18
Reach-1	16932	2 year	1449.20	25.30	31.24		31.26	0.00047	2.08	1774.75	659.24	0.16
Reach-1	16932	10 year	3013.20	25.30	33.19		33.21	0.00032	2.14	3256.36	817.90	0.14
Reach-1	16932	25 year	4217.00	25.30	34.18		34.20	0.00031	2.28	4090.95	905.03	0.14
Reach-1	16932	50 year	5337.50	25.30	35.16		35.19	0.00026	2.29	5052.90	1009.01	0.14
Reach-1	16932	100 year	6663.00	25.30	36.27		36.29	0.00022	2.24	6323.66	1209.44	0.12
Reach-1	16457	2 year	1449.20	23.40	30.80		30.89	0.00115	3.73	1164.71	512.37	0.25
Reach-1	16457	10 year	3013.20	23.40	32.88		32.95	0.00085	3.83	2453.41	684.80	0.23
Reach-1	16457	25 year	4217.00	23.40	33.87		33.94	0.00086	4.12	3156.82	736.27	0.23
Reach-1	16457	50 year	5337.50	23.40	34.90		34.96	0.00075	4.12	3936.06	784.21	0.22
Reach-1	16457	100 year	6663.00	23.40	36.04		36.10	0.00063	4.03	4861.48	834.88	0.20
Reach-1	16096	2 year	1449.20	23.89	30.41		30.48	0.00113	3.46	1223.30	496.74	0.26
Reach-1	16096	10 year	3013.20	23.89	32.60		32.65	0.00079	3.61	2463.11	637.22	0.23
Reach-1	16096	25 year	4217.00	23.89	33.58		33.64	0.00081	3.95	3103.73	664.59	0.24
Reach-1	16096	50 year	5337.50	23.89	34.64		34.70	0.00071	4.00	3821.29	693.02	0.23
Reach-1	16096	100 year	6663.00	23.89	35.81		35.87	0.00062	4.03	4662.01	740.15	0.21
Reach-1	15393	2 year	1449.20	21.18	29.81	28.08	29.87	0.00075	2.99	1241.40	637.52	0.20
Reach-1	15393	10 year	3013.20	21.18	32.29	29.22	32.31	0.00025	2.10	2917.01	868.84	0.12

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Reach-1	15393	25 year	4217.00	21.18	33.26	29.66	33.29	0.00024	2.20	3600.13	898.22	0.12
Reach-1	15393	50 year	5337.50	21.18	34.37	29.90	34.39	0.00020	2.14	4373.08	938.89	0.11
Reach-1	15393	100 year	6663.00	21.18	35.59	30.16	35.62	0.00017	2.10	5226.56	995.41	0.10
Reach-1	15308	2 year	1449.20	19.00	29.66	23.75	29.79	0.00058	3.20	741.43	676.00	0.19
Reach-1	15308	10 year	3013.20	19.00	32.23	26.20	32.28	0.00029	2.65	3228.87	810.69	0.14
Reach-1	15308	25 year	4217.00	19.00	33.21	28.25	33.26	0.00030	2.88	4026.16	821.56	0.14
Reach-1	15308	50 year	5337.50	19.00	34.32	29.11	34.37	0.00027	2.84	4949.29	834.23	0.13
Reach-1	15308	100 year	6663.00	19.00	35.55	29.94	35.59	0.00024	2.83	5987.65	858.20	0.13
Reach-1	15236		Culvert									
Reach-1	15023	2 year	1453.90	21.14	29.02	26.00	29.56	0.00328	5.97	299.61	516.05	0.42
Reach-1	15023	10 year	3028.40	21.14	31.71	29.30	31.80	0.00074	3.60	2523.03	795.79	0.21
Reach-1	15023	25 year	4239.40	21.14	33.11	30.50	33.18	0.00053	3.35	3661.67	821.10	0.18
Reach-1	15023	50 year	5366.80	21.14	34.27	30.50	34.32	0.00044	3.26	4616.40	834.17	0.17
Reach-1	15023	100 year	6699.50	21.14	35.51	30.73	35.56	0.00037	3.23	5670.51	858.50	0.16
Reach-1	14968	2 year	1409.70	20.40	29.22	25.68	29.26	0.00036	2.22	1076.30	346.01	0.15
Reach-1	14968	10 year	2897.80	20.40	31.69	26.56	31.75	0.00036	2.74	1927.65	611.82	0.16
Reach-1	14968	25 year	4021.10	20.40	33.09	27.08	33.15	0.00037	3.02	2433.14	649.92	0.16
Reach-1	14968	50 year	5029.40	20.40	34.22	27.49	34.29	0.00036	3.22	2846.21	676.08	0.16
Reach-1	14968	100 year	6194.50	20.40	35.45	27.92	35.53	0.00036	3.40	3294.41	683.96	0.16
Reach-1	14903		Bridge									
Reach-1	14807	2 year	1409.40	21.04	28.73	25.46	28.88	0.00093	3.60	607.55	279.36	0.25
Reach-1	14807	10 year	2897.00	21.04	30.69	26.91	30.98	0.00134	5.11	1031.57	566.04	0.31
Reach-1	14807	25 year	4019.10	21.04	31.67	27.74	32.04	0.00160	6.00	1264.23	608.87	0.34
Reach-1	14807	50 year	5026.80	21.04	32.42	28.40	32.87	0.00178	6.67	1444.78	634.04	0.36
Reach-1	14807	100 year	6191.40	21.04	33.22	29.33	33.74	0.00195	7.33	1635.03	651.68	0.39
Reach-1	14671	2 year	1409.40	20.76	28.52	24.93	28.73	0.00113	3.99	510.43	215.83	0.27
Reach-1	14671	10 year	2897.00	20.76	30.41	26.97	30.76	0.00154	5.49	881.93	374.62	0.33
Reach-1	14671	25 year	4019.10	20.76	31.47	27.93	31.81	0.00146	5.78	1205.07	479.52	0.33
Reach-1	14671	50 year	5026.80	20.76	32.27	28.85	32.60	0.00134	5.84	1461.08	561.59	0.32
Reach-1	14671	100 year	6191.40	20.76	33.11	30.12	33.43	0.00123	5.88	1730.29	658.44	0.31
Reach-1	14470	2 year	1409.40	20.60	28.08	24.87	28.39	0.00206	4.83	440.13	152.05	0.33
Reach-1	14470	10 year	2897.00	20.60	29.63	27.39	30.25	0.00336	7.10	733.71	262.05	0.44
Reach-1	14470	25 year	4019.10	20.60	30.87	28.58	31.38	0.00276	7.06	1143.83	400.81	0.40
Reach-1	14470	50 year	5026.80	20.60	31.92	29.86	32.28	0.00199	6.42	1627.08	518.68	0.35
Reach-1	14470	100 year	6191.40	20.60	32.89	30.70	33.16	0.00148	5.88	2182.77	627.81	0.31
Reach-1	14329		Bridge									
Reach-1	14157	2 year	1409.40	20.50	26.80	25.49	27.22	0.00383	5.85	400.27	516.86	0.44
Reach-1	14157	10 year	2897.00	20.50	29.28	26.99	29.32	0.00052	2.75	2357.29	628.13	0.17
Reach-1	14157	25 year	4019.10	20.50	30.84	27.70	30.88	0.00033	2.47	3389.35	691.88	0.14
Reach-1	14157	50 year	5026.80	20.50	31.90	27.70	31.93	0.00028	2.44	4140.97	733.64	0.13
Reach-1	14157	100 year	6191.40	20.50	32.82	27.70	32.86	0.00026	2.50	4835.90	770.23	0.13

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	13604	2 year	1409.90	18.99	26.36		26.41	0.00054	2.45	1030.09	456.55	0.17
Reach-1	13604	10 year	2897.20	18.99	29.13		29.15	0.00019	1.84	2434.78	545.58	0.11
Reach-1	13604	25 year	4018.60	18.99	30.73		30.76	0.00014	1.75	3338.76	579.22	0.09
Reach-1	13604	50 year	5026.20	18.99	31.80		31.83	0.00013	1.79	3967.43	601.51	0.09
Reach-1	13604	100 year	6191.20	18.99	32.72		32.76	0.00013	1.91	4531.82	624.20	0.09
Reach-1	13066	2 year	1409.90	18.12	25.63		25.76	0.00147	3.82	865.54	354.59	0.27
Reach-1	13066	10 year	2897.20	18.12	28.84		28.90	0.00055	3.07	2070.10	391.59	0.18
Reach-1	13066	25 year	4018.60	18.12	30.51		30.57	0.00045	3.11	2737.20	408.20	0.16
Reach-1	13066	50 year	5026.20	18.12	31.58		31.65	0.00045	3.28	3182.09	418.92	0.16
Reach-1	13066	100 year	6191.20	18.12	32.49		32.57	0.00049	3.59	3571.81	437.00	0.17
Reach-1	12805	2 year	1411.10	17.20	25.35		25.45	0.00091	3.33	934.53	269.33	0.22
Reach-1	12805	10 year	2900.60	17.20	28.67		28.75	0.00058	3.42	1893.22	308.68	0.19
Reach-1	12805	25 year	4023.60	17.20	30.34		30.43	0.00056	3.72	2425.57	328.02	0.19
Reach-1	12805	50 year	5033.00	17.20	31.40		31.51	0.00060	4.06	2780.59	340.31	0.20
Reach-1	12805	100 year	6199.90	17.20	32.29		32.42	0.00068	4.53	3086.29	351.76	0.21
Reach-1	12393	2 year	1411.10	16.66	25.19	20.03	25.21	0.00019	1.73	1790.72	301.59	0.11
Reach-1	12393	10 year	2900.60	16.66	28.55	20.95	28.58	0.00020	2.21	2914.84	415.33	0.11
Reach-1	12393	25 year	4023.60	16.66	30.23	21.42	30.26	0.00021	2.46	3636.66	445.26	0.12
Reach-1	12393	50 year	5033.00	16.66	31.29	21.79	31.33	0.00023	2.72	4159.53	555.66	0.13
Reach-1	12393	100 year	6199.90	16.66	32.16	22.18	32.21	0.00025	2.97	4653.88	574.06	0.13
Reach-1	11890	2 year	1411.10	15.80	23.54	21.10	24.26	0.00405	7.18	260.93	118.23	0.47
Reach-1	11890	10 year	2900.60	15.80	26.47	23.80	27.66	0.00458	9.59	465.77	206.99	0.53
Reach-1	11890	25 year	4023.60	15.80	29.57	25.30	29.80	0.00107	5.54	1776.81	431.87	0.27
Reach-1	11890	50 year	5033.00	15.80	30.79	26.58	30.98	0.00087	5.29	2317.22	455.51	0.25
Reach-1	11890	100 year	6199.90	15.80	31.67	27.57	31.86	0.00090	5.58	2733.10	493.05	0.25
Reach-1	11822	2 year	1411.10	14.88	23.56	19.31	23.92	0.00157	4.91	330.65	56.68	0.31
Reach-1	11822	10 year	2900.60	14.88	26.50	21.61	27.22	0.00214	7.07	505.47	84.07	0.38
Reach-1	11822	25 year	4023.60	14.88	28.53	23.08	29.48	0.00229	8.18	697.26	217.02	0.40
Reach-1	11822	50 year	5033.00	14.88	29.54	24.33	30.62	0.00247	8.93	933.22	299.41	0.42
Reach-1	11822	100 year	6199.90	14.88	30.20	25.64	31.45	0.00285	9.90	1128.46	352.86	0.46
Reach-1	11812		Culvert									
Reach-1	11750	2 year	1414.20	15.50	23.39	19.67	23.82	0.00199	5.41	311.92	56.04	0.35
Reach-1	11750	10 year	2906.20	15.50	25.98	21.94	26.88	0.00293	7.98	477.42	78.48	0.44
Reach-1	11750	25 year	4031.30	15.50	27.72	23.52	28.88	0.00313	9.17	636.19	99.61	0.47
Reach-1	11750	50 year	5044.90	15.50	28.60	24.86	30.16	0.00386	10.67	771.36	227.30	0.53
Reach-1	11750	100 year	6215.30	15.50	29.08	26.23	31.08	0.00485	12.26	889.95	266.29	0.59
Reach-1	11500	2 year	1414.20	14.51	22.93		23.30	0.00193	5.48	389.41	82.66	0.34
Reach-1	11500	10 year	2906.20	14.51	25.36		26.07	0.00283	7.89	626.05	112.07	0.43
Reach-1	11500	25 year	4031.30	14.51	27.15		27.97	0.00283	8.76	935.09	238.38	0.44
Reach-1	11500	50 year	5044.90	14.51	28.14		28.97	0.00286	9.27	1239.77	433.36	0.45
Reach-1	11500	100 year	6215.30	14.51	28.64		29.56	0.00322	10.08	1491.47	517.46	0.48

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Reach-1	11048	2 year	1414.20	13.72	22.18	17.97	22.44	0.00151	4.28	430.46	242.78	0.28
Reach-1	11048	10 year	2906.20	13.72	25.09	20.36	25.16	0.00042	2.85	1683.95	580.02	0.16
Reach-1	11048	25 year	4031.30	13.72	27.10	22.99	27.14	0.00018	2.09	2933.24	713.68	0.11
Reach-1	11048	50 year	5044.90	13.72	28.11	23.53	28.15	0.00015	2.04	3669.33	735.71	0.10
Reach-1	11048	100 year	6215.30	13.72	28.60	23.85	28.66	0.00018	2.25	4032.88	745.66	0.11
Reach-1	10970		Bridge									
Reach-1	10936	2 year	1418.60	12.45	21.53	16.99	21.83	0.00130	4.52	364.09	150.77	0.28
Reach-1	10936	10 year	2914.10	12.45	24.74	19.34	25.15	0.00126	5.54	640.51	622.81	0.29
Reach-1	10936	25 year	4042.70	12.45	27.06	21.45	27.10	0.00016	2.20	2863.87	665.88	0.10
Reach-1	10936	50 year	5059.70	12.45	28.08	22.42	28.12	0.00016	2.30	3575.83	809.60	0.11
Reach-1	10936	100 year	6234.00	12.45	28.57	23.30	28.62	0.00019	2.58	3995.28	914.91	0.12
Reach-1	10885		Culvert									
Reach-1	10806	2 year	1418.60	12.36	20.85	17.29	21.40	0.00261	6.00	242.72	78.39	0.38
Reach-1	10806	10 year	2914.10	12.36	21.88	19.81	23.67	0.00716	10.81	277.32	157.69	0.65
Reach-1	10806	25 year	4042.70	12.36	23.07	21.37	25.71	0.00888	13.13	317.46	192.23	0.74
Reach-1	10806	50 year	5059.70	12.36	25.76	22.63	25.94	0.00079	4.61	1791.33	556.12	0.23
Reach-1	10806	100 year	6234.00	12.36	26.68	23.99	26.83	0.00060	4.20	2308.73	570.85	0.20
Reach-1	10529	2 year	1418.60	10.94	20.74	16.88	20.84	0.00070	2.82	574.91	459.14	0.19
Reach-1	10529	10 year	2914.10	10.94	22.62	20.65	22.68	0.00015	1.51	1475.13	494.29	0.09
Reach-1	10529	25 year	4042.70	10.94	24.30	20.88	24.36	0.00006	1.12	2366.63	579.19	0.06
Reach-1	10529	50 year	5059.70	10.94	25.80	21.07	25.85	0.00004	0.95	3220.48	591.79	0.05
Reach-1	10529	100 year	6234.00	10.94	26.70	21.28	26.76	0.00004	0.98	3738.07	599.34	0.05
Reach-1	10000	2 year	1418.60	10.11	19.18	14.86	19.45	0.00153	4.29	469.77	253.45	0.28
Reach-1	10000	10 year	2914.10	10.11	22.11	17.14	22.23	0.00069	3.62	1739.67	565.78	0.20
Reach-1	10000	25 year	4042.70	10.11	24.09	19.67	24.16	0.00035	2.91	3022.23	883.17	0.15
Reach-1	10000	50 year	5059.70	10.11	25.68	20.46	25.74	0.00022	2.52	4756.27	1136.63	0.12
Reach-1	10000	100 year	6234.00	10.11	26.59	21.32	26.64	0.00020	2.52	5798.01	1171.00	0.12
Reach-1	9856	2 year	1418.60	11.57	18.96	14.94	19.22	0.00153	4.11	352.88	61.89	0.28
Reach-1	9856	10 year	2914.10	11.57	21.53	16.87	21.98	0.00180	5.56	595.40	659.60	0.32
Reach-1	9856	25 year	4042.70	11.57	23.49	18.11	23.95	0.00150	5.78	832.60	777.95	0.31
Reach-1	9856	50 year	5059.70	11.57	25.63	19.25	25.70	0.00028	2.81	4171.94	839.62	0.14
Reach-1	9856	100 year	6234.00	11.57	26.54	20.65	26.60	0.00027	2.90	4939.70	860.23	0.14
Reach-1	9813		Culvert									
Reach-1	9732	2 year	1424.80	11.51	18.75	14.84	19.03	0.00163	4.20	346.48	61.32	0.29
Reach-1	9732	10 year	2912.60	11.51	20.84	16.77	21.44	0.00253	6.31	509.99	298.59	0.38
Reach-1	9732	25 year	4039.30	11.51	22.00	18.00	22.83	0.00305	7.53	615.80	686.69	0.43
Reach-1	9732	50 year	5054.30	11.51	23.63	18.87	23.74	0.00055	3.54	2444.14	789.89	0.19
Reach-1	9732	100 year	6228.40	11.51	25.15	20.21	25.20	0.00027	2.71	3669.80	831.01	0.13
Reach-1	9375	2 year	1424.80	10.04	18.24		18.49	0.00134	4.03	391.71	102.00	0.28
Reach-1	9375	10 year	2912.60	10.04	20.41		20.66	0.00120	4.62	936.94	367.90	0.28
Reach-1	9375	25 year	4039.30	10.04	21.83		22.00	0.00079	4.15	1528.29	473.21	0.23

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Reach-1	9375	50 year	5054.30	10.04	23.46		23.56	0.00045	3.46	2465.02	660.87	0.18
Reach-1	9375	100 year	6228.40	10.04	25.03		25.10	0.00027	2.93	3603.59	770.88	0.14
Reach-1	9101	2 year	1424.80	10.36	17.72	14.18	18.03	0.00187	4.57	372.75	139.12	0.32
Reach-1	9101	10 year	2912.60	10.36	19.94	16.28	20.26	0.00166	5.26	1129.52	537.05	0.32
Reach-1	9101	25 year	4039.30	10.36	21.62	18.55	21.78	0.00082	4.17	2111.34	602.63	0.23
Reach-1	9101	50 year	5054.30	10.36	23.34	19.79	23.43	0.00047	3.50	3216.01	748.45	0.18
Reach-1	9101	100 year	6228.40	10.36	24.96	20.15	25.02	0.00028	2.95	4492.20	846.02	0.14
Reach-1	9081		Bridge									
Reach-1	9000	2 year	1424.80	9.13	16.98	13.27	17.24	0.00155	4.18	413.24	122.13	0.30
Reach-1	9000	10 year	2912.60	9.13	19.84	15.35	20.20	0.00143	5.17	854.72	225.59	0.30
Reach-1	9000	25 year	4039.30	9.13	21.40	16.81	21.75	0.00127	5.40	1241.71	271.42	0.29
Reach-1	9000	50 year	5054.30	9.13	22.90	17.67	23.19	0.00098	5.20	1680.24	315.41	0.26
Reach-1	9000	100 year	6228.40	9.13	24.58	18.39	24.84	0.00081	5.14	2342.70	573.56	0.24
Reach-1	8500	2 year	1424.80	7.91	16.34	12.04	16.56	0.00114	3.81	430.57	84.66	0.26
Reach-1	8500	10 year	2912.60	7.91	19.14	14.16	19.52	0.00132	5.16	807.26	167.15	0.29
Reach-1	8500	25 year	4039.30	7.91	20.61	15.31	21.06	0.00141	5.85	1064.29	183.34	0.31
Reach-1	8500	50 year	5054.30	7.91	22.12	16.19	22.59	0.00129	6.09	1369.92	221.90	0.30
Reach-1	8500	100 year	6228.40	7.91	23.92	17.14	24.34	0.00106	6.04	1886.80	372.55	0.28
Reach-1	8229	2 year	1458.70	7.95	14.90	13.15	15.73	0.00690	7.32	199.38	39.62	0.57
Reach-1	8229	10 year	2983.10	7.95	17.54	15.53	18.61	0.00632	8.69	524.29	264.98	0.57
Reach-1	8229	25 year	4143.00	7.95	19.94	17.90	20.48	0.00282	6.93	1121.37	319.47	0.40
Reach-1	8229	50 year	5190.20	7.95	21.71	18.59	22.10	0.00186	6.32	1595.15	340.77	0.33
Reach-1	8229	100 year	6400.40	7.95	23.77	19.18	23.94	0.00081	4.65	2651.67	450.35	0.23
Reach-1	8118		Culvert									
Reach-1	8019	2 year	1458.70	5.86	15.29	10.37	15.63	0.00180	4.65	313.82	50.13	0.30
Reach-1	8019	10 year	2983.10	5.86	17.55	12.87	18.34	0.00331	7.17	439.55	94.53	0.41
Reach-1	8019	25 year	4143.00	5.86	18.89	14.40	20.01	0.00409	8.59	521.60	113.30	0.47
Reach-1	8019	50 year	5190.20	5.86	19.97	15.65	21.37	0.00455	9.66	590.51	173.18	0.50
Reach-1	8019	100 year	6400.40	5.86	21.39	17.13	22.24	0.00287	8.28	1092.87	251.21	0.40
Reach-1	7885	2 year	1458.70	5.67	15.19	9.81	15.39	0.00096	3.62	421.80	76.52	0.23
Reach-1	7885	10 year	2983.10	5.67	17.42	11.89	17.88	0.00161	5.53	652.40	127.36	0.31
Reach-1	7885	25 year	4143.00	5.67	18.80	13.18	19.40	0.00187	6.50	843.05	147.78	0.34
Reach-1	7885	50 year	5190.20	5.67	19.93	14.25	20.64	0.00199	7.14	1018.06	160.76	0.36
Reach-1	7885	100 year	6400.40	5.67	21.09	15.46	21.91	0.00210	7.78	1212.36	174.04	0.37
Reach-1	7471	2 year	1456.90	5.10	14.89	9.31	15.04	0.00070	3.32	669.33	317.70	0.20
Reach-1	7471	10 year	2979.60	5.10	16.97	12.23	17.26	0.00116	4.94	969.07	338.55	0.26
Reach-1	7471	25 year	4138.50	5.10	18.29	13.42	18.67	0.00138	5.81	1164.17	355.51	0.29
Reach-1	7471	50 year	5184.60	5.10	19.39	14.23	19.85	0.00150	6.43	1332.39	365.46	0.31
Reach-1	7471	100 year	6394.00	5.10	20.52	15.04	21.06	0.00163	7.07	1508.54	375.64	0.33
Reach-1	7000	2 year	1456.90	4.42	14.37	10.20	14.58	0.00130	4.14	697.53	255.58	0.26
Reach-1	7000	10 year	2979.60	4.42	16.43	13.69	16.68	0.00149	5.19	1295.71	317.03	0.29

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Reach-1	7000	25 year	4138.50	4.42	17.78	14.48	18.05	0.00151	5.68	1794.03	414.58	0.30
Reach-1	7000	50 year	5184.60	4.42	19.01	15.17	19.25	0.00128	5.61	2325.47	446.94	0.28
Reach-1	7000	100 year	6394.00	4.42	20.24	15.72	20.46	0.00112	5.58	2893.87	471.11	0.27
Reach-1	6500	2 year	1469.50	3.91	13.54	9.71	13.78	0.00158	4.44	679.66	444.63	0.29
Reach-1	6500	10 year	3007.70	3.91	15.77	13.28	15.94	0.00113	4.46	1669.47	492.62	0.25
Reach-1	6500	25 year	4179.00	3.91	17.26	14.07	17.40	0.00092	4.42	2309.55	505.48	0.23
Reach-1	6500	50 year	5237.30	3.91	18.57	14.50	18.69	0.00077	4.36	2879.06	513.51	0.22
Reach-1	6500	100 year	6462.00	3.91	19.84	14.93	19.96	0.00069	4.42	3437.61	521.32	0.21
Reach-1	6000	2 year	1469.50	3.32	12.54		12.77	0.00171	4.45	693.66	303.86	0.30
Reach-1	6000	10 year	3007.70	3.32	15.04		15.21	0.00120	4.56	1532.49	357.58	0.26
Reach-1	6000	25 year	4179.00	3.32	16.68		16.84	0.00097	4.55	2133.85	375.45	0.24
Reach-1	6000	50 year	5237.30	3.32	18.09		18.23	0.00082	4.54	2671.83	390.75	0.23
Reach-1	6000	100 year	6462.00	3.32	19.41		19.55	0.00076	4.66	3198.09	405.64	0.22
Reach-1	5500	2 year	1469.50	3.02	11.89		12.02	0.00111	3.57	951.85	404.05	0.24
Reach-1	5500	10 year	3007.70	3.02	14.65		14.73	0.00063	3.36	2112.13	437.54	0.19
Reach-1	5500	25 year	4179.00	3.02	16.37		16.45	0.00051	3.37	2904.35	481.60	0.18
Reach-1	5500	50 year	5237.30	3.02	17.83		17.90	0.00043	3.37	3633.31	519.76	0.17
Reach-1	5500	100 year	6462.00	3.02	19.18		19.25	0.00040	3.46	4356.57	551.48	0.16
Reach-1	5088	2 year	1469.50	1.35	11.56		11.61	0.00053	2.69	1389.48	447.88	0.17
Reach-1	5088	10 year	3007.70	1.35	14.44		14.48	0.00036	2.72	2744.86	489.77	0.15
Reach-1	5088	25 year	4179.00	1.35	16.21		16.25	0.00031	2.79	3629.18	506.67	0.14
Reach-1	5088	50 year	5237.30	1.35	17.69		17.73	0.00028	2.85	4388.35	519.31	0.13
Reach-1	5088	100 year	6462.00	1.35	19.05		19.09	0.00027	2.99	5100.78	531.05	0.13
Reach-1	4500	2 year	1469.50	0.81	10.89	7.08	11.02	0.00095	3.58	778.83	197.71	0.22
Reach-1	4500	10 year	3007.70	0.81	13.85	9.27	14.02	0.00093	4.37	1469.26	273.43	0.23
Reach-1	4500	25 year	4179.00	0.81	15.70	10.08	15.86	0.00082	4.55	1999.34	298.36	0.23
Reach-1	4500	50 year	5237.30	0.81	17.24	10.70	17.41	0.00074	4.67	2475.83	336.05	0.22
Reach-1	4500	100 year	6462.00	0.81	18.61	11.35	18.79	0.00074	4.96	3134.54	513.61	0.22
Reach-1	4137	2 year	1469.50	0.48	10.58		10.66	0.00040	2.59	1005.71	245.19	0.16
Reach-1	4137	10 year	3007.70	0.48	13.55		13.66	0.00042	3.24	1898.20	335.92	0.17
Reach-1	4137	25 year	4179.00	0.48	15.43		15.54	0.00039	3.45	2547.41	353.44	0.17
Reach-1	4137	50 year	5237.30	0.48	17.03		17.14	0.00036	3.58	3124.31	372.46	0.16
Reach-1	4137	100 year	6462.00	0.48	18.42		18.54	0.00037	3.84	3655.32	391.59	0.17
Reach-1	4008	2 year	1464.10	0.26	10.41	5.02	10.57	0.00064	3.32	575.05	341.48	0.20
Reach-1	4008	10 year	2992.30	0.26	13.33	6.86	13.55	0.00070	4.25	1211.30	427.10	0.22
Reach-1	4008	25 year	4145.90	0.26	15.20	8.02	15.44	0.00065	4.53	1655.44	454.16	0.22
Reach-1	4008	50 year	5185.70	0.26	16.80	8.96	17.04	0.00060	4.69	2033.24	462.73	0.22
Reach-1	4008	100 year	6103.50	0.26	18.21	9.73	18.45	0.00055	4.78	2366.15	470.29	0.21
Reach-1	3903		Bridge									
Reach-1	3835	2 year	1450.00	0.06	9.99	4.91	10.17	0.00073	3.44	505.57	307.55	0.21
Reach-1	3835	10 year	2960.60	0.06	12.20	6.76	12.58	0.00118	5.16	776.08	407.21	0.28
Reach-1	3835	25 year	4095.90	0.06	13.40	7.91	13.92	0.00146	6.16	924.46	429.20	0.32

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3835	50 year	5120.60	0.06	14.31	8.85	14.96	0.00169	6.97	1037.18	445.91	0.35
Reach-1	3835	100 year	6061.70	0.06	15.05	9.64	15.82	0.00188	7.65	1129.46	453.56	0.37
Reach-1	3391	2 year	1450.00	1.02	9.70		9.83	0.00071	3.15	815.92	258.31	0.21
Reach-1	3391	10 year	2960.60	1.02	11.86		12.04	0.00086	4.11	1464.02	327.96	0.24
Reach-1	3391	25 year	4095.90	1.02	13.06		13.26	0.00091	4.58	1864.60	340.81	0.25
Reach-1	3391	50 year	5120.60	1.02	13.97		14.20	0.00095	4.95	2181.61	350.32	0.26
Reach-1	3391	100 year	6061.70	1.02	14.73		14.98	0.00098	5.25	2450.06	358.18	0.26
Reach-1	2950	2 year	1450.00	1.26	8.98		9.25	0.00190	4.80	1287.60	395.83	0.32
Reach-1	2950	10 year	2960.60	1.26	10.83		11.27	0.00265	6.62	2042.27	415.34	0.39
Reach-1	2950	25 year	4095.90	1.26	11.85		12.40	0.00307	7.66	2469.93	423.48	0.43
Reach-1	2950	50 year	5120.60	1.26	12.62		13.27	0.00340	8.49	2799.23	429.84	0.46
Reach-1	2950	100 year	6061.70	1.26	13.25		13.99	0.00368	9.18	3073.31	435.81	0.48
Reach-1	2381	2 year	1450.00	0.98	7.68	6.05	7.98	0.00260	5.20	560.73	255.79	0.37
Reach-1	2381	10 year	2960.60	0.98	9.10	7.71	9.54	0.00348	6.91	955.92	291.67	0.44
Reach-1	2381	25 year	4095.90	0.98	9.94	8.42	10.45	0.00379	7.72	1208.21	306.25	0.47
Reach-1	2381	50 year	5120.60	0.98	10.58	8.92	11.14	0.00403	8.36	1404.53	313.70	0.49
Reach-1	2381	100 year	6061.70	0.98	11.11	9.29	11.71	0.00419	8.85	1574.13	319.99	0.50
Reach-1	1890	2 year	1439.30	0.64	6.75	5.26	6.90	0.00171	4.05	765.92	515.72	0.30
Reach-1	1890	10 year	2937.40	0.64	7.98	6.27	8.17	0.00204	5.03	1389.75	528.42	0.34
Reach-1	1890	25 year	4059.20	0.64	8.71	6.80	8.93	0.00228	5.68	1689.09	535.78	0.36
Reach-1	1890	50 year	5074.00	0.64	9.22	7.13	9.49	0.00254	6.26	1904.48	540.36	0.38
Reach-1	1890	100 year	6042.10	0.64	9.67	7.45	9.97	0.00275	6.75	2091.03	544.29	0.40
Reach-1	1500	2 year	1439.30	0.50	6.24		6.31	0.00135	3.25	1262.26	622.53	0.25
Reach-1	1500	10 year	2937.40	0.50	7.39		7.48	0.00155	3.99	2005.49	690.32	0.28
Reach-1	1500	25 year	4059.20	0.50	8.02		8.13	0.00186	4.66	2483.86	781.69	0.31
Reach-1	1500	50 year	5074.00	0.50	8.51		8.63	0.00189	4.92	2870.07	787.51	0.32
Reach-1	1500	100 year	6042.10	0.50	8.94		9.06	0.00191	5.14	3208.96	792.08	0.33
Reach-1	1000	2 year	1439.30	0.40	5.62	4.10	5.65	0.00080	2.35	1897.63	1111.70	0.19
Reach-1	1000	10 year	2937.40	0.40	6.74	4.64	6.76	0.00080	2.69	3240.54	1267.69	0.20
Reach-1	1000	25 year	4059.20	0.40	7.35	4.93	7.38	0.00080	2.89	4032.17	1286.55	0.20
Reach-1	1000	50 year	5074.00	0.40	7.85	5.19	7.88	0.00080	3.03	4667.51	1294.67	0.21
Reach-1	1000	100 year	6042.10	0.40	8.28	5.40	8.31	0.00080	3.16	5224.77	1301.75	0.21

HEC-RAS Output for Reedy Branch Alternative #2 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	7801	2 YR	35.50	69.60	71.42	71.01	71.70	0.01213	4.30	8.37	9.77	0.65
Reach-1	7801	10 YR	75.20	69.60	71.85	71.85	71.98	0.00650	3.78	40.01	388.85	0.50
Reach-1	7801	25 YR	95.30	69.6	71.90	71.90	72.05	0.00747	4.13	46.01	411.80	0.53
Reach-1	7801	50 YR	115.50	69.60	71.94	71.94	72.10	0.00839	4.45	51.12	414.38	0.57
Reach-1	7801	100 YR	138.90	69.60	71.99	71.99	72.17	0.00919	4.73	56.80	417.21	0.60
Reach-1	7545	2 YR	35.50	66.69	68.57	68.12	68.83	0.01044	4.09	9.54	108.02	0.60
Reach-1	7545	10 YR	75.20	66.69	68.88	68.80	68.89	0.00012	0.51	138.68	114.09	0.07
Reach-1	7545	25 YR	95.30	66.69	69.02	68.80	69.03	0.00015	0.58	155.02	118.49	0.07
Reach-1	7545	50 YR	115.50	66.69	69.04	68.80	69.04	0.00021	0.70	156.45	118.86	0.09
Reach-1	7545	100 YR	138.90	66.69	69.12	68.80	69.13	0.00026	0.80	166.19	121.40	0.10
Reach-1	7428	2 YR	35.50	65.56	68.58	66.98	68.59	0.00035	1.10	79.19	153.38	0.12
Reach-1	7428	10 YR	75.20	65.56	68.84	67.89	68.86	0.00073	1.70	110.93	192.30	0.18
Reach-1	7428	25 YR	95.30	65.56	68.97	68.07	68.99	0.00078	1.81	131.52	232.46	0.19
Reach-1	7428	50 YR	115.50	65.56	68.96	68.23	68.99	0.00119	2.23	128.89	222.73	0.23
Reach-1	7428	100 YR	138.90	65.56	69.02	68.36	69.06	0.00140	2.46	140.71	237.14	0.25
Reach-1	7399		Culvert									
Reach-1	7371	2 YR	35.50	65.23	67.03	66.65	67.33	0.01291	4.38	8.11	6.12	0.66
Reach-1	7371	10 YR	75.20	65.23	67.73	67.48	68.20	0.01249	5.68	15.28	25.02	0.70
Reach-1	7371	25 YR	95.30	65.23	68.05	67.73	68.38	0.00872	5.22	29.16	31.99	0.60
Reach-1	7371	50 YR	115.50	65.23	68.20	68.00	68.57	0.00940	5.65	34.17	35.28	0.63
Reach-1	7371	100 YR	138.90	65.23	68.18	68.18	68.74	0.01390	6.85	33.80	35.04	0.76
Reach-1	7222	2 YR	35.50	62.60	63.89	63.89	64.43	0.03054	5.91	6.01	5.61	1.01
Reach-1	7222	10 YR	75.20	62.60	64.63	64.63	65.42	0.02874	7.13	10.54	6.70	1.00
Reach-1	7222	25 YR	95.30	62.60	64.93	64.93	65.81	0.02810	7.53	12.65	7.15	1.00
Reach-1	7222	50 YR	115.50	62.60	65.20	65.20	66.17	0.02786	7.90	14.63	7.54	1.00
Reach-1	7222	100 YR	138.90	62.60	66.48	65.49	66.86	0.00804	5.12	34.87	158.37	0.55
Reach-1	7004	2 YR	35.50	58.56	60.54	59.87	60.74	0.00742	3.57	9.96	6.35	0.50
Reach-1	7004	10 YR	75.20	58.56	61.91	60.61	62.13	0.00511	3.77	19.94	8.19	0.43
Reach-1	7004	25 YR	95.30	58.56	62.65	60.92	62.85	0.00391	3.62	26.34	9.18	0.38
Reach-1	7004	50 YR	115.50	58.56	63.99	61.20	64.11	0.00160	2.83	47.08	31.30	0.25
Reach-1	7004	100 YR	138.90	58.56	66.52	61.49	66.54	0.00022	1.44	158.14	338.31	0.10
Reach-1	6771		Culvert									
Reach-1	6708	2 YR	35.50	56.92	58.37	58.17	58.69	0.01630	4.57	7.77	7.23	0.78
Reach-1	6708	10 YR	75.20	56.92	59.56	58.83	59.82	0.00721	4.14	18.17	10.29	0.55
Reach-1	6708	25 YR	95.30	56.92	60.11	59.09	60.35	0.00533	3.93	24.24	11.71	0.48
Reach-1	6708	50 YR	115.50	56.92	60.72	59.33	60.92	0.00330	3.63	33.42	19.27	0.39
Reach-1	6708	100 YR	138.90	56.92	61.77	59.57	61.88	0.00124	2.78	67.85	53.20	0.26
Reach-1	6622	2 YR	35.50	55.38	58.23		58.27	0.00135	1.74	20.45	10.84	0.22
Reach-1	6622	10 YR	75.20	55.38	59.45		59.52	0.00115	2.12	38.59	24.63	0.22
Reach-1	6622	25 YR	95.30	55.38	60.04		60.11	0.00088	2.10	62.29	53.02	0.20

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6622	50 YR	115.50	55.38	60.71		60.75	0.00055	1.87	99.59	59.42	0.16
Reach-1	6622	100 YR	138.90	55.38	61.77		61.80	0.00025	1.47	176.01	86.18	0.11
Reach-1	6504	2 YR	35.50	55.52	57.99		58.05	0.00261	2.32	29.01	34.89	0.27
Reach-1	6504	10 YR	75.20	55.52	59.34		59.38	0.00112	2.08	93.94	78.60	0.19
Reach-1	6504	25 YR	95.30	55.52	59.99		60.01	0.00060	1.71	156.18	106.66	0.15
Reach-1	6504	50 YR	115.50	55.52	60.68		60.69	0.00031	1.36	235.59	122.31	0.11
Reach-1	6504	100 YR	138.90	55.52	61.77		61.77	0.00013	1.00	384.57	154.02	0.07
Reach-1	6351	2 YR	35.50	55.23	57.78	56.38	57.81	0.00096	1.56	26.68	21.84	0.20
Reach-1	6351	10 YR	75.20	55.23	59.23	56.91	59.27	0.00049	1.61	71.14	66.16	0.15
Reach-1	6351	25 YR	95.30	55.23	59.90	57.11	59.93	0.00038	1.60	93.61	90.27	0.14
Reach-1	6351	50 YR	115.50	55.23	60.61	57.32	60.64	0.00030	1.56	117.60	145.38	0.13
Reach-1	6351	100 YR	138.90	55.23	61.72	57.53	61.74	0.00019	1.43	154.88	195.05	0.10
Reach-1	6317		Culvert									
Reach-1	6288	2 YR	35.40	54.92	56.38	56.11	56.62	0.01229	3.97	8.92	8.62	0.69
Reach-1	6288	10 YR	75.20	54.92	57.40	56.74	57.61	0.00529	3.76	21.14	20.97	0.49
Reach-1	6288	25 YR	95.20	54.92	57.70	56.95	57.93	0.00520	4.01	25.01	23.21	0.49
Reach-1	6288	50 YR	115.40	54.92	57.92	57.13	58.20	0.00549	4.33	28.01	24.90	0.51
Reach-1	6288	100 YR	138.70	54.92	58.14	57.34	58.46	0.00576	4.69	31.05	26.74	0.53
Reach-1	5862	2 YR	35.40	49.18	55.03		55.05	0.00053	1.21	31.86	15.56	0.11
Reach-1	5862	10 YR	75.20	49.18	56.93		56.96	0.00043	1.41	76.48	32.89	0.11
Reach-1	5862	25 YR	95.20	49.18	57.19		57.23	0.00055	1.65	85.42	35.34	0.12
Reach-1	5862	50 YR	115.40	49.18	57.35		57.40	0.00071	1.91	91.29	36.86	0.14
Reach-1	5862	100 YR	138.70	49.18	57.50		57.56	0.00091	2.20	96.69	38.34	0.16
Reach-1	5571	2 YR	35.40	51.43	54.83	52.67	54.86	0.00076	1.37	25.85	12.18	0.16
Reach-1	5571	10 YR	75.20	51.43	56.83	53.33	56.85	0.00028	1.23	106.45	71.36	0.11
Reach-1	5571	25 YR	95.20	51.43	57.07	53.60	57.10	0.00034	1.40	124.25	76.47	0.12
Reach-1	5571	50 YR	115.40	51.43	57.21	53.84	57.24	0.00043	1.60	134.48	79.26	0.13
Reach-1	5571	100 YR	138.70	51.43	57.31	54.09	57.35	0.00055	1.85	142.62	81.41	0.15
Reach-1	5515		Culvert									
Reach-1	5466	2 YR	35.40	48.92	52.02	50.46	52.10	0.00299	2.33	15.19	6.76	0.27
Reach-1	5466	10 YR	75.20	48.92	54.37	51.23	54.43	0.00121	2.07	45.13	18.35	0.18
Reach-1	5466	25 YR	95.20	48.92	56.46	51.55	56.48	0.00029	1.30	148.89	85.49	0.09
Reach-1	5466	50 YR	115.40	48.92	56.76	51.84	56.78	0.00031	1.39	176.73	98.47	0.10
Reach-1	5466	100 YR	138.70	48.92	56.89	52.14	56.92	0.00039	1.58	190.13	104.23	0.11
Reach-1	5438	2 YR	35.40	48.66	51.81		51.96	0.00659	3.14	11.26	4.99	0.37
Reach-1	5438	10 YR	75.20	48.66	54.30		54.38	0.00199	2.40	42.02	32.37	0.23
Reach-1	5438	25 YR	95.20	48.66	56.45		56.47	0.00025	1.18	173.58	93.23	0.09
Reach-1	5438	50 YR	115.40	48.66	56.75		56.77	0.00026	1.25	203.25	102.92	0.09
Reach-1	5438	100 YR	138.70	48.66	56.89		56.90	0.00033	1.42	217.00	107.34	0.10
Reach-1	5381	2 YR	35.40	48.86	51.67		51.73	0.00227	2.08	17.12	9.44	0.26
Reach-1	5381	10 YR	75.20	48.86	54.31		54.33	0.00028	1.26	84.37	45.93	0.10

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	5381	25 YR	95.20	48.86	56.45		56.46	0.00004	0.60	264.04	120.46	0.04
Reach-1	5381	50 YR	115.40	48.86	56.76		56.76	0.00004	0.64	301.99	133.57	0.04
Reach-1	5381	100 YR	138.70	48.86	56.89		56.89	0.00005	0.72	320.10	142.24	0.05
Reach-1	5356	2 YR	49.30	47.99	51.65	49.29	51.69	0.00094	1.69	32.34	22.92	0.17
Reach-1	5356	10 YR	109.60	47.99	54.28	50.13	54.32	0.00043	1.73	81.75	67.25	0.13
Reach-1	5356	25 YR	140.10	47.99	56.45	50.47	56.46	0.00006	0.81	329.79	217.89	0.05
Reach-1	5356	50 YR	167.20	47.99	56.75	50.83	56.76	0.00006	0.83	372.65	228.23	0.05
Reach-1	5356	100 YR	199.80	47.99	56.88	51.13	56.89	0.00008	0.93	391.42	281.43	0.06
Reach-1	5301		Culvert									
Reach-1	5241	2 YR	49.30	46.32	48.25	47.52	48.33	0.00353	2.24	21.98	16.99	0.35
Reach-1	5241	10 YR	109.60	46.32	49.46	48.03	49.56	0.00219	2.45	44.75	20.67	0.29
Reach-1	5241	25 YR	140.10	46.32	49.92	48.24	50.02	0.00204	2.57	54.53	22.07	0.29
Reach-1	5241	50 YR	167.20	46.32	50.24	48.41	50.35	0.00204	2.71	61.76	23.04	0.29
Reach-1	5241	100 YR	199.80	46.32	50.54	48.61	50.68	0.00212	2.90	69.07	26.64	0.30
Reach-1	4994	2 YR	49.30	43.38	46.94		47.12	0.00677	3.44	14.34	6.24	0.40
Reach-1	4994	10 YR	109.60	43.38	48.20		48.54	0.00817	4.74	24.27	10.31	0.46
Reach-1	4994	25 YR	140.10	43.38	48.57		49.00	0.00908	5.36	30.63	24.45	0.49
Reach-1	4994	50 YR	167.20	43.38	48.81		49.29	0.00974	5.79	37.67	34.77	0.52
Reach-1	4994	100 YR	199.80	43.38	49.05		49.57	0.01020	6.17	47.42	46.58	0.53
Reach-1	4798	2 YR	49.30	42.16	44.70		45.07	0.01768	4.93	10.00	6.22	0.68
Reach-1	4798	10 YR	109.60	42.16	45.62	45.43	46.23	0.01801	6.41	20.67	19.19	0.73
Reach-1	4798	25 YR	140.10	42.16	45.95		46.59	0.01700	6.79	27.71	23.83	0.73
Reach-1	4798	50 YR	167.20	42.16	46.21		46.86	0.01604	7.01	34.35	27.48	0.72
Reach-1	4798	100 YR	199.80	42.16	46.48		47.14	0.01509	7.21	42.43	31.36	0.71
Reach-1	4624	2 YR	49.30	39.14	40.85	40.72	41.33	0.02676	5.57	8.85	6.99	0.87
Reach-1	4624	10 YR	109.60	39.14	41.78	41.59	42.51	0.02585	6.87	15.96	8.41	0.88
Reach-1	4624	25 YR	140.10	39.14	42.11	41.93	42.97	0.02595	7.42	18.97	9.76	0.89
Reach-1	4624	50 YR	167.20	39.14	42.37	42.22	43.33	0.02605	7.91	21.64	11.70	0.90
Reach-1	4624	100 YR	199.80	39.14	42.63	42.56	43.73	0.02593	8.45	25.24	15.64	0.91
Reach-1	4494	2 YR	49.30	35.80	37.74		38.08	0.01661	4.70	10.50	7.38	0.69
Reach-1	4494	10 YR	109.60	35.80	38.74		39.27	0.01649	5.87	18.68	9.17	0.71
Reach-1	4494	25 YR	140.10	35.80	39.07		39.72	0.01657	6.47	21.96	10.38	0.73
Reach-1	4494	50 YR	167.20	35.80	39.30	38.86	40.07	0.01741	7.04	24.44	11.22	0.76
Reach-1	4494	100 YR	199.80	35.80	39.54	39.17	40.45	0.01849	7.68	27.24	12.09	0.79
Reach-1	4291	2 YR	49.30	33.47	35.11		35.33	0.01111	3.73	13.22	10.83	0.59
Reach-1	4291	10 YR	109.60	33.47	35.83		36.23	0.01350	5.07	21.62	12.52	0.68
Reach-1	4291	25 YR	140.10	33.47	36.12		36.59	0.01414	5.53	25.34	13.21	0.70
Reach-1	4291	50 YR	167.20	33.47	36.39		36.91	0.01346	5.76	29.10	14.46	0.69
Reach-1	4291	100 YR	199.80	33.47	36.68		37.25	0.01290	6.05	33.52	16.42	0.69
Reach-1	4182	2 YR	49.30	32.22	33.69		33.81	0.00610	2.80	17.62	14.74	0.45
Reach-1	4182	10 YR	109.60	32.22	34.19		34.48	0.01048	4.33	25.31	16.31	0.61
Reach-1	4182	25 YR	140.10	32.22	35.27		35.42	0.00337	3.12	44.86	19.76	0.37

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4182	50 YR	167.20	32.22	35.78		35.92	0.00266	3.02	55.40	21.39	0.33
Reach-1	4182	100 YR	199.80	32.22	36.16		36.31	0.00258	3.13	63.74	22.59	0.33
Reach-1	4044	2 YR	49.30	30.62	31.71	31.71	32.12	0.03428	5.13	9.62	12.00	1.01
Reach-1	4044	10 YR	109.60	30.62	33.38		33.55	0.00439	3.24	33.78	16.88	0.40
Reach-1	4044	25 YR	140.10	30.62	35.09		35.16	0.00103	2.14	66.57	23.19	0.21
Reach-1	4044	50 YR	167.20	30.62	35.63		35.70	0.00091	2.18	79.90	26.31	0.20
Reach-1	4044	100 YR	199.80	30.62	36.00		36.09	0.00097	2.35	90.02	27.59	0.21
Reach-1	3761	2 YR	49.30	27.45	30.98		31.01	0.00058	1.30	37.99	15.51	0.15
Reach-1	3761	10 YR	109.60	27.45	33.24		33.27	0.00034	1.39	80.88	24.71	0.12
Reach-1	3761	25 YR	140.10	27.45	35.04		35.06	0.00015	1.19	135.84	36.53	0.09
Reach-1	3761	50 YR	167.20	27.45	35.57		35.60	0.00016	1.28	156.49	40.10	0.09
Reach-1	3761	100 YR	199.80	27.45	35.94		35.97	0.00018	1.43	171.63	42.53	0.10
Reach-1	3523	2 YR	49.30	27.24	30.75		30.80	0.00134	1.87	26.38	10.44	0.21
Reach-1	3523	10 YR	109.60	27.24	33.12		33.16	0.00063	1.81	78.94	30.33	0.15
Reach-1	3523	25 YR	140.10	27.24	34.99		35.01	0.00024	1.42	154.98	50.96	0.10
Reach-1	3523	50 YR	167.20	27.24	35.53		35.55	0.00024	1.50	184.09	56.91	0.10
Reach-1	3523	100 YR	199.80	27.24	35.89		35.92	0.00027	1.66	205.32	60.88	0.11
Reach-1	3284	2 YR	49.30	27.75	30.48	28.79	30.52	0.00104	1.59	30.95	15.04	0.20
Reach-1	3284	10 YR	109.60	27.75	33.02	29.43	33.05	0.00035	1.41	93.45	50.30	0.12
Reach-1	3284	25 YR	140.10	27.75	34.96	29.69	34.97	0.00011	1.03	223.66	82.21	0.07
Reach-1	3284	50 YR	167.20	27.75	35.50	29.90	35.51	0.00010	1.06	270.40	90.10	0.07
Reach-1	3284	100 YR	199.80	27.75	35.86	30.14	35.87	0.00012	1.17	304.02	97.82	0.08
Reach-1	3208	2 YR	96.10	26.97	29.65	29.12	30.10	0.01476	5.37	17.88	8.99	0.67
Reach-1	3208	10 YR	235.30	26.97	32.47	30.48	32.83	0.00555	4.87	49.20	14.41	0.43
Reach-1	3208	25 YR	328.30	26.97	34.75	31.19	34.89	0.00152	3.44	168.35	78.15	0.24
Reach-1	3208	50 YR	411.90	26.97	35.27	31.73	35.43	0.00155	3.67	211.80	87.48	0.25
Reach-1	3208	100 YR	508.50	26.97	35.58	32.32	35.77	0.00190	4.19	239.73	99.03	0.28
Reach-1	3163		Culvert									
Reach-1	3113	2 YR	96.10	25.96	28.64	28.03	28.91	0.00869	4.24	24.72	23.88	0.55
Reach-1	3113	10 YR	235.30	25.96	29.74	29.08	30.29	0.01016	6.16	43.73	41.65	0.64
Reach-1	3113	25 YR	328.30	25.96	34.66	29.60	34.67	0.00008	1.07	796.89	225.63	0.07
Reach-1	3113	50 YR	411.90	25.96	35.35	30.02	35.36	0.00008	1.10	956.06	236.03	0.07
Reach-1	3113	100 YR	508.50	25.96	35.68	30.48	35.69	0.00009	1.25	1034.89	241.01	0.07
Reach-1	3074	2 YR	96.10	25.84	27.62	27.62	28.24	0.02986	6.27	15.32	12.46	1.00
Reach-1	3074	10 YR	235.30	25.84	28.68	28.68	29.60	0.02476	7.68	31.39	27.15	0.97
Reach-1	3074	25 YR	328.30	25.84	34.66	29.33	34.66	0.00005	0.85	921.13	209.99	0.05
Reach-1	3074	50 YR	411.90	25.84	35.35	29.53	35.35	0.00005	0.91	1068.24	216.84	0.06
Reach-1	3074	100 YR	508.50	25.84	35.68	30.09	35.69	0.00006	1.06	1140.34	220.12	0.06
Reach-1	3007	2 YR	96.10	21.82	24.48		24.89	0.01375	5.17	18.58	9.77	0.66
Reach-1	3007	10 YR	235.30	21.82	25.86		26.62	0.01619	6.99	33.68	12.08	0.74
Reach-1	3007	25 YR	328.30	21.82	34.65		34.66	0.00005	1.00	794.54	157.00	0.05
Reach-1	3007	50 YR	411.90	21.82	35.34		35.35	0.00006	1.11	905.24	164.37	0.06

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3007	100 YR	508.50	21.82	35.67		35.68	0.00008	1.30	959.58	167.43	0.06
Reach-1	2509	2 YR	96.10	18.50	22.51	20.61	22.62	0.00213	2.69	39.37	21.76	0.28
Reach-1	2509	10 YR	235.30	18.50	25.15	21.93	25.24	0.00091	2.72	145.70	55.31	0.20
Reach-1	2509	25 YR	328.30	18.50	34.64	22.57	34.65	0.00001	0.65	1176.95	160.31	0.03
Reach-1	2509	50 YR	411.90	18.50	35.33	23.12	35.33	0.00002	0.75	1289.67	168.47	0.03
Reach-1	2509	100 YR	508.50	18.50	35.65	23.59	35.66	0.00002	0.89	1344.93	188.19	0.04
Reach-1	2076	2 YR	96.10	17.78	19.62	19.62	20.25	0.03157	6.37	15.09	12.07	1.00
Reach-1	2076	10 YR	235.30	17.78	24.95	20.68	24.98	0.00036	1.66	287.60	150.23	0.13
Reach-1	2076	25 YR	328.30	17.78	34.64	21.23	34.65	0.00000	0.23	2565.68	289.30	0.01
Reach-1	2076	50 YR	411.90	17.78	35.33	21.67	35.33	0.00000	0.28	2776.91	325.34	0.01
Reach-1	2076	100 YR	508.50	17.78	35.65	22.14	35.66	0.00000	0.33	2883.25	331.88	0.01
Reach-1	2002	2 YR	137.50	15.34	18.66	17.89	19.04	0.00867	5.05	31.12	16.20	0.56
Reach-1	2002	10 YR	354.70	15.34	24.90	19.45	24.95	0.00038	2.25	324.28	98.19	0.14
Reach-1	2002	25 YR	508.70	15.34	34.64	20.24	34.65	0.00001	0.45	2188.92	262.61	0.02
Reach-1	2002	50 YR	640.30	15.34	35.33	20.82	35.33	0.00001	0.53	2381.79	298.92	0.02
Reach-1	2002	100 YR	788.30	15.34	35.65	21.40	35.65	0.00001	0.63	2479.42	305.58	0.03
Reach-1	1502	2 YR	137.50	12.83	18.15		18.20	0.00059	1.86	92.10	39.72	0.15
Reach-1	1502	10 YR	354.70	12.83	24.87		24.88	0.00006	1.07	752.65	152.13	0.06
Reach-1	1502	25 YR	508.70	12.83	34.64		34.64	0.00000	0.45	3050.30	325.80	0.02
Reach-1	1502	50 YR	640.30	12.83	35.33		35.33	0.00001	0.52	3275.28	331.23	0.02
Reach-1	1502	100 YR	788.30	12.83	35.65		35.65	0.00001	0.62	3382.30	333.78	0.02
Reach-1	1058	2 YR	137.50	12.30	17.98	14.26	18.01	0.00031	1.49	155.23	79.38	0.12
Reach-1	1058	10 YR	354.70	12.30	24.86	15.56	24.86	0.00003	0.78	1060.83	169.32	0.04
Reach-1	1058	25 YR	508.70	12.30	34.64	16.47	34.64	0.00000	0.40	3576.43	385.97	0.02
Reach-1	1058	50 YR	640.30	12.30	35.32	17.09	35.33	0.00000	0.47	3844.02	395.96	0.02
Reach-1	1058	100 YR	788.30	12.30	35.65	17.62	35.65	0.00001	0.55	3971.94	400.73	0.02
Reach-1	918	2 YR	176.70	13.48	17.77	15.45	17.89	0.00185	2.77	63.74	19.13	0.27
Reach-1	918	10 YR	466.50	13.48	24.80	16.98	24.84	0.00020	1.84	349.64	139.76	0.10
Reach-1	918	25 YR	676.50	13.48	34.62	17.83	34.64	0.00003	1.05	1136.23	287.56	0.04
Reach-1	918	50 YR	854.50	13.48	35.30	18.46	35.32	0.00004	1.26	1245.10	328.30	0.05
Reach-1	918	100 YR	1053.60	13.48	35.64	19.08	35.64	0.00002	0.91	2805.76	333.85	0.04
Reach-1	813		Culvert									
Reach-1	734	2 YR	176.70	11.71	14.15	13.50	14.50	0.00430	4.77	37.07	18.91	0.60
Reach-1	734	10 YR	466.50	11.71	16.15	14.91	16.68	0.00296	5.86	79.67	24.39	0.54
Reach-1	734	25 YR	676.50	11.71	16.79	15.62	17.60	0.00362	7.22	93.72	25.92	0.62
Reach-1	734	50 YR	854.50	11.71	17.06	16.14	18.20	0.00468	8.56	99.78	26.58	0.71
Reach-1	734	100 YR	1053.60	11.71	17.28	16.68	18.86	0.00609	10.07	104.58	27.10	0.82
Reach-1	636	2 YR	176.70	9.55	12.48	12.48	13.58	0.01415	8.42	21.00	9.68	1.01
Reach-1	636	10 YR	466.50	9.55	14.69	14.69	16.00	0.00846	9.55	57.29	26.81	0.84
Reach-1	636	25 YR	676.50	9.55	15.64	15.64	16.96	0.00706	10.04	88.18	38.07	0.79
Reach-1	636	50 YR	854.50	9.55	16.22	16.22	17.59	0.00668	10.51	112.32	44.87	0.78
Reach-1	636	100 YR	1053.60	9.55	16.72	16.72	18.17	0.00665	11.10	136.22	50.71	0.79

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	592	2 YR	176.70	7.70	11.90	10.04	12.18	0.00218	4.18	42.26	12.00	0.39
Reach-1	592	10 YR	466.50	7.70	14.06	12.00	14.73	0.00336	6.58	73.60	20.64	0.50
Reach-1	592	25 YR	676.50	7.70	15.23	13.10	16.01	0.00320	7.32	102.97	96.39	0.51
Reach-1	592	50 YR	854.50	7.70	16.04	14.16	16.85	0.00297	7.64	129.36	145.27	0.50
Reach-1	592	100 YR	1053.60	7.70	16.58	15.26	17.52	0.00322	8.35	149.03	168.65	0.53
Reach-1	564		Bridge									
Reach-1	546	2 YR	176.70	7.65	11.64	10.24	11.93	0.00265	4.33	40.82	14.96	0.46
Reach-1	546	10 YR	466.50	7.65	13.48	12.09	14.12	0.00395	6.42	72.65	19.93	0.59
Reach-1	546	25 YR	676.50	7.65	14.22	13.03	15.14	0.00484	7.71	88.60	23.40	0.67
Reach-1	546	50 YR	854.50	7.65	14.72	13.71	15.87	0.00549	8.64	100.91	25.77	0.72
Reach-1	546	100 YR	1053.60	7.65	15.17	14.40	16.59	0.00599	9.62	113.00	27.80	0.76
Reach-1	338	2 YR	176.70	7.07	10.80	9.89	11.13	0.00600	4.90	52.10	29.62	0.49
Reach-1	338	10 YR	466.50	7.07	12.56	11.59	13.04	0.00600	6.61	142.75	72.12	0.53
Reach-1	338	25 YR	676.50	7.07	13.31	12.54	13.82	0.00601	7.27	199.94	82.15	0.54
Reach-1	338	50 YR	854.50	7.07	13.84	12.91	14.38	0.00600	7.72	245.39	89.32	0.55
Reach-1	338	100 YR	1053.60	7.07	14.35	13.31	14.92	0.00600	8.15	293.63	96.35	0.56

HEC-RAS Output for Fornes Run Alternative #2 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8363	2 YR	160.30	58.09	65.63	60.36	65.64	0.00012	1.23	295.99	87.19	0.08
Reach-1	8363	10 YR	264.70	58.09	66.15	61.19	66.18	0.00026	1.91	347.70	116.00	0.12
Reach-1	8363	25 YR	341.70	58.09	66.36	61.67	66.41	0.00039	2.37	374.10	132.47	0.15
Reach-1	8363	50 YR	410.00	58.09	66.49	62.05	66.56	0.00052	2.79	392.25	143.94	0.17
Reach-1	8363	100 YR	485.60	58.09	66.61	62.39	66.70	0.00067	3.20	410.40	154.59	0.20
Reach-1	8290		Culvert									
Reach-1	8188	2 YR	160.30	57.22	61.26	59.83	61.42	0.00316	3.23	50.96	26.79	0.36
Reach-1	8188	10 YR	264.70	57.22	61.99	60.50	62.24	0.00348	4.04	74.77	41.52	0.40
Reach-1	8188	25 YR	341.70	57.22	62.26	60.89	62.60	0.00429	4.74	87.73	53.15	0.45
Reach-1	8188	50 YR	410.00	57.22	62.54	61.17	62.93	0.00461	5.16	103.49	62.09	0.47
Reach-1	8188	100 YR	485.60	57.22	62.82	61.49	63.26	0.00478	5.53	122.34	69.24	0.49
Reach-1	7703	2 YR	160.30	56.00	58.58	58.12	58.93	0.00924	4.85	42.92	45.15	0.61
Reach-1	7703	10 YR	264.70	56.00	59.11	58.76	59.56	0.00958	5.78	72.73	66.25	0.64
Reach-1	7703	25 YR	341.70	56.00	59.65		60.02	0.00671	5.51	114.01	85.54	0.55
Reach-1	7703	50 YR	410.00	56.00	59.94		60.32	0.00640	5.71	139.70	94.70	0.55
Reach-1	7703	100 YR	485.60	56.00	60.18		60.58	0.00642	5.99	163.52	101.04	0.56
Reach-1	7189	2 YR	160.30	51.20	53.90	53.45	54.35	0.01089	5.42	32.24	21.04	0.66
Reach-1	7189	10 YR	264.70	51.20	57.17	54.11	57.26	0.00077	2.71	182.71	82.09	0.21
Reach-1	7189	25 YR	341.70	51.20	59.27	54.51	59.30	0.00021	1.76	418.57	139.45	0.11
Reach-1	7189	50 YR	410.00	51.20	59.50	54.84	59.53	0.00025	1.96	449.73	143.06	0.12
Reach-1	7189	100 YR	485.60	51.20	59.64	55.17	59.68	0.00031	2.22	470.26	145.39	0.14
Reach-1	6632	2 YR	160.30	46.73	52.00	49.10	52.13	0.00194	2.87	55.82	14.32	0.26
Reach-1	6632	10 YR	264.70	46.73	57.13	49.93	57.14	0.00007	0.93	501.29	145.29	0.05
Reach-1	6632	25 YR	341.70	46.73	59.26	50.44	59.26	0.00003	0.66	899.16	214.05	0.03
Reach-1	6632	50 YR	410.00	46.73	59.48	50.87	59.48	0.00003	0.74	945.98	218.58	0.04
Reach-1	6632	100 YR	485.60	46.73	59.61	51.29	59.62	0.00004	0.85	976.02	221.43	0.04
Reach-1	6343	2 YR	160.30	46.73	51.67		51.74	0.00090	2.35	108.28	64.68	0.21
Reach-1	6343	10 YR	264.70	46.73	57.12		57.13	0.00005	1.00	660.92	139.39	0.06
Reach-1	6343	25 YR	341.70	46.73	59.25		59.25	0.00003	0.93	990.52	172.50	0.05
Reach-1	6343	50 YR	410.00	46.73	59.46		59.47	0.00004	1.09	1027.54	175.77	0.06
Reach-1	6343	100 YR	485.60	46.73	59.59		59.60	0.00006	1.26	1050.75	177.80	0.06
Reach-1	6071	2 YR	192.40	46.10	51.30	48.68	51.43	0.00136	2.88	78.58	189.36	0.25
Reach-1	6071	10 YR	344.90	46.10	57.05	49.67	57.09	0.00016	1.79	269.12	309.29	0.10
Reach-1	6071	25 YR	461.80	46.10	59.25	50.32	59.25	0.00001	0.44	2408.29	377.35	0.02
Reach-1	6071	50 YR	569.00	46.10	59.46	50.77	59.46	0.00001	0.52	2489.46	385.63	0.03
Reach-1	6071	100 YR	690.90	46.10	59.59	51.27	59.59	0.00001	0.62	2540.11	387.78	0.03
Reach-1	5876		Culvert									
Reach-1	5636	2 YR	192.40	41.02	43.57	43.24	44.10	0.00706	5.87	32.80	18.47	0.78
Reach-1	5636	10 YR	344.90	41.02	44.56	44.06	45.21	0.00603	6.49	53.17	22.70	0.75
Reach-1	5636	25 YR	461.80	41.02	45.22	44.56	45.91	0.00531	6.69	69.08	25.52	0.72
Reach-1	5636	50 YR	569.00	41.02	45.69	44.96	46.44	0.00512	6.97	81.65	27.55	0.71

APPENDIX H
HYDRAULIC AND HYDROLOGIC INPUT AND OUTPUT

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	5636	100 YR	690.90	41.02	46.17	45.36	46.98	0.00498	7.25	95.28	29.59	0.71
Reach-1	5493	2 YR	192.40	39.45	42.88		43.13	0.00487	4.00	50.70	27.80	0.47
Reach-1	5493	10 YR	344.90	39.45	44.07		44.35	0.00380	4.38	89.58	37.81	0.44
Reach-1	5493	25 YR	461.80	39.45	44.86		45.15	0.00301	4.53	122.16	44.74	0.41
Reach-1	5493	50 YR	569.00	39.45	45.36		45.69	0.00292	4.84	145.82	49.05	0.41
Reach-1	5493	100 YR	690.90	39.45	45.86		46.23	0.00288	5.17	171.38	53.32	0.41
Reach-1	5288	2 YR	192.40	37.92	41.61		41.97	0.00645	4.79	40.18	15.28	0.52
Reach-1	5288	10 YR	344.90	37.92	42.82		43.34	0.00621	5.85	61.39	23.83	0.53
Reach-1	5288	25 YR	461.80	37.92	43.87		44.38	0.00450	5.87	95.39	40.60	0.47
Reach-1	5288	50 YR	569.00	37.92	44.36		44.93	0.00460	6.32	116.88	48.29	0.48
Reach-1	5288	100 YR	690.90	37.92	44.90		45.49	0.00437	6.57	145.76	58.03	0.48
Reach-1	4919	2 YR	192.40	35.89	40.26	38.77	40.41	0.00279	3.43	85.43	62.42	0.34
Reach-1	4919	10 YR	344.90	35.89	42.65	39.94	42.70	0.00058	2.28	280.00	98.70	0.17
Reach-1	4919	25 YR	461.80	35.89	43.85	40.33	43.89	0.00041	2.18	408.32	116.06	0.15
Reach-1	4919	50 YR	569.00	35.89	44.34	40.63	44.39	0.00044	2.38	467.87	123.29	0.16
Reach-1	4919	100 YR	690.90	35.89	44.89	40.90	44.94	0.00046	2.54	537.57	131.25	0.16
Reach-1	4682	2 YR	244.90	34.00	39.79		39.90	0.00171	3.05	129.29	71.75	0.27
Reach-1	4682	10 YR	479.10	34.00	42.55		42.58	0.00041	2.12	481.54	169.66	0.14
Reach-1	4682	25 YR	650.80	34.00	43.78		43.80	0.00029	2.01	703.89	192.94	0.13
Reach-1	4682	50 YR	809.90	34.00	44.27		44.30	0.00033	2.20	800.85	202.26	0.13
Reach-1	4682	100 YR	997.10	34.00	44.81		44.85	0.00035	2.38	913.44	211.86	0.14
Reach-1	4597	2 YR	244.90	33.77	39.45	36.75	39.70	0.00304	3.95	62.06	44.76	0.33
Reach-1	4597	10 YR	479.10	33.77	42.44	38.20	42.53	0.00084	2.89	297.35	112.08	0.19
Reach-1	4597	25 YR	650.80	33.77	43.69	39.07	43.76	0.00062	2.76	456.49	142.23	0.17
Reach-1	4597	50 YR	809.90	33.77	44.18	40.44	44.25	0.00070	3.02	527.27	150.67	0.18
Reach-1	4597	100 YR	997.10	33.77	44.71	40.93	44.80	0.00074	3.25	609.69	156.73	0.19
Reach-1	4545	2 YR	244.90	35.01	39.06	37.67	39.44	0.00597	4.93	50.38	17.14	0.48
Reach-1	4545	10 YR	479.10	35.01	42.20	38.93	42.43	0.00174	4.01	137.19	73.90	0.28
Reach-1	4545	25 YR	650.80	35.01	43.63	39.79	43.72	0.00068	2.88	303.20	102.48	0.18
Reach-1	4545	50 YR	809.90	35.01	44.10	40.66	44.21	0.00073	3.11	353.79	112.35	0.19
Reach-1	4545	100 YR	997.10	35.01	44.62	41.19	44.75	0.00076	3.30	415.92	123.41	0.20
Reach-1	4506		Culvert									
Reach-1	4469	2 YR	244.90	32.55	36.82	35.62	37.24	0.00307	5.18	48.34	18.16	0.53
Reach-1	4469	10 YR	479.10	32.55	39.44	36.96	39.75	0.00116	4.68	114.80	71.57	0.36
Reach-1	4469	25 YR	650.80	32.55	40.55	37.79	40.71	0.00060	3.81	251.90	93.81	0.26
Reach-1	4469	50 YR	809.90	32.55	41.26	38.32	41.41	0.00052	3.79	323.96	108.52	0.25
Reach-1	4469	100 YR	997.10	32.55	42.70	38.87	42.79	0.00028	3.14	501.26	137.19	0.19
Reach-1	4362	2 YR	244.90	31.60	36.73		36.87	0.00158	2.94	83.28	21.31	0.26
Reach-1	4362	10 YR	479.10	31.60	39.42		39.55	0.00094	3.03	213.35	90.30	0.21
Reach-1	4362	25 YR	650.80	31.60	40.49		40.62	0.00081	3.13	324.13	112.65	0.20
Reach-1	4362	50 YR	809.90	31.60	41.21		41.34	0.00078	3.27	408.10	122.76	0.20
Reach-1	4362	100 YR	997.10	31.60	42.66		42.75	0.00050	2.94	599.69	140.68	0.17

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4249	2 YR	244.90	31.37	36.11	34.80	36.51	0.00669	5.26	60.97	47.33	0.51
Reach-1	4249	10 YR	479.10	31.37	39.42	36.72	39.45	0.00039	1.97	386.30	142.02	0.14
Reach-1	4249	25 YR	650.80	31.37	40.51	37.20	40.54	0.00028	1.84	556.67	169.67	0.12
Reach-1	4249	50 YR	809.90	31.37	41.23	37.46	41.26	0.00025	1.86	685.03	187.83	0.12
Reach-1	4249	100 YR	997.10	31.37	42.68	37.72	42.70	0.00014	1.55	976.67	213.63	0.09
Reach-1	4027	2 YR	244.90	30.79	35.56	33.43	35.71	0.00195	3.13	106.34	72.65	0.30
Reach-1	4027	10 YR	479.10	30.79	39.34	34.64	39.38	0.00028	1.96	451.28	110.60	0.13
Reach-1	4027	25 YR	650.80	30.79	40.43	35.46	40.48	0.00028	2.15	578.27	122.69	0.13
Reach-1	4027	50 YR	809.90	30.79	41.14	35.94	41.20	0.00030	2.36	668.75	131.10	0.14
Reach-1	4027	100 YR	997.10	30.79	42.61	36.31	42.66	0.00023	2.31	872.90	146.66	0.13
Reach-1	3819	2 YR	244.90	30.63	34.73	33.26	35.07	0.00502	4.65	53.37	23.58	0.46
Reach-1	3819	10 YR	479.10	30.63	39.29	34.48	39.32	0.00026	1.91	531.47	150.54	0.12
Reach-1	3819	25 YR	650.80	30.63	40.39	35.86	40.42	0.00024	1.99	703.51	162.08	0.12
Reach-1	3819	50 YR	809.90	30.63	41.10	36.27	41.13	0.00025	2.13	821.43	169.87	0.12
Reach-1	3819	100 YR	997.10	30.63	42.58	36.64	42.61	0.00018	2.02	1086.41	187.22	0.11
Reach-1	3713	2 YR	244.90	31.05	34.34	33.22	34.68	0.00282	4.66	52.70	19.98	0.50
Reach-1	3713	10 YR	479.10	31.05	39.19	34.29	39.28	0.00024	2.59	235.87	146.48	0.17
Reach-1	3713	25 YR	650.80	31.05	40.36	34.97	40.40	0.00013	2.11	637.10	179.57	0.13
Reach-1	3713	50 YR	809.90	31.05	41.07	35.52	41.11	0.00013	2.21	773.91	202.71	0.13
Reach-1	3713	100 YR	997.10	31.05	42.57	36.19	42.60	0.00008	1.93	1107.60	241.08	0.10
Reach-1	3670		Culvert									
Reach-1	3631	2 YR	244.90	30.31	33.47	33.47	34.38	0.02384	7.69	31.94	18.41	1.00
Reach-1	3631	10 YR	479.10	30.31	38.52	34.51	38.75	0.00106	3.91	128.13	90.31	0.26
Reach-1	3631	25 YR	650.80	30.31	39.79	35.15	39.91	0.00057	3.09	398.08	142.03	0.20
Reach-1	3631	50 YR	809.90	30.31	40.92	35.69	41.02	0.00044	2.95	580.14	177.53	0.17
Reach-1	3631	100 YR	997.10	30.31	42.51	36.28	42.57	0.00027	2.60	902.45	232.72	0.14
Reach-1	3534	2 YR	244.90	28.83	32.82	31.22	33.06	0.00351	3.89	62.91	21.21	0.40
Reach-1	3534	10 YR	479.10	28.83	38.60	32.30	38.62	0.00012	1.41	699.53	165.66	0.09
Reach-1	3534	25 YR	650.80	28.83	39.82	32.96	39.84	0.00011	1.52	916.95	189.20	0.09
Reach-1	3534	50 YR	809.90	28.83	40.94	33.89	40.96	0.00011	1.59	1141.70	218.17	0.09
Reach-1	3534	100 YR	997.10	28.83	42.52	34.36	42.54	0.00008	1.55	1524.37	265.96	0.08
Reach-1	3491	2 YR	273.50	28.37	32.29	31.17	32.76	0.00810	5.50	49.68	16.49	0.56
Reach-1	3491	10 YR	551.00	28.37	38.50	32.57	38.59	0.00044	2.62	307.37	138.61	0.15
Reach-1	3491	25 YR	750.70	28.37	39.70	33.37	39.81	0.00048	2.98	371.48	163.13	0.16
Reach-1	3491	50 YR	938.70	28.37	40.81	34.13	40.93	0.00049	3.22	430.42	188.92	0.17
Reach-1	3491	100 YR	1165.10	28.37	42.37	35.05	42.50	0.00045	3.35	514.14	225.30	0.16
Reach-1	3423		Culvert									
Reach-1	3336	2 YR	273.50	28.37	31.75	31.03	32.23	0.01024	5.53	49.50	21.32	0.64
Reach-1	3336	10 YR	551.00	28.37	37.76	32.24	37.80	0.00025	1.87	411.21	189.91	0.12
Reach-1	3336	25 YR	750.70	28.37	38.28	32.91	38.34	0.00036	2.34	452.67	194.43	0.15
Reach-1	3336	50 YR	938.70	28.37	38.53	33.82	38.62	0.00050	2.80	473.52	196.22	0.17
Reach-1	3336	100 YR	1165.10	28.37	38.81	34.27	38.94	0.00067	3.33	496.52	198.17	0.20

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	3266	2 YR	273.50	26.28	30.48		30.89	0.00687	5.19	53.64	21.71	0.52
Reach-1	3266	10 YR	551.00	26.28	37.77		37.78	0.00009	1.15	779.57	191.67	0.07
Reach-1	3266	25 YR	750.70	26.28	38.29		38.30	0.00012	1.38	880.97	198.45	0.08
Reach-1	3266	50 YR	938.70	26.28	38.55		38.57	0.00016	1.62	933.25	201.86	0.09
Reach-1	3266	100 YR	1165.10	26.28	38.84		38.87	0.00020	1.89	991.82	205.60	0.10
Reach-1	3200	2 YR	273.50	24.19	30.46	26.89	30.59	0.00125	2.89	97.47	25.53	0.23
Reach-1	3200	10 YR	551.00	24.19	37.72	28.27	37.76	0.00016	1.90	442.38	230.15	0.10
Reach-1	3200	25 YR	750.70	24.19	38.27	29.08	38.29	0.00011	1.65	907.87	280.07	0.08
Reach-1	3200	50 YR	938.70	24.19	38.53	29.74	38.56	0.00015	1.92	980.43	284.75	0.09
Reach-1	3200	100 YR	1165.10	24.19	38.81	30.50	38.85	0.00019	2.20	1061.91	289.91	0.11
Reach-1	3156		Culvert									
Reach-1	3114	2 YR	273.50	24.09	29.19	26.81	29.45	0.00327	4.08	67.08	16.34	0.35
Reach-1	3114	10 YR	551.00	24.09	34.52	28.25	34.71	0.00086	3.55	155.73	122.86	0.20
Reach-1	3114	25 YR	750.70	24.09	35.41	29.08	35.50	0.00050	2.82	492.79	139.28	0.16
Reach-1	3114	50 YR	938.70	24.09	35.86	29.77	35.96	0.00059	3.16	555.44	143.37	0.17
Reach-1	3114	100 YR	1165.10	24.09	36.29	30.51	36.41	0.00070	3.53	618.71	147.38	0.19
Reach-1	3049	2 YR	273.50	23.69	29.18		29.26	0.00081	2.24	122.20	30.77	0.19
Reach-1	3049	10 YR	551.00	23.69	34.58		34.62	0.00015	1.66	487.36	110.39	0.10
Reach-1	3049	25 YR	750.70	23.69	35.41		35.46	0.00019	1.99	584.51	122.88	0.11
Reach-1	3049	50 YR	938.70	23.69	35.85		35.92	0.00025	2.33	639.78	129.77	0.13
Reach-1	3049	100 YR	1165.10	23.69	36.27		36.37	0.00033	2.72	696.66	136.49	0.14
Reach-1	2991	2 YR	293.20	23.30	28.87	26.61	29.12	0.00318	4.08	73.34	21.72	0.37
Reach-1	2991	10 YR	599.60	23.30	34.54	28.13	34.60	0.00032	2.32	480.65	130.61	0.13
Reach-1	2991	25 YR	824.40	23.30	35.36	29.01	35.44	0.00039	2.72	619.51	143.37	0.15
Reach-1	2991	50 YR	1032.40	23.30	35.79	29.71	35.89	0.00050	3.16	681.88	149.95	0.17
Reach-1	2991	100 YR	1281.50	23.30	36.20	30.43	36.33	0.00064	3.65	745.08	155.97	0.20
Reach-1	2946		Culvert									
Reach-1	2884	2 YR	293.20	21.91	27.07	25.37	27.41	0.00478	4.69	63.35	20.53	0.45
Reach-1	2884	10 YR	599.60	21.91	28.73	26.86	29.32	0.00557	6.23	103.94	32.09	0.51
Reach-1	2884	25 YR	824.40	21.91	29.49	27.74	30.27	0.00612	7.22	142.59	75.11	0.54
Reach-1	2884	50 YR	1032.40	21.91	30.10	28.42	30.96	0.00615	7.77	191.32	84.97	0.56
Reach-1	2884	100 YR	1281.50	21.91	30.72	29.19	31.64	0.00609	8.25	247.65	95.11	0.56
Reach-1	2718	2 YR	293.20	21.25	26.51		26.74	0.00293	3.84	76.41	19.86	0.34
Reach-1	2718	10 YR	599.60	21.25	28.20		28.52	0.00293	4.73	146.50	62.78	0.36
Reach-1	2718	25 YR	824.40	21.25	29.09		29.39	0.00250	4.83	211.48	84.05	0.34
Reach-1	2718	50 YR	1032.40	21.25	29.80		30.09	0.00212	4.79	276.04	97.83	0.32
Reach-1	2718	100 YR	1281.50	21.25	30.49		30.77	0.00189	4.82	348.49	111.32	0.31
Reach-1	2475	2 YR	293.20	20.31	25.58	23.57	25.90	0.00411	4.55	66.63	19.78	0.40
Reach-1	2475	10 YR	599.60	20.31	26.60	25.10	27.38	0.00764	7.20	97.35	37.39	0.57
Reach-1	2475	25 YR	824.40	20.31	27.08	26.17	28.22	0.01015	8.82	117.01	44.88	0.66
Reach-1	2475	50 YR	1032.40	20.31	27.41	27.01	28.92	0.01265	10.23	133.03	52.85	0.75
Reach-1	2475	100 YR	1281.50	20.31	28.08	28.08	29.69	0.01228	10.83	179.17	79.06	0.75

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	2190	2 YR	293.20	20.06	25.00		25.11	0.00174	3.10	158.37	102.47	0.29
Reach-1	2190	10 YR	599.60	20.06	25.97		26.15	0.00221	4.09	266.75	119.04	0.34
Reach-1	2190	25 YR	824.40	20.06	26.55		26.75	0.00231	4.53	337.28	125.03	0.35
Reach-1	2190	50 YR	1032.40	20.06	27.00		27.22	0.00240	4.88	394.88	129.72	0.36
Reach-1	2190	100 YR	1281.50	20.06	27.48		27.72	0.00251	5.27	457.55	134.64	0.38
Reach-1	2008	2 YR	293.20	20.00	23.22	23.22	24.23	0.02602	8.07	36.34	36.24	1.00
Reach-1	2008	10 YR	599.60	20.00	24.39	24.39	25.22	0.01624	8.10	108.76	68.66	0.83
Reach-1	2008	25 YR	824.40	20.00	24.83	24.83	25.78	0.01642	8.94	141.85	80.39	0.86
Reach-1	2008	50 YR	1032.40	20.00	25.20	25.20	26.23	0.01624	9.53	172.96	90.03	0.87
Reach-1	2008	100 YR	1281.50	20.00	25.57	25.57	26.69	0.01624	10.15	208.56	99.93	0.88
Reach-1	1780	2 YR	293.20	16.24	20.24		20.44	0.00432	4.24	125.97	113.68	0.43
Reach-1	1780	10 YR	599.60	16.24	21.61		21.74	0.00239	4.07	289.01	124.90	0.34
Reach-1	1780	25 YR	824.40	16.24	22.37		22.50	0.00202	4.16	386.95	131.18	0.33
Reach-1	1780	50 YR	1032.40	16.24	22.95		23.09	0.00189	4.33	464.84	135.96	0.32
Reach-1	1780	100 YR	1281.50	16.24	23.53		23.68	0.00185	4.57	544.41	140.26	0.32
Reach-1	1515	2 YR	293.20	14.33	18.48		18.93	0.00798	5.40	55.10	22.89	0.58
Reach-1	1515	10 YR	599.60	14.33	19.94		20.66	0.00743	6.91	100.31	42.88	0.60
Reach-1	1515	25 YR	824.40	14.33	20.91		21.60	0.00583	7.04	170.23	85.04	0.55
Reach-1	1515	50 YR	1032.40	14.33	21.69		22.29	0.00467	6.92	240.37	95.78	0.50
Reach-1	1515	100 YR	1281.50	14.33	22.27		22.89	0.00456	7.28	297.88	103.76	0.50
Reach-1	1274	2 YR	293.20	12.60	17.57		17.78	0.00283	3.82	94.17	46.51	0.36
Reach-1	1274	10 YR	599.60	12.60	19.40		19.64	0.00214	4.38	203.19	69.65	0.33
Reach-1	1274	25 YR	824.40	12.60	20.50		20.74	0.00183	4.59	284.84	80.88	0.32
Reach-1	1274	50 YR	1032.40	12.60	21.28		21.54	0.00175	4.85	352.61	91.69	0.32
Reach-1	1274	100 YR	1281.50	12.60	21.78		22.10	0.00201	5.43	400.29	97.71	0.34
Reach-1	1121	2 YR	293.20	12.55	15.52	15.52	16.69	0.02826	8.68	33.78	14.65	1.01
Reach-1	1121	10 YR	599.60	12.55	17.01	17.01	18.71	0.02653	10.48	57.23	16.99	1.01
Reach-1	1121	25 YR	824.40	12.55	17.89	17.89	19.88	0.02566	11.31	72.88	18.38	1.00
Reach-1	1121	50 YR	1032.40	12.55	19.06	19.06	20.78	0.01746	10.64	110.40	57.82	0.85
Reach-1	1121	100 YR	1281.50	12.55	20.01	20.01	21.39	0.01212	9.98	181.65	83.16	0.73
Reach-1	1031	2 YR	293.20	10.07	14.22		14.66	0.00782	5.35	58.02	31.30	0.57
Reach-1	1031	10 YR	599.60	10.07	15.81		16.31	0.00545	6.04	143.13	77.85	0.51
Reach-1	1031	25 YR	824.40	10.07	16.73		17.15	0.00406	5.94	225.55	93.92	0.46
Reach-1	1031	50 YR	1032.40	10.07	17.34		17.76	0.00370	6.10	284.07	97.42	0.45
Reach-1	1031	100 YR	1281.50	10.07	18.03		18.44	0.00333	6.24	352.69	101.37	0.43
Reach-1	723	2 YR	305.80	7.79	13.18	11.07	13.40	0.00235	3.75	90.32	34.71	0.33
Reach-1	723	10 YR	632.10	7.79	14.69	12.43	15.08	0.00297	5.23	154.39	50.33	0.40
Reach-1	723	25 YR	876.20	7.79	15.49	13.27	16.01	0.00341	6.14	209.27	91.26	0.43
Reach-1	723	50 YR	1101.80	7.79	16.10	13.94	16.65	0.00345	6.57	266.77	98.88	0.44
Reach-1	723	100 YR	1371.10	7.79	16.57	14.62	17.28	0.00411	7.49	319.37	143.63	0.49
Reach-1	426	2 YR	305.80	7.17	12.48	10.46	12.69	0.00243	3.76	104.09	70.64	0.34
Reach-1	426	10 YR	632.10	7.17	14.02	11.88	14.29	0.00235	4.62	232.75	201.63	0.35
Reach-1	426	25 YR	876.20	7.17	14.84	12.92	15.14	0.00238	5.11	351.39	283.51	0.36
Reach-1	426	50 YR	1101.80	7.17	15.58	13.42	15.84	0.00201	5.06	489.04	313.69	0.34

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	426	100 YR	1371.10	7.17	16.07	13.88	16.35	0.00211	5.44	590.68	333.71	0.35
Reach-1	157	2 YR	305.80	6.57	11.89	9.85	12.06	0.00210	3.50	128.09	72.31	0.31
Reach-1	157	10 YR	632.10	6.57	13.43	11.38	13.65	0.00210	4.38	270.97	116.51	0.33
Reach-1	157	25 YR	876.20	6.57	14.25	12.06	14.50	0.00210	4.81	376.76	144.71	0.34
Reach-1	157	50 YR	1101.80	6.57	14.98	12.52	15.26	0.00210	5.18	521.14	275.02	0.35
Reach-1	157	100 YR	1371.10	6.57	15.47	13.08	15.75	0.00210	5.42	664.86	294.68	0.35

HEC-RAS Output for Greens Mill Run North Fork Alternative #2 (Future Land-Use Conditions)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	8786	2 YR	162.80	68.89	74.85	72.66	74.92	0.00071	2.83	178.81	315.03	0.21
Reach-1	8786	10 YR	296.70	68.89	74.82	73.90	75.10	0.00284	5.64	152.80	299.16	0.42
Reach-1	8786	25 YR	384.20	68.89	74.17	74.17	75.37	0.01130	10.37	72.66	57.22	0.81
Reach-1	8786	50 YR	464.30	68.89	74.18	74.18	75.91	0.01639	12.51	72.93	62.10	0.98
Reach-1	8786	100 YR	554.30	68.89	74.78	74.78	75.60	0.00887	9.92	144.61	208.58	0.74
Reach-1	8740		Culvert									
Reach-1	8687	2 YR	162.80	67.66	72.24	71.74	72.52	0.00365	4.94	45.56	36.35	0.42
Reach-1	8687	10 YR	296.70	67.66	72.45	72.45	73.12	0.00859	7.83	52.39	40.42	0.65
Reach-1	8687	25 YR	384.20	67.66	72.75	72.75	73.47	0.00883	8.29	62.86	98.24	0.67
Reach-1	8687	50 YR	464.30	67.66	72.94	72.94	73.77	0.00961	8.87	69.58	128.86	0.70
Reach-1	8687	100 YR	554.30	67.66	73.15	73.15	74.08	0.01019	9.39	76.82	156.87	0.73
Reach-1	8272	2 YR	162.80	67.10	70.54	70.48	70.73	0.00497	4.67	55.60	91.18	0.47
Reach-1	8272	10 YR	296.70	67.10	71.01		71.13	0.00230	3.49	112.99	147.39	0.32
Reach-1	8272	25 YR	384.20	67.10	71.24		71.36	0.00164	3.07	148.79	167.58	0.28
Reach-1	8272	50 YR	464.30	67.10	71.26		71.42	0.00225	3.61	151.79	169.34	0.32
Reach-1	8272	100 YR	554.30	67.10	71.53		71.66	0.00135	2.93	201.03	193.11	0.25
Reach-1	7868	2 YR	162.80	65.21	68.02		68.36	0.00675	4.72	34.51	16.08	0.57
Reach-1	7868	10 YR	296.70	65.21	69.19	68.07	69.64	0.00610	5.37	55.21	19.24	0.56
Reach-1	7868	25 YR	384.20	65.21	69.96		70.31	0.00415	4.93	94.68	110.27	0.47
Reach-1	7868	50 YR	464.30	65.21	70.77		70.84	0.00086	2.50	223.78	192.83	0.22
Reach-1	7868	100 YR	554.30	65.21	71.38		71.42	0.00027	1.54	363.48	264.44	0.13
Reach-1	7348	2 YR	162.80	61.03	65.91	63.09	66.00	0.00121	2.35	69.19	19.99	0.22
Reach-1	7348	10 YR	296.70	61.03	67.68	63.97	67.79	0.00101	2.68	129.32	62.89	0.21
Reach-1	7348	25 YR	384.20	61.03	69.02	64.44	69.10	0.00057	2.36	260.63	130.51	0.17
Reach-1	7348	50 YR	464.30	61.03	70.34	64.83	70.37	0.00023	1.71	481.78	190.13	0.11
Reach-1	7348	100 YR	554.30	61.03	71.21	65.22	71.23	0.00014	1.41	657.29	289.77	0.09
Reach-1	6966	2 YR	321.20	59.80	65.17	62.81	65.40	0.00162	3.88	88.10	28.02	0.34
Reach-1	6966	10 YR	607.40	59.80	66.76	64.13	67.13	0.00191	5.00	139.62	42.17	0.39
Reach-1	6966	25 YR	795.70	59.80	68.35	64.82	68.67	0.00121	4.76	211.66	119.26	0.32
Reach-1	6966	50 YR	960.20	59.80	69.83	65.34	70.11	0.00083	4.50	281.35	151.04	0.27
Reach-1	6966	100 YR	1143.50	59.80	70.96	65.87	71.09	0.00044	3.56	667.81	288.37	0.20
Reach-1	6917		Culvert									
Reach-1	6830	2 YR	321.20	59.86	64.63	63.41	65.14	0.00488	5.73	56.60	24.76	0.57
Reach-1	6830	10 YR	607.40	59.86	65.51	64.96	66.49	0.00723	8.12	97.77	78.81	0.71
Reach-1	6830	25 YR	795.70	59.86	66.15	66.15	67.01	0.00591	8.10	178.16	166.40	0.66
Reach-1	6830	50 YR	960.20	59.86	66.44	66.44	67.34	0.00608	8.56	217.60	177.23	0.68
Reach-1	6830	100 YR	1143.50	59.86	66.98	66.70	67.71	0.00478	8.13	290.01	199.35	0.61
Reach-1	6499	2 YR	321.20	59.58	63.73		63.90	0.00230	3.58	141.22	114.11	0.37
Reach-1	6499	10 YR	607.40	59.58	65.04		65.17	0.00141	3.58	336.14	180.52	0.31
Reach-1	6499	25 YR	795.70	59.58	65.70		65.81	0.00107	3.44	459.91	194.64	0.27

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	6499	50 YR	960.20	59.58	66.12		66.22	0.00097	3.46	543.86	203.66	0.26
Reach-1	6499	100 YR	1143.50	59.58	66.85		66.92	0.00065	3.08	696.68	216.29	0.22
Reach-1	5998	2 YR	321.20	58.16	62.27		62.54	0.00321	4.18	82.90	41.68	0.43
Reach-1	5998	10 YR	607.40	58.16	63.97		64.29	0.00218	4.69	183.45	127.08	0.39
Reach-1	5998	25 YR	795.70	58.16	65.11		65.27	0.00105	3.78	482.78	298.76	0.28
Reach-1	5998	50 YR	960.20	58.16	65.64		65.76	0.00085	3.61	643.08	310.09	0.25
Reach-1	5998	100 YR	1143.50	58.16	66.56		66.64	0.00050	3.04	939.01	329.98	0.20
Reach-1	5499	2 YR	321.20	56.76	61.13		61.30	0.00188	3.55	130.91	94.90	0.32
Reach-1	5499	10 YR	607.40	56.76	63.80		63.85	0.00035	2.20	655.58	263.13	0.15
Reach-1	5499	25 YR	795.70	56.76	64.99		65.02	0.00022	1.95	988.84	299.52	0.12
Reach-1	5499	50 YR	960.20	56.76	65.52		65.54	0.00021	2.00	1150.46	318.81	0.12
Reach-1	5499	100 YR	1143.50	56.76	66.47		66.49	0.00015	1.83	1469.39	346.09	0.11
Reach-1	5469	2 YR	321.20	57.01	61.13	59.07	61.23	0.00076	2.69	160.65	83.33	0.25
Reach-1	5469	10 YR	607.40	57.01	63.74	60.03	63.82	0.00033	2.55	349.31	212.34	0.18
Reach-1	5469	25 YR	795.70	57.01	64.95	60.45	65.01	0.00021	2.27	827.31	309.78	0.15
Reach-1	5469	50 YR	960.20	57.01	65.48	60.76	65.53	0.00020	2.35	995.14	332.48	0.15
Reach-1	5469	100 YR	1143.50	57.01	66.44	61.09	66.48	0.00016	2.24	1359.75	668.82	0.13
Reach-1	5400		Culvert									
Reach-1	5333	2 YR	321.20	56.33	60.99	58.57	61.08	0.00061	2.53	180.26	168.44	0.23
Reach-1	5333	10 YR	607.40	56.33	63.09	59.49	63.13	0.00025	2.15	681.41	300.32	0.16
Reach-1	5333	25 YR	795.70	56.33	64.36	60.03	64.39	0.00015	1.91	1144.05	424.41	0.13
Reach-1	5333	50 YR	960.20	56.33	65.41	60.50	65.43	0.00010	1.68	1609.94	458.45	0.10
Reach-1	5333	100 YR	1143.50	56.33	66.45	60.96	66.47	0.00007	1.55	2114.20	516.08	0.09
Reach-1	5149	2 YR	321.20	56.02	60.84		60.94	0.00102	2.81	203.54	155.58	0.24
Reach-1	5149	10 YR	607.40	56.02	63.05		63.08	0.00026	1.89	765.00	314.58	0.13
Reach-1	5149	25 YR	795.70	56.02	64.34		64.35	0.00014	1.54	1196.38	355.00	0.10
Reach-1	5149	50 YR	960.20	56.02	65.40		65.41	0.00008	1.26	1760.47	578.07	0.07
Reach-1	5149	100 YR	1143.50	56.02	66.45		66.45	0.00005	1.04	2386.96	621.59	0.06
Reach-1	4497	2 YR	321.20	54.69	60.71		60.72	0.00013	1.22	555.52	221.86	0.10
Reach-1	4497	10 YR	607.40	54.69	62.98		62.99	0.00007	1.12	1162.32	322.67	0.07
Reach-1	4497	25 YR	795.70	54.69	64.29		64.30	0.00005	1.08	1610.42	382.80	0.07
Reach-1	4497	50 YR	960.20	54.69	65.37		65.38	0.00004	1.04	2074.75	468.02	0.06
Reach-1	4497	100 YR	1143.50	54.69	66.42		66.43	0.00003	0.97	2603.42	540.68	0.05
Reach-1	4074	2 YR	321.20	53.69	60.67	57.34	60.68	0.00005	0.86	1126.83	539.03	0.06
Reach-1	4074	10 YR	607.40	53.69	62.97	58.48	62.97	0.00002	0.61	2411.03	576.05	0.04
Reach-1	4074	25 YR	795.70	53.69	64.28	58.72	64.29	0.00001	0.56	3186.19	632.04	0.03
Reach-1	4074	50 YR	960.20	53.69	65.36	58.90	65.36	0.00001	0.53	3890.48	672.64	0.03
Reach-1	4074	100 YR	1143.50	53.69	66.42	59.36	66.42	0.00001	0.52	4621.15	712.59	0.03
Reach-1	4027	2 YR	328.10	53.79	60.65	57.09	60.67	0.00014	1.52	584.17	306.15	0.11
Reach-1	4027	10 YR	506.70	53.79	62.96	57.98	62.97	0.00007	1.29	1032.49	389.00	0.08
Reach-1	4027	25 YR	583.60	53.79	64.27	58.23	64.28	0.00004	1.18	1288.44	463.64	0.07
Reach-1	4027	50 YR	636.70	53.79	65.35	58.39	65.36	0.00003	1.09	1498.61	519.95	0.06

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	4027	100 YR	685.30	53.79	66.41	58.48	66.42	0.00003	1.02	1703.89	581.38	0.05
Reach-1	3919		Culvert									
Reach-1	3894	2 YR	323.80	52.81	57.59	56.11	58.04	0.00342	5.35	60.49	21.45	0.50
Reach-1	3894	10 YR	497.60	52.81	58.03	56.94	58.86	0.00550	7.33	68.40	25.19	0.64
Reach-1	3894	25 YR	578.40	52.81	58.20	57.29	59.23	0.00648	8.18	71.69	26.63	0.70
Reach-1	3894	50 YR	633.00	52.81	58.31	57.51	59.48	0.00712	8.71	73.93	27.57	0.74
Reach-1	3894	100 YR	682.40	52.81	58.39	57.71	59.70	0.00778	9.22	75.55	28.24	0.77
Reach-1	3582	2 YR	323.80	52.39	56.18		56.51	0.00697	5.40	87.26	100.89	0.55
Reach-1	3582	10 YR	497.60	52.39	57.10		57.24	0.00320	4.37	254.49	228.81	0.39
Reach-1	3582	25 YR	578.40	52.39	58.01		58.06	0.00109	2.93	473.49	250.86	0.23
Reach-1	3582	50 YR	633.00	52.39	58.20		58.25	0.00103	2.92	521.99	255.72	0.23
Reach-1	3582	100 YR	682.40	52.39	58.34		58.39	0.00101	2.95	557.71	259.24	0.23
Reach-1	3086	2 YR	325.20	50.43	55.05		55.12	0.00138	2.83	194.88	118.72	0.25
Reach-1	3086	10 YR	501.40	50.43	56.64		56.68	0.00054	2.23	409.73	153.38	0.17
Reach-1	3086	25 YR	583.50	50.43	57.79		57.81	0.00028	1.82	601.32	180.89	0.13
Reach-1	3086	50 YR	639.00	50.43	57.97		58.00	0.00029	1.90	635.74	188.42	0.13
Reach-1	3086	100 YR	689.30	50.43	58.10		58.13	0.00031	1.98	660.67	193.62	0.13
Reach-1	2963	2 YR	325.20	49.39	55.01	52.59	55.05	0.00025	1.81	223.23	105.11	0.14
Reach-1	2963	10 YR	501.40	49.39	56.60	53.00	56.64	0.00017	1.82	327.57	158.73	0.13
Reach-1	2963	25 YR	583.50	49.39	57.77	53.16	57.79	0.00011	1.60	503.16	233.52	0.10
Reach-1	2963	50 YR	639.00	49.39	57.95	53.25	57.98	0.00012	1.70	524.77	255.89	0.11
Reach-1	2963	100 YR	689.30	49.39	58.08	53.34	58.11	0.00013	1.79	540.29	274.73	0.11
Reach-1	2919		Culvert									
Reach-1	2837	2 YR	325.20	49.18	54.60	52.25	54.87	0.00207	4.15	82.07	51.30	0.36
Reach-1	2837	10 YR	501.40	49.18	55.88	53.12	56.20	0.00184	4.63	137.97	107.17	0.36
Reach-1	2837	25 YR	583.50	49.18	57.40	53.47	57.50	0.00054	2.98	453.88	238.11	0.20
Reach-1	2837	50 YR	639.00	49.18	57.65	53.69	57.74	0.00052	2.99	516.33	259.54	0.20
Reach-1	2837	100 YR	689.30	49.18	57.81	53.89	57.90	0.00053	3.06	558.34	280.21	0.20
Reach-1	2497	2 YR	325.20	48.70	54.56		54.58	0.00021	1.41	407.01	192.00	0.11
Reach-1	2497	10 YR	501.40	48.70	55.89		55.91	0.00017	1.48	712.17	263.93	0.10
Reach-1	2497	25 YR	583.50	48.70	57.39		57.40	0.00007	1.11	1178.65	337.73	0.07
Reach-1	2497	50 YR	639.00	48.70	57.64		57.65	0.00007	1.13	1264.51	343.08	0.07
Reach-1	2497	100 YR	689.30	48.70	57.79		57.81	0.00008	1.17	1317.65	346.36	0.07
Reach-1	1998	2 YR	325.20	48.28	54.46		54.49	0.00018	1.35	407.82	173.88	0.10
Reach-1	1998	10 YR	501.40	48.28	55.80		55.83	0.00016	1.46	682.27	231.42	0.10
Reach-1	1998	25 YR	583.50	48.28	57.35		57.36	0.00008	1.18	1077.17	281.53	0.07
Reach-1	1998	50 YR	639.00	48.28	57.60		57.61	0.00008	1.23	1148.85	289.88	0.07
Reach-1	1998	100 YR	689.30	48.28	57.75		57.76	0.00009	1.28	1193.11	294.93	0.08
Reach-1	1500	2 YR	325.20	48.00	54.46		54.46	0.00000	0.29	1142.34	300.52	0.02
Reach-1	1500	10 YR	501.40	48.00	55.81		55.81	0.00000	0.37	1618.68	413.89	0.02
Reach-1	1500	25 YR	583.50	48.00	57.35		57.35	0.00000	0.35	2311.76	476.87	0.02

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach-1	1500	50 YR	639.00	48.00	57.60		57.60	0.00000	0.37	2433.08	488.10	0.02
Reach-1	1500	100 YR	689.30	48.00	57.75		57.75	0.00000	0.39	2507.55	497.16	0.02
Reach-1	902	2 YR	325.20	47.80	54.46		54.46	0.00000	0.28	1158.45	225.19	0.02
Reach-1	902	10 YR	501.40	47.80	55.80		55.81	0.00000	0.34	1478.46	244.06	0.02
Reach-1	902	25 YR	583.50	47.80	57.35		57.35	0.00000	0.31	1865.22	259.12	0.02
Reach-1	902	50 YR	639.00	47.80	57.60		57.60	0.00000	0.33	1930.60	262.44	0.02
Reach-1	902	100 YR	689.30	47.80	57.75		57.75	0.00000	0.35	1970.44	264.39	0.02
Reach-1	841	2 YR	308.60	47.80	54.46	48.21	54.46	0.00000	0.21	1453.19	256.66	0.02
Reach-1	841	10 YR	523.00	47.80	55.80	48.38	55.81	0.00000	0.29	1816.32	283.75	0.02
Reach-1	841	25 YR	583.90	47.80	57.35	48.43	57.35	0.00000	0.26	2265.85	297.98	0.02
Reach-1	841	50 YR	713.90	47.80	57.60	48.52	57.60	0.00000	0.31	2340.81	300.59	0.02
Reach-1	841	100 YR	820.50	47.80	57.75	48.58	57.75	0.00000	0.35	2386.38	302.65	0.02
Reach-1	723		Culvert									
Reach-1	664	2 YR	308.50	43.18	47.26	47.26	48.74	0.03353	9.78	31.53	10.59	1.00
Reach-1	664	10 YR	523.00	43.18	54.41	49.14	54.42	0.00019	1.63	760.00	268.85	0.09
Reach-1	664	25 YR	583.90	43.18	56.65	49.40	56.66	0.00004	0.85	1473.81	433.33	0.04
Reach-1	664	50 YR	713.80	43.18	56.96	49.82	56.97	0.00006	1.02	1629.74	513.14	0.05
Reach-1	664	100 YR	819.90	43.18	57.25	50.11	57.26	0.00006	1.05	1780.89	528.36	0.05
Reach-1	415	2 YR	308.50	42.21	45.98	44.48	46.18	0.00300	3.70	101.80	56.22	0.37
Reach-1	415	10 YR	523.00	42.21	54.40	45.28	54.40	0.00002	0.80	2019.87	538.05	0.04
Reach-1	415	25 YR	583.90	42.21	56.65	45.47	56.65	0.00001	0.55	3361.82	639.52	0.03
Reach-1	415	50 YR	713.80	42.21	56.96	45.86	56.96	0.00001	0.64	3563.21	659.78	0.03
Reach-1	415	100 YR	819.90	42.21	57.25	46.14	57.25	0.00001	0.70	3759.88	702.83	0.03

H.9 EPA SWMM Output – Secondary Systems Existing and Proposed Conditions

Output from the Secondary System existing and future EPA SWMM models is provided electronically, via the included DVD.

