



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

W. LYNDO TIPPETT  
SECRETARY

September 15, 2004

**MEMORANDUM TO:** Mr. Conrad Burrell, Member, Board of Transportation  
Mr. J. B. Setzer, P.E., Division Engineer, Division 14  
Mr. David King  
Mr. Calvin Leggett, P.E.  
Mr. Kevin Lacy, P.E. (3) Attention: Jim Dunlop, P.E.  
Mr. John Williamson  
Mr. Gregory J. Thorpe, Ph.D. (2)  
Ms. Deborah Barbour, P.E.  
Mr. Jay Bennett, P.E.  
Mr. Mike Bruff, P.E.  
Mr. A. L. Avant  
Mr. Van Argabright, P.E.  
Mr. Doug Lane  
Mr. Omar S. Sultan  
Mr. Art McMillan, P.E.

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**FROM:**

Ms. Nicole M. Hackler  
Feasibility Studies Unit

*Nicole M. Hackler*

**SUBJECT:**

Feasibility Study FS-0214A; Improvements to NC 107 from SR 1002 to  
NC 281, Jackson County.

Our staff has completed a feasibility study for the proposed project referenced above. This brief analysis suggests improvements that would be logical if the project were to be funded. A copy of the report is attached for your information.

NMH/nmh

Attachment

cc: Mr. Len Sanderson, P.E.

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# Feasibility Study

## Improvements to NC 107 From Just South of NC 281 to Just North of SR 1002

### Jackson County

Division 14  
FS-0214A *R-4753*



Feasibility Studies Unit  
Program Development Branch  
N.C. Department of Transportation

Documentation Prepared by Stantec Consulting Services Inc.

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9/10/2004

Date

Improvements to NC 107  
From Just South of NC 281 to Just North of SR 1002

Jackson County

FS-0214A

**I. General Description**

This feasibility study addresses the proposed improvements to NC 107 from just south of NC 281 to just north of SR 1002 in Jackson County. The current cross section of this existing 4.1 mile segment includes two 10-foot lanes with paved shoulders that vary from zero to four feet in width. Exhibit 1 shows the study segment of NC 107 which is bounded by the Tuckasegee River on its left side and by steep slopes, characteristic of Jackson County's mountainous terrain, on its right side.

The slopes and river create a very constrained corridor which limits the extent to which improvements can be made. The level of development is low-density and the existing and projected traffic volumes are, for the most part, within the capacity of a two-lane road. Therefore, the improvements discussed in this report are intended to increase safety and capacity by improving; lane and shoulder widths, intersections, and the alignments of specific segments where possible. The majority of the project is considered to be a 3-R (Resurfacing, Restoration, and Rehabilitation) improvement.

This study is the initial step in the planning and design process for this project and is not the product of exhaustive environmental or design investigations. The purpose of this study is to describe the proposed project, including costs, and to identify potential problems that may require consideration in the planning and design phases.

**II. Need for Project**

The purpose of the project is to increase the safety and traffic capacity along the previously described segment of NC 107, which is designated as a minor arterial in the North Carolina Statewide Functional Classification System. The study section is currently a two-lane shoulder facility with five unsignalized intersections and several residential and commercial driveway entrances. The existing right-of-way is estimated to be approximately 60 feet with no access control.

The existing alignment includes several sharp curves. This alignment, combined with the terrain and the lack of exclusive storage for turning vehicles at intersections, yields an operating speed along most of the study section that is well below the posted 45 mph speed limit.

The unsignalized intersections along NC 107 include: NC 281, Moody Bridge Road (SR 1172), Caney Fork Road (SR 1737), Helen Zachary Road (SR 1735), and Cullowhee Road (SR 1002).

Land use along the corridor is composed of some sparse residential and commercial development mixed with several large agricultural tracts. There is one structure, known locally as the Dr. John Brinkley House (Brinkley House), which appears to have local significance. Dr. Brinkley was an individual of local historic importance, and a historic marker located along NC 107 bears his name and describes his accomplishments. Although the house is not listed

on the National Register of Historic Properties, the recommended improvements avoid impacting the associated property to the extent possible.

There are no railroad crossings or existing bicycle or pedestrian facilities along this section of NC 107. There is one existing bridge (Bridge No. 52) over Caney Fork Creek. Bridge No. 52 was built in 1990 and has a deck width of 44 feet. There is also one culvert along this section of NC 107. The culvert is a double barrel 6-foot x 6-foot reinforced concrete box culvert (RCBC) located about mid-way between NC 281 and SR 1172.

At its south end, this project ties into the proposed replacement of Bridge No. 39 (TIP No. B-3480) which crosses the East Fork of the Tuckasegee River. TIP B-3480 includes road widening and turn lanes at the NC 281/NC 107 intersection. Two other intersections will also be improved under the North Carolina Moving Ahead Program. They are located at NC 107/SR 1737 and NC 107/SR 1002, where southbound left turn lanes will be constructed at both locations. All aforementioned improvements are consistent with the recommended upgrades contained in this Feasibility Study. There are no other programmed improvements in the 2004-2010 TIP in the immediate vicinity of this project.

An accident analysis was conducted for the study section of NC 107 for the period of May 1, 2000 through April 30, 2003. The results for this three year period included 77 reported crashes consisting of no fatal crashes, 36 non-fatal injury crashes, and 41 property damage only crashes. The total crash rate for the studied section of roadway is 321.83 which is substantially higher than the 2000-2002 Statewide crash rate of 123.32 for two-lane rural NC Routes.

The predominant crash types were rear-end/slow/stop or collisions with fixed objects. The collision with fixed objects was by far the most frequent and is most likely indicative of inadequate pavement and shoulder width combined with the poor horizontal alignment. Many of the rear-end accidents occur at intersections, most likely due to sudden stops behind vehicles waiting to make a left turn. As traffic increases, higher accident rates can be expected to occur, unless shoulder widening and exclusive turn lanes at intersections are provided.

### **III. Traffic Operations**

The base year 2002 Average Daily Traffic (ADT) along the study section of NC 107 is estimated to be between 4,600 vehicles per day (vpd) and 7,200 vpd. For the design year 2025, the estimated traffic volumes will range from 9,800 vpd to 13,600 vpd. Truck traffic is estimated to make up five percent of daily traffic.

A traffic analysis was conducted for the study section of NC 107. The analysis was conducted for the year 2002 existing conditions, year 2025 No-Build conditions, and year 2025 Build scenario.

