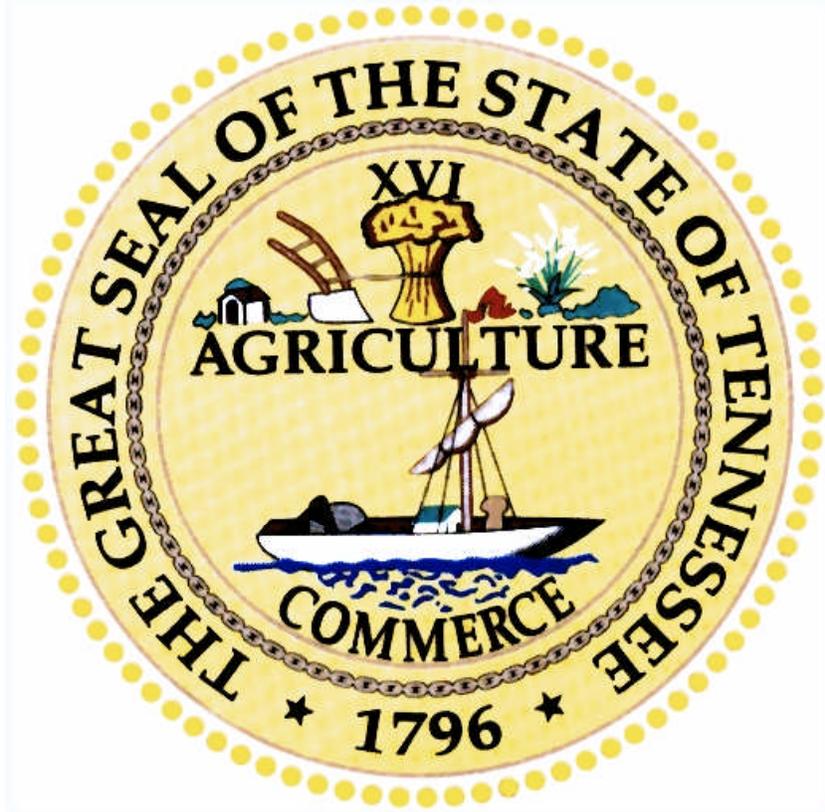


# ***TECHNICAL REPORT***

***STATE ROUTE 8 (US-127)  
FROM STATE ROUTE 27 TO PALISADES DR  
HAMILTON COUNTY  
PIN 115819.00***



***PREPARED BY  
ARCADIS  
For the  
TENNESSEE DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION***

***FINAL REPORT  
December 23, 2011***

*This document is covered by 23 USC § 409 and its production pursuant to fulfilling public planning requirements does not waive the provisions of § 409.*

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## **Executive Summary**

The subject of this Technical Report is the State Route (SR) 8 (US-127, Signal Mountain Boulevard) corridor in Hamilton County. The Tennessee Department of Transportation is studying approximately 3.05 miles of SR-8 (US-127), from SR-27 (Suck Creek Road) (Log Mile (LM) 13.96) to Palisades Drive (LM 17.01) inside the Signal Mountain town limits, to determine appropriate strategies and costs of future improvement options for this corridor. A location map is attached.

SR-8 (US-127) has been experiencing significant degradation for several years resulting in large rockslides, roadway failures, and traffic delays. TDOT is seeking to ensure motorists have a safe, efficient and reliable route between Signal Mountain and Chattanooga.

The geologic and drainage assessment identified the need for major drainage improvements, slope improvements and roadway stability improvements along the route. The study corridor contains one of the ten most hazardous rock fall sites in the state of Tennessee. Based on these findings and the purpose of the study, the following improvement options were developed:

### **Option 1 (No-Build)**

The No-Build Option assumes no modifications or improvements will be made over the planning horizon. Routine maintenance related activities as well as scheduled resurfacing, signing, and possible safety improvements may occur. This Option, however, does not support the project's stated purpose and need for addressing areas of insufficient drainage and roadway stability concern areas.

### **Option 2 (Reconstruction)**

Option 2 would follow the existing alignment of SR-8 (US-127), providing a 45 miles per hour minimum design speed, with two (2) lanes and an additional truck climbing lane from LM 14.00 to LM 15.65 and from LM 16.59 to LM 16.92. The estimated cost of Option 2 is \$75 million. Large cut and fill slopes will cause considerable impacts to adjacent property owners and significant visual impacts to the route. This Option would meet the stated purpose and need by creating a safer, more efficient and reliable route between Signal Mountain and Chattanooga.