I. Stormwater Best Management Practice Conceptual Design

BMP SITE EVALUATION WORKSHEET

The following worksheet is a summary of desktop and field analyses for determining the feasibility of a BMP. The desktop section shall be completed prior to field visits. After field visits are completed, the worksheet shall be updated based on any field observations that modify the desktop notes.

Site ID: ________________________

Site Address and Directions from a Major Highway:

PART I. DESKTOP ANALYSIS

Date Performed: ____________________ **Person Performing Analysis:** ______________________

BMP Information:
1. Parcel ID:
2. Property Owner Name/Type:
3. BMP Type: ❑ Bioretention ❑ Permeable Pavement ❑ Wet Detention Basin ❑ Grassed Swale ❑ Stormwater Wetland ❑ Dry Detention Basin ❑ Filter Strip ❑ Infiltration Device ❑ Other: ___________________
4. The BMP will be a: ❑ New BMP ❑ Retrofit to an Existing BMP (provide a description of the retrofit opportunity):
5. Available Space for BMP (sf):
6. Existing Drainage Infrastructure: ❑ None ❑ Nearby ❑ Existing
7. Potential Constraints in BMP Area: Grading: ❑ None ❑ <1 foot ❑ 1-2 feet ❑ >2 feet Utilities: ❑ None ❑ Sewer ❑ Water ❑ Gas ❑ Electrical ❑ Other: _______________ Vegetation: ❑ None ❑ Landscaping ❑ Trees Access: ❑ No Access ❑ Limited Access ❑ Good Access Additional Drainage Infrastructure Required? ❑ None ❑ Minimal ❑ Vertical Retrofit ❑ Horizontal Addition ❑ Major Infrastructure
8. Hydrologic Soil Group: _________ Water Table Depth: ________ ft
9. Additional BMP Notes/Desktop Observations:

Drainage Area Information:
1. Drainage Area ID:
2. Parcel ID (if different from BMP):
3. Property Owner Name (if different from BMP):
4. Size (ac):
5. Impervious Surface Area (ac):
6. Land uses (list individually): Land Use / Area (ac) / % of Total Drainage Area Urban Agriculture Forest Water Bare Ground Wetlands Others:
7. Average Slope (%):
8. Are there any environmental sensitive areas? Select all that apply and attach any necessary details: ❑ Steep Slopes ❑ Wetlands ❑ Riparian Buffers ❑ Endangered/Threatened Species Habitat
9. Receiving Water:
10. DWQ Classification of Receiving Water:
11. Use Support Rating for Receiving Water:
12. Additional Drainage Area Notes/Desktop Observations:

PART II. FIELD ANALYSIS

Date Performed: ______________________

Field Crew: ____

1. What is the existing land use of the proposed BMP area?
2. What is the condition of the existing land use? *Examples: Parking lot, recently repaved; Parking lot, deteriorating surface; Landscaped lawn in good condition; Open lawn with poor grass cover*
3. Are there physical constraints that impact the BMP? *Examples to look for: buried utilities/manholes, overhead utility lines, trees within BMP area, nearby buildings/structures* ❑ No ❑ Yes, describe:
4. Is the BMP proposed in the low point of the subject property? ❑ Yes ❑ No, describe:
5. Is there vertical relief to impound water and discharge from the BMP? ❑ Yes ❑ No, describe:
6. Will the BMP cause new closed system or open channel surcharging? ❑ No ❑ Yes, describe:
7. Describe site drainage patterns:
8. Are there physical constraints that impact the drainage area draining to the BMP? ❑ No ❑ Yes, describe:
9. Describe the access to the BMP for maintenance:

10. Desktop delineation checked/modified if necessary? ❑ Yes ❑ No

11. Will the BMP cause a public safety risk? ❑ No ❑ Yes, describe:

12. Provide a sketch of the area and locations of any field photographs:

Additional Comments/Notes:

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *1*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 5.64 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	1.93	6.11	2.60	30.70	0.19	2.24
Roof impervious	1.54	6.11	1.95	18.36	0.11	1.04
Managed pervious	1.89	6.11	1.42	16.39	0.28	3.23
Wooded pervious		6.11	0.94	0.00	0.14	0.00
Area taken up by BMP	0.28	6.11	1.95	3.33	0.11	0.19
Fraction Impervious (I) =	0.62		Pre-BMP TN Load (lb/yr) =	68.78	Pre-BMP TP Load (lb/yr) =	6.70
Total Area of Development =	5.64		Pre-BMP TN Export (lb/ac/yr)	12.20	Pre-BMP TP Export (lb/ac/yr)	1.19
			Post-BMP TN Load (lb/yr) =	51.59	Post-BMP TP Load (lb/yr) =	4.02
			Post-BMP TN Export (lb/ac/yr)	9.15	Post-BMP TP Export (lb/ac/yr)	0.71
			Post-BMP TN Potential Reduction (lbs/ac/yr)	3.05	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.48

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	1771.24
100	941.65
55	634.69
0	0.00
100	171.01
Pre-BMP TSS Load (lb/yr) =	3518.59
Pre-BMP TSS Export (lb/ac/yr)	623.86
Post-BMP TSS Load (lb/yr) =	527.79
Post-BMP TSS Export (lb/ac/yr)	93.58
Post-BMP TSS Potential Reduction (lbs/ac/yr)	530.28

BMP #1 - J.H. Rose High School Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	94,423	151,255	Input
Subbasin CN	79	98	Input
S (in)	2.7	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	6,625	119,629	Calculated
Subbasin Water Quality Volume (cf)	552	9,969	Calculated

Summary Calculations		
Total Watershed Area (sf)	245,678	Calculated
Total Watershed Area (ac)	0.5	Calculated
Total Water Quality Runoff Volume (sf*in)	126,253	Calculated
Total Water Quality Runoff Volume (cf)	10,521	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	10,521	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	10	Calculated
Suface Area (sf)	12,187	Input
Suface Area (ac)	0.3	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	360	Input
BMP Width (ft)	34	Input
BMP L:W Ratio	11:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *2*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	**25**	**40**	**85**	**NC BMP Manual**
Stormwater Wetland	**40**	**40**	**85**	**NC BMP Manual**
Permeable Pavement (infiltrating)	**30**	**60**	**85**	**NC BMP Manual**
Bioretention (with IWS)	**60**	**60**	**85**	**NC BMP Manual**
Bioretention (without IWS)	**35**	**45**	**85**	**NC BMP Manual**
Permeable Pavement (detention)	**10**	**10**	**75**	**NC BMP Manual**
Dry Detention	**10**	**10**	**50**	**NC BMP Manual**

Catchment 1:

Total acreage of catchment 1 = 39.03 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	5.85	3.24	2.60	49.32	0.19	3.60
Roof impervious	5.85	3.24	1.95	36.99	0.11	2.09
Managed pervious	26.80	3.24	1.42	123.31	0.28	24.32
Wooded pervious		3.24	0.94	0.00	0.14	0.00
Area taken up by BMP	0.52	3.24	1.95	3.28	0.11	0.18
Fraction Impervious (I) =	0.30		**Pre-BMP TN Load (lb/yr) =**	212.90	**Pre-BMP TP Load (lb/yr) =**	30.19
Total Area of Development =	39.03		**Pre-BMP TN Export (lb/ac/yr)**	5.45	**Pre-BMP TP Export (lb/ac/yr)**	0.77
			Post-BMP TN Load (lb/yr) =	159.67	**Post-BMP TP Load (lb/yr) =**	18.11
			Post-BMP TN Export (lb/ac/yr)	4.09	**Post-BMP TP Export (lb/ac/yr)**	0.46
			Post-BMP TN Potential Reduction (lbs/ac/yr)	1.36	**Post-BMP TP Potential Reduction (lbs/ac/yr)**	0.31

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	2845.29
100	1896.86
55	4776.23
0	0.00
100	167.96
Pre-BMP TSS Load (lb/yr) =	9686.33
Pre-BMP TSS Export (lb/ac/yr)	248.18
Post-BMP TSS Load (lb/yr) =	1452.95
Post-BMP TSS Export (lb/ac/yr)	37.23
Post-BMP TSS Potential Reduction (lbs/ac/yr)	210.95

BMP #2 - ECU Athletic Maintenance Building Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	1,190,103	510,044	Input
Subbasin CN	39	98	Input
S (in)	15.6	0.2	Calculated
Runoff Depth (in)	0.3	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	398,901	403,397	Calculated
Subbasin Water Quality Volume (cf)	33,242	33,616	Calculated

Summary Calculations		
Total Watershed Area (sf)	1,700,147	Calculated
Total Watershed Area (ac)	3.3	Calculated
Total Water Quality Runoff Volume (sf*in)	802,298	Calculated
Total Water Quality Runoff Volume (cf)	66,858	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	66,858	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	36	Calculated
Suface Area (sf)	22,581	Input
Suface Area (ac)	0.5	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	500	Input
BMP Width (ft)	45	Input
BMP L:W Ratio	11:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *3*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wetland*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates		TN	TP	TSS	Design Standard
	Wet Detention Pond	25	40	85	NC BMP Manual
	Stormwater Wetland	40	40	85	NC BMP Manual
	Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
	Bioretention (with IWS)	60	60	85	NC BMP Manual
	Bioretention (without IWS)	35	45	85	NC BMP Manual
	Permeable Pavement (detention)	10	10	75	NC BMP Manual
	Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 =	21.25	ac						
First BMP's TN removal rate =	40	%	First BMP's TP removal rate =	40	%	First BMP's TSS removal rate =	85	
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =		
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =		
TOTAL TN REMOVAL RATE =	40	%	TOTAL TP REMOVAL RATE =	40	%	TOTAL TSS REMOVAL RATE =	85	

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	12.85	7.78	2.60	259.93	0.19	18.99	150	14995.99
Roof impervious	4.13	7.78	1.95	62.69	0.11	3.54	100	3214.62
Managed pervious	3.13	7.78	1.42	34.62	0.28	6.83	55	1340.77
Wooded pervious		7.78	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	1.14	7.78	1.95	17.26	0.11	0.97	100	885.28
Fraction Impervious (I) =	0.80		Pre-BMP TN Load (lb/yr) =	374.49	Pre-BMP TP Load (lb/yr) =	30.33	Pre-BMP TSS Load (lb/yr) =	20436.65
Total Area of Development =	21.25		Pre-BMP TN Export (lb/ac/yr)	17.62	Pre-BMP TP Export (lb/ac/yr)	1.43	Pre-BMP TSS Export (lb/ac/yr)	961.72
			Post-BMP TN Load (lb/yr) =	224.70	Post-BMP TP Load (lb/yr) =	18.20	Post-BMP TSS Load (lb/yr) =	3065.50
			Post-BMP TN Export (lb/ac/yr)	10.57	Post-BMP TP Export (lb/ac/yr)	0.86	Post-BMP TSS Export (lb/ac/yr)	144.26
			Post-BMP TN Potential Reduction (lbs/ac/yr)	7.05	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.57	Post-BMP TSS Potential Reduction (lbs/ac/yr)	817.47

BMP #3 - Greenville Square Shopping Center Wetland

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	186,028	739,622	Input
Subbasin CN	80	98	Input
S (in)	2.5	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	15,502	584,971	Calculated
Subbasin Water Quality Volume (cf)	1,292	48,748	Calculated

Summary Calculations		
Total Watershed Area (sf)	925,650	Calculated
Total Watershed Area (ac)	1.8	Calculated
Total Water Quality Runoff Volume (sf*in)	600,474	Calculated
Total Water Quality Runoff Volume (cf)	50,039	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	50,039	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	12	Calculated
Suface Area (sf)	49,559	Input
Suface Area (ac)	1.1	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	330	Input
BMP Width (ft)	130	Input
BMP L:W Ratio	3:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *4*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 1.61 ac

First BMP's TN removal rate = 25 %		First BMP's TP removal rate = 40 %		First BMP's TSS removal rate = 85	
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE = 25 %		TOTAL TP REMOVAL RATE = 40 %		TOTAL TSS REMOVAL RATE = 85	

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.83	8.68	2.60	18.67	0.19	1.36
Roof impervious	0.62	8.68	1.95	10.43	0.11	0.59
Managed pervious	0.09	8.68	1.42	1.05	0.28	0.21
Wooded pervious		8.68	0.94	0.00	0.14	0.00
Area taken up by BMP	0.08	8.68	1.95	1.35	0.11	0.08
Fraction Impervious (I) =	0.90		Pre-BMP TN Load (lb/yr) =	31.51	Pre-BMP TP Load (lb/yr) =	2.24
Total Area of Development =	1.61		Pre-BMP TN Export (lb/ac/yr)	19.57	Pre-BMP TP Export (lb/ac/yr)	1.39
			Post-BMP TN Load (lb/yr) =	23.63	Post-BMP TP Load (lb/yr) =	1.34
			Post-BMP TN Export (lb/ac/yr)	14.68	Post-BMP TP Export (lb/ac/yr)	0.83
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.89	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.56

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	1077.39
100	535.08
55	40.81
0	0.00
100	69.23
Pre-BMP TSS Load (lb/yr) =	1722.51
Pre-BMP TSS Export (lb/ac/yr)	1069.88
Post-BMP TSS Load (lb/yr) =	258.38
Post-BMP TSS Export (lb/ac/yr)	160.48
Post-BMP TSS Potential Reduction (lbs/ac/yr)	909.40

BMP #4 - Pirates Pointe Shopping Center Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	7,201	62,930	Input
Subbasin CN	39	98	Input
S (in)	15.6	0.2	Calculated
Runoff Depth (in)	0.3	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	2,414	49,772	Calculated
Subbasin Water Quality Volume (cf)	201	4,148	Calculated

Summary Calculations		
Total Watershed Area (sf)	70,132	Calculated
Total Watershed Area (ac)	0.1	Calculated
Total Water Quality Runoff Volume (sf*in)	52,186	Calculated
Total Water Quality Runoff Volume (cf)	4,349	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	4,349	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	15	Calculated
Suface Area (sf)	3,476	Input
Suface Area (ac)	0.1	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	80	Input
BMP Width (ft)	50	Input
BMP L:W Ratio	2:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *5*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 108.15 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	44.74	8.04	2.60	935.13	0.19	68.34	150	53950.02
Roof impervious	44.74	8.04	1.95	701.35	0.11	39.56	100	35966.68
Managed pervious	17.14	8.04	1.42	195.69	0.28	38.59	55	7579.54
Wooded pervious		8.04	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	1.53	8.04	1.95	23.95	0.11	1.35	100	1228.00
Fraction Impervious (I) =	0.83		Pre-BMP TN Load (lb/yr) =	1856.12	Pre-BMP TP Load (lb/yr) =	147.84	Pre-BMP TSS Load (lb/yr) =	98724.25
Total Area of Development =	108.15		Pre-BMP TN Export (lb/ac/yr)	17.16	Pre-BMP TP Export (lb/ac/yr)	1.37	Pre-BMP TSS Export (lb/ac/yr)	912.85
			Post-BMP TN Load (lb/yr) =	1392.09	Post-BMP TP Load (lb/yr) =	88.70	Post-BMP TSS Load (lb/yr) =	14808.64
			Post-BMP TN Export (lb/ac/yr)	12.87	Post-BMP TP Export (lb/ac/yr)	0.82	Post-BMP TSS Export (lb/ac/yr)	136.93
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.29	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.55	Post-BMP TSS Potential Reduction (lbs/ac/yr)	775.92

BMP #5 - Greenville Mall Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	813,270	3,897,744	Input
Subbasin CN	77	98	Input
S (in)	3.0	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	38,889	3,082,749	Calculated
Subbasin Water Quality Volume (cf)	3,241	256,896	Calculated

Summary Calculations		
Total Watershed Area (sf)	4,711,014	Calculated
Total Watershed Area (ac)	9.0	Calculated
Total Water Quality Runoff Volume (sf*in)	3,121,638	Calculated
Total Water Quality Runoff Volume (cf)	260,136	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	260,136	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	47	Calculated
Suface Area (sf)	66,540	Input
Suface Area (ac)	1.5	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	520	Input
BMP Width (ft)	100	Input
BMP L:W Ratio	5:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *6*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates		TN	TP	TSS	Design Standard
	Wet Detention Pond	25	40	85	NC BMP Manual
	Stormwater Wetland	40	40	85	NC BMP Manual
	Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
	Bioretention (with IWS)	60	60	85	NC BMP Manual
	Bioretention (without IWS)	35	45	85	NC BMP Manual
	Permeable Pavement (detention)	10	10	75	NC BMP Manual
	Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 27.96 ac

First BMP's TN removal rate =	25	%	First BMP's TP removal rate =	40	%	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25	%	TOTAL TP REMOVAL RATE =	40	%	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	15.68	7.94	2.60	323.78	0.19	23.66	150	18679.66
Roof impervious	7.15	7.94	1.95	110.66	0.11	6.24	100	5674.96
Managed pervious	4.14	7.94	1.42	46.66	0.28	9.20	55	1807.13
Wooded pervious		7.94	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.99	7.94	1.95	15.36	0.11	0.87	100	787.62
Fraction Impervious (I) =	0.82		**Pre-BMP TN Load (lb/yr) =**	496.46	**Pre-BMP TP Load (lb/yr) =**	39.97	**Pre-BMP TSS Load (lb/yr) =**	26949.38
Total Area of Development =	27.96		**Pre-BMP TN Export (lb/ac/yr)**	17.76	**Pre-BMP TP Export (lb/ac/yr)**	1.43	**Pre-BMP TSS Export (lb/ac/yr)**	963.85
			Post-BMP TN Load (lb/yr) =	372.34	**Post-BMP TP Load (lb/yr) =**	23.98	**Post-BMP TSS Load (lb/yr) =**	4042.41
			Post-BMP TN Export (lb/ac/yr)	13.32	**Post-BMP TP Export (lb/ac/yr)**	0.86	**Post-BMP TSS Export (lb/ac/yr)**	144.58
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.44	**Post-BMP TP Potential Reduction (lbs/ac/yr)**	0.57	**Post-BMP TSS Potential Reduction (lbs/ac/yr)**	819.28

BMP #6 - University Commons Shopping Center Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	223,457	994,481	Input
Subbasin CN	30	98	Input
S (in)	23.3	0.2	Calculated
Runoff Depth (in)	0.7	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	152,759	786,541	Calculated
Subbasin Water Quality Volume (cf)	12,730	65,545	Calculated

Summary Calculations		
Total Watershed Area (sf)	1,217,938	Calculated
Total Watershed Area (ac)	2.3	Calculated
Total Water Quality Runoff Volume (sf*in)	939,299	Calculated
Total Water Quality Runoff Volume (cf)	78,275	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	78,275	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	22	Calculated
Suface Area (sf)	43,208	Input
Suface Area (ac)	1.0	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	680	Input
BMP Width (ft)	70	Input
BMP L:W Ratio	10:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *7*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 1.3 ac

First BMP's TN removal rate =	35 %	First BMP's TP removal rate =	45 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35 %	TOTAL TP REMOVAL RATE =	45 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.80	6.11	2.60	12.71	0.19	0.93
Roof impervious	0.00	6.11	1.95	0.00	0.11	0.00
Managed pervious	0.42	6.11	1.42	3.64	0.28	0.72
Wooded pervious		6.11	0.94	0.00	0.14	0.00
Area taken up by BMP	0.08	6.11	1.95	0.96	0.11	0.05
Fraction Impervious (I) =	0.62		Pre-BMP TN Load (lb/yr) =	17.31	Pre-BMP TP Load (lb/yr) =	1.70
Total Area of Development =	1.30		Pre-BMP TN Export (lb/ac/yr)	13.31	Pre-BMP TP Export (lb/ac/yr)	1.31
			Post-BMP TN Load (lb/yr) =	11.25	Post-BMP TP Load (lb/yr) =	0.94
			Post-BMP TN Export (lb/ac/yr)	8.65	Post-BMP TP Export (lb/ac/yr)	0.72
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.66	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.59

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	733.20
100	0.00
55	141.04
0	0.00
100	49.07
Pre-BMP TSS Load (lb/yr) =	923.30
Pre-BMP TSS Export (lb/ac/yr)	710.23
Post-BMP TSS Load (lb/yr) =	138.50
Post-BMP TSS Export (lb/ac/yr)	106.54
Post-BMP TSS Potential Reduction (lbs/ac/yr)	603.70

BMP #7 - Guy Smith Park Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	21,780	34,848	Input
Subbasin CN	74	98	Input
S (in)	3.5	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	505	27,561	Calculated
Subbasin Water Quality Volume (cf)	42	2,297	Calculated

Summary Calculations		
Total Watershed Area (sf)	56,628	Calculated
Total Watershed Area (ac)	0.1	Calculated
Total Water Quality Runoff Volume (sf*in)	28,067	Calculated
Total Water Quality Runoff Volume (cf)	2,339	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	2,339	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	8	Calculated
Suface Area (sf)	3,498	Input
Suface Area (ac)	0.1	Calculated
BMP Depth (ft)	2.0	Input
BMP Length (ft)	70	Input
BMP Width (ft)	50	Input
BMP L:W Ratio	1:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *8*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 1.2 ac

First BMP's TN removal rate =	35 %	First BMP's TP removal rate =	45 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35 %	TOTAL TP REMOVAL RATE =	45 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.55	4.66	2.60	6.62	0.19	0.48	150	382.10
Roof impervious	0.00	4.66	1.95	0.00	0.11	0.00	100	0.00
Managed pervious	0.55	4.66	1.42	3.61	0.28	0.71	55	139.70
Wooded pervious		4.66	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.11	4.66	1.95	0.98	0.11	0.06	100	50.17
Fraction Impervious (I) =	0.46		Pre-BMP TN Load (lb/yr) =	11.21	Pre-BMP TP Load (lb/yr) =	1.25	Pre-BMP TSS Load (lb/yr) =	571.96
Total Area of Development =	1.20		Pre-BMP TN Export (lb/ac/yr)	9.34	Pre-BMP TP Export (lb/ac/yr)	1.04	Pre-BMP TSS Export (lb/ac/yr)	476.64
			Post-BMP TN Load (lb/yr) =	7.29	Post-BMP TP Load (lb/yr) =	0.69	Post-BMP TSS Load (lb/yr) =	85.79
			Post-BMP TN Export (lb/ac/yr)	6.07	Post-BMP TP Export (lb/ac/yr)	0.57	Post-BMP TSS Export (lb/ac/yr)	71.50
			Post-BMP TN Potential Reduction (lbs/ac/yr)	3.27	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.47	Post-BMP TSS Potential Reduction (lbs/ac/yr)	405.14

BMP #8 - S. Greenville Elementary School Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	28,448	23,824	Input
Subbasin CN	74	98	Input
S (in)	3.5	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	660	18,843	Calculated
Subbasin Water Quality Volume (cf)	55	1,570	Calculated

Summary Calculations		
Total Watershed Area (sf)	52,272	Calculated
Total Watershed Area (ac)	0.1	Calculated
Total Water Quality Runoff Volume (sf*in)	19,502	Calculated
Total Water Quality Runoff Volume (cf)	1,625	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	1,625	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	4	Calculated
Suface Area (sf)	4,692	Input
Suface Area (ac)	0.1	Calculated
BMP Depth (ft)	2.0	Input
BMP Length (ft)	372	Input
BMP Width (ft)	12	Input
BMP L:W Ratio	31:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *9*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Stormwater Wetland*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 12.66 ac

First BMP's TN removal rate =	40	%	First BMP's TP removal rate =	40	%	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	40	%	TOTAL TP REMOVAL RATE =	40	%	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	8.02	7.93	2.60	165.42	0.19	12.09	150	9543.74
Roof impervious	2.30	7.93	1.95	35.55	0.11	2.01	100	1822.85
Managed pervious	1.17	7.93	1.42	13.17	0.28	2.60	55	509.99
Wooded pervious		7.93	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	1.17	7.93	1.95	18.07	0.11	1.02	100	926.43
Fraction Impervious (I) =	0.82		Pre-BMP TN Load (lb/yr) =	232.20	Pre-BMP TP Load (lb/yr) =	17.71	Pre-BMP TSS Load (lb/yr) =	12803.00
Total Area of Development =	12.66		Pre-BMP TN Export (lb/ac/yr)	18.34	Pre-BMP TP Export (lb/ac/yr)	1.40	Pre-BMP TSS Export (lb/ac/yr)	1011.30
			Post-BMP TN Load (lb/yr) =	139.32	Post-BMP TP Load (lb/yr) =	10.63	Post-BMP TSS Load (lb/yr) =	1920.45
			Post-BMP TN Export (lb/ac/yr)	11.00	Post-BMP TP Export (lb/ac/yr)	0.84	Post-BMP TSS Export (lb/ac/yr)	151.69
			Post-BMP TN Potential Reduction (lbs/ac/yr)	7.34	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.56	Post-BMP TSS Potential Reduction (lbs/ac/yr)	859.60

BMP #9 - Carolina East Mall Stormwater Wetland

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	101,827	449,642	Input
Subbasin CN	77	98	Input
S (in)	3.0	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	4,869	355,625	Calculated
Subbasin Water Quality Volume (cf)	406	29,635	Calculated

Summary Calculations		
Total Watershed Area (sf)	551,470	Calculated
Total Watershed Area (ac)	1.1	Calculated
Total Water Quality Runoff Volume (sf*in)	360,494	Calculated
Total Water Quality Runoff Volume (cf)	30,041	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	30,041	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	7	Calculated
Suface Area (sf)	50,891	Input
Suface Area (ac)	1.2	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	325	Input
BMP Width (ft)	170	Input
BMP L:W Ratio	2:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *10*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 =	4.84	ac					
First BMP's TN removal rate =	35	%	First BMP's TP removal rate =	45	%	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35	%	TOTAL TP REMOVAL RATE =	45	%	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	3.92	8.74	2.60	88.97	0.19	6.50
Roof impervious	0.46	8.74	1.95	7.87	0.11	0.44
Managed pervious	0.28	8.74	1.42	3.50	0.28	0.69
Wooded pervious		8.74	0.94	0.00	0.14	0.00
Area taken up by BMP	0.18	8.74	1.95	3.09	0.11	0.17
Fraction Impervious (I) =	0.90		Pre-BMP TN Load (lb/yr) =	103.42	Pre-BMP TP Load (lb/yr) =	7.81
Total Area of Development =	4.84		Pre-BMP TN Export (lb/ac/yr)	21.37	Pre-BMP TP Export (lb/ac/yr)	1.61
			Post-BMP TN Load (lb/yr) =	80.96	Post-BMP TP Load (lb/yr) =	5.63
			Post-BMP TN Export (lb/ac/yr)	16.73	Post-BMP TP Export (lb/ac/yr)	1.16
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.64	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.45

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	5133.15
100	403.35
55	135.47
0	0.00
100	158.24
Pre-BMP TSS Load (lb/yr) =	5830.21
Pre-BMP TSS Export (lb/ac/yr)	1204.59
Post-BMP TSS Load (lb/yr) =	2754.23
Post-BMP TSS Export (lb/ac/yr)	569.06
Post-BMP TSS Potential Reduction (lbs/ac/yr)	635.53

BMP #10 - Hastings Ford Dealership Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	20,164	190,667	Input
Subbasin CN	80	98	Input
S (in)	2.5	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	1,680	150,799	Calculated
Subbasin Water Quality Volume (cf)	140	12,567	Calculated

Summary Calculations		
Total Watershed Area (sf)	210,830	Calculated
Total Watershed Area (ac)	0.4	Calculated
Total Water Quality Runoff Volume (sf*in)	152,480	Calculated
Total Water Quality Runoff Volume (cf)	12,707	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	12,707	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	19	Calculated
Suface Area (sf)	7,887	Input
Suface Area (ac)	0.2	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	325	Input
BMP Width (ft)	25	Input
BMP L:W Ratio	13:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *11*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 0.82 ac

First BMP's TN removal rate =	35 %	First BMP's TP removal rate =	45 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35 %	TOTAL TP REMOVAL RATE =	45 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.56	7.23	2.60	10.56	0.19	0.77
Roof impervious	0.04	7.23	1.95	0.61	0.11	0.03
Managed pervious	0.14	7.23	1.42	1.48	0.28	0.29
Wooded pervious		7.23	0.94	0.00	0.14	0.00
Area taken up by BMP	0.07	7.23	1.95	0.99	0.11	0.06
Fraction Impervious (I) =	0.74		Pre-BMP TN Load (lb/yr) =	13.64	Pre-BMP TP Load (lb/yr) =	1.15
Total Area of Development =	0.82		Pre-BMP TN Export (lb/ac/yr)	16.64	Pre-BMP TP Export (lb/ac/yr)	1.41
			Post-BMP TN Load (lb/yr) =	8.87	Post-BMP TP Load (lb/yr) =	0.63
			Post-BMP TN Export (lb/ac/yr)	10.81	Post-BMP TP Export (lb/ac/yr)	0.77
			Post-BMP TN Potential Reduction (lbs/ac/yr)	5.82	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.63

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	609.10
100	31.39
55	57.31
0	0.00
100	50.97
Pre-BMP TSS Load (lb/yr) =	748.77
Pre-BMP TSS Export (lb/ac/yr)	913.13
Post-BMP TSS Load (lb/yr) =	112.32
Post-BMP TSS Export (lb/ac/yr)	136.97
Post-BMP TSS Potential Reduction (lbs/ac/yr)	776.16

BMP #11 - Jiffy Lube Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	9,353	26,366	Input
Subbasin CN	80	98	Input
S (in)	2.5	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	779	20,853	Calculated
Subbasin Water Quality Volume (cf)	65	1,738	Calculated

Summary Calculations		
Total Watershed Area (sf)	35,719	Calculated
Total Watershed Area (ac)	0.1	Calculated
Total Water Quality Runoff Volume (sf*in)	21,633	Calculated
Total Water Quality Runoff Volume (cf)	1,803	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	1,803	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	7	Calculated
Suface Area (sf)	3,072	Input
Suface Area (ac)	0.1	Calculated
BMP Depth (ft)	2.0	Input
BMP Length (ft)	55	Input
BMP Width (ft)	45	Input
BMP L:W Ratio	1:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *12*
Date: *4/27/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 13 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	3.41	3.92	2.60	34.74	0.19	2.54
Roof impervious	1.46	3.92	1.95	11.17	0.11	0.63
Managed pervious	7.90	3.92	1.42	43.96	0.28	8.67
Wooded pervious		3.92	0.94	0.00	0.14	0.00
Area taken up by BMP	0.23	3.92	1.95	1.76	0.11	0.10
Fraction Impervious (I) =	0.37		Pre-BMP TN Load (lb/yr) =	91.62	Pre-BMP TP Load (lb/yr) =	11.94
Total Area of Development =	13.00		Pre-BMP TN Export (lb/ac/yr)	7.05	Pre-BMP TP Export (lb/ac/yr)	0.92
			Post-BMP TN Load (lb/yr) =	68.72	Post-BMP TP Load (lb/yr) =	7.16
			Post-BMP TN Export (lb/ac/yr)	5.29	Post-BMP TP Export (lb/ac/yr)	0.55
			Post-BMP TN Potential Reduction (lbs/ac/yr)	1.76	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.37

	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	150	2003.98
Roof impervious	100	572.57
Managed pervious	55	1702.66
Wooded pervious	0	0.00
Area taken up by BMP	100	90.40
	Pre-BMP TSS Load (lb/yr) =	4369.61
	Pre-BMP TSS Export (lb/ac/yr)	336.12
	Post-BMP TSS Load (lb/yr) =	655.44
	Post-BMP TSS Export (lb/ac/yr)	50.42
	Post-BMP TSS Potential Reduction (lbs/ac/yr)	285.71

BMP #12 - Jaycee Park Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	354,143	212,137	Input
Subbasin CN	77	98	Input
S (in)	3.0	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	16,934	167,781	Calculated
Subbasin Water Quality Volume (cf)	1,411	13,982	Calculated

Summary Calculations		
Total Watershed Area (sf)	566,280	Calculated
Total Watershed Area (ac)	1.1	Calculated
Total Water Quality Runoff Volume (sf*in)	184,715	Calculated
Total Water Quality Runoff Volume (cf)	15,393	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	15,393	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	18	Calculated
Suface Area (sf)	10,048	Input
Suface Area (ac)	0.2	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	100	Input
BMP Width (ft)	100	Input
BMP L:W Ratio	1:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *13*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates		TN	TP	TSS	Design Standard
	Wet Detention Pond	25	40	85	NC BMP Manual
	Stormwater Wetland	40	40	85	NC BMP Manual
	Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
	Bioretention (with IWS)	60	60	85	NC BMP Manual
	Bioretention (without IWS)	35	45	85	NC BMP Manual
	Permeable Pavement (detention)	10	10	75	NC BMP Manual
	Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 0.31 ac

First BMP's TN removal rate =	35 %	First BMP's TP removal rate =	45 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35 %	TOTAL TP REMOVAL RATE =	45 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.20	6.36	2.60	3.29	0.19	0.24	150	189.95
Roof impervious	0.00	6.36	1.95	0.00	0.11	0.00	100	0.00
Managed pervious	0.08	6.36	1.42	0.75	0.28	0.15	55	29.18
Wooded pervious		6.36	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.03	6.36	1.95	0.34	0.11	0.02	100	17.38
Fraction Impervious (I) =	0.64		Pre-BMP TN Load (lb/yr) =	4.38	Pre-BMP TP Load (lb/yr) =	0.41	Pre-BMP TSS Load (lb/yr) =	236.52
Total Area of Development =	0.31		Pre-BMP TN Export (lb/ac/yr)	14.14	Pre-BMP TP Export (lb/ac/yr)	1.32	Pre-BMP TSS Export (lb/ac/yr)	762.97
			Post-BMP TN Load (lb/yr) =	2.85	Post-BMP TP Load (lb/yr) =	0.22	Post-BMP TSS Load (lb/yr) =	35.48
			Post-BMP TN Export (lb/ac/yr)	9.19	Post-BMP TP Export (lb/ac/yr)	0.72	Post-BMP TSS Export (lb/ac/yr)	114.44
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.95	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.59	Post-BMP TSS Potential Reduction (lbs/ac/yr)	648.52

BMP #13 - Andrew A. Best Freedom Park Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	4,827	8,677	Input
Subbasin CN	74	98	Input
S (in)	3.5	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	112	6,863	Calculated
Subbasin Water Quality Volume (cf)	9	572	Calculated

Summary Calculations		
Total Watershed Area (sf)	13,504	Calculated
Total Watershed Area (ac)	0.0	Calculated
Total Water Quality Runoff Volume (sf*in)	6,975	Calculated
Total Water Quality Runoff Volume (cf)	581	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	581	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	6	Calculated
Suface Area (sf)	1,191	Input
Suface Area (ac)	0.0	Calculated
BMP Depth (ft)	2.0	Input
BMP Length (ft)	100	Input
BMP Width (ft)	7	Input
BMP L:W Ratio	14:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *14*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 3.73 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	1.56	6.34	2.60	25.77	0.19	1.88	150	1486.69
Roof impervious	0.83	6.34	1.95	10.20	0.11	0.58	100	522.96
Managed pervious	1.12	6.34	1.42	10.05	0.28	1.98	55	389.19
Wooded pervious		6.34	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.22	6.34	1.95	2.78	0.11	0.16	100	142.40
Fraction Impervious (I) =	0.64		Pre-BMP TN Load (lb/yr) =	48.79	Pre-BMP TP Load (lb/yr) =	4.60	Pre-BMP TSS Load (lb/yr) =	2541.24
Total Area of Development =	3.73		Pre-BMP TN Export (lb/ac/yr)	13.08	Pre-BMP TP Export (lb/ac/yr)	1.23	Pre-BMP TSS Export (lb/ac/yr)	681.30
			Post-BMP TN Load (lb/yr) =	36.59	Post-BMP TP Load (lb/yr) =	2.76	Post-BMP TSS Load (lb/yr) =	381.19
			Post-BMP TN Export (lb/ac/yr)	9.81	Post-BMP TP Export (lb/ac/yr)	0.74	Post-BMP TSS Export (lb/ac/yr)	102.19
			Post-BMP TN Potential Reduction (lbs/ac/yr)	3.27	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.49	Post-BMP TSS Potential Reduction (lbs/ac/yr)	579.10

BMP #14 - First Pentecostal Holiness Church Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	58,420	104,059	Input
Subbasin CN	80	98	Input
S (in)	2.5	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	4,868	82,301	Calculated
Subbasin Water Quality Volume (cf)	406	6,858	Calculated

Summary Calculations		
Total Watershed Area (sf)	162,479	Calculated
Total Watershed Area (ac)	0.3	Calculated
Total Water Quality Runoff Volume (sf*in)	87,169	Calculated
Total Water Quality Runoff Volume (cf)	7,264	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	7,264	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	9	Calculated
Suface Area (sf)	9,787	Input
Suface Area (ac)	0.2	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	270	Input
BMP Width (ft)	80	Input
BMP L:W Ratio	3:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *16*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates		TN	TP	TSS	Design Standard
	Wet Detention Pond	25	40	85	NC BMP Manual
	Stormwater Wetland	40	40	85	NC BMP Manual
	Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
	Bioretention (with IWS)	60	60	85	NC BMP Manual
	Bioretention (without IWS)	35	45	85	NC BMP Manual
	Permeable Pavement (detention)	10	10	75	NC BMP Manual
	Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 =	1.43	ac					
First BMP's TN removal rate =	35	%	First BMP's TP removal rate =	45	%	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35	%	TOTAL TP REMOVAL RATE =	45	%	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.49	4.31	2.60	5.47	0.19	0.40	150	315.33
Roof impervious	0.11	4.31	1.95	0.91	0.11	0.05	100	46.82
Managed pervious	0.78	4.31	1.42	4.80	0.28	0.95	55	185.75
Wooded pervious		4.31	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.05	4.31	1.95	0.41	0.11	0.02	100	21.19
Fraction Impervious (I) =	0.42		Pre-BMP TN Load (lb/yr) =	11.59	Pre-BMP TP Load (lb/yr) =	1.42	Pre-BMP TSS Load (lb/yr) =	569.09
Total Area of Development =	1.43		Pre-BMP TN Export (lb/ac/yr)	8.10	Pre-BMP TP Export (lb/ac/yr)	0.99	Pre-BMP TSS Export (lb/ac/yr)	397.97
			Post-BMP TN Load (lb/yr) =	7.53	Post-BMP TP Load (lb/yr) =	0.78	Post-BMP TSS Load (lb/yr) =	85.36
			Post-BMP TN Export (lb/ac/yr)	5.27	Post-BMP TP Export (lb/ac/yr)	0.55	Post-BMP TSS Export (lb/ac/yr)	59.70
			Post-BMP TN Potential Reduction (lbs/ac/yr)	2.84	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.45	Post-BMP TSS Potential Reduction (lbs/ac/yr)	338.27

BMP #16 - Dream Park Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	36,297	25,994	Input
Subbasin CN	61	98	Input
S (in)	6.4	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	461	20,559	Calculated
Subbasin Water Quality Volume (cf)	38	1,713	Calculated

Summary Calculations		
Total Watershed Area (sf)	62,291	Calculated
Total Watershed Area (ac)	0.1	Calculated
Total Water Quality Runoff Volume (sf*in)	21,020	Calculated
Total Water Quality Runoff Volume (cf)	1,752	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	1,752	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	10	Calculated
Suface Area (sf)	2,143	Input
Suface Area (ac)	0.0	Calculated
BMP Depth (ft)	2.5	Input
BMP Length (ft)	71	Input
BMP Width (ft)	30	Input
BMP L:W Ratio	2:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *17*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 30.77 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	7.32	4.32	2.60	82.32	0.19	6.02
Roof impervious	5.57	4.32	1.95	46.99	0.11	2.65
Managed pervious	17.33	4.32	1.42	106.43	0.28	20.99
Wooded pervious		4.32	0.94	0.00	0.14	0.00
Area taken up by BMP	0.54	4.32	1.95	4.55	0.11	0.26
Fraction Impervious (I) =	0.42		**Pre-BMP TN Load (lb/yr) =**	240.29	**Pre-BMP TP Load (lb/yr) =**	29.91
Total Area of Development =	30.77		**Pre-BMP TN Export (lb/ac/yr)**	7.81	**Pre-BMP TP Export (lb/ac/yr)**	0.97
			Post-BMP TN Load (lb/yr) =	180.22	**Post-BMP TP Load (lb/yr) =**	17.95
			Post-BMP TN Export (lb/ac/yr)	5.86	**Post-BMP TP Export (lb/ac/yr)**	0.58
			Post-BMP TN Potential Reduction (lbs/ac/yr)	1.95	**Post-BMP TP Potential Reduction (lbs/ac/yr)**	0.39

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	4748.98
100	2409.94
55	4122.36
0	0.00
100	233.31
Pre-BMP TSS Load (lb/yr) =	11514.59
Pre-BMP TSS Export (lb/ac/yr)	374.21
Post-BMP TSS Load (lb/yr) =	1727.19
Post-BMP TSS Export (lb/ac/yr)	56.13
Post-BMP TSS Potential Reduction (lbs/ac/yr)	318.08

BMP #17 - Eastern Elementary School Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	778,601	561,741	Input
Subbasin CN	79	98	Input
S (in)	2.7	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	54,625	444,284	Calculated
Subbasin Water Quality Volume (cf)	4,552	37,024	Calculated

Summary Calculations		
Total Watershed Area (sf)	1,340,341	Calculated
Total Watershed Area (ac)	2.6	Calculated
Total Water Quality Runoff Volume (sf*in)	498,909	Calculated
Total Water Quality Runoff Volume (cf)	41,576	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	41,576	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	21	Calculated
Suface Area (sf)	23,505	Input
Suface Area (ac)	0.5	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	195	Input
BMP Width (ft)	127	Input
BMP L:W Ratio	2:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *18*
Date: *4/28/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 =	3.37	ac						
First BMP's TN removal rate =	25	%	First BMP's TP removal rate =	40	%	First BMP's TSS removal rate =	85	
Second BMP's TN removal rate =		%	Second BMP's TP removal rate =		%	Second BMP's TSS removal rate =		
Third BMP's TN removal rate =		%	Third BMP's TP removal rate =		%	Third BMP's TSS removal rate =		
TOTAL TN REMOVAL RATE =	25	%	TOTAL TP REMOVAL RATE =	40	%	TOTAL TSS REMOVAL RATE =	85	

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)	(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	1.66	8.22	2.60	35.46	0.19	2.59	150	2046.05
Roof impervious	1.20	8.22	1.95	19.16	0.11	1.08	100	982.65
Managed pervious	0.36	8.22	1.42	4.18	0.28	0.82	55	161.99
Wooded pervious		8.22	0.94	0.00	0.14	0.00	0	0.00
Area taken up by BMP	0.16	8.22	1.95	2.51	0.11	0.14	100	128.75
Fraction Impervious (I) =	0.85		Pre-BMP TN Load (lb/yr) =	61.32	Pre-BMP TP Load (lb/yr) =	4.64	Pre-BMP TSS Load (lb/yr) =	3319.44
Total Area of Development =	3.37		Pre-BMP TN Export (lb/ac/yr)	18.20	Pre-BMP TP Export (lb/ac/yr)	1.38	Pre-BMP TSS Export (lb/ac/yr)	985.00
			Post-BMP TN Load (lb/yr) =	45.99	Post-BMP TP Load (lb/yr) =	2.78	Post-BMP TSS Load (lb/yr) =	497.92
			Post-BMP TN Export (lb/ac/yr)	13.65	Post-BMP TP Export (lb/ac/yr)	0.83	Post-BMP TSS Export (lb/ac/yr)	147.75
			Post-BMP TN Potential Reduction (lbs/ac/yr)	4.55	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.55	Post-BMP TSS Potential Reduction (lbs/ac/yr)	837.25

BMP #18 - Arlington Crossing Shopping Center Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	22,432	124,366	Input
Subbasin CN	80	98	Input
S (in)	2.5	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	1,869	98,361	Calculated
Subbasin Water Quality Volume (cf)	156	8,197	Calculated

Summary Calculations		
Total Watershed Area (sf)	146,797	Calculated
Total Watershed Area (ac)	0.3	Calculated
Total Water Quality Runoff Volume (sf*in)	100,231	Calculated
Total Water Quality Runoff Volume (cf)	8,353	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	8,353	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	15	Calculated
Suface Area (sf)	6,823	Input
Suface Area (ac)	0.2	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	225	Input
BMP Width (ft)	30	Input
BMP L:W Ratio	8:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *19*
Date: *6/10/2015*
By: *LEL* Checked By:
BMP: *Wet Detention Basin*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 5.86 ac

First BMP's TN removal rate =	25 %	First BMP's TP removal rate =	40 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	25 %	TOTAL TP REMOVAL RATE =	40 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	3.38	6.86	2.60	60.25	0.19	4.40
Roof impervious	0.71	6.86	1.95	9.45	0.11	0.53
Managed pervious	1.11	6.86	1.42	10.84	0.28	2.14
Wooded pervious		6.86	0.94	0.00	0.14	0.00
Area taken up by BMP	0.66	6.86	1.95	8.82	0.11	0.50
Fraction Impervious (I) =	0.70		Pre-BMP TN Load (lb/yr) =	89.36	Pre-BMP TP Load (lb/yr) =	7.57
Total Area of Development =	5.86		Pre-BMP TN Export (lb/ac/yr)	15.25	Pre-BMP TP Export (lb/ac/yr)	1.29
			Post-BMP TN Load (lb/yr) =	67.02	Post-BMP TP Load (lb/yr) =	4.54
			Post-BMP TN Export (lb/ac/yr)	11.44	Post-BMP TP Export (lb/ac/yr)	0.78
			Post-BMP TN Potential Reduction (lbs/ac/yr)	3.81	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.52

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	3476.24
100	484.55
55	420.04
0	0.00
100	452.07
Pre-BMP TSS Load (lb/yr) =	4832.90
Pre-BMP TSS Export (lb/ac/yr)	824.73
Post-BMP TSS Load (lb/yr) =	724.93
Post-BMP TSS Export (lb/ac/yr)	123.71
Post-BMP TSS Potential Reduction (lbs/ac/yr)	701.02

BMP #19 - Physicians East Medical Center Wet Detention Basin

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	77,242	178,020	Input
Subbasin CN	79	98	Input
S (in)	2.7	0.2	Calculated
Runoff Depth (in)	0.1	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	5,419	140,797	Calculated
Subbasin Water Quality Volume (cf)	452	11,733	Calculated

Summary Calculations		
Total Watershed Area (sf)	255,262	Calculated
Total Watershed Area (ac)	0.5	Calculated
Total Water Quality Runoff Volume (sf*in)	146,216	Calculated
Total Water Quality Runoff Volume (cf)	12,185	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	12,185	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	5	Calculated
Suface Area (sf)	28,721	Input
Suface Area (ac)	0.7	Calculated
BMP Depth (ft)	3.0	Input
BMP Length (ft)	430	Input
BMP Width (ft)	150	Input
BMP L:W Ratio	3:1	Calculated

Coastal Plain of the Tar-Pamlico River Basin:

Includes Greenville and Washington as well as Pitt and Beaufort Counties

BMP Removal Calculation Worksheet (Automated)

Project Name: *20*
Date: *12/14/2015*
By: *LEL* Checked By:
BMP: *Bioretention without IWS*

Directions:

> It may be advantageous to split the development into separate catchments to be handled by separate BMPs. The tables below allow the development to be split into as many as three catchments, and can be copied for greater than three. NOTE: Unless runoff flowing onto the development from offsite is routed separately around or through the site, the offsite catchment area draining in must be included in the acreage values of the appropriate land use(s) and treated.

> **Above each table:** Enter the catchment acreage in the top green blank. Based on a comparison of the post-development TN and TP export coefficients you calculated above to the rule requirements of 4.0 lb/ac/yr TN and 0.4 lb/ac/yr TP, select BMP(s) from the list for treating the catchment runoff. Enter the chosen BMP(s) nutrient removal rates in the green blanks. If more than one BMP is to be used in series, the combined removal rates will be calculated automatically in the blue blanks.

> **Catchment Tables:** Enter the acres of each type of land cover in the green boxes. The spreadsheet will calculate all of the light blue boxes. NOTE: Compare the Total Catchment Acreage for the Development (final table) to the value you established in the pre-BMP worksheet tables, and also to the site plans, for consistency. All of these values need to be the same

BMP Nutrient Removal Rates

	TN	TP	TSS	Design Standard
Wet Detention Pond	25	40	85	NC BMP Manual
Stormwater Wetland	40	40	85	NC BMP Manual
Permeable Pavement (infiltrating)	30	60	85	NC BMP Manual
Bioretention (with IWS)	60	60	85	NC BMP Manual
Bioretention (without IWS)	35	45	85	NC BMP Manual
Permeable Pavement (detention)	10	10	75	NC BMP Manual
Dry Detention	10	10	50	NC BMP Manual

Catchment 1:

Total acreage of catchment 1 = 0.5 ac

First BMP's TN removal rate =	35 %	First BMP's TP removal rate =	45 %	First BMP's TSS removal rate =	85
Second BMP's TN removal rate =	%	Second BMP's TP removal rate =	%	Second BMP's TSS removal rate =	
Third BMP's TN removal rate =	%	Third BMP's TP removal rate =	%	Third BMP's TSS removal rate =	
TOTAL TN REMOVAL RATE =	35 %	TOTAL TP REMOVAL RATE =	45 %	TOTAL TSS REMOVAL RATE =	85

(1) Type of Land Cover	(2) Catchment Acreage	(3) S.M. Formula (0.51 + 9.1 I)	(4) Average EMC of TN (mg/L)	(5) Column (2) * (3) * (4)	(6) Average EMC of TP (mg/L)	(7) Column (2) * (3) * (6)
Transportation impervious	0.46	8.88	2.60	10.62	0.19	0.78
Roof impervious	0.00	8.88	1.95	0.00	0.11	0.00
Managed pervious	-0.03	8.88	1.42	-0.40	0.28	-0.08
Wooded pervious		8.88	0.94	0.00	0.14	0.00
Area taken up by BMP	0.07	8.88	1.95	1.24	0.11	0.07
Fraction Impervious (I) =	0.92		Pre-BMP TN Load (lb/yr) =	11.46	Pre-BMP TP Load (lb/yr) =	0.77
Total Area of Development =	0.50		Pre-BMP TN Export (lb/ac/yr)	22.93	Pre-BMP TP Export (lb/ac/yr)	1.54
			Post-BMP TN Load (lb/yr) =	7.45	Post-BMP TP Load (lb/yr) =	0.42
			Post-BMP TN Export (lb/ac/yr)	14.90	Post-BMP TP Export (lb/ac/yr)	0.84
			Post-BMP TN Potential Reduction (lbs/ac/yr)	8.02	Post-BMP TP Potential Reduction (lbs/ac/yr)	0.69

(6) Average EMC of TSS (mg/L)	(7) Column (2) * (3) * (6)
150	612.86
100	0.00
55	-15.38
0	0.00
100	63.50
Pre-BMP TSS Load (lb/yr) =	660.97
Pre-BMP TSS Export (lb/ac/yr)	1321.94
Post-BMP TSS Load (lb/yr) =	99.15
Post-BMP TSS Export (lb/ac/yr)	198.29
Post-BMP TSS Potential Reduction (lbs/ac/yr)	1123.65

BMP #20 - Wahl-Coates Elementary School Bioretention

Project: City of Greenville - Greens Mill Run Watershed Master Plan
Prepared By: LEL
Checked By: JTC
Date: 12/14/15

Drainage Area Parameters			
Water Quality Event Depth (in)	1.0		Input
	Pervious	**Impervious**	
Drainage Area (sf)	1,742	20,038	Input
Subbasin CN	74	98	Input
S (in)	3.5	0.2	Calculated
Runoff Depth (in)	0.0	0.8	Calculated
Subbasin Water Quality Voulme (sf*in)	40	15,848	Calculated
Subbasin Water Quality Volume (cf)	3	1,321	Calculated

Summary Calculations		
Total Watershed Area (sf)	21,780	Calculated
Total Watershed Area (ac)	0.0	Calculated
Total Water Quality Runoff Volume (sf*in)	15,888	Calculated
Total Water Quality Runoff Volume (cf)	1,324	Calculated

BMP Design		
Designed Water Quality Runoff Volume (cf)	1,324	Input
BMP Water Quality Treatment Rating (%)	100	Calculated
Average Ponding Depth (in)	5	Calculated
Suface Area (sf)	3,114	Input
Suface Area (ac)	0.1	Calculated
BMP Depth (ft)	2.0	Input
BMP Length (ft)	60	Input
BMP Width (ft)	52	Input
BMP L:W Ratio	1:1	Calculated

J. Digital Copy of Hydraulic and Hydrologic Models

Digital copies of the HEC-HMS, HEC-RAS, and SWMM models used for this WSMP are provided electronically, via the included DVD.

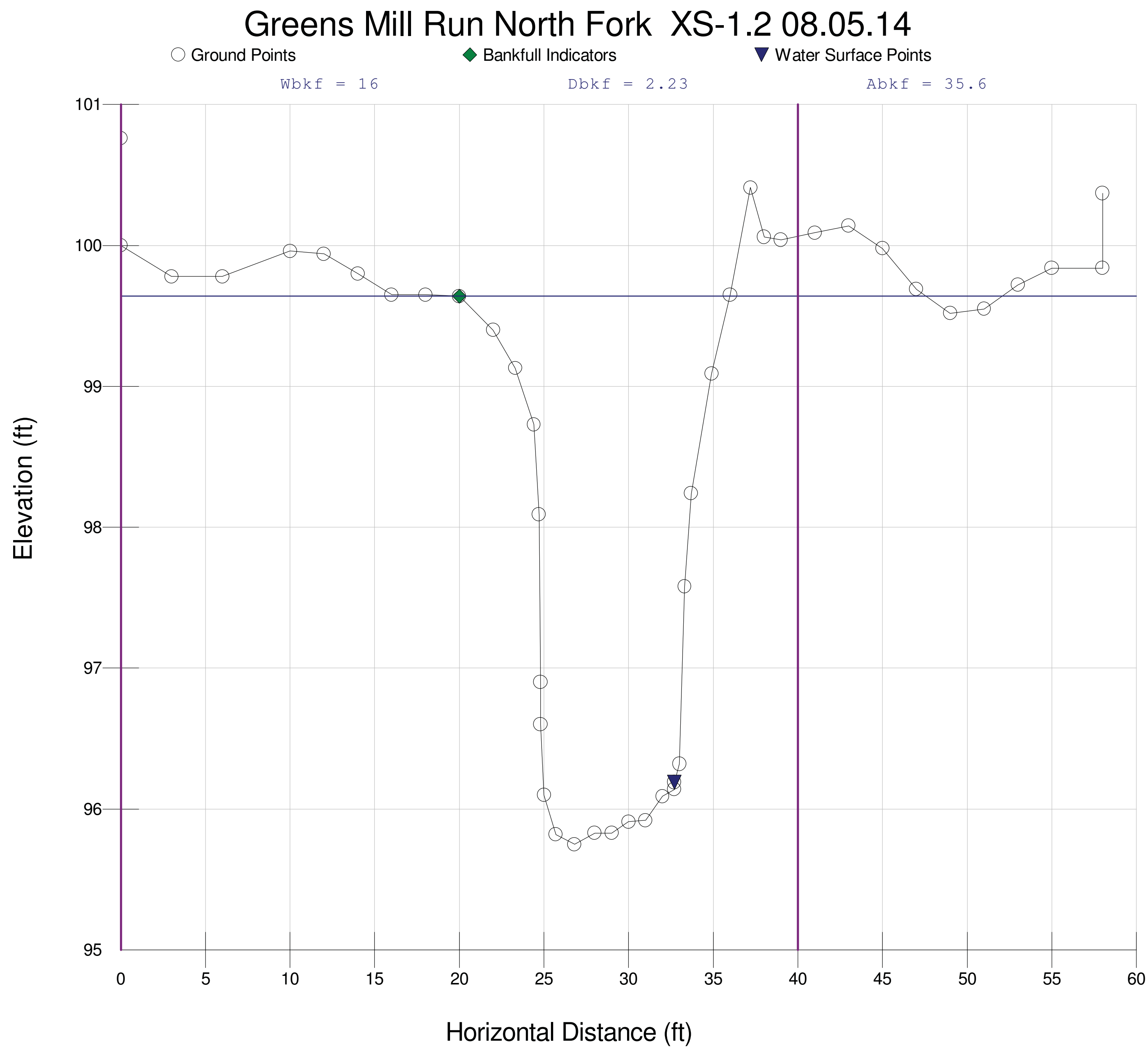
K. Stream Assessment

Table K.1: Field Data Collection – Stream Cross-Sections

XS	Reach	DA (sq mi)	Wbkf (ft)	Dbkf (ft)	Abkf (sf)	Confidence in Field Indicators	Rosgen Class
1.2	Greens Mill Run North Fork	1.11	16.0	2.2	36	Confident	E5
2.2	Greens Mill Run	1.68	17.0	4.0	67	Confident	E5
3.2	Greens Mill Run	3.87	16.2	3.8	61	Confident	E5
4.2	Unnamed Tributary	1.56	19.9	3.4	67	Confident	E5
5.2	Greens Mill Run	7.68	19.4	3.9	76	Confident	E5
6.3	Greens Mill Run	10.1	21.6	3.1	66	Confident	E5
7.2	Greens Mill Run	10.7	29.1	3.3	96	Uncertain (Urban, Incised)	G5
8.1	Fornes Run	0.91	13.6	3.3	45	Uncertain (Urban, Incised)	E5
9.3	Reedy Branch	0.22	15.9	2.8	45	Confident	E5
11.1	Unnamed Tributary	0.08	4.0	2.1	8	Uncertain (Urban, Incised)	G5
12.1	Greens Mill Run	11.00	32.7	3.4	113	Uncertain (Urban, Incised)	G6
13.1	Unnamed Tributary	1.44	20.3	3.1	63	Confident	E5
14.1	Unnamed Tributary	2.49	14.6	4.0	59	Confident	E5
14.2	Unnamed Tributary	2.49	14.3	3.3	47	Confident	E5

Table K.2: Field Data Collection – Stream Top Widths

Location	Top Width (ft)	Notes
1.1	14.8	
1.2	16.0	XS 1-2
2.1	20.8	
2.2	17.0	XS 2-2
3.1	23.0	
3.2	16.2	XS 3-2
3.3	16.0	
4.1	24.0	
4.2	19.9	XS 4-2
5.1	26.8	
5.2	19.4	XS 5-2
5.3	19.0	
6.1	22.0	
6.2	24.0	
6.3	22.3	XS-6-3
7.1	39.0	
7.2	43.8	XS 7-2
8.1	19.5	XS 8-1
8.2	30.0	
9.1	28.0+	
9.2	30.0+	
9.3	17.4	XS 9-3
9.3	17.4	XS 9-3
10.1	41.5	
10.1	41.5	
10.2	48.2	
10.2	48.2	
10.3	40.0	
10.3	40.0	
11.1	12.5	XS 11.1
12.1	43.0	XS 12.1
13.1	27.3	XS 13.1
14.1	14.6	XS 14.1
14.2	14.3	XS 14.2


Greens Mill Run North Fork XS-1.2 08.05.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 16
Dbkf = 2.23
Abkf = 35.6
Elevation (ft)
Horizontal Distance (ft)
101
100
99
98
97
96
95
0
5
10
15
20
25
30
35
40
45
50
55
60

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-1.2 08.05.14
Survey Date: 08/05/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.16 ft

TAPE	FS	ELEV	NOTE
0	4.4	100.76	LEP
0	5.16	100	gr @ LEP
3	5.38	99.78	Low ground cover
6	5.38	99.78	Low ground cover
10	5.2	99.96	Low ground cover
12	5.22	99.94	Low ground cover
14	5.36	99.8	Low ground cover
16	5.51	99.65	Low ground cover
18	5.51	99.65	Low ground cover
20	5.52	99.64	BKF, Low ground cover
22	5.76	99.4	Low ground cover
23.3	6.03	99.13	Start sandy deposition
24.4	6.43	98.73	
24.7	7.07	98.09	
24.8	8.26	96.9	UC Bank
24.8	8.56	96.6	UC Bank
25	9.06	96.1	
25.7	9.34	95.82	
26.8	9.41	95.75	TW WD=~0.4
28	9.33	95.83	
29	9.33	95.83	All sand bottom w/ sand dunes
30	9.25	95.91	
31	9.24	95.92	
32	9.07	96.09	
32.7	9.02	96.14	Toe of bank
32.7	8.97	96.19	LEW
33	8.84	96.32	
33.3	7.58	97.58	
33.7	6.92	98.24	
34.9	6.07	99.09	Sandy deposition
36	5.51	99.65	Sandy deposition
37.2	4.75	100.41	Top of berm
38	5.1	100.06	
39	5.12	100.04	
41	5.07	100.09	
43	5.02	100.14	
45	5.18	99.98	Start low ground cover
47	5.47	99.69	
49	5.64	99.52	
51	5.61	99.55	
53	5.44	99.72	
55	5.32	99.84	
58	5.32	99.84	gr @ REP
58	4.79	100.37	REP

Cross Sectional Geometry

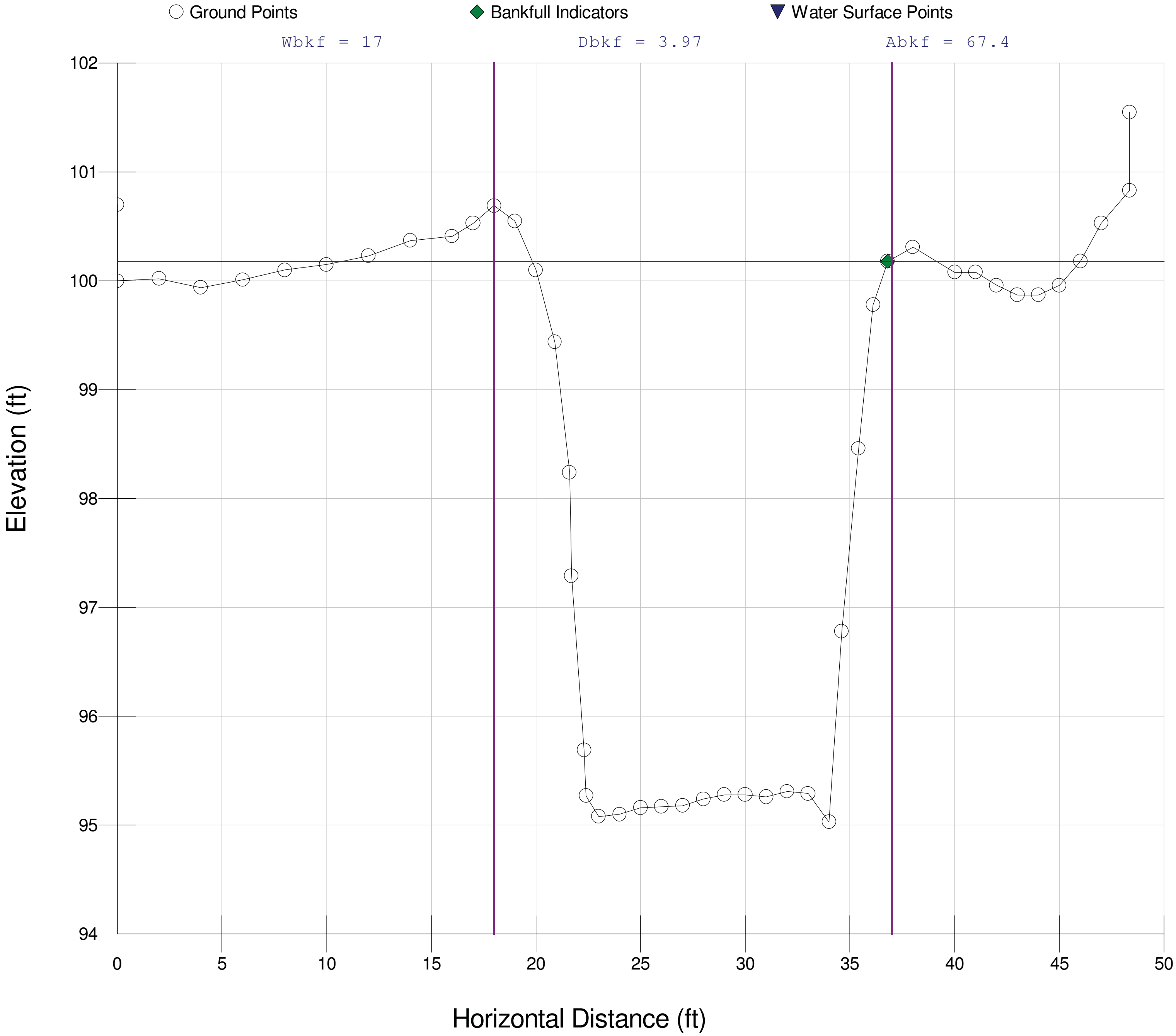
	Channel	Left	Right
Floodprone Elevation (ft)	103.53	103.53	103.53
Bankfull Elevation (ft)	99.64	99.64	99.64
Floodprone Width (ft)	58	-----	-----
Bankfull Width (ft)	15.98	2.2	13.78
Entrenchment Ratio	3.63	-----	-----
Mean Depth (ft)	2.23	0.13	2.56
Maximum Depth (ft)	3.89	0.28	3.89
Width/Depth Ratio	7.17	16.57	5.38
Bankfull Area (sq ft)	35.58	0.29	35.28
Wetted Perimeter (ft)	20.16	2.5	18.22
Hydraulic Radius (ft)	1.76	0.12	1.94
Begin BKF Station	20	20	22.2
End BKF Station	35.98	22.2	35.98

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Greens Mill Run XS-2.2 08.05.14



RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-2.2 08.05.14
Survey Date: 08/05/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.49 ft

TAPE	FS	ELEV	NOTE
0	4.79	100.7	LEP
0	5.49	100	gr @ LEP
2	5.47	100.02	
4	5.55	99.94	
6	5.48	100.01	
8	5.39	100.1	
10	5.34	100.15	
12	5.26	100.23	
14	5.12	100.37	
16	5.08	100.41	
17	4.96	100.53	
18	4.8	100.69	
19	4.94	100.55	TOB
20	5.39	100.1	
20.9	6.05	99.44	
21.6	7.25	98.24	
21.7	8.2	97.29	
22.3	9.8	95.69	WSE
22.4	10.22	95.27	Sand-bed channel
23	10.41	95.08	
24	10.39	95.1	
25	10.33	95.16	
26	10.32	95.17	
27	10.31	95.18	
28	10.25	95.24	
29	10.21	95.28	
30	10.21	95.28	
31	10.23	95.26	
32	10.18	95.31	
33	10.2	95.29	
34	10.46	95.03	
34.6	8.71	96.78	
35.4	7.03	98.46	
36.1	5.71	99.78	
36.8	5.31	100.18	BKF
38	5.18	100.31	
40	5.41	100.08	
41	5.41	100.08	
42	5.53	99.96	
43	5.62	99.87	
44	5.62	99.87	
45	5.53	99.96	
46	5.31	100.18	
47	4.96	100.53	
48.35	4.66	100.83	gr @ REP
48.35	3.94	101.55	REP

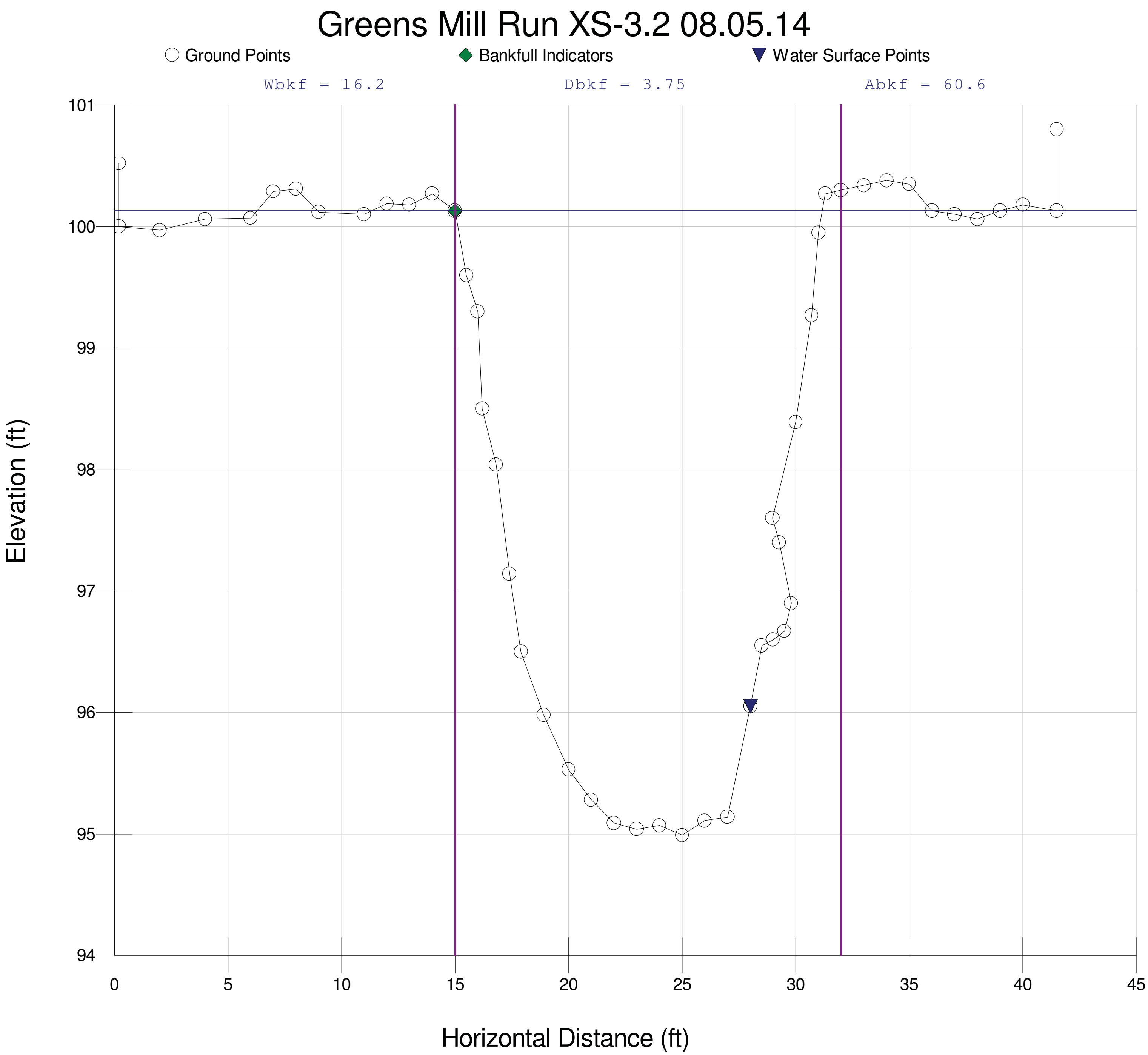
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	105.33	105.33	105.33
Bankfull Elevation (ft)	100.18	100.18	100.18
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	16.98	2.79	14.19
Entrenchment Ratio	5.89	-----	-----
Mean Depth (ft)	3.97	1.89	4.38
Maximum Depth (ft)	5.15	4.98	5.15
Width/Depth Ratio	4.28	1.47	3.24
Bankfull Area (sq ft)	67.39	5.28	62.11
Wetted Perimeter (ft)	23.48	10.99	22.44
Hydraulic Radius (ft)	2.87	0.48	2.77
Begin BKF Station	19.82	19.82	22.61
End BKF Station	36.8	22.61	36.8

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			



Greens Mill Run XS-3.2 08.05.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 16.2
Dbkf = 3.75
Abkf = 60.6
Elevation (ft)
Horizontal Distance (ft)
101
100
99
98
97
96
95
94
0
5
10
15
20
25
30
35
40
45

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-3.2 08.05.14
Survey Date: 08/05/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.65 ft

TAPE	FS	ELEV	NOTE
0.2	5.13	100.52	LEP
0.2	5.65	100	gr @ LEP
2	5.68	99.97	
4	5.59	100.06	
6	5.58	100.07	
7	5.36	100.29	Top of Berm
8	5.34	100.31	
9	5.53	100.12	
11	5.55	100.1	
12	5.46	100.19	
13	5.47	100.18	
14	5.38	100.27	
15	5.52	100.13	BKF
15.5	6.05	99.6	
16	6.35	99.3	
16.2	7.15	98.5	
16.8	7.61	98.04	
17.4	8.51	97.14	root
17.9	9.15	96.5	
18.9	9.67	95.98	WD=0.2
20	10.12	95.53	
21	10.37	95.28	
22	10.56	95.09	
23	10.61	95.04	TW WD=1.12
24	10.58	95.07	
25	10.66	94.99	
26	10.54	95.11	
27	10.51	95.14	
28	9.6	96.05	REW WD=0.5
28.5	9.1	96.55	
29	9.05	96.6	
29.5	8.98	96.67	
29.8	8.75	96.9	
29.27	8.25	97.4	UC Bank
28.98	8.05	97.6	UC Bank
30	7.26	98.39	
30.7	6.38	99.27	
31	5.7	99.95	
31.3	5.38	100.27	
32	5.35	100.3	
33	5.31	100.34	
34	5.27	100.38	
35	5.3	100.35	
36	5.52	100.13	Drainage Swale
37	5.55	100.1	
38	5.59	100.06	
39	5.52	100.13	
40	5.47	100.18	
41.5	5.52	100.13	gr @ REP

41.5	4.85	100.8	REP

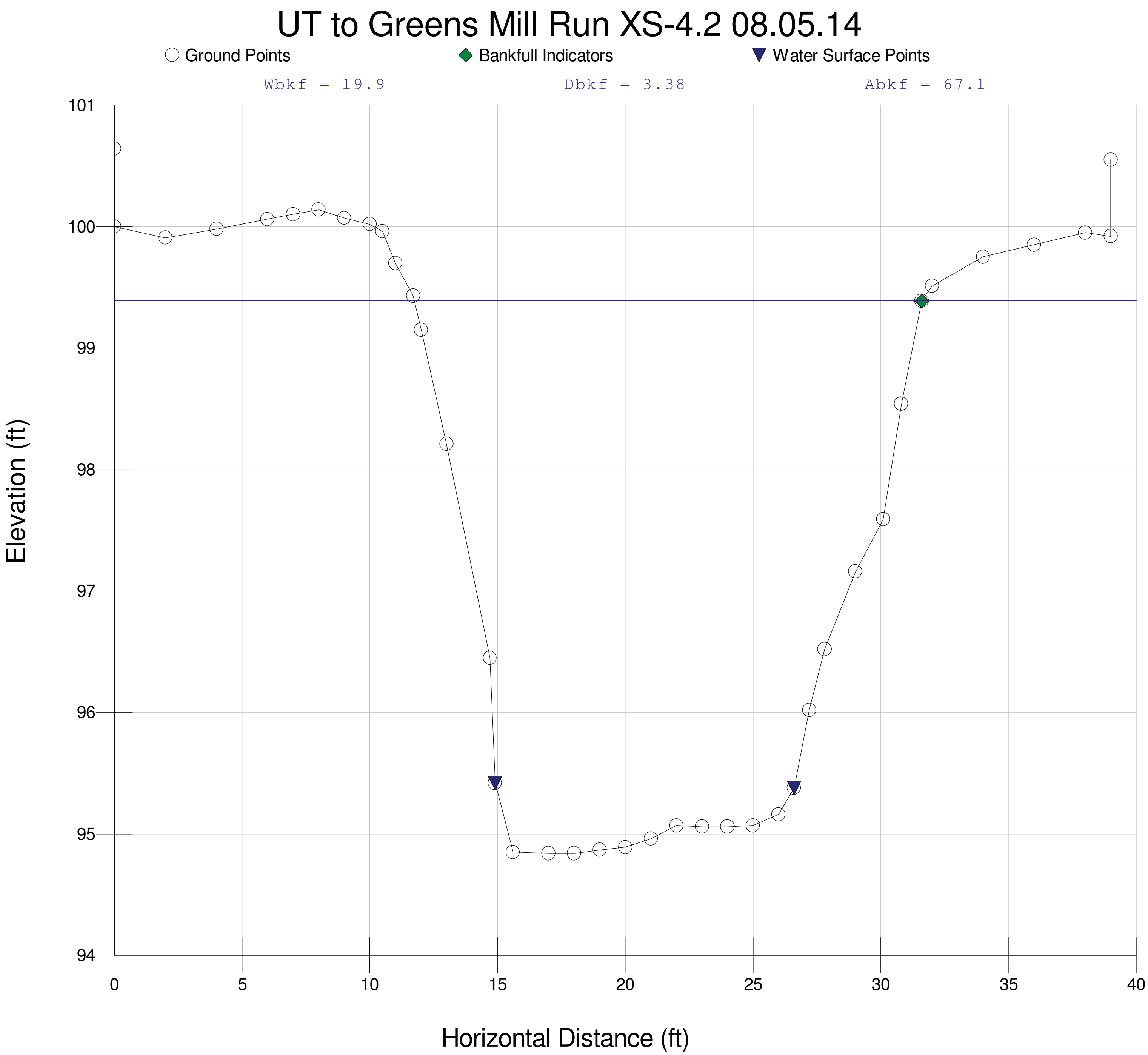
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	105.27	105.27	105.27
Bankfull Elevation (ft)	100.13	100.13	100.13
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	16.17	8.08	8.09
Entrenchment Ratio	6.18	-----	-----
Mean Depth (ft)	3.75	3.57	3.92
Maximum Depth (ft)	5.14	5.09	5.14
Width/Depth Ratio	4.31	2.26	2.06
Bankfull Area (sq ft)	60.61	28.86	31.75
Wetted Perimeter (ft)	22.09	15.32	16.95
Hydraulic Radius (ft)	2.74	1.88	1.87
Begin BKF Station	15	15	23.08
End BKF Station	31.17	23.08	31.17

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


UT to Greens Mill Run XS-4.2 08.05.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 19.9
Dbkf = 3.38
Abkf = 67.1
Elevation (ft)
Horizontal Distance (ft)
101
100
99
98
97
96
95
94
0
5
10
15
20
25
30
35
40

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-4.2 08.05.14
Survey Date: 08/05/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.32 ft

TAPE	FS	ELEV	NOTE
0	4.68	100.64	LEP
0	5.32	100	gr @ LEP
2	5.41	99.91	
4	5.34	99.98	
6	5.26	100.06	
7	5.22	100.1	
8	5.18	100.14	
9	5.25	100.07	
10	5.3	100.02	
10.5	5.36	99.96	
11	5.62	99.7	TOB
11.7	5.89	99.43	
12	6.17	99.15	
13	7.11	98.21	
14.7	8.87	96.45	
14.9	9.9	95.42	LEW
15.6	10.47	94.85	WD=0.63
17	10.48	94.84	
18	10.48	94.84	
19	10.45	94.87	
20	10.43	94.89	
21	10.36	94.96	
22	10.25	95.07	
23	10.26	95.06	
24	10.26	95.06	
25	10.25	95.07	
26	10.16	95.16	
26.6	9.94	95.38	REW
27.2	9.3	96.02	
27.8	8.8	96.52	
29	8.16	97.16	
30.1	7.73	97.59	
30.8	6.78	98.54	
31.6	5.93	99.39	BKF
32	5.81	99.51	
34	5.57	99.75	
36	5.47	99.85	
38	5.37	99.95	
39	5.4	99.92	gr @ REP
39	4.77	100.55	REP

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	103.94	103.94	103.94
Bankfull Elevation (ft)	99.39	99.39	99.39

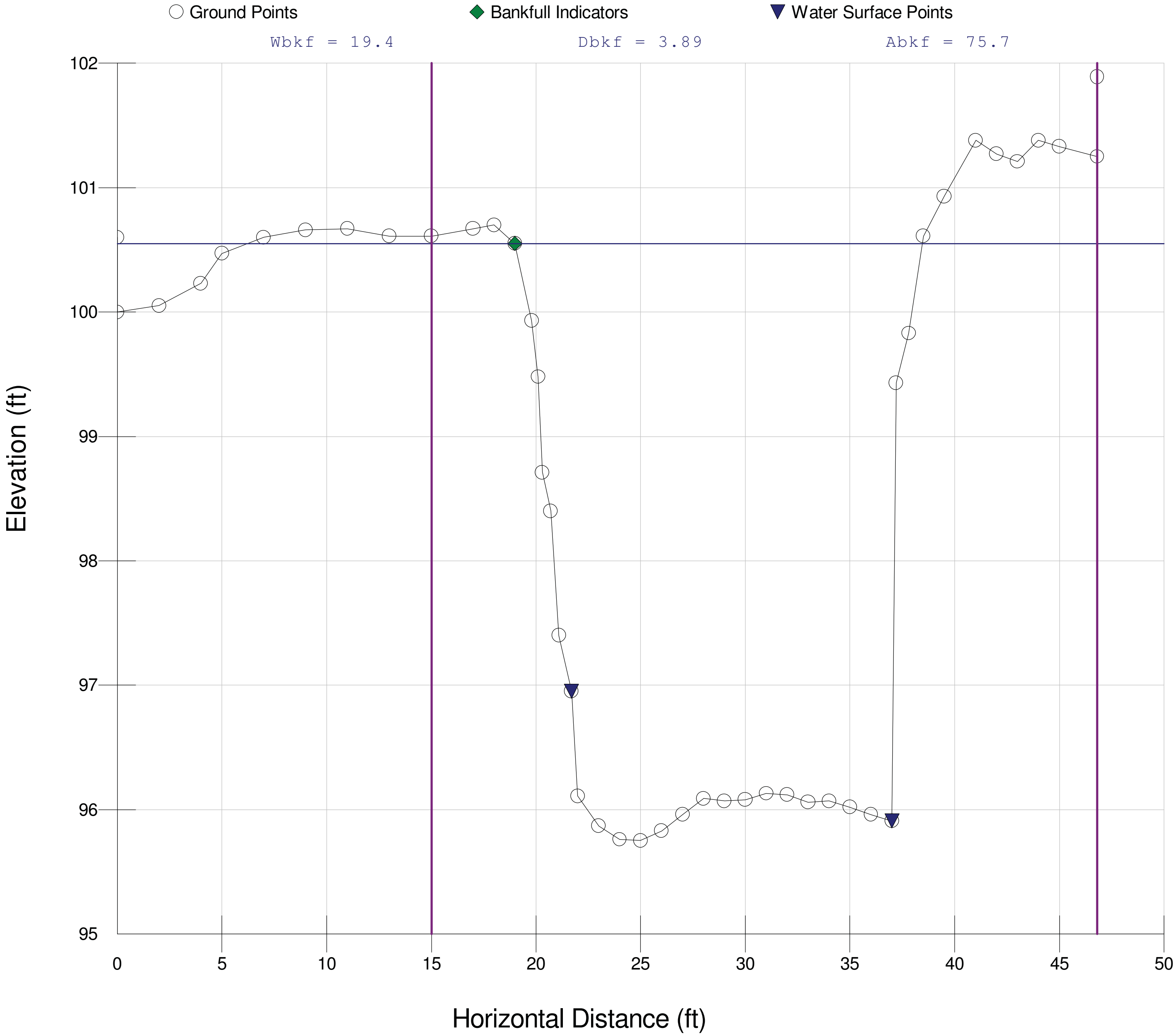
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	19.86	10.55	9.31
Entrenchment Ratio	5.04	-----	-----
Mean Depth (ft)	3.38	3.6	3.13
Maximum Depth (ft)	4.55	4.55	4.33
Width/Depth Ratio	5.88	2.93	2.97
Bankfull Area (sq ft)	67.07	37.96	29.1
Wetted Perimeter (ft)	23.72	17.15	15.22
Hydraulic Radius (ft)	2.83	2.21	1.91
Begin BKF Station	11.74	11.74	22.29
End BKF Station	31.6	22.29	31.6

