

# **NCDOT STIP A-0010A**

**US 19/23 (Future I-26) Improvements**

## **Concurrence Point 2A Bridging and Alignment Review**

**March 2019**

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## ATTACHMENTS

Figure 1-1 thru 1-10: Hydraulic Crossings

Table 1: Preliminary Hydraulic Recommendations for Major Crossings

Natural Resources Technical Report (November 2015) Sections 3.2, 5.0, and Figure 3

## I. INTRODUCTION

### I.1 PROJECT DESCRIPTION

The North Carolina Department of Transportation (NCDOT) is proposing to upgrade existing US 19/23 (Future I 26) from north of I-240 to Exit 13 – Forks of Ivy (SR 2148/Stockton Road) in Buncombe County. The existing roadway is a four-lane, median-divided freeway with full control of access. The project is included in the 2018-2027 NCDOT State Transportation Improvement Program (STIP) as Project Numbers A 0010A, B-4442, B 4443, and B-4444. The project is approximately 12 miles long and involves upgrading the existing multi-lane roadway, overpasses, and interchanges to current interstate standards. The proposed project would replace Bridge Numbers 345 and 346 on US 19/23 over SR 1839 (Old Marshall Highway).

The project involves a crossing of the privately-owned Craggy Mountain Rail Line, which runs east-west through Buncombe County, just south of Exit 23 – Merrimon Avenue. No new water crossings are proposed as a part of this project. The project area is within the jurisdiction of the French Broad River Metropolitan Planning Organization (MPO).

### I.2 PURPOSE AND NEED

The purpose and need, as concurred upon by the Merger Team at Concurrence Point 1 (February 2015), is as follows:

The **needs** to be addressed by this proposed action include:

- Existing and Projected Roadway Capacity Deficiencies.
- Geometric Deficiencies along the Corridor.
- Deteriorating Pavement Structure and Substructure.
- Functionally-Obsolete and/or Structurally-Deficient Bridges.

The **purposes** of this proposed action include:

- Reduce congestion to achieve Level of Service D for all freeway segments and intersections that impact the mainline in the design year.
- Address geometric deficiencies using current freeway design criteria.
- Rectify the deteriorating pavement structure and substructure.
- Evaluate and rehabilitate or replace bridges.

### I.3 DETAILED STUDY ALTERNATIVES

For the Upgrade-Existing Alternative, the following design options were carried forward for detailed study in this proposed action:

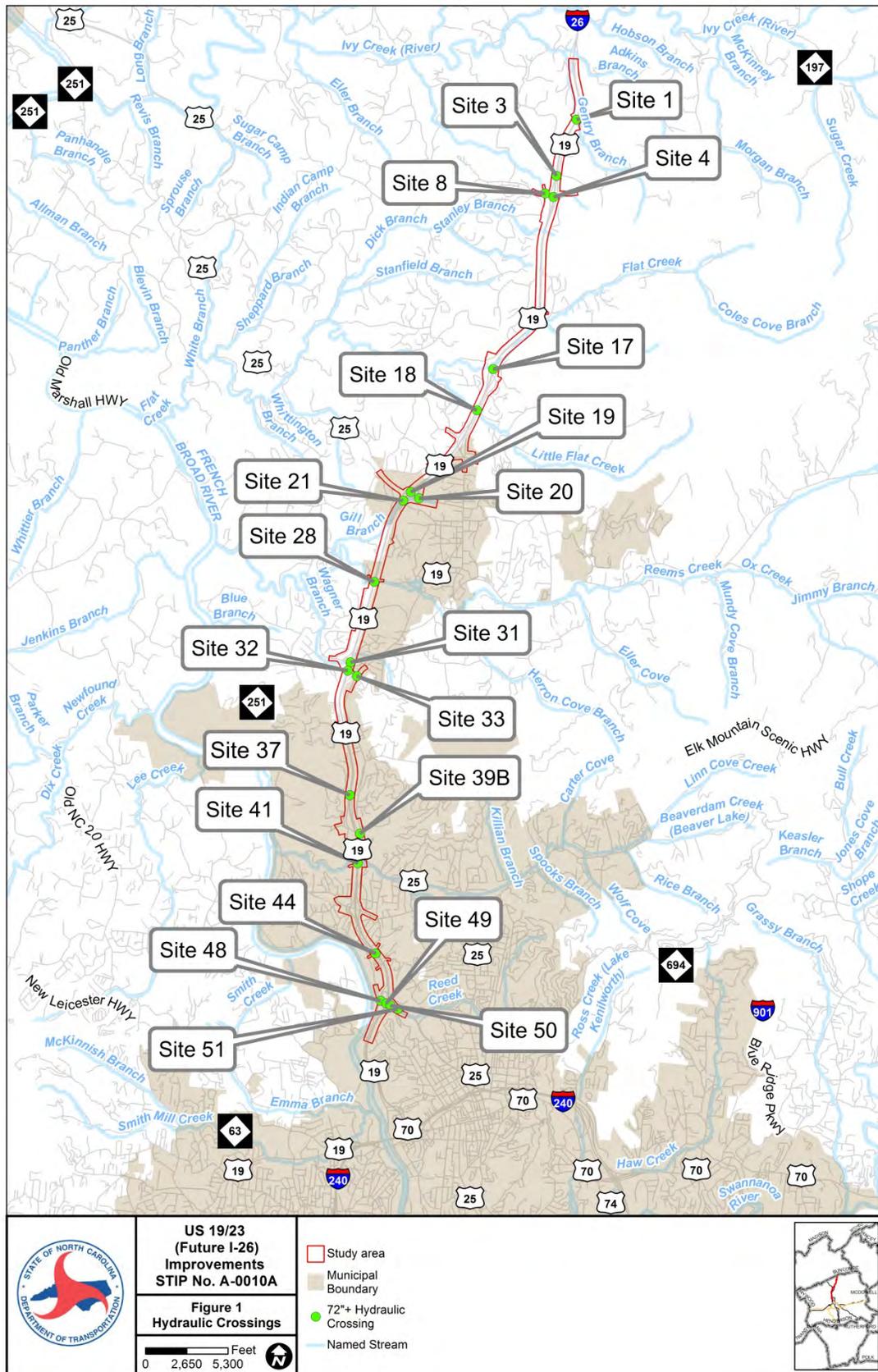
- One design options from north of I-240 to New Stock Road (Exit 21):
  - Design Option 1A (revised): Best-Fit Widening to 8 Lanes (variable median width)
- Two design options from New Stock Road (Exit 21) to Weaver Boulevard (Exit 19):
  - Design Option 2A (revised): Best-Fit Widening to 6 Lanes with a 46-foot Grassed Median
- One design option from Weaver Boulevard (Exit 19) to Stockton Road (Exit 13):
  - Design Option 3: Upgrade Existing 4-Lane Section with a 46-foot Grassed Median

## **2. INFORMATION FOR CP2A BRIDGING AND ALIGNMENT REVIEW**

A Preliminary Hydraulics Study completed for the proposed project identified 21 hydraulic crossings. There are no USGS Stream Gage sites on the identified streams, however flood studies have been completed for several of the waterways. Beaverdam Creek (into French Broad River), Beaverdam Creek (into French Broad River Tributary 1), Reed Creek, and Reems Creek have been re-delineated. Limited Detail flood studies have been completed for Gill Branch and Flat Creek (into French Broad River).

The report includes recommendations for the existing stream crossing structures, as shown on Figure 1 and summarized in Table 1. All stream crossings are jurisdictional streams; therefore, the culvert and pipe recommendations are oversized to account for the buried depth of the structures to maintain depth requirements for hydraulic performance.

Figure 1



## SITE I

Site 1 is located at Gentry Branch, a tributary to Adkins Branch, classified as WS-II, HQW, and crosses Whitt Road. The surrounding area consists of mainly agricultural land and sparse residential land use. Homes are located within 200 feet of the crossing but are at an elevation at least 20 feet higher than the stream bottom. The stream banks are nearly vertical in places, with erosion evident, and heavy vegetation.

Drainage Area:	0.99 square miles
Existing Structure:	7'x7' RCBC
Existing Channel:	5' base width, 8' top width, and a sandy/gravel bottom with cobbles
Recommended Structure:	Extend existing 7'x7' RCBC (50')

Because the existing culvert is in good condition and the high height of fill at the location, it is recommended to retain and extend the north end of the existing culvert. There is a stream confluence located at the downstream end of the existing culvert. Approximately 70 feet of the incoming stream will need to be relocated to account for the new outlet location.



Site I – looking upstream



Site I – upstream face



Site I – looking downstream



Site I – downstream face

## 2.1 SITE 3

Site 3 is located on an unnamed tributary to Blackstock Branch. The unnamed tributary crosses I-26.

Drainage Area: 0.14 square miles  
Existing Structure: 52" CMP with headwall that has deformed to 56"x50"  
Existing Channel: upstream bottom width 2'; downstream channel width 3'  
Recommended Structure: Replace with 72" CMP

The next downstream structure is a 42" corrugated metal pipe, located approximately 50 feet downstream, which serves as a conveyance under a driveway to a nearby home. It is recommended that the pipe be replaced due to the potential for upstream development and the discrepancy between the existing pipe and calculated minimum size requirement.



Site 3 – looking upstream



Site 3 – upstream face



Site 3 – looking downstream



Site 3 – downstream face

## 2.2 SITE 4

Site 4 is located on an unnamed tributary to that conveys to Blackstock Branch and crosses I-26. The upstream headwall has approximately 20 cubic yards of erosion at the south end. The downstream end has a plunge pool with a 30" corrugated metal pipe carrying an additional inflow from an unidentified source.

Drainage Area:	0.36 square miles
Existing Structure:	66" CMP with upstream headwall
Existing Channel:	Downstream channel width of 4'
Recommended Structure:	Replace with 96" CMP

The existing 66" CMP does not show signs of deficiency, however its capacity is insufficient to handle the 50-year storm event. The new 96" CMP should retain the current stream slope and extend to the proposed fill line.



Site 4 – looking upstream



Site 4 – upstream face



Site 4 – looking downstream



Site 4 – downstream face

### 2.3 SITE 8

Site 8 also carries Blackstock Branch, and is at the intersection of the on ramp to US 19 and Jupiter Road. The area is characterized by heavy brush and trees and a steep fill slope. The banks of the downstream stream are approximately 8' high. The upstream end has a stream width of 4', with vertical banks. At the time of field investigation, a repair to a slope failure had just been completed. The slope failure was at the upstream side, at the east corner of the headwall.

Drainage Area:	0.41 square miles
Existing Structure:	60" CMP with upstream headwall
Existing Channel:	Downstream channel width of 4'
Recommended Structure:	Replace with 96" CMP

The existing 60" CMP does not show signs of deficiency; however, its capacity is insufficient to handle the 50-year storm event. The new structure should retain the current stream slope and extend to the proposed fill line.



Site 8 – looking upstream



Site 8 – upstream face



Site 8 – downstream face

## 2.4 SITE 17

Site 17 conveys Flat Creek for 1,000 feet and crosses I-26. The upstream end of the culvert is an “improved inlet”, and water flows freely through both barrels. The upstream end also has a sharp angle approach into the culvert. The downstream end is lined with Class A riprap. Heavy vegetation with trees up to a foot in diameter line the banks. There is a FEMA Limited Detail Study for this area of Flat Creek. Approximately 1 mile downstream is the confluence with Little Flat Creek.

Drainage Area:	7.0 square miles
Existing Structure:	2@9'x8' RCBC
Existing Channel:	20' wide
Recommended Structure:	Extend existing 2@9'x8' RCBC (50')

This crossing was calculated to require a 3@10'x10' culvert to meet the size requirements for a 50-year storm event; however, this culvert does not show signs of insufficiency and it is therefore recommended to retain and extend the existing culvert 50 feet. The culvert should retain the normal slope of the stream. An improved inlet should be added to the upstream end of the culvert to mimic the existing conditions.



Site 17 – looking upstream



Site 17 – upstream face



Site 17 – looking downstream



Site 17 – downstream face

## 2.5 SITE 18

Site 18 is located on Little Flat Creek, about a mile upstream from the confluence with Flat Creek and flows under I-26. The banks are approximately 3 feet high and grassy. The surrounding area is wooded. During the time of field visit, there was evidence of a recent high water of up to 2-3 feet above the normal water surface. There is a home within 300 feet of the structure, but it is located between 5 feet and 10 feet above the normal water surface.

Drainage Area: 3.04 square miles  
Existing Structure: 3@ 8'x8' RCBC  
Existing Channel: Upstream width of 10' and downstream width of 12'-15'  
Recommended Structure: Extend existing 3@8'x8' RCBC (18')



Site 18 – looking upstream



Site 18 – upstream face



Site 18 – looking downstream



Site 18 – downstream face

## 2.6 SITE 19

This crossing spans an unnamed tributary of Gill Branch on I-26. The culvert likely has a blind junction. The upstream side has a 4-5 feet base with vertical banks. The stream at the downstream end of the crossing is approximately 8' wide. There is a 2-foot drop from the end of the pipe to the streambed. The banks are eroded and are vertical, reaching 8-10 feet tall.

Drainage Area:	3.0 square miles
Existing Structure:	48" CMP
Existing Channel:	Downstream channel width of 8'
Recommended Structure:	Replace with 84" CMP



Site 19 – looking upstream



Site 19 – upstream face



Site 19 – looking downstream



Site 19 – downstream face

## 2.7 SITE 20A

Site 20A carries Gill Branch Creek. The crossing is located on Weaver Boulevard (US 25/70). The upstream drainage area is dominated by a large shopping center. Drainage from the shopping center appears to be directed to a piped stream, Gill Branch, which runs beneath the complex. Approximately 30 feet upstream from Crossing 20 is a 96" corrugated metal pipe which carries the flow. There is an approximate 1-foot elevation drop between the upstream structure and the structure at Crossing 20. The downstream structure is a 7'x6' reinforced concrete box culvert. There is a current Limited Detail Flood Study for the crossing.

Drainage Area:	0.35 square miles
Existing Structure:	7'x6' RCBC
Existing Channel:	Downstream channel width of 4'
Recommended Structure:	Retain existing 7'x6' RCBC

It is recommended to retain the RCBC. The flow requirements for a 50 year storm indicated that a single 7'x7' RCBC would be required; however, since the drainage area is small and this recommendation only proposes to increase the existing height by 1 foot, it would likely be most cost effective to retain the length of the existing culvert.



Site 20A – upstream face



Site 20A – downstream face

## 2.8 SITE 21

Site 21 is located just downstream from Crossing 20 on Gill Branch. The crossing is located on I-26. The stream makes a sharp turn to enter the box culvert, and erosion is present behind the wingwalls at the upstream culvert end. Visible erosion is present and the banks are vertical on the upstream side. At the downstream end of the culvert, the waterway also makes a sharp turn to avoid a 25 to 30-foot tall retaining wall which is located 50 feet from the outlet. There is a heavily eroded concrete gutter that outlets just downstream from the outlet end of the culvert. The banks downstream are stable. There is a current Limited Detail Flood Study for Crossing 21.

Drainage Area:	0.70 square miles
Existing Structure:	8'x6' RCBC
Existing Channel:	Width of 10' at both ends of culvert
Recommended Structure:	Replace with 9'x9' RCBC

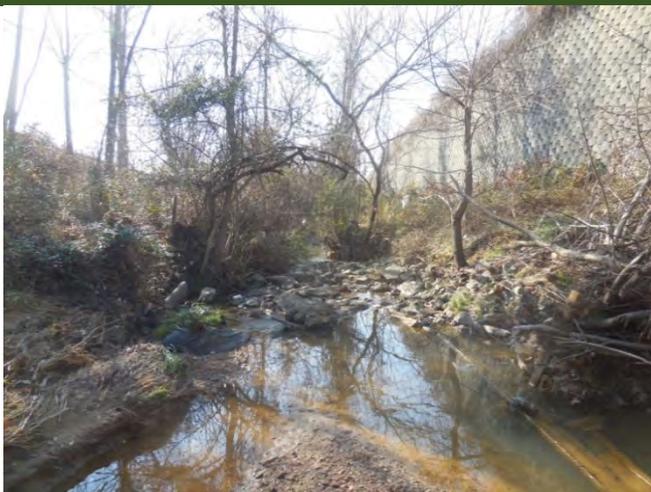
It is recommended to replace the existing RCBC with a 9'x9' box culvert. As the existing culvert is not well aligned to the stream, the proposed culvert would better follow the stream. The propose size would better meet the capacity requirements for a 50-year storm event.



Site 21 – looking upstream



Site 21 – upstream face



Site 21 – looking downstream



Site 21 – downstream face

## 2.9 SITE 28

Site 28 crosses Reems Creek with two 4-span bridges with concrete bents and a reinforced concrete floor on steel I-beams. The bridge carrying the northbound lanes of I-26 is structure number 100370, and the I-26 southbound lane structure is 100373. Both span Reems Creek. The existing bridges are approximately 270' long each. This bridge replacement is listed in the NCDOT STIP as B-4442. This crossing is Reems Creek has a Re-delineated floodplain, though the FIRM indicates that the hydraulic effects of the road at this location on the special flood hazard area have not been determined. The bridges will need to be replaced to accommodate the new road alignment.

Drainage Area:	31.4 square miles
Existing Structure:	2@ 4-span bridges; 270 feet long
Existing Channel:	Stream width varies between 20' and 30' with 4'-6' tall vertical banks
Recommended Structure:	Replace with 2@ 4-span bridges 290 feet



Site 28 – looking upstream



Site 28 – upstream face



Site 28 – looking downstream



Site 28 – downstream face

## 2.10 SITE 31

Site 31 is located at an unnamed tributary of Wagner Branch on I-26. The upstream flow makes a sharp angle into the barrel at a headwall. There are boulders averaging 2 feet in diameter at the east bank, at the toe of a 1:1 slope at the upstream end. The surrounding land is wooded. There is evidence of erosion behind the upstream headwall. Downstream, the pipe invert is approximately 2 feet above the receiving streambed. The downstream end outlets into Wagner Branch which is a tributary to Reems Creek. There are large branches and foliage growing around the pipes at this crossing. This crossing is located upstream of Crossing 33, spanning over the unnamed tributary of Wagner branch. The downstream structure is a 48" CMP.

Drainage Area:	0.24 square miles
Existing Structure:	60" CMP with upstream headwall
Existing Channel:	6' base with cobble silt bottom with boulders
Recommended Structure:	Replace with 84" CMP

It is recommended to replace the existing structure with an 84" CMP.



