WK DICKSON

AN ARDURRA COMPANY



TOWN OF BLACK MOUNTAIN

BLACK MOUNTAIN STORMWATER MASTER PLAN

Executive Summary | December 2025









DRAFT

TOWN OF BLACK MOUNTAIN

STORMWATER MASTER PLAN

EXECUTIVE SUMMARY

WK Dickson/Ardurra Project No. 20230691.00.GV

December 2025

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EXECUTIVE SUMMARY

The Town of Black Mountain (Town) Stormwater Master Plan (SWMP) is funded by a Local Assistance for Stormwater Infrastructure Investments (LASII) from the American Rescue Plan Act (ARPA). The purpose of the SWMP is to develop a GIS map of the Town's stormwater system, identify flooding issues, assess the existing conveyance system capacity and infrastructure condition, develop and prioritize flood reduction projects, and establish an implementation strategy for the recommended capital infrastructure projects.

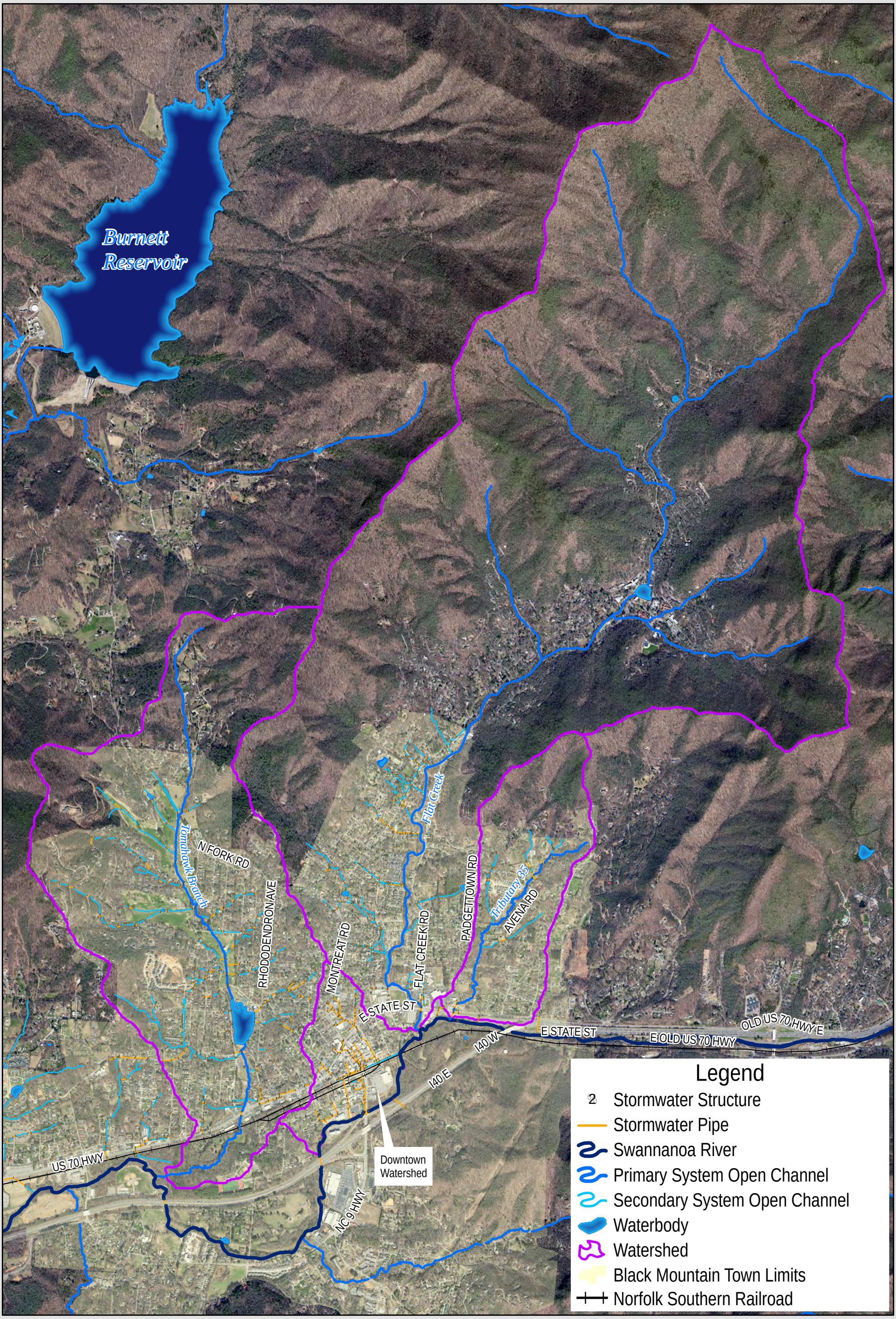
The Study Area for the SWMP includes the following:

- Secondary stormwater conveyance system in the Downtown corridor,
- Tomahawk Branch watershed, both the primary system culvert crossings and the secondary stormwater conveyance system located in the surrounding residential areas of Lake Tomahawk,
- Flat Creek Tributary 1 primary system culvert crossings in the vicinity of Portmanvilla, Sixth, and Seventh Street roads, and
- Tributary 35 (of the Swannanoa River) primary system culvert crossings in the vicinity of Avena and Padgettown roads.

The watersheds within the Town are all tributary to the Swannanoa River. In some cases, the closed system stormwater outfalls are located very closely to or directly into the Swannanoa River.

Based on historical records obtained from the National Oceanic and Atmospheric Administration (NOAA) online national climate data service[1], Hurricane Helene brought over 14 inches of rainfall in a span of three days to the mountains in September 2024, resulting in catastrophic flooding along the Swannanoa River corridor. Many roadways and bridges within the Town of Black Mountain were impacted. As a result, the Town desired to develop projects that would meet the 50-year level of service (LOS) where feasible. All proposed projects were evaluated and developed with this goal. However, there are a few areas where downstream hydraulic conditions and/or available cover prevent this level of flood reduction.

The Study Area for the Town's SWMP is shown in Figure ES-1.



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Figure ES-1: Project Location
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 1,000 2,000
Feet
1 in = 2,000 ft

ES.1 Existing Stormwater Infrastructure

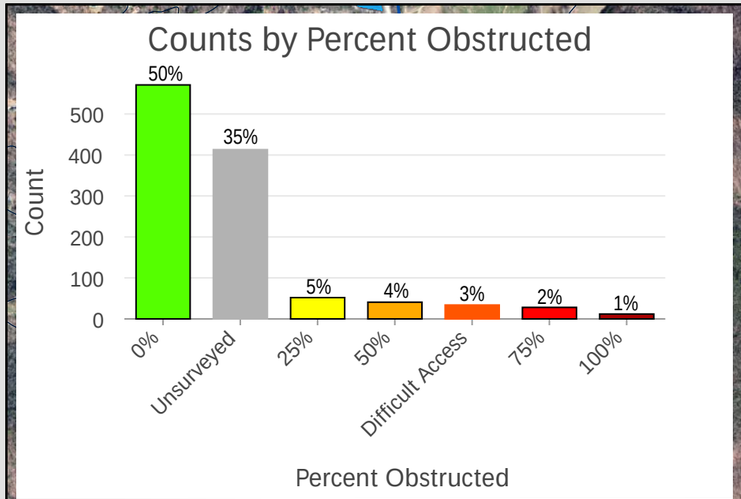
The Town manages an extensive stormwater conveyance system, including streams, roadside ditches and swales, and nearly nine (9) miles of closed pipe conveyance. Privately-owned stormwater infrastructure and private ponds also impact the Town's stormwater system. This SWMP includes assessment of the Town's stormwater conveyance system and includes multiple objectives: (1) reduce street and property flooding, (2) develop solutions to remove pipes presently located underneath commercial and government structures, (3) evaluate stormwater assets for maintenance and criticality, and (4) provide options to achieve a high level of service for roadways.

The stormwater inventory conducted for this SWMP determined that approximately 13 percent of the Town's evaluated structures are partially obstructed at 50% or less and require maintenance/debris removal. Approximately six (6) percent of the evaluated structures were severely obstructed (over 75 percent) at the time of assessment. The remaining 81 percent of evaluated structures were found to be clear of debris. Based on the results of the field assessments, four high-priority maintenance areas were identified and are shown in Figure ES-2. Beyond these four areas, it is recommended that the Town begin a systematic maintenance program to clear obstructions, beginning with the stormwater assets located in the Tomahawk Branch Watershed.

ES.2 Infrastructure Criticality Analysis

As part of the Town of Black Mountain Stormwater Master Plan, a preliminary condition assessment was completed to identify high-priority areas for detailed CCTV and/or maintenance needs. Prioritization is based on the likelihood of asset failure, as well as the consequence of asset failure. By evaluating the likelihood of asset failure in relation to the consequence of asset failure, a combined criticality score is then developed for each asset. This criticality score can enable the Town to more strategically evaluate which assets to focus capital improvement resources on for repair, rehabilitation, or further condition assessments. Of the pipes evaluated, 20% scored in Level 4 or 5, indicating the highest need for stormwater rehabilitation efforts. Within the structures evaluated, 21% scored in Level 4 or 5, indicating the highest need for stormwater structure rehabilitation efforts.

Because the data in the GIS database are dynamic, the results of the prioritization tool are a static representation based upon when the tool is run. As data are updated in the database, the tool can be utilized, and the results of the prioritization process can be updated easily. Typically, a jurisdiction may use a prioritization tool such as this on an annual or semi-annual basis as budgets are developed and capital plans and O&M plans are revised. A valuable component of this dynamic prioritization tool is the ability to quickly perform different scenario analyses to determine the relative benefit of capital and operation and maintenance (O&M) projects. The Town can determine if the at-risk score of a particular component can be dramatically reduced by improvement. In some cases, the consequence of failure score is so high that an improved asset will always remain in the high-risk category. These assets can be monitored on a frequent basis to consistently check their condition and proactively work to prevent a failure. Conversely, assets with the greatest likelihood of failure scores are often the target of initial condition assessment and rehabilitation programs. Town staff can perform scenario analyses to determine where condition assessment and rehabilitation programs can most reduce the at-risk scores of critical assets. The criticality of the Town's stormwater pipes are shown in Figure ES-3.



**The location of unknown/unsurveyed structures are not exact.
Unknown structure locations are assumed based upon pipe size and material changes between upstream and downstream surveyed structures. It is inferred from the results of the stormwater inventory and survey that there are many buried structures or underground junction boxes.

There are a few concentrated areas where obstructions and debris need to be removed.
Most of the obstructions are spread out across the Town's system.
It is recommended that the Town start with the four high priority areas identified and then move to systematic cleaning/maintenance beginning with the Tomahawk Branch watershed.

Legend

Stormwater Structures
Percent Obstructed
- 0%
- 25%
- 50%
- 75%
- 100%
- # Difficult Access Structure
- 2 Unsurveyed Structure

- Waterbody
- Stormwater Pipe
- Minor Channel
- Major Channel
- Road
- Watershed
- High Priority Maintenance Area

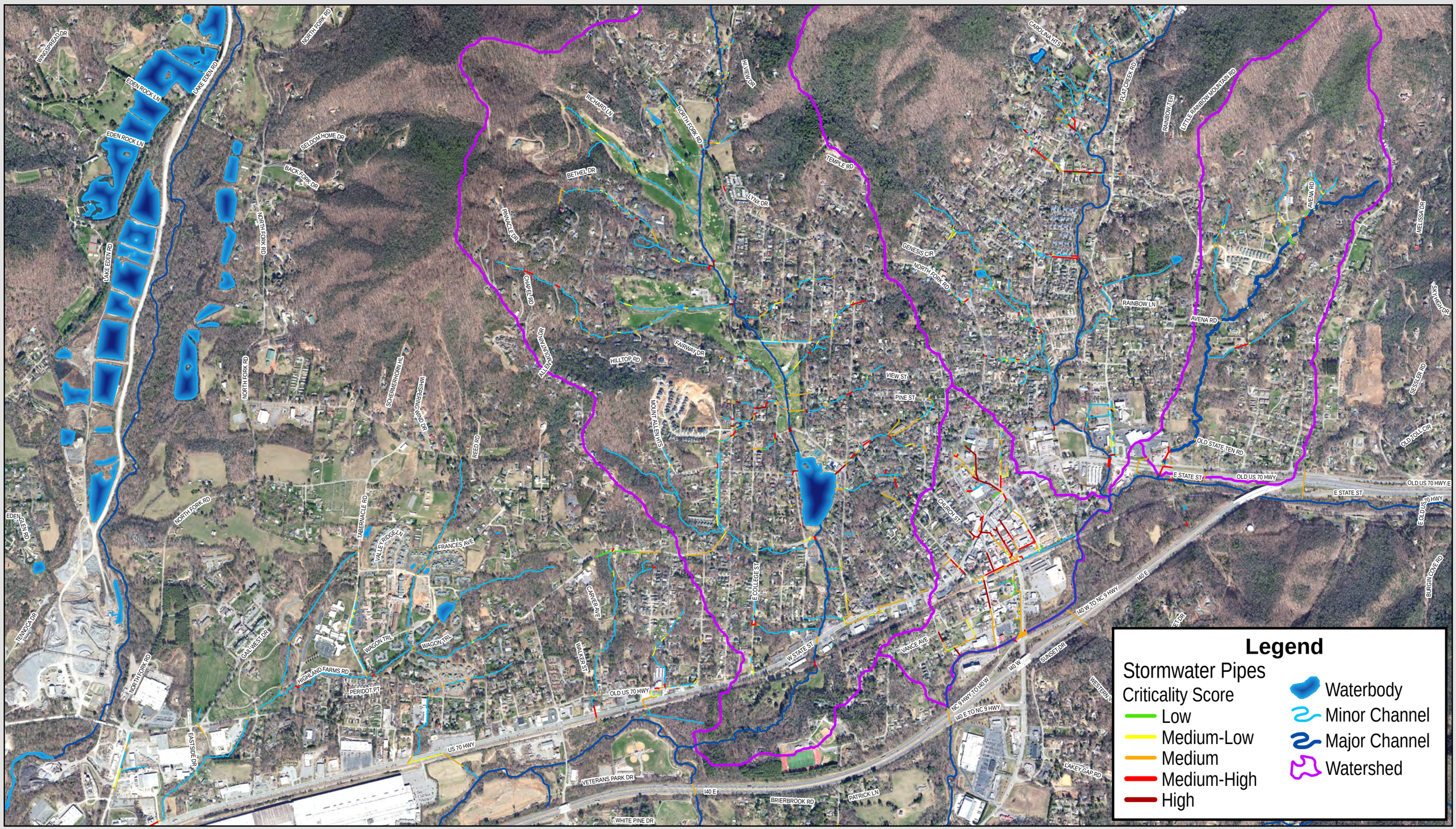
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TOWN OF BLACK MOUNTAIN NORTH CAROLINA 1893

Figure ES-2: High Priority Maintenance Areas
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 1,250 2,500 Feet

1 in = 1,250 ft



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TOWN OF BLACK MOUNTAIN NORTH CAROLINA 1893

Figure ES-3: Criticality Analysis Results - Stormwater Pipes
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 1,250 2,500 Feet

1 in = 1,250 ft

N

ES.3 Stormwater Capital Improvement Projects

Developing flood mitigation alternatives in an urban environment is a complex process based on limitations imposed by the constraints within the environment, such as floodplain encroachments, increased peak flows due to impervious areas, public and private utilities, and private property. Improvements in this portion of the study were identified through an iterative process of infrastructure improvements, open channel improvements, floodplain benching, and detention options where feasible. As previously noted, the Town desired to focus the stormwater capital projects towards achieving a goal of a 50-YR LOS. In some cases, existing conditions limit options to plan for the desired LOS. Options for providing a high LOS are presented herein.

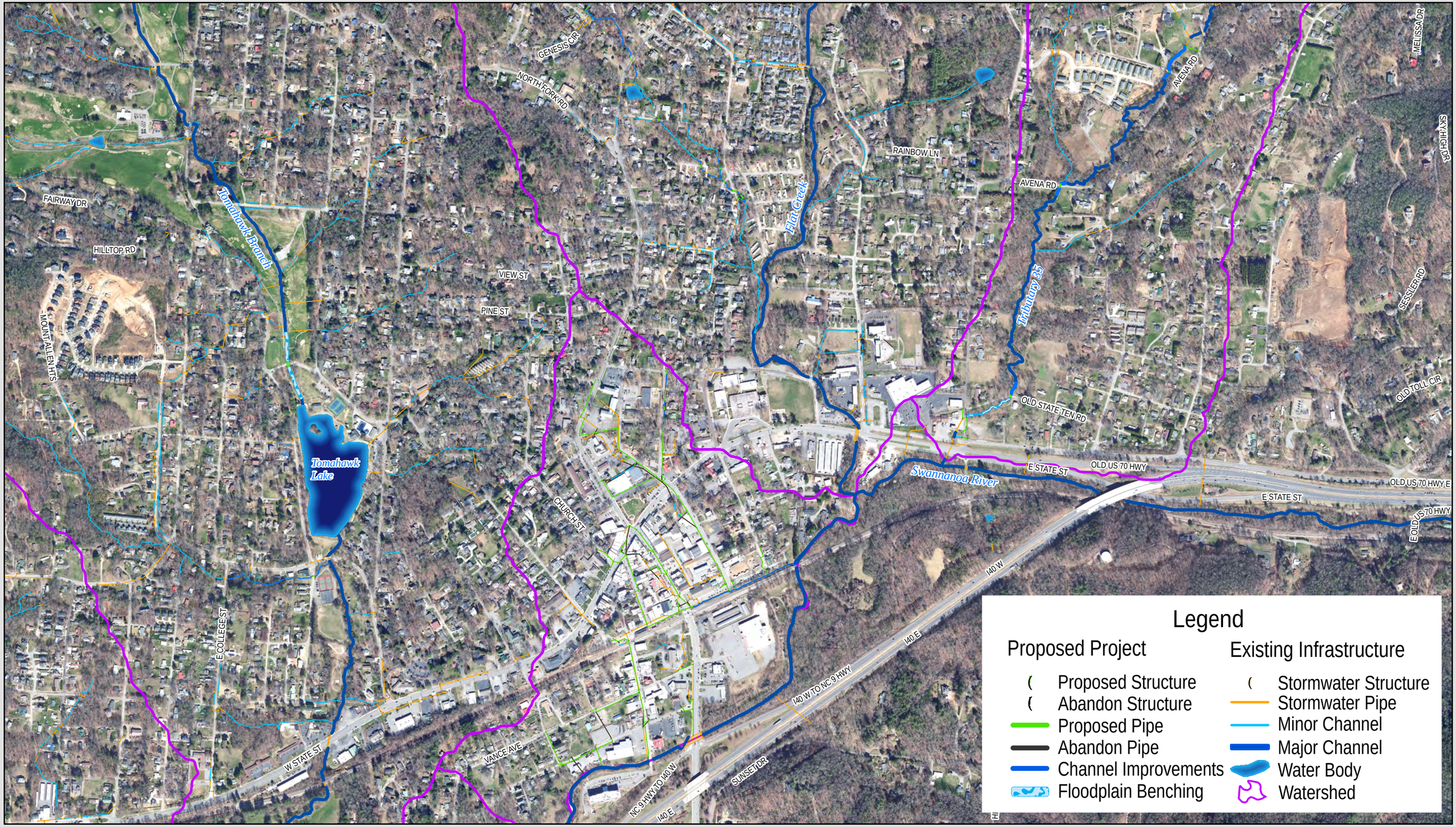
1D PCSWMM models were developed to analysis the Town's existing stormwater system, including the downtown secondary system and the culvert crossings along the three major tributaries to the Swannanoa River running through Town: Tomahawk Branch, Flat Creek, and Tributary 35. The results of the existing system capacity analysis indicated that much of the Town's stormwater system does meet a 10-year LOS and in the downtown area does not meet a 2-year LOS. The models were then used to develop planning level capital improvement projects to meet the Town's desired 50-year LOS. Twenty-nine (29) stormwater improvement capital projects were identified in phases to address the Town's goals within the SWMP. Each stormwater project is identified by watershed and a project ID. Downtown projects are additionally designated by the outfall locations for Sutton Avenue, Black Mountain Avenue, Terry Estates Drive, and NC9. The proposed projects are shown in Figure ES-4.

ES.4 Prioritization and Recommendations

To appropriately allocate Town resources, the flood reduction projects listed above were prioritized based on the following categories:

- Utility Conflicts
- Severity of Street Flooding
- Land or Right-of-Way Ownership
- Effect of Improvements
- Cost Effectiveness
- Bonus Points for Grant Funding Eligibility
- Bonus Points for Criticality Analysis

In some instances, project prioritization will be impacted by the required sequencing to provide the highest possible flood reduction benefits and to reduce or negate any downstream impacts for the proposed projects. Table ES.1 shows the proposed prioritizations and planning level cost estimates for the proposed capital stormwater improvement projects. The total cost for stormwater improvements in the Downtown corridor is approximately $27 Million, and the total cost to provide improvements along primary stream culvert crossings in Tomahawk Branch, Flat Creek, and Tributary 35 (Avena Rd area) is approximately $8 Million. Proposed project sheet summaries and planning level cost estimates are provided following Table ES.1.



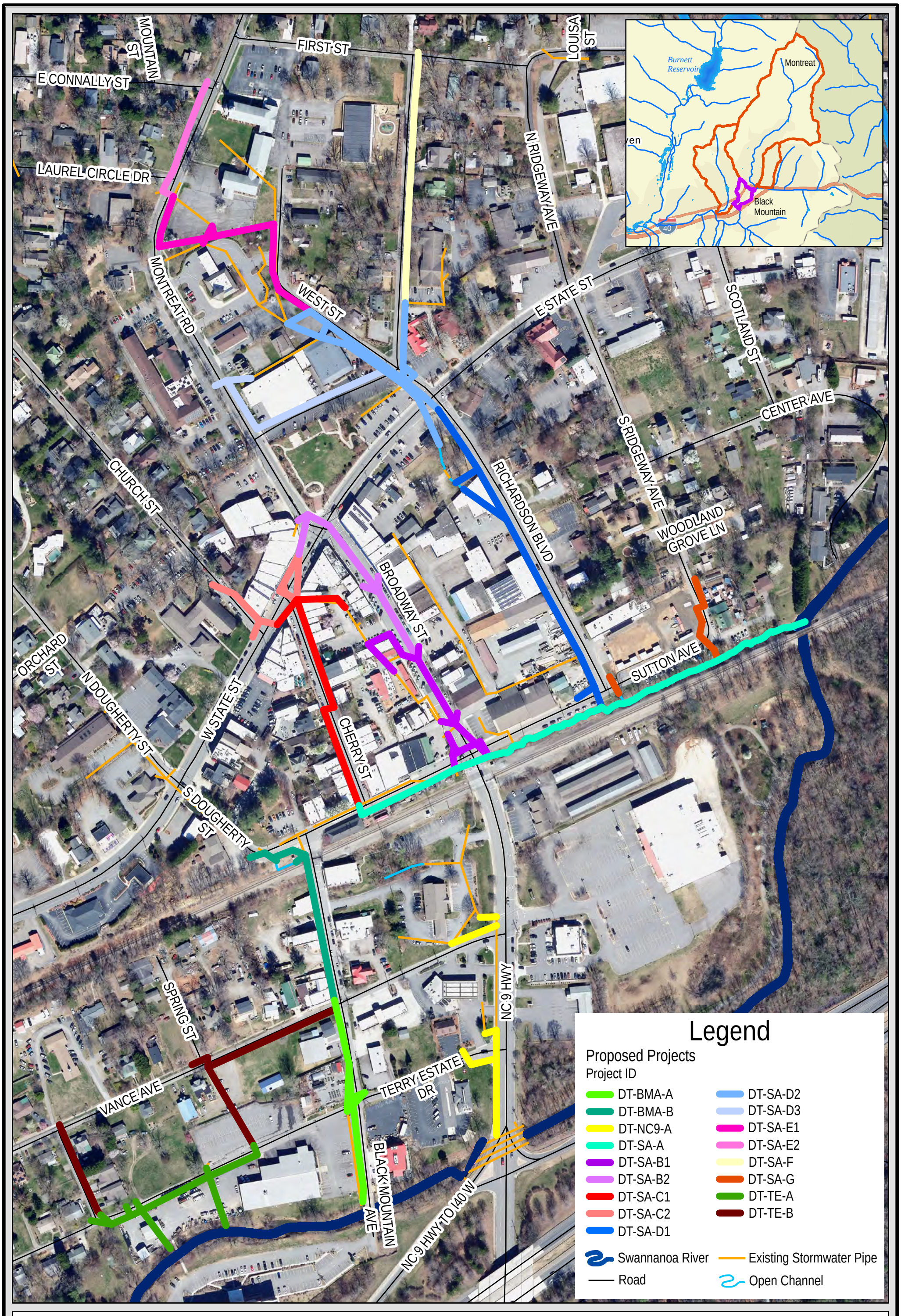
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Figure ES-4: Proposed Projects
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 700 1,400 Feet
1 in = 700 ft

TABLE ES.1. PROPOSED CIP PLANNING COST AND PRIORITIZATION SUMMARY

PROPOSED STORMWATER IMPROVEMENT PROJECT		PROJECT PLANNING LEVEL OPINION OF COST	PRIORITIZATION SCORE
DOWNTOWN SYSTEM			
DT-SA-A	Sutton Ave	$ 2,250,000	88
DT-SA-B1	Broadway St Phase I	$ 2,029,000	83
DT-SA-B2	Broadway St Phase II	$ 1,292,000	88
DT-SA-C1	Cherry St Phase I	$ 1,510,000	75
DT-SA-C2	Cherry St Phase II	$ 1,021,000	88
DT-SA-D1	Police Station/Post Office Phase I	$ 4,303,000	71
DT-SA-D2	Police Station/Post Office Phase II	$ 1,932,000	87
DT-SA-D3	Police Station/Post Office Phase III	$ 923,000	81
DT-SA-E1	West St to Montreat Rd	$ 1,228,000	76
DT-SA-E2	Montreat Rd at Laurel Circle Dr	$ 797,000	49
DT-SA-F	Midland Ave	$ 1,121,000	82
DT-SA-G	S. Ridgeway Ave	$ 827,000	76
DT-BMA-A	Black Mountain Ave Phase I	$ 1,880,000	82
DT-BMA-B	Black Mountain Ave Phase II	$ 1,308,000	88
DT-TE-A	Terry Estate Dr Phase I	$ 1,963,000	61
DT-TE-B	Terry Estate Dr Phase II	$ 1,380,000	78
DT-NC9-A	NC 9	$ 1,335,000	68
TOMAHAWK BRANCH PRIMARY SYSTEM			
TB-A1	Laurel Circle Culvert Replacement	$ 760,000	58
TB-A2	Golf Course Floodplain Benching	$ 690,000	53
TB-B	Swannanoa Ave Culvert	$ 430,000	77
FLAT CREEK PRIMARY SYSTEM			
FC-TRIB1-A	Portmanvilla Rd	$ 900,000	87
FC-TRIB1-B	6th St	$ 633,000	78
FC-TRIB1-C	7th St	$ 405,000	87
FC-TRIB1-D	Montreat Rd	$ 546,000	88
TRIBUTARY 35 PRIMARY SYSTEM			
TR35-A	Padgettown Rd	$ 1,422,000	62
TR35-B1	Old State 10 Rd	$ 608,000	77
TR35-B2	Tributary 35 Floodplain Benching	$ 425,000	66
TR35-C	Avena Rd	$ 438,000	85
TR35-D	Bellgrove Rd / Avena Rd	$ 824,000	83



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Figure ES-5: Proposed Stormwater Improvement Projects
DOWNTOWN DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200
Feet
1 in = 200 ft

PROJECT NAME: **Sutton Ave and Open Channel Stormwater Improvements** PROJECT ID: **DT-SA-A**

PROJECT INFORMATION

LOCATION: Sutton Ave: Cherry St to Broadway St outfall
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 1360

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 25 LF of new 42" RCP across Sutton Ave at Cherry St.
- Replace existing pipe on south side of Sutton Ave with 280 LF of 42" RCP.
- Replace existing pipe in the Broadway St/SuttonAve intersection with 100 LF of 48" RCP.
- Replace exising outfall pipe with 20 LF of 60" RCP.
- Install 940 LF of channel improvements from the outfall to the confluence with the Swannanoa River.*

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Sutton Ave at Cherry St	< 2-YR	50-YR	100
Sutton Ave at Broadway St	< 2-YR	50-YR	100
Future Outfall Projects*	< 2-YR	50-YR	100

**Open Channel improvements along existing roadside channel from outfall at Broadway St to the confluence with the Swannanoa River provide capacity for future outfall improvements at Richardson Blvd and S. Ridgeway Ave.*

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,394,000
Design and Permitting	$ 493,800
Other Project Costs	$ 362,200
Total Project	**$ 2,250,000**

PROJECT AREA MAP



PROJECT NAME **Sutton Ave and Open Channel Stormwater Improvements** PROJECT ID: **DT-SA-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 420

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 51,060.00	$ 51,100.00
Erosion Control	1	LS	$ 41,850.00	$ 41,900.00
Traffic Control	1	LS	$ 16,740.00	$ 16,700.00
Moderate Utility Conflict	1	LS	$ 125,550.00	$ 125,600.00
Unclassified Excavation/Hauling	500	CY	$ 72.00	$ 36,000.00
Infrastructure Removal and Disposal	400	LF	$ 115.00	$ 46,000.00
Structure Removal and Disposal	6	EA	$ 6,800.00	$ 40,800.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	6	EA	$ 12,000.00	$ 72,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	400	LF	$ 670.00	$ 268,000.00
New Pipe: 60-inch	20	LF	$ 875.00	$ 17,500.00
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	940	LF	$ 350.00	$ 329,000.00
Roadway/Sidewalk Replacement	240	SY	$ 110.00	$ 26,400.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 322,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,394,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 69,700.00
Design and Permitting	20%	$ 278,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ 150,000.00
Geotechnical Investigation	1%	$ 13,900.00
Structural Evaluation	1%	$ 13,900.00
Real Estate	2%	$ 27,900.00
Utility Relocation	2%	$ 27,900.00
Project Maintenance (3yr)	5%	$ 69,700.00
Construction Inspections	10%	$ 139,400.00
Construction	100%	$ 1,394,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 2,250,000.00

PROJECT NAME: **Broadway St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-B1**

PROJECT INFORMATION

LOCATION: Broadway St in Downtown Business District
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 700

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24" pipe in Broadway St with 325 LF of 42-inch RCP.
- Replace existing catch basins and connecting pipes along Broadway with larger pipes.
- Re-route private system to proposed Broadway system and remove pipe under structure.
- Install upsized and new crossings and connections at Montreat Rd and Sutton Ave.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**83**

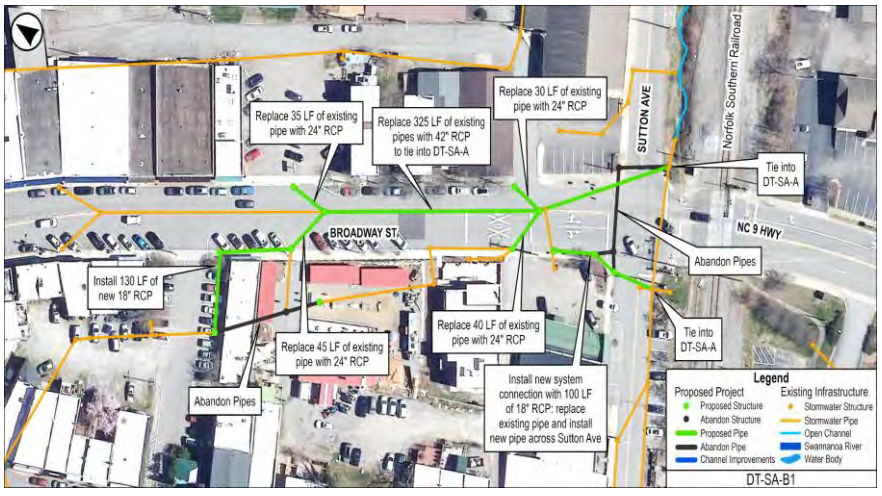
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Broadway St at Sutton Ave	< 2-YR	50-YR	100
Side system along Broadway	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,390,000
Design and Permitting	$ 278,000
Other Project Costs	$ 361,000
Total Project	**$ 2,029,000**

PROJECT AREA MAP



PROJECT NAME **Broadway St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-B1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 700
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 50,915.00	$ 50,900.00
Erosion Control	1	LS	$ 37,160.00	$ 37,200.00
Traffic Control	1	LS	$ 14,864.00	$ 14,900.00
Major Utility Conflict	1	LS	$ 222,960.00	$ 223,000.00
Unclassified Excavation/Hauling	500	CY	$ 72.00	$ 36,000.00
Infrastructure Removal and Disposal	720	LF	$ 115.00	$ 82,800.00
Structure Removal and Disposal	15	EA	$ 6,800.00	$ 102,000.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	375	LF	$ 390.00	$ 146,300.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	325	LF	$ 670.00	$ 217,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	380	SY	$ 110.00	$ 41,800.00
New Concrete Curb and Gutter	125	LF	$ 110.00	$ 13,800.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 321,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,390,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 69,500.00
Design and Permitting	20%	$ 278,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,900.00
Structural Evaluation	1%	$ 13,900.00
Real Estate	2%	$ 27,800.00
Utility Relocation	2%	$ 27,800.00
Project Maintenance (3yr)	5%	$ 69,500.00
Construction Inspections	10%	$ 139,000.00
Construction	100%	$ 1,390,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 2,029,000.00

PROJECT NAME: **Broadway St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-B2**

PROJECT INFORMATION

LOCATION: Broadway St north to Montreat Rd
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 615

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24" pipe in Broadway St with 210 LF of 36-inch RCP.
- Install 285 LF of new 30-inch RCP from 36-inch RCP in Broadway St across E State St.
- Replace 30 LF of existing pipe across Montreat Rd at E State St with 30-inch RCP.
- Remove pipe across Montreat flowing to first catch basin on W. State St.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

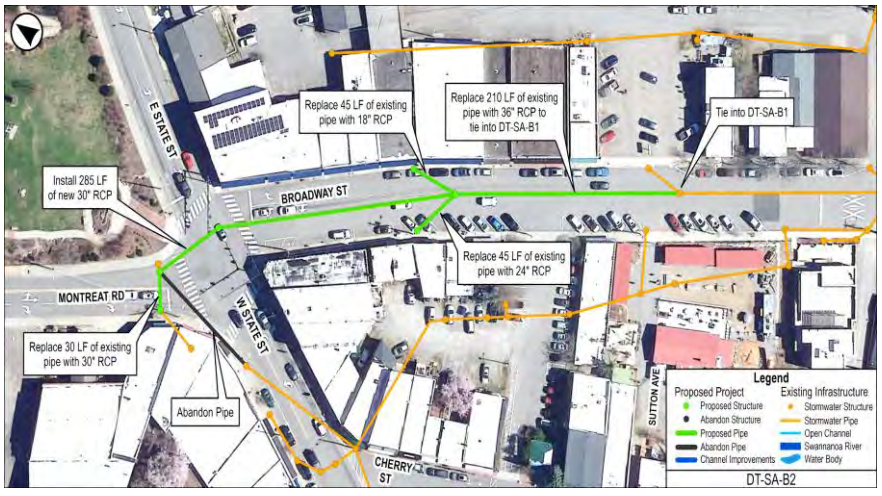
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
E State St at Broadway St	NA	50-YR	New Crossing
Montreat Rd at E State St	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 885,000
Design and Permitting	$ 177,000
Other Project Costs	$ 230,000
Total Project	**$ 1,292,000**

PROJECT AREA MAP



PROJECT NAME **Broadway St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-B2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 615
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 32,425.00	$ 32,400.00
Erosion Control	1	LS	$ 26,580.00	$ 26,600.00
Traffic Control	1	LS	$ 10,632.00	$ 10,600.00
Moderate Utility Conflict	1	LS	$ 79,740.00	$ 79,700.00
Unclassified Excavation/Hauling	620	CY	$ 72.00	$ 44,600.00
Infrastructure Removal and Disposal	435	LF	$ 115.00	$ 50,000.00
Structure Removal and Disposal	5	EA	$ 6,800.00	$ 34,000.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	90	LF	$ 390.00	$ 35,100.00
New Pipe: 30-inch to 36-inch	525	LF	$ 535.00	$ 280,900.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	310	SY	$ 110.00	$ 34,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 204,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 885,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 44,300.00
Design and Permitting	20%	$ 177,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,900.00
Structural Evaluation	1%	$ 8,900.00
Real Estate	2%	$ 17,700.00
Utility Relocation	2%	$ 17,700.00
Project Maintenance (3yr)	5%	$ 44,300.00
Construction Inspections	10%	$ 88,500.00
Construction	100%	$ 885,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,292,000.00

PROJECT NAME: **Cherry St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-C1**

PROJECT INFORMATION

LOCATION: Cherry St from W State St to Sutton Ave
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 690

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe on Cherry St with 270 LF of 36-inch RCP and tie into 42-inch RCP at Sutton Ave.
- Install 330 LF of new 36-inch RCP along Cherry St. from W. State St.
- Replace existing pipe crossing Cherry St at W State St with 85 LF of 36-inch RCP.
- Remove pipe under structure at corner of W State St and Cherry St. to re-route flow to right-of-way.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**75**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Cherry St at W State St	< 2-YR	50-YR	100
Cherry St at Sutton Ave	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,034,000
Design and Permitting	$ 206,800
Other Project Costs	$ 269,200
Total Project	**$ 1,510,000**

PROJECT AREA MAP



PROJECT NAME **Cherry St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-C1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 690
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 37,855.00	$ 37,900.00
Erosion Control	1	LS	$ 31,030.00	$ 31,000.00
Traffic Control	1	LS	$ 12,412.00	$ 12,400.00
Moderate Utility Conflict	1	LS	$ 93,090.00	$ 93,100.00
Unclassified Excavation/Hauling	860	CY	$ 72.00	$ 61,900.00
Infrastructure Removal and Disposal	500	LF	$ 115.00	$ 57,500.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	4	EA	$ 8,600.00	$ 34,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	690	LF	$ 535.00	$ 369,200.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	390	SY	$ 110.00	$ 42,900.00
New Concrete Curb and Gutter	300	LF	$ 110.00	$ 33,000.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 239,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,034,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 51,700.00
Design and Permitting	20%	$ 206,800.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 10,300.00
Structural Evaluation	1%	$ 10,300.00
Real Estate	2%	$ 20,700.00
Utility Relocation	2%	$ 20,700.00
Project Maintenance (3yr)	5%	$ 51,700.00
Construction Inspections	10%	$ 103,400.00
Construction	100%	$ 1,034,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,510,000.00

PROJECT NAME: **Cherry St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-C2**

PROJECT INFORMATION

LOCATION: Church St and W State St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 420

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing crossings at Church St and W State St with 50 LF of 30-inch RCP and 50 LF of 36-inch RCP.
- Replace existing pipe along Church St with 24-inch RCP and connect to new system at W. State St/Cherry St.
- Install 160 LF of 18-inch RCP along W. State St to redirect flow to proposed Cherry St system.
- Remove remaining connection between Montreat Rd and Cherry St.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
W State St at Church St	< 2-YR	50-YR	100
W State St east of Cherry St	2-YR	50-YR	100
Church St at W State St	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 699,000
Design and Permitting	$ 139,800
Other Project Costs	$ 182,200
Total Project	**$ 1,021,000**

PROJECT AREA MAP



PROJECT NAME **Cherry St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-C2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 420
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 25,635.00	$ 25,600.00
Erosion Control	1	LS	$ 21,015.00	$ 21,000.00
Traffic Control	1	LS	$ 8,406.00	$ 8,400.00
Moderate Utility Conflict	1	LS	$ 63,045.00	$ 63,000.00
Unclassified Excavation/Hauling	340	CY	$ 72.00	$ 24,500.00
Infrastructure Removal and Disposal	440	LF	$ 115.00	$ 50,600.00
Structure Removal and Disposal	8	EA	$ 6,800.00	$ 54,400.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	325	LF	$ 390.00	$ 126,800.00
New Pipe: 30-inch to 36-inch	95	LF	$ 535.00	$ 50,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	260	SY	$ 110.00	$ 28,600.00
New Concrete Curb and Gutter	210	LF	$ 110.00	$ 23,100.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 161,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 699,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 35,000.00
Design and Permitting	20%	$ 139,800.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 7,000.00
Structural Evaluation	1%	$ 7,000.00
Real Estate	2%	$ 14,000.00
Utility Relocation	2%	$ 14,000.00
Project Maintenance (3yr)	5%	$ 35,000.00
Construction Inspections	10%	$ 69,900.00
Construction	100%	$ 699,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,021,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase I** PROJECT ID: **DT-SA-D1**

PROJECT INFORMATION

LOCATION: Richardson Blvd / Post Office
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 1600

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 150 LF of 3' x 7' RCBC along Richardson Blvd to the outfall in the open channel along Sutton Ave.
- Install 570 LF of twin 42-inch RCP north along Richardson Blvd to the post office.
- Install 190 LF of 42-inch pipe to the intersection with E State St.
- Install 70 LF of new 36-inch RCP adjacent to the post office to reroute flow to the right-of-way.
- Project allows for stormwater improvements upstream at Police Station.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	0
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**71**

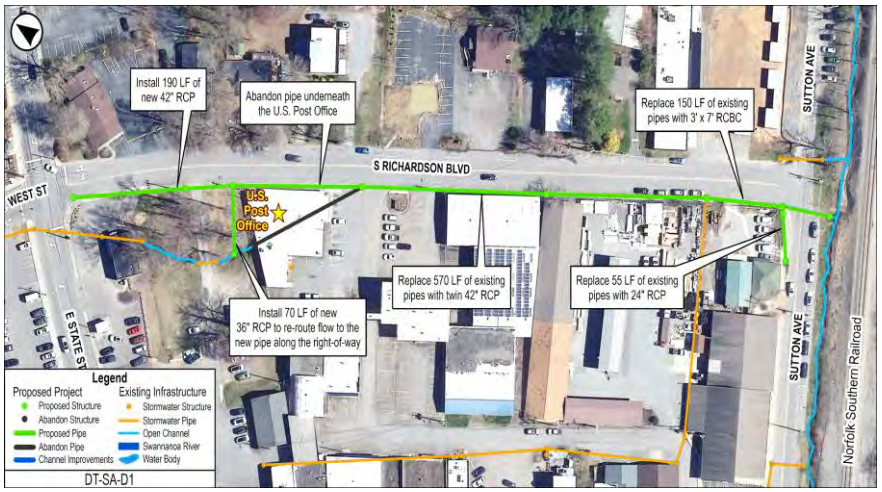
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Sutton Ave at Richardson	< 2-YR	50-YR	100
Post Office Infrastructure	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 2,913,000
Design and Permitting	$ 632,600
Other Project Costs	$ 757,400
Total Project	**$ 4,303,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase I** PROJECT ID: **DT-SA-D1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 1600
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 106,720.00	$ 106,700.00
Erosion Control	1	LS	$ 87,475.00	$ 87,500.00
Traffic Control	1	LS	$ 34,990.00	$ 35,000.00
Moderate Utility Conflict	1	LS	$ 262,425.00	$ 262,400.00
Unclassified Excavation/Hauling	2310	CY	$ 72.00	$ 166,300.00
Infrastructure Removal and Disposal	760	LF	$ 115.00	$ 87,400.00
Structure Removal and Disposal	6	EA	$ 6,800.00	$ 40,800.00
Standard Structure	3	EA	$ 8,600.00	$ 25,800.00
Large Structure or Headwall	8	EA	$ 12,000.00	$ 96,000.00
New Pipe: 18-inch to 24-inch	50	LF	$ 390.00	$ 19,500.00
New Pipe: 30-inch to 36-inch	70	LF	$ 535.00	$ 37,500.00
New Pipe: 42-inch to 54-inch	1330	LF	$ 670.00	$ 891,100.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	150	LF	$ 1,700.00	$ 255,000.00
Rip Rap	50	TN	$ 50.00	$ 2,500.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	610	SY	$ 110.00	$ 67,100.00
New Concrete Curb and Gutter	550	LF	$ 110.00	$ 60,500.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 672,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 2,913,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 145,700.00
Design and Permitting	20%	$ 582,600.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 29,100.00
Structural Evaluation	1%	$ 29,100.00
Real Estate	2%	$ 58,300.00
Utility Relocation	2%	$ 58,300.00
Project Maintenance (3yr)	5%	$ 145,700.00
Construction Inspections	10%	$ 291,300.00
Construction	100%	$ 2,913,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 4,303,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase II** PROJECT ID: **DT-SA-D2**

PROJECT INFORMATION

LOCATION: West St at E State St / Police Station
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 775

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 170 LF of new 42-inch RCP from Honeycutt St crossing E State St to tie-into proposed project DT-SA-D1.
- Install 55 LF of new 24-inch RCP and 200 LF of new 36-inch RCP in a new alignment along West St.
- Install new connecting pipes north of the police station to re-route flow to the right-of-way.
- Remove/abandon in place stormwater system running underneath police station to south of E State St.
- Install 235 LF of 24-inch RCP at the West/Midland intersection.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**87**

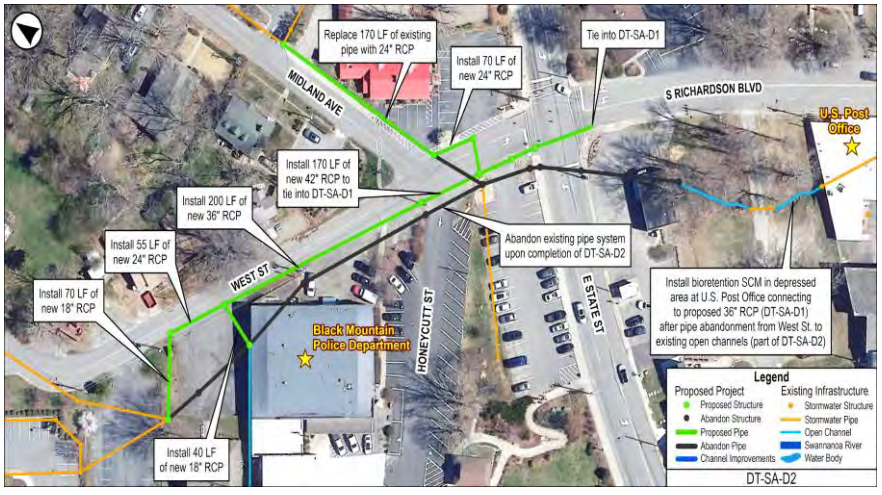
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
E State St/Richardson INT	< 2-YR	50-YR	100
West/Midland INT	< 2-YR	50-YR	100
Police Station Infrastructure	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,323,000
Design and Permitting	$ 264,600
Other Project Costs	$ 344,400
Total Project	**$ 1,932,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase II** PROJECT ID: **DT-SA-D2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 775
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 48,475.00	$ 48,500.00
Erosion Control	1	LS	$ 39,735.00	$ 39,700.00
Traffic Control	1	LS	$ 15,894.00	$ 15,900.00
Moderate Utility Conflict	1	LS	$ 119,205.00	$ 119,200.00
Unclassified Excavation/Hauling	940	CY	$ 72.00	$ 67,700.00
Infrastructure Removal and Disposal	710	LF	$ 115.00	$ 81,700.00
Structure Removal and Disposal	10	EA	$ 6,800.00	$ 68,000.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	4	EA	$ 12,000.00	$ 48,000.00
New Pipe: 18-inch to 24-inch	400	LF	$ 390.00	$ 156,000.00
New Pipe: 30-inch to 36-inch	200	LF	$ 535.00	$ 107,000.00
New Pipe: 42-inch to 54-inch	175	LF	$ 670.00	$ 117,300.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	370	SY	$ 110.00	$ 40,700.00
New Concrete Curb and Gutter	425	LF	$ 110.00	$ 46,800.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 305,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,323,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 66,200.00
Design and Permitting	20%	$ 264,600.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,200.00
Structural Evaluation	1%	$ 13,200.00
Real Estate	2%	$ 26,500.00
Utility Relocation	2%	$ 26,500.00
Project Maintenance (3yr)	5%	$ 66,200.00
Construction Inspections	10%	$ 132,300.00
Construction	100%	$ 1,323,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,932,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase III** PROJECT ID: **DT-SA-D3**

PROJECT INFORMATION

LOCATION: Montreat Rd and Honeycutt St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 575

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with paved over inlet across Montreat Rd at Fire Station with 35 LF of 24-inch RCP.
- Install 540 LF of new 24-inch RCP along Montreat Rd to Honeycutt St connecting to 42-inch RCP at West St.
- Remove existing pipe directing public water onto private property just north of the Fire Station.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	0
FINAL PROJECT SCORE:	**81**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd at Fire Station	< 2-YR	50-YR	100
Honeycutt St	NA	50-YR	New System

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 632,000
Design and Permitting	$ 126,400
Other Project Costs	$ 164,600
Total Project	**$ 923,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase III** PROJECT ID: **DT-SA-D3**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 575
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 23,135.00	$ 23,100.00
Erosion Control	1	LS	$ 18,960.00	$ 19,000.00
Traffic Control	1	LS	$ 7,584.00	$ 7,600.00
Moderate Utility Conflict	1	LS	$ 56,880.00	$ 56,900.00
Unclassified Excavation/Hauling	510	CY	$ 72.00	$ 36,700.00
Infrastructure Removal and Disposal	100	LF	$ 115.00	$ 11,500.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	4	EA	$ 8,600.00	$ 34,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	575	LF	$ 390.00	$ 224,300.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	310	SY	$ 110.00	$ 34,100.00
New Concrete Curb and Gutter	150	LF	$ 110.00	$ 16,500.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 146,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 632,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 31,600.00
Design and Permitting	20%	$ 126,400.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 6,300.00
Structural Evaluation	1%	$ 6,300.00
Real Estate	2%	$ 12,600.00
Utility Relocation	2%	$ 12,600.00
Project Maintenance (3yr)	5%	$ 31,600.00
Construction Inspections	10%	$ 63,200.00
Construction	100%	$ 632,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 923,000.00

PROJECT NAME: **West St to Montreat Rd Stormwater Improvements** PROJECT ID: **DT-SA-E1**

PROJECT INFORMATION

LOCATION: West St to Montreat Rd
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 760

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 735 LF of new 24-inch system along Montreat Rd and West St to connect to Proposed Project DT-SA-D2.
- This requires a permanent easement along the property line with the bank and church.
- Install 575 LF of new 24-inch system along Montreat Rd at Fire Station and Honeycutt Rd.
- Proposed project re-routes flow away from private property into the right-of-way.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**76**

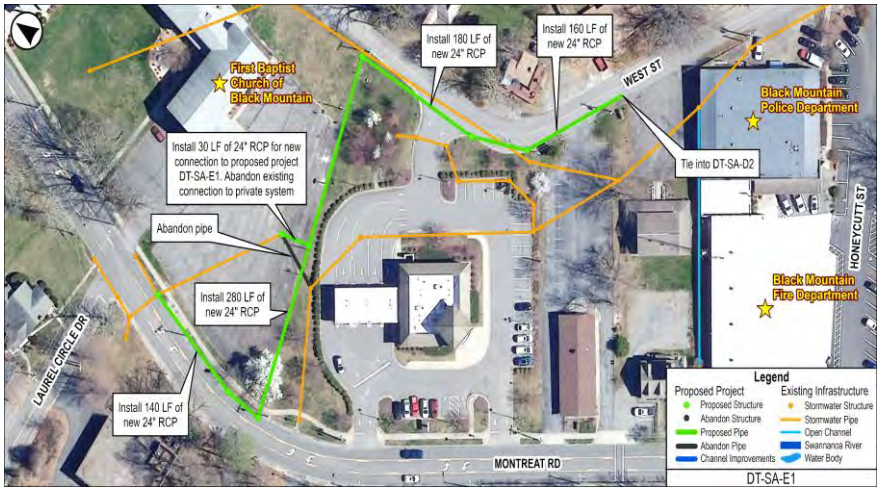
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd at the Church	NA	50-YR	New System
West St behind Bank	NA	50-YR	New System

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 841,000
Design and Permitting	$ 168,200
Other Project Costs	$ 218,800
Total Project	**$ 1,228,000**

PROJECT AREA MAP



PROJECT NAME **West St to Montreat Rd Stormwater Improvements** PROJECT ID: **DT-SA-E1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 760
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 30,820.00	$ 30,800.00
Erosion Control	1	LS	$ 25,260.00	$ 25,300.00
Traffic Control	1	LS	$ 10,104.00	$ 10,100.00
Moderate Utility Conflict	1	LS	$ 75,780.00	$ 75,800.00
Unclassified Excavation/Hauling	910	CY	$ 72.00	$ 65,500.00
Infrastructure Removal and Disposal	30	LF	$ 115.00	$ 3,500.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	8	EA	$ 8,600.00	$ 68,800.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	760	LF	$ 390.00	$ 296,400.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	210	SY	$ 110.00	$ 23,100.00
New Concrete Curb and Gutter	300	LF	$ 110.00	$ 33,000.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 194,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 841,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 42,100.00
Design and Permitting	20%	$ 168,200.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,400.00
Structural Evaluation	1%	$ 8,400.00
Real Estate	2%	$ 16,800.00
Utility Relocation	2%	$ 16,800.00
Project Maintenance (3yr)	5%	$ 42,100.00
Construction Inspections	10%	$ 84,100.00
Construction	100%	$ 841,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,228,000.00

PROJECT NAME: **Montreat Rd at Laurel Circle Dr Stormwater Improvements** PROJECT ID: **DT-SA-E2**

PROJECT INFORMATION

LOCATION:	Montreat Rd: E. Connally St to Laurel Circle Dr	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 260 LF of new 24-inch RCP along Montreat Rd from E. Connally St to Laurel Circle Dr.
- Replace 90 LF of existing pipe with 24-inch RCP across Laurel Circle Dr to tie-into proposed project DT-SA-E1.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	8
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**49**

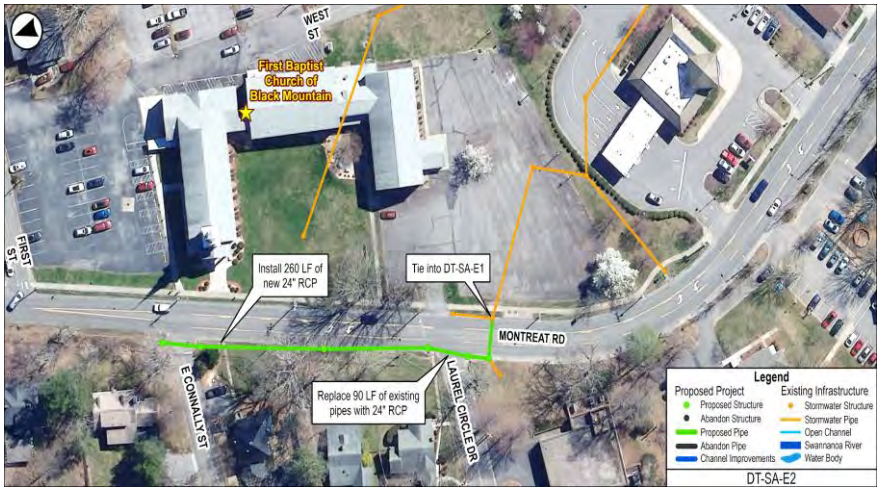
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Dr	< 2-YR	25-YR	45
E Connally St at Montreat Rd	NA	25-YR	New Crossing

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 546,000
Design and Permitting	$ 109,200
Other Project Costs	$ 141,800
Total Project	**$ 797,000**

PROJECT AREA MAP



PROJECT NAME **Montreat Rd at Laurel Circle Dr Stormwater Improvements** PROJECT ID: **DT-SA-E2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 350

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 19,975.00	$ 20,000.00
Erosion Control	1	LS	$ 14,580.00	$ 14,600.00
Traffic Control	1	LS	$ 5,832.00	$ 5,800.00
Major Utility Conflict	1	LS	$ 87,480.00	$ 87,500.00
Unclassified Excavation/Hauling	300	CY	$ 72.00	$ 21,600.00
Infrastructure Removal and Disposal	95	LF	$ 115.00	$ 10,900.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	350	LF	$ 390.00	$ 136,500.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	240	LF	$ 110.00	$ 26,400.00
Replace Driveway Culvert Pipe	30	LF	$ 300.00	$ 9,000.00
Replace Existing Concrete Driveway	15	SY	$ 120.00	$ 1,800.00
			Construction Contingency (30%):	$ 126,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 546,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 27,300.00
Design and Permitting	20%	$ 109,200.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,500.00
Structural Evaluation	1%	$ 5,500.00
Real Estate	2%	$ 10,900.00
Utility Relocation	2%	$ 10,900.00
Project Maintenance (3yr)	5%	$ 27,300.00
Construction Inspections	10%	$ 54,600.00
Construction	100%	$ 546,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 797,000.00