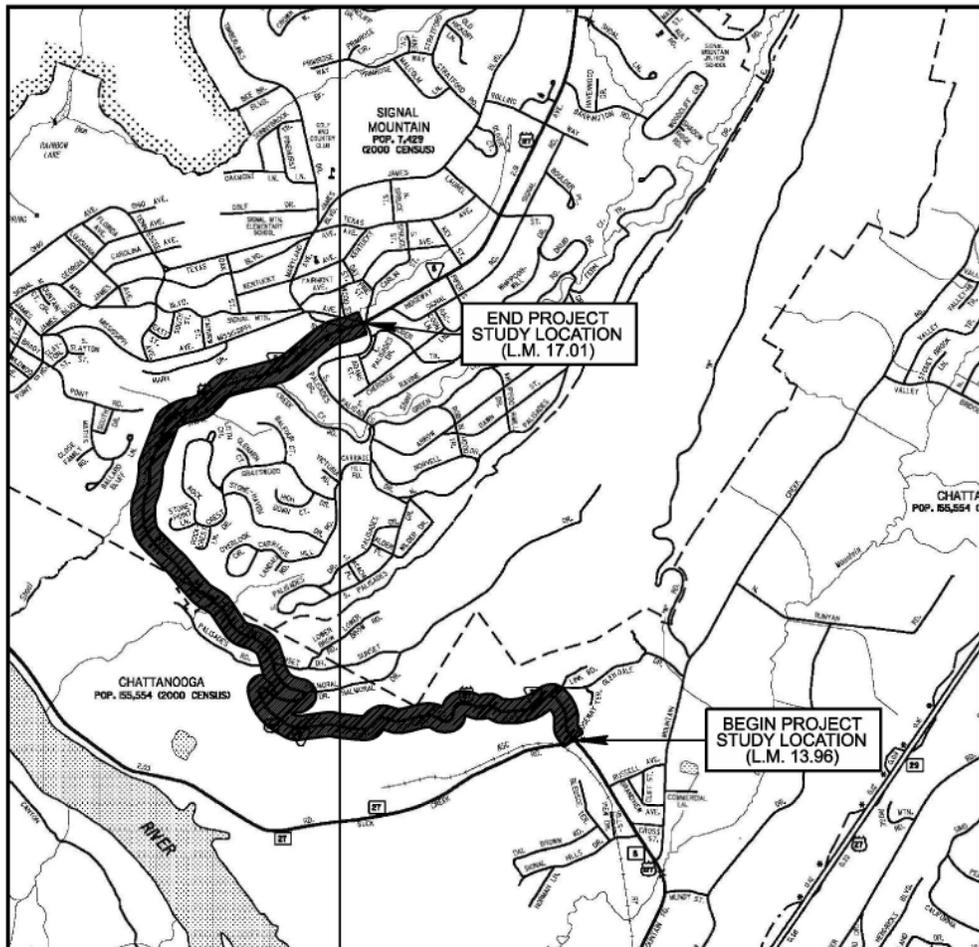
### **Option 3 (New Alignment)**

Option 3 consists of constructing an entirely new alignment that would follow the existing Mountain Creek Road, W Road and Anderson Pike routes, providing a 45 miles per hour minimum design speed, with two (2) lanes and an additional truck climbing lane along the W Road from Mile 0.6 to Mile 1.8 and from Mile 3 to Mile 4.4. The estimated cost of Option 3 is \$132 million. Large cut and fill slopes will cause considerable impacts to adjacent property owners and substantially alter the existing landscape. This Option would meet the majority of the stated purpose and need by creating a safer and more reliable route between Signal Mountain and Chattanooga. Option 3 increases the route length from Mountain Creek Road (LM 13.52) to Laurel Street (LM 17.55) by approximately two (2) miles. However, this option reduces the State Highway System by approximately one (1) mile.

#### Option 4 (Spot Improvements)

Option 4 would maintain the existing alignment and lanes along SR-8 (US-127), with improvements to select areas. Twenty (20) locations were identified as needing culvert repairs. It is assumed that these repairs will be completed by state and local forces and therefore no cost are included. Twenty-five (25) locations were identified as needing culvert modifications, one area needing rock fall mitigation, one area of undercut roadway and nine areas of roadway stability concern. Four (4) improvement options were developed for the rock fall mitigations and three (3) improvement options were developed for the roadway stability concern areas. Estimated costs were calculated for all improvement options. The estimated cost varies depending on spot improvement options selected, with the maximum being \$50 million. However, a possible spot improvement scenario along the roadway would cost \$5.5 million. Option 4 would meet the majority of the stated purpose and need by creating a more reliable and direct route between Signal Mountain and Chattanooga. The reliability improves by reducing closures due to roadway failures and rock slides. However, Option 4 maintains the existing alignment, shoulders and lanes, so it would not significantly reduce crashes or improve efficiency along the route.

#### Project Location Map



## **Purpose of Study**

The subject of this Technical Report is the State Route (SR) 8 (Signal Mountain Boulevard) corridor located in Hamilton County. The Tennessee Department of Transportation (TDOT) is studying approximately 3.05 miles of SR-8 (US-127) to determine appropriate strategies and costs of future improvement Options for SR-8 (US-127). The limits of the study are from SR-27 (Suck Creek Road) (LM 13.96) to Palisades Drive (LM 17.01). The development of this Technical Report was requested by the Town of Signal Mountain.

This study analyzes existing roadway concerns and identifies options for improvements. The improvement Options will be developed to best provide for the future transportation needs of SR-8 (US-127). Also, an early environmental screening (EES) will be made to determine the likely impacts to sensitive locations within the study area.

## **History and Background**

SR-8 (US-127) begins at US-41/US-76 at the Georgia border in Chattanooga and ends at SR-56 in McMinnville, Tennessee.

A map of the study area is shown on Figure 1 and a vicinity map is shown on Figure 2.