Site 31 – looking upstream



Site 31 – upstream face



Site 31 – looking downstream



Site 31 – downstream face

## 2.11 SITE 32

Site 32 carries an unnamed tributary of Wagner branch on I-26. The inlet pipe to the tributary is a 42" corrugated metal pipe with a concrete headwall. The outlet pipe is a 60" CMP. There are visible drop inlet structures located throughout the length of the pipe. There is evidence of erosion along the pipe also. Water is flowing around the upstream headwall and inlet. The upstream and downstream banks are unstable and there are surrounding branches and foliage around the downstream face. Although no significant buildup of debris was noted at the time of the field visit, there is a moderate potential for buildup as the banks are highly vegetated. The incoming upstream flow enters from a sharp angle. There is a high water mark at 7 feet above invert.

Drainage Area:	0.24 square miles
Existing Structure:	42"/60" CMP
Existing Channel:	6' base with silt, gravel, cobble bottom. 3' bank walls
Recommended Structure:	Replace with 84" CMP

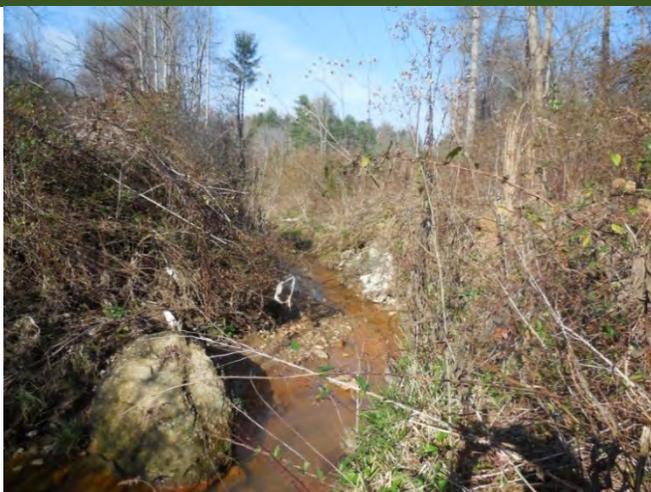
The recommended action is to replace the existing 42"/60" CMP system with an 84" CMP and drop inlets. As the existing system carries stream flow and allows for additional water along its length, the replacement system should do the same.



Site 32 – looking upstream



Site 32 – upstream face



Site 32 – looking downstream



Site 32 – downstream face

## 2.12 SITE 33

Site 33 conveys an unnamed tributary adjacent to Leisure Mountain Road. The vertical banks have an abundance of vegetation and are also unstable with considerable erosion. There are two pipes which appear to originate from the adjacent car wash, which contributes to the upstream flow. At this inlet, the slopes are failing, as is the brick and concrete retaining wall. At the downstream face, there is an intersecting fence and an approximate 2-foot drop into a 12-foot wide pool. The area is heavily wooded and, the vertical banks are unstable. Riprap is present and there is approximately 100 cubic yards of erosion. There is a berm located roughly 50 to 60 feet.

Drainage Area:	0.20 square miles
Existing Structure:	48" CMP
Existing Channel:	sandy/gravel bottom with riprap and a 4'-5' base width
Recommended Structure:	Replace with 72" CMP

The recommended action is to replace the existing 48" CMP with a 72" CMP.



Site 33 – looking upstream



Site 33 – upstream face



Site 33 – looking downstream

### 2.13 SITE 37

Site 37 conveys an unnamed tributary to Beaverdam Creek Tributary 1. Site 37 is located on I-26 and Old Weaverville Road. Evidence of accumulating sediment buildup is present at the downstream end. Banks at the upstream and downstream ends of the culvert are all in stable condition. The upstream channel flows parallel to I-26 and turns to enter into the upstream end at a headwall. Additionally, there is a residence located within 200 feet of the stream, at an elevation approximately 10 feet above the stream bottom. At the downstream end, there is a residence within 50 feet of the channel at an elevation of roughly 5 feet above the banks.

Drainage Area:	0.27 square miles
Existing Structure:	66" CMP
Existing Channel:	gravel and cobble bottom with a 5'-6' base
Recommended Structure:	Extend Existing 66" CMP (130')

The recommended action is to extend the existing 66" CMP to the proposed fill limits (130'). However, a 72" pipe was sized to fit the flow at this location for a 50-year storm. Because the existing culvert is in good condition, it is recommended to keep the existing culvert.



Site 37 – looking upstream



Site 37 – upstream face



Site 37 – looking downstream



Site 37 – downstream face

## 2.14 SITE 39B

Site 39B carries Beaverdam Creek Tributary 1 at the intersection of Weaverville Road and the ramps to I-26 northbound lanes. The banks are stabilized with riprap. There is a large rock at the culvert entrance, and at the time of field visit, the flow was limited to the east barrel. There is roughly 1 cubic yard of erosion behind the wingwall at the upstream side. Downstream is the confluence with Beaverdam Creek. This site has a re-delineated floodplain and the crossing is in special flood hazard zone AE. It should be noted that there are commercial properties and buildings located both up and downstream of this site within the flood zone.

Drainage Area:	2.08 square miles
Existing Structure:	2@8'x5' RCBC
Existing Channel:	channel base is between 8'-10' with a depth of flow of approximately 4-6 inches
Recommended Structure:	Replace with 9'x9' RCBC

The new structure is recommended to be a single 9'x 9' box culvert to meet the size requirements for a 50-year storm event.



Site 39B – looking upstream



Site 39B – upstream face



Site 39B – looking downstream



Site 39B – downstream face

## 2.15 SITE 41

Site 41 is approximately 500 feet downstream of the confluence of Beaverdam Creek Tributary 1 to Beaverdam Creek on I-26. Flow is in a westerly direction. The site consists of two 5-span bridges of I-26. The stream is characterized by 4 to 5 feet tall banks, with vertical sides at the stream location, and 4:1 side slopes beyond that. There is Class A riprap lining the banks beneath the bridge. A railroad track lies in span 2 of the bridges. The stream flows in span 4, and a gravel road with access to a waste facility is located beneath span 5 of the bridges. The bridges are in good condition, but will be replaced as part of the project.

Beaverdam Creek is a Class C stream and flows to the French Broad River. The surrounding area is lightly wooded. This stream crossing has moderate damage potential as there are at least six nearby commercial properties established in the floodplain. This site has a re-delineated floodplain and the crossing is in special flood hazard zone AE.

Drainage Area:	11.9 square miles
Existing Structure:	2@5-span bridge 380' long
Existing Channel:	Stream base width of 12'-15' with depth of flow 3'
Recommended Structure:	Replace with 2@ 5-span bridges 380' long



Site 41 – looking upstream



Site 41 – upstream face



Site 41 – looking downstream

## 2.16 SITE 44

Site 44 is an unnamed tributary to the French Broad River on I-26. The surrounding area consists of woods and businesses with parking lots. At the upstream side, there are two 54-inch pipes carrying the flow. The southern pipe is reinforced concrete with a corrugated metal pipe extension. The north pipe is corrugated metal. It was noted that the pipes seem to flow beneath a business located just upstream. There is a plunge pool at the base of the two pipes, approximately 50 feet across and 50 feet upstream of site 44. The banks surrounding the pool have a slope of approximately 1:1. The upstream end of the pipe has riprap inlet protection. It was noted that there were two sewer manholes located at each the north and south sides of the pool, at the top of the slopes.

The culvert outlet also ends in a pool. The tail end has silted in approximately 3 feet with silt and small cobbles. There is a building located within 50 feet, with the finished floor elevation at roughly 15 feet above the culvert outlet and a 60" corrugated metal pipe located just downstream. In addition, there is a concrete flume located at the southern edge of the pool. There is moderate vegetation and debris at this crossing with trees greater than a foot in diameter.

The crossing is approximately 1000' from the confluence of the unnamed tributary with the French Broad River. The waterway is piped from the pool at the downstream end of the crossing, through a 60" corrugated metal pipe, to the confluence with the French Broad River. There is evidence of vegetative debris at the upstream end of the 60" CMP.

Drainage Area:	0.83 square miles
Existing Structure:	7'x6' RCBC
Existing Channel:	Downstream channel width of 4'
Recommended Structure:	Retain existing 7'x6' RCBC

There is no recommended action for this crossing. The existing dimensions are calculated to be hydraulically sound for the facilitation of a 50 year storm event. There is insufficient space allotted to expand the length of this culvert so the fill slopes should be adjusted at this location to fit the current inverts.



Site 44 – looking upstream



Site 44 – upstream face



Site 44 – looking downstream



Site 44 – downstream face

## 2.17 SITE 48

Site 48 is located at the crossing of Reed Creek beneath Braodway Street to I-26 East. The crossing is housed in four 8'x9' reinforced concrete box culverts. Flow only travels through barrel 4 (southern) as the other barrels are filled with 2'-3' of silt. The entire culvert structure curves at approximately a 20 degree turn at mid-span. In barrel 4, there are medium sized cobbles 6"-12" in diameter throughout the length that compose the stream bottom.

The waterway at the downstream end of the culvert has Class A riprap that lines both the banks for approximately 35 feet beyond the culvert end. Heavy debris and large rocks lay in the downstream channel. The downstream structure is a grouping of four 72" corrugated metal pipes which serves as a bridge. There is evidence of erosion and debris in the stream bed. The banks have 1:1 side slopes and it appears as though broken concrete and other rocks have been deposited in an unsuccessful attempt to stabilize the banks.

At the upstream end, the width of the stream base varies between 20 to 30 feet wide and the slope of the stable banks range from a 1:1 ratio to vertical. Evidence of unusual scour potential appears at the rock wall at the upstream northern face. There is evidence of erosion behind the upstream wing wall, and the stream approaches the structure at a sharp angle. There are large, submerged rocks in the streambed at the upstream side. There is also debris partially blocking barrels 2 and 3 of the culvert. The upstream structure is a 4-span bridge, Crossing 49. Reed Creek is a FEMA modeled stream.

Drainage Area:	3.72 square miles
Existing Structure:	4@8'x9' RCBC
Existing Channel:	width of the base at the downstream end varies between 20' and 10' wide with a water depth of 1'
Recommended Structure:	Extend existing 4@8'x9' RCBC (108')

It is recommended to extend the existing RCBC 108 feet. The new structure is recommended to retain the existing dimensions which currently exceed the size requirements for a 50-year storm event.



Site 48 – looking upstream



Site 48 – upstream face



Site 48 – looking downstream



Site 48 – downstream face

## 2.18 SITE 49

Site 49 is located on Reed Creek and is a 4-span bridge carrying I-26. Reed Creek flows in span 3, and to the south, Broadway Road passes through span 2. Beneath the bridge, Reed Creek has riprap lined banks at a 1:1 slope up to the bridge piers. Beyond the piers, the slope extends at a 3:1 ratio. The upstream structure, approximately 500 feet away, is a 4@8'x9' box culvert (Crossing 48) and the downstream structure is another 4@8'x9' box (Crossing 50). Reed Creek is a Class C stream, and the crossing is located within the flood limits of the FEMA Detailed, Re-delineated study. The bridge will be replaced as part of the project.

Drainage Area:	3.71 square miles
Existing Structure:	2@ 4-span bridge 310 feet long
Existing Channel:	Sandy/gravel bottom with large submerged rocks
Recommended Structure:	Replace bridges 310 feet long



Site 49 – looking upstream



Site 49 – upstream face



Site 49 – looking downstream



Site 49 – downstream face

## 2.19 SITE 50

Site 50 is the location where Reed Creek flows under the Exit 25 on-ramp of I-26. It is approximately 300 feet upstream from Crossing 49, on the same waterway. Banks along the upstream side are characterized by 3:1 side slopes with small to medium sized trees and brush. Water only flows through barrel 3 and 4 of the structure; the other barrels are filled with accumulated sediment. There is evidence of high water levels at 3 feet above the normal water surface level at the upstream side. An appreciable volume of silt deposit is observed at the site. At the downstream end, sediment reaches up to 4 feet high in barrel 1. Water flows swiftly through the 10-foot wide base at the outlet. Signs of high water levels creep up to 5 to 6 feet from water surface at the downstream outlet.

Drainage Area:	3.68 square miles
Existing Structure:	4@8'x9' RCBC
Existing Channel:	the upstream end, water is 1' deep and the stream has a 20'-30' wide base. The stream bottom consists of cobbles and gravel
Recommended Structure:	Extend existing 4@8'x9' RCBC (35')

It is recommended to extend the existing RCBC 35 feet, which exceeds the size requirements for a 50-year storm event.



Site 50 – looking upstream



Site 50 – upstream face



Site 50 – looking downstream



Site 50 – downstream face

## 2.20 SITE 51

Crossing 51 is further upstream on Reed Creek from crossing 50 and flows under Campus Drive at the intersection of Broadway Road. The upstream end has a 30' wide base with 3:1 side slopes. At this site, the creek has accumulated multiple gravel and silt bars. At the time of the site visit, debris covered barrels 2, 3, and 4, restricting water to only flow through the southernmost barrel.

At the downstream end, banks are vertical at 8 feet tall and the streambed has a sandy gravel bottom with small cobbles prevalent throughout. A 36" corrugated metal pipe outlets into the downstream flow. Reed Creek has been modeled by a Detailed Redelineated model by FEMA.

Drainage Area:	3.60 square miles
Existing Structure:	4@8'x9' RCBC
Existing Channel:	30' wide base at the upstream end; sandy gravel bottom downstream
Recommended Structure:	Retain existing 4@8'x9' RCBC

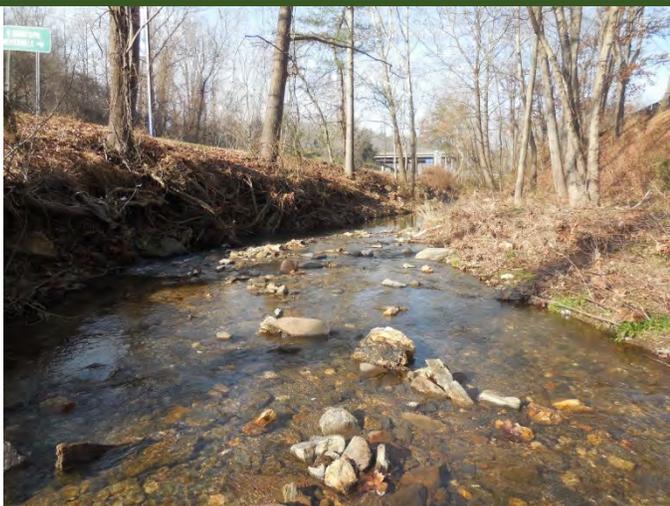
It is recommended to retain the existing RCBC, which exceeds the size requirements for a 50-year storm event.



Site 51 – looking upstream



Site 51 – upstream face

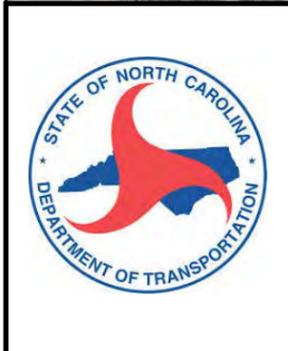
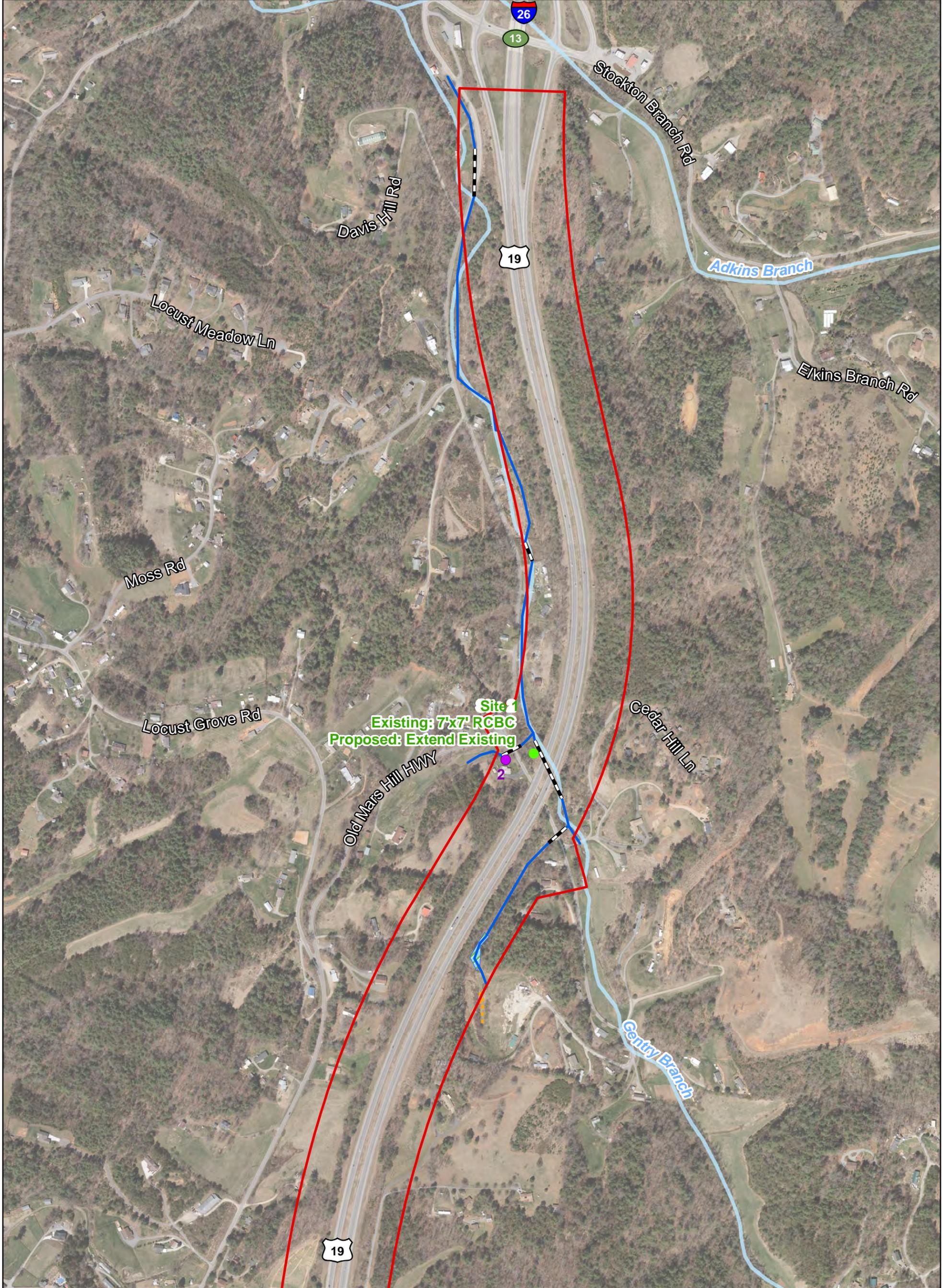