PROJECT NAME: **Midland Ave Stormwater Improvements** PROJECT ID: **DT-SA-F**

PROJECT INFORMATION

LOCATION: Midland Ave
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 675

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing culvert crossing at First St and Midland Ave with 30 LF of 24-inch RCP.
- Replace existing pipe and open channel system along Midland Ave with 24-inch RCP.
- Tie-into 24-inch RCP (part of proposed project DT-SA-D2) at Town Hall.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**82**

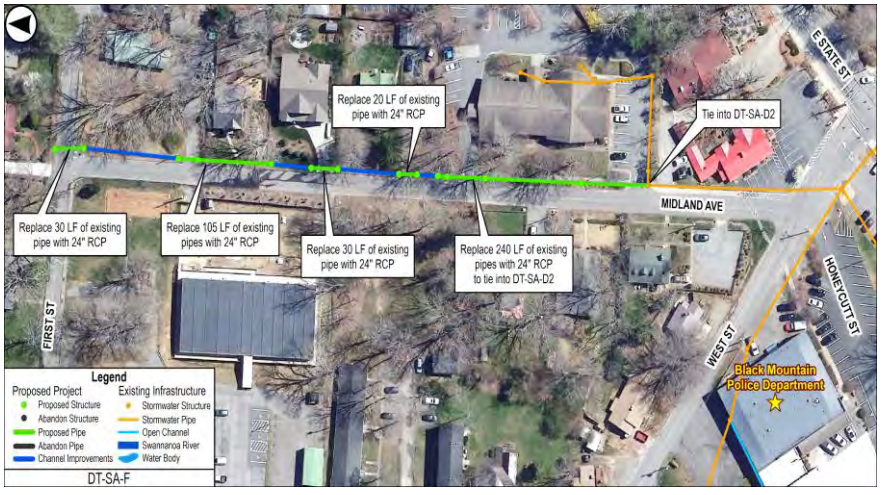
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
First St at Midland Ave	2-YR	50-YR	100
System at Town Hall	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 768,000
Design and Permitting	$ 153,600
Other Project Costs	$ 199,400
Total Project	**$ 1,121,000**

PROJECT AREA MAP



PROJECT NAME **Midland Ave Stormwater Improvements** PROJECT ID: **DT-SA-F**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 425

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 28,125.00	$ 28,100.00
Erosion Control	1	LS	$ 25,115.00	$ 25,100.00
Traffic Control	1	LS	$ 10,046.00	$ 10,000.00
Minor Utility Conflict	1	LS	$ 25,115.00	$ 25,100.00
Unclassified Excavation/Hauling	210	CY	$ 72.00	$ 15,100.00
Infrastructure Removal and Disposal	425	LF	$ 115.00	$ 48,900.00
Structure Removal and Disposal	5	EA	$ 6,800.00	$ 34,000.00
Standard Structure	13	EA	$ 8,600.00	$ 111,800.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	425	LF	$ 390.00	$ 165,800.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	250	LF	$ 350.00	$ 87,500.00
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	70	LF	$ 300.00	$ 21,000.00
Replace Existing Concrete Driveway	40	SY	$ 120.00	$ 4,800.00
			Construction Contingency (30%):	$ 177,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 768,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 38,400.00
Design and Permitting	20%	$ 153,600.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 7,700.00
Structural Evaluation	1%	$ 7,700.00
Real Estate	2%	$ 15,400.00
Utility Relocation	2%	$ 15,400.00
Project Maintenance (3yr)	5%	$ 38,400.00
Construction Inspections	10%	$ 76,800.00
Construction	100%	$ 768,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,121,000.00

PROJECT NAME: **S. Ridgeway Ave Stormwater Improvements** PROJECT ID: **DT-SA-G**

PROJECT INFORMATION

LOCATION:	Sutton Ave at S. Ridgway Ave	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	310

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 50 LF of 30-inch RCP across Sutton Ave on east side of Richardson Blvd.
- Install 80 LF of new 18-inch RCP and 100 LF of new 24-inch RCP along S. Ridgeway Ave.
- Replace existing pipe with 85 LF of 36-inch RCP to outfall at the open channel along Sutton Ave.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	0
FINAL PROJECT SCORE:	**76**

	LEVEL OF SERVICE		% REDUCTION
KEY CROSSING	EXISTING	PROPOSED	50 YR
Sutton Ave at Richardson	< 2-YR	50-YR	100
Sutton Ave at Ridgeway Ave	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 532,000
Design and Permitting	$ 156,400
Other Project Costs	$ 138,600
Total Project	**$ 827,000**

PROJECT AREA MAP



PROJECT NAME **S. Ridgeway Ave Stormwater Improvements** PROJECT ID: **DT-SA-G**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 310
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 19,475.00	$ 19,500.00
Erosion Control	1	LS	$ 14,215.00	$ 14,200.00
Traffic Control	1	LS	$ 5,686.00	$ 5,700.00
Major Utility Conflict	1	LS	$ 85,290.00	$ 85,300.00
Unclassified Excavation/Hauling	170	CY	$ 72.00	$ 12,200.00
Infrastructure Removal and Disposal	105	LF	$ 115.00	$ 12,100.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	175	LF	$ 390.00	$ 68,300.00
New Pipe: 30-inch to 36-inch	135	LF	$ 535.00	$ 72,200.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	75	LF	$ 110.00	$ 8,300.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 123,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 532,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 26,600.00
Design and Permitting	20%	$ 106,400.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,300.00
Structural Evaluation	1%	$ 5,300.00
Real Estate	2%	$ 10,600.00
Utility Relocation	2%	$ 10,600.00
Project Maintenance (3yr)	5%	$ 26,600.00
Construction Inspections	10%	$ 53,200.00
Construction	100%	$ 532,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 827,000.00

PROJECT NAME: **Black Mountain Ave Stormwater Improvements Phase I** PROJECT ID: **DT-BMA-A**

PROJECT INFORMATION

LOCATION: Vance Ave to the Swannanoa River
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 585

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 85 LF of 30" RCP across Vance St at Black Mountain Ave.
- Replace 175 LF of existing pipe with 30" RCP and 36" RCP at Vance Ave intersection and moving south.
- Install 370 LF of new 36" RCP just north of the Terry Estate Dr intersection to the outfall.
- Install 40 LF of new 24" RCP across Black Mountain Ave at Terry Estate Dr.
- Remove 195 LF of existing pipe from service at Terry Estate Dr/Black Mountain Ave intersection.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**82**

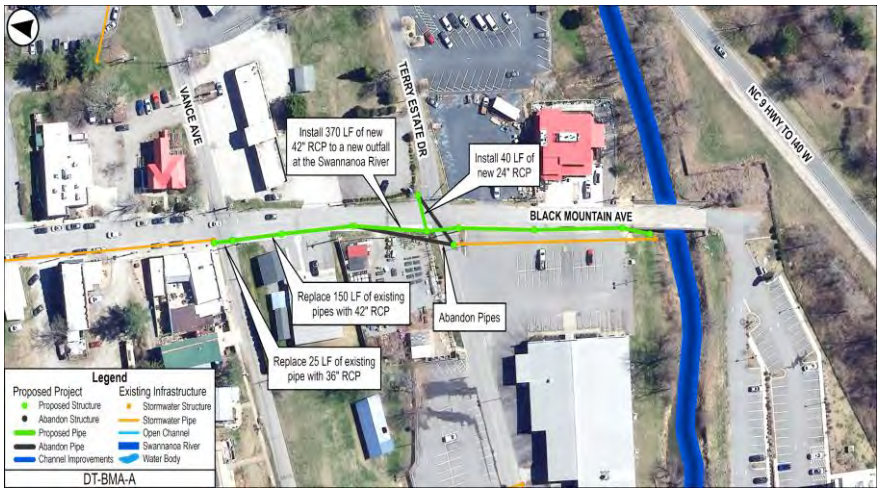
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate at Black Mtn Ave	< 2-YR	50-YR	100
Vance Ave at Black Mtn Ave	< 2-YR	25-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,253,000
Design and Permitting	$ 300,600
Other Project Costs	$ 326,400
Total Project	**$ 1,880,000**

PROJECT AREA MAP



PROJECT NAME **Black Mountain Ave Stormwater Improvements Phase I** PROJECT ID: **DT-BMA-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 585
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 45,910.00	$ 45,900.00
Erosion Control	1	LS	$ 37,630.00	$ 37,600.00
Traffic Control	1	LS	$ 15,052.00	$ 15,100.00
Moderate Utility Conflict	1	LS	$ 112,890.00	$ 112,900.00
Unclassified Excavation/Hauling	860	CY	$ 72.00	$ 61,900.00
Infrastructure Removal and Disposal	370	LF	$ 115.00	$ 42,600.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	3	EA	$ 8,600.00	$ 25,800.00
Large Structure or Headwall	8	EA	$ 12,000.00	$ 96,000.00
New Pipe: 18-inch to 24-inch	40	LF	$ 390.00	$ 15,600.00
New Pipe: 30-inch to 36-inch	25	LF	$ 535.00	$ 13,400.00
New Pipe: 42-inch to 54-inch	520	LF	$ 670.00	$ 348,400.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	560	SY	$ 110.00	$ 61,600.00
New Concrete Curb and Gutter	450	LF	$ 110.00	$ 49,500.00
Replace Driveway Culvert Pipe	25	LF	$ 300.00	$ 7,500.00
Replace Existing Concrete Driveway	15	SY	$ 120.00	$ 1,800.00
			Construction Contingency (30%):	$ 289,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,253,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 62,700.00
Design and Permitting	20%	$ 250,600.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 12,500.00
Structural Evaluation	1%	$ 12,500.00
Real Estate	2%	$ 25,100.00
Utility Relocation	2%	$ 25,100.00
Project Maintenance (3yr)	5%	$ 62,700.00
Construction Inspections	10%	$ 125,300.00
Construction	100%	$ 1,253,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,880,000.00

PROJECT NAME: **Black Mountain Ave Stormwater Improvements Phase II** PROJECT ID: **DT-BMA-B**

PROJECT INFORMATION

LOCATION:	S. Doughtery St to Vance Ave	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	585

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace nearly 400 LF of existing pipe along Black Mountain Ave from S. Doughtery St to Vance Ave.
- Install 160 LF of new 24" RCP at S. Doughtery St. to Black Mountain Ave.
- Replace existing culvert adjacent to the railroad tracks with 30 LF of 18" RCP.
- Install 50 LF of stormwater channel improvements as needed.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Black Mountain Ave at RR	< 2-YR	50-YR	100
S. Dougherty St Bend	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 862,000
Design and Permitting	$ 222,400
Other Project Costs	$ 223,600
Total Project	**$ 1,308,000**

PROJECT AREA MAP



PROJECT NAME **Black Mountain Ave Stormwater Improvements Phase II** PROJECT ID: **DT-BMA-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 585
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 31,570.00	$ 31,600.00
Erosion Control	1	LS	$ 28,185.00	$ 28,200.00
Traffic Control	1	LS	$ 11,274.00	$ 11,300.00
Minor Utility Conflict	1	LS	$ 28,185.00	$ 28,200.00
Unclassified Excavation/Hauling	550	CY	$ 72.00	$ 39,600.00
Infrastructure Removal and Disposal	500	LF	$ 115.00	$ 57,500.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	190	LF	$ 390.00	$ 74,100.00
New Pipe: 30-inch to 36-inch	395	LF	$ 535.00	$ 211,300.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	350	SY	$ 110.00	$ 38,500.00
New Concrete Curb and Gutter	400	LF	$ 110.00	$ 44,000.00
Replace Driveway Culvert Pipe	50	LF	$ 300.00	$ 15,000.00
Replace Existing Concrete Driveway	30	SY	$ 120.00	$ 3,600.00
			Construction Contingency (30%):	$ 199,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 862,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 43,100.00
Design and Permitting	20%	$ 172,400.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ 50,000.00
Geotechnical Investigation	1%	$ 8,600.00
Structural Evaluation	1%	$ 8,600.00
Real Estate	2%	$ 17,200.00
Utility Relocation	2%	$ 17,200.00
Project Maintenance (3yr)	5%	$ 43,100.00
Construction Inspections	10%	$ 86,200.00
Construction	100%	$ 862,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,308,000.00

PROJECT NAME: **Terry Estate Dr Stormwater Improvements Phase I** PROJECT ID: **DT-TE-A**

PROJECT INFORMATION

LOCATION: Terry Estate Drive
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 745

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipes across Terry Estate Dr in 5 locations with larger pipes.
- Replace the existing pipe on the south side of Terry Estate Dr with 55 LF of 30-inch and 400 LF of 36-inch RCP.
- Install a new 42-inch outfall pipe across the parking lot to the Swannanoa River.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	24
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	10
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**61**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate Dr at Bridge St	< 2-YR	50-YR	100
Terry Estate Dr	< 2-YR	25-YR	96

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,310,000
Design and Permitting	$ 312,000
Other Project Costs	$ 341,000
Total Project	**$ 1,963,000**

PROJECT AREA MAP



PROJECT NAME **Terry Estate Dr Stormwater Improvements Phase I** PROJECT ID: **DT-TE-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 745
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 48,010.00	$ 48,000.00
Erosion Control	1	LS	$ 35,045.00	$ 35,000.00
Traffic Control	1	LS	$ 14,018.00	$ 14,000.00
Major Utility Conflict	1	LS	$ 210,270.00	$ 210,300.00
Unclassified Excavation/Hauling	630	CY	$ 72.00	$ 45,400.00
Infrastructure Removal and Disposal	730	LF	$ 115.00	$ 84,000.00
Structure Removal and Disposal	7	EA	$ 6,800.00	$ 47,600.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	120	LF	$ 390.00	$ 46,800.00
New Pipe: 30-inch to 36-inch	485	LF	$ 535.00	$ 259,500.00
New Pipe: 42-inch to 54-inch	140	LF	$ 670.00	$ 93,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	410	SY	$ 110.00	$ 45,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 302,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,310,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 65,500.00
Design and Permitting	20%	$ 262,000.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,100.00
Structural Evaluation	1%	$ 13,100.00
Real Estate	2%	$ 26,200.00
Utility Relocation	2%	$ 26,200.00
Project Maintenance (3yr)	5%	$ 65,500.00
Construction Inspections	10%	$ 131,000.00
Construction	100%	$ 1,310,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,963,000.00

PROJECT NAME: **Terry Estate Dr Stormwater Improvements Phase II** PROJECT ID: **DT-TE-B**

PROJECT INFORMATION

LOCATION: Vance Ave at Bridge St and Spring St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 715

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe and stormwater roadside ditches along Bridge St with 260 LF of 24-inch RCP.
- Replace existing pipe crossing Spring St and Vance St with 70 LF of 24-inch RCP.
- Install 375 LF of new 24-inch RCP to re-route flow to Vance Ave and Black Mountain Ave rights-of-way.
- Remove/abandon in place stormwater pipe running south to Terry Estate Dr through private property.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**78**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Vance Ave at Bridge St	10-YR	50-YR	100
Vance Ave/Spring St INT	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 945,000
Design and Permitting	$ 189,000
Other Project Costs	$ 246,000
Total Project	**$ 1,380,000**

PROJECT AREA MAP



PROJECT NAME **Terry Estate Dr Stormwater Improvements Phase II** PROJECT ID: **DT-TE-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 715
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 34,625.00	$ 34,600.00
Erosion Control	1	LS	$ 28,380.00	$ 28,400.00
Traffic Control	1	LS	$ 11,352.00	$ 11,400.00
Moderate Utility Conflict	1	LS	$ 85,140.00	$ 85,100.00
Unclassified Excavation/Hauling	590	CY	$ 72.00	$ 42,500.00
Infrastructure Removal and Disposal	580	LF	$ 115.00	$ 66,700.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	265	LF	$ 390.00	$ 103,400.00
New Pipe: 30-inch to 36-inch	450	LF	$ 535.00	$ 240,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	180	SY	$ 110.00	$ 19,800.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 218,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 945,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 47,300.00
Design and Permitting	20%	$ 189,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 9,500.00
Structural Evaluation	1%	$ 9,500.00
Real Estate	2%	$ 18,900.00
Utility Relocation	2%	$ 18,900.00
Project Maintenance (3yr)	5%	$ 47,300.00
Construction Inspections	10%	$ 94,500.00
Construction	100%	$ 945,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,380,000.00

PROJECT NAME: **NC 9 Stormwater Improvements** PROJECT ID: **DT-NC9-A**

PROJECT INFORMATION

LOCATION: Vance Ave to outfall at Swannanoa River
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 595

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe along NC 9 with 280 LF of 36-inch RCP and tie-into culvert at Swannanaoa River.
- Replace existing pipe along Terry Estate Dr with 24-inch RCP and tie into proposed 36-inch pipe at NC 9.
- Install 130 LF of new 24-inch RCP to route flow along the Vance Ave right-of -way to tie into the NC 9 system.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**68**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate Dr west of NC9	< 2-YR	50-YR	100
Terry Estate Dr at NC9	25-YR	50-YR	100
Vance Ave at NC9	25-YR	50-YR	100
Vance Ave west of NC 9	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 880,000
Design and Permitting	$ 226,000
Other Project Costs	$ 229,000
Total Project	**$ 1,335,000**

PROJECT AREA MAP



PROJECT NAME **NC 9 Stormwater Improvements** PROJECT ID: **DT-NC9-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 595

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 32,250.00	$ 32,300.00
Erosion Control	1	LS	$ 26,435.00	$ 26,400.00
Traffic Control	1	LS	$ 10,574.00	$ 10,600.00
Moderate Utility Conflict	1	LS	$ 79,305.00	$ 79,300.00
Unclassified Excavation/Hauling	540	CY	$ 72.00	$ 38,900.00
Infrastructure Removal and Disposal	470	LF	$ 115.00	$ 54,100.00
Structure Removal and Disposal	7	EA	$ 6,800.00	$ 47,600.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	315	LF	$ 390.00	$ 122,900.00
New Pipe: 30-inch to 36-inch	280	LF	$ 535.00	$ 149,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	270	SY	$ 110.00	$ 29,700.00
New Concrete Curb and Gutter	220	LF	$ 110.00	$ 24,200.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 203,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 880,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 44,000.00
Design and Permitting	20%	$ 176,000.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,800.00
Structural Evaluation	1%	$ 8,800.00
Real Estate	2%	$ 17,600.00
Utility Relocation	2%	$ 17,600.00
Project Maintenance (3yr)	5%	$ 44,000.00
Construction Inspections	10%	$ 88,000.00
Construction	100%	$ 880,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,335,000.00



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Figure ES-6: Proposed Stormwater Improvement Projects
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

PROJECT NAME: **Laurel Circle Culvert Replacement (Tomahawk Branch)** PROJECT ID: **TB-A1**

PROJECT INFORMATION

LOCATION:	Laurel Circle Dr north of Lake Tomahawk	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	220

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing arch culverts with 40 LF of triple 5' x 9' RCBC.
- Install floodplain benching upstream/downstream of proposed culvert (documented separately).
- Tomahawk Lake analysis is required to determine any additional measures to improve the level of service.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	8
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	2
FINAL PROJECT SCORE:	**58**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Drive	< 2-YR	10-YR	0

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 455,000
Design and Permitting	$ 186,000
Other Project Costs	$ 119,000
Total Project	**$ 760,000**

PROJECT AREA MAP



PROJECT NAME **Laurel Circle Culvert Replacement (Tomahawk Branch)** PROJECT ID: **TB-A1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 120

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 16,650.00	$ 16,700.00
Erosion Control	1	LS	$ 14,865.00	$ 14,900.00
Traffic Control	1	LS	$ 5,946.00	$ 5,900.00
Minor Utility Conflict	1	LS	$ 14,865.00	$ 14,900.00
Unclassified Excavation/Hauling	190	CY	$ 72.00	$ 13,700.00
Infrastructure Removal and Disposal	120	LF	$ 115.00	$ 13,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	120	LF	$ 1,700.00	$ 204,000.00
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	100	LF	$ 350.00	$ 35,000.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 105,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 455,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 22,800.00
Design and Permitting	20%	$ 91,000.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 4,600.00
Structural Evaluation	1%	$ 4,600.00
Real Estate	2%	$ 9,100.00
Utility Relocation	2%	$ 9,100.00
Project Maintenance (3yr)	5%	$ 22,800.00
Construction Inspections	10%	$ 45,500.00
Construction	100%	$ 455,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 760,000.00

PROJECT NAME: **Tomahawk Branch Floodplain Benching at Golf Course** PROJECT ID: **TB-A2**

PROJECT INFORMATION

LOCATION:	Laurel Circle Dr north of Lake Tomahawk	STORMWATER PROJECT TYPE:	Floodplain Benching
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	500

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install approximately 500 LF of channel improvements with floodplain benching to lower WSELs.
- Floodplain benching improvements are located up and downstream of the proposed RCBC in project TB-A1.

PROJECT PRIORITIZATION AND PROPERTY REQUIREMENTS

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	8
Public or Privately-Owned Land	4
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**53**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Drive	< 2-YR	10-YR	0

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 406,000
Design and Permitting	$ 146,200
Other Project Costs	$ 137,800
Total Project	**$ 690,000**

PROJECT AREA MAP



PROJECT NAME: **Tomahawk Branch Floodplain Benching at Golf C** PROJECT ID: **TB-A2**

PROJECT TYPE: Floodplain Benching WATERSHED: Tomahawk Branch

PLANNING LEVEL COST ESTIMATE

- Construction estimate includes 30% contingency for planning.
- Proposed project footprints are based on GIS and modeling analyses.
- Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 15,660.00	$ 15,700.00
Erosion Control	1	LS	$ 13,980.00	$ 14,000.00
Traffic Control	1	LS	$ 5,592.00	$ 5,600.00
Minor Utility Conflict	1	LS	$ 13,980.00	$ 14,000.00
Clearing and Grubbing	1110	SY	$ 5.50	$ 6,100.00
Earthwork	370	CY	$ 90.00	$ 33,300.00
Fine Grading	1110	SY	$ 18.00	$ 20,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Infrastructure Removal and Disposal	-	LF	$ 115.00	-
Stone, Class B	125	TN	$ 92.00	$ 11,500.00
Filter Fabric/Geotextiles	2780	SY	$ 35.00	$ 97,300.00
Plantings	1110	SY	$ 7.00	$ 7,800.00
3-gallon Container Plants	135	EA	$ 70.00	$ 9,500.00
Riffle Grade Control	2	EA	$ 4,025.00	$ 8,100.00
Floodplain Tree Removal	1	LS	$ 15,000.00	$ 15,000.00
Log Grade Control Structure	-	EA	$ 4,000.00	-
Pump Around Operation	1	LS	$ 46,000.00	$ 46,000.00
Golf Course Bridge	1	LS	$ 25,000.00	$ 25,000.00
			Construction Contingency (30%):	$ 77,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 406,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 20,300.00
Design and Permitting	20%	$ 81,200.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 4,100.00
Structural Evaluation	1%	$ 4,100.00
Real Estate	10%	$ 40,600.00
Utility Relocation	2%	$ 8,100.00
Project Maintenance (3yr)	5%	$ 20,300.00
Construction Inspections	10%	$ 40,600.00
Construction	100%	$ 406,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 690,000.00

PROJECT NAME: **Swannanoa Ave Culvert Replacement and Stream Stabilization** PROJECT ID: **TB-B**

PROJECT INFORMATION

LOCATION:	Swannanoa Ave near Cragmont Rd	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	355

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing culvert with 30 LF of 48-inch RCP.
- Install approximately 200 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**77**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Swannanoa Ave	2-YR	25-YR	50

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 250,000
Design and Permitting	$ 115,000
Other Project Costs	$ 65,000
Total Project	**$ 430,000**

PROJECT AREA MAP



PROJECT NAME **Swannanoa Ave Culvert Replacement and Stream Stabilization** PROJECT ID: **TB-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 35
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 9,140.00	$ 9,100.00
Erosion Control	1	LS	$ 8,155.00	$ 8,200.00
Traffic Control	1	LS	$ 3,262.00	$ 3,300.00
Minor Utility Conflict	1	LS	$ 8,155.00	$ 8,200.00
Unclassified Excavation/Hauling	40	CY	$ 72.00	$ 2,900.00
Infrastructure Removal and Disposal	35	LF	$ 115.00	$ 4,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	35	LF	$ 670.00	$ 23,500.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	320	LF	$ 350.00	$ 112,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 58,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 250,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 12,500.00
Design and Permitting	20%	$ 50,000.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,500.00
Structural Evaluation	1%	$ 2,500.00
Real Estate	2%	$ 5,000.00
Utility Relocation	2%	$ 5,000.00
Project Maintenance (3yr)	5%	$ 12,500.00
Construction Inspections	10%	$ 25,000.00
Construction	100%	$ 250,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 430,000.00

PROJECT NAME: **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT INFORMATION

LOCATION: Padgettown Rd/US Hwy 70E Intersection
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 460

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 145 LF of twin 60-inch RCP by-pass system to depression area south of the gas station.
- Replace existing pipe across Padgettown Road at Old US 70E with twin 48" RCP.
- Excavate and enlarge existing open channel and outfall area downstream of gas station.
- Existing conditions severly limit options to provide desired LOS. An option is presented herein.
- Additional survey and engineering investigation required to determine constructability and achievable LOS.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	16
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**62**

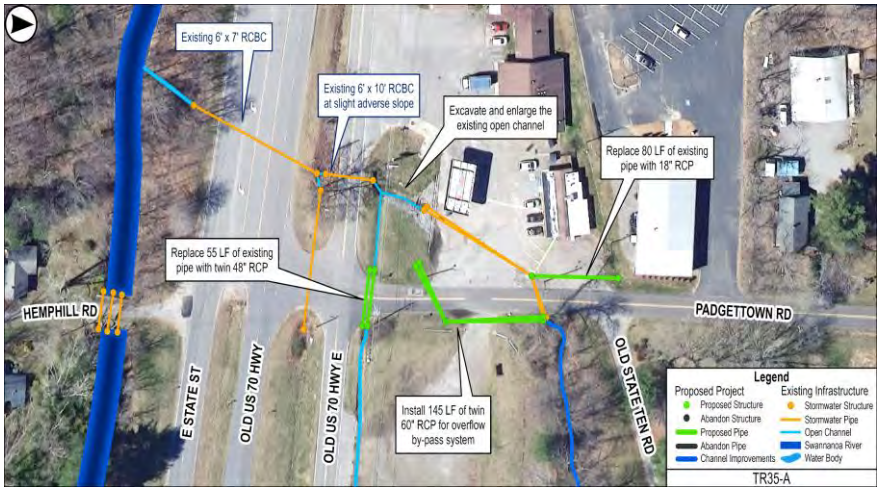
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown at Old US70E	2-YR	25-YR	80
Gas Station (Twin 36")	2-YR	10-YR	76
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Padgettown Rd (Twin 60")	NA	25-YR	New Crossing

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 909,000
Design and Permitting	$ 276,800
Other Project Costs	$ 236,200
Total Project	**$ 1,422,000**

PROJECT AREA MAP



PROJECT NAME **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 460

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 33,290.00	$ 33,300.00
Erosion Control	1	LS	$ 24,300.00	$ 24,300.00
Traffic Control	1	LS	$ 9,720.00	$ 9,700.00
Major Utility Conflict	1	LS	$ 145,800.00	$ 145,800.00
Unclassified Excavation/Hauling	770	CY	$ 72.00	$ 55,400.00
Infrastructure Removal and Disposal	125	LF	$ 115.00	$ 14,400.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	1	EA	$ 8,600.00	$ 8,600.00
Large Structure or Headwall	5	EA	$ 12,000.00	$ 60,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	90	LF	$ 670.00	$ 60,300.00
New Pipe: 60-inch	290	LF	$ 875.00	$ 253,800.00
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	100	SY	$ 110.00	$ 11,000.00
Earthwork	105	CY	$ 90.00	$ 9,500.00
Fine Grading	550	SY	$ 18.00	$ 9,900.00
Plantings	250	SY	$ 7.00	$ 1,800.00
			Construction Contingency (30%):	$ 210,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 909,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 45,500.00
Design and Permitting	20%	$ 181,800.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 9,100.00
Structural Evaluation	1%	$ 9,100.00
Real Estate	2%	$ 18,200.00
Utility Relocation	2%	$ 18,200.00
Project Maintenance (3yr)	5%	$ 45,500.00
Construction Inspections	10%	$ 90,900.00
Construction	100%	$ 909,000.00

PLANNING LEVEL OPINION OF TOTAL PROJECT COST: $ 1,422,000.00

PROJECT NAME: **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT INFORMATION

LOCATION: Old State 10 Rd Culvert Crossing
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 160

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 30 LF of twin 4'x6' RCBC under Old State 10 Rd.
- Install 100 LF of upstream channel improvements to accommodate flow into new RCBC.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**77**

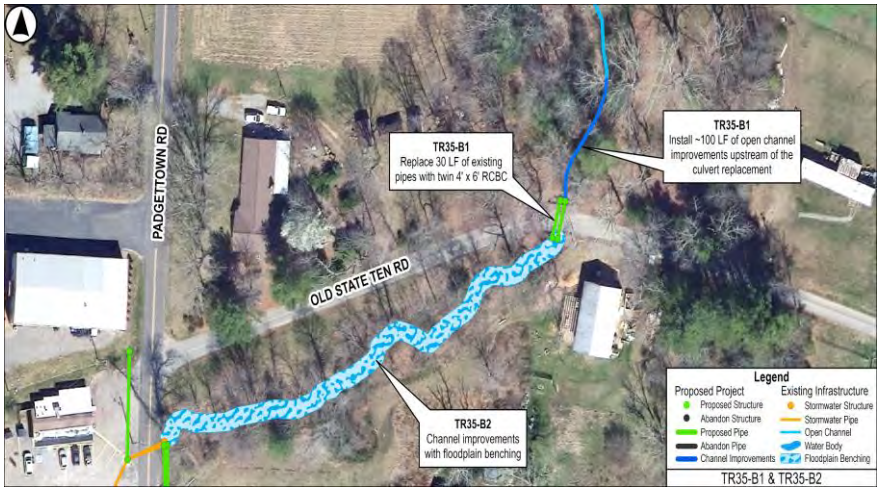
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 351,000
Design and Permitting	$ 165,200
Other Project Costs	$ 91,800
Total Project	**$ 608,000**

PROJECT AREA MAP



PROJECT NAME **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 60
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 12,860.00	$ 12,900.00
Erosion Control	1	LS	$ 9,385.00	$ 9,400.00
Traffic Control	1	LS	$ 3,754.00	$ 3,800.00
Major Utility Conflict	1	LS	$ 56,310.00	$ 56,300.00
Unclassified Excavation/Hauling	70	CY	$ 72.00	$ 5,000.00
Infrastructure Removal and Disposal	30	LF	$ 115.00	$ 3,500.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	60	LF	$ 1,700.00	$ 102,000.00
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	100	LF	$ 350.00	$ 35,000.00
Roadway/Sidewalk Replacement	30	SY	$ 110.00	$ 3,300.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 81,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 351,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 17,600.00
Design and Permitting	20%	$ 70,200.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,500.00
Structural Evaluation	1%	$ 3,500.00
Real Estate	2%	$ 7,000.00
Utility Relocation	2%	$ 7,000.00
Project Maintenance (3yr)	5%	$ 17,600.00
Construction Inspections	10%	$ 35,100.00
Construction	100%	$ 351,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 608,000.00

PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10 Rd** PROJECT ID: **TR35-B2**

PROJECT INFORMATION

LOCATION: Old State 10 Road near Padgettown Rd
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Floodplain Benching
DRAINAGE IMPROVEMENTS (LF): 350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install approximately 350 LF of channel improvements with floodplain benching to lower WSELs.
- Floodplain benching improvements are located downstream of the proposed RCBC in project TR35-B1.

PROJECT PRIORITIZATION AND PROPERTY REQUIREMENTS

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	16
Public or Privately-Owned Land	4
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**66**

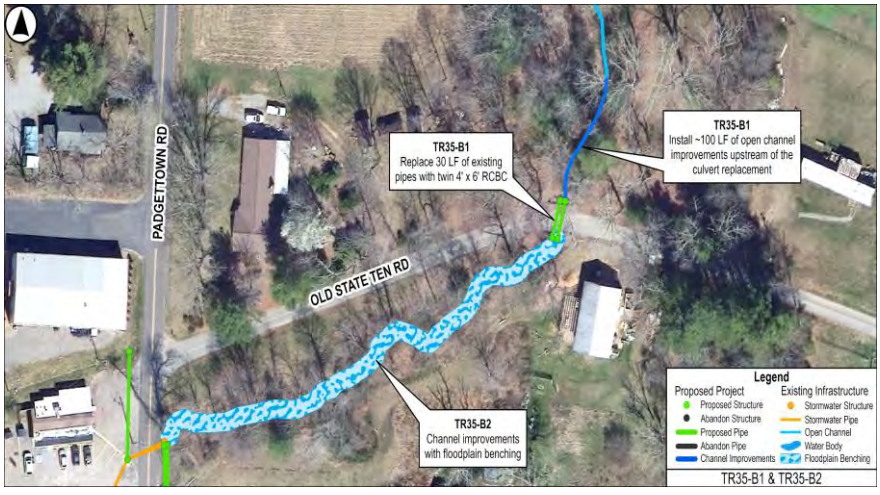
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 234,000
Design and Permitting	$ 111,800
Other Project Costs	$ 79,200
Total Project	**$ 425,000**

PROJECT AREA MAP



PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10** PROJECT ID: **TR35-B2**

PROJECT TYPE: Floodplain Benching WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

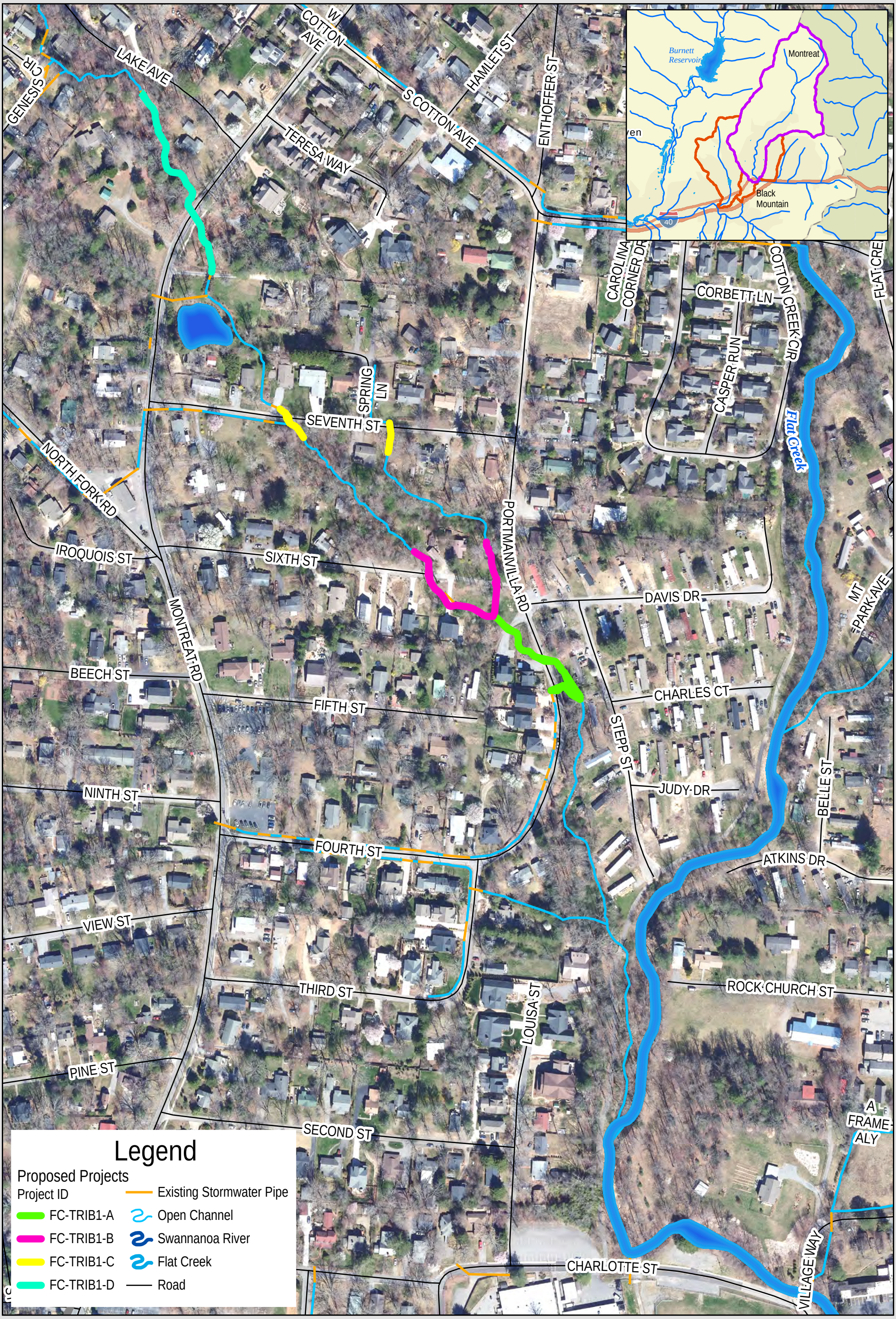
- Construction estimate includes 30% contingency for planning.
- Proposed project footprints are based on GIS and modeling analyses.
- Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 9,090.00	$ 9,100.00
Erosion Control	1	LS	$ 8,120.00	$ 8,100.00
Traffic Control	1	LS	$ 3,248.00	$ 3,200.00
Minor Utility Conflict	1	LS	$ 8,120.00	$ 8,100.00
Clearing and Grubbing	390	SY	$ 5.50	$ 2,100.00
Earthwork	0	CY	$ 90.00	$ -
Fine Grading	390	SY	$ 18.00	$ 7,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Infrastructure Removal and Disposal	-	LF	$ 115.00	-
Stone, Class B	75	TN	$ 92.00	$ 6,900.00
Filter Fabric/Geotextiles	1940	SY	$ 35.00	$ 67,900.00
Plantings	390	SY	$ 7.00	$ 2,700.00
3-gallon Container Plants	95	EA	$ 70.00	$ 6,700.00
Riffle Grade Control	2	EA	$ 4,025.00	$ 8,100.00
Floodplain Tree Removal	1	LS	$ 15,000.00	$ 15,000.00
Log Grade Control Structure	-	EA	$ 4,000.00	-
Pump Around Operation	1	LS	$ 46,000.00	$ 46,000.00
			Construction Contingency (30%):	$ 43,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 234,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,700.00
Design and Permitting	20%	$ 46,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,300.00
Structural Evaluation	1%	$ 2,300.00
Real Estate	10%	$ 23,400.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,700.00
Construction Inspections	10%	$ 23,400.00
Construction	100%	$ 234,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 425,000.00



WK DICKSON
AN ARDURRA COMPANY

Figure ES-7: Proposed Stormwater Improvement Projects
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

PROJECT NAME: **Portmanvilla Rd Stormwater Improvements** PROJECT ID: **FC-TRIB1-A**

PROJECT INFORMATION

LOCATION: Portmanvilla Rd near Davis Dr
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 540

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CMP with 35 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing 30-inch CMP with 45 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Replace existing upstream private pipe with 25 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Replace existing downstream private pipe with 40 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Install approximately 250 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**87**

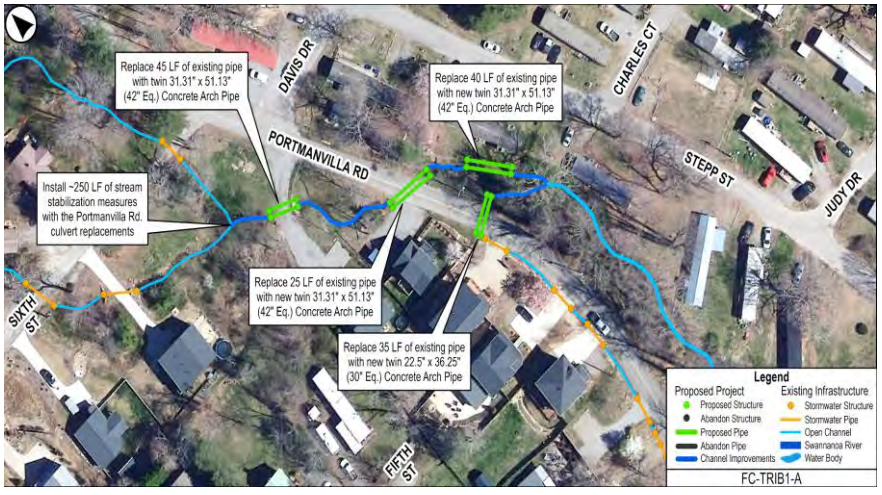
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Portmanvilla Rd (15" CMP)	< 2-YR	50-YR	100
Portmanvilla Rd (30" RCP)	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 572,000
Design and Permitting	$ 179,400
Other Project Costs	$ 148,600
Total Project	**$ 900,000**

PROJECT AREA MAP



PROJECT NAME **Portmanvilla Rd Stormwater Improvements** PROJECT ID: **FC-TRIB1-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 290
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 20,940.00	$ 20,900.00
Erosion Control	1	LS	$ 17,160.00	$ 17,200.00
Traffic Control	1	LS	$ 6,864.00	$ 6,900.00
Moderate Utility Conflict	1	LS	$ 51,480.00	$ 51,500.00
Unclassified Excavation/Hauling	270	CY	$ 72.00	$ 19,400.00
Infrastructure Removal and Disposal	140	LF	$ 115.00	$ 16,100.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	4	EA	$ 12,000.00	$ 48,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	290	LF	$ 500.00	$ 145,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	250	LF	$ 350.00	$ 87,500.00
Roadway/Sidewalk Replacement	60	SY	$ 110.00	$ 6,600.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 132,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 572,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 28,600.00
Design and Permitting	20%	$ 114,400.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,700.00
Structural Evaluation	1%	$ 5,700.00
Real Estate	2%	$ 11,400.00
Utility Relocation	2%	$ 11,400.00
Project Maintenance (3yr)	5%	$ 28,600.00
Construction Inspections	10%	$ 57,200.00
Construction	100%	$ 572,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 900,000.00

PROJECT NAME: **6th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-B**

PROJECT INFORMATION

LOCATION: 6th St near Portmanvilla Rd
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 500

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CMP with 20 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing 42-inch CMP with 30 LF of twin 26.625" x 43.75" (36" Eq) Concrete Arch Pipe.
- Install approximately 150 LF of stream stabilization measures upstream of the proposed culverts.
- Install approximately 250 LF of stream stabilization measures downstream of the proposed culverts.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**78**

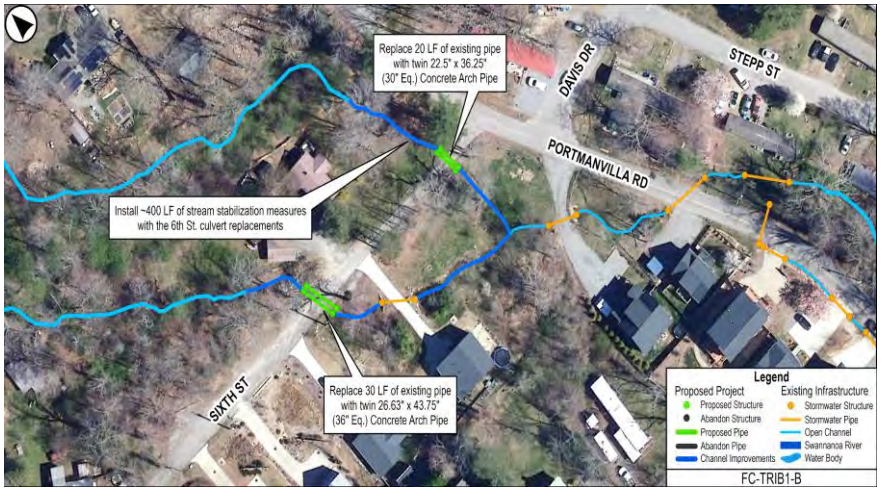
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
6th St at Portmanvilla Rd	< 2-YR	50-YR	100
6th Street	10-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 389,000
Design and Permitting	$ 142,800
Other Project Costs	$ 101,200
Total Project	**$ 633,000**

PROJECT AREA MAP



PROJECT NAME **6th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 100
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 14,250.00	$ 14,300.00
Erosion Control	1	LS	$ 12,725.00	$ 12,700.00
Traffic Control	1	LS	$ 5,090.00	$ 5,100.00
Minor Utility Conflict	1	LS	$ 12,725.00	$ 12,700.00
Unclassified Excavation/Hauling	70	CY	$ 72.00	$ 5,000.00
Infrastructure Removal and Disposal	50	LF	$ 115.00	$ 5,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	100	LF	$ 500.00	$ 50,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	400	LF	$ 350.00	$ 140,000.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 90,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 389,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 19,500.00
Design and Permitting	20%	$ 77,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,900.00
Structural Evaluation	1%	$ 3,900.00
Real Estate	2%	$ 7,800.00
Utility Relocation	2%	$ 7,800.00
Project Maintenance (3yr)	5%	$ 19,500.00
Construction Inspections	10%	$ 38,900.00
Construction	100%	$ 389,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 633,000.00

PROJECT NAME: **7th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-C**

PROJECT INFORMATION

LOCATION: 7th St near Portmanvilla Rd
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 210

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CPP with 25 LF of 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing triple 24-inch CMP with 25 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Install approximately 110 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**87**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
7th St at Portmanvilla Rd	< 2-YR	50-YR	100
7th Street	2-YR	25-YR	78

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 233,000
Design and Permitting	$ 111,600
Other Project Costs	$ 60,400
Total Project	**$ 405,000**

PROJECT AREA MAP



PROJECT NAME **7th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-C**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 100
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 8,525.00	$ 8,500.00
Erosion Control	1	LS	$ 7,615.00	$ 7,600.00
Traffic Control	1	LS	$ 3,046.00	$ 3,000.00
Minor Utility Conflict	1	LS	$ 7,615.00	$ 7,600.00
Unclassified Excavation/Hauling	60	CY	$ 72.00	$ 4,300.00
Infrastructure Removal and Disposal	100	LF	$ 115.00	$ 11,500.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	100	LF	$ 500.00	$ 50,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	110	LF	$ 350.00	$ 38,500.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 54,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 233,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,700.00
Design and Permitting	20%	$ 46,600.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,300.00
Structural Evaluation	1%	$ 2,300.00
Real Estate	2%	$ 4,700.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,700.00
Construction Inspections	10%	$ 23,300.00
Construction	100%	$ 233,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 405,000.00

PROJECT NAME: **Montreat Road Culvert Replacement (Flat Creek)** PROJECT ID: **FC-TRIB1-D**

PROJECT INFORMATION

LOCATION: Montreat Rd near Lake Ave
WATERSHED: Tomahawk Branch
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24-inch CMP with 50 LF of 42-inch RCP.
- Install approximately 200 LF of stream stabilization measures upstream.
- Install approximately 100 LF of stream stabilization measures downstream of the proposed culvert.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd near Lake Ave	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 329,000
Design and Permitting	$ 130,800
Other Project Costs	$ 86,200
Total Project	**$ 546,000**

PROJECT AREA MAP



PROJECT NAME **Montreat Road Culvert Replacement (Flat Creek)** PROJECT ID: **FC-TRIB1-D**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

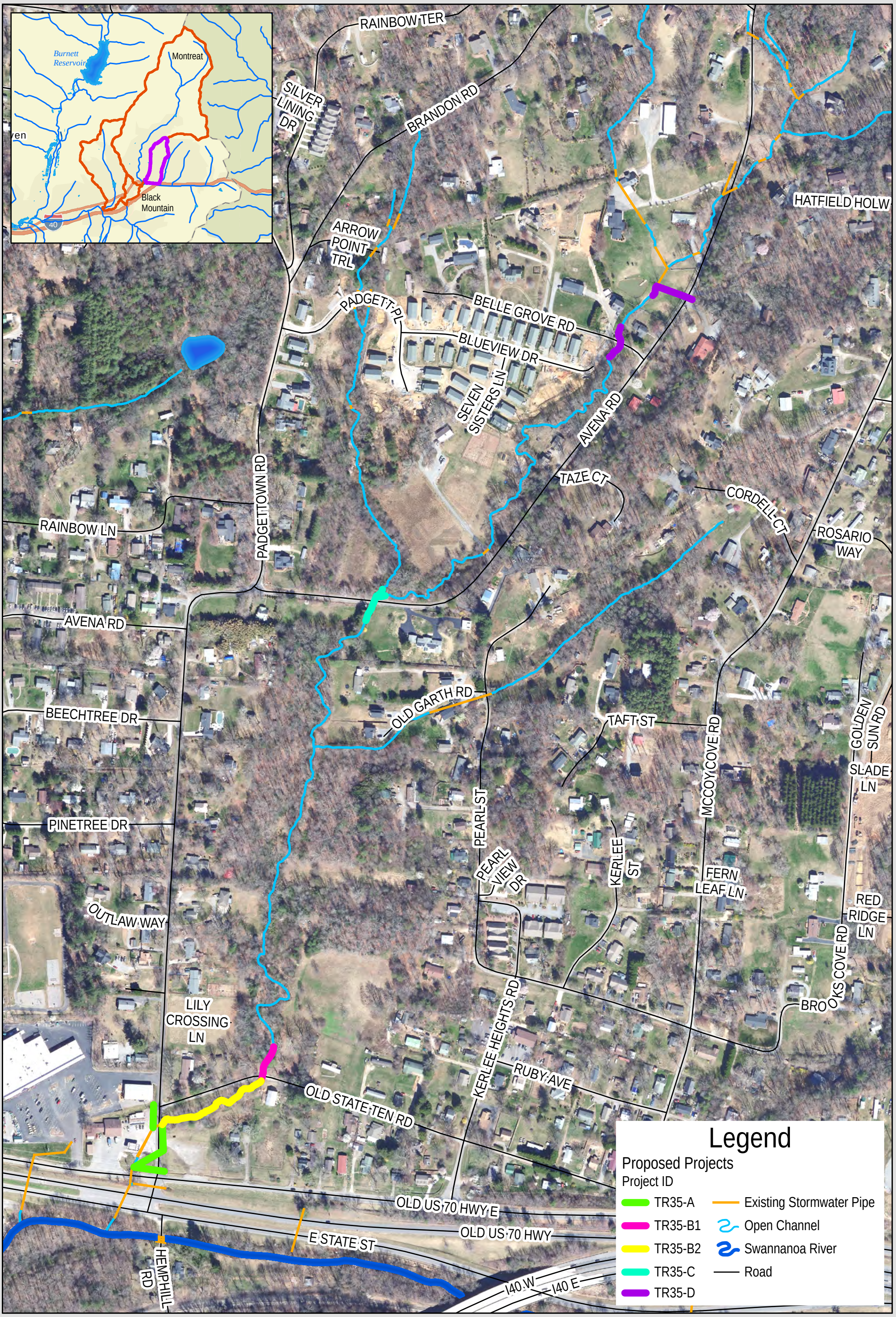
Construction cost includes 30% contingency for planning. Improvements (LF): 50
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 12,060.00	$ 12,100.00
Erosion Control	1	LS	$ 8,805.00	$ 8,800.00
Traffic Control	1	LS	$ 3,522.00	$ 3,500.00
Major Utility Conflict	1	LS	$ 52,830.00	$ 52,800.00
Unclassified Excavation/Hauling	60	CY	$ 72.00	$ 4,300.00
Infrastructure Removal and Disposal	50	LF	$ 115.00	$ 5,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	50	LF	$ 670.00	$ 33,500.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	300	LF	$ 350.00	$ 105,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 76,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 329,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 16,500.00
Design and Permitting	20%	$ 65,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,300.00
Structural Evaluation	1%	$ 3,300.00
Real Estate	2%	$ 6,600.00
Utility Relocation	2%	$ 6,600.00
Project Maintenance (3yr)	5%	$ 16,500.00
Construction Inspections	10%	$ 32,900.00
Construction	100%	$ 329,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 546,000.00



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AN ARDURRA COMPANY

Figure ES-8: Proposed Stormwater Improvement Projects
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300
Feet
1 in = 300 ft

PROJECT NAME: **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT INFORMATION

LOCATION: Padgettown Rd/US Hwy 70E Intersection
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 460

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 145 LF of twin 60-inch RCP by-pass system to depression area south of the gas station.
- Replace existing pipe across Padgettown Road at Old US 70E with twin 48" RCP.
- Excavate and enlarge existing open channel and outfall area downstream of gas station.
- Existing conditions severly limit options to provide desired LOS. An option is presented herein.
- Additional survey and engineering investigation required to determine constructability and achievable LOS.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	16
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**62**

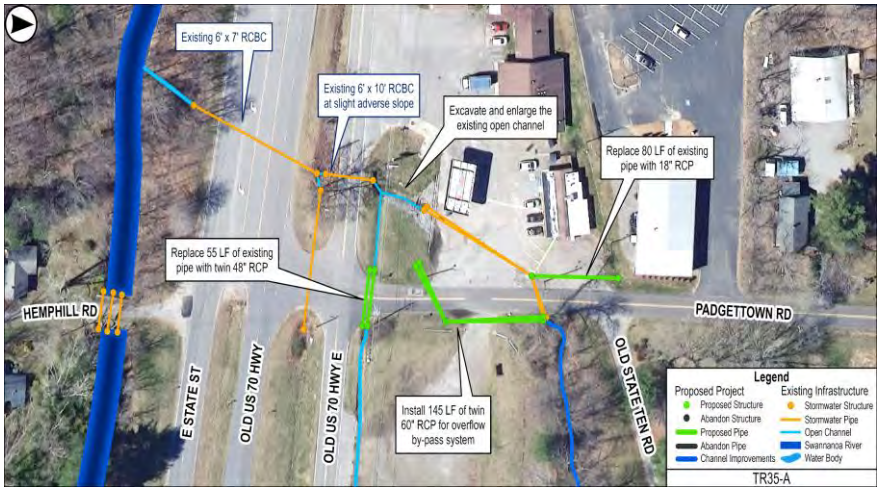
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown at Old US70E	2-YR	25-YR	80
Gas Station (Twin 36")	2-YR	10-YR	76
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Padgettown Rd (Twin 60")	NA	25-YR	New Crossing

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 909,000
Design and Permitting	$ 276,800
Other Project Costs	$ 236,200
Total Project	**$ 1,422,000**

PROJECT AREA MAP



PROJECT NAME **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 460

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 33,290.00	$ 33,300.00
Erosion Control	1	LS	$ 24,300.00	$ 24,300.00
Traffic Control	1	LS	$ 9,720.00	$ 9,700.00
Major Utility Conflict	1	LS	$ 145,800.00	$ 145,800.00
Unclassified Excavation/Hauling	770	CY	$ 72.00	$ 55,400.00
Infrastructure Removal and Disposal	125	LF	$ 115.00	$ 14,400.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	1	EA	$ 8,600.00	$ 8,600.00
Large Structure or Headwall	5	EA	$ 12,000.00	$ 60,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	90	LF	$ 670.00	$ 60,300.00
New Pipe: 60-inch	290	LF	$ 875.00	$ 253,800.00
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	100	SY	$ 110.00	$ 11,000.00
Earthwork	105	CY	$ 90.00	$ 9,500.00
Fine Grading	550	SY	$ 18.00	$ 9,900.00
Plantings	250	SY	$ 7.00	$ 1,800.00
			Construction Contingency (30%):	$ 210,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 909,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 45,500.00
Design and Permitting	20%	$ 181,800.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 9,100.00
Structural Evaluation	1%	$ 9,100.00
Real Estate	2%	$ 18,200.00
Utility Relocation	2%	$ 18,200.00
Project Maintenance (3yr)	5%	$ 45,500.00
Construction Inspections	10%	$ 90,900.00
Construction	100%	$ 909,000.00

PLANNING LEVEL OPINION OF TOTAL PROJECT COST: $ 1,422,000.00

PROJECT NAME: **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT INFORMATION

LOCATION: Old State 10 Rd Culvert Crossing
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 160

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 30 LF of twin 4'x6' RCBC under Old State 10 Rd.
- Install 100 LF of upstream channel improvements to accommodate flow into new RCBC.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**77**

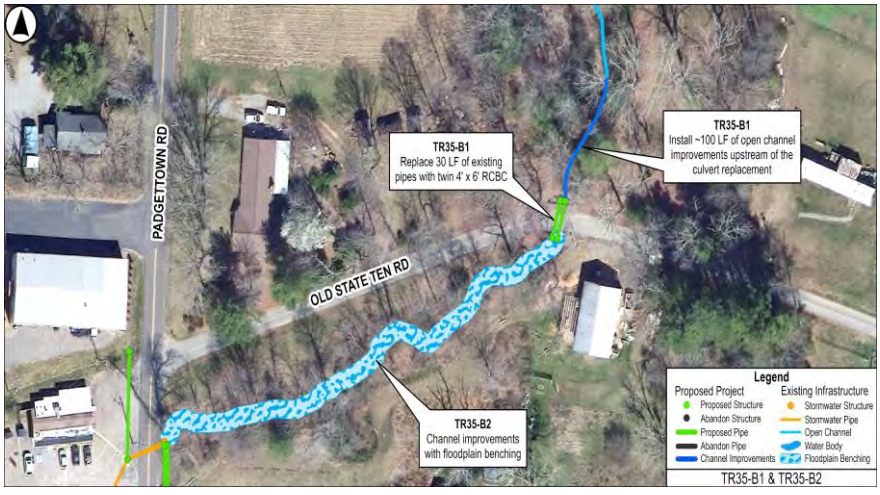
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 351,000
Design and Permitting	$ 165,200
Other Project Costs	$ 91,800
Total Project	**$ 608,000**

PROJECT AREA MAP



PROJECT NAME **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 60
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 12,860.00	$ 12,900.00
Erosion Control	1	LS	$ 9,385.00	$ 9,400.00
Traffic Control	1	LS	$ 3,754.00	$ 3,800.00
Major Utility Conflict	1	LS	$ 56,310.00	$ 56,300.00
Unclassified Excavation/Hauling	70	CY	$ 72.00	$ 5,000.00
Infrastructure Removal and Disposal	30	LF	$ 115.00	$ 3,500.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	60	LF	$ 1,700.00	$ 102,000.00
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	100	LF	$ 350.00	$ 35,000.00
Roadway/Sidewalk Replacement	30	SY	$ 110.00	$ 3,300.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 81,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 351,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 17,600.00
Design and Permitting	20%	$ 70,200.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,500.00
Structural Evaluation	1%	$ 3,500.00
Real Estate	2%	$ 7,000.00
Utility Relocation	2%	$ 7,000.00
Project Maintenance (3yr)	5%	$ 17,600.00
Construction Inspections	10%	$ 35,100.00
Construction	100%	$ 351,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 608,000.00

PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10 Rd** PROJECT ID: **TR35-B2**

PROJECT INFORMATION

LOCATION: Old State 10 Road near Padgettown Rd
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Floodplain Benching
DRAINAGE IMPROVEMENTS (LF): 350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install approximately 350 LF of channel improvements with floodplain benching to lower WSELs.
- Floodplain benching improvements are located downstream of the proposed RCBC in project TR35-B1.