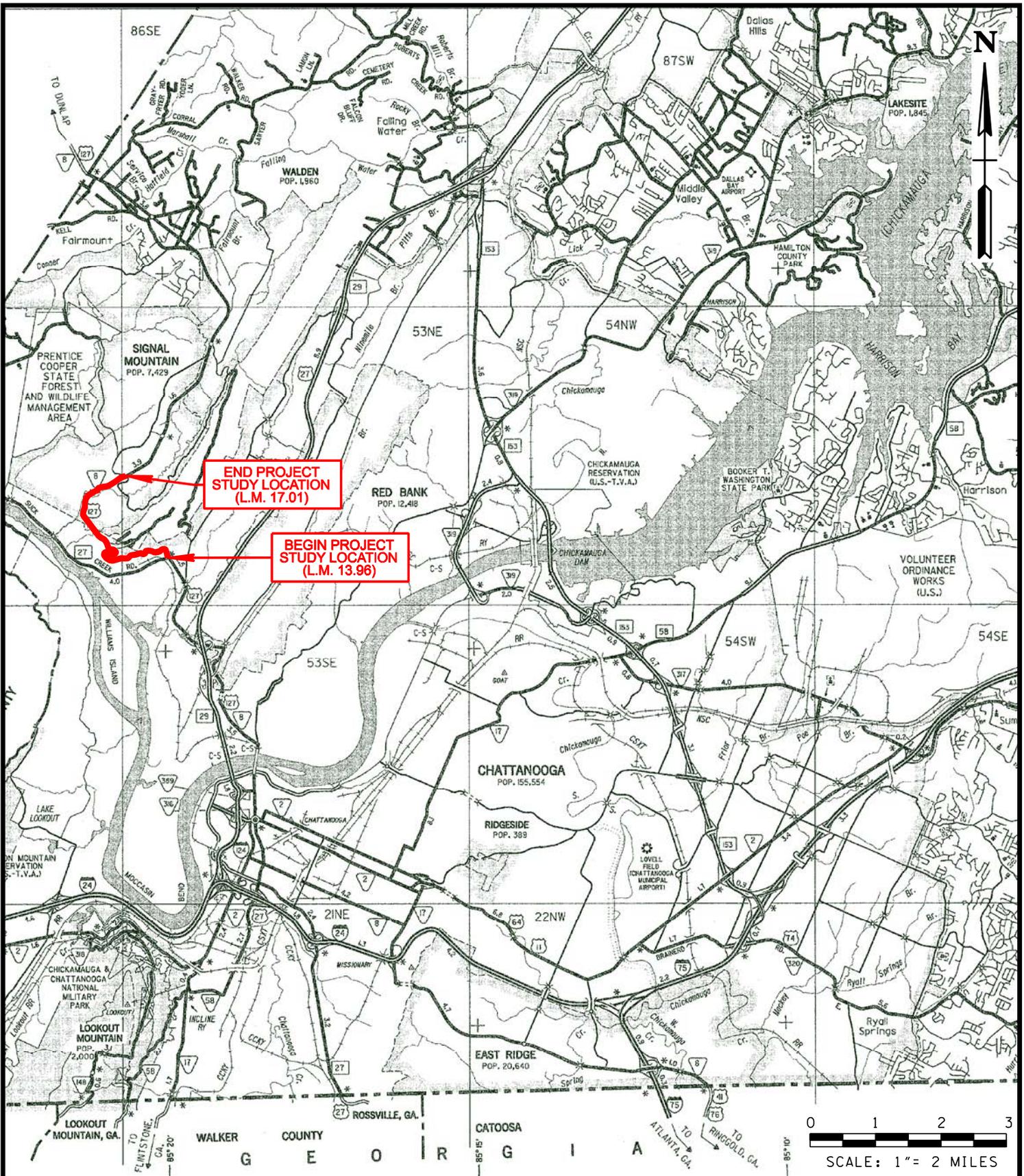
Between the years of 1975 and 1985, the study area experienced three major earth slides resulting in traffic delays. In 1992, TDOT proposed constructing a five (5) lane roadway on the existing alignment of SR-8 (US-127) (Signal Mountain Boulevard). This proposal was opposed by the community and local officials. In recent years, there have been several roadway failures resulting in delays along the route including a large rock slide in late 2009. There have also been multiple minor slides causing roadway closures in duration of one day or less. Repaving of the existing route was completed in July 2011. All field observations were completed prior to resurfacing.

## **Existing Conditions**

### **Description of the Study Area**

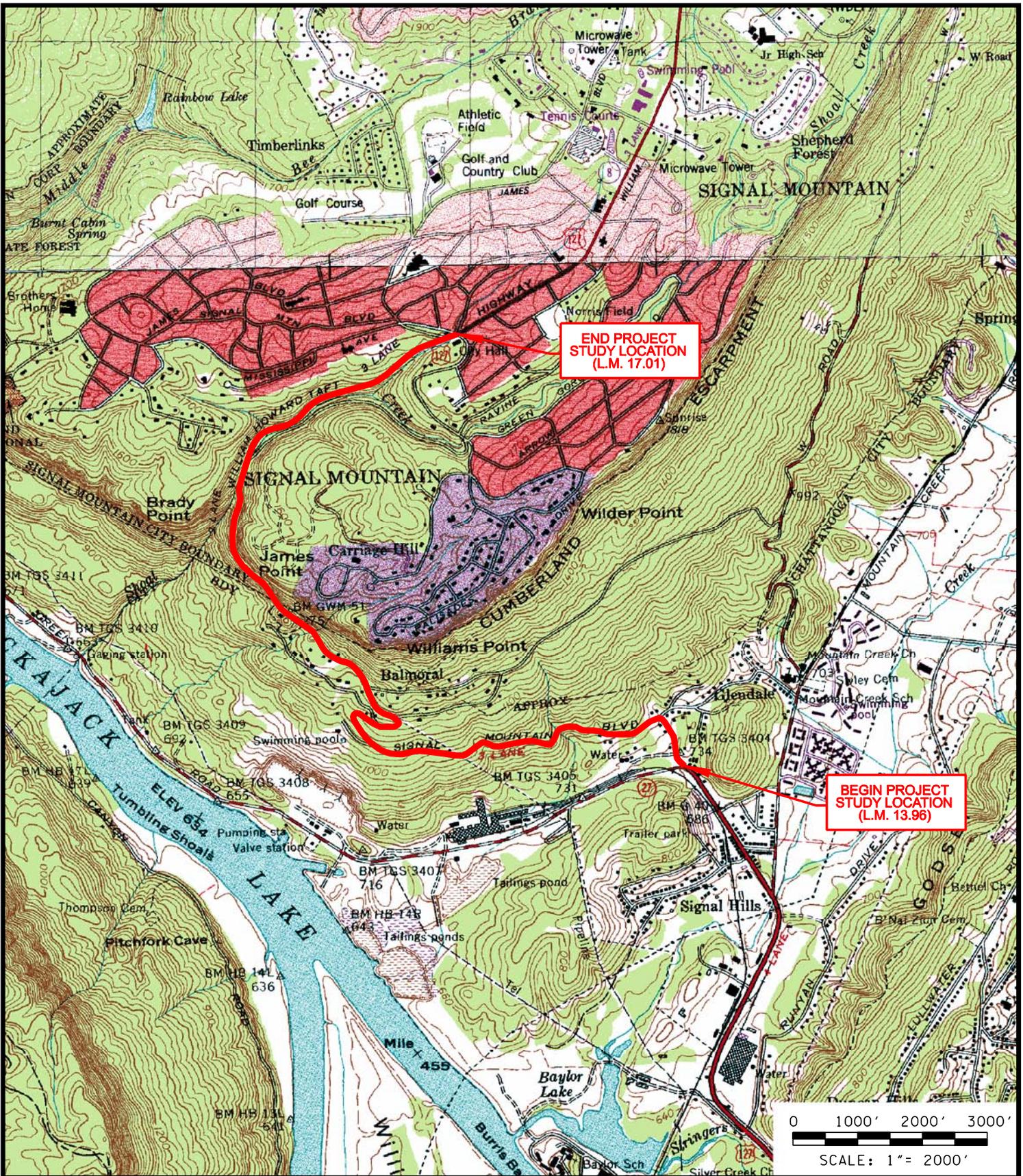
This study begins in Hamilton County, west of Chattanooga, and ends inside the Signal Mountain town limits. Land uses along the 3.05-mile corridor are commercial and residential.