Site 51 – looking downstream



Site 51 – downstream face

**Attachment I**  
**Figure I-1 thru I-10**  
**Hydraulic Crossings**



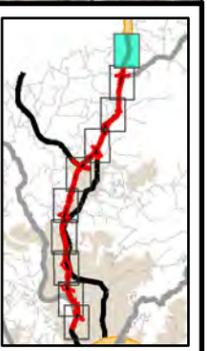
**US 19/23  
(Future I-26)  
Improvements  
STIP No. A-0010A**

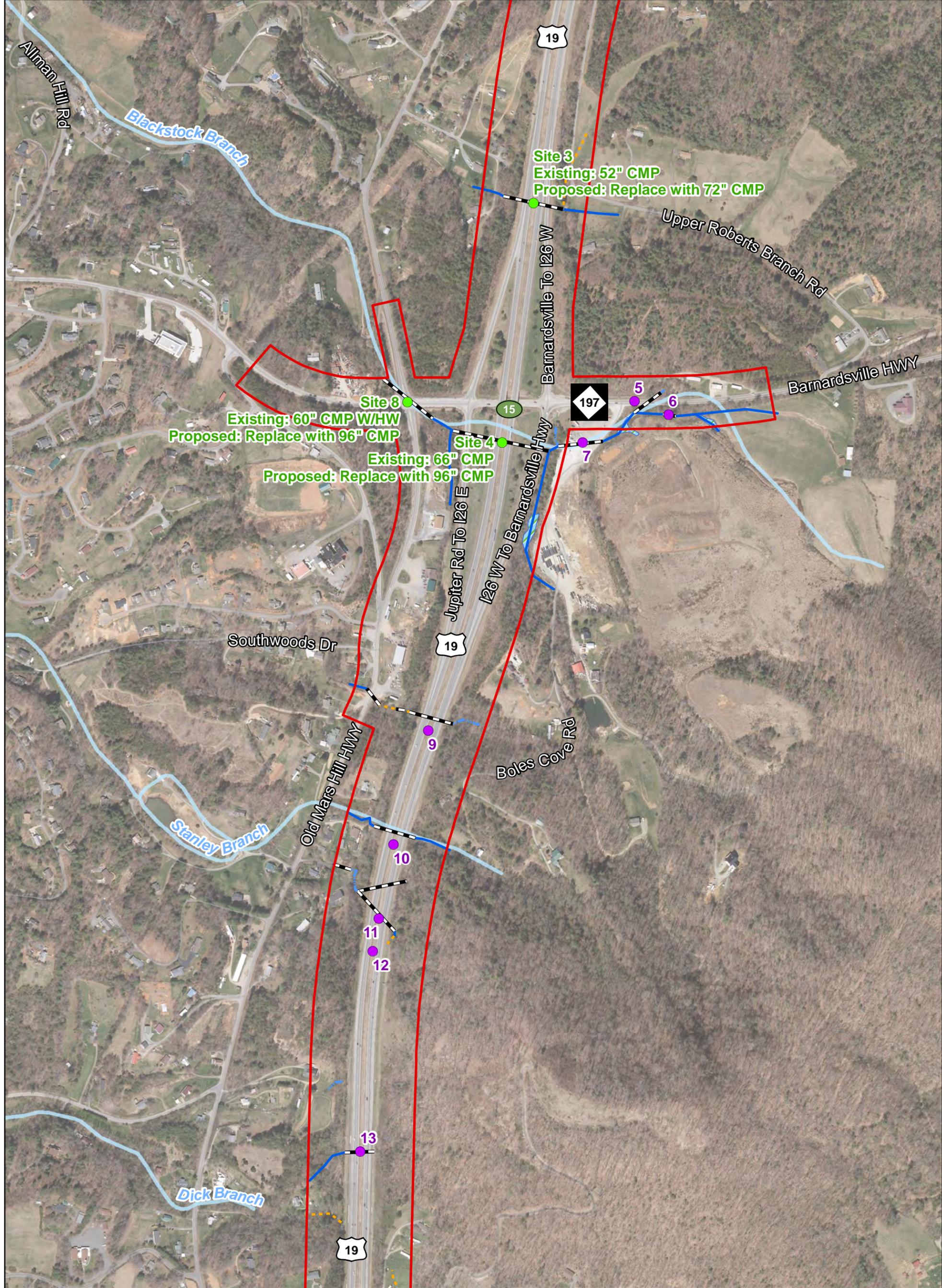
**Figure 1-1  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





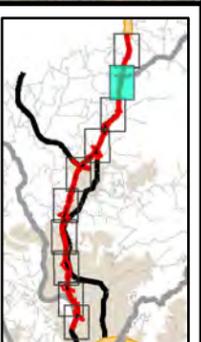
**US 19/23  
(Future I-26)  
Improvements  
STIP No. A-0010A**

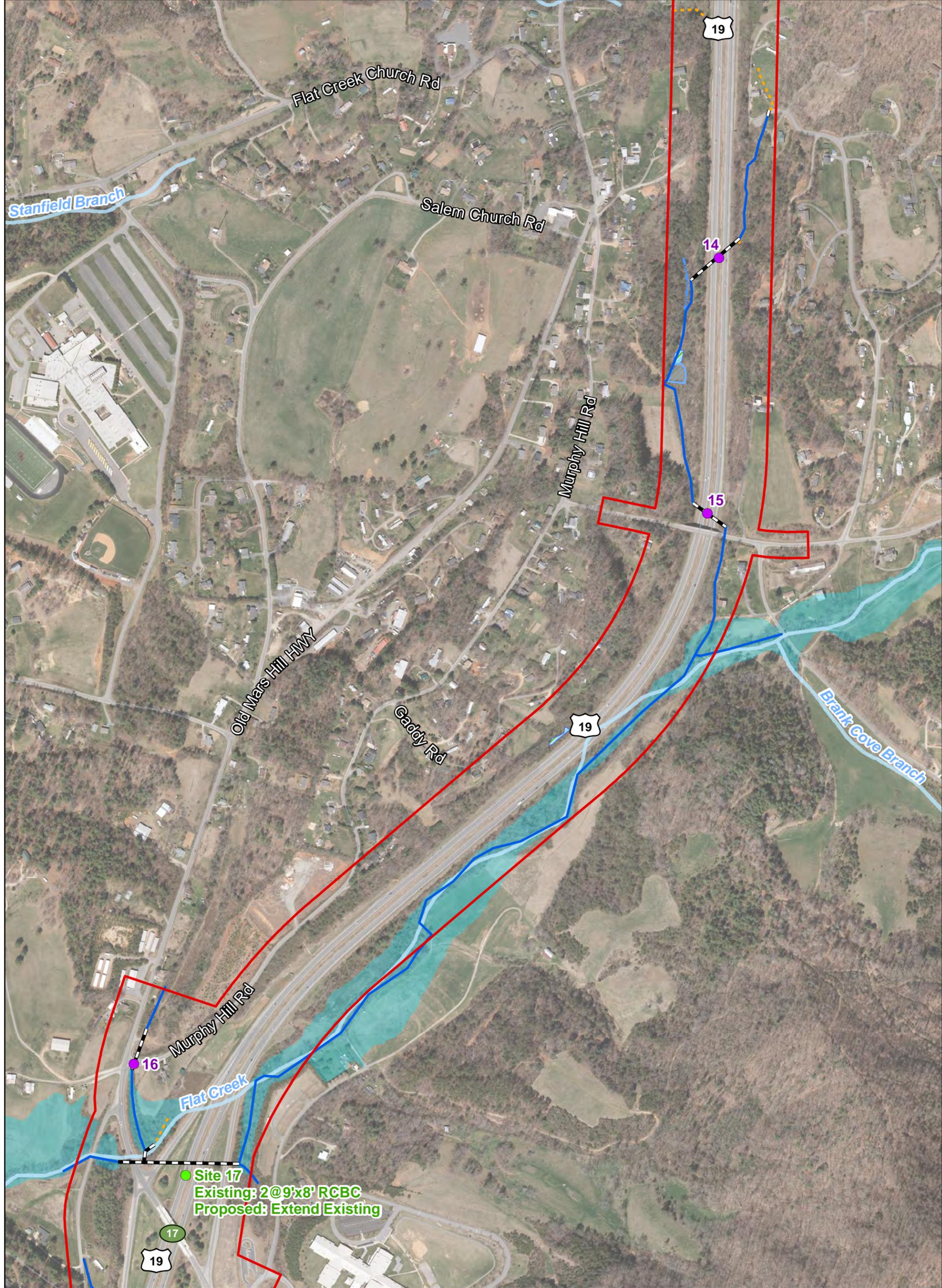
**Figure 1-2  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- - - Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





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**Figure 1-3  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- - - Intermittent Stream
- Perennial Stream
- - - Ephemeral Channel
- Culvert
- Pond
- Wetland

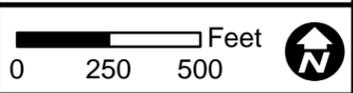
- Flood Hazard Zones**
- 1% Annual Chance Flood Hazard
  - Regulatory Floodway
  - Special Floodway
  - Area of Undetermined Flood Hazard
  - 0.2% Annual Chance Flood Hazard
  - Future Conditions 1% Annual Chance Flood Hazard
  - Area with Reduced Risk Due to Levee





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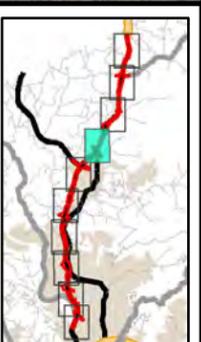
**Figure 1-4  
Hydraulic Crossings**

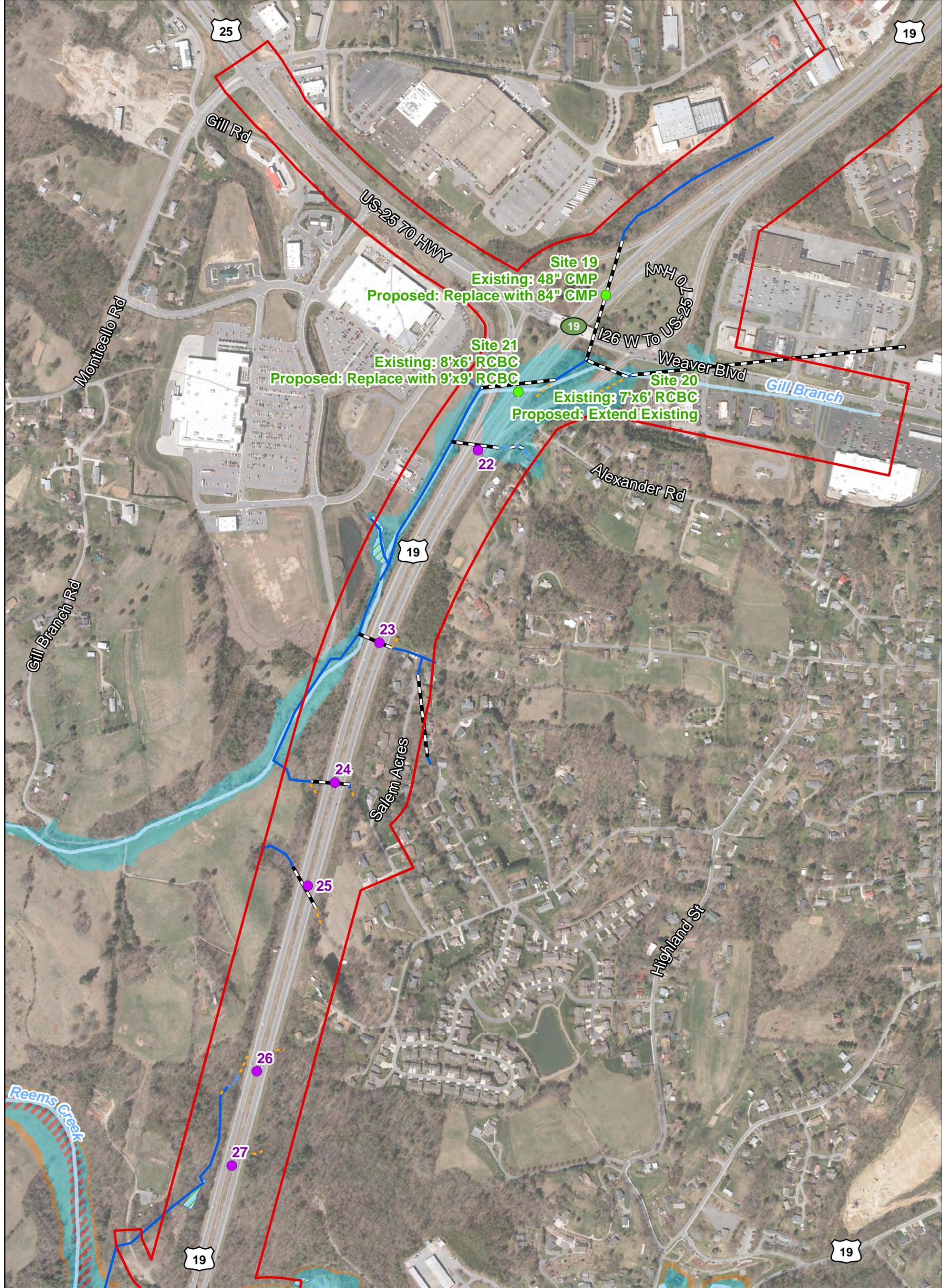


- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream

- Delineated Features**
- Intermittent Stream
  - Perennial Stream
  - Ephemeral Channel
  - Culvert
  - ▨ Pond
  - ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





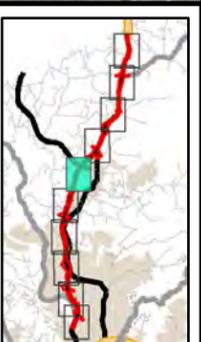
**US 19/23  
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Improvements  
STIP No. A-0010A**

**Figure 1-5  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- - - Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





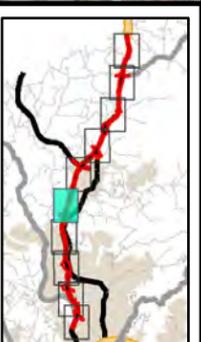
**US 19/23  
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STIP No. A-0010A**

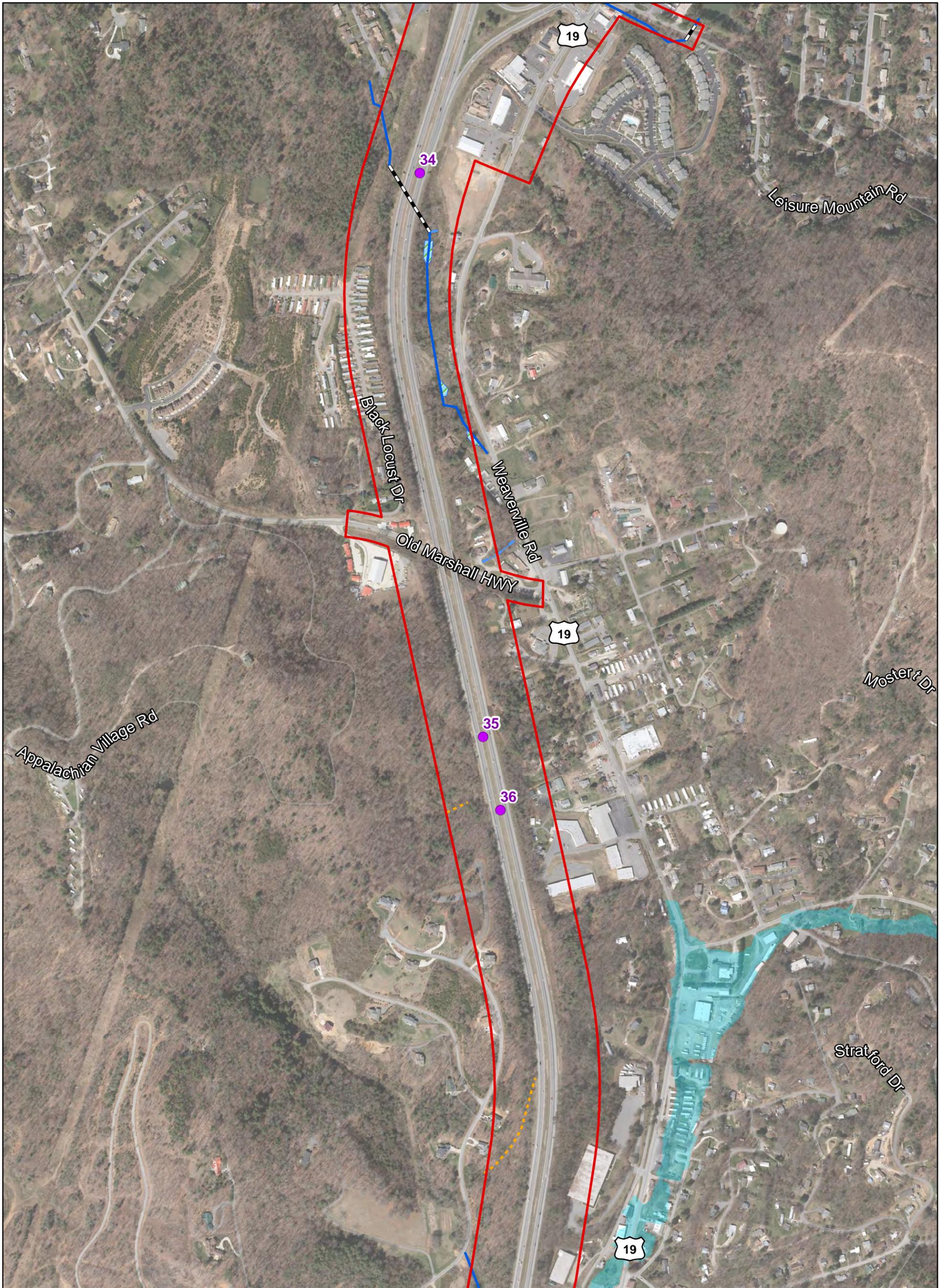
**Figure 1-6  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- - - Intermittent Stream
- Perennial Stream
- - - Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





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**Figure 1-7  
Hydraulic Crossings**