PROJECT PRIORITIZATION AND PROPERTY REQUIREMENTS

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	16
Public or Privately-Owned Land	4
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**66**

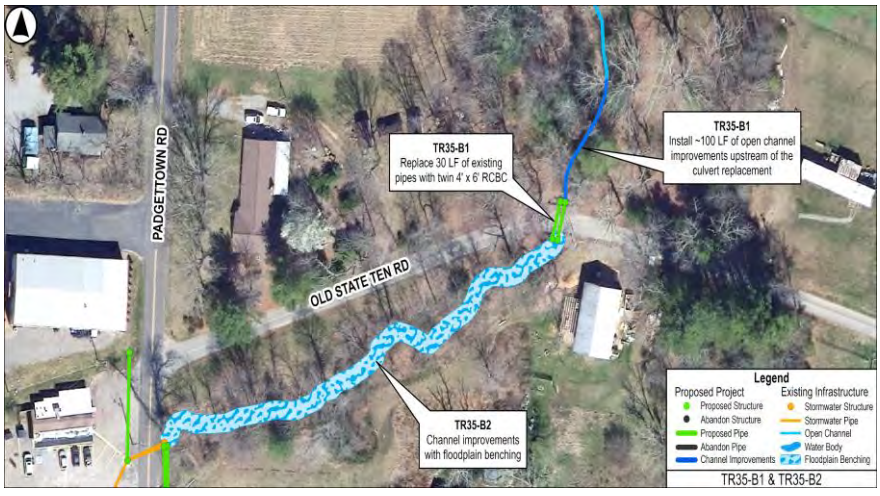
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 234,000
Design and Permitting	$ 111,800
Other Project Costs	$ 79,200
Total Project	**$ 425,000**

PROJECT AREA MAP



PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10** PROJECT ID: **TR35-B2**

PROJECT TYPE: Floodplain Benching WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

- Construction estimate includes 30% contingency for planning.
- Proposed project footprints are based on GIS and modeling analyses.
- Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 9,090.00	$ 9,100.00
Erosion Control	1	LS	$ 8,120.00	$ 8,100.00
Traffic Control	1	LS	$ 3,248.00	$ 3,200.00
Minor Utility Conflict	1	LS	$ 8,120.00	$ 8,100.00
Clearing and Grubbing	390	SY	$ 5.50	$ 2,100.00
Earthwork	0	CY	$ 90.00	$ -
Fine Grading	390	SY	$ 18.00	$ 7,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Infrastructure Removal and Disposal	-	LF	$ 115.00	-
Stone, Class B	75	TN	$ 92.00	$ 6,900.00
Filter Fabric/Geotextiles	1940	SY	$ 35.00	$ 67,900.00
Plantings	390	SY	$ 7.00	$ 2,700.00
3-gallon Container Plants	95	EA	$ 70.00	$ 6,700.00
Riffle Grade Control	2	EA	$ 4,025.00	$ 8,100.00
Floodplain Tree Removal	1	LS	$ 15,000.00	$ 15,000.00
Log Grade Control Structure	-	EA	$ 4,000.00	-
Pump Around Operation	1	LS	$ 46,000.00	$ 46,000.00
			Construction Contingency (30%):	$ 43,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 234,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,700.00
Design and Permitting	20%	$ 46,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,300.00
Structural Evaluation	1%	$ 2,300.00
Real Estate	10%	$ 23,400.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,700.00
Construction Inspections	10%	$ 23,400.00
Construction	100%	$ 234,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 425,000.00

PROJECT NAME: **Avena Road Culvert Replacement and Stream Stabilizaton** PROJECT ID: **TR35-C**

PROJECT INFORMATION

LOCATION:	Avena Road near Padgettown Rd	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tributary 35	DRAINAGE IMPROVEMENTS (LF):	230

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 40 LF of twin 48" RCP across Avena Rd.
- Install approximately 120 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**85**

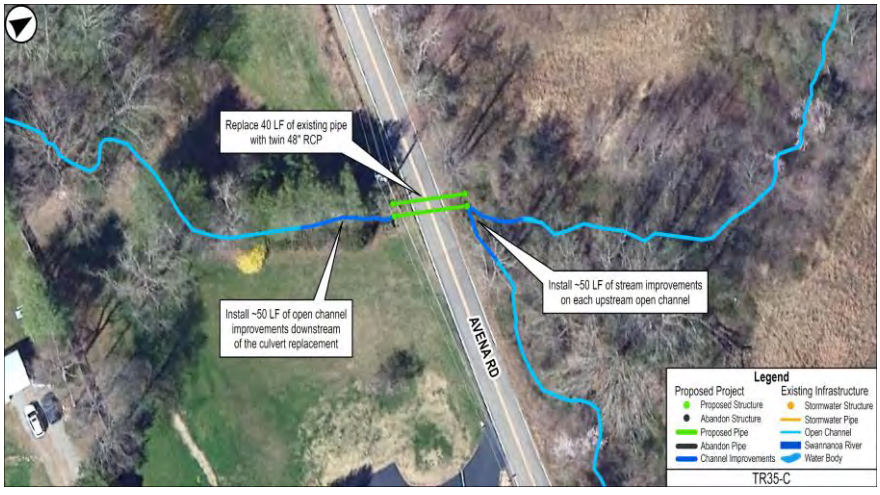
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Avena Road	2-YR	25-YR	97

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 235,000
Design and Permitting	$ 142,000
Other Project Costs	$ 61,000
Total Project	**$ 438,000**

PROJECT AREA MAP



PROJECT NAME **Avena Road Culvert Replacement and Stream Stabilizaton** PROJECT ID: **TR35-C**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 80
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 8,605.00	$ 8,600.00
Erosion Control	1	LS	$ 7,680.00	$ 7,700.00
Traffic Control	1	LS	$ 3,072.00	$ 3,100.00
Minor Utility Conflict	1	LS	$ 7,680.00	$ 7,700.00
Unclassified Excavation/Hauling	120	CY	$ 72.00	$ 8,600.00
Infrastructure Removal and Disposal	40	LF	$ 115.00	$ 4,600.00
Structure Removal and Disposal	1	EA	$ 6,800.00	$ 6,800.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	80	LF	$ 670.00	$ 53,600.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	150	LF	$ 350.00	$ 52,500.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 54,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 235,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,800.00
Design and Permitting	20%	$ 47,000.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,400.00
Structural Evaluation	1%	$ 2,400.00
Real Estate	2%	$ 4,700.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,800.00
Construction Inspections	10%	$ 23,500.00
Construction	100%	$ 235,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 438,000.00

PROJECT NAME: **Bellgrove Road/Avena Road Stormwater Improvements** PROJECT ID: **TR35-D**

PROJECT INFORMATION

LOCATION: Bellegrove Rd and Avena Rd Culvert Crossings
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 475

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 20 LF of twin 48" RCP under Bellegrove Rd.
- Install approximately 140 LF of stream stabilization measures with the Bellgrove culvert.
- Replace existing pipe with 135 LF of 30" RCP under Avena Rd.
- Install 35 LF of channel improvements downstream of 30" RCP.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**83**

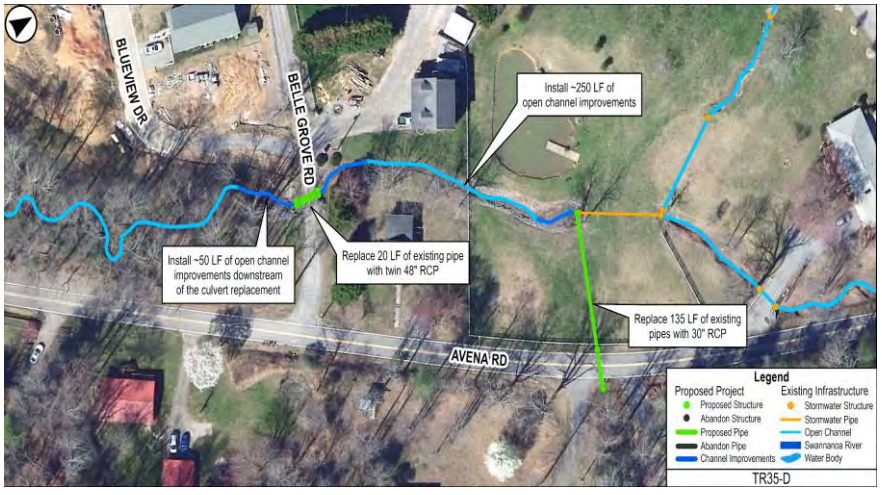
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Bellegrove Road	2-YR	50-YR	100
Avena Road	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 499,000
Design and Permitting	$ 194,800
Other Project Costs	$ 130,200
Total Project	**$ 824,000**

PROJECT AREA MAP



PROJECT NAME **Bellgrove Road/Avena Road Stormwater Improvements** PROJECT ID: **TR35-D**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 175
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 18,295.00	$ 18,300.00
Erosion Control	1	LS	$ 14,995.00	$ 15,000.00
Traffic Control	1	LS	$ 5,998.00	$ 6,000.00
Moderate Utility Conflict	1	LS	$ 44,985.00	$ 45,000.00
Unclassified Excavation/Hauling	180	CY	$ 72.00	$ 13,000.00
Infrastructure Removal and Disposal	155	LF	$ 115.00	$ 17,800.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	135	LF	$ 535.00	$ 72,200.00
New Pipe: 42-inch to 54-inch	40	LF	$ 670.00	$ 26,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	300	LF	$ 350.00	$ 105,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 115,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 499,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 25,000.00
Design and Permitting	20%	$ 99,800.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,000.00
Structural Evaluation	1%	$ 5,000.00
Real Estate	2%	$ 10,000.00
Utility Relocation	2%	$ 10,000.00
Project Maintenance (3yr)	5%	$ 25,000.00
Construction Inspections	10%	$ 49,900.00
Construction	100%	$ 499,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 824,000.00

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TOWN OF BLACK MOUNTAIN

BLACK MOUNTAIN STORMWATER MASTER PLAN

Draft Report | December 2025









DRAFT

TOWN OF BLACK MOUNTAIN

STORMWATER MASTER PLAN

WK Dickson/Ardurra Project No. 20230691.00.GV

December 2025

Prepared for:
Town of Black Mountain
160 Midland Avenue
Black Mountain, North Carolina 28711

Prepared by:
WK Dickson LLC dba Ardurra Group North Carolina
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919-782-0495
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1. INTRODUCTION

The Town of Black Mountain (Town) Stormwater Master Plan (SWMP) is funded by a Local Assistance for Stormwater Infrastructure Investments (LASII) from the American Rescue Plan Act (ARPA). The purpose of the SWMP is to develop a GIS map of the Town's stormwater system, identify flooding issues, assess the existing conveyance system capacity and infrastructure condition, develop and prioritize flood reduction projects, and establish an implementation strategy for the recommended capital infrastructure projects.

The Study Area for the SWMP includes the following:

- Secondary stormwater conveyance system in the Downtown corridor,
- Tomahawk Branch watershed, both the primary system culvert crossings and the secondary stormwater conveyance system located in the surrounding residential areas of Lake Tomahawk,
- Flat Creek Tributary 1 primary system culvert crossings in the vicinity of Portmanvilla, Sixth, and Seventh Street roads, and
- Tributary 35 (of the Swannanoa River) primary system culvert crossings in the vicinity of Avena and Padgettown roads.

The watersheds within the Town are all tributary to the Swannanoa River. In some cases, the closed system stormwater outfalls are located very closely to or directly into the Swannanoa River. As shown in Exhibit 1, the main outfall for the downtown commercial area from Broadway Street and westward is a corrugated plastic 18-inch pipe outfall to an open channel. This open channel runs parallel to Sutton Avenue from Broadway Street down to its confluence with the Swannanoa River, collecting runoff from the downtown corridor north of the railroad via four additional outfalls.



Exhibit 1
18-inch CPP outlet to Sutton Ave Open Channel

Based on historical records obtained from the National Oceanic and Atmospheric Administration (NOAA) online national climate data service[1], Hurricane Helene brought over 14 inches of rainfall in a span of three days to the mountains in September 2024, resulting in catastrophic flooding along the Swannanoa River corridor. Many roadways and bridges within the Town of Black Mountain were impacted. As a result, the Town desired to develop projects that would meet the 50-year level of service where feasible. All proposed projects were evaluated and developed with this goal. However, there are a few areas where downstream hydraulic conditions and/or available cover prevent this level of flood reduction.

The Study Area for the Town's SWMP is shown in Figure 1-1.

Burnett Reservoir

N FORK RD

Tomahawk Branch

RHODODENDRON AVE

MONTREAT RD

FLAT CREEK RD

Flat Creek

PADGETTOWN RD

Tributary 35

AVENA RD

E STATE ST

E STATE ST

E OLD US 70 HWY

OLD US 70 HWY E

I40 W

I40 E

US 70 HWY

NC 9 HWY

'RZQWRZQ
:DWHUVKHG

Legend

2 6WRUPZDWHU 6WUXFW

6WRUPZDWHU 3LSH

6ZDQQDQRD 5LYHU

3ULPDU\ 6\VWHP 2SH

6HFRQGDU\ 6\VWHP 2

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2. EXISTING WATERSHED CONDITIONS

2.1. Existing Conditions Survey and Field Data Collection

Stormwater utility infrastructure throughout the Town was collected by Kee Mapping and Survey (Kee) personnel to compile a GIS stormwater inventory database for the Town. This was accomplished by using survey-grade Global Positioning Systems (GPS) as the primary means of data capture to locate the x, y, and z coordinates of each visible stormwater system structure. Conventional surveying techniques were used to obtain attributes, including but not limited to size, material, slope, and length. All coordinate system data were collected using horizontal datum NAD 1983 and vertical datum NAVD 1988. A total of 1195 closed system structures were surveyed and/or inventoried. Figure 2-1 shows the Town's surveyed and inventoried stormwater system. A summary of closed system structures is noted in Table 2.1.

TABLE 2.1: INVENTORY SUMMARY – CLOSED SYSTEM STRUCTURES

STRUCTURE TYPE	NUMBER SURVEYED
Culvert Pipe Ends	505
Closed System Pipe Ends	126
Inlets	247
Junction Boxes	52
Manholes	14
Unknown Structures	251

As noted in Table 2.1, there are a significant number of unknown structures. These were included when field crews found different pipe sizes and/or materials between surveyed stormwater structures. CCTV will be required to obtain additional information on stormwater systems with unknown structures prior to any project design and construction.

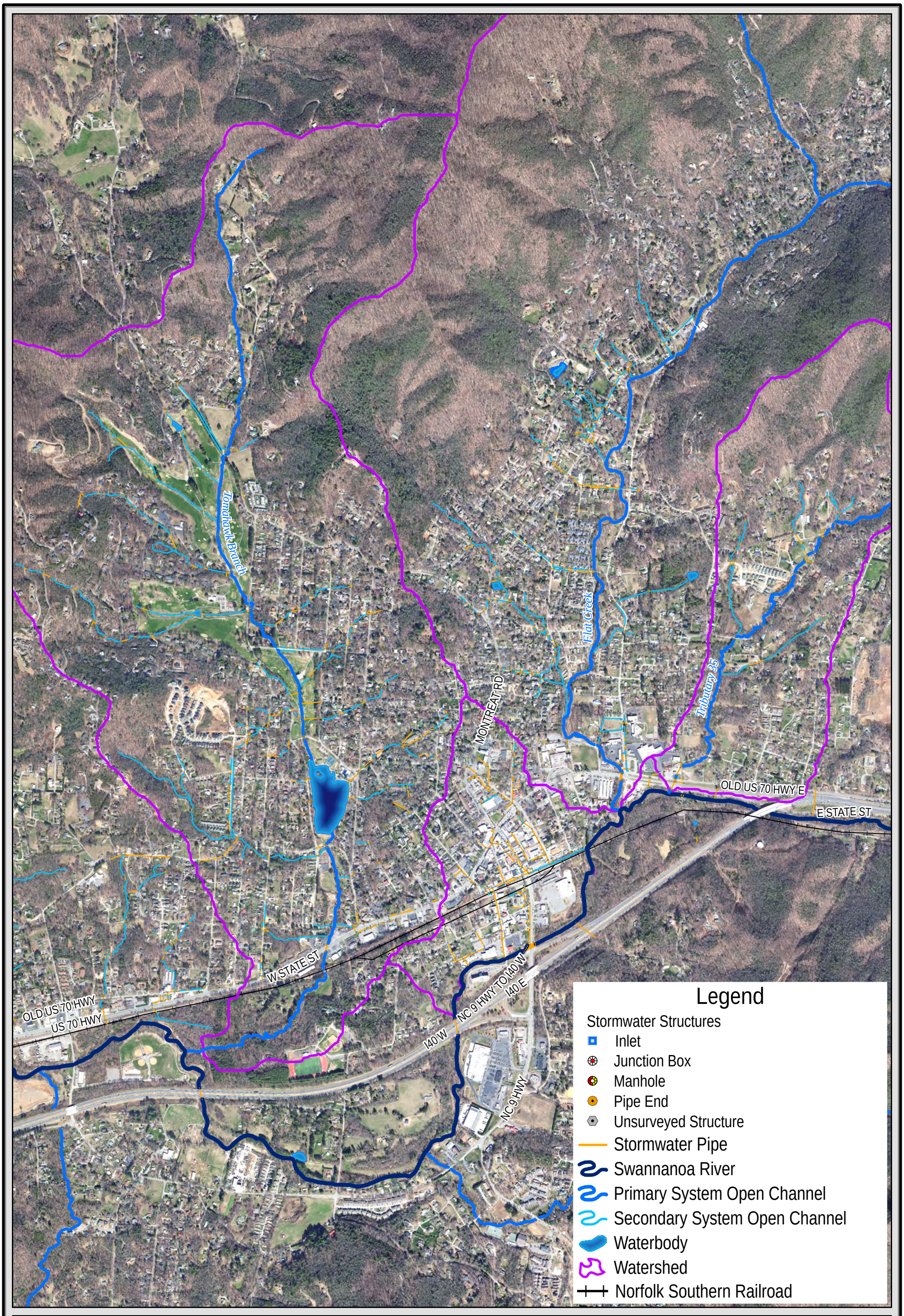
Additionally, numerous structures were found to be obstructed with sediment and/or debris during the field data collection. These are identified in the stormwater inventory GIS geodatabase provided to the Town and are also shown in Figure 2-2. Obstructed structures by watershed are provided in Appendix A.

Over 46,500 linear feet of pipe were also collected as part of the Town's infrastructure inventory. Unknown pipe sizes were documented because of difficult access or obstructed structures. A summary of the Town's infrastructure is noted in Table 2.2 and shown in Figure 2-1.

TABLE 2.2: INVENTORY SUMMARY – PIPES

PIPE DIAMETER	% OF INVENTORY
<= 15-inch	28%
18- to 24-inch	30%
30- to 36-inch	10%
42- to 90-inch	3%
Pipe Size Unknown	29%

An additional 108,000 linear feet of open channel are included in the Town inventory as identified by the survey or in GIS for connectivity.

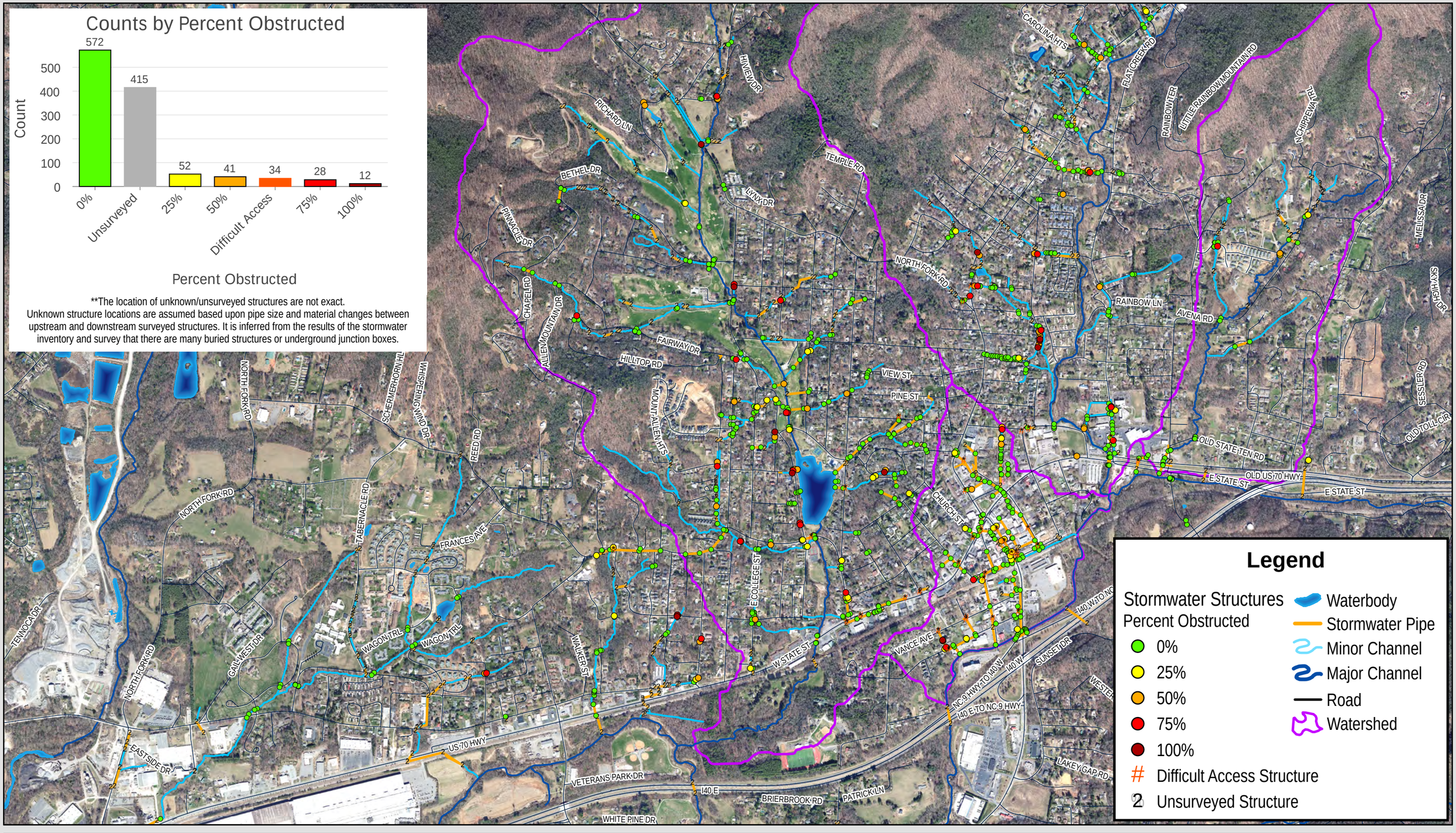


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Figure 2-1: Stormwater Inventory
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 600 1,200
Feet
1 in = 1,200 ft

N
W E
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Figure 2-2: Obstructed & Difficult Access Stormwater Structures
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 1,250 2,500 Feet

1 in = 1,250 ft

2.2. Hydrology and Flood Zones

The Town is generally located north of I-40 and the Swannanoa River. The Town primarily encompasses three tributaries to the Swannanoa River: Tomahawk Branch, Flat Creek, and Tributary 35 (of the Swannanoa River), as identified by Federal Emergency Management Agency (FEMA). Known flooding locations from the Town's 2022 Stormwater Master Plan Update[2] and meetings with Town staff were used to identify areas to model and evaluate the Town's existing stormwater conveyance system.

Additionally, FEMA models for Tomahawk Branch, Flat Creek, Tributary 35, and the Swannanoa River were downloaded from the North Carolina Flood Risk Information System (FRIS)[3] system and the bridge data and water surface elevations were used in modeling and evaluating the primary open channel systems.

The hydrologic make-up of the Town is shown in Figure 2-3.

2.3. NOAA Precipitation

Precipitation data were obtained from National Oceanic and Atmospheric Administration (NOAA). 24-hour precipitation depths as shown in Table 2.2 were obtained from NOAA Atlas 14, Volume 2, Version 3 for the Town's North Fork 2 Station (Station ID 31-6236)[4]. This station was chosen as the basis for the storm events as it is located at a high elevation in the mountains and is representative of the intensity and depth of rainfall coming off the mountains and draining down to the Town proper.

TABLE 2.3: NOAA RAINFALL DEPTHS

RECURRENCE INTERVAL	ANNUAL EXCEEDANCE PROBABILITY	NOAA 24-HOUR RAINFALL DEPTH (in)
2-YR, 24HR	5%	3.39
10-YR, 24HR	10%	5.00
25-YR, 24HR	4%	5.98
50-YR, 24HR	2%	6.76
100-YR, 24HR	1%	7.57

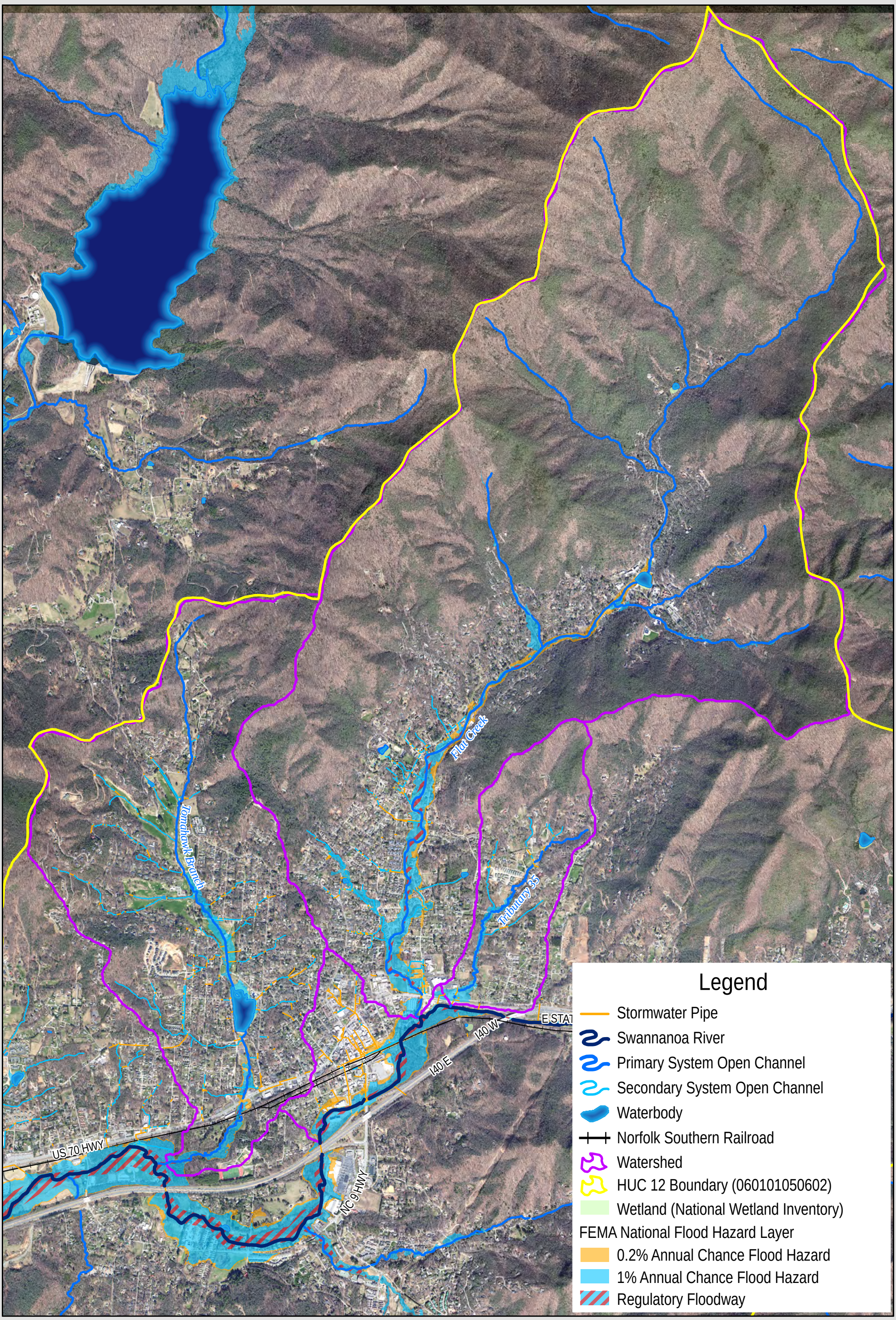
2.4. Land Use and Soils

The Town has a mix of land uses, including substantial low intensity residential development, forested areas in the upper parts of Flat Creek, and significant commercial development in the downtown corridor. There are some on-going residential developments in the upper parts of the Tomahawk Branch and Tributary 35 watersheds. These developments were included as existing land use for the watershed characterization. For example, the Tudorcroft development in Tomahawk Branch was incorporated into the existing land use data set. The Town has a very well-developed impervious land cover dataset provided by Raftelis that was also incorporated into the watershed characterization. For the purposes of the modeled watersheds, the current land use was assumed to be the future land use.

General characteristics of the modeled watersheds are noted in Table 2.2. Overall land use and soils maps for the Town as well as additional detail on the hydrologic parameterization[5,6] of the watershed models is provided in Appendix B.

TABLE 2.4: WATERSHED CHARACTERISTICS SUMMARY

WATERSHED	DRAINAGE AREA (SQ MI)	PRIMARY LAND USE	WATERSHED PERCENT IMPERVIOUSNESS	PRIMARY HYDROLOGIC SOIL GROUP
Study Area	8.68	Forest	9.4%	B
Downtown	0.23	Impervious	52.6%	B and D
Tomahawk Branch	1.93	Low Intensity Residential	15.3%	B
Flat Creek	6.04	Deciduous Forest	5.9%	B and A
Tributary 35	0.48	Low Intensity Residential	12.4%	B



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Figure 2-3: Hydrology
TOWN OF BLACK MOUNTAIN, NC
Town of Black Mountain Stormwater Master Plan

0 1,000 2,000 Feet

1 in = 2,000 ft

N
W E
S

3. EXISTING STORMWATER SYSTEM ANALYSIS

The purpose of the stormwater system analysis is to determine the existing level of service for the Town's mapped stormwater conveyance system and to develop proposed solutions to mitigate flooding. The Town's stormwater system was modeled in 1D PCSWMM. PCSWMM analyzes both the hydrologic watershed conditions and the conveyance hydraulics. Bridge data for primary systems was imported from corresponding FEMA models. Additional information on the hydraulic analyses and input data[7] is provided in Appendix C. A hard copy of the PCSWMM input/output is available upon request. A summary of the existing conditions for each watershed is noted below.

3.1. Downtown System

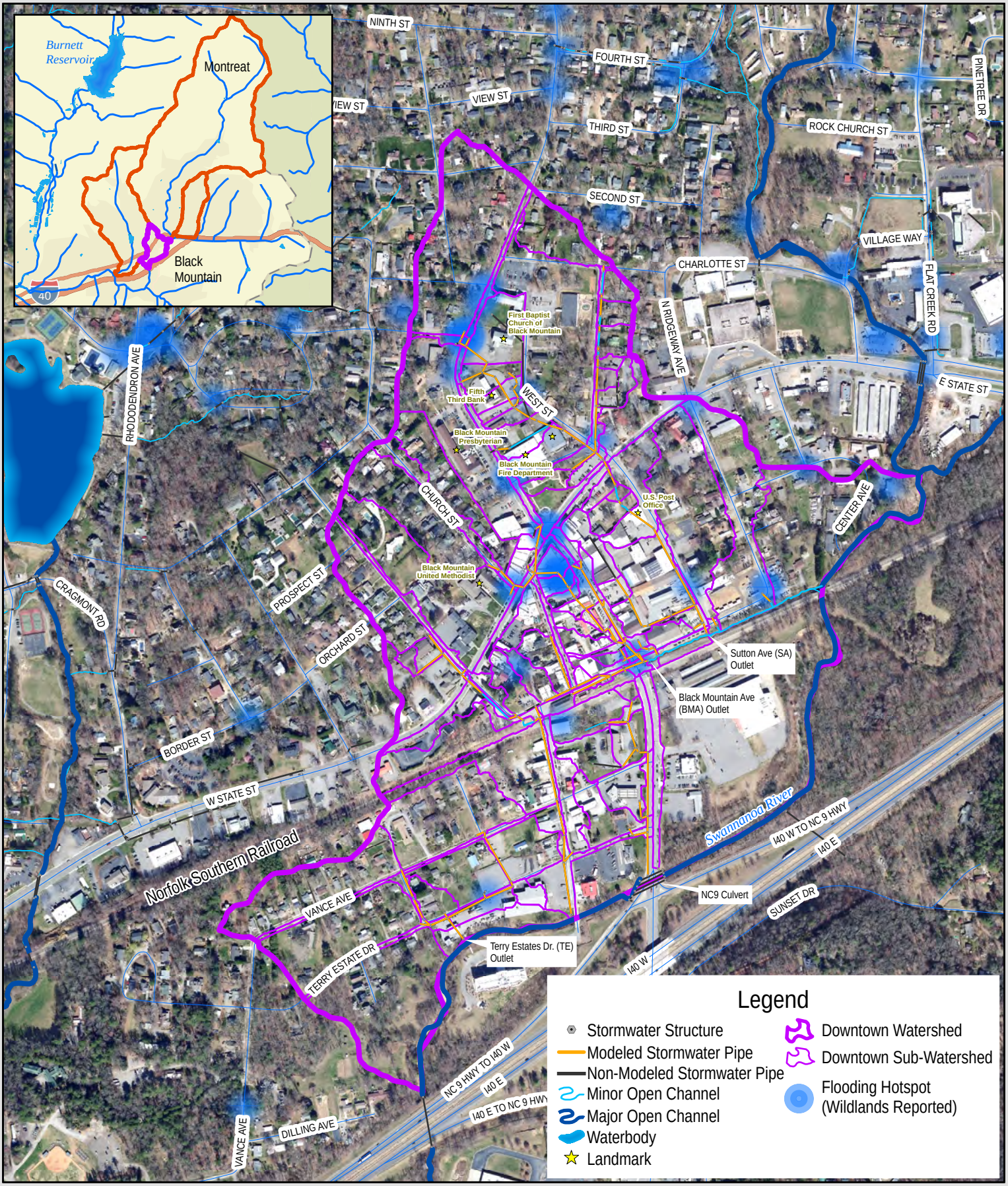
The downtown stormwater conveyance system consists of a significant amount of aged infrastructure that runs between public and private property. Several systems have pipes that convey public water underneath commercial and government buildings. The existing downtown stormwater, shown in Figure 3-1, has four primary outlets (three direct to the Swannanoa River and one to an open channel paralleling the railroad and Sutton Ave to the Swannanoa River). These are noted as the Sutton Ave outlet (SA), NC Highway 9 outlet (NC9), Black Mountain Ave outlet (BMA), and Terry Estates Drive outlet (TE).

Figure 3-1 also indicates locations of previously documented flooding issues at the intersection of Broadway and Sutton and along the following roads: W State St, West St, Montreat Rd, Richardson Blvd, Midland Ave, and Terry Estates Dr.

Model results for the existing system level of service are noted in Figures 3-2 and 3-3. The level of service for key locations in the downtown corridor is noted in Table 3.1.

TABLE 3.1: DOWNTOWN SECONDARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	EXISTING PIPE	EXISTING SYSTEM LEVEL OF SERVICE
NORTH OF RAILROAD		
Sutton Ave (east of Cherry St)	15" RCP	< 2-YR
Sutton Ave (at Broadway St)	15" CMP	< 2-YR
Broadway St (north of Sutton Ave)	24" RCP	2-YR
Richardson Blvd (2 crossings at Sutton Ave)	30" RCP / 15" HDPE	< 2-YR
S. Ridgeway Dr (at Sutton Ave)	15" HDPE	< 2-YR
W. State St (at Church St)	18" RCP	< 2-YR
W. State St (at Cherry St)	18" VCP and PVC	< 2-YR
Cherry St (at W. State St)	18" RCP	< 2-YR
W. State St (at Broadway St)	18" and 24" RCP	2-YR
E. State St (at Richardson Blvd)	15" VCP	< 2-YR
Police Station (pipe under building)	15" RCP	< 2-YR
SOUTH OF RAILROAD		
Railroad Crossing - S. Dougherty St	12" VCP	< 2-YR
Black Mountain Ave (at Terry Estates Dr)	12" CMP	< 2-YR
Terry Estates Dr (5 crossings)	12" and 15" CPP	< 2-YR



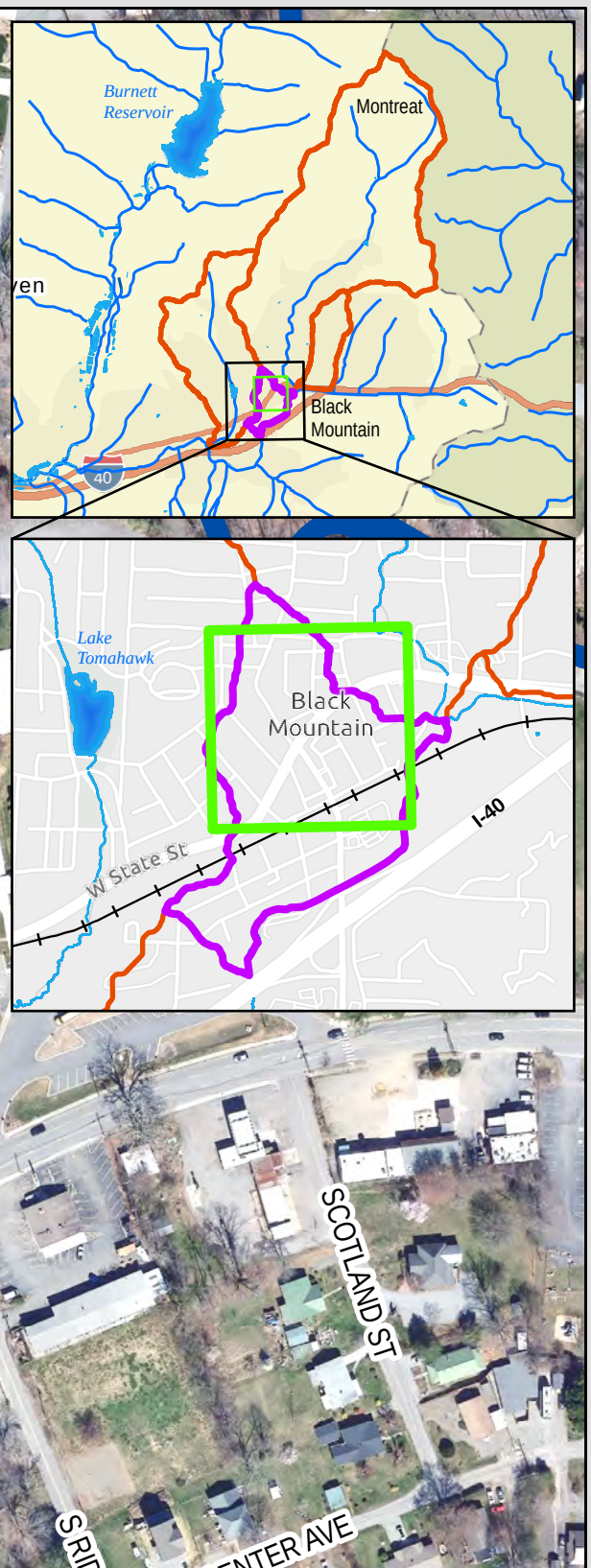
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Figure 3-1: Downtown Secondary System
Town of Black Mountain Stormwater Master Plan

0 300 600 Feet
1 inch = 600 feet

N
W E
S

Sutton Avenue / Richardson Boulevard Outfall Systems	
ROADWAY	LEVEL OF SERVICE
Sutton Ave at S. Ridgeway Ave	< 2-YR
2 Sutton Ave at Richardson Blvd Crossings	< 2-YR
East State St at Richardson Blvd	< 2-YR
System between Montreat Rd and West St	2-YR
System along West Street at the Police Station	< 2-YR
Laurel Circle Dr at Montreat Rd	< 2-YR
West Street at Midland Ave	2-YR
First St at Midland Ave	2-YR
Sutton Ave east of NC 9	25-YR
Sutton Ave and Broadway St intersection	< 2-YR
Cherry St at Sutton Ave	< 2-YR
System along west side of Broadway St	< 2-YR
Cherry St at West State St	2-YR
West State St at Church St	< 2-YR
Church St at West State St	< 2-YR
Church St	< 2-YR
Montreat Rd at East State St	< 2-YR
24" System in Broadway to Cherry St	2-YR
24" System in Broadway north of Cherry St	25-YR



SECOND ST
N RIDGEWAY AVE
LAUREL CIRCLE DR
WEST ST
Police Station
HONEYCUTT ST
MONTREAT RD
CHURCH ST
BROADWAY ST
E STATE ST
SCOTLAND ST
S RIDGEWAY AVE
CENTER AVE
U.S. Post Office
S RICHARDSON BLVD
W STATE ST
CHERRY ST
SUTTON AVE
NC 9 HWY
Norfolk Southern Railway
Modeled as overland flow between pipes. No defined channel.

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- Modeled Open Channel
- Non-Modeled Pipe*
- Non-Modeled Swannanoa NC9 HWY Culvert

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River
- Norfolk Southern Railway

Evidence of pipe in the field; survey/inventory data not sufficient enough to model

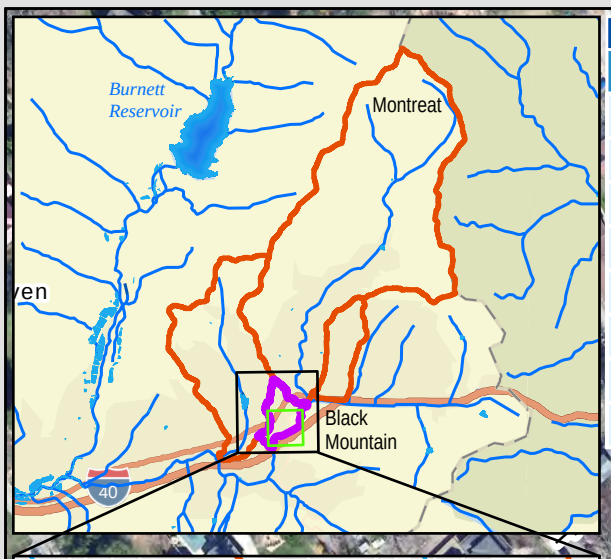
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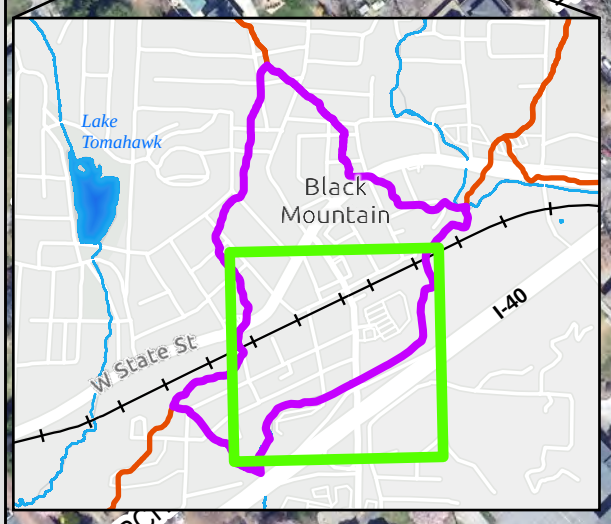
Figure 3-2: Existing Conditions Level of Service
DOWNTOWN (NORTH) DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet

1 in = 200 ft

N W E S





Black Mountain Avenue Outfall System	
ROADWAY	LEVEL OF SERVICE
Terry Estate Dr at Black Mtn Ave	< 2-YR
Black Mountain Ave at Terry Estate Dr	< 2-YR
Vance Ave at Black Mtn Ave	< 2-YR
Railroad Tracks at Black Mtn Ave	< 2-YR
S. Dougherty St at Black Mtn Ave	25-YR
S. Dougherty St Bend	< 2-YR
West State St (US 70)	25-YR
N. Dougherty St at West State St	25-YR

NC 9 Outfall System	
ROADWAY	LEVEL OF SERVICE
Terry Estate Dr west of NC 9	< 2-YR
Terry Estate Dr at NC 9	25-YR
Vance Ave at NC 9	25-YR
Vance Ave west of NC 9	2-YR

Bridge Street / Terry Estate Outfall System	
ROADWAY	LEVEL OF SERVICE
3 Terry Estate Dr Crossings near Bridge St	< 2-YR
2 Terry Estate Dr Crossings east of Bridge St	< 2-YR
Vance Ave at Bridge St	10-YR
Vance Ave near Spring St	2-YR

Modeled as overland flow between pipes. No defined channel.

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- Modeled Open Channel
- Non-Modeled Pipe*
- Non-Modeled Swannanoa NC9 HWY Culvert

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River
- Norfolk Southern Railway

*Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 3-3: Existing Conditions Level of Service
DOWNTOWN (SOUTH) DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

3.2. Tomahawk Branch Watershed

3.2.1 Primary System

Tomahawk Branch watershed is 1.93 square miles and encompasses several residential developments around Tomahawk Lake as shown in Figure 3-4. Known flooding locations along the primary system are concentrated at Laurel Circle Dr and Hiawassee Ave. Model results for the existing system level of service are noted in Figure 3-5. The level of service for key locations is noted in Table 3.2.

TABLE 3.2: TOMAHAWK PRIMARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	EXISTING PIPE	EXISTING SYSTEM LEVEL OF SERVICE
Laurel Circle Dr (north of Lake Tomahawk)	Triple Arch CMP Culvert	< 2-YR
Cragmont Rd (south of Lake Tomahawk)	Twin 90" CMP Culvert	50-YR
W. State St	Twin 7' x 10' RCBC*	50-YR
Swannanoa Ave (south of Cragmont Rd)	30" CMP / 48" CMP	2-YR

**Reinforced Concrete Box Culvert*

3.2.2 Secondary System

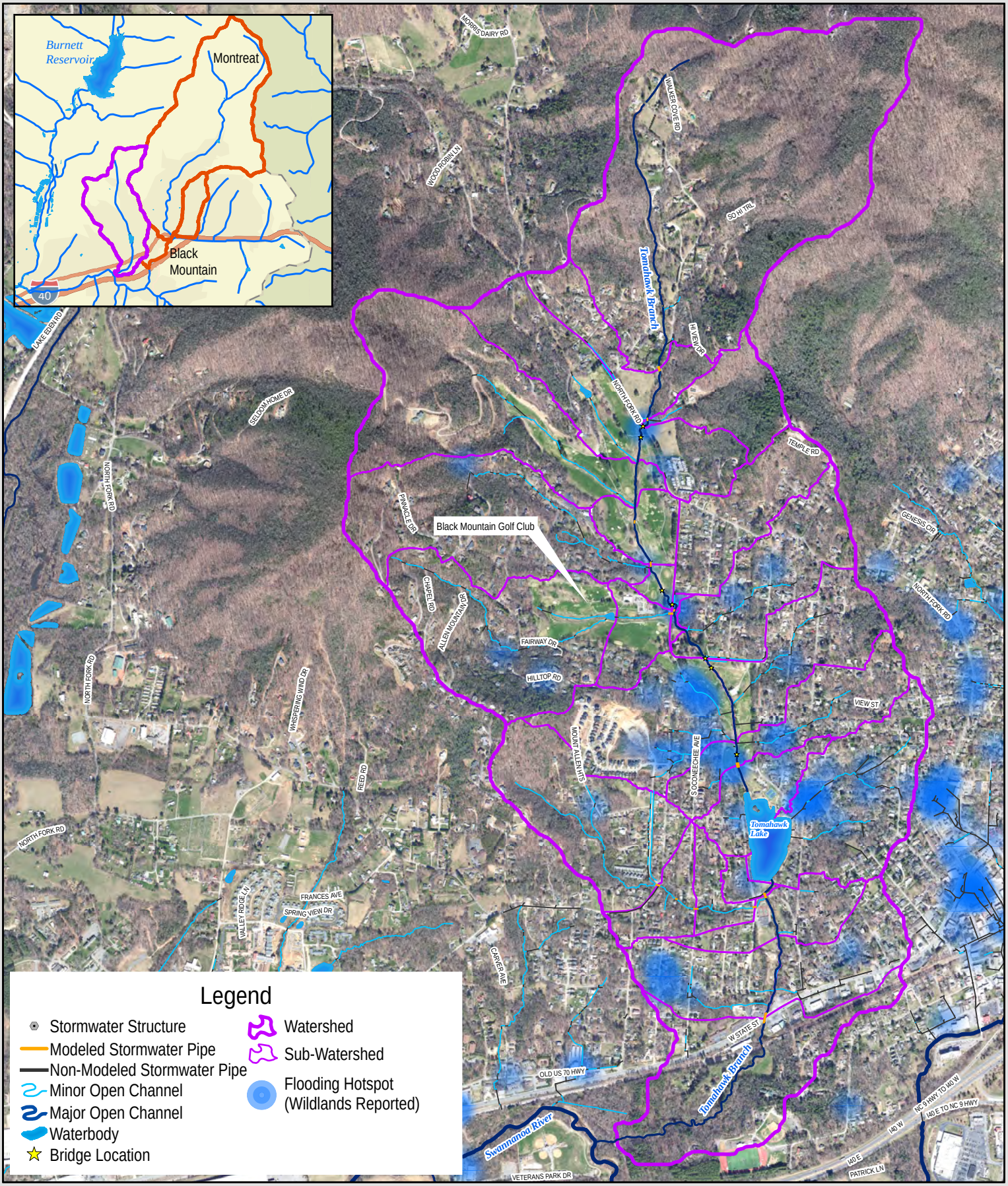
There are multiple secondary systems that drain to Tomahawk Branch north of Tomahawk Lake and directly to the lake itself as noted in Figure 3-6. 0.3 square miles of secondary system drainage area was modeled with seven (7) outfalls to Tomahawk Branch upstream of the lake and four (4) outfalls directly to Tomahawk Lake. One small system across Walnut St at Tomahawk Ave was also included in the secondary system model with an outlet to an open channel on the west side of Tomahawk Ave.

Runoff from the Tudorcroft residential development in the upper parts of the watershed have been a concern for downstream residents. Previously documented flooding locations are shown in Figure 3-6.

Model results for the existing system level of service are noted in Figure 3-7. The level of service for key locations is noted in Table 3.3.