The US Census estimated Signal Mountain's 2009 population to be 7,254 residents while Hamilton County's population is 336,463 residents. The unemployment rate for Hamilton County in August 2009 was 10.8 percent as compared to the statewide unemployment rate of 10.3 percent. The State Department of Labor and Workforce Development reported the 2009 average annual wage for Hamilton County to be \$42,787. The statewide average annual wage for 2009 was \$41,725.



# STUDY AREA MAP

DRAWN BY:	CHECKED BY:
	<b>HAM</b>
<b>SR-8 (US-127) Signal Mountain Blvd.</b>	
<b>PIN 115819.00</b>	
<b>FIGURE 1</b>	DATE: <b>8-29-2011</b>



# VICINITY MAP

DRAWN BY:	CHECKED BY: <b>HAM</b>
<b>SR-8 (US-127) Signal Mountain Blvd.</b>	
<b>PIN 115819.00</b>	
<b>FIGURE 2</b>	DATE: <b>8-29-2011</b>

## Roadway Geometrics

The study segment of SR-8 (US-127) is an urban minor arterial having predominately eleven (11) foot travel lanes and two (2) feet or less paved shoulder width. Several deficient vertical and horizontal curves exist along the route restricting sight distance and travel time. The major aspects of the SR-8 (US-127) geometrics are presented in Table 1.

**Table 1. Study Segment Geometrics Summary**

<b>Geometric Data</b>	SR-8 (US-127), from SR-27 to Palisades Dr
<b>Functional Classification</b>	Urban Minor Arterial
<b>Length</b>	3.05 miles
<b>Average Right-of-Way Width</b>	Forty (40) feet
<b>Average No. Travel Lanes</b>	Three (two northbound and one southbound)
<b>Average Lane Width</b>	Eleven (11) feet
<b>Average Shoulder Width</b>	Two (2) feet (paved)
<b>Median Type</b>	None
<b>Average Median Width</b>	N/A
<b>Bicycle Facilities</b>	None
<b>Average Sidewalk Width</b>	None
<b>Topography</b>	Mountainous
<b>Major Intersections</b>	One Way Stop control at SR-27 Signalized intersection at Palisades Drive
<b>Drainage</b>	Ditches
<b>Posted Speed Limit</b>	40 mph (L.M. 13.96 to L.M. 15.8) 30 mph (L.M. 15.80 to L.M. 16.4) 35 mph (L.M. 16.4 to L.M. 17.01)

## Crash Rate Analysis

Section crash rate analyses were developed for SR-8 (US-127) to identify existing safety issues. Section crash rates are based on the number of crashes on a roadway section, the average daily traffic on the roadway section, and the length of the section being analyzed. Crash rate analysis is based on a three (3) year period (2005-2007) and is expressed in crashes per 1 million vehicle-miles of travel.

Within the study area, SR-8 (US-127) consists of a section of urban minor arterial 3.05 miles in length and has a crash rate of 2.424. The state wide average for comparable roadway sections is 2.419. One (1) fatal crash with one (1) fatality occurred near LM 16.11 and one (1) fatal crash with one (1) fatality occurred LM 16.54 on SR-8 (US-127) during the study period. The crashes were primarily comprised of the following six types:

- Head On – 7 of 97 (7%)
- Rear End – 10 of 97 (10%)
- Angle – 23 of 97 (24%)
- Sideswipe Same Direction – 8 of 97 (8%)
- Sideswipe Opposite Direction – 7 of 97 (7%)
- No collision with vehicle – 40 of 97 (41%)

A summary of the SR-8 (US-127) section crash rate is provided in Table 2 and a crash rate calculation sheet is provided in Appendix A.

**Table 2. Section Crash Rate Summary**

Log Mile		Length	Highway Classification	Highway Type	Total Crashes	Crash Rates	
						Section	State Wide Average
13.96 (Hamilton Co.)	17.01 (Hamilton Co.)	3.05	Urban Minor Arterial	2 lane (with truck-climbing lane)	97	2.424	2.419

### Level of Service

The projected base year (2011) Annual Average Daily Traffic (AADT) along SR-8 (US-127) is 11,980. The projected future year (2031) AADT is 12,460.

The base year and design year operating characteristics for the study segments were analyzed as part of the study. A “Level of Service” (LOS) was used to gauge the operational performance of the roadway segment. The LOS is a qualitative measure that describes traffic conditions related to speed and travel time, freedom to maneuver, traffic interruptions, etc.

There are six levels ranging from “A” to “F” with “F” being the worst. Each level represents a range of operating conditions. Table 3 shows the traffic flow conditions and approximate driver comfort level at each level of service.

The TDOT provided 2011 and 2031 AADTs have been analyzed and are projected to operate at an LOS D for both base and design year traffic volumes.

**Table 3. Level of Service Operational Criteria**

Level of Service (LOS)	Traffic Flow Conditions
A	Free flow operations. Vehicles are almost completely unimpeded in their ability to maneuver with the traffic stream. The general level of physical and psychological comfort provided to the driver is high.
B	Reasonable free flow operations. The ability to maneuver within the traffic stream is only slightly restricted and the general level of physical and psychological comfort provided to the driver is still high.
C	Flow with speeds at or near free flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted and lane changes require more vigilance on the part of the driver. The driver notices an increase in tension.
D	Speeds decline with increasing traffic. Freedom to maneuver within the traffic stream is more noticeably limited. The driver experiences reduced physical and psychological comfort levels.
E	At lower boundary, the facility is at capacity. Operations are volatile because there are virtually no gaps in the traffic stream. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.
F	Breakdowns in traffic flow. The number of vehicles entering the highway section exceeds the capacity or ability of the highway to accommodate that number of vehicles. There is little room to maneuver. The driver experiences poor levels of physical and psychological comfort.

## Geologic Assessment

### Introduction

The purpose of the geologic assessment is to evaluate SR-8 (US-127) between SR-27 (LM 13.96) and Palisades Drive (LM 17.01); to investigate a range of Options including spot improvements and widening. This evaluation focuses on rock fall hazards, acid producing materials (pyritic shale and coal) and roadway stability concern areas. This planning level assessment included review of TDOT provided documents, geologic maps and field observations. No subsurface investigations, field survey or geotechnical analysis were performed.