For the 2002 base conditions, the segment with the highest traffic volumes (the segment between SR 1002 and SR 1735) operates at a Level of Service (LOS) D. For the 2025 No Build scenario, this same segment is predicted to operate at LOS E. The improvements will provide wider travel lanes and shoulders to increase capacity. Although a design year 2025 LOS E is anticipated for the highest volume segment in the Build scenario, this segment is predicted to operate at a LOS D or better through the year 2024. All other segments along the facility are predicted to operate at a LOS D in 2025.

In addition to the proposed widening, an exclusive left turn lane is proposed at the intersection of SR 1172. This turn lane will allow a northbound left from NC 107 onto SR 1172, and will improve safety by allowing turning vehicles to wait outside the stream of through traffic. In later planning and design stages auxiliary right turn lanes may also need to be investigated for this project.

Signals would further improve the LOS at the intersections. However, the only movements experiencing low LOS are the minor street approaches which have relatively small volumes. Based on the traffic projections, it is not anticipated that approach volumes will warrant signals. As the projected traffic volumes mature, the Traffic Engineering and Safety Systems Branch will periodically evaluate the intersections to determine when and if signals are warranted.

#### IV. Alternatives

Two alternatives were developed for this project. Alternative A is comprised solely of improvements along the existing alignment consistent with 3-R guidelines, and is approximately 4.2 miles long. The base right of way for Alternative A is 100 feet, however factoring in slope stakes to allow for construction in this mountainous region, right of way varies up to a maximum of 215 feet (in Segment 8). Alternative A also shows right of way being held at the existing 60-foot width in Segments 2, 10 and 14. These areas are shown at the minimum right of way due to constraints either by the Tuckasegee River, historic locations, park property, newly widened segments, or a combination thereof. Please see the detailed descriptions below and the attached plans for further clarification.

Alternative B is the same as Alternative A with the exception of two segments, 4B and 7B. These two segments each involve new-location realignments to remove existing curves. The existing curves are extremely sharp and located at the base of the mountainside. Any realignment in these areas will require substantial earthwork, as well as variable right of way to allow for placement of slope stakes. The base right of way for Alternative B is 100 feet, however segments 4B and 7B require 480 feet and 460 feet of right of way, respectively, to allow for construction in this mountainous area. Please see the detailed descriptions below and the attached plans for further clarification. The length of this alternative is approximately 3.9 miles long.

Exhibit 2 shows the recommended typical cross-sections for the different segments. Exhibit 3 shows the alternatives and their segments. The alternatives are described below:

##### Alternative A

Alternative A involves 3-R improvements only and is composed of several segments that correspond to Exhibit 3. Because Alternative A utilizes the existing alignment, the existing operating speed of the facility will not change. Each of these segments is described below:

**Segment 1** – Segment 1 runs from the beginning of the project, approximately 600 feet south of NC 281, to approximately 200 feet south of the Brinkley House. This segment will be symmetrically widened to two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a southbound left turn lane is proposed at the NC 281 intersection.

**Segment 2** – Segment 2 is constrained by the stone wall in front of the Brinkley House on the right side and by the Tuckasegee River on the left side. In order to minimize impacts, asymmetrical widening to the left is recommended with a 600-foot long retaining wall on the river side. The widening will result in two 12-foot lanes with a 4-foot paved shoulder on the right

side and an 8-foot shoulder (4 feet of which shall be paved) on the left side. The existing right-of-way on the right side will be retained.

**Segment 3** – Segment 3 is similar to Segment 1 in that it involves symmetrical widening to a 24 foot section with 8-foot shoulders (4 feet of which shall be paved). Segment 3 will also include extension on both sides of an existing double barreled 6-foot x 6-foot RCBC.

**Segment 4A** – Segment 4A is proposed as asymmetrical widening to the right side to avoid impacts to the river. The existing right-of-way on the left side will be retained. This segment will result in two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved).

**Segments 5 and 6** – Segments 5 and 6 are symmetrical widening to a 24-foot section with 8-foot shoulders (4 feet of which shall be paved).

**Segments 7A and 8** – Segments 7A and 8 are proposed as asymmetrical widening to the right side to avoid impacts to the river. The existing right-of-way on the left side will be retained. These segments will result in two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a northbound left turn lane is proposed at the SR 1172 intersection.

**Segment 9** – Segment 9 will be symmetrically widened to two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a southbound left turn lane is proposed at the SR 1737 intersection.

**Segment 10** – Because it is constrained by a park and existing residential properties, Segment 10 only includes widening of the paved shoulder. The recommended improvements to this section are resurfacing and extension of the existing 2-foot paved shoulders to 4-foot paved shoulders. These improvements will be constructed within the existing right-of-way. NC 107 crosses existing Bridge No. 52 over Caney Fork Creek within this segment. Bridge No. 52 was built in 1990 with a deck width of 44 feet. As a result of its 2002 inspection, this bridge has sufficiency rating of 88, with an estimated 42 years of remaining life. There are no improvements to Bridge No. 52 proposed as part of this project.

**Segment 11** – Segment 11 involves symmetrical widening to a 24-foot section with 8-foot shoulders (4 feet of which shall be paved).

**Segment 12** – Segment 12 is proposed as asymmetrical widening to the right side to avoid impacts to the river. The existing right-of-way on the left side will be retained. This segment will result in two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved).

**Segment 13** – Segment 13 is proposed as asymmetrical widening to the left. The widening will result in two 12-foot lanes with a 4-foot paved shoulder on the right side and an 8-foot shoulder (4 feet of which shall be paved) on the left side.

**Segment 14** – Segment 14 already has sufficient pavement width (12-foot lanes with a 4-foot paved shoulder). Therefore, improvements to segment 14 are limited to resurfacing only.

**Segment 15** – The width of Segment 15 is currently sufficient with two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). However, this segment will be widened to accommodate the addition of a southbound left turn lane which is proposed at the SR 1002 intersection. The existing northbound right turn lane will be maintained.

## **Alternative B**

Alternative B involves 3-R improvements and new location realignments. The new-location segments (Segments 4B and 7B) remove existing curves and improve the design speed to 50 mph in those sections. The segments correspond to Exhibit 3. Each of these segments is described below:

**Segment 1** – Segment 1 runs from the beginning of the project, approximately 600 feet south of NC 281, to approximately 200 feet south of the Brinkley House. This segment will be symmetrically widened to two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a southbound left turn lane is proposed at the NC 281 intersection.