TABLE 3.3: TOMAHAWK SECONDARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	EXISTING PIPE	EXISTING SYSTEM LEVEL OF SERVICE
Stream crossing Byrd Rd, Hiawassee Ave, and S. Oconeechee Ave	18" and 24" CMP	< 2-YR
Tomahawk Ave (downstream of above system)	36" CMP	2-YR
Hiawassee Ave at Fairway Dr	18" CMP/HDPE	< 2-YR
Tomahawk Ave (just north of Fairway Dr)	18" CPP	2-YR
Tomahawk Ave and Hickory St	15" CPP/18" CMP	2-YR
Rhododendron Ave (at Eighth St)	24" CMP	2-YR
Rhododendron Ave (at Laurel Circle Dr to Lake)	24" CMP	< 2-YR
Azalea Ave (north of Ninth St)	18" CPP	< 2-YR
9th St (west of Azalea Ave)	18" CPP	< 2-YR
Laurel Ave (south of 9th St)	36" CMP	2-YR



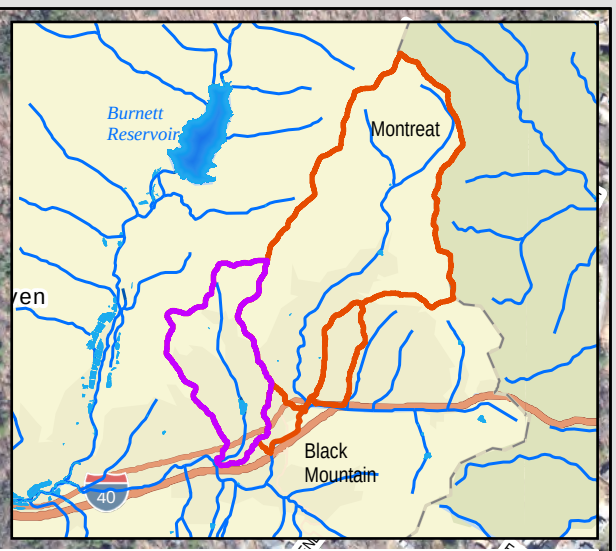
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TOWN OF BLACK MOUNTAIN 1893

Figure 3-4: Tomahawk Branch Primary System
Town of Black Mountain Stormwater Master Plan

0 750 1,500 Feet
1 in = 1,500 ft

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S



CULVERT CROSSING	LEVEL OF SERVICE
W State St (Hwy 70)	50-YR
Cragmont Rd	50-YR
Laurel Circle Dr	<2-YR
9th St Bridge	25-YR
Hiawassee Ave Bridge	25-YR
Chapel Rd	25-YR
Walker Cove Rd	50-YR
Hiawassee Ave (South of Ross Dr)	50-YR
Swannanoa Ave	2-YR
E College St	50-YR
Cragmont Rd (Secondary Crossing)	25-YR

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*
- Bridge Location

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Tomahawk Branch
- Tomahawk Lake

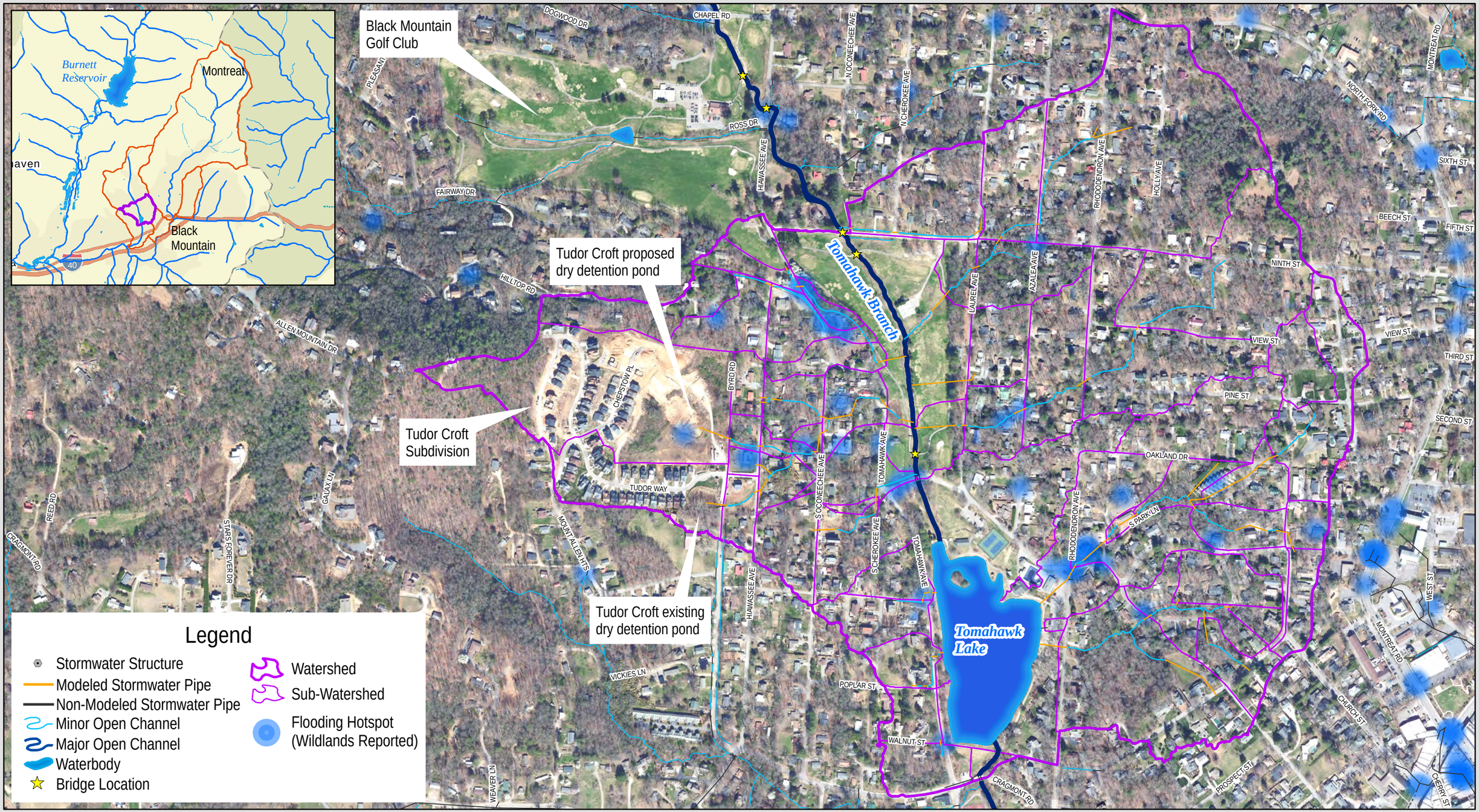
*Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 3-5: Existing Conditions Level of Service
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 250 500 Feet
1 in = 500 ft

N W E S



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TOWN OF BLACK MOUNTAIN 1893 NORTH CAROLINA

Figure 3-6: Tomahawk Branch Secondary System
Town of Black Mountain Stormwater Master Plan

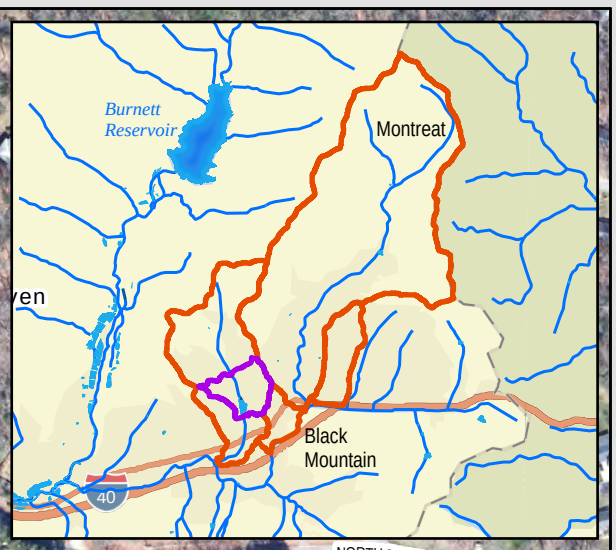
0 500 1,000 Feet

1 in = 500 ft

N W E S

East of Tomahawk Branch / Tomahawk Lake	
ROADWAY	LEVEL OF SERVICE
N. Cherokee Ave at 9th St	< 2-YR
Laurel Ave (north of 9th St)	25-YR
Laurel Ave (south of 9th St)	2-YR
9th Street	< 2-YR
Azalea Ave (north of 9th St)	< 2-YR
Rhododendron Ave (south of 10th St)	10-YR
Laurel Ave at 8th St	25-YR
8th St at Laurel Ave	2-YR
Laurel Ave (south of 8th St)	< 2-YR
Azalea Ave (south of 8th St)	< 2-YR
Rhododendron Ave (south of View St)	2-YR
View St	< 2-YR
Rhododendron Ave at Laurel Circle Dr	< 2-YR
N. Park Ln	2-YR
Oakland Dr	10-YR
S. Park Ln	25-YR
Church St	< 2-YR
Laurel Circle Dr at Church St	25-YR
Rhododendron Ave	10-YR
S Laurel Circle (west)	2-YR
Circle Ln	25-YR
S Laurel Circle (central)	25-YR
S Laurel Circle (east)	25-YR
Connally St (east of N Dougherty St)	25-YR
Connally St (west of N Dougherty St)	10-YR

West of Tomahawk Branch / Tomahawk Lake	
ROADWAY	LEVEL OF SERVICE
Fairway Dr at Hiawassee Ave	< 2-YR
Tomahawk Ave (north of Fairway Dr)	2-YR
Hiawassee Ave (parallel north)	25-YR
Hiawassee Ave (parallel south)	25-YR
S. Oconeechee Ave (north)	25-YR
Byrd Rd (north)	< 2-YR
Hiawassee Ave (north central)	< 2-YR
Hiawassee Ave (south central)	10-YR
Byrd Rd (south)	10-YR
Hiawassee Ave (south)	10-YR
S. Oconeechee Ave (central)	< 2-YR
Tomawhawk Ave	2-YR
S. Oconeechee Ave (south)	25-YR
Hickory St at Tomahawk Ave	2-YR
Tomahawk Ave north of Hickory Dr	2-YR
Tomahawk Ave south of Hickory Dr	2-YR
Walnut St at Tomahawk Ave	2-YR



Intersection of Fairway Dr and Tomahawk Ave and further south on Tomahawk Ave are known flooding locations. There is no stormwater infrastructure in this area. Runoff overflows the stormwater ditches flowing down Tomahawk Ave and across properties towards Tomahawk Branch.

Intersection of Laurel Circle Dr and Tomahawk Ave is a known flooding location. There is no stormwater infrastructure in this area. The pipes along S. Cherokee Ave end and runoff overflows into the intersection towards Tomahawk Branch.

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*
- Primary System Culvert**

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Tomahawk Branch
- Tomahawk Lake

*Evidence of pipe in the field; survey/inventory data not sufficient enough to model
**Level of Service for Primary System Culverts provided on a separate map

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Figure 3-7: Existing Conditions Level of Service
TOMAHAWK BRANCH SECONDARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 300 600 Feet

1 in = 300 ft

3.3. Flat Creek Watershed

The Flat Creek watershed is six (6) square miles, including the 0.35 square mile Flat Creek Tributary 1 watershed. Most of the primary road crossings along Flat Creek are bridges, which were modeled using FEMA data as shown in Figure 3-8. The most downstream Flat Creek crossing prior to confluence with the Swannanoa River is at US 70 East and is a triple 11' x 10' Reinforced Concrete Box Culvert (RCBC). Known flooding concerns are primarily located along Flat Creek Tributary 1 from Portmanvilla Rd upstream to Montreat Rd.

Model results for the existing system level of service are noted in Figure 3-9. The level of service for key locations along Flat Creek Tributary 1 is noted in Table 3.4.

TABLE 3.4: FLAT CREEK PRIMARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	EXISTING PIPE	EXISTING SYSTEM LEVEL OF SERVICE
Montreat Rd (NC 9)	24" CMP	2-YR
Seventh St	Triple 24" CMP	2-YR
Seventh St (west of Portmanvilla Rd)	15" PVC	< 2-YR
Sixth St	42" CMP	10-YR
Sixth St (west of Portmanvilla Rd)	15" CMP	< 2-YR
Portmanvilla Rd	30" CMP	2-YR
Portmanvilla Rd	15" CMP	< 2-YR
US 70 (E. State St)	Triple 11' x 10' RCBC	50-YR

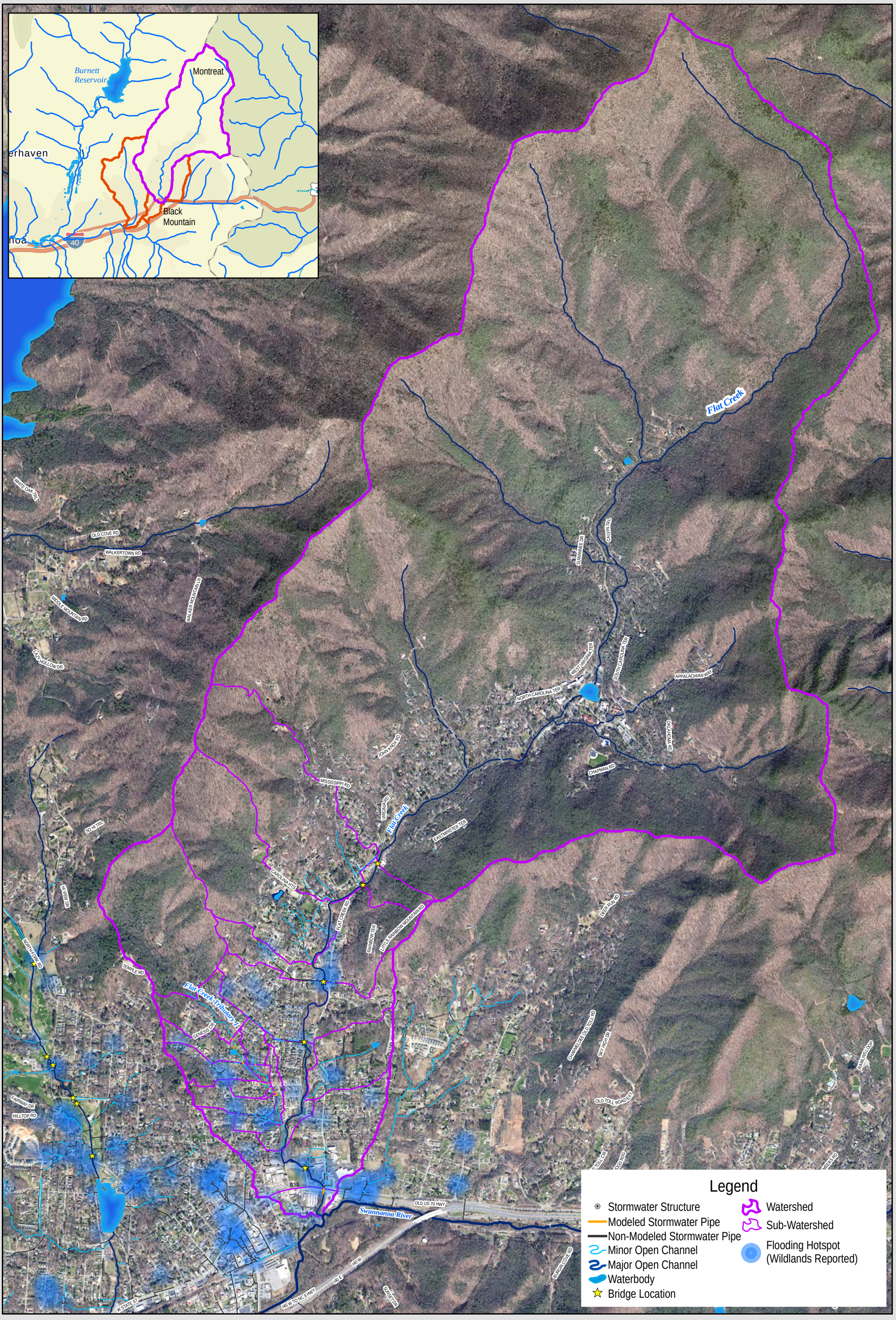
3.4. Tributary 35 / Avena Road Watershed

The Tributary 35 (of the Swannanoa River) watershed encompasses approximately 0.48 square miles and includes two primary thoroughfares: Avena Road and Padgettown Road. The stormwater conveyance system is comprised of open channel, culvert crossings, and outfalls to the Swannanoa River via a 6' x 7' RCBC underneath US 70 as shown in Figure 3-10. Primary flooding concerns within this watershed include the crossing at Old State 10 Rd and Padegettown Rd from Old State 10 Rd to Old US 70E.

Model results for the existing system level of service are shown in Figure 3-11 and noted in Table 3.5.

TABLE 3.5: TRIBUTARY 35 PRIMARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	EXISTING PIPE	EXISTING SYSTEM LEVEL OF SERVICE
Avena Rd (near Bellgrove Rd)	48" CMP	2-YR
Bellgrove Rd	Twin 36" CMP	2-YR
Avena Rd	48" CMP	10-YR
Old State 10 Rd	Twin 36" HDPE/CPP	2-YR
Padgettown Rd (north of Old US 70 E)	Twin 36" CMP	< 2-YR
Old US 70 East	6' x 10' RCBC	25-YR
US 70 (E. State St)	6' x 7' RCBC	50-YR

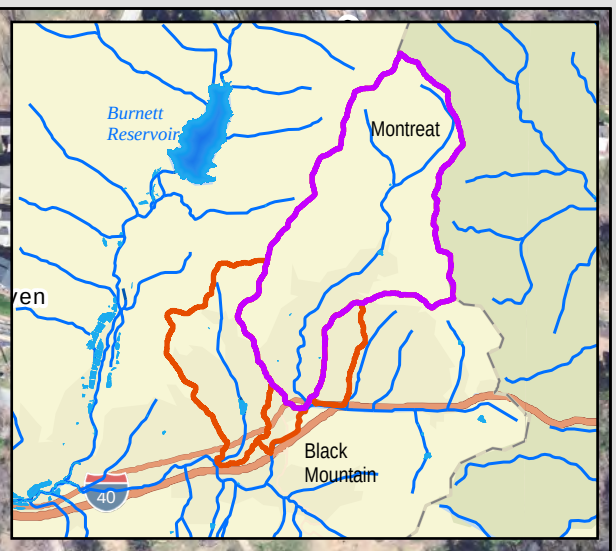


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Figure 3-8: Flat Creek Tributary 1 Primary System
Town of Black Mountain Stormwater Master Plan

0 750 1,500 Feet
1 in = 1,500 ft

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CUVLERT CROSSING	LEVEL OF SERVICE
US 70 (Triple 11'x10' RCBC)	50-YR
Flat Creek Tributary 1 Culverts	
Portmanvilla Rd (15" CMP)	< 2-YR
Portmanvilla Rd (30" CMP)	2-YR
6th Street near Portmanvilla Rd (15" CMP)	<2-YR
6th Street (42" CMP)	10-YR
7th Street near Portmanvilla Rd (15" CPP)	< 2-YR
7th Street (Triple 24" CMP)	2-YR
Montreat Rd (24" CMP)	2-YR

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*

Stormwater Structures

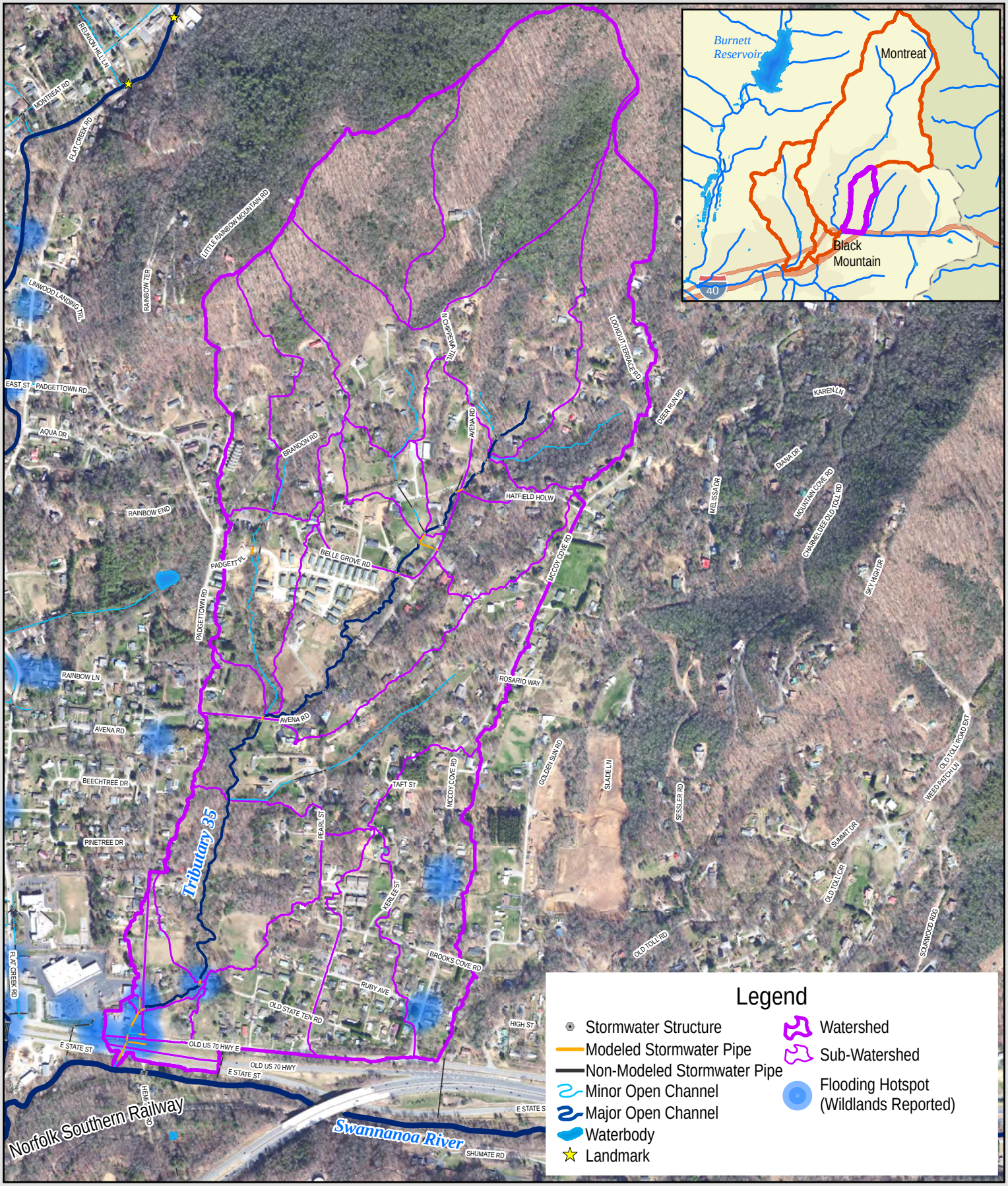
- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River
- Flat Creek
- Bridge Location

Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 3-9: Existing Conditions Level of Service
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 125 250 Feet
1 in = 250 ft

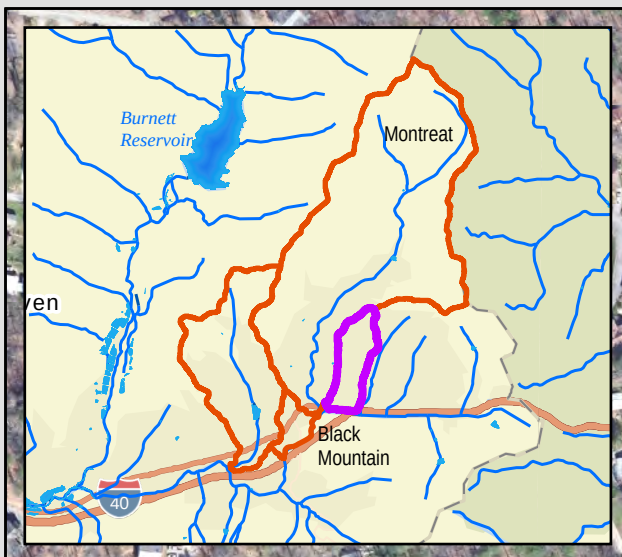


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Figure 3-10: Avena Rd./Tributary 35 Primary System
Town of Black Mountain Stormwater Master Plan

0 400 800 Feet
1 in = 800 ft

N
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CULVERT CROSSING	LEVEL OF SERVICE
US-70 (6'x7' RCBC)	50-YR
Old US-70 (6' x10' RCBC)	25-YR
Parking Lot (Twin 36" CMP)	2-YR
Padgettown Rd (Twin 36" CMP)	< 2-YR
Padgettown Rd (24" CMP)	2-YR
Old State Ten Rd (Twin 36" CPP)	2-YR
Avena Rd (48" CPP)	2-YR
Padgett Place (Twin 36" CPP)	50-YR
Belle Grove Rd (Twin 36" CPP)	2-YR
Avena Rd (24" CMP)	2-YR
Avena Rd (48" CMP)	50-YR

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River

*Evidence of pipe in the field; survey/inventory data not sufficient enough to model

LOS results at US-70 include the use of the depression area between Old US-70 and US-70 as a storage area.

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Figure 3-11: Existing Conditions Level of Service
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet

1 in = 300 ft

N W E S

3.5. Intense Storm Analyses

The 2-yr and 5-yr, 6-hr storm events were also modeled as SCS Type II storm events to simulate high-intensity rainfall events for the purpose of developing projects more resilient to climate change. Storm events, in general, are becoming more frequent with higher intensity. These types of rainfall events tend to lead towards generating more runoff rather than less intense rains leading to more infiltration. The shorter rainfall events were modeled to evaluate the impact on the Town's infrastructure of a more frequent, higher-peaked storm event to assess the system's capacity to handle intense events that may generate more runoff than infiltration.

The rainfall depths are noted in Table 3.6 were obtained from NOAA Atlas 14, Volume 2, Version 3 for the Town's North Fork 2 Station (Station ID 31-6236).[4]

TABLE 3.6: NOAA RAINFALL DEPTHS - 6 HR STORMS[4]

RECURRENCE INTERVAL	NOAA 6-HOUR RAINFALL DEPTH (in)
2-YR, 6HR	2.23
5-YR, 6HR	2.79

In the Downtown corridor, the model results indicated that the level of service (LOS) for roadways in the 5-yr, 6-hr storm event mirrored that of the 2-yr, 24-hr storm. For a high-intensity rainfall, the existing system shows significant flooding across major roadways in and around Downtown. In the Tomahawk Branch secondary system, most roadways meet a level of service sufficient to handle the modeled 5-yr, 6-hr storm event.

As indicated by the modeling results, the following culverts along primary systems in the Tomahawk Branch, Flat Creek Tributary 1, and Tributary 35 / Avena Rd watersheds, do not provide a level of service to handle the 5-yr, 6-hr storm event:

- Sixth Street near Portmanvilla Road
- Portmanvilla Road
- Padgettown Road just south Old State 10 Road

4. CRITICALITY ANALYSIS

As part of the Town of Black Mountain Stormwater Master Plan, a preliminary condition assessment was completed to identify high priority areas for detailed CCTV and/or maintenance needs. Prioritization is based on the likelihood of asset failure, as well as the consequence of asset failure. By evaluating the likelihood of asset failure in relation to the consequence of asset failure, a combined criticality score is then developed for each asset. This criticality score can enable the Town to more strategically evaluate which assets to focus capital improvement resources on for repair, rehabilitation, or further condition assessments. This section summarizes the results of a GIS audit and the scoring criteria and methodology used in developing the condition assessment.

4.1. Project Background

WK Dickson (An Ardurra Company) collected and analyzed the stormwater infrastructure data which included GIS stormwater data, building and transportation locations, and geographic features. This data was audited to determine the availability of necessary attribute information to conduct the criticality analysis. Upon resolution of the identified data gaps, WK Dickson performed a criticality assessment by running the criticality toolset to generate results. The results of this prioritization are included in this report as the findings of asset criticality within the Town of Black Mountain. The detailed methodology for customizing the prioritization tool for the Town can be found in Appendix D.

4.2. Criticality Analysis

After the scoring criteria and attribute analysis was completed, the pipe and structure matrices were populated and the asset criticality analysis was run. As a result, the highest scoring assets indicate the most critical assets in terms of overall risk due to consequence and likelihood of failure. Since there are a different number of assets for each utility system grouping, the distribution range differs.

Table 4.1 summarizes the number of stormwater pipe assets falling into each scoring category. A single pipe asset is defined as a section of pipe between either two (2) structures or between a structure and an outfall. The table presents the total criticality score as well as the likelihood and consequence scores.

When reviewing the table, it is noticeable that the class ranges are not uniform. The data was evaluated and confirmed that the criticality analysis followed a normal distribution. In an effort to highlight the infrastructure at both ends of the spectrum, the following class ranges were devised based on a modified bell curve: the top and bottom 5% of total scores were classified as ‘High’ and ‘Low’, the middle 63% as ‘Medium’, and the remaining 13.5% on either side of the middle as ‘Medium-High’ and ‘Medium-Low’. The purpose of these class ranges is to assign a criticality level to each asset, which informs overall scoring for rehabilitation projects. Assets rated at criticality levels 4 or 5 are typically the highest priority for rehabilitation.

Table 4.1 also shows the criticality levels for stormwater pipes. Of the pipes evaluated, 20% scored in Level 4 or 5, indicating the highest need for stormwater rehabilitation efforts. Exhibit 4.1 shows the distribution graphically.

TABLE 4-1: STORMWATER PIPES SCORING SUMMARY AND DISTRIBUTION

CATEGORIES ASSIGNED					
	Low (1)	Medium-Low (2)	Medium (3)	Medium-High (4)	High (5)
TOTAL CRITICALITY SCORE DISTRIBUTION					
	40-180	181-220	221-390	391-480	481-700
Stormwater Pipes	46	121	405	126	45
LIKELIHOOD SCORE DISTRIBUTION					
	20-108	109-196	197-284	285-372	373-460
Stormwater Pipes	82	288	256	103	14
CONSEQUENCE SCORE DISTRIBUTION					
	0-88	89-176	177-264	265-352	353-440
Stormwater Pipes	266	333	128	13	3

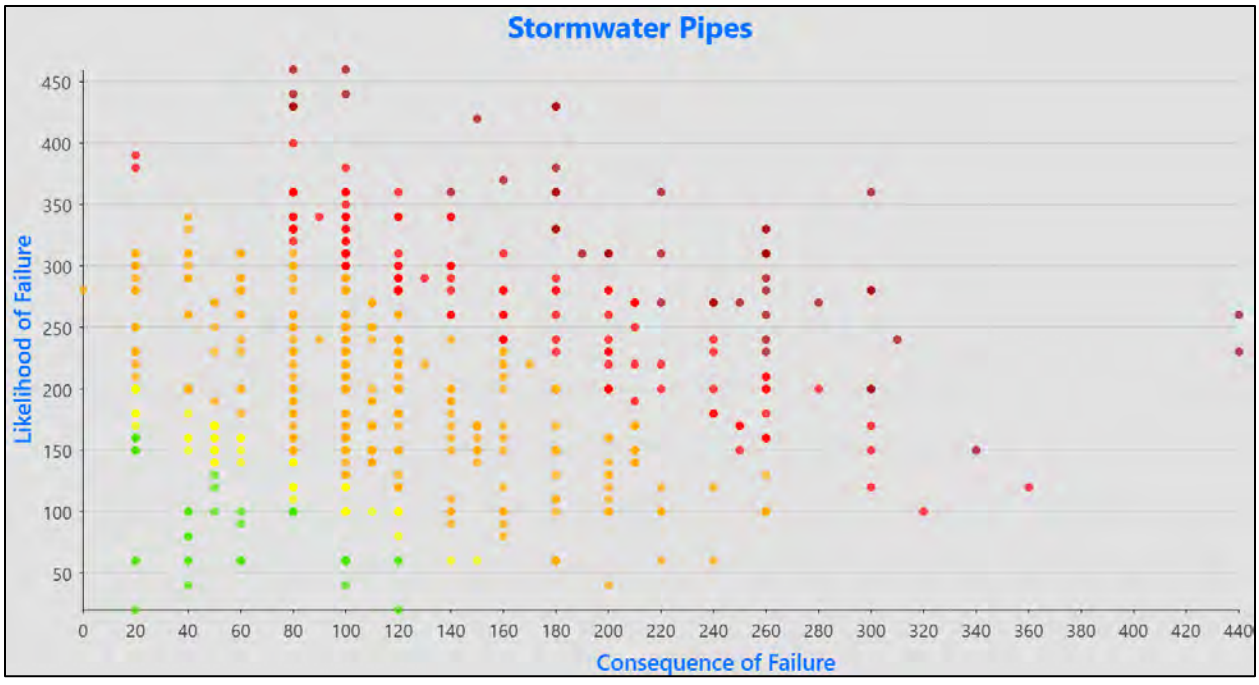


Exhibit 4.1
Stormwater Pipe Scoring Results

Table 4.2 shows the criticality levels for stormwater structures. Within the structures evaluated, 21% scored in Level 4 or 5, indicating the highest need for stormwater structure rehabilitation efforts. Exhibit 4.2 shows the distribution graphically.

TABLE 4.2: STORMWATER STRUCTURES SCORING SUMMARY AND DISTRIBUTION

CATEGORIES ASSIGNED					
	Low (1)	Medium-Low (2)	Medium (3)	Medium-High (4)	High (5)
TOTAL CRITICALITY SCORE DISTRIBUTION					
	60-155	156-185	186-315	316-400	401-585
Stormwater Structures	48	180	719	190	57
LIKELIHOOD SCORE DISTRIBUTION					
	20-98	99-176	177-254	255-332	333-410
Stormwater Structures	77	767	252	78	20
CONSEQUENCE SCORE DISTRIBUTION					
	0-62	63-124	125-186	187-248	249-310
Stormwater Structures	593	370	182	40	9

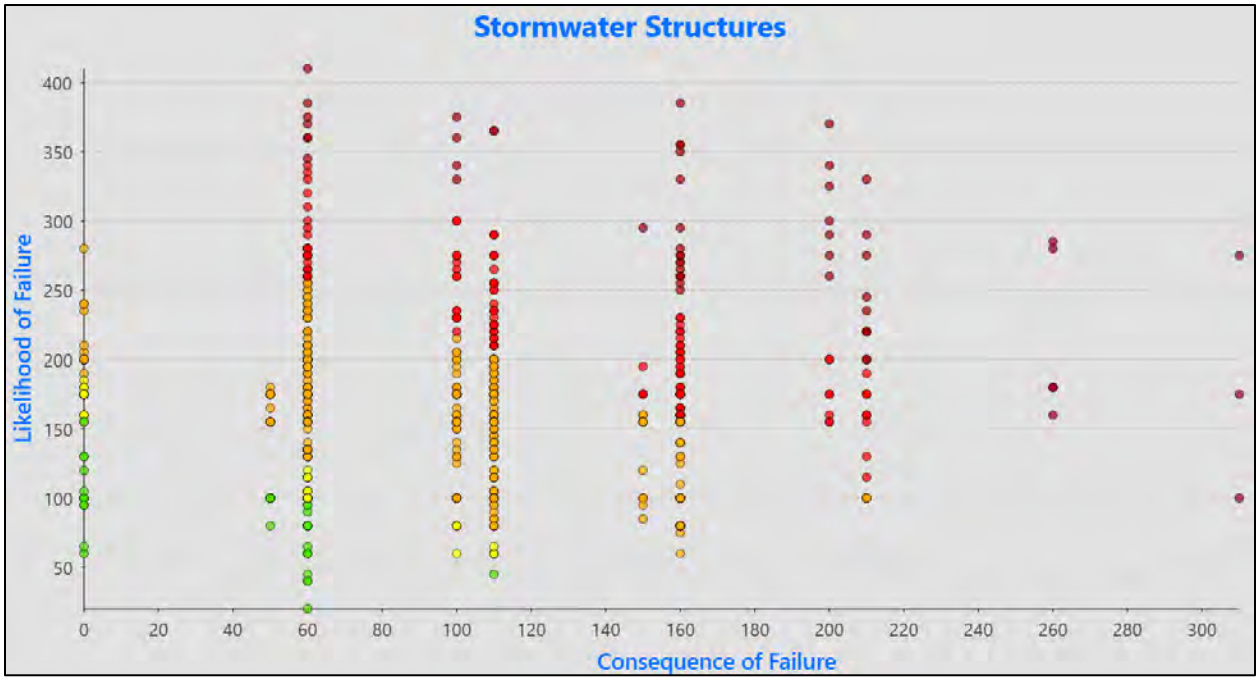


Exhibit 4.2
Stormwater Structure Scoring Results

4.3. Operations and Maintenance Recommendations

The stormwater drainage systems evaluated in this report are composed of a series of culverts, closed drainage systems, and open channels. It is recommended that properly scheduled maintenance be conducted at routine intervals to prolong system life and to identify and address system failures in a timely manner.

The condition assessment evaluated pipes and structures based on likelihood and consequence of failure. It is recommended that the Town prioritize the areas with high-risk infrastructure shown in red and dark red in Figures 4-1 through 4-4 for repair, rehabilitation, or further conditions assessment.

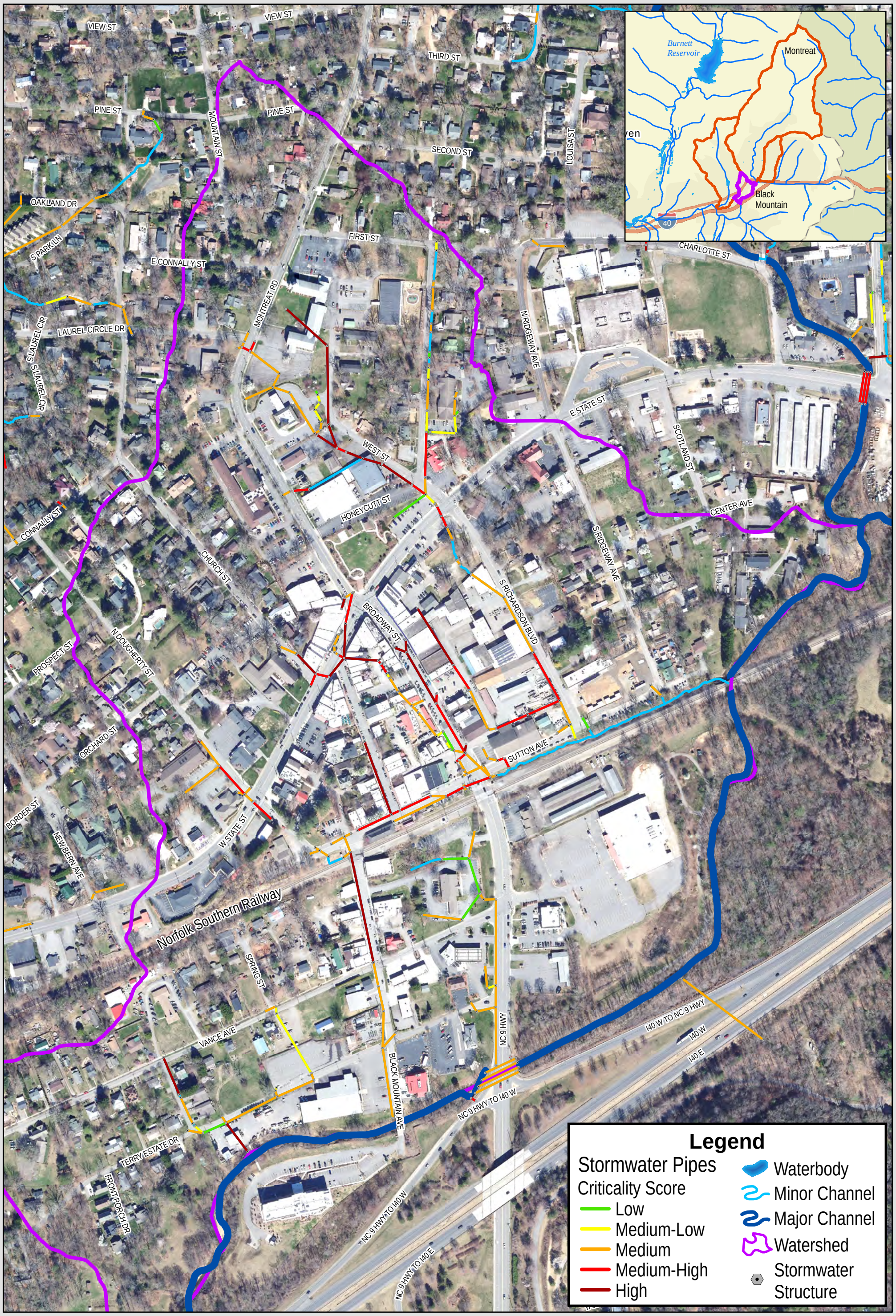
Stormwater structure result maps indicating high-risk structures are provided in Appendix D. Additional detail on the scoring criteria is also provided in Appendix D.

4.4. Criticality Analysis as an Ongoing Process

Because the data in the GIS database are dynamic, the results of the prioritization tool are a static representation based upon when the tool is run. As data are updated in the database, the tool can be utilized, and the results of the prioritization process can be updated easily. Typically, a jurisdiction may use a prioritization tool such as this on an annual or semi-annual basis as budgets are developed and capital plans and O&M plans are revised.

It should be noted that the criticality rating system will always generate assets that are rated as high-risk components. The rating system is a relative one, where the risk of a particular asset is rated relative to the other assets that are also evaluated. Therefore, the Town will always have assets that rank in the Level 4 or Level 5 risk category. As these assets are rehabilitated, replaced or repaired their likelihood of failure score will improve and their total risk rating can be reduced. Meanwhile, lower at-risk components will age and deteriorate over time and their risk scores will increase.

A valuable component of this dynamic prioritization tool is the ability to quickly perform different scenario analyses to determine the relative benefit of capital and operation and maintenance (O&M) projects. The Town can determine if the at-risk score of a particular component can be dramatically reduced by improvement. In some cases, the consequence of failure score is so high that an improved asset will always remain in the high-risk category. These assets can be monitored on a frequent basis to consistently check their condition and proactively work to prevent a failure. Conversely, assets with the greatest likelihood of failure scores are often the target of initial condition assessment and rehabilitation programs. Town staff can perform scenario analyses to determine where condition assessment and rehabilitation programs can most reduce the at-risk scores of critical assets.



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Figure 4-1: Criticality Analysis Results - Stormwater Pipes
DOWNTOWN SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet
1 in = 300 ft

N W E S

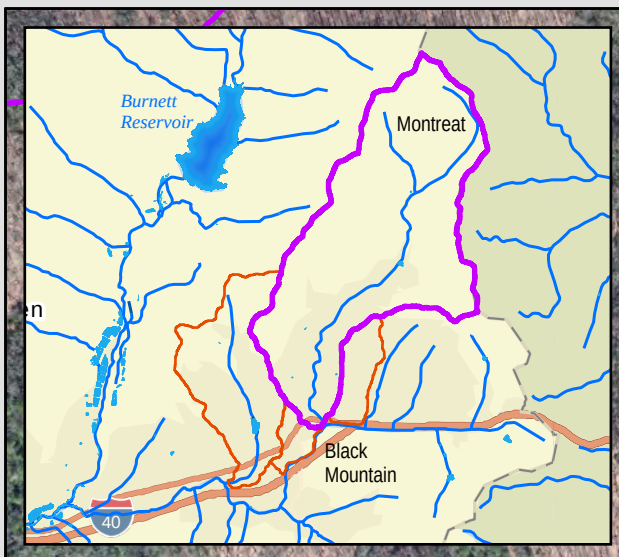


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Figure 4-2: Criticality Analysis Results - Stormwater Pipes
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 300 600 Feet
1 in = 600 ft

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Legend

Stormwater Pipes
Criticality Score
- Low
- Medium-Low
- Medium
- Medium-High
- High

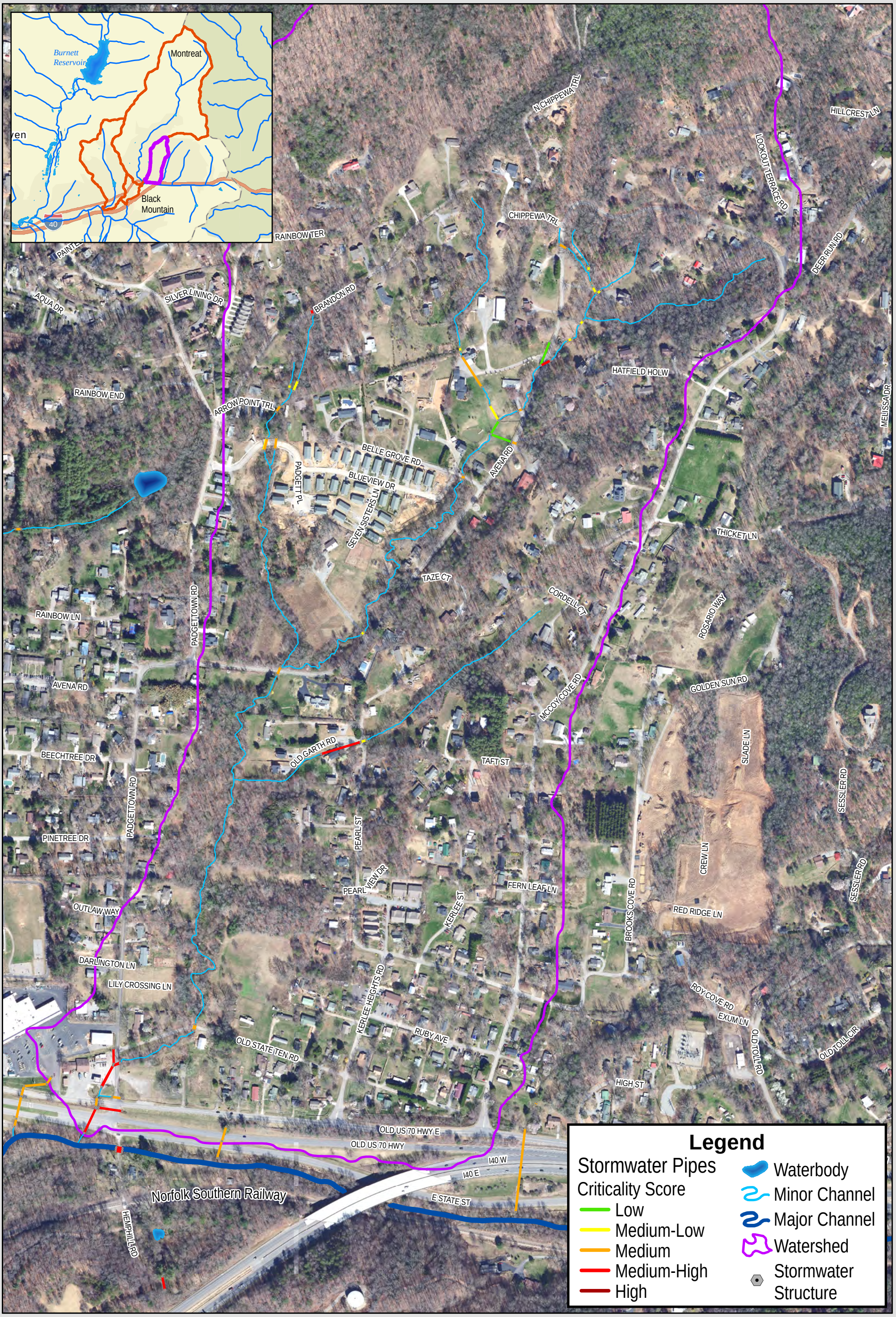
- Waterbody
- Minor Channel
- Major Channel
- Watershed
- Stormwater Structure

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Figure 4-3: Criticality Analysis Results - Stormwater Pipes
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 250 500 Feet
1 in = 500 ft

N W E S



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Figure 4-4: Criticality Analysis Results - Stormwater Pipes
AVENA ROAD/TRIBUTARY 35 WATERSHED
Town of Black Mountain Stormwater Master Plan

0 200 400 Feet
1 in = 400 ft

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5. PROPOSED CAPITAL IMPROVEMENT PLAN

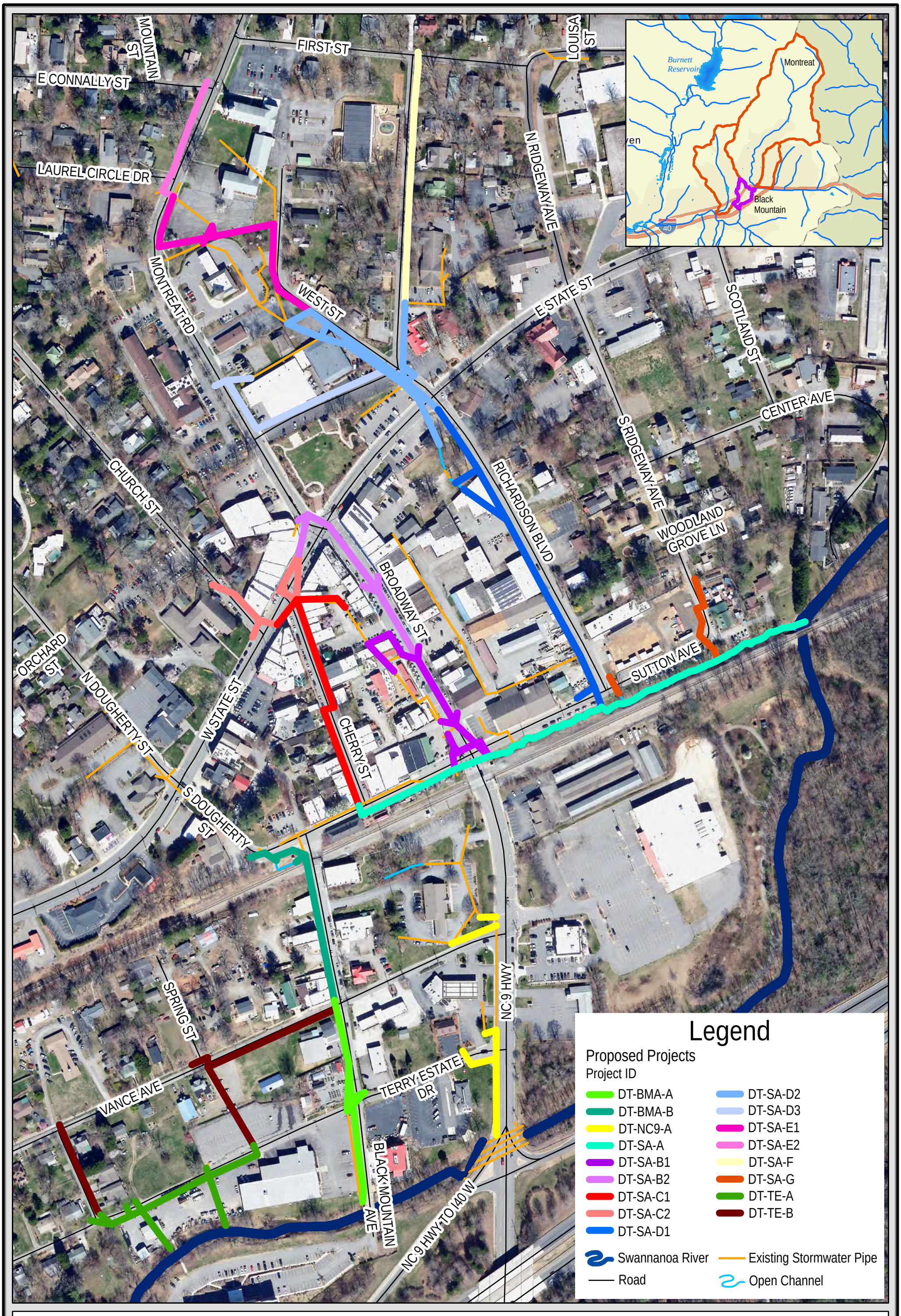
Developing flood mitigation alternatives in an urban environment is a complex process based on limitations imposed by the constraints within the environment, such as floodplain encroachments, increased peak flows due to impervious areas, public and private utilities, and private property. Improvements in this portion of the study were identified through an iterative process of infrastructure improvements, open channel improvements, floodplain benching, and detention options where feasible. As previously noted, the Town desired to focus the stormwater capital projects towards achieving a goal of a 50-YR LOS. In some cases, existing conditions limit options to plan for the desired LOS. Options for providing a high LOS are presented herein.

5.1. Downtown System

The Downtown system is a complex network of pipes in a limited space, combined with nearby utilities, businesses, and the railroad. Much of the Downtown stormwater conveyance system currently runs through private property, with several stormwater pipes located under commercial and critical Town facilities. The proposed improvements focused on re-aligning stormwater infrastructure to the public right-of-way, removal of public water from private systems where feasible, removing pipes underneath structures, providing a greater LOS for roadways, and providing flood reduction to nearby businesses and property owners. The proposed projects are shown in Figure 5-1. The proposed LOS for the Downtown corridor is shown in Figures 5-2 and 5-3 for areas north and south of the railroad. A summary of the proposed stormwater improvements and proposed LOS is provided in Table 5.1.

TABLE 5.1: DOWNTOWN SECONDARY SYSTEM - PROPOSED LEVEL OF SERVICE

ROADWAY CROSSING	PROPOSED PIPE	EXISTING SYSTEM LEVEL OF SERVICE	PROPOSED SYSTEM LEVEL OF SERVICE
NORTH OF RAILROAD			
Sutton Ave (east of Cherry St)	42" RCP	< 2-YR	50-YR
Sutton Ave (at Broadway St)	48" RCP	< 2-YR	50-YR
Broadway St (north of Sutton Ave)	42" RCP	2-YR	50-YR
Richardson Blvd (2 crossings at Sutton Ave)	3' x 7' RCBC / 30" RCP	< 2-YR	50-YR
S. Ridgeway Dr (at Sutton Ave)	36" RCP	< 2-YR	50-YR
W. State St (at Church St)	36" RCP	< 2-YR	50-YR
W. State St (at Cherry St)	18" RCP	< 2-YR	50-YR
Cherry St (at W. State St)	36" RCP	< 2-YR	50-YR
W. State St (at Broadway St)	30" RCP	2-YR	50-YR
E. State St (at Richardson Blvd)	42" RCP	< 2-YR	50-YR
Police Station (pipe under building)	36" RCP	< 2-YR	50-YR
SOUTH OF RAILROAD			
Railroad Crossing - S. Dougherty St	30" RCP	< 2-YR	50-YR
Black Mountain Ave (at Terry Ests.)	42" RCP	< 2-YR	50-YR
Terry Estates Dr (5 crossings)	24", 30", 36" RCP	< 2-YR	25-YR / 50-YR



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Figure 5-1: Proposed Stormwater Improvement Projects
DOWNTOWN DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200
Feet
1 in = 200 ft

Sutton Avenue / Richardson Boulevard Outfall Systems	
ROADWAY	LEVEL OF SERVICE
Sutton Ave at S. Ridgeway Ave	50-YR
2 Sutton Ave at Richardson Blvd Crossings	50-YR
East State St at Richardson Blvd	50-YR
System between Montreat Rd and West St	50-YR
System along West Street at the Police Station	50-YR
Laurel Circle Dr at Montreat Rd	25-YR
West Street at Midland Ave	50-YR
First St at Midland Ave	50-YR
Sutton Ave east of NC 9	50-YR
Sutton Ave and Broadway St intersection	50-YR
Cherry St at Sutton Ave	50-YR
System along west side of Broadway St	50-YR
Cherry St at West State St	50-YR
West State St at Church St	50-YR
Church St at West State St	50-YR
Church St	50-YR
Montreat Rd at East State St	50-YR
24" System in Broadway to Cherry St	50-YR
24" System in Broadway north of Cherry St	50-YR

Legend

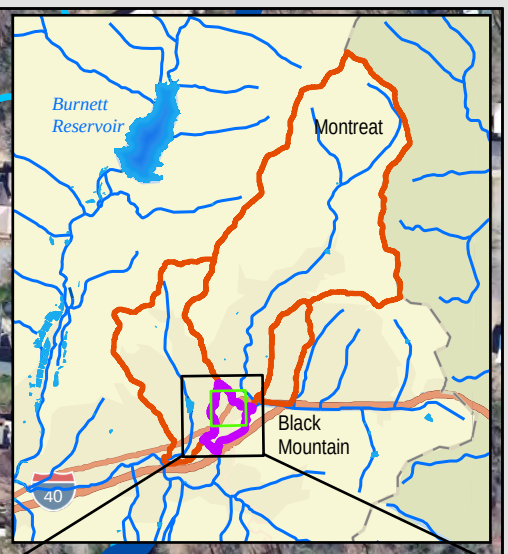
Stormwater Pipe Level of Service

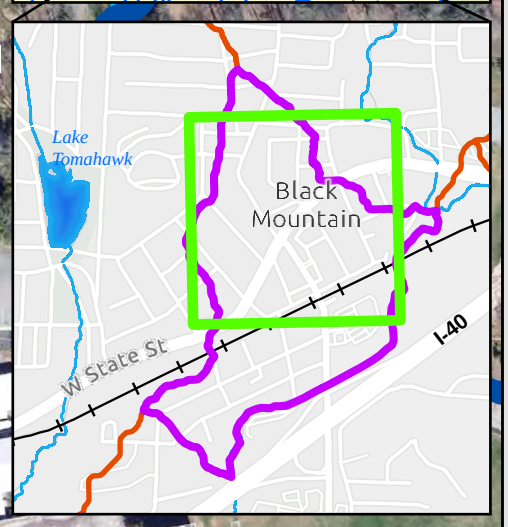
- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Proposed Pipe Abandonment
- Non-Modeled Swannanoa NC9 HWY Culvert
- Non-Modeled Pipe*

Stormwater Structures

- Existing Structure
- Proposed Structure
- Proposed Structure Abandonment
- Proposed Channel Improvements
- Existing Open Channel
- Swannanoa River
- Norfolk Southern Railway

*Evidence of pipe in the field; survey/inventory data not sufficient enough to model





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Figure 5-2:Proposed Conditions Level of Service
DOWNTOWN (NORTH) DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

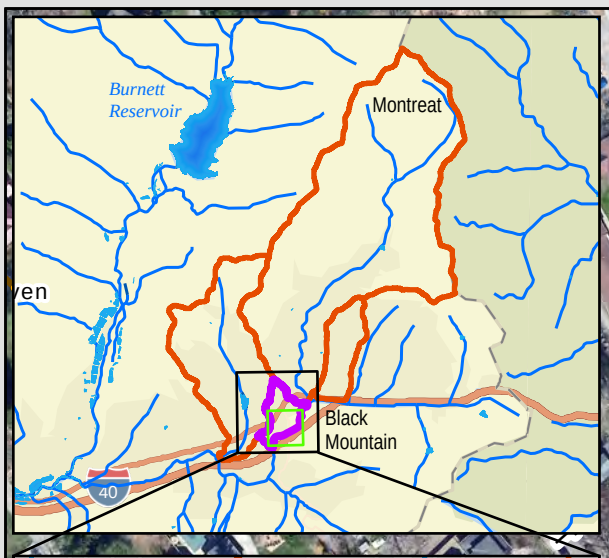
0 100 200 Feet
1 in = 200 ft

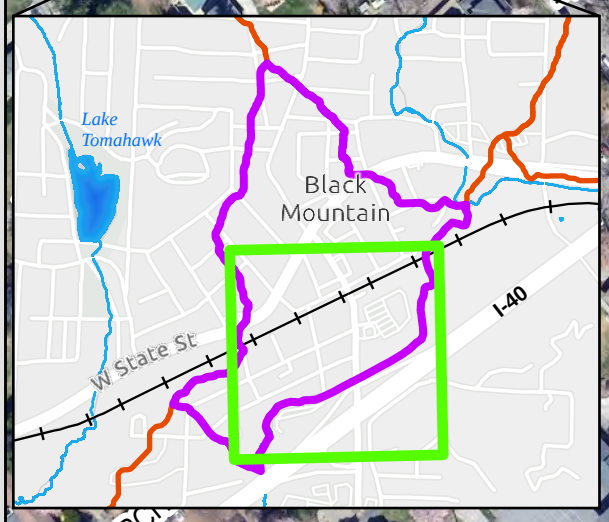
N W E S

Black Mountain Avenue Outfall System	
ROADWAY	LEVEL OF SERVICE
Terry Estate Dr at Black Mtn Ave	50-YR
Black Mountain Ave at Terry Estate Dr	50-YR
Vance Ave at Black Mtn Ave	25-YR
Railroad Tracks at Black Mtn Ave	50-YR
S. Dougherty St at Black Mtn Ave	50-YR
S. Dougherty St Bend	50-YR
West State St (US 70)	25-YR
N. Dougherty St at West State St	50-YR

NC 9 Outfall System	
ROADWAY	LEVEL OF SERVICE
Terry Estate Dr west of NC 9	50-YR
Terry Estate Dr at NC 9	50-YR
Vance Ave at NC 9	50-YR
Vance Ave west of NC 9	50-YR

Bridge Street / Terry Estate Outfall System	
ROADWAY	LEVEL OF SERVICE
3 Terry Estate Dr Crossings near Bridge St	25-YR
2 Terry Estate Dr Crossings east of Bridge St	25-YR
Vance Ave at Bridge St	50-YR
Vance Ave near Spring St	50-YR





Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Proposed Pipe Abandonment
- Non-Modeled Swannanoa NC9 HWY Culvert
- Non-Modeled Pipe*

Stormwater Structures

- Existing Structure
- Proposed Structure
- Proposed Structure Abandonment
- Proposed Channel Improvements
- Existing Open Channel
- Swannanoa River
- Norfolk Southern Railway

**Evidence of pipe in the field; survey/inventory data not sufficient enough to model*

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Figure 5-3: Proposed Conditions Level of Service
DOWNTOWN (SOUTH) DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

N W E S

5.2. Tomahawk Branch Watershed

5.2.1 Primary System

Improvements along Tomahawk Branch focused on the Laurel Circle Drive culvert. Based on observed field conditions, the culvert is in a low spot in the roadway, making it difficult to significantly increase the culvert size due to cover limitations. With upstream and downstream floodplain benching along the golf course for additional storage area and replacing the existing arch pipes with a triple barrel 5' x 9' RCBC, the Town may achieve a 10-yr LOS at this location. Proposed projects and proposed LOS are shown in Figures 5-5 and 5-5. Recommended infrastructure improvements are noted below in Table 5.2.