### Document Review

Prior to field work beginning, a review of provided documentation was completed. These documents consisted of reports relating to events, previous work and past evaluations of the project area ranging in dates from 1996 to 2011. Several of these reports provide information just outside of the scoped project area at the foot of Signal Mountain but include valuable information regarding retaining wall failures, foundation investigations, roadway failures, rock fall assessments, soil descriptions and recommendations relating remediation and repair.

A geologic map of the area was also reviewed to determine what formations would be encountered during the field work, geologic structure and the potential for the occurrence of acid producing material in the limits of the project. The geologic map of the area is shown on Figure 3.



## Geology

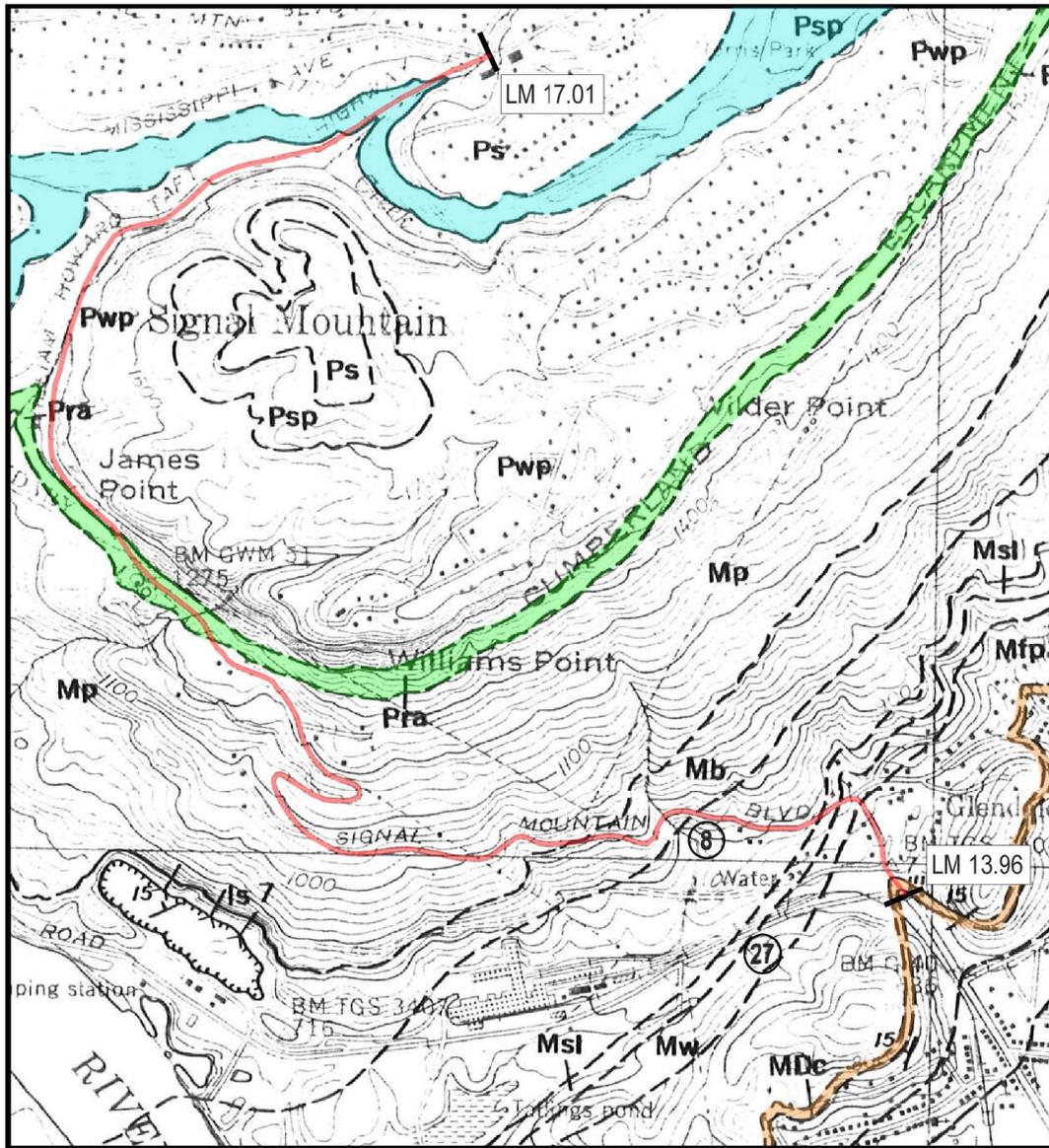
The project lies in the Valley and Ridge physiographic province. From the Cambrian through the Paleozoic ages, the Valley and Ridge physiographic province, experienced transgression and regression cycles in sea level. During the late-Paleozoic, this province experienced uplift. Northwest-verging folding and faulting accompanied this uplift, and the resulting topographic expressions consist of roughly parallel valleys and ridges trending northeast to southwest. Rocks of this province include various limestones, shales, and sandstones ranging in age from lower Cambrian to middle Carboniferous.

More specifically, the rocks contained in the project site, range in ages from Devonian to Pennsylvanian. These rocks form a syncline that is Walden Ridge. The rock strikes generally northeast-southwest with gentle dips of two (2) to fifteen (15) degrees in toward the axis of the syncline. A significant fault is noted at the base of Walden Ridge called the Cranmore Cove Fault. A geologic map of the area is shown on Figure 3.

The occurrence of potential acid producing material was noted during the evaluation of the geologic map. Three potential sources are indicated. The first are minor coal seams in the Signal Point Shale, which are described and may be encountered in the road cut between LM 16.7 and LM 16.9. The second are minor coal seams in the Raccoon Formation which are encountered in an outcrop along the road cut between LM 15.85 and LM 15.9. These coal seams tend to be thin, as seen in Photo 1 Appendix B, and discontinuous in the out crop as seen in Photo 2 Appendix B. The last formation noted is the Chattanooga Shale which is a known source of pyritic, acid producing material and is located at SR-27 (Suck Creek Road). All three formations and their relationship to SR-8 (US-127) are shown on Figure 4.