**Segment 2** – Segment 2 is constrained by the stone wall in front of the Brinkley House on the right side and by the Tuckasegee River on the left side. In order to minimize impacts, asymmetrical widening to the left is recommended with a 600-foot long retaining wall on the river side. The widening will result in two 12-foot lanes with a 4-foot paved shoulder on the right side and an 8-foot shoulder (4 feet of which shall be paved) on the left side. The existing right-of-way on the right side will be retained.

**Segment 3** – Segment 3 is similar to Segment 1 in that it involves symmetrical widening to a 24-foot section with 8-foot shoulders (4 feet of which shall be paved). Segment 3 will also include extension on both sides of an existing double barreled 6-foot x 6-foot RCBC.

**Segment 4B** – Segment 4B is proposed as a new-location realignment, with a 50 mph design speed, to the east of the existing roadway. The realignment will remove the existing 20 mph curve and will require a large cut section into the mountainside. Existing NC 107 will intersect (T-intersection) with the realignment at the south end and will be cul-de-saced at the north end. The cross section for this segment is proposed as two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved).

**Segment 6** – Segment 6 is symmetrical widening to a 24-foot section with 8-foot shoulders (4 feet of which shall be paved).

**Segment 7B** – Segment 7B is proposed as a new-location realignment, with a 50 mph design speed, to the east of the existing roadway. The realignment will remove a second existing 20 mph curve and will require a large cut section into the mountainside. Existing NC 107 will be teed into the realignment at both the south and north ends. The cross section for this segment is proposed as two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a northbound left turn lane is proposed at the SR 1172 intersection.

**Segment 8** – Segment 8 is proposed as asymmetrical widening to the right side to avoid impacts to the river. The existing right-of-way on the left side will be retained. This segment will result in two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved).

**Segment 9** – Segment 9 will be symmetrically widened to two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). Addition of a southbound left turn lane is proposed at the SR 1737 intersection.

**Segment 10** – Because it is constrained by a park and existing residential properties, Segment 10 only includes widening of the paved shoulder. The recommended improvements to this section are resurfacing and extension of the existing 2-foot paved shoulders to 4-foot paved shoulders. These improvements will be constructed within the existing right-of-way. NC 107

crosses existing Bridge No. 52 over Caney Fork Creek within this segment. Bridge No. 52 was built in 1990 with a deck width of 44 feet. As a result of its 2002 inspection, this bridge has sufficiency rating of 88, with an estimated 42 years of remaining life. There are no improvements to Bridge No. 52 proposed as part of this project.

**Segment 11** – Segment 11 involves symmetrical widening to a 24-foot section with 8-foot shoulders (4 feet of which shall be paved).

**Segment 12** – Segment 12 is proposed as asymmetrical widening to the right side to avoid impacts to the river. The existing right-of-way on the left side will be held. This segment will result in two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved).

**Segment 13** – Segment 13 is proposed as asymmetrical widening to the left. The widening will result in two 12-foot lanes with a 4-foot paved shoulder on the right side and an 8-foot shoulder (4 feet of which shall be paved) on the left side.

**Segment 14** – Segment 14 is already sufficient pavement width (12-foot lanes with a 4-foot paved shoulder). Therefore, improvements to segment 14 are limited to resurfacing only.

**Segment 15** – The width of Segment 15 is currently sufficient with two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). However, this segment will be widened to accommodate the addition of a southbound left turn lane which is proposed at the SR 1002 intersection. The existing northbound right turn lane will be maintained.

The estimated relocations and cost breakdowns for the two alternatives are listed below:

	Alternative A	Alternative B
<b>Relocations</b>		
Residences .....	13	11
Businesses .....	10	11
<b>Cost Estimates</b>		
Construction .....	\$ 8,500,000	\$ 14,400,000
Right-of-way .....	<u>\$ 4,600,000</u>	<u>\$ 5,000,000</u>
<b>TOTAL COST .....</b>	<b>\$ 13,100,000</b>	<b>\$ 19,400,000</b>

**V. Recommendations**

As described in Section IV, Alternative A involves widening along NC 107 that will ultimately provide a consistent cross section of two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). All of the improvements will be constructed along the existing alignment. Alternative A is not recommended because, although it improves safety and capacity, it does not address the two extremely sharp curves (the first approximately 0.5 miles south of SR 1172 and the second just north of SR 1172) in the existing alignment.

Alternative B, which is described in detail in Section IV, is a combination of widening and new location segments that ultimately provides two 12-foot lanes with 8-foot shoulders (4 feet of which shall be paved). The main distinction between the two alternatives is that Alternative B includes two new-location segments that eliminate the two existing sharp curves. The addition of these new-location segments, each with a proposed design speed of 50 mph, provides a much better overall alignment and allows a consistent 45-mph speed to be posted along the facility. Therefore, Alternative B is the Recommended Alternative.

The recommended improvements extend from approximately 600 feet south of NC 281 to approximately 400 feet north of SR 1002. The majority of the project is shoulder-widening and includes both symmetrical and asymmetrical segments as described in Section IV. In addition to the widening improvements, two new-location segments are recommended. The purpose of the new location segments is to remove the existing sharp curves and provide a consistent design speed along the facility.

The recommended improvements and associated cost estimate also include:

- The extension on both sides of one existing major drainage structure (double 6-foot x 6-foot RCBC). The culvert is located approximately 1.3 miles north of NC 281.
- A proposed retaining wall located on the river side of NC 107 across from the Brinkley House. The proposed wall is approximately 600 feet long. The wall will allow an existing stone wall on the right side of the road to be preserved while avoiding impacts to the river.

## VI. Additional Comments

An exhaustive environmental screening was not conducted for this study. However, the following information summarizes conclusions about the project study area based on existing data.