TABLE 5.2: TOMAHAWK PRIMARY SYSTEM - EXISTING CONDITIONS LEVEL OF SERVICE

ROADWAY CROSSING	PROPOSED PIPE	EXISTING SYSTEM LEVEL OF SERVICE	PROPOSED SYSTEM LEVEL OF SERVICE
Laurel Circle Dr (north of Lake Tomahawk)	Triple RCBC	< 2-YR	10-YR
Cragmont Rd (south of Lake Tomahawk)	NA	50-YR	50-YR
W. State St (US 70)	NA	50-YR	50-YR
Swannanoa Ave (south of Cragmont Rd)	48" RCP	2-YR	25-YR

5.2.2 Secondary System

The Town is currently completing projects to improve the stormwater drainage system on Tomahawk Ave at Fairway Dr. This includes upsizing the existing culvert that drains from the right-of-way on Tomahawk Ave to the golf course from a 15" to 24" culvert, establishing swales along both sides of Tomahawk Ave and along the west side of the golf course pathway, and routing the stormwater to a new bioretention facility on the golf course.

Secondary system improvements located within the Tomahawk Lake watershed should be coordinated with the Town's maintenance plan and infrastructure criticality improvements. It is also recommended that the Town conduct additional, detailed evaluation of the stormwater systems draining to Lake Tomahawk as well as evaluating the lake itself for additional storage capacity. Key stormwater conveyance crossings that are both under capacity and have been designated as high-risk infrastructure (as determined by the criticality analysis) are noted in Table 5.3 below.

TABLE 5.3: TOMAHAWK SECONDARY SYSTEM RECOMMENDED IMPROVEMENT AREAS

ROADWAY CROSSING	EXISTING LEVEL OF SERVICE	CRITICALITY ASSESSMENT
Rhododendron Ave (south of Tenth St)	10-YR	Medium-High
Rhododendron Ave (near Eighth St)	2-YR	Medium-High
Rhododendron Ave (Laurel Circle Dr to Lake)	< 2-YR	Medium / High
S. Laurel Circle (near Circle Dr)	2-YR	High
Tomahawk Ave (just north of Fairway Dr)	2-YR	Medium-High
Hiawassee Ave (north of Tudor Way)	< 2-YR	Medium-High
S. Oconeechee Ave (downstream of noted Hiawassee Ave crossing)	< 2-YR	Medium-High
Hickory St / Tomahawk Ave to Lake	2-YR	Medium-High / High

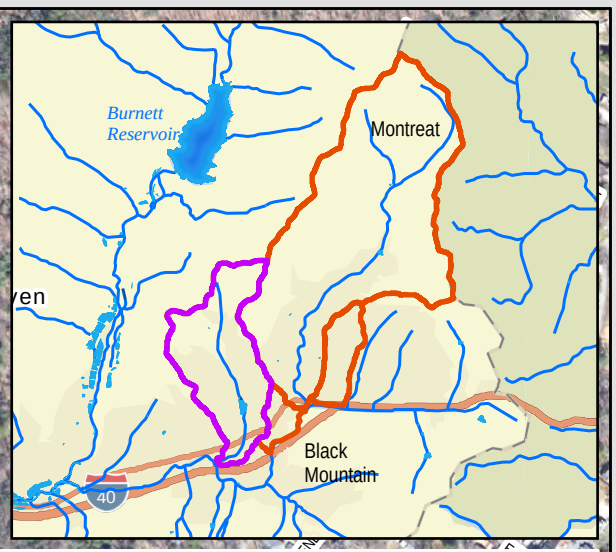


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Figure 5-4: Proposed Stormwater Improvement Projects
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200
Feet
1 in = 200 ft

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CULVERT CROSSING	LEVEL OF SERVICE
W State St (Hwy 70)	50-YR
Cragmont Rd.	50-YR
Laurel Circle Dr.	10-YR
9th St Bridge	25-YR
Hiawassee Ave Bridge	25-YR
Chapel Rd.	25-YR
Golf Course Bridge	2-YR
North Fork Rd. Bridge	50-YR
Private Dr.	50-YR
Walker Cove Rd.	50-YR
Hiawassee Ave (South of Ross Dr.)	50-YR
Swannanoa Ave	25-YR
E College St.	50-YR
Cragmont Rd. (Secondary Crossing)	25-YR

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*
- Bridge Location

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Tomahawk Branch
- Tomahawk Lake

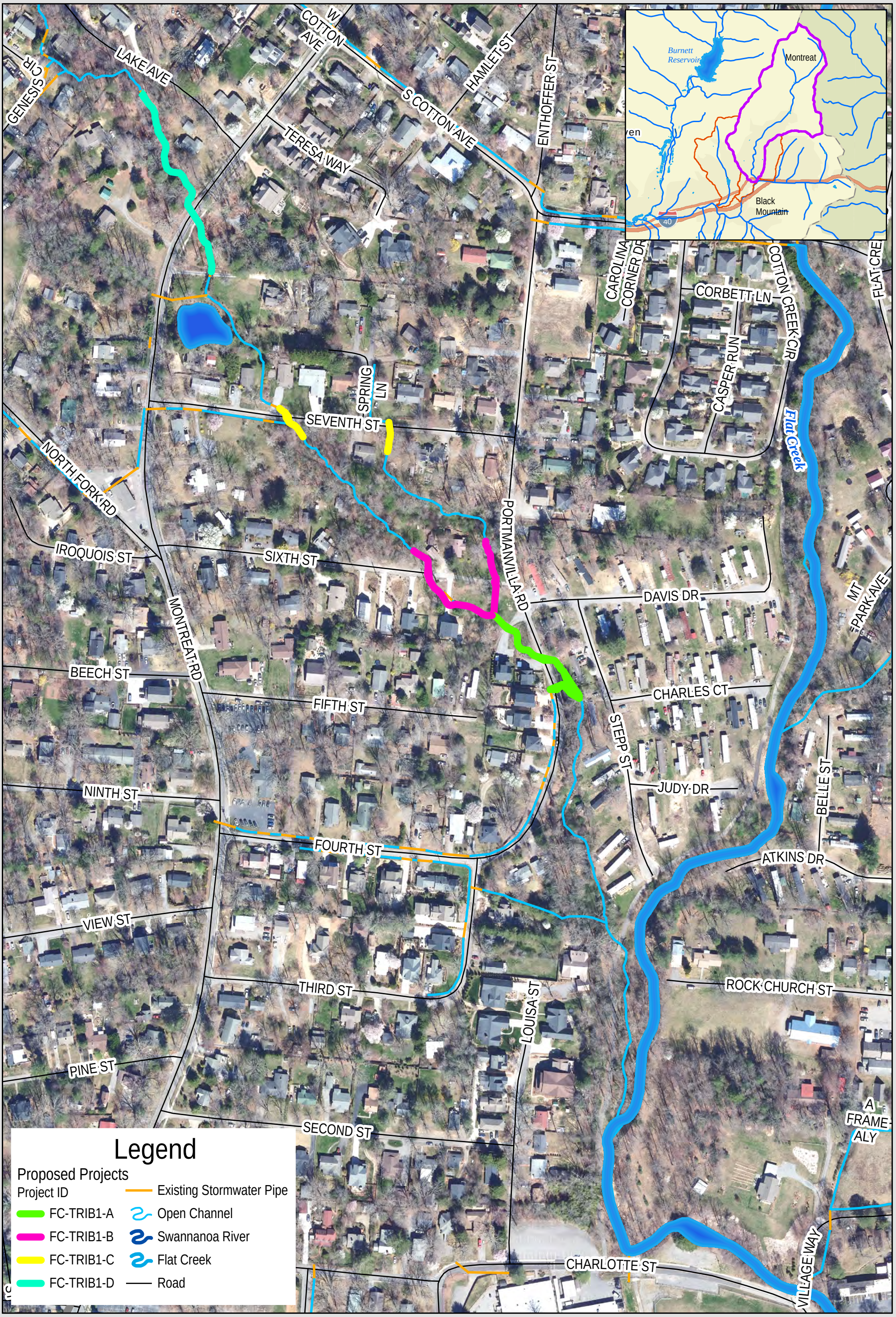
*Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 5-5: Proposed Conditions Level of Service
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 250 500 Feet
1 in = 500 ft

N W E S

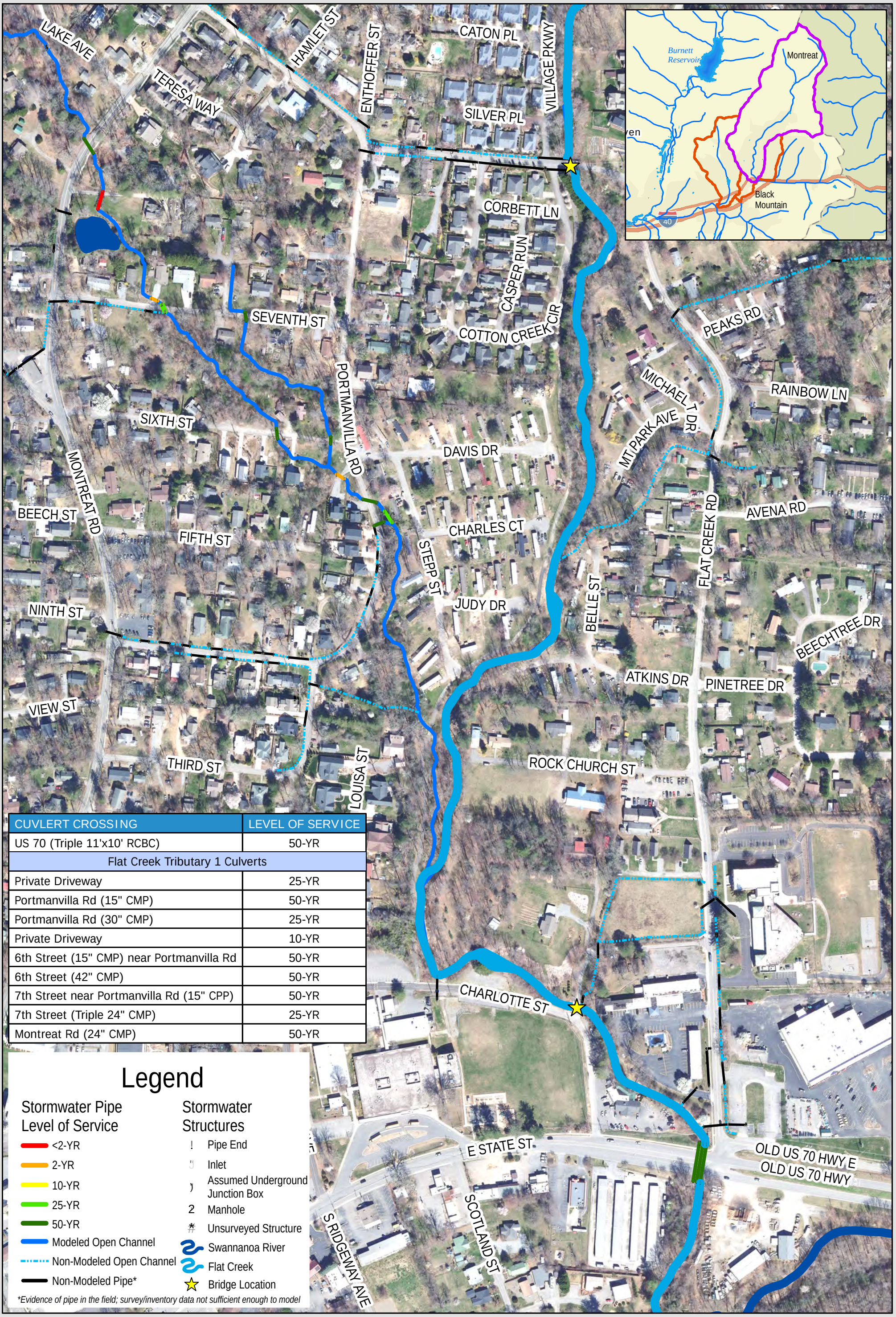


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Figure 5-6: Proposed Stormwater Improvement Projects
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

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CUVLERT CROSSING	LEVEL OF SERVICE
US 70 (Triple 11'x10' RCBC)	50-YR
Flat Creek Tributary 1 Culverts	
Private Driveway	25-YR
Portmanvilla Rd (15" CMP)	50-YR
Portmanvilla Rd (30" CMP)	25-YR
Private Driveway	10-YR
6th Street (15" CMP) near Portmanvilla Rd	50-YR
6th Street (42" CMP)	50-YR
7th Street near Portmanvilla Rd (15" CPP)	50-YR
7th Street (Triple 24" CMP)	25-YR
Montreat Rd (24" CMP)	50-YR

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River
- Flat Creek
- Bridge Location

Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 5-7: Proposed Conditions Level of Service
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 125 250 Feet
1 in = 250 ft

5.3. Flat Creek Watershed

Proposed improvements focused on the known flooding concerns located along Flat Creek Tributary 1 from Portmanvilla Rd upstream to Montreat Rd. Except for the NC DOT large RCBC culvert at US 70, the primary stream crossings along Flat Creek within the Town are bridges. As previously noted, these were modeled using FEMA data. Bridge improvements were not included as part of the SWMP.

Proposed improvements along Flat Creek Tributary 1 are shown in Figure 5-6 and the proposed level of service is provided in Figure 5-7. The proposed LOS for key roadway crossings is noted in Table 5.4.

TABLE 5.4: FLAT CREEK PRIMARY SYSTEM - PROPOSED LEVEL OF SERVICE

ROADWAY CROSSING	PROPOSED PIPE	EXISTING SYSTEM LEVEL OF SERVICE	PROPOSED SYSTEM LEVEL OF SERVICE
Montreat Rd (NC 9)	42" RCP	2-YR	50-YR
Seventh St	Triple 22.5" x 36.25" Arch (30" Eq)	2-YR	25-YR
Seventh St (west of Portmanvilla Rd)	22.5" x 36.25" Arch (30" Eq)	< 2-YR	50-YR
Sixth St	Twin 26.63" x 43.75" Arch (36" Eq)	10-YR	50-YR
Sixth St (west of Portmanvilla Rd)	Twin 22.5" x 36.25" Arch (30" Eq)	< 2-YR	50-YR
Portmanvilla Rd (existing 30" CMP)	Twin 31.31" x 51.13" Arch (42" Eq)	2-YR	50-YR
Portmanvilla Rd (existing 15" CMP)	Twin 22.5" x 36.25" Arch (30" Eq)	< 2-YR	50-YR
US 70 (E. State St)	NA	50-YR	50-YR

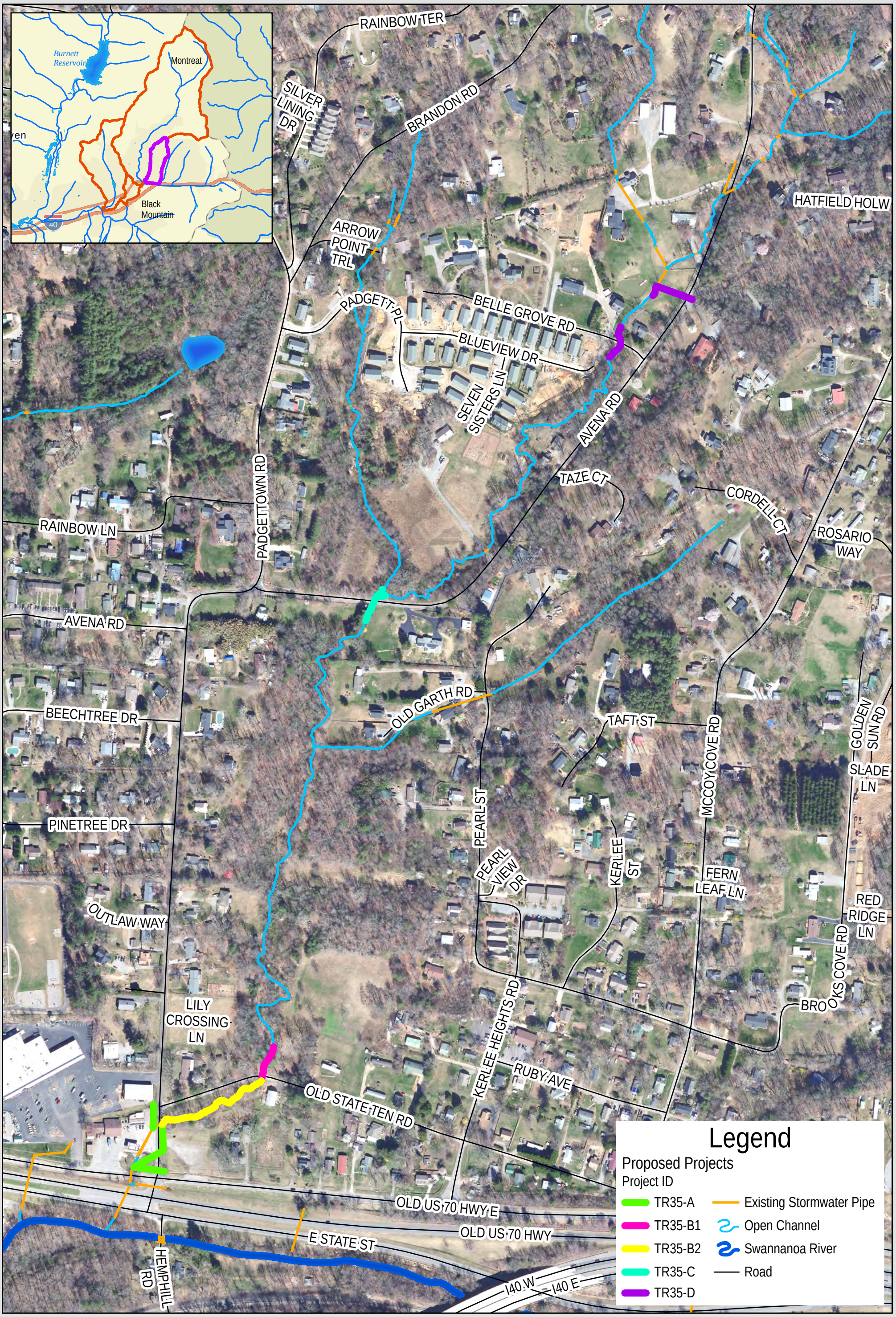
5.4. Tributary 35 / Avena Road Watershed

Tributary 35 of the Swannanoa River is located on the eastern edge of the Town. Historical flooding has been noted along Old State 10 Rd and Padegettown Rd. New development is underway near Bellgrove Rd and Avena Rd in the upper part of the watershed. The primary system consists of open channel and culverts. Infrastructure improvements focused on providing the Town's desired level of service along main roadways, allowing for emergency vehicle access.

Proposed projects are shown in Figure 5-8 and the resulting proposed LOS is provided in Figure 5-9. Proposed LOS for the primary system crossings are also noted below in Table 5.5. It should be noted that the existing conditions around Padgettown Road and Old US 70 East limit the amount of flood reduction achievable in this area.

TABLE 5.5: TRIBUTARY 35 PRIMARY SYSTEM - PROPOSED LEVEL OF SERVICE

ROADWAY CROSSING	PROPOSED PIPE	EXISTING SYSTEM LEVEL OF SERVICE	PROPOSED SYSTEM LEVEL OF SERVICE
Avena Rd (near Bellgrove Rd)	30" RCP	2-YR	50-YR
Bellgrove Rd	Twin 48" RCP	2-YR	50-YR
Avena Rd	Twin 48" RCP	10-YR	25-YR
Old State 10 Rd	Twin 4' x 6' RCBC	2-YR	25-YR
Padgettown Rd (north of Old US 70 E) New Bypass System	Twin 60" RCP	< 2-YR	10-YR
Old US 70 East	6' x 10' RCBC	25-YR	25-YR
US 70 (E. State St)	6' x 7' RCBC	50-YR	50-YR

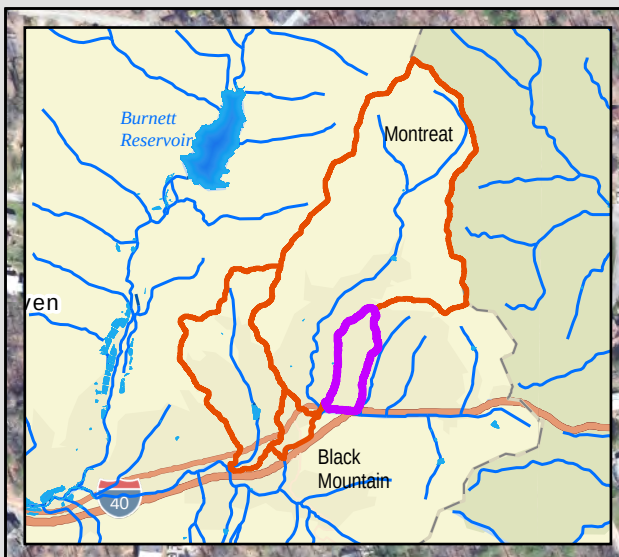


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Figure 5-8: Proposed Stormwater Improvement Projects
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet
1 in = 300 ft

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CULVERT CROSSING	LEVEL OF SERVICE
US-70 (6'x7' RCBC)	100-YR
Old US-70 (6' x10' RCBC)	50-YR
Padgettown Rd (15" CMP)	50-YR
Parking Lot (Twin 36" CMP)	10-YR
Parking Lot (12" CMP)	100-YR
Padgettown Rd (Twin 36" CMP)	10-YR
Unimproved property	10-YR
Padgettown Rd (24" CMP)	25-YR
Old State Ten Rd (Twin 36" CPP)	25-YR
Avena Rd (48" CMP)	25-YR
Padgett Place (Twin 36" CPP)	100-YR
Belle Grove Rd (Twin 36" CMP)	50-YR
Avena Rd (24" CMP+18" CMP)	50-YR
Avena Rd (48" CMP)	100-YR

LOS results at US-70 include the use of the depression area between Old US-70 and US70 as a storage area.

Legend

Stormwater Pipe Level of Service

- <2-YR
- 2-YR
- 10-YR
- 25-YR
- 50-YR
- Modeled Open Channel
- Non-Modeled Open Channel
- Non-Modeled Pipe*

Stormwater Structures

- Pipe End
- Inlet
- Assumed Underground Junction Box
- Manhole
- Unsurveyed Structure
- Swannanoa River

*Evidence of pipe in the field; survey/inventory data not sufficient enough to model

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Figure 5-9: Proposed Conditions Level of Service
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet
1 in = 300 ft

N W E S

5.5. Intense Storm Analysis

As noted in Section 3.5, the 2-yr and 5-yr, 6-hr storm events were modeled to simulate high-intensity rainfall events for the purpose of developing projects more resilient to climate change. These storm events were also modeled with the proposed stormwater improvement projects for each watershed. The modeling results indicate that the proposed capital projects would provide carrying capacity to prevent roadway overtopping during an intense storm event.

6. ANTICIPATED PERMITTING

The proposed improvements described in Sections 5 and 7 may require local, State, and/or Federal permits or approvals prior to the onset of construction. Based on the types of projects identified within the Town, permits or approvals may be required for any of the following reasons:

- Stream, riparian buffer, and/or wetland impacts;
- FEMA floodway and floodplain impacts;
- Land disturbance; and
- Potable water and sewer line adjustments.

The permitting matrix in Table 6-1 shows the different types of permits that are anticipated for each of the proposed projects. Riparian buffer requirements may apply to projects located within fifty (50) feet of a streambank. Coordination with the North Carolina Department of Environmental Quality (NCDEQ) is recommended to determine if buffer impacts are exempt or allowable with mitigation.

The types of 404/401 permits are described below and may vary based on the length of stream impacts and/or acreage of wetland impacts. Wetlands will need to be delineated to determine the acreage of impacts. Permit requirements for a given project may change based on the final design and any changes to the existing regulations. The appropriate permitting agencies should be contacted during the design process to determine if permits will be required.

6.1. NCDEQ Division of Water Resources 401 Water Quality Certification and USACE 404

Proposed improvements must adhere to the requirements set forth in Section 401 and 404 of the Clean Water Act. Required permitting can range from activities that are pre-authorized to those requiring pre-construction notification (PCN) for a Nationwide Permit (NWP) to those requiring an Individual Permit (IP). Individual permits may be required for projects with stream impacts greater than 300 feet and wetland impacts greater than 0.5 acres. It is anticipated that NWP #3 (Maintenance) and NWP #13 (Bank Stabilization) may be required to support the projects that include work within channels that are claimed jurisdictional by the US Army Corps of Engineers (USACE). More detailed explanations of the types of 404 permits are provided below.

NWP#3 – Maintenance

This permit authorizes the repair, replacement, or rehabilitation of any previously permitted or currently serviceable structure. A PCN is not required for minor deviations in the structure's configuration or filled area that occur because of changes in materials, construction techniques, or safety standards necessary to make repair or replacement, provided environmental impacts are minimal. A PCN to the USACE is required if a significant amount of sediment is excavated/filled within the channel. The NCDEQ Division of Water Resources (DWR) does not typically require a PCN for NWP #3 but usually receives one as a courtesy. A general water quality certification (WQC) is conditionally authorized under a NWP #3. If an activity does not meet the general WQC conditions, an individual WQC from DWR will be required.

Other provisions imposed by the State of North Carolina require that culvert inverts must be buried a minimum of 1-foot below the streambed for culverts greater than or equal to 48 inches in diameter to allow low flow passage of water and aquatic life. Culverts less than 48 inches in diameter should be buried to a depth of 20% or greater of the culvert's diameter.

NWP #13 – Bank Stabilization

This permit authorizes the reshaping of channel banks or bank stabilization activities that are necessary for erosion prevention. The placement of material is prohibited in any special aquatic site in a manner that may impede surface water flow into or out of a wetland area, or in a manner that will be eroded during normal or high flows. The activity must be part of a single and complete project and cannot exceed one cubic yard per running foot placed below the high-water mark line. If stabilization activities exceed 500 linear feet, then a PCN is required for both the USACE and DWR. DWR must also be notified and should fill be placed within the streambed. A WQC is conditionally authorized under a NWP #13. If an activity does not meet the general WQC conditions, an individual WQC from DWR will be required.

NWP #27 – Stream and Wetland Restoration Activities

This permit authorizes stream enhancement, stream restoration, and channel relocation for restoration purposes that provide gains in aquatic functions. Stream channelization and the conversion of streams to other aquatic uses such as impoundments or waterfowl habitat are not authorized. A PCN to the USACE is required for any restoration activities occurring on private or public lands. DWR requires a PCN if impacts are proposed for greater than 500 feet of stream bank or if in-stream structures are used.

Impacts proposed to the streams may need evaluation under the State Environmental Policy Act (SEPA). An Environmental Assessment (EA) is required under SEPA if greater than 500 linear feet of perennial stream is disturbed, and stream restoration or enhancement is not performed. Channel disturbances are defined as activities that remove or degrade stream uses such as channelization, culvert placement, riprap, and other hard structures. A list of some other conditions that should be followed under regulations provided by the USACE and DWR include the following:

- Soil erosion and sediment controls must be used and maintained in effective operating conditions during construction, and all exposed soil and fills should be stabilized at the earliest possible date.
- No activity is authorized under any NWP that is likely to jeopardize the existence of a threatened or endangered species, or which will destroy or adversely modify the habitat of such species.
- No activity is authorized that may affect historic properties listed or eligible for listing in the National Register of Historic Places.
- More than one NWP used for a single and complete project is prohibited.
- Impacts to the waters of the US should be avoided and minimized to the greatest extent practicable.
- Mitigation in all its forms will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.
- Hardening techniques should be avoided and minimized to the greatest practicable extent.

6.2. Individual Permits

Individual permits are required when stream or wetland impacts do not meet the conditions of a nationwide permit. Permit applications may be reviewed by multiple agencies including but not limited to USACE, DWR, EPA, State Historic Preservation Office (SHPO), North Carolina Wildlife Resources Commission (NCWRC), and United States Fish and Wildlife Service (USFWS). The application is also made available for public review. There is no defined timeline for review of the application for an IP; therefore, the permitting process for an IP is typically significantly longer than the review time for a NWP. Typically, 404 and 401 Individual Permits are applied for jointly and their review is concurrent. There are no anticipated individual permit requirements for proposed projects as part of the Town's Proposed Capital Improvement Plan.

6.3. Federal Emergency Management Agency (FEMA)

Streams with a drainage area greater than one (1) square mile are typically modelled and mapped by FEMA for flood insurance purposes. The 100-year floodway and floodplain have been mapped for the watersheds included in the Town's SWMP (Tomahawk Branch, Flat Creek, Tributary 35 of the Swannanoa River, and the Swannanoa River). Any proposed projects that will include grading within a FEMA defined floodway will require a Conditional Letter of Map Revision (CLOMR) submitted to FEMA for pre-approval purposes and a Letter of Map Revision (LOMR) upon completion of construction.

6.4. Erosion and Sedimentation Control

The NCDEQ Division of Energy, Mineral, and Land Resources (DEMLR) is another agency that requires notification before proposed activities are constructed. DEMLR requires that an erosion and sedimentation control plan be submitted to the for approval before the start of construction for any disturbance greater than one (1) acre.

TABLE 6.1: ANTICIPATED PERMITTING MATRIX FOR PROPOSED PROJECTS

PROPOSED STORMWATER IMPROVEMENT PROJECT		FEMA	NCDEQ /NPDES	404/401 (NWP)	404/401 (IP)	NC DOT	Railroad
DOWNTOWN SYSTEM							
DT-SA-A	Sutton Ave	x		x		x	x
DT-SA-B	Broadway St			x		x	
DT-SA-C	Cherry St					x	
DT-SA-D1	Police Station/Post Office Phase I	x		x			
DT-SA-D2	Police Station/Post Office Phase II					x	
DT-SA-E	West St / Honeycutt St					x	
DT-SA-F	Montreat Rd / Midland Ave					x	
DT-SA-G	S. Ridgeway Ave	x		x			
DT-BMR-A	Black Mountain Ave Phase I			x			
DT-BMR-B	Black Mountain Ave Phase II						x
DT-TE-A	Terry Estate Dr Phase I	x		x			
DT-TE-B	Terry Estate Dr Phase II						
DT-NC9-A	NC 9	x		x		x	
TOMAHAWK BRANCH PRIMARY SYSTEM							
TB-A1	Laurel Circle	x		x			
TB-A2	Golf Course Floodplain Benching	x		x			
TB-B	Swannanoa Ave	x		x			
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM							
FC-TRIB1-A	Portmanvilla Rd	x		x			
FC-TRIB1-B	6th St	x		x			
FC-TRIB1-C	7th St	x		x			
FC-TRIB1-D	Montreat Rd	x		x		x	
TRIBUTARY 35 / AVENA ROAD PRIMARY SYSTEM							
TR35-A	Padgettown Rd	x		x		x	
TR35-B1	Old State 10 Rd	x		x			
TR35-B2	Tributary 35 Floodplain Benching	x		x			
TR35-C	Avena Rd	x		x		x	
TR35-D	Bellgrove Rd / Avena Rd			x		x	

7. PRIORITIZATION AND RECOMMENDATIONS

Infrastructure capital projects are proposed in areas where historic flooding has been reported, where infrastructure has been determined to be high risk, and in general where the desired level of service for stormwater conveyance is not provided.

7.1. Infrastructure Project Prioritization

After completing the assessments and modeling documented in this Report, conceptual solutions were developed to address stormwater quantity and protecting and restoring natural stream corridors where possible. The recommended solutions begin with projects that reduce flooding, which was identified as a priority for the Town.

The initial conceptual analysis of each proposed project was evaluated through a prioritization process based on utility conflicts, level of street flooding, property ownership, effect of improvements, and cost effectiveness. A summary of the prioritization criteria used in the initial evaluation is noted below and documented in Table 7.1.

1. **Utility Conflicts**: The number and type of sanitary sewer conflicts and/or stream crossings within the proposed project footprint.
2. **Street Flooding:** Improvements to help meet the LOS across major and minor public streets.
3. **Public or Private Land:** Location of the proposed project and whether it is situated on Town, NCDOT, or privately-owned land.
4. **Effect of Improvements**: Flood reduction risk to a property by 0.5’ or greater and the number of properties experiencing the flood reduction risk.
5. **Cost Effectiveness**: Ratio of total project cost to project benefits.

Bonus points were awarded for projects that may be eligible for grant funding and stormwater systems with medium-high and high criticality scores.

TABLE 7.1. INFRASTRUCTURE PRIORITIZATION CRITERIA

CATEGORY	RATING	DESCRIPTION
Utility Conflicts	3	Minimal Utility Conflicts
	2	Stream Crossing, Water Main Conflict, and/or Minor Sewer Conflict
	1	Potential Re-Alignment of Sewer
Street Flooding	4	Improvements Help Meet LOS for Principal Arterial and Major Collector
	3	Improvements Help Meet LOS for Minor Arterial and Other Public Streets
	2	Project Improves Los for Public Roads at Primary System Crossings, but Desired Los Not Met
	1	LOS Improved for Secondary Systems, but Desired Los Not Met
Publicly Or Privately-Owned Land	4	Town
	3	County
	2	Public and Private
	1	NCDOT
	1	1 Private Landowner
	0	2+ Private Landowners
Effects Of Improvements*	4	Reduces Flood Risk > 5 Properties
	3	Reduces Flood Risk At 2-5 Properties and Potential Structural Flooding
	2	Reduces Flood Risk At 2-5 Properties
	1	Reduces Flood Risk < 2 Properties
Cost Effectiveness	4	Cost/Benefit Ratio < $20,000
	3	Cost/Benefit Ratio: $20,000 - $30,000
	2	Cost/Benefit Ratio: $30,001 - $40,000
	1	Cost/Benefit Ratio: $40,001 - $50,000
	0	Cost/Benefit Ratio > $50,000
Grant Bonus Points	1	Project May Be Eligible for 1 Grant
	2	Project May Be Eligible for 2 Grants
	3	Project May Be Eligible for 3 or More Grants
Criticality Bonus Points	1	Project Aligns with Infrastructure in the Medium Category
	2	Project Aligns with Infrastructure in the Medium-High and High Categories

**Flood risk defined as reduction of 0.5' or greater*

Weighting factors for infrastructure improvement projects placed emphasis on the primary goal of reducing street flooding. The weighting factors, which standardize the final project scores on a 100-point scale, are shown in Table 7.2.

TABLE 7.2. INFRASTRUCTURE WEIGHTING FACTORS

CRITERIA	WEIGHTING FACTOR
Utility Conflicts	4
Street Flooding	8
Publicly Or Privately-Owned Land	4
Effect Of Improvements	5
Cost Effectiveness	5

7.2. Planning Level Cost Estimates

The opinions on project costs have been prepared to assist Town staff in making planning level decisions and prioritizing improvements. The costs presented herein are not final design cost estimates. The preliminary project cost estimates were developed using recent bid tabulations from other communities within North Carolina. They include easement acquisitions, environmental permitting, surveying, engineering, legal, and administrative costs.

The cost estimates are planning-level costs based on current information. Costs are subject to change based on local factors, materials, delivery, construction, and other influences. A detailed breakdown of estimated capital and project costs per proposed stormwater improvement project is in Appendix E.

7.3. Project Recommendations

The recommended projects are focused on improving the Town's stormwater conveyance system. System upgrades to replace aging infrastructure, improve carrying capacity, and reduce flooding are presented herein. The Town should continue to promote nature-based solutions and green infrastructure in redevelopment and future development projects to reduce stormwater runoff.

Table 7-3, on the next page shows the total prioritization score of each proposed stormwater capital improvement project. Opinions of total project cost are also provided in Table 7-3. The planning costs presented are based on the infrastructure necessary to meet the Town's 50-year desired level of service where feasible.

Projects were also evaluated based on the prioritization criteria noted in Section 7.1. As noted in Table 7-3, there are several instances where a phase II or upstream project has a higher priority score. However, the downstream project should be constructed first to provide the capacity for implementing stormwater improvements upstream.

The Town should re-visit the prioritization lists annually to determine if the priorities should change. Project sheets and detailed cost estimates for each proposed project are provided in Appendix E.

TABLE 7.3. PROPOSED CIP PLANNING COST AND PRIORITIZATION SUMMARY

PROPOSED STORMWATER IMPROVEMENT PROJECT		PROJECT PLANNING LEVEL OPINION OF COST	PRIORITIZATION SCORE
DOWNTOWN SYSTEM			
DT-SA-A	Sutton Ave	$ 2,250,000	88
DT-SA-B1	Broadway St Phase I	$ 2,029,000	83
DT-SA-B2	Broadway St Phase II	$ 1,292,000	88
DT-SA-C1	Cherry St Phase I	$ 1,510,000	75
DT-SA-C2	Cherry St Phase II	$ 1,021,000	88
DT-SA-D1	Police Station/Post Office Phase I	$ 4,303,000	71
DT-SA-D2	Police Station/Post Office Phase II	$ 1,932,000	87
DT-SA-D3	Police Station/Post Office Phase III	$ 923,000	81
DT-SA-E1	West St to Montreat Rd	$ 1,228,000	76
DT-SA-E2	Montreat Rd at Laurel Circle Dr	$ 797,000	49
DT-SA-F	Midland Ave	$ 1,121,000	82
DT-SA-G	S. Ridgeway Ave	$ 827,000	76
DT-BMA-A	Black Mountain Ave Phase I	$ 1,880,000	82
DT-BMA-B	Black Mountain Ave Phase II	$ 1,308,000	88
DT-TE-A	Terry Estate Dr Phase I	$ 1,963,000	61
DT-TE-B	Terry Estate Dr Phase II	$ 1,380,000	78
DT-NC9-A	NC 9	$ 1,335,000	68
TOMAHAWK BRANCH PRIMARY SYSTEM			
TB-A1	Laurel Circle Culvert Replacement	$ 760,000	58
TB-A2	Golf Course Floodplain Benching	$ 690,000	53
TB-B	Swannanoa Ave Culvert	$ 430,000	77
FLAT CREEK PRIMARY SYSTEM			
FC-TRIB1-A	Portmanvilla Rd	$ 900,000	87
FC-TRIB1-B	6th St	$ 633,000	78
FC-TRIB1-C	7th St	$ 405,000	87
FC-TRIB1-D	Montreat Rd	$ 546,000	88
TRIBUTARY 35 PRIMARY SYSTEM			
TR35-A	Padgettown Rd	$ 1,422,000	62
TR35-B1	Old State 10 Rd	$ 608,000	77
TR35-B2	Tributary 35 Floodplain Benching	$ 425,000	66
TR35-C	Avena Rd	$ 438,000	85
TR35-D	Bellgrove Rd / Avena Rd	$ 824,000	83

8. FUNDING OPPORTUNITIES

There have been substantial changes in the North Carolina stormwater funding landscape over the last five (5) years that have enabled new capital investment in stormwater infrastructure by communities large and small. Available funding, and thus competitiveness for each grant or loan program changes year-to-year as priorities fluctuate at the state and federal level. Keeping up to date on these changes and leveraging one funding source to gain access to another are both crucial elements to developing a successful funding strategy for a given project.

As the Town navigates the current and future opportunities, the key will be to evaluate each funding program, the selection criteria, application deadlines, and funding timelines to estimate compatibility with the Town's project goals and timeline.

Multiple federal and state agencies provide funding opportunities for municipalities and organizations to implement watershed management projects. As the Town of Black Mountain explores opportunities to fully fund or partially fund this Capital Improvement Plan, additional investigation will be needed to determine complete project eligibility and competitiveness for each funding program identified.

The financial resource summary provided below is informational and are current grant programs available at the time this SWMP was prepared. A summary of key points for each one is provided in Table 10.1.

8.1. Clean Water State Revolving Fund (CWSRF)

Administered through the NCDEQ Division of Water Infrastructure, the Clean Water State Revolving Fund (CWSRF) program funds construction projects related to wastewater treatment, wastewater collection, reclaimed water, stormwater control measures (SCMs), stream restoration, and energy efficient projects. These projects may be funded by low-interest loans or Principal Forgiveness (PF) and any local government can apply for this funding. Additional information can be found here: CWSRF | NCDEQ

8.2. Water Resources Development Grant – State and Local Projects

Through the NCDEQ Division of Water Resources, the Water Resources Development Grant (WRDG) provided funding to local governments to support technical assistance (planning, engineering, and design) and implementation of water-related projects. The seven eligible projects include: general navigation, recreational navigation, water management, stream restoration, water-based recreation, the NRCS Environmental Quality Incentives Program (EQIP) (stream restoration), and feasibility/engineering studies. Relevant to the Town of Black Mountain, the non-navigation/coastal projects are referred to as State and Local Projects (S&L) and will fund up to a 50% cost-share. The maximum award for constructions projects is $200,000 and the maximum award for feasibility/engineering studies is $50,000. The applicant must be a local government entity. Further information on can be found here: WRDG | NCDEQ-DWR

TABLE 8.1. FUNDING OPPORTUNITIES

FUNDING AGENCY	PROGRAM	POTENTIAL PROJECT TYPES	TENTATIVE APPLICATION DEADLINE
NCDEQ-DWI	Clean Water State Revolving Fund (CWSRF)	Stormwater SCMs, Stream Restoration	March/April & Sept. 2025 Cycles
NCDEQ-DWR	Water Resources Development Grant (WRDG)	Stormwater SCMs, Watershed Planning, Engineering Study, Stream/Wetland/Floodplain Restoration, Bank Stabilization, Dam Removal, Trails/River Access, Land Acquisition, NRCS EQIP Projects	June 30, 2025 & Dec. 31, 2025
NCDEQ-DWR	205(j) WQ Management Planning Grant*	Water Quality Planning, Stormwater Infrastructure Mapping, Stormwater SCMs, Watershed Assessment	Sept 19, 2025
GOLDEN LEAF FOUNDATION	Flood Mitigation Grant	Stormwater Management, Engineering/ Planning, Stormwater System Mapping, Flood Mitigation	Oct. 24. 2024 Dec. 26, 2024 Feb. 20, 2025
NCLWF	NC Land and Water Fund Grants	Stream/Wetland Restoration, Land Acquisition, Innovative Stormwater Management, Planning	March 1, 2025
NCDOJ	Environmental Enhancement Grant (EEG)	Stormwater Management, Stream/Wetland Restoration, Planning, Land Acquisition, Research	LOI: March 1, 2025 Due: April 4, 2025
USDA - NRCS	Emergency Watershed Protection (EWP)	Stream Debris Removal, Stream/Erosion Stabilization, Repair Stormwater Infrastructure/Flood Management Structures, Conservation Practices, Purchase EWP Buyouts	Submit Application With 60 Days of Declared Disaster
NCDA&CS	Streamflow Rehabilitation Assistance Program (StRAP)	Stream Debris Removal, Stream Stabilization, Stream Restoration, Repair to Impoundment Structures	Spring 2025
FEMA	Building Resilient Infrastructure and Communities (BRIC)**	Mitigate Impacts to Infrastructure due to Natural Hazards, Flood Control, Stormwater Infrastructure, Stream Stabilization/Restoration, Capability and Capacity Building Projects	LOI: TBD Sub-App: TBD Final App: TBD
FEMA	Hazard Mitigation Grant Program (HMGP)	Disaster Specific Funding to Support Recovery and Mitigation Efforts	Based On Date of Declared Disaster
FEMA	Flood Mitigation Assistance (FMA)	Floodplain Property Buyouts due to Repetitive Loss, Individual and Localized Flood Reduction Projects, Capability and Capacity Building Projects	LOI: Dec 20, 2024 Sub-App: TBD Final App: TBD

**Grant applicant must be a Council of Government*

***Projects outside of a declared disaster area compete at the national level.*

8.3. Golden Leaf Flood Mitigation Grant

As an annual appropriation from the North Carolina General Assembly, the Golden LEAF Foundation administers the Flood Mitigation Program (FMP) grant that awards funding for flood mitigation projects to local units of government. The program will fund construction of improvements to or the addition of new publicly owned stormwater infrastructure, including natural drainage ways, streams, green infrastructure stormwater control measures (SCMs), flood controls, and grey infrastructure. Improvements must mitigate flooding impacts for the future. Funds can also be used to cover planning or engineering studies related to flood mitigation solutions. The maximum grant award request is $2M, although most projects do not exceed $1M. Applications are reviewed twice a year. There is no financial match requirement. Learn more about the program here: FMP | Golden LEAF

8.4. North Carolina Water and Land Fund

Funded through the NC General Assembly, the North Carolina Water and Land Fund (NCWLF) (formerly known as the Clean Water Management Trust Fund) funds projects focused on conservation, ecological restoration, and water quality improvements throughout the state. Grants are available for Acquisition, Restoration, Innovative Stormwater, and Planning activities. Most appropriate for the Town to consider, the Restoration grant funds stream restoration and stabilization, wetland restoration and creation, dam removal and fish-passage culvert replacement, and other projects that improve surface water quality, including stormwater green infrastructure facilities and removal of infrastructure from floodplains.

Local units of government and non-profit organizations are eligible to apply. While the max funding request is not capped, recent awards have generally ranged from $150,000 to $900,000. The availability of funding varies year to year based on General Assembly priorities. No cost-share is required, however matching funds is a major component of project scoring. For stream projects, NCLWF requires a conservation easement to be established to protect a 50’ wide vegetated riparian buffer on both sides of the stream (100’ in total). To learn more about the Restoration grant program or any of the other NCLWF programs visit this website: NCLWF

8.5. Environmental Enhancement Grant (EEG)

Resulting from a legal settlement between the NC Attorney General and Smithfield Foods, the Environmental Enhancement Grant (EEG) was established to support projects that improve North Carolina’s air, water, and quality. Non-profit, academic, and governmental entities are eligible to apply, and awards generally range from $5,000 to $500,000. Eligible projects include land acquisition, remediation, restoration, planning, education, research, and construction activities. Projects that provide benefits to underserved or overburdened communities and address environmental justice issues. A financial match is not required but is advantageous. More information on scoring criteria and the application process can be found here: EEG | NCDOJ

8.6. Emergency Watershed Protection

The Emergency Watershed Protection (EWP) Program provides emergency federal recovery assistance to communities impacted by natural disasters. The program is administered through the USDA and NRCS and offers technical and financial assistance. In the absence of a federal or state disaster declaration, the NRSC State Conservationist can declare a local watershed emergency to open access to the EWP program.

Eligible projects include stream debris removal, stream bank and land erosion stabilization, repair or replacement of drainage facilities, repair of flood control structures, repair some conservation practices, and purchase EWP Buyouts. Projects must provide protection from future flooding, reduce threats to life and property, and restore hydraulic capacity to the natural environment. The program applicant/sponsor must be a local governmental entity and there is a 25% cost-share required. More detail about the program can be found here: EWP | USDA

8.7. Streamflow Rehabilitation Assistance Program

Under the North Carolina Department of Agriculture and Consumer Services (NCDA&CS), the Streamflow Rehabilitation Assistance Program (StRAP) funds projects that reduce flooding, improve streams through bank stabilization, stream debris removal, and stream restoration activities, and protect or improve drainage infrastructure (e.g., principal spillway, emergency spillway, and impoundment maintenance). Local governmental entities and non-profit organizations are eligible to apply, and awards can range from <$100,000 to $1M. More information can be found here: StRAP | NCDACS

8.8. Federal Emergency Management Agency (FEMA)

The Federal Emergency Management Agency (FEMA) provides multiple avenues for financial assistance, some of which are managed by the NC Department of Public Safety Division of Emergency Management. Additional information on these programs can be found at these links: Hazard Mitigation Assistance Grants | FEMA.gov and North Carolina Department of Public Safety's Division of Emergency Management.

Building Resilient Infrastructure and Communities (BRIC)

FEMA has several hazard mitigation programs that are particularly well-suited for stormwater projects. The newest of these programs is a retooling of the former Pre-Disaster Mitigation Program (PDM), known as the Building Resilient Infrastructure and Communities (BRIC) grant program. It represents a significant shift in the way FEMA conducts pre-disaster mitigation funding. It is a standard Stafford Act program with a 25% local match required. Applications are accepted in the fall of each year through the state emergency management agency, which is NCDPS. This program focuses on projects that have multi-layer benefits for the community and those that employ nature-based solutions. These can include flood control, water, sewer, or infrastructure construction projects or plans and studies to help develop future projects called Capability & Capacity Building (C&CB) proposals. The request amount is capped at $50M.

Eligible project types include shovel-ready (construction) projects, phased projects, and C&CB projects (planning and design). C&CB planning projects will be selected at the state level and awarded sooner than construction projects that will be scored and compete at the national level. It is important to note that applications are conducted through NCDPS, and that FEMA requires a minimum Benefit Cost Analysis (BCA) score for all non-planning projects. Currently, the BRIC program has not received funding, but it could be a source if the program is reinstated. More information can be found here: BRIC | NCDPS.

FEMA Hazard Mitigation Grant (HMGP)

FEMA's Hazard Mitigation Grant Program (HMGP) also funds stormwater projects that are designed to reduce flooding impacts. It is different from the BRIC and HMA programs in that it is not pre-disaster funding. HMGP funds are made available to areas that were covered under a federal disaster declaration. The need for the project submitted does not have to be a result of the disaster but must align with the

area's FEMA-approved Hazard Mitigation Plan. Pre-applications are normally due to NCDPS within 6 months after the declaration. Read further about the program here: HMGP | NCDPS

Flood Mitigation Assistance (Floodplain Buyouts)

Another program under the FEMA mitigation umbrella is the Flood Mitigation Assistance (FMA) grant program. The focus of this program is to fund projects that reduce or eliminate repetitive flood damage to buildings or structures insured by the National Flood Insurance Program (NFIP). The primary purpose of the FMA is to support individual floodplain property buyouts in NFIP communities. The program can also fund C&CB activities and localized flood rick reduction projects. As with the BRIC program, FEMA prioritizes projects that integrate nature-based solutions. Applications for this program follow the same process and general timeframe as BRIC program. Learn more about this program here: BRIC | NCDPS

9. REFERENCES

1. NOAA National Climate Data for Hurricane Helene: Daily Summaries Station Details: ASHEVILLE, NC US, GHCND:USW00013872 | Climate Data Online (CDO) | National Climatic Data Center (NCDC)
2. Town of Black Mountain Stormwater Master Plan Update (2022), Wildlands Engineering.
3. FEMA Models downloaded from the North Carolina Flood Risk Information System (FRIS): NCEM FRIS
4. NOAA National Weather Service ATLAS 14: https://hdsc.nws.noaa.gov/pfds/
5. Urban Hydrology for Small Watersheds, United States Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, Technical Release 55, June 1986.
6. USACE HEC-HMS Land Cover Curve Numbers: Curve Numbers | HEC-HMS | USACE
7. Environmental Protection Agency: Storm Water Management Model (SWMM) | US EPA
8. References for Anticipated Permits and Funding Opportunities are provided within Sections 6 and 8, respectively.

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TOWN OF BLACK MOUNTAIN

BLACK MOUNTAIN STORMWATER MASTER PLAN

Appendix | December 2025









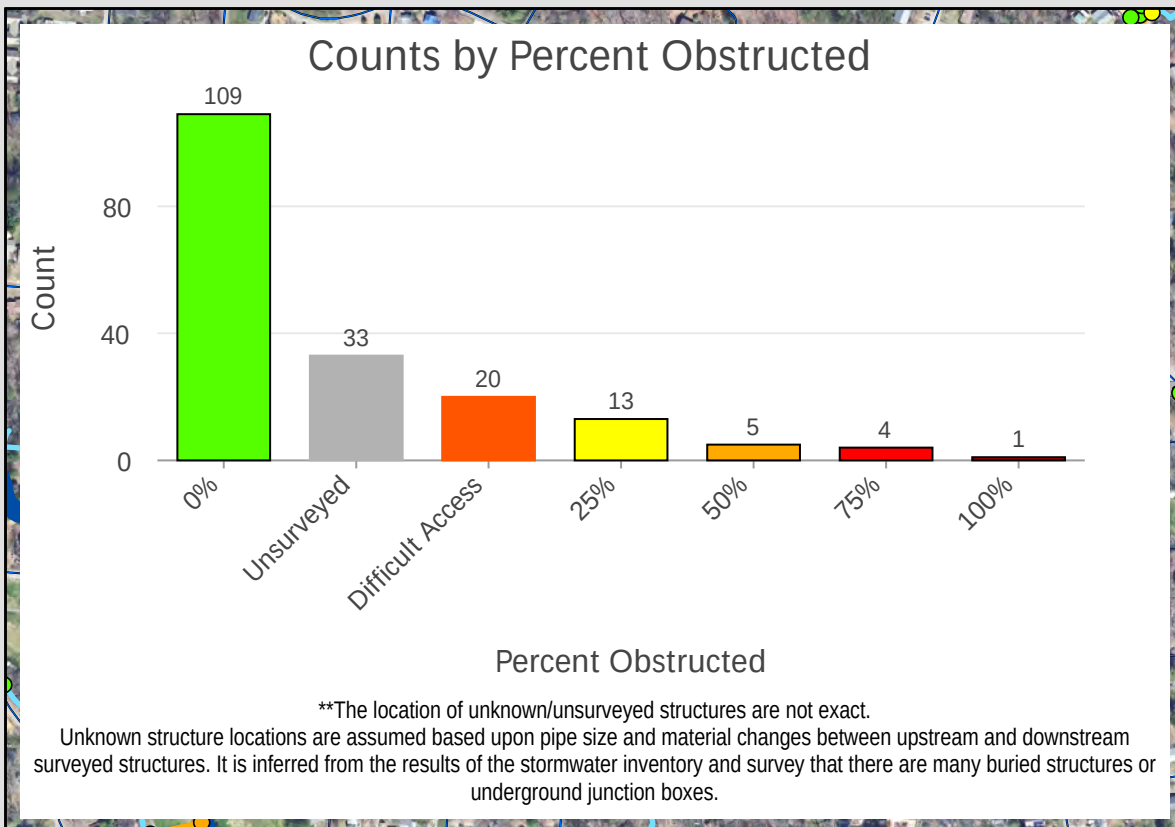
APPENDIX A
MAPS

Figure A-1 Downtown Obstructed Structures

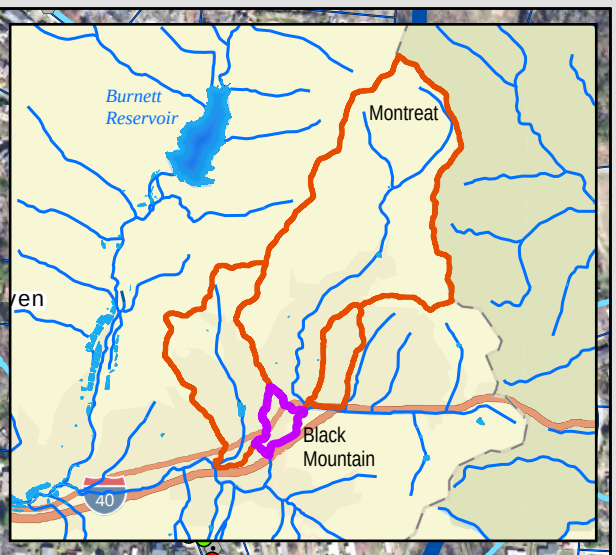
Figure A-2 Tomahawk Branch Obstructed Structures

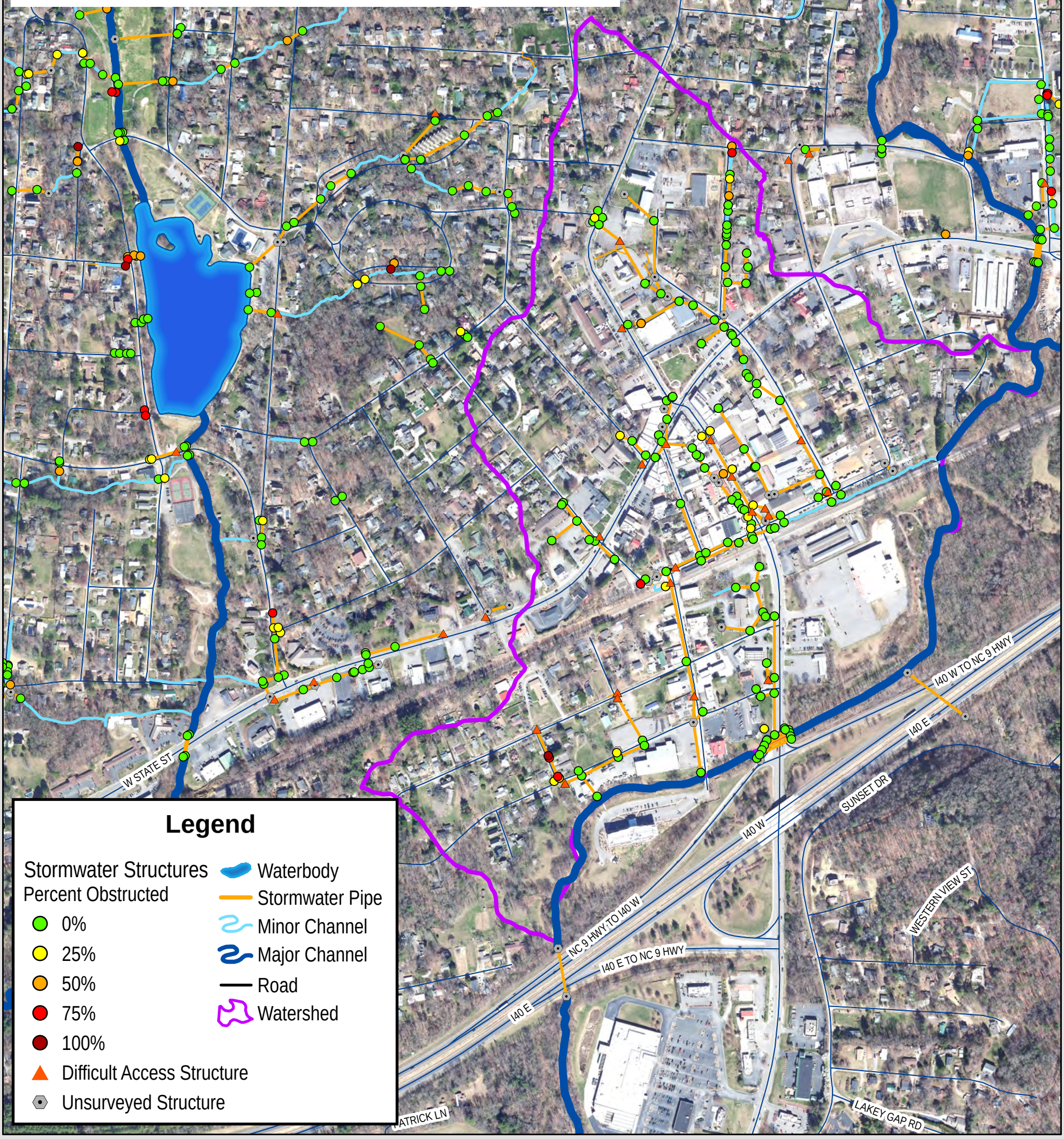
Figure A-3 Flat Creek Obstructed Structures

Figure A-4 Tributary 35 / Avena Rd Obstructed Structures



**The location of unknown/unsurveyed structures are not exact.
Unknown structure locations are assumed based upon pipe size and material changes between upstream and downstream surveyed structures. It is inferred from the results of the stormwater inventory and survey that there are many buried structures or underground junction boxes.