0 250 500 Feet 

 Study area

 72"+ Hydraulic Crossing

 <72" Hydraulic Crossing

 Exit

 Named Stream

**Delineated Features**

 Intermittent Stream

 Perennial Stream

 Ephemeral Channel

 Culvert

 Pond

 Wetland

**Flood Hazard Zones**

 1% Annual Chance Flood Hazard

 Regulatory Floodway

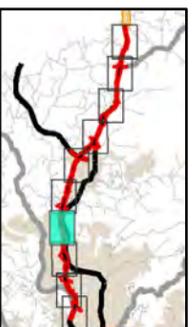
 Special Floodway

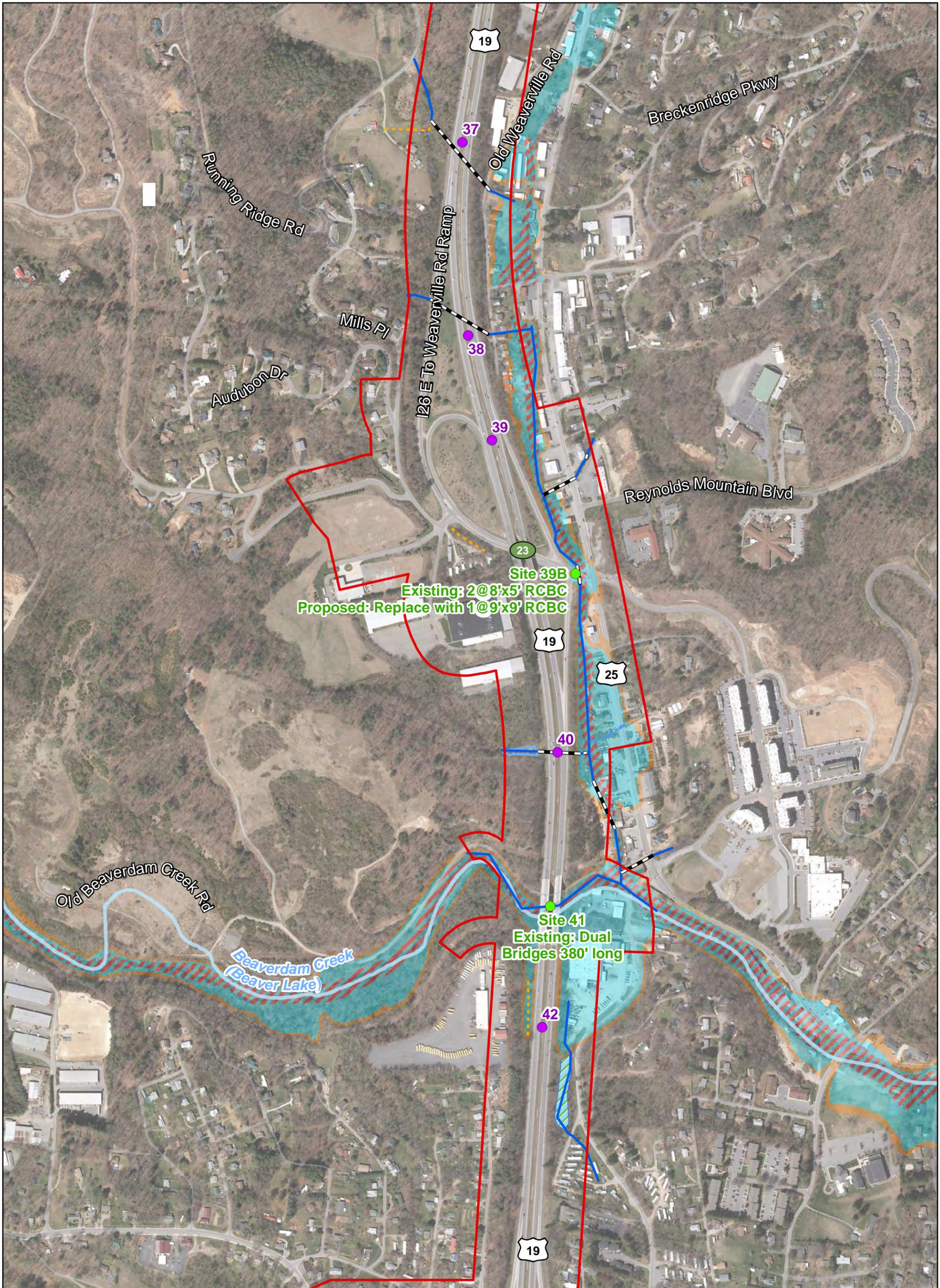
 Area of Undetermined Flood Hazard

 0.2% Annual Chance Flood Hazard

 Future Conditions 1% Annual Chance Flood Hazard

 Area with Reduced Risk Due to Levee





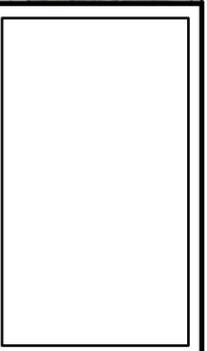
**US 19/23  
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Improvements  
STIP No. A-0010A**

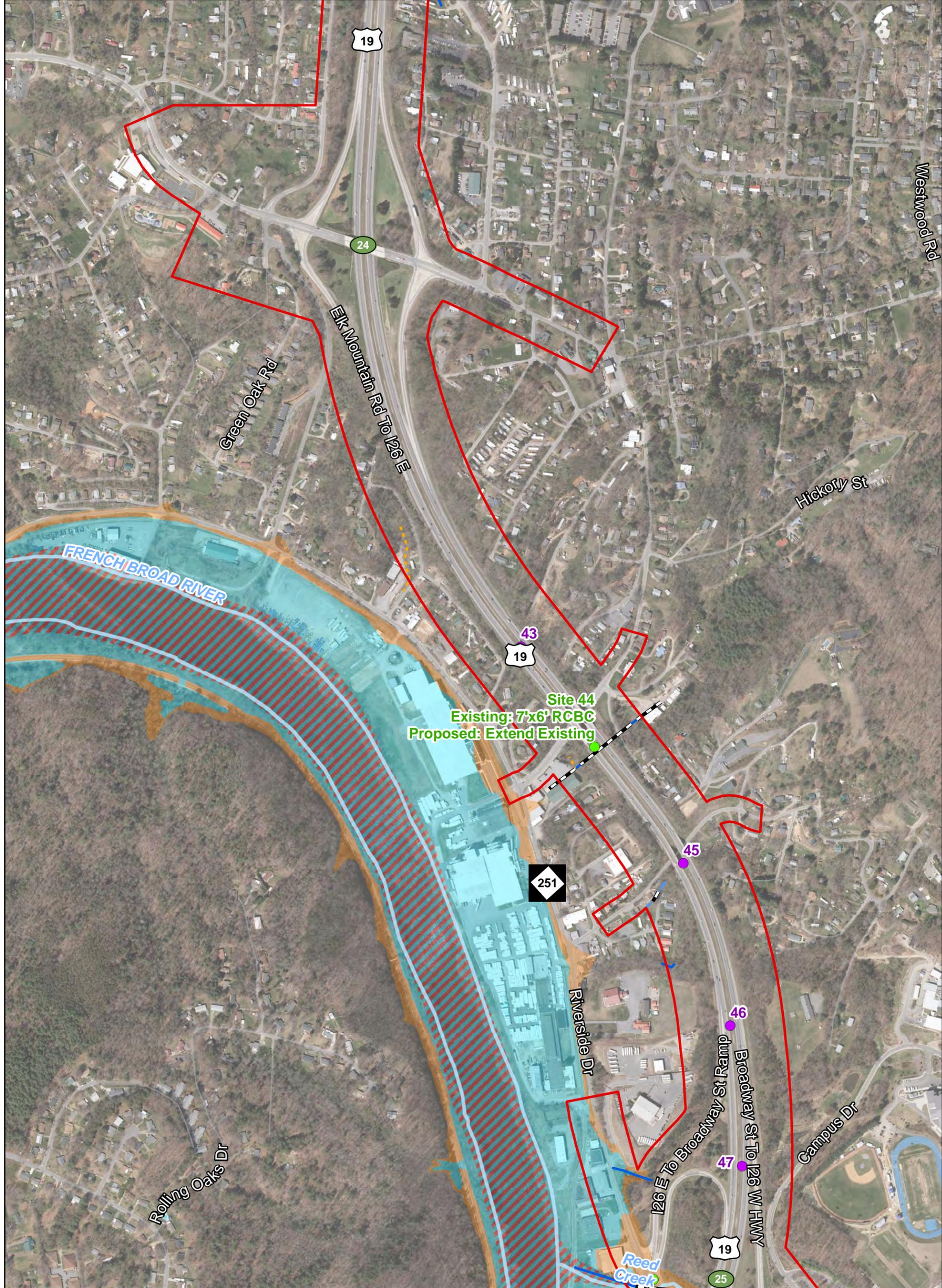
**Figure 1-8  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- - - Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- 1% Annual Chance Flood Hazard
  - Regulatory Floodway
  - Special Floodway
  - Area of Undetermined Flood Hazard
  - 0.2% Annual Chance Flood Hazard
  - Future Conditions 1% Annual Chance Flood Hazard
  - Area with Reduced Risk Due to Levee





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(Future I-26)  
Improvements  
STIP No. A-0010A**

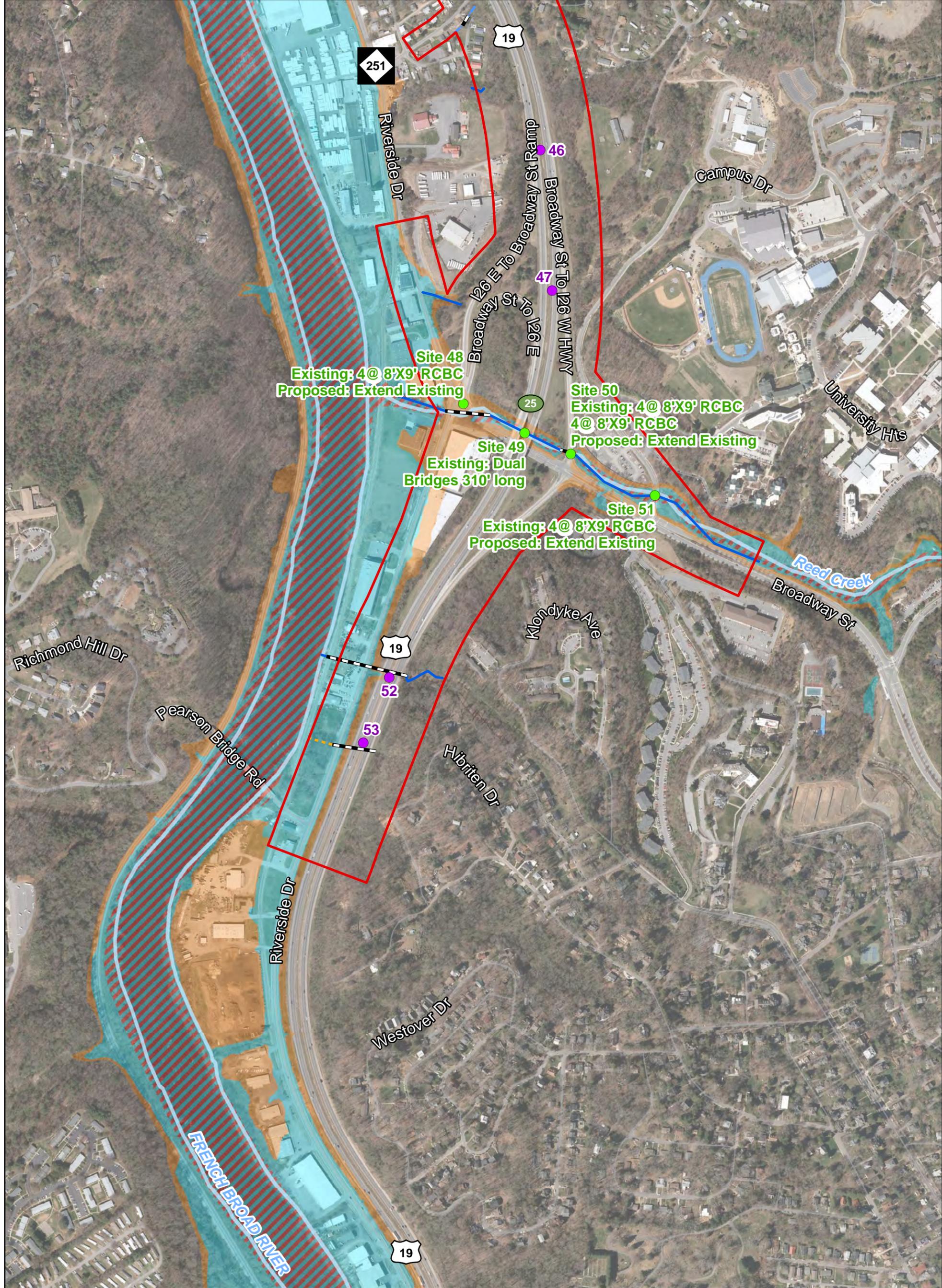
**Figure 1-9  
Hydraulic Crossings**



- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee





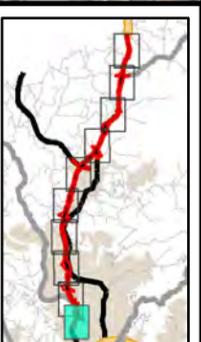
**US 19/23  
(Future I-26)  
Improvements  
STIP No. A-0010A**

**Figure 1-10  
Hydraulic Crossings**

0 250 500 Feet

- Study area
- 72"+ Hydraulic Crossing
- <72" Hydraulic Crossing
- Exit
- Named Stream
- Intermittent Stream
- Perennial Stream
- Ephemeral Channel
- Culvert
- ▨ Pond
- ▨ Wetland

- Flood Hazard Zones**
- ▨ 1% Annual Chance Flood Hazard
  - ▨ Regulatory Floodway
  - ▨ Special Floodway
  - ▨ Area of Undetermined Flood Hazard
  - ▨ 0.2% Annual Chance Flood Hazard
  - ▨ Future Conditions 1% Annual Chance Flood Hazard
  - ▨ Area with Reduced Risk Due to Levee



**Attachment 2**  
**Table I**  
**Preliminary Hydraulic Recommendations**

**PRELIMINARY HYDRAULIC RECOMMENDATIONS FOR MAJOR CROSSINGS**

SITE NUMBER	ROUTE	LAT	LONG	STREAM NAME	Stream Class	Stream ID	FEMA STUDY TYPE	DRAINAGE AREA (Mi <sup>2</sup> )	EXISTING STRUCTURE	MINIMUM RECOMMENDED / DESIGN STRUCTURE*
									Number, Size, Structure Type	Number, Size, Structure Type
1	I-26	35.7718	-82.5392	Gentry Branch	WS-II	SA	none	0.99	(1) 7'x7' RCBC	extend existing (50')
3	I-26	35.7619	-82.543	Unnamed tributary to Blackstock Branch	C	SD	none	0.14	(1) 52" cmp	(1) 72" cmp @ 303'
4	I-26	35.7581	-82.5433	Unnamed tributary to Blackstock Branch	C	SH	none	0.36	(1) 66" cmp	(1) 96" cmp @ 468'
8	Jupiter Road (NC 197)	35.7587	-82.5448	Unnamed tributary to Blackstock Branch	C	SE	none	0.41	(1) 60" cmp	(1) 96" cmp @356'
17	I-26	35.7276	-82.5543	Flat Creek	C	SQ	Limited	6.96	(2) 9'x8' RCBC	extend existing (50')
18	I-26	35.7201	-82.5584	Little Flat Creek	C	ST	none	3.04	(3) 8'x8' RCBC	extend existing (18')
19	I-26	35.7053	-82.5718	Unnamed tributary to Gill Branch	C	SW	none	0.15	(1) 48" cmp	(1) 84" cmp @ 445'
20	Weaver Blvd (US 25/70)	35.7041	-82.5702	Gill Branch	C	SX	Limited	0.35	(1) 7'x6' RCBC	(1) 7'x7' RCBC
21	I-26	35.7038	-82.5736	Gill Branch	C	SX	Limited	0.7	(1) 8'x6' RCBC	(1) 9'x9' RCBC @400'
28	I-26	35.6889	-82.5791	Reems Creek	C	SGG	Limited	31.4	(2) 270' Bridge	(2) 290' Bridge
31	I-26	35.675	-82.5837	Unnamed tributary	C	Tributary to SJJ	none	0.24	(1) 60" cmp	(1) 84" cmp @661'
32	I-26	35.6738	-82.584	Unnamed tributary to Wagner Branch	C	SJJ	none	0.24	(1) 42"/60" cmp	(1) 84" cmp @ 306'
33	Weaverville Road	35.6723	-82.5822	Unnamed tributary	C	SKK	none	0.2	(1) 48" cmp	(1) 72" cmp @177'
37	I-26 and Old Weaverville Road	35.6511	-82.5829	Unnamed tributary to Beaverdam Creek	C	SNN	none	0.27	(1) 66" cmp	extend existing (130')

**PRELIMINARY HYDRAULIC RECOMMENDATIONS FOR MAJOR CROSSINGS**

39B	Weaverville Road and I-26 NB ramps	35.6446	-82.5803	Beaverdam Creek Tributary 1	C	SRR	none	2.08	(2) 8'x5' RCBC	(1) 9'x9' RCBC @ 233'
41	I-26	35.6392	-82.5805	Beaverdam Creek	C	SVV	none	11.9	(2) 380' bridge	(2) 380' bridge
44	I-26	35.624	-82.5762	Unnamed tributary to the French Broad River	C	SCCC	none	0.38	(1) 7'x6' RCBC	retain existing
48	Broadway St	35.615	-82.5744	Reed Creek	C	SAAA	detailed	3.72	(4) 8'x9' RCBC	extend existing (108')
49	I-26	35.6148	-82.5733	Reed Creek	C	SAAA	detailed	3.71	(2) 310' bridge	(2) 310' bridge
50	I-26 Ramp	35.6146	-82.5724	Reed Creek	C	SAAA	detailed	3.68	(4) 8'x9' RCBC	extend existing (35')
51	Campus Drive/ Broadway Road intersection	35.6139	-82.5708	Reed Creek	C	SAAA	detailed	3.6	(4) 8'x9' RCBC	retain existing

\*Recommended culvert sizes were calculated based on HW/D=1.2 per NCDOT guidelines

**Attachment 3**  
**Natural Resources Technical Report (November 2015)**  
**Section 3.2 Water Resources**  
**Section 5.0 Jurisdictional Issues**  
**Figure 3 Jurisdictional Resources**

### 3.2 Water Resources

Water resources in the study area are part of the French Broad river basin (U.S. Geological Survey [USGS] Hydrologic Unit 06010105). Fifty-seven streams were identified in the study area (Table 2). The location of each water resource is shown in Figures 3a through 3n (Appendix A). The physical characteristics of these streams are provided in Table 3.