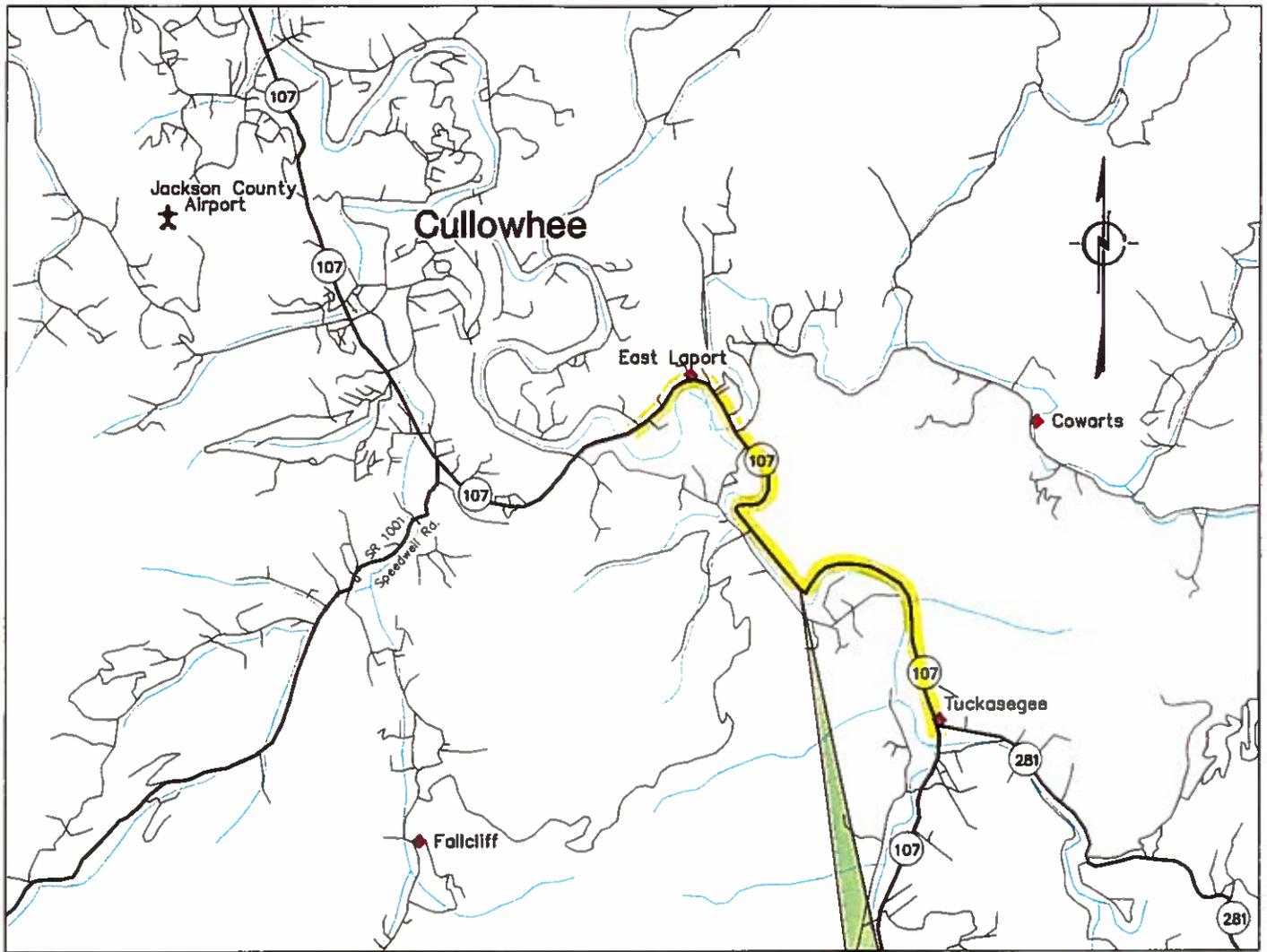
There are no properties listed on the National Register of Historic Places within the immediate vicinity of the proposed improvements, although the Brinkley House may be eligible. There are also no known archaeological sites within the project study area.

According to the Natural Heritage Program GIS database, there are two Threatened or Endangered species that may potentially exist in the immediate project area. These species are a fish (Wounded darter, *etheostoma vulneratum*) and an amphibian (Hellbender, *cryptobranchus alleganiensis*). There is also a Montane-Alluvial Forest natural community along the river that is considered a critical area for protection.

The majority of the proposed improvements are within, or immediately adjacent to, existing right-of-way. The exceptions are the two curve realignments and their associated cut areas. However, most of the impacted area associated with these cuts is on, or adjacent to, disturbed/developed property. Therefore, no impacts to threatened or endangered species are anticipated.

According to the National Wetlands Inventory (NWI), there are no wetland areas in the immediate vicinity of the proposed improvements.

The proposed improvements include one stream crossing where a major drainage structure extension will be required. This location is an existing crossing where the box culvert will be extended on both sides to accommodate the widening. The proposed improvements avoid impacting the Tuckasegee River which has a WS-III, B; T classification. This classification indicates that this reach is a trout water used for primary recreation in a moderately developed watershed.