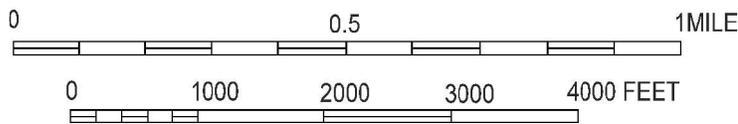
The soils on the slope below the escarpment on which the road is constructed are described in previous reports as fill overlying colluvium. The fill varies in thickness from seven (7) to nine (9) feet in the area around SR-27 (Suck Creek Road) to a "thin veneer" just above LM 15.15 and Palisades Road (LM 15.19). The thickness of the fill varies as the road traverses up the mountain. The composition of the fill ranges from predominantly gravel to clay with some sand and gravel. The soils overlain by the fill fall into two general categories: (1) colluvial clay and silt with sand and (2) gravel and boulders in a colluvial matrix of clay. The colluvium overlies residual clay, decomposed shale and limestone, weathered shale and limestone and then competent rock. Depth to rock varies considerably with borings to fifty (50) plus feet without auger refusal in the area of Palisades Road (LM 15.19) from reports provided.

Site visits were conducted on June 8 and 10, 2011, prior to the recent resurfacing of SR-8 (US-127). Structural measurements between LM 15.85 and LM 16.1 were taken during the field work as part of the geologic assessment. Bedding measurements reveal the rock strikes to the northeast and dips to the northwest at fifteen (15) degrees. This indicates the cut face is in the eastern limb of the syncline. Two joint sets were measured; Set 1 ranging azimuths of 040-060 degrees and Set 2 ranging azimuths of 312 to 321 degrees with vertical to near vertical (>85 degrees) dips. These joint sets create detached blocks where the joint sets intersect close to the surface of the cut-face. Joint spacing ranges one



1.5°  
TRUE NORTH  
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION 1963



CONTOUR INTERVAL 20 FEET  
DATUM IS MEAN SEA LEVEL

Map modified from:  
GEOLOGIC MAP OF CHATTANOOGA QUADRANGLE, TENNESSEE  
Finlayson, Barnes, Colvin, and Luther  
1964

- Psp Shale, yellowish-brown to medium dark gray, locally contains thin coal seams. Thickness 55 to 140 feet.  
Signal Point Shale
- Pra Shale, silty, olive to light brownish-gray with minor sandstone and local thin coal seams. Thickness 80 to 160 feet.  
Raccoon Mountain
- MDC Shale, bituminous, brownish-black (weathers yellowish-orange to brown), fissile. Thickness about 20 feet.  
Chattanooga Shale



# POTENTIAL ACID PRODUCING MATERIAL ASSESSMENT

DRAWN BY: <b>DAP</b>	CHECKED BY: <b>HAM</b>
<b>SR-8 (US-127) Signal Mountain Blvd.</b>	
<b>PIN 115819.00</b>	
<b>FIGURE 4</b>	DATE: <b>8-29-2011</b>

and one-half (1.5) to two and one-half (2.5) feet where joint measurements for this assessment were taken. These joints ranged from tight to slightly open and stained. Additional joints include open joints along bedding planes. Other joints observed are estimated to have dips ranging forty-five (45) to sixty (60) degrees as seen in Photo 3 Appendix B.

### **Rock Fall Assessment**

The road cut from LM 16.4 to LM 16.6 has several undercuts of the excavation face along with vegetative growth with accompanying root jacking creating a potential for rock falls. Along SR-8 (US-127) between LM 15.85 and LM 16.1, a vertical, to near vertical cut face is less than five (5) feet from the road. This section has been evaluated in the past and has received a Rock Hazard Rating of 709 making it one (1) of the ten (10) most hazardous rock fall sites in the state. A number of overhangs and detached blocks were noted. As previously discussed the detach blocks are due to intersecting joints close to the cut-face surface. The stability of some of these detached blocks is further reduced by root jacking caused by the growth of trees and other vegetation. The following is a list of major features noted during the rock fall assessment;

- Over-hang at LM 16.0, see Photo 4 Appendix B
- Over-hang at LM 15.99, see Photo 5 Appendix B
- Wedge failure at LM 15.99, see Photo 6 Appendix B
- Block failures over-hang L.M 15.9, see Photos 7 and 8 Appendix B
- Over-hang at LM 15.89, see Photo 9 Appendix B

A number of smaller hazards were noted and more hazards are likely covered by vegetation and not visible at the time this assessment was made.

### **Roadway Stability Concern Areas**

An undercut area located parallel to the southbound lane between LM 16.4 and LM 16.6 was identified. Additionally, nine (9) roadway stability concern areas were discovered and investigated for spot improvements. During the investigation, each improvement area shows the need for varying degrees of treatment. The locations can be seen on Geology Assessment Figures in Appendix C. All areas noted are in the south bound lane. With a few exceptions, the areas had characteristic curvilinear cracking in pavement which begins at the shoulder, extends to the center of the south bound lane or to the center of the road in some cases. The cracks trace approximately 22 to 236 feet before terminating back into the shoulder. There are also varying degrees of vertical displacement from one-half (1/2) inch to two (2) inches. Table 4, *Roadway Spot Improvements*, provides a summary of the areas and ranks them in severity - one (1) most severe, nine (9) least severe.

### **Drainage Assessment**

The SR-8 (US-127) drainage evaluation provides an assessment of the existing drainage system and planning level recommendations for proposed improvements. The assessment consists of a field inspection, utility research and preliminary hydrologic and hydraulic calculations. The flow capacity of existing structures is estimated and compared to the source flows to measure the effectiveness of the existing structure. No detailed hydrologic or hydraulic calculations, comprehensive

routing or downstream impacts were analyzed as part of the assessment. All preliminary results are based on aerial photographs and field observations. Results were utilized to determine problem areas and for preliminary improvement recommendations.

The drainage study area for SR-8 (US-127) is from SR-27 (LM 13.96) to Palisades Drive (LM 17.01). The site location is shown on Figure 1 and 2.