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

Greens Mill Run XS-5.2 08.06.14



RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-5.2 08.06.14
Survey Date: 08/06/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.93 ft

TAPE	FS	ELEV	NOTE
0	5.33	100.6	LEP
0	5.93	100	gr @ LEP
2	5.88	100.05	
4	5.7	100.23	
5	5.46	100.47	Sandy deposition
7	5.33	100.6	easement
9	5.27	100.66	easement
11	5.26	100.67	easement
13	5.32	100.61	easement
15	5.32	100.61	easement
17	5.26	100.67	easement
18	5.23	100.7	
19	5.38	100.55	BKF
19.8	6	99.93	
20.1	6.45	99.48	
20.3	7.22	98.71	
20.7	7.53	98.4	
21.1	8.53	97.4	
21.7	8.98	96.95	LEW
22	9.82	96.11	Toe
23	10.06	95.87	
24	10.17	95.76	
25	10.18	95.75	TW WD=1.29
26	10.1	95.83	
27	9.97	95.96	
28	9.84	96.09	
29	9.86	96.07	
30	9.85	96.08	
31	9.8	96.13	
32	9.81	96.12	
33	9.87	96.06	
34	9.86	96.07	
35	9.91	96.02	
36	9.97	95.96	
37	10.02	95.91	REW Toe WD=1.13
37.2	6.5	99.43	
37.8	6.1	99.83	
38.5	5.32	100.61	
39.5	5	100.93	
41	4.55	101.38	TOB
42	4.66	101.27	
43	4.72	101.21	
44	4.55	101.38	
45	4.6	101.33	
46.8	4.68	101.25	gr @ REP
46.8	4.04	101.89	REP

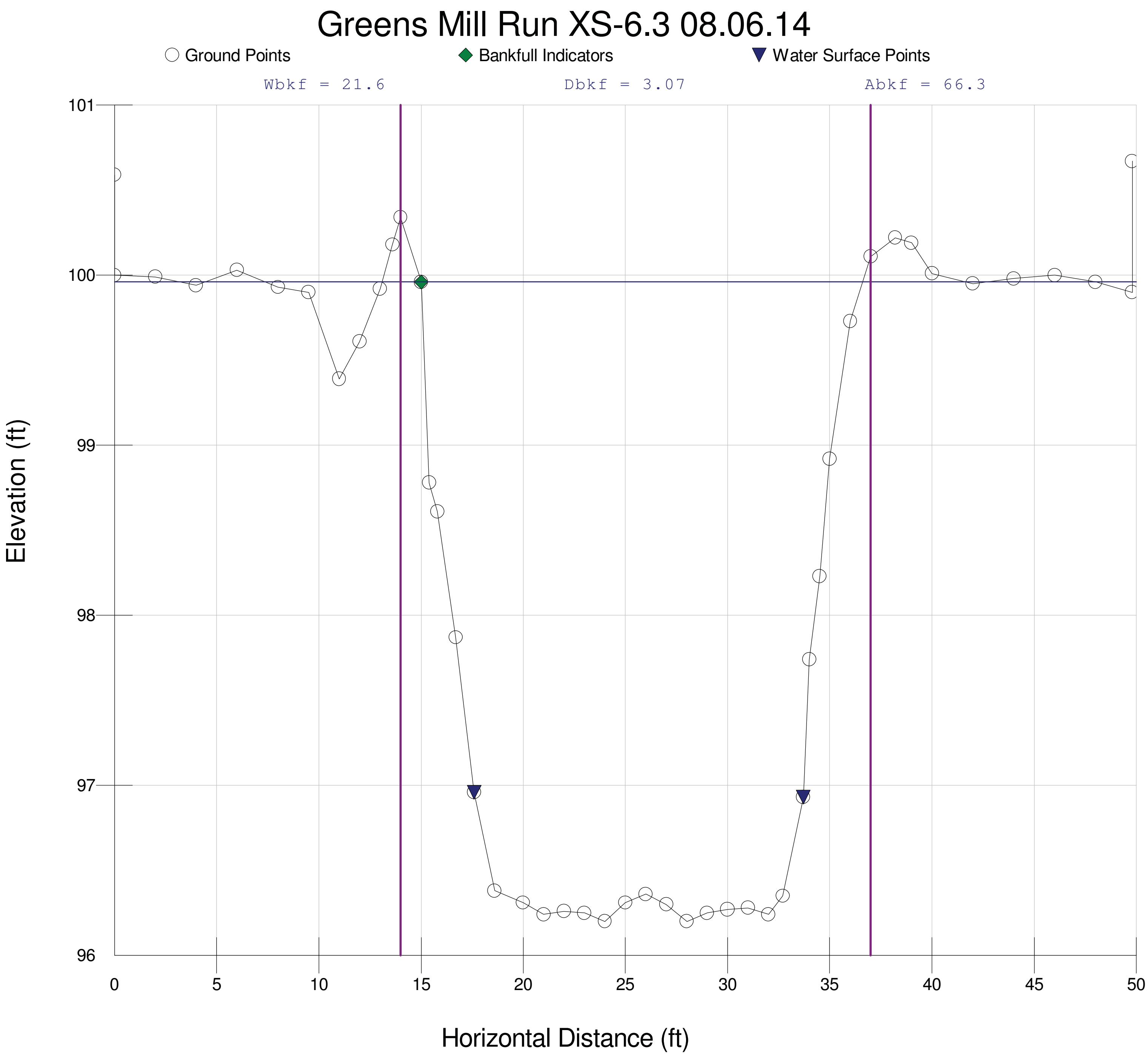
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	105.35	105.35	105.35
Bankfull Elevation (ft)	100.55	100.55	100.55
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	19.45	4.4	15.05
Entrenchment Ratio	5.14	-----	-----
Mean Depth (ft)	3.89	2.8	4.21
Maximum Depth (ft)	4.8	4.72	4.8
Width/Depth Ratio	5	1.57	3.57
Bankfull Area (sq ft)	75.71	12.32	63.39
Wetted Perimeter (ft)	25.85	11.73	23.57
Hydraulic Radius (ft)	2.93	1.05	2.69
Begin BKF Station	19	19	23.4
End BKF Station	38.45	23.4	38.45

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			



Greens Mill Run XS-6.3 08.06.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 21.6
Dbkf = 3.07
Abkf = 66.3
Elevation (ft)
Horizontal Distance (ft)
101
100
99
98
97
96
0
5
10
15
20
25
30
35
40
45
50

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-6.3 08.06.14
Survey Date: 08/06/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.35 ft

TAPE	FS	ELEV	NOTE
0	4.76	100.59	LEP
0	5.35	100	gr @ LEP
2	5.36	99.99	Thick grass
4	5.41	99.94	Thick grass
6	5.32	100.03	Thick grass
8	5.42	99.93	Thick grass
9.5	5.45	99.9	Thick grass
11	5.96	99.39	Thick grass
12	5.74	99.61	Thick grass
13	5.43	99.92	Thick grass
13.6	5.17	100.18	Thick grass
14	5.01	100.34	Top left bank
15	5.39	99.96	BKF
15.4	6.57	98.78	
15.8	6.74	98.61	
16.7	7.48	97.87	
17.6	8.39	96.96	LEW
18.6	8.97	96.38	Toe
20	9.04	96.31	
21	9.11	96.24	
22	9.09	96.26	
23	9.1	96.25	
24	9.15	96.2	
25	9.04	96.31	
26	8.99	96.36	
27	9.05	96.3	
28	9.15	96.2	TW WD=0.8
29	9.1	96.25	
30	9.08	96.27	
31	9.07	96.28	
32	9.11	96.24	
32.7	9	96.35	Toe
33.7	8.42	96.93	REW
34	7.61	97.74	
34.5	7.12	98.23	
35	6.43	98.92	
36	5.62	99.73	
37	5.24	100.11	
38.2	5.13	100.22	TOB
39	5.16	100.19	
40	5.34	100.01	
42	5.4	99.95	
44	5.37	99.98	
46	5.35	100	
48	5.39	99.96	
49.8	5.45	99.9	gr @ REP
49.8	4.68	100.67	REP

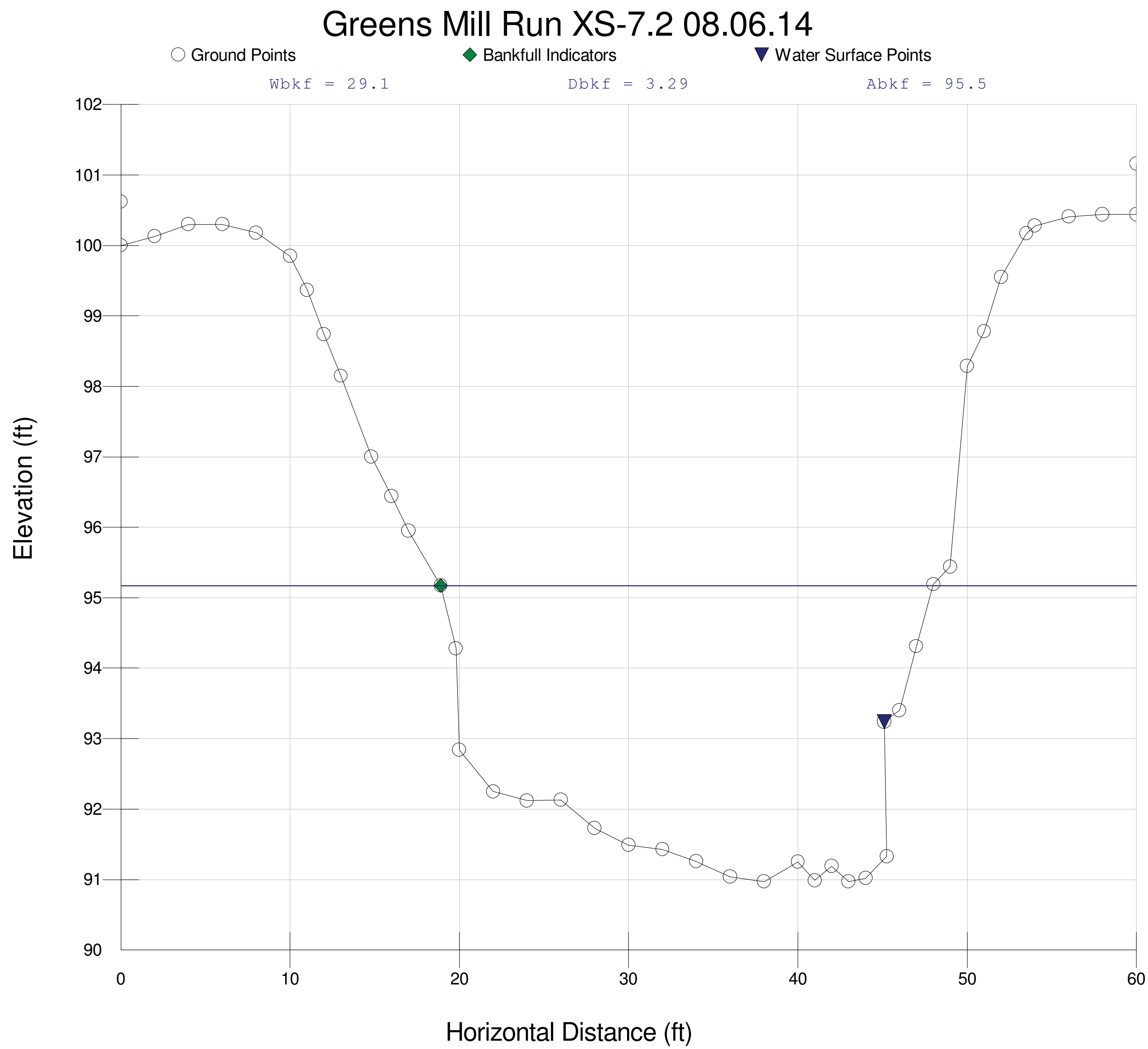
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	103.72	103.72	103.72
Bankfull Elevation (ft)	99.96	99.96	99.96
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	21.61	9.9	11.71
Entrenchment Ratio	4.63	-----	-----
Mean Depth (ft)	3.07	3.14	3.01
Maximum Depth (ft)	3.76	3.76	3.76
Width/Depth Ratio	7.04	3.15	3.89
Bankfull Area (sq ft)	66.31	31.11	35.21
Wetted Perimeter (ft)	24.92	15.25	16.99
Hydraulic Radius (ft)	2.66	2.04	2.07
Begin BKF Station	15	15	24.9
End BKF Station	36.61	24.9	36.61

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Greens Mill Run XS-7.2 08.06.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 29.1
Dbkf = 3.29
Abkf = 95.5
Elevation (ft)
Horizontal Distance (ft)
102
101
100
99
98
97
96
95
94
93
92
91
90
0
10
20
30
40
50
60

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-7.2 08.06.14
Survey Date: 08/06/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.8 ft

TAPE	FS	ELEV	NOTE
0	5.18	100.62	LEP
0	5.8	100	gr @ LEP
2	5.67	100.13	
4	5.5	100.3	
6	5.5	100.3	
8	5.62	100.18	
10	5.95	99.85	
11	6.43	99.37	
12	7.06	98.74	
13	7.65	98.15	
14.8	8.8	97	sand/organic interface BKF- field i
16	9.36	96.44	
17	9.85	95.95	
18.9	10.63	95.17	BKF
19.8	11.52	94.28	
20	12.96	92.84	Toe WD=0.46
22	13.55	92.25	Toe
24	13.68	92.12	
26	13.67	92.13	
28	14.07	91.73	
30	14.31	91.49	Rock?
32	14.37	91.43	Rock?
34	14.54	91.26	WD=2.06
36	14.76	91.04	
38	14.83	90.97	Rock? WD=2.32
40	14.55	91.25	Rock - same as ones on bank (granit
41	14.81	90.99	
42	14.61	91.19	
43	14.83	90.97	
44	14.78	91.02	
45.25	14.47	91.33	Toe
45.1	12.56	93.24	REW
46	12.4	93.4	
47	11.49	94.31	Start tree roots
48	10.61	95.19	
49	10.36	95.44	
50	7.51	98.29	On root/tree
51	7.02	98.78	
52	6.25	99.55	
53.5	5.63	100.17	
54	5.52	100.28	
56	5.39	100.41	
58	5.36	100.44	
60	5.36	100.44	gr @ REP
60	4.64	101.16	REP

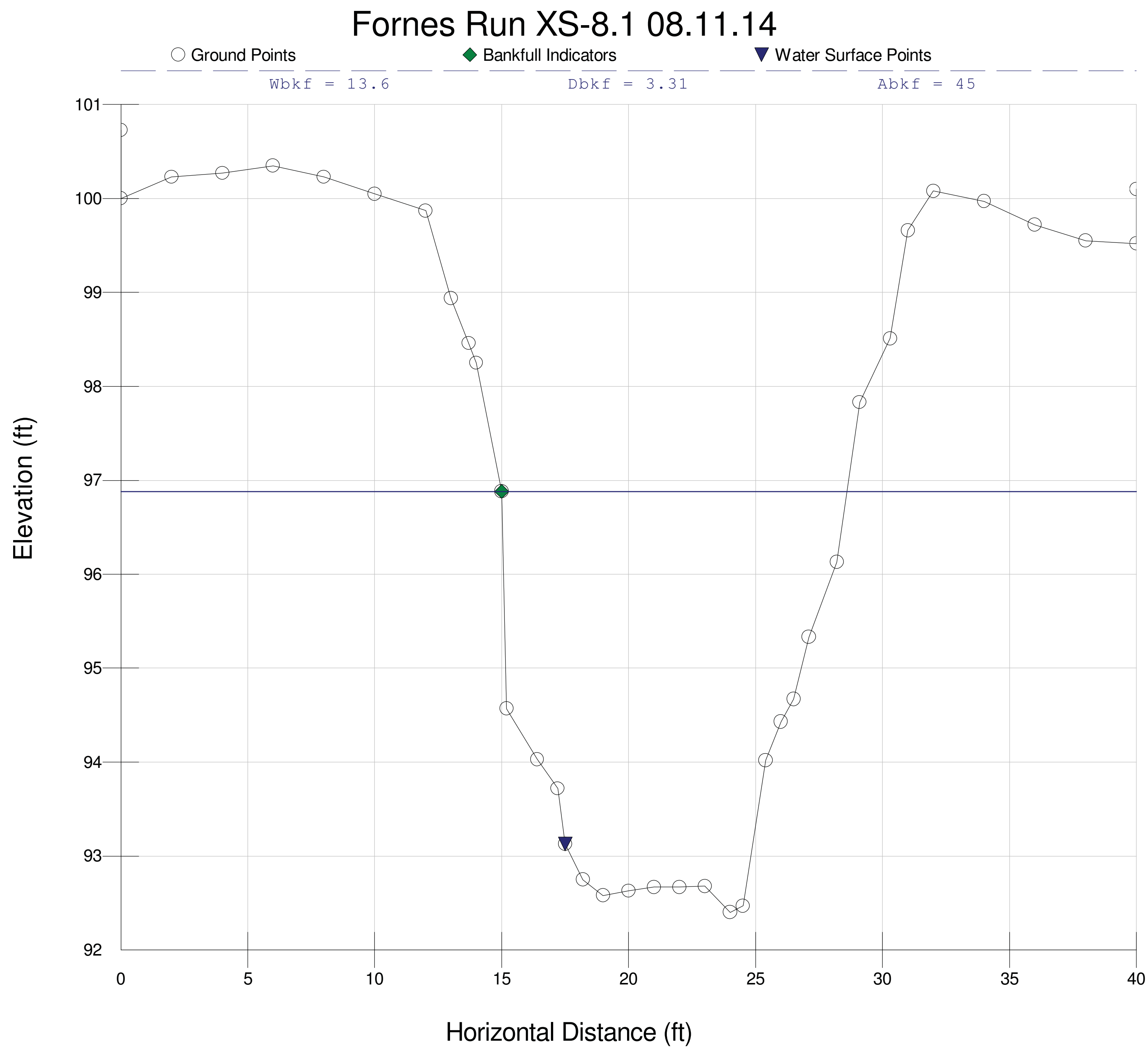
Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	99.37	99.37	99.37
Bankfull Elevation (ft)	95.17	95.17	95.17
Floodprone Width (ft)	40.77	-----	-----
Bankfull Width (ft)	29.08	12.53	16.55
Entrenchment Ratio	1.4	-----	-----
Mean Depth (ft)	3.29	2.95	3.54
Maximum Depth (ft)	4.2	3.72	4.2
Width/Depth Ratio	8.84	4.25	4.68
Bankfull Area (sq ft)	95.55	36.93	58.62
Wetted Perimeter (ft)	33.75	18.02	23.18
Hydraulic Radius (ft)	2.83	2.05	2.53
Begin BKF Station	18.9	18.9	31.43
End BKF Station	47.98	31.43	47.98

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			



Fornes Run XS-8.1 08.11.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 13.6
Dbkf = 3.31
Abkf = 45
Elevation (ft)
Horizontal Distance (ft)
101
100
99
98
97
96
95
94
93
92
0
5
10
15
20
25
30
35
40

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-8.1 08.11.14
Survey Date: 08/11/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.23 ft

TAPE	FS	ELEV	NOTE
0	4.5	100.73	LEP
0	5.23	100	gr @ LEP
2	5	100.23	
4	4.96	100.27	
6	4.88	100.35	
8	5	100.23	
10	5.18	100.05	
12	5.36	99.87	TOB
13	6.29	98.94	
13.7	6.77	98.46	
14	6.98	98.25	
15	8.35	96.88	BKF
15.2	10.66	94.57	
16.4	11.2	94.03	
17.2	11.51	93.72	log holding bank
17.5	12.1	93.13	LEW
18.2	12.48	92.75	Toe
19	12.65	92.58	
20	12.6	92.63	
21	12.56	92.67	
22	12.56	92.67	
23	12.55	92.68	
24	12.83	92.4	
24.5	12.76	92.47	Toe WD=0.77
25.4	11.21	94.02	
26	10.8	94.43	
26.5	10.56	94.67	
27.1	9.9	95.33	Top sandy deposit
28.2	9.1	96.13	
29.1	7.4	97.83	
30.3	6.72	98.51	
31	5.57	99.66	
32	5.15	100.08	
34	5.26	99.97	
36	5.51	99.72	
38	5.68	99.55	
40	5.71	99.52	gr @ REP
40	5.13	100.1	REP

Cross Sectional Geometry

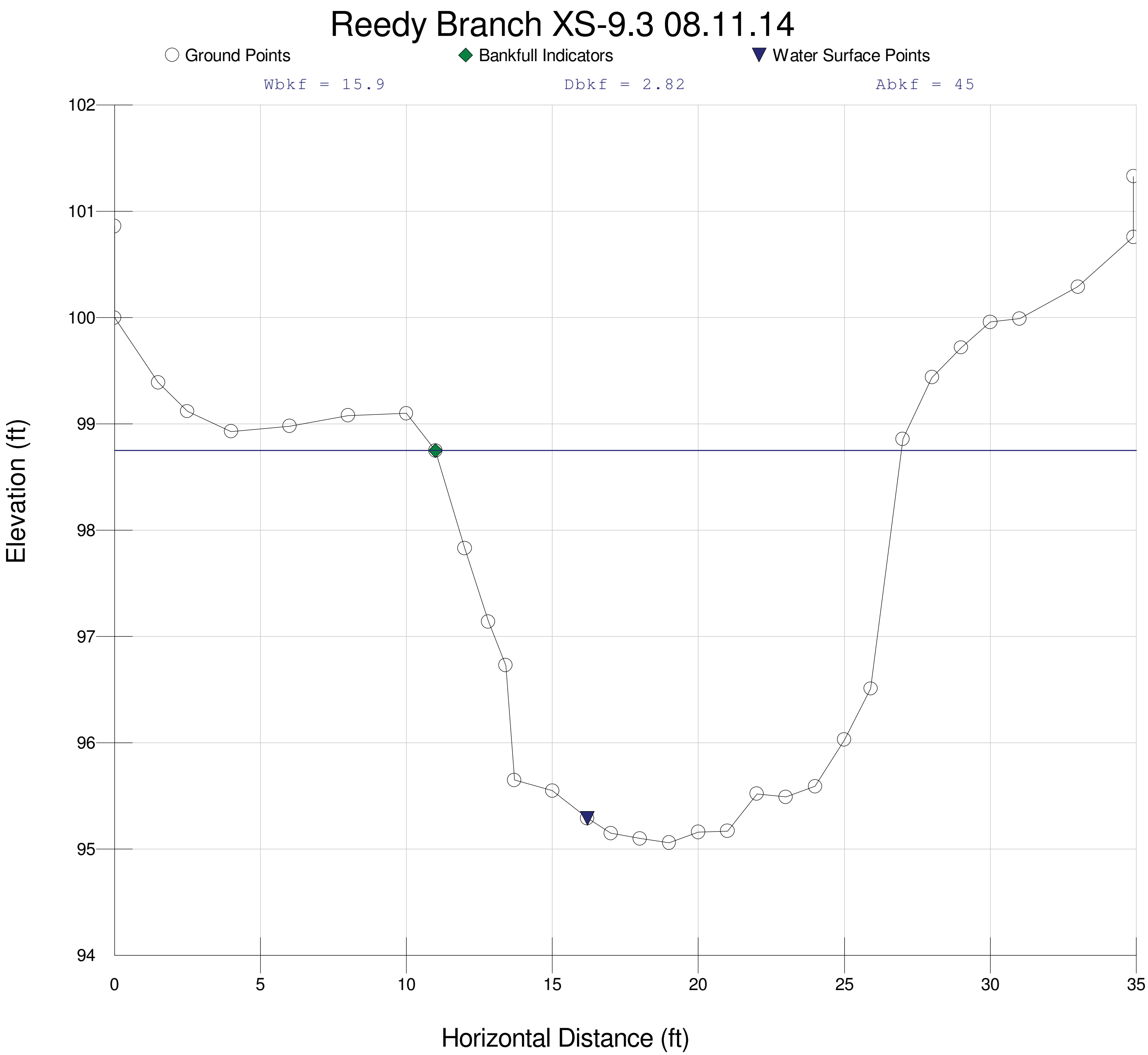
	Channel	Left	Right
Floodprone Elevation (ft)	107.34	107.34	107.34
Bankfull Elevation (ft)	99.87	99.87	99.87
Floodprone Width (ft)	40	-----	-----
Bankfull Width (ft)	24.7	12.35	15.65

Entrenchment Ratio	1.62	-----	-----
Mean Depth (ft)	3.84	5.48	2.19
Maximum Depth (ft)	7.47	7.47	7.42
Width/Depth Ratio	6.43	2.25	7.15
Bankfull Area (sq ft)	94.79	67.72	27.07
Wetted Perimeter (ft)	32.67	23.86	23.66
Hydraulic Radius (ft)	2.9	2.84	1.14
Begin BKF Station	12	12	24.35
End BKF Station	40	24.35	40

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


Reedy Branch XS-9.3 08.11.14
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 15.9
Dbkf = 2.82
Abkf = 45
Elevation (ft)
Horizontal Distance (ft)
102
101
100
99
98
97
96
95
94
0
5
10
15
20
25
30
35

RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS-9.3 08.11.14
Survey Date: 08/11/2014

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.89 ft

TAPE	FS	ELEV	NOTE
0	5.03	100.86	LEP
0	5.89	100	gr @ LEP
1.5	6.5	99.39	
2.5	6.77	99.12	
4	6.96	98.93	
6	6.91	98.98	
8	6.81	99.08	
10	6.79	99.1	
11	7.14	98.75	BKF
12	8.06	97.83	
12.8	8.75	97.14	
13.4	9.16	96.73	
13.7	10.24	95.65	Toe
15	10.34	95.55	
16.2	10.6	95.29	LEW
17	10.74	95.15	
18	10.79	95.1	
19	10.83	95.06	
20	10.73	95.16	
21	10.72	95.17	
22	10.37	95.52	
23	10.4	95.49	
24	10.3	95.59	
25	9.86	96.03	
25.9	9.38	96.51	
27	7.03	98.86	
28	6.45	99.44	
29	6.17	99.72	
30	5.93	99.96	
31	5.9	99.99	
33	5.6	100.29	
34.9	5.13	100.76	gr @ REP
34.9	4.56	101.33	REP

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	102.44	102.44	102.44
Bankfull Elevation (ft)	98.75	98.75	98.75
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	15.95	4.04	11.91
Entrenchment Ratio	6.27	-----	-----
Mean Depth (ft)	2.82	1.87	3.14
Maximum Depth (ft)	3.69	3.21	3.69
Width/Depth Ratio	5.66	2.16	3.79
Bankfull Area (sq ft)	44.97	7.55	37.42

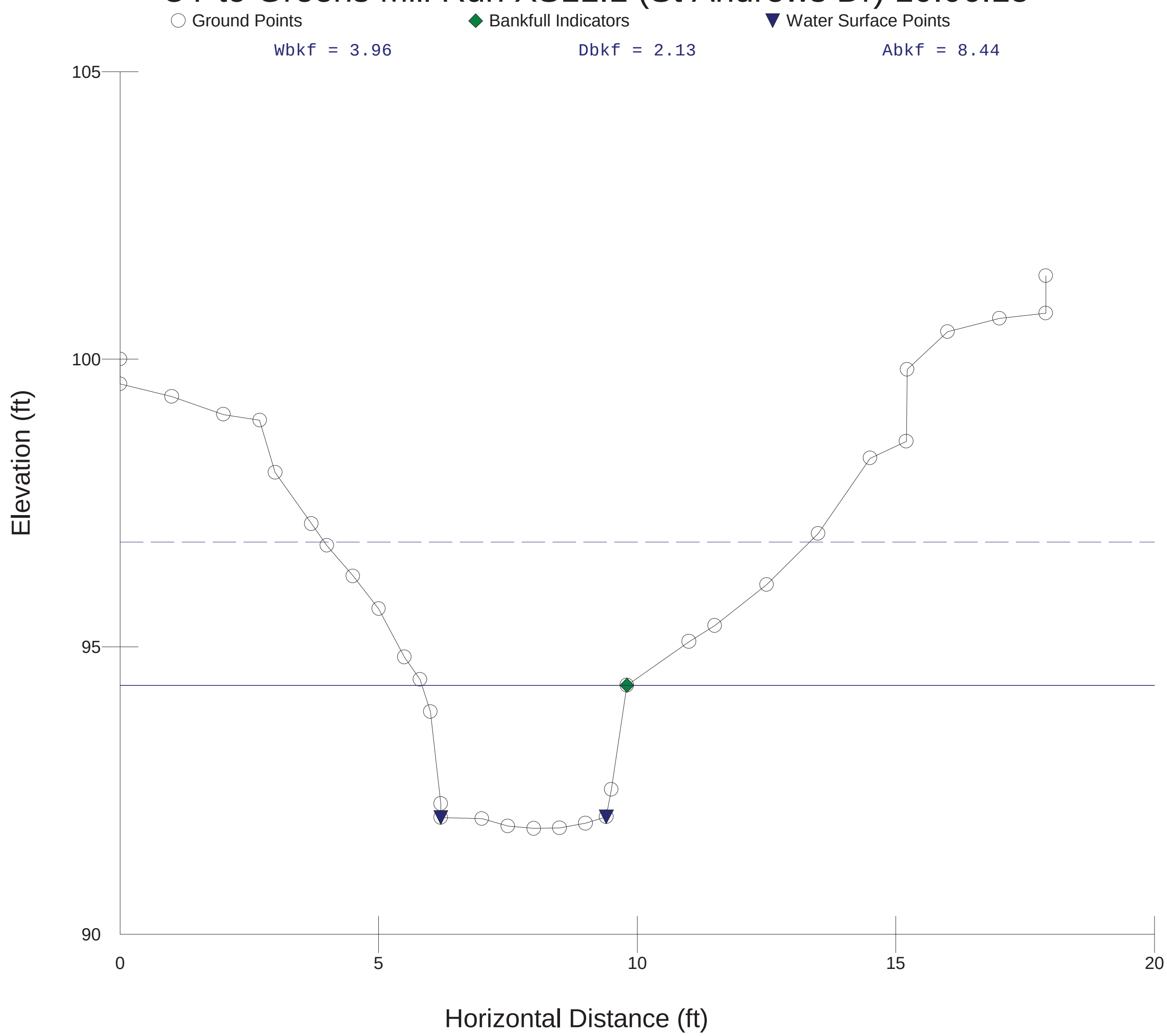
Wetted Perimeter (ft)	19.26	8.82	16.87
Hydraulic Radius (ft)	2.33	0.86	2.22
Begin BKF Station	11	11	15.04
End BKF Station	26.95	15.04	26.95

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

UT to Greens Mill Run XS11.1 (St Andrews Dr) 10.06.15



RIVERMORPH CROSS SECTION SUMMARY

River Name: Greens Mill Run
Reach Name: Greens Mill Run
Cross Section Name: XS11.1 10.06.15
Survey Date: 10/06/2015

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 6.46 ft

TAPE	FS	ELEV	NOTE
0	6.46	100	LEP
0	6.89	99.57	gr at LEP
1	7.11	99.35	
2	7.42	99.04	
2.7	7.52	98.94	
3	8.43	98.03	
3.7	9.32	97.14	
4	9.7	96.76	
4.5	10.23	96.23	
5	10.8	95.66	
5.5	11.64	94.82	
5.8	12.03	94.43	
6	12.59	93.87	
6.2	14.19	92.27	
6.2	14.43	92.03	LEW
7	14.45	92.01	SB
7.5	14.58	91.88	SB
8	14.62	91.84	SB
8.5	14.61	91.85	SB
9	14.53	91.93	SB
9.4	14.42	92.04	REW
9.5	13.94	92.52	
9.8	12.13	94.33	BKF
11	11.37	95.09	
11.5	11.09	95.37	
12.5	10.38	96.08	
13.5	9.49	96.97	
14.5	8.18	98.28	
15.2	7.89	98.57	
15.22	6.64	99.82	
16	5.98	100.48	
17	5.75	100.71	
17.9	5.66	100.8	gr at REP
17.9	5.01	101.45	REP

Cross Sectional Geometry

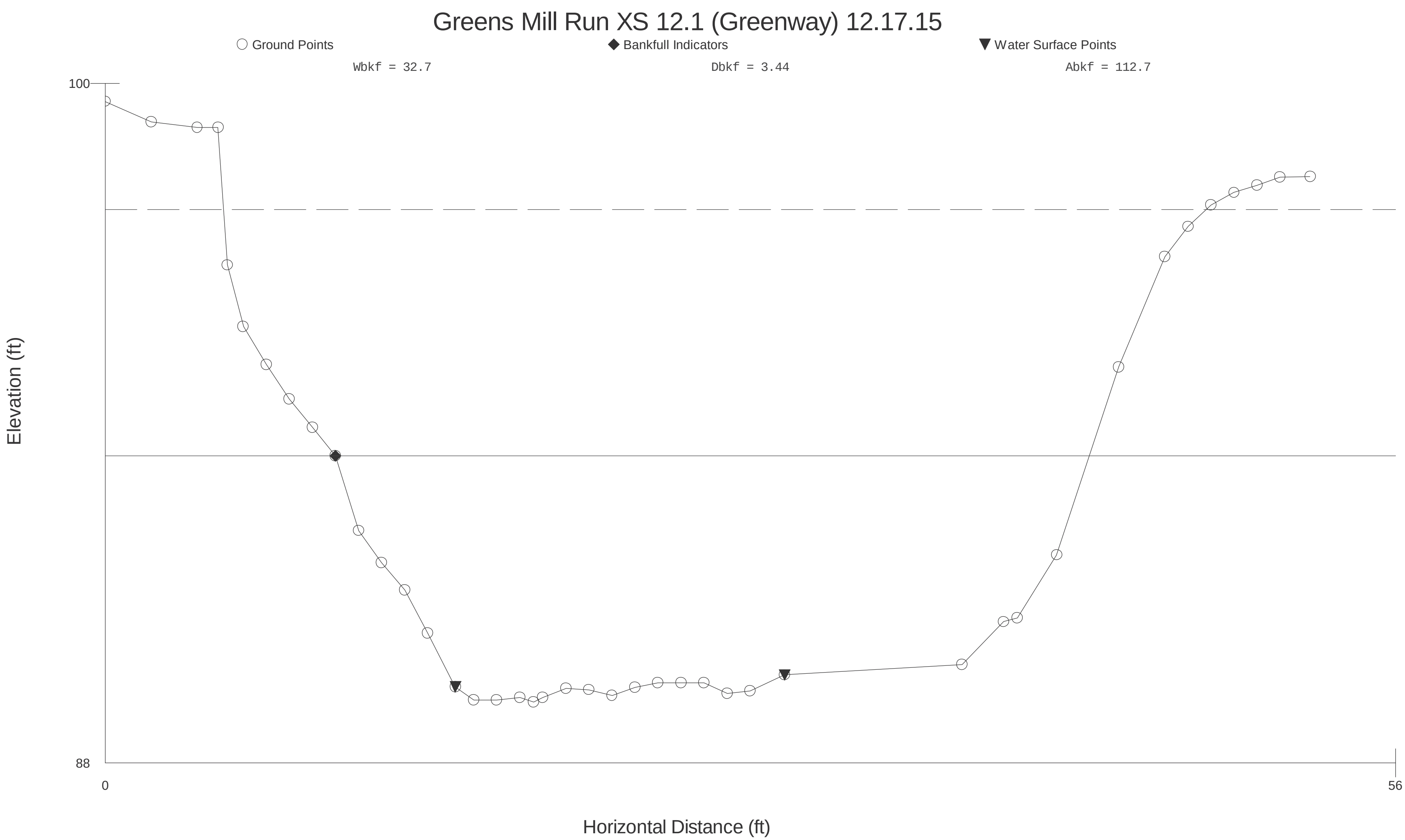
	Channel	Left	Right
Floodprone Elevation (ft)	96.82	96.82	96.82
Bankfull Elevation (ft)	94.33	94.33	94.33
Floodprone Width (ft)	9.38	-----	-----
Bankfull Width (ft)	3.96	1.98	1.98
Entrenchment Ratio	2.37	-----	-----
Mean Depth (ft)	2.13	2.08	2.18
Maximum Depth (ft)	2.49	2.48	2.49
Width/Depth Ratio	1.86	0.95	0.91

Bankfull Area (sq ft)	8.44	4.12	4.32
Wetted Perimeter (ft)	7.91	6.45	6.4
Hydraulic Radius (ft)	1.07	0.64	0.68
Begin BKF Station	5.84	5.84	7.82
End BKF Station	9.8	7.82	9.8

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			



Greens Mill Run XS 12.1 (Greenway) 12.17.15
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 32.7
Dbkf = 3.44
Abkf = 112.7
100
88
0
56
Elevation (ft)
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Additional Sites
Reach Name: Greensmill Run (Greenway Site 12)
Cross Section Name: XS-1 by Greenway
Survey Date: 12/17/2015

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5 ft

TAPE	FS	ELEV	NOTE
0	5.32	99.68	LEP
2	5.68	99.32	
4	5.78	99.22	
4.9	5.87	99.22	LB
5.3	8.21	96.79	
6	9.3	95.7	
7	9.97	95.03	
8	10.58	94.42	
9	11.08	93.92	
10	11.58	93.42	BKF
11	12.9	92.1	
12	13.47	91.53	
13	13.95	91.05	' field indicated bkf
14	14.71	90.29	
15.2	15.66	89.34	LEW
16	15.89	89.11	
17	15.89	89.11	
18	15.85	89.15	
18.6	15.93	89.07	
19	15.85	89.15	
20	15.69	89.31	
21	15.71	89.29	
22	15.81	89.19	
23	15.67	89.33	
24	15.59	89.41	
25	15.59	89.41	
26	15.59	89.41	
27	15.78	89.22	
28	15.73	89.27	
29.5	15.45	89.55	REW
37.2	15.27	89.73	
39	14.51	90.49	
39.6	14.44	90.56	
41.3	13.33	91.67	
44	10.01	94.99	
46	8.06	96.94	
47	7.53	97.47	RB
48	7.15	97.85	
49	6.93	98.07	
50	6.8	98.2	
51	6.66	98.34	
52.3	6.65	98.35	REP

Cross Sectional Geometry

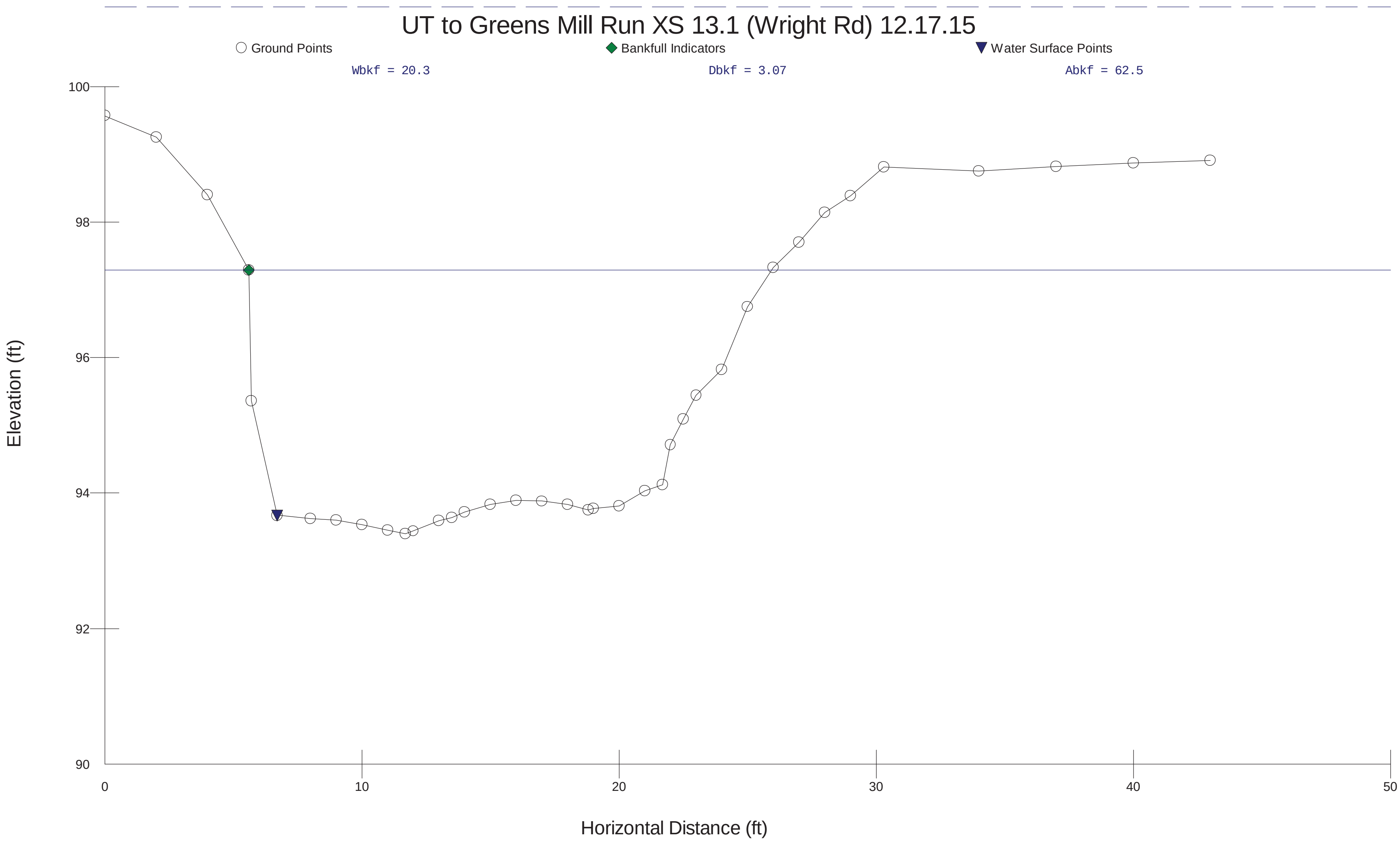
Channel Left Right

Floodprone Elevation (ft)	97.77	97.77	97.77
Bankfull Elevation (ft)	93.42	93.42	93.42
Floodprone Width (ft)	42.65	-----	-----
Bankfull Width (ft)	32.72	16.68	16.04
Entrenchment Ratio	1.3	-----	-----
Mean Depth (ft)	3.44	3.55	3.33
Maximum Depth (ft)	4.35	4.35	4.2
Width/Depth Ratio	9.51	4.7	4.82
Bankfull Area (sq ft)	112.72	59.23	53.49
Wetted Perimeter (ft)	35.67	22.41	21.54
Hydraulic Radius (ft)	3.16	2.64	2.48
Begin BKF Station	10	10	26.68
End BKF Station	42.72	26.68	42.72

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


UT to Greens Mill Run XS 13.1 (Wright Rd) 12.17.15
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 20.3
Dbkf = 3.07
Abkf = 62.5
Elevation (ft)
100
98
96
94
92
90
0
10
20
30
40
50
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Additional Sites
Reach Name: UT to Greens Mill Run (Wright Road Site 13)
Cross Section Name: XS-1 DS of Wright Road
Survey Date: 12/17/2015

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5 ft

TAPE	FS	ELEV	NOTE
0	5.43	99.57	Ground at Pin
2	5.75	99.25	
4	6.6	98.4	
5.6	7.71	97.29	BKF
5.7	9.64	95.36	
6.7	11.33	93.67	LEW
8	11.38	93.62	
9	11.4	93.6	
10	11.47	93.53	
11	11.55	93.45	
11.7	11.6	93.4	TW
12	11.56	93.44	
13	11.41	93.59	
13.5	11.36	93.64	Left edge of gravel bar
14	11.28	93.72	Gravel Bar
15	11.17	93.83	
16	11.11	93.89	
17	11.12	93.88	
18	11.17	93.83	
18.8	11.25	93.75	Right edge of Gravel bar
19	11.23	93.77	
20	11.19	93.81	
21	10.97	94.03	
21.7	10.88	94.12	
22	10.29	94.71	
22.5	9.91	95.09	
23	9.56	95.44	
24	9.18	95.82	
25	8.25	96.75	
26	7.67	97.33	
27	7.3	97.7	
28	6.86	98.14	
29	6.61	98.39	
30.3	6.19	98.81	Right Top of Bank
34	6.25	98.75	
37	6.18	98.82	
40	6.13	98.87	
43	6.09	98.91	Ground at Pin

Cross Sectional Geometry

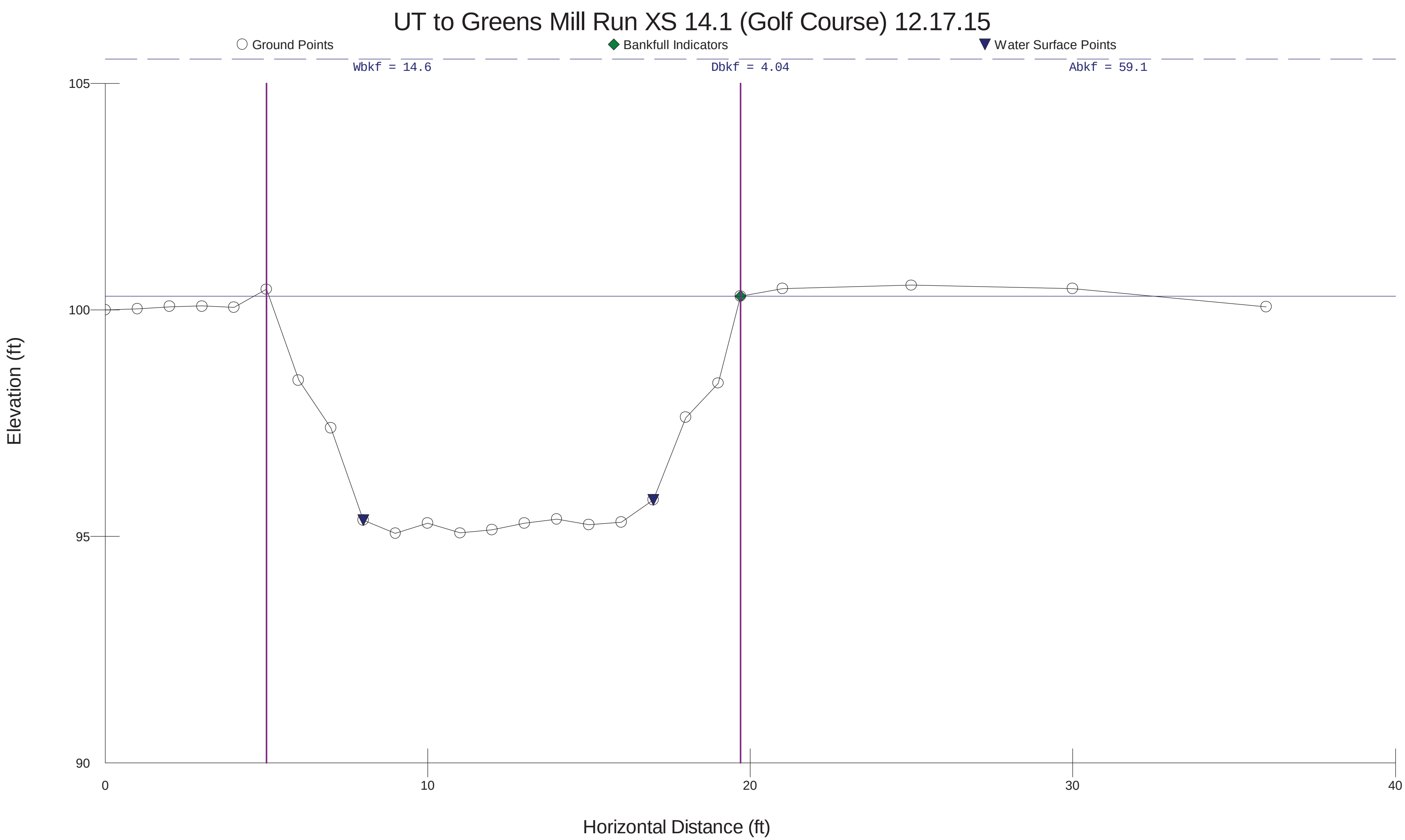
	Channel	Left	Right
Floodprone Elevation (ft)	101.18	101.18	101.18
Bankfull Elevation (ft)	97.29	97.29	97.29
Floodprone Width (ft)	200	-----	-----
Bankfull Width (ft)	20.33	10.17	10.16

Entrenchment Ratio	9.84	-----	-----
Mean Depth (ft)	3.07	3.57	2.58
Maximum Depth (ft)	3.89	3.89	3.54
Width/Depth Ratio	6.62	2.85	3.94
Bankfull Area (sq ft)	62.5	36.26	26.24
Wetted Perimeter (ft)	24.38	16.42	14.79
Hydraulic Radius (ft)	2.56	2.21	1.77
Begin BKF Station	5.6	5.6	15.77
End BKF Station	25.93	15.77	25.93

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			



UT to Greens Mill Run XS 14.1 (Golf Course) 12.17.15
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 14.6
Dbkf = 4.04
Abkf = 59.1
105
100
95
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

RIVERMORPH CROSS SECTION SUMMARY

River Name: Additional Sites
Reach Name: UT to Greens Mill Run (Golf Course Site 14)
Cross Section Name: XS-1 by Golf Course
Survey Date: 12/17/2015

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.53 ft

TAPE	FS	ELEV	NOTE
0	5.53	100	LEP
1	5.51	100.02	
2	5.46	100.07	
3	5.45	100.08	
4	5.48	100.05	
5	5.08	100.45	
6	7.09	98.44	'field determined BKF
7	8.14	97.39	
8	10.18	95.35	LEW
9	10.47	95.06	TW
10	10.24	95.29	
11	10.46	95.07	
12	10.39	95.14	
13	10.24	95.29	
14	10.15	95.38	
15	10.28	95.25	
16	10.22	95.31	
17	9.73	95.8	REW
18	7.91	97.62	
19	7.15	98.38	
19.7	5.23	100.3	BKF
21	5.06	100.47	
25	4.99	100.54	
30	5.06	100.47	
36	5.47	100.06	REP

Cross Sectional Geometry

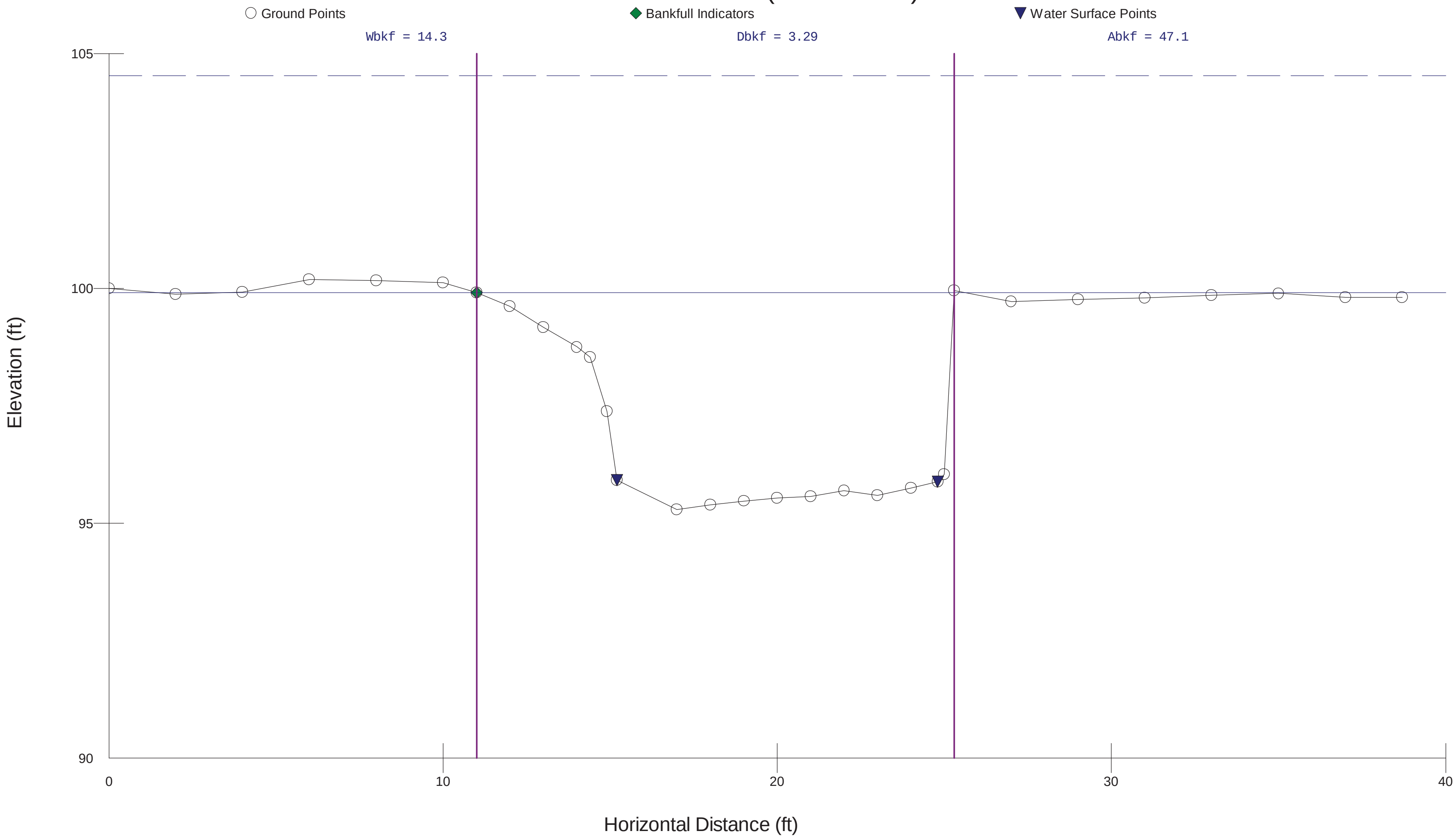
	Channel	Left	Right
Floodprone Elevation (ft)	105.54	105.54	105.54
Bankfull Elevation (ft)	100.3	100.3	100.3
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	14.63	7.44	7.19
Entrenchment Ratio	6.84	-----	-----
Mean Depth (ft)	4.04	4.08	4
Maximum Depth (ft)	5.24	5.24	5.08
Width/Depth Ratio	3.62	1.82	1.8
Bankfull Area (sq ft)	59.07	30.32	28.75
Wetted Perimeter (ft)	20.41	15.49	15.08
Hydraulic Radius (ft)	2.89	1.96	1.91
Begin BKF Station	5.07	5.07	12.51
End BKF Station	19.7	12.51	19.7

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			

UT to Greens Mill Run XS 14.2 (Golf Course) 12.17.15



RIVERMORPH CROSS SECTION SUMMARY

River Name: Additional Sites
Reach Name: UT to Greens Mill Run (Golf Course Site 14)
Cross Section Name: XS-2 by Golf Course
Survey Date: 12/17/2015

Cross Section Data Entry

BM Elevation: 100 ft
Backsight Rod Reading: 5.41 ft

TAPE	FS	ELEV	NOTE
0	5.41	100	LEP
2	5.54	99.87	
4	5.49	99.92	
6	5.22	100.19	
8	5.25	100.16	
10	5.29	100.12	
11	5.5	99.91	BKF
12	5.79	99.62	
13	6.24	99.17	
14	6.66	98.75	
14.4	6.88	98.53	' field indicated BKF
14.9	8.03	97.38	
15.2	9.5	95.91	LEW
17	10.12	95.29	TW
18	10.02	95.39	
19	9.94	95.47	
20	9.88	95.53	
21	9.84	95.57	
22	9.72	95.69	
23	9.82	95.59	
24	9.66	95.75	
24.8	9.53	95.88	REW
25	9.37	96.04	Base of retaining wall
25.3	5.46	99.95	top of retaining wall
27	5.69	99.72	
29	5.65	99.76	
31	5.61	99.8	
33	5.56	99.85	
35	5.52	99.89	
37	5.6	99.81	
38.7	5.6	99.81	REP

Cross Sectional Geometry

	Channel	Left	Right
Floodprone Elevation (ft)	104.53	104.53	104.53
Bankfull Elevation (ft)	99.91	99.91	99.91
Floodprone Width (ft)	100	-----	-----
Bankfull Width (ft)	14.3	8.8	5.5
Entrenchment Ratio	6.99	-----	-----
Mean Depth (ft)	3.29	2.77	4.12
Maximum Depth (ft)	4.62	4.62	4.39
Width/Depth Ratio	4.35	3.17	1.33
Bankfull Area (sq ft)	47.08	24.42	22.67
Wetted Perimeter (ft)	20.32	15.54	13.57
Hydraulic Radius (ft)	2.32	1.57	1.67

Begin BKF Station	11	11	19.8
End BKF Station	25.3	19.8	25.3

Entrainment Calculations

Entrainment Formula: Rosgen Modified Shields Curve

	Channel	Left Side	Right Side
Slope	0	0	0
Shear Stress (lb/sq ft)			
Movable Particle (mm)			


XS 1.2 Looking Downstream


XS 1.2 Looking Left to Right


XS 1.2 Looking Right to Left


XS 1.2 Looking Upstream


XS 2.2 Looking Downstream


XS 2.2 Looking Left to Right


XS 2.2 Looking Right to Left


XS 2.2 Looking Upstream


XS 3.2 Looking Downstream


XS 3.2 Looking Left to Right


XS 3.2 Looking Right to Left


XS 3.2 Looking Upstream


XS 4.2 Looking Downstream


XS 4.2 Looking Left to Right


XS 4.2 Looking Right to Left


XS 4.2 Looking Upstream


XS 5.2 Looking Downstream


XS 5.2 Looking Left to Right


XS 5.2 Looking Right to Left


XS 5.2 Looking Upstream


XS 6.3 Looking Downstream


XS 6.3 Looking Left to Right


XS 6.3 Looking Right to Left


XS 6.3 Looking Upstream


XS 7.2 Looking Downstream


XS 7.2 Looking Left to Right


XS 7.2 Looking Right to Left


XS 7.2 Looking Upstream


XS 8.1 Looking Downstream


XS 8.1 Looking Left to Right


XS 8.1 Looking Right to Left


XS 8.1 Looking Upstream


XS 9.3 Looking Downstream


XS 9.3 Looking Left to Right


XS 9.3 Looking Right to Left


XS 9.3 Looking Upstream


XS 11.1 Looking Downstream


XS 11.1 Right Bank


XS 11.1 Left Bank


XS 11.1 Looking Upstream


XS 12.1 (Greenway) Looking Upstream


XS 12.1 (Greenway) Left Bank


XS 12.1 (Greenway) Looking Downstream


XS 12.1 (Greenway) Right Bank


XS 13.1 (Wright Road) Left Bank


XS 13.1 (Wright Road) Looking Downstream


XS 13.1 (Wright Road) Right Bank


XS 14.1 (Golf Course) Left Bank


XS 14.1 (Golf Course) Looking Downstream


XS 14.1 (Golf Course) Looking Upstream

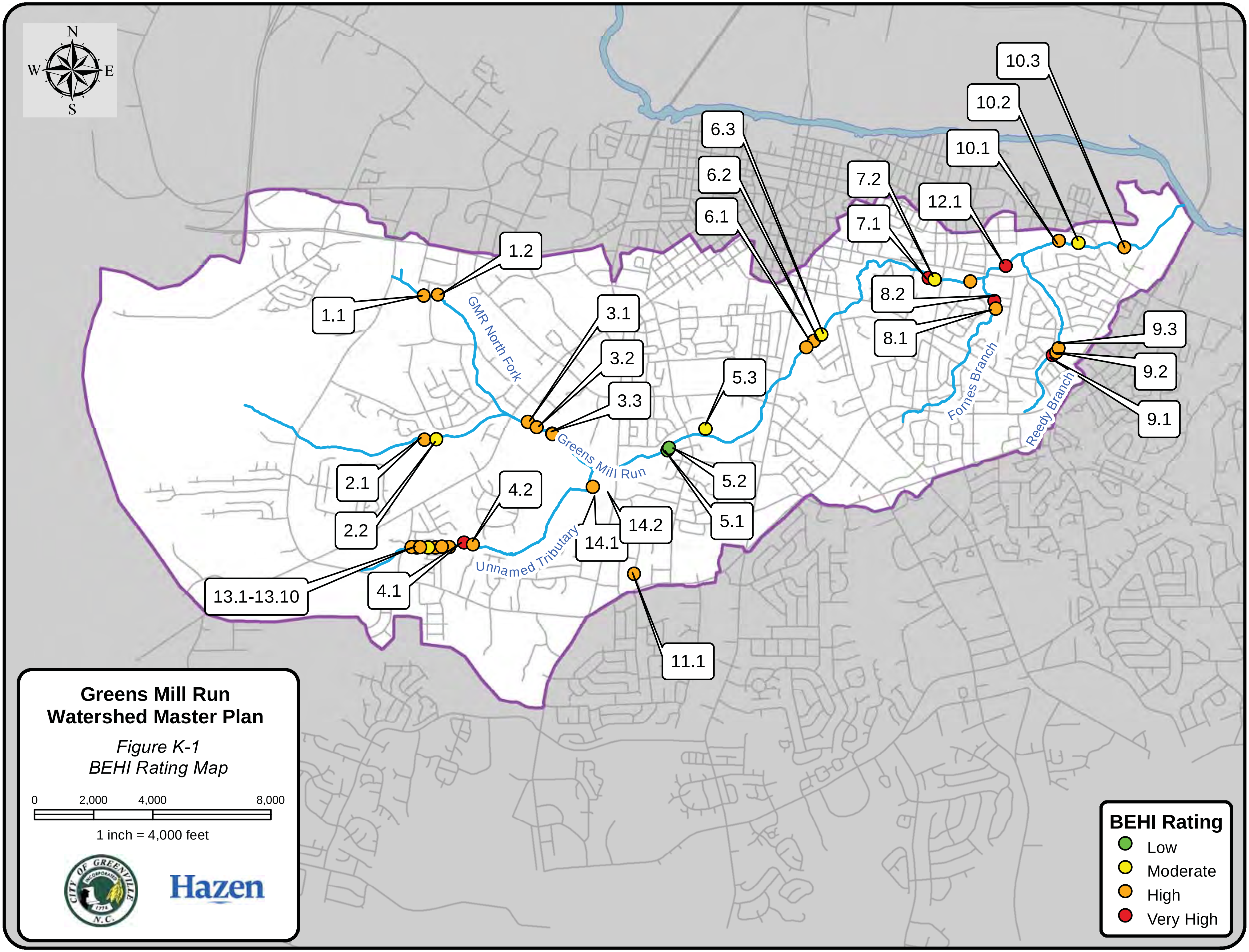

XS 14.1 (Golf Course) Right Bank


XS 14.2 (Golf Course) Left Bank


XS 14.2 (Golf Course) Looking Downstream


XS 14.2 (Golf Course) Looking Upstream

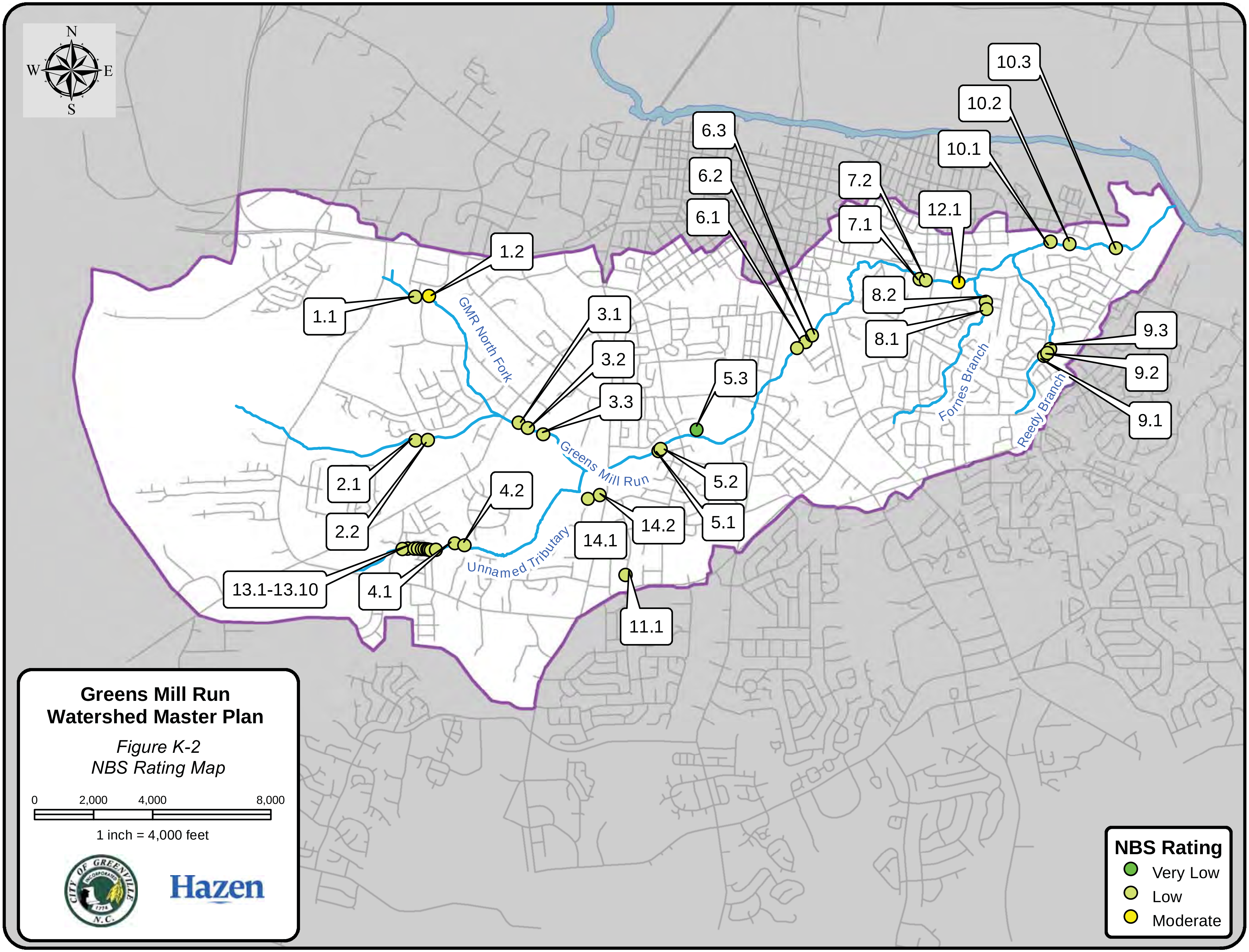
XS 14.2 (Golf Course) Right Bank



Greens Mill Run Watershed Master Plan

Figure K-1

BEHI Rating Map



Greens Mill Run Watershed Master Plan

Figure K-2
NBS Rating Map

Table K.3: BEHI and NBS Ratings

Location	Class	BEHI Score	BEHI Description	NBS	Predicted Erosion Rate (ft/yr)	Notes
1.1	E5	38.8	High	Low	0.10	Left
1.2	E5	30.5	High	Moderate	0.15	XS 1-2, Left
2.1	E5	32.2	High	Low	0.10	Right
2.2	E5	26.5	Moderate	Low	0.02	XS 2-2, Right
3.1	E5	34.3	High	Low	0.10	Left
3.2	E5	36.0	High	Low	0.10	XS 3-2, Right
3.3	E5	34.4	High	Low	0.10	Left
4.1	E5	40.0	Very High	Low	0.60	Right
4.2	E5	35.6	High	Low	0.10	XS 4-2, Left
5.1	E5	16.4	Low	Low	0.02	Right
5.2	E5	17.5	Low	Low	0.02	XS 5-2, Right
5.3	E5	20.0	Moderate	Very Low	0.01	Left
6.1	E5	35.6	High	Low	0.10	Left
6.2	E5	32.0	High	Low	0.10	Right
6.3	E5	23.5	Moderate	Low	0.02	XS-6-3, Right
7.1	G5	43.0	Very High	Low	0.60	Right
7.2	G5	21.0	Moderate	Low	0.02	XS 7-2, Right
8.1	E5	41.3	High	Low	0.10	XS 8-1,Right
8.2	E5	42.5	Very High	Low	0.60	Left
9.1	E5	42.3	Very High	Low	0.60	Right
9.2	E5	33.1	High	Low	0.10	Left
9.3	E5	34.9	High	Low	0.10	XS 9-3, Left
9.3	E5	32.6	High	Low	0.10	XS 9-3, Right
10.1	E5	36.5	High	Low	0.10	Left
10.1	E5	24.4	Moderate	Very Low	0.01	Right
10.2	E5	27.6	Moderate	Low	0.02	Left
10.2	E5	28.0	Moderate	Very Low	0.01	Right
10.3	E5	31.4	High	Low	0.10	Left
10.3	E5	33.8	High	Very Low	0.07	Right
11.1	G5	39.9	High	Low	0.10	Right
11.1	G5	39.7	High	Low	0.10	Left
12.1	G6	42.7	Very High	Low	0.60	Left
13.1	E5	38.3	High	Low	0.10	Right
13.2	E5	38.7	High	Low	0.10	Right
13.3	E5	30.5	High	Low	0.10	Right
13.4	E5	35.6	High	Low	0.10	Right
13.5	E5	35.1	High	Low	0.10	Right
13.6	E5	30.0	High	Low	0.10	Right
13.7	E5	32.0	High	Low	0.10	Right
13.8	E5	28.7	High	Low	0.10	Right
13.9	E5	32.8	High	Low	0.10	Right
13.10	E5	34.7	High	Low	0.10	Righ
14.1	E5	37.8	High	Low	0.10	Right
14.1	E5	30.9	High	Low	0.10	Right (2)
14.2	E5	27.1	Moderate	Low	0.02	Left

Table K.4: BEHI and NBS Location Data

Location	XS/BEHI and Bank	Latitude	Longitude
1.1	BEHI, Left	35.60152	-77.4178
1.2	XS 1-2, BEHI, Left	35.60158	-77.41621
2.1	BEHI, Right	35.58814	-77.41801
2.2	XS 2-2, BEHI, Right	35.58817	-77.41663
3.1	BEHI, Left	35.58964	-77.40622
3.2	XS 3-2, BEHI, Right	35.58912	-77.4052
3.3	BEHI, Left	35.5885	-77.40346
4.1	BEHI, Right	35.57849	-77.41371
4.2	XS 4-2, BEHI, Left	35.57829	-77.41266
5.1	BEHI, Right	35.58679	-77.39036
5.2	XS 5-2, BEHI, Right	35.58698	-77.39016
5.3	BEHI, Left	35.58871	-77.38599
6.1	BEHI, Left	35.59614	-77.37437
6.2	BEHI, Right	35.59672	-77.37344
6.3	XS-6-3, BEHI, Right	35.59733	-77.37265
7.1	BEHI, Right	35.60242	-77.36031
7.2	XS 7-2, BEHI, Right	35.60226	-77.35962
8.1	XS 8-1,BEHI, Right	35.59947	-77.35273
8.2	BEHI, Left	35.60017	-77.35283
9.1	BEHI, Right	35.59503	-77.34631
9.2	BEHI, Left	35.59532	-77.34591
9.3	XS 9-3, BEHI, Left	35.59568	-77.34560
9.3	XS 9-3, BEHI, Right	35.59568	-77.34560
10.1	BEHI, Left	35.60569	-77.34536
10.1	BEHI, Right	35.60569	-77.34536
10.2	BEHI, Left	35.60545	-77.34318
10.2	BEHI, Right	35.60545	-77.34318
10.3	BEHI, Left	35.60494	-77.33793
10.3	BEHI, Right	35.60494	-77.33793
11.1	XS 11.1 BEHI, Right	35.57536	-77.39427
11.1	XS 11.1 BEHI, Left	35.57546	-77.39418
12.1	XS 12.1 BEHI Left	35.60203	-77.35628
13.1	BEHI Right	35.57795	-77.41590
13.2	BEHI, Right	35.57791	-77.41644
13.3	BEHI, Right	35.57797	-77.41670
13.4	BEHI, Right	35.57801	-77.41688
13.5	BEHI, Right	35.57801	-77.41716
13.6	BEHI, Right	35.57805	-77.41797
13.7	BEHI, Right	35.57808	-77.41832
13.8	BEHI, Right	35.57811	-77.41908
13.9	BEHI, Right	35.57805	-77.41967
13.10	BEHI, Right	35.58715	-77.41997
14.1	XS 14.1 BEHI Right	35.58245	-77.39859
14.1	XS 14.1 BEHI Right (2)	35.58250	-77.39812
14.2	XS 14.2, BEHI Left	35.58277	-77.39718

Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 1.1 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	4.1 **(A)**	**Bankfull Height** (ft) =	4.1 **(B)**	(A) / (B) =	1.00 **(C)**	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.667 **(D)**	**Study Bank Height** (ft) =	4.1 **(A)**	(D) / (A) =	0.16 **(E)**	**7.8**

Weighted Root Density (G)

Root Density as **%** =	1 **(F)**	(F) × (E) =	0.16268 **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	125 **(H)**	**10.0**

Surface Protection (I)

Surface Protection as **%** =	1 **(I)**	**10.0**

Bank Material Adjustment:

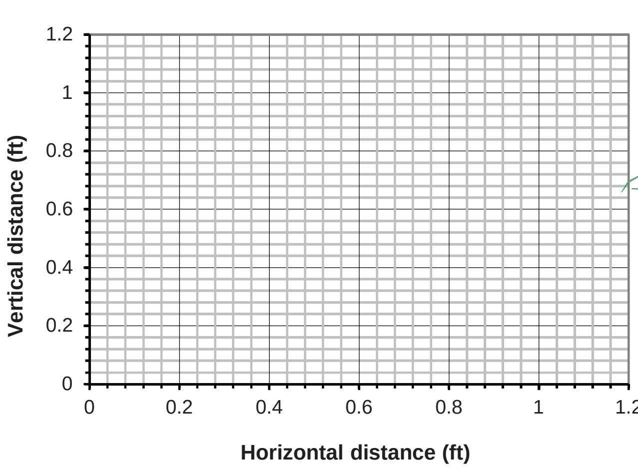
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

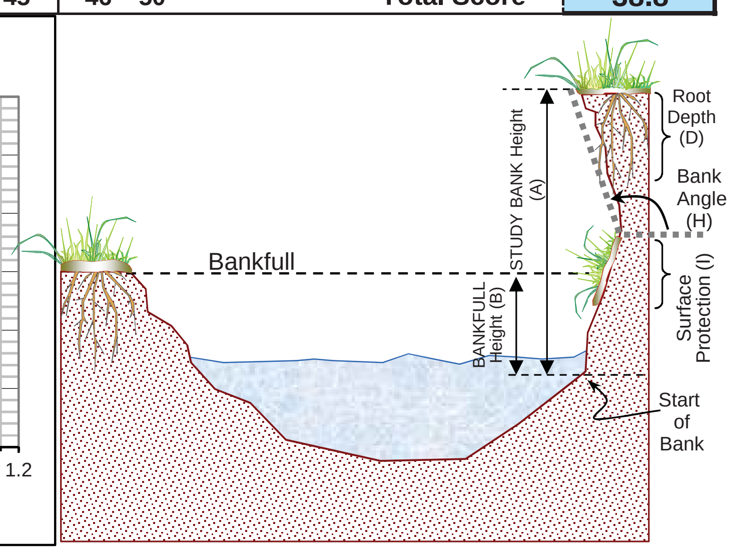
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **38.8**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 1.2 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**3.82** **(A)**	**Bankfull Height** (ft) =	**3.82** **(B)**	(A) / (B) =	**1.00** **(C)**	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**1** **(D)**	**Study Bank Height** (ft) =	**3.82** **(A)**	(D) / (A) =	**0.26** **(E)**	**6.4**

Weighted Root Density (G)

Root Density as **%** =	**8** **(F)**	(F) × (E) =	**2.09424** **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	**80** **(H)**	**5.9**

Surface Protection (I)

Surface Protection as **%** =	**20** **(I)**	**7.2**

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

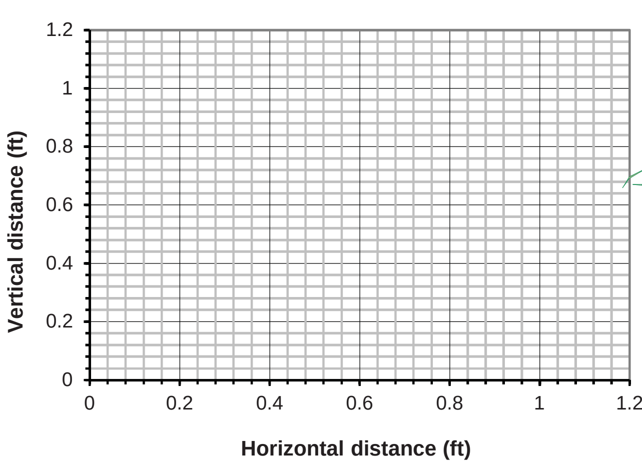
Bank Material Adjustment: **0**

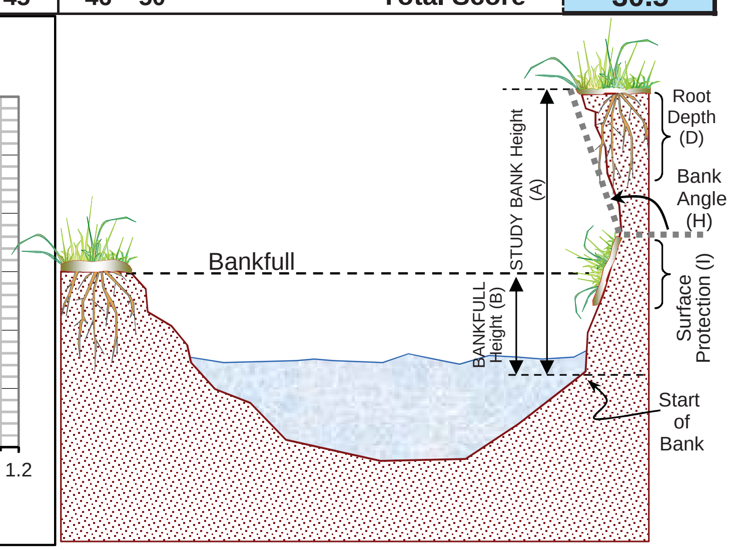
Stratification Adjustment

Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating	**High**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	and Total Score	**30.5**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 2.1 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	4.8 (A)	**Bankfull Height** (ft) =	4.8 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	1.5 (D)	**Study Bank Height** (ft) =	4.8 (A)	(D) / (A) =	0.31 (E)	5.8

Weighted Root Density (G)

Root Density as % =	20 (F)	(F) × (E) =	6.25 (G)	8.9

Bank Angle (H)

Bank Angle as *Degrees* =	110 (H)	8.7

Surface Protection (I)

Surface Protection as % =	15 (I)	7.9

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

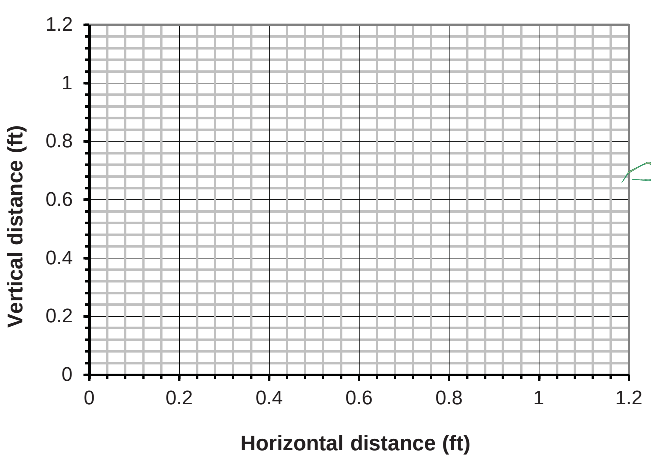
Bank Material Adjustment: 0

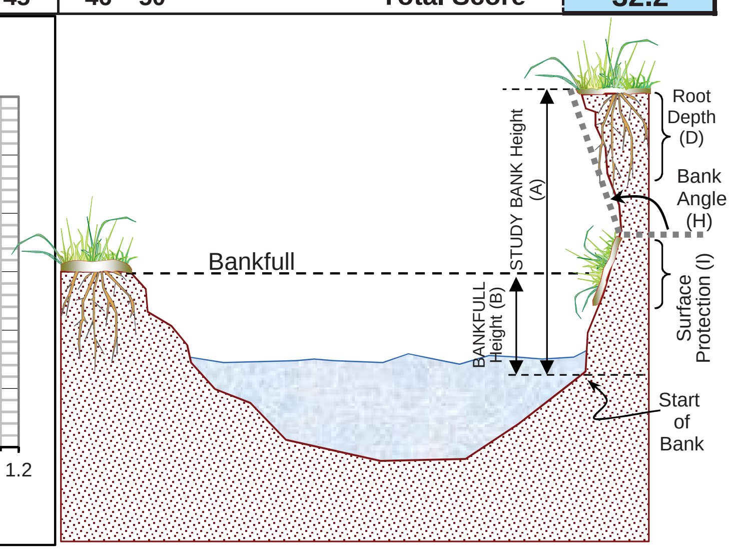
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **32.2**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 2.2 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.28 (A)	Bankfull Height (ft) =	5.28 (B)	(A) / (B) =	1.00 (C)	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.667 (D)	Study Bank Height (ft) =	5.28 (A)	(D) / (A) =	0.13 (E)	**8.1**

Weighted Root Density (G)

Root Density as % =	3 (F)	(F) × (E) =	0.37898 (G)	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	80 (H)	**5.9**

Surface Protection (I)

Surface Protection as % =	90 (I)	**1.5**

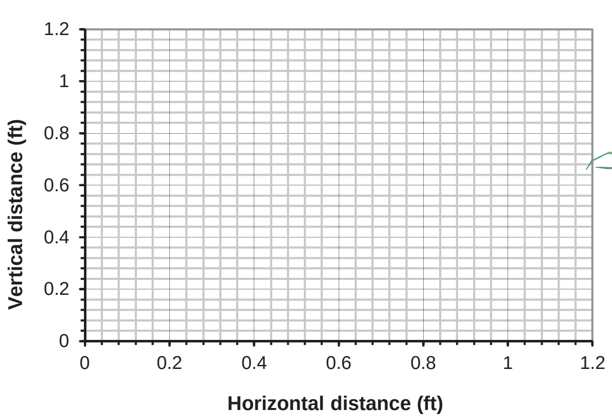
Bank Material Adjustment:

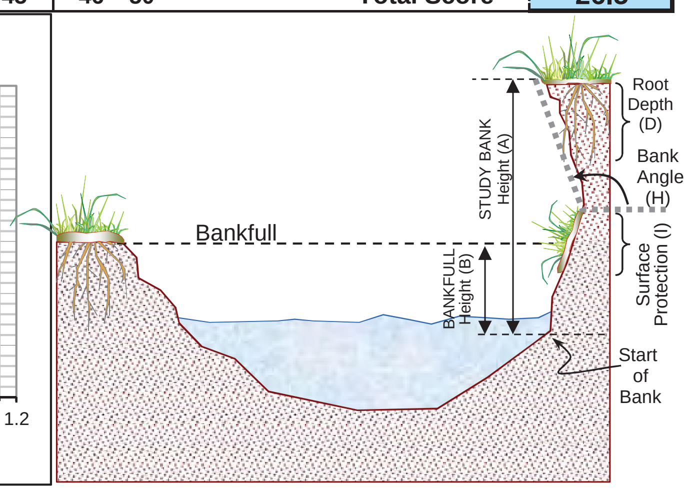
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

Bank Material Adjustment	**0**
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	**0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** / **26.5**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**		Location: **Greenville, NC**	
Station: **BEHI 3.1 08.05.14**		Observers: **KAB, MAM, AC, BM**	
Date: **08/05/14**	Stream Type: **E5**	Valley Type:	

Variable	Input 1	Input 2	Calculation	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 5.33 (A)	Bankfull Height (ft) = 5.33 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	Root Depth (ft) = 1 (D)	Study Bank Height (ft) = 5.33 (A)	(D) / (A) =	0.19 (E)	7.4
Weighted Root Density (G)		Root Density as % = 15 (F)	(F) × (E) =	2.81426 (G)	10.0
Bank Angle (H)			Bank Angle as *Degrees* =	80 (H)	5.9
Surface Protection (I)			Surface Protection as % =	1 (I)	10.0

Bank Material Adjustment:

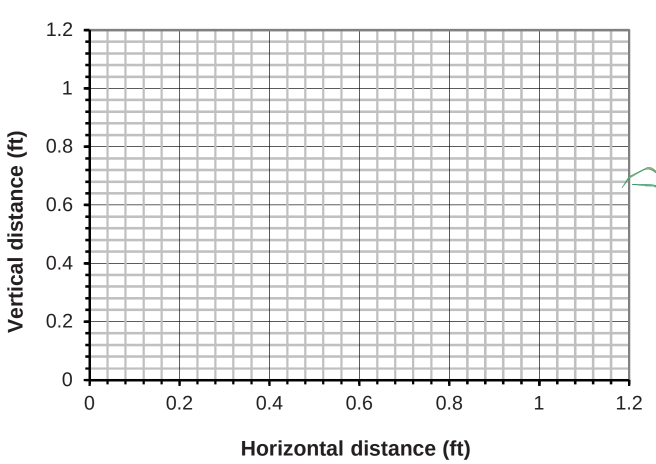
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

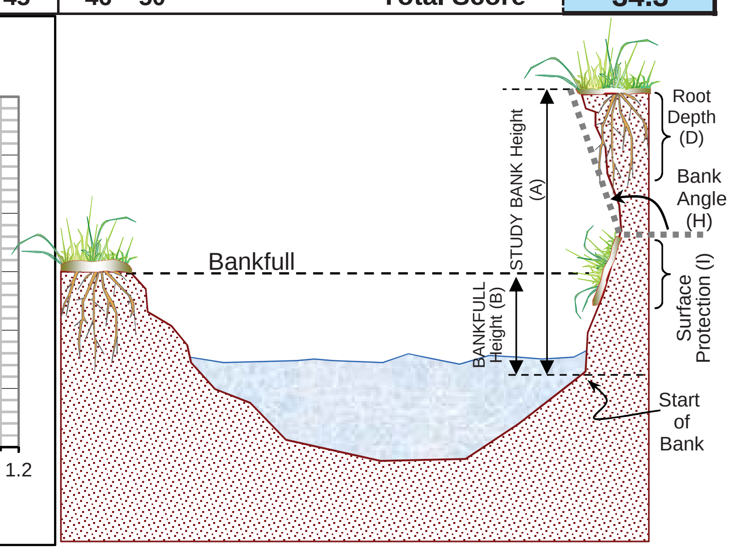
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **34.3**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 3.2 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.13 (A)	Bankfull Height (ft) =	5.13 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.667 (D)	Study Bank Height (ft) =	5.13 (A)	(D) / (A) =	0.13 (E)	8.1

Weighted Root Density (G)

Root Density as % =	3 (F)	(F) × (E) =	0.39006 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	85 (H)	6.8

Surface Protection (I)

Surface Protection as % =	5 (I)	10.0

Bank Material Adjustment:

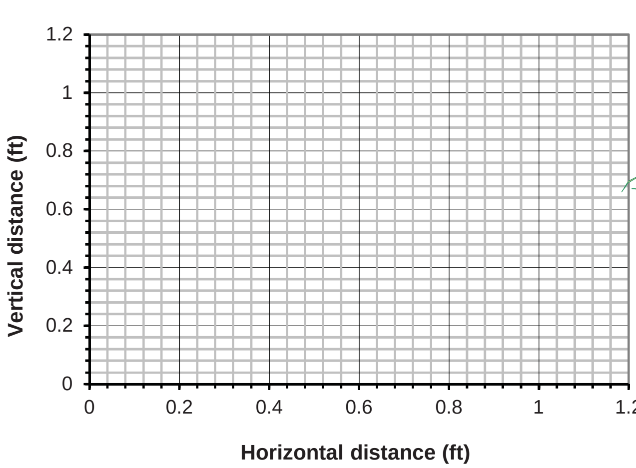
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

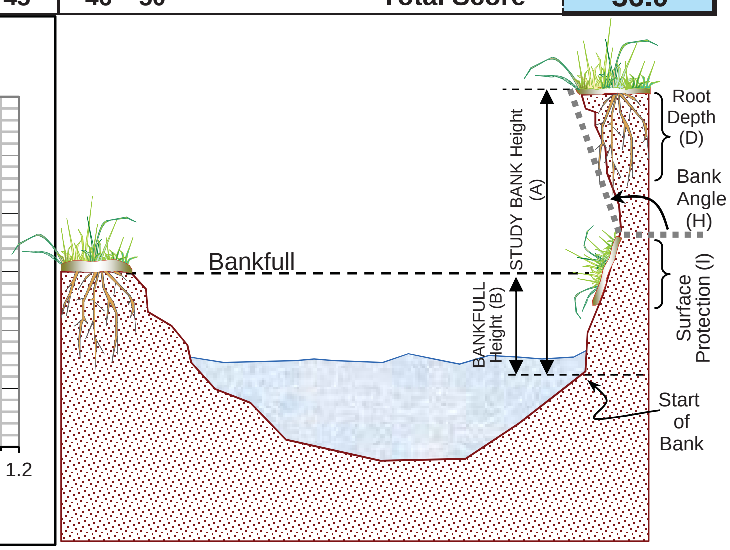
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating	**High**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	and Total Score	**36.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 3.3 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	4 (A)	**Bankfull Height** (ft) =	4 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	1 (D)	**Study Bank Height** (ft) =	4 (A)	(D) / (A) =	0.25 (E)	6.5

Weighted Root Density (G)

Root Density as % =	15 (F)	(F) × (E) =	3.75 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	85 (H)	6.8

Surface Protection (I)

Surface Protection as % =	5 (I)	10.0

Bank Material Adjustment:

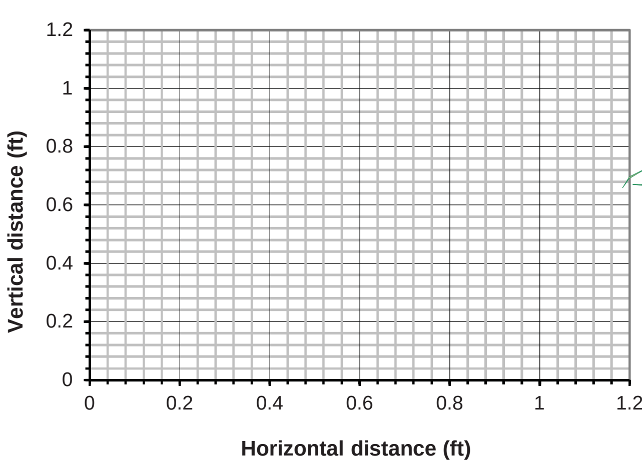
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

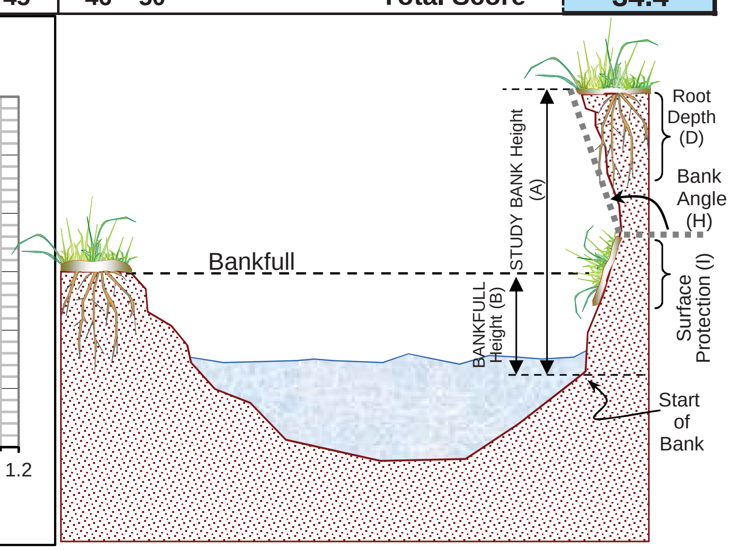
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **34.4**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**		Location: **Greenville, NC**	
Station: **BEHI 4.1 08.05.14**		Observers: **KAB, MAM, AC, BM**	
Date: **08/05/14**	Stream Type: **E5**	Valley Type:	

Variable	Input 1	Input 2	Calculation	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 5.7 (A)	Bankfull Height (ft) = 4.4 (B)	(A) / (B) =	1.30 (C)	4.6
Root Depth / Study Bank Height (E)	Root Depth (ft) = 1.5 (D)	Study Bank Height (ft) = 5.7 (A)	(D) / (A) =	0.26 (E)	6.4
Weighted Root Density (G)		Root Density as % = 20 (F)	(F) × (E) =	5.26316 (G)	9.0
Bank Angle (H)			Bank Angle as *Degrees* =	135 (H)	10.0
Surface Protection (I)			Surface Protection as % =	5 (I)	10.0

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

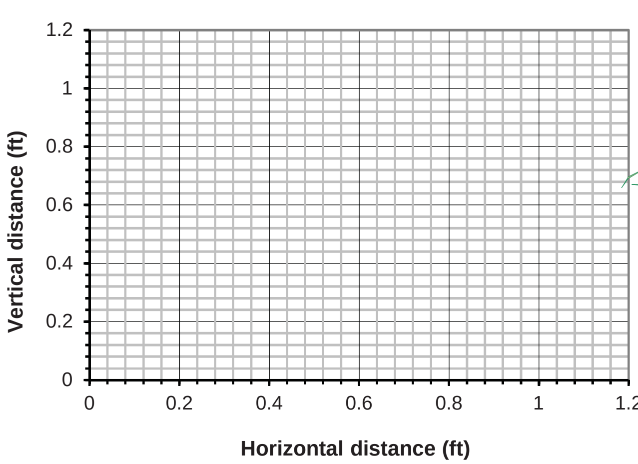
Bank Material Adjustment: 0

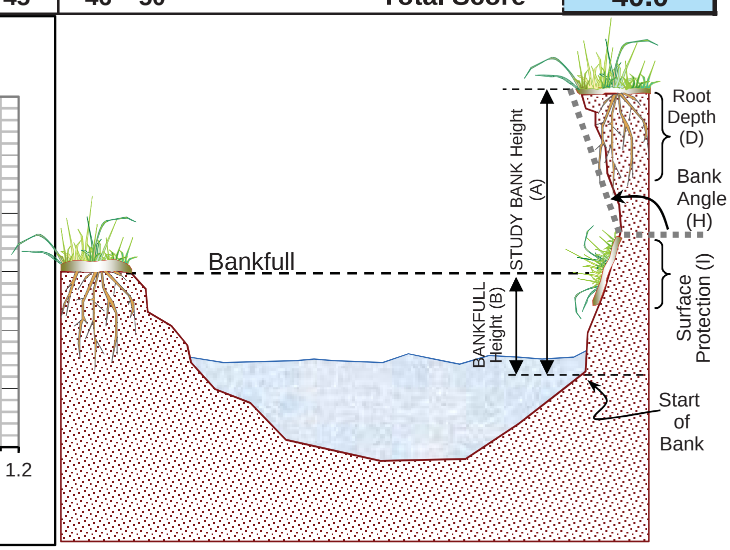
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: **Very High** — **40.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 4.2 08.05.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/05/14**	Stream Type: **E5**	Valley Type:

Variable	Input 1	Input 2	Calculation	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) = **5.05** (A)	**Bankfull Height** (ft) = **4.79** (B)	(A) / (B) =	**1.05** (C)	**1.5**
Root Depth / Study Bank Height (E)	**Root Depth** (ft) = **0.333** (D)	**Study Bank Height** (ft) = **5.05** (A)	(D) / (A) =	**0.07** (E)	**8.8**
Weighted Root Density (G)		**Root Density** as **%** = **5** (F)	(F) × (E) =	**0.3297** (G)	**10.0**
Bank Angle (H)			**Bank Angle** as *Degrees* =	**75** (H)	**5.4**
Surface Protection (I)			**Surface Protection** as **%** =	**5** (I)	**10.0**

Bank Material Adjustment:

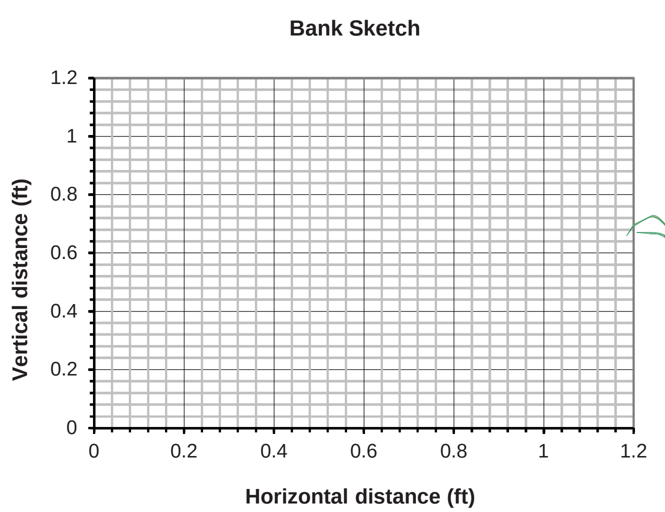
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

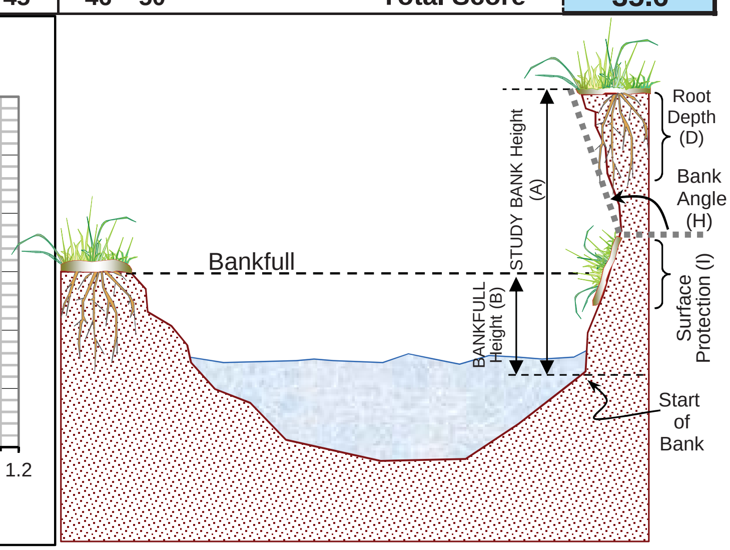
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **35.6**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 5.1 08.06.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/06/14**	Stream Type: **E5**	Valley Type:

Variable	Input	Input	Calculation	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) = 4.3 (A)	**Bankfull Height** (ft) = 4.3 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	**Root Depth** (ft) = 4 (D)	**Study Bank Height** (ft) = 4.3 (A)	(D) / (A) =	0.93 (E)	1.6
Weighted Root Density (G)		**Root Density** as % = 30 (F)	(F) × (E) =	27.907 (G)	6.2
Bank Angle (H)			**Bank Angle** as *Degrees* =	80 (H)	5.9
Surface Protection (I)			**Surface Protection** as % =	85 (I)	1.7

Bank Material Adjustment:

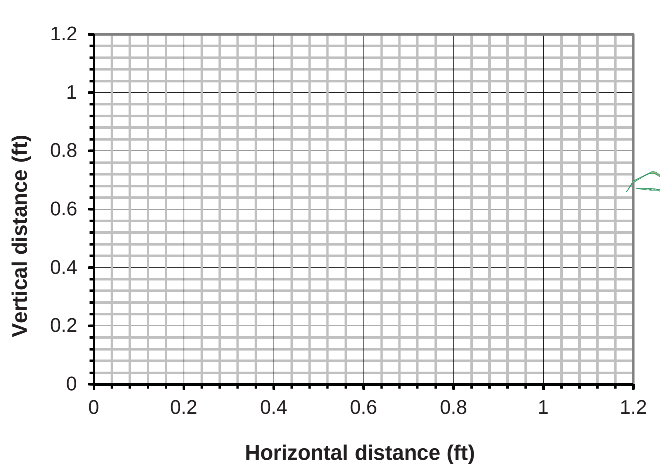
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

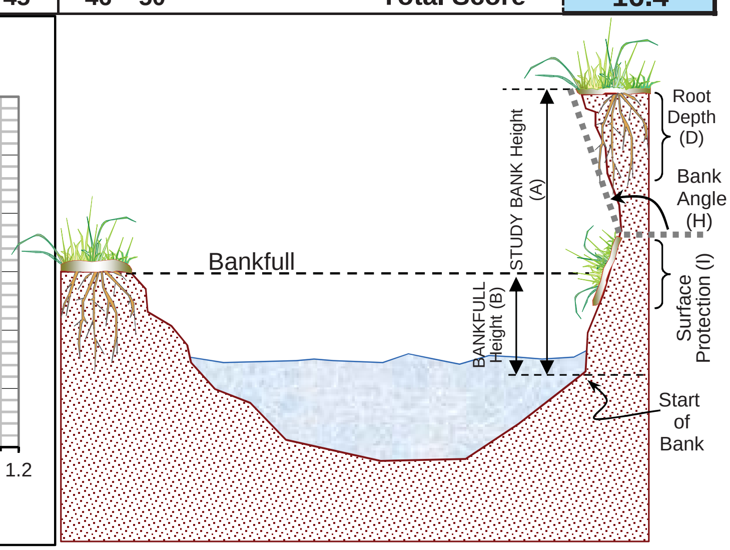
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Low** 16.4

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 5.2 08.06.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/06/14**	Stream Type: **E5**	Valley Type:

							BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) =	5.47 (A)	**Bankfull Height** (ft) =	5.47 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	**Root Depth** (ft) =	5.47 (D)	**Study Bank Height** (ft) =	5.47 (A)	(D) / (A) =	1.00 (E)	1.0
Weighted Root Density (G)			**Root Density** as % =	30 (F)	(F) × (E) =	30 (G)	5.9
Bank Angle (H)					**Bank Angle** as *Degrees* =	90 (H)	7.9
Surface Protection (I)					**Surface Protection** as % =	85 (I)	1.7

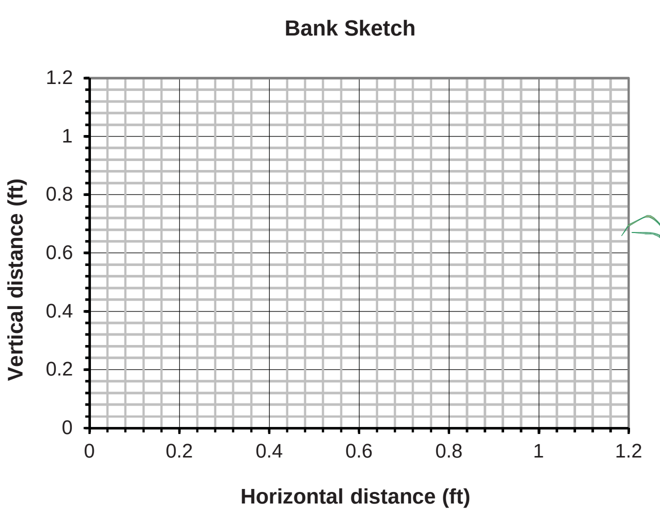
Bank Material Adjustment:

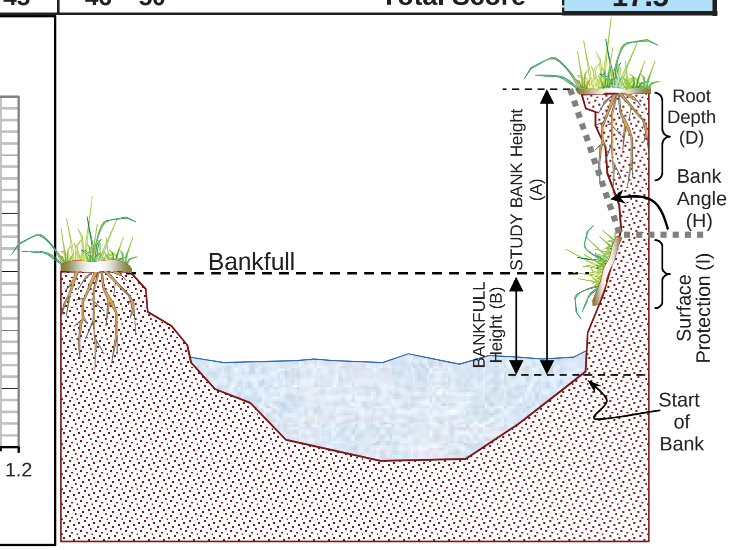
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	Low 17.5





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 5.3 08.06.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/06/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	3.85 (A)	Bankfull Height (ft) =	3.85 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	3 (D)	Study Bank Height (ft) =	3.85 (A)	(D) / (A) =	0.78 (E)	2.5

Weighted Root Density (G)

Root Density as % =	30 (F)	(F) × (E) =	23.3766 (G)	6.8

Bank Angle (H)

Bank Angle as *Degrees* =	75 (H)	5.4

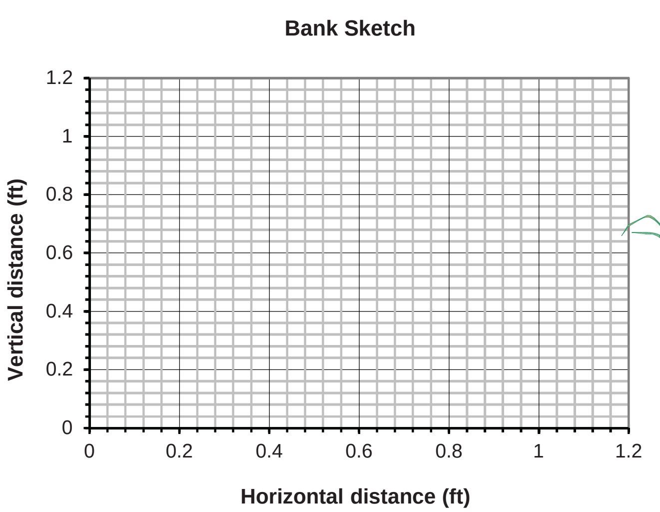
Surface Protection (I)

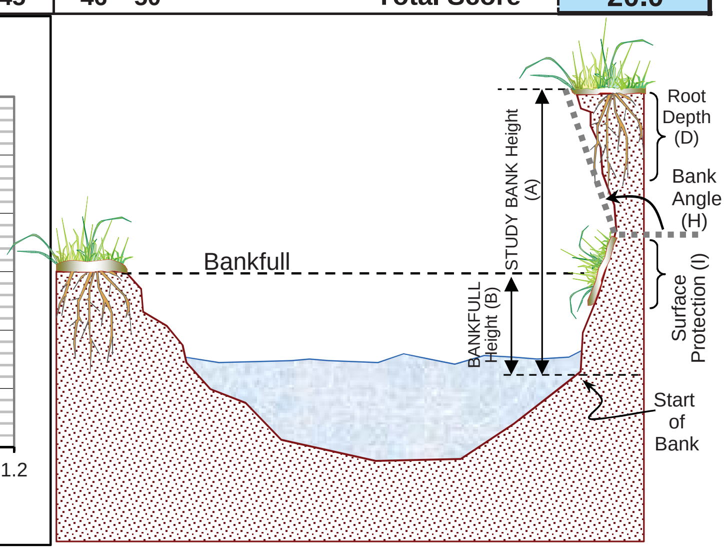
Surface Protection as % =	50 (I)	4.3

Bank Material Adjustment:
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment	0
Stratification Adjustment Add 5–10 points, depending on position of unstable layers in relation to bankfull stage	0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** **20.0**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R** Location: **Greenville, NC**

Station: **BEHI 6.1 08.06.14** Observers: **KAB, MAM, AC, BM**

Date: **08/06/14** Stream Type: **E5** Valley Type:

Variable	Inputs	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 3.57 (A); Bankfull Height (ft) = 3.57 (B); (A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	Root Depth (ft) = 1 (D); Study Bank Height (ft) = 3.57 (A); (D) / (A) =	0.28 (E)	6.1
Weighted Root Density (G)	Root Density as % = 5 (F); (F) × (E) =	1.40056 (G)	10.0
Bank Angle (H)	Bank Angle as *Degrees* =	105 (H)	8.5
Surface Protection (I)	Surface Protection as % =	2 (I)	10.0

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

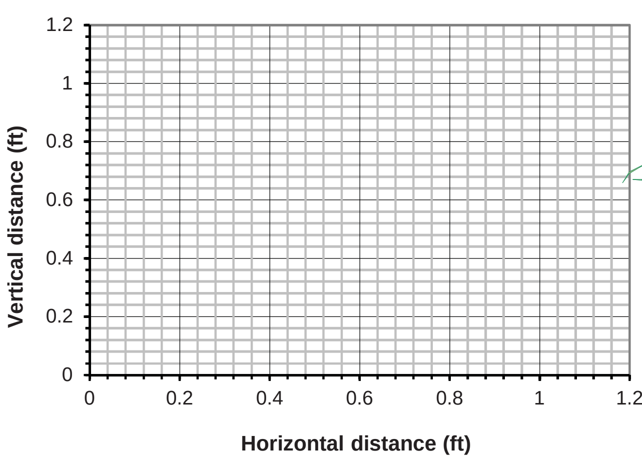
Bank Material Adjustment: 0

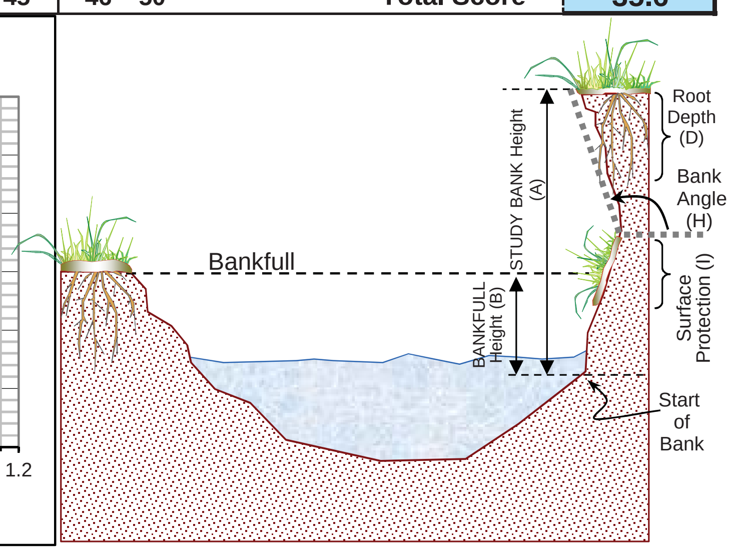
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** **35.6**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**		Location: **Greenville, NC**	
Station: **BEHI 6.2 08.06.14**		Observers: **KAB, MAM, AC, BM**	
Date: **08/06/14**	Stream Type: **E5**	Valley Type:	

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	3.05 (A)	Bankfull Height (ft) =	3.05 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	1 (D)	Study Bank Height (ft) =	3.05 (A)	(D) / (A) =	0.33 (E)	5.6

Weighted Root Density (G)

Root Density as % =	3 (F)	(F) x (E) =	0.98361 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	75 (H)	5.4

Surface Protection (I)

Surface Protection as % =	1 (I)	10.0

Bank Material Adjustment:

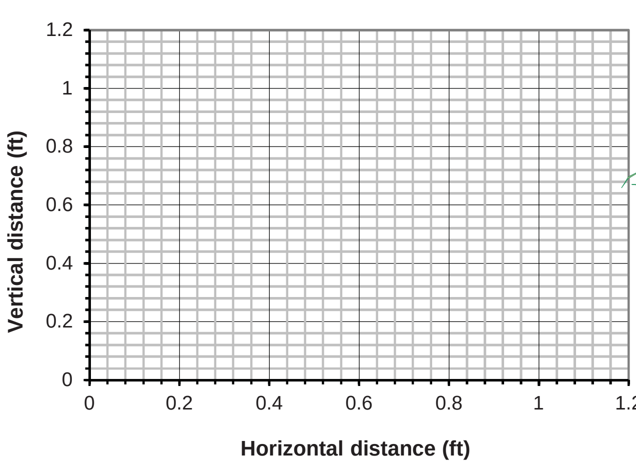
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

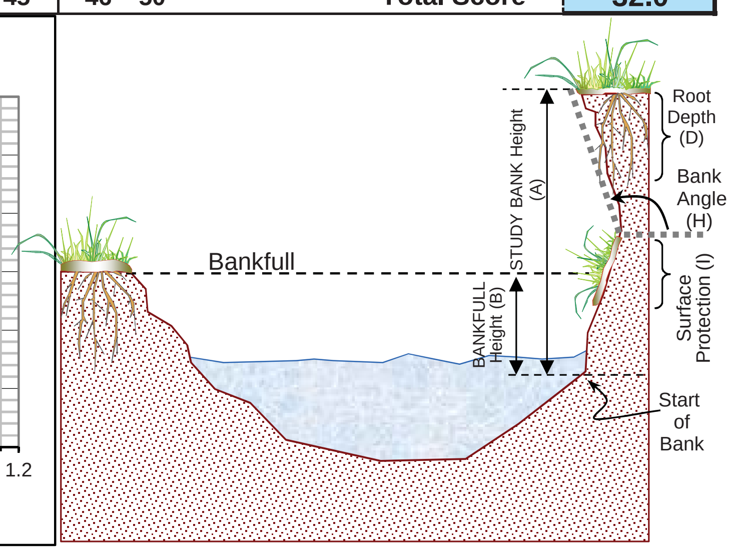
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **32.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**		Location: **Greenville, NC**	
Station: **BEHI 6.3 08.06.14**		Observers: **KAB, MAM, AC, BM**	
Date: **08/06/14**	Stream Type: **E5**	Valley Type:	

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	3.98 **(A)**	**Bankfull Height** (ft) =	3.98 **(B)**	(A) / (B) =	1.00 **(C)**	**1.0**
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	0.667 **(D)**	**Study Bank Height** (ft) =	3.98 **(A)**	(D) / (A) =	0.17 **(E)**	**7.6**
Weighted Root Density (G)						
		Root Density as % =	10 **(F)**	(F) × (E) =	1.67588 **(G)**	**10.0**
Bank Angle (H)						
				Bank Angle as *Degrees* =	45 **(H)**	**3.2**
Surface Protection (I)						
				Surface Protection as % =	85 **(I)**	**1.7**

Bank Material Adjustment:

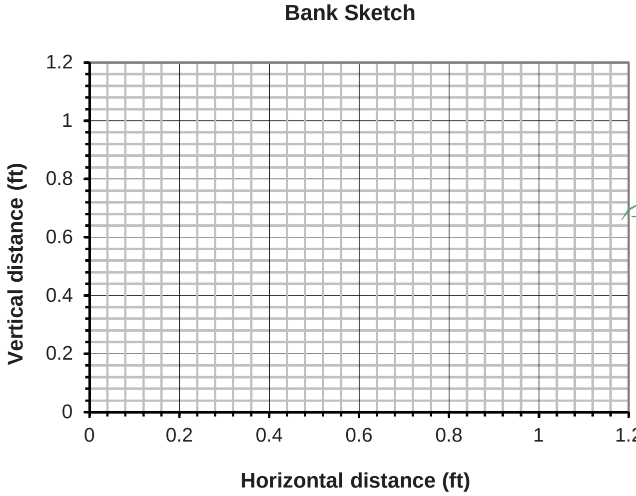
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

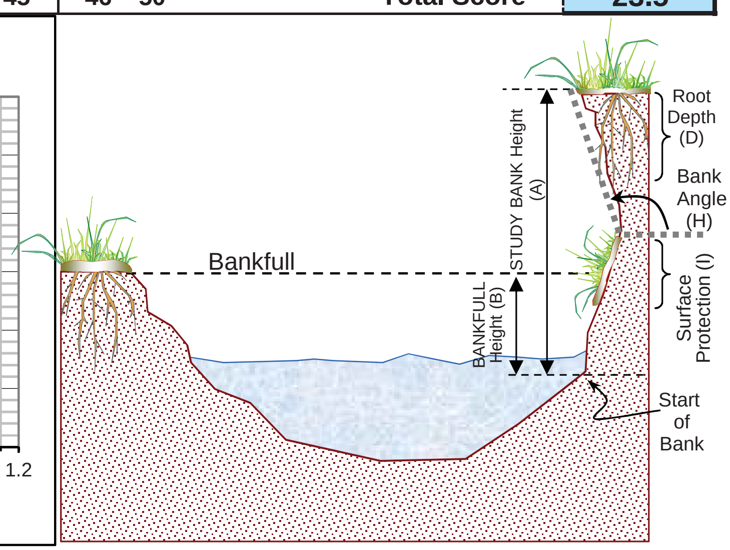
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** / **23.5**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 7.1 08.06.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/06/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	10.1 (A)	**Bankfull Height** (ft) =	5.81 (B)	(A) / (B) =	1.74 (C)	6.7

Root Depth / Study Bank Height (E)

Root Depth (ft) =	1 (D)	**Study Bank Height** (ft) =	10.1 (A)	(D) / (A) =	0.10 (E)	8.4

Weighted Root Density (G)

Root Density as % =	15 (F)	(F) × (E) =	1.48515 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	90 (H)	7.9

Surface Protection (I)

Surface Protection as % =	1 (I)	10.0

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment	0

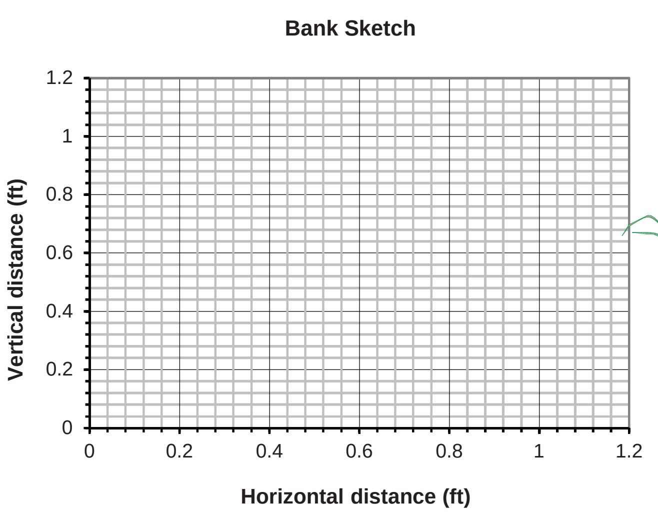
Stratification Adjustment

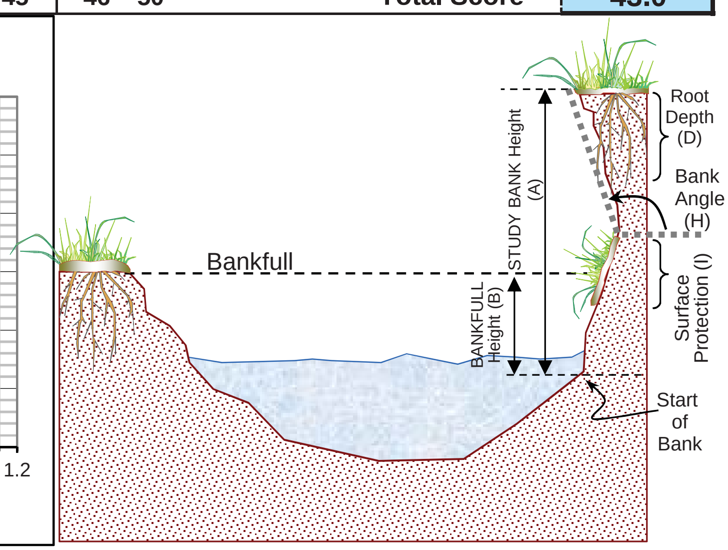
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage

Stratification Adjustment	0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating	**Very High**
and **Total Score**	**43.0**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 7.2 08.06.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/06/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	8.84 (A)	**Bankfull Height** (ft) =	5.67 (B)	(A) / (B) =	1.56 (C)	5.8

Root Depth / Study Bank Height (E)

Root Depth (ft) =	8.84 (D)	**Study Bank Height** (ft) =	8.84 (A)	(D) / (A) =	1.00 (E)	1.0

Weighted Root Density (G)

Root Density as **%** =	60 (F)	(F) × (E) =	60 (G)	3.5

Bank Angle (H)

Bank Angle as *Degrees* =	100 (H)	8.3

Surface Protection (I)

Surface Protection as **%** =	75 (I)	2.3

Bank Material Adjustment:

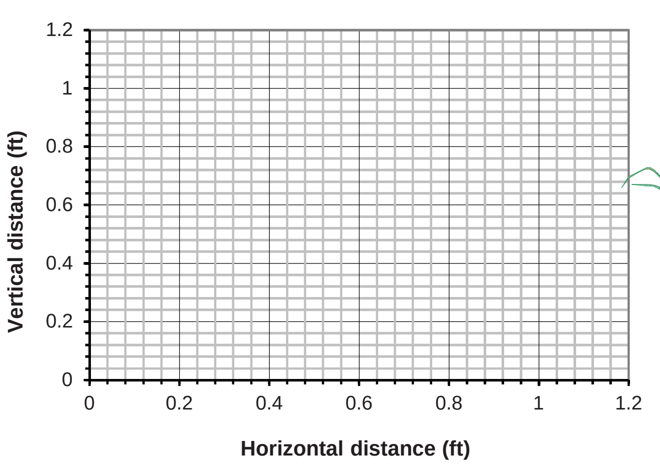
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

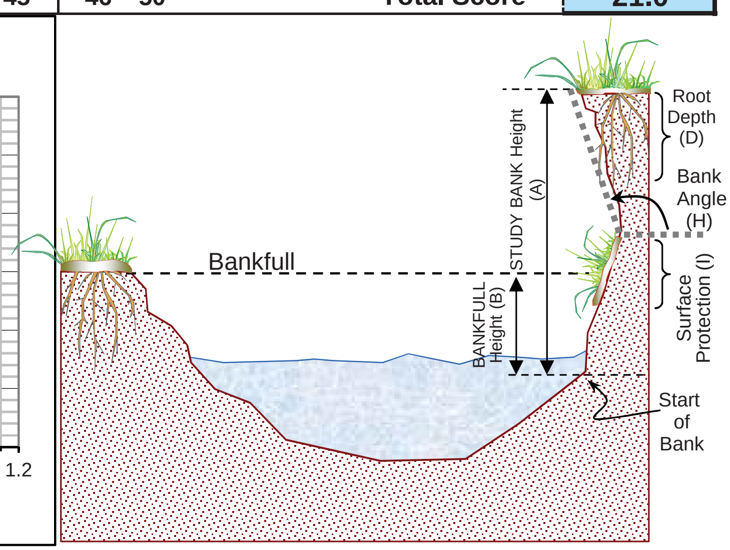
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** 21.0

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 8.1 08.11.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14**	Stream Type: **E5**	Valley Type:

Variable	Input 1	Value	Input 2	Value	Formula	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) =	8 **(A)**	**Bankfull Height** (ft) =	4.4 **(B)**	(A) / (B) =	1.82 **(C)**	**7.0**
Root Depth / Study Bank Height (E)	**Root Depth** (ft) =	0.5 **(D)**	**Study Bank Height** (ft) =	8 **(A)**	(D) / (A) =	0.06 **(E)**	**8.9**
Weighted Root Density (G)			**Root Density** as **%** =	1 **(F)**	(F) × (E) =	0.0625 **(G)**	**10.0**
Bank Angle (H)					**Bank Angle** as *Degrees* =	75 **(H)**	**5.4**
Surface Protection (I)					**Surface Protection** as **%** =	1 **(I)**	**10.0**

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

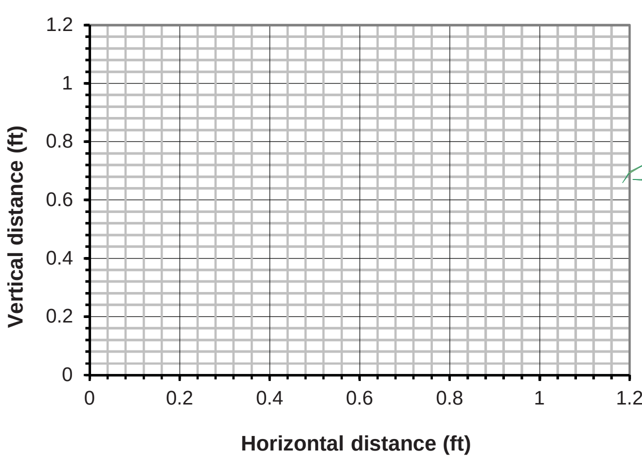
Bank Material Adjustment: **0**

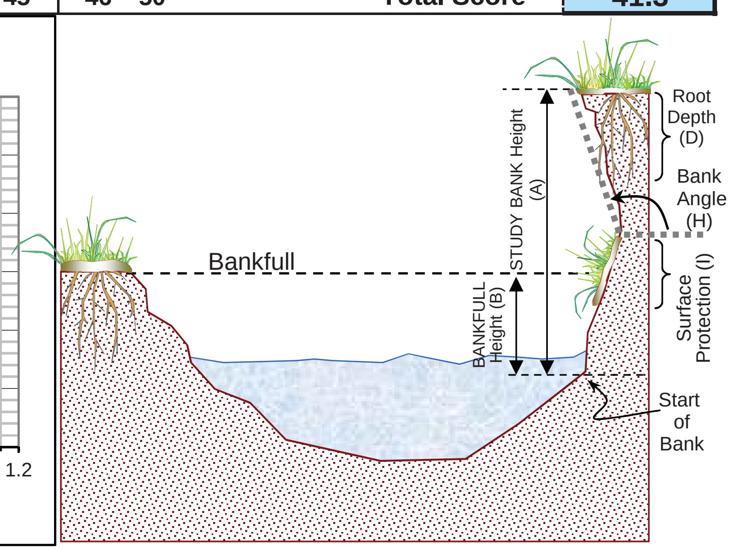
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: **Very High** **41.3**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 8.2 08.11.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**7.98** **(A)**	**Bankfull Height** (ft) =	**4.4** **(B)**	(A) / (B) =	**1.81** **(C)**	**7.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**0.667** **(D)**	**Study Bank Height** (ft) =	**7.98** **(A)**	(D) / (A) =	**0.08** **(E)**	**8.7**

Weighted Root Density (G)

Root Density as **%** =	**1** **(F)**	(F) × (E) =	**0.08358** **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	**85** **(H)**	**6.8**

Surface Protection (I)

Surface Protection as **%** =	**3** **(I)**	**10.0**

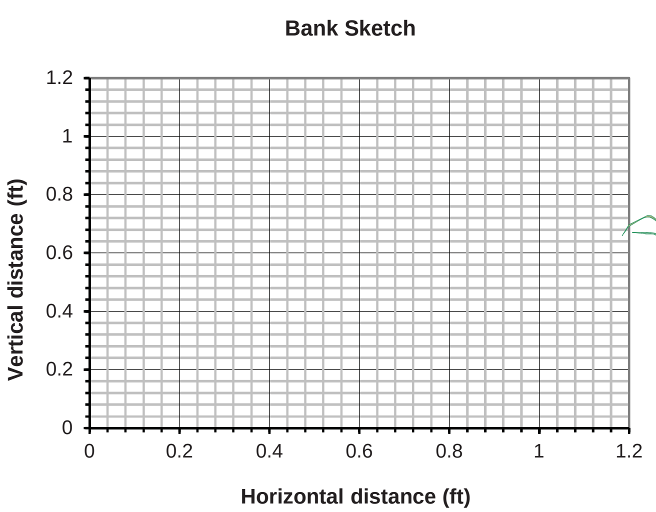
Bank Material Adjustment:

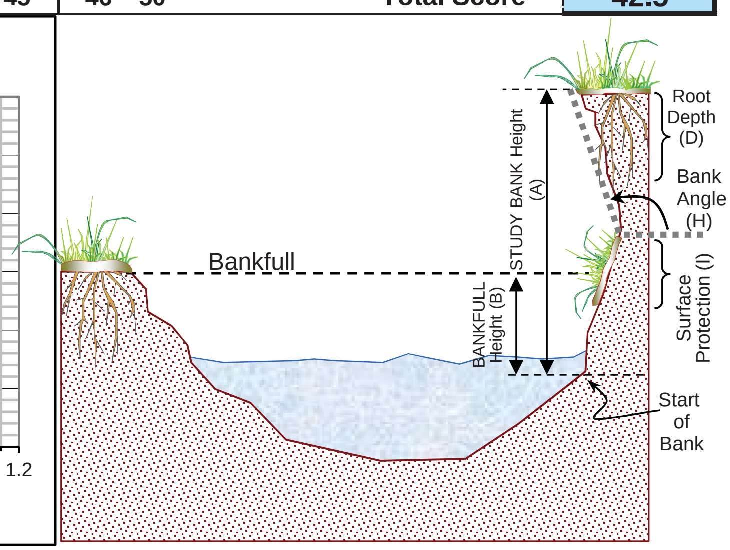
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	**10 – 19.5**	**20 – 29.5**	**30 – 39.5**	**40 – 45**	**46 – 50**	**Very High** / **42.5**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**		Location: **Greenville, NC**	
Station: **BEHI 9.1 08.11.14**		Observers: **KAB, MAM, AC, BM**	
Date: **08/11/14**	Stream Type: **E5**	Valley Type:	

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**8.61** (A)	**Bankfull Height** (ft) =	**4.19** (B)	(A) / (B) =	**2.05** (C)	**7.9**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**2.5** (D)	**Study Bank Height** (ft) =	**8.61** (A)	(D) / (A) =	**0.29** (E)	**6.0**

Weighted Root Density (G)

Root Density as **%** =	**8** (F)	(F) x (E) =	**2.32288** (G)	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	**100** (H)	**8.3**

Surface Protection (I)

Surface Protection as **%** =	**2** (I)	**10.0**

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment: **0**

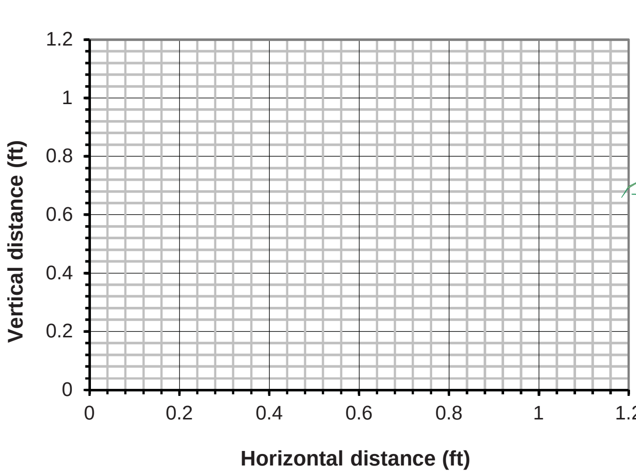
Stratification Adjustment

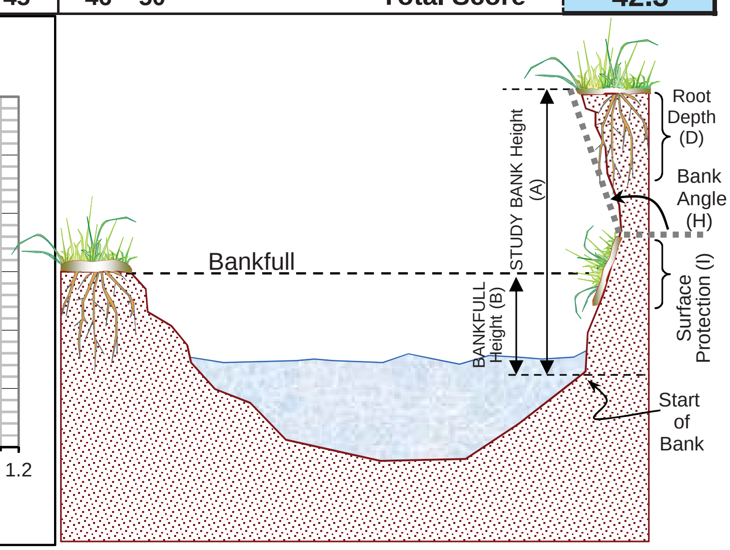
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and Total Score: **Very High** **42.3**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 9.2 08.11.14**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14**	Stream Type: **E5**	Valley Type:

Variable	Input	Input	Calculation	Value	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) = **10** (A)	**Bankfull Height** (ft) = **4.14** (B)	(A) / (B) =	**2.42** (C)	**8.5**
Root Depth / Study Bank Height (E)	**Root Depth** (ft) = **2.5** (D)	**Study Bank Height** (ft) = **10** (A)	(D) / (A) =	**0.25** (E)	**6.5**
Weighted Root Density (G)		**Root Density** as **%** = **8** (F)	(F) × (E) =	**2** (G)	**10.0**
Bank Angle (H)			**Bank Angle** as *Degrees* =	**75** (H)	**5.4**
Surface Protection (I)			**Surface Protection** as **%** =	**70** (I)	**2.7**

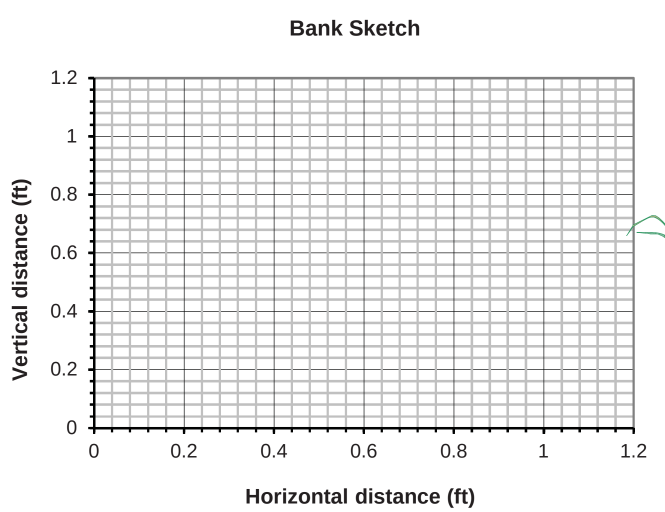
Bank Material Adjustment:

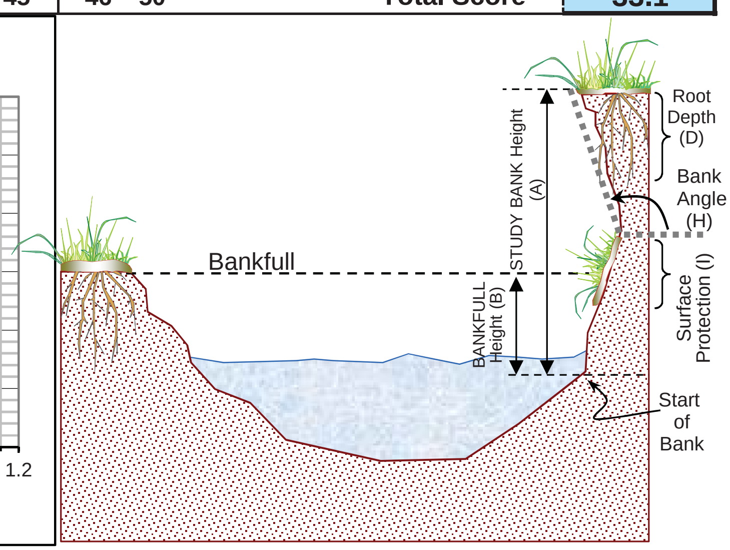
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **33.1**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 9.3 08.11.14 (L)**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14** Stream Type: **E5**	Valley Type:	

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**3.45 (A)**	**Bankfull Height** (ft) =	**3.45 (B)**	(A) / (B) =	**1.00 (C)**	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**0.75 (D)**	**Study Bank Height** (ft) =	**3.45 (A)**	(D) / (A) =	**0.22 (E)**	**7.0**

Weighted Root Density (G)

Root Density as **%** =	**3 (F)**	(F) × (E) =	**0.65217 (G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	**90 (H)**	**7.9**

Surface Protection (I)

Surface Protection as **%** =	**10 (I)**	**9.0**

Bank Material Adjustment:

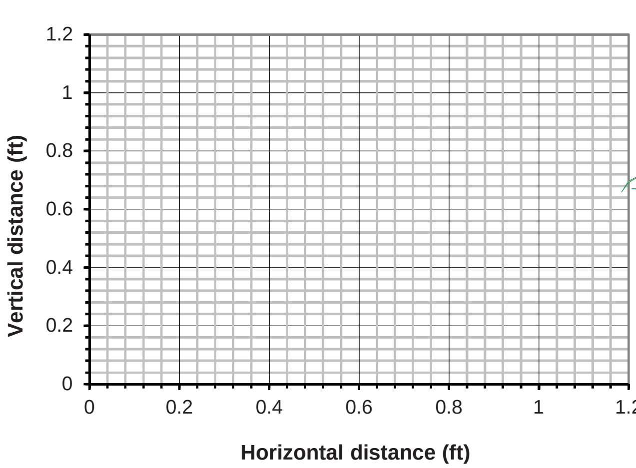
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

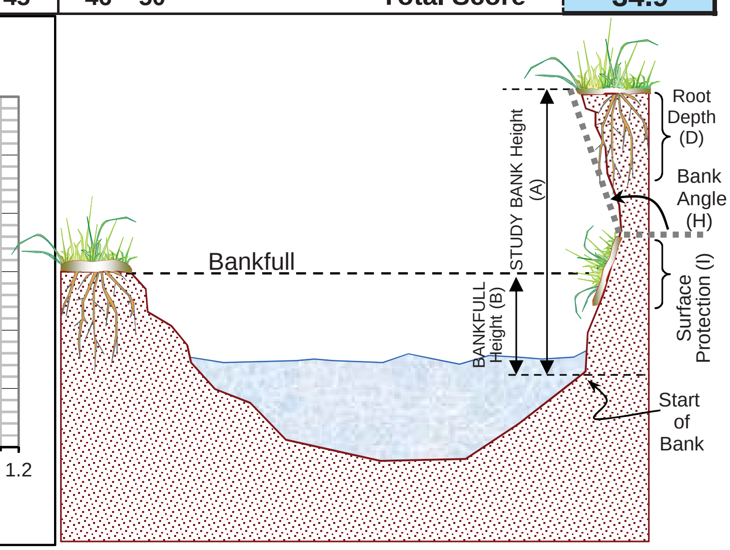
Bank Material Adjustment **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **34.9**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R** Location: **Greenville, NC**

Station: **BEHI 9.3 08.11.14 (R)** Observers: **KAB, MAM, AC, BM**

Date: **08/11/14** Stream Type: **E5** Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	4.37 **(A)**	**Bankfull Height** (ft) =	3.51 **(B)**	(A) / (B) =	1.25 **(C)**	4.3

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.75 **(D)**	**Study Bank Height** (ft) =	4.37 **(A)**	(D) / (A) =	0.17 **(E)**	7.6

Weighted Root Density (G)

Root Density as **%** =	15 **(F)**	(F) × (E) =	2.57437 **(G)**	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	90 **(H)**	7.9

Surface Protection (I)

Surface Protection as **%** =	70 **(I)**	2.7

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

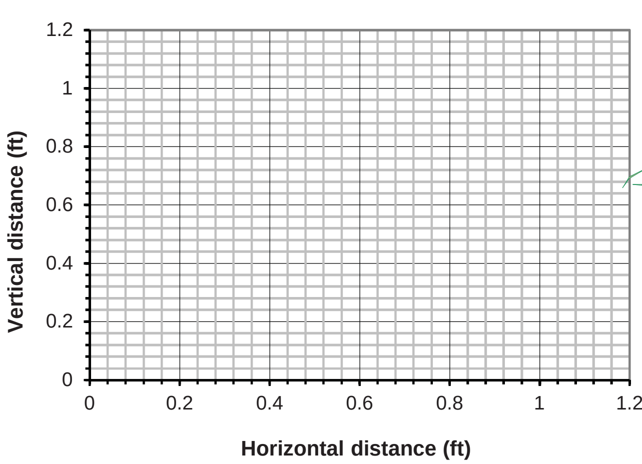
Bank Material Adjustment: 0

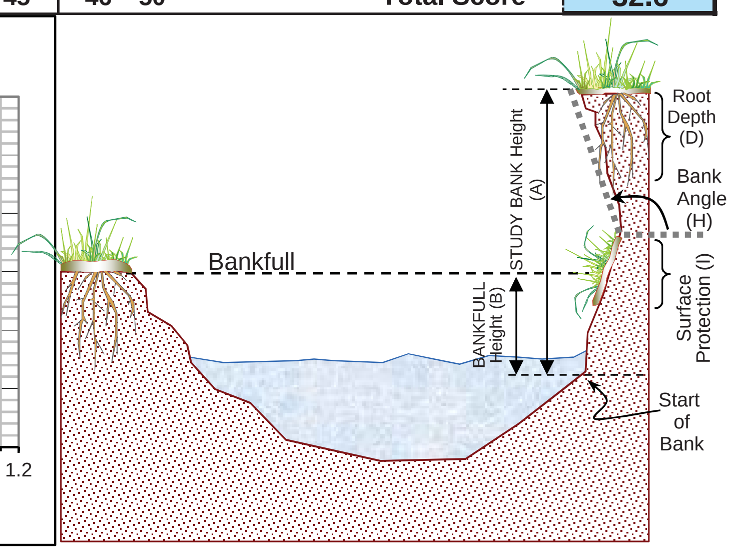
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **32.6**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 10.1 08.11.14 (L)**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14**	Stream Type: **E5**	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**7.74** (A)	**Bankfull Height** (ft) =	**7.74** (B)	(A) / (B) =	**1.00** (C)	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**1.5** (D)	**Study Bank Height** (ft) =	**7.74** (A)	(D) / (A) =	**0.19** (E)	**7.4**

Weighted Root Density (G)

Root Density as **%** =	**7** (F)	(F) × (E) =	**1.35659** (G)	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	**95** (H)	**8.1**

Surface Protection (I)

Surface Protection as **%** =	**5** (I)	**10.0**

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

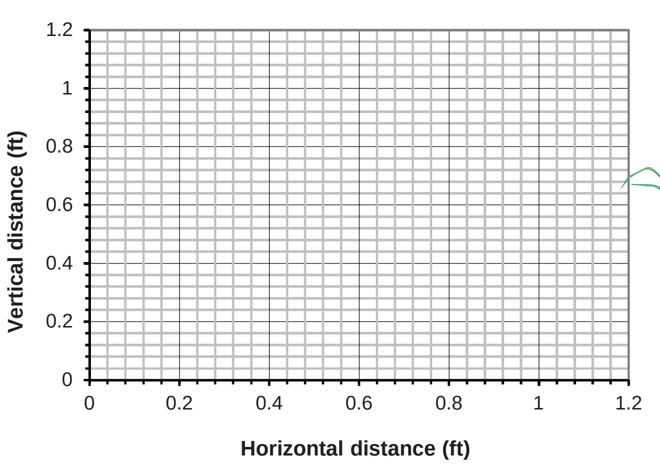
Bank Material Adjustment: **0**

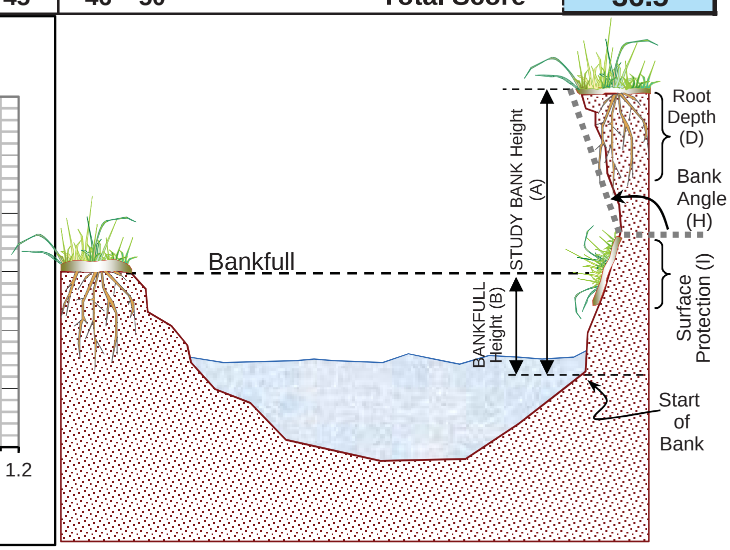
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **36.5**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**	Location: **Greenville, NC**
Station: **BEHI 10.1 08.11.14 (R)**	Observers: **KAB, MAM, AC, BM**
Date: **08/11/14** Stream Type: **E5**	Valley Type:

Variable	Inputs	Calculation	Value	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 8.35 (A); Bankfull Height (ft) = 7.74 (B)	(A) / (B) =	1.08 (C)	1.7
Root Depth / Study Bank Height (E)	Root Depth (ft) = 7.5 (D); Study Bank Height (ft) = 8.35 (A)	(D) / (A) =	0.90 (E)	1.9
Weighted Root Density (G)	Root Density as % = 25 (F)	(F) × (E) =	22.4551 (G)	6.9
Bank Angle (H)	Bank Angle as *Degrees* =		70 (H)	4.9
Surface Protection (I)	Surface Protection as % =		10 (I)	9.0

Bank Material Adjustment:

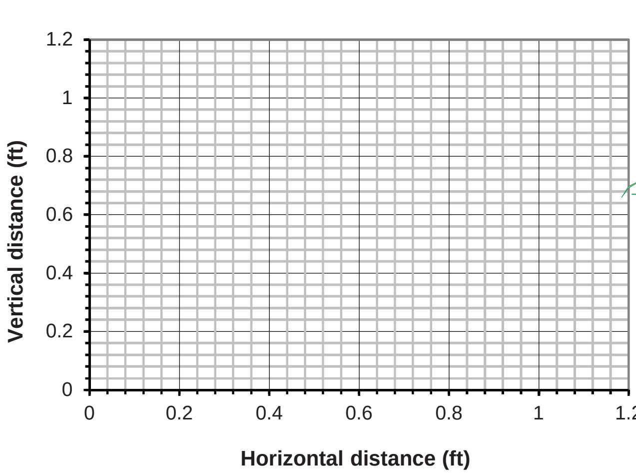
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

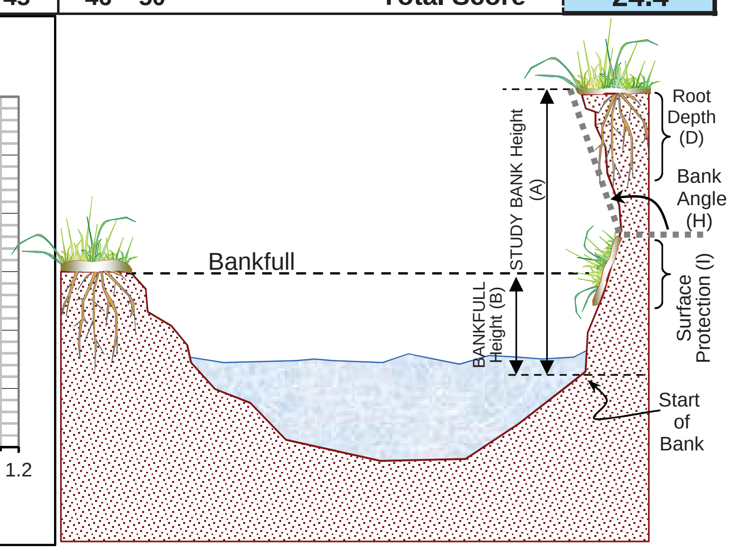
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** 24.4

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R** Location: **Greenville, NC**

Station: **BEHI 10.2 08.11.14 (L)** Observers: **KAB, MAM, AC, BM**

Date: **08/11/14** Stream Type: **E5** Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	7.05 (A)	Bankfull Height (ft) =	6.55 (B)	(A) / (B) =	1.08 (C)	1.7

Root Depth / Study Bank Height (E)

Root Depth (ft) =	2 (D)	Study Bank Height (ft) =	7.05 (A)	(D) / (A) =	0.28 (E)	6.1

Weighted Root Density (G)

Root Density as % =	15 (F)	(F) × (E) =	4.25532 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	67.5 (H)	4.7

Surface Protection (I)

Surface Protection as % =	40 (I)	5.1

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

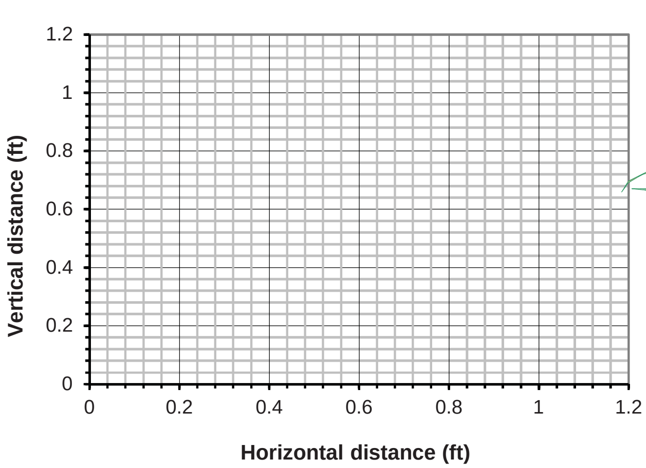
Bank Material Adjustment: 0

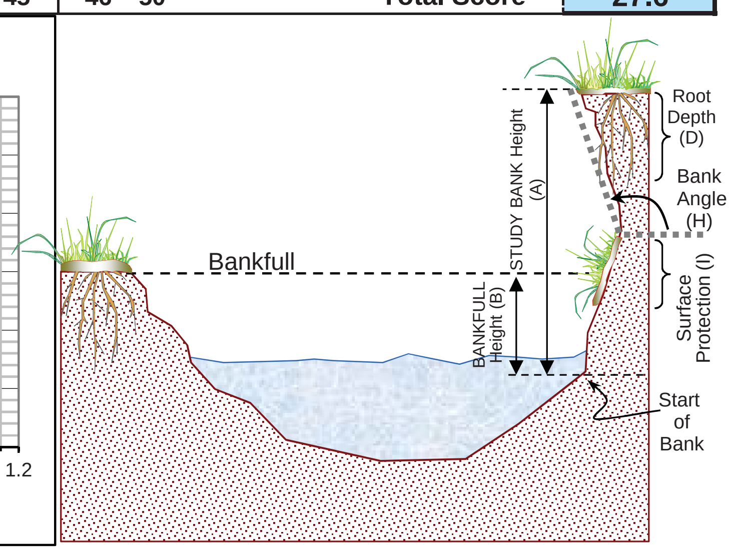
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **Moderate** **27.6**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greens Mill Run, Reach - Greens Mill R**	Location:	**Greenville, NC**
Station:	**BEHI 10.2 08.11.14 (R)**	Observers:	**KAB, MAM, AC, BM**
Date:	**08/11/14** Stream Type: **E5**	Valley Type:	

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.76 **(A)**	**Bankfull Height** (ft) =	5.76 **(B)**	(A) / (B) =	1.00 **(C)**	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	3 **(D)**	**Study Bank Height** (ft) =	5.76 **(A)**	(D) / (A) =	0.52 **(E)**	**3.8**

Weighted Root Density (G)

Root Density as **%** =	3 **(F)**	(F) × (E) =	1.5625 **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	45 **(H)**	**3.2**

Surface Protection (I)

Surface Protection as **%** =	3 **(I)**	**10.0**

Bank Material Adjustment:

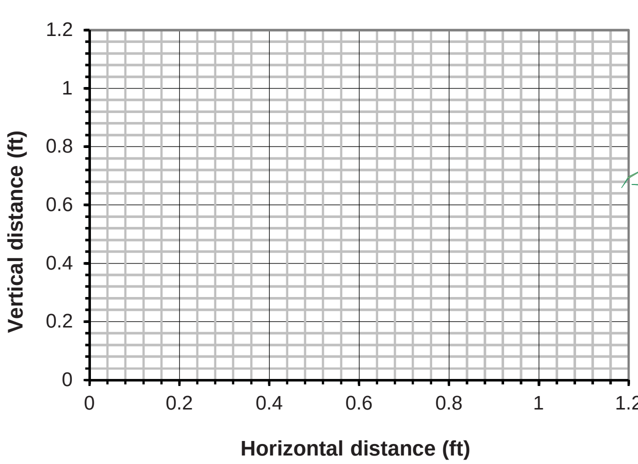
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

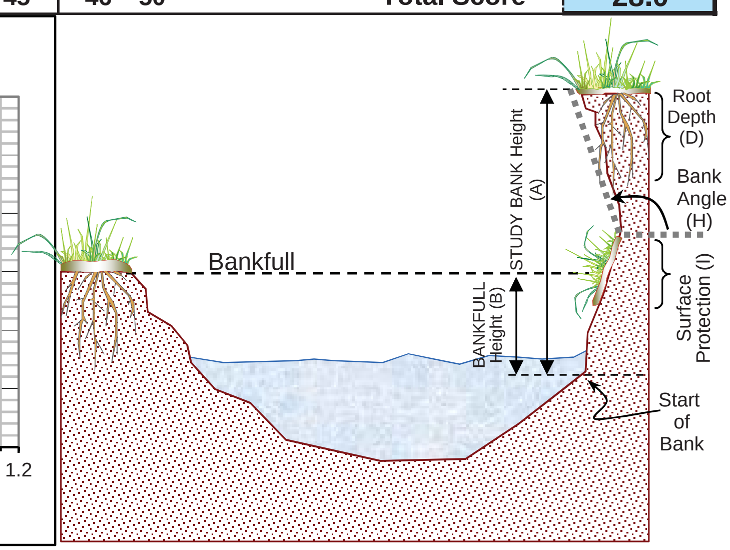
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** **28.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R** Location: **Greenville, NC**

Station: **BEHI 10.3 08.11.14 (L)** Observers: **KAB, MAM, AC, BM**

Date: **08/11/14** Stream Type: **E5** Valley Type:

Variable	Input 1	Input 2	Calculation	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 6.67 (A)	Bankfull Height (ft) = 6.67 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	Root Depth (ft) = 1.5 (D)	Study Bank Height (ft) = 6.67 (A)	(D) / (A) =	0.22 (E)	7.0
Weighted Root Density (G)		Root Density as % = 10 (F)	(F) × (E) =	2.24888 (G)	10.0
Bank Angle (H)			Bank Angle as *Degrees* =	65 (H)	4.4
Surface Protection (I)			Surface Protection as % =	10 (I)	9.0

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

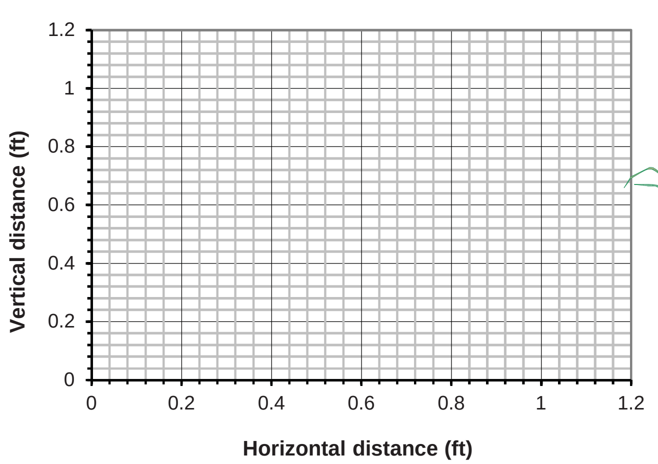
Bank Material Adjustment: 0

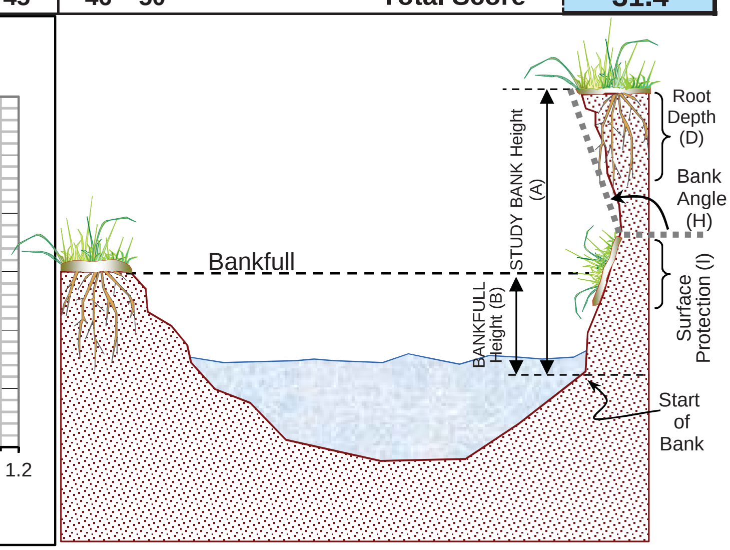
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **31.4**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run, Reach - Greens Mill R**	Location: **Greenville, NC**
Station: **BEHI 10.3 08.11.14 (R)**	Observers: **KAB, MAM, AC, BM**
Date: **08/11/14** Stream Type: **E5**	Valley Type:

Variable	Input 1	Value	Input 2	Value	Formula	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) =	6.72 (A)	Bankfull Height (ft) =	6.72 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)	Root Depth (ft) =	1.5 (D)	Study Bank Height (ft) =	6.72 (A)	(D) / (A) =	0.22 (E)	7.0
Weighted Root Density (G)			Root Density as % =	10 (F)	(F) x (E) =	2.23214 (G)	10.0
Bank Angle (H)					Bank Angle as *Degrees* =	85 (H)	6.8
Surface Protection (I)					Surface Protection as % =	10 (I)	9.0

Bank Material Adjustment:

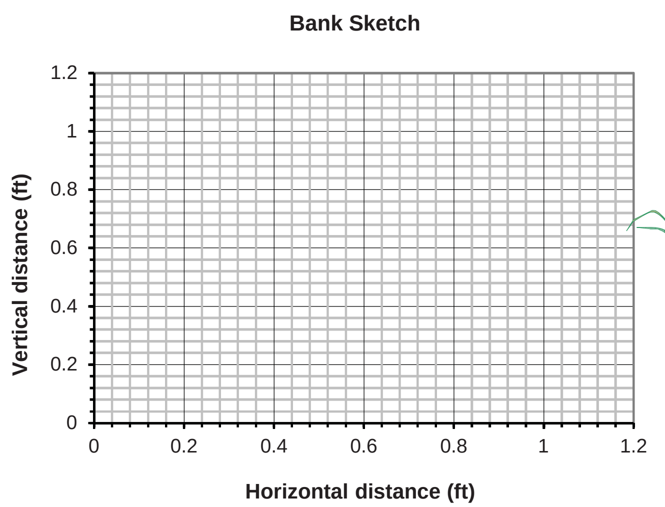
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

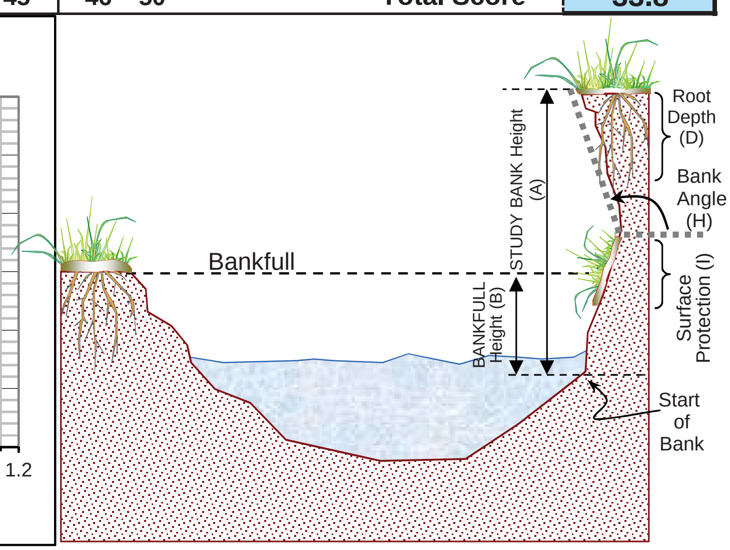
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **33.8**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**BEHI 11.1 10.06.15 (L)**	Observers:	**KAB, MAM, AC, BM**
Date:	**10/06/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	7.1 (A)	Bankfull Height (ft) =	2.5 (B)	(A) / (B) =	2.84 (C)	10.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	7.1 (D)	Study Bank Height (ft) =	7.1 (A)	(D) / (A) =	1.00 (E)	1.0

Weighted Root Density (G)

Root Density as % =	1 (F)	(F) × (E) =	1 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	55 (H)	3.7

Surface Protection (I)

Surface Protection as % =	5 (I)	10.0

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

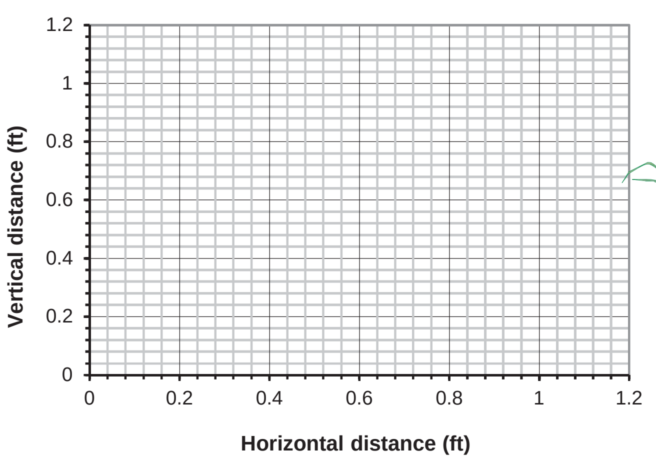
Bank Material Adjustment 5

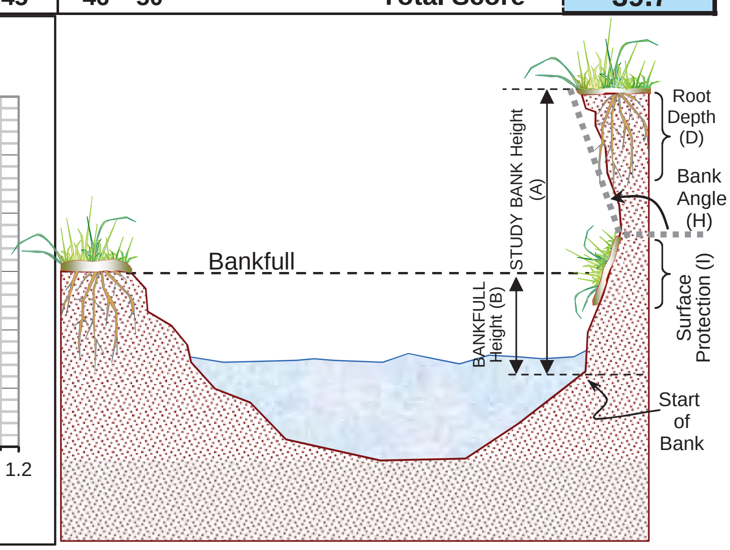
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage
0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** **39.7**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **BEHI 11.1 10.06.15 (R)** Observers: **KAB, MAM, AC, BM**

Date: **10/06/15** Stream Type: Valley Type:

Variable	Input 1	Input 2	Formula	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 8 (A)	Bankfull Height (ft) = 2.5 (B)	(A) / (B) =	3.20 (C)	10.0
Root Depth / Study Bank Height (E)	Root Depth (ft) = 7.1 (D)	Study Bank Height (ft) = 8 (A)	(D) / (A) =	0.89 (E)	2.0
Weighted Root Density (G)		Root Density as % = 3 (F)	(F) × (E) =	2.6625 (G)	10.0
Bank Angle (H)			Bank Angle as *Degrees* =	40 (H)	2.9
Surface Protection (I)			Surface Protection as % =	0 (I)	10.0

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

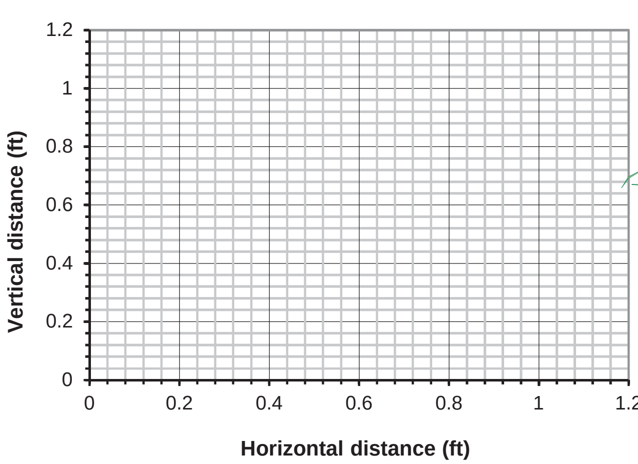
Bank Material Adjustment: 5

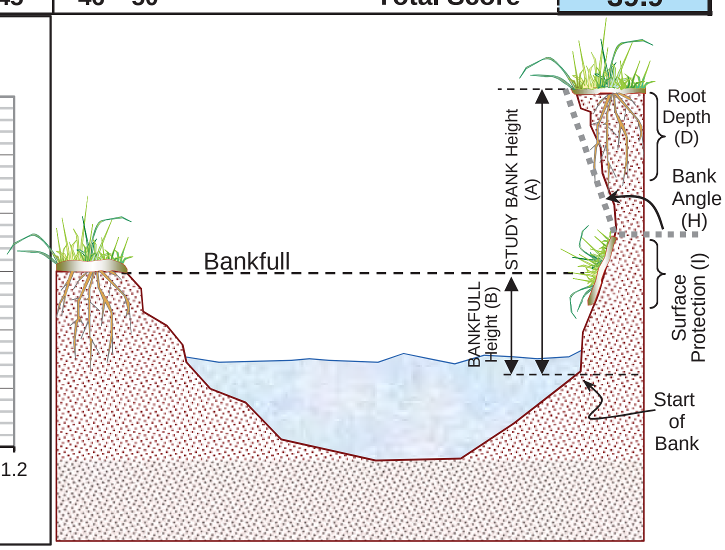
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **39.9**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**Greensmill Run (Greenway Site 12)**	Location:	**Greenville, NC**
Station:	**12.1 XS-1 BEHI 1L**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	10 (A)	Bankfull Height (ft) =	4.31 (B)	(A) / (B) =	2.32 (C)	8.3

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.5 (D)	Study Bank Height (ft) =	10 (A)	(D) / (A) =	0.05 (E)	9.0

Weighted Root Density (G)

Root Density as % =	1 (F)	(F) × (E) =	0.05 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	75 (H)	5.4

Surface Protection (I)

Surface Protection as % =	1 (I)	10.0

Bank Material Adjustment:

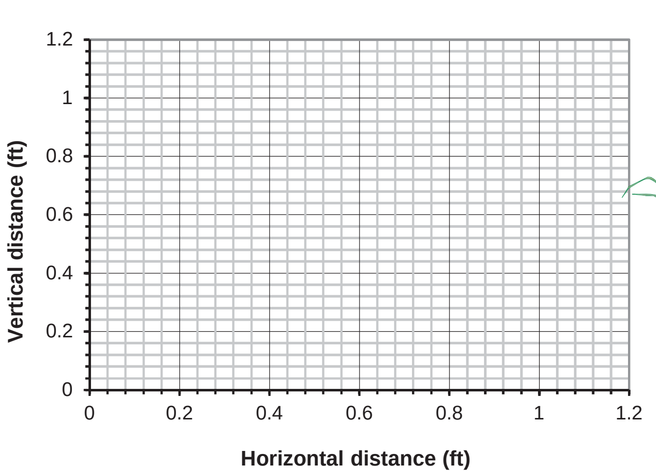
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

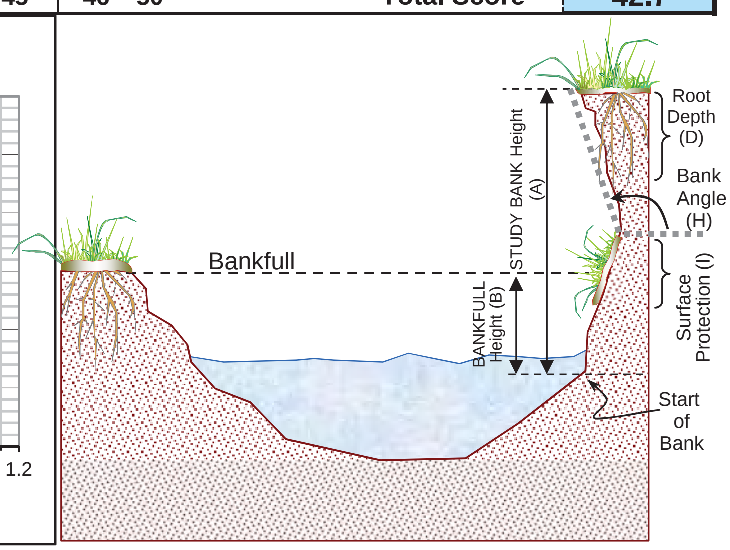
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Very High** 42.7

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**
Station: **13.1 BEHI 1 R**	Observers: **Krouse, Crissman**
Date: **12/17/15** Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	6.5 (A)	Bankfull Height (ft) =	3 (B)	(A) / (B) =	2.17 (C)	8.1

Root Depth / Study Bank Height (E)

Root Depth (ft) =	3 (D)	Study Bank Height (ft) =	6.5 (A)	(D) / (A) =	0.46 (E)	4.3

Weighted Root Density (G)

Root Density as % =	1 (F)	(F) × (E) =	0.46154 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	80 (H)	5.9

Surface Protection (I)

Surface Protection as % =	0 (I)	10.0

Bank Material Adjustment:

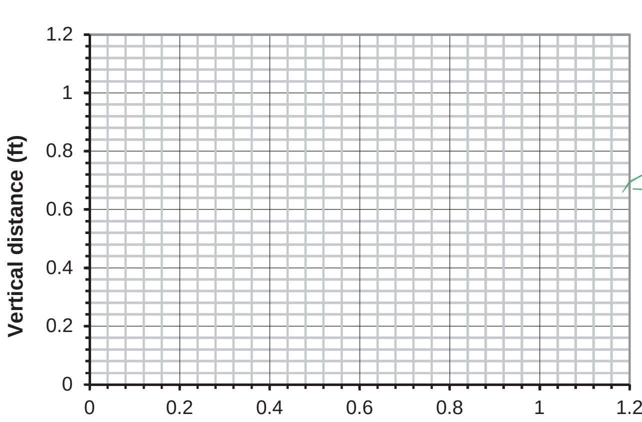
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

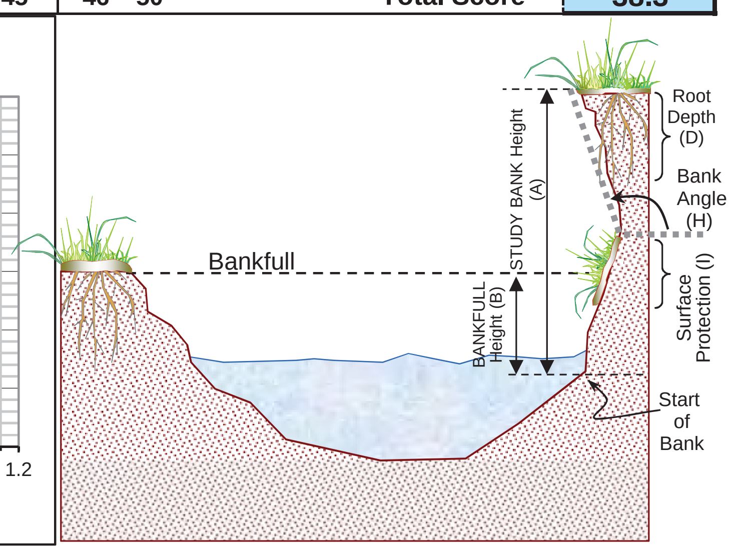
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** **38.3**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**13.2 BEHI 2R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5 **(A)**	**Bankfull Height** (ft) =	3 **(B)**	(A) / (B) =	1.67 **(C)**	**6.3**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.5 **(D)**	**Study Bank Height** (ft) =	5 **(A)**	(D) / (A) =	0.10 **(E)**	**8.4**

Weighted Root Density (G)

Root Density as **%** =	5 **(F)**	(F) × (E) =	0.5 **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	60 **(H)**	**3.9**

Surface Protection (I)

Surface Protection as **%** =	1 **(I)**	**10.0**

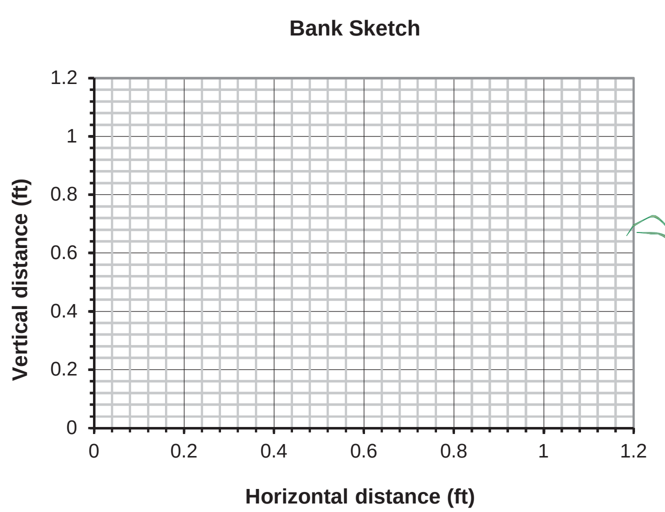
Bank Material Adjustment:

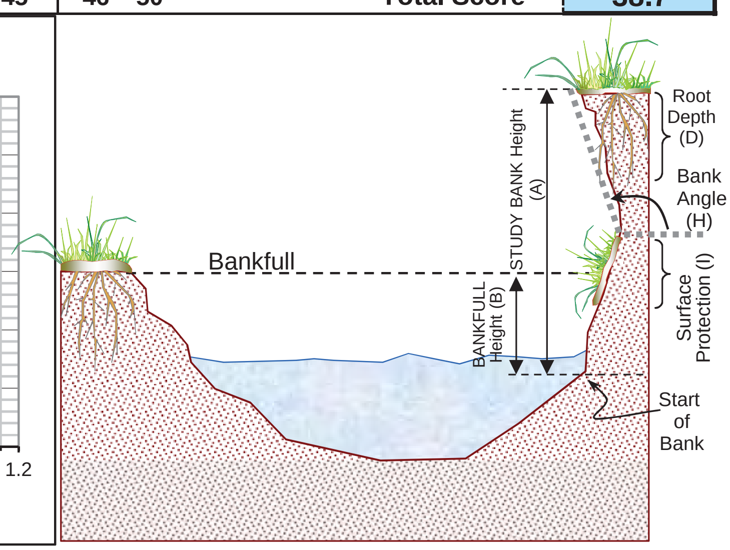
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

Bank Material Adjustment | **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage | **0**

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **38.7**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**13.3 BEHI 3R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	7 (A)	**Bankfull Height** (ft) =	2.9 (B)	(A) / (B) =	2.41 (C)	8.4

Root Depth / Study Bank Height (E)

Root Depth (ft) =	7 (D)	**Study Bank Height** (ft) =	7 (A)	(D) / (A) =	1.00 (E)	1.0

Weighted Root Density (G)

Root Density as % =	30 (F)	(F) × (E) =	30 (G)	5.9

Bank Angle (H)

Bank Angle as *Degrees* =	90 (H)	7.9

Surface Protection (I)

Surface Protection as % =	20 (I)	7.2

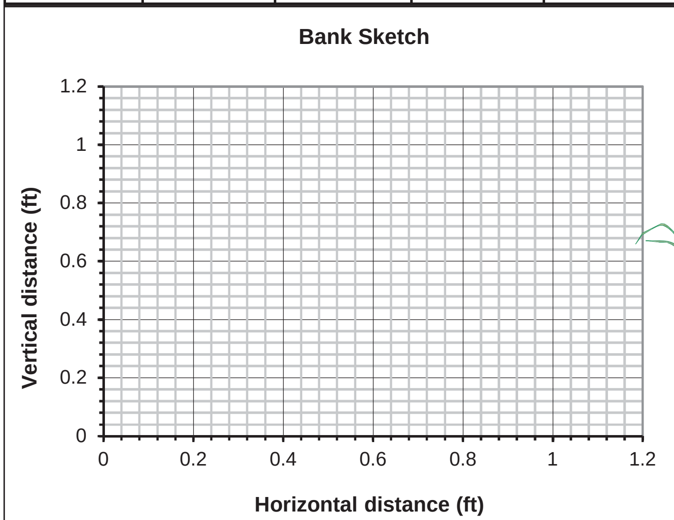
Bank Material Adjustment:

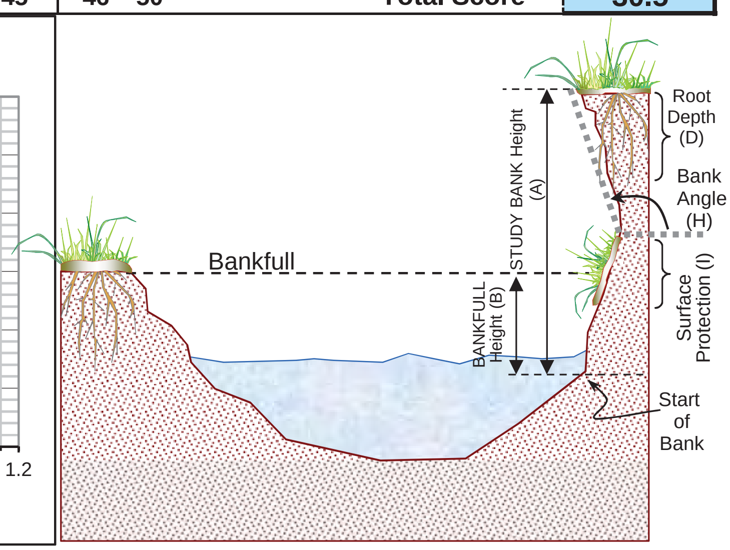
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **30.5**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run**		Location: **Greenville, NC**	
Station: **13.4 BEHI 4R**		Observers: **Krouse, Crissman**	
Date: **12/17/15**	Stream Type:	Valley Type:	

Variable	Inputs	Calculation	Value	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	Study Bank Height (ft) = 7 (A); Bankfull Height (ft) = 2.9 (B)	(A) / (B) =	2.41 (C)	8.4
Root Depth / Study Bank Height (E)	Root Depth (ft) = 4.5 (D); Study Bank Height (ft) = 7 (A)	(D) / (A) =	0.64 (E)	3.2
Weighted Root Density (G)	Root Density as % = 10 (F)	(F) × (E) =	6.42857 (G)	8.8
Bank Angle (H)	Bank Angle as *Degrees* =		90 (H)	7.9
Surface Protection (I)	Surface Protection as % =		20 (I)	7.2

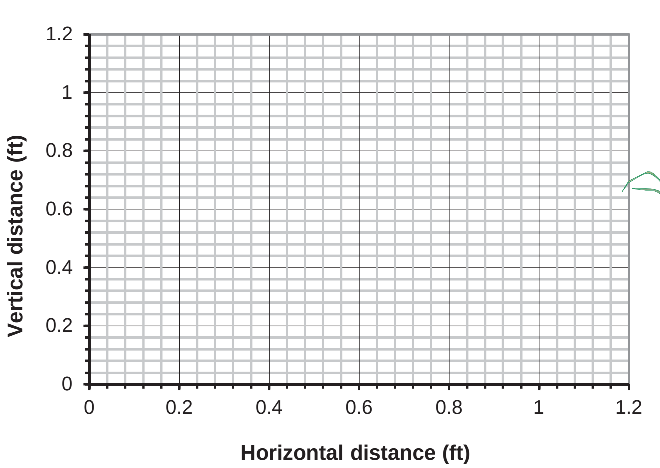
Bank Material Adjustment:
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

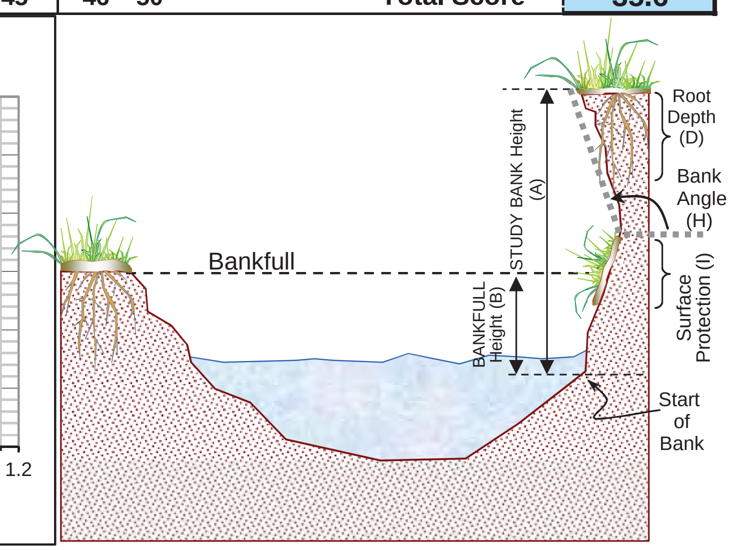
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **35.6**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **13.5 BEHI 5R** Observers: **Krouse, Crissman**

Date: **12/17/15** Stream Type: Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	**6** (A)	**Bankfull Height** (ft) =	**2.6** (B)	(A) / (B) =	**2.31** (C)	**8.3**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	**6** (D)	**Study Bank Height** (ft) =	**6** (A)	(D) / (A) =	**1.00** (E)	**1.0**

Weighted Root Density (G)

Root Density as **%** =	**15** (F)	(F) × (E) =	**15** (G)	**7.9**

Bank Angle (H)

Bank Angle as *Degrees* =	**90** (H)	**7.9**

Surface Protection (I)

Surface Protection as **%** =	**5** (I)	**10.0**

Bank Material Adjustment:

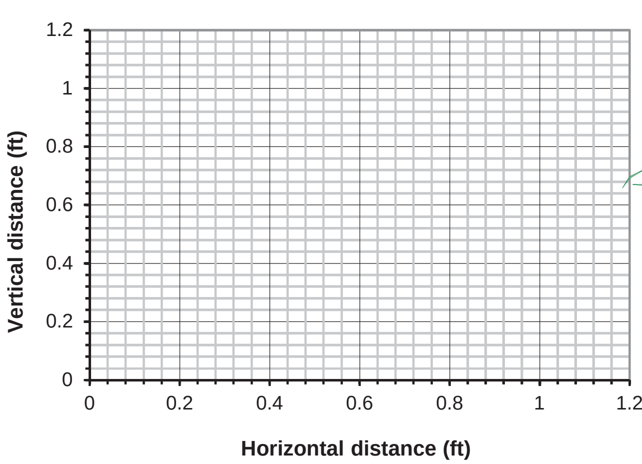
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

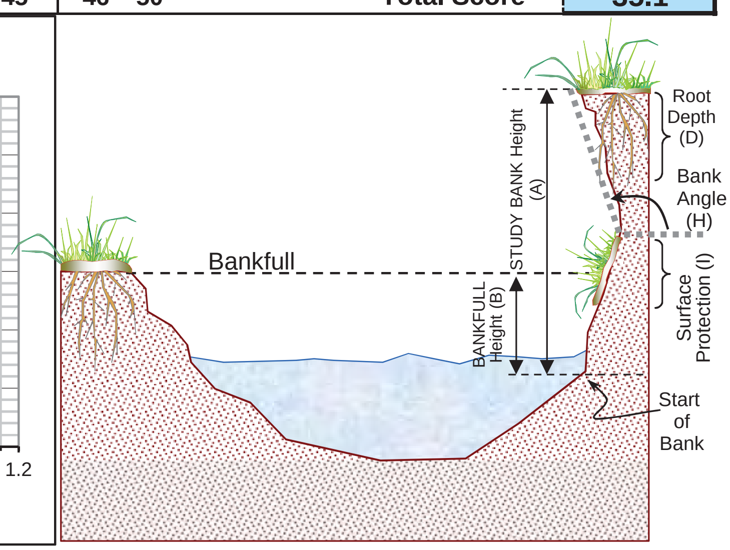
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **35.1**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**
Station: **13.6 BEHI 6R**	Observers: **Krouse, Crissman**
Date: **12/17/15** Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	7 (A)	**Bankfull Height** (ft) =	2 (B)	(A) / (B) =	3.50 (C)	10.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	6 (D)	**Study Bank Height** (ft) =	7 (A)	(D) / (A) =	0.86 (E)	2.2

Weighted Root Density (G)

Root Density as **%** =	45 (F)	(F) × (E) =	38.5714 (G)	5.2

Bank Angle (H)

Bank Angle as *Degrees* =	100 (H)	8.3

Surface Protection (I)

Surface Protection as **%** =	50 (I)	4.3

Bank Material Adjustment:

- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

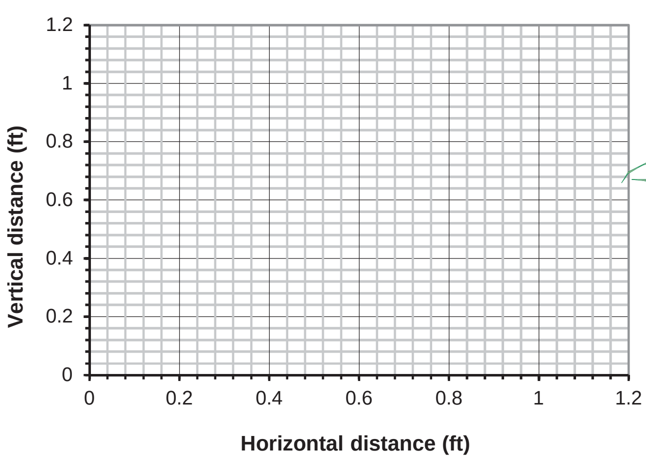
Bank Material Adjustment: 0

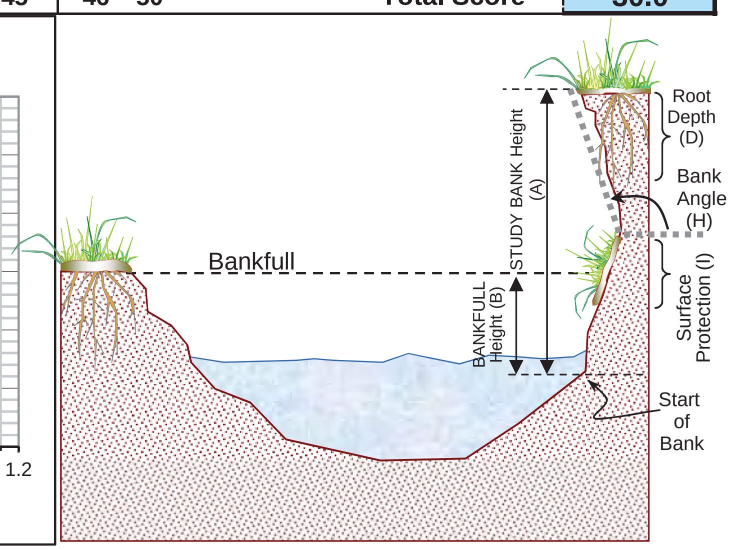
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** / **30.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**13.7 BEHI 7R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	6.5 **(A)**	**Bankfull Height** (ft) =	2.2 **(B)**	(A) / (B) =	2.95 **(C)**	**10.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	3 **(D)**	**Study Bank Height** (ft) =	6.5 **(A)**	(D) / (A) =	0.46 **(E)**	**4.3**

Weighted Root Density (G)

Root Density as **%** =	40 **(F)**	(F) × (E) =	18.4615 **(G)**	**7.4**

Bank Angle (H)

Bank Angle as *Degrees* =	80 **(H)**	**5.9**

Surface Protection (I)

Surface Protection as **%** =	50 **(I)**	**4.3**

Bank Material Adjustment:

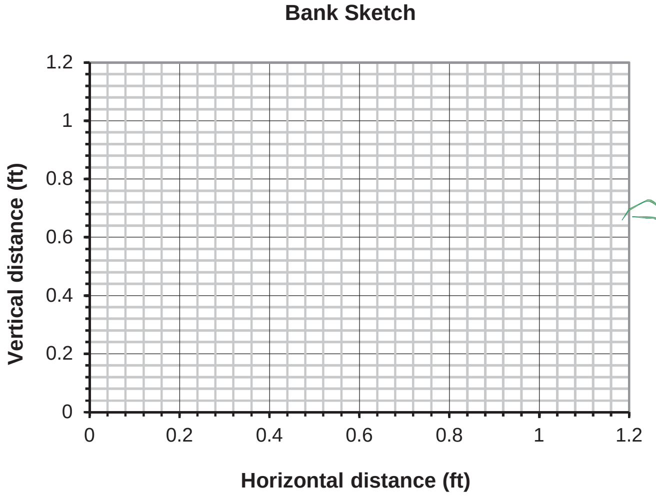
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