**Proposed Project**



Jackson County



**North Carolina  
Department of Transportation**

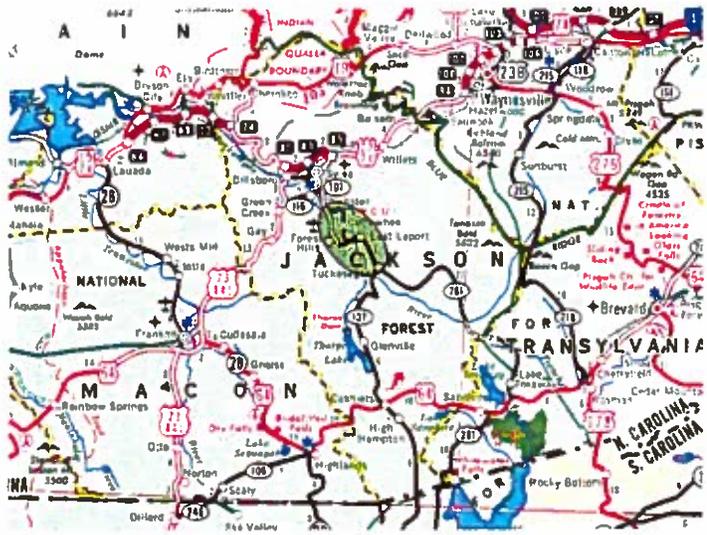
**Feasibility Study  
NC 107**

**South of NC 281 to North of SR 1002**

**FS-0214A**

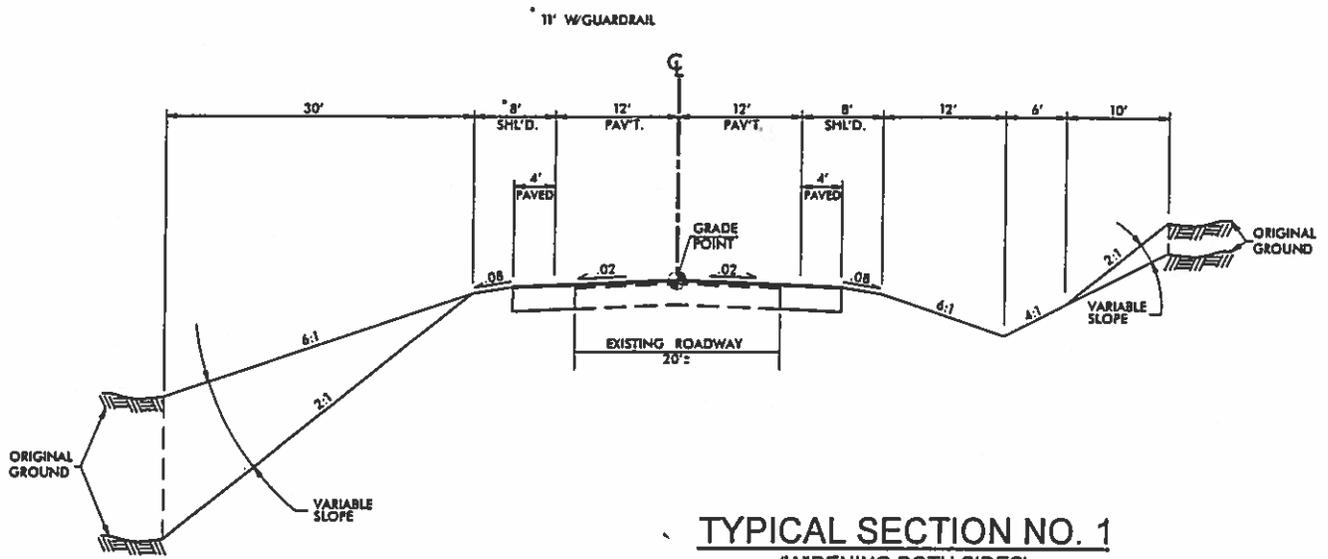
**Jackson County, North Carolina**

**Project Vicinity**

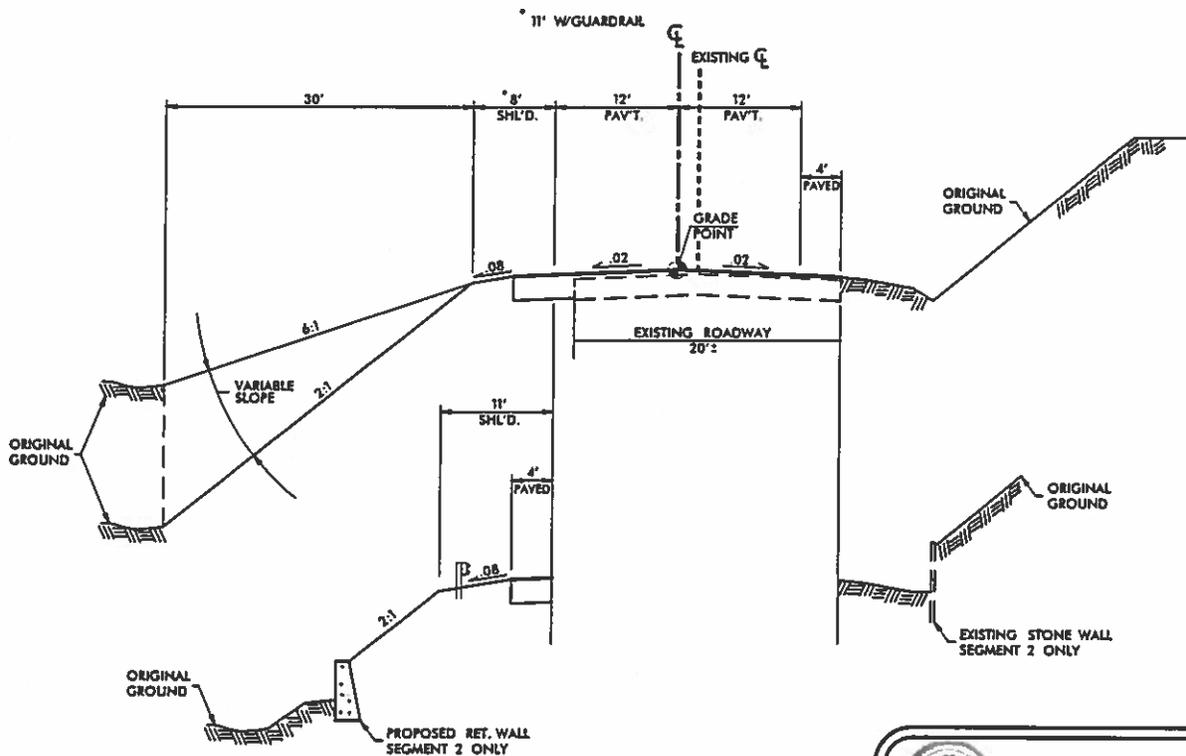


Not to Scale

Exhibit 1



**TYPICAL SECTION NO. 1**  
 (WIDENING BOTH SIDES)  
 YELLOW SEGMENTS 1, 3, 5, 6, 9, 11, & 15



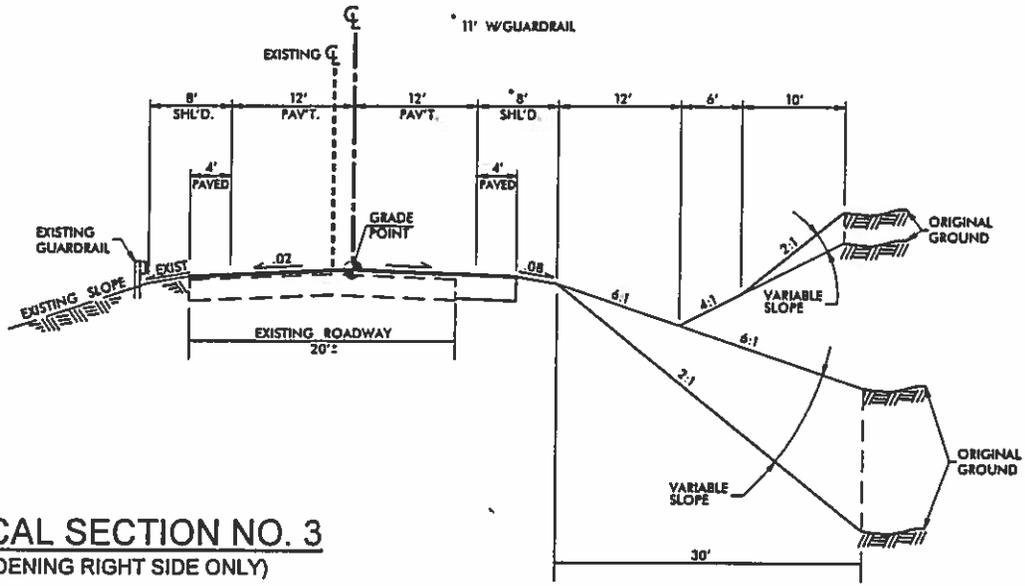
**TYPICAL SECTION NO. 2**  
 (WIDENING LEFT SIDE ONLY)  
 ORANGE SEGMENTS 2 & 13