**Table 4. Roadway Spot Improvements**

Roadway Stability Concern Areas (Ranked by Severity)	Log Mile Location	Approximate Length (ft)	Approximate Vertical Displacement at Crack (in)	Photo Numbers Appendix B
1	15.9	173	2	10, 11
2	16.02	58	0.5	12
3	15.42	38	0.5	13, 14
4	15.37	236	0.5	15
5	15.65	22	0.5	16, 17
6	15.72	22	0.5	18
7	14.69	128	1	19
8	14.37	77	0.5	20, 21
9	14.32	51	0.5	22

### Existing Utilities

Existing water and sewer utility data/maps were obtained from Tennessee American Water Company and the Hamilton County Waste Water Treatment Authority. Overhead utility lines, water lines and sewer lines are shown on Drainage Assessment/Modification Figures in Appendix E.

### Summary of Site Visit

A site visit was conducted on June 20, 2011, which was before the recent resurfacing, to observe the condition of the existing system. A number of drainage impacts were noted which are contributing to the need for some of the roadway spot improvements. At the intersection of Sunset Drive and SR-8 (US-127) (LM 15.42) the reinforced concrete pipe (RCP) cross-drain is covered and completely blocked at the outlet end. Piping also occurs under the roadway from adjacent ditch. These conditions can be seen in Photos 42, 43, and 44 Appendix D. At LM 15.65 the cross-drain inlet clogs up and sends water across the road and is undercutting the pavement as seen in Photos 39 and 40 Appendix D. Concrete conveyance undercutting also exists at LM 15.72 as seen in Photo 41 Appendix D. At LM 15.87, the top of rock is scoured and the concrete conveyance is undercut as shown in Photos 33 and 34 Appendix D. This condition is directly across from the roadway failure that occurred in December 2009. Several locations of the concrete

conveyance are breached by sewer caps as shown in Photo 35 Appendix D at LM 15.98, potentially allowing water to enter the subgrade of the road. As seen in Photo 38 Appendix D of LM 15.99, the concrete conveyance is breached, does not extend to the cut face and chokes down restricting flow, all conditions which potentially allow water to back up and enter the subgrade of the road. At LM 16.02 and other various locations, the concrete conveyance does not extend to the cut face as shown in Photos 36 and 37 Appendix D. This condition potentially allows water to enter the subgrade of the road. All of the drainage issues mentioned may be contributing to instability of the road. Allowing water into the subgrade by joints in the rock or through the fill and in combination with steep slopes may be impacting roadway stability.

Cross and parallel drains were of various diameter, material and condition. A summary of the existing ditches and cross drains based on field observations is provided in Tables 5 and 6.

**Table 5. Existing Ditch Summary**

Log Mile Range	Side	Ditch Lining	Condition
14.0	East	Soil	Section between exist. 48" RCP and 48" RCP under SR-8 (US-127) has scour and erosion
14.0 to 14.09	East	Vegetation	Over grown vegetation.
14.09 to 14.13	East	Grouted rock	Fair condition
14.13 to 14.44	East	Soil lined ditch	Eroding
14.44 to 14.5	East	No ditch	N/A
14.5 to 14.64	East	Rip rap lined ditch	Fair condition
14.64 to 14.69	East	Concrete channel w/ wall	Fair condition
14.69 to 14.8	East	Soil lined (w/ some riprap)	Significant erosion noted along ditch
14.8 to 15.13	East	Soil lined ditch	Eroding
15.13 to 15.18	East	Soil with some asphalt	Eroding
15.18 to 15.3	East	No ditch. Short section of closed storm sewer system.	N/A
15.3 to 16.3	East	Concrete lined ditch	Fair condition
16.3 to 16.9	West	Weathered rock	Fair condition with debris and erosion

**Table 6. Existing Cross/Parallel Drain Summary**

Log Mile	Material	Diameter (in)	Culvert Orientation	Condition
13.99	RCP	48	Crossing	Fair condition – erosion at upstream inlet
14.01	RCP	48	Parallel	Fair condition – erosion at downstream outlet
14.03	RCP	24	Parallel	Fair condition – significant vegetation
14.09	RCP - Elliptical	60x36	Parallel	Fair condition
14.12	RCP - Elliptical	38x24	Parallel	Fair condition
14.26	CMP	24	Crossing	Some siltation
14.37	Clay	18	Crossing	50-75% obstructed by silt, woody debris, and roadside trash
14.42	CMP	24	Crossing	Obstructed by vegetation
14.54	RCP	18	Crossing	75% obstructed by silt, woody debris, and roadside trash. Significant erosion present
14.69	CMP	24	Crossing	Inlet of culvert has been damaged and appears to obstruct 100% of flow. Significant erosion present.
14.75	RCP	24	Crossing	50% obstructed by silt, woody debris, and roadside trash. Erosion upstream of the culvert inlet
15.20	RCP	18	Parallel	Grate obstructed by woody debris.
15.25	RCP	18	Parallel	Siltation observed inside the catch basin and at the upstream inlet of the pipe
15.29	CMP-arch	18x12	Parallel	Inlet partially obstructed
15.43	RCP	18	Parallel	Outlet could not be located. Appears to be buried by debris.
15.54	CMP	18	Parallel	Fair condition
15.58	CMP	18	Parallel	Inlet damaged with partial obstruction by debris.
15.62	CMP	18	Parallel	Fair condition
15.66	CMP	18	Parallel	Fair condition
15.66	RCP	36	Crossing	Fair condition, some debris at grate inlet
16.27	RCB	120x90	Crossing	Fair condition
16.46	RCP	18	Crossing	Inlet is bent, partially obstructed
16.56	RCP	24	Crossing	Inlet completely clogged
16.69	RCP	18	Crossing	Fair condition
16.79	RCP	30	Crossing	Headwall damage
16.86	RCP	2-24	Crossing	Headwall damage

Figures denoting the approximate location of drainage features are provided in Appendix E.

## **Existing Hydrologic and Hydraulic Conditions**

Peak flow estimates were computed utilizing methodology provided in chapter 4 of the *TDOT Drainage Manual, May 15, 2011*. Peak flows were computed using the Rational Method for drainage areas less than 100 acres and regression equation for rural watersheds when the drainage area exceeded 100 acres. Contributing drainage areas of existing drainage structures were delineated using site topography and land uses were determined from aerial photography. Recurrence interval for peak flow estimates is based on TDOT criteria (Table 4-1, Hydrologic Design Criteria). The criteria, is summarized below.