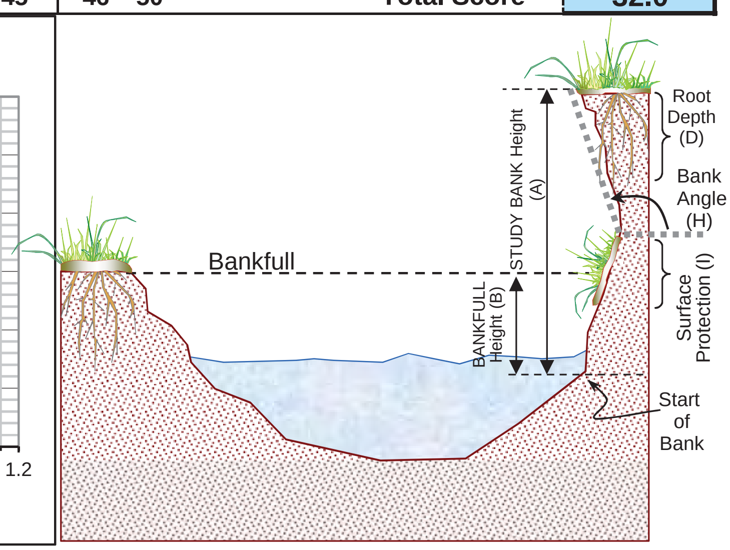
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	**Adjective Rating** and **Total Score**
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **32.0**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **13.8 BEHI 8R** Observers: **Krouse, Crissman**

Date: **12/29/15** Stream Type: Valley Type:

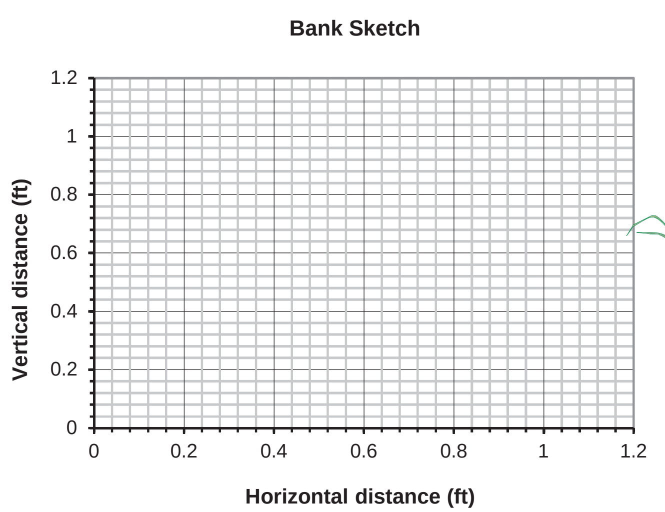
						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	8 (A)	Bankfull Height (ft) =	2.7 (B)	(A) / (B) =	2.96 (C)	10.0
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	8 (D)	Study Bank Height (ft) =	8 (A)	(D) / (A) =	1.00 (E)	1.0
Weighted Root Density (G)						
		Root Density as % =	35 (F)	(F) × (E) =	35 (G)	5.5
Bank Angle (H)						
				Bank Angle as *Degrees* =	90 (H)	7.9
Surface Protection (I)						
				Surface Protection as % =	50 (I)	4.3

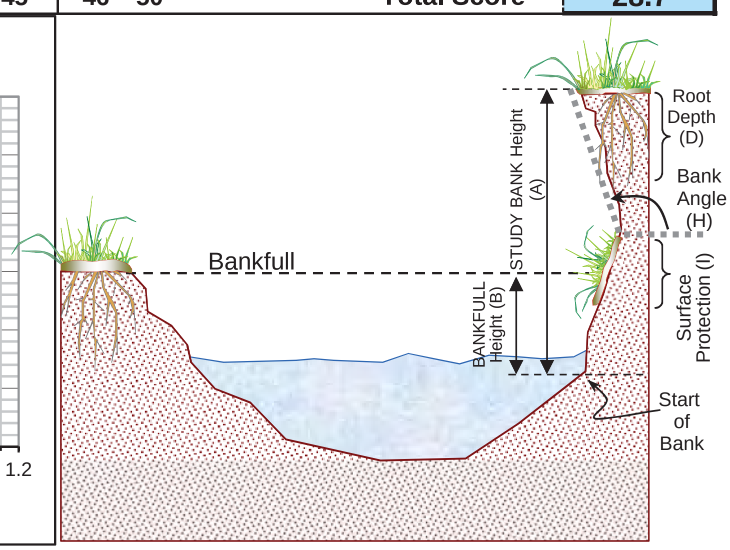
Bank Material Adjustment:
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** / **28.7**





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**13.9 BEHI 9R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.5 **(A)**	**Bankfull Height** (ft) =	2.6 **(B)**	(A) / (B) =	2.12 **(C)**	**8.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	5 **(D)**	**Study Bank Height** (ft) =	5.5 **(A)**	(D) / (A) =	0.91 **(E)**	**1.8**

Weighted Root Density (G)

Root Density as **%** =	10 **(F)**	(F) × (E) =	9.09091 **(G)**	**8.6**

Bank Angle (H)

Bank Angle as *Degrees* =	75 **(H)**	**5.4**

Surface Protection (I)

Surface Protection as **%** =	10 **(I)**	**9.0**

Bank Material Adjustment:

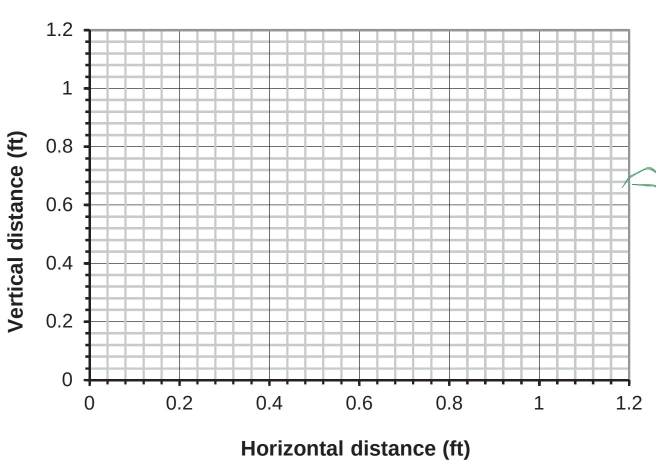
Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

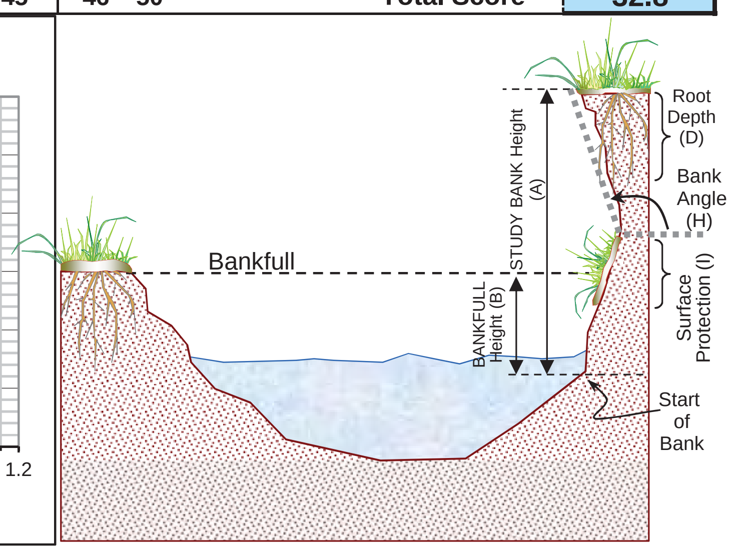
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **32.8**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**13.10 BEHI 10R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

Variable	Input 1	Value	Input 2	Value	Formula	Result	BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)	**Study Bank Height** (ft) =	**6** (A)	**Bankfull Height** (ft) =	**1.8** (B)	(A) / (B) =	**3.33** (C)	**10.0**
Root Depth / Study Bank Height (E)	**Root Depth** (ft) =	**5** (D)	**Study Bank Height** (ft) =	**6** (A)	(D) / (A) =	**0.83** (E)	**2.3**
Weighted Root Density (G)			**Root Density** as **%** =	**5** (F)	(F) × (E) =	**4.16667** (G)	**10.0**
Bank Angle (H)					**Bank Angle** as *Degrees* =	**50** (H)	**3.4**
Surface Protection (I)					**Surface Protection** as **%** =	**10** (I)	**9.0**

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

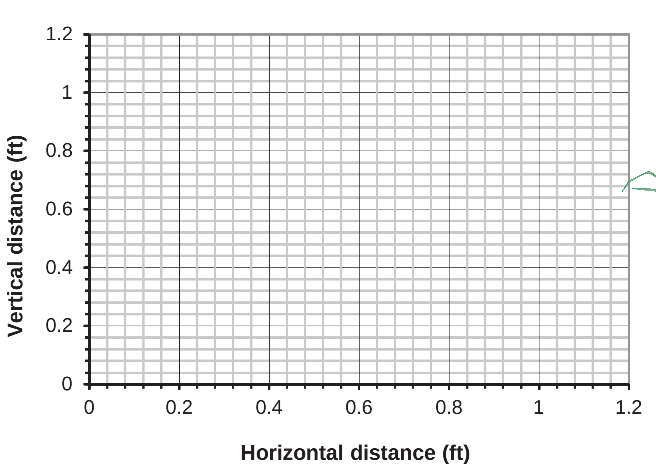
Bank Material Adjustment: **0**

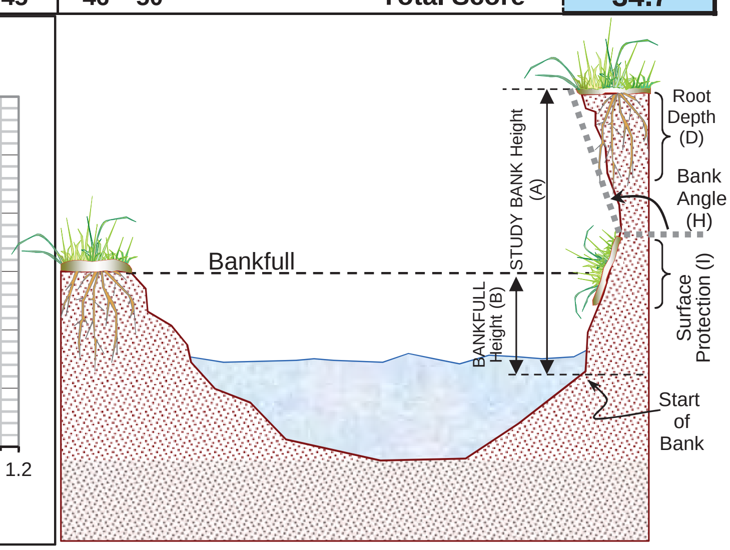
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** **34.7**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**BEHI 14.1 R**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	4.5 **(A)**	**Bankfull Height** (ft) =	4.5 **(B)**	(A) / (B) =	1.00 **(C)**	**1.0**

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.25 **(D)**	**Study Bank Height** (ft) =	4.5 **(A)**	(D) / (A) =	0.06 **(E)**	**8.9**

Weighted Root Density (G)

Root Density as **%** =	0 **(F)**	(F) × (E) =	0 **(G)**	**10.0**

Bank Angle (H)

Bank Angle as *Degrees* =	90 **(H)**	**7.9**

Surface Protection (I)

Surface Protection as **%** =	0 **(I)**	**10.0**

Bank Material Adjustment:

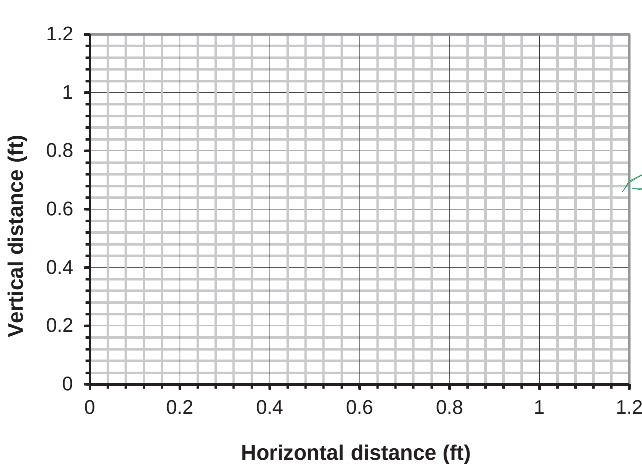
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

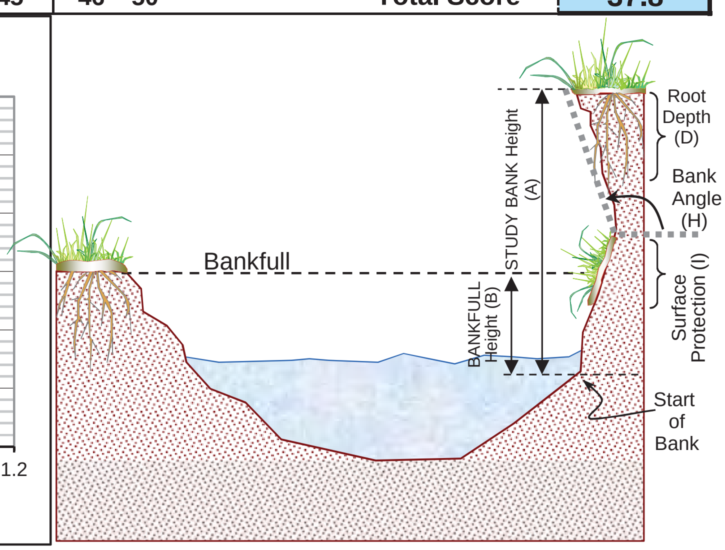
Bank Material Adjustment: **0**

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: **0**

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**High** / **37.8**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream:	**UT to Greens Mill Run**	Location:	**Greenville, NC**
Station:	**BEHI 14.1 R1**	Observers:	**Krouse, Crissman**
Date:	**12/17/15**	Stream Type:	Valley Type:

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.1 (A)	Bankfull Height (ft) =	5.1 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.5 (D)	Study Bank Height (ft) =	5.1 (A)	(D) / (A) =	0.10 (E)	8.4

Weighted Root Density (G)

Root Density as % =	20 (F)	(F) × (E) =	1.96078 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	70 (H)	4.9

Surface Protection (I)

Surface Protection as % =	25 (I)	6.5

Bank Material Adjustment:

Bedrock (Overall Very Low BEHI)
Boulders (Overall Low BEHI)
Cobble (Subtract 10 points if uniform medium to large cobble)
Gravel or Composite Matrix (Add 5–10 points depending on percentage of bank material that is composed of sand)
Sand (Add 10 points)
Silt/Clay (no adjustment)

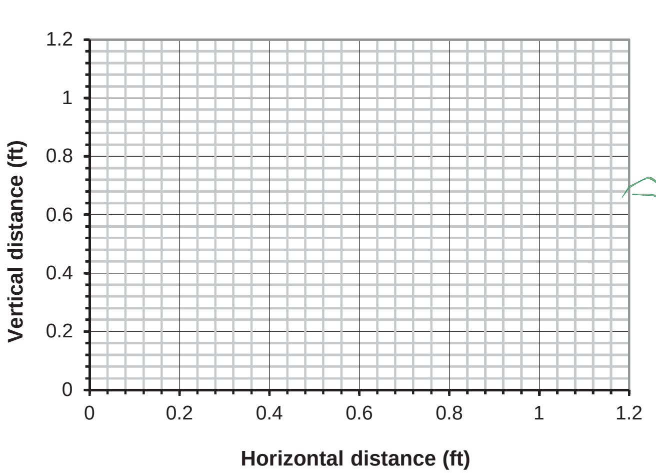
Bank Material Adjustment: 0

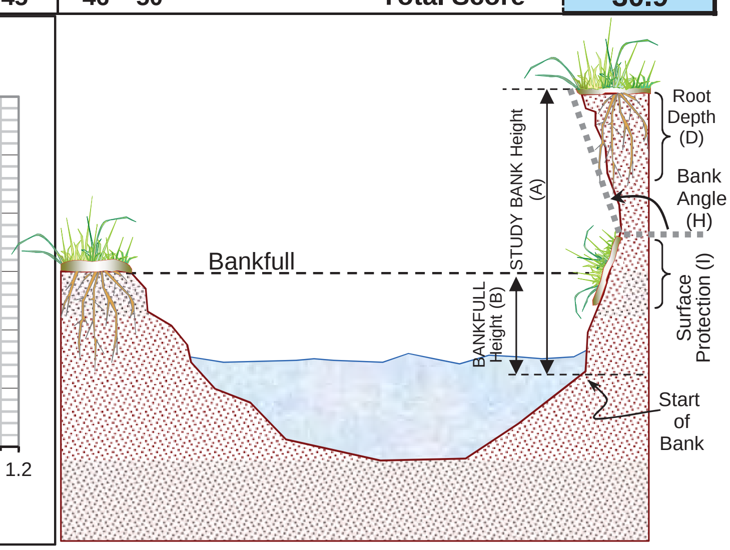
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** **30.9**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **Greens Mill Run**		Location: **Greenville, NC**	
Station: **14.1 BEHI R2**		Observers: **Krouse, Crissman**	
Date: **12/17/15**	Stream Type:	Valley Type:	

BEHI Score (Fig. 3-7)

Study Bank Height / Bankfull Height (C)

Study Bank Height (ft) =	5.1 (A)	**Bankfull Height** (ft) =	5.1 (B)	(A) / (B) =	1.00 (C)	1.0

Root Depth / Study Bank Height (E)

Root Depth (ft) =	0.5 (D)	**Study Bank Height** (ft) =	5.1 (A)	(D) / (A) =	0.10 (E)	8.4

Weighted Root Density (G)

Root Density as **%** =	20 (F)	(F) × (E) =	1.96078 (G)	10.0

Bank Angle (H)

Bank Angle as *Degrees* =	70 (H)	4.9

Surface Protection (I)

Surface Protection as **%** =	25 (I)	6.5

Bank Material Adjustment:
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

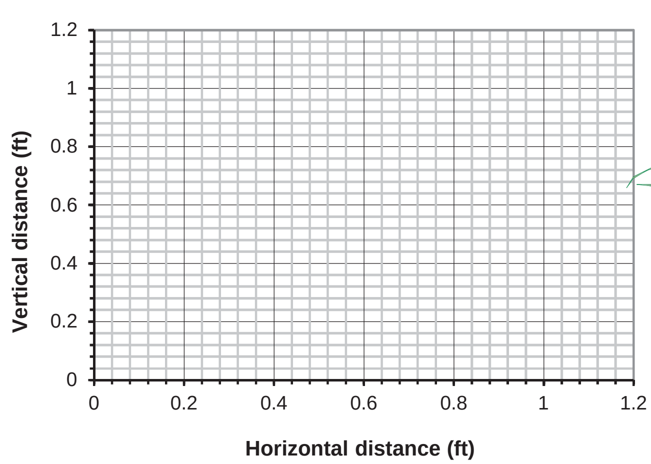
Bank Material Adjustment: 0

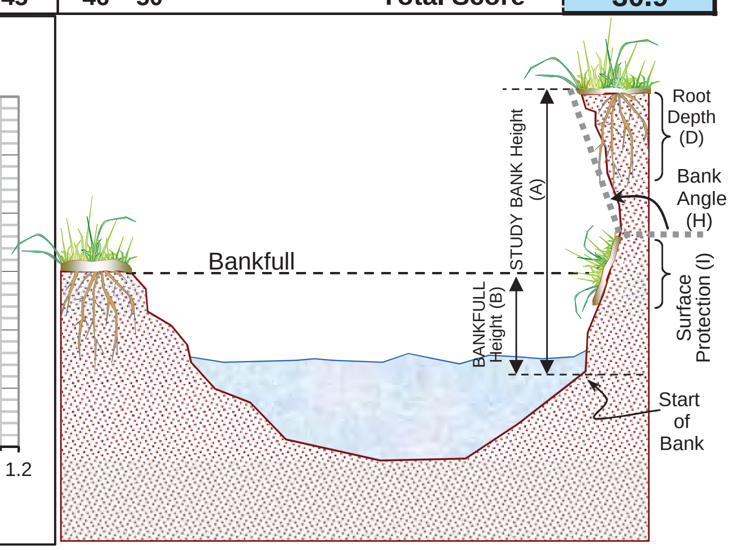
Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50

Adjective Rating and **Total Score**: **High** **30.9**

Bank Sketch





Worksheet 3-11. Form to calculate Bank Erosion Hazard Index (BEHI) variables and an overall BEHI rating. Use **Figure 3-7** with BEHI variables to determine BEHI score.

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **14.2 BEHI 1L** Observers: **Krouse, Crissman**

Date: **12/17/15** Stream Type: Valley Type:

						BEHI Score (Fig. 3-7)
Study Bank Height / Bankfull Height (C)						
Study Bank Height (ft) =	4.62 (A)	Bankfull Height (ft) =	4.62 (B)	(A) / (B) =	1.00 (C)	1.0
Root Depth / Study Bank Height (E)						
Root Depth (ft) =	0.5 (D)	Study Bank Height (ft) =	4.62 (A)	(D) / (A) =	0.11 (E)	8.3
Weighted Root Density (G)						
		Root Density as % =	30 (F)	(F) × (E) =	3.24675 (G)	10.0
Bank Angle (H)						
				Bank Angle as *Degrees* =	80 (H)	5.9
Surface Protection (I)						
				Surface Protection as % =	80 (I)	1.9

Bank Material Adjustment:

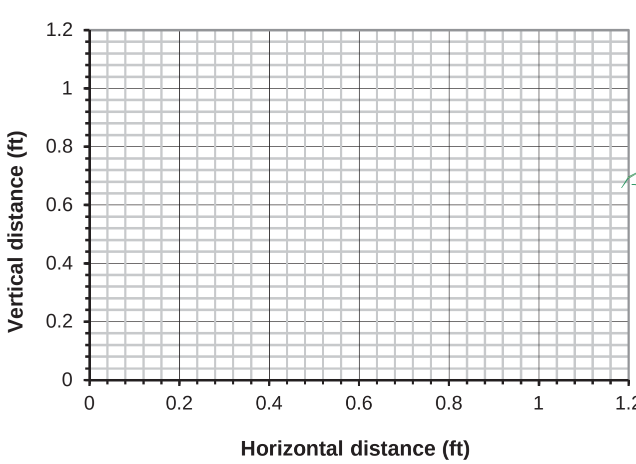
- **Bedrock** (Overall Very Low BEHI)
- **Boulders** (Overall Low BEHI)
- **Cobble** (Subtract 10 points if uniform medium to large cobble)
- **Gravel or Composite Matrix** (Add 5–10 points depending on percentage of bank material that is composed of sand)
- **Sand** (Add 10 points)
- **Silt/Clay** (no adjustment)

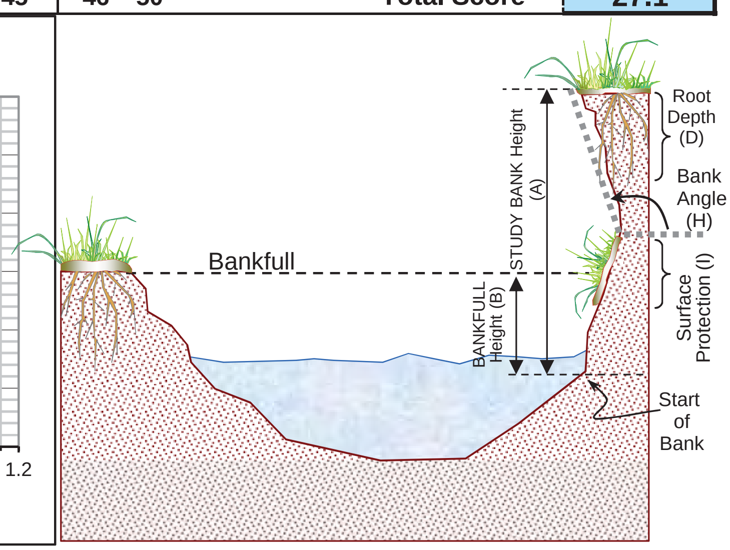
Bank Material Adjustment: 0

Stratification Adjustment
Add 5–10 points, depending on position of unstable layers in relation to bankfull stage: 0

Very Low	Low	Moderate	High	Very High	Extreme	Adjective Rating and Total Score
5 – 9.5	10 – 19.5	20 – 29.5	30 – 39.5	40 – 45	46 – 50	**Moderate** / **27.1**

Bank Sketch





Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 1.1 08.05.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………..……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………….……………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	4.8	**4.12**	**1.17**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill** Location: **Greenville, NC**

Station: **BEHI 1.2 08.05.14** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

	Method	Level	Purpose
(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)	Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High	
	Extensive deposition (continuous, cross-channel)……………..…………….....……. …………....NBS = Extreme	
	Chute cutoffs, down-valley meander migration, converging flow……………………..…………..NBS = Extreme	

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		20.45		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Moderate

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	3.89	2.23	1.74	Moderate

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	3.89			1.76				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Moderate**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill** Location: **Greenville, NC**

Station: **BEHI 2.1 08.05.14** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High

Extensive deposition (continuous, cross-channel)……………..…………….…..……. …………...NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow……………………..…………….NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		34.6		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress: **Low**

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	5.3	4.9	1.08	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	5.15			2.03				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)		
Stream: **Greens Mill Run, Reach - Greens Mill**	Location: **Greenville, NC**	
Station: **BEHI 2.2 08.05.14**	Stream Type:	Valley Type:
Observers: **KAB, MAM, AC, BM**		Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)		
(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)	Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
	Extensive deposition (continuous, cross-channel)……………..…………….....……. ……………...NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow……………………..…………….NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		**16.98**		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**5.15**	**3.97**	**1.3**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	**5.15**			**3.97**				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating							
Near-Bank Stress (NBS) ratings	**Method number**						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 3.1 08.05.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………..…….. …………....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………..…………..NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	5.67	**5.63**	**1.01**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill** Location: **Greenville, NC**

Station: **BEHI 3.2 08.05.14** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous……… ……………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..………….……. ……………..NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………….……………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		16.17		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	5.14	3.75	1.37	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	5.14			3.75				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 3.3 08.05.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High

Extensive deposition (continuous, cross-channel)……………..……………..……. …………...NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow……………….………….…………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	4.2	**3.52**	**1.19**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 4.1 08.05.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………..……. …………....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow………………….……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
4.6	**3.35**	**1.37**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 4.2 08.05.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/05/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… ………………..…..NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………..……. …………....NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………….…………….NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	19.86		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
4.55	**3.38**	**1.35**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
4.55			**3.38**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 5.1 08.06.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………..…NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….………………..……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………….…….………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**5.53**	**4.87**	**1.14**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill** Location: **Greenville, NC**

Station: **BEHI 5.2 08.06.14** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)
- Transverse and/or central bars-short and/or discontinuous............ ....NBS = High / Very High
- Extensive deposition (continuous, cross-channel)...................................... ....NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow.....................................NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		25.68		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	4.8	3.89	1.23	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	4.8			3.03				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I**	Location: **Greenville, NC**	
Station: **BEHI 5.3 08.06.14**	Stream Type: **E5**	Valley Type:
Observers: **KAB, MAM, AC, BM**		Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)	Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
	Extensive deposition (continuous, cross-channel)…………….………………..…….. …………...NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow…………………….……….……NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Very Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**4.02**	**5.18**	**0.78**	**Very Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Very Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 6.1 08.06.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………..…NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………..……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………..……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
4.14	**3.95**	**1.05**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I**	Location: **Greenville, NC**		
Station: **BEHI 6.2 08.06.14**	Stream Type: **E5**	Valley Type:	
Observers: **KAB, MAM, AC, BM**		Date: **08/06/14**	

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….………………..……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow………………….……………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**3.85**	**3.68**	**1.05**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill** Location: **Greenville, NC**

Station: **BEHI 6.3 08.06.14** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..………………..……. …………....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………..…………..NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		31.34		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress

Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	3.76	3.07	1.22	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	3.76			2.16				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 7.1 08.06.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….…………….…….. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow………………….……………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**5.81**	**5.17**	**1.12**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 7.2 08.06.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/06/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………..…NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..………………..…… …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow………………….……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	29.08		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
4.2	**3.29**	**1.28**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
4.2			**3.29**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 8.1 08.11.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I — **(1)**

Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High

Extensive deposition (continuous, cross-channel)…………….……………..……. …………...NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow……………….…………….NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	13.6		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
4.48	**3.31**	**1.35**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
4.48			**3.31**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 8.2 08.11.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….……………...…… …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow………………….…………….NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	3.2	**2.6**	**1.23**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I**	Location: **Greenville, NC**	
Station: **BEHI 9.1 08.11.14**	Stream Type: **E5**	Valley Type:
Observers: **KAB, MAM, AC, BM**		Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I	**(1)**	Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
		Extensive deposition (continuous, cross-channel)……………..………………..……… …………...NBS = Extreme
		Chute cutoffs, down-valley meander migration, converging flow…………………….……………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**3.96**	**3.33**	**1.19**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 9.2 08.11.14** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………...……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………….…………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**3.79**	**3.38**	**1.12**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 9.3 08.11.14 (L)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….………………..…… …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………….…………...NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	15.95		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.69	**2.82**	**1.31**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.69			**2.82**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 9.3 08.11.14 (R)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous……………………........NBS = High / Very High
Extensive deposition (continuous, cross-channel)………………………………………………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………………………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	15.95		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.69	**2.82**	**1.31**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.69			**2.82**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 10.1 08.11.14 (L)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I — **(1)**

Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High

Extensive deposition (continuous, cross-channel)…………….……………..……. …………....NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow……………………….…………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**6.8**	**6.79**	**1**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 10.1 08.11.14 (R)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………...……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………..……….....NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Very Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	5.6	**6.79**	**0.82**	**Very Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Very Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 10.2 08.11.14 (L)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..………………..……. …………....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………………..…………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**6.85**	**5.75**	**1.19**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 10.2 08.11.14 (R)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High

Extensive deposition (continuous, cross-channel)……………..………………..……. …………....NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow………………………..…………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress

Very Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	5.23	**5.75**	**0.91**	**Very Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Very Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I** Location: **Greenville, NC**

Station: **BEHI 10.3 08.11.14 (L)** Stream Type: **E5** Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………...……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………….…..…………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**6.67**	**6.14**	**1.09**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greens Mill Run, Reach - Greens Mill I**	Location: **Greenville, NC**	
Station: **BEHI 10.3 08.11.14 (R)**	Stream Type: **E5**	Valley Type:
Observers: **KAB, MAM, AC, BM**		Date: **08/11/14**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………......NBS = High / Very High
Extensive deposition (continuous, cross-channel)…………….……………...……. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow……………….…….……….NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)				

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Very Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**5.95**	**6.14**	**0.97**	**Very Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)								

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Very Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **11.1 BEHI L** Stream Type: Valley Type:

Observers: **KAB, MAM, AC, BM** Date: **10/06/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I (1)

Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High

Extensive deposition (continuous, cross-channel)……………..………………..…… ……………...NBS = Extreme

Chute cutoffs, down-valley meander migration, converging flow…………………… ……………..NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		3.96		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	2.49	2.13	1.17	Low

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	2.49			2.13				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**
Station: **11.1 BEHI R**	Stream Type: Valley Type:
Observers: **KAB, MAM, AC, BM**	Date: **10/06/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)	Transverse and/or central bars-short and/or discontinuous…………………………..…NBS = High / Very High
	Extensive deposition (continuous, cross-channel)……………..……………...……………….....NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow…………………………..………..NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		**4.02**		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**2.52**	**2.13**	**1.18**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	**2.52**			**2.13**				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **Greensmill Run (Greenway Site 12)** Location: **Greenville, NC**

Station: **12.1 XS-1 BEHI 1L** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..………………...…… …………....NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… .……….…..NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	Ratio R_c / W_{bkf}	Near-Bank Stress (NBS)
		32.72		

(3)	Pool Slope S_p	Average Slope S	Ratio S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	Ratio d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	4.35	3.44	1.26	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	4.35			3.44				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **13.1 BEHI 1 R** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)	Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
	Extensive deposition (continuous, cross-channel)……………..………………..……. …………...NBS = Extreme
	Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		**20.33**		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**3.89**	**3.07**	**1.27**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	**3.89**			**3.07**				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **13.2 BEHI 2 R** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous…………. ………………..….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………...……. ……………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow……………………. ……………..NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		20.33		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress

Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	3.89	3.07	1.27	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	3.89			3.07				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.3 BEHI 3R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I — (1)

- Transverse and/or central bars-short and/or discontinuous………… ………………..…NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………...……. …………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		20.33		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	3.89	**3.07**	**1.27**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	3.89			**3.07**				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating — **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.4 BEHI 4R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………...…… …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	20.33		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.89	**3.07**	**1.27**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.89			**3.07**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating	**Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.5 BEHI 5R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ………………...….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………...…… …………....NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	Ratio R_c / W_{bkf}	Near-Bank Stress (NBS)
	20.33		

(3)

Pool Slope S_p	Average Slope S	Ratio S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	Ratio d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.89	3.07	1.27	Low

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.89			3.07				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.6 BEHI 6R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… ……………..….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………..……. …………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		20.33		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	3.89	**3.07**	**1.27**	**Low**

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	3.89			**3.07**				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating: Low

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.7 BEHI 7R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ……………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..………………..…….. …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………… .…………..NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
2.7	**2.7**	**1**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**		Location: **Greenville, NC**	
Station: **13.8 BEHI 8R**	Stream Type:		Valley Type:
Observers: **Krouse, Crissman**			Date: **12/29/15**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… …………….….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)…………….…………….….…… …………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… ……….……NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	20.33		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.89	**3.07**	**1.27**	**Low**

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.89			**3.07**				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.9 BEHI 9R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… ………………..…..NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………...……. ……………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… ……………..NBS = Extreme

Level II

	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
(2)		**20.33**		

	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)
(3)				

	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)
(4)				

Dominant Near-Bank Stress
Low

Level III

	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
(5)	**3.89**	**3.07**	**1.27**	**Low**

	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
(6)	**3.89**			**3.07**				

Level IV

	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
(7)	**0**	**0**

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating | **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run**	Location: **Greenville, NC**	
Station: **13.10 BEHI 10R**	Stream Type:	Valley Type:
Observers: **Krouse, Crissman**		Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
Transverse and/or central bars-short and/or discontinuous………… ……………..….NBS = High / Very High
Extensive deposition (continuous, cross-channel)……………..……………..…… …………...NBS = Extreme
Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	20.33		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
3.89	3.07	1.27	Low

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
3.89			3.07				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **14.1 BEHI R (1)** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1) Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2) Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3) Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4) Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5) Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6) Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7) Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous………… ……………….….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………...…… …………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………… ……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
	14.63		

(3)

Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
5.24	4.04	1.3	Low

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
5.24			4.04				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **14.1 BEHI R (2)** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

	Method	Level	Purpose
(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous…………. ………………..….NBS = High / Very High
- Extensive deposition (continuous, cross-channel)……………..……………..……. …………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow……………………. ……………NBS = Extreme

Level II

(2)

Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	Ratio R_c / W_{bkf}	Near-Bank Stress (NBS)
	14.63		

(3)

Pool Slope S_p	Average Slope S	Ratio S_p / S	Near-Bank Stress (NBS)

(4)

Pool Slope S_p	Riffle Slope S_{rif}	Ratio S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)

Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	Ratio d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
5.24	4.04	1.3	Low

(6)

Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
5.24			4.04				

Level IV

(7)

Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**

Worksheet 3-12. Various field methods of estimating Near-Bank Stress (NBS) risk ratings to calculate erosion rate.

Estimating Near-Bank Stress (NBS)

Stream: **UT to Greens Mill Run** Location: **Greenville, NC**

Station: **14.2 BEHI L** Stream Type: Valley Type:

Observers: **Krouse, Crissman** Date: **12/17/15**

Methods for Estimating Near-Bank Stress (NBS)

(1)	Channel pattern, transverse bar or split channel/central bar creating NBS	Level I	Reconaissance
(2)	Ratio of radius of curvature to bankfull width (R_c / W_{bkf})	Level II	General prediction
(3)	Ratio of pool slope to average water surface slope (S_p / S)	Level II	General prediction
(4)	Ratio of pool slope to riffle slope (S_p / S_{rif})	Level II	General prediction
(5)	Ratio of near-bank maximum depth to bankfull mean depth (d_{nb} / d_{bkf})	Level III	Detailed prediction
(6)	Ratio of near-bank shear stress to bankfull shear stress (τ_{nb} / τ_{bkf})	Level III	Detailed prediction
(7)	Velocity profiles / Isovels / Velocity gradient	Level IV	Validation

Level I

(1)
- Transverse and/or central bars-short and/or discontinuous……………………………..…..NBS = High / Very High
- Extensive deposition (continuous, cross-channel)………………………………..……………...NBS = Extreme
- Chute cutoffs, down-valley meander migration, converging flow…………………………………..NBS = Extreme

Level II

(2)	Radius of Curvature R_c (ft)	Bankfull Width W_{bkf} (ft)	*Ratio* R_c / W_{bkf}	Near-Bank Stress (NBS)
		14.3		

(3)	Pool Slope S_p	Average Slope S	*Ratio* S_p / S	Near-Bank Stress (NBS)

(4)	Pool Slope S_p	Riffle Slope S_{rif}	*Ratio* S_p / S_{rif}	Near-Bank Stress (NBS)

Dominant Near-Bank Stress
Low

Level III

(5)	Near-Bank Max Depth d_{nb} (ft)	Mean Depth d_{bkf} (ft)	*Ratio* d_{nb} / d_{bkf}	Near-Bank Stress (NBS)
	4.62	3.29	1.4	Low

(6)	Near-Bank Max Depth d_{nb} (ft)	Near-Bank Slope S_{nb}	Near-Bank Shear Stress τ_{nb} (lb/ft^2)	Mean Depth d_{bkf} (ft)	Average Slope S	Bankfull Shear Stress τ_{bkf} (lb/ft^2)	Ratio τ_{nb} / τ_{bkf}	Near-Bank Stress (NBS)
	4.62			3.29				

Level IV

(7)	Velocity Gradient (ft / sec / ft)	Near-Bank Stress (NBS)
	0	0

Converting Values to a Near-Bank Stress (NBS) Rating

Near-Bank Stress (NBS) ratings	Method number (1)	(2)	(3)	(4)	(5)	(6)	(7)
Very Low	N / A	> 3.00	< 0.20	< 0.40	< 1.00	< 0.80	< 0.50
Low	N / A	2.21 – 3.00	0.20 – 0.40	0.41 – 0.60	1.00 – 1.50	0.80 – 1.05	0.50 – 1.00
Moderate	N / A	2.01 – 2.20	0.41 – 0.60	0.61 – 0.80	1.51 – 1.80	1.06 – 1.14	1.01 – 1.60
High	See	1.81 – 2.00	0.61 – 0.80	0.81 – 1.00	1.81 – 2.50	1.15 – 1.19	1.61 – 2.00
Very High	(1)	1.50 – 1.80	0.81 – 1.00	1.01 – 1.20	2.51 – 3.00	1.20 – 1.60	2.01 – 2.40
Extreme	Above	< 1.50	> 1.00	> 1.20	> 3.00	> 1.60	> 2.40

Overall Near-Bank Stress (NBS) rating **Low**


BEHI 1.1 Left Bank


BEHI 1.1 Looking Downstream


BEHI 1.1 Looking Upstream


BEHI 1.2 Left Bank at XS 1.2


BEHI 1.2 Looking Dowsntream at XS 1.2


BEHI 1.2 Looking Upstream at XS 1.2


BEHI 2.1 Looking Downstream


BEHI 2.1 Looking Upstream


BEHI 2.1 Right Bank


BEHI 2.2 Looking Downstream at XS 2.2


BEHI 2.2 Looking Upstream at XS 2.2


BEHI 2.2 Right Bank at XS 2.2


BEHI 3.1 Left Bank


BEHI 3.1 Looking Downstream at XS 3.1


BEHI 3.1 Looking Upstream at XS 3.1


BEHI 3.2 Looking Downstream at XS 3.2


BEHI 3.2 Looking Upstream at XS 3.2


BEHI 3.2 Right Bank at XS 3.2


BEHI 3.3 Left Bank


BEHI 3.3 Looking Downstream at XS 3.3


BEHI 3.3 Looking Upstream at XS 3.3


BEHI 4.1 Looking Downstream at XS 4.1


BEHI 4.1 Looking Upstream at XS 4.1


BEHI 4.1 Right Bank


BEHI 4.2 Left Bank at XS 4.2


BEHI 4.2 Looking Downstream at XS 4.2


BEHI 4.2 Looking Upstream at XS 4.2


BEHI 5.1 Looking Downstream at XS 5.1


BEHI 5.1 Looking Upstream at XS 5.1

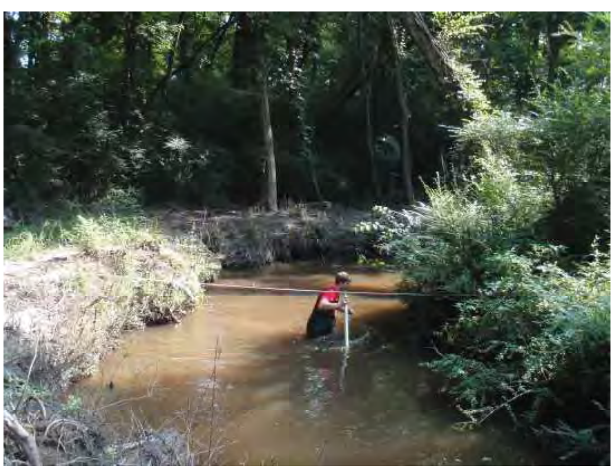

BEHI 5.1 Right Bank


BEHI 5.2 Looking Upstream at XS 5.2


BEHI 5.2 Right Bank at XS 5.2


BEHI 5.2 Looking Downstream at XS 5.2


BEHI 5.3 Left Bank


BEHI 5.3 Looking Downstream at XS 5.3

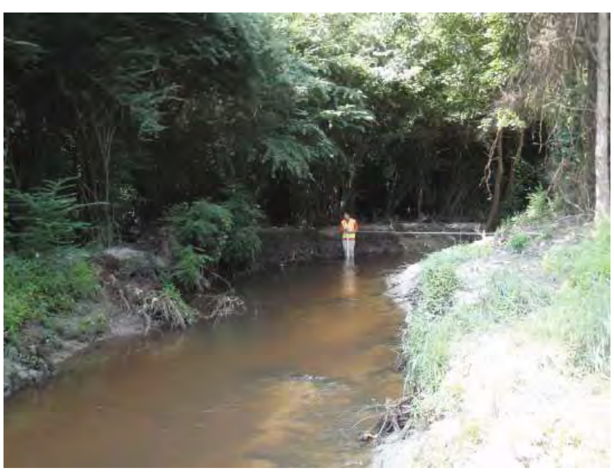

BEHI 5.3 Looking Upstream at XS 5.3


BEHI 6.1 Left Bank


BEHI 6.1 Looking Downstream at XS 6.1


BEHI 6.1 Looking Upstream at XS 6.1


BEHI 6.2 Looking Downstream at XS 6.2


BEHI 6.2 Looking Upstream at XS 6.2


BEHI 6.2 Right Bank


BEHI 6.3 Looking Downstream at XS 6.3


BEHI 6.3 Looking Upstream at XS 6.3


BEHI 6.3 Right Bank at XS 6.3


BEHI 7.1 Right Bank


BEHI 7.1 Looking Downstream at XS 7.1


BEHI 7.1 Looking Upstream at XS 7.1


BEHI 7.2 Looking Downstream at XS 7.2


BEHI 7.2 Looking Upstream at XS 7.2


BEHI 7.2 Right Bank at XS 7.2


BEHI 8.1 Looking Downstream at XS 8.1


BEHI 8.1 Looking Upstream at XS 8.1


BEHI 8.1 Right Bank at XS 8.1


BEHI 8.2 Looking Upstream at XS 8.2


BEHI 8.2 Left Bank at XS 8.2


BEHI 8.2 Looking Downstream at XS 8.2


BEHI 9.1 Looking Downstream at XS 9.1


BEHI 9.1 Looking Upstream at XS 9.1


BEHI 9.1 Right Bank at XS 9.1


BEHI 9.2 Left Bank at XS 9.2


BEHI 9.2 Looking Downstream at XS 9.2


BEHI 9.2 Looking Upstream at XS 9.2


BEHI 9.3 Left Bank at XS 9.3


BEHI 9.3 Looking Downstream at XS 9.3


BEHI 9.3 Looking Upstream at XS 9.3


BEHI 9.3 Right Bank at XS 9.3


BEHI 10.1 Left Bank at XS 10.1


BEHI 10.1 Looking Downstream at XS 10.1


BEHI 10.1 Looking Upstream at XS 10.1


BEHI 10.1 Right Bank at XS 10.1


BEHI 10.2 Left Bank at XS 10.2


BEHI 10.2 Looking Downstream at XS 10.2


BEHI 10.2 Looking Upstream at XS 10.2


BEHI 10.2 Right Bank at XS 10.2


BEHI 10.3 Left Bank at XS 10.3


BEHI 10.3 Looking Downstream at XS 10.3


BEHI 10.3 Looking Upstream at XS 10.3


BEHI 10.3 Right Bank at XS 10.3


BEHI 11.1 Left Bank


BEHI 11.1 Right Bank


BEHI 12.1 Left Bank


BEHI 13.1 Right Bank


BEHI 13.2 Right Bank


BEHI 13.3 Right Bank


BEHI 13.4 Right Bank


BEHI 13.5 Right Bank


BEHI 13.6 Right Bank


BEHI 13.7 Right Bank

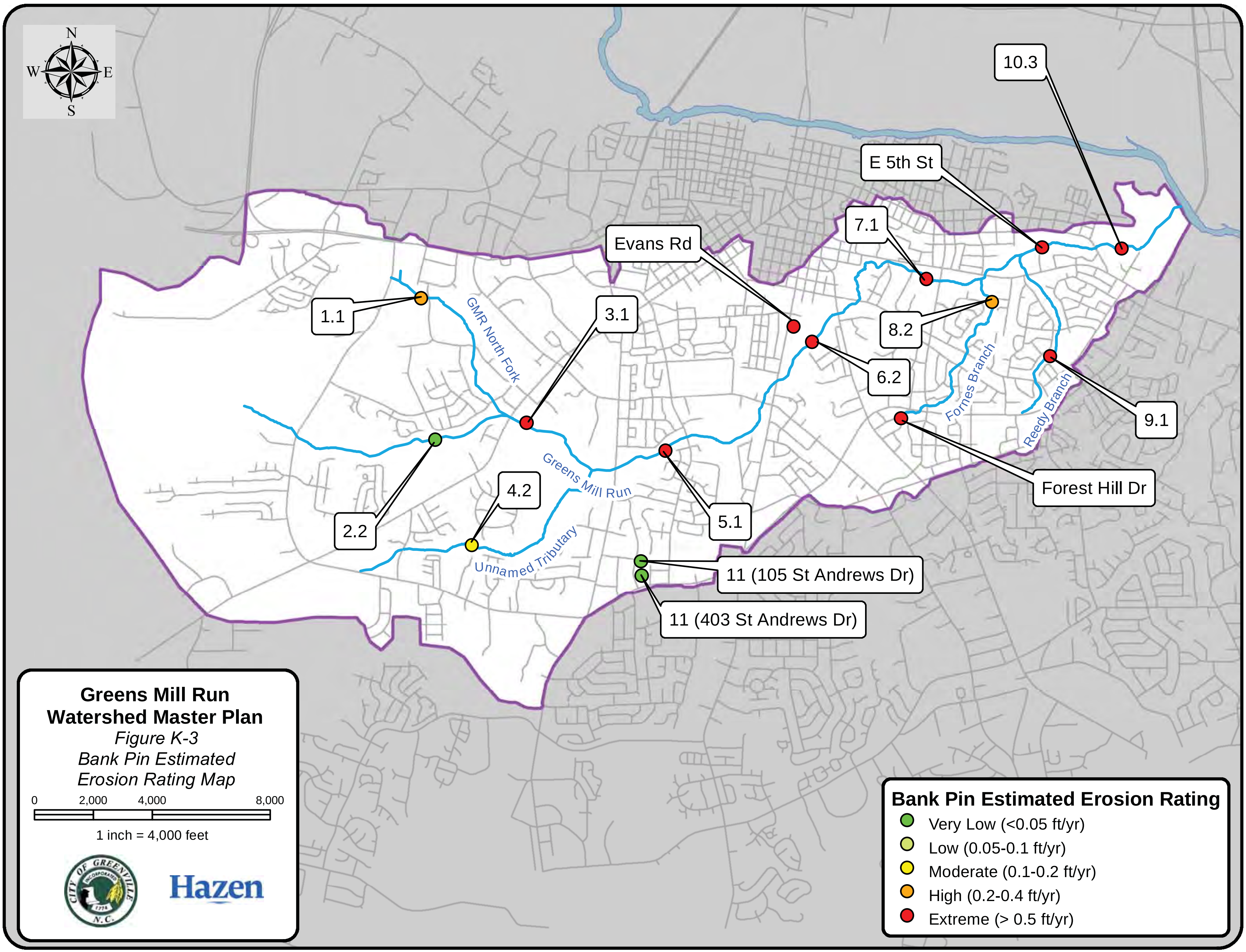

BEHI 13.8 Right Bank


BEHI 13.9 Right Bank


BEHI 13.10 Right Bank


BEHI 14.1 Right Bank


BEHI 14.2 Left Bank



N
W
E
S
10.3
E 5th St
7.1
Evans Rd
1.1
3.1
8.2
6.2
9.1
GMR North Fork
Fornes Branch
Reedy Branch
Forest Hill Dr
Greens Mill Run
4.2
5.1
2.2
Unnamed Tributary
11 (105 St Andrews Dr)
11 (403 St Andrews Dr)
Greens Mill Run
Watershed Master Plan
Figure K-3
Bank Pin Estimated
Erosion Rating Map
0
2,000
4,000
8,000
1 inch = 4,000 feet
Hazen
Bank Pin Estimated Erosion Rating
Very Low (<0.05 ft/yr)
Low (0.05-0.1 ft/yr)
Moderate (0.1-0.2 ft/yr)
High (0.2-0.4 ft/yr)
Extreme (> 0.5 ft/yr)

Table K.5: Bank Pin Monitoring Data

Location	Bank	Approximate Bank Height (ft)	Vertical Distance From Toe (ft)	Length of Pin Exposed From Bank (ft) (02.03.15-2.23.15)	Length of Pin Exposed From Bank (ft) (06.18.15)	Length of Pin Exposed From Bank (ft) (10.06.15)	Measured Bank Erosion at Pin (ft)	Notes: (02.03.15, 02.23.15)	Notes: (06.18.15, 06.23.15)
1.1 (BEHI)	Left	3.9			6.23.15				
Top pin			2.4	0.21	0.29		0.08	3 ft #5 Rebar	
Bottom pin			1.55	0.11	0.21		0.1	3 ft #5 Rebar	
2.2 (XS)	Right	5.15			6.23.15				
Top Pin			3.45	0.24	0.22		-0.02	3 ft #5 Rebar	Vegetated heavily: Moss, Fern, Oak Saplings
Bottom Pin			2.25	0.24	0.16		-0.08	3 ft #5 Rebar	
3.1 (BEHI)	Left	4.9			6.23.15				
Top			3.4	0.19	1.7		1.51	3 ft #5 Rebar	
Middle			2.4	0.19	1.48		1.29	3 ft #5 Rebar	
Bottom			1.2	0.18	1.1		0.92	3 ft #5 Rebar	
4.2 (XS)	Left	5			6.23.15				
Top			2.7	0.23	0.27		0.04	3 ft #5 Rebar	
Middle			1.9	0.24	0.29		0.05	3 ft #5 Rebar	
Bottom			1.2	0.22	0.24		0.02	3 ft #5 Rebar	
5.1 (BEHI)	Right	4.8			6.23.15				
Top			3.1	0.3	0.16		-0.14	3 ft #5 Rebar	
Middle			2.3	0.33	0.26		-0.07	3 ft #5 Rebar	
Bottom			1.3	0.3	0.9		0.6	3 ft #5 Rebar	
6.2 (BEHI)	Right	2.6							
Top			1.5	0.2	0.41		0.21	3 ft #5 Rebar	
Bottom			0.6	0.22	0.34		0.12	3 ft #5 Rebar	
7.1 (BEHI)	Right	10.1			6.23.15				
Top			6	0.55	0.32		-0.23	3 ft #5 Rebar	
Middle			3.6	0.48	0.57		0.09	3 ft #5 Rebar	
Bottom			2.3	0.21	0.66		0.45	3 ft #5 Rebar	

Table K.5 Continued

Location	Bank	Approximate Bank Height (ft)	Vertical Distance From Toe (ft)	Length of Pin Exposed From Bank (ft) (02.03.15-2.23.15)	Length of Pin Exposed From Bank (ft) (06.18.15)	Length of Pin Exposed From Bank (ft) (10.06.15)	Measured Bank Erosion at Pin (ft)	Notes: (02.03.15, 02.23.15)	Notes: (06.18.15, 06.23.15)
8.2 (BEHI)	Left	7.98			7.21.15				
Top			3.9	0.27	0.34		0.07	3 ft #5 Rebar	
Middle			2.6	0.33	0.43		0.1	3 ft #5 Rebar	
Bottom			0.5	0.4	0.41		0.01	3 ft #5 Rebar	
9.1 (BEHI)	Right	8.61			6.23.15				
Top			3.5	0.25	0.23		-0.02	3 ft #5 Rebar	
Middle			2	0.34	NA			3 ft #5 Rebar	Covered by slumping
Bottom			0.6	0.42	NA			3 ft #5 Rebar	Covered by slumping
10.3 (BEHI)	Right	6.72							
Top			5.3	0.31	0.11		-0.2	3 ft #5 Rebar	Possible slumping at top
Middle			3.8	0.26	0.45		0.19	3 ft #5 Rebar	
Bottom			1.5	0.38	0.51		0.13	3 ft #5 Rebar	
403 St Andews Dr	Left	5		2.11.15	07.21.15	10.06.15			
Top			3.2	0.25	0.21	0.4	0.15	3 ft #5 Rebar	
Middle			1.9	0.2	0.2	0.2	0	3 ft #5 Rebar	
Bottom			0.75	0.19	0.2	0.2	0.01	3 ft #5 Rebar	
105 St Andrews Dr				2.23.15		10.06.15			
Top	Left	5.4	4.4	0.23		0.25	0.02	3 ft #5 Rebar	
Middle			3	0.24		0.28	0.04	3 ft #5 Rebar	
Bottom			1.4	0.23		0.33	0.1	3 ft #5 Rebar	

Table K.5 Continued

Location	Bank	Approximate Bank Height (ft)	Vertical Distance From Toe (ft)	Length of Pin Exposed From Bank (ft) (02.03.15-2.23.15)	Length of Pin Exposed From Bank (ft) (06.18.15)	Length of Pin Exposed From Bank (ft) (10.06.15)	Measured Bank Erosion at Pin (ft)	Notes: (02.03.15, 02.23.15)	Notes: (06.18.15, 06.23.15)
1908 Forest Hill Dr	Left	6		2.23.2015					
Top			3.5	0.38	3		2.62	3 ft #5 Rebar	3' Pin completely exposed, laying on bank, 4.2' x 4.3' scour area
Middle			2.5	0.34	0.35		0.01	3 ft #5 Rebar	
Bottom			0.9	0.25	0.27		0.02	3 ft #5 Rebar	
1705 Evans Street	Right	7.5		2.23.2015					
Top			4.8	0.22	0.76		0.54	3 ft #5 Rebar	
Middle			3.2	0.29	0.55		0.26	3 ft #5 Rebar	
Bottom			1.1	0.22	0.25		0.03	3 ft #5 Rebar	
2200 East 5th St	Right			2.23.2015					
Top			3.5	0.2	0.48		0.28	3 ft #5 Rebar	
Middle			2.6	0.26	0.23		-0.03	3 ft #5 Rebar	
Bottom			1.1	0.17	0.33		0.16	3 ft #5 Rebar	


Site 1.1 Bank Pins Left Bank


Site 1.1 Bank Pins Looking Downstream


Site 1.1 Bank Pins Looking Upstream


Site 2.2 Bank Pins Right Bank


Site 2.2 Bank Pins Looking Downstream


Site 2.2 Bank Pins Looking Upstream


Site 3.1 Bank Pins Left Bank


Site 3.1 Bank Pins Looking Downstream


Site 3.1 Bank Pins Looking Upstream


Site 4.2 Bank Pins Left Bank


Site 4.2 Bank Pins Looking Downstream


Site 4.2 Bank Pins Looking Upstream


Site 5.1 Bank Pins Right Bank


Site 5.1 Bank Pins Looking Downstream


Site 5.1 Bank Pins Looking Upstream2


Site 5.1 Bank Pins Looking Upstream


Site 6.2 Bank Pins Right Bank


Site 6.2 Bank Pins Looking Downstream


Site 6.2 Bank Pins Looking Upstream


Site 7.1 Bank Pins Right Bank


Site 7.1 Bank Pins Looking Downstream


Site 7.1 Bank Pins Looking Upstream


Site 8.2 Bank Pins Left Bank


Site 8.2 Bank Pins Looking Downstream


Site 8.2 Bank Pins Looking Upstream


Site 9.1 Bank Pins Right Bank


Site 9.1 Bank Pins Looking Upstream


Site 9.1 Bank Pins Looking Downstream


Site 10.3 Bank Pins Right Bank


Site 10.3 Bank Pins Looking Downstream


Site 10.3 Bank Pins Looking Upstream


Site 11 (105 St Andrews Dr) Bank Pins Left Bank


Site 11 (105 St Andrews Dr) Bank Pins Looking Downstream


Site 11 (105 St Andrews Dr) Bank Pins Looking Upstream


Site 11 (403 St Andrews Dr) Bank Pins Left Bank


Site 11 (403 St Andrews Dr) Bank Pins Looking Downstream


Site 11 (403 St Andrews Dr) Bank Pins Looking Upstream

L. NCDOT Bridge Inspection Reports

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY PITT

BRIDGE NUMBER 730030

INSPECTION CYCLE 2 YRS

ROUTE SR1703

ACROSS GREEN MILL RUN

M.P. 0

LOCATION 0.2 MI E JCT SR1707

PRECAST PRESTRESSED CONC.CORED SLAB

SUPERSTRUCTURE PRECAST PRESTRESSED CONC.CORED SLAB JOIST

SUBSTRUCTURE E.BTS&INT.BTS:RC CAPS/H-PILES @ VAR CTS.

1@24':1@51':1@24.75'

SPANS 1@25':1@50':1@25'

LONGITUDE 77° 22' 5.45"

LATITUDE 35° 36' 1.85"

INSPECTION DATE 09/09/2013

PRESENT CONDITION GOOD

PRESENT POSTING Not Posted NOT POSTED

PROPOSED POSTING

OTHER SIGNS PRESENT NONE

LOOKING EAST

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

NATIONAL BRIDGE INVENTORY-------- STRUCTURE INVENTORY AND APPRAISAL Run Date: 09/25/2013

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA BRIDGE 730030
(8) STRUCTURE NUMBER(FEDERAL) 000000001470030
(5) INVENTORY ROUTE (ON/UNDER) - ON 31017030
(2) STATE HIGHWAY DEPARTMENT DISTRICT 1
(3) COUNTY CODE 147 (4) PLACE CODE 28080
(6) FEATURE INTERSECTED - GREEN MILL RUN
(7) FACILITY CARRIED SR1703
(9) LOCATION 0.2 MI E JCT SR1707
(11)MILEPOINT 0
(16)LAT 35° 36' 1.85" (17)LONG 77° 22' 5.45"
(98)BORDER BRIDGE STATE CODE PCT SHARE
(99)BORDER BRIDGE STRUCTURE NO

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Prestressed Concrete
TYPE - Slab CODE 501
(44) STRUCTURE TYPE APPR :
TYPE - CODE 000
(45) NUMBER OF SPANS IN MAIN UNIT 3
(46) NUMBER OF APPROACH SPANS
(107)DECK STRUCTURE TYPE - 2 CODE
(108)WEARING SURFACE / PROTECTIVE SYSTEM :
(A) TYPE OF WEARING SURFACE - CODE
(B) TYPE OF MEMBRANE - CODE
(C) TYPE OF DECK PROTECTION - CODE

AGE AND SERVICE

(27) YEAR BUILT 2006
(106)YEAR RECONSTRUCTED
(42) TYPE OF SERVICE : ON - Highway - Pedestrian
UNDER - Waterway CODE 55
(28) LANES: ON STRUCTURE 3 UNDER STRUCTURE 0
(29) AVERAGE DAILY TRAFFIC 13000
(30) YEAR OF ADT 2012 (109) TRUCK ADT PCT 6%
(19) BYPASS OR DETOUR LENGTH 3 MI

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN 51 FT
(49) STRUCTURE LENGTH 100 FT
(50)CURB OR SIDEWALK: LEFT 4.9585 FT RIGHT 4.9585 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB 44.666 FT
(52) DECK WIDTH OUT TO OUT 60.417 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS) 45 FT
(33) BRIDGE MEDIAN - No Median CODE 0
(34) SKEW 25° (35) STRUCTURE FLARED 0
(10) INVENTORY ROUTE MIN VERT CLEAR 999.9 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR 44.666 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY 999.9 FT
(54) MIN VERT UNDERCLEAR REF Not a Highway or Railroad 0 FT
(55) MIN LAT UNDERCLEAR RT REF Not a Highway or Railroad 000 FT
(56) MIN LAT UNDERCLEAR LT REF - 000 FT

NAVIGATION DATA

(38) NAVIGATION CONTROL - No Navigational Control CODE 0
(111)PIER PROTECTION - CODE
(39) NAVIGATION VERTICAL CLEARANCE 0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR FT
(40) NAVIGATION HORIZONTAL CLEARANCE 0 FT

SUFFICIENCY RATING = 80.4
STATUS = Not Deficient

CLASSIFICATION CODE

(112)NBIS BRIDGE SYSTEM - YES
(104)HIGHWAY SYSTEM Is not on NHS 0
(26) FUNCTIONAL CLASS - Minor Arterial 16
(100)STRAHNET HIGHWAY - Not a STRAHNET Route 0
(101)PARALLEL STRUCTURE - No Parallel Structure N
(102)DIRECTION OF TRAFFIC - 2-way Traffic 2
(103)TEMPORARY STRUCTURE -
(110)DESIGNATED NATIONAL NETWORK - Not on the National Network 0
(20) TOLL On Free Road 3
(31) MAINTAIN - State Highway Agency 01
(22) OWNER - State Highway Agency 01
(37) HISTORICAL SIGNIFICANCE - Not Eligible 5

CONDITION CODE

(58) DECK 7
(59) SUPERSTRUCTURE 7
(60) SUBSTRUCTURE 7
(61) CHANNEL & CHANNEL PROTECTION 7
(62) CULVERTS N

LOAD RATING AND POSTING CODE

(31) DESIGN LOAD HS 25 or greater 9
(63) OPERATING RATING METHOD - Load Factor 1
(64) OPERATING RATING - HS-53 95
(65) INVENTORY RATING METHOD - Load Factor 1
(66) INVENTORY RATING - HS-32 57
(70) BRIDGE POSTING - No Posting Required 5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED A
DESCRIPTION - Open, No Restriction

APPRAISAL CODE

(67) STRUCTURAL EVALUATION 7
(68) DECK GEOMETRY 5
(69) UNDERCLEARANCES,VERTI & HORIZ N
(71) WATERWAY ADEQUACY 7
(72) APPROACH ROADWAY ALIGNMENT 8
(36) TRAFFIC SAFETY FEATURES 1111
(113)SCOUR CRITICAL BRIDGES 8

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK - CODE
(76) LENGTH OF STRUCTURE IMPROVEMENT
(94) BRIDGE IMPROVEMENT COST
(95) ROADWAY IMPROVEMENT COST
(96) TOTAL PROJECT COST
(97) YEAR OF IMPROVEMENT COST ESTIMATE
(114)FUTURE ADT 26000 (115) YEAR FUTURE ADT 2025

INSPECTIONS

(90) INSPECTION DATE 09/09/2013
(92) CRITICAL FEATURE INSPECTION : (93) CFI DATE
A) FRACTURE CRIT DETAIL - NO A)
B) UNDERWATER INSP - NO B)
C) OTHER SPECIAL INSP NO C)
SCOUR

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE Run Date: 09/25/2013

COUNTY : PITT | DIVISION : 2 | DISTRICT: 1 | STRUCTURE NUMBER : 730030 | LENGTH : 100 FEET

ROUTE CARRIED : SR1703 | FEATURE INTERSECTED : GREEN MILL RUN

LOCATED : 0.2 MI E JCT SR1707 | BRIDGE NAME : | CITY : GREENVILLE

FUNC. CLASS : 16 | SYST.ON : FA | SYST.UNDER : NFA | ADT & YR : 13000 2012 | RAIL TYPE : LT 639 RT 639

BUILT : 2006 | BY : DOH | PROJ : 8.2221601 | FED.AID PROJ : BRSTP-1703(2 | DESIGN LOAD : HS 25 or greater

REHAB : | BY : | PROJ : | ALIGNMENT : TAN. | SKEW : 115 | LANES : ON 3 UNDER 0

NAVIGATION : VC 0 FT HC 0 FT | HT. CRN. TO BED : 14 FT | WATER DEPTH : 2 FT

SUPERSTRUCTURE : PRECAST PRESTRESSED CONC.CORED SLAB

SUBSTRUCTURE : E.BTS&INT.BTS:RC CAPS/H-PILES @ VAR CTS.

SPANS : 1@24':1@51':1@24.75'

BEAMS OR GIRDERS : 19 LINES PPC CONC.CORED SLAB SECTIONS

FLOOR : PPC CS/2 AWS | ENCROACHMENT : | DECK (OUT TO OUT) : 60.417 FT

CLEAR ROADWAY : 44.666 FT | BETWEEN RAILS : 54.583 FT | SIDEWALK OR CURB : LT 4.9585 FT RT 4.9585 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. : HS-32 | OPE.RTG. : HS-53 | CONTR.MEMBER : CS - B | POSTED : SV TTST DATE 11/21/2006

SYSTEM : Secondary S.R. Route | GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY

INSPECTION TYPE Routine Inspection
BRIDGE NO. 730030 COUNTY PITT ROUTE SR1703 OVER GREEN MILL RUN
STRUCTURE TYPE PRECAST PRESTRESSED CONC.CORED SLAB JOIST
ROUTE ORIENTATION W - E SPANS 1@25':1@50':1@25'

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

INSPECTION ITEM

DECK ITEMS			GRADES
1. WEARING SURFACE			F
2. DECK NO. OF EA TYPE SPN GRADE RATES SI & A ITEM 58	a. CONCRETE	3	G
	b. TIMBER		
	c. STEEL PLANK		
	d. OPEN GRID		
3. RAILING	a. CONCRETE		
	b. TIMBER		
	c. ALUMINUM		G
	d. STEEL		
4. CURBS, WHEELGUARDS, PARAPETS, MEDIANS			G
5. WALKWAYS (ON OR ATTACHED TO STRUCTURE)			G
6. DECK EXP JTS. OR DEVICES. NO. OF EACH	a. STEEL PL OR FINGER		
	b. MISC PREFAB		
	c. COMPRESSION SEAL		
	d. STANDARD JOINTS	2	G
	e. OPEN JOINTS		
7. DECK DEBRIS (INCLUDES EXCESS SAND/GRAVEL)			G

SUPER STR. (FM. 1 (90)B TRUSS) ITEM 59	
10. LONGITUDINAL BEAMS OR GIRDERS	G
11. LONGITUDINAL JOIST OR STRINGERS	
12. INT. DIAP'S, X-FRAMES, BRACING & CONN'S	
13. END DIAP'S, CURTAIN WALLS, & CONN'S	
14. FLOOR BEAMS AND CONNECTIONS	
15. BEARING ASSEMBLIES (INCLUDING MISALIGN)	
16. DRAINAGE SYSTEM (ON STRUCTURE)	G
17. MOVABLE SPAN MACHINERY	

SUB STR. ITEMS. ITEM 60 (INCLUDE SCOUR)		
35. TIM SUB STR.	a. ABUT. & INT. BENT CAPS & RISERS	
	b. PILES, POST, SILLS, & BRACING	
	c. BULKHEADS, WING'S, & TIE BACKS	
36. CONC SUB STR.	a. ABUT. & INT. BENT CAPS	G
	b. ABUT. & BENT COL'S BREASTWALLS	
	c. ABUT. & INT. BENT PILES	
	d. BACKWALLS, WING'S, RETAIN. WALLS	G
	e. ABUT. & BENT FOOTINGS & SILLS	
37. STEEL SUB STR.	a. ABUT. & INT. BENT CAPS & RISERS	
	b. PILES, BRACING, AND BULKHEADS	G
38. FOUNDATION PILES TYPE MATERIAL		
39. SLOPE PROT., RIP-RAP (INCLUDE DRAINAGE)		F
40. FENDER SYSTEMS		
41. DRIFT		G

ITEM 61

45. CHANNEL & CHANNEL PROT.	a. WATERWAY	G
	b. ALIGNMENT	G
	c. SCOUR	G
	d. SLOPE PROT., RIP-RAP, DIKES, ETC.	
50. APPROACH ROADWAY CONDITION		G
51. APPROACH SLABS		
52. PAINT SYSTEM	CODE	
53. UTILITIES		
54. RESPONSE TO LIVE LOAD		G
55. ESTIMATED REMAINING LIFE		50
60. REGULATORY SIGN NOTICE ISSUED		NO
61. PROMPT-ACTION NOTICE ISSUED		NO
62. PRESENTLY POSTED		NO
63. TOT. FIELD INSP TIME (INCLUDE WRITE UP)(MAN HR)		10
64. TOTAL SNOOPER INSP. TIME (HRS)		
65. TOTAL TRAFFIC CONTROL TIME (MAN HRS)		

70. SI&A GENERAL CONDITION RATINGS		
a. DECK	ITEM 58	7
b. SUPERSTRUCTURE	ITEM 59	7
c. SUBSTRUCTURE	ITEM 60	7
d. CHANNEL & CHANNEL PROT.	ITEM 61	7

71. SI&A FIELD APPRAISAL RATINGS	
a. WATERWAY ADAQUACY	7
b. APPR. RDWY. ALIGNMENT	8
72. FIELD SCOUR EVALUATION	G

USE OF INSP. ACCESSIBILITY EQUIPMENT		
SNOOPER (CODE S, 4, OR N)	HRS	NO
LADDER		NO
BUCKET TRUCK		NO
BOAT		NO
OTHER		NO

SPECIAL INSPECTION REQUESTED FOR

NOTE

80. INSPECTED BY:	[illegible]
81. REVIEWED BY:	

Bridge I&A Form 1(82)H State of North Carolina Dept. of Transportation Division of Highways	FIELD INSPECTION REPORT Bridge Inspecion & Analysis	

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
1	F	(AWS) TRANSVERSE CRACK TO 1 1/2" OVER EBT 1. SIMILAR OVER INT. BTS. & EBT 2. (PHOTO) LONGITUDINAL CRACKS HAIRLINE TO 1/16" WIDE IN THE LEFT LANE OF SPAN 2. SIMILAR RT LANE & C/L OF SPAN 1. (PHOTO)
2a	G	(CONC DECK) SEE ITEM 10.
5	G	(WALKWAYS) TRANSVERSE CRACKS IN THE LEFT & RIGHT WALKWAYS WITH PATCH MATERIAL FAILING. (PHOTO)
6d	G	(STANDARD JOINTS) COVERED BY AWS. SIGNS OF LEAKAGE ON THE CAPS. SEE ITEM #1.
10	G	(PPC SLABS) SOME WATER LEAKAGE NOTED BETWEEN SLABS.
10A	NO	(CURVED GIRDERS) NO CURVED GIRDERS
36d	G	(CONC. RETAINING WALLS) SE RETAINING WALL CRACKED & DELAMINATED ADJACENT TO THE SIDEWALK.
39	F	(SLOPES) RIP RAP PLACED AT END BENTS 1, AND 2. VEGETATION AT NW SLOPE. SIMLAR AT NE & SW SLOPES. (PHOTO)
45b	G	(CHANNEL ALIGNMENT) CREEK ENTERS AT A SKEW TOWARDS BENT 2.
50	G	(APPROACH ROADWAY) BOTH APPROACHES ARE TRANSVERSE CRACKED WITH GOOD TRANSITIONS.
62	NO	(PRESENT POSTED) NOT POSTED.

BRIDGE INSPECTOR'S RECOMMENDATION FOR MAINTENANCE REPAIRS

Bridge: 730030 County PITT Date: 09/09/2013

These Repairs Should Be Made Within Twelve Months From Date Of This Inspection

MMS Code	Description of Function	Unit	Quantity	Remarks	Est. Cost
2816	Asphalt Surface Repair or Replacement	SY	89	APPROACHES HAVE CRACKS. WEARING SURFACE HAS CRACKS.	
2910	Manual Brush and Tree Control	LF	60	VEGETATION AT SLOPES.	

Key

Priority Maintenance Item Critical Finding Item Priority Maintenance Level Not Determined

SIMILAR TRANSVERSE CRACKS IN WEARING SURFACE OVER SUPPORTS.

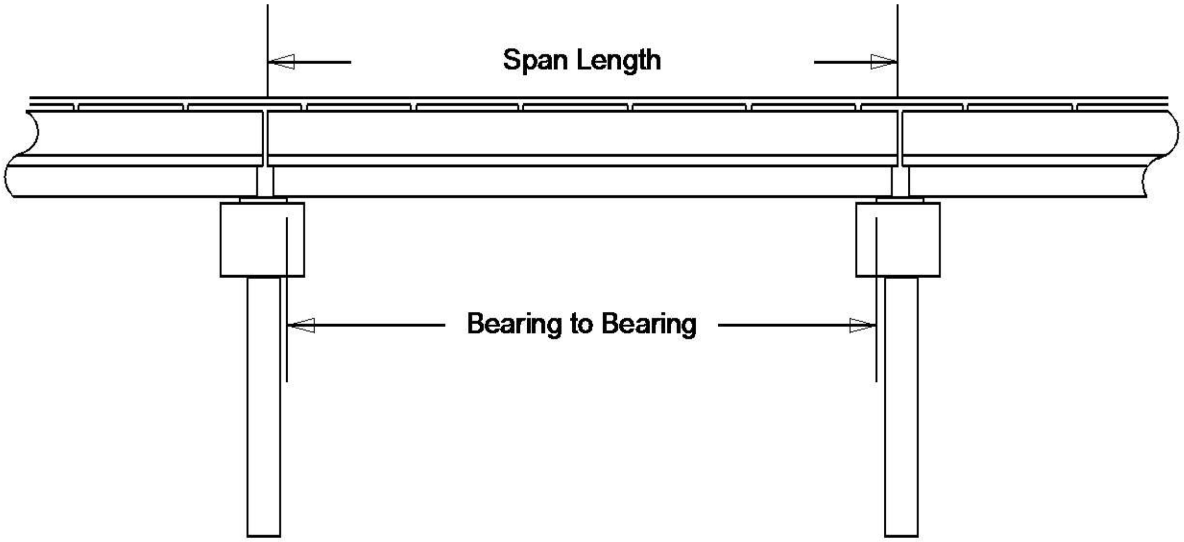
TRANSVERSE CRACK VISIBLE THRU FAILED PATCH MATERIAL ALONG RT WALKWAY. SIMLAR AT LT SIDE.

VEGETATION AT NW SLOPE. SIMLAR AT NE & SW SLOPES.

SIMILAR LONGITUDINAL CRACKS IN LT LANE OF SPAN 2. SIMLAR AT RT LANE & C/L OF SPAN 1.

Structure Data Worksheet

County: PITT Structure No: 730030 Date: 09/09/2013 Inspected By: BGL



Span No	Span Length	Bearing to Bearing	Comments
1	24'	22.5'	
2	51'	51'	
3	24.75'	23.25'	

Stream Bed Soundings

(See next sheet for profile sketch)

Bridge No: 730030 County: PITT Date: 09/09/2013 By: BGL

Record sounding from top of rail. Other location if needed: TOP OF RAILS

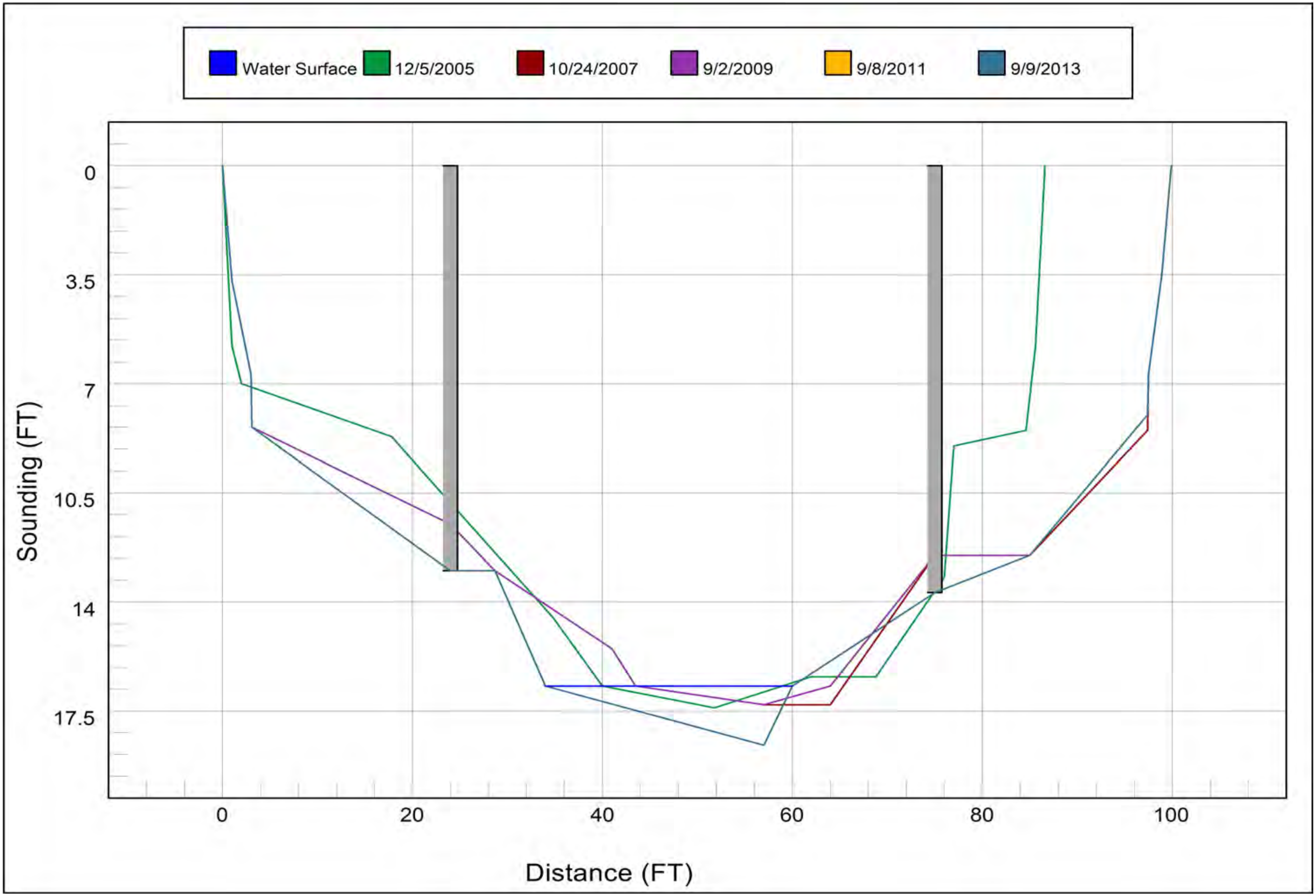
Distance from Highwater Mark to top of rail: 6.7 Location of Highwater Mark: TOP OF CAPS

DOWNSTREAM			UPSTREAM		
Distance (Station) (ft)	Sounding (ft)	Description	Distance (Station) (ft)	Sounding (ft)	Description
0	0		0	0	
1	3.7	TOP OF RETAIN. WALL			
3	6.7	Top of Cap	3	6.5	Top of Cap
3.1	8.4	TOP OF RIP RAP	3.1	8.3	TOP OF RIP RAP
24	13	BENT 1	24	13	BENT 1
28.7	13	TOE OF RIP RAP			
34	16.7	WSWE/ NORTH			
57	18.6	BED			
60	16.7	WSWE			
75	13.7	BENT 2	75	14.5	BENT 2
85	12.5	TOE OF RIP RAP	85	12.5	TOE OF RIP RAP
97.4	8	TOP OF RIP RAP	97.4	8.6	TOP OF RIP RAP
97.5	6.7	Top of Cap	97.5	6.4	Top of Cap
98.9	3.5	TOP OF RETAIN. WALL			
99.9	0		99.9	0	

Bridge: 730030 County PITT Date: 09/09/2013

STREAMBED PROFILE (Downstream)

Top of Rail = 0 FT (Sounding)



Bridge Inspection Field Sketch

Roadway	40.167ft Wide	3 Paved Lanes	Looking East
Left Shoulder	7.125ft Wide	2.5ft Curb & Gutter	4.625ft Walkway
Right Shoulder	6.75ft Wide	2.5ft Curb & Gutter	4.25ft Walkway
Left Guardrail			
Right Guardrail	6.75ft from road		

VERIFIED 9-9-13 BY BGL

Title	Description
730030 APPROACH ROADWAY	LOOKING EAST.

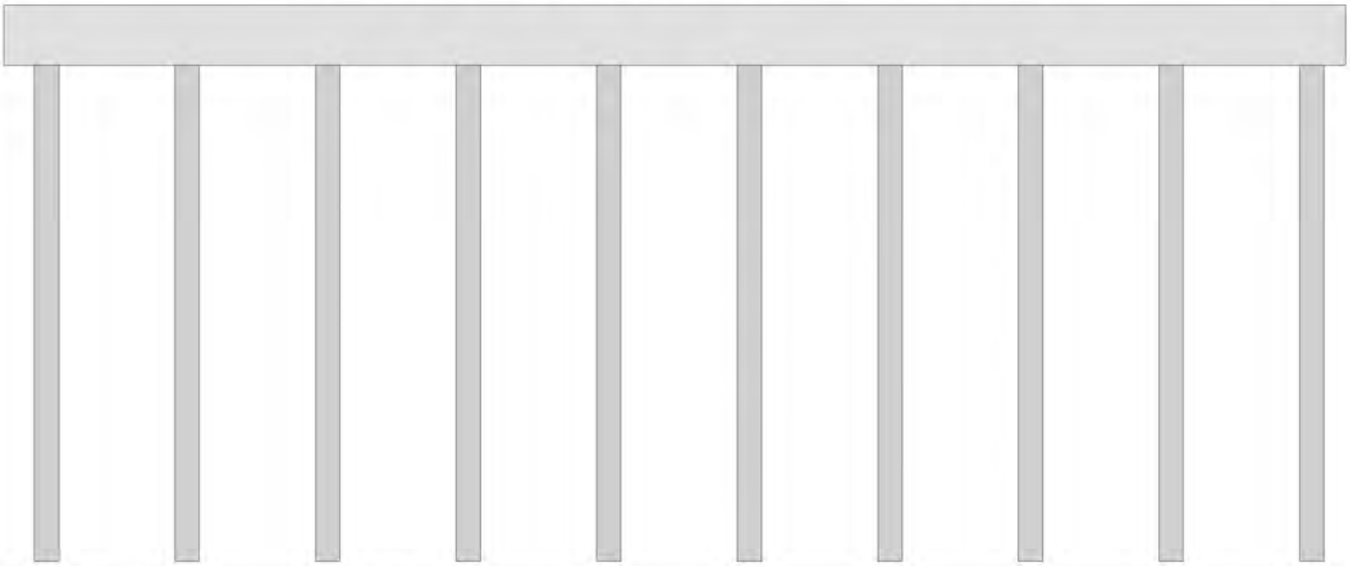
Bridge No: 730030	Drawn By: P.D.IPOCK	Date: 9-8-2011	File Name: S0050001394

Bridge Inspection Field Sketch

Title	Description
730030-BLANK PAGE 1	BLANK PAGE

Bridge No: 730030	**Drawn By:** P.D.IPOCK	**Date:** 9-8-2011	**File Name:** S0050001395

Bridge Inspection Field Sketch



Cap Information			Material Cast-in-Place Concrete			
Length	Width	Height	Left Overhang	Right Overhang	Left Beam to End of Cap.	Right Beam to End of Cap.
66.812 ft.	2.667 ft.	3.000 ft.	2.125 ft.	1.625 ft.	3.375 ft.	3.458 ft.

Subcap Information			Material		
Length	Width	Height	Left Overhang	Right Overhang	Left Pile to Splice.

Sill Information			Material
Length	Width	Height	

Pile #	Material	Spacing	Width/Dia.	Height	Length	Orientation	Driven?	Replacement?	Removed?	Collar?
1	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
2	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
3	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
4	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
5	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
6	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
7	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
8	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
9	Steel	7 ft.	1.208 ft.X1.167ft.			Vertical	Yes	No	No	No
10	Steel		1.208 ft.X1.167ft.			Vertical	Yes	No	No	No

Bent/Abutment #: 1 Similar Bents: 2 Note; EndBent Piles Not Visible.

VERIFIED 9-9-13 BY BGL

Title

730030 SUBSTRUCTURE/ BT.1

Description

SIMILAR INT. BTS.

Bridge No: 730030 **Drawn By:** P.D.IPOCK **Date:** 9-8-2011 **File Name:** S0050001397

Bridge Inspection Field Sketch

Title	Description
730030-BLANK PAGE 2	BLANK PAGE

Bridge No:	Drawn By:	Date:	File Name:
730030	P.D.IPOCK	9-8-2011	S0050001396

Bridge Inspection Field Sketch

Deck Width/Out to Out	60.417ft	Between Rails			54.583ft
Clear Roadway	44.666ft	Wearing Surface			0.187ft
Right & Left Turn Lane Width	13ft	Median Height			0ft
Curb Height		Left	0.479ft	Right	0.479ft
Sidewalk Width		Left	5.25ft	Right	5.208ft
Clear Roadway (Rail to Median)		Left	15.833ft	Right	15.833ft
Guardrail Width		Left	1.083ft	Right	1.083ft
Top of Rail to Deck/Wearing Surface		Left	4.021ft	Right	4.021ft
Bridge Rail		Left	Type 60	Right	Type 60
Concrete End Posts		Height	4.167ft	Width	1.145ft

Measurements for Span #	1		
Deck Thickness	1.75	Left Overhang	0
Top of Rail to Bottom of Beam	6.417	Right Overhang	0

Number of Slabs	Slab Width	Slab Height	Comments
20	3ft	1.75ft	

VERIFIED 9-9-13 BY BGL

Title

730030 SUPERSTRUCTURE/ SPAN 1

Description

SIMILAR SECTION.

Bridge No: 730030 **Drawn By:** P.D.IPOCK **Date:** 9-8-2011 **File Name:** S0050001398

SW GUARDRAIL END TERMINAL. (NE END SIMILAR)

LOOKING EAST, SR 1703

LOOKING EAST

SW GUARDRAIL POST SPACINGS AT TRANSITION TO BRIDGE RAIL. (NE TRANSITION SIMILAR)

SW GUARDRAIL CONNECTION. (NE CONNECTION SIMILAR)

LOOKING UPSTREAM-SOUTH

LOOKING WEST, SR 1703

SOUTH SIDE, LOOKING WEST

END BT 2. (END BT 1 SIMILAR)

SPAN 2 SIDE OF BT 1. (BT 2 SIMILAR)

SPAN 2 UNDERSIDE. (ALL SPANS SIMILAR)

NORTH SIDE, LOOKING WEST

LOOKING DOWNSTREAM-NORTH

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY PITT

BRIDGE NUMBER 730040

INSPECTION CYCLE 2 YRS

ROUTE SR1598

ACROSS GREEN MILL RUN

M.P. 0

LOCATION 2.43 MI E JCT US 13

SUPERSTRUCTURE TRIPLE 13'X14' RCBC;102' ALONG CENTERLINE CULVERT

SUBSTRUCTURE

SPANS

LONGITUDE 77° 21' 12.82"

LATITUDE 35° 36' 98.86"

INSPECTION DATE 09/03/2013

PRESENT CONDITION FAIR

PRESENT POSTING N NOT POSTED

PROPOSED POSTING

OTHER SIGNS PRESENT NONE

LOOKING EAST

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

NATIONAL BRIDGE INVENTORY-------- STRUCTURE INVENTORY AND APPRAISAL Run Date: 09/16/2013

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA BRIDGE	730040
(8) STRUCTURE NUMBER(FEDERAL)	000000001470040
(5) INVENTORY ROUTE (ON/UNDER) - ON	31015980
(2) STATE HIGHWAY DEPARTMENT DISTRICT	1
(3) COUNTY CODE 147 (4) PLACE CODE	28080
(6) FEATURE INTERSECTED - GREEN MILL RUN	
(7) FACILITY CARRIED SR1598	
(9) LOCATION 2.43 MI E JCT US 13	
(11)MILEPOINT	0
(16)LAT 35° 36' 98.86" (17)LONG 77° 21' 12.82"	
(98)BORDER BRIDGE STATE CODE PCT SHARE	
(99)BORDER BRIDGE STRUCTURE NO	

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Concrete continuous	
TYPE - Culverts (includes frame culverts) CODE	219
(44) STRUCTURE TYPE APPR :	
TYPE - CODE	000
(45) NUMBER OF SPANS IN MAIN UNIT	3
(46) NUMBER OF APPROACH SPANS	
(107)DECK STRUCTURE TYPE - N CODE	
(108)WEARING SURFACE / PROTECTIVE SYSTEM :	
(A) TYPE OF WEARING SURFACE - CODE	
(B) TYPE OF MEMBRANE - CODE	
(C) TYPE OF DECK PROTECTION - CODE	

AGE AND SERVICE

(27) YEAR BUILT	1972
(106)YEAR RECONSTRUCTED	
(42) TYPE OF SERVICE : ON - Highway	
UNDER - Waterway CODE	15
(28) LANES: ON STRUCTURE 5 UNDER STRUCTURE	0
(29) AVERAGE DAILY TRAFFIC	21000
(30) YEAR OF ADT 2012 (109) TRUCK ADT PCT	6%
(19) BYPASS OR DETOUR LENGTH	4 MI

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN	13 FT
(49) STRUCTURE LENGTH	41 FT
(50)CURB OR SIDEWALK: LEFT 0 FT RIGHT	0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB	0 FT
(52) DECK WIDTH OUT TO OUT	0 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)	64 FT
(33) BRIDGE MEDIAN - No Median CODE	0
(34) SKEW 0° (35) STRUCTURE FLARED	0
(10) INVENTORY ROUTE MIN VERT CLEAR	999.9 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR	64 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY	999.9 FT
(54) MIN VERT UNDERCLEAR REF Not a Highway or Railroad	0 FT
(55) MIN LAT UNDERCLEAR RT REF Not a Highway or Railroad	000 FT
(56) MIN LAT UNDERCLEAR LT REF -	000 FT

NAVIGATION DATA

(38) NAVIGATION CONTROL - No Navigational Control CODE	0
(111)PIER PROTECTION - CODE	
(39) NAVIGATION VERTICAL CLEARANCE	0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR	FT
(40) NAVIGATION HORIZONTAL CLEARANCE	0 FT

SUFFICIENCY RATING =	93.7
STATUS = Not Deficient	

CLASSIFICATION — CODE

(112)NBIS BRIDGE SYSTEM -	YES
(104)HIGHWAY SYSTEM Is not on NHS	0
(26) FUNCTIONAL CLASS - Minor Arterial	16
(100)STRAHNET HIGHWAY - Not a STRAHNET Route	0
(101)PARALLEL STRUCTURE - No Parallel Structure	N
(102)DIRECTION OF TRAFFIC - 2-way Traffic	2
(103)TEMPORARY STRUCTURE -	
(110)DESIGNATED NATIONAL NETWORK - Not on the National Network	0
(20) TOLL On Free Road	3
(31) MAINTAIN - State Highway Agency	01
(22) OWNER - State Highway Agency	01
(37) HISTORICAL SIGNIFICANCE - Not Eligible	5

CONDITION — CODE

(58) DECK	N
(59) SUPERSTRUCTURE	N
(60) SUBSTRUCTURE	N
(61) CHANNEL & CHANNEL PROTECTION	5
(62) CULVERTS	6

LOAD RATING AND POSTING — CODE

(31) DESIGN LOAD HS 20 + MOD	6
(63) OPERATING RATING METHOD - No Rating Analysis or Evaluatic	5
(64) OPERATING RATING - HS-26	46
(65) INVENTORY RATING METHOD - No Rating Analysis or Evaluatic	5
(66) INVENTORY RATING - HS-20	36
(70) BRIDGE POSTING - No Posting Required	5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED	A
DESCRIPTION - Open, No Restriction	

APPRAISAL — CODE

(67) STRUCTURAL EVALUATION	6
(68) DECK GEOMETRY	N
(69) UNDERCLEARANCES,VERTI & HORIZ	N
(71) WATERWAY ADEQUACY	7
(72) APPROACH ROADWAY ALIGNMENT	8
(36) TRAFFIC SAFETY FEATURES	NNNN
(113)SCOUR CRITICAL BRIDGES	8

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK - CODE	
(76) LENGTH OF STRUCTURE IMPROVEMENT	
(94) BRIDGE IMPROVEMENT COST	
(95) ROADWAY IMPROVEMENT COST	
(96) TOTAL PROJECT COST	
(97) YEAR OF IMPROVEMENT COST ESTIMATE	
(114)FUTURE ADT 42000 (115) YEAR FUTURE ADT	2025

INSPECTIONS

(90) INSPECTION DATE		09/03/2013
(92) CRITICAL FEATURE INSPECTION :		(93) CFI DATE
A) FRACTURE CRIT DETAIL -	NO	A)
B) UNDERWATER INSP -	NO	B)
C) OTHER SPECIAL INSP	NO	C)
SCOUR		

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE   Run Date: 09/16/2013

COUNTY : PITT
DIVISION : 2
DISTRICT: 1
STRUCTURE NUMBER : 730040
LENGTH : 41 FEET

ROUTE CARRIED : SR1598
FEATURE INTERSECTED : GREEN MILL RUN

LOCATED : 2.43 MI E JCT US 13
BRIDGE NAME :
CITY : GREENVILLE

FUNC. CLASS : 16
SYST.ON : FA
SYST.UNDER : NFA
ADT & YR : 21000 2012
RAIL TYPE : LT 0 RT 0

BUILT : 1972
BY : SHC
PROJ : 9.8022034
FED.AID PROJ :
DESIGN LOAD : HS 20 + MOD

REHAB :
BY :
PROJ :
ALIGNMENT : TAN.
SKEW : 90
LANES : ON 5 UNDER 0

NAVIGATION : VC 0 FT HC 0 FT
HT. CRN. TO BED : 17 FT
WATER DEPTH : 2 FT

SUPERSTRUCTURE : TRIPLE 13'X14' RCBC;102' ALONG CENTERLINE CULVERT

SUBSTRUCTURE :

SPANS :

BEAMS OR GIRDERS :

FLOOR :
ENCROACHMENT :
DECK (OUT TO OUT) : 0 FT

CLEAR ROADWAY : 0 FT
BETWEEN RAILS : 0 FT
SIDEWALK OR CURB : LT 0 FT RT 0 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. : HS-20
OPE.RTG. : HS-26
CONTR.MEMBER : RCBC
POSTED : SV TTST DATE

SYSTEM : Secondary S.R. Route
GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY
(R. C. BOX CULVERTS)

INSPECTION TYPE Routine Inspection INSPECTION DATE 09/03/2013 ROUTE ORIENTATION W - E
BRIDGE NO. 730040 ROUTE SR1598 OVER GREEN MILL RUN

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Top Slab			F
2. Bottom Slab			
3. Ext. & Int. Walls			F
4. Wingwalls - Retaining Walls			G
5. Headwalls, Toewalls, Flumes			G
6. Structure Alignment - Settlement			G
7. Drainage Systems (On Structure)			G
8. Channel & Channel Protection	a. Waterway		F
	b. Alignment		P
	c. Scour		G
	d. Slope Prot. (Rip-Rap, Dikes, etc.)		
9. Approach Roadway Condition			F
10. Estimated Remaining Life			25
11. Channel & Channel Protection		Item 61	5
12. Culvert & Retaining Walls		Item 62	6
13. Waterway Adequacy		Item 71	7
14. Approach Roadway		Item 72	8
15. Field Scour Evaluation			B
16. Presently Posted			NO
17. Regulatory Sign Notice Issued			NO
18. Prompt Action Notice Issued			NO
19. Total Field Inspection Time			8
20. Inspected By		B G Littleton [signature]	

Bridge I&A Form 1(82)H State of North Carolina Dept. of Transportation Division of Highways	FIELD INSPECTION REPORT Bridge Inspecion & Analysis	

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
8a	F	(WATERWAY) SILT IN BARREL 1. (PHOTO) DRIFT @ THE SOUTH END OF INT. WALL 2. (PHOTO) PIPE & DEBRIS IN BARREL 3. (PHOTO)
8b	P	(CHANNEL ALIGNMENT) CREEK ENTERS AT A SKEW.
8c	G	(SCOUR) SCOUR NOTED BEHIND THE S.W. WING IS STABLE. STREAMBED TO 1' BELOW INVERT AT BARREL 3, UPSTREAM END. STREAMBED TO 1.333' TO 1.583' BELOW INVERT AT BARREL 2, UPSTREAM END.
9	F	(APPROACH ROADWAY) BOTH APPROACHES CRACKED WITH SLIGHT SETTLEMENT ALONG CULVERT EDGES. WEARING SURFACE OVER CULVERT HAS CRACKS.
1	F	(TOP SLAB) H/L TRANSVERSE CRACK WITH EFFLORESCENCE IN THE TOP SLAB OF BARREL 3, 30' FROM THE N. END. OTHER AREAS ARE SIMILAR. (BOTTOM SLABS) NOT VISIBLE.
3	F	(INT. & EXT. WALLS) VERTICAL & DIAGONAL CRACKS TO 1/16" NOTED. H/L TO 1/16" DIAGONAL CRACK IN THE EAST WALL OF BARREL 1. SIMILAR CRACKS IN BOTH WALLS OF BARREL 2. H/L TO 1/16" VERTICAL CRACK IN THE WEST WALL OF BARREL 2, 15' FROM THE N. END. SIMILAR CRACKS IN THE E. WALL OF BARREL 2 @ 10' & 20' FROM THE N.END. H/L TO 1/16" VERTICAL CRACK IN THE E. WALL OF BARREL 2 @ MIDSPAN.
4	G	(WINGWALLS) H/L MAPCRACKING NOTED @ THE NW WING.