**Table 2. Water resources in the study area**

Stream Name	Map ID	Figure #	NCDWR Index Number	Best Use Classification
Gentry Branch	SA	3a	6-96-11-1	WS-II;HQW
UT to Gentry Branch	SB	3a	6-96-11-1	WS-II;HQW
UT to Gentry Branch	SC	3b	6-96-11-1	WS-II;HQW
Blackstock Branch	SE	3b	6-96-13	C
UT to Blackstock Branch	SD	3b	6-96-13	C
UT to Blackstock Branch	SF	3b	6-96-13	C
UT to Blackstock Branch	SG	3b	6-96-13	C
UT to Blackstock Branch	SH	3c	6-96-13	C
UT to Blackstock Branch	SI	3c	6-96-13	C
UT to Blackstock Branch	SJ	3c	6-96-13	C
Stanley Branch	SL	3c	6-88-4-1	C
UT to Stanley Branch	SK	3c	6-88-4-1	C
UT to Stanley Branch	SM	3c	6-88-4-1	C
Dick Branch	SO	3c	6-88-4	C
UT to Dick Branch	SN	3c	6-88-4	C
Flat Creek, including pond	SQ	3d/3e	6-88	C
UT to Flat Creek	SP	3d	6-88	C
UT to Flat Creek	SR	3e	6-88	C
UT to Flat Creek	SS	3e	6-88	C
UT to Flat Creek	SDDD	3e	6-88	C
UT to Flat Creek	SEEE	3e	6-88	C
Little Flat Creek	ST	3e/3f	6-88-3	C
UT to Little Flat Creek	SU	3e/3f	6-88-3	C
UT Garrison Branch	SV	3f	6-88-3	C
Gill Branch	SX	3g	6-87-12	C
UT to Gill Branch	SW	3f/3g	6-87-12	C
UT to Gill Branch	SY	3g	6-87-12	C
UT to Gill Branch	SZ	3g	6-87-12	C
UT to Gill Branch	SAA	3g	6-87-12	C
UT to Gill Branch	SBB	3g	6-87-12	C
UT to Gill Branch	SCC	3g	6-87-12	C

Stream Name	Map ID	Figure #	NCDWR Index Number	Best Use Classification
UT to Gill Branch	SDD	3g	6-87-12	C
UT to Gill Branch	SEE	3g	6-87-12	C
Reems Creek	SGG	3h	6-87-(10)	C
UT to Reems Creek	SFF	3h	6-87-(10)	C
UT to Reems Creek	SHH	3h	6-87-(10)	C
Wagner Branch	SJJ	3i	6-87-13	C
UT to Wagner Branch	SII	3i	6-87-13	C
UT to Wagner Branch	SKK	3i	6-87-13	C
UT to Wagner Branch	SLL	3i/3j	6-87-13	C
UT to Wagner Branch	SMM	3j	6-87-13	C
Beaverdam Creek (Beaver Lake)	SVV	3l	6-82	C
UT to Beaverdam Creek	SNN	3k	6-82	C
UT to Beaverdam Creek	SOO	3k	6-82	C
UT to Beaverdam Creek	SPP	3k/3l	6-82	C
UT to Beaverdam Creek	SQQ	3k	6-82	C
UT to Beaverdam Creek	SRR	3k/3l	6-82	C
UT to Beaverdam Creek	SSS	3l	6-82	C
UT to Beaverdam Creek, including pond	STT	3l	6-82	C
UT to Beaverdam Creek	SUU	3l	6-82	C
UT to Beaverdam Creek	SWW	3l	6-82	C
UT to French Broad River	SXX	3m	6-(54.75)	B
UT to French Broad River	SYY	3m	6-(54.75)	B
UT to French Broad River	SCCC	3m	6-(54.75)	B
UT to French Broad River	SZZ	3n	6-(54.75)	B
UT to French Broad River	SBBB	3n	6-(54.75)	B
Reed Creek	SAAA	3n	6-80	C

Best Use Surface Water Classification:

Class C - Waters protected for uses such as secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner.

Class B - Waters protected for all Class C uses in addition to primary recreation. Primary recreational activities include swimming, skin diving, water skiing, and similar uses involving human body contact with water where such activities take place in an organized manner or on a frequent basis.

Water Supply II (WS-II) - Waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I classification is not feasible. These waters are also protected for Class C uses. WS-II waters are generally in predominantly undeveloped watersheds. All WS-II waters are HQW by supplemental classification.

High Quality Waters (HQW) - Supplemental classification intended to protect waters which are rated excellent based on biological and physical/chemical characteristics through Division monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission.

**Table 3. Physical characteristics of water resources in the study area**

Stream Name/ Map ID	Figure #	Bank Height (ft)	Bank Width (ft)	Water Depth (in)	Channel Substrate	Velocity	Clarity
Gentry Branch/ SA	3a	3	8	6	Silt, Sand, Gravel, Cobble	Moderate	Slightly Turbid
SB	3a	1	3	2	Silt, Sand	Moderate	Clear
SC	3b	1	3	2	Silt, Sand, Gravel	Slow	Clear
SD	3b	4	2	5	Silt, Sand, Gravel, Bedrock	Slow	Clear
Blackstock Branch/ SE	3b	2	6	7	Silt, Sand, Gravel	Slow	Clear
SF	3b	0.25	1	2	Silt, Sand	Slow	Clear
SG	3b	0.25	1	2	Silt	Slow	Clear
SH	3c	0.25	1	3	Silt	Moderate	Clear
SI	3c	1	6	6	Silt, Sand, Gravel	Moderate	Clear
SJ	3c	0.5	2	2	Silt, Sand, Gravel	Moderate	Slightly Turbid
SK	3c	0.25	1	2	Silt, Sand, Gravel	Slow	Clear
Stanley Branch/ SL	3c	0.5	4	2	Silt, Sand	Fast	Clear
SM	3c	0.5	1	2	Silt, Sand, Gravel	Moderate	Slightly Turbid
SN	3c	1	1	2	Silt, Sand, Gravel	Moderate	Slightly Turbid
Dick Branch/ SO	3c	0.25	3	2	Silt, Sand, Gravel	Moderate	Slightly Turbid
SP	4d	0.25	1	3	Silt, Sand, Gravel	Moderate	Slightly Turbid
Flat Creek/ SQ	3d/3e	4	40	12	Silt, Sand, Gravel, Cobble, Bedrock	Fast	Clear
SR	3e	1	4	12	Silt, Sand, Gravel	Moderate	Slightly Turbid
SS	3e	4	3	6	Silt, Sand, Gravel	Moderate	Slightly Turbid
Little Flat Creek/ ST	3e/3f	2	20	12	Silt, Sand, Cobble, Gravel, Boulder	Fast	Clear
SU	3e/3f	1	3	2	Silt, Sand, Cobble, Gravel, Boulder	Moderate	Slightly Turbid
SV	3f	0.5	3	2	Silt, Sand	Slow	Clear
SW	3f/3g	2	6	6	Silt, Sand, Gravel, Cobble	Slow	Clear
Gill Branch/ SX	3g	3	30	6	Silt, Sand, Gravel, Cobble	Slow	Clear

Stream Name/ Map ID	Figure #	Bank Height (ft)	Bank Width (ft)	Water Depth (in)	Channel Substrate	Velocity	Clarity
SY	3g	1	1	2	Silt, Sand, Gravel	Slow	Clear
SZ	3g	0.5	2	1	Silt, Sand, Gravel, Cobble	Slow	Clear
SAA	3g	0.5	2	6	Silt, Sand, Gravel	Slow	Clear
SBB	3g	1	1	3	Silt, Sand, Gravel	Moderate	Clear
SCC	3g	2	2	3	Silt, Gravel, Cobble	Moderate	Clear
SDD	3g	3	3	1	Silt, Sand, Gravel, Cobble	Moderate	Clear
SEE	3g	3	4	1	Silt, Sand, Gravel, Cobble	Slow	Slightly Turbid
SFF	3h	2	3	3	Silt, Sand	Moderate	Clear
Reems Creek/ SGG	3h	5	40	6	Silt, Sand, Gravel, Cobble, Boulder	Moderate	Clear
SHH	3h	1	3	4	Silt, Sand, Gravel	Moderate	Slightly Turbid
SII	3i	2	3	3	Silt, Sand	Slow	Slightly Turbid
Wagner Branch/ SJJ	3i	5	8	3	Silt, Sand	Slow	Clear
SKK	3i	3	6	2	Silt, Gravel, Cobble	Slow	Clear
SLL	3i/3j	4	8	3	Silt, Sand, Gravel, Cobble	Moderate	Clear
SMM	3j	0.5	1	1	Silt	Slow	Slightly Turbid
SNN	3k	4	8	4	Silt, Sand, Gravel, Cobble	Slow	Slightly Turbid
SOO	3k	1	4	2	Silt, Sand, Gravel, Cobble	Moderate	Clear
SPP	3k/3l	2	8	4	Silt, Sand, Cobble, Gravel, Bedrock	Slow	Clear
SQQ	3k	0.5	1	2	Silt, Sand, Gravel	Moderate	Clear
SRR	3k/3m	1	3	3	Silt, Sand, Gravel	Moderate	Clear
SSS	2l	0.5	2	2	Silt, Sand, Gravel	Slow	Clear
STT	3l	-	-	24+	Silt (impounded stream)	Moderate	Turbid
SUU	3l	0.5	1	1	Culvert	Slow	Clear
Beaverdam Creek/ SVV	3l	4	40	12	Silt, Sand, Gravel, Cobble, Boulder, Bedrock	Slow	Clear
SWW	3l	1	2	1	Silt, Sand, Gravel	Moderate	Clear
SXX	3m	2	3	1	Silt, Sand, Gravel	Slow	Clear
SYY	3m	1	1	1	Silt, Sand, Gravel	Slow	Clear

Stream Name/ Map ID	Figure #	Bank Height (ft)	Bank Width (ft)	Water Depth (in)	Channel Substrate	Velocity	Clarity
SZZ	3n	2	3	3	Silt, Sand, Gravel	Slow	Clear
Reed Creek/ SAAA	3n	1	20	6	Silt, Sand, Gravel, Cobble	Fast	Clear
SBBB	3n	1	1	1	Silt, Sand, Gravel, Cobble, Boulder, Bedrock	Moderate	Clear
SCCC	3m	1	10	6	Silt, Sand, Gravel	Slow	Clear
SDDD	3e	2	4	3	Silt, Sand, Gravel, Bedrock	Moderate	Clear
SEEE	3e	1	1	1	Silt, Sand	Slow	Turbid

Three ponds were located in the study area totaling approximately 0.37 acre: P1 (0.20 acre), P2 (0.15 acre), and P3 (0.02 acre) (Appendix A, Figures 3b, 3d, and 3l, respectively). P1 is an impoundment of the perennial stream SQ (Flat Creek), and P2 is an impoundment of the perennial stream STT. P3 consists of an excavated pit sustained by high groundwater and surface run off. The outlet of P3 drains through a channelized ditch to SC.

There are no designated anadromous fish waters or Primary Nursery Areas (PNA) present in the study area. No streams within the study area are designated as trout water by the North Carolina Wildlife Resources Commission (NCWRC). The northern portion of the study area, which drains to Gentry Branch is classified as High Quality Waters (HQW) and a WS-II water supply watershed. No streams within the study area are included in the *North Carolina 2014 Final 303(d) List of Impaired Waters* due to sedimentation or turbidity.

Benthic samples have been taken at the French Broad River at SR 1348 and given a rating of “Good-Fair” in 2007. No fish monitoring data are available for the study area.

## 4.0 BIOTIC RESOURCES

### 4.1 Terrestrial Communities

Five terrestrial communities were identified in the study area: maintained/disturbed, montane oak-hickory forest, montane alluvial forest, rich cove forest, and piedmont/mountain semi-permanent impoundment. Figures 4a through 4n show the location and extent of these terrestrial communities in the study area. A brief description of each community type follows. Scientific names of all species identified are included in Appendix B.

#### 4.1.1 Maintained/Disturbed

This community incorporates several land cover types, including residential, commercial, industrial, pasture areas, and cleared/maintained transportation corridors. The majority of the study area is designated maintained/disturbed land, which includes US 19/23 and surrounding development. Plant communities in residential areas often contain relict species, usually canopy

bellied woodpecker, downy woodpecker, northern mockingbird\*, European starling, Carolina wren\*, song sparrow\*, common crow\*, turkey vulture\*, mourning dove\*, red-tailed hawk\*, and tufted titmouse\*. Reptile and amphibian species that may use terrestrial communities located in the study area include the American toad, common snapping turtle\*, copperhead, eastern box turtle\*, eastern fence lizard, five-lined skink\*, marbled salamander, rat snake, spotted salamander, timber rattlesnake, and wood frog.

**4.3 Aquatic Communities**

Aquatic communities in the study area consist of both perennial and intermittent mountain streams as well as impounded ponds. Smaller fish species expected to occur in the larger streams such as Flat Creek, Little Flat Creek, Reems Creek, Beaverdam Creek, and Reed Creek include northern hogsucker, redbreast sunfish, fantail darter, redline darter, creek chub, river chub, bluehead chub, Tennessee shiner, and warpaint shiner. Intermittent streams in the study area are relatively small in size and would support aquatic communities of spring peeper and various benthic macroinvertebrates. Ponds within the study area could provide habitat to support muskrat, beaver\*, mink, raccoon\*, great blue heron\*, snapping turtle\*, yellow-bellied slider, northern water snake, queen snake, bullfrog, and green frog\*.

**4.4 Invasive Species**

Fifteen species from the NCDOT Invasive Exotic Plant List for North Carolina were found to occur in the study area. The species identified were tree-of-heaven (Threat), garlic mustard (Threat), Oriental bittersweet (Threat), ground ivy (Moderate Threat), English ivy (Moderate Threat), sericea (Threat), Chinese privet (Threat), Japanese honeysuckle (Moderate Threat), Japanese stilt grass (Threat), Princess tree (Threat), golden bamboo (Moderate Threat), kudzu (Threat), multiflora rose (Threat), Johnson grass (Moderate Threat), and Chinese wisteria (Moderate Threat). NCDOT will manage invasive plant species associated with the project as appropriate.

**5.0 JURISDICTIONAL ISSUES**

**5.1 Clean Water Act Waters of the U.S**

Fifty-seven jurisdictional streams were identified in the study area (Table 5). The locations of these streams are shown on (Appendix A). USACE and NCDWR stream delineation forms are included in Appendix C. All of the jurisdictional streams in the study area have been designated as cool water streams for the purposes of stream mitigation.

**Table 5. Jurisdictional characteristics of water resources in the study area**

Map ID/ Stream Name	Length (ft.)	Classification	Compensatory Mitigation Required	River Basin Buffer
SA/ Gentry Branch	2,017	Perennial	Yes	Not Subject

<b>Map ID/ Stream Name</b>	<b>Length (ft.)</b>	<b>Classification</b>	<b>Compensatory Mitigation Required</b>	<b>River Basin Buffer</b>
SB	132	Perennial	Yes	Not Subject
SC	966	Perennial	Yes	Not Subject
SD	258	Perennial	Yes	Not Subject
SE/ Blackstock Branch	1,041	Perennial	Yes	Not Subject
SF	130	Perennial	Yes	Not Subject
SG	25	Intermittent	Yes	Not Subject
SH	112	Intermittent	Yes	Not Subject
SI	717	Perennial	Yes	Not Subject
SJ	431	Perennial	Yes	Not Subject
SK	163	Intermittent	Yes	Not Subject
	68	Perennial	Yes	Not Subject
SL/ Stanley Branch	386	Perennial	Yes	Not Subject
SM	6	Perennial	Yes	Not Subject
	159	Intermittent	Yes	Not Subject
SN	96	Intermittent	Yes	Not Subject
SO/ Dick Branch	264	Perennial	Yes	Not Subject
SP	306	Intermittent	Yes	Not Subject
SQ/ Flat Creek	6,434	Perennial	Yes	Not Subject
SR	724	Perennial	Yes	Not Subject
SS	570	Perennial	Yes	Not Subject
ST/ Little Flat Creek	414	Perennial	Yes	Not Subject
SU	937	Perennial	Yes	Not Subject
SV	94	Intermittent	Yes	Not Subject
SW	1,062	Perennial	Yes	Not Subject
SX/ Gill Branch	2,308	Perennial	Yes	Not Subject
SY	117	Intermittent	Yes	Not Subject
SZ	185	Intermittent	Yes	Not Subject
SAA	260	Perennial	Yes	Not Subject
SBB	106	Perennial	Yes	Not Subject
SCC	250	Perennial	Yes	Not Subject
SDD	221	Perennial	Yes	Not Subject
SEE	229	Perennial	Yes	Not Subject
SFF	1,037	Perennial	Yes	Not Subject
	103	Intermittent	Yes	Not Subject
SGG/ Reems Creek	935	Perennial	Yes	Not Subject
SHH	1,721	Perennial	Yes	Not Subject
SII	228	Perennial	Yes	Not Subject

Map ID/ Stream Name	Length (ft.)	Classification	Compensatory Mitigation Required	River Basin Buffer
SJJ/ Wagner Branch	583	Perennial	Yes	Not Subject
SKK	1,197	Perennial	Yes	Not Subject
SLL	1,501	Perennial	Yes	Not Subject
	96	Intermittent	Yes	Not Subject
SMM	47	Intermittent	Yes	Not Subject
SNN	408	Perennial	Yes	Not Subject
SOO	305	Perennial	Yes	Not Subject
SPP	2,311	Perennial	Yes	Not Subject
SQQ	178	Perennial	Yes	Not Subject
SRR	24	Perennial	Yes	Not Subject
SSS	230	Intermittent	Yes	Not Subject
STT	224	Perennial	Yes	Not Subject
SUU	40	Perennial	Yes	Not Subject
SVV/ Beaverdam Creek	1,326	Perennial	Yes	Not Subject
SWW	951	Perennial	Yes	Not Subject
SXX	190	Intermittent	Yes	Not Subject
SY Y	55	Perennial	Yes	Not Subject
SZZ	228	Perennial	Yes	Not Subject
SAAA/ Reed Creek	1,746	Perennial	Yes	Not Subject
SBBB	257	Perennial	Yes	Not Subject
SCCC	80	Perennial	Yes	Not Subject
SDDD	154	Perennial	Yes	Not Subject
SEEE	20	Perennial	Yes	Not Subject

Fourteen jurisdictional wetlands were identified within the study area. The locations of these wetlands are shown on Figures 3a through 3n (Appendix A). Wetland classification and quality rating data are presented in Table 6. All wetlands in the study area are within the French Broad river basin (USGS Hydrologic Unit 06010105).

USACE wetland delineation forms and NCDWQ wetland rating forms for each wetland are included in Appendix C. Descriptions of the terrestrial communities at each wetland site are presented in Section 4.1 and Table 6.