Legend

Stormwater Structures
Percent Obstructed
- 0%
- 25%
- 50%
- 75%
- 100%
- Difficult Access Structure
- Unsurveyed Structure

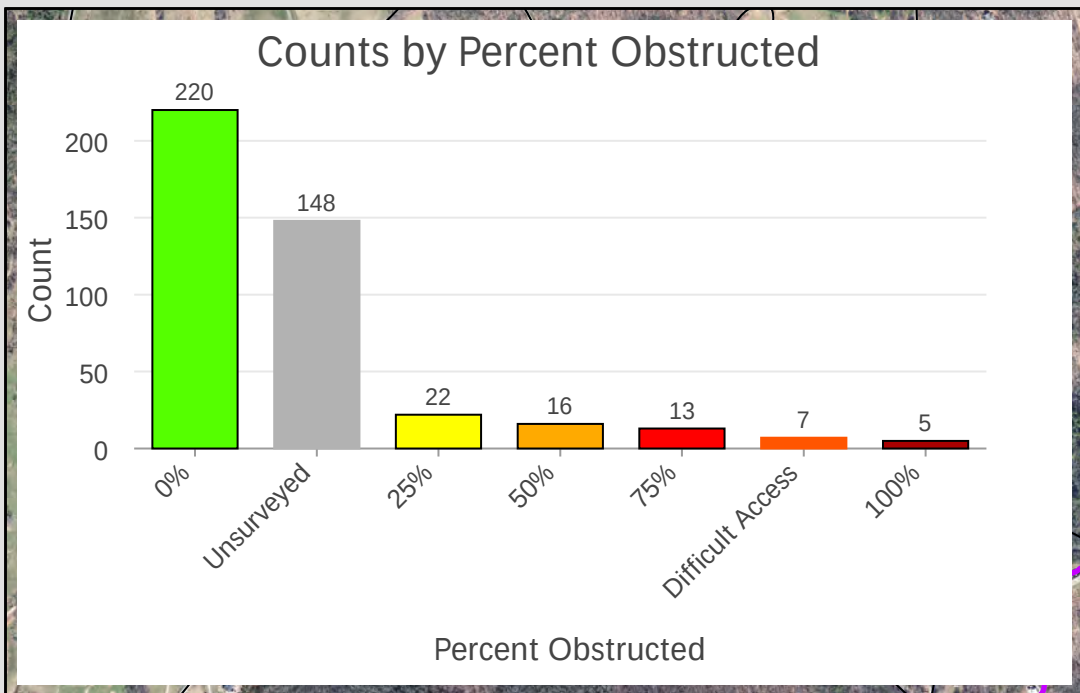
- Waterbody
- Stormwater Pipe
- Minor Channel
- Major Channel
- Road
- Watershed

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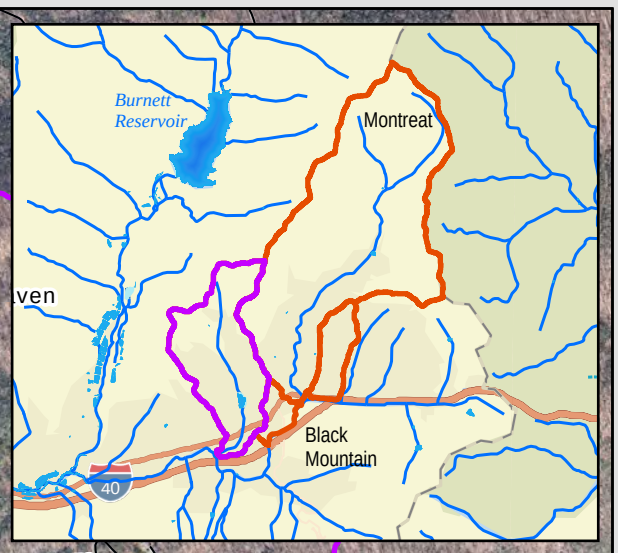
Figure A-1: Obstructed & Difficult Access Stormwater Structures
DOWNTOWN DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 250 500 Feet
1 in = 500 ft

N W E S



**The location of unknown/unsurveyed structures are not exact.
Unkown structure locations are assumed based upon pipe size and material changes between upstream and downstream surveyed structures. It is inferred from the results of the stormwater inventory and survey that there are many buried structures or underground junction boxes.



SO HI TRL
HI VIEW DR
SELDOM HOME DR
TEMPLE RD
PINNACLE DR
CHAPEL RD
ALLEN MOUNTAIN DR
NORTH FORK RD
FAIRWAY DR
HILLTOP RD
VIEW ST
WHISPERING WIND DR
REED RD
MOUNT ALLEN HTS
VALLEY RIDGE LN
FRANCES AVE
CARVER AVE
W STATE ST
NC 9 HWY; TO I40 W
VETERANS PARK DR
I40 W
I40 E
BRIERBROOK RD
PATRICK LN
WHITE PINE DR

Legend

Stormwater Structures
Percent Obstructed
- 0%
- 25%
- 50%
- 75%
- 100%
- Difficult Access Structure
- Unsurveyed Structure

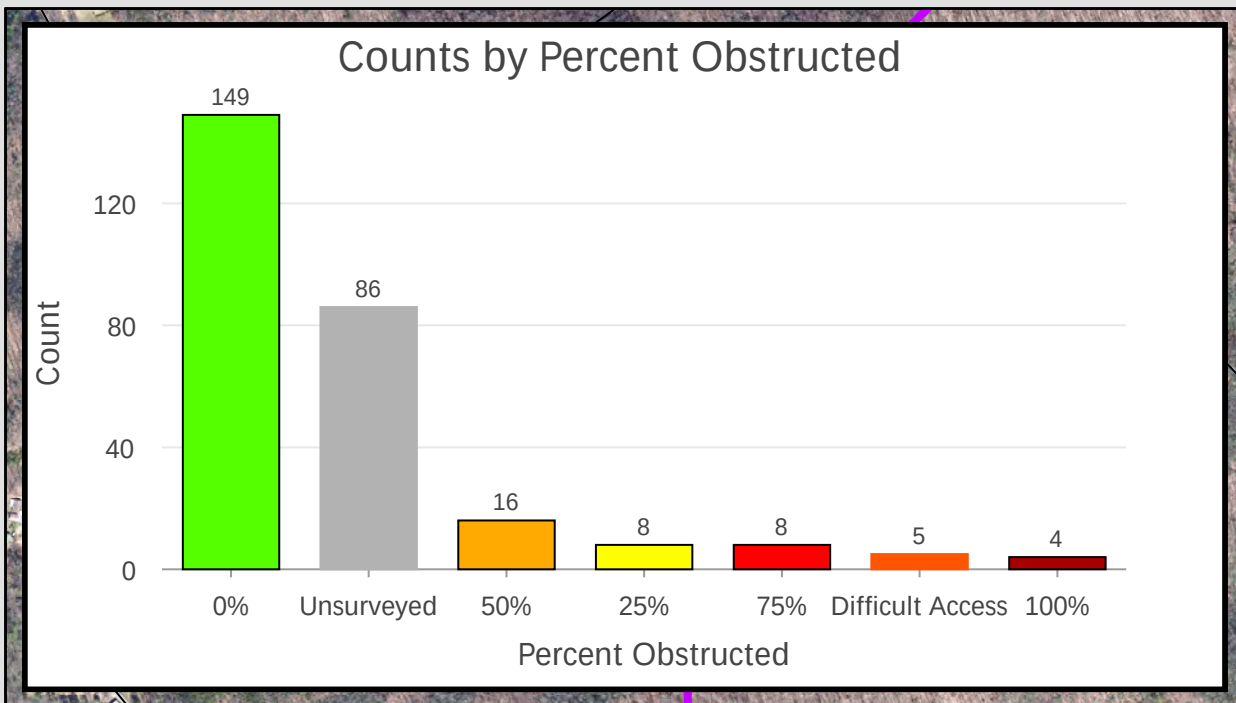
- Waterbody
- Stormwater Pipe
- Minor Channel
- Major Channel
- Road
- Watershed

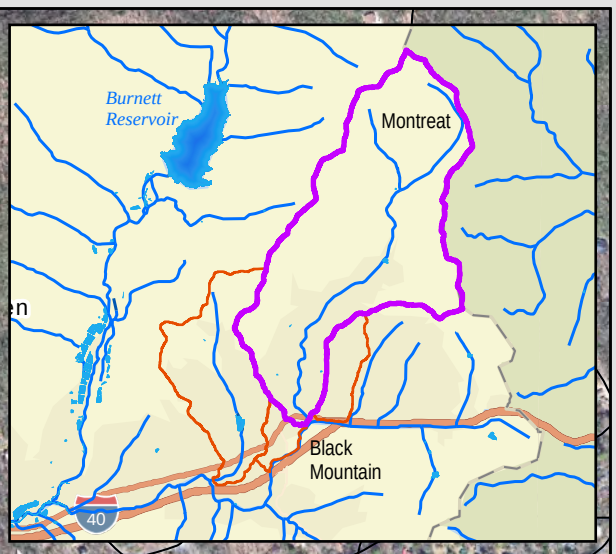
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Figure A-2: Obstructed & Difficult Access Stormwater Structures
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 500 1,000 Feet
1 in = 1,000 ft

N W E S





**The location of unknown/unsurveyed structures are not exact.
Unknown structure locations are assumed based upon pipe size and material changes between upstream and downstream surveyed structures. It is inferred from the results of the stormwater inventory and survey that there are many buried structures or underground junction boxes.

Legend

Stormwater Structures
Percent Obstructed
- 0%
- 25%
- 50%
- 75%
- 100%
- Difficult Access Structure
- Unsurveyed Structure

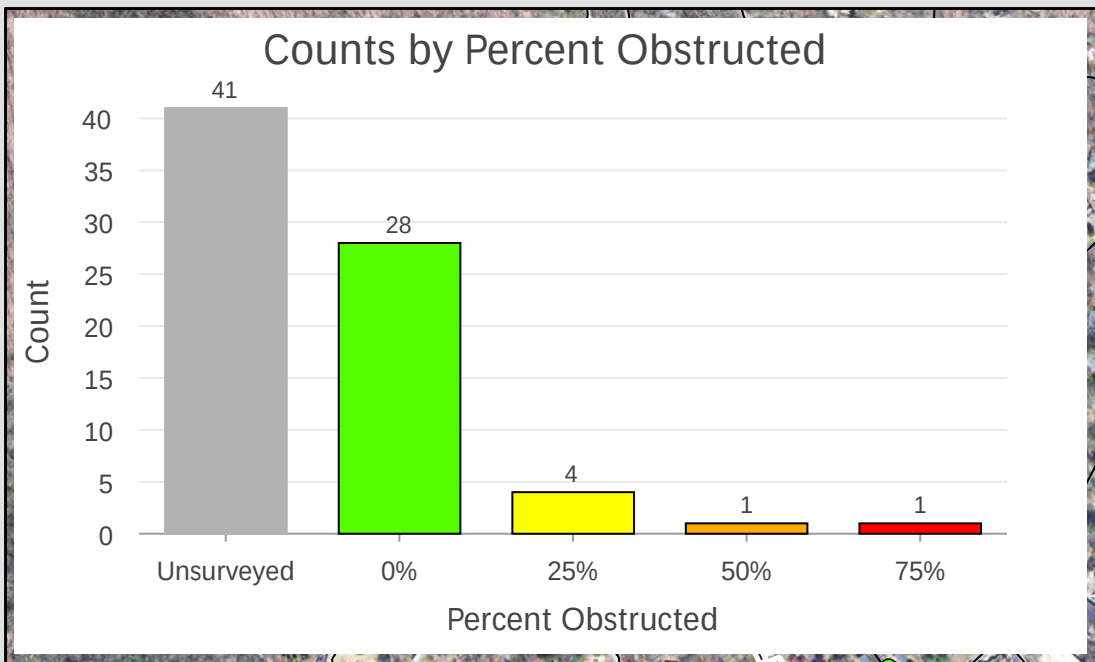
- Waterbody
- Stormwater Pipe
- Minor Channel
- Major Channel
- Road
- Watershed

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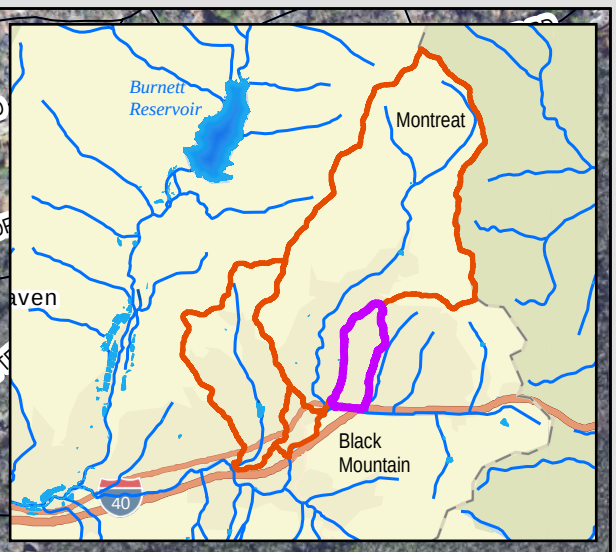
Figure A-3: Obstructed & Difficult Access Stormwater Structures
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 400 800 Feet
1 in = 800 ft

N W E S



**The location of unknown/unsurveyed structures are not exact.
Unkown structure locations are assumed based upon pipe size and material changes between upstream and downstream surveyed structures. It is inferred from the results of the stormwater inventory and survey that there are many buried structures or underground junction boxes.



Legend

Stormwater Structures
Percent Obstructed
- 0%
- 25%
- 50%
- 75%
- 100%
- Difficult Access Structure
- Unsurveyed Structure

- Waterbody
- Stormwater Pipe
- Minor Channel
- Major Channel
- Road
- Watershed

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Figure A-4: Obstructed & Difficult Access Stormwater Structures
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 300 600 Feet
1 in = 600 ft

N W E S

HYDROLOGIC ANALYSIS

Per the contract, PCSWMM developed by the CHI was selected as the hydrologic and hydraulic model to evaluate both the primary and secondary stormwater conveyance systems. The model uses the EPB-developed SWMM engine for computations and is particularly effective at evaluating systems that may: (a) have significant backwater effects from rising water surface elevations within the primary systems, (b) have attenuation within drainage ditches or behind roadways, and (c) show a sensitivity to the timing response of runoff to rainfall.

The precipitation data for the 24-hour duration, NRCS Type II storm was used to represent the synthetic rainfall event. The NRCS curve number approach was selected to calculate runoff volumes from the precipitation data, and the sub-basin unit hydrographs for these flood volumes were developed using the NRCS lag times.

The NRCS curve number approach was selected to calculate runoff volumes from the precipitation data, and the sub-basin unit hydrographs for these flood volumes were developed using the watershed width parameter. PCSWMM simulates the surface runoff response to precipitation for an interconnected system of surfaces, channels, and ponds. Input data for the PCSWMM model was developed using topographic data, land cover data, and soils maps in GIS to delineate and calculate the basin areas and NRCS hydrologic parameters.

The PCSWMM model offers a variety of methods for simulating the rainfall-runoff response, hydrograph development, and channel routing. One advantage to using PCSWMM to model both hydrology and hydraulics is that channel routing is modeled in the EXTRAN (hydraulics) block automatically based on the geometry and nature of the conveyance system. This eliminates the need to iterate between a hydrologic model and a hydraulic model to produce reasonable flows.

B. 1 Watershed Delineation and Connectivity

Watersheds were delineated for the Town study areas utilizing digital LiDAR data available from the State of North Carolina, survey, and the stormwater inventory. The preliminary watersheds were created using automated delineation procedures in a GIS platform and then adjusted as necessary based on the conveyance system and known ridge lines. Subwatersheds were selected at hydrologically and hydraulically significant points, such as major roadway crossings, stream convergences, known problem areas, etc. Secondary systems like Downtown and Tomahawk Branch/Lake areas were delineated in more detail to effectively evaluate the closed stormwater system.

Watershed maps showing the sub-basins and hydrological connectivity are provided in Section 2 of the SWMP. In its entirety, the study covers an area of approximately 5,557 acres (8.68 square miles). Drainage areas for each of the watersheds studied are noted in Table B.1. The upper parts of the primary

system watersheds extend outside of the Town limits. However, runoff from these areas drains down the mountain and through the Town's stormwater conveyance system on its way to the Swannanoa River.

TABLE B-1: WATERSHED DRAINAGE AREAS

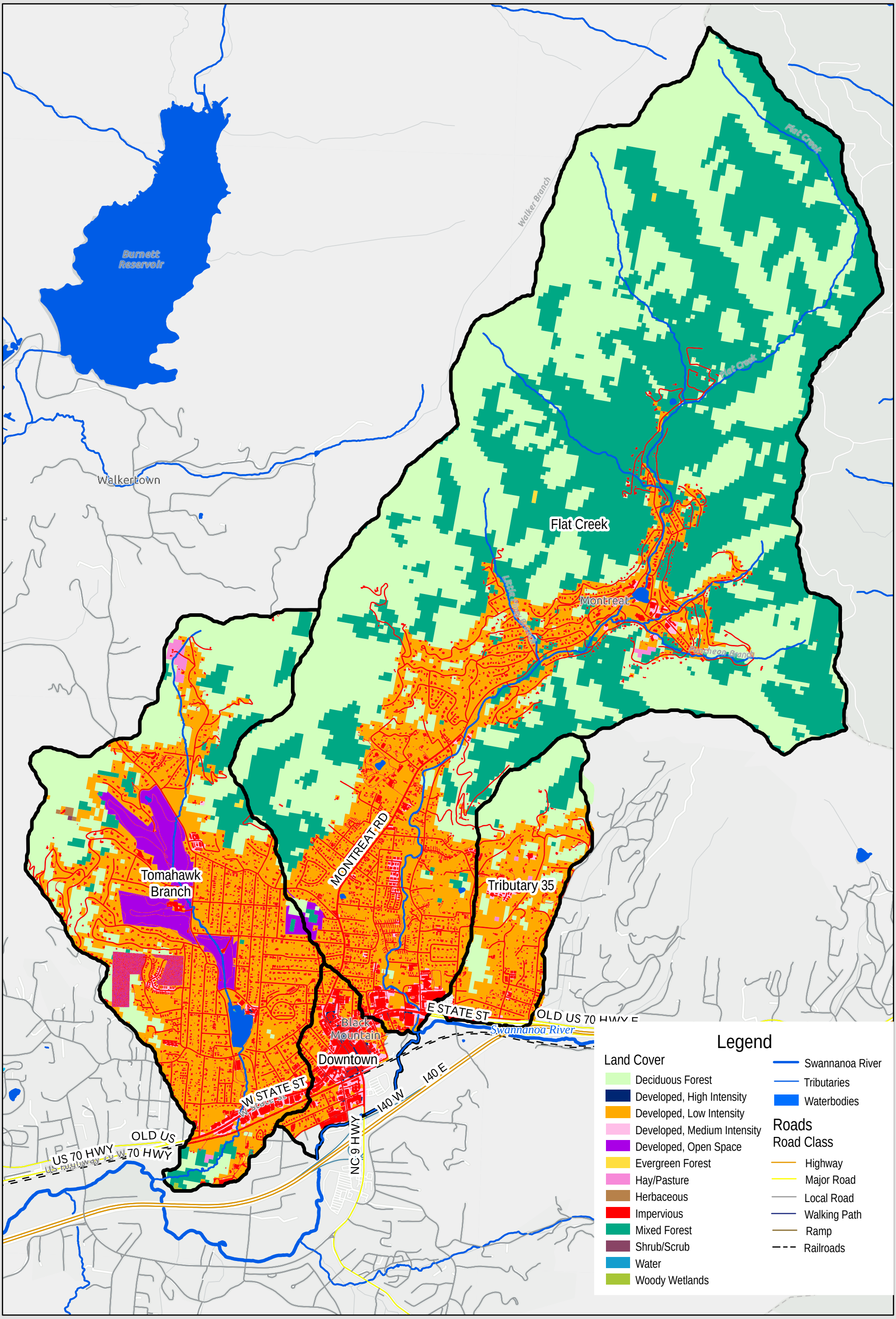
WATERSHED	AREA (ACRES)	PERCENT OF WATERSHED LOCATED INSIDE TOWN LIMITS
Downtown	151	100%
Tomahawk Branch	1,233	73%
Flat Creek	3,863	13%
Tributary 35 (of the Swannanoa)	310	69%
TOTAL STUDY DRAINAGE AREA	**5,557**	**42%**

B. 2 Land Cover

Land cover represents the physical surface characteristics of the watershed, describing what is present on the ground e.g., impervious surfaces, open water, forest, etc. Land cover directly influences the hydrologic response of a watershed by affecting infiltration, evapotranspiration, and surface runoff. In combination with other basin characteristics, land cover is used to estimate hydrologic parameters such as the SCS curve number for the basin.

One of the most critical land cover components in an urban environment is impervious surface coverage. Using a high-resolution impervious layer developed by Raftelis, Ardurra integrated this dataset into the overall land cover classification framework. Next, water features were identified and incorporated into the dataset using USGS data products (3DHP). After establishing impervious and water features, the National Land Cover Dataset (NLCD) was used to classify remaining areas and fill data gaps. In total, fifteen (15) land cover categories were delineated within the Town. Aerial imagery, field observations, and current development plans provided by the Town of Black Mountain (e.g., Tudor Croft Development) were used to verify and refine the land cover classifications as necessary.

Land cover within the Town is mostly forest (especially in the upper watershed of Flat Creek) and low intensity development. The overall land cover map for the watershed study is shown in Figure B-1. Acreage of each existing land cover groups and correlating percentages are listed in Tables B-2 and B-6.



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Figure B-1: Land Cover
Town of Black Mountain Stormwater Master Plan

0 1,000 2,000 Feet

1 in = 2,000 ft

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TABLE B.2: BLACK MOUNTAIN LAND COVER

LAND COVER CATEGORY	EXISTING	
	AREA (ACRES)	PERCENT OF BASIN AREA
Deciduous Forest	2046.2	37.1
Mixed Forest	1505.6	27.3
Low Intensity Development	1236.3	22.4
Impervious	517.1	9.4
Developed Open Space	107.7	2.0
Water	52.0	0.9
Medium Intensity Development	40.0	0.7
Hay/Pasture	8.8	0.2
High Intensity Development	4.0	0.1
Evergreen Forest	2.3	0.0
Grassland/Herbaceous	1.3	0.0
Woody Wetland	0.7	0.0
Shrub/Scrub	0.2	0.0

TABLE B-3: DOWNTOWN WATERSHED LAND COVER

LAND COVER CATEGORY	EXISTING	
	AREA (ACRES)	PERCENT OF BASIN AREA
Impervious	61.8	52.6
Low Intensity Development	38.6	32.8
Medium Intensity Development	13.5	11.5
High Intensity Development	3.5	3.0
Water	0.1	0.0

TABLE B-4: TOMAHAWK BRANCH LAND COVER

LAND COVER CATEGORY	EXISTING	
	AREA (ACRES)	PERCENT OF BASIN AREA
Low Intensity Development	507.9	42.0
Deciduous Forest	318.3	25.8
Impervious	189.2	15.3
Developed Open Space	103.0	8.4
Mixed Forest	78.7	6.4
Water	16.8	1.4
Medium Intensity Development	9.4	0.8
Hay/Pasture	6.6	0.5
Grassland/Herbaceous	1.3	0.1
Evergreen Forest	0.9	0.1
Woody Wetlands	0.7	0.1
Shrub/Scrub	0.2	0.0
High Intensity Development	0.1	0.0

TABLE B-5: FLAT CREEK LAND COVER

LAND COVER CATEGORY	EXISTING	
	AREA (ACRES)	PERCENT OF BASIN AREA
Deciduous Forest	1622.8	42.0
Mixed Forest	1412.4	36.6
Low Intensity Development	544.0	14.1
Impervious	227.7	5.9
Water	35.1	0.9
Medium Intensity Development	13.5	0.3
Developed Open Space	4.8	0.1
Hay/Pasture	1.6	0.0
Evergreen Forest	1.3	0.0
High Intensity Development	2.3	0.0

TABLE B-6: AVENDA ROAD/TRIBUTARY 35 LAND COVER

LAND COVER CATEGORY	EXISTING	
	AREA (ACRES)	PERCENT OF BASIN AREA
Low Intensity Development	146.3	47.1
Deciduous Forest	106.6	34.4
Impervious	38.5	12.4
Mixed Forest	14.7	4.7
Medium Intensity Development	3.6	1.2
Hay/Pasture	0.7	0.2

B. 3 Soils

The infiltration rate of soil influences the volume of surface runoff that results from given storm events. Soils with high infiltration rates produce lower runoff than soils with lower infiltration rates. The Soil Conservation Service has prepared soil maps for Buncombe County that identify four (4) primary soil groups. This data is available digitally and was obtained for the Town of Black Mountain. The groups (A, B, C, and D) correspond to decreasing rates of infiltration. A general description of the four (4) soil groups taken from the USDA, SCS, NEH-4 (1972) is presented in Table B-7. A map of the hydrologic soil groups (HSG) is shown in Figure B-2.

TABLE B-7: HYDROLOGIC SOIL GROUPS

SOIL GROUP	DESCRIPTION
A	Group A soils have high infiltration rates even when thoroughly wetted and consist chiefly of deep, well to excessively drained sand or gravels. These soils have a high rate of water transmission (greater than 0.3 inches per hour).
B	Group B soils have moderate infiltration rates even when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission (0.15 to 0.3 inches per hour).
C	Group C soils have slow infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission (0.5 to 0.15 inches per hour).

SOIL GROUP	DESCRIPTION
D	Group D soils have a very slow infiltration rate when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission (0 to 0.05 inches per hour).
A/D B/D C/D	The first letter applies to the drained condition and the second to the undrained condition. For the purpose of hydrologic soil group, adequately drained means that the seasonal high-water table is kept at least 60 centimeters (24 inches) below the surface.

Soils within study area are predominantly NRCS hydrologic soil groups A and B soils. It should be noted that all soils designated as dual hydrologic soils groups (A/D, B/D, and C/D) were assumed to be D for the hydrologic analysis. Additionally, soils that were not surveyed due to significant soil disturbance (deemed "disturbed" or "urban" soils) were also assumed to be D for the hydrologic analysis. A breakdown of the HSGs for the entire study area and each watershed is provided in Tables B-8 through B-12.

TABLE B-8: AREA DISTRIBUTION OF HYDROLOGIC SOIL GROUPS – OVERALL STUDY AREA

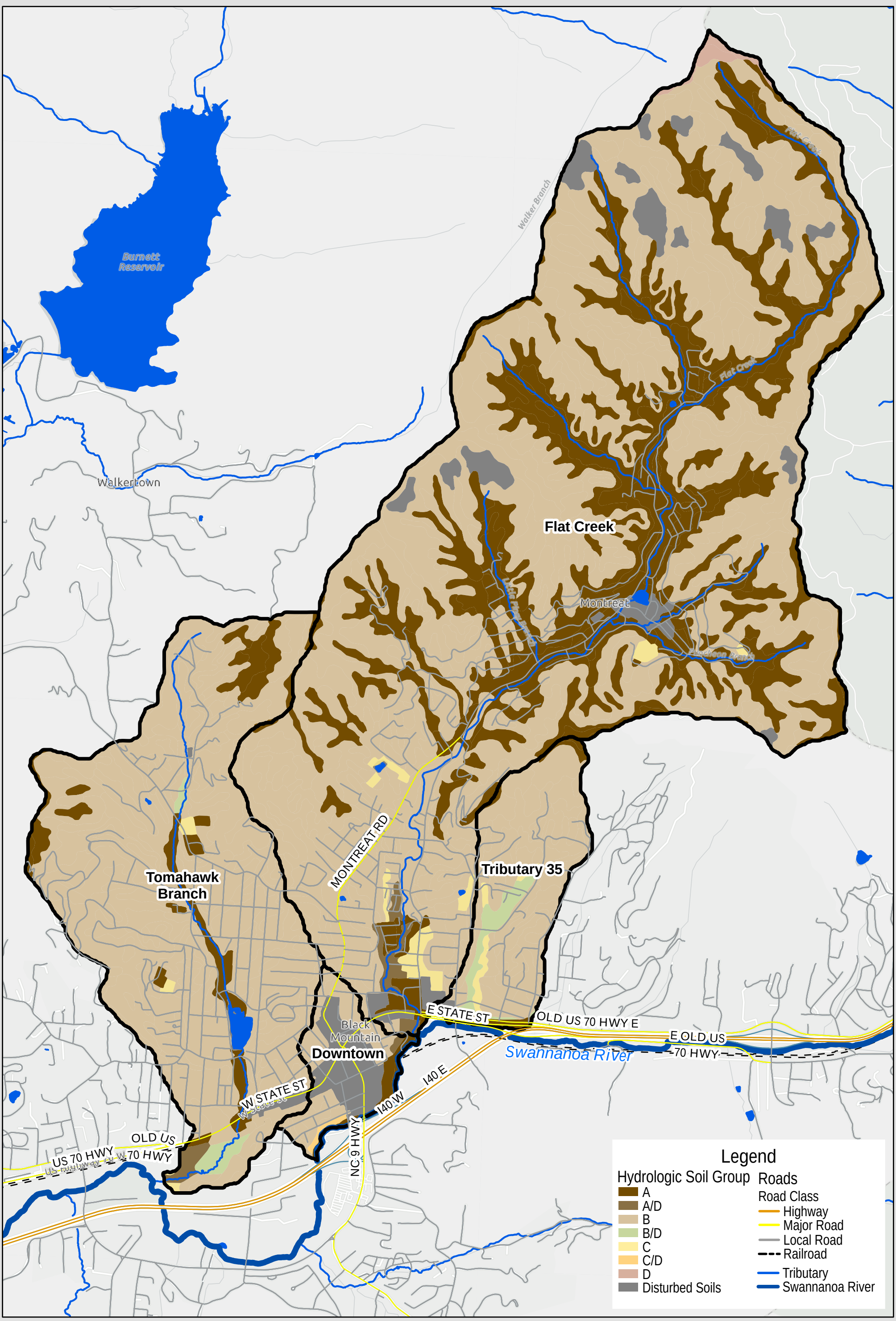
SOIL GROUP	TOTAL AREA (ACRE)	PERCENT OF TOTAL AREA
A	1,284.5	23.3%
B	3,878.2	70.2%
C	51.8	0.9%
D*	307.5	5.6%

**Includes A/D, B/D, C/D, and Non-surveyed (Null) soils*

TABLE B-9: AREA DISTRIBUTION OF HYDROLOGIC SOIL GROUPS – DOWNTOWN WATERSHED

SOIL GROUP	TOTAL AREA (ACRE)	PERCENT OF TOTAL AREA
A	1.3	1.1%
B	59.6	50.7%
D*	56.7	48.2%

**Includes A/D, B/D, C/D, and Non-surveyed (Null) soils*



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Figure B-2: Hydrologic Soil Groups
Town of Black Mountain Stormwater Master Plan

0 1,000 2,000 Feet

1 in = 2,000 ft

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TABLE B-10: AREA DISTRIBUTION OF HYDROLOGIC SOIL GROUPS – TOMAHAWK BRANCH

SOIL GROUP	TOTAL AREA (ACRE)	PERCENT OF TOTAL AREA
A	108.5	8.8%
B	1,071.3	86.9%
C	6.8	0.6%
D*	46.3	3.8%

**Includes A/D, B/D, C/D, and Non-surveyed (Null) soils*

TABLE B-11: AREA DISTRIBUTION OF HYDROLOGIC SOIL GROUPS – FLAT CREEK

SOIL GROUP	TOTAL AREA (ACRE)	PERCENT OF TOTAL AREA
A	1,162.8	30.1%
B	2488.5	64.4%
C	34.0	0.9%
D*	178.0	4.6%

**Includes A/D, B/D, C/D, and Non-surveyed (Null) soils*

TABLE B-12: AREA DISTRIBUTION OF HYDROLOGIC SOIL GROUPS – AVENA RD. / TRIBUTARY 35

SOIL GROUP	TOTAL AREA (ACRE)	PERCENT OF TOTAL AREA
A	12.4	4.0%
B	260.4	83.9%
C	11.0	3.5%
D*	26.5	8.5%

**Includes A/D, B/D, C/D, and Non-surveyed (Null) soils*

As there is a high-resolution impervious cover layer available for the Town, it became the primary basis for a mixed methods approach to determine land cover for the study area. To supplement the high-resolution impervious cover, U.S. Geological Survey 3D Hydrography Program (3DHP) data were used to capture water features with high accuracy within the study area. Areas not represented in these datasets were supplemented with classifications from the National Land Cover Database (NLCD).

To avoid double-counting impervious areas already represented in the dedicated impervious layer, all NLCD classes identified as high, medium, or low-density developed were reclassified to match the "Developed – Open Space" category. These are demarcated with an * in Table B-13.

The combined land cover and soil data were then used to assign curve numbers (CNs) based on the U.S. Army Corps of Engineers (USACE) HEC-HMS guidance. These are also noted in Table B-13 below. A composite runoff curve number was calculated for each of the sub-basins based on the weighted curve number for the sub-basin.

TABLE B-13: CURVE NUMBERS BASED ON LAND COVER AND SOIL GROUPS

LAND USE CATEGORY	SOIL GROUP			
	A	B	C	D
Water	98	98	98	98
Impervious	98	98	98	98
Developed Open Space	49	69	79	84
Low Intensity Development*	49	69	79	84
Medium Intensity Development*	49	69	79	84
High Intensity Development*	49	69	79	84
Barren Land	78	86	91	93
Deciduous Forest	45	66	77	83
Evergreen Forest	25	55	70	77
Mixed Forest	36	60	73	79
Shrub/Scrub	55	72	81	86
Grassland/Herbaceous	50	69	79	84
Pasture/Hay	49	69	79	84
Cultivated Crops	67	78	85	89
Woody Wetlands	30	58	71	78
Emergent Herbaceous Wetlands	30	58	71	78

A summary of the hydrologic input for each of the watershed models can be provided upon request.

B. 4 Rainfall

Rainfall distributions for Black Mountain are derived using the NRCS Type II standard distribution. Total rainfall volumes for the modeled frequency storms were based on data obtained from NOAA Atlas 14. Table B-14 shows the total rainfall volumes used for this study.

TABLE B-14: DESIGN STORM RAINFALL DEPTHS

DESIGN STORM	RAINFALL DEPTH (IN)
2-YR, 24HR	3.39
10-YR, 24HR	5.00
25-YR, 24HR	5.98
50-YR, 24HR	6.76
100-YR, 24HR	7.57
2-YR, 6HR	2.23
5-YR, 6HR	2.79

While the depth-duration-frequency curves are calculated based on real rainfall data, the rainfall data used for the PCSWMM represents the Type II synthetic rainfall distribution. Actual runoff is based on several factors including rainfall intensity, duration and the antecedent moisture conditions of the watershed.

B. 5 Hydrograph Translation

The lag time, as defined by the NRCS for use in the NRCS dimensionless unit hydrograph method, is the time, or lag, between the center of mass of rainfall excess and the peak of the unit hydrograph. The lag time is based on the subwatershed time of concentration, or travel time, and is a function of the subwatershed size, shape, slope, cover, and other basin characteristics. For the NRCS method, the subwatershed lag time is calculated to be 0.6 times the time of concentration for each subwatershed.

The times of concentration for the subwatersheds were calculated from the methodology described in TR-55. The longest flow path is divided into three types of flow; overland flow, shallow concentrated flow, and channel flow. A spreadsheet was developed to tabulate the incremental travel times for each type of flow for each sub-basin. The incremental travel times were totaled and multiplied by 0.6 to compute the lag time for each sub-basin.

The equation detailing the travel time for sheet flow is as follows:

$$T_t = \frac{.007\,(nL)^{0.8}}{(P_2)^{0.5}\,s^{0.4}}$$

T_t = Travel Time in hours

n = Manning Roughness Coefficient (Paved=0.011, Unpaved=0.24)

L = flow length in feet

P_2 = 2-year, 24 hour rainfall = 3.76 inches

S = slope of hydraulic grade line (land slope in ft/ft)

For shallow concentrated flow, the velocity (V) is calculated for either paved or unpaved sections by using the following equations:

$$\text{Unpaved } V = 16.1345\ (S)^{1/2}$$

$$\text{Paved } V = 20.3282\ (S)^{1/2}$$

The travel time for shallow flow is then calculated by dividing the flow length (L in feet) by velocity as follows:

$$T_t = \text{Travel Time} = L / (3600*V)$$

The open channel travel times are determined by a modified version of the Manning equation, which is as follows:

$$V = \frac{1.49\ R^{2/3}\ S^{0.5}}{n}$$

V = Average full-flow velocity (ft/s)

R = Hydraulic radius (ft)

S = Slope of hydraulic grade line (ft/ft)

n = Manning roughness coefficient

Instead of a time of concentration parameter, the PCSWMM model uses a watershed width parameter to crate the unit hydrograph used in the model that will translate the rainfall into runoff. The watershed width is a parameter unique to PCSWMM that typically represents the watershed area divided by the longest flow path. The width parameter is typically calibrated to flow gauge data, if available.

The watersheds studied lacked flow gauge data, so the peak flows from PCSWMM were compared to flows developed using the Rational Method, USGS Regression where applicable, Stream Stats flows, and FEMA model flows. Based on the flow comparison, the watershed widths for each basin were adjusted in some instances to produce reasonable flows.

HYDRAULIC ANALYSIS

The purpose of the hydraulic modeling analysis is to determine an existing level of flooding for the stormwater drainage network and to develop proposed solutions to mitigate flooding, on both the primary systems and the secondary systems.

The stormwater models were developed using survey, stormwater inventory, FEMA models, and LiDAR data. Detailed and limited detailed FEMA study models were downloaded from the North Carolina Flood Risk Information System (FRIS) website. The bridge data included in the FEMA models for Tomahawk Branch, Flat Creek, Flat Creek Tributary 1, and Tributary 35 (of the Swannanoa River) were imported into PCSWMM to include in the primary system analyses. The FEMA water surface elevations were also used as the fixed starting water surface elevation to evaluate the primary and secondary stormwater systems. LiDAR data available from the State of North Carolina was used to supplement open channel cross sections.

C.1 Stormwater Inventory

For the SWMP, stormwater utility infrastructure throughout the subwatershed was collected by Kee Mapping and Surveying personnel (located in Asheville, NC) to compile a GIS stormwater inventory database for the Town. This was accomplished by using GPS as the primary means of data capture to locate the x, y, and z coordinates of each visible stormwater system structure and conventional surveying techniques to obtain other attributes including but not limited to size, material, slope, and length. Data was obtained for those streams and open channels required to complete connectivity for modeling purposes. The data was collected using horizontal datum NAD 1983 and vertical datum NAVD 1988.

Attributes collected as part of the inventory were used to populate the various models. Field visits and digital photographs for each structure and some channels were used to estimate the roughness coefficients and energy loss coefficients.

C.2 Roughness Coefficients

Manning's roughness coefficients, or 'n' values, represent the resistance to flow and influence the flow capacity of channels and floodplains. The PCSWMM model uses these coefficients to compute friction loss longitudinally in the channel and floodplain. The roughness value is a function of the type and density of the vegetation, channel bottom and stream bank material, degree of channel meandering, and depth of flow.

Roughness coefficients were determined for all stream reaches for which hydraulic analyses were performed. The right or left bank of the stream is referenced facing downstream. Roughness coefficients used in this study are listed in Table C-1. All roughness coefficients were estimated through field observation and by referencing standard engineering manuals.

TABLE C-1: ROUGHNESS COEFFICIENTS

LOCATION	RANGE OF 'N' VALUES
Main Channel	0.04 - 0.065
Left Overbank	0.04 - 0.16
Right Overbank	0.035 - 0.16

C.3 Starting Water Surface Elevation

The starting water surface elevations (WSEL) for the PCSWMM models were set based on the FEMA water surface elevations where available. Table C-2 indicates the number of outfalls for each watershed model and if FEMA WSELs were referenced directly from the models. Where FEMA WSELs were not directly published, the FEMA results were interpolated between storm events.

All 2-yr 24-hr, 2-yr and 5-yr 6-hr storm events used normal outfall conditions as the starting water surface elevations.

The Town is currently engaged in the Swannanoa Floodplain Bench Project, which provides additional floodplain storage along the south bank of the Swannanoa River to lower WSELs. The project is located between Hemphill Road and the Norfolk Southern Railway near the confluence with Flat Creek. The second phase of the project extends floodplain benching along the south bank to just I-40 East near Riverwalk Park and includes construction of a 1.3-acre wetland to lower WSELS.

Preliminary (unapproved) FEMA WSELS for the Swannanoa Floodplain Bench Project were provided by the Town's consultant. These were considered with the proposed capital improvement projects as the floodplain project will likely be constructed prior to recommended capital projects within the Town.

TABLE C-2: FEMA WSEL REFERENCES

Model	Outfalls to the Swannanoa River	FEMA WSELs	Swannanoa FPB Projected WSELs
Downtown	4	10-, 50-, and 100-yr	Yes
Tributary 35	Direct Confluence	10-, 50-, and 100-yr	Yes
Flat Creek	Used Flat Creek FEMA	10-, 50-, and 100-yr	No
Tomahawk	Used Tomahawk FEMA	10-, 50-, and 100-yr	No

C.4 Model Run Descriptions and Assumptions

PCSWMM is a dynamic rainfall-runoff model capable of modeling the hydrologic response of a watershed and hydraulic routing throughout a stormwater conveyance system. The model calculates the effect of backwater, flat or negative slopes, energy losses, and minor headlosses associated with bends, entrances and exits.

Input data for the PCSWMM (hydraulics) computer model include the following:

- Conveyance pipes including structure inverts, pipe sizes and lengths;
- Open channel cross section geometries;
- Roughness coefficients for pipes and channels;
- Energy loss coefficients for flow in the pipes and channels;
- Storage rating curves; and
- Overland flow characteristics.

PCSWMM provides an accurate evaluation of the existing and proposed conditions because it combines hydrology and hydraulics while accounting for the routing effects of the channel and overbank storage areas. Because hydrology and hydraulics are combined, changes to peak flows or water surface elevations resulting from proposed modifications to the existing channels or culverts are calculated in the model in one (1) step. Additionally, changes to flow from proposed pipes and channel improvements are seen both upstream and downstream, reducing the potential for a stormwater system having increased flooding downstream.

The 2-, 10-, 25-, 50- and 100-year 24-hour storm events were modeled as well as the 2- and 5-year 6-hour storm events. The hydraulic analysis for this study is based only on the condition of unobstructed flow. Therefore, flood elevations shown on the profiles are considered valid only if hydraulic structures remain unobstructed and do not fail. Flood elevations may be raised by debris blockage of the culvert, channel, or floodplain.

Energy Loss Coefficients

Contraction and expansion of flow produces energy losses caused by the transition. The magnitude of these losses is related to the velocity and the estimated loss coefficient. Where the transitions are gradual, the losses are small. At abrupt changes in cross-sectional area, the losses are higher. Energy losses resulting from expansion are greater than losses associated with contraction. Energy loss coefficients used for the hydraulic PCSWMM models are presented in Table C-3.

Additional energy losses for structures having bends were divided between the two (2) joining pipes. The bend losses used for this project are based on NCDOT values and are shown below in Table C-4.

TABLE C-3: ENERGY LOSS COEFFICIENTS FOR PCSWMM MODELS

TYPE OF TRANSITION	EXPANSION	CONTRACTION
None	0	0
Manhole/Inlet	0.7	0.5
Open Channel	1	0.5–Headwall/ 0.9 - Projecting

TABLE C-4: BEND LOSS COEFFICIENTS

ANGLE (°)	LOSS COEFFICIENT	ANGLE (°)	LOSS COEFFICIENT
90	0.70	40	0.38
80	0.66	30	0.28
70	0.61	25	0.22
60	0.55	20	0.16
50	0.47	15	0.10

APPENDIX D
CONDITION ASSESSMENT METHODOLOGY

D.1 Data Collection and Analysis

Since running the prioritization tool is highly dependent upon existing infrastructure data, WK Dickson worked closely with the Town to compile as much available data regarding the stormwater infrastructure as possible. The data collection and analysis tasks included:

- Inventory and review of stormwater GIS database and attributes
- Collection and review of relevant transportation and geographic data
- Summary and analysis of data reviewed
- Confidence level and applicability to the prioritization tool

As a result, the following information pertaining to the stormwater infrastructure was collected and analyzed for the prioritization tool:

- GIS data and attributes for stormwater systems
- GIS data for the following relevant layers:
    - Road centerlines
    - Building footprints
    - Soils
    - Hydrography
    - Critical Facilities

D.2 Summary of Existing Facilities

In order to clearly identify critical infrastructure for each utility, WK Dickson separated the stormwater infrastructure database into stormwater pipes and stormwater structures. The following discussion presents a summary of the stormwater system assets and relative attributes that were incorporated into the prioritization tool for the criticality assessment.

Stormwater System Assets

The Town of Black Mountain stormwater system asset infrastructure data is noted in Table D-1. Attributes assigned to these assets and considered for the stormwater system included the following:

- Unique ID
- Pipe diameter
- Pipe material
- Pipe length
- Pipe slope
- Pipe condition

- Proximity to corrosive soils
- Proximity to transportation infrastructure
- Proximity to buildings
- Proximity to hydrographic features
- Proximity to critical facilities

The stormwater system assets listed below were incorporated into the prioritization tool.

TABLE D-1: STORMWATER SYSTEM ASSET SUMMARY

ASSET NAME	NUMBER	UNITS
Unknown Storm Pipe	12,828	LF
Irregular Dimension Storm Pipe	2,205	LF
4” Storm Pipe	38	LF
6” Storm Pipe	67	LF
8” Storm Pipe	432	LF
10” Storm Pipe	281	LF
12" Storm Pipe	3,934	LF
15" Storm Pipe	7,256	LF
16” Storm Pipe	111	LF
18" Storm Pipe	6,984	LF
20” Storm Pipe	144	LF
21" Storm Pipe	45	LF
24” Storm Pipe	6,335	LF
30" Storm Pipe	2,286	LF
36" Storm Pipe	2,019	LF
42" Storm Pipe	70	LF
48" Storm Pipe	938	LF
60” Storm Pipe	146	LF
66” Storm Pipe	193	LF
90” Storm Pipe	183	LF
Inlet	246	EA
Junction Box	52	EA
Pipe End	631	EA
Manhole	14	EA
Unknown Structure	251	EA

Critical Facilities

Critical facilities are those service locations within the system where failure of infrastructure would have an impact on a large concentration of customers or customers that provide critical operations. In the case of Black Mountain, the critical facilities were determined to be a combination of schools, fire stations, medical facilities, police stations, libraries, hazardous waste facilities, and nursing homes/assisted living facilities. Within the study area it was determined that there are thirty critical facilities. The critical facilities identified are as follows: nursing homes/assisted living facilities (4), medical facilities (5), fire stations (2), police stations (3), hazardous waste facilities (3), a library (1), and schools (12).

Soil Corrosivity

Corrosion is a significant factor affecting the long-term integrity of stormwater infrastructure. The degree of soil corrosivity varies depending on the material composition of the asset, as soils influence concrete and metallic structures differently. For this analysis, WK Dickson utilized data from the USDA SSURGO (Soil Survey Geographic Database), which provides corrosivity ratings classified as 'Low', Moderate', or 'High' for both concrete and metallic materials. These ratings are based on soil drainage class, total acidity, electrical resistivity and conductivity. Each stormwater asset was spatially overlaid with the SSURGO soil areas to determine the soil unit in which it was located. The corresponding corrosivity rating for that soil was then applied to the asset based on its material type. For pipes intersecting multiple soil units, the corrosivity rating associated with the soil encompassing the majority of the pipe's length was assigned. Plastic assets e.g., HDPE, CPP, CPE, PVC, etc. were given a rating of 0, as plastic materials are not subject to corrosion.

Within the USDA SSURGO database, some soil areas are not included in the soil survey due to extensive disturbance from development. This condition is common in the downtown area of Black Mountain due to the extent of development in this area. Because these soils lack reliable data, WK Dickson assigned a moderate corrosivity rating to all non-plastic stormwater assets within these soil regions to provide a reasonable, conservative estimate of potential corrosion risk.

D. 3 GIS Data Audit

WK Dickson performed an audit of the Town's GIS data to establish a confidence level for utilizing the data in the creation of the criticality assessment tool. The audit consisted of the following tasks:

- Review of GIS layer data to determine ability to assess for the criticality analysis
- Review of attribute fields utilized for the assessment tool
- Analysis of attribute data for use in the assessment tool
- Review of weighted criticality scoring values to determine audit locations/databases

The data collection and audit enabled the tool to be applied with a high level of confidence and reliability. Tables D-2 and D-3 summarize the reliability of the attribute data based on the percentage of data available for each attribute relative to the total number of assets. Reliability can be improved over time as more information is entered into and linked to the GIS database.

TABLE D-2: STORMWATER PIPES ATTRIBUTE RELIABILITY

STORMWATER PIPES – LIKELIHOOD		STORMWATER PIPES – CONSEQUENCE	
FIELD	DATA SET	FIELD	DATA SET
Installation Date	0.0%	Proximity to Hydrographic features	100.0%
Pipe Length	100.0%	Pipe Diameter	75.1%
Age	0.0%	Proximity to Critical Facilities	100.0%
Remaining Life	0.0%	Proximity to Transportation Infrastructure	100.0%
Material Type	73.5%	Proximity to Buildings	100.0%
Pipe Slope	45.8%	**Average**	**93.8%**
Corrosive Soils	100.0%		
Condition	75.1%		
Proximity to Frequent Flooding Locations	100.0%		
Average	**82.4%**		

TABLE D-3: STORMWATER STRUCTURE ATTRIBUTE RELIABILITY

STORMWATER STRUCTURES – LIKELIHOOD		STORMWATER STRUCTURES – CONSEQUENCE	
FIELD	DATA SET	FIELD	DATA SET
Installation Date	0.00%	Proximity to Hydrographic Features	100.00%
Proximity to Frequent Flooding Locations	100.00%	Proximity to Buildings	100.00%
Age	0.00%	Proximity to Critical Facilities	100.00%
Remaining Life	0.00%	Proximity to Transportation Infrastructure	100.00%
Material Type	71.5%	**Average**	**100.00%**
Structure Obstructions	62.7%		
Condition	64.7%		
Corrosive Soils	100.00%		
Average	**79.8%**		

As shown in Tables D-2 and D-3, data reliability was sufficiently high to obtain a good measure of the criticality of each asset. Average values were calculated without including the reliability ratings of the fields: “Installation Date”, “Age”, and “Remaining Life”. This is because despite not having adequate age data, the other available data was sufficient enough to evaluate the infrastructure.

D. 4 Criticality Scoring and Methodology

Attribute scoring categories provide a quantitative value for the likelihood and consequence of failure and associated criticality score summation. Tasks for the criticality scoring and methodology included:

- Establishment of scoring criteria and attribute factors
- Establishment of final scoring system and documentation of methodology
- Application of scoring criteria to system assets to obtain ranking and thresholds

Each attribute was assigned between 2 to 6 factors with a scoring range between 0 and 100. Scores were added together within the likelihood of failure category and the consequence of failure category to develop a total cumulative score.

Tables D-4 through D-7 summarize the final attributes, attribute factors, and factor scoring used in the prioritization tool for the criticality assessment.

Limitations of the scoring system included availability of data, accuracy of data, and associated reliability scoring as discussed in the GIS data audit section.

D. 5 Results

Criticality Results for the Stormwater Pipes are provided in Section 4 of the SWMP. Maps of the criticality results for the Stormwater Structures are shown in Figures D-1 through D-4.