Bridge I&A Form 1(82)H State of North Carolina Dept. of Transportation Division of Highways	FIELD INSPECTION REPORT Bridge Inspecion & Analysis	

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
5	G	(HEADWALLS) NO NOTEWORTHY PROBLEMS.
16	NO	(PRESENTLY POSTED) NOT POSTED

BRIDGE INSPECTOR'S RECOMMENDATION FOR MAINTENANCE REPAIRS

Bridge: 730040 County PITT Date: 09/03/2013

These Repairs Should Be Made Within Twelve Months From Date Of This Inspection

MMS Code	Description of Function	Unit	Quantity	Remarks	Est. Cost
2816	Asphalt Surface Repair or Replacement	SY	285	BOTH APPROACHES SLIGHTLY SETTLED. WEARING SURFACE CRACKED OVER THE CULVERT IN ALL LANES.	
3366	Drift and Debris Removal	HR	40	DRIFT @ THE SOUTH END OF INTERIOR WALL 2 & IN BARREL 3.	
3370	Maintenance and Repair of NBIS Pipes and Culverts	LF	102	CRACKS IN THE SLABS & WALLS.	

Key

Priority Maintenance Item Critical Finding Item Priority Maintenance Level Not Determined

SILT IN BARREL 1.

DRIFT @ THE SOUTH END OF INT. WALL 2.

PIPE & DEBRIS IN BARREL 3

Bridge Inspection Field Sketch

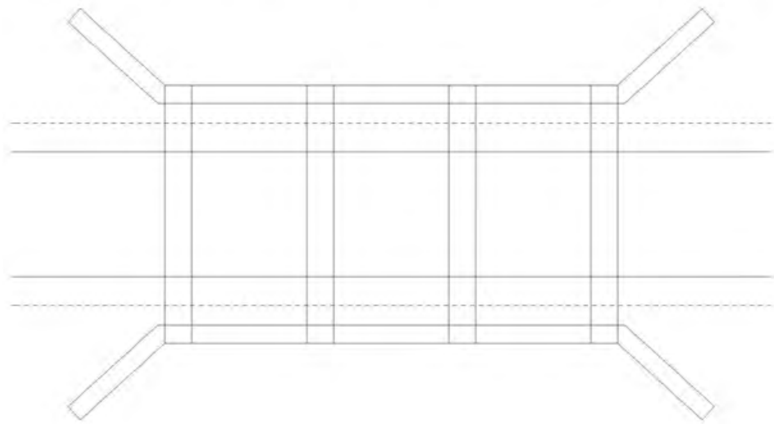
Roadway	64ft Wide	5 Paved Lanes	Looking East
Left Shoulder	13ft Wide		13ft Unpaved
Right Shoulder	13ft Wide		13ft Unpaved
Left Guardrail			
Right Guardrail			

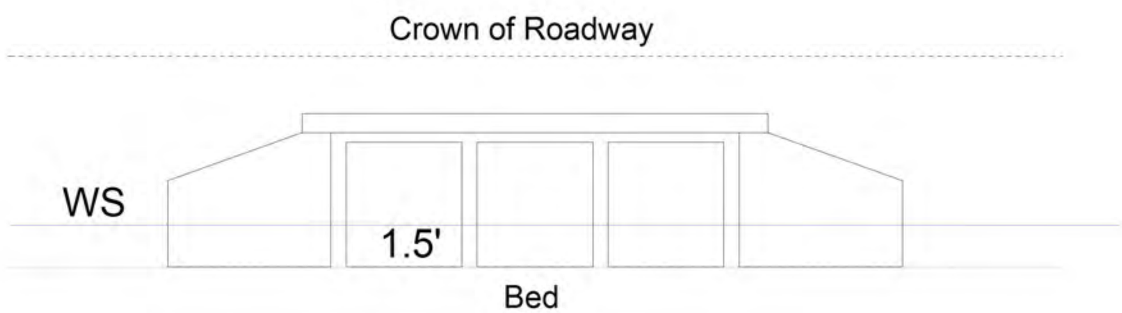
VERIFIED BY; PD IPOCK, 9-3-2013.

Title 730040 APPROACH ROADWAY/ WEST APPROACH	**Description** LOOKING EAST.

Bridge No: 730040	**Drawn By:** P.D.IPOCK	**Date:** 9-8-11	**File Name:** S0050001311

Bridge Inspection Field Sketch





Number of Barrels	Skew	Distance From Crown to Bed
3	90°	17ft
Length Along Center Line of Culvert		Length Along Center Line of Roadway
102ft		40.666 ft

Barrel #	Width	Height	Wall Thickness	Scour at Inlet	Scour at Outlet
1	13ft	14ft		0	0
2	13ft	14ft	0.833ft	1.583'	0
3	13ft	14ft	0.833ft	UP TO 1'	0

VERIFIED BY; PD IPOCK, 9-3-2013.

Title	**Description**
730040 STRUCTURE	TRIPLE RCBC.

Bridge No: 730040	**Drawn By:** P.D. IPOCK	**Date:** 9-8-11	**File Name:** S0050002807

LOOKING EAST

DOWNSTREAM NORTH

NORTH END, LOOKING EAST.

UPSTREAM SOUTH

LOOKING WEST, US 264 BUS.

SOUTH END, LOOKING EAST.

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY PITT

BRIDGE NUMBER 730047

INSPECTION CYCLE 2 YRS

NC11/NC43/NC903

ROUTE NC11

ACROSS GREEN MILL RUN

M.P. 0

LOCATION 1.0 MI N JCT US 264 BYP

SUPERSTRUCTURE TRIPLE 11'X10' RCBC;88'5 ALONG CENTERLINE CULVERT

SUBSTRUCTURE

SPANS

LONGITUDE 77° 23' 46.05"

LATITUDE 35° 35' 66.39"

INSPECTION DATE 09/03/2013

PRESENT CONDITION GOOD

PRESENT POSTING Not Posted NOT POSTED

PROPOSED POSTING

OTHER SIGNS PRESENT NONE

LOOKING NORTH

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA BRIDGE 730047
(8) STRUCTURE NUMBER(FEDERAL) 000000001470047
(5) INVENTORY ROUTE (ON/UNDER) - ON 31000110
(2) STATE HIGHWAY DEPARTMENT DISTRICT 1
(3) COUNTY CODE 147 (4) PLACE CODE 28080
(6) FEATURE INTERSECTED - GREEN MILL RUN
(7) FACILITY CARRIED NC11
(9) LOCATION 1.0 MI N JCT US 264 BYP
(11)MILEPOINT 0
(16)LAT 35° 35' 66.39" (17)LONG 77° 23' 46.05"
(98)BORDER BRIDGE STATE CODE PCT SHARE
(99)BORDER BRIDGE STRUCTURE NO

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Concrete continuous
TYPE - Culverts (includes frame culverts) CODE 219
(44) STRUCTURE TYPE APPR :
TYPE - CODE 000
(45) NUMBER OF SPANS IN MAIN UNIT 3
(46) NUMBER OF APPROACH SPANS
(107)DECK STRUCTURE TYPE - N CODE
(108)WEARING SURFACE / PROTECTIVE SYSTEM :
(A) TYPE OF WEARING SURFACE - CODE
(B) TYPE OF MEMBRANE - CODE
(C) TYPE OF DECK PROTECTION - CODE

AGE AND SERVICE

(27) YEAR BUILT 1955
(106)YEAR RECONSTRUCTED
(42) TYPE OF SERVICE : ON - Highway
UNDER - Waterway CODE 15
(28) LANES: ON STRUCTURE 5 UNDER STRUCTURE 0
(29) AVERAGE DAILY TRAFFIC 26000
(30) YEAR OF ADT 2012 (109) TRUCK ADT PCT 12%
(19) BYPASS OR DETOUR LENGTH 7 MI

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN 11 FT
(49) STRUCTURE LENGTH 37 FT
(50)CURB OR SIDEWALK: LEFT 0 FT RIGHT 0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB 0 FT
(52) DECK WIDTH OUT TO OUT 0 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS) 60 FT
(33) BRIDGE MEDIAN - No Median CODE 0
(34) SKEW 20° (35) STRUCTURE FLARED 0
(10) INVENTORY ROUTE MIN VERT CLEAR 999.9 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR 60 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY 999.9 FT
(54) MIN VERT UNDERCLEAR REF Not a Highway or Railroad 0 FT
(55) MIN LAT UNDERCLEAR RT REF Not a Highway or Railroad 000 FT
(56) MIN LAT UNDERCLEAR LT REF - 000 FT

NAVIGATION DATA

(38) NAVIGATION CONTROL - No Navigational Control CODE 0
(111)PIER PROTECTION - CODE
(39) NAVIGATION VERTICAL CLEARANCE 0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR FT
(40) NAVIGATION HORIZONTAL CLEARANCE 0 FT

SUFFICIENCY RATING = 86.35
STATUS = Not Deficient

CLASSIFICATION CODE

(112)NBIS BRIDGE SYSTEM - YES
(104)HIGHWAY SYSTEM Is not on NHS 0
(26) FUNCTIONAL CLASS - Other Principal Arterial 14
(100)STRAHNET HIGHWAY - Not a STRAHNET Route 0
(101)PARALLEL STRUCTURE - No Parallel Structure N
(102)DIRECTION OF TRAFFIC - 2-way Traffic 2
(103)TEMPORARY STRUCTURE -
(110)DESIGNATED NATIONAL NETWORK - On the National Network 1
(20) TOLL On Free Road 3
(31) MAINTAIN - State Highway Agency 01
(22) OWNER - State Highway Agency 01
(37) HISTORICAL SIGNIFICANCE - Not Eligible 5

CONDITION CODE

(58) DECK N
(59) SUPERSTRUCTURE N
(60) SUBSTRUCTURE N
(61) CHANNEL & CHANNEL PROTECTION 6
(62) CULVERTS 7

LOAD RATING AND POSTING CODE

(31) DESIGN LOAD HS 20 + MOD 6
(63) OPERATING RATING METHOD - Load Factor 1
(64) OPERATING RATING - HS-26 46
(65) INVENTORY RATING METHOD - Load Factor 1
(66) INVENTORY RATING - HS-20 36
(70) BRIDGE POSTING - No Posting Required 5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED A
DESCRIPTION - Open, No Restriction

APPRAISAL CODE

(67) STRUCTURAL EVALUATION 7
(68) DECK GEOMETRY N
(69) UNDERCLEARANCES,VERTI & HORIZ N
(71) WATERWAY ADEQUACY 7
(72) APPROACH ROADWAY ALIGNMENT 8
(36) TRAFFIC SAFETY FEATURES NNNN
(113)SCOUR CRITICAL BRIDGES 8

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK - CODE
(76) LENGTH OF STRUCTURE IMPROVEMENT
(94) BRIDGE IMPROVEMENT COST
(95) ROADWAY IMPROVEMENT COST
(96) TOTAL PROJECT COST
(97) YEAR OF IMPROVEMENT COST ESTIMATE
(114)FUTURE ADT 52000 (115) YEAR FUTURE ADT 2025

INSPECTIONS

(90) INSPECTION DATE 09/03/2013
(92) CRITICAL FEATURE INSPECTION : (93) CFI DATE
A) FRACTURE CRIT DETAIL - NO A)
B) UNDERWATER INSP - NO B)
C) OTHER SPECIAL INSP NO C)
SCOUR

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE   Run Date: 09/16/2013

COUNTY :	DIVISION :	DISTRICT:	STRUCTURE NUMBER :	LENGTH :
PITT	2	1	730047	37 FEET

ROUTE CARRIED : NC11

FEATURE INTERSECTED : GREEN MILL RUN

LOCATED : 1.0 MI N JCT US 264 BYP

BRIDGE NAME :

CITY : GREENVILLE

FUNC. CLASS :	SYST.ON :	SYST.UNDER :	ADT & YR :	RAIL TYPE :
14	FA	NFA	26000 2012	LT 0 RT 0

BUILT :	BY :	PROJ :	FED.AID PROJ :	DESIGN LOAD :
1955	BMU			HS 20 + MOD

REHAB :	BY :	PROJ :	ALIGNMENT :	SKEW :	LANES :
			TAN.	70	ON 5 UNDER 0

NAVIGATION : VC 0 FT HC 0 FT

HT. CRN. TO BED : 13 FT

WATER DEPTH : 2 FT

SUPERSTRUCTURE : TRIPLE 11'X10' RCBC;88'5 ALONG CENTERLINE CULVERT

SUBSTRUCTURE :

SPANS :

BEAMS OR GIRDERS :

FLOOR :

ENCROACHMENT :

DECK (OUT TO OUT) : 0 FT

CLEAR ROADWAY : 0 FT

BETWEEN RAILS : 0 FT

SIDEWALK OR CURB : LT 0 FT RT 0 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. :	OPE.RTG. :	CONTR.MEMBER :	POSTED :		
HS-20	HS-26	RCBC	SV	TTST	DATE

SYSTEM : Primary N.C. Route

GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY
(R. C. BOX CULVERTS)

INSPECTION TYPE Routine Inspection INSPECTION DATE 09/03/2013 ROUTE ORIENTATION S - N
BRIDGE NO. 730047 ROUTE NC11 OVER GREEN MILL RUN

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Top Slab			G
2. Bottom Slab			
3. Ext. & Int. Walls			G
4. Wingwalls - Retaining Walls			G
5. Headwalls, Toewalls, Flumes			G
6. Structure Alignment - Settlement			G
7. Drainage Systems (On Structure)			G
8. Channel & Channel Protection	a. Waterway		F
	b. Alignment		F
	c. Scour		G
	d. Slope Prot. (Rip-Rap, Dikes, etc.)		
9. Approach Roadway Condition			G
10. Estimated Remaining Life			18
11. Channel & Channel Protection		Item 61	6
12. Culvert & Retaining Walls		Item 62	7
13. Waterway Adequacy		Item 71	7
14. Approach Roadway		Item 72	8
15. Field Scour Evaluation			G
16. Presently Posted			NO
17. Regulatory Sign Notice Issued			NO
18. Prompt Action Notice Issued			NO
19. Total Field Inspection Time			8
20. Inspected By		B G Littleton	

Bridge I&A Form 1(82)H

State of North Carolina
Dept. of Transportation
Division of Highways

FIELD INSPECTION REPORT

Bridge Inspecion & Analysis

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
8a	F	(WATERWAY) SILT IN ALL BARRELS WITH SCATTERED DEBRIS/DRIFT.
8b	F	(CHANNEL ALIGNMENT) CREEK ENTERS AT A SKEW.
1	G	(TOP SLAB) NO NOTEWORTHY DEFECTS. (BOTTOM SLAB) NOT VISIBLE DUE TO SILT.
3	G	(WALLS) THERE IS A HL DIAGONAL CRACK AT THE SOUTH EXTERIOR WALL OF BARREL #1 NEAR THE EAST END. SIMILAR AT OTHERS. THERE IS A HL VERTICAL CRACK AT THE NORTH INTERIOR WALL OF BARREL #1 NEAR THE EAST END. SIMILAR AT RANDOM IN ALL BARRELS. SURFACE ABRASION AT THE LOWER PORTION OF BARREL #1 DUE TO WATER ACTION. ALL OTHERS ARE SIMILAR.
4	G	(WINGWALLS) THE SE WINGWALL IS VERTICALLY CRACKED TO 1/4" AT THE JUNCTION OF THE EXTERIOR WALL OF BARREL #1. HL MAP CRACKS AT THE SW WINGWALL. ALL OTHERS ARE SIMILAR.
5	G	(HEADWALLS) HEAVY VEGETATION ALONG THE EAST HEADWALL. (PHOTO)
16	NO	(PRESENTLY POSTED) NOT POSTED

BRIDGE INSPECTOR'S RECOMMENDATION FOR MAINTENANCE REPAIRS

Bridge: 730047 County PITT Date: 09/03/2013

These Repairs Should Be Made Within Twelve Months From Date Of This Inspection

MMS Code	Description of Function	Unit	Quantity	Remarks	Est. Cost
2910	Manual Brush and Tree Control	LF	40	HEAVY VEGETATION ALONG THE EAST HEADWALL.	
3370	Maintenance and Repair of NBIS Pipes and Culverts	LF	8	CRACK AT SE WINGWALL JUNCTION TO EXTERIOR WALL.	

Key

Priority Maintenance Item Critical Finding Item Priority Maintenance Level Not Determined

HEAVY VEGETATION ALONG THE EAST HEADWALL.

Bridge Inspection Field Sketch

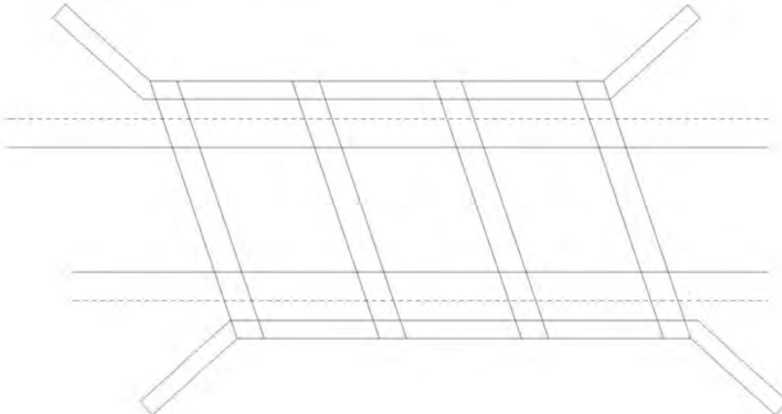
Roadway	60ft Wide	5 Paved Lanes	Looking North
Left Shoulder	10ft Wide		10ft Unpaved
Right Shoulder	11ft Wide		11ft Unpaved
Left Curb	2.417ft Wide		
Right Curb	2.417ft Wide		

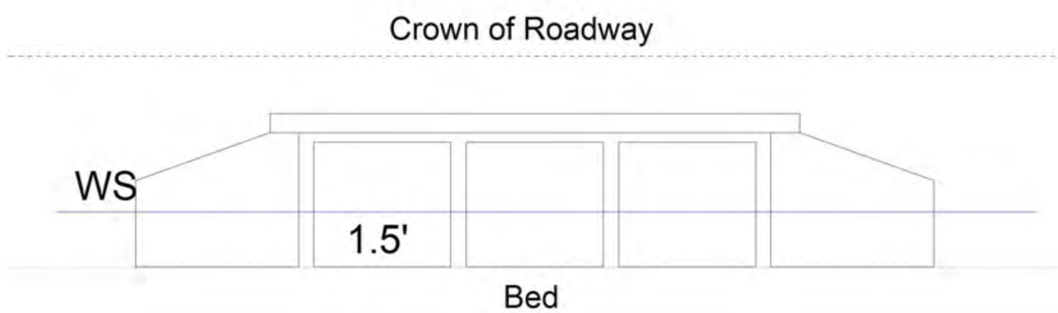
VERIFIED 9-3-13 BY BGL

Title	Description
730047 APPROACH ROADWAY	LOOKING NORTH.

Bridge No: 730047	Drawn By: P.D.IPOCK	Date: 9-12-11	File Name: S0050001283

Bridge Inspection Field Sketch





Number of Barrels	Skew	Distance From Crown to Bed
3	70°	13ft
Length Along Center Line of Culvert		Length Along Center Line of Roadway
88.417ft		36.58ft

Barrel #	Width	Height	Wall Thickness	Scour at Inlet	Scour at Outlet
1	11ft	10ft		1'	0
2	11ft	10ft	0.667ft	1'	0
3	11ft	10ft	0.667ft	0	0

VERIFIED 9-3-13 BY BGL

Title	Description
730047 STRUCTURE	TRIPLE RCBC.

Bridge No: 730047	Drawn By: P.D.IPOCK	Date: 9-12-11	File Name: S0050002817

LOOKING SOUTH, NC11/NC43/NC903

LOOKING NORTH

EAST END, LOOKING SOUTH

LOOKING DOWNSTREAM-EAST

LOOKING UPSTREAM-WEST

WEST END, LOOKING SOUTH

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY PITT

BRIDGE NUMBER 730238

INSPECTION CYCLE 2 YRS

ROUTE SR1702

ACROSS GREEN MILL RUN

M.P. 0

LOCATION 1.1 MI.N.JCT.US264BYP

SUPERSTRUCTURE TRIPLE 9'X6'RCBC;137'10 ALONG CENTERLINE CULVERT

SUBSTRUCTURE

SPANS

LONGITUDE 77° 22' 39.63"

LATITUDE 35° 35' 34.31"

INSPECTION DATE 09/03/2013

PRESENT CONDITION GOOD

PRESENT POSTING N NOT POSTED

PROPOSED POSTING

OTHER SIGNS PRESENT NONE

LOOKING NORTH

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

NATIONAL BRIDGE INVENTORY-------- STRUCTURE INVENTORY AND APPRAISAL Run Date: 09/17/2013

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA	BRIDGE	730238
(8) STRUCTURE NUMBER(FEDERAL)		000000001470238
(5) INVENTORY ROUTE (ON/UNDER) - ON		31017020
(2) STATE HIGHWAY DEPARTMENT DISTRICT		1
(3) COUNTY CODE 147	(4) PLACE CODE	28080
(6) FEATURE INTERSECTED - GREEN MILL RUN		
(7) FACILITY CARRIED SR1702		
(9) LOCATION 1.1 MI.N.JCT.US264BYP		
(11)MILEPOINT		0
(16)LAT 35° 35' 34.31"	(17)LONG	77° 22' 39.63"
(98)BORDER BRIDGE STATE CODE	PCT SHARE	
(99)BORDER BRIDGE STRUCTURE NO		

SUFFICIENCY RATING = 91.75

STATUS = Not Deficient

CLASSIFICATION

		CODE
(112)NBIS BRIDGE SYSTEM -		YES
(104)HIGHWAY SYSTEM	Is not on NHS	0
(26) FUNCTIONAL CLASS -	Minor Arterial	16
(100)STRAHNET HIGHWAY -	Not a STRAHNET Route	0
(101)PARALLEL STRUCTURE -	No Parallel Structure	N
(102)DIRECTION OF TRAFFIC -	2-way Traffic	2
(103)TEMPORARY STRUCTURE -		
(110)DESIGNATED NATIONAL NETWORK -	Not on the National Network	0
(20) TOLL	On Free Road	3
(31) MAINTAIN -	State Highway Agency	01
(22) OWNER -	State Highway Agency	01
(37) HISTORICAL SIGNIFICANCE -	Not Eligible	5

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Concrete continuous		
TYPE - Culverts (includes frame culverts)	CODE	219
(44) STRUCTURE TYPE APPR :		
TYPE -	CODE	000
(45) NUMBER OF SPANS IN MAIN UNIT		3
(46) NUMBER OF APPROACH SPANS		
(107)DECK STRUCTURE TYPE - N	CODE	
(108)WEARING SURFACE / PROTECTIVE SYSTEM :		
(A) TYPE OF WEARING SURFACE -	CODE	
(B) TYPE OF MEMBRANE -	CODE	
(C) TYPE OF DECK PROTECTION -	CODE	

CONDITION

	CODE
(58) DECK	N
(59) SUPERSTRUCTURE	N
(60) SUBSTRUCTURE	N
(61) CHANNEL & CHANNEL PROTECTION	7
(62) CULVERTS	7

LOAD RATING AND POSTING

		CODE
(31) DESIGN LOAD	HS 20 + MOD	6
(63) OPERATING RATING METHOD -	Load and Resistance Factor	3
(64) OPERATING RATING -	HS-45	81
(65) INVENTORY RATING METHOD -	Load and Resistance Factor	3
(66) INVENTORY RATING -	HS-34	62
(70) BRIDGE POSTING -	No Posting Required	5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED		A
DESCRIPTION -	Open, No Restriction	

AGE AND SERVICE

(27) YEAR BUILT		1990
(106)YEAR RECONSTRUCTED		
(42) TYPE OF SERVICE : ON - Highway		
UNDER - Waterway	CODE	15
(28) LANES: ON STRUCTURE 5	UNDER STRUCTURE	0
(29) AVERAGE DAILY TRAFFIC		22000
(30) YEAR OF ADT 2012	(109) TRUCK ADT PCT	6%
(19) BYPASS OR DETOUR LENGTH		5 MI

APPRAISAL

	CODE
(67) STRUCTURAL EVALUATION	7
(68) DECK GEOMETRY	N
(69) UNDERCLEARANCES,VERTI & HORIZ	N
(71) WATERWAY ADEQUACY	7
(72) APPROACH ROADWAY ALIGNMENT	7
(36) TRAFFIC SAFETY FEATURES	NNNN
(113)SCOUR CRITICAL BRIDGES	8

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN		9 FT
(49) STRUCTURE LENGTH		40 FT
(50)CURB OR SIDEWALK: LEFT 0 FT	RIGHT	0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB		0 FT
(52) DECK WIDTH OUT TO OUT		0 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)		64 FT
(33) BRIDGE MEDIAN - No Median	CODE	0
(34) SKEW 41°	(35) STRUCTURE FLARED	0
(10) INVENTORY ROUTE MIN VERT CLEAR		999.9 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR		64 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY		999.9 FT
(54) MIN VERT UNDERCLEAR REF Not a Highway or Railroad		0 FT
(55) MIN LAT UNDERCLEAR RT REF Not a Highway or Railroad		000 FT
(56) MIN LAT UNDERCLEAR LT REF -		000 FT

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK -	CODE
(76) LENGTH OF STRUCTURE IMPROVEMENT	
(94) BRIDGE IMPROVEMENT COST	
(95) ROADWAY IMPROVEMENT COST	
(96) TOTAL PROJECT COST	
(97) YEAR OF IMPROVEMENT COST ESTIMATE	
(114)FUTURE ADT 44000	(115) YEAR FUTURE ADT 2025

NAVIGATION DATA

(38) NAVIGATION CONTROL - No Navigational Control	CODE	0
(111)PIER PROTECTION -	CODE	
(39) NAVIGATION VERTICAL CLEARANCE		0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR		FT
(40) NAVIGATION HORIZONTAL CLEARANCE		0 FT

INSPECTIONS

(90) INSPECTION DATE 09/03/2013

(92) CRITICAL FEATURE INSPECTION :		(93) CFI DATE
A) FRACTURE CRIT DETAIL -	NO	A)
B) UNDERWATER INSP -	NO	B)
C) OTHER SPECIAL INSP	NO	C)
SCOUR		

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE Run Date: 09/17/2013

COUNTY : PITT
DIVISION : 2
DISTRICT: 1
STRUCTURE NUMBER : 730238
LENGTH : 40 FEET

ROUTE CARRIED : SR1702
FEATURE INTERSECTED : GREEN MILL RUN

LOCATED : 1.1 MI.N.JCT.US264BYP
BRIDGE NAME :
CITY : GREENVILLE

FUNC. CLASS : 16
SYST.ON : FA
SYST.UNDER : NFA
ADT & YR : 22000 2012
RAIL TYPE : LT 0 RT 0

BUILT : 1990
BY : DOH
PROJ : 9.8022010
FED.AID PROJ :
DESIGN LOAD : HS 20 + MOD

REHAB :
BY :
PROJ :
ALIGNMENT : TAN
SKEW : 49
LANES : ON 5 UNDER 0

NAVIGATION : VC 0 FT HC 0 FT
HT. CRN. TO BED : 9 FT
WATER DEPTH : 1 FT

SUPERSTRUCTURE : TRIPLE 9'X6'RCBC;137'10 ALONG CENTERLINE CULVERT

SUBSTRUCTURE :

SPANS :

BEAMS OR GIRDERS :

FLOOR :
ENCROACHMENT :
DECK (OUT TO OUT) : 0 FT

CLEAR ROADWAY : 0 FT
BETWEEN RAILS : 0 FT
SIDEWALK OR CURB : LT 0 FT RT 0 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. : HS-34
OPE.RTG. : HS-45
CONTR.MEMBER : RCBC
POSTED : SV TTST DATE 09/18/1990

SYSTEM : Secondary S.R. Route
GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY
(R. C. BOX CULVERTS)

INSPECTION TYPE Routine Inspection INSPECTION DATE 09/03/2013 ROUTE ORIENTATION S - N
BRIDGE NO. 730238 ROUTE SR1702 OVER GREEN MILL RUN

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Top Slab			G
2. Bottom Slab			
3. Ext. & Int. Walls			G
4. Wingwalls - Retaining Walls			G
5. Headwalls, Toewalls, Flumes			G
6. Structure Alignment - Settlement			G
7. Drainage Systems (On Structure)			G
8. Channel & Channel Protection	a. Waterway		G
	b. Alignment		G
	c. Scour		G
	d. Slope Prot. (Rip-Rap, Dikes, etc.)		
9. Approach Roadway Condition			G
10. Estimated Remaining Life			48
11. Channel & Channel Protection		Item 61	7
12. Culvert & Retaining Walls		Item 62	7
13. Waterway Adequacy		Item 71	7
14. Approach Roadway		Item 72	8
15. Field Scour Evaluation			G
16. Presently Posted			NO
17. Regulatory Sign Notice Issued			NO
18. Prompt Action Notice Issued			NO
19. Total Field Inspection Time			8
20. Inspected By		B G Littleton	

Bridge I&A Form 1(82)H State of North Carolina Dept. of Transportation Division of Highways	FIELD INSPECTION REPORT Bridge Inspecion & Analysis	

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
9	G	(APPROACH ROADWAY) TRANSVERSE & LONGITUDINAL CRACKS IN THE AWS WITH GOOD TRANSITIONS.
1	G	(TOP SLABS) TRANSVERSE CRACK IN THE TOP SLAB EXTENDING INTO THE N. WALL OF BARREL 2 WITH LEAKAGE @ 15' FROM THE EAST END. (BOTTOM SLABS) NOT VISIBLE, COVERED BY SILT & WATER.
3	G	(INT. & EXT. WALLS) THE NORTH INTERIOR WALL HAS VERTICAL CRACKS WITH WATER LEAKAGE APPROXIMATELY 15' FROM THE EAST END IN BARREL 2. H/L VERTICAL CRACKS NOTED IN THE INTERIOR AND EXTERIOR WALLS.
4	G	(WINGWALLS) JOINT MATERIAL MISSING @ ALL CORNERS. (PHOTO)
5	G	(HEADWALLS) NO NOTEWORTHY PROBLEMS.
16	NO	(PRESENT POSTING) NOT POSTED.

BRIDGE INSPECTOR'S RECOMMENDATION FOR MAINTENANCE REPAIRS

Bridge: 730238 County PITT Date: 09/03/2013

These Repairs Should Be Made Within Twelve Months From Date Of This Inspection

MMS Code	Description of Function	Unit	Quantity	Remarks	Est. Cost
3350	Maint R C Wings and Walls	SF	12	JOINT MATERIAL MISSING BETWEEN RETAINING WALL & WING SECTIONS AT ALL CORNERS.	

Key

Priority Maintenance Item Critical Finding Item Priority Maintenance Level Not Determined

SE RETAINING WALL IS MISSING JOINT MATERIAL BETWEEN SECTIONS ALLOWING FILL LEAKAGE. SIMILAR AT ALL CORNERS.

Bridge Inspection Field Sketch

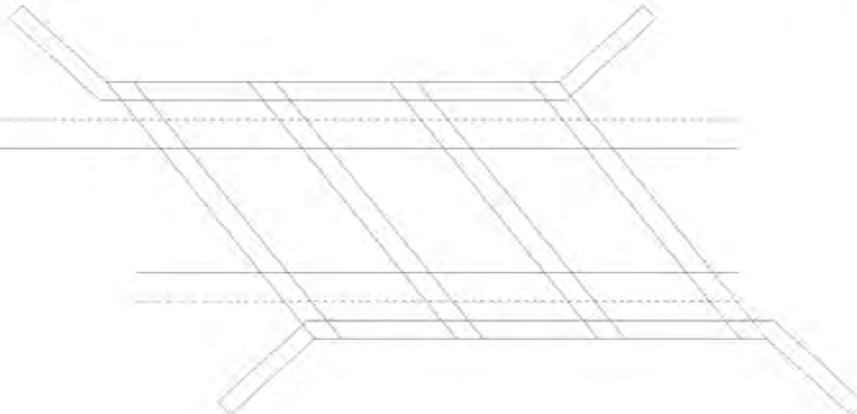
Roadway	64ft Wide	5 Paved Lanes	Looking North
Left Guardrail	2ft from road		
Right Guardrail	2ft from road		

VERIFIED 9-3-13 BY BGL

Title	Description
730238 APPROACH ROADWAY	LOOKING NORTH.

Bridge No: 730238	Drawn By: P.D.IPOCK	Date: 9-8-2011	File Name: S0050001293

Bridge Inspection Field Sketch



Number of Barrels	Skew	Distance From Crown to Bed
3	49°	9ft
Length Along Center Line of Culvert		Length Along Center Line of Roadway
137.833ft		40.167ft

Barrel #	Width	Height	Wall Thickness	Scour at Inlet	Scour at Outlet
1	9ft	6ft		0	0
2	9ft	6ft	0.667ft	0	0
3	9ft	6ft	0.667ft	0	0

VERIFIED 9-3-13 BY BGL

Title	**Description**
730238 STRUCTURE	TRIPLE RCBC.

Bridge No: 730238	**Drawn By:** P.D.IPOCK	**Date:** 9-8-2011	**File Name:** S0050002816

LOOKING SOUTH, SR 1702

EAST SIDE, LOOKING SOUTH

LOOKING DOWNSTREAM-EAST

LOOKING NORTH

LOOKING UPSTREAM-WEST

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY PITT

BRIDGE NUMBER 730410

INSPECTION CYCLE 2 YRS

ROUTE SR1707

ACROSS GREEN MILL RUN

M.P. 0

LOCATION 0.1 MI.SE.JCT.SR1703

SUPERSTRUCTURE TRIPLE 12'X9'RCBC;93'ALONG CENTERLINE CULVERT

SUBSTRUCTURE

SPANS

LONGITUDE 77° 22' 13.76"

LATITUDE 35° 35' 57.56"

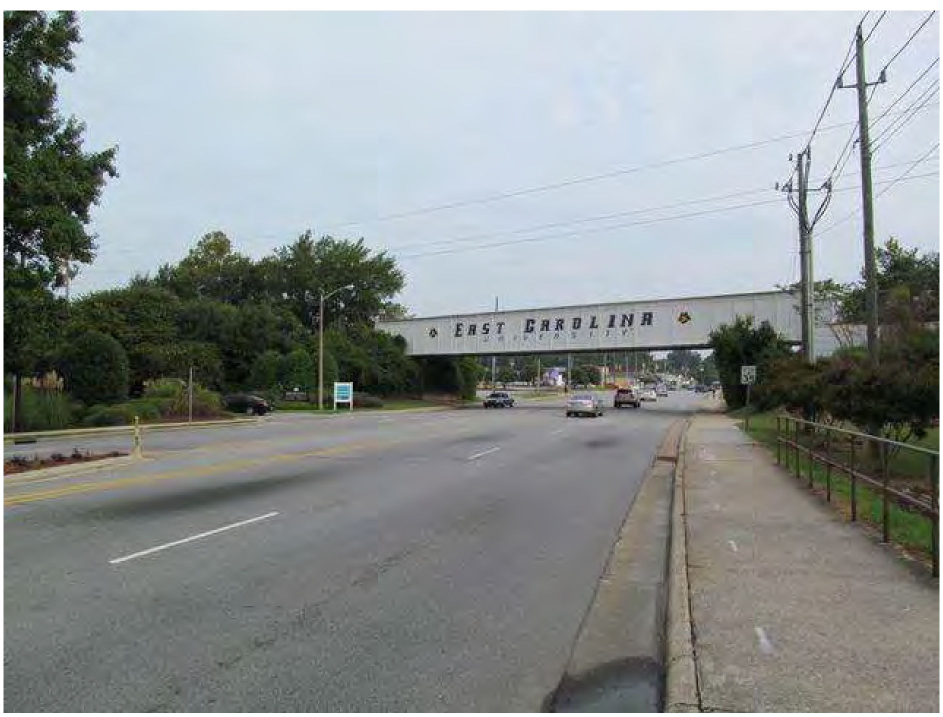
INSPECTION DATE 09/03/2013

PRESENT CONDITION GOOD

PRESENT POSTING N NOT POSTED

PROPOSED POSTING

OTHER SIGNS PRESENT NONE



LOOKING NORTH

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA   BRIDGE   730410
(8) STRUCTURE NUMBER(FEDERAL)   000000001470410
(5) INVENTORY ROUTE (ON/UNDER) - ON   31017070
(2) STATE HIGHWAY DEPARTMENT DISTRICT   1
(3) COUNTY CODE   147   (4) PLACE CODE   28080
(6) FEATURE INTERSECTED -   GREEN MILL RUN
(7) FACILITY CARRIED   SR1707
(9) LOCATION   0.1 MI.SE.JCT.SR1703
(11)MILEPOINT   0
(16)LAT   35° 35' 57.56"   (17)LONG   77° 22' 13.76"
(98)BORDER BRIDGE STATE CODE   PCT SHARE
(99)BORDER BRIDGE STRUCTURE NO

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Concrete continuous
TYPE -   Culverts (includes frame culverts)   CODE   219
(44) STRUCTURE TYPE APPR :
TYPE -   CODE   000
(45) NUMBER OF SPANS IN MAIN UNIT   3
(46) NUMBER OF APPROACH SPANS
(107)DECK STRUCTURE TYPE -   N   CODE
(108)WEARING SURFACE / PROTECTIVE SYSTEM :
(A) TYPE OF WEARING SURFACE -   CODE
(B) TYPE OF MEMBRANE   -   CODE
(C) TYPE OF DECK PROTECTION -   CODE

AGE AND SERVICE

(27) YEAR BUILT   1955
(106)YEAR RECONSTRUCTED
(42) TYPE OF SERVICE : ON -   Highway
UNDER -   Waterway   CODE   15
(28) LANES: ON STRUCTURE   5   UNDER STRUCTURE   0
(29) AVERAGE DAILY TRAFFIC   21000
(30) YEAR OF ADT   2012   (109) TRUCK ADT PCT   6%
(19) BYPASS OR DETOUR LENGTH   3 MI

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN   12 FT
(49) STRUCTURE LENGTH   37 FT
(50)CURB OR SIDEWALK: LEFT   0 FT   RIGHT   0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB   0 FT
(52) DECK WIDTH OUT TO OUT   0 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)   52 FT
(33) BRIDGE MEDIAN -   No Median   CODE   0
(34) SKEW   0°   (35) STRUCTURE FLARED   0
(10) INVENTORY ROUTE MIN VERT CLEAR   999.9 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR   52.3 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY   999.9 FT
(54) MIN VERT UNDERCLEAR REF   Not a Highway or Railroad   0 FT
(55) MIN LAT UNDERCLEAR RT REF   Not a Highway or Railroad   000 FT
(56) MIN LAT UNDERCLEAR LT REF -   000 FT

NAVIGATION DATA

(38) NAVIGATION CONTROL -   No Navigational Control   CODE   0
(111)PIER PROTECTION -   CODE
(39) NAVIGATION VERTICAL CLEARANCE   0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR   FT
(40) NAVIGATION HORIZONTAL CLEARANCE   0 FT

SUFFICIENCY RATING =   95.27
STATUS =   Not Deficient

CLASSIFICATION   CODE

(112)NBIS BRIDGE SYSTEM -   YES
(104)HIGHWAY SYSTEM   Is not on NHS   0
(26) FUNCTIONAL CLASS -   Minor Arterial   16
(100)STRAHNET HIGHWAY -   Not a STRAHNET Route   0
(101)PARALLEL STRUCTURE -   No Parallel Structure   N
(102)DIRECTION OF TRAFFIC -   2-way Traffic   2
(103)TEMPORARY STRUCTURE -
(110)DESIGNATED NATIONAL NETWORK - Not on the National Network   0
(20) TOLL   On Free Road   3
(31) MAINTAIN -   State Highway Agency   01
(22) OWNER -   State Highway Agency   01
(37) HISTORICAL SIGNIFICANCE -   Not Eligible   5

CONDITION   CODE

(58) DECK   N
(59) SUPERSTRUCTURE   N
(60) SUBSTRUCTURE   N
(61) CHANNEL & CHANNEL PROTECTION   7
(62) CULVERTS   7

LOAD RATING AND POSTING   CODE

(31) DESIGN LOAD   HS 20 + MOD   6
(63) OPERATING RATING METHOD -   Load and Resistance Factor   3
(64) OPERATING RATING -   HS-27   48
(65) INVENTORY RATING METHOD -   Load and Resistance Factor   3
(66) INVENTORY RATING -   HS-21   37
(70) BRIDGE POSTING -   No Posting Required   5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED   A
DESCRIPTION -   Open, No Restriction

APPRAISAL   CODE

(67) STRUCTURAL EVALUATION   7
(68) DECK GEOMETRY   N
(69) UNDERCLEARANCES,VERTI & HORIZ   N
(71) WATERWAY ADEQUACY   7
(72) APPROACH ROADWAY ALIGNMENT   8
(36) TRAFFIC SAFETY FEATURES   NNNN
(113)SCOUR CRITICAL BRIDGES   8

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK -   CODE
(76) LENGTH OF STRUCTURE IMPROVEMENT
(94) BRIDGE IMPROVEMENT COST
(95) ROADWAY IMPROVEMENT COST
(96) TOTAL PROJECT COST
(97) YEAR OF IMPROVEMENT COST ESTIMATE
(114)FUTURE ADT   42000   (115) YEAR FUTURE ADT   2025

INSPECTIONS

(90) INSPECTION DATE   09/03/2013
(92) CRITICAL FEATURE INSPECTION :   (93) CFI DATE
A) FRACTURE CRIT DETAIL -   NO   A)
B) UNDERWATER INSP -   NO   B)
C) OTHER SPECIAL INSP   NO   C)
SCOUR

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE   Run Date: 09/17/2013

COUNTY : PITT | DIVISION : 2 | DISTRICT: 1 | STRUCTURE NUMBER : 730410 | LENGTH : 37 FEET

ROUTE CARRIED : SR1707 | FEATURE INTERSECTED : GREEN MILL RUN

LOCATED : 0.1 MI.SE.JCT.SR1703 | BRIDGE NAME : | CITY : GREENVILLE

FUNC. CLASS : 16 | SYST.ON : FA | SYST.UNDER : NFA | ADT & YR : 21000 2012 | RAIL TYPE : LT 0 RT 0

BUILT : 1955 | BY : BMU | PROJ : | FED.AID PROJ : | DESIGN LOAD : HS 20 + MOD

REHAB : | BY : | PROJ : | ALIGNMENT : TAN. | SKEW : 90 | LANES : ON 5 UNDER 0

NAVIGATION : VC 0 FT HC 0 FT | HT. CRN. TO BED : 12 FT | WATER DEPTH : 1 FT

SUPERSTRUCTURE : TRIPLE 12'X9'RCBC;93'ALONG CENTERLINE CULVERT

SUBSTRUCTURE :

SPANS :

BEAMS OR GIRDERS :

FLOOR : | ENCROACHMENT : | DECK (OUT TO OUT) : 0 FT

CLEAR ROADWAY : 0 FT | BETWEEN RAILS : 0 FT | SIDEWALK OR CURB : LT 0 FT RT 0 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. : HS-21 | OPE.RTG. : HS-27 | CONTR.MEMBER : RCBC | POSTED : SV TTST DATE

SYSTEM : Secondary S.R. Route | GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY
(R. C. BOX CULVERTS)

INSPECTION TYPE Routine Inspection INSPECTION DATE 09/03/2013 ROUTE ORIENTATION S - N
BRIDGE NO. 730410 ROUTE SR1707 OVER GREEN MILL RUN

EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

1. Top Slab			G
2. Bottom Slab			
3. Ext. & Int. Walls			G
4. Wingwalls - Retaining Walls			G
5. Headwalls, Toewalls, Flumes			G
6. Structure Alignment - Settlement			G
7. Drainage Systems (On Structure)			G
8. Channel & Channel Protection	a. Waterway		F
	b. Alignment		G
	c. Scour		G
	d. Slope Prot. (Rip-Rap, Dikes, etc.)		
9. Approach Roadway Condition			F
10. Estimated Remaining Life			18
11. Channel & Channel Protection		Item 61	6
12. Culvert & Retaining Walls		Item 62	7
13. Waterway Adequacy		Item 71	7
14. Approach Roadway		Item 72	8
15. Field Scour Evaluation			G
16. Presently Posted			NO
17. Regulatory Sign Notice Issued			NO
18. Prompt Action Notice Issued			NO
19. Total Field Inspection Time			6
20. Inspected By		B G Little	

Bridge I&A Form 1(82)H

State of North Carolina
Dept. of Transportation
Division of Highways

FIELD INSPECTION REPORT

Bridge Inspecion & Analysis

Team Leader BG LITTLETON, JR.

Assisted By PD IPOCK

Item No.	Grade	
8a	F	(WATERWAY) SILT IN BARREL 1 (PHOTO)
8c	G	(SCOUR) NO NOTEWORTHY PROBLEMS..
9	F	(APPROACH ROADWAY) CRACKS & SETTLEMENT IN ALL LANES @ BOTH APPROACHES. (PHOTO)
1	G	(TOP SLAB) TOP SLAB EXHIBITS TRANSVERSE CRACKING ALONG THE CONSTRUCTION JOINT ~ 18' FROM THE EAST END OF BARREL 3. TOP SLAB HAS TRANSVERSE AND DIAGONAL CRACKING WITH WATER LEAKAGE IN BARREL 3 APPROXIMATELY 25' FROM THE WEST END. (BOTTOM SLABS) NOT VISIBLE.
3	G	(WALLS) H/L CRACKS NOTED @ RANDOM.
4	G	(WINGWALLS) NO NOTEWORTHY PROBLEMS.
5	G	(HEADWALLS) NO NOTEWORTHY PROBLEMS.
16	NO	(PRESENTLY POSTED) NOT POSTED

BRIDGE INSPECTOR'S RECOMMENDATION FOR MAINTENANCE REPAIRS

Bridge: 730410 County PITT Date: 09/03/2013

These Repairs Should Be Made Within Twelve Months From Date Of This Inspection

MMS Code	Description of Function	Unit	Quantity	Remarks	Est. Cost
2816	Asphalt Surface Repair or Replacement	SY	236	BOTH APPROACHES ARE CRACKED & SETTLED.	
3370	Maintenance and Repair of NBIS Pipes and Culverts	LF	38	SILT BLOCKING BARREL 1.	

Key

Priority Maintenance Item

Critical Finding Item

Priority Maintenance Level Not Determined

SILT IN BARREL 1. SIMILAR IN BARREL 3 @ THE EAST END.

SILT @ THE WEST END OF BARREL 1.

NORTH BOUND LANES @ THE SOUTH APPROACH CRACKED WITH SETTLEMENT. SIMILAR IN ALL LANES @ BOTH APPROACHES.

Bridge Inspection Field Sketch

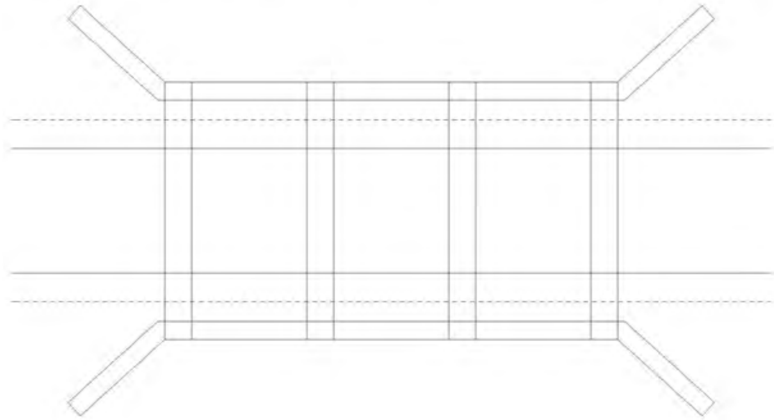
Roadway	52.333ft Wide	4 Paved Lanes	Looking North
Left Rail	16.25ft Wide		
Right Guardrail	8.917ft Wide		
MEDIAN	0ft LT To The Yellow Line	5ft RT To The Yellow Line	13.667ft Yellow Line To Yellow Line

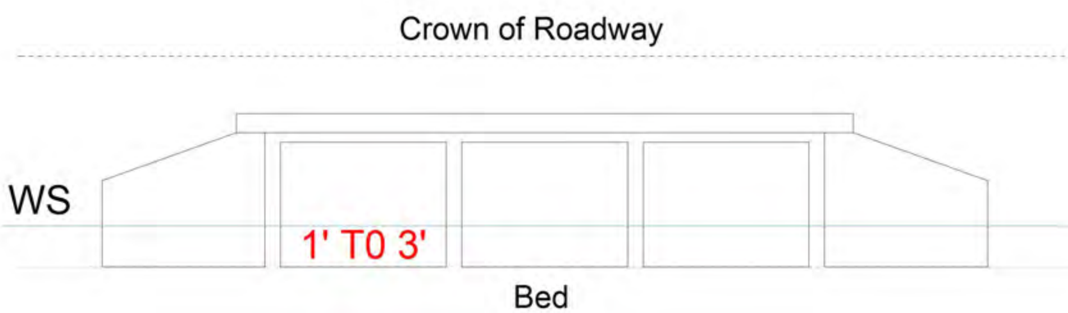
VERIFIED BY; PD IPOCK, 9-3-2013.

Title	**Description**
730410 APPROACH ROADWAY/ SOUTH APPROACH	LOOKING NORTH.

Bridge No: 730410	**Drawn By:** P.D.IPOCK	**Date:** 9-8-11	**File Name:** S0050001333

Bridge Inspection Field Sketch





Number of Barrels	Skew	Distance From Crown to Bed
3	90°	12ft
Length Along Center Line of Culvert		Length Along Center Line of Roadway
93ft		37.334 ft

Barrel #	Width	Height	Wall Thickness	Scour at Inlet	Scour at Outlet
1	12ft	9ft		0	0
2	12ft	9ft	0.667ft	0	0
3	12ft	9ft	0.667ft	0	0

VERIFIED BY; PD IPOCK, 9-3-2013.

Title	Description
730410 STRUCTURE	TRIPLE RCBC.

Bridge No: 730410	Drawn By: P.D.IPOCK	Date: 9-8-11	File Name: S0050002815

EAST END, LOOKING WEST.

DOWNSTREAM EAST

LOOKING NORTH

UPSTREAM WEST

WEST END, LOOKING WEST.

LOOKING SOUTH, SR 1707.

NC DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BRIDGE MANAGEMENT UNIT

ATTENTION: MMVC REVISED

BRIDGE INSPECTION REPORT

INSPECTION TYPE: Routine Inspection

COUNTY: PITT
BRIDGE NUMBER: 730425
INSPECTION CYCLE: 2 YRS

NORFOLK SOUTHERN RAILROAD

ROUTE: NORFOLK S.
ACROSS: SR1707
M.P.: 0

LOCATION: 0.1 MI S JCT SR 1703

SUPERSTRUCTURE: I-BEAMS & DECK PLATE GIRDERS

SUBSTRUCTURE: RC PIERS

SPANS:

LONGITUDE: 77° 22' 14.21"
LATITUDE: 35° 35' 59.26"

INSPECTION DATE: 10/02/2013
PRESENT CONDITION: CLEARANCE ONLY

PRESENT POSTING: Not Posted NOT POSTED
PROPOSED POSTING:

OTHER SIGNS PRESENT: NONE

LOOKING NORTH

Fracture Critical	No
Temporary Shoring	No
Scour Critical	No
Scour POA	No

SIGN NOTICE ISSUED FOR		NUMBERED REQUIRED
No	WEIGHT LIMIT	
No	DELINEATORS	
No	NARROW BRIDGE	
No	ONE LANE BRIDGE	
No	LOW CLEARANCE	

NATIONAL BRIDGE INVENTORY-------- STRUCTURE INVENTORY AND APPRAISAL   Run Date: 10/10/2013

IDENTIFICATION

(1) STATE NAME -NORTH CAROLINA	BRIDGE	730425
(8) STRUCTURE NUMBER(FEDERAL)		000000001470425
(5) INVENTORY ROUTE (ON/UNDER) - ON		31017070
(2) STATE HIGHWAY DEPARTMENT DISTRICT		1
(3) COUNTY CODE 147	(4) PLACE CODE	28080
(6) FEATURE INTERSECTED - SR1707		
(7) FACILITY CARRIED NORFOLK S.		
(9) LOCATION 0.1 MI S JCT SR 1703		
(11)MILEPOINT		0
(16)LAT 35° 35' 59.26"	(17)LONG	77° 22' 14.21"
(98)BORDER BRIDGE STATE CODE	PCT SHARE	
(99)BORDER BRIDGE STRUCTURE NO		

STRUCTURE TYPE AND MATERIAL

(43) STRUCTURE TYPE MAIN: Steel		
TYPE - Stringer Mutlibeam or Girder	CODE	302
(44) STRUCTURE TYPE APPR :		
TYPE -	CODE	000
(45) NUMBER OF SPANS IN MAIN UNIT		1
(46) NUMBER OF APPROACH SPANS		
(107)DECK STRUCTURE TYPE - N	CODE	
(108)WEARING SURFACE / PROTECTIVE SYSTEM :		
(A) TYPE OF WEARING SURFACE -	CODE	
(B) TYPE OF MEMBRANE -	CODE	
(C) TYPE OF DECK PROTECTION -	CODE	

AGE AND SERVICE

(27) YEAR BUILT		1953
(106)YEAR RECONSTRUCTED		
(42) TYPE OF SERVICE : ON - Railroad		
UNDER - Highway	CODE	21
(28) LANES: ON STRUCTURE 0	UNDER STRUCTURE	5
(29) AVERAGE DAILY TRAFFIC		21000
(30) YEAR OF ADT 2012	(109) TRUCK ADT PCT	6%
(19) BYPASS OR DETOUR LENGTH		3 MI

GEOMETRIC DATA

(48) LENGTH OF MAXIMUM SPAN		136 FT
(49) STRUCTURE LENGTH		136 FT
(50)CURB OR SIDEWALK: LEFT 0 FT	RIGHT	0 FT
(51) BRIDGE ROADWAY WIDTH CURB TO CURB		0 FT
(52) DECK WIDTH OUT TO OUT		0 FT
(32) APPROACH ROADWAY WIDTH (W/SHOULDERS)		63 FT
(33) BRIDGE MEDIAN - No Median	CODE	0
(34) SKEW 25°	(35) STRUCTURE FLARED	0
(10) INVENTORY ROUTE MIN VERT CLEAR		16.167 FT
(47) INVENTORY ROUTE TOTAL HORIZ CLEAR		67.417 FT
(53) MIN VERT CLEAR OVER BRIDGE RDWY		999.9 FT
(54) MIN VERT UNDERCLEAR REF Highway		15.5 FT
(55) MIN LAT UNDERCLEAR RT REF Highway		9 FT
(56) MIN LAT UNDERCLEAR LT REF -		0 FT

NAVIGATION DATA

(38) NAVIGATION CONTROL - Not Applicable	CODE	N
(111)PIER PROTECTION -	CODE	
(39) NAVIGATION VERTICAL CLEARANCE		0
(116)VERT - LIFT BRIDGE NAV MIN VERT CLEAR		FT
(40) NAVIGATION HORIZONTAL CLEARANCE		0 FT

SUFFICIENCY RATING =	0
STATUS = Functionally Obsolete	

CLASSIFICATION — CODE

(112)NBIS BRIDGE SYSTEM -		NO
(104)HIGHWAY SYSTEM	Is not on NHS	0
(26) FUNCTIONAL CLASS -	Minor Arterial	16
(100)STRAHNET HIGHWAY -	Not a STRAHNET Route	0
(101)PARALLEL STRUCTURE -	No Parallel Structure	N
(102)DIRECTION OF TRAFFIC -	2-way Traffic	2
(103)TEMPORARY STRUCTURE -		
(110)DESIGNATED NATIONAL NETWORK -	Not on the National Network	0
(20) TOLL	On Free Road	3
(31) MAINTAIN -	Railroad	27
(22) OWNER -	Railroad	27
(37) HISTORICAL SIGNIFICANCE -	Not Eligible	5

CONDITION — CODE

(58) DECK	N
(59) SUPERSTRUCTURE	N
(60) SUBSTRUCTURE	N
(61) CHANNEL & CHANNEL PROTECTION	N
(62) CULVERTS	N

LOAD RATING AND POSTING — CODE

(31) DESIGN LOAD	Railroad	8
(63) OPERATING RATING METHOD -	No Rating Analysis or Evaluatic	5
(64) OPERATING RATING -	HS-	0
(65) INVENTORY RATING METHOD -	No Rating Analysis or Evaluatic	5
(66) INVENTORY RATING -	HS-	0
(70) BRIDGE POSTING -	No Posting Required	5
(41) STRUCTURE OPEN, POSTED ,OR CLOSED		A
DESCRIPTION -	Open, No Restriction	

APPRAISAL — CODE

(67) STRUCTURAL EVALUATION	9
(68) DECK GEOMETRY	2
(69) UNDERCLEARANCES,VERTI & HORIZ	4
(71) WATERWAY ADEQUACY	N
(72) APPROACH ROADWAY ALIGNMENT	0
(36) TRAFFIC SAFETY FEATURES	NNNN
(113)SCOUR CRITICAL BRIDGES	N

PROPOSED IMPROVEMENTS

(75) TYPE OF WORK -	CODE	
(76) LENGTH OF STRUCTURE IMPROVEMENT		
(94) BRIDGE IMPROVEMENT COST		
(95) ROADWAY IMPROVEMENT COST		
(96) TOTAL PROJECT COST		
(97) YEAR OF IMPROVEMENT COST ESTIMATE		
(114)FUTURE ADT 42000	(115) YEAR FUTURE ADT	2025

INSPECTIONS

(90) INSPECTION DATE		10/02/2013
(92) CRITICAL FEATURE INSPECTION :		(93) CFI DATE
A) FRACTURE CRIT DETAIL -	NO	A)
B) UNDERWATER INSP -	NO	B)
C) OTHER SPECIAL INSP	NO	C)
SCOUR		

Structure No: 730425 County: PITT Run Date:

Span Number	Feature Intersected	Inventory Route	Minimum Maximum Vertical Clearance	Milepoint	Base Highway Network	LRS Inventory Route	Toll	Functional Classification	Numer of Lanes	Average Daily Traffic	Year of Average Daily Traffic	Total Horizontal Clearance	See Note 1 Reference Feature	Minimum Vertical Underclearance	Right Lateral Underclearance	Left Lateral Underclearance	Underclearance Appraisal Grade	STRAHNET Highway Designator	Direction of Traffic	Highway System of Route
	6	5	10	11	12	13	20	26	28	29	30	47	54A	54	55	56	69	100	102	104
1	SR 1707	31017070	16.17		0			16	5	21000	2012	67.42	H	15.5	9		9	0	2	0

Note 1: Items 54, 55, and 56 are not reported FHWA under route data points but are collected for each under route to determine the minimum value for Underclearance Appraisal Item 69. The under route that generates the lowest Underclearance Appraisal value will be reported on the Facility Carried record.

BRIDGE MANAGEMENT UNIT

DATA ON EXISTING STRUCTURE   Run Date: 10/10/2013

COUNTY : PITT   DIVISION : 2   DISTRICT: 1   STRUCTURE NUMBER : 730425   LENGTH : 136 FEET

ROUTE CARRIED : NORFOLK S.   FEATURE INTERSECTED : SR1707

LOCATED : 0.1 MI S JCT SR 1703   BRIDGE NAME :   CITY : GREENVILLE

FUNC. CLASS : 16   SYST.ON : FA   SYST.UNDER : NFA   ADT & YR : 21000 2012   RAIL TYPE : LT 0 RT 0

BUILT : 1953   BY : N&SRR   PROJ :   FED.AID PROJ :   DESIGN LOAD : Railroad

REHAB :   BY :   PROJ :   ALIGNMENT : TAN   SKEW : 65   LANES : ON 0 UNDER 5

NAVIGATION : VC 0 FT HC 0 FT   HT. CRN. TO BED : 0 FT   WATER DEPTH : 0 FT

SUPERSTRUCTURE : I-BEAMS & DECK PLATE GIRDERS

SUBSTRUCTURE : RC PIERS

SPANS :

BEAMS OR GIRDERS : I-BEAMS & DECK PLATE GIRDERS

FLOOR :   ENCROACHMENT :   DECK (OUT TO OUT) : 0 FT

CLEAR ROADWAY : 0 FT   BETWEEN RAILS : 0 FT   SIDEWALK OR CURB : LT 0 FT RT 0 FT

VERT.CL.OVER : 999.9 FT

INV.RTG. : HS-   OPE.RTG. : HS-   CONTR.MEMBER :   POSTED : SV TTST DATE

SYSTEM : Secondary Railroads   GREEN LINE ROUTE : N

UNDER ROUTES AND CLEARANCES

Span	Route Description	Vertical Clearances		Horizontal Clearances		
		MMVC	MVC	Total	Left	Right
1	SR 1707	16.1670	15.50	67.4170	0	9

Note: All measurements are in feet.

REMARKS :

BRIDGE I & A FORM1 (90)A

BRIDGE INSPECTION RECORD AND SUMMARY

INSPECTION TYPE Routine Inspection
BRIDGE NO. 730425 COUNTY PITT ROUTE NORFOLK S. OVER SR1707
STRUCTURE TYPE I-BEAMS & DECK PLATE GIRDERS
ROUTE ORIENTATION SPANS

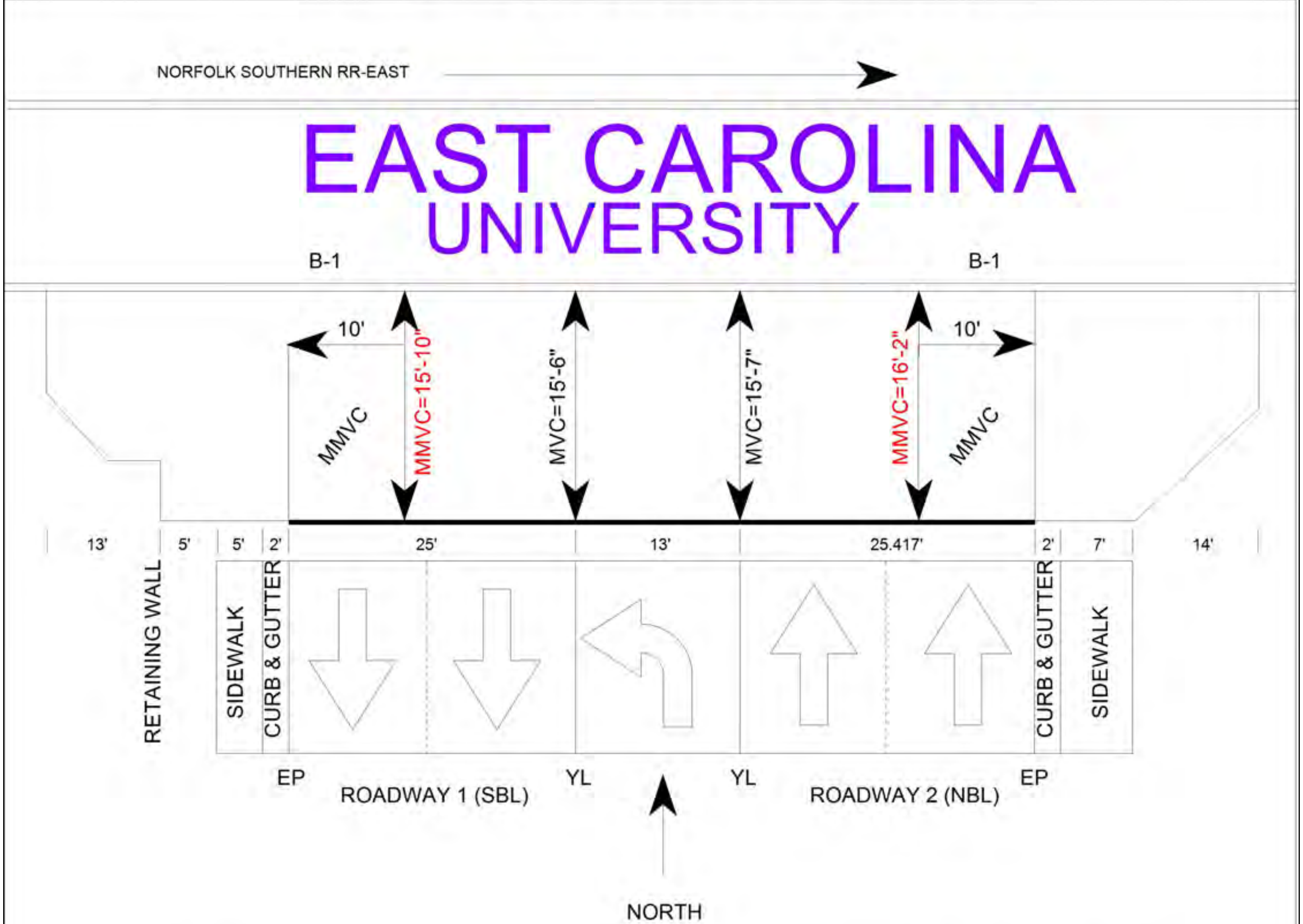
EVALUATION CODES: CRITICAL (C, 0 - 3); POOR (P, 4); FAIR (F, 5, 6); GOOD (G, 7 - 9)

INSPECTION ITEM			
DECK ITEMS			GRADES
1. WEARING SURFACE			
2. DECK NO. OF EA TYPE SPN GRADE RATES SI & A ITEM 58	a. CONCRETE		
	b. TIMBER		
	c. STEEL PLANK		
	d. OPEN GRID		
3. RAILING	a. CONCRETE		
	b. TIMBER		
	c. ALUMINUM		
	d. STEEL		
4. CURBS, WHEELGUARDS, PARAPETS, MEDIANS			
5. WALKWAYS (ON OR ATTACHED TO STRUCTURE)			
6. DECK EXP JTS. OR DEVICES. NO. OF EACH	a. STEEL PL OR FINGER		
	b. MISC PREFAB		
	c. COMPRESSION SEAL		
	d. STANDARD JOINTS		
	e. OPEN JOINTS		
7. DECK DEBRIS (INCLUDES EXCESS SAND/GRAVEL)			
SUPER STR. (FM. 1 (90)B TRUSS) ITEM 59			
10. LONGITUDINAL BEAMS OR GIRDERS			
11. LONGITUDINAL JOIST OR STRINGERS			
12. INT. DIAP'S, X-FRAMES, BRACING & CONN'S			
13. END DIAP'S, CURTAIN WALLS, & CONN'S			
14. FLOOR BEAMS AND CONNECTIONS			
15. BEARING ASSEMBLIES (INCLUDING MISALIGN)			
16. DRAINAGE SYSTEM (ON STRUCTURE)			
17. MOVABLE SPAN MACHINERY			
SUB STR. ITEMS. ITEM 60 (INCLUDE SCOUR)			
35. TIM SUB STR.	a. ABUT. & INT. BENT CAPS & RISERS		
	b. PILES, POST, SILLS, & BRACING		
	c. BULKHEADS, WING'S, & TIE BACKS		
36. CONC SUB STR.	a. ABUT. & INT. BENT CAPS		
	b. ABUT. & BENT COL'S BREASTWALLS		
	c. ABUT. & INT. BENT PILES		
	d. BACKWALLS, WING'S, RETAIN. WALLS		
	e. ABUT. & BENT FOOTINGS & SILLS		
37. STEEL SUB STR.	a. ABUT. & INT. BENT CAPS & RISERS		
	b. PILES, BRACING, AND BULKHEADS		
38. FOUNDATION PILES TYPE MATERIAL			
39. SLOPE PROT., RIP-RAP (INCLUDE DRAINAGE)			
40. FENDER SYSTEMS			
41. DRIFT			

ITEM 61		
45. CHANNEL & CHANNEL PROT.	a. WATERWAY	
	b. ALIGNMENT	
	c. SCOUR	
	d. SLOPE PROT., RIP-RAP, DIKES, ETC.	
50. APPROACH ROADWAY CONDITION		
51. APPROACH SLABS		
52. PAINT SYSTEM	CODE	
53. UTILITIES		
54. RESPONSE TO LIVE LOAD		
55. ESTIMATED REMAINING LIFE		
60. REGULATORY SIGN NOTICE ISSUED		
61. PROMPT-ACTION NOTICE ISSUED		
62. PRESENTLY POSTED		
63. TOT. FIELD INSP TIME (INCLUDE WRITE UP)(MAN HR)		
64. TOTAL SNOOPER INSP. TIME (HRS)		
65. TOTAL TRAFFIC CONTROL TIME (MAN HRS)		
70. SI&A GENERAL CONDITION RATINGS		
a. DECK	ITEM 58	
b. SUPERSTRUCTURE	ITEM 59	
c. SUBSTRUCTURE	ITEM 60	
d. CHANNEL & CHANNEL PROT.	ITEM 61	
71. SI&A FIELD APPRAISAL RATINGS		
a. WATERWAY ADAQUACY		
b. APPR. RDWY. ALIGNMENT		
72. FIELD SCOUR EVALUATION		
USE OF INSP. ACCESSIBILITY EQUIPMENT		
SNOOPER (CODE S, 4, OR N)	HRS	
LADDER		
BUCKET TRUCK		
BOAT		
OTHER		
SPECIAL INSPECTION REQUESTED FOR		
NOTE		
80. INSPECTED BY:	[illegible]	
81. REVIEWED BY:		

<table>
<tr><td>Bridge I&A Form 1(82)H
State of North Carolina
Dept. of Transportation
Division of Highways</td><td colspan="2"># FIELD INSPECTION REPORT
Bridge Inspecion & Analysis</td><td></td></tr>
<tr><td colspan="4">Team Leader BG LITTLETON, JR.</td></tr>
<tr><td colspan="4">Assisted By PD IPOCK</td></tr>
<tr><td>Item No.</td><td>Grade</td><td colspan="2"></td></tr>
</table>

Bridge Inspection Field Sketch



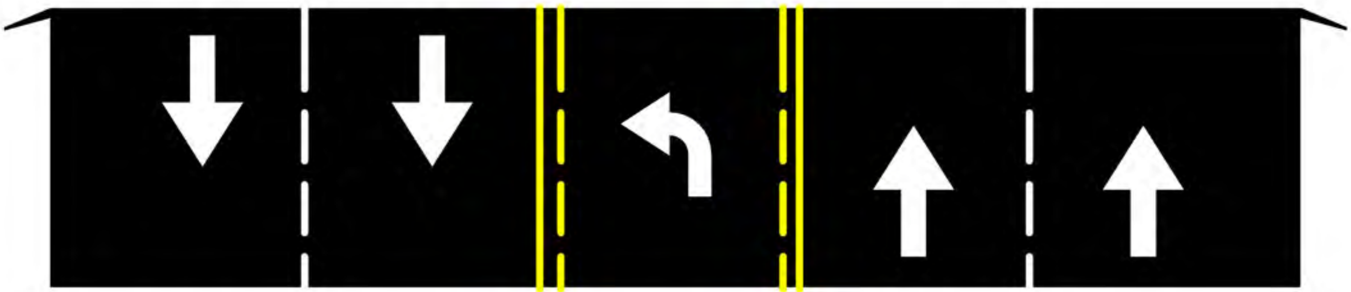
Roadway 1		Direction of Traffic	South
Distance to Right Rail		Distance to Left Rail	
Distance to Left Retaining Wall	12'	Distance to Right Toe of Slope	
MMVC	15.833' UNDER B-1 @ 10 FT FROM THE LT EDGE OF THRU LANES (EP)		
MVC	15.5' UNDER B-1 @ 25' RT OF LT EDGE OF THRU LANES (@ YELLOW LINE)		
Median Type: Left Turn Lane	Median Width: 13'		
Roadway 2		Direction of Traffic	North
Distance to Left Rail		Distance to Right Rail	
Distance to Right Toe of Slope	9'	Distance to Left Toe of Slope	
MMVC	16.167' UNDER B-1 @ 10 FT FROM THE RT EDGE OF THRU LANES (EP)		
MVC	15.583' UNDER B-1 @ 25.417' LT OF RT EDGE OF THRU LANES (@ YELLOW LINE)		

UPDATED & VERIFIED 10-2-13 BY BGL

Title UNDERCLEARANCES-SPAN 1	**Description** HORZ/VERT UNDERCLEARANCES

Bridge No: 730425	**Drawn By:** BG LITTLETON, JR.	**Date:** 10-3-11	**File Name:** S0050001417

Bridge Inspection Field Sketch



Roadway (EP TO EP)	63.417 ft Wide	5 Paved Lanes	Looking North
Left Curb & Gutter	2.0 ft Wide		
Right Curb & Gutter	2.0 ft Wide		
Left Guardrail			
Right Guardrail			

VERIFIED 10-2-13 BY BGL

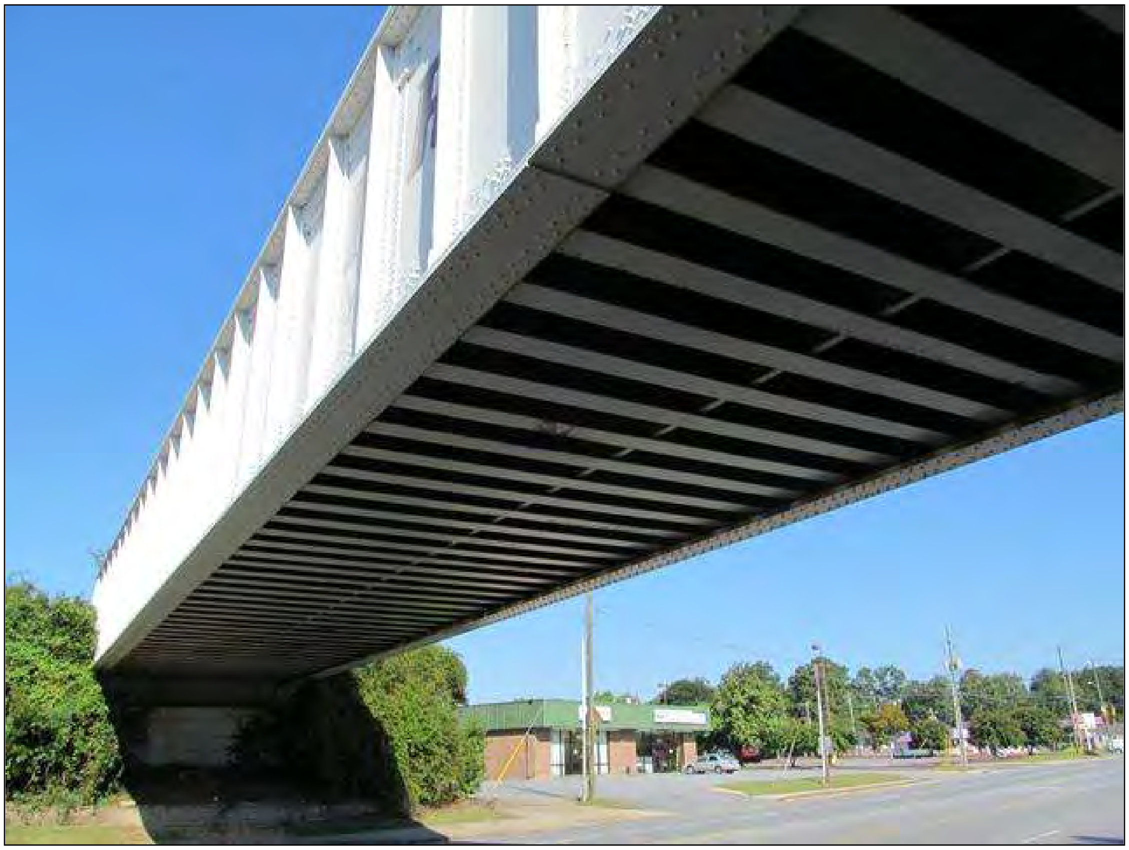
Title	Description
730425 SOUTH APPROACH ROADWAY	LOOKING NORTH.

Bridge No: 730425	Drawn By: P.D. IPOCK	Date: 10-3-11	File Name: S0050002831

LOOKING NORTH

LOOKING SOUTH, SR 1707

Structure 730425 County PITT Date: 10/02/2013 Structure Photos



SPAN UNDERSIDE

M. Prioritization

The proposed projects were prioritized separately between the four project types: Primary System flood control, Secondary System flood control, stream stabilization, and stormwater BMPs. Within each project type, projects were prioritized for the entire watershed. Prioritization was developed by assigning raw scores to each project using the categories and scores listed in **Table M-1**. In order to more specifically address the Primary and Secondary System projects for the GMR watershed, the scoring protocol presented in the SOP was expanded to include additional criteria. Modifications to the SOP protocol are *italicized* in **Table M-1**.

The raw scores for each factor were derived from project-specific conditions, except Cost Effectiveness, which used project benefit-cost bases to determine benefit ratios. For flood control projects, the benefit ratio was calculated by addition of the weighted scores for Public Health and Safety, Severity of Street Flooding, and Effective of Improvements. The sum of these scores was divided by the estimated project cost, then multiplied by a constant (5,000) to amplify the results to the ratios shown in **Table M-2**. Stream stabilization, cost benefit scores were based on cost per linear foot of stabilization. For stormwater best management projects, the total nutrient removal was summed, and then the estimated project cost was divided by the removal cost. To obtain the listed benefit ratios, a constant (35,000), was divided by the nutrient removal cost. The benefit ratios were then converted into raw scores using the criteria provided in **Table M-2**.

The raw scores were weighted using the factors shown in **Table M-3**. The weighted scores for each project were then summed and ranked to determine the project prioritization as presented in **Table M-4** and **Table M-5**. Where projects had tied scores, the Cost Effectiveness benefit ratios were used to determine final rankings, with higher benefit ratios being assigned the higher ranking. In some cases, project ranking for the Primary System projects was adjusted to account for dependency between projects. The modified rankings are provided in **Section 10**. The approach to incorporating project dependency in the prioritization was as follows:

- Projects were ordered from highest-lowest (ascending) raw rank.
- Projects with no dependence on other improvements were ranked in the order that the project fell within the overall ranking, with the modified ranking accounting for modified rankings of dependent projects.
- Projects with dependency on other improvements were prioritized as groups, with each set of dependent projects forming a group. The groups were ranked in the order that the highest ranking project within the group fell within the overall ranking. The remaining projects within that group were assigned the next consecutive ranks, in the order of their original ranking.

The Primary System improvements include two sets of alternatives for each stream; however, only one alternative per stream may be selected to achieve the stated reductions in flooding and levels of service. Additionally, selection of projects from different sets of alternatives on Greens Mill Run and Greens Mill Run North Fork will yield different results than presented herein due to interactivity between the two streams.

Table M-1: Prioritization Evaluation Criteria and Raw Scores

Category	General Description	Raw Score	Evaluation Criteria
Public Health and Safety	Evaluates potential impact of flooding on public health and safety. Generally, refers to flooding in and around habitable structures.	5	Flood water depth and/or velocity completely surrounds and threatens the structural integrity of habitable structures or vehicles. Finished Floor Flooding Occurs during the design storm.
		3	Flood water surrounds structure but does not cause imminent danger. Crawl space and HVAC units are flooded.
		1	Yard flooding occurs and flood waters are near HVAC, crawl spaces or foundations.
		0	Minor yard flooding may occur but habitable structure is not directly affected.
Severity of Street Flooding (City-Owned)	Evaluates impact of flood depths to or through an area	5	Street LOS requirements are not met and are so severe that the street becomes impassable during the design storm or street flooding has spread into private property. Flooding is noted on NCDOT roads as a result spread issues on adjacent city owned street. Roadway overtopping > 6" in depth
		3	Street LOS requirements are not met and the streets are passable only through the center of the street. Flooding noted on collector and local streets. Roadway overtopping < 6" in depth
		1	LOS requirements exceeded but street flooding is considered minor nuisance for traffic.
		0	LOS requirements are met. No roadway overtopping
Cost Effectiveness	Evaluates the benefit/cost of the proposed improvements	5	Project benefit ratio is greater than 1.5. Stream stabilization cost < $400 per linear foot
		3	Project benefit ratio is between 0.5 and 1.5. Stream stabilization cost < $600 per linear foot
		1	Project benefit ratio is between 0.075 and 0.5. Stream stabilization cost < $1,000 per linear foot
		0	Project benefit ratio is less than 0.075. Stream stabilization cost > $1,000 per linear foot

Table M-1 Continued

Category	General Description	Raw Score	Evaluation Criteria
Effect of Improvements	Evaluates the number of drainage issues resolved and the number of citizens positively affected	5	Multiple major drainage issues are being resolved through the proposed improvements such as street spread and increased drainage capacity. Proposed improvements would resolve major drainage issues for more than 5 properties. Primary system crossing LOS is improved to meet the desired LOS.
		3	Single drainage issue is being resolved and it is considered major. Proposed improvements would resolve drainage issues for 3-5 properties. Primary system crossing LOS is improved, but desired LOS is not met.
		1	Single drainage issue is being resolved and it is considered major. Proposed improvements would resolve drainage issues for 2-3 properties. Primary system crossing LOS is maintained.
		0	Single drainage issue is being resolved and it is considered minor. Proposed improvements would resolve drainage issue(s) for a single property at most.
Water Quality/Quantity	Evaluates the impact a BMP would have on water quality, water quantity and NPDES Phase II Compliance	5	Provides both water quantity and water quality benefits. Does not use manufactured or proprietary BMP technology. Incorporates some form of green solution such as infiltration, LID, sustainability etc. Is considered a BMP retrofit.
		3	Provides water quality benefits but does not provide water quantity benefit. Is considered a BMP retrofit.
		1	Improvements will have minimal impacts on water quality and would primarily serve as a demonstration project. Is considered a BMP retrofit.
		0	Improvements will have no measurable impact on water quality and would serve only as a demonstration project.
Open Channel - Erosion Control	Evaluates the severity of erosion control issues and impact on water quality	5	Severe erosion problems are evident and are contributing significantly to water quality issues.
		3	Moderate erosion problems are evident and are contributing to water quality issues. Primary System improvement with > 2,000 linear feet of floodplain benching with documented erosion.
		1	Minor erosion control issues are evident and are contributing to water quality issues. Primary System improvement with < 2,000 linear feet of floodplain benching with documented erosion
		0	Minor erosion control issues are evident and are not contributing to water quality issues in a significant way.

Table M-1 Continued

Category	General Description	Raw Score	Evaluation Criteria
Implementation Constraints	Considers potential constraints that may either delay or make the project too difficult to construct. Some examples would include significant permitting issues, high mitigation costs, numerous easement needs, required partnering with other communities, the NCDOT, or railroads	5	Only minor local or state permits required. Does not involve ACOE, DWQ or FEMA. Proposed improvements can be completed without permanent or temporary easements. Project can proceed independent of other stormwater improvements identified in the master plan.
		3	Requires State and Federal permits that are typically easy to obtain such as Nationwide permits, FEMA No Rise etc. Primarily requires temporary easements with only a few permanent easements needed to build the project. Improvements may have limited coordination with other projects such as DOT widening, GUC utility improvements or downstream drainage improvements. Significant delays in the schedule due to this coordination is not anticipated. Project can proceed independent of other stormwater improvements identified in the master plan. Project is self-mitigating or requires very minor mitigation.
		1	Numerous permits required including federal, state and local agencies. Examples would include an individual permit or FEMA CLOMR/LOMR. Extensive permanent and temporary easements are required. Project cannot proceed independent of other stormwater improvements identified in the master plan. Primary System improvement requires floodplain benching
Grant Funding	Evaluates the availability and potential to receive grant funding	5	Project qualifies for multiple grants. Grant does not require significant match (20% match or less) City does not have an open grant from the agency providing the funding. Project meets all ranking criteria and will score highly in most if not all categories.
		3	Project qualifies for only one type of grant funding. Grant requires match between 20% and 50% range. City has an open grant from agency providing the funding. Project meets most if not all of the ranking criteria and will score high in key categories.
		1	Project qualifies for only one type of grant funding. Grant requires match equal to or greater than 50%. City has an open grant from agency providing the funding. Project meets some of the ranking criteria and may score high in one or two categories.
		0	Project does not qualify for any type of grant funding.

Table M-1 Continued

Category	General Description	Raw Score	Evaluation Criteria
Constructability	Evaluates relative constructability of the project including site constraints, traffic and neighborhood impacts, and impacts on adjacent property owners.	5	Limited to no site constraints. Limited to no utility conflicts. Limited to no impacts on adjacent property owners. Limited to no impacts on traffic or surround neighborhoods.
		3	Some site constraints exist but are considered fairly minor. Some utility conflicts exist but are routine and do not require major utility relocation. Some traffic and neighborhood impacts occur but are fairly minor. Examples include temporary lane closures, occasional hauling or traffic detours though adjacent neighborhoods.
		1	Site constraints exist and are fairly major. Utility conflicts exist and require rerouting or relocation of existing utilities. Traffic and neighborhood impacts occur and are fairly major. Examples included extended road closures or hauling operations.

Table M-2: Conversion of Benefit Ratios to Raw Scores

Raw Score	Benefit Ratio
5	≥1.5
3	0.5-1.5
1	0.075-0.5
0	<0.075

Table M-3: Prioritization Raw Score Weight Factors

Weight Factor	Criteria
10	Public Health and Safety Severity of Street Flooding (City-Owned) Cost Effectiveness
6	Effect of Improvements Water Quality/Quantity Open Channel - Erosion Control Implementation Constraints Grant Funding
3	Constructability

Table M-4: Primary System Flood Control Project Prioritization Matrix

Project	Public Health and Safety		Severity of Street Flooding (Public ROW)		Cost Effectiveness		Effect of Improvements		Water Quality - BMP		Water Quality - Erosion Control		Implementation Constraints		Grant Funding		Constructability		Total Weighted Score	Raw Rank	Tie-Break Rank
Allen Road - North Fork Greens Mill Run (Alternative #1 / #2)	5	50	5	50	3	30	5	30	0	0	0	0	3	18	0	0	3	9	187	1	1
Southeast Greenville Boulevard - Reedy Branch (Alternative #1 / #2)	5	50	5	50	3	30	5	30	0	0	0	0	3	18	0	0	1	3	181	2	2
Reedy Branch Project Group (Alternative #1)	5	50	5	50	3	30	5	30	0	0	0	0	1	6	0	0	1	3	169	3	3
South Wright Road - Reedy Branch (Alternative #1)																					
East 10th Street - Reedy Branch (Alternative #1)																					
Greens Mill Run Project Group (Alternative #2)	5	50	5	50	1	10	1	6	0	0	3	18	1	6	1	6	1	3	149	4	4
Rock Spring Road - Greens Mill Run (Alternative #2)																					
South Elm Street - Greens Mill Run (Alternative #2)																					
Greens Mill Run Project Group (Alternative #1)	5	50	5	50	1	10	1	6	0	0	3	18	1	6	1	6	1	3	149	4	5
Rock Spring Road - Greens Mill Run (Alternative #1)																					
College Hill Road - Greens Mill Run (Alternative #1)																					
South Elm Street - Greens Mill Run (Alternative #1)																					
North Fork Project Group (Alternative #2)	3	30	5	50	1	10	3	18	0	0	3	18	1	6	1	6	1	3	141	6	6
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #2)																					
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #2)																					
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #2)																					
Ellsworth Drive - North Fork Greens Mill Run (Alternative #2)																					
Fornes Run Project Group (Alternative #1)	5	50	5	50	0	0	5	30	0	0	0	0	1	6	0	0	1	3	139	7	7
Crestwood Drive - Fornes Run (Alternative #1)																					
North Overlook Drive - Fornes Run (Alternative #1)																					
Norfolk Southern Railway (FR) - Fornes Run (Alternative #1)																					
East 14th Street - Fornes Run (Alternative #1)																					
South Wright Road - Reedy Branch (Alternative #2)	1	10	5	50	3	30	3	18	0	0	0	0	3	18	0	0	3	9	135	8	8
North Fork Project Group (Alternative #1)	3	30	5	50	0	0	3	18	0	0	3	18	1	6	1	6	1	3	131	9	9
Spring Forest Road (US) - North Fork Greens Mill Run (Alternative #1)																					
Norfolk Southern Railway (NF) - North Fork Greens Mill Run (Alternative #1)																					
Spring Forest Road (DS) - North Fork Greens Mill Run (Alternative #1)																					
Ellsworth Drive - North Fork Greens Mill Run (Alternative #1)																					
Fornes Run Project Group (Alternative #2)	5	50	5	50	0	0	1	6	0	0	0	0	1	6	0	0	1	3	115	10	10
North Overlook Drive - Fornes Run (Alternative #2)																					
Norfolk Southern Railway (FR) - Fornes Run (Alternative #2)																					

*Project groups indicate project-dependency. Only one set of alternatives may be chosen per Primary System stream in order to achieve stated performance.
**Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table M-5: Secondary System Flood Control Project Prioritization Matrix

Project	Public Health and Safety		Severity of Street Flooding (Public ROW)		Cost Effectiveness		Effect of Improvements		Water Quality - BMP		Water Quality - Erosion Control		Implementation Constraints		Grant Funding		Constructability		Total Weighted Score	Raw Rank	Tie-Break Rank
Greenbriar Drive System	5	50	2	20	3	30	5	30	0	0	0	0	3	18	0	0	1	3	151	1	1
Cedar Lane System	0	0	5	50	3	30	4	24	0	0	0	0	5	30	0	0	3	9	143	2	2
Dellwood Drive System	1	10	5	50	3	30	4	24	0	0	0	0	3	18	0	0	1	3	135	3	3
Circle Drive System	1	10	5	50	1	10	5	30	0	0	0	0	5	30	0	0	1	3	133	4	4
Jaycee Park System	0	0	5	50	3	30	1	6	0	0	0	0	5	30	0	0	3	9	125	5	5
Arlington Boulevard System	0	0	5	50	1	10	5	30	0	0	0	0	5	30	0	0	1	3	123	6	6
Slay Drive System	1	10	5	50	1	10	3	18	0	0	0	0	5	30	0	0	1	3	121	7	7
Commerce Street System	0	0	5	50	3	30	1	6	0	0	0	0	3	18	0	0	3	9	113	8	8
Brownlea Drive System	0	0	5	50	1	10	1	6	0	0	0	0	5	30	0	0	3	9	105	9	9
Bradley Street System	1	10	1	10	1	10	3	18	0	0	0	0	5	30	0	0	1	3	81	10	10
Lakewood Drive System	1	10	3	30	1	10	2	12	0	0	0	0	1	6	0	0	3	9	77	11	11
Brook Hollow System	1	10	1	10	1	10	5	30	0	0	0	0	1	6	0	0	1	3	69	12	12

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

Table M-6: Stream Stabilization Project Prioritization Matrix

Project	Public Health and Safety		Severity of Street Flooding (Public ROW)		Cost Effectiveness		Effect of Improvements		Water Quality - BMP		Water Quality - Erosion Control		Implementation Constraints		Grant Funding		Constructability		Total Weighted Score	Raw Rank	Tie-Break Rank
Forest Hill Drive	5	50	0	0	0	0	1	6	0	0	5	30	3	18	3	18	3	9	131	1	1
St Andrews Drive	0	0	1	10	1	10	5	30	0	0	5	30	3	18	3	18	1	3	119	2	2
East 10th Street at Rock Spring Road	5	50	0	0	0	0	1	6	0	0	3	18	3	18	3	18	3	9	119	2	3
Dickinson Avenue	0	0	0	0	1	10	0	0	0	0	5	30	3	18	3	18	5	15	91	4	4
South Evans Street	0	0	0	0	0	0	0	0	0	0	5	30	3	18	3	18	3	9	75	5	5
Cedar Lane	0	0	0	0	0	0	1	6	0	0	3	18	3	18	3	18	3	9	69	6	6
South Elm Street	0	0	0	0	0	0	1	6	0	0	3	18	3	18	3	18	3	9	69	6	7
Greenway at East 10th Street	0	0	0	0	0	0	0	0	0	0	3	18	3	18	3	18	3	9	63	8	8

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost per linear foot, with lower costs receiving a higher tie-breaking rank.