**Table 6. Jurisdictional characteristics of wetlands in the study area**

Map ID	Figure #	NCWAM Classification	Hydrologic Classification	NCDWQ Wetland Rating	Area (ac.)
WA	3b	Headwater Forest	Riparian	56	0.18
WB	3b/3c3	Non-Tidal Freshwater Marsh	Riparian	52	0.09
WC	3b2/3c	Non-Tidal Freshwater Marsh	Riparian	47	0.10
WD	3c	Headwater Forest	Riparian	56	0.20
WE	3d	Headwater Forest	Riparian	56	0.08
WF	3d	Basin Wetland	Non-riparian	25	0.06
WG	3g	Non-Tidal Freshwater Marsh	Riparian	52	0.29
WH	3h	Headwater Forest	Riparian	47	0.15
WI	3h	Basin Wetland	Non-riparian	30	0.06
WJ	3j	Headwater Forest	Riparian	52	0.14
WK	3j	Headwater Forest	Riparian	52	0.06
WL	3j	Non-Tidal Freshwater Marsh	Riparian	50	0.06
WM	3k	Non-Tidal Freshwater Marsh	Non-riparian	12	0.01
WN	3l	Headwater Forest	Riparian	52	0.58
				<b>Total</b>	<b>2.06</b>

**5.2 Clean Water Act Permits**

An Section 404 Individual Permit will likely be applicable due to the quantity of stream and wetland impacts anticipated for this project. The USACE holds the final discretion as to what permit will be required to authorize project construction. If a Section 404 Individual Permit is required then a Section 401 Individual Water Quality Certification (WQC) from the NCDWR will also be needed.

**5.3 Coastal Area Management Act Areas of Environmental Concern**

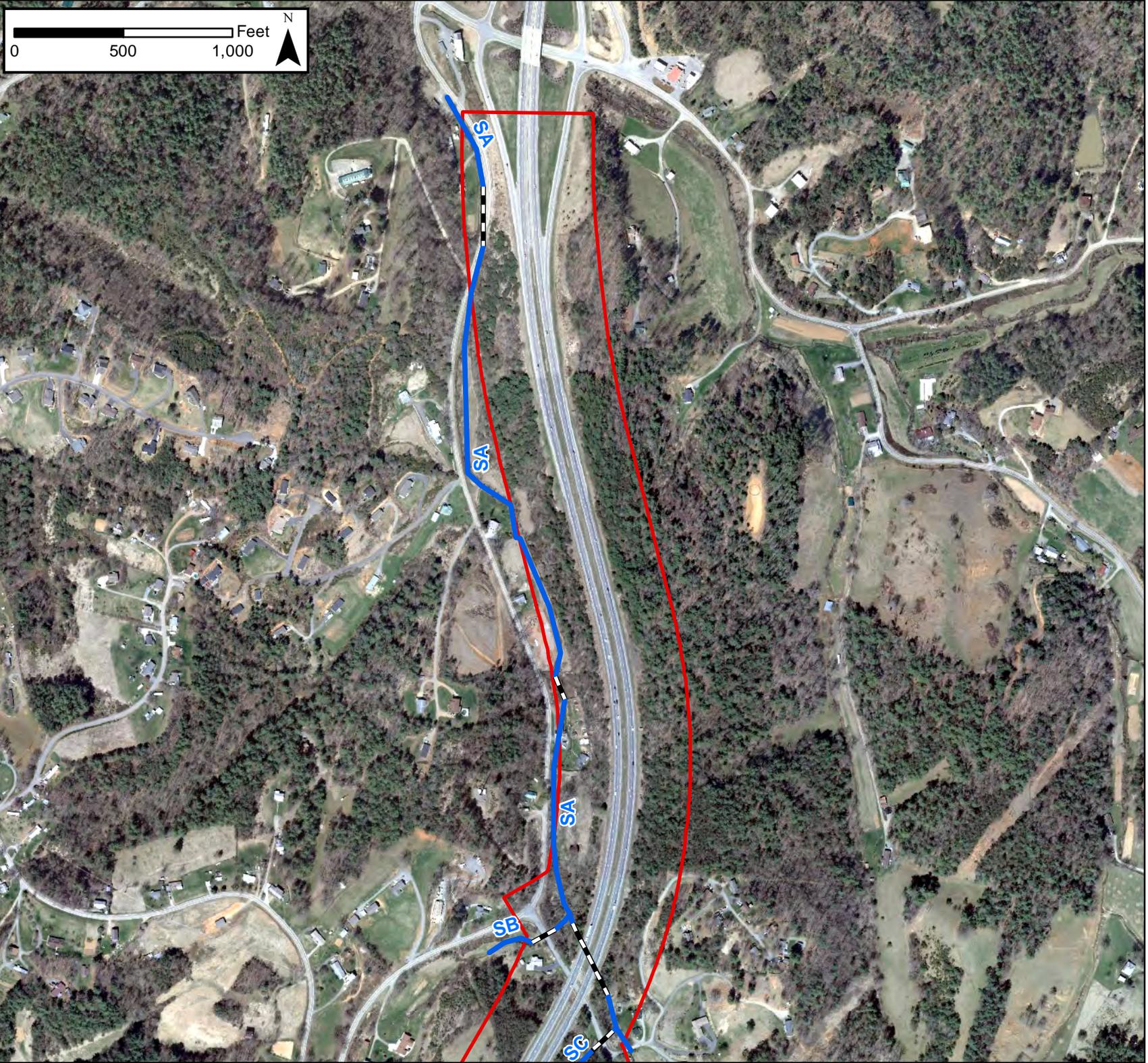
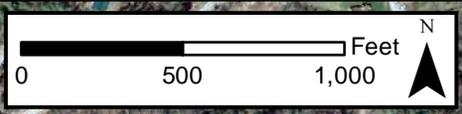
There are no Areas of Environmental Concern (AEC) in the study area that fall under the jurisdiction of the Coastal Area Management Act (CAMA).

**5.4 Construction Moratoria**

No trout or other construction moratoria will apply to any streams or waters in the study area. Confirmation from the NCWRC that no construction moratorium is required is pending. Information will be added upon receipt.

**Figure 3:**  
**Jurisdictional Features Map**





**US 19/23  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

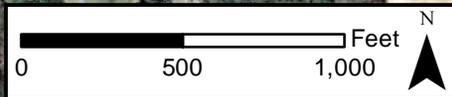
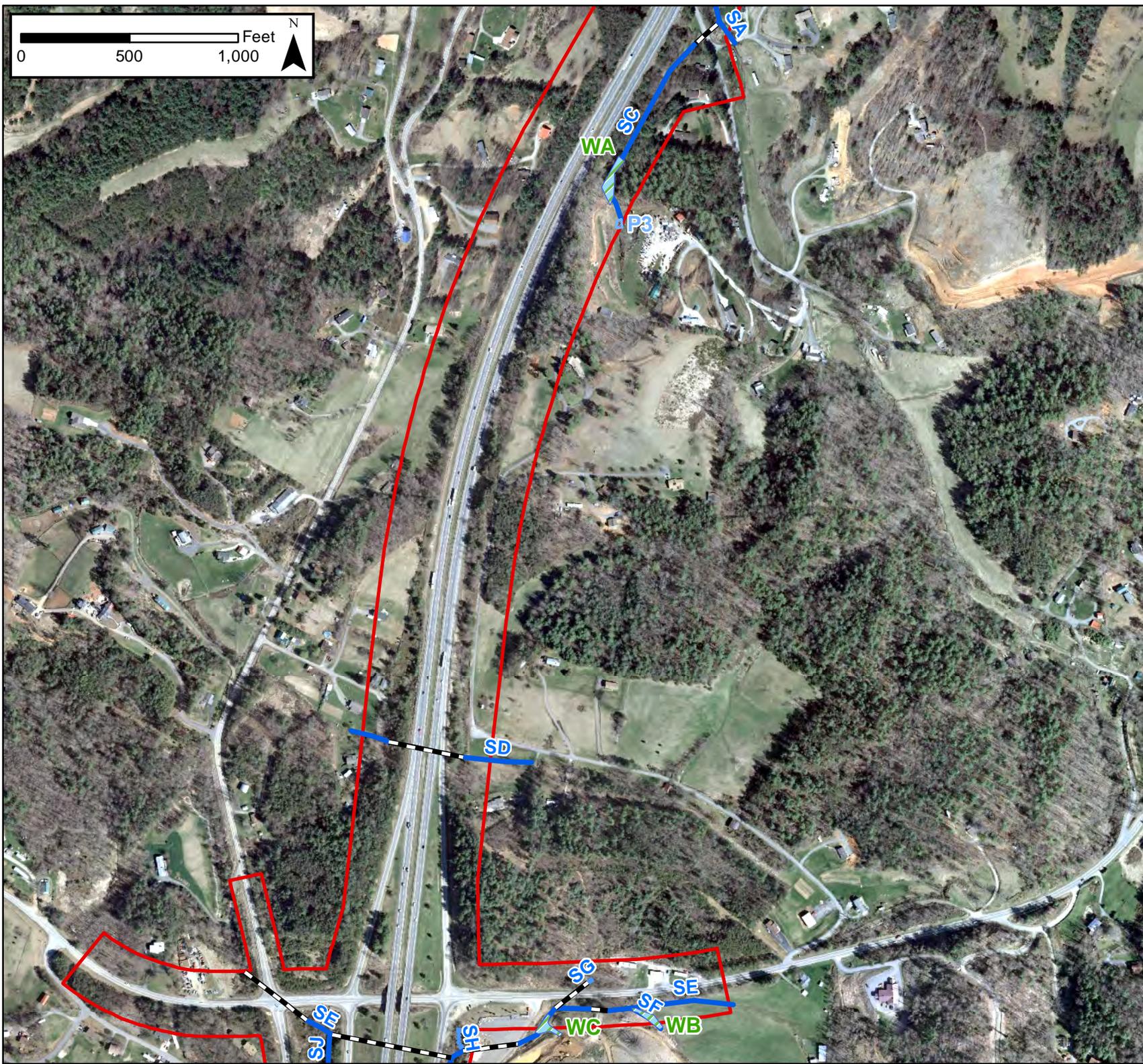


**COUNTIES**  
 Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 3a  
Jurisdictional Features**

November 2015  
 NAD83 UTM 17N  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
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- Culvert

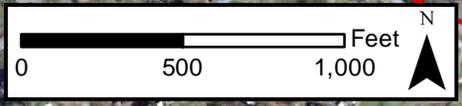
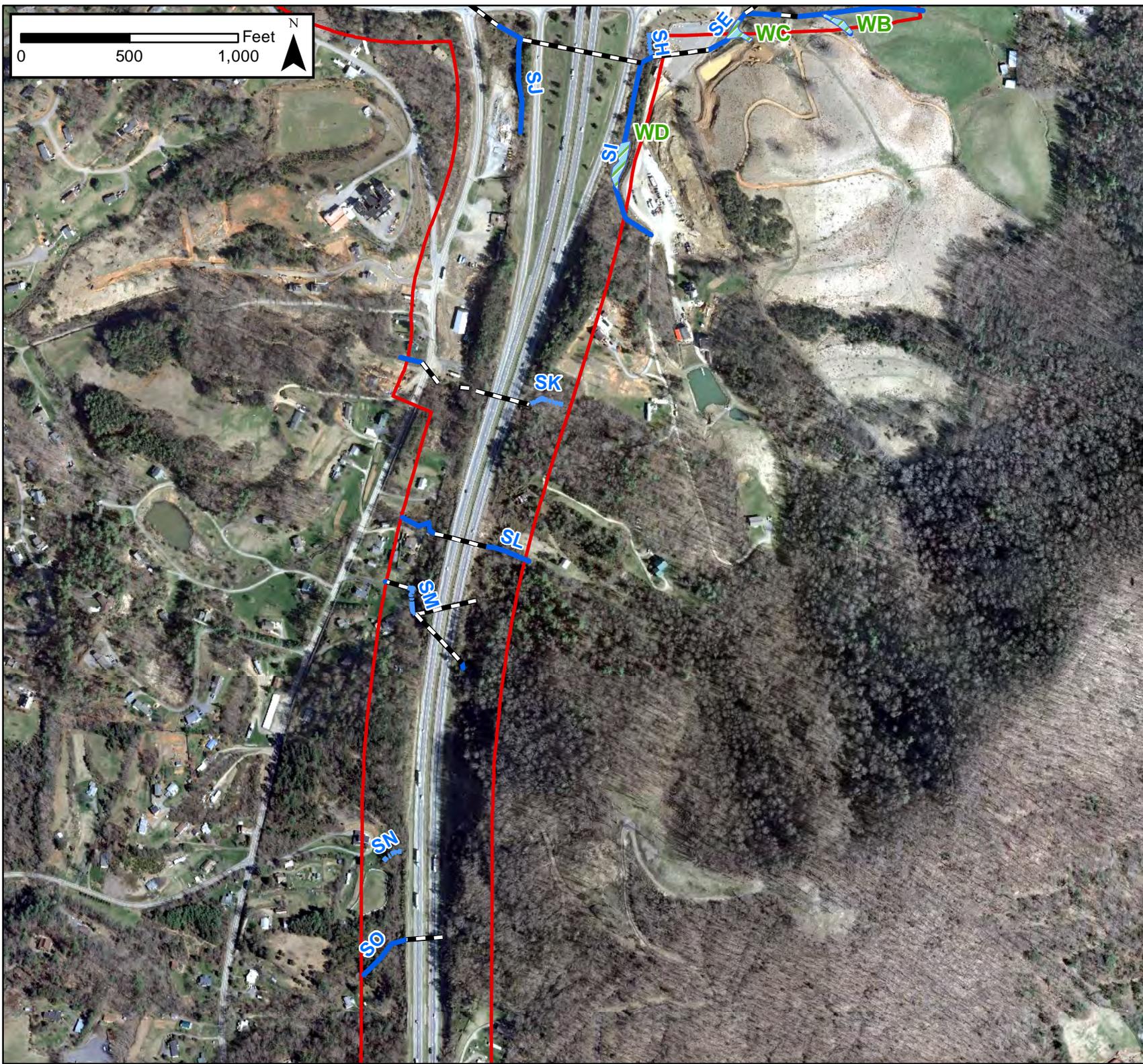


**COUNTIES**  
Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 3b  
Jurisdictional Features**

November 2015  
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Improvements  
STIP No. A-0010A**

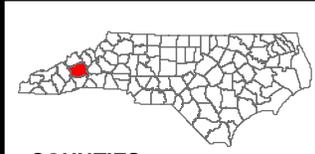


**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

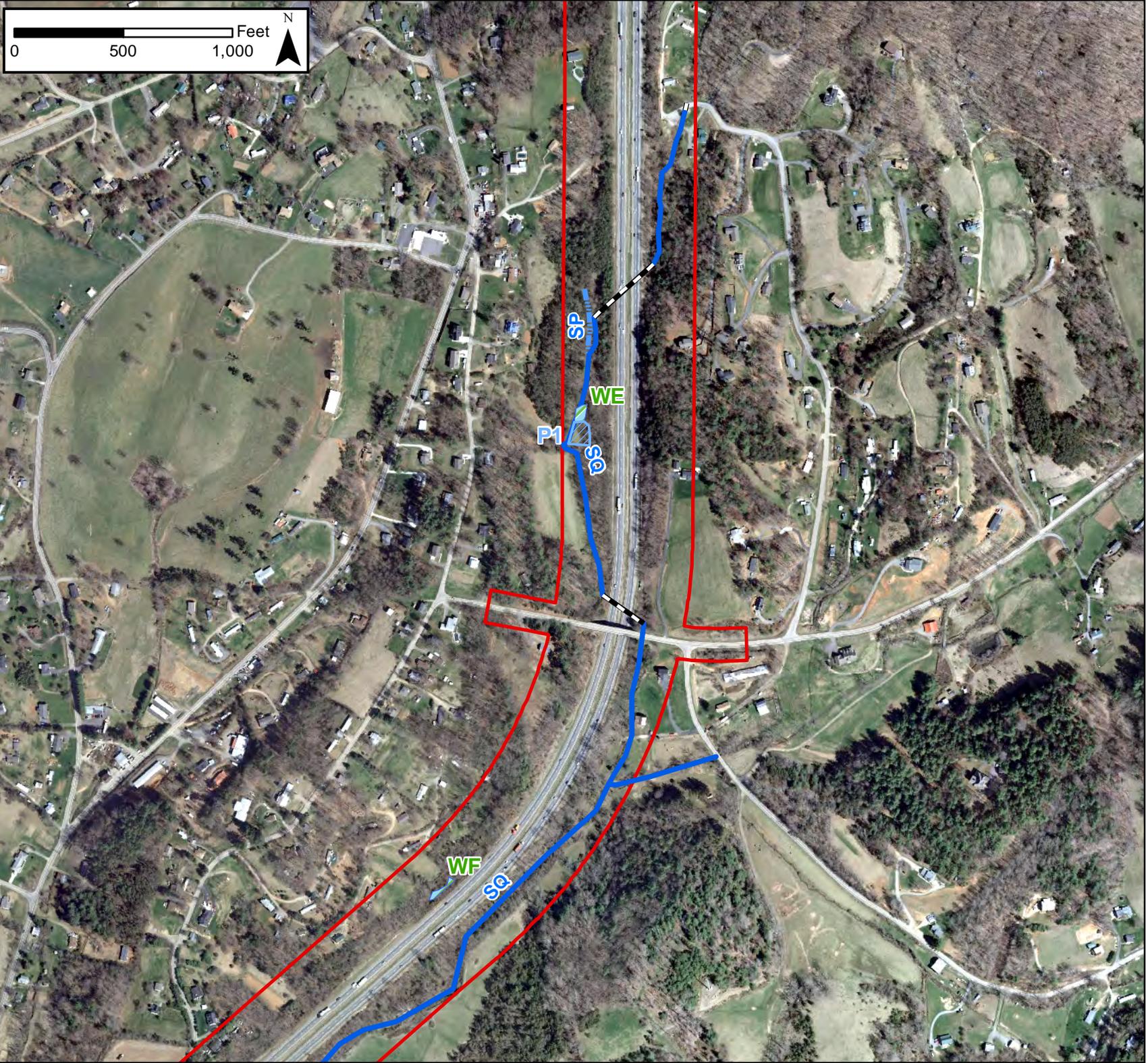
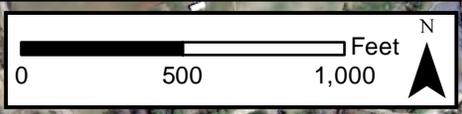


**COUNTIES**  
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**Upper French Broad  
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**Figure 3c  
Jurisdictional Features**

November 2015  
 NAD83 UTM 17N  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