D-1 Downtown Secondary System – Criticality Analysis Stormwater Structures

D-2 Tomahawk Branch Primary System – Criticality Analysis Stormwater Structures

D-3 Flat Creek Primary System – Criticality Analysis Stormwater Structures

D-4 Tributary 35 / Avena Rd Primary System – Criticality Analysis Stormwater Structures

TABLE D-4: STORMWATER PIPES SCORING MATRIX – LIKELIHOOD OF FAILURE

ATTRIBUTE	ATTRIBUTE FACTOR	ATTRIBUTE FACTOR SCORING
Slope	Less than 0.2%	50
	Between 0.2% and 1%	20
	Between 1% and 2% or Null	0
	Between 2% and 4%	50
	Greater than 4%	100
Corrosive Soils*	High	100
	Moderate or Null	80
	Low	60
Condition	Needs Repair	100
	Poor	80
	Fair or Unknown	50
	Good	20
	Excellent	0
Material*	Brick/VCP	100
	CMP/CPP	80
	CPE/HDPE/Other/Unknown	40
	DIP/Steel/CAS	20
	PRE/PVC/RCP/CSU/PCCP/CP/CON	0
Proximity to Frequent Flooding Locations	Less than or equal to 100 feet	100
	Greater than 100 feet	0

**Category considers pipe material in the analysis.*

TABLE D-5: STORMWATER PIPES SCORING MATRIX – CONSEQUENCE OF FAILURE

ATTRIBUTE	ATTRIBUTE FACTOR	ATTRIBUTE FACTOR SCORING
Pipe Diameter	Greater than 42	100
	37 to 42	80
	25 to 36	60
	16 to 24	40
	8 to 15	20
	Less than 8	0
	Unknown/Null	50
Proximity to Transportation Infrastructure	Under Railroad	100
	Under Road	60
	Not Under Road	0
Proximity to Building	Underneath Building	200
	Less than 20 feet from Building	100
	Greater than 20 feet from Building	0
Proximity to Critical Facility	Underneath Facility	200
	Less than 100 feet from Facility	100
	Greater than 100 feet from Facility	0
Proximity to Waterbody / Waterway	Less than or equal to 25 feet	100
	26 to 50 feet	50
	Greater than 50 feet	0

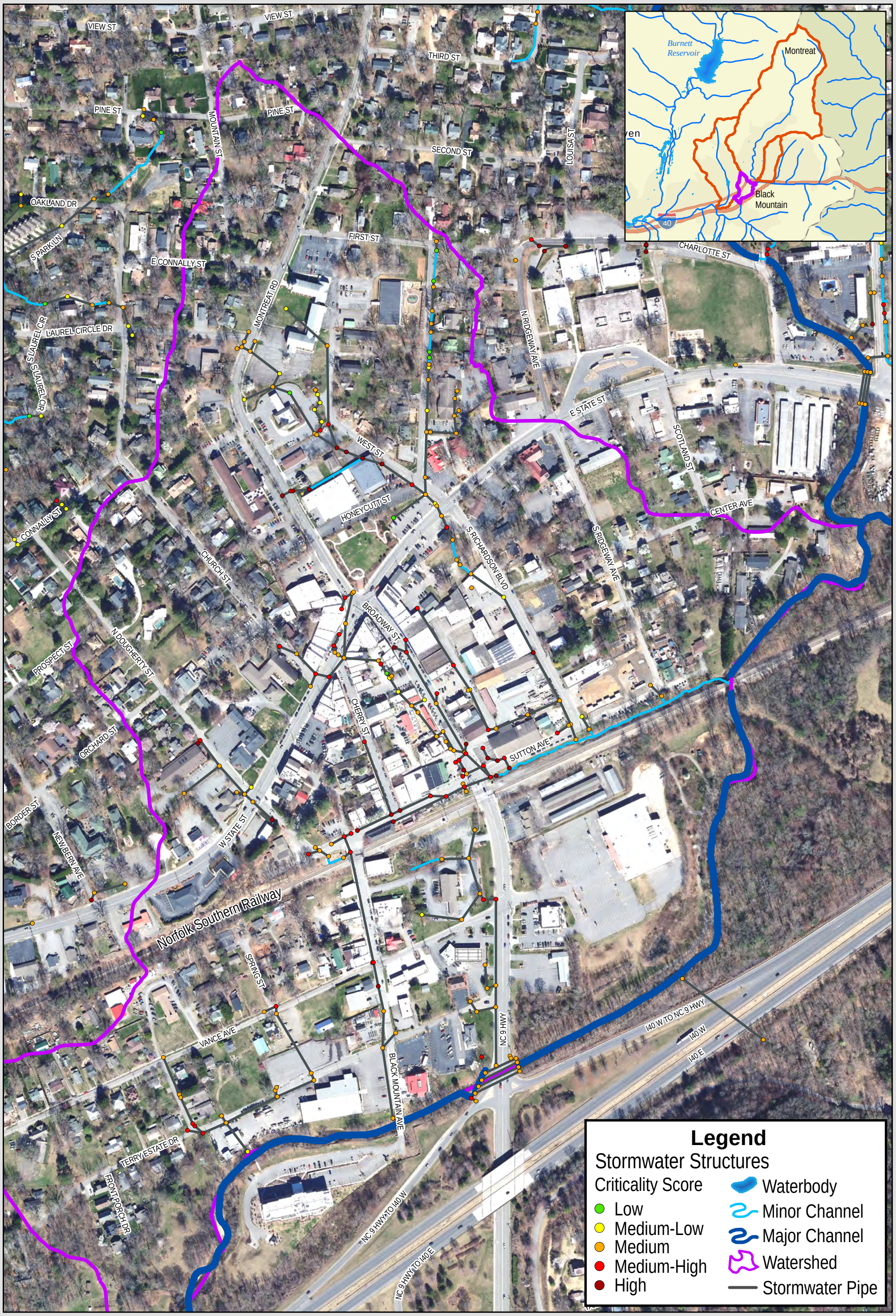
TABLE D-6: STORMWATER STRUCTURE SCORING MATRIX – LIKELIHOOD OF FAILURE

ATTRIBUTE	ATTRIBUTE FACTOR	ATTRIBUTE FACTOR SCORING
Corrosive Soils*	High	100
	Moderate or Null	80
	Low	60
Proximity to Frequent Flooding Location	Less than or equal to 100 feet	100
	Greater than 100 feet	0
Material*	Brick/VCP/Stone	100
	CMP/CPP	80
	Concrete Block	60
	HDPE/Other/Unknown	40
	DIP	20
	PVC/PreCast/RCP/Concrete	0
Percent Obstructed	100%	50
	75%	30
	50%	15
	25% or Null	5
	0%	0
Condition	Needs Repair	100
	Poor	80
	Fair or Unknown	50
	Good	20
	Excellent	0

**Category considers pipe material in the analysis.*

TABLE D-7: STORMWATER STRUCTURE SCORING MATRIX – CONSEQUENCE OF FAILURE

ATTRIBUTE	ATTRIBUTE FACTOR	ATTRIBUTE FACTOR SCORING
Proximity to Waterbody / Waterway	Up to 100 feet	100
	101 feet to 500 feet	50
	Greater than 500 feet	0
Proximity to Transportation Infrastructure	Within 100 feet of Railroad	100
	Within 50 feet of Roadway	60
	Not Within 50 feet of Roadway	0
Proximity to Building	Within 20 feet of Building	100
	Greater than 20 feet from Building	0
Proximity to Critical Facility	Within 100 feet of Facility	100
	Not within 100 feet of Facility	0



Legend

Stormwater Structures

Criticality Score

- Low
- Medium-Low
- Medium
- Medium-High
- High

- Waterbody
- Minor Channel
- Major Channel
- Watershed
- Stormwater Pipe

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Figure D-1: Criticality Analysis Results - Stormwater Structures
DOWNTOWN SECONDARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet

1 in = 300 ft

N W E S

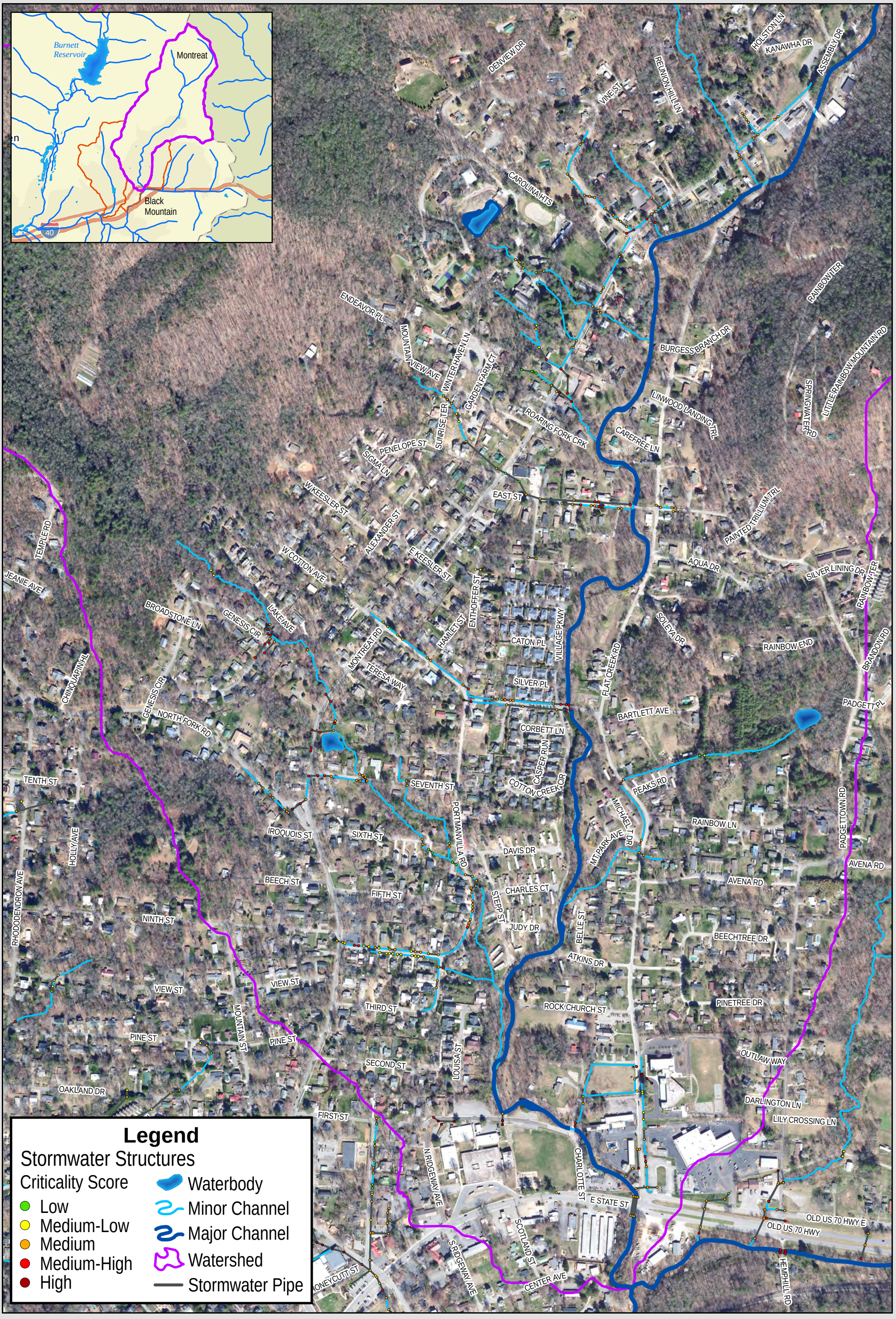


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Figure D-2: Criticality Analysis Results - Stormwater Structures
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 300 600 Feet
1 in = 600 ft

N
W E
S



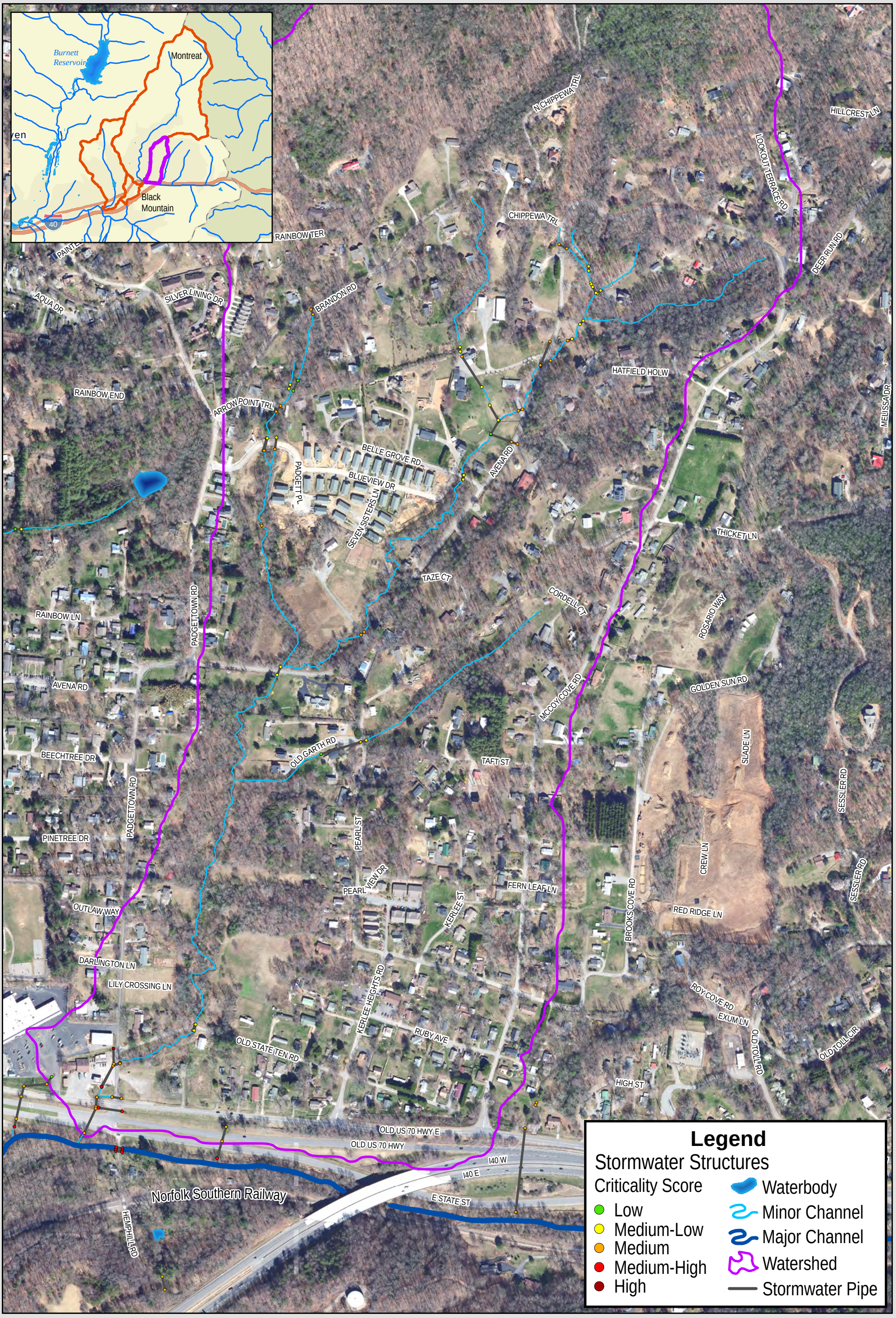
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Figure D-3: Criticality Analysis Results - Stormwater Structures
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 250 500 Feet

1 in = 500 ft

N W E S



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Figure D-4: Criticality Analysis Results - Stormwater Structures
AVENA ROAD/TRIBUTARY 35 WATERSHED
Town of Black Mountain Stormwater Master Plan

0 200 400 Feet
1 in = 400 ft

N
W E
S

APPENDIX E
PROPOSED CAPITAL IMPROVEMENT PLAN

Downtown Proposed Projects Map (17 Projects)

Downtown Project Sheets and Planning Level Opinions of Cost

Tomahawk Branch Proposed Projects Map (3 Projects)

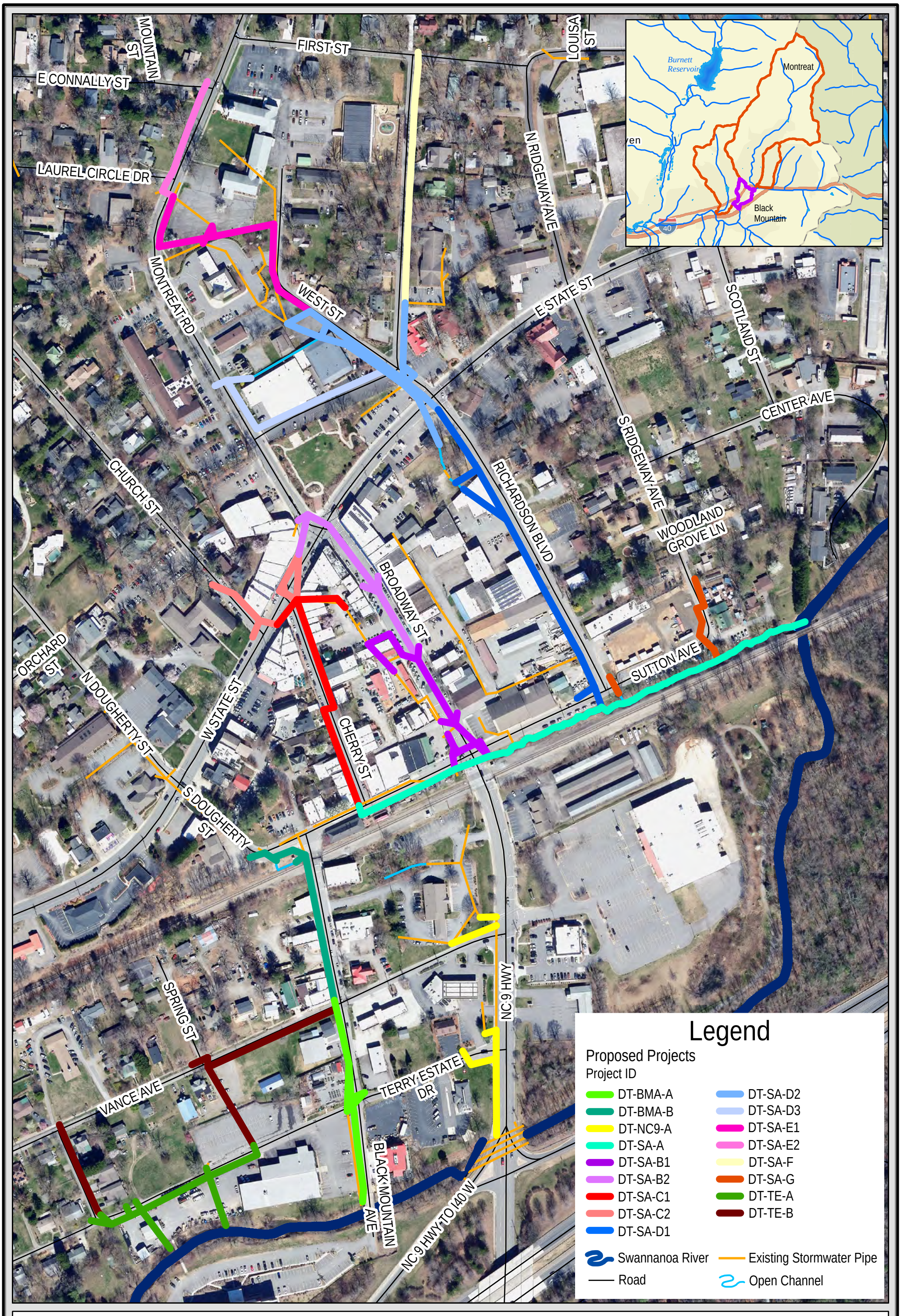
Tomahawk Branch Sheets and Planning Level Opinions of Cost

Flat Creek Proposed Projects Map (4 Projects)

Flat Creek Branch Sheets and Planning Level Opinions of Cost

Tributary 35 / Avena Rd Proposed Projects Map (5 Projects)

Tributary 35 / Avena Rd Sheets and Planning Level Opinions of Cost



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Figure E-1: Proposed Stormwater Improvement Projects
DOWNTOWN DRAINAGE SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

N W E S

PROJECT NAME: **Sutton Ave and Open Channel Stormwater Improvements** PROJECT ID: **DT-SA-A**

PROJECT INFORMATION

LOCATION: Sutton Ave: Cherry St to Broadway St outfall
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 1360

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 25 LF of new 42" RCP across Sutton Ave at Cherry St.
- Replace existing pipe on south side of Sutton Ave with 280 LF of 42" RCP.
- Replace existing pipe in the Broadway St/SuttonAve intersection with 100 LF of 48" RCP.
- Replace exising outfall pipe with 20 LF of 60" RCP.
- Install 940 LF of channel improvements from the outfall to the confluence with the Swannanoa River.*

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Sutton Ave at Cherry St	< 2-YR	50-YR	100
Sutton Ave at Broadway St	< 2-YR	50-YR	100
Future Outfall Projects*	< 2-YR	50-YR	100

**Open Channel improvements along existing roadside channel from outfall at Broadway St to the confluence with the Swannanoa River provide capacity for future outfall improvements at Richardson Blvd and S. Ridgeway Ave.*

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,394,000
Design and Permitting	$ 493,800
Other Project Costs	$ 362,200
Total Project	**$ 2,250,000**

PROJECT AREA MAP



PROJECT NAME **Sutton Ave and Open Channel Stormwater Improvements** PROJECT ID: **DT-SA-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 420

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 51,060.00	$ 51,100.00
Erosion Control	1	LS	$ 41,850.00	$ 41,900.00
Traffic Control	1	LS	$ 16,740.00	$ 16,700.00
Moderate Utility Conflict	1	LS	$ 125,550.00	$ 125,600.00
Unclassified Excavation/Hauling	500	CY	$ 72.00	$ 36,000.00
Infrastructure Removal and Disposal	400	LF	$ 115.00	$ 46,000.00
Structure Removal and Disposal	6	EA	$ 6,800.00	$ 40,800.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	6	EA	$ 12,000.00	$ 72,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	400	LF	$ 670.00	$ 268,000.00
New Pipe: 60-inch	20	LF	$ 875.00	$ 17,500.00
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	940	LF	$ 350.00	$ 329,000.00
Roadway/Sidewalk Replacement	240	SY	$ 110.00	$ 26,400.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 322,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,394,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 69,700.00
Design and Permitting	20%	$ 278,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ 150,000.00
Geotechnical Investigation	1%	$ 13,900.00
Structural Evaluation	1%	$ 13,900.00
Real Estate	2%	$ 27,900.00
Utility Relocation	2%	$ 27,900.00
Project Maintenance (3yr)	5%	$ 69,700.00
Construction Inspections	10%	$ 139,400.00
Construction	100%	$ 1,394,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 2,250,000.00

PROJECT NAME: **Broadway St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-B1**

PROJECT INFORMATION

LOCATION: Broadway St in Downtown Business District
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 700

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24" pipe in Broadway St with 325 LF of 42-inch RCP.
- Replace existing catch basins and connecting pipes along Broadway with larger pipes.
- Re-route private system to proposed Broadway system and remove pipe under structure.
- Install upsized and new crossings and connections at Montreat Rd and Sutton Ave.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**83**

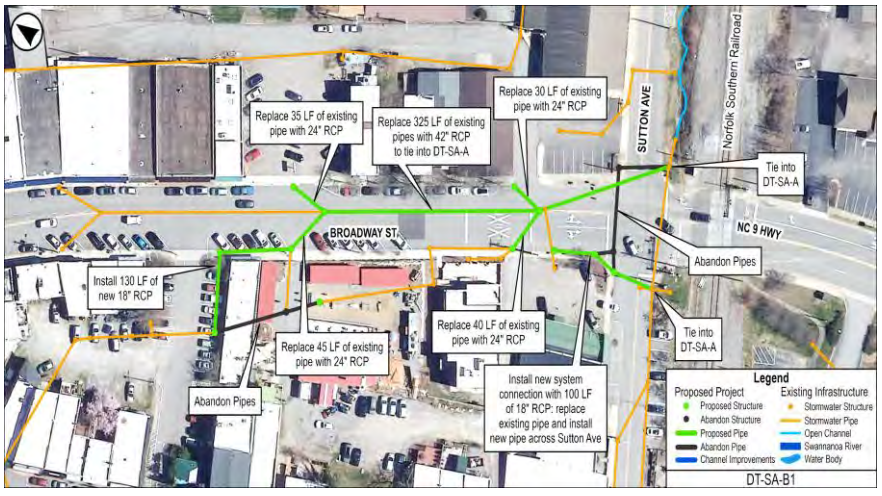
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Broadway St at Sutton Ave	< 2-YR	50-YR	100
Side system along Broadway	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,390,000
Design and Permitting	$ 278,000
Other Project Costs	$ 361,000
Total Project	**$ 2,029,000**

PROJECT AREA MAP



PROJECT NAME **Broadway St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-B1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 700
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 50,915.00	$ 50,900.00
Erosion Control	1	LS	$ 37,160.00	$ 37,200.00
Traffic Control	1	LS	$ 14,864.00	$ 14,900.00
Major Utility Conflict	1	LS	$ 222,960.00	$ 223,000.00
Unclassified Excavation/Hauling	500	CY	$ 72.00	$ 36,000.00
Infrastructure Removal and Disposal	720	LF	$ 115.00	$ 82,800.00
Structure Removal and Disposal	15	EA	$ 6,800.00	$ 102,000.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	375	LF	$ 390.00	$ 146,300.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	325	LF	$ 670.00	$ 217,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	380	SY	$ 110.00	$ 41,800.00
New Concrete Curb and Gutter	125	LF	$ 110.00	$ 13,800.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 321,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,390,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 69,500.00
Design and Permitting	20%	$ 278,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,900.00
Structural Evaluation	1%	$ 13,900.00
Real Estate	2%	$ 27,800.00
Utility Relocation	2%	$ 27,800.00
Project Maintenance (3yr)	5%	$ 69,500.00
Construction Inspections	10%	$ 139,000.00
Construction	100%	$ 1,390,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 2,029,000.00

PROJECT NAME: **Broadway St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-B2**

PROJECT INFORMATION

LOCATION: Broadway St north to Montreat Rd
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 615

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24" pipe in Broadway St with 210 LF of 36-inch RCP.
- Install 285 LF of new 30-inch RCP from 36-inch RCP in Broadway St across E State St.
- Replace 30 LF of existing pipe across Montreat Rd at E State St with 30-inch RCP.
- Remove pipe across Montreat flowing to first catch basin on W. State St.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

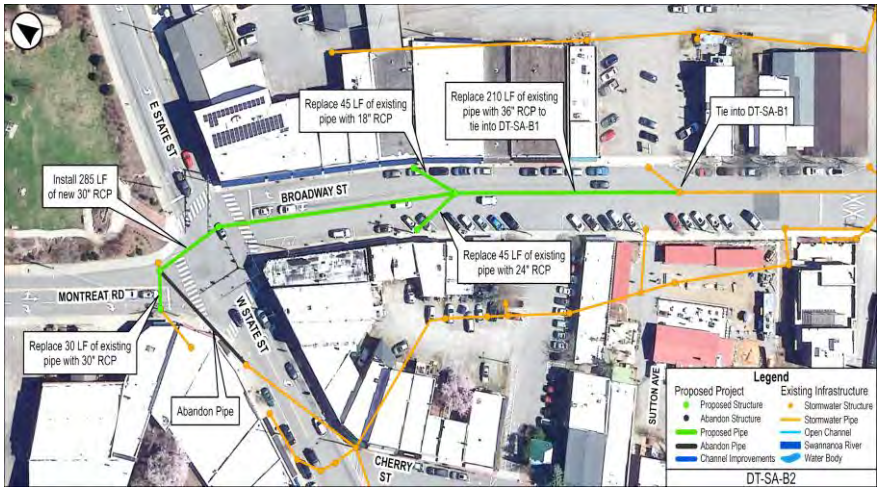
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
E State St at Broadway St	NA	50-YR	New Crossing
Montreat Rd at E State St	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 885,000
Design and Permitting	$ 177,000
Other Project Costs	$ 230,000
Total Project	**$ 1,292,000**

PROJECT AREA MAP



PROJECT NAME **Broadway St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-B2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 615
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 32,425.00	$ 32,400.00
Erosion Control	1	LS	$ 26,580.00	$ 26,600.00
Traffic Control	1	LS	$ 10,632.00	$ 10,600.00
Moderate Utility Conflict	1	LS	$ 79,740.00	$ 79,700.00
Unclassified Excavation/Hauling	620	CY	$ 72.00	$ 44,600.00
Infrastructure Removal and Disposal	435	LF	$ 115.00	$ 50,000.00
Structure Removal and Disposal	5	EA	$ 6,800.00	$ 34,000.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	90	LF	$ 390.00	$ 35,100.00
New Pipe: 30-inch to 36-inch	525	LF	$ 535.00	$ 280,900.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	310	SY	$ 110.00	$ 34,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 204,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 885,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 44,300.00
Design and Permitting	20%	$ 177,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,900.00
Structural Evaluation	1%	$ 8,900.00
Real Estate	2%	$ 17,700.00
Utility Relocation	2%	$ 17,700.00
Project Maintenance (3yr)	5%	$ 44,300.00
Construction Inspections	10%	$ 88,500.00
Construction	100%	$ 885,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,292,000.00

PROJECT NAME: **Cherry St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-C1**

PROJECT INFORMATION

LOCATION: Cherry St from W State St to Sutton Ave
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 690

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe on Cherry St with 270 LF of 36-inch RCP and tie into 42-inch RCP at Sutton Ave.
- Install 330 LF of new 36-inch RCP along Cherry St. from W. State St.
- Replace existing pipe crossing Cherry St at W State St with 85 LF of 36-inch RCP.
- Remove pipe under structure at corner of W State St and Cherry St. to re-route flow to right-of-way.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**75**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Cherry St at W State St	< 2-YR	50-YR	100
Cherry St at Sutton Ave	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,034,000
Design and Permitting	$ 206,800
Other Project Costs	$ 269,200
Total Project	**$ 1,510,000**

PROJECT AREA MAP



PROJECT NAME **Cherry St Stormwater Improvements Phase I** PROJECT ID: **DT-SA-C1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 690
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 37,855.00	$ 37,900.00
Erosion Control	1	LS	$ 31,030.00	$ 31,000.00
Traffic Control	1	LS	$ 12,412.00	$ 12,400.00
Moderate Utility Conflict	1	LS	$ 93,090.00	$ 93,100.00
Unclassified Excavation/Hauling	860	CY	$ 72.00	$ 61,900.00
Infrastructure Removal and Disposal	500	LF	$ 115.00	$ 57,500.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	4	EA	$ 8,600.00	$ 34,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	690	LF	$ 535.00	$ 369,200.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	390	SY	$ 110.00	$ 42,900.00
New Concrete Curb and Gutter	300	LF	$ 110.00	$ 33,000.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 239,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,034,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 51,700.00
Design and Permitting	20%	$ 206,800.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 10,300.00
Structural Evaluation	1%	$ 10,300.00
Real Estate	2%	$ 20,700.00
Utility Relocation	2%	$ 20,700.00
Project Maintenance (3yr)	5%	$ 51,700.00
Construction Inspections	10%	$ 103,400.00
Construction	100%	$ 1,034,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,510,000.00

PROJECT NAME: **Cherry St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-C2**

PROJECT INFORMATION

LOCATION: Church St and W State St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 420

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing crossings at Church St and W State St with 50 LF of 30-inch RCP and 50 LF of 36-inch RCP.
- Replace existing pipe along Church St with 24-inch RCP and connect to new system at W. State St/Cherry St.
- Install 160 LF of 18-inch RCP along W. State St to redirect flow to proposed Cherry St system.
- Remove remaining connection between Montreat Rd and Cherry St.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
W State St at Church St	< 2-YR	50-YR	100
W State St east of Cherry St	2-YR	50-YR	100
Church St at W State St	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 699,000
Design and Permitting	$ 139,800
Other Project Costs	$ 182,200
Total Project	**$ 1,021,000**

PROJECT AREA MAP



PROJECT NAME **Cherry St Stormwater Improvements Phase II** PROJECT ID: **DT-SA-C2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 420
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 25,635.00	$ 25,600.00
Erosion Control	1	LS	$ 21,015.00	$ 21,000.00
Traffic Control	1	LS	$ 8,406.00	$ 8,400.00
Moderate Utility Conflict	1	LS	$ 63,045.00	$ 63,000.00
Unclassified Excavation/Hauling	340	CY	$ 72.00	$ 24,500.00
Infrastructure Removal and Disposal	440	LF	$ 115.00	$ 50,600.00
Structure Removal and Disposal	8	EA	$ 6,800.00	$ 54,400.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	325	LF	$ 390.00	$ 126,800.00
New Pipe: 30-inch to 36-inch	95	LF	$ 535.00	$ 50,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	260	SY	$ 110.00	$ 28,600.00
New Concrete Curb and Gutter	210	LF	$ 110.00	$ 23,100.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 161,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 699,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 35,000.00
Design and Permitting	20%	$ 139,800.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 7,000.00
Structural Evaluation	1%	$ 7,000.00
Real Estate	2%	$ 14,000.00
Utility Relocation	2%	$ 14,000.00
Project Maintenance (3yr)	5%	$ 35,000.00
Construction Inspections	10%	$ 69,900.00
Construction	100%	$ 699,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,021,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase I** PROJECT ID: **DT-SA-D1**

PROJECT INFORMATION

LOCATION: Richardson Blvd / Post Office
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 1600

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 150 LF of 3' x 7' RCBC along Richardson Blvd to the outfall in the open channel along Sutton Ave.
- Install 570 LF of twin 42-inch RCP north along Richardson Blvd to the post office.
- Install 190 LF of 42-inch pipe to the intersection with E State St.
- Install 70 LF of new 36-inch RCP adjacent to the post office to reroute flow to the right-of-way.
- Project allows for stormwater improvements upstream at Police Station.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	0
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**71**

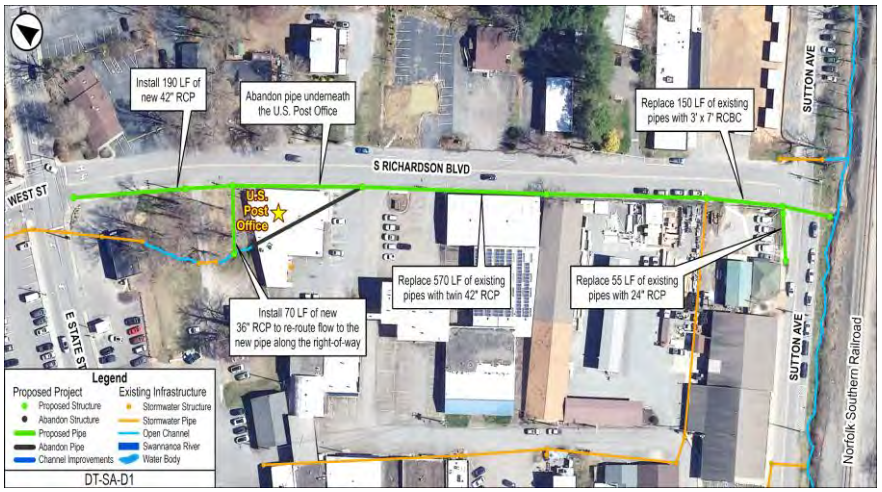
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Sutton Ave at Richardson	< 2-YR	50-YR	100
Post Office Infrastructure	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 2,913,000
Design and Permitting	$ 632,600
Other Project Costs	$ 757,400
Total Project	**$ 4,303,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase I** PROJECT ID: **DT-SA-D1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 1600
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 106,720.00	$ 106,700.00
Erosion Control	1	LS	$ 87,475.00	$ 87,500.00
Traffic Control	1	LS	$ 34,990.00	$ 35,000.00
Moderate Utility Conflict	1	LS	$ 262,425.00	$ 262,400.00
Unclassified Excavation/Hauling	2310	CY	$ 72.00	$ 166,300.00
Infrastructure Removal and Disposal	760	LF	$ 115.00	$ 87,400.00
Structure Removal and Disposal	6	EA	$ 6,800.00	$ 40,800.00
Standard Structure	3	EA	$ 8,600.00	$ 25,800.00
Large Structure or Headwall	8	EA	$ 12,000.00	$ 96,000.00
New Pipe: 18-inch to 24-inch	50	LF	$ 390.00	$ 19,500.00
New Pipe: 30-inch to 36-inch	70	LF	$ 535.00	$ 37,500.00
New Pipe: 42-inch to 54-inch	1330	LF	$ 670.00	$ 891,100.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	150	LF	$ 1,700.00	$ 255,000.00
Rip Rap	50	TN	$ 50.00	$ 2,500.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	610	SY	$ 110.00	$ 67,100.00
New Concrete Curb and Gutter	550	LF	$ 110.00	$ 60,500.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 672,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 2,913,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 145,700.00
Design and Permitting	20%	$ 582,600.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 29,100.00
Structural Evaluation	1%	$ 29,100.00
Real Estate	2%	$ 58,300.00
Utility Relocation	2%	$ 58,300.00
Project Maintenance (3yr)	5%	$ 145,700.00
Construction Inspections	10%	$ 291,300.00
Construction	100%	$ 2,913,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 4,303,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase II** PROJECT ID: **DT-SA-D2**

PROJECT INFORMATION

LOCATION: West St at E State St / Police Station
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 775

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 170 LF of new 42-inch RCP from Honeycutt St crossing E State St to tie-into proposed project DT-SA-D1.
- Install 55 LF of new 24-inch RCP and 200 LF of new 36-inch RCP in a new alignment along West St.
- Install new connecting pipes north of the police station to re-route flow to the right-of-way.
- Remove/abandon in place stormwater system running underneath police station to south of E State St.
- Install 235 LF of 24-inch RCP at the West/Midland intersection.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**87**

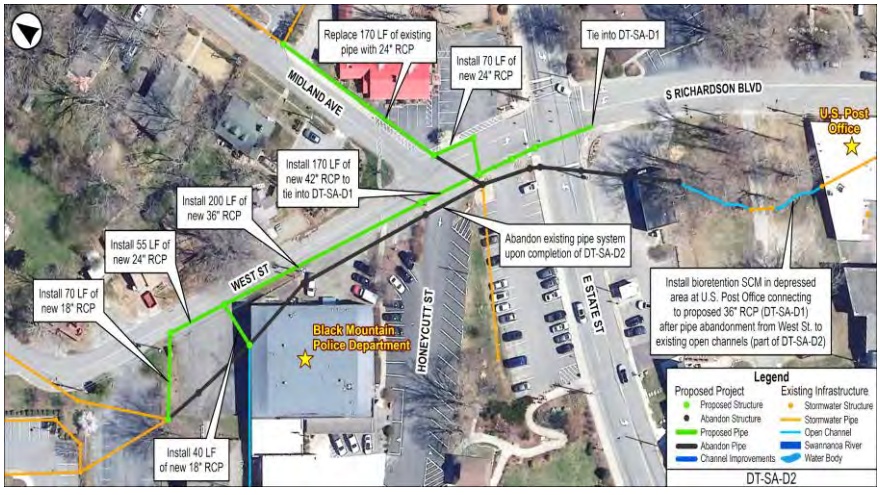
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
E State St/Richardson INT	< 2-YR	50-YR	100
West/Midland INT	< 2-YR	50-YR	100
Police Station Infrastructure	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,323,000
Design and Permitting	$ 264,600
Other Project Costs	$ 344,400
Total Project	**$ 1,932,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase II** PROJECT ID: **DT-SA-D2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 775
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 48,475.00	$ 48,500.00
Erosion Control	1	LS	$ 39,735.00	$ 39,700.00
Traffic Control	1	LS	$ 15,894.00	$ 15,900.00
Moderate Utility Conflict	1	LS	$ 119,205.00	$ 119,200.00
Unclassified Excavation/Hauling	940	CY	$ 72.00	$ 67,700.00
Infrastructure Removal and Disposal	710	LF	$ 115.00	$ 81,700.00
Structure Removal and Disposal	10	EA	$ 6,800.00	$ 68,000.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	4	EA	$ 12,000.00	$ 48,000.00
New Pipe: 18-inch to 24-inch	400	LF	$ 390.00	$ 156,000.00
New Pipe: 30-inch to 36-inch	200	LF	$ 535.00	$ 107,000.00
New Pipe: 42-inch to 54-inch	175	LF	$ 670.00	$ 117,300.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	370	SY	$ 110.00	$ 40,700.00
New Concrete Curb and Gutter	425	LF	$ 110.00	$ 46,800.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 305,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,323,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 66,200.00
Design and Permitting	20%	$ 264,600.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,200.00
Structural Evaluation	1%	$ 13,200.00
Real Estate	2%	$ 26,500.00
Utility Relocation	2%	$ 26,500.00
Project Maintenance (3yr)	5%	$ 66,200.00
Construction Inspections	10%	$ 132,300.00
Construction	100%	$ 1,323,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,932,000.00

PROJECT NAME: **Police Station / Post Office Stormwater Improvements Phase III** PROJECT ID: **DT-SA-D3**

PROJECT INFORMATION

LOCATION: Montreat Rd and Honeycutt St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 575

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with paved over inlet across Montreat Rd at Fire Station with 35 LF of 24-inch RCP.
- Install 540 LF of new 24-inch RCP along Montreat Rd to Honeycutt St connecting to 42-inch RCP at West St.
- Remove existing pipe directing public water onto private property just north of the Fire Station.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	0
FINAL PROJECT SCORE:	**81**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd at Fire Station	< 2-YR	50-YR	100
Honeycutt St	NA	50-YR	New System

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 632,000
Design and Permitting	$ 126,400
Other Project Costs	$ 164,600
Total Project	**$ 923,000**

PROJECT AREA MAP



PROJECT NAME **Police Station / Post Office Stormwater Improvements Phase III** PROJECT ID: **DT-SA-D3**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 575
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 23,135.00	$ 23,100.00
Erosion Control	1	LS	$ 18,960.00	$ 19,000.00
Traffic Control	1	LS	$ 7,584.00	$ 7,600.00
Moderate Utility Conflict	1	LS	$ 56,880.00	$ 56,900.00
Unclassified Excavation/Hauling	510	CY	$ 72.00	$ 36,700.00
Infrastructure Removal and Disposal	100	LF	$ 115.00	$ 11,500.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	4	EA	$ 8,600.00	$ 34,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	575	LF	$ 390.00	$ 224,300.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	310	SY	$ 110.00	$ 34,100.00
New Concrete Curb and Gutter	150	LF	$ 110.00	$ 16,500.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 146,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 632,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 31,600.00
Design and Permitting	20%	$ 126,400.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 6,300.00
Structural Evaluation	1%	$ 6,300.00
Real Estate	2%	$ 12,600.00
Utility Relocation	2%	$ 12,600.00
Project Maintenance (3yr)	5%	$ 31,600.00
Construction Inspections	10%	$ 63,200.00
Construction	100%	$ 632,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 923,000.00

PROJECT NAME: **West St to Montreat Rd Stormwater Improvements** PROJECT ID: **DT-SA-E1**

PROJECT INFORMATION

LOCATION: West St to Montreat Rd
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 760

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 735 LF of new 24-inch system along Montreat Rd and West St to connect to Proposed Project DT-SA-D2.
- This requires a permanent easement along the property line with the bank and church.
- Install 575 LF of new 24-inch system along Montreat Rd at Fire Station and Honeycutt Rd.
- Proposed project re-routes flow away from private property into the right-of-way.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**76**

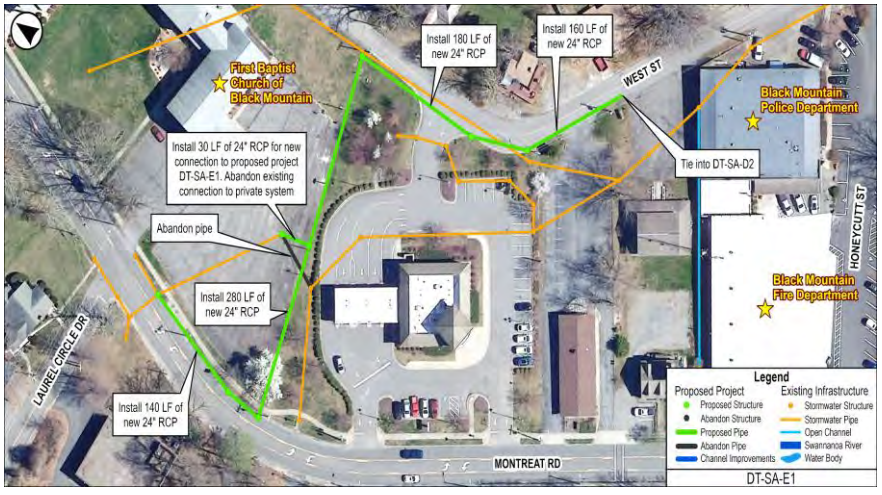
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd at the Church	NA	50-YR	New System
West St behind Bank	NA	50-YR	New System

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 841,000
Design and Permitting	$ 168,200
Other Project Costs	$ 218,800
Total Project	**$ 1,228,000**

PROJECT AREA MAP



PROJECT NAME **West St to Montreat Rd Stormwater Improvements** PROJECT ID: **DT-SA-E1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 760
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 30,820.00	$ 30,800.00
Erosion Control	1	LS	$ 25,260.00	$ 25,300.00
Traffic Control	1	LS	$ 10,104.00	$ 10,100.00
Moderate Utility Conflict	1	LS	$ 75,780.00	$ 75,800.00
Unclassified Excavation/Hauling	910	CY	$ 72.00	$ 65,500.00
Infrastructure Removal and Disposal	30	LF	$ 115.00	$ 3,500.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	8	EA	$ 8,600.00	$ 68,800.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	760	LF	$ 390.00	$ 296,400.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	210	SY	$ 110.00	$ 23,100.00
New Concrete Curb and Gutter	300	LF	$ 110.00	$ 33,000.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 194,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 841,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 42,100.00
Design and Permitting	20%	$ 168,200.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,400.00
Structural Evaluation	1%	$ 8,400.00
Real Estate	2%	$ 16,800.00
Utility Relocation	2%	$ 16,800.00
Project Maintenance (3yr)	5%	$ 42,100.00
Construction Inspections	10%	$ 84,100.00
Construction	100%	$ 841,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,228,000.00

PROJECT NAME: **Montreat Rd at Laurel Circle Dr Stormwater Improvements** PROJECT ID: **DT-SA-E2**

PROJECT INFORMATION

LOCATION:	Montreat Rd: E. Connally St to Laurel Circle Dr	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 260 LF of new 24-inch RCP along Montreat Rd from E. Connally St to Laurel Circle Dr.
- Replace 90 LF of existing pipe with 24-inch RCP across Laurel Circle Dr to tie-into proposed project DT-SA-E1.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	8
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**49**

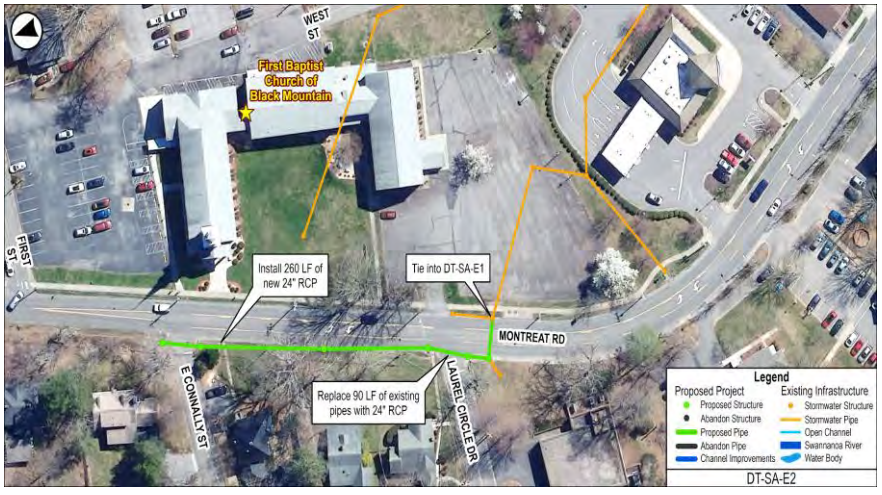
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Dr	< 2-YR	25-YR	45
E Connally St at Montreat Rd	NA	25-YR	New Crossing

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 546,000
Design and Permitting	$ 109,200
Other Project Costs	$ 141,800
Total Project	**$ 797,000**

PROJECT AREA MAP



PROJECT NAME **Montreat Rd at Laurel Circle Dr Stormwater Improvements** PROJECT ID: **DT-SA-E2**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 350

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 19,975.00	$ 20,000.00
Erosion Control	1	LS	$ 14,580.00	$ 14,600.00
Traffic Control	1	LS	$ 5,832.00	$ 5,800.00
Major Utility Conflict	1	LS	$ 87,480.00	$ 87,500.00
Unclassified Excavation/Hauling	300	CY	$ 72.00	$ 21,600.00
Infrastructure Removal and Disposal	95	LF	$ 115.00	$ 10,900.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	350	LF	$ 390.00	$ 136,500.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	240	LF	$ 110.00	$ 26,400.00
Replace Driveway Culvert Pipe	30	LF	$ 300.00	$ 9,000.00
Replace Existing Concrete Driveway	15	SY	$ 120.00	$ 1,800.00
			Construction Contingency (30%):	$ 126,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 546,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 27,300.00
Design and Permitting	20%	$ 109,200.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,500.00
Structural Evaluation	1%	$ 5,500.00
Real Estate	2%	$ 10,900.00
Utility Relocation	2%	$ 10,900.00
Project Maintenance (3yr)	5%	$ 27,300.00
Construction Inspections	10%	$ 54,600.00
Construction	100%	$ 546,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 797,000.00

PROJECT NAME: **Midland Ave Stormwater Improvements** PROJECT ID: **DT-SA-F**

PROJECT INFORMATION

LOCATION: Midland Ave
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 675

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing culvert crossing at First St and Midland Ave with 30 LF of 24-inch RCP.
- Replace existing pipe and open channel system along Midland Ave with 24-inch RCP.
- Tie-into 24-inch RCP (part of proposed project DT-SA-D2) at Town Hall.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**82**

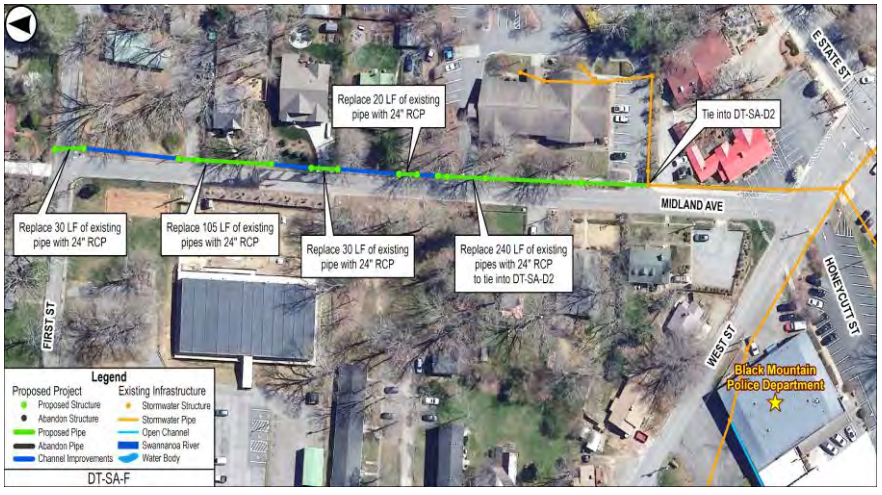
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
First St at Midland Ave	2-YR	50-YR	100
System at Town Hall	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 768,000
Design and Permitting	$ 153,600
Other Project Costs	$ 199,400
Total Project	**$ 1,121,000**

PROJECT AREA MAP



PROJECT NAME **Midland Ave Stormwater Improvements** PROJECT ID: **DT-SA-F**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 425
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 28,125.00	$ 28,100.00
Erosion Control	1	LS	$ 25,115.00	$ 25,100.00
Traffic Control	1	LS	$ 10,046.00	$ 10,000.00
Minor Utility Conflict	1	LS	$ 25,115.00	$ 25,100.00
Unclassified Excavation/Hauling	210	CY	$ 72.00	$ 15,100.00
Infrastructure Removal and Disposal	425	LF	$ 115.00	$ 48,900.00
Structure Removal and Disposal	5	EA	$ 6,800.00	$ 34,000.00
Standard Structure	13	EA	$ 8,600.00	$ 111,800.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	425	LF	$ 390.00	$ 165,800.00
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	250	LF	$ 350.00	$ 87,500.00
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	70	LF	$ 300.00	$ 21,000.00
Replace Existing Concrete Driveway	40	SY	$ 120.00	$ 4,800.00
			Construction Contingency (30%):	$ 177,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 768,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 38,400.00
Design and Permitting	20%	$ 153,600.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 7,700.00
Structural Evaluation	1%	$ 7,700.00
Real Estate	2%	$ 15,400.00
Utility Relocation	2%	$ 15,400.00
Project Maintenance (3yr)	5%	$ 38,400.00
Construction Inspections	10%	$ 76,800.00
Construction	100%	$ 768,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,121,000.00

PROJECT NAME: **S. Ridgeway Ave Stormwater Improvements** PROJECT ID: **DT-SA-G**

PROJECT INFORMATION

LOCATION:	Sutton Ave at S. Ridgway Ave	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	310

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 50 LF of 30-inch RCP across Sutton Ave on east side of Richardson Blvd.
- Install 80 LF of new 18-inch RCP and 100 LF of new 24-inch RCP along S. Ridgeway Ave.
- Replace existing pipe with 85 LF of 36-inch RCP to outfall at the open channel along Sutton Ave.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	0
FINAL PROJECT SCORE:	**76**

	LEVEL OF SERVICE		% REDUCTION
KEY CROSSING	EXISTING	PROPOSED	50 YR
Sutton Ave at Richardson	< 2-YR	50-YR	100
Sutton Ave at Ridgeway Ave	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 532,000
Design and Permitting	$ 156,400
Other Project Costs	$ 138,600
Total Project	**$ 827,000**

PROJECT AREA MAP



PROJECT NAME **S. Ridgeway Ave Stormwater Improvements** PROJECT ID: **DT-SA-G**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 310
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 19,475.00	$ 19,500.00
Erosion Control	1	LS	$ 14,215.00	$ 14,200.00
Traffic Control	1	LS	$ 5,686.00	$ 5,700.00
Major Utility Conflict	1	LS	$ 85,290.00	$ 85,300.00
Unclassified Excavation/Hauling	170	CY	$ 72.00	$ 12,200.00
Infrastructure Removal and Disposal	105	LF	$ 115.00	$ 12,100.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	175	LF	$ 390.00	$ 68,300.00
New Pipe: 30-inch to 36-inch	135	LF	$ 535.00	$ 72,200.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	110	SY	$ 110.00	$ 12,100.00
New Concrete Curb and Gutter	75	LF	$ 110.00	$ 8,300.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 123,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 532,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 26,600.00
Design and Permitting	20%	$ 106,400.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,300.00
Structural Evaluation	1%	$ 5,300.00
Real Estate	2%	$ 10,600.00
Utility Relocation	2%	$ 10,600.00
Project Maintenance (3yr)	5%	$ 26,600.00
Construction Inspections	10%	$ 53,200.00
Construction	100%	$ 532,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 827,000.00

PROJECT NAME: **Black Mountain Ave Stormwater Improvements Phase I** PROJECT ID: **DT-BMA-A**

PROJECT INFORMATION

LOCATION: Vance Ave to the Swannanoa River
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 585

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 85 LF of 30" RCP across Vance St at Black Mountain Ave.
- Replace 175 LF of existing pipe with 30" RCP and 36" RCP at Vance Ave intersection and moving south.
- Install 370 LF of new 36" RCP just north of the Terry Estate Dr intersection to the outfall.
- Install 40 LF of new 24" RCP across Black Mountain Ave at Terry Estate Dr.
- Remove 195 LF of existing pipe from service at Terry Estate Dr/Black Mountain Ave intersection.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	4
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**82**

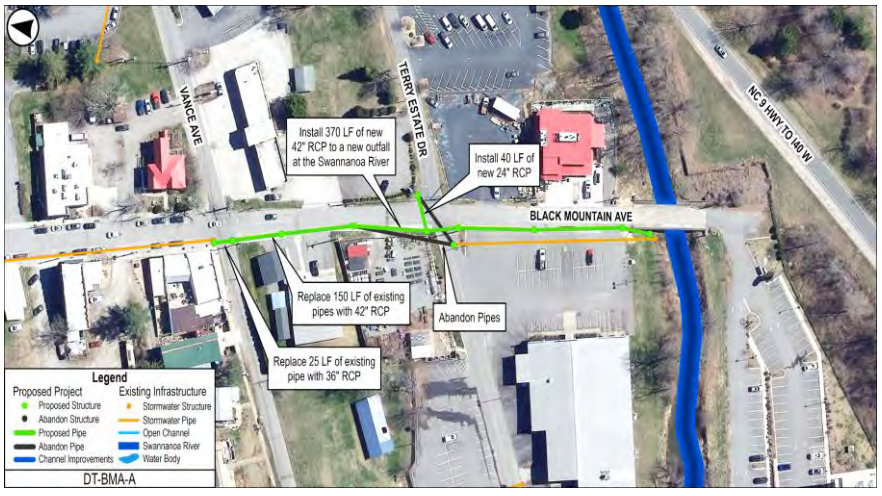
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate at Black Mtn Ave	< 2-YR	50-YR	100
Vance Ave at Black Mtn Ave	< 2-YR	25-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,253,000
Design and Permitting	$ 300,600
Other Project Costs	$ 326,400
Total Project	**$ 1,880,000**