Table M-7: Stormwater Best Management Practice Project Prioritization Matrix

Project	Public Health and Safety		Severity of Street Flooding (Public ROW)		Cost Effectiveness		Effect of Improvements		Water Quality - BMP		Water Quality - Erosion Control		Implementation Constraints		Grant Funding		Constructability		Total Weighted Score	Raw Rank	Tie-Break Rank
Jaycee Park	0	0	0	0	5	50	0	0	5	30	0	0	5	30	3	18	5	15	143	1	1
Eastern Elementary School	0	0	0	0	5	50	0	0	5	30	0	0	5	30	3	18	5	15	143	1	2
University Commons Shopping Center	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	3
ECU Athletic Maintenance Building	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	4
Greenville Square Shopping Center	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	5
Carolina East Mall	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	6
Pirates Pointe Shopping Center	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	7
First Pentecostal Holiness Church	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	8
Physicians East Medical Center	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	5	15	131	3	9
J.H. Rose High School	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	3	9	125	10	10
Jiffy Lube	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	3	9	125	10	11
Greenville Mall	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	1	3	119	12	12
Arlington Crossing Shopping Center	0	0	0	0	5	50	0	0	5	30	0	0	3	18	3	18	1	3	119	12	13
Guy Smith Park	0	0	0	0	3	30	0	0	3	18	0	0	5	30	3	18	5	15	111	14	14
Dream Park	0	0	0	0	3	30	0	0	3	18	0	0	5	30	3	18	5	15	111	14	15
Andrew A. Best Freedom Park	0	0	0	0	3	30	0	0	3	18	0	0	5	30	3	18	5	15	111	14	16
S. Greenville Elementary School	0	0	0	0	3	30	0	0	3	18	0	0	5	30	3	18	3	9	105	17	17
Hastings Ford Dealership	0	0	0	0	5	50	0	0	3	18	0	0	1	6	3	18	3	9	101	18	18
Wahl Coates Elementary School	0	0	0	0	3	30	0	0	3	18	0	0	1	6	3	18	1	3	75	19	19

*Tie-break rank reflects tie-breaking of projects with tied raw ranks, based on cost effectiveness benefit ratios, with higher ratios receiving a higher tie-breaking rank.

N. Greens Mill Run Benthic and Water Quality Monitoring Reports

GREENS MILL RUN WATER QUALITY MONITORING

Dr. Eban Bean, Dr. Michael O'Driscoll, and Dr. Charles Humphrey
East Carolina University

Final Report Submitted to Hazen and Sawyer

March 3, 2016

Table of Contents

EXECUTIVE SUMMARY

East Carolina University was awarded an 18-month contract to monitor water quality in the Greens Mill Run (GMR) watershed (13.4 mi^2) as part of the City of Greenville's Watershed Master Planning project. The GMR watershed was selected because it is currently listed on the 303d list of impaired waters for North Carolina.

The goal of the water quality monitoring program was to determine whether nutrients, pathogens, sediments, or metals are impairing GMR, and if so, to locate any potential sources of degradation. Water quality monitoring included sampling stream flow during base and wet weather conditions at least four times at five locations on the main stem of GMR (1-5), two tributaries, Reedy Branch (GMR 6) and Fornes Branch (GMR 7), and two culverts adjacent to the ECU main campus (GMR 9 & GMR 10). Two longitudinal surveys of water quality were conducted at 20 locations along GMR. Stage and conductivity were recorded continuously at three locations within the watershed as well.

Sampling results were compared with water quality standards or surrogate standards to evaluate whether parameters may be contributing to stream degradation. Exceedance of standards occurred more frequently during storm flow events rather than baseflow events. Total suspended solids (TSS) concentrations exceeded 20 mg/l (standard for High Quality Waters) during two storm flow events at nearly all sites on GMR, while the turbidity standard was violated during only one of those storms at three sites upstream of Arlington Rd. Agricultural land use in head waters and in-stream channel erosion from excess storm flows are likely the most significant contributors of sediment loads to GMR.

Results showed E. coli concentrations in the streams exceeded the EPA recommended levels more frequently during storm flows in comparison to baseflow. Fornes Branch and Reedy Branch likely contributed to the rise in total coliform and E. coli concentrations on GMR between Charles Blvd. and Green Springs Park. Elevated pathogen concentrations on Fornes Branch and Reedy Branch may result from pet waste within these primarily residential subwatersheds.

Although nutrient concentrations did not exceed existing numeric standards, baseflow nitrate-nitrogen concentrations exceeded conservative numeric guidelines set in Florida (0.3 mg/l). Results of $^{15}N\text{-}NO_3$ analysis suggest fertilizer or soil as the primary source of nitrate, although wastewater could not be ruled out. The agricultural head waters areas were primary sources of nitrate-nitrite, as baseflow concentrations consistently decreased downstream to Arlington Blvd. Although the highest concentrations were from the two outfalls adjacent to ECU main campus (GMR 9 and GMR 10), relatively low flowrates had a negligible effect on in-stream water quality. Nitrate-nitrite concentrations tended to decrease between Charles Blvd. and Green Springs Park, in spite of higher concentrations on Fornes Branch and Reedy Branch.

Total dissolved phosphorus concentrations during storm flow events also exceeded numeric guidelines from Florida (0.06 mg/l). Concentrations generally increased steadily between Memorial Ave. and Green Springs Park, with the highest storm flow concentrations generally occurring on Fornes Branch and Reedy Branch.

Concentrations along GMR generally increased downstream as the cumulative watershed becomes more urbanized and impervious.

None of the metals were found to exceed state standards, as concentrations were below detection limits for copper (10 µg/l) and lead (5 µg/l) and zinc concentrations were less than state standards (50 µg/l).

In-stream erosion resulting from excess stormwater runoff, primarily between Arlington Blvd. and Green Springs Park, is the most probable cause of degradation within Greens Mill Run. Further monitoring and assessment on this section of stream and tributaries would more specifically locate sources of degradation.

INTRODUCTION

Study Location

Greens Mill Run (GMR) is located within Pitt County, NC. The GMR watershed (HUC12: 030201030403) is located in the Coastal Plain, where the bulk of discharge to streams is from unconfined aquifers (Winner and Coble 1996). The watershed is approximately 14 square miles and the main stem of GMR is approximately 7.3 miles long. The main stem of GMR flows from agricultural and forested headwaters to the west through urban areas of Greenville, NC, eastward to the Tar River. Topographic relief and land cover are shown with the GMR watershed boundary in Figures 1 and 2, respectively. There are two primary, named tributaries towards the lower end of GMR, Fornes Branch and Reedy Branch, with each watershed less than 1 square mile in area.

Soils within the GMR watershed are mostly poorly drained with fine-loamy texture. Typically the surficial aquifer drains to streams and it is underlain at approximately 10-20 ft below the surface by a shallow confining unit, known as the Yorktown confining unit (which overlays the Yorktown aquifer). As much of the GMR watershed was at one time used for agricultural production, remnant drainage channels and tile drains have served as collectors of stormwater runoff as fields have been converted to commercial, industrial, and residential land uses. In 2003, 49.5% of the GMR watershed was low or high density development (EEP, 2005), and has continued to increase since. These channels efficiently convey runoff to GMR and its tributaries. Intense urbanization and development coupled with limited stormwater controls have led to channel incision along much of GMR, tributaries of GMR, and nearby streams within the urban corridor (Hardison et al., 2009). This has also led to flooding after heavy rain events. Historical channelization has also reduced the stream length and increased the channel slope along sections of GMR, for example along 10^{th} St. adjacent to the East Carolina University campus, where the former channel remains north of the thoroughfare.

On average, the watershed receives 126 cm (49.56 in.) of rain per year, ranging from a maximum of 15.6 cm (6.14 in.) in August to a low of 7.92 cm (3.12 in.) in November (NCEI, 2015). The mean air temperature is 16.2°C (61.6°F), from a low of 5.6°C (42.1°F) in January to a high of 26.8°C (80.3°F) in July (NCEI, 2015). Elevated evapotranspiration in the summer months can result in reductions in streamflow during this period. On an annual basis, evapotranspiration accounts for approximately 70% of precipitation losses (Sun et al. 2002). Based on previous studies in the region, groundwater inputs to streams are typically lowest during the period of June–November. Total discharge follows this seasonal pattern but may also increase during September due to increased runoff from tropical storms. Typically streamflow is greatest during March and lowest during October. Groundwater is usually the dominant source of streamflow, contributing approximately 60% of annual discharge (O'Driscoll et al. 2010).

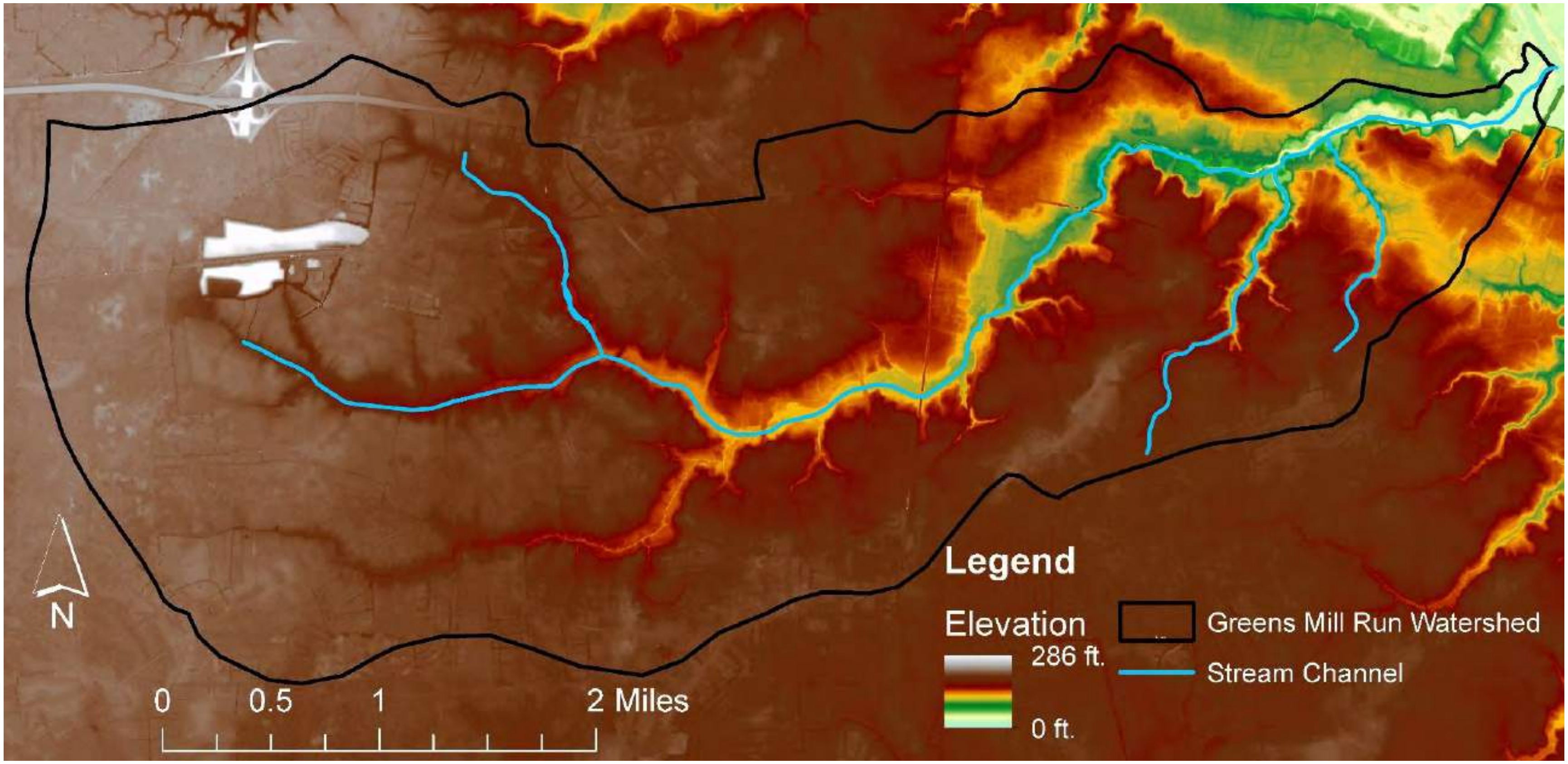


Figure 1. Topography within and around Greens Mill Run watershed.

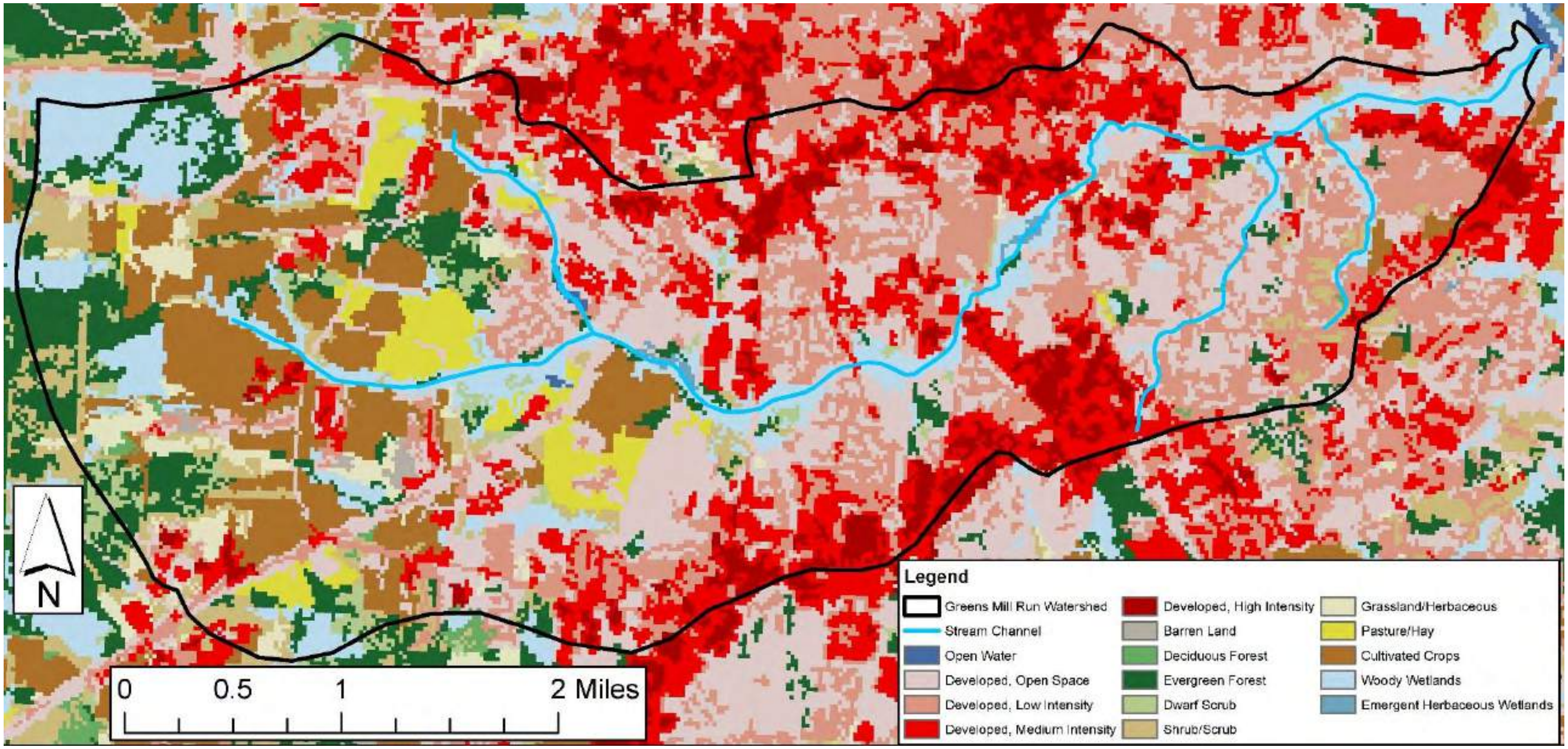


Figure 2. Land cover within and around Greens Mill Run watershed. Data are from the National Land Cover Data set.

Current Condition

The North Carolina Department of Environmental Quality currently lists Greens Mill Run as being Class C surface waters, meaning it is protected for secondary recreation (wading, boating, and other types of infrequent, unorganized, or incidental human body contact), fishing, wildlife, fish consumption, aquatic life (propagation, survival, and maintenance of biological integrity), and agriculture. In addition, NCDEQ has applied the supplemental classification for Nutrient Sensitive Waters (NSW), which is “intended for waters needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation” (NCDEQ, 2015a) and is applied to Greens Mill Run as a tributary to the Tar River (NCDEQ, 2015b).

Since 2004, the 7.3 mile stretch of Greens Mill Run from its source to the Tar River has been classified as impaired for not meeting the aquatic life standard due to poor bioclassification rating for ecological or biological integrity of benthos. This classification does not specify the cause of the condition and may result from individual or multiple environmental factors.

Study Objectives

The goal of the water quality monitoring program is to determine whether nutrients, pathogens, sediments, or metals are contributing to impairment of Greens Mill Run.

METHODS

Sampling and monitoring plans were developed to evaluate the flow and water quality over time within Greens Mill Run.

Water Quality Sampling and Measurements

Nine sampling and monitoring sites were selected along Greens Mill Run, including five on the main stem (GMR 1-5), two on its tributary streams (GMR 6, Reedy Branch, and GMR 7, Fornes Branch), and two at stormwater outfalls (GMR 9, 10) (Table 1 and Figure 3). Water quality samples and measurements were collected during baseflow and wet weather flow (or storm flow) events during the study period. These sites were distributed along GMR and its tributaries to evaluate water quality throughout the watershed and determine if any section(s) of GMR was more affected than others. In addition, baseflow and wet weather flow samples were collected across seasons to evaluate seasonal fluctuations of water quality.

Samples were collected during four baseflow and four wet weather flow (or storm flow) events. All sites were sampled for each base flow sampling and all sites were sampled for two wet weather flow events (November 24 and February 2), with all but the two outfall sites (GMR 9 and GMR 10) being sampled for the remaining two wet weather flow events (July 13 and September 25). Samples were also collected in coordination with benthic sampling on August 18-21, 2014; when available results were included with those from the other four baseflow events. Seasonal baseflow and storm flow events dates are listed in Table 2 and occurred approximately during each season between October 2014 and September 2015. Rainfall less than 1.00 in. during 72 hours (3 days) prior to sampling was required for baseflow events. This criterion was supported with monitoring data as storm hydrographs returned to baseflow within 72 hours of precipitation events, except for the largest of rainfall events. In addition, samples were also collected in conjunction with benthic sampling in August 2014 and met the criteria for baseflow sampling.

Table 1. Locations and data collection for each sampling and monitoring sites along Greens Mill Run.

Location	Latitude	Longitude	Sampling	Stage Monitoring	Conductivity Monitoring
GMR 1	35° 35' 25.08" N	77° 24' 34.02" W	Y		
GMR 2	35° 35' 6.36" N	77° 23' 51.00" W	Y		
GMR 3	35° 35' 24.24" N	77° 22' 45.72" W	Y		
GMR 4	35° 35' 57.48" N	77° 22' 16.26" W	Y		
GMR 5	35° 36' 19.02" N	77° 20' 34.56" W	Y	Y	Y
GMR 6 (Reedy Branch)	35° 36' 8.58" N	77° 20' 54.96" W	Y	Y	Y
GMR 7 (Fornes Branch)	35° 36' 7.20" N	77° 21' 14.52" W	Y		
GMR 9 (Outfall)	35° 36' 11.47" N	77° 21' 39.75" W	Y		
GMR 10 (Outfall)	35° 36' 14.32" N	77° 21' 52.59" W	Y		
GMR RT	35° 36' 15.04" N	77° 21' 53.47" W		Y	Y

Table 2. Sampling dates for baseflows, wet weather flows, and longitudinal surveys.

Sampling	Dates	
Baseflow	2014: Aug 18-21, Oct 13;	2015: Feb 24, Apr 13, Aug 24[a]
Wet Weather Flow	2014: Nov 24;	2015: Feb 2, Jul 13, Sep 25[a,b]
Longitudinal Surveys		2015: Apr 13, Aug 24

[a]Samples for metals analysis collected at GMR 1, 3, and 5. [b]Samples for isotope analyses collected at all sampling sites.

The target threshold for storm flow sampling was set at 0.50 in. of rainfall within a three hour period. Only the July 13 event did not meet this criterion, when approximately 0.34 in. fell during a three hour period. Wet weather flow samples were collected by first flush sampling on November 24, 2014, and February 2, 2015. All other base flow and wet weather flow samples were collected via direct grab sampling. For grab sampling, bottles were rinsed in stream water three times prior to collecting each sample. Sample bottles were labeled with identification numbers and immediately put on ice after collection.

TSS and Nutrient Analyses
For each sampling event, samples were collected in high density polyethylene (HDPE) bottles, for water quality analyses at the Environmental Research Lab. Samples were filtered on same day as they were collected. These analyses included Total Suspended Solids (TSS), nitrogen species (Ammonia (NH_4), Nitrate+Nitrite (NO_{2+3}), Total Dissolved Nitrogen (TDN)), phosphate (PO_4), Dissolved Organic Carbon (DOC), and chloride (Cl). Nutrient samples were frozen until analyses were performed.

Bacterial Analyses
Samples for bacteria analyses were also collected for each sampling event. Analyses were completed at the ECU Environmental Health Sciences Water Laboratory. Bacteria samples were collected in sealed polyethylene terephthalate (PET) bottles and were analyzed for total coliform and *E. coli*. Samples were diluted (dilution factors of 10-100) before preparation and incubation because of anticipated high concentrations. Samples were prepared and incubated within 6 hours of collection. Samples were analyzed for total coliform and *E. coli* using the IDEXX *Colilert* substrate with *Quantitray 2000* for most probable number (MPN) determination. The sample trays were incubated at 35°C for 24 hours and wells which illuminated yellow under laboratory lights were recorded as positives for total coliform. Tray wells that illuminated under a black light were recorded as positives for *E. coli*.

Metals Analyses
Samples were collected of baseflow on August 24, 2015 and wet weather flow on September 25, 2015 for metals analyses (Copper (Cu), Lead (Pb), and Zinc (Zn)) at GMR 1, 3, and 5. The sample analyses were performed by Environment One Laboratories, Inc. in Greenville, NC using EPA method 200.7 for Cu and Zn, and Standard Method 3113B-04 for Pb.

Isotope Analyses
Wet weather samples were collected for isotope analyses on September 25, 2015. These samples will be analyzed at the University of California at Davis for ^{15}N and ^{18}O in NO_3. These data will provide information on the sources of nitrogen entering GMR. Samples were sent to UC Davis in December.

In Stream Measurements
In stream water quality readings for temperature, specific conductivity, conductivity, dissolved oxygen concentration, and pH were measured using calibrated YSI 556 MPS sensors. Turbidity was measured using a HACH 2020we turbidimeter.

At each site, field sampling sheets were completed to record field meter readings, sample identification numbers, location of any photos, arrival and departure time, and relevant other notes. Field sheets were scanned and stored electronically.

Monitoring Sites

Three sites (GMR RT, GMR 5, and GMR 6) were also selected as water level monitoring sites. At GMR 5 and GMR 6, Onset HOBO Water Level Data Logger (U20-001 or U20L-01) were deployed to record and collect pressure every 30 minutes. Readings were corrected for atmospheric pressure fluctuations to estimate water level records. Staff gauges were also installed at each location. Stage was monitored at these sites during the period of January 9 through October 14, 2015. A third monitoring site, GMR RT, was located at the Rock Springs Rd. bridge crossing of Greens Mill Run, between GMR 4 and GMR 5, and across 10th St. from ECU's main campus. This site was instrumented with a Campbell Scientific Radar Water-Level Sensor (CS475-L) to measure and record water levels at least every minute.

Discharge was calculated from stage records using stage-discharge rating curves. Stage and discharge were measured on nine occasions during the monitoring period. Flow meters were used to measure the flow velocity across the stream cross-section. The cross-section area was estimated by measuring equally spaced depths across the channel width. Discharge was calculated as the product of the average flow velocity and cross-sectional area. Staff gauge water levels were also recorded and used to correct water level records as necessary.

The stage-discharge rating curves took the form of $Q = C*(s^n)$, where Q is the discharge (cfs), s is the stage (ft.), and C and n were values determined by linear regression. Rating curves were developed by linear regression of discharge and stage on log-log plots. Rating curve equations are listed in the Appendix.

These three sites were also instrumented with conductivity loggers. Conductivity can be used in place of direct measurement of other water quality parameters and at a much lower cost to record changes in water quality over time. Each site was instrumented with an Onset HOBO Fresh Water Conductivity Data Logger (U24-001) and set to record every 30 minutes.

Longitudinal Surveys

Two longitudinal surveys were conducted (April 15 and August 24) during base flow conditions along the main stem and tributaries of GMR. These surveys were conducted to provide a finer spatial resolution of water quality variation along GMR. Any significant changes along GMR could where sources of water quality degradation may be entering. A total of 24 sites, including the 9 routine sampling sites and 15 additional sites, were included in these surveys (Figure 3). At each site, a YSI 556 MPS was used to measure temperature, specific conductivity, dissolved oxygen, and pH, while turbidity was measured using a LaMotte 2020we turbidimeter. At each site, field sampling sheets were completed to record field meter readings, sample identification numbers, location of any photos, arrival and departure time, and relevant other notes. Field sheets were scanned and stored electronically.

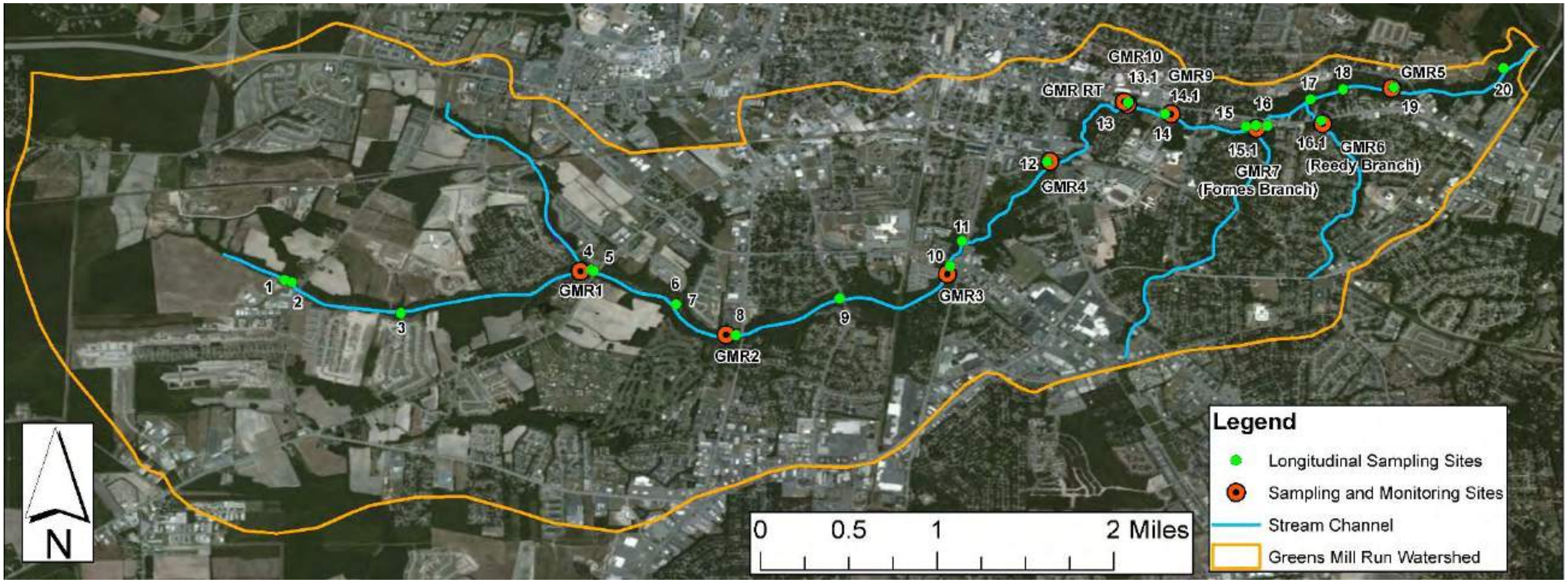


Figure 3. Greens Mill Run sampling and monitoring sites (GMR 1-7, 9, 10, RT) and longitudinal sampling sites (1-20). Longitudinal sampling sites ending in ".1" are sites located on tributaries that intersect GMR downstream of the whole numbered site (e.g. 15.1 and 15).

RESULTS AND DISCUSSION

Stream Flow

During the major base and storm flow monitoring period (October 2014 - September 2015), baseflow was generally consistent over the monitoring period, except between October 2014 through January 2015, when base flow was lower. Data from the GMR Real Time station (Figure 4) is representative of discharge records from GMR 5 and GMR 6 (Reedy Branch), included in Appendix A. Flow at GMR 5 was greater than at GMR RT due to the larger watershed area, while flow at GMR 6 was less than at GMR RT due to smaller watershed area. Based on the discharge data, the October 2014 baseflow sampling event was during the period with the lowest base flow and the February, April, and Aug 2015 baseflow sampling events were during periods of higher base flows. Presumably this could result in greater dilution of non-point source contaminants on for the latter three sampling events.

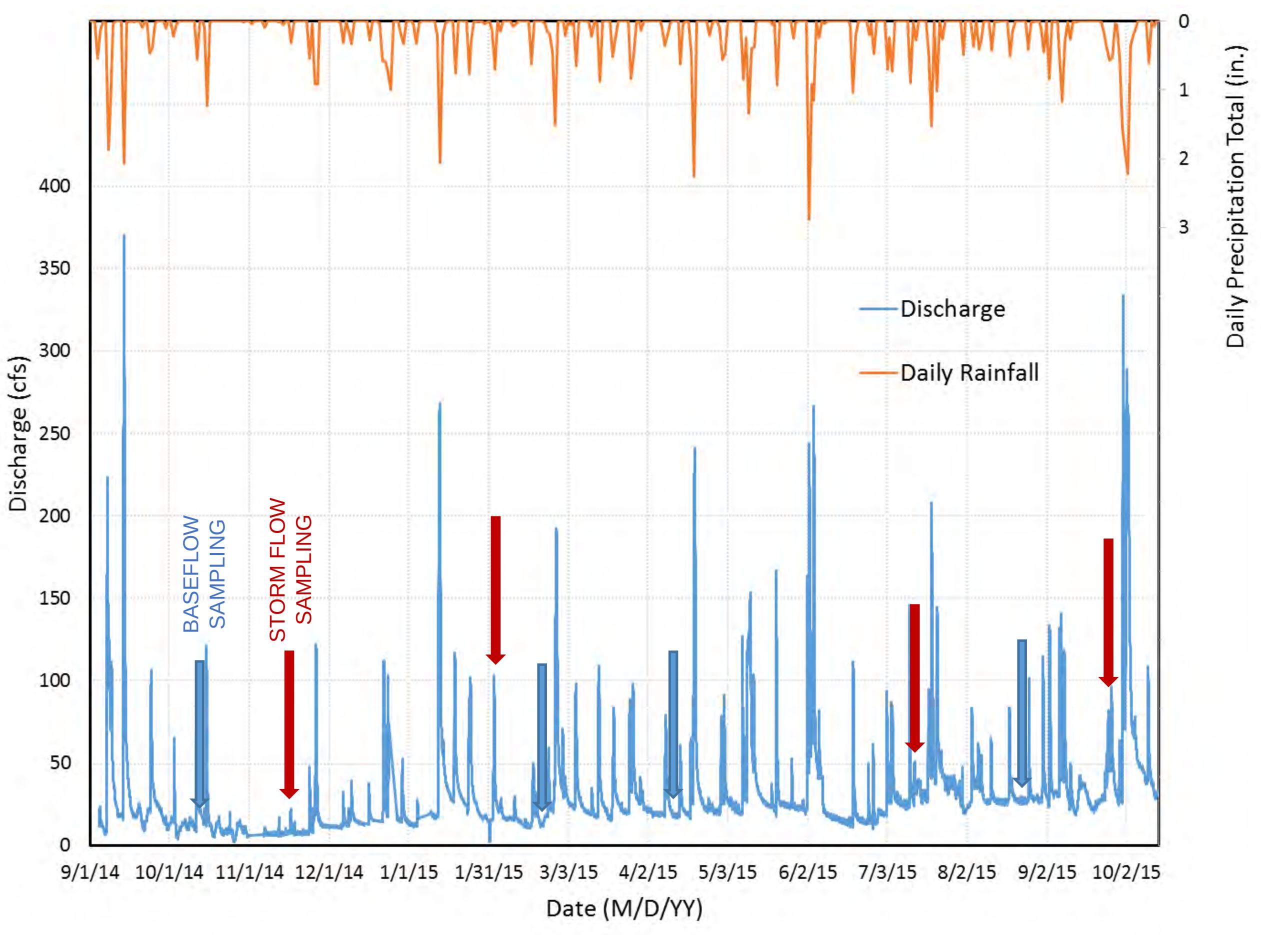


Figure 4. Flow record at GMR RT and daily rainfall totals for nearby NCDC weather stations. Baseflow and storm flow sampling events are denoted with blue and red arrows, respectively.

Water Quality

Turbidity

Turbidity is an indicator of water clarity and serves as a metric for suspended sediment and colored dissolved organic matter. The NC standard for turbidity in surface water is 50 NTU (instantaneous) or 25 NTU (10 day average). All turbidity measurements, including from longitudinal surveys, were less than 20 NTU, except for the storm flow on February 2. On February 2, all in stream turbidities exceeded 20 NTU, with GMR 1, GMR 2, and GMR 3, exceeding the instantaneous standard of 50 NTU, with the maximum turbidity measured during this study of 110 NTU at GMR 3. Median turbidities were generally lower at downstream sites for base and storm flows on the main stem of GMR (sites 1-5) and were noticeably higher during storm flows on tributaries to GMR (sites 6, 7, 9, and 10 (Figure 5). Among all sites, turbidities tended to be lowest at the two outfalls (GMR 9 and 10) and likely do not contribute significantly to turbidity at GMR 5 at baseflow or storm flow. Turbidities tended to have a higher range during wet weather flows, although medians at many sites were similar. During wet weather flows this likely occurs due to increased transport of organic matter and sediments from the less urbanized head waters. In addition, flushing of organic rich waters from riparian wetlands can also increase turbidity during storm events in coastal plain streams. In-stream channel erosion above GMR 3 may also be contributing sediments during storm flows.

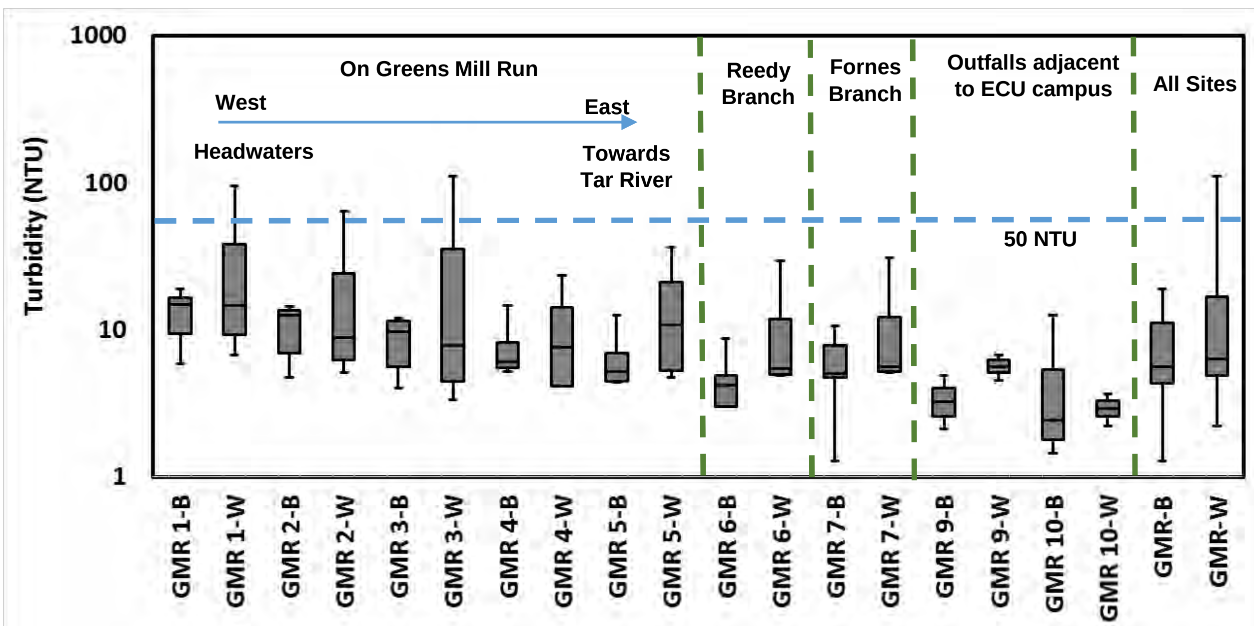


Figure 5. Box and whisker plots of turbidity measurements for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively. Instantaneous turbidity limit of 50 NTU displayed for reference.

In general across all storm flows, turbidities decreased from GMR 1 to GMR 3 and tended to increase at GMR 4 or GMR 5. This suggests that during wet weather flow events, turbidity may be generated at greater rates from areas of the watershed upstream of GMR 1 compared to sites immediately downstream. Storm flow turbidities at GMR 6 (Reedy Branch) and GMR 7 (Fornes Branch) were also greater than GMR 4 for three of four events. Since GMR 6 and GMR 7 are also tributaries to GMR between GMR 4 and GMR 5, increases in turbidity from GMR 3 to GMR 5 may be significantly influenced by inputs from GMR 6 and GMR 7.

In general baseflow turbidities decreased consistently from GMR 1 to GMR 5. Although during two sampling events, February 24 and August 24, turbidities increased from GMR 3 to GMR 4. During base flow, turbidity most likely results from fine suspended sediments remaining in the water column following storm events or due to biological growth in the water column.

Turbidity measurements recorded during the two longitudinal surveys are shown in Figure 6. Turbidities from outfalls (GMR 9 and 10) and Reedy Branch (GMR 6) were lower than nearby turbidities on GMR, while Fornes Branch (GMR 7) turbidities were comparable to those on GMR upstream and downstream of the confluence.

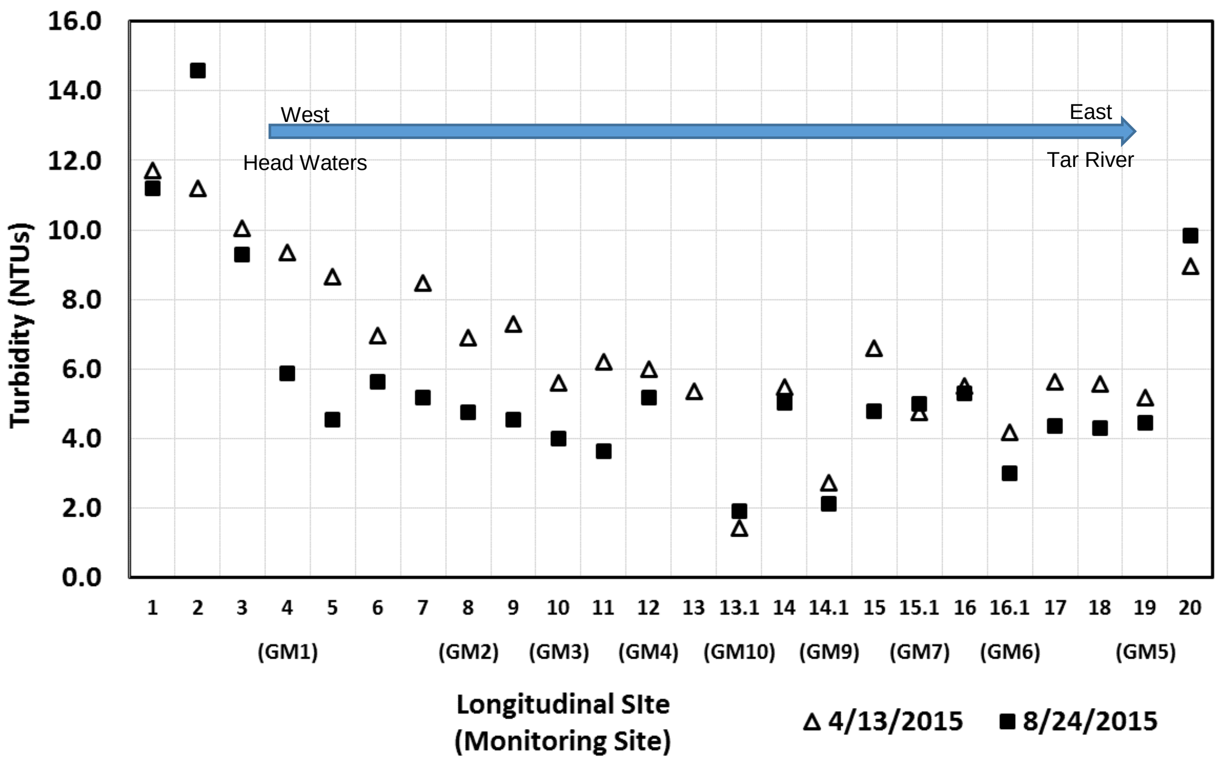


Figure 6. Turbidity readings from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR.

In general, turbidities were slightly higher on April 13 than August 24. The most downstream turbidity readings (site 20) were noticeably higher than upstream turbidity values. This was likely due to algal growth within the water column and influence from the Tar River. Turbidities clearly decreased on both dates from the most upstream point (site 1), 11 - 12 NTU, to just upstream of GMR 4 (site 11), 3 – 7 NTU. Downstream from

GMR 4, turbidities increased at GMR 4 (site 12) to or stabilized at 4 – 6 NTU, generally declining downstream slightly to GMR 5 (site 19).

Total Suspended Solids

Although there is not a standard for most streams, NC has a standard for TSS for high quality waters set at 20 mg/l. Wet weather TSS values were generally higher than baseflow TSS values at each site, and storm flow medians were greater than corresponding base flow medians at each site (Figure 7). Baseflow TSS values ranged from less than 1 mg/l to just greater than 24 mg/l, while storm flow TSS values ranged from less than 3 mg/l to greater than 1800 mg/l. Outfall base flow TSS concentrations were generally less than all other stream sites for baseflow and storm flow samples. Base flow concentrations generally decreased from GMR 1 to GMR 5, with Fornes Branch (GMR 7) and Reedy Branch (GMR 6) being equal or slightly less than TSS values at GMR 5. Although, for two base flow events, GMR 2 was noticeably below GMR 1 and GMR 3, resulting in the median being slightly less than those sites. This may have resulted from dilution and relatively lower sediment contributions between GMR 1 and GMR 2, increasing downstream between GMR 2 and GMR 3.

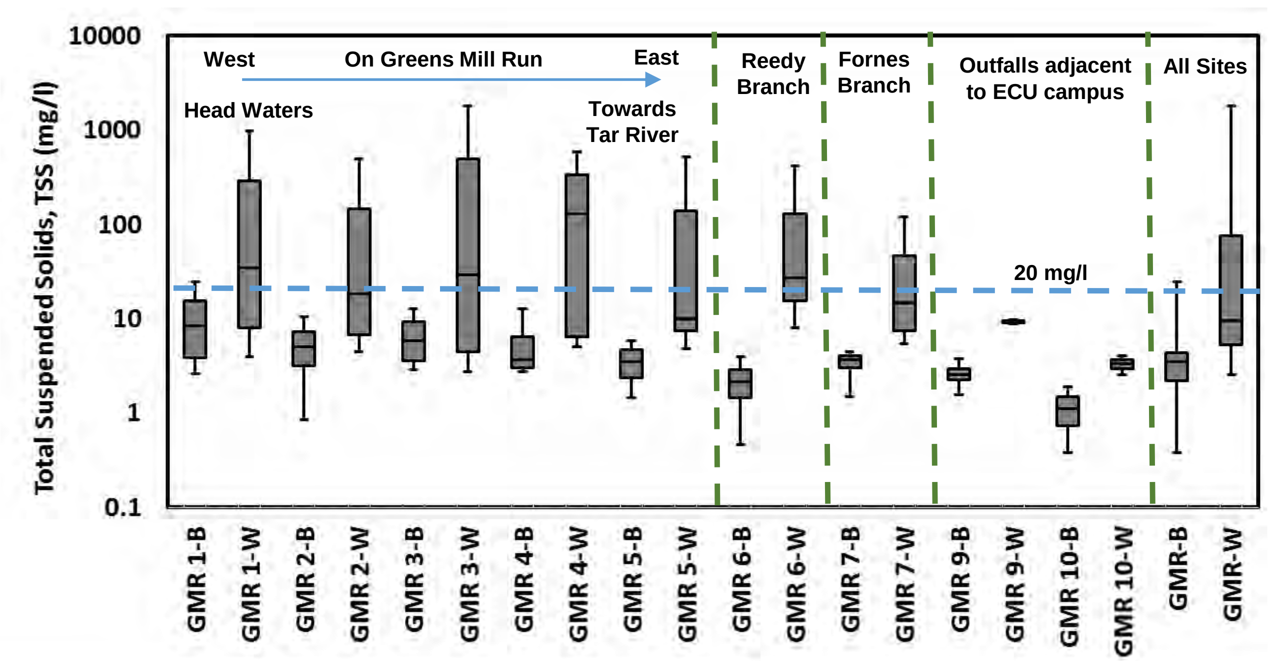


Figure 7. Box and whisker plots of total suspended solids (TSS) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

Storm flow TSS concentrations were generally consistent between GMR 1 and GMR 3, increasing to GMR 4, and decreasing to GMR 5. For all storm sampling events, except July 13, TSS concentrations on Reedy Branch (GMR 6) and Fornes Branch (GMR 7) were less than at GMR 4, and corresponded to GMR 5 concentrations being less than GMR 4 concentrations as well. In addition, for all storm events, except February 2, TSS concentrations increased from GMR 3 to GMR 4.

Dissolved Organic Carbon

Dissolved Organic Carbon (DOC) does not have a water quality criteria. It is produced by the decomposition of organic substances, commonly in streams or wetlands. Median DOC concentrations were greater for storm flows than base flows at each site. Concentrations of DOC were typically between 2 and 8 mg/l for base flow samples and between 4 and 10 mg/l for storm flows. Outfalls adjacent to ECU had lower median concentrations than GMR and tributary sites for storm and base flows, although two of the three highest base flow DOC concentrations recorded were from outfall samples collected on February 24.

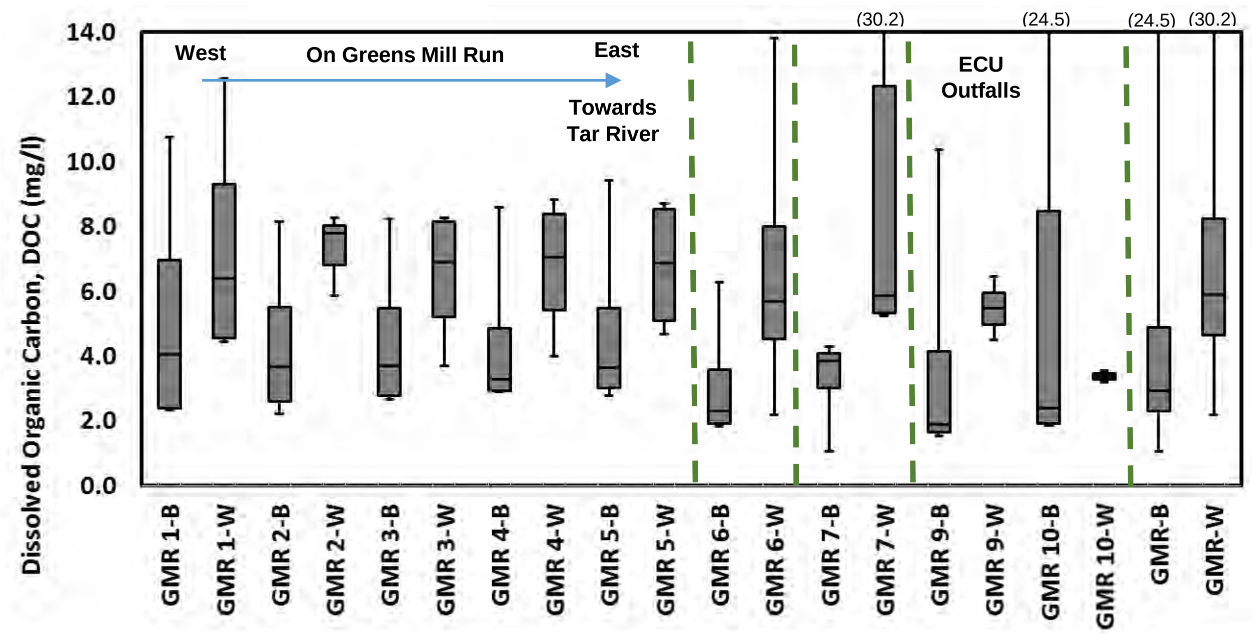


Figure 8. Box and whisker plots of Dissolved Organic Carbon (DOC) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

Base flow DOC concentrations generally decreased from GMR 1 to GMR 2, increasing only slightly from GMR 3 through to GMR 5. For each base flow sampling, DOC varied by only 1 – 2 mg/l between GMR 1 and GMR 5. Base flow concentrations at GMR 6 (Reedy Branch) and GMR 7 (Fornes Branch) were generally less than at GMR 4 and GMR 5.

Storm flow concentrations were generally consistent between GMR 1 and GMR 5, varying by 1 – 4 mg/l along the main stem of GMR. Storm flow concentrations were lower on Reedy Branch (GMR 6) and tended to be lower on Fornes Branch (GMR 7) than samples collected on GMR. Although, the two highest storm flow concentrations were collected from these tributaries on November 24.

Specific Conductivity

Specific conductivity (SC) provides an indication of the concentration of dissolved ions in the water column. It can also be used to indicate significant changes in water chemistry such as from wastewater or road salts. Chloride (Cl) is a primary ion in common salts. Since fluctuations of Cl concentrations and SC measurements were nearly identical, Cl results are included in Appendix C.

Median base flow SC values were greater for base flow than storm flow for all sites. Conductivity logger plots for GMR RT, GMR 5, and GMR 6 (included in Appendix B) generally showed a similar pattern of a sharp spike in conductivity at the beginning of storm events, followed by a sharp decrease as storm events extended, and increasing towards an equilibrium value following events as the end of the storm hydrograph and interflow taper off. Conductivity values were less than 0.20 mS/cm throughout the record, except during a period in late February, following road salt applications due to ice and snow events in Greenville. Base flow conductivities increased noticeably from late winter into summer before declining in fall. This was due to reduced baseflow during the summer months allowing greater concentrations of dissolved ions increasing conductivity to around 0.1 mS/cm for GMR RT and GMR 6.With greater baseflow rates in winter and fall, dissolved ion concentrations were diluted, decreasing base flow conductivities to near zero. Overall, this response is indicative of lower base flow rates in the summer when ground water levels are lowest, compared to the winter and fall when groundwater levels are higher.

In general SC values were lower on the two tributaries, Reedy Branch (GMR 6) and Fornes Branch (GMR 7) than on GMR for base and storm flows. The highest base flow SC values were consistently found in the outfalls adjacent to the ECU campus, which were generally 2– 3x greater than all other stream measurements. This is likely due to seepage of wastewater into the groundwater and storm water collection system due to observed flow for base flow sampling events and similarly high and consistent Cl, NO_{2+3}, and NH_4 concentrations. These conductivities may also result from fertilizers. Results of isotope analyses of NO_3 may provide better information to assign a source to these elevated concentrations. However, the baseflow SC values from GMR 9 and 10 had essentially no impact on the instream quality, as seen in Figures 9 (little increase from GMR 4 to 5) and 10 (minimal increase from site 13 to 15), due to a relatively negligible flow rates compared to in GMR.

Base flow SC measurements along GMR ranged from 0.09 to 0.41 mS/cm. In general, SC decreased between GMR 1 and GMR 3 and increased between GMR 3 and GMR4 and between GMR 4 and GMR 5. The highest SC values for all base flow measurements occurred on February 24 for all stream sites except GMR 1, which recorded the lowest conductivity of all events on this date. This was likely due to road salt applied to Greenville roads over the previous weeks. Conductivity was noticeably elevated in late February at each monitoring site; plots of conductivity records are in the Appendix B. Due to a lower density of roads upstream of GMR 1, SC values were less affected than downstream sites receiving runoff from urban areas of Greenville.

Storm flow SC measurements on November 24 and September 25 followed similar trends, with the greatest values at GMR 1 decreasing to GMR 2 and further to GMR 3, but increasing slightly at GMR 4 before slightly decreasing to GMR 5. For the two other storm events on February 2 and July 13, the fluctuations were noticeably different, with the lowest values at GMR 1, increasing to GMR 2, slightly decreasing to GMR 3, increasing to a maximum at GMR 4, and decreasing to GMR 5. These results may have occurred if readings occurred before storm flow fully displaced baseflow water at the site, especially upstream of GMR 4. However, for all storm flows, SC decreased between GMR 2 and GMR 3, increased between GMR 3 and GMR 4, and decreased again between GMR 4 and GMR 5. Lower SC values at Reedy Branch (GMR 6), Fornes Branch (GMR 7), and the two outfalls (GMR 9 and 10) also likely contributed to the decrease between GMR 4 and GMR 5.

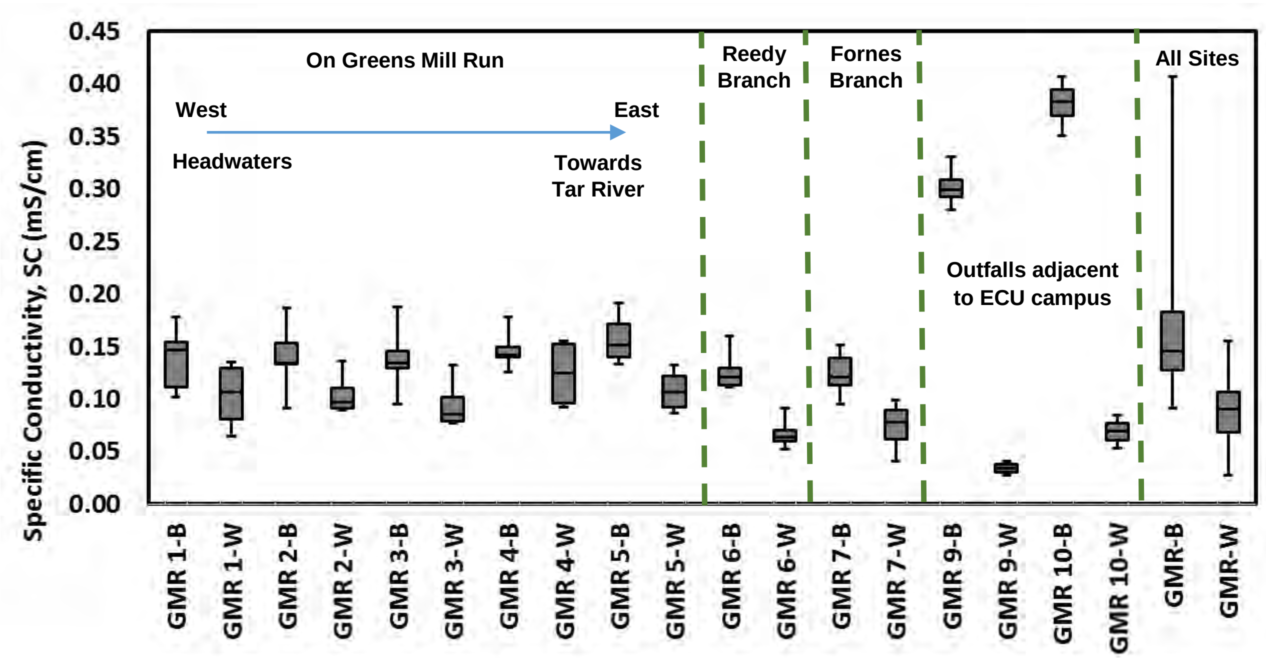


Figure 9. Box and whisker plots of specific conductivity (SC) measurements for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

Longitudinal surveys provided greater resolution of changes in SC between sampling sites along GMR for two base flow sampling dates (Figure 10). Between the upper most site (1) and GMR 1 (site 4) SC values were greater than those of sites between GMR 1 and GMR 2 (site 8). There was a noticeable increase in SC at GMR 2 though that remained through GMR 4 (site 12). Elevated conductivities from the two outfalls adjacent to the ECU campus, GMR 10 (site 13.1) and GMR 9 (site 14.1) corresponded with steady increases of SC in GMR. While lower SC from Fornes Branch (GMR 7; site 15.1) did cause downstream SC to decrease, flow from Reedy Branch (GMR 6; site 16.1) preceded a slight decrease in conductivity that remained through to furthest downstream site (20).

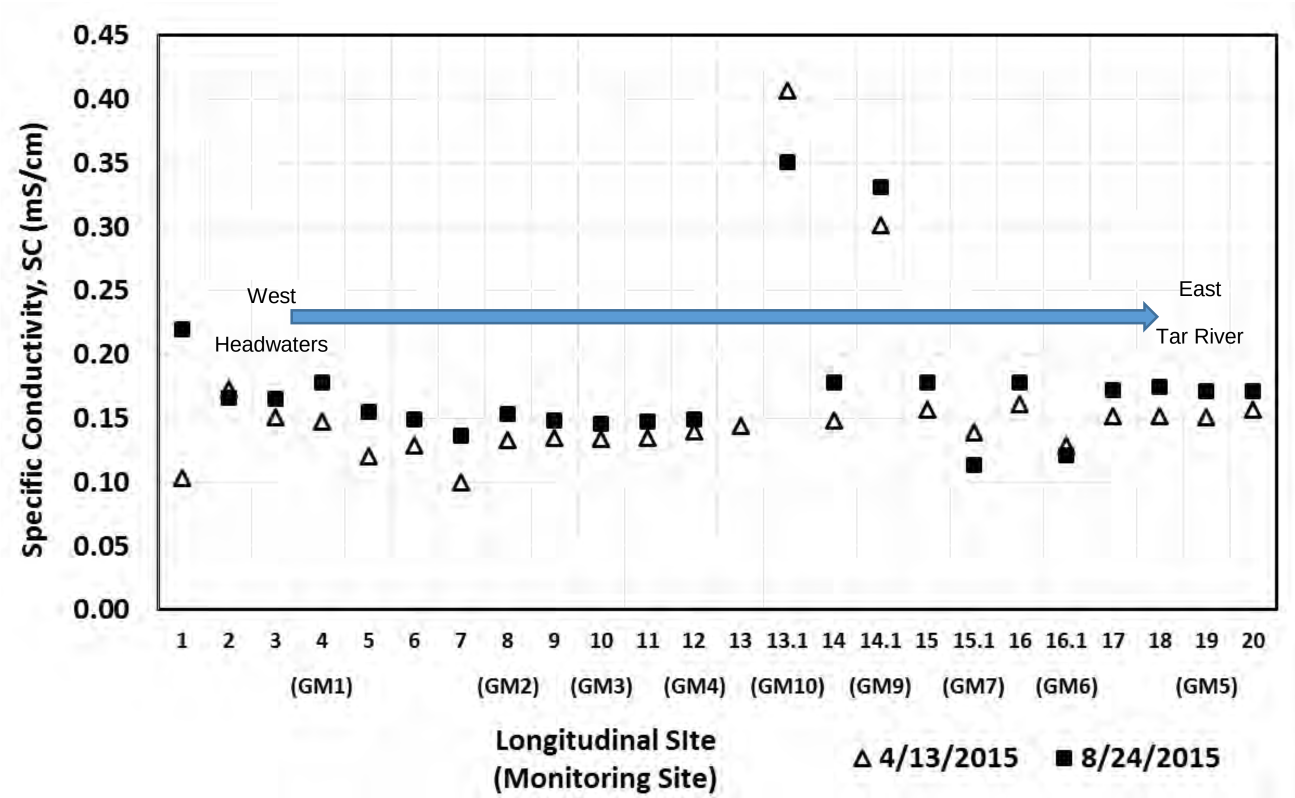


Figure 10. Specific conductivity readings from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR.

Total Dissolved Nitrogen

Nitrogen is an essential nutrient in the environment and can be transformed between different species through biological processes. Total Dissolved Nitrogen (TDN) includes Ammonium (NH_4), Nitrate and Nitrite (NO_{2+3}), and more complex dissolved forms of cumulatively referred to as Organic Nitrogen (ON). TDN concentrations for base flows and storm flows are summarized in Figure 11. Based on guidelines already developed in Florida, their criteria for TDN in streams ranges between 0.67-1.87 mg/l depending on the region. All but two samples on GMR (1-5) exceeded 0.67 mg/l, but the maximum was 1.50 mg/l. Thus, all sites would violate a conservative threshold based on Florida guidelines.

Base flow TDN concentrations tended to be slightly higher than storm flow concentrations. Base flow concentrations were higher at GMR 1 than storm flows, while storm flows were higher than base flows at GMR 4. At GMR 2, GMR 3, and GMR 5, the concentrations were similar between baseflow and storm flow. Base flow TDN concentrations generally decreased from GMR 1 to GMR 2, generally remained consistent from GMR 2 to GMR 5. Although base flow TDN concentrations at Reedy Branch (GMR 6), Fornes Branch (GMR 7), and the two outfalls adjacent to the ECU campus (GMR 9 and GMR 10) tended to be greater than concentrations at GMR 4, GMR 5 concentrations were not noticeably greater than GMR 4.

Concentrations of TDN from the two outfalls (GMR 9 and GMR 10) were elevated above in-stream concentrations at other sites, which corresponded to elevated SC values and could indicate a possible wastewater contribution. The artificially closed drainage networks for GMR 9 and GMR 10 lack in-stream treatment processes (e.g. denitrification, biological uptake) that likely occur within the main stem of GMR, Fornes Branch, and Reedy Branch. Elevated concentrations of TDN from GMR 9 and GMR 10 watersheds are likely not mitigated as well as for areas draining to the remaining sampling sites.

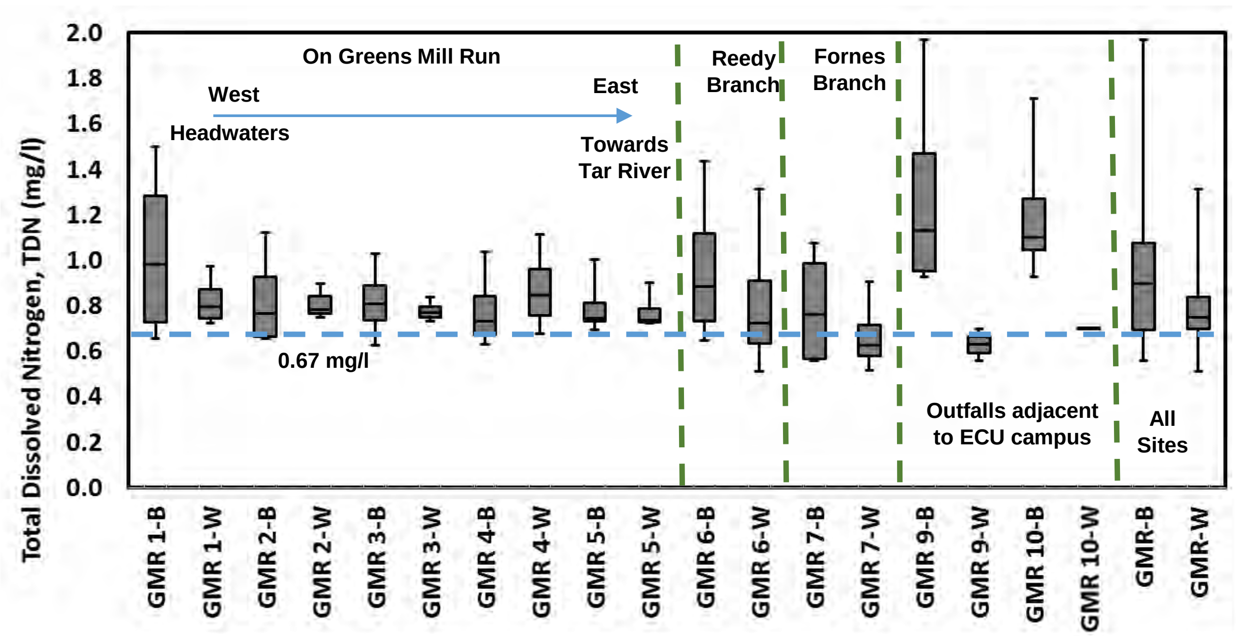


Figure 11. Box and whisker plots of Total Dissolved Nitrogen (TDN) measurements for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively. Florida guideline of 0.67 mg/l of TDN added for reference.

Storm flow TDN concentrations tended to decrease between GMR 1 and GMR 3, while increasing at GMR 4 before decreasing at GMR 5. Storm flow concentrations on Reedy Branch (GMR 6) tended to influence the TDN concentration at GMR 5 more so than Fornes Branch (GMR 7) and the two outfalls adjacent to the ECU campus (GMR 9 and GMR 10). When Reedy Branch concentrations were higher or lower than at GMR 4, GMR 5 concentrations were also higher or lower than GMR 4.

Concentrations of Ammonium (NH_4) and Nitrate and Nitrite (NO_{2+3}) were also analyzed. Organic nitrogen concentrations were calculated as TDN less the concentrations of NH_4 and NO_{2+3}. Generally, ammonium concentrations were relatively low (<0.25 mg/l at all sites/dates; see Appendix C for plots) compared to nitrate concentrations at baseflow (>0.35 mg/l at all sites except Fornes Branch, GMR 7) and organic nitrogen concentrations during storm flow (typically > 0.2 mg/l at all sites).

Nitrate and Nitrite

Nitrate & nitrite (NO_{2+3}) concentrations for base flows and storm flows are summarized in Figure 12. Reference streams (undisturbed, forested watersheds) in the southeastern Coastal Plain generally have nitrate concentrations below 0.3 mg/l (EPA, 2000), in contrast GMR sites typically had nitrate concentrations greater than 0.3 mg/l indicating anthropogenic nitrate inputs are affecting downstream waters. The highest concentrations for baseflow were at GMR 1, while storm flow concentrations were highest at GMR 4 and GMR 5. Base flow median NO_{2+3} concentrations were higher than storm flow median concentrations for all sampling sites. In general base flow NO_{2+3} concentrations decreased between GMR 1 and GMR 3 and increased slightly between GMR 3 and GMR 5. Although NO_{2+3} concentrations on Fornes Branch (GMR 7) were typically lower than at GMR 4, NO_{2+3} concentrations were typically greater on Reedy Branch (GMR 6) and from the outfall pipes adjacent to the ECU campus (GMR 9 and 10). These sources likely accounts for the general increase in NO_{2+3} between GMR 4 and GMR 5. The Reedy Branch watershed is dominated by residential developments, suggesting that elevated NO_{2+3} concentrations may result from lawn fertilization. Results of isotope analyses are expected to provide information on NO_3 sources.

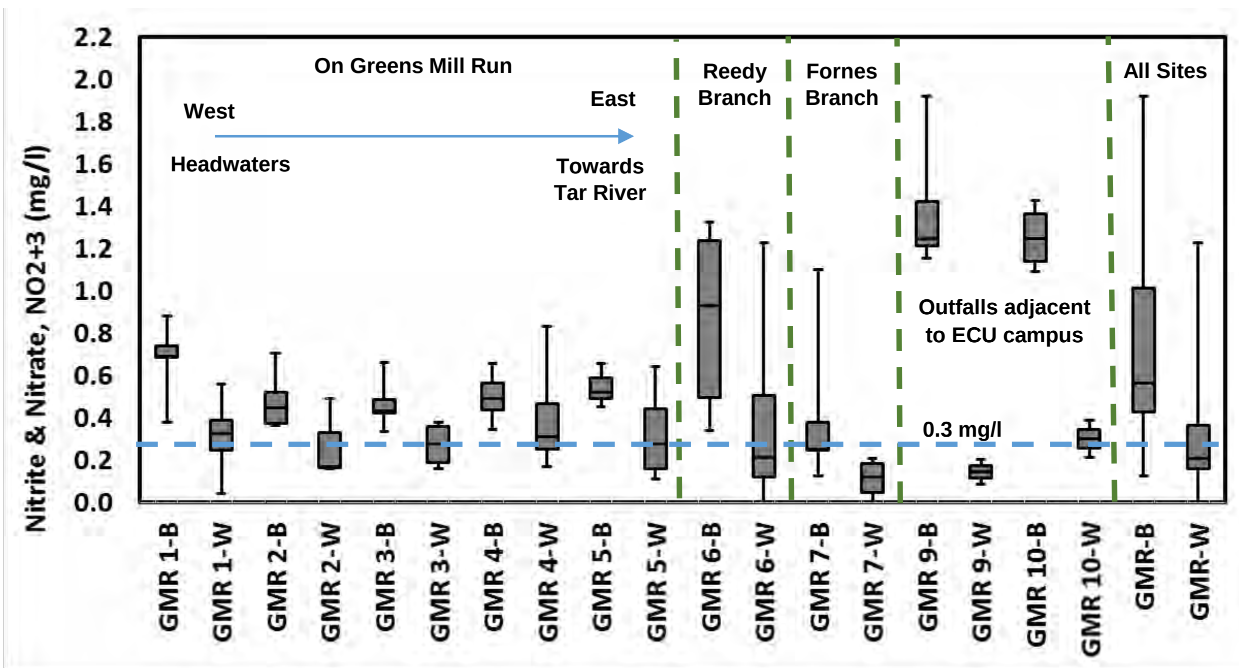


Figure 12. Box and whisker plots of Nitrate and Nitrite (NO_{2+3}) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively. Florida guideline of 0.3 mg/l of NO_{2+3} added for reference.

For storm flows, NO_{2+3} concentrations generally decreased from GMR 1 to GMR 2, but increased between GMR 2 and GMR4 and decreased slightly from GMR 4 to GMR 5. Median storm flow concentrations on Reedy Branch (GMR 6), Fornes Branch (GMR 7), and the two outfalls adjacent to the ECU Campus (GMR 9 and GMR 10) were generally all below the concentrations at GMR 4, leading to lower concentrations at GMR 5.

^{15}N and ^{18}O Isotopes in NO_3

To help identify the source of NO_{2+3} during storm flows, samples from each site were collected at each site for analyses of N^{15} and O^{18} in NO_3. Since N in fertilizer is typically derived from atmospheric N and the N in air is the reference standard used for $\delta^{15}N$, ^{15}N in nitrate derived from fertilizer is typically found at low levels (depleted) and the $\delta^{15}N$ composition of fertilizer should be close to 0 (Kendall et al. 2007). Since denitrifying bacteria reduce and remove nitrate from surface waters, and the bacteria preferentially remove the lighter ^{14}N, the remaining nitrate becomes enriched with ^{15}N. Similarly ^{18}O becomes enriched as denitrification occurs. Therefore, as waters with nitrate experience denitrification the ^{15}N and ^{18}O become enriched in the nitrate pool remaining in the water. This means that samples with ^{15}N values that are enriched may also suggest a nitrate source that was initially less enriched, if denitrification occurred as the nitrate cycled through the watershed. This trend is shown indicated by the denitrification arrow in Figure 13.

In Figure 13, the majority of samples fall in the range corresponding to soil and waste sources provided by Kendall et al. (2007). The ranges for nitrate sources from Kendall et al. (2007) are based on a broad range of data sources. Although the general ranges presented by Kendall et al. (2007) may represent the initial fertilizer sources in eastern North Carolina, it appears that there may be an offset as the nitrate sourced from fertilizer migrates through the soils, to the groundwater, and ultimately to a stream or wetland. Local work by Spruill et al. (2002) provided a tighter range of ^{15}N values for groundwater underlying croplands and golf courses (most fertilizer sources had ^{15}N from 4-10 o/oo) and underlying septic, poultry, and hog waste (most waste sources had ^{15}N from 10 to 22 o/oo). Spruill et al. (2002) used a cutoff for ^{15}N of 10 o/oo to discriminate between fertilizer and waste sources. In addition, Iverson et al. (2015) measured septic drainfield ^{15}N in Pitt County and their median ^{15}N value for 8 measurements was approximately 18 o/oo for groundwater and 11 o/oo for streams adjacent to septic systems. Recent work in Beaufort County by O'Driscoll et al. (2014) traced a septic plume and found that wastewater-affected groundwater was indicated by ^{15}N compositions of approximately 10 o/oo or greater. Overall, these regional datasets suggest that wastewater in eastern NC tends to be on the enriched side of the range provide by Kendall et al. (2007), generally > 10 o/oo ^{15}N-NO3.

The study by Spruill et al. (2002) measured ^{15}N in groundwater of the North Carolina Coastal Plain. Their data showed enriched fertilizer ^{15}N relative to the ranges provided by Kendall and others (2007). It is likely that the enrichment that occurs between fertilizer application and transport to the groundwater (presumably linked to denitrification or mixing with more enriched soil N or wastewater sources) can explain this offset. We included the Spruill et al. (2002) data in Figure 13, as those may provide a tighter range for comparison with regional ^{15}N data. Based on these data, the ^{15}N range of our current study samples suggest fertilizer or soil N as the dominant source of nitrate in GMR. However, wastewater influences could not be ruled out because when mixed with fertilizer or soil N sources, wastewater sources would tend to enrich samples and there were locations where enrichment was observed.

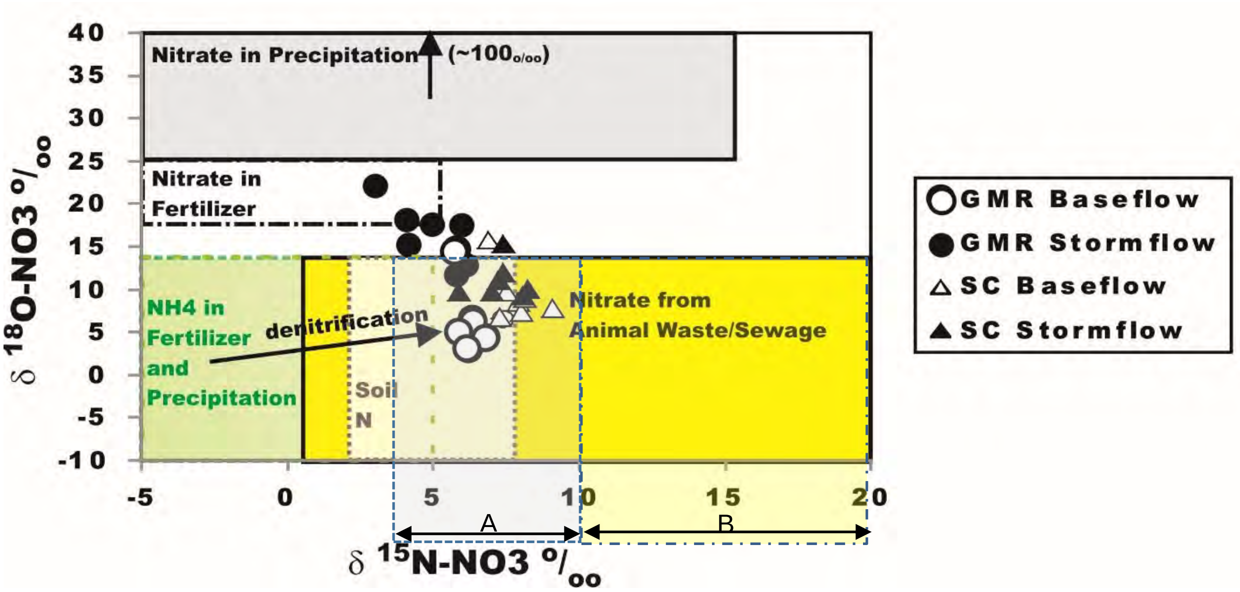


Figure 13. 15N and 18O isotopes in nitrate measured at sampling stations along Swift Creek (SC) and Greens Mill Run (GMR) overlain on the source ranges (shaded) presented by Kendall et al. (2007). Sample collection for isotopic analyses occurred on 8/24//2015 (baseflow) and 9/25/2015 (stormflow). A: Fertilizer 15N 25-75th per centile range measured under crop fields and golf courses in eastern North Carolina (Spruill et al. 2002). B: Waste 15N 25-75th percentile range measured under septic drainfields, poultry, and hog farms in eastern North Carolina (Spruill et al. 2002, Iverson et al. 2015).

To evaluate if mixing or denitrification is the mechanism for enrichment of ^{15}N a plot of NO_3-N vs ^{15}N-NO_3 can provide insights. If denitrification is the mechanism for ^{15}N enrichment, then an inverse relationship is expected between NO_3-N and ^{15}N, whereas if mixing with enriched sources of ^{15}N is the mechanism then ^{15}N would increase with increasing NO_3-N concentrations. These plots are shown in Figure 14 and suggest that mixing between groundwater and runoff sources plays a major role in the declining NO_3 during the storm event. During baseflow ^{15}N did not change much across the range of NO_3 suggesting a similar source and since ^{15}N does not appear to be enriched downstream, the data suggest limited denitrification along the stream channel. During baseflow the elevated nitrate occurs at GMR 9 and GMR 10 outfalls and Reedy Branch (GMR 6). These inputs cause a slight increase in NO_3 concentration at the lowest mainstem station (GMR 5) relative to the upstream station (GMR 4). During the storm the decrease in NO_3 and the corresponding decline in ^{15}N suggest that rainfall with lower NO_3 concentration (and depleted ^{15}N signatures) mixed with groundwater elevated in NO_3, resulting in NO_3 concentration reductions.

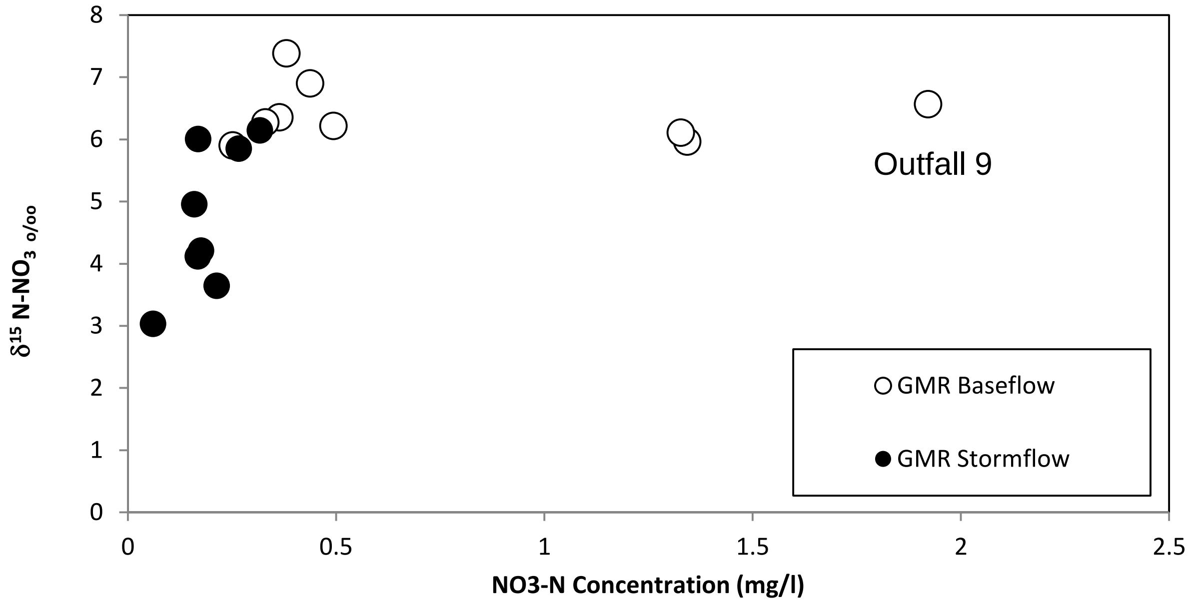


Figure 14. Nitrate vs δ^{15}N for GMR for the baseflow (8/24/15) and stormflow (9/25/15) events.

Overall, the data from one baseflow event and one storm runoff event suggest the dominant sources of NO_3 are likely fertilizer and soil-based, with increasing atmospheric deposition inputs during storms. The elevated ^{18}O in GMR stormflow samples indicates the increasing importance of atmospheric nitrogen sources during storm events in this urban catchment.

The pattern across the GMR watershed of similar ^{15}N and elevated ^{18}O during baseflow conditions suggests a similar source of nitrates during baseflow (Figures 15 and 16). It also suggests that from headwaters to the bottom of the watershed, there was not substantial denitrification occurring on this date (which may be a function of hyporheic zone and riparian buffer impairment). The ^{18}O in nitrate from Fornes Branch, suggests either lab error or a contrasting groundwater source from this highly incised urban channel. Since the ^{18}O in nitrate from Fornes Branch during the storm event was also enriched (Figure 16), it is unlikely that the pattern is related to a lab error. Along the main stem of Greens Mill Run there is a decline of ^{18}O from headwaters to station GMR 5, which may indicate changes in groundwater ^{18}O sources. Based on median values for baseflow, the ^{15}N during baseflow along GMR falls within the range of fertilizer (medians: 6.63 δ^{15}N-NO_3 o/oo, 4.48 δ ^{18}O-NO_3 o/oo; Spruill et al. 2002) or soil nitrogen (Kendall et al. 2007).

During the storm event, there was a general decline in ^{15}N from headwaters to GMR 5, while ^{18}O tended to increase. These data suggest mixing of multiple N sources during the storm. Other studies (Silva et al. 2002) have shown that increasing impervious area can result in increasing ^{18}O in nitrate indicating increased importance of atmospheric sources.

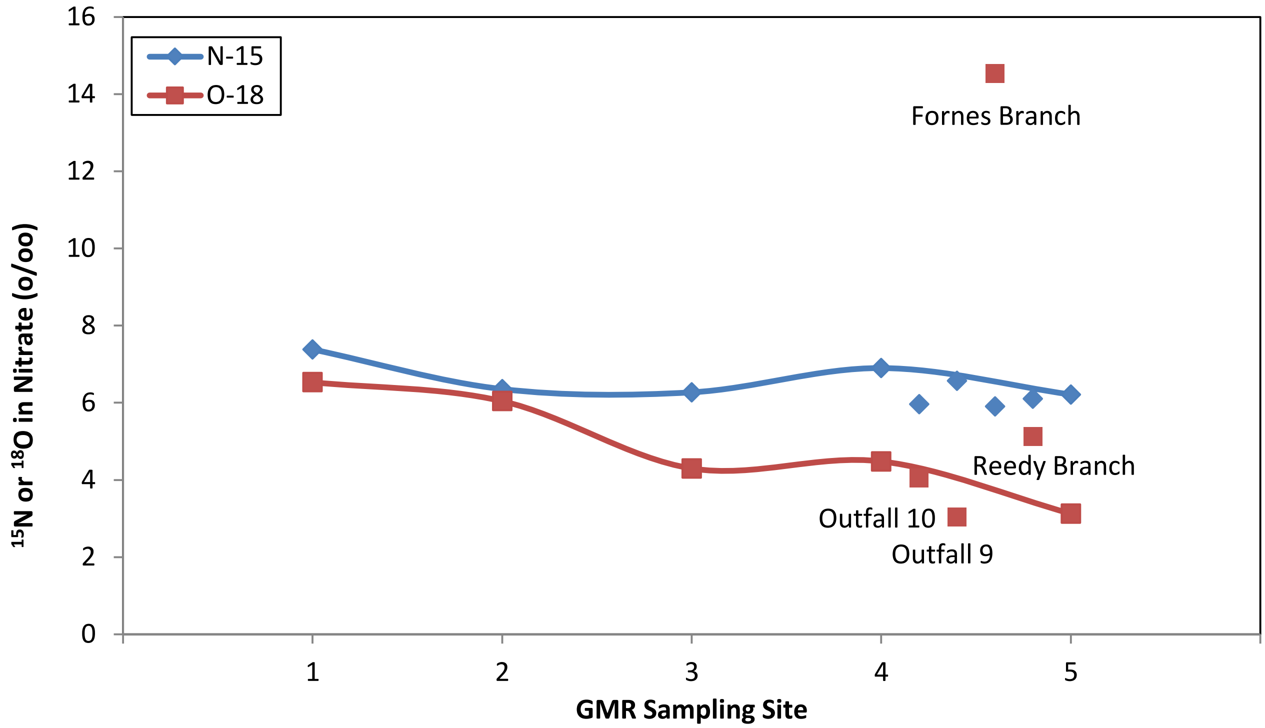


Figure 15. GMR ^{15}N and ^{18}O in nitrate trends from headwaters to lowest monitoring point during baseflow.

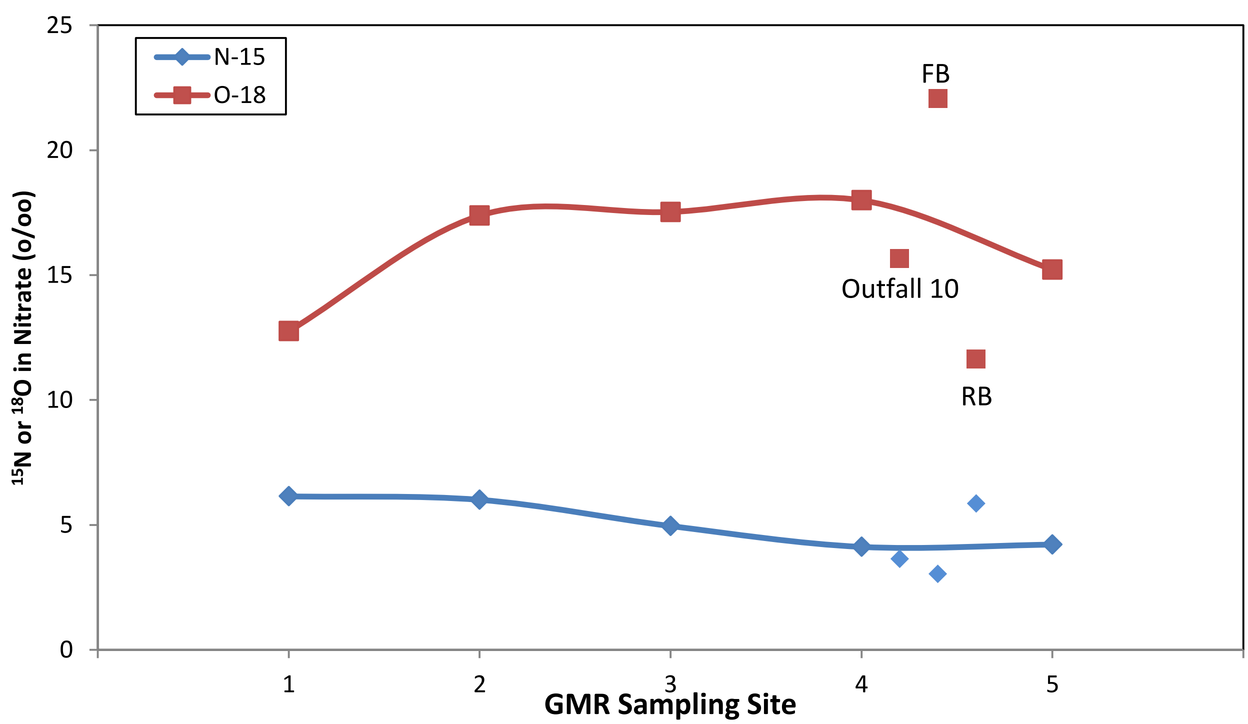


Figure 16. GMR ^{15}N and ^{18}O in nitrate trends from headwaters to lowest monitoring point during stormflow.

Along GMR there was a subtle increase of nitrate with increasing chloride during the baseflow event (Figure 17). The elevated nitrate and chloride at GMR 9 and GMR 10 outfalls during baseflow suggest the possibility of wastewater connection with these outfalls. These outfalls also typically had elevated specific conductivity during baseflow. However the ^{15}N signatures of the outfalls more closely falls within the fertilizer range. More detailed sampling and further analyses of the surrounding infrastructure and land-use draining to these pipes could help further elucidate the source of elevated nitrate. Retrofits at these outfalls could decrease nitrogen transport to GMR.

During the storm event the nitrate concentrations typically declined relative to baseflow conditions. From the headwaters to the lowest point, there was not much variability in nitrate concentrations along the main stem, with the exception of a large decline between GMR 1 and GMR 2. Similarly chloride data was relatively consistent along the main stem with a small decline from GMR 1 to GMR 2 and GMR 4 to GMR 5 likely related to dilution by stormwater and precipitation inputs (Figure 18).

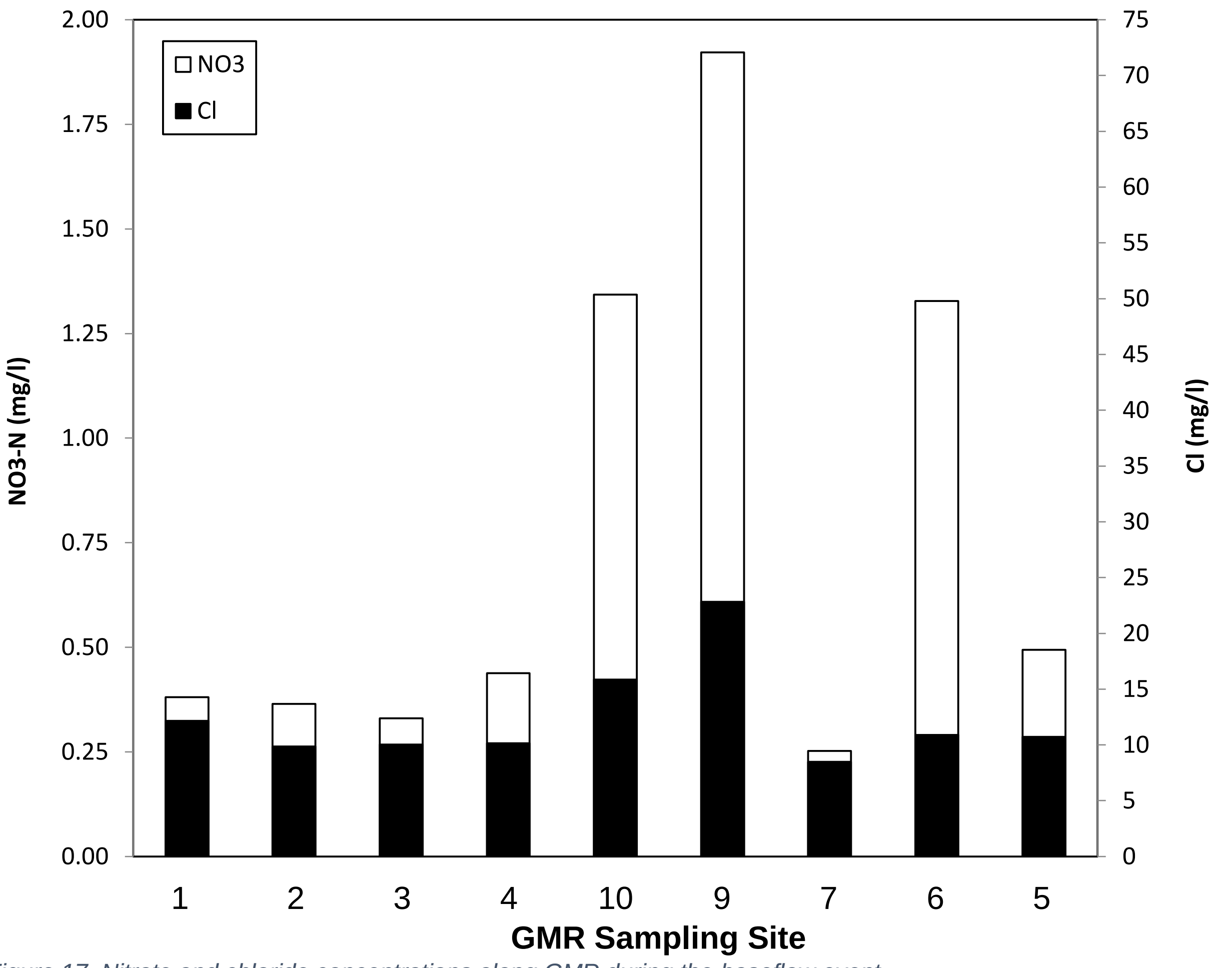


Figure 17. Nitrate and chloride concentrations along GMR during the baseflow event.

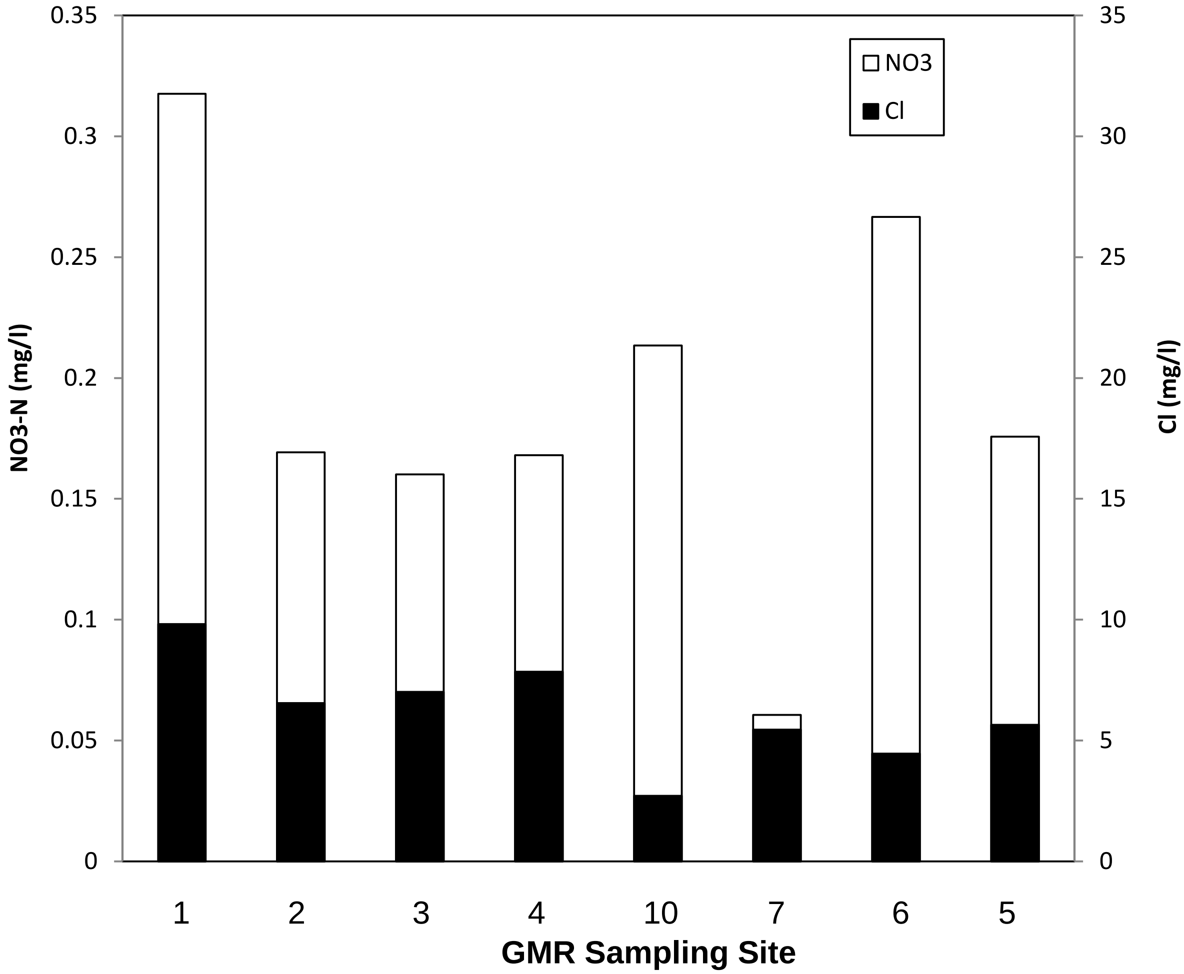


Figure 18. Nitrate and chloride concentrations along GMR during storm event.