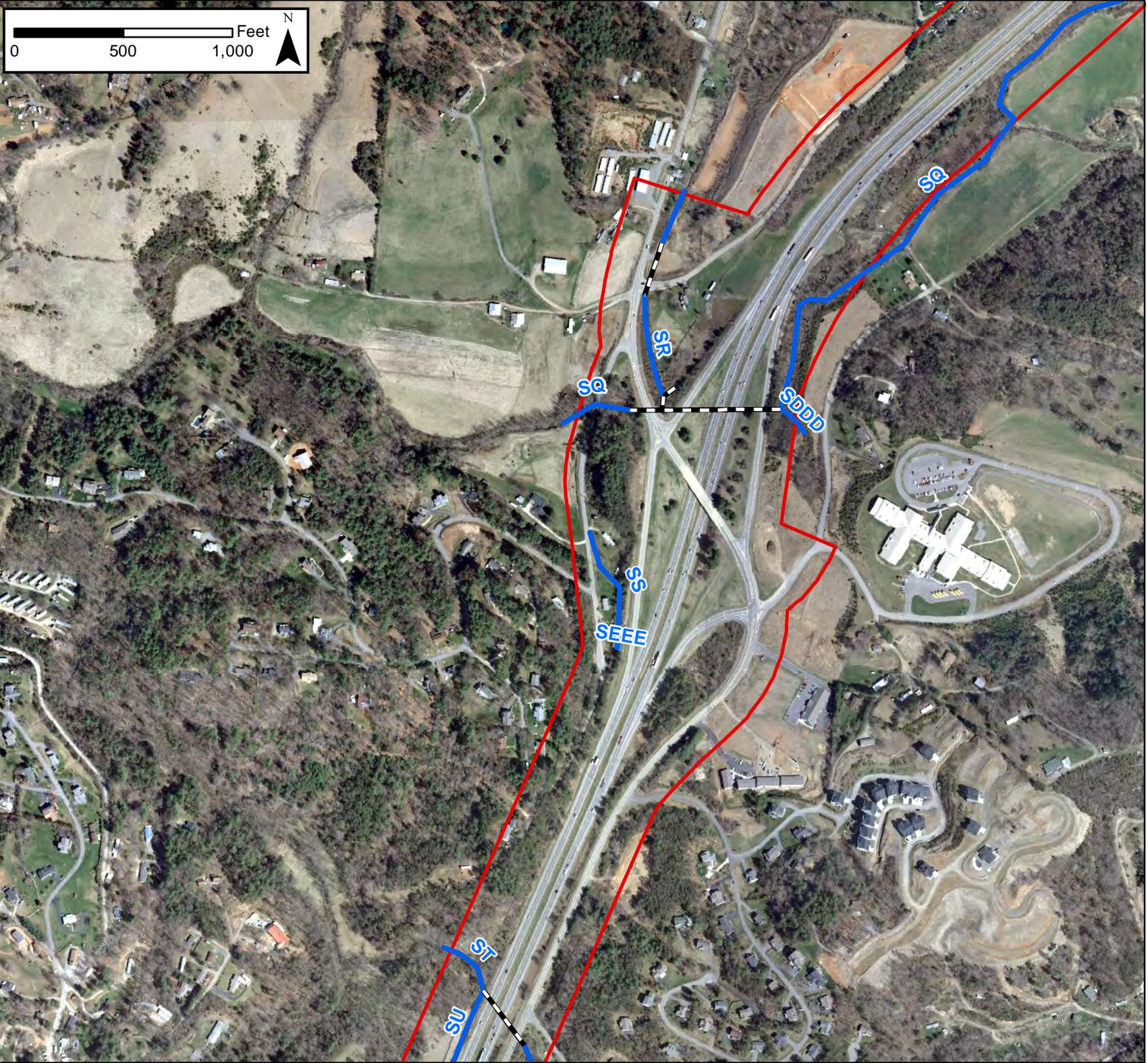


**COUNTIES**  
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**Figure 3d  
Jurisdictional Features**

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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

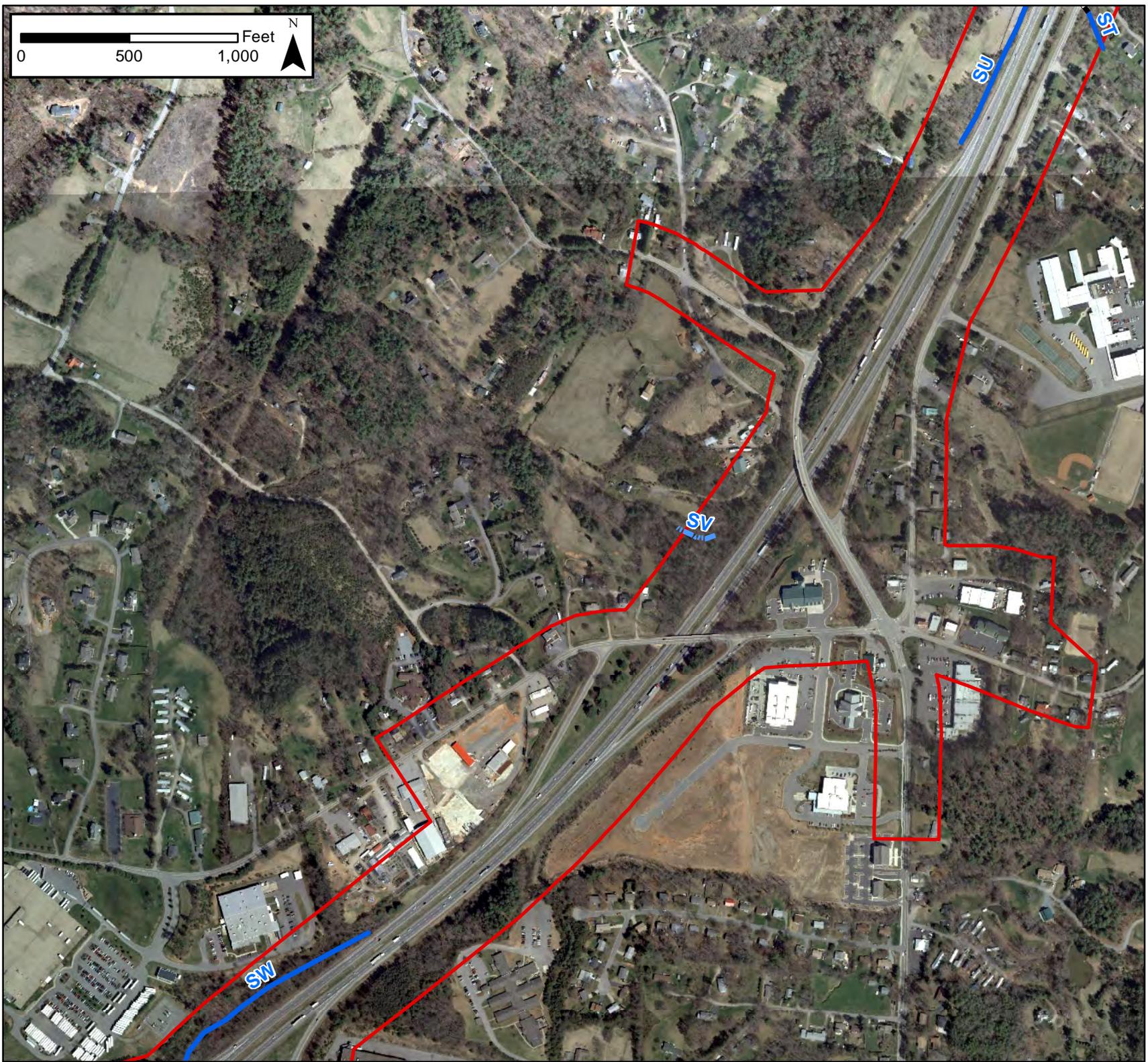
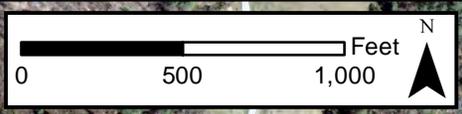


**COUNTIES**  
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**Upper French Broad  
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**Figure 3e  
Jurisdictional Features**

November 2015  
 NAD83 UTM 17N  
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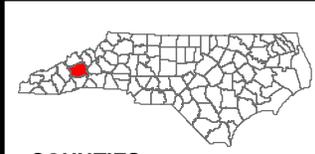


**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

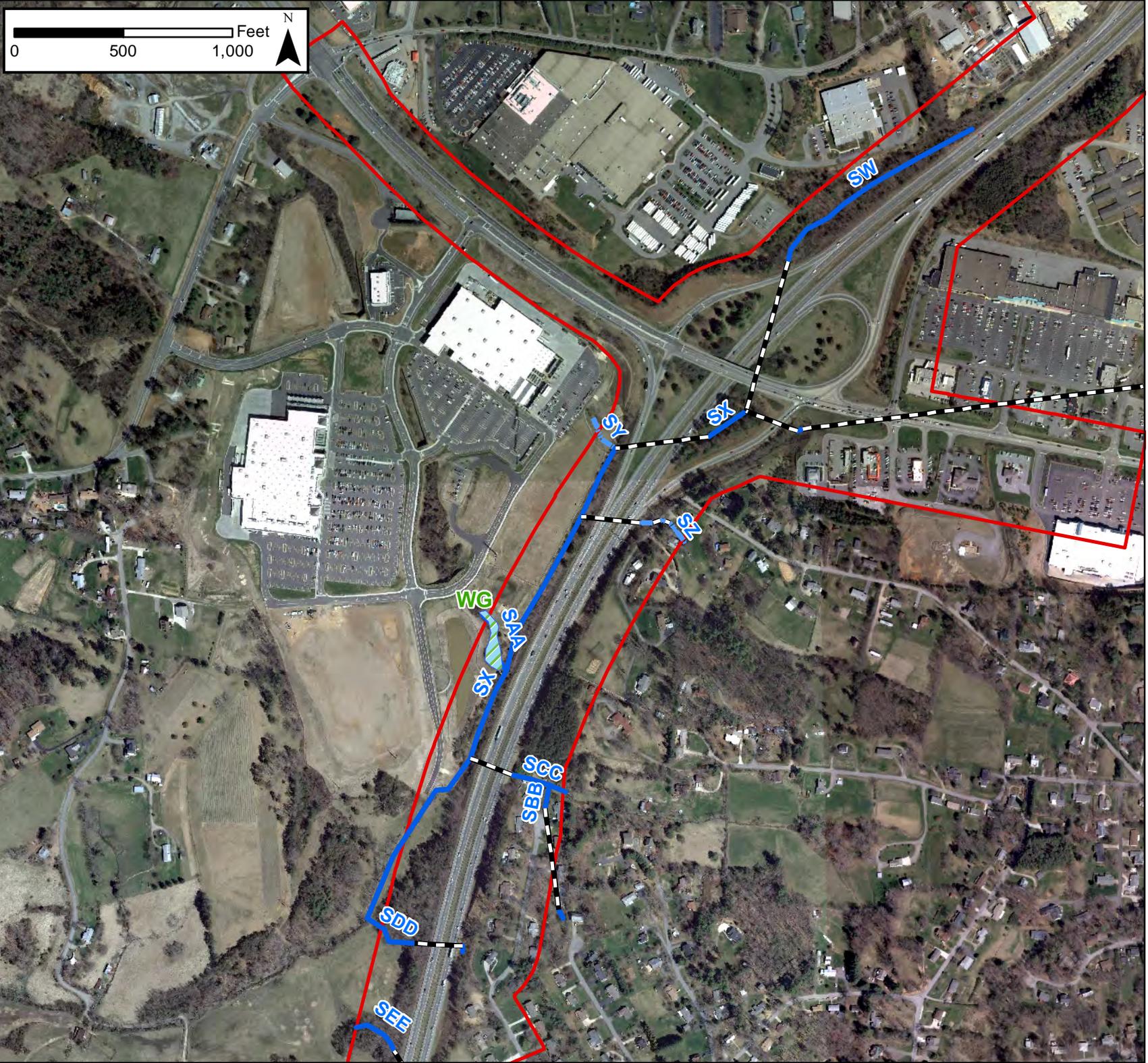


**COUNTIES**  
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**Upper French Broad  
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**Figure 3f  
Jurisdictional Features**

November 2015  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

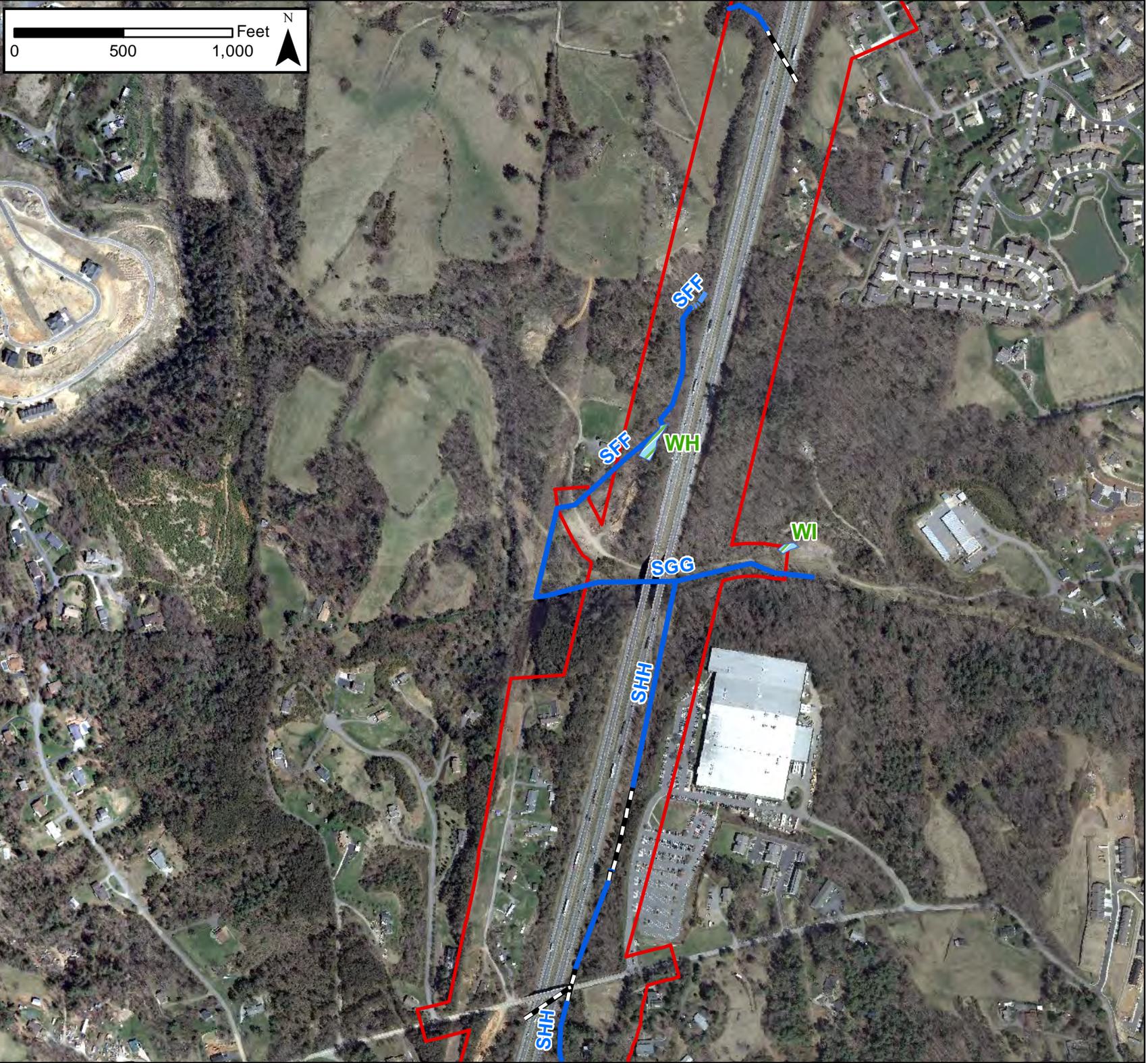
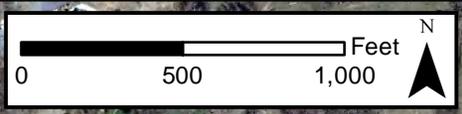


**COUNTIES**  
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**Upper French Broad  
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**Figure 3g  
Jurisdictional Features**

November 2015  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

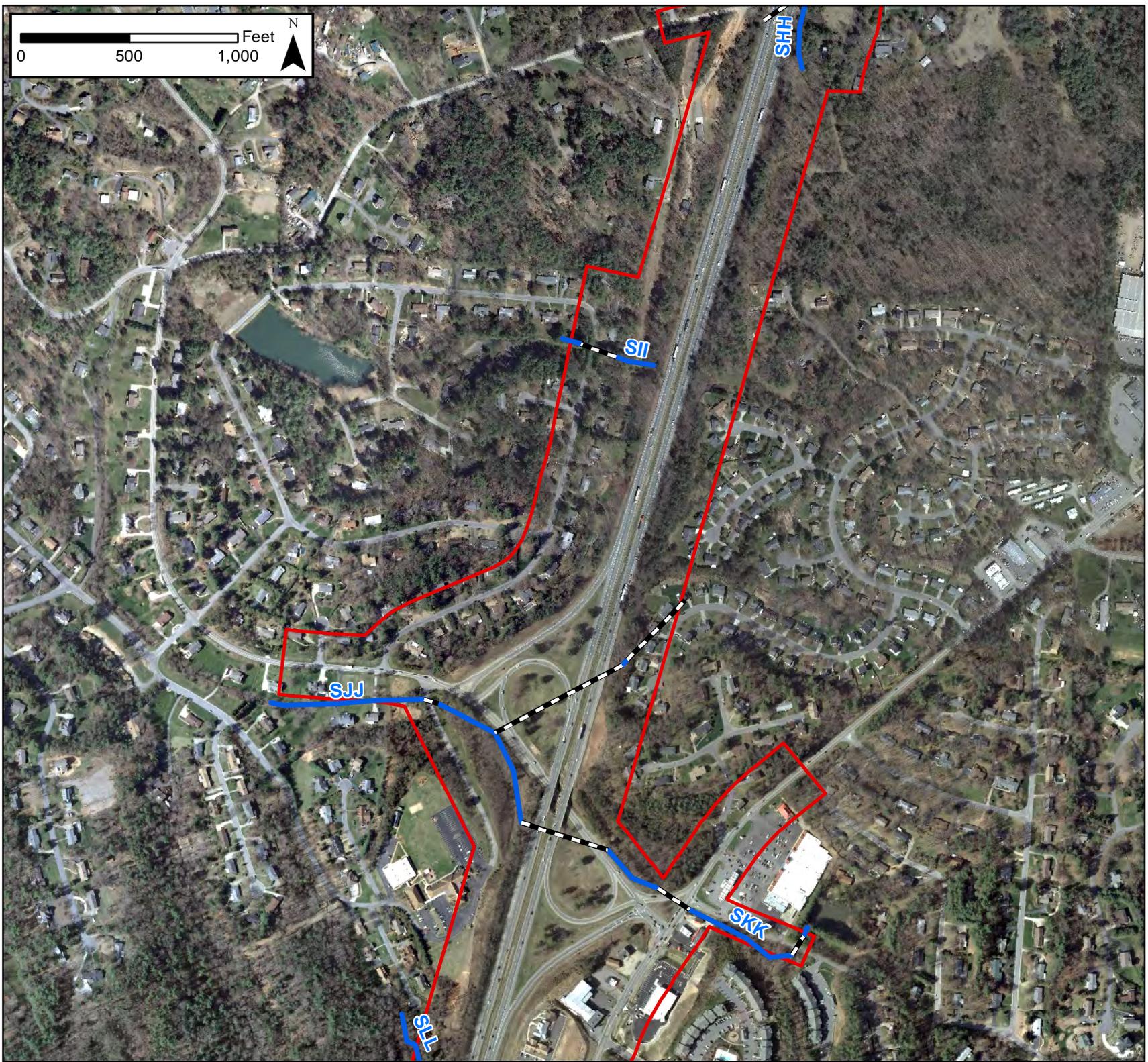


**COUNTIES**  
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**Upper French Broad  
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**Figure 3h  
Jurisdictional Features**