PROJECT AREA MAP



PROJECT NAME **Black Mountain Ave Stormwater Improvements Phase I** PROJECT ID: **DT-BMA-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 585
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 45,910.00	$ 45,900.00
Erosion Control	1	LS	$ 37,630.00	$ 37,600.00
Traffic Control	1	LS	$ 15,052.00	$ 15,100.00
Moderate Utility Conflict	1	LS	$ 112,890.00	$ 112,900.00
Unclassified Excavation/Hauling	860	CY	$ 72.00	$ 61,900.00
Infrastructure Removal and Disposal	370	LF	$ 115.00	$ 42,600.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	3	EA	$ 8,600.00	$ 25,800.00
Large Structure or Headwall	8	EA	$ 12,000.00	$ 96,000.00
New Pipe: 18-inch to 24-inch	40	LF	$ 390.00	$ 15,600.00
New Pipe: 30-inch to 36-inch	25	LF	$ 535.00	$ 13,400.00
New Pipe: 42-inch to 54-inch	520	LF	$ 670.00	$ 348,400.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	560	SY	$ 110.00	$ 61,600.00
New Concrete Curb and Gutter	450	LF	$ 110.00	$ 49,500.00
Replace Driveway Culvert Pipe	25	LF	$ 300.00	$ 7,500.00
Replace Existing Concrete Driveway	15	SY	$ 120.00	$ 1,800.00
			Construction Contingency (30%):	$ 289,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,253,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 62,700.00
Design and Permitting	20%	$ 250,600.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 12,500.00
Structural Evaluation	1%	$ 12,500.00
Real Estate	2%	$ 25,100.00
Utility Relocation	2%	$ 25,100.00
Project Maintenance (3yr)	5%	$ 62,700.00
Construction Inspections	10%	$ 125,300.00
Construction	100%	$ 1,253,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,880,000.00

PROJECT NAME: **Black Mountain Ave Stormwater Improvements Phase II** PROJECT ID: **DT-BMA-B**

PROJECT INFORMATION

LOCATION:	S. Doughtery St to Vance Ave	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Downtown	DRAINAGE IMPROVEMENTS (LF):	585

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace nearly 400 LF of existing pipe along Black Mountain Ave from S. Doughtery St to Vance Ave.
- Install 160 LF of new 24" RCP at S. Doughtery St. to Black Mountain Ave.
- Replace existing culvert adjacent to the railroad tracks with 30 LF of 18" RCP.
- Install 50 LF of stormwater channel improvements as needed.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Black Mountain Ave at RR	< 2-YR	50-YR	100
S. Dougherty St Bend	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 862,000
Design and Permitting	$ 222,400
Other Project Costs	$ 223,600
Total Project	**$ 1,308,000**

PROJECT AREA MAP



PROJECT NAME **Black Mountain Ave Stormwater Improvements Phase II** PROJECT ID: **DT-BMA-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 585
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 31,570.00	$ 31,600.00
Erosion Control	1	LS	$ 28,185.00	$ 28,200.00
Traffic Control	1	LS	$ 11,274.00	$ 11,300.00
Minor Utility Conflict	1	LS	$ 28,185.00	$ 28,200.00
Unclassified Excavation/Hauling	550	CY	$ 72.00	$ 39,600.00
Infrastructure Removal and Disposal	500	LF	$ 115.00	$ 57,500.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	6	EA	$ 8,600.00	$ 51,600.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	190	LF	$ 390.00	$ 74,100.00
New Pipe: 30-inch to 36-inch	395	LF	$ 535.00	$ 211,300.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	350	SY	$ 110.00	$ 38,500.00
New Concrete Curb and Gutter	400	LF	$ 110.00	$ 44,000.00
Replace Driveway Culvert Pipe	50	LF	$ 300.00	$ 15,000.00
Replace Existing Concrete Driveway	30	SY	$ 120.00	$ 3,600.00
			Construction Contingency (30%):	$ 199,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 862,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 43,100.00
Design and Permitting	20%	$ 172,400.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ 50,000.00
Geotechnical Investigation	1%	$ 8,600.00
Structural Evaluation	1%	$ 8,600.00
Real Estate	2%	$ 17,200.00
Utility Relocation	2%	$ 17,200.00
Project Maintenance (3yr)	5%	$ 43,100.00
Construction Inspections	10%	$ 86,200.00
Construction	100%	$ 862,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,308,000.00

PROJECT NAME: **Terry Estate Dr Stormwater Improvements Phase I** PROJECT ID: **DT-TE-A**

PROJECT INFORMATION

LOCATION: Terry Estate Drive
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 745

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipes across Terry Estate Dr in 5 locations with larger pipes.
- Replace the existing pipe on the south side of Terry Estate Dr with 55 LF of 30-inch and 400 LF of 36-inch RCP.
- Install a new 42-inch outfall pipe across the parking lot to the Swannanoa River.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	24
Public or Privately-Owned Land	4
Effect of Improvements	15
Cost Effectiveness	10
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**61**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate Dr at Bridge St	< 2-YR	50-YR	100
Terry Estate Dr	< 2-YR	25-YR	96

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 1,310,000
Design and Permitting	$ 312,000
Other Project Costs	$ 341,000
Total Project	**$ 1,963,000**

PROJECT AREA MAP



PROJECT NAME **Terry Estate Dr Stormwater Improvements Phase I** PROJECT ID: **DT-TE-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 745
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 48,010.00	$ 48,000.00
Erosion Control	1	LS	$ 35,045.00	$ 35,000.00
Traffic Control	1	LS	$ 14,018.00	$ 14,000.00
Major Utility Conflict	1	LS	$ 210,270.00	$ 210,300.00
Unclassified Excavation/Hauling	630	CY	$ 72.00	$ 45,400.00
Infrastructure Removal and Disposal	730	LF	$ 115.00	$ 84,000.00
Structure Removal and Disposal	7	EA	$ 6,800.00	$ 47,600.00
Standard Structure	9	EA	$ 8,600.00	$ 77,400.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	120	LF	$ 390.00	$ 46,800.00
New Pipe: 30-inch to 36-inch	485	LF	$ 535.00	$ 259,500.00
New Pipe: 42-inch to 54-inch	140	LF	$ 670.00	$ 93,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	410	SY	$ 110.00	$ 45,100.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 302,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 1,310,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 65,500.00
Design and Permitting	20%	$ 262,000.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 13,100.00
Structural Evaluation	1%	$ 13,100.00
Real Estate	2%	$ 26,200.00
Utility Relocation	2%	$ 26,200.00
Project Maintenance (3yr)	5%	$ 65,500.00
Construction Inspections	10%	$ 131,000.00
Construction	100%	$ 1,310,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,963,000.00

PROJECT NAME: **Terry Estate Dr Stormwater Improvements Phase II** PROJECT ID: **DT-TE-B**

PROJECT INFORMATION

LOCATION: Vance Ave at Bridge St and Spring St
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 715

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe and stormwater roadside ditches along Bridge St with 260 LF of 24-inch RCP.
- Replace existing pipe crossing Spring St and Vance St with 70 LF of 24-inch RCP.
- Install 375 LF of new 24-inch RCP to re-route flow to Vance Ave and Black Mountain Ave rights-of-way.
- Remove/abandon in place stormwater pipe running south to Terry Estate Dr through private property.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**78**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Vance Ave at Bridge St	10-YR	50-YR	100
Vance Ave/Spring St INT	< 2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 945,000
Design and Permitting	$ 189,000
Other Project Costs	$ 246,000
Total Project	**$ 1,380,000**

PROJECT AREA MAP



PROJECT NAME **Terry Estate Dr Stormwater Improvements Phase II** PROJECT ID: **DT-TE-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 715
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 34,625.00	$ 34,600.00
Erosion Control	1	LS	$ 28,380.00	$ 28,400.00
Traffic Control	1	LS	$ 11,352.00	$ 11,400.00
Moderate Utility Conflict	1	LS	$ 85,140.00	$ 85,100.00
Unclassified Excavation/Hauling	590	CY	$ 72.00	$ 42,500.00
Infrastructure Removal and Disposal	580	LF	$ 115.00	$ 66,700.00
Structure Removal and Disposal	4	EA	$ 6,800.00	$ 27,200.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	265	LF	$ 390.00	$ 103,400.00
New Pipe: 30-inch to 36-inch	450	LF	$ 535.00	$ 240,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	180	SY	$ 110.00	$ 19,800.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 218,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 945,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 47,300.00
Design and Permitting	20%	$ 189,000.00
Environmental Permitting	-	$ -
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 9,500.00
Structural Evaluation	1%	$ 9,500.00
Real Estate	2%	$ 18,900.00
Utility Relocation	2%	$ 18,900.00
Project Maintenance (3yr)	5%	$ 47,300.00
Construction Inspections	10%	$ 94,500.00
Construction	100%	$ 945,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,380,000.00

PROJECT NAME: **NC 9 Stormwater Improvements** PROJECT ID: **DT-NC9-A**

PROJECT INFORMATION

LOCATION: Vance Ave to outfall at Swannanoa River
WATERSHED: Downtown
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 595

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe along NC 9 with 280 LF of 36-inch RCP and tie-into culvert at Swannanaoa River.
- Replace existing pipe along Terry Estate Dr with 24-inch RCP and tie into proposed 36-inch pipe at NC 9.
- Install 130 LF of new 24-inch RCP to route flow along the Vance Ave right-of -way to tie into the NC 9 system.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**68**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Terry Estate Dr west of NC9	< 2-YR	50-YR	100
Terry Estate Dr at NC9	25-YR	50-YR	100
Vance Ave at NC9	25-YR	50-YR	100
Vance Ave west of NC 9	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 880,000
Design and Permitting	$ 226,000
Other Project Costs	$ 229,000
Total Project	**$ 1,335,000**

PROJECT AREA MAP



PROJECT NAME **NC 9 Stormwater Improvements** PROJECT ID: **DT-NC9-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Downtown

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning.
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

Improvements (LF): 595

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 32,250.00	$ 32,300.00
Erosion Control	1	LS	$ 26,435.00	$ 26,400.00
Traffic Control	1	LS	$ 10,574.00	$ 10,600.00
Moderate Utility Conflict	1	LS	$ 79,305.00	$ 79,300.00
Unclassified Excavation/Hauling	540	CY	$ 72.00	$ 38,900.00
Infrastructure Removal and Disposal	470	LF	$ 115.00	$ 54,100.00
Structure Removal and Disposal	7	EA	$ 6,800.00	$ 47,600.00
Standard Structure	7	EA	$ 8,600.00	$ 60,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	315	LF	$ 390.00	$ 122,900.00
New Pipe: 30-inch to 36-inch	280	LF	$ 535.00	$ 149,800.00
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	270	SY	$ 110.00	$ 29,700.00
New Concrete Curb and Gutter	220	LF	$ 110.00	$ 24,200.00
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 203,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 880,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 44,000.00
Design and Permitting	20%	$ 176,000.00
Environmental Permitting	-	$ 50,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 8,800.00
Structural Evaluation	1%	$ 8,800.00
Real Estate	2%	$ 17,600.00
Utility Relocation	2%	$ 17,600.00
Project Maintenance (3yr)	5%	$ 44,000.00
Construction Inspections	10%	$ 88,000.00
Construction	100%	$ 880,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 1,335,000.00



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Figure E-2: Proposed Stormwater Improvement Projects
TOMAHAWK BRANCH PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

N W E S

PROJECT NAME: **Laurel Circle Culvert Replacement (Tomahawk Branch)** PROJECT ID: **TB-A1**

PROJECT INFORMATION

LOCATION:	Laurel Circle Dr north of Lake Tomahawk	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	220

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing arch culverts with 40 LF of triple 5' x 9' RCBC.
- Install floodplain benching upstream/downstream of proposed culvert (documented separately).
- Tomahawk Lake analysis is required to determine any additional measures to improve the level of service.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	8
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	2
FINAL PROJECT SCORE:	**58**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Drive	< 2-YR	10-YR	0

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 455,000
Design and Permitting	$ 186,000
Other Project Costs	$ 119,000
Total Project	**$ 760,000**

PROJECT AREA MAP



PROJECT NAME **Laurel Circle Culvert Replacement (Tomahawk Branch)** PROJECT ID: **TB-A1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 120
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 16,650.00	$ 16,700.00
Erosion Control	1	LS	$ 14,865.00	$ 14,900.00
Traffic Control	1	LS	$ 5,946.00	$ 5,900.00
Minor Utility Conflict	1	LS	$ 14,865.00	$ 14,900.00
Unclassified Excavation/Hauling	190	CY	$ 72.00	$ 13,700.00
Infrastructure Removal and Disposal	120	LF	$ 115.00	$ 13,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	120	LF	$ 1,700.00	$ 204,000.00
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	100	LF	$ 350.00	$ 35,000.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 105,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 455,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 22,800.00
Design and Permitting	20%	$ 91,000.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 4,600.00
Structural Evaluation	1%	$ 4,600.00
Real Estate	2%	$ 9,100.00
Utility Relocation	2%	$ 9,100.00
Project Maintenance (3yr)	5%	$ 22,800.00
Construction Inspections	10%	$ 45,500.00
Construction	100%	$ 455,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 760,000.00

PROJECT NAME: **Tomahawk Branch Floodplain Benching at Golf Course** PROJECT ID: **TB-A2**

PROJECT INFORMATION

LOCATION:	Laurel Circle Dr north of Lake Tomahawk	STORMWATER PROJECT TYPE:	Floodplain Benching
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	500

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install approximately 500 LF of channel improvements with floodplain benching to lower WSELs.
- Floodplain benching improvements are located up and downstream of the proposed RCBC in project TB-A1.

PROJECT PRIORITIZATION AND PROPERTY REQUIREMENTS

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	8
Public or Privately-Owned Land	4
Effect of Improvements	10
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**53**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Laurel Circle Drive	< 2-YR	10-YR	0

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 406,000
Design and Permitting	$ 146,200
Other Project Costs	$ 137,800
Total Project	**$ 690,000**

PROJECT AREA MAP



PROJECT NAME: **Tomahawk Branch Floodplain Benching at Golf C** PROJECT ID: **TB-A2**

PROJECT TYPE: Floodplain Benching WATERSHED: Tomahawk Branch

PLANNING LEVEL COST ESTIMATE

- Construction estimate includes 30% contingency for planning.
- Proposed project footprints are based on GIS and modeling analyses.
- Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 15,660.00	$ 15,700.00
Erosion Control	1	LS	$ 13,980.00	$ 14,000.00
Traffic Control	1	LS	$ 5,592.00	$ 5,600.00
Minor Utility Conflict	1	LS	$ 13,980.00	$ 14,000.00
Clearing and Grubbing	1110	SY	$ 5.50	$ 6,100.00
Earthwork	370	CY	$ 90.00	$ 33,300.00
Fine Grading	1110	SY	$ 18.00	$ 20,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Infrastructure Removal and Disposal	-	LF	$ 115.00	-
Stone, Class B	125	TN	$ 92.00	$ 11,500.00
Filter Fabric/Geotextiles	2780	SY	$ 35.00	$ 97,300.00
Plantings	1110	SY	$ 7.00	$ 7,800.00
3-gallon Container Plants	135	EA	$ 70.00	$ 9,500.00
Riffle Grade Control	2	EA	$ 4,025.00	$ 8,100.00
Floodplain Tree Removal	1	LS	$ 15,000.00	$ 15,000.00
Log Grade Control Structure	-	EA	$ 4,000.00	-
Pump Around Operation	1	LS	$ 46,000.00	$ 46,000.00
Golf Course Bridge	1	LS	$ 25,000.00	$ 25,000.00
			Construction Contingency (30%):	$ 77,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 406,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 20,300.00
Design and Permitting	20%	$ 81,200.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 4,100.00
Structural Evaluation	1%	$ 4,100.00
Real Estate	10%	$ 40,600.00
Utility Relocation	2%	$ 8,100.00
Project Maintenance (3yr)	5%	$ 20,300.00
Construction Inspections	10%	$ 40,600.00
Construction	100%	$ 406,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 690,000.00

PROJECT NAME: **Swannanoa Ave Culvert Replacement and Stream Stabilization** PROJECT ID: **TB-B**

PROJECT INFORMATION

LOCATION:	Swannanoa Ave near Cragmont Rd	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tomahawk Branch	DRAINAGE IMPROVEMENTS (LF):	355

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing culvert with 30 LF of 48-inch RCP.
- Install approximately 200 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**77**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Swannanoa Ave	2-YR	25-YR	50

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 250,000
Design and Permitting	$ 115,000
Other Project Costs	$ 65,000
Total Project	**$ 430,000**

PROJECT AREA MAP



PROJECT NAME **Swannanoa Ave Culvert Replacement and Stream Stabilization** PROJECT ID: **TB-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

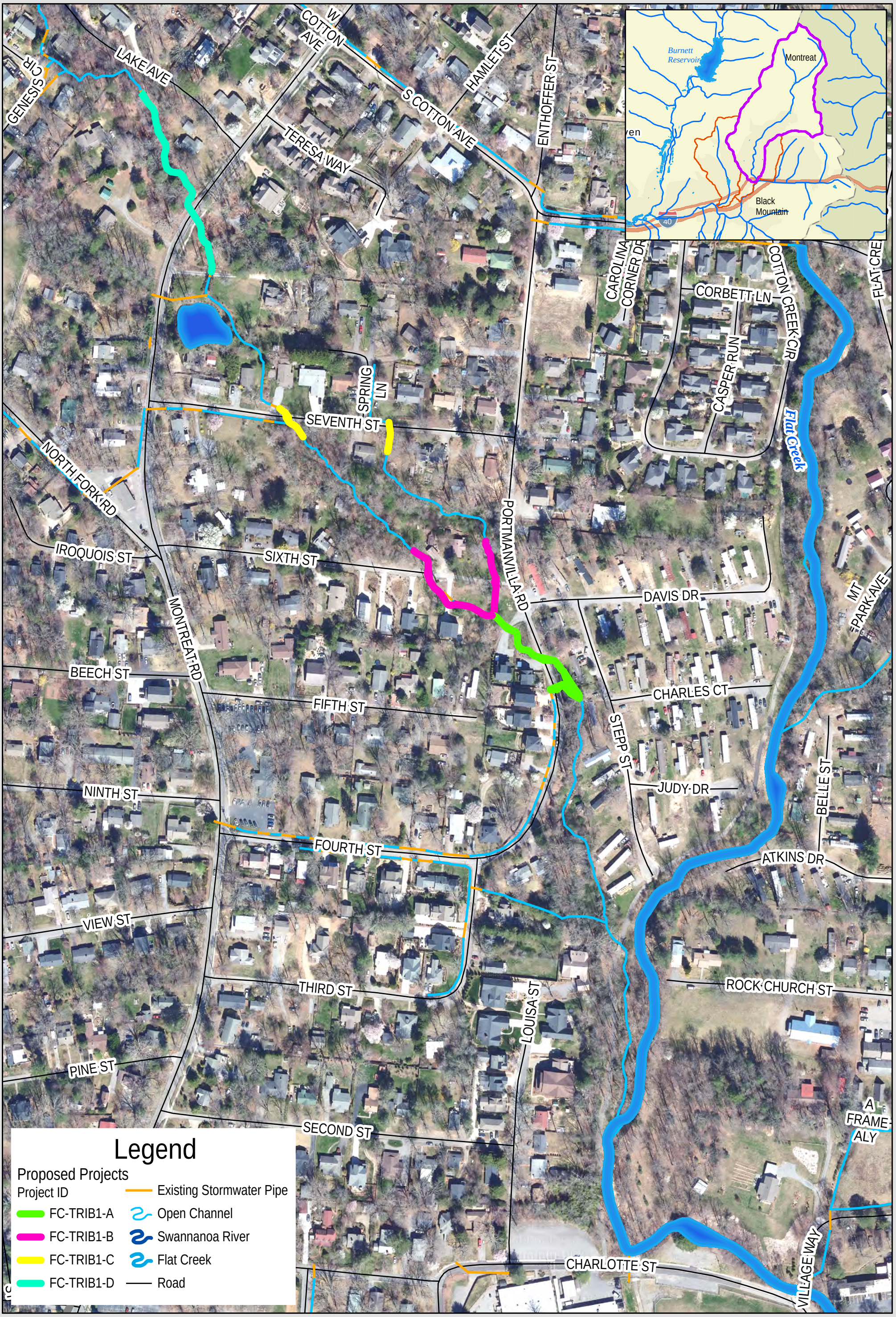
Construction cost includes 30% contingency for planning. Improvements (LF): 35
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 9,140.00	$ 9,100.00
Erosion Control	1	LS	$ 8,155.00	$ 8,200.00
Traffic Control	1	LS	$ 3,262.00	$ 3,300.00
Minor Utility Conflict	1	LS	$ 8,155.00	$ 8,200.00
Unclassified Excavation/Hauling	40	CY	$ 72.00	$ 2,900.00
Infrastructure Removal and Disposal	35	LF	$ 115.00	$ 4,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	-	EA	$ 12,000.00	-
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	35	LF	$ 670.00	$ 23,500.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	320	LF	$ 350.00	$ 112,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 58,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 250,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 12,500.00
Design and Permitting	20%	$ 50,000.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,500.00
Structural Evaluation	1%	$ 2,500.00
Real Estate	2%	$ 5,000.00
Utility Relocation	2%	$ 5,000.00
Project Maintenance (3yr)	5%	$ 12,500.00
Construction Inspections	10%	$ 25,000.00
Construction	100%	$ 250,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 430,000.00



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Figure E-3: Proposed Stormwater Improvement Projects
FLAT CREEK TRIBUTARY 1 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 100 200 Feet
1 in = 200 ft

N
W E
S

PROJECT NAME: **Portmanvilla Rd Stormwater Improvements** PROJECT ID: **FC-TRIB1-A**

PROJECT INFORMATION

LOCATION: Portmanvilla Rd near Davis Dr
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 540

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CMP with 35 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing 30-inch CMP with 45 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Replace existing upstream private pipe with 25 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Replace existing downstream private pipe with 40 LF of twin 31.31" x 51.13" (42" Eq) Concrete Arch Pipe.
- Install approximately 250 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**87**

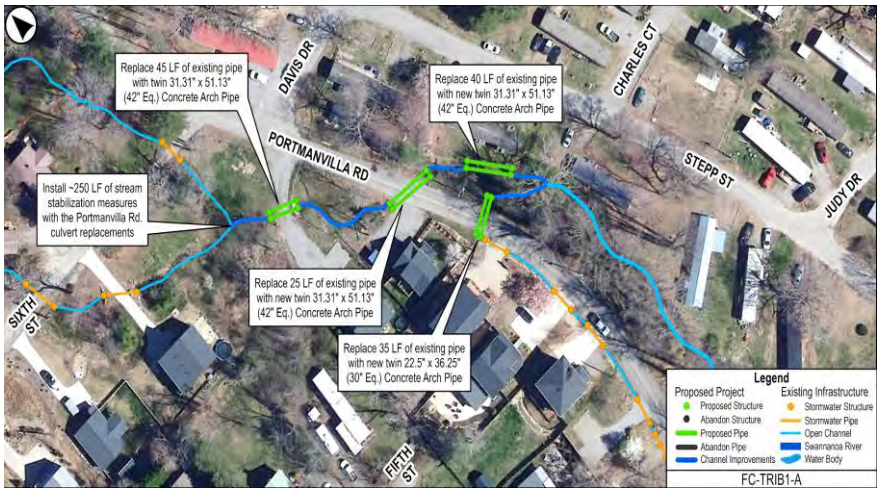
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Portmanvilla Rd (15" CMP)	< 2-YR	50-YR	100
Portmanvilla Rd (30" RCP)	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 572,000
Design and Permitting	$ 179,400
Other Project Costs	$ 148,600
Total Project	**$ 900,000**

PROJECT AREA MAP



PROJECT NAME **Portmanvilla Rd Stormwater Improvements** PROJECT ID: **FC-TRIB1-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 290
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 20,940.00	$ 20,900.00
Erosion Control	1	LS	$ 17,160.00	$ 17,200.00
Traffic Control	1	LS	$ 6,864.00	$ 6,900.00
Moderate Utility Conflict	1	LS	$ 51,480.00	$ 51,500.00
Unclassified Excavation/Hauling	270	CY	$ 72.00	$ 19,400.00
Infrastructure Removal and Disposal	140	LF	$ 115.00	$ 16,100.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	4	EA	$ 12,000.00	$ 48,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	290	LF	$ 500.00	$ 145,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	250	LF	$ 350.00	$ 87,500.00
Roadway/Sidewalk Replacement	60	SY	$ 110.00	$ 6,600.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 132,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 572,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 28,600.00
Design and Permitting	20%	$ 114,400.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,700.00
Structural Evaluation	1%	$ 5,700.00
Real Estate	2%	$ 11,400.00
Utility Relocation	2%	$ 11,400.00
Project Maintenance (3yr)	5%	$ 28,600.00
Construction Inspections	10%	$ 57,200.00
Construction	100%	$ 572,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 900,000.00

PROJECT NAME: **6th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-B**

PROJECT INFORMATION

LOCATION: 6th St near Portmanvilla Rd
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 500

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CMP with 20 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing 42-inch CMP with 30 LF of twin 26.625" x 43.75" (36" Eq) Concrete Arch Pipe.
- Install approximately 150 LF of stream stabilization measures upstream of the proposed culverts.
- Install approximately 250 LF of stream stabilization measures downstream of the proposed culverts.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	2
FINAL PROJECT SCORE:	**78**

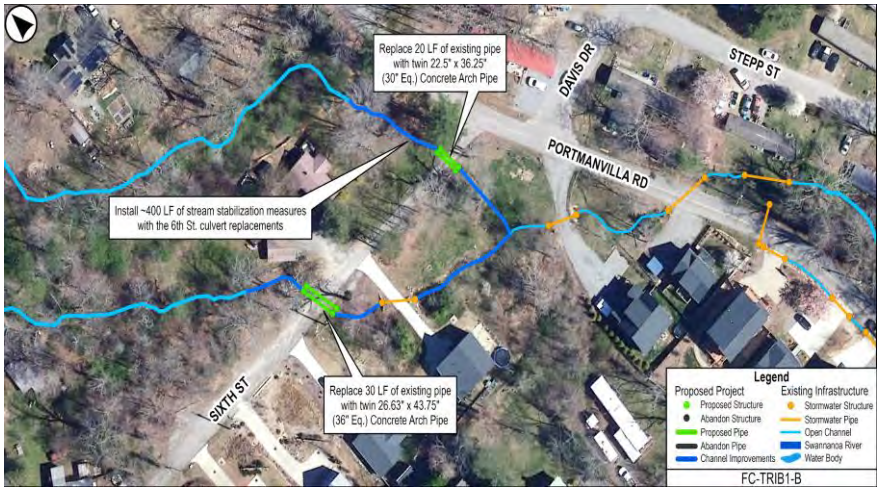
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
6th St at Portmanvilla Rd	< 2-YR	50-YR	100
6th Street	10-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 389,000
Design and Permitting	$ 142,800
Other Project Costs	$ 101,200
Total Project	**$ 633,000**

PROJECT AREA MAP



PROJECT NAME **6th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-B**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 100
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 14,250.00	$ 14,300.00
Erosion Control	1	LS	$ 12,725.00	$ 12,700.00
Traffic Control	1	LS	$ 5,090.00	$ 5,100.00
Minor Utility Conflict	1	LS	$ 12,725.00	$ 12,700.00
Unclassified Excavation/Hauling	70	CY	$ 72.00	$ 5,000.00
Infrastructure Removal and Disposal	50	LF	$ 115.00	$ 5,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	100	LF	$ 500.00	$ 50,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	400	LF	$ 350.00	$ 140,000.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	15	LF	$ 300.00	$ 4,500.00
Replace Existing Concrete Driveway	10	SY	$ 120.00	$ 1,200.00
			Construction Contingency (30%):	$ 90,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 389,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 19,500.00
Design and Permitting	20%	$ 77,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,900.00
Structural Evaluation	1%	$ 3,900.00
Real Estate	2%	$ 7,800.00
Utility Relocation	2%	$ 7,800.00
Project Maintenance (3yr)	5%	$ 19,500.00
Construction Inspections	10%	$ 38,900.00
Construction	100%	$ 389,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 633,000.00

PROJECT NAME: **7th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-C**

PROJECT INFORMATION

LOCATION: 7th St near Portmanvilla Rd
WATERSHED: Flat Creek
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 210

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 15-inch CPP with 25 LF of 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Replace existing triple 24-inch CMP with 25 LF of twin 22.5" x 36.25" (30" Eq) Concrete Arch Pipe.
- Install approximately 110 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**87**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
7th St at Portmanvilla Rd	< 2-YR	50-YR	100
7th Street	2-YR	25-YR	78

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 233,000
Design and Permitting	$ 111,600
Other Project Costs	$ 60,400
Total Project	**$ 405,000**

PROJECT AREA MAP



PROJECT NAME **7th Street Culvert Replacements and Stream Stabilization** PROJECT ID: **FC-TRIB1-C**

PROJECT TYPE: Stormwater Drainage WATERSHED: Flat Creek

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 100
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 8,525.00	$ 8,500.00
Erosion Control	1	LS	$ 7,615.00	$ 7,600.00
Traffic Control	1	LS	$ 3,046.00	$ 3,000.00
Minor Utility Conflict	1	LS	$ 7,615.00	$ 7,600.00
Unclassified Excavation/Hauling	60	CY	$ 72.00	$ 4,300.00
Infrastructure Removal and Disposal	100	LF	$ 115.00	$ 11,500.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	100	LF	$ 500.00	$ 50,000.00
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	110	LF	$ 350.00	$ 38,500.00
Roadway/Sidewalk Replacement	50	SY	$ 110.00	$ 5,500.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 54,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 233,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,700.00
Design and Permitting	20%	$ 46,600.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,300.00
Structural Evaluation	1%	$ 2,300.00
Real Estate	2%	$ 4,700.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,700.00
Construction Inspections	10%	$ 23,300.00
Construction	100%	$ 233,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 405,000.00

PROJECT NAME: **Montreat Road Culvert Replacement (Flat Creek)** PROJECT ID: **FC-TRIB1-D**

PROJECT INFORMATION

LOCATION: Montreat Rd near Lake Ave
WATERSHED: Tomahawk Branch
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing 24-inch CMP with 50 LF of 42-inch RCP.
- Install approximately 200 LF of stream stabilization measures upstream.
- Install approximately 100 LF of stream stabilization measures downstream of the proposed culvert.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**88**

KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Montreat Rd near Lake Ave	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 329,000
Design and Permitting	$ 130,800
Other Project Costs	$ 86,200
Total Project	**$ 546,000**

PROJECT AREA MAP



PROJECT NAME **Montreat Road Culvert Replacement (Flat Creek)** PROJECT ID: **FC-TRIB1-D**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tomahawk B

PLANNING LEVEL COST ESTIMATE

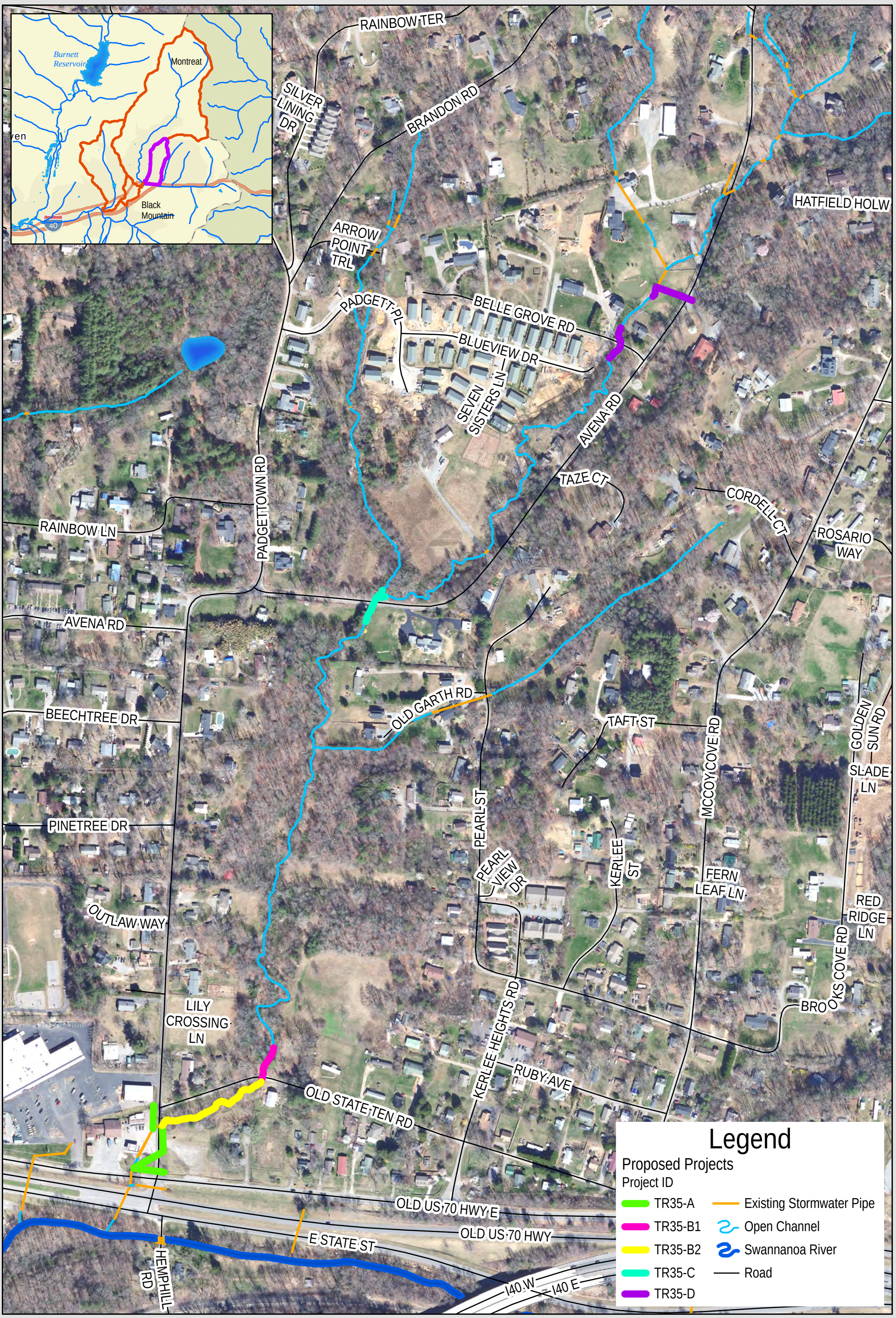
Construction cost includes 30% contingency for planning. Improvements (LF): 50
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 12,060.00	$ 12,100.00
Erosion Control	1	LS	$ 8,805.00	$ 8,800.00
Traffic Control	1	LS	$ 3,522.00	$ 3,500.00
Major Utility Conflict	1	LS	$ 52,830.00	$ 52,800.00
Unclassified Excavation/Hauling	60	CY	$ 72.00	$ 4,300.00
Infrastructure Removal and Disposal	50	LF	$ 115.00	$ 5,800.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	50	LF	$ 670.00	$ 33,500.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	300	LF	$ 350.00	$ 105,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 76,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 329,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 16,500.00
Design and Permitting	20%	$ 65,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,300.00
Structural Evaluation	1%	$ 3,300.00
Real Estate	2%	$ 6,600.00
Utility Relocation	2%	$ 6,600.00
Project Maintenance (3yr)	5%	$ 16,500.00
Construction Inspections	10%	$ 32,900.00
Construction	100%	$ 329,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 546,000.00



WK DICKSON
AN ARDURRA COMPANY

Figure E-4: Proposed Stormwater Improvement Projects
AVENA ROAD/TRIBUTARY 35 PRIMARY SYSTEM
Town of Black Mountain Stormwater Master Plan

0 150 300 Feet
1 in = 300 ft

N
W E
S

PROJECT NAME: **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT INFORMATION

LOCATION: Padgettown Rd/US Hwy 70E Intersection
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 460

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install 145 LF of twin 60-inch RCP by-pass system to depression area south of the gas station.
- Replace existing pipe across Padgettown Road at Old US 70E with twin 48" RCP.
- Excavate and enlarge existing open channel and outfall area downstream of gas station.
- Existing conditions severly limit options to provide desired LOS. An option is presented herein.
- Additional survey and engineering investigation required to determine constructability and achievable LOS.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	16
Public or Privately-Owned Land	8
Effect of Improvements	15
Cost Effectiveness	15
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**62**

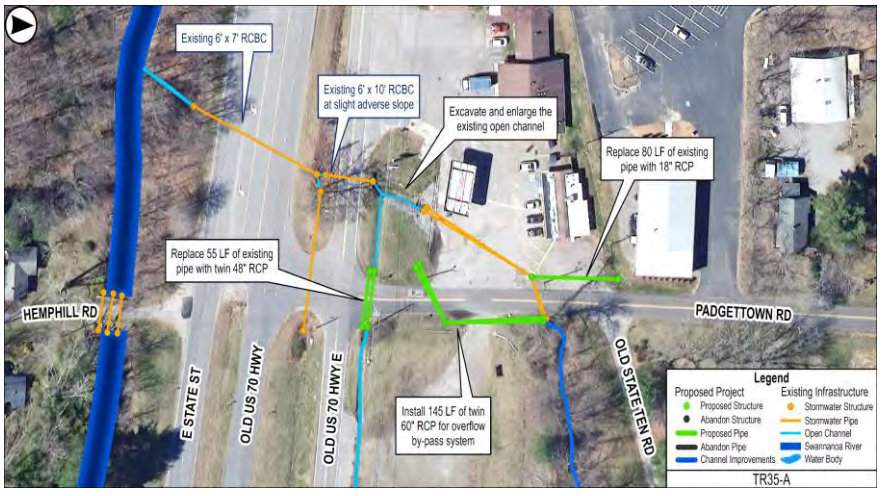
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown at Old US70E	2-YR	25-YR	80
Gas Station (Twin 36")	2-YR	10-YR	76
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Padgettown Rd (Twin 60")	NA	25-YR	New Crossing

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 909,000
Design and Permitting	$ 276,800
Other Project Costs	$ 236,200
Total Project	**$ 1,422,000**

PROJECT AREA MAP



PROJECT NAME **Padgettown Rd Stormwater Improvements** PROJECT ID: **TR35-A**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 460
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 33,290.00	$ 33,300.00
Erosion Control	1	LS	$ 24,300.00	$ 24,300.00
Traffic Control	1	LS	$ 9,720.00	$ 9,700.00
Major Utility Conflict	1	LS	$ 145,800.00	$ 145,800.00
Unclassified Excavation/Hauling	770	CY	$ 72.00	$ 55,400.00
Infrastructure Removal and Disposal	125	LF	$ 115.00	$ 14,400.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Standard Structure	1	EA	$ 8,600.00	$ 8,600.00
Large Structure or Headwall	5	EA	$ 12,000.00	$ 60,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	90	LF	$ 670.00	$ 60,300.00
New Pipe: 60-inch	290	LF	$ 875.00	$ 253,800.00
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	-	LF	$ 350.00	-
Roadway/Sidewalk Replacement	100	SY	$ 110.00	$ 11,000.00
Earthwork	105	CY	$ 90.00	$ 9,500.00
Fine Grading	550	SY	$ 18.00	$ 9,900.00
Plantings	250	SY	$ 7.00	$ 1,800.00
			Construction Contingency (30%):	$ 210,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 909,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 45,500.00
Design and Permitting	20%	$ 181,800.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 9,100.00
Structural Evaluation	1%	$ 9,100.00
Real Estate	2%	$ 18,200.00
Utility Relocation	2%	$ 18,200.00
Project Maintenance (3yr)	5%	$ 45,500.00
Construction Inspections	10%	$ 90,900.00
Construction	100%	$ 909,000.00

PLANNING LEVEL OPINION OF TOTAL PROJECT COST: $ 1,422,000.00

PROJECT NAME: **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT INFORMATION

LOCATION: Old State 10 Rd Culvert Crossing
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 160

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 30 LF of twin 4'x6' RCBC under Old State 10 Rd.
- Install 100 LF of upstream channel improvements to accommodate flow into new RCBC.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	4
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**77**

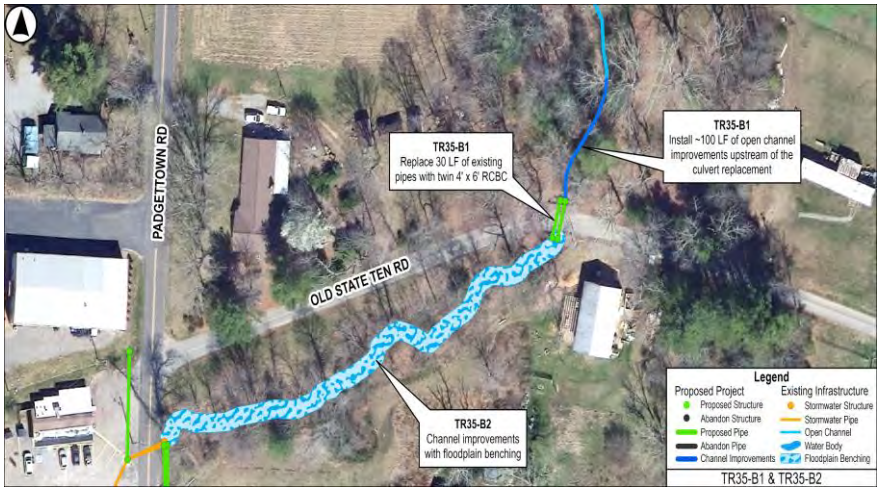
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 351,000
Design and Permitting	$ 165,200
Other Project Costs	$ 91,800
Total Project	**$ 608,000**

PROJECT AREA MAP



PROJECT NAME **Old State 10 Rd Culvert Replacement and Stream Stabilization** PROJECT ID: **TR35-B1**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 60
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 12,860.00	$ 12,900.00
Erosion Control	1	LS	$ 9,385.00	$ 9,400.00
Traffic Control	1	LS	$ 3,754.00	$ 3,800.00
Major Utility Conflict	1	LS	$ 56,310.00	$ 56,300.00
Unclassified Excavation/Hauling	70	CY	$ 72.00	$ 5,000.00
Infrastructure Removal and Disposal	30	LF	$ 115.00	$ 3,500.00
Structure Removal and Disposal	2	EA	$ 6,800.00	$ 13,600.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	-	LF	$ 670.00	-
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	60	LF	$ 1,700.00	$ 102,000.00
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	100	LF	$ 350.00	$ 35,000.00
Roadway/Sidewalk Replacement	30	SY	$ 110.00	$ 3,300.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 81,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 351,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 17,600.00
Design and Permitting	20%	$ 70,200.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 3,500.00
Structural Evaluation	1%	$ 3,500.00
Real Estate	2%	$ 7,000.00
Utility Relocation	2%	$ 7,000.00
Project Maintenance (3yr)	5%	$ 17,600.00
Construction Inspections	10%	$ 35,100.00
Construction	100%	$ 351,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 608,000.00

PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10 Rd** PROJECT ID: **TR35-B2**

PROJECT INFORMATION

LOCATION: Old State 10 Road near Padgettown Rd
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Floodplain Benching
DRAINAGE IMPROVEMENTS (LF): 350

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Install approximately 350 LF of channel improvements with floodplain benching to lower WSELs.
- Floodplain benching improvements are located downstream of the proposed RCBC in project TR35-B1.

PROJECT PRIORITIZATION AND PROPERTY REQUIREMENTS

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	16
Public or Privately-Owned Land	4
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	3
Criticality Bonus	1
FINAL PROJECT SCORE:	**66**

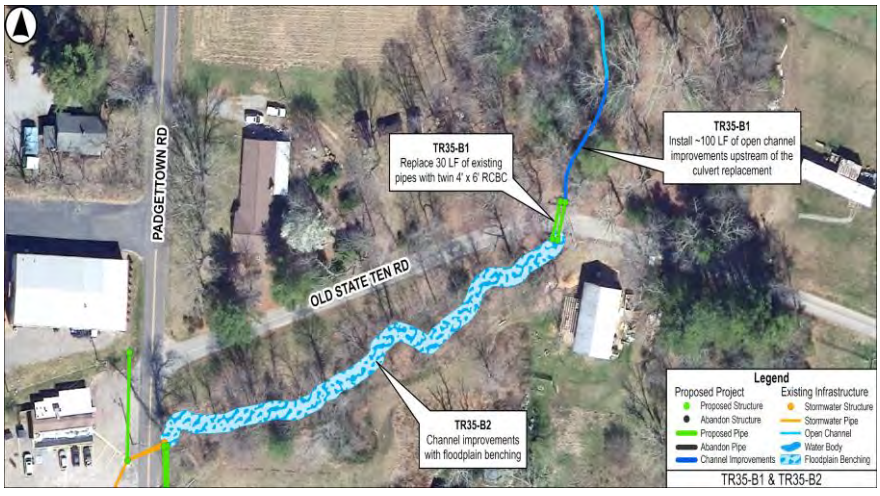
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Padgettown Rd (Twin 36")	< 2-YR	10-YR	68
Old State 10 Road (Twin 36")	2-YR	25-YR	91

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 234,000
Design and Permitting	$ 111,800
Other Project Costs	$ 79,200
Total Project	**$ 425,000**

PROJECT AREA MAP



PROJECT NAME: **Tributary 35 Floodplain Benching at Old State 10** PROJECT ID: **TR35-B2**

PROJECT TYPE: Floodplain Benching WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

- Construction estimate includes 30% contingency for planning.
- Proposed project footprints are based on GIS and modeling analyses.
- Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 9,090.00	$ 9,100.00
Erosion Control	1	LS	$ 8,120.00	$ 8,100.00
Traffic Control	1	LS	$ 3,248.00	$ 3,200.00
Minor Utility Conflict	1	LS	$ 8,120.00	$ 8,100.00
Clearing and Grubbing	390	SY	$ 5.50	$ 2,100.00
Earthwork	0	CY	$ 90.00	$ -
Fine Grading	390	SY	$ 18.00	$ 7,000.00
Structure Removal and Disposal	-	EA	$ 6,800.00	-
Infrastructure Removal and Disposal	-	LF	$ 115.00	-
Stone, Class B	75	TN	$ 92.00	$ 6,900.00
Filter Fabric/Geotextiles	1940	SY	$ 35.00	$ 67,900.00
Plantings	390	SY	$ 7.00	$ 2,700.00
3-gallon Container Plants	95	EA	$ 70.00	$ 6,700.00
Riffle Grade Control	2	EA	$ 4,025.00	$ 8,100.00
Floodplain Tree Removal	1	LS	$ 15,000.00	$ 15,000.00
Log Grade Control Structure	-	EA	$ 4,000.00	-
Pump Around Operation	1	LS	$ 46,000.00	$ 46,000.00
			Construction Contingency (30%):	$ 43,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 234,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,700.00
Design and Permitting	20%	$ 46,800.00
Environmental Permitting	-	$ 65,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,300.00
Structural Evaluation	1%	$ 2,300.00
Real Estate	10%	$ 23,400.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,700.00
Construction Inspections	10%	$ 23,400.00
Construction	100%	$ 234,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 425,000.00

PROJECT NAME: **Avena Road Culvert Replacement and Stream Stabilizaton** PROJECT ID: **TR35-C**

PROJECT INFORMATION

LOCATION:	Avena Road near Padgettown Rd	STORMWATER PROJECT TYPE:	Stormwater Drainage
WATERSHED:	Tributary 35	DRAINAGE IMPROVEMENTS (LF):	230

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 40 LF of twin 48" RCP across Avena Rd.
- Install approximately 120 LF of stream stabilization measures.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	12
Street Flooding	32
Public or Privately-Owned Land	8
Effect of Improvements	10
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**85**

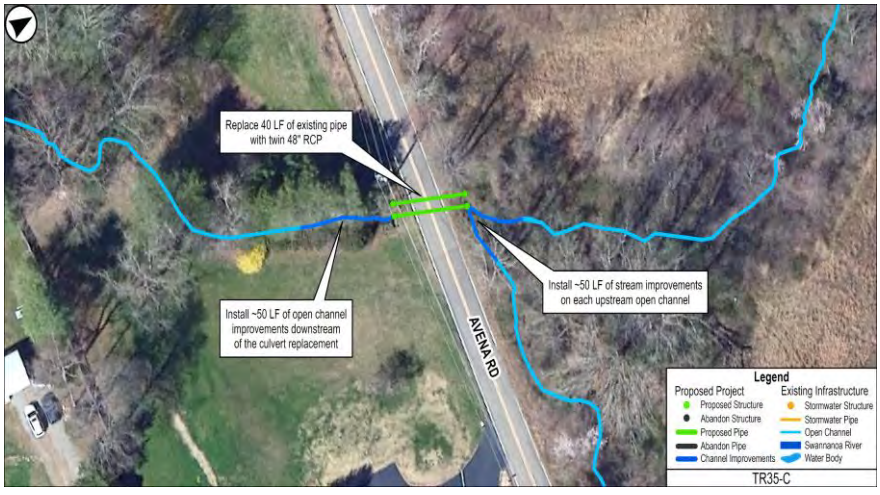
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Avena Road	2-YR	25-YR	97

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 235,000
Design and Permitting	$ 142,000
Other Project Costs	$ 61,000
Total Project	**$ 438,000**

PROJECT AREA MAP



PROJECT NAME **Avena Road Culvert Replacement and Stream Stabilizaton** PROJECT ID: **TR35-C**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 80
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 8,605.00	$ 8,600.00
Erosion Control	1	LS	$ 7,680.00	$ 7,700.00
Traffic Control	1	LS	$ 3,072.00	$ 3,100.00
Minor Utility Conflict	1	LS	$ 7,680.00	$ 7,700.00
Unclassified Excavation/Hauling	120	CY	$ 72.00	$ 8,600.00
Infrastructure Removal and Disposal	40	LF	$ 115.00	$ 4,600.00
Structure Removal and Disposal	1	EA	$ 6,800.00	$ 6,800.00
Standard Structure	-	EA	$ 8,600.00	-
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	-	LF	$ 535.00	-
New Pipe: 42-inch to 54-inch	80	LF	$ 670.00	$ 53,600.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	150	LF	$ 350.00	$ 52,500.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 54,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 235,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 11,800.00
Design and Permitting	20%	$ 47,000.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 2,400.00
Structural Evaluation	1%	$ 2,400.00
Real Estate	2%	$ 4,700.00
Utility Relocation	2%	$ 4,700.00
Project Maintenance (3yr)	5%	$ 11,800.00
Construction Inspections	10%	$ 23,500.00
Construction	100%	$ 235,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 438,000.00

PROJECT NAME: **Bellgrove Road/Avena Road Stormwater Improvements** PROJECT ID: **TR35-D**

PROJECT INFORMATION

LOCATION: Bellegrove Rd and Avena Rd Culvert Crossings
WATERSHED: Tributary 35
STORMWATER PROJECT TYPE: Stormwater Drainage
DRAINAGE IMPROVEMENTS (LF): 475

PROJECT DESCRIPTION

To improve level of service for surrounding roadways and reduce flood risk to nearby property owners:

- Replace existing pipe with 20 LF of twin 48" RCP under Bellegrove Rd.
- Install approximately 140 LF of stream stabilization measures with the Bellgrove culvert.
- Replace existing pipe with 135 LF of 30" RCP under Avena Rd.
- Install 35 LF of channel improvements downstream of 30" RCP.

PROJECT PRIORITIZATION and LEVEL OF SERVICE

CRITERIA	TOTAL SCORE
Utility Conflict	8
Street Flooding	24
Public or Privately-Owned Land	8
Effect of Improvements	20
Cost Effectiveness	20
Grant Bonus	2
Criticality Bonus	1
FINAL PROJECT SCORE:	**83**

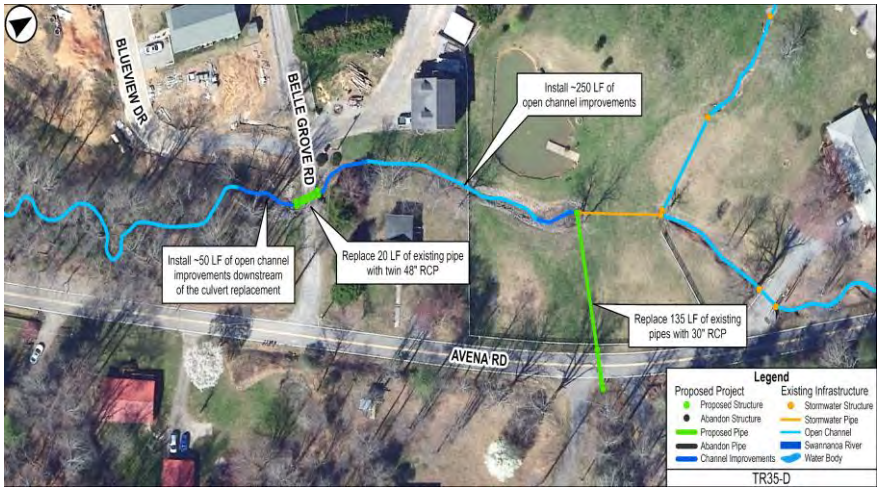
KEY CROSSING	LEVEL OF SERVICE EXISTING	LEVEL OF SERVICE PROPOSED	% REDUCTION 50 YR
Bellegrove Road	2-YR	50-YR	100
Avena Road	2-YR	50-YR	100

PLANNING LEVEL OPINION OF COST

Construction estimate includes 30% contingency for planning. Design and permitting includes environmental permitting estimates. Proposed project footprints are based on GIS and modeling analyses. Detailed planning level costs are provided separately.

ITEM	COST OPINION
Construction	$ 499,000
Design and Permitting	$ 194,800
Other Project Costs	$ 130,200
Total Project	**$ 824,000**

PROJECT AREA MAP



PROJECT NAME **Bellgrove Road/Avena Road Stormwater Improvements** PROJECT ID: **TR35-D**

PROJECT TYPE: Stormwater Drainage WATERSHED: Tributary 35

PLANNING LEVEL COST ESTIMATE

Construction cost includes 30% contingency for planning. Improvements (LF): 175
Proposed project footprints are based on GIS and modeling analyses.
Real estate, if privately-owned land, is estimated based on property value.

CONSTRUCTION COST:

ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	AMOUNT
Mobilization	1	LS	$ 18,295.00	$ 18,300.00
Erosion Control	1	LS	$ 14,995.00	$ 15,000.00
Traffic Control	1	LS	$ 5,998.00	$ 6,000.00
Moderate Utility Conflict	1	LS	$ 44,985.00	$ 45,000.00
Unclassified Excavation/Hauling	180	CY	$ 72.00	$ 13,000.00
Infrastructure Removal and Disposal	155	LF	$ 115.00	$ 17,800.00
Structure Removal and Disposal	3	EA	$ 6,800.00	$ 20,400.00
Standard Structure	2	EA	$ 8,600.00	$ 17,200.00
Large Structure or Headwall	2	EA	$ 12,000.00	$ 24,000.00
New Pipe: 18-inch to 24-inch	-	LF	$ 390.00	-
New Pipe: 30-inch to 36-inch	135	LF	$ 535.00	$ 72,200.00
New Pipe: 42-inch to 54-inch	40	LF	$ 670.00	$ 26,800.00
New Pipe: 60-inch	-	LF	$ 875.00	-
Arch Pipe (22.5" - 31.3")	-	LF	$ 500.00	-
Large RCBC	-	LF	$ 1,700.00	-
Rip Rap	25	TN	$ 50.00	$ 1,300.00
Open Channel Improvements	300	LF	$ 350.00	$ 105,000.00
Roadway/Sidewalk Replacement	20	SY	$ 110.00	$ 2,200.00
New Concrete Curb and Gutter	-	LF	$ 110.00	-
Replace Driveway Culvert Pipe	-	LF	$ 300.00	-
Replace Existing Concrete Driveway	-	SY	$ 120.00	-
			Construction Contingency (30%):	$ 115,000.00
			PLANNING LEVEL OPINION OF CONSTRUCTION COST:	**$ 499,000.00**

PROJECT COST:

PROJECT BUDGET ITEM	% of CONSTRUCTION	AMOUNT
Survey	5%	$ 25,000.00
Design and Permitting	20%	$ 99,800.00
Environmental Permitting	-	$ 95,000.00
Railroad Permitting/Coordination	-	$ -
Geotechnical Investigation	1%	$ 5,000.00
Structural Evaluation	1%	$ 5,000.00
Real Estate	2%	$ 10,000.00
Utility Relocation	2%	$ 10,000.00
Project Maintenance (3yr)	5%	$ 25,000.00
Construction Inspections	10%	$ 49,900.00
Construction	100%	$ 499,000.00
PLANNING LEVEL OPINION OF TOTAL PROJECT COST:		$ 824,000.00