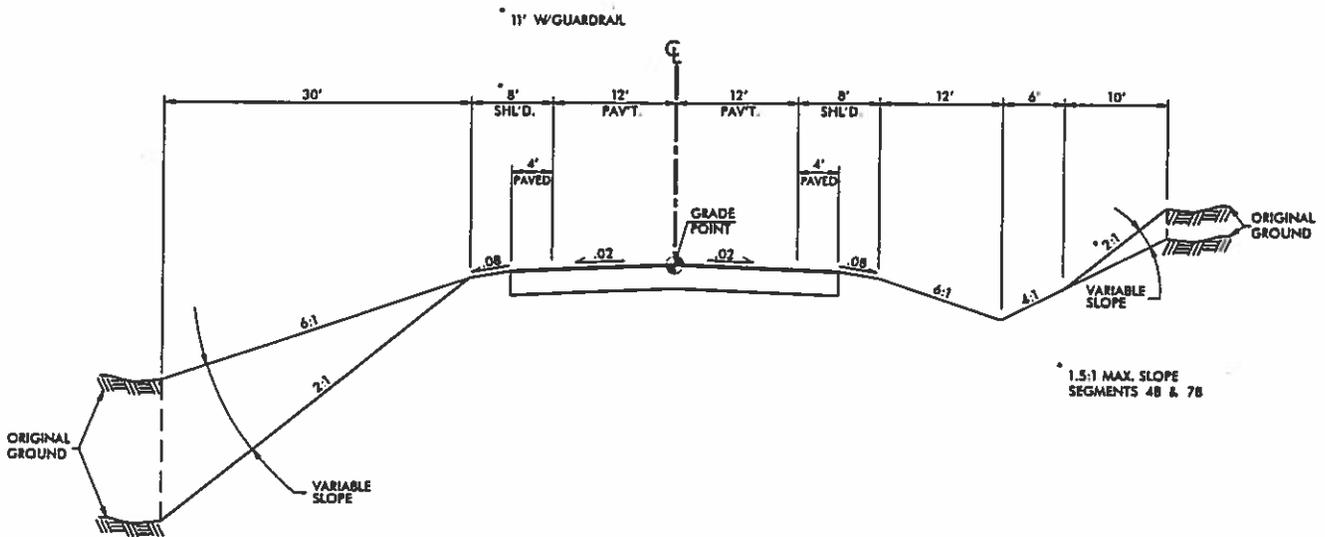
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**Feasibility Study**  
**NC 107**

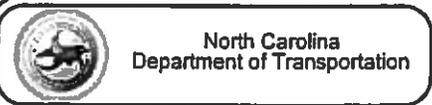
South of NC 281 to North of SR 1002  
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**TYPICAL SECTION NO. 3**  
 (WIDENING RIGHT SIDE ONLY)  
 GREEN SEGMENTS 4A, 7A, 8, & 12