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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

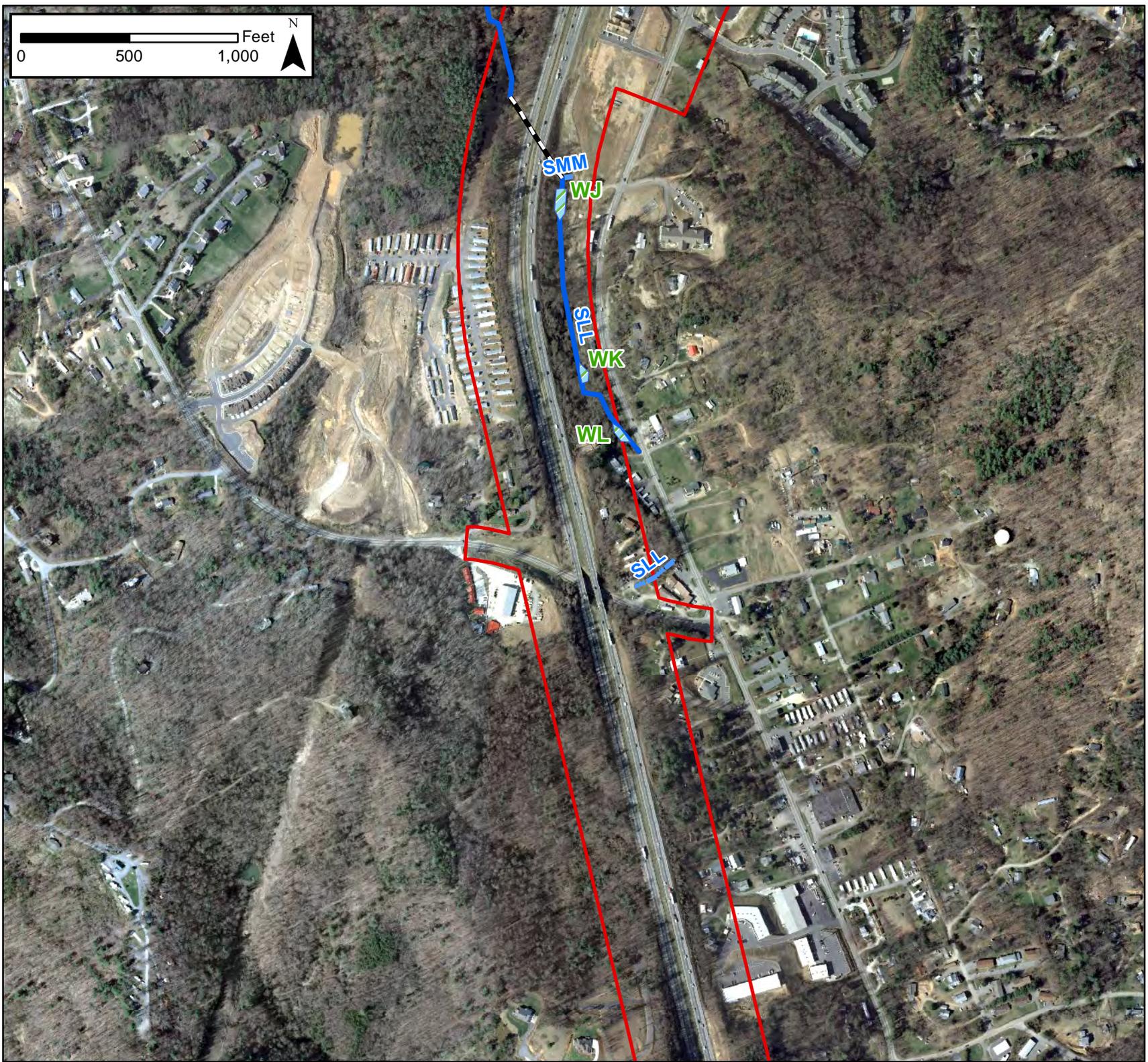
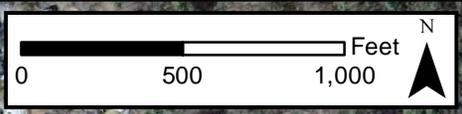


**COUNTIES**  
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**Upper French Broad  
HUC 06010105**

**Figure 3i  
Jurisdictional Features**

November 2015  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

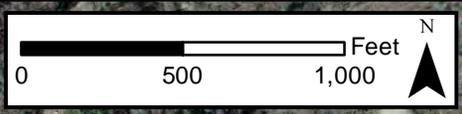


**COUNTIES**  
 Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 3j  
Jurisdictional Features**

November 2015  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

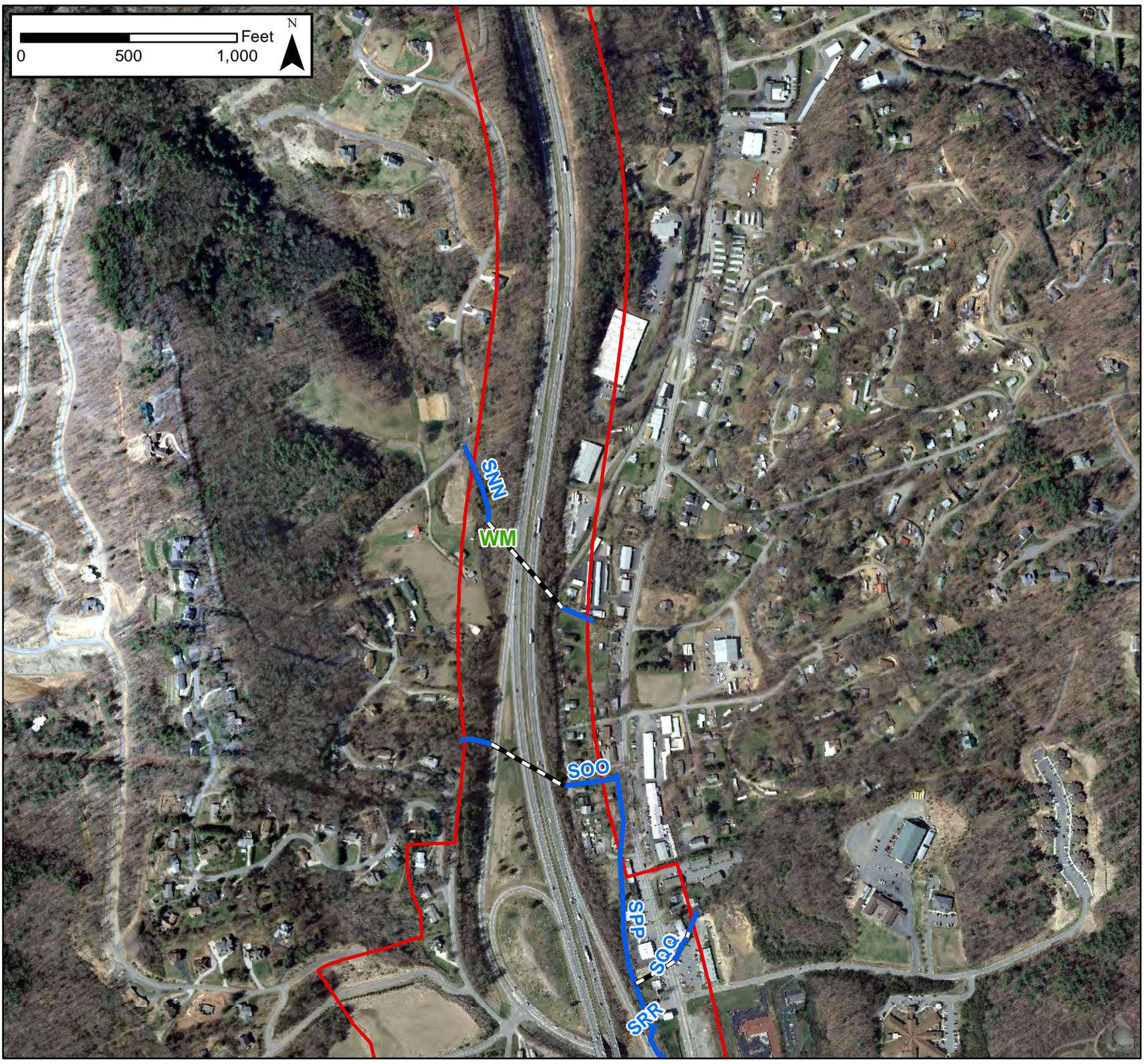


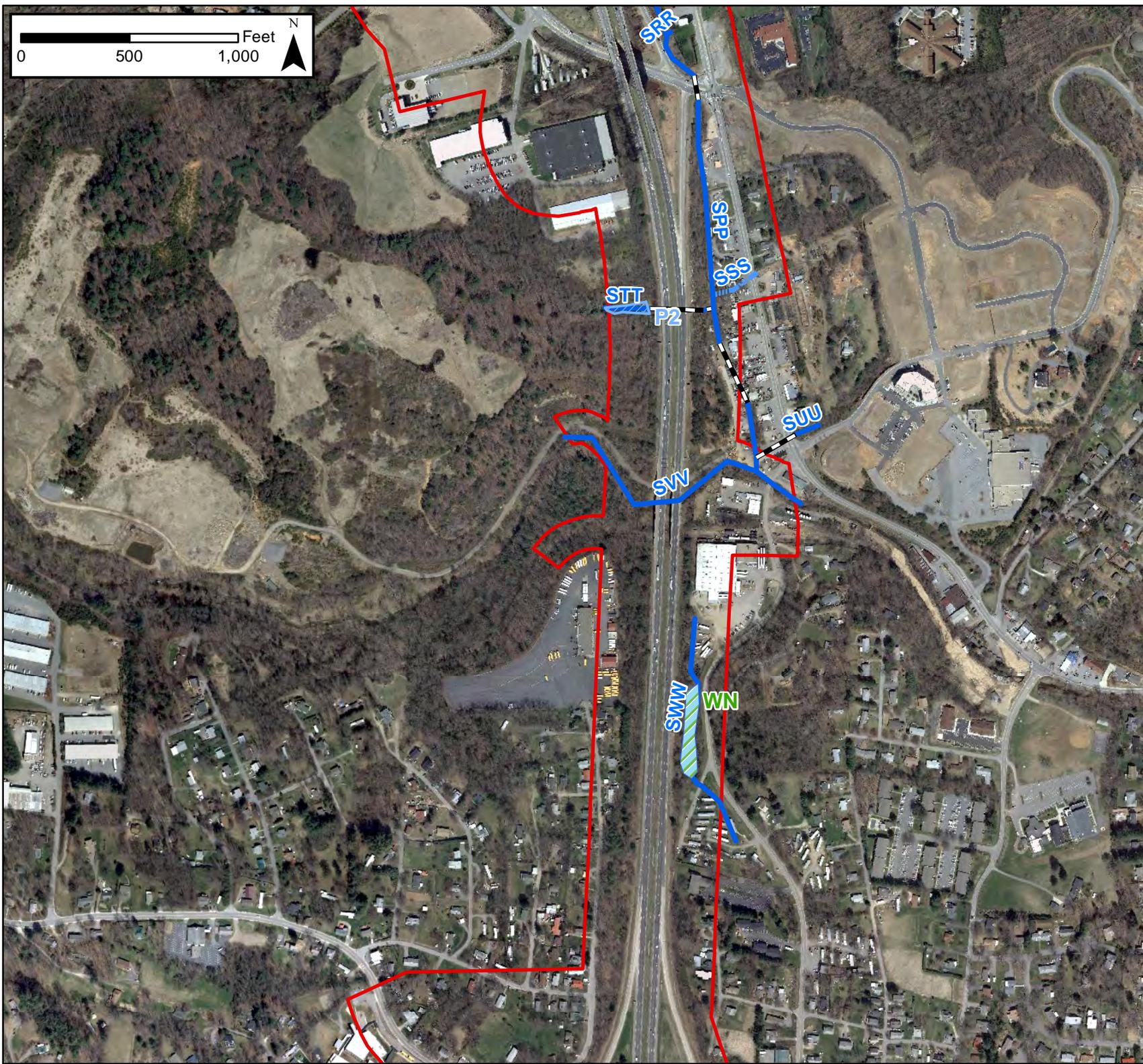
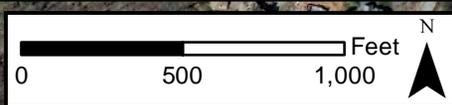
**COUNTIES**  
Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 3k  
Jurisdictional Features**

November 2015  
NAD83 UTM 17N  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

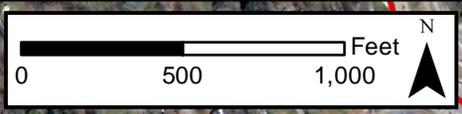


**COUNTIES**  
 Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 31  
Jurisdictional Features**

November 2015  
 NAD83 UTM 17N  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Intermittent
- Perennial
- Culvert

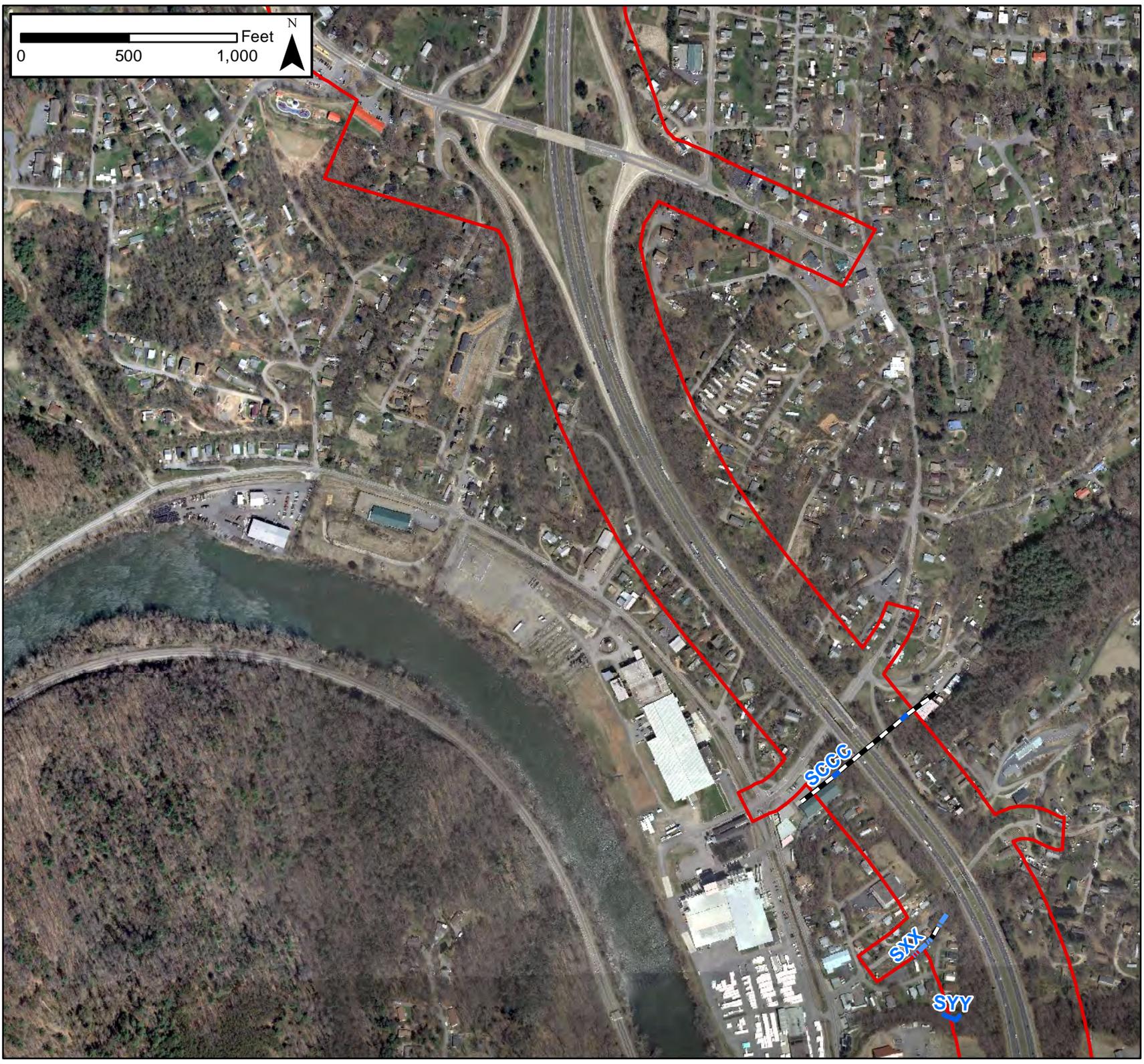


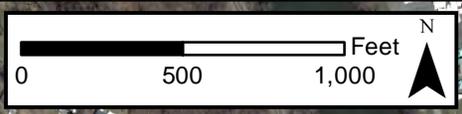
**COUNTIES**  
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**Upper French Broad  
HUC 06010105**

**Figure 3m  
Jurisdictional Features**

November 2015  
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(Future I-26)  
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**NC DOT**

**URS Project No. 31829457**

**Legend**

- Study area
- Ponds
- Wetlands
- Culvert
- Intermittent
- Perennial



**COUNTIES**  
 Buncombe

**Upper French Broad  
HUC 06010105**

**Figure 3n  
Jurisdictional Features**

November 2015  
 NAD83 UTM 17N  
 This map is for reference only.