Organic Nitrogen

Organic Nitrogen (ON) concentrations for base flows and storm flows are summarized in Figure 19. Storm flow concentrations tended to be greater than base flow concentrations, with storm flow concentrations being higher than base flow at each site. Base flow ON concentrations were lower at GMR 1 than GMR 2 on October 13 and February 24, while for the other two base flows, concentrations decreased only slightly. Concentrations were generally similar between GMR 2 and GMR 3, typically decreased to GMR 4 and to GMR 5. Base flow samples from the outfalls adjacent to the ECU Campus were generally absent of ON and Reedy Branch (GMR 6) had relatively low ON concentrations as well.

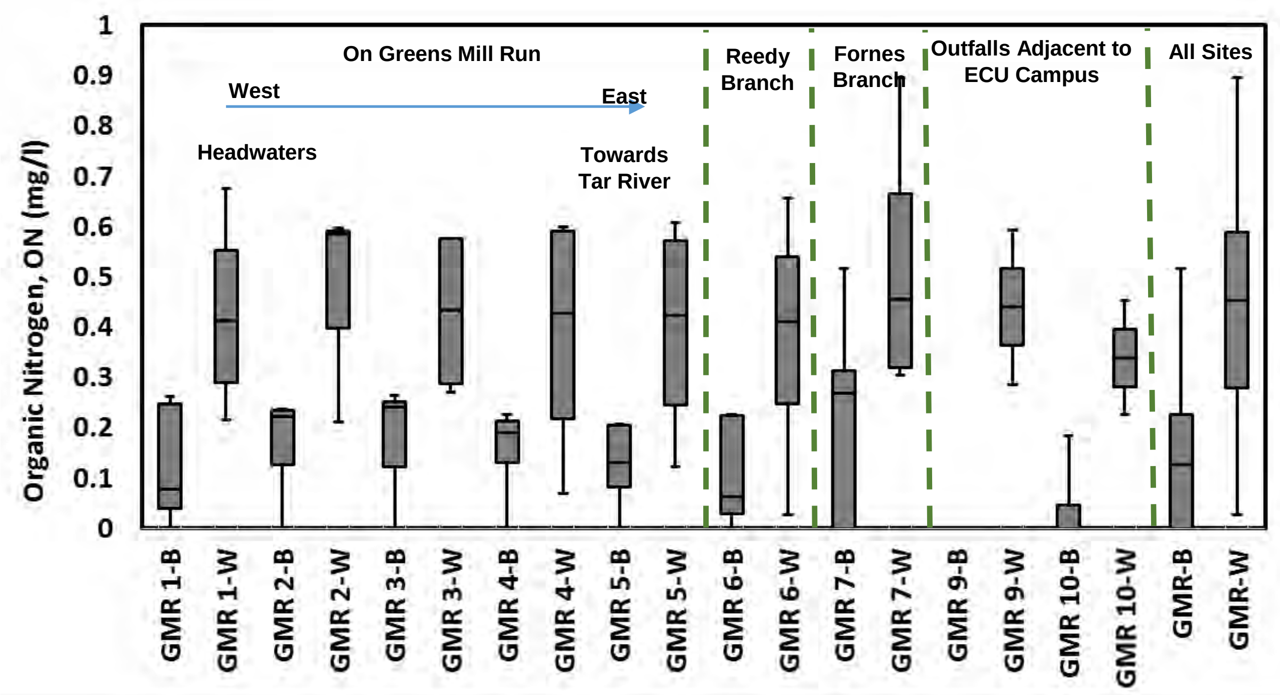


Figure 19. Box and whisker plots of Organic Nitrogen (ON) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

For all baseflow sampling events except on February 24, Fornes Branch (GMR 7) had the highest concentrations of ON and lowest concentrations of NO_{2+3} for GMR sites 1-7. The TDN concentrations were generally comparable to concentrations for GMR sites 1-6 for all other baseflow samplings. The coldest baseflow sampling event during the study was on February 24, which was when the only baseflow event which Fornes Branch ON was not the highest and NO_{2+3} was not the lowest. This suggests immobilization of NO_{2+3} to ON is occurring more in the Fornes Branch sub watershed than elsewhere in the greater GMR. While many areas within the GMR watershed are similarly dominated by residential development, the Fornes Branch watershed has a noticeably denser tree canopy and especially along the stream itself. This may provide for better stream health to immobilize NO_{2+3}. In addition, denser tree population could increase uptake of NO_{2+3} while also releasing greater concentrations of organic nitrogen in turn. In addition, there is a buried peat layer exposed along the incised banks of Fornes Branch that may provide organic nitrogen to the stream.

Storm flow ON concentrations were greater for all sites on November 24 and September 25 (over 0.45 mg/l) than on February 2 and July 13 (under 0.35 mg/l), which were the two smaller rainfall events. Storm flow concentrations generally did not vary between adjacent sites, most notably for the November 24 and September 25 storms. Fornes Branch (GMR 7) storm flow ON concentrations tended to be greater than for Reedy Branch (GMR 6). Outfall (GMR 9 and 10) concentrations tended to be slightly lower than Fornes Branch as well.

Total Dissolved Phosphorus

Phosphorus is an essential nutrient in the environment as well and in excess can lead to algal blooms and eutrophication. In addition the Nutrient Sensitive Waters supplemental classification for Greens Mill Run is due to being a tributary to the Tar River and includes Phosphorus. Total Dissolved Phosphorus (TDP) includes phosphate ($PO4_4$) and other forms of soluble phosphorus. Based on guidelines already developed in Florida, criteria for TDP in streams range between 0.06 - 0.49 mg/l depending on the region. Concentrations on GMR (1-5) exceeded 0.06 mg/l during baseflow on October 13 and August 24, and during storm flow during November 24 and September 25 events, with a maximum of 0.18 mg/l. However, all baseflow samples from the upstream outfall (GMR 10; 0.09 – 0.23 mg/l) exceeded 0.06 mg/l, and the maximum overall concentration was 0.85 mg/l from Reedy Branch during November 24 storm flow. Base flow and storm flow TDP concentrations summarized in Figure 20. Concentrations of TDP were highly variable, with median storm flow concentrations being slightly higher than median base flow concentrations at each site except for GMR 3 and GMR 10.

Along GMR (1-5), base flow concentrations were generally lower than storm flow concentrations, with GMR 3 being the only site with a greater median base flow than storm flow. Base flow concentrations typically changed very little ($\leq$ 0.02 mg/l) between GMR 1 and GMR 4, but concentrations at GMR 5 (0.02 – 0.07 mg/l) were typically higher than at GMR 4 (0.03 – 0.06 mg/l). Base flow concentrations at the upstream outfall (GMR 10; 0.09 – 0.23 mg/l) were all higher than all but one other base flow sample (0.10 mg/l; all others < 0.07 mg/l) from any other sample and higher than most storm flow sample concentrations ($\leq$ 0.17 mg/l, except for one). By contrast, TDP base flow TDP concentrations at the other outfall (GMR 9; 0.01 – 0.02 mg/l) were less than or equal to all other base flow sample concentrations.

Storm flow TDP concentrations tended to increase moving downstream between GMR 1 and GMR 5. The highest storm flow concentrations for each site on GMR (1-5) were from the November 24 event, followed by the September 25, and with little difference between the February 2 and July 13 events. Storm flow concentrations on Fornes Branch (GMR 7) and from the upstream outfall (GMR 10) were higher than GMR 4 concentrations for each storm, while concentrations from Reedy Branch were comparable to or also higher than GMR 4. These inputs contributed to the consistent increase in TDP storm flow concentrations between GMR 4 and GMR 5.

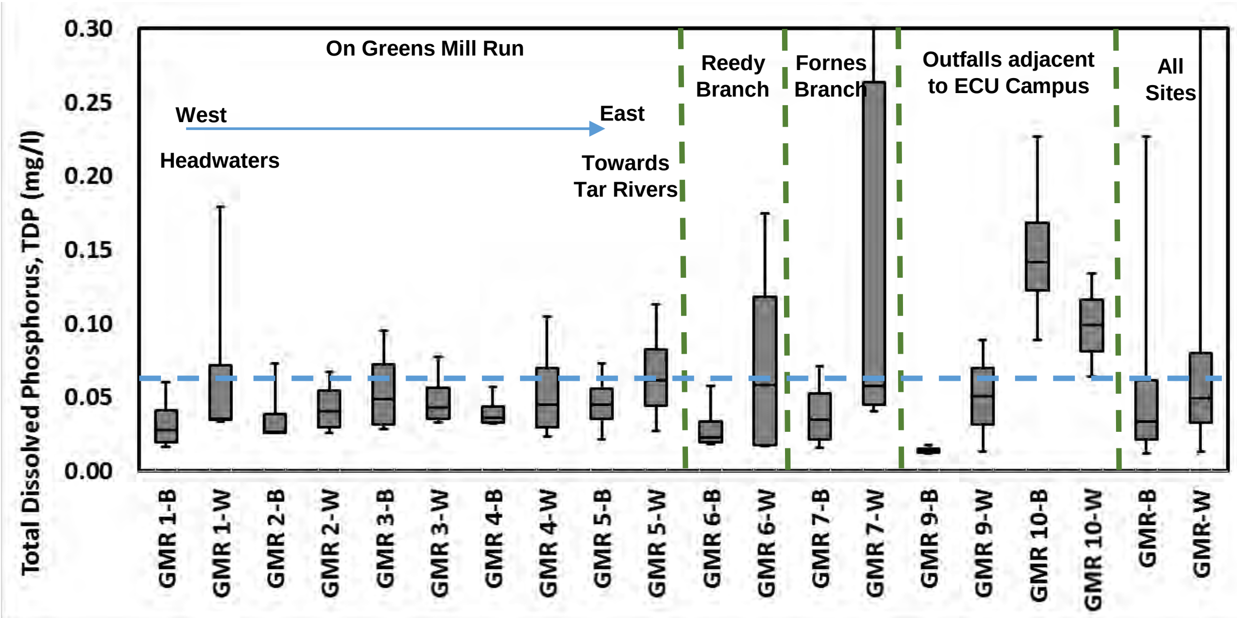


Figure 20. Box and whisker plots of Total Dissolved Phosphorus (TDP) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively. Florida guideline of 0.06 mg/l of TDP added for reference.

Phosphate

Phosphate (PO_4) is a constituent of TDP and fluctuations in concentration were generally similar to those observed for TDP. The PO_4 concentrations from base flow and storm flow are summarized in Figure 21. Along GMR (1-5), storm flow concentrations generally were slightly higher for storm flows than base flows.

Base flow concentrations generally increased between GMR 1 and GMR 5, with the most consistent and noticeable increase between GMR 4 and GMR 5. Baseflow concentrations at Reedy Branch (GMR 6), Fornes Branch (GMR 7), and the downstream outfall (GMR 9) (0.001 – 0.052 mg/l) were generally less than concentrations at GMR 5 (0.01 – 0.055 mg/l) for each sampling event. However, baseflow concentrations from the upstream outfall (GMR 10; 0.059 – 0.22 mg/l) were higher than all other base flow samples ($\leq$ 0.055 mg/l).

Storm flow PO_4 concentrations were highest from the November 24 event for all sampled sites. Concentrations generally increased between GMR 1 and GMR 5, with increases from GMR 3 to GMR 4 and from GMR 4 to GMR 5 being the most consistent and noticeable. Storm flow PO_4 concentrations from Fornes Branch (GMR 7) and the downstream outfall (GMR 9) were greater than from GMR 4 for each event, with concentrations from Reedy Branch (GMR 6) being typically greater than those at GMR 4 as well. These influxes likely contributed to the concentration increase between GMR 4 and GMR 5.

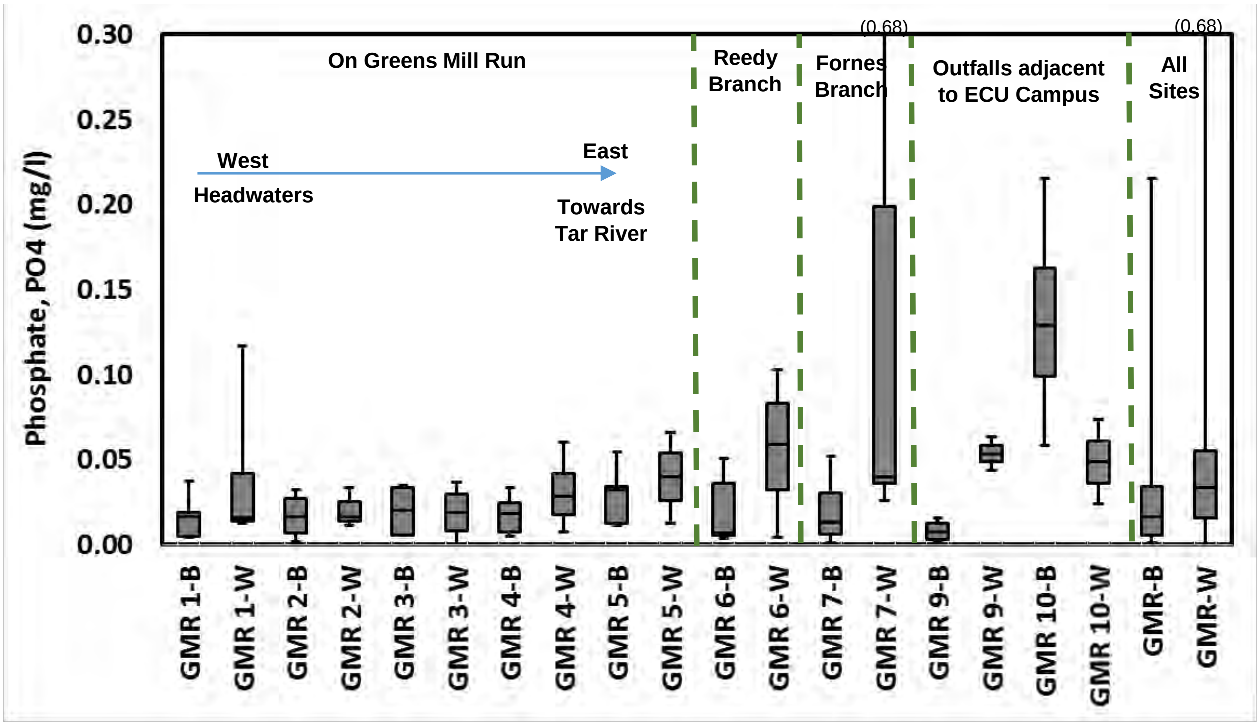


Figure 21. Box and whisker plots of Phosphate (PO_4) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

Dissolved Oxygen

North Carolina water quality standards (15A NCAC 2B) for dissolved oxygen (DO) for freshwater aquatic life is 5 mg/l (daily average). All DO concentrations were greater than 5 mg/l, except at GMR 1 from the July 13 storm event (4.84 mg/l; Figure 22) and from the upper most longitudinal site (1) on August 24 (1.44 mg/l; Figure 23). Saturated dissolved oxygen capacity in water decreases as water temperatures increase. The water temperature at GMR 1 on July 13 was 26.8 °C, while water temperatures were the highest water temperature recorded in this study. The highest storm flow and base flow DO concentrations for each site were recorded on February 2 and 24, respectively, when temperatures were the lowest for sampling events. In general, in stream measurements of DO from sampling sites (GMR 1 – 7) generally did not have consistent trends of note.

Samples and measurements for base flow sampling were collected first from all sampling sites (GMR 1-7, 9, and 10), due to limited hold times for sample processing. Measurements from these sites for the longitudinal surveys were collected at the same time as samplings. All other longitudinal survey sites were visited between late morning and late afternoon of the same day. Earlier measurements from base flow sampling sites were higher on April 13 due to warming temperatures during the day, while earlier measurements also tended to be higher for tributaries (GMR 6, 7, and potentially 9 and 10) on August 24, but were lower at sites on GMR (1 – 5) most likely due to algal oxygen production within the water column with increasing solar radiation over the day.

Aside from temporal trends throughout the day, there are a few spatial trends from the surveys to note as well. Arrows have been added to Figure 23 to assist with describing trends along GMR. The lowest DO concentrations for each survey were at one of the two most upstream sites (site 1 and 2). From the head waters, DO increased to GMR 1 (site 4). On April 13, concentrations continued a general rising trend until GMR 4 (site 12), where DO concentrations began to decrease until after the Fornes Branch confluence (site 16). By comparison, on August 24, DO generally decreased between GMR 1 (site 4) and until below the Fornes Branch confluence (site 16). For both surveys, DO then increased with inputs of higher DO from Reedy Branch (GMR 6, site 16.1) to site 18, where DO decreased to the Tar River.

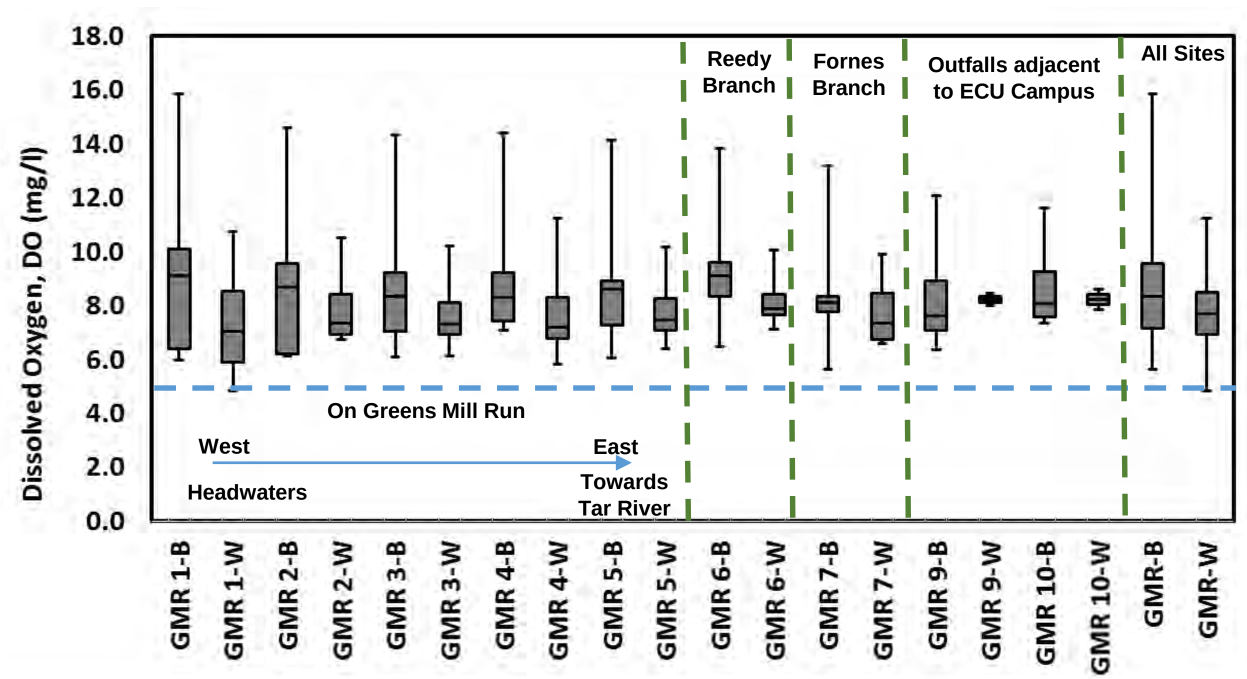


Figure 22. Box and whisker plots of Dissolved Oxygen (DO) concentration measurements for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively. NC standard of 5 mg/l of DO added for reference.

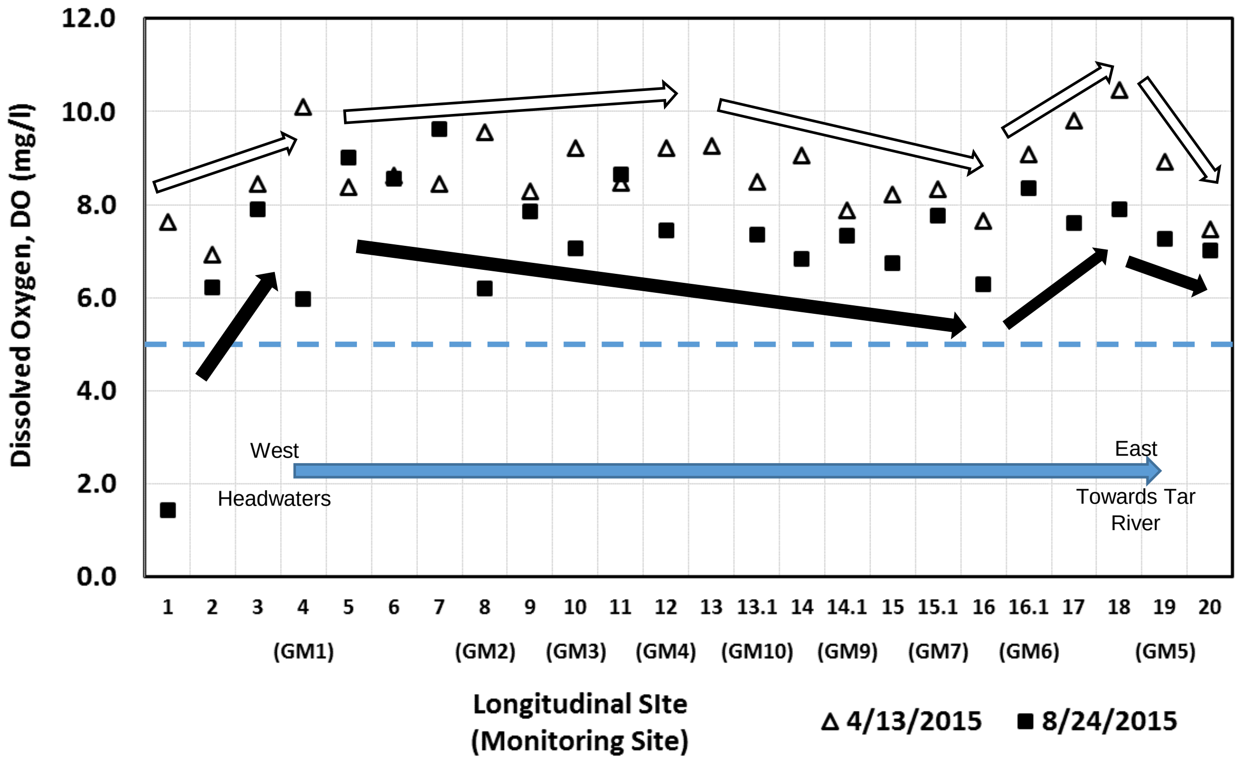


Figure 23. Dissolved Oxygen (DO) readings from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR. NC standard of 5 mg/l of DO added for reference.

E. coli and Total Coliform

E. coli is a species of fecal coliform bacteria used to indicate the presence of waste. Analysis was mostly focused on *E. coli*, as that is the US EPA (1986) recommended indicator bacteria for fresh waters. The NC standard for *E. coli* in Class C waters is 576/100 ml or $10^{2.8}$. When temperatures are warmer, bacteria grow quicker, and also animals are more active and may contribute more waste to streams.

Storm flow *E. coli* concentrations were elevated relative to baseflow *E. coli* concentrations for each of the 7 sampling locations along GMR (Figure 24). Statistically significant differences (p = 0.000) were observed when comparing *E. coli* concentrations for all baseflow samples (geometric mean = 457 MPN/100 mL or log10 = 2.660) to all storm flow samples (geometric mean = 1979 MPN/100 mL or log10 = 3.296). Similar trends were found regarding total coliform concentrations (Figure 25). More specifically, the total coliform concentrations were elevated during storm flow conditions (geometric mean = 9519 MPN/100 mL or log10 = 3.979) relative to baseflow conditions (geometric mean = 2307 MPN/100 mL or log10 = 3.363) for all sampling locations, and the differences between the baseflow and storm flow samples were statistically significant (p = 0.0048).

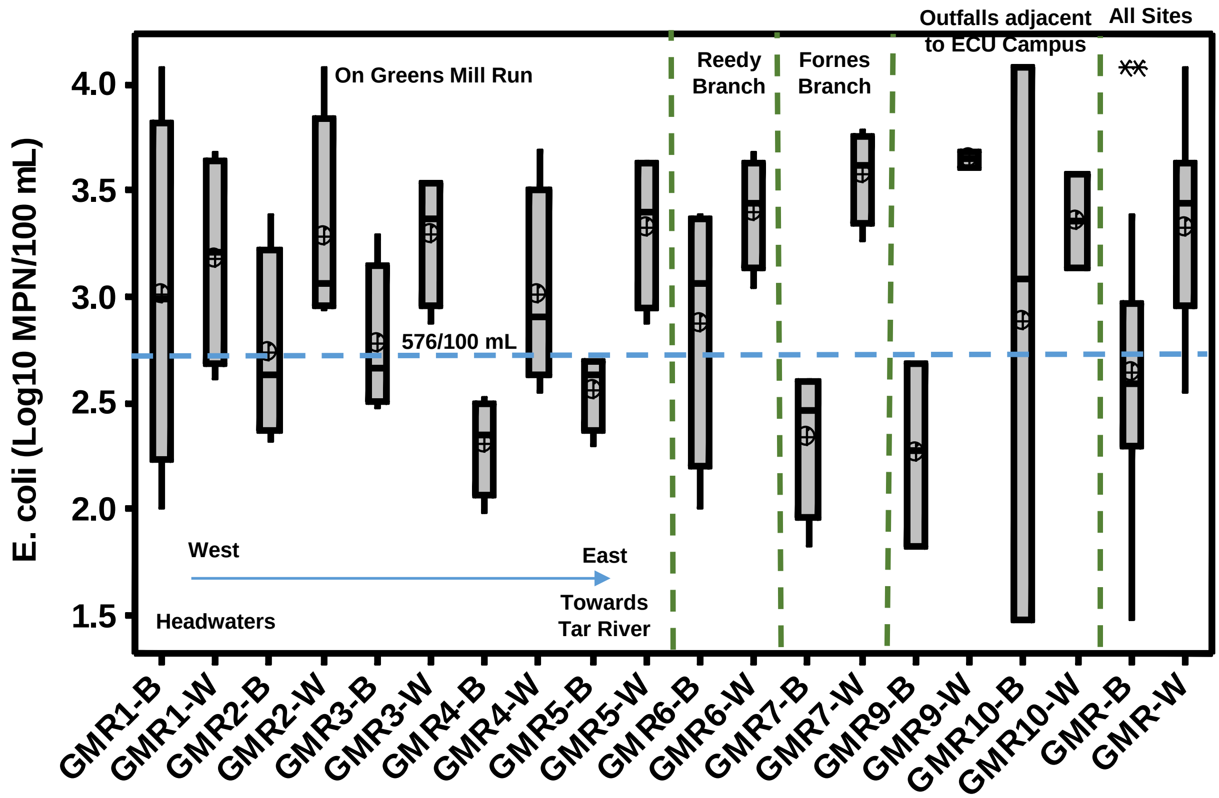


Figure 24. Box and whisker plots of E. coli concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and wet weather flow values, respectively.

Baseflow *E. coli* concentrations were lowest during the February sampling event (geometric mean = 203 MPN/100 mL or log10 = 2.307), and highest during the October event (geometric mean 803 MPN/100 mL or log10 = 2.905) (Figure 24). The August and April sampling events yielded similar *E. coli* concentrations with 563 MPN/100 mL (log10 = 2.751) and 475 MPN/100 mL (log10 = 2.677), respectively. *E. coli* concentrations were significantly lower in February relative to April ($p = 0.049$), August ($p = 0.0022$), and October at $p = 0.0542$. The geometric mean storm flow *E. coli* concentrations were typically higher during the warmer sampling periods of July (2109 MPN/100 mL or Log10 = 3.324) and September (3254 MPN/100 mL or log10 = 3.512), relative to October (1401 MPN/100 mL or log10 = 3.146) and February (1595 MPN/100 mL or log10 = 3.203), but the differences were not significant ($p > 0.05$).

The *E. coli* concentrations in GMR during baseflow conditions were variable, but typically declined along the main stem of the stream from GMR 1 to GMR 4, with an increase between GMR 4 and GMR 5. This suggests that E. coli inputs during baseflow decrease from the headwaters to the bottom of the watershed and that inputs within the urban reaches were less than inputs from rural and agricultural areas in headwaters. Storm flow *E. coli* concentrations along GMR were more variable than baseflow *E. coli* concentrations, and no discernable trend was recognized along the main stem regarding sampling location and *E. coli* concentrations. Storm flow *E. coli* and total coliform concentrations were typically higher in Reedy Branch (GMR 6) and Fornes Branch (GMR 7) than on the main stem of GMR. These higher concentrations may be due to pet waste within the primarily residential subwatersheds.

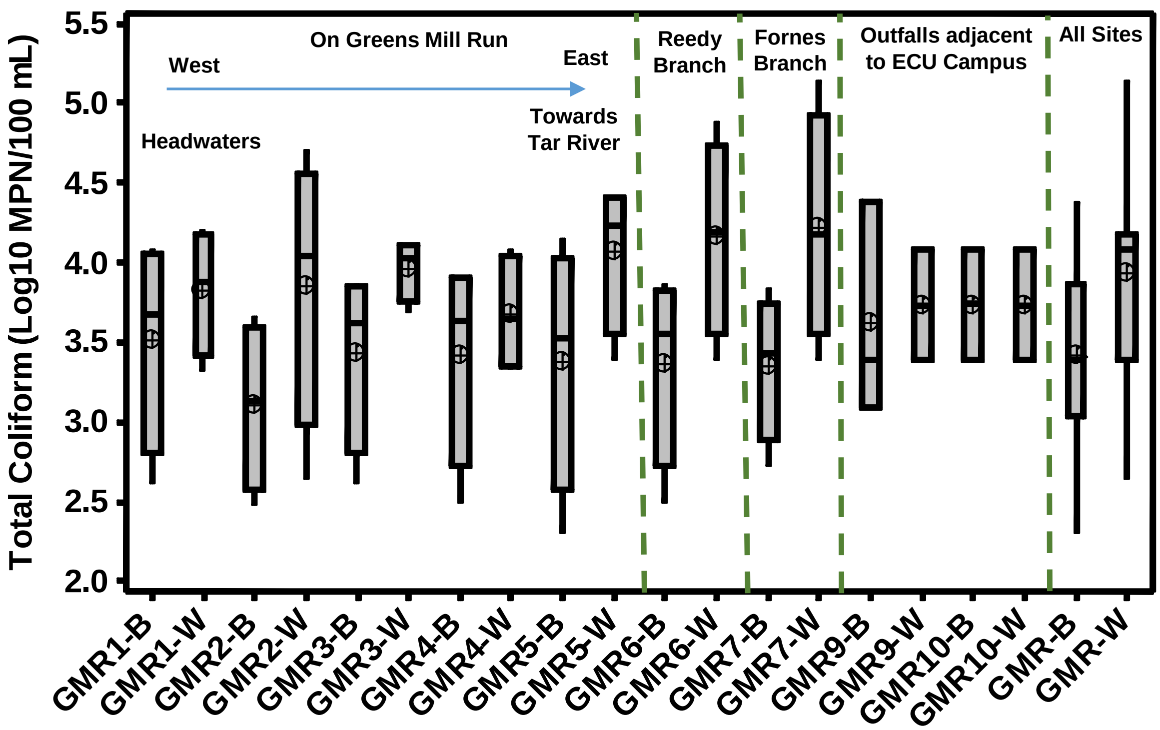


Figure 25. Box and whisker plots of total coliform concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and wet weather flow values, respectively.

Metals

Results of metals analyses are included in Table 3. All results of metals analyses were below detection limits for Copper (10 µg/l) and Lead (5.0 µg/l). All samples returned detectable concentrations of Zinc, although only slightly above the detection limit (10 µg/l) as well.

Table 3. Analytical results of metals analyses on baseflow and wet weather flow samples.

Monitoring Site		**Baseflow 8/24/2015**			**Wet Weather Flow 9/25/2015**	
	Copper (µg/l)	Lead (µg/l)	Zinc (µg/l)	Copper (µg/l)	Lead (µg/l)	Zinc (µg/l)
GMR 1	<10	<5.0	10	<10	<5.0	12
GMR 3	<10	<5.0	12	<10	<5.0	21
GMR 5	<10	<5.0	12	<10	<5.0	23

*Analytical method for analysis of Copper and Zinc: EPA 200.7; Analytical method for analysis of Lead: Standard Method 3113B-04.

CONCLUSIONS AND RECOMMENDATIONS

Water Quality Standards

The water quality standard for turbidity was violated at sites GMR 1, 2, and 3 during storm flow on February 2. This is likely due to runoff and erosion from head waters upstream of GMR 1.

No standards are in place for TSS other than High Quality Waters, which is 20 mg/l. While GMR does not have this designation, concentrations for the November 24 and February 2 storm events exceeded this threshold, with the highest concentrations occurring at GMR 4 and GMR 3, respectively. Concentrations of TSS at GMR 1 were typically higher than GMR 2, which likely result from erosion from agricultural areas and within the stream channel above GMR 1.

Measurements of pH were occasionally below 6.0, mostly between GMR 1 and GMR 3, but never below 4.3. While GMR does not have the supplemental classification of Swamp Waters applied to it, the head waters have been less impacted by urbanization and it is likely that lower pH values are naturally occurring.

Samples for *E. coli* exceeded 576 MPN/100 ml for many base flow events and for most storm flow events. It should be noted that this metric is suggested by the US EPA (1986) for the single sample count for infrequently used full body contact recreation.

While no standards currently exist for NO_{2+3}, TDN, or TDP concentrations in North Carolina, baseflow concentrations of TDN and NO_{2+3}, and storm flow TDP, exceeded conservative limits that have been established in Florida. Depending on future limits on nutrients in North Carolina, current concentrations of these nutrients may violate future water quality standards.

Storm flow

Most parameters were elevated during storm flows relative to base flows. Several indicators suggest that pollutants decrease between GMR 1 and GMR 3, most notable were turbidity, TSS, *E. coli*, SC, and total dissolved nitrogen generally declining for storm flows. This suggests sources upstream of GMR 1 in the less developed head waters of GMR.

For several pollutants there was an increasing trend from GMR 3 to GMR 4 followed by a decreasing to GMR 5, including SC, TDN, NO_{2+3}, and TSS, while Turbidity and PO_4 continued to increase between GMR 4 and GMR 5. Between GMR 3 and GMR 4, the cumulative drainage area increases by 1.5 mi^2, from 9 mi^2 to 10.5 mi^2 (Table 4) located primarily to the northwest of GMR. The majority of storm flow from this area enters GMR from the northwest via three mostly linear earthen channels located west of Evans St. between Arlington Blvd. and 14th St. There is a noticeable lack of riparian vegetation along these channels, especially upstream of Evans St. This is in contrast to two other tributaries to GMR, Fornes Branch and Reedy Branch, which have better riparian conditions and generally better water quality. Channel erosion within these channels could be a significant source of sediment to GMR. Sediments may also have resulted from greenway construction beginning in May of 2015 adjacent to GMR between GMR 3 and GMR 4. Turbidity was higher at site 12 (GMR 4) than sites 10 (GMR 3) and 11 (immediately downstream of Evans St.) for the August longitudinal survey. As much of this area is residential, increased nitrogen is likely due to fertilization of lawns. Water quality sampling and monitoring on these channels could provide insight into the significance of pollutant contributions from these areas.

Table 4. Subwatershed areas within the Greens Mill Run watershed.

Location	Monitoring Site Name	Incremental		Cumulative	
		Drainage Area (mi^2)	Percent of Total Watershed Area	Drainage Area (mi^2)	Percent of Total Watershed Area
Dickinson Ave. Crossing	GMR 1	2.05	15.3%	2.05	15.3%
Memorial Dr. Crossing	GMR 2	5.39	40.1%	7.44	55.4%
Arlington Blvd. Crossing	GMR 3	1.56	11.6%	9.01	67.0%
Charles Blvd. Crossing	GMR 4	1.45	10.8%	10.46	77.8%
Reedy Branch	*GMR 6*	*0.64*	*4.8%*		
Fornes Branch	*GMR 7*	*1.01*	*7.6%*		
East ECU campus and Residential	*GMR 9*	*0.09*	*0.7%*		
Central ECU campus	*GMR 10*	*0.04*	*0.3%*		
Between GMR 4 and GMR RT	*GMR RT*	*0.37*	*2.7%*		
Remaining Area	*N/A*	*0.68*	*5.1%*		
Green Springs Park	GMR 5	1.05	7.8%	11.51	85.6%
Tar River	N/A	1.93	14.4%	13.44	100.0%

Four significant tributaries located between GMR 4 and GMR 5 were sampled, with Fornes Branch (GMR 7) having the largest drainage area of them. Each tributary generally had lower SC, and TSS, values than GMR 4, indicating dilution of these parameters before GMR 5. In addition, the channel slope decreases noticeably upstream of GMR 5 and the channel widens, which would reduce channel velocities and promote deposition, reducing TSS and Turbidity. While Reedy Branch (GMR 6) generally had higher TDN concentrations than GMR 4, the other tributaries were lower, also diluting TDN concentrations at GMR 5. Increases of PO_4 and TDP between GMR 4 and GMR 5 may have been facilitated by higher concentrations from Fornes Branch (GMR 7) and Reedy Branch (GMR 6). While *E. coli* and Total coliform did not increase from GMR 3 to GMR 4, concentrations did increase from GMR 4 to GMR 5, aided by higher concentrations on Fornes Branch (GMR 7) and Reedy Branch (GMR 6).

Baseflow

During baseflow, all NO_{2+3} concentrations exceeded 0.3 mg/l, a conservative standard in Florida. Concentrations decreased from GMR 1 to GMR 3, increasing at GMR 4, and decreasing to GMR 5. Higher NO_{2+3} upstream of GMR 1 may result from present or past agricultural drainage in those areas, and ^{15}N results suggest fertilizer or soil as the dominant source of NO_3 during baseflow. The increase of NO_{2+3} between GMR 3 and GMR 4 corresponded with slight increases of SC, NH_4, and DOC, which might suggest a waste water source input in this area and ^{15}N results did not rule out wastewater as a source. Although no increase of E. coli or Total Coliform was observed between GMR 3 and GMR 4, if a wastewater leak occurred from a buried pipe adjacent to GMR, flow through soil could be sufficient to remove bacteria without affecting other dissolved contaminants.

Summary and Recommendations

Several indicators suggested that pollutant and sediment inputs increased downstream. In general most water quality parameters increased downstream of GMR 3 (Table 5). However, during summer dissolved oxygen decreased in the lower portions of the watershed. Overall, the water quality data suggested that urban and agricultural land-uses in the watershed have contributed non-point source pollution resulting in increases in nutrient, sediment, and bacteria inputs to Greens Mill Run. Pollutants originating upstream of GMR 1 tended to be mitigated between GMR 1 and GMR 3. However, future development without appropriate stormwater management could significantly impact stream stability and pollutant loadings on GMR. Most water quality parameters, with the exception of nitrate and dissolved oxygen, increased with storm flow suggesting that improved stormwater management could help reduce water quality degradation. The nitrate decline during storm events, suggests a groundwater source of nitrate, presumably related to agricultural fertilizer inputs as the increases correspond to the upper portions of the watershed that contain extensive agricultural drainage. Because of the long history of agricultural fertilizer inputs the groundwater source may be elevated for decades but current BMPs could reduce surficial inputs over time.

Table 5. General water quality results associated with storm flow inputs and reaches with notable increases of pollutant. NC water quality standards are indicated with an asterisk.

	Standard* or Guideline Level	Standards or Guidelines Exceeded	Locations of Notable Increases during Storm flows
Specific Conductivity	n/a	n/a	GMR 3-4
Dissolved Oxygen	5 mg/l*	No	n/a
Turbidity	50/25 NTU*	Rare (GMR 1-3 on February 2 storm flow)	GMR 4 – 5, Fornes and Reedy Branch
Total Suspended Sediment	20 mg/l (High Quality Waters)	Storm flows	GMR 3 – 4
Nitrate	0.3 mg/l	All base flow, some storm flow	GMR 3 – 4
Dissolved Organic Nitrogen	n/a	n/a	GMR 3 – 4
Total Dissolved Nitrogen	0.67 mg/l	All base and storm flows	GMR 3 – 4
Total Dissolved Phosphorus	0.06 mg/l	Some base flow and some storm flow	GMR 3 – 5;
Dissolved Organic Carbon	n/a	n/a	GMR 3 – 4
E. Coli	576/100ml*	Many baseflow and most storm flow	GMR 4 – 5
Total Coliform	n/a	n/a	GMR 4 – 5

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APPENDICES

APPENDIX A: Rating Curves and Discharge Records

Rating Curves

Rating curve equations for each station are listed below.

Table A1. Rating curve coefficients ($Q = C*h^n$) for the three stage monitoring sites on Greens Mill Run.

Station	Rating Curve Coefficients	
	C	n
GMR RT	29.0	1.15
GMR 5	2.93	1.25
GMR 7	1.12	0.64

Discharge Records

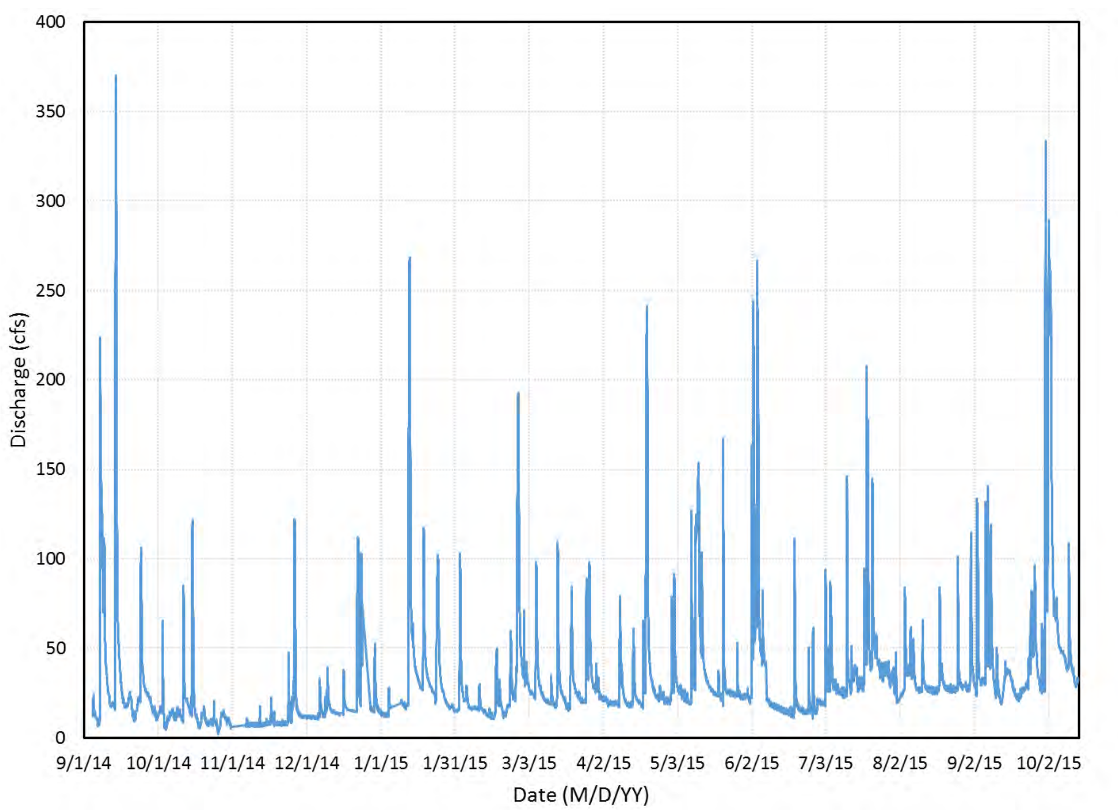


Figure A1. Discharge record for GMR RT flow monitoring site (September 4, 2014 - October 14, 2015).

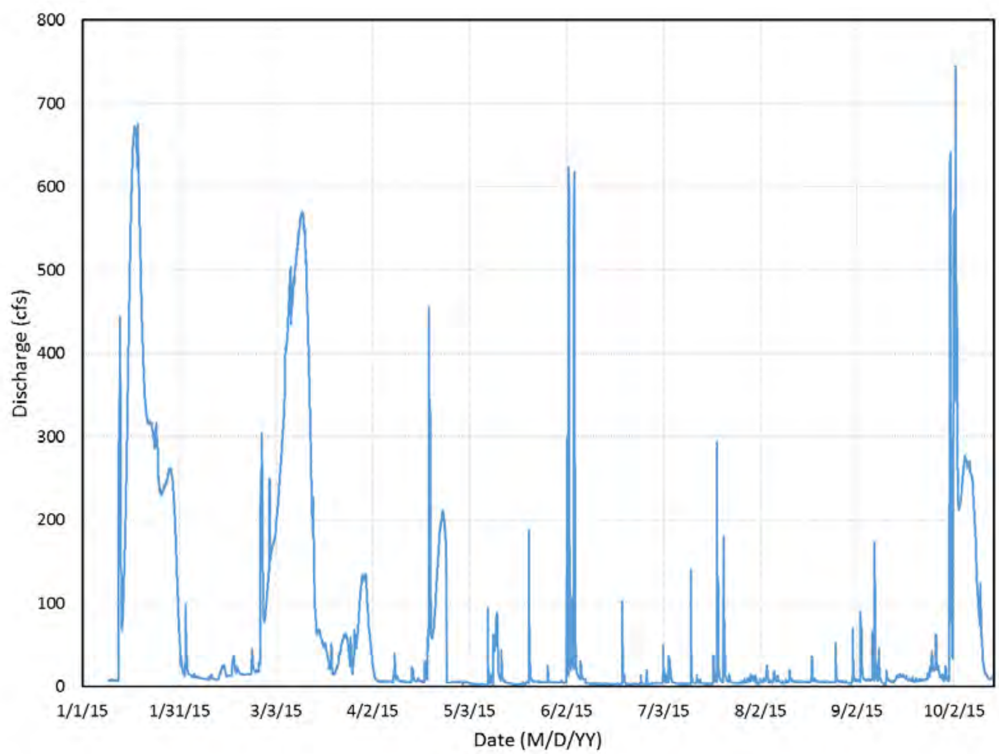


Figure A2. Discharge record for GMR 5 monitoring site (January 9 - October 14, 2015).

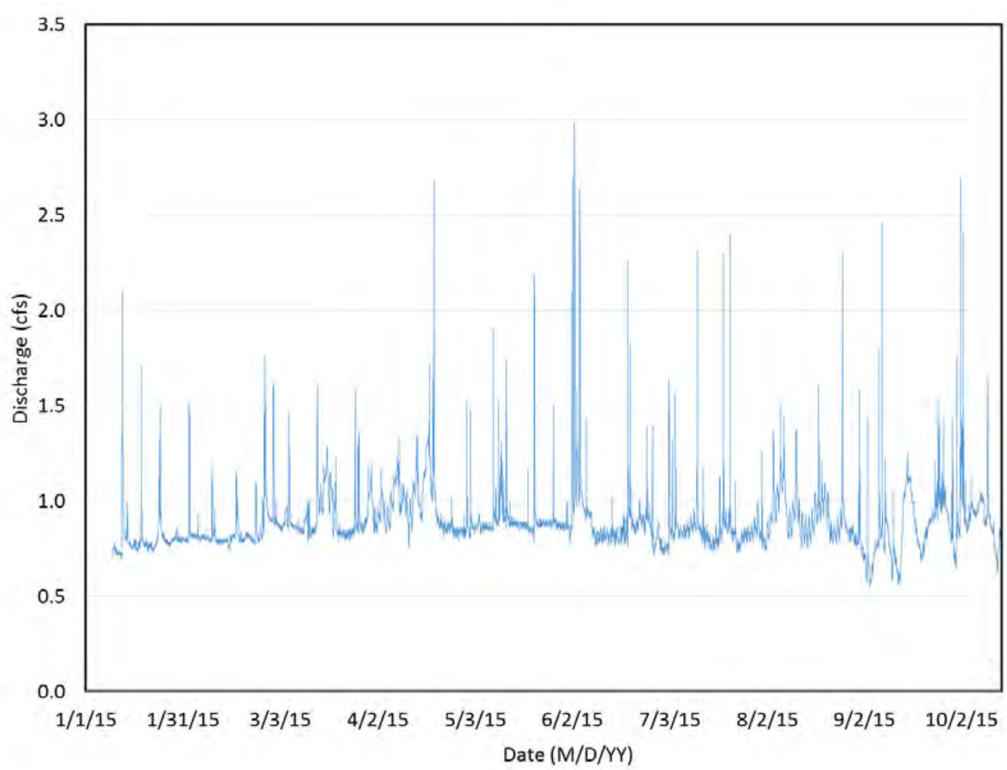


Figure A3. Discharge data for GMR 6 (Reedy Branch) monitoring site (January 9 - October 14, 2015).

APPENDIX B: Conductivity Records

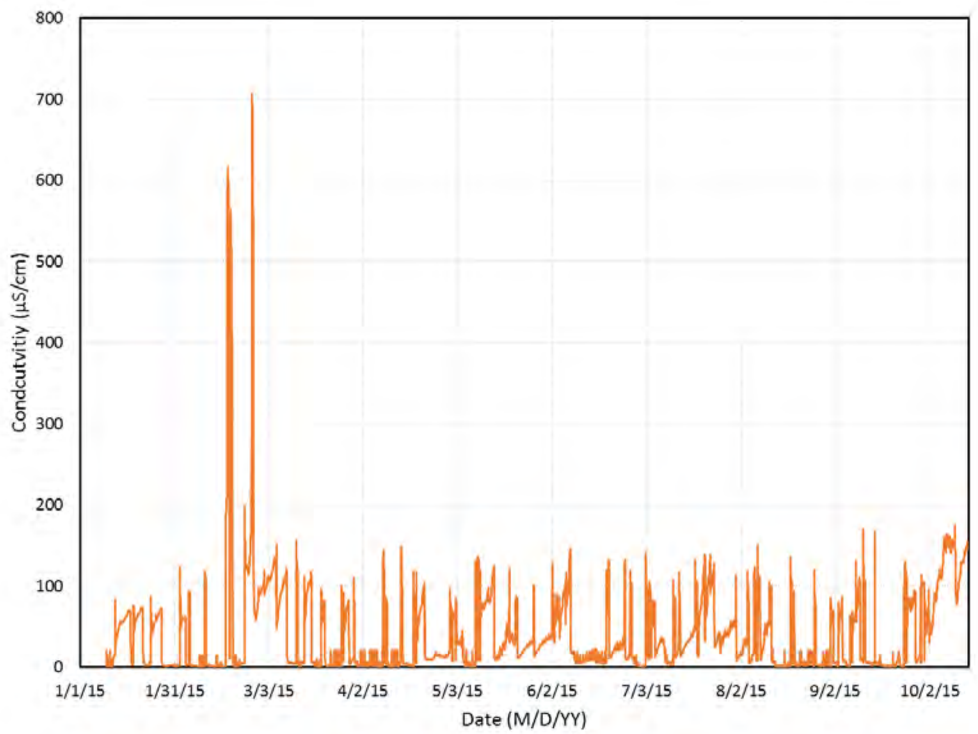


Figure B1. Conductivity record for GMR RT (at College Hill Dr.; January 9 - October 14, 2015).

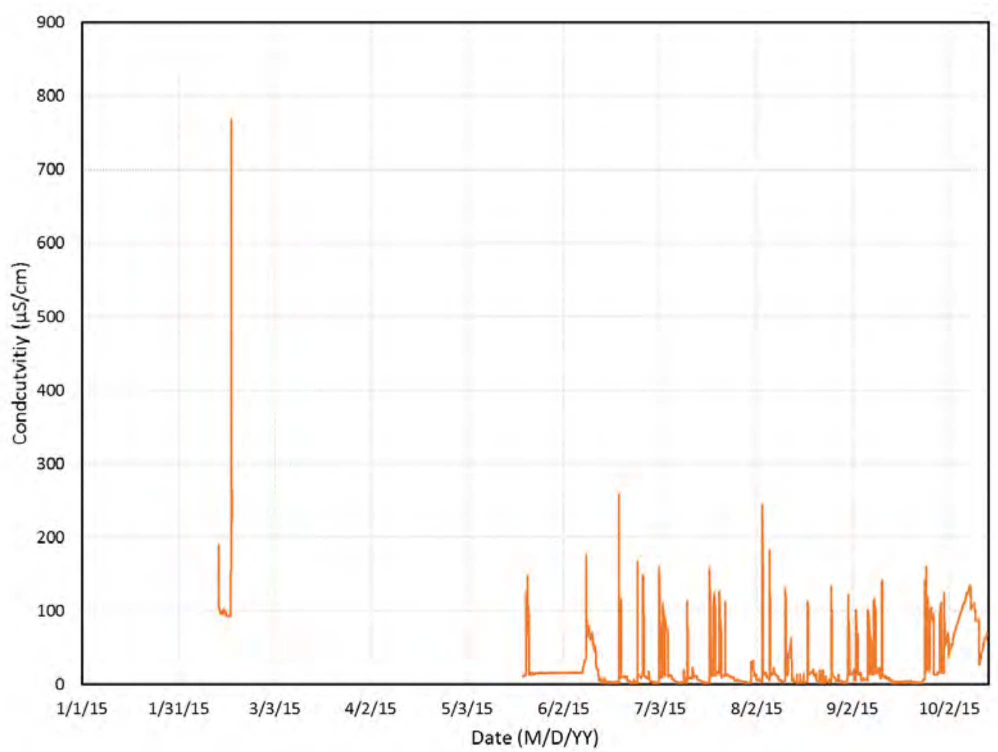


Figure B2. Conductivity record for GMR 5 (February 13 - October 14, 2015). Gaps in data resulted from improper configuration of logger.

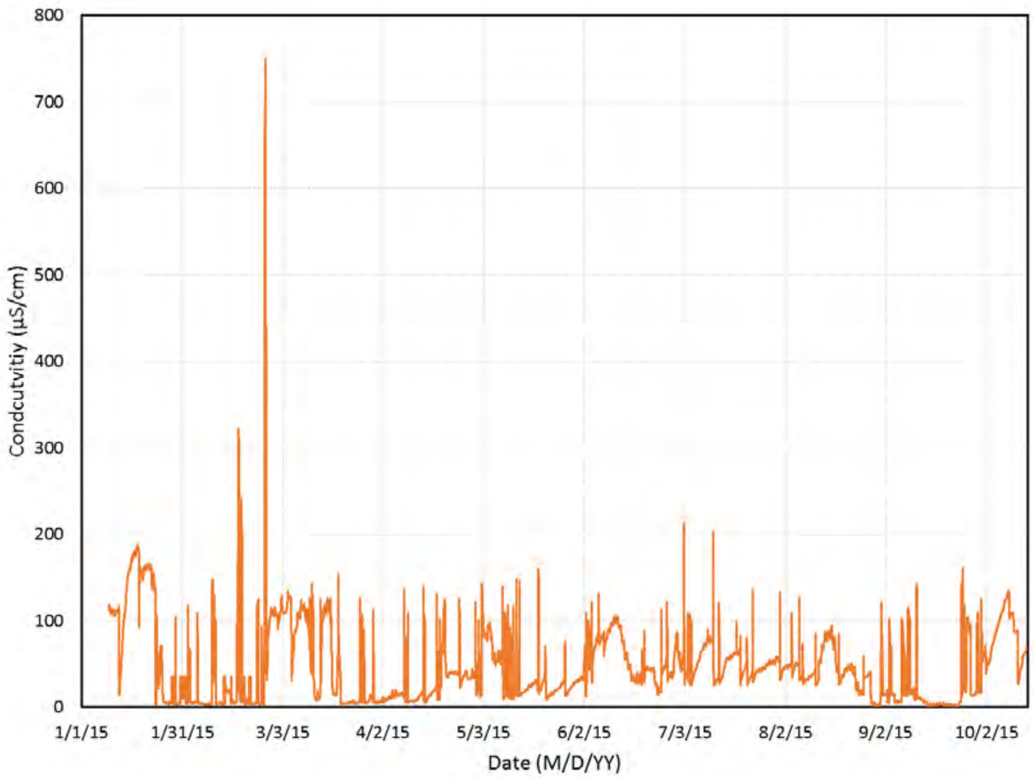


Figure B3. Conductivity record for GMR 6, Reedy Branch (January 9 - October 14, 2015).

APPENDIX C: Water Quality Measurements and Concentrations

Temperature

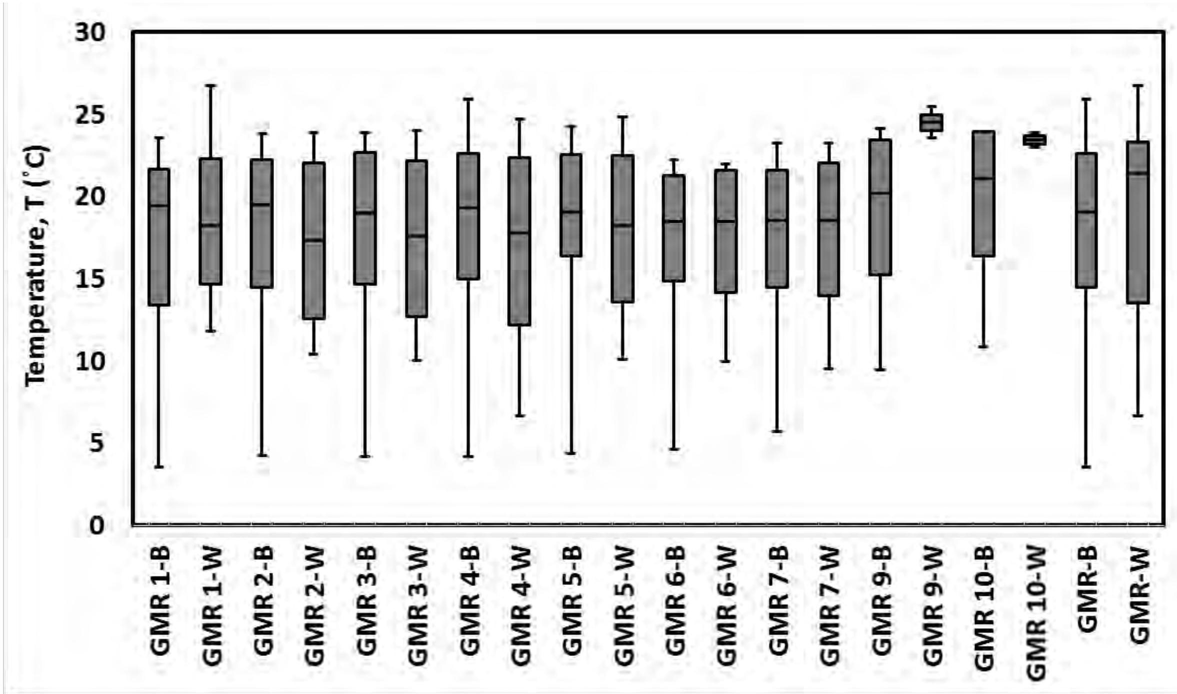


Figure C1. Box and whisker plots of Temperatures recorded for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

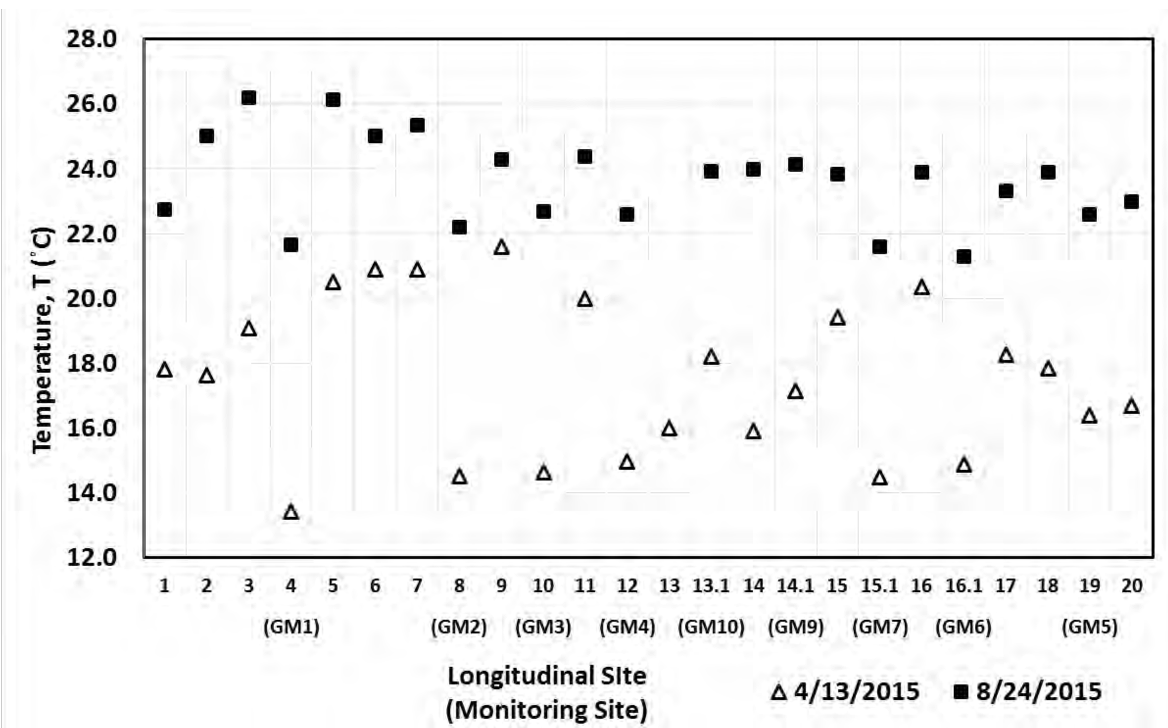


Figure C2. Temperature readings from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR.

Dissolved Oxygen Saturation

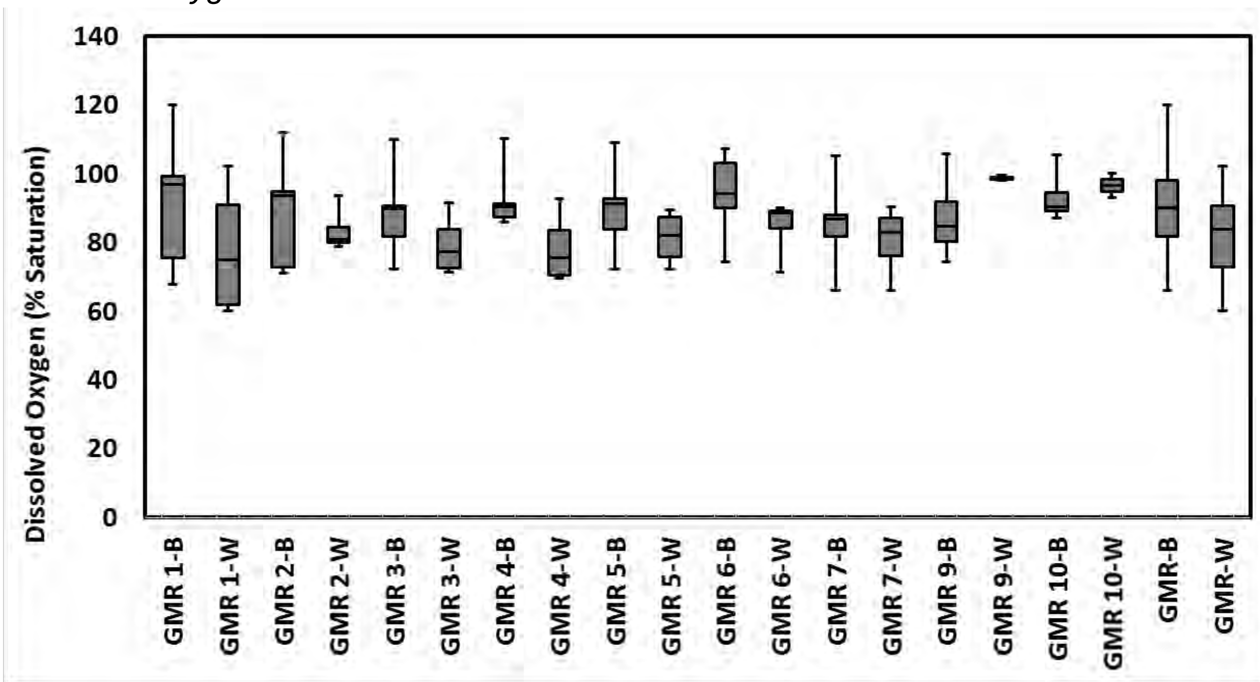


Figure C3. Box and whisker plots of Dissolved Oxygen saturation (%) recorded for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

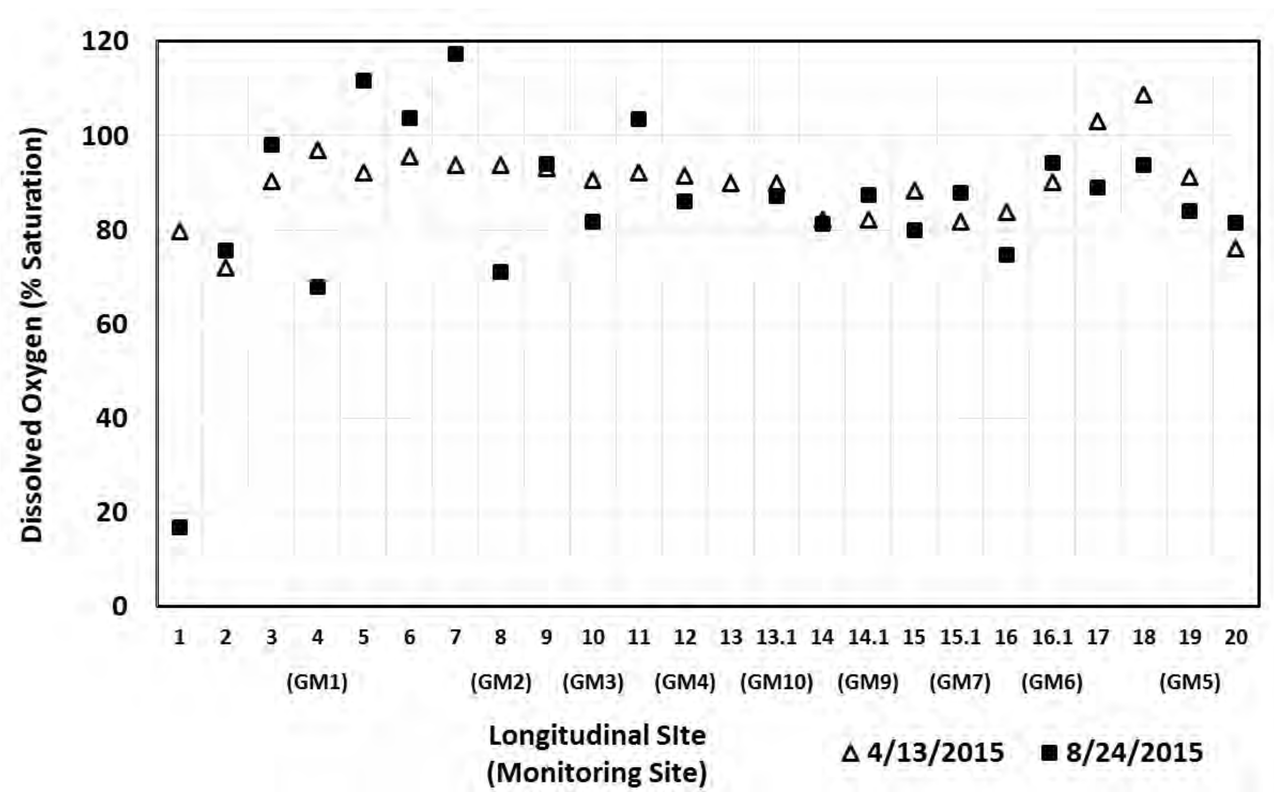


Figure C4. Dissolved Oxygen saturation readings from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR.

pH

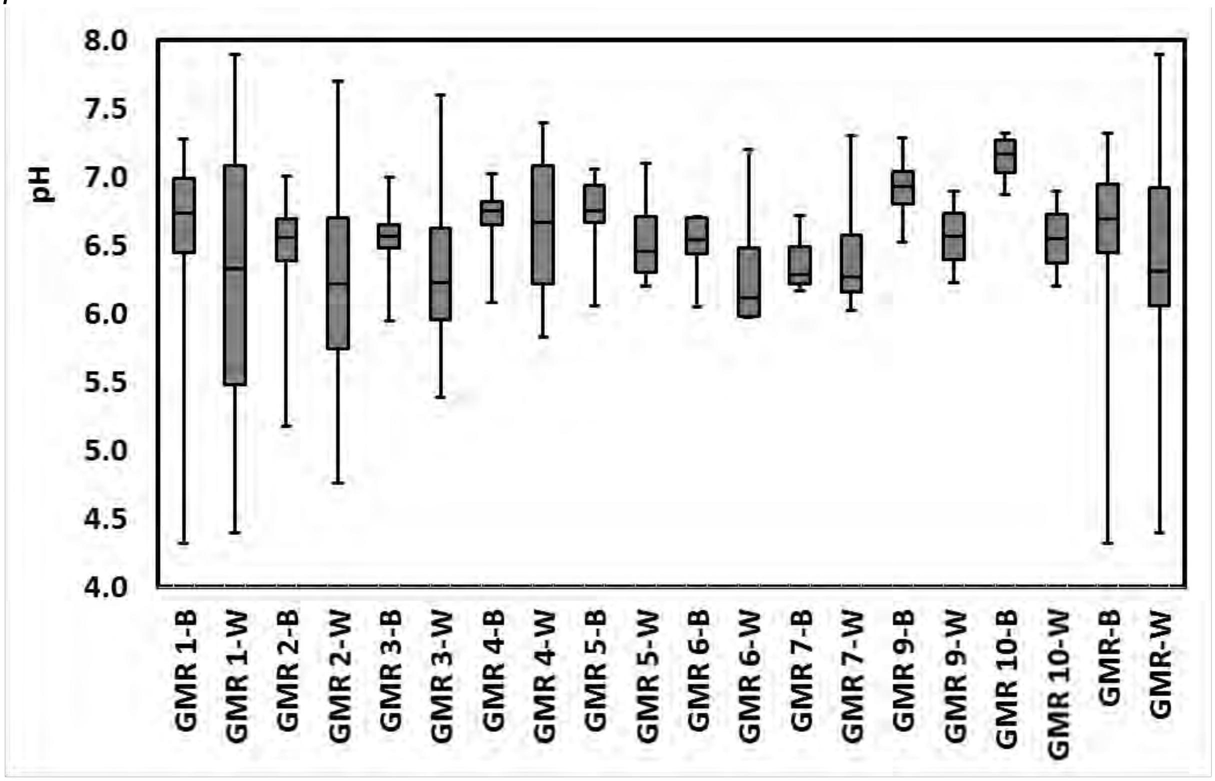


Figure C5. Box and whisker plots of pH records for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

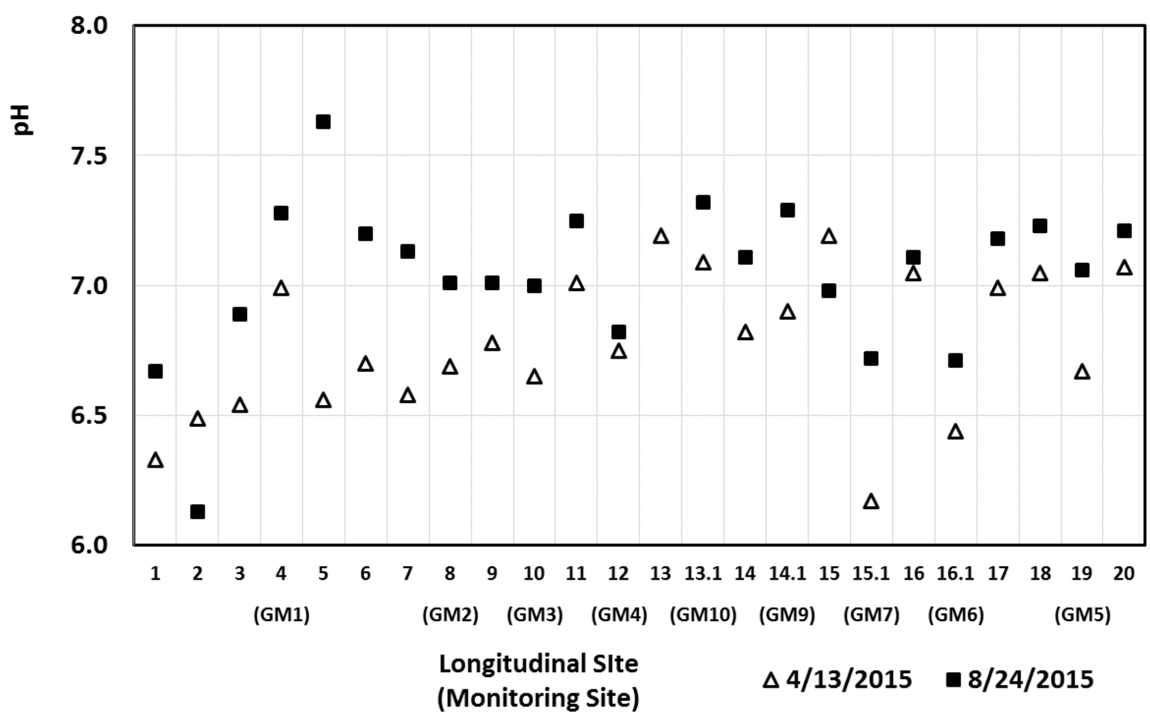


Figure C6. pH records from longitudinal surveys on Greens Mill Run. Tributaries (GMR 6, 7, 9, and 10) are noted by the addition of ".1" to the site number of the immediate upstream site on GMR.

Chloride

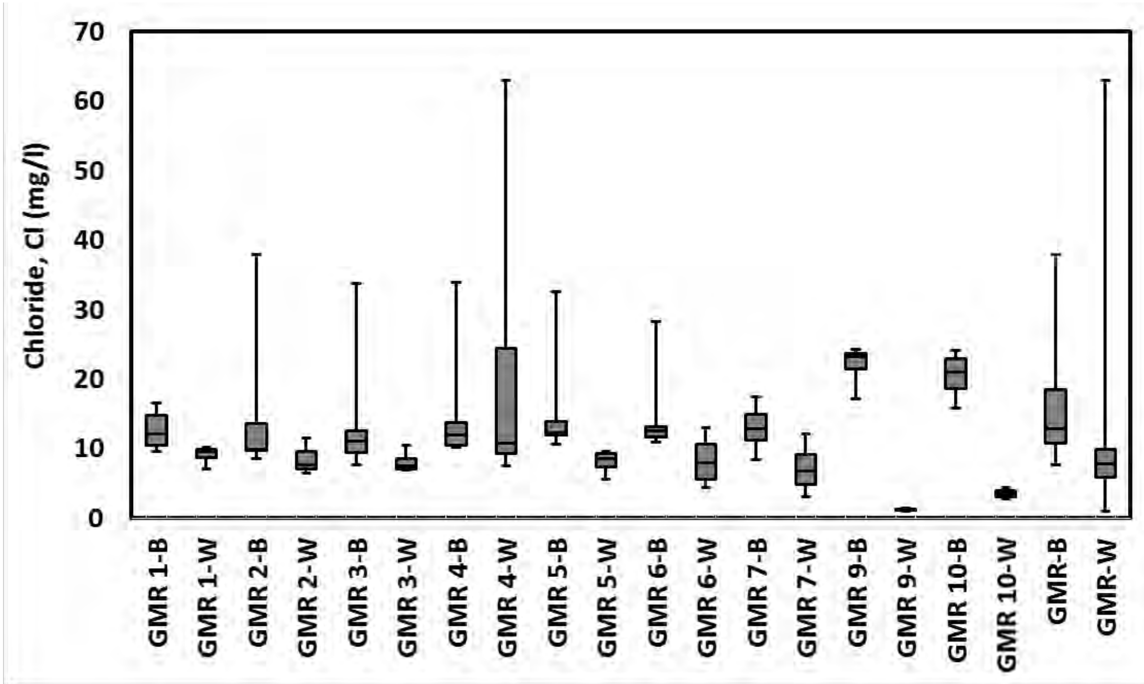


Figure C7 Box and whisker plots of Chloride (Cl) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

Ammonium

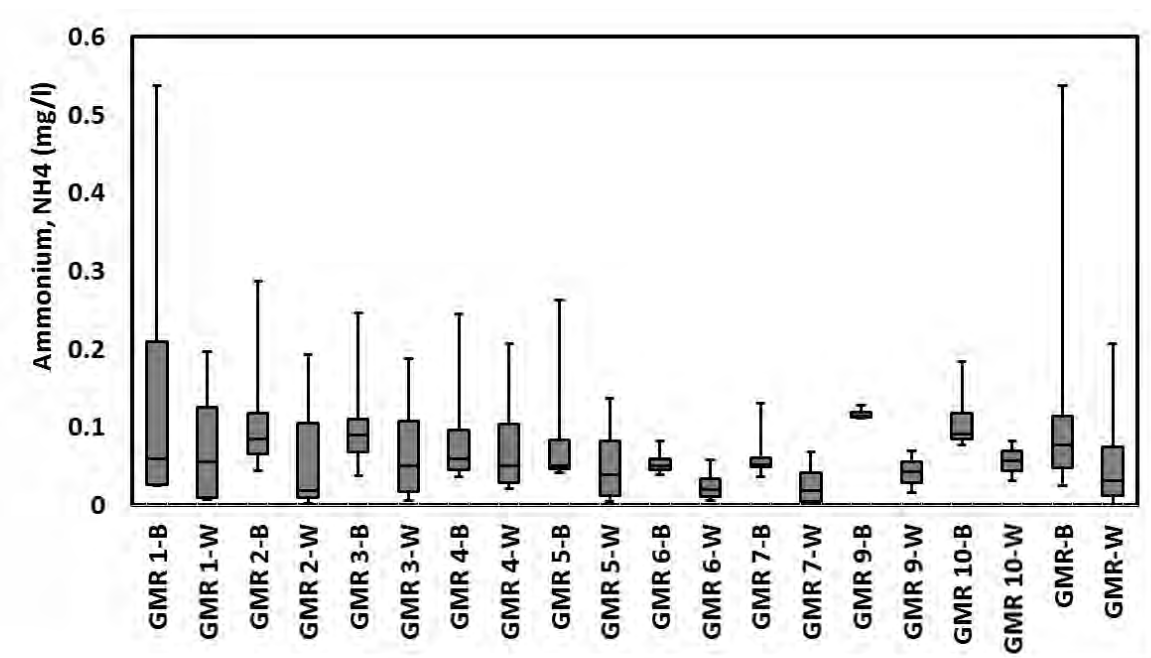


Figure C8. Box and whisker plots of Chloride (Cl) concentrations for base (B) and wet weather (W) flows. GMR-B and GMR-W are combined for all base and storm flow values, respectively.

M E M O R A N D U M

WK DICKSON
community infrastructure consultants

720 Corporate Center Drive   Raleigh, North Carolina 27607   919.782.0495 tel.   919.782.9672 fax

TO: **Lisa Kirby**

FROM: **Ward Marotti and Tom Murray, PE**

DATE: **January 28, 2016**

RE: **Benthic Macroinvertebrate Sampling Summary - Swift Creek and Greens Mill Run: 2014 &2015**

Sampling Plan

- The study began with review of the data results that caused the impairment listings:

Table 1. NC Division of Water Resources Sampling Results

	Swift Creek	Greens Mill Run	Hardee Creek
Site ID	JB241	OB110	OB112
Date	8/22/1995	3/2/2004	2/27/2012
Sample Method	EPT	Swamp	Swamp
EPT Taxa Richness	5	0	7
EPT Biotic Index	5.99		5.38
NC Biotic Index		7.93	6.58
Bioclassification	Poor	Severe	Moderate

- In August 2014 seven locations were sampled in each watershed, including the ones listed above that caused the impairment listings as shown in the attached Figures 1 and 2;
- Hardee Creek was identified as an appropriate reference reach and also sampled in August 2014;
- In addition to the benthic macroinvertebrate sampling, ambient sampling was performed by ECU at each of the monitoring locations;
- The optimal sampling period (i.e. seasonal adjustments are not required for Biotic Index and Bioclassification calculations) for both the EPT and Standard Qualitative methods is June-September;
- The optimal sampling period for the Swamp Method is February – early March;

- Because the Swamp method caused Greens Mill Run's impairment listing, data were collected in February 2015 at Swift Creek and Greens Mill Run's two downstream-most 2014 sample sites, as well as at the Hardee Creek Site;

- The 2014 results confirmed that several of the upstream-most sampling sites in both the Swift Creek and Greens Mill Run watersheds had subwatersheds that are too small to collect data that is comparable to the DWR data that caused the listings. As a result, the 2015 (February and August) sampling focused on the two downstream-most locations within both watersheds.

- Waters with bioclassifications of Poor and Fair using the standard and EPT methods are considered impaired; Good-Fair, Good, and Excellent are supporting. Using the swamp method, waters with Severe bioclassifications are considered impaired; Moderate and Natural are supporting.

    - Formal bioclassifications used for use support evaluations are determined using both the NC Biotic Index and EPT Taxa Richness.

Results

Swift Creek

Swift Creek has demonstrated observable improvement between the 1995 and 2015 collections. 2015 bioclassifications at sites 6 (NC 11) and 7 (NC 102; original DWQ listing site) were Good-Fair. In spite of this, benthic habitat remains poor and modifications to dredging noted below are recommended.

Greens Mill Run

Upper Greens Mill Run shows a clear improvement from 2004. 2015 bioclassifications at sites 4 (Charles Blvd.) and 5 (5th St./Green Springs Park; original DWQ listing site) were Fair. 2014 bioclassification for site 4 is Good-Fair, using only the NC Biotic Index. When EPT taxa are integrated, however, site 4's bioclassification is Fair.

Ambient Monitoring

Data collected and summarized by ECU demonstrates that impervious watershed conditions are likely to have led to high levels of total suspended solids and inorganic nitrogen at sampling locations. Channelization and lack of woody debris likely contribute to high inorganic nitrogen and limited denitrification. TSS concentrations are significantly higher during wet weather events which could be indicative of high levels of in stream erosion and scour.

Table 2. 2014 and 2015 Monitoring Results

---------- August 2014 ----------								
Site ID	Swift Creek							Hardee
	1	2	3	4	5	6	7	
EPT Taxa Richness	2	1	2	2	3	4	5	8

Table 2. 2014 and 2015 Monitoring Results

NC Biotic Index	7.6	7.5	7.1	7.3	7.2	6.5	6.6	5.9
Bioclassification[1]	F	F	F	F	F	G-F	G-F	Good
Sampling Method	Standard Qualitative							
Site ID	Greens Mill Run							
	1	2	3	4	5	6	7	
EPT Taxa Richness	2	6	6	4	3	2	2	
NC Biotic Index	7.1	6.8	6.8	6.5	7.2	6.7	7	
Bioclassification[1]	F	F	F	G-F	F	G-F	F	
Sampling Method	Standard Qualitative							
---------- February 2015 ----------								
Site ID	Swift Creek			Greens Mill				Hardee
	6	7		4	5			
EPT Taxa Richness	2	4		2	2			9
NC Biotic Index	7.6	6.4		7.3	7			6.3
Bioclassification[1]	F	G-F		F	F			G-F
Sampling Method	Swamp							
---------- August 2015 ----------								
Site ID	Swift Creek			Greens Mill				Hardee
	6	7		4	5			
EPT Taxa Richness	9	13		9	4			6
NC Biotic Index	6.8	6.6		6.9	7			6.2
Bioclassification	G-F	G-F		F	F			F
Sampling Method	Standard Qualitative							

[1] Ratings based only on biotic index values

Summary/Conclusions

Swift Creek results (2014 and 2015, downstream-most sample site) support its removal from the 303(d) impaired waters list.

Greens Mill Run results do not support its removal from the 303(d) impaired waters list. 2014 results from sites 4 and 6 (unnamed tributary @ 10th St.) indicate that portions of the watershed may have conditions suitable for removal from the 303(d) list. None of the sampling results at site 5 support removal from the 303(d) list.

Ambient data results do not indicate that water quality is the primary contributor to low benthic diversity and associated impairment. The lack of adequate habitat conditions throughout the watersheds is likely to be the primary contributor to the benthic community's low diversity. The ongoing maintenance (dredging) of streams for flood control removes large amounts of organic material and significantly disturbs stream channels. This is likely to be the primary contributor to habitat impacts.

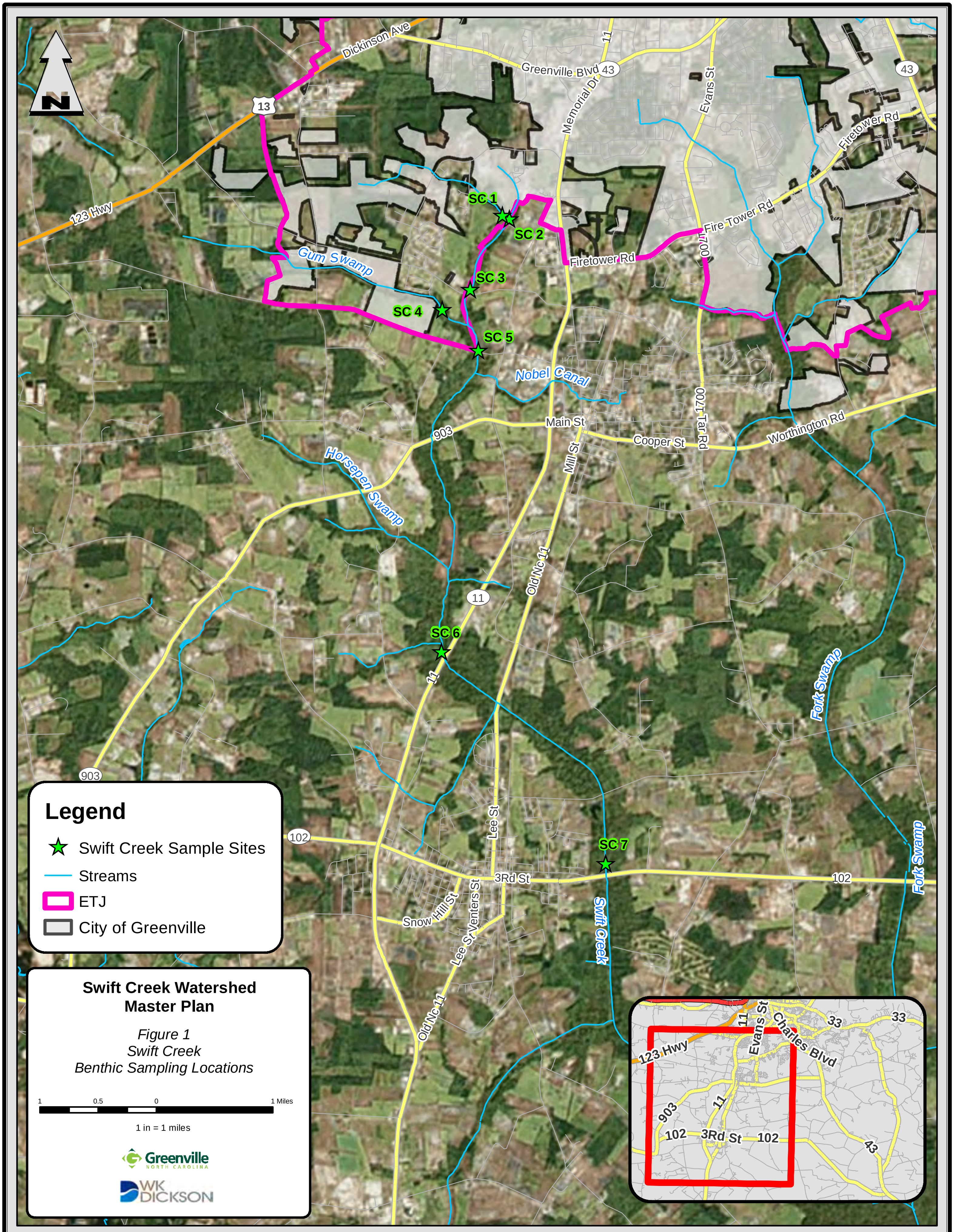
Next Steps

Submit the Swift Creek data to DEQ in support of delisting.

Continue monitoring in Greens Mill Run at sites 4, 5, and 6 to determine if the 2014 results at sites 4 and 6 are an anomaly, or if they accurately represent conditions. Add one or two sampling sites along Greens Mill Run's 'main stem,' between sites 4 and 5 to more clearly define the transition point of benthic diversity. If 2016 data are similar to 2014, submit them to DEQ to support the removal of portions of the watershed from the 303(d) list.

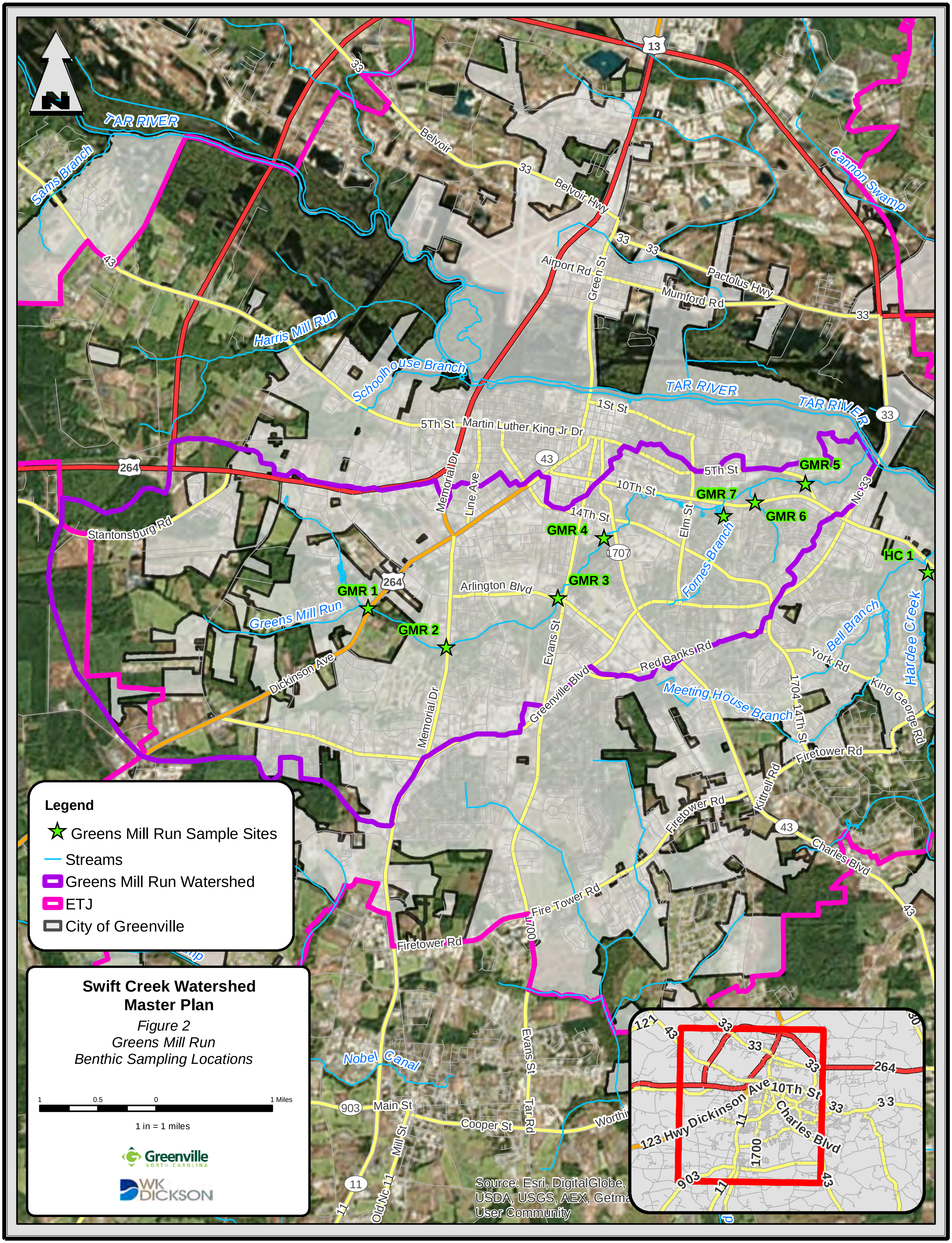
Discuss the adjustment of dredging with the City and other stakeholders, especially within the Greens Mill Run watershed. If dredging can be adjusted to limit impacts in and near the sample locations, begin habitat enhancements within these locations. Identify a reference reach with higher EPT taxa richness and lower (better) NC Biotic Index values than Hardee Creek. Once habitat enhancements have been stabilized within Greens Mill Run (3-6 months), collect and transplant a diverse population from the reference site(s).

Begin the formulation of a Category 4b Plan (a TMDL alternative that allows communities greater flexibility and control), and be prepared to propose its implementation should the habitat enhancement/relocation cited above not provide monitoring results that support Greens Mill Run's complete de-listing. This option leverages strategies already developed by the City for water quality management, and projects developed as part of Master Plan.



Swift Creek Watershed Master Plan

Figure 1
Swift Creek
Benthic Sampling Locations



Swift Creek Watershed Master Plan

Figure 2
Greens Mill Run
Benthic Sampling Locations