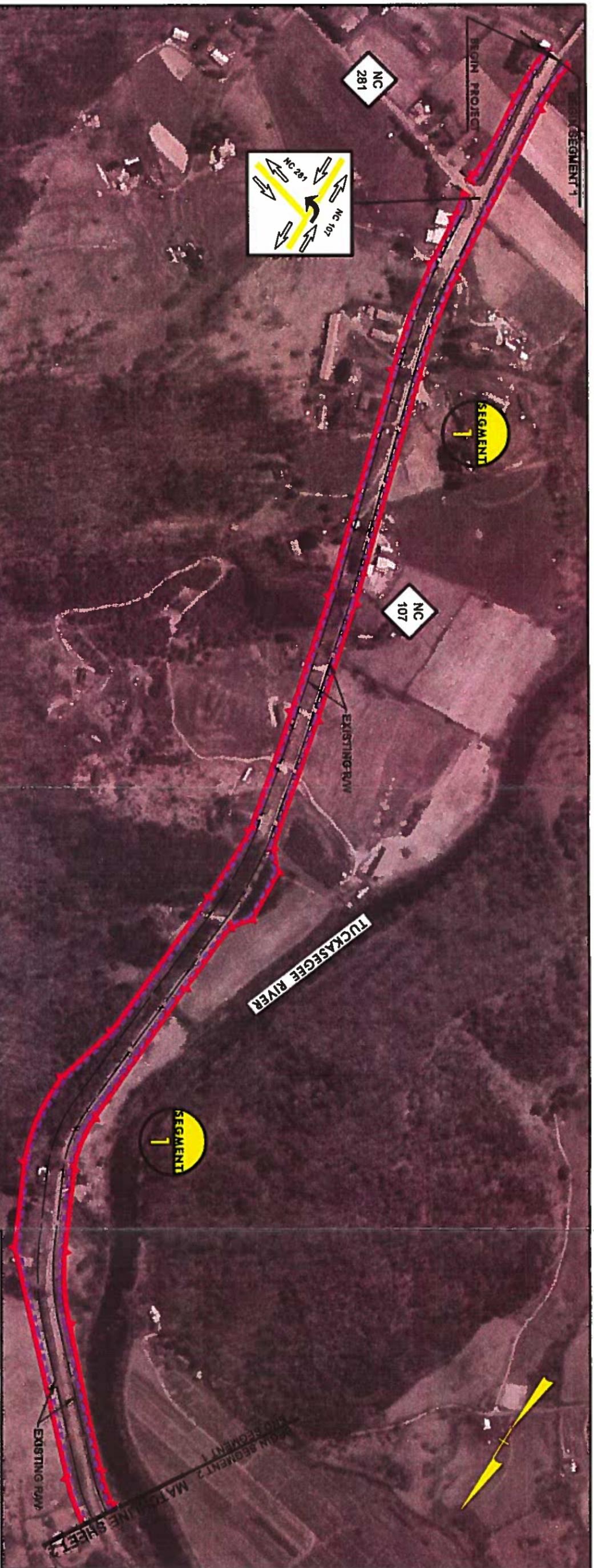
**TYPICAL SECTION NO. 4**  
 (RELOCATION)  
 PURPLE SEGMENTS 4B & 7B



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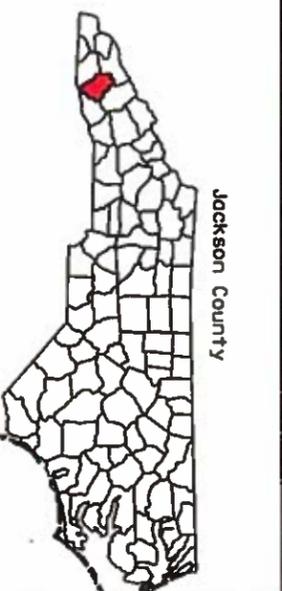
**Feasibility Study  
 NC 107**

South of NC 281 to North of SR 1002  
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 Jackson County, North Carolina  
 Sheet 2 of 2



**LEGEND**

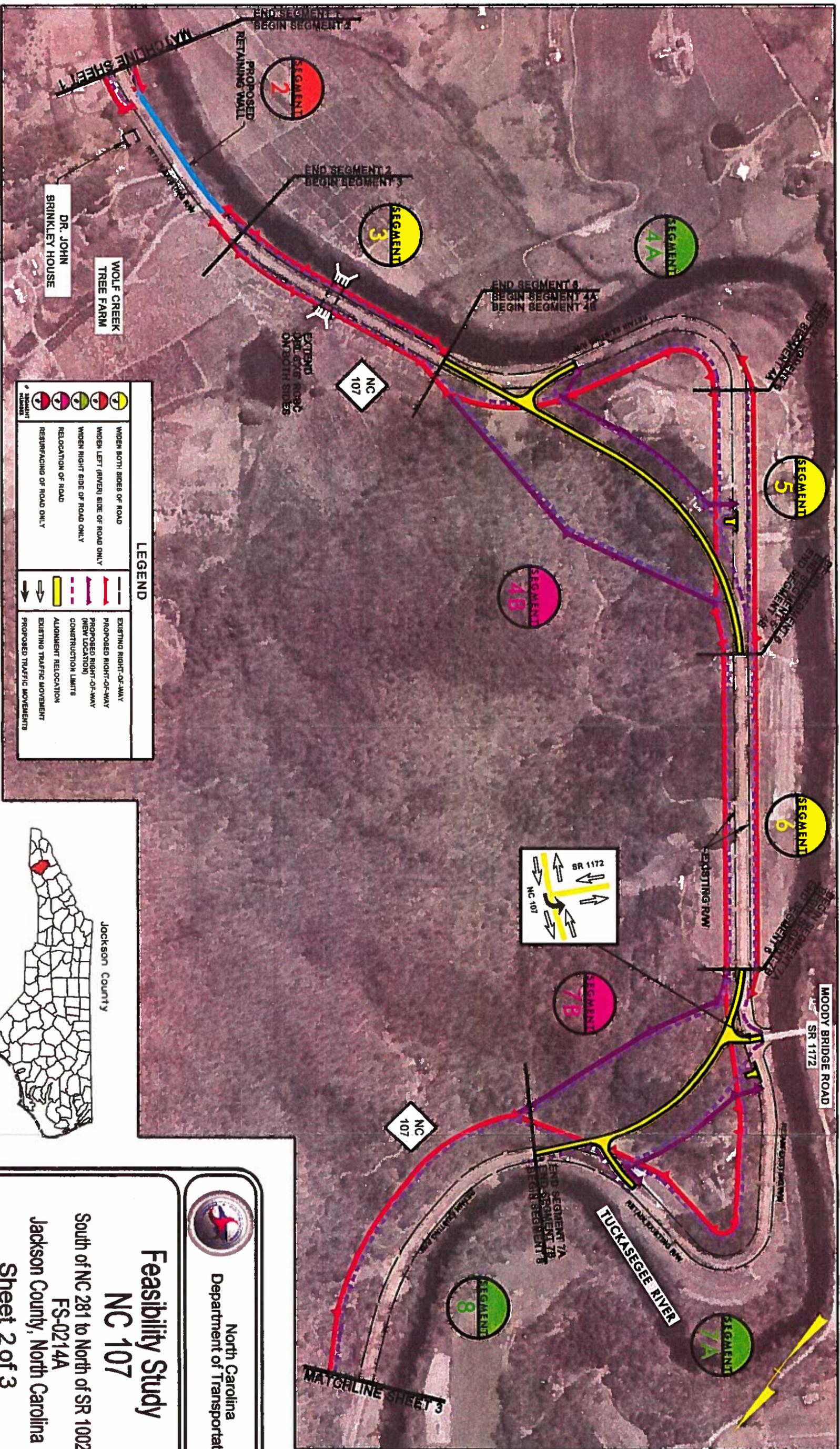
	WIDEN BOTH SIDES OF ROAD		EXISTING RIGHT-OF-WAY
	WIDEN LEFT (RIVER) SIDE OF ROAD ONLY		PROPOSED RIGHT-OF-WAY (NEW LOCATION)
	WIDEN RIGHT SIDE OF ROAD ONLY		CONSTRUCTION LIMITS
	RELOCATION OF ROAD		ALIGNMENT RELOCATION
	RESURFACING OF ROAD ONLY		EXISTING TRAFFIC MOVEMENT
			PROPOSED TRAFFIC MOVEMENTS



North Carolina
   
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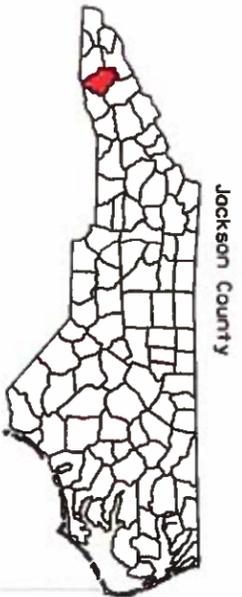
**Feasibility Study**
  
**NC 107**
  
 South of NC 281 to North of SR 1002
   
 FS-0214A
   
 Jackson County, North Carolina
   
**Sheet 1 of 3**
  
 Exhibit 3

Scale: 1"=400'



**LEGEND**

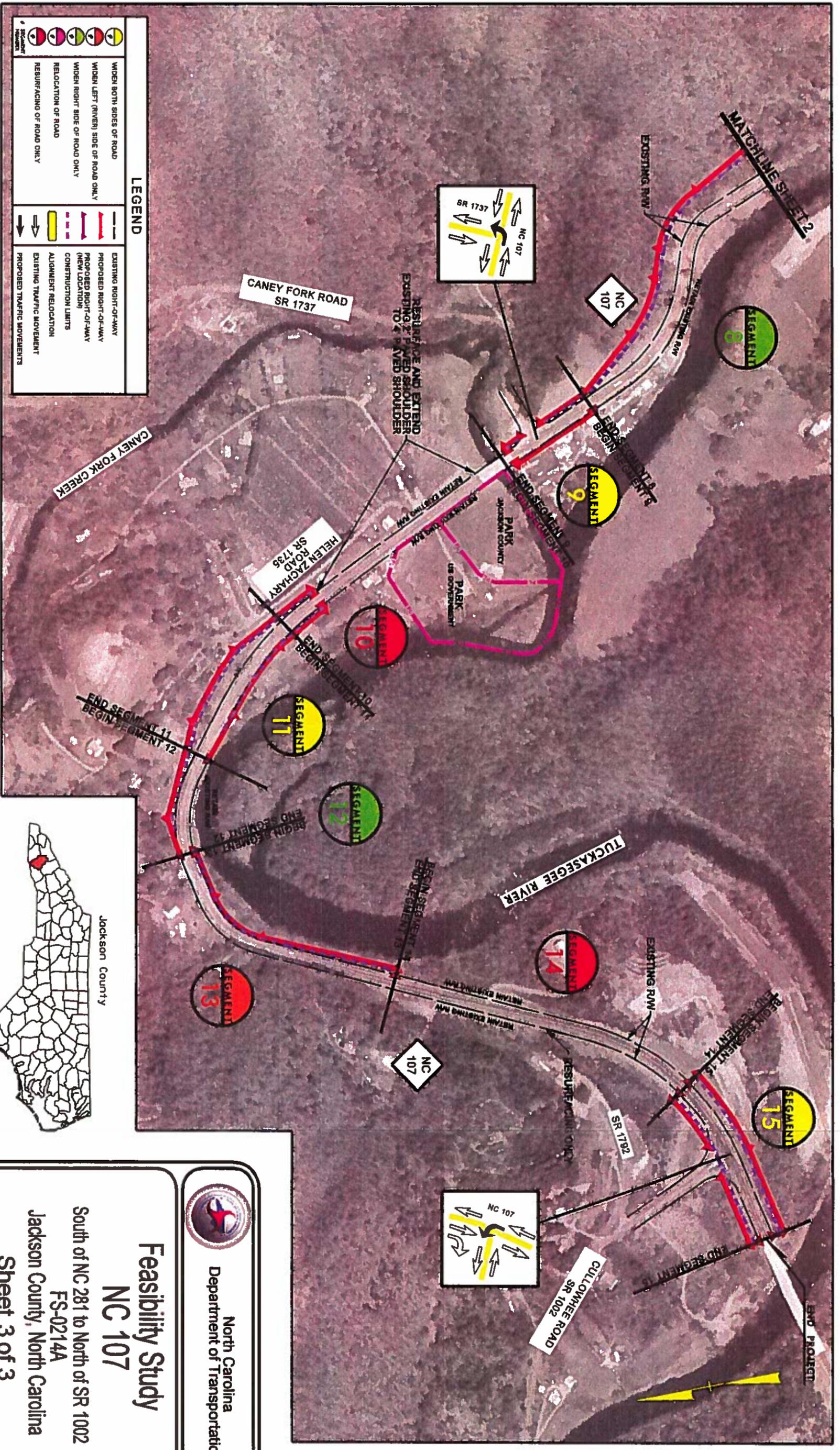
	WIDEN BOTH SIDES OF ROAD		EXISTING RIGHT-OF-WAY
	WIDEN LEFT (REVER) SIDE OF ROAD ONLY		PROPOSED RIGHT-OF-WAY (NEW LOCATION)
	WIDEN RIGHT SIDE OF ROAD ONLY		CONSTRUCTION LIMITS
	RELOCATION OF ROAD		ALIGNMENT RELOCATION
	RESURFACING OF ROAD ONLY		EXISTING TRAFFIC MOVEMENT
	EXTEND LEFT SIDE ROAD ON BOTH SIDES		PROPOSED TRAFFIC MOVEMENT



  
 North Carolina  
 Department of Transportation

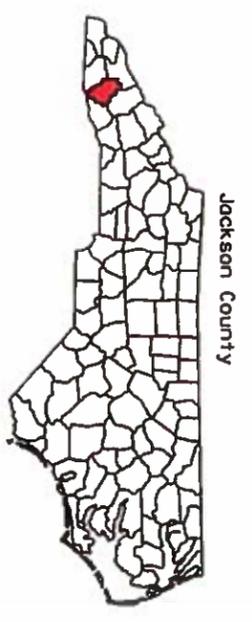
**Feasibility Study**  
**NC 107**  
 South of NC 281 to North of SR 1002  
 FS-0214A  
 Jackson County, North Carolina  
**Sheet 2 of 3**

Scale: 1"=400'  
 Exhibit 3



**LEGEND**

	WIDEN BOTH SIDES OF ROAD		EXISTING RIGHT-OF-WAY
	WIDEN LEFT (RIVER) SIDE OF ROAD ONLY		PROPOSED RIGHT-OF-WAY
	WIDEN RIGHT SIDE OF ROAD ONLY		PROPOSED RIGHT-OF-WAY (NEW LOCATION)
	RELOCATION OF ROAD		CONSTRUCTION LIMITS
	RESURFACING OF ROAD ONLY		ALIGNMENT RELOCATION
			EXISTING TRAFFIC MOVEMENT
			PROPOSED TRAFFIC MOVEMENTS



North Carolina  
Department of Transportation

**Feasibility Study**

**NC 107**

South of NC 281 to North of SR 1002  
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Scale: 1"=400'

Exhibit 3