- Cross Drains (50-year recurrence interval for design and check 100-year)
- Parallel Drains (10-year recurrence interval)
- Ditch Design (10-year recurrence interval)

Culvert flow capacity is estimated by the *FHWA, Hydraulic Design Series No. 5, Hydraulic Design of Culverts (2005)*. Based on site conditions, inlet controls the hydraulic flow for cross and parallel drains. Table 7 summarizes the culvert capacity along with the source flow.

**Table 7. Summary of Culvert Capacity and Source Flow**

LM	Material	Diameter (in)	50-yr Source Flow (cfs)	Flow Capacity (cfs)
13.99	RCP	48	196	170
14.01	RCP	48	149	75
14.03	RCP	24	112	30
14.09	RCP - Elliptical	60x36	112	140
14.12	RCP - Elliptical	38x24	150	55
14.26	CMP	24	15	24
14.37	Clay	18	15	15
14.42	CMP	24	85	24
14.54	RCP	18	70	12
14.69	CMP	24	40	24
14.75	RCP	24	30	30
15.20	RCP	18	2.5	16
15.25	RCP	18	2	16
15.29	CMP-arch	18x12	65	6
15.43	RCP	18	50	16
15.54	CMP	18	50	12
15.58	CMP	18	50	12
15.62	CMP	18	50	12
15.66	CMP	18	50	12
15.66	RCP	36	155	60
16.27	RCB	120x90	700	800
16.46	RCP	18	81	16
16.56	RCP	24	116	24
16.69	RCP	18	60	16
16.79	RCP	30	33	40
16.86	RCP	2-24	67	50

Flow Capacities in red are less than the source flow

Results indicate that eighteen (18) of the twenty-six (26) culverts are undersized for the source flows. Culvert capacities were computed based on “ideal” conditions; therefore, inlet obstructions along with culvert damage were not taken into consideration. No detailed hydrologic or hydraulic calculations were performed as part of this assessment. All preliminary flow calculations are based on aerial photographs and field observations only. No field surveying was completed.

## Environmental Scan

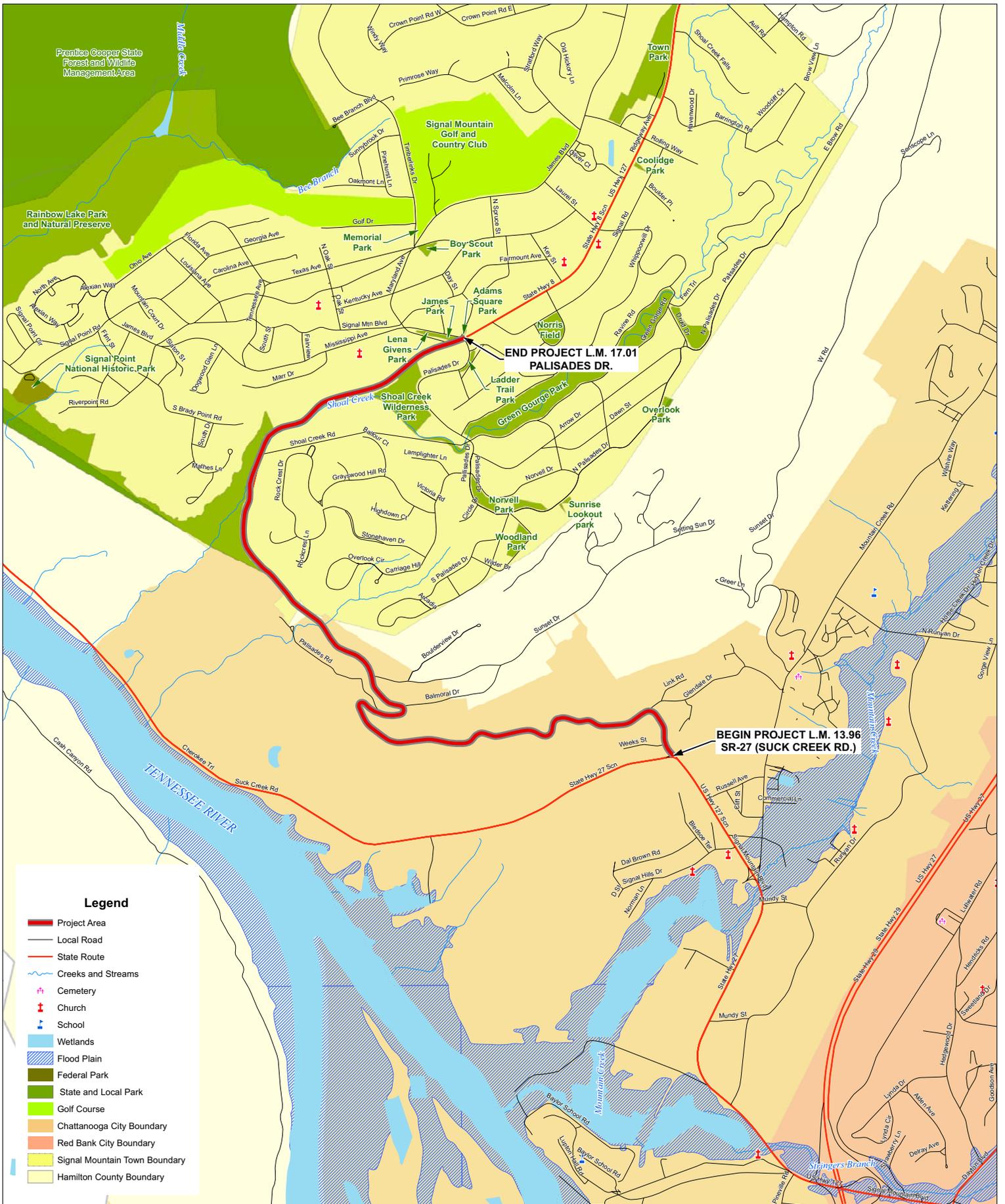
In preparation for roadway improvement projects, TDOT has introduced an Early Environmental Screening (EES) process. By screening the latest available environmental data during the early stages of project planning, TDOT and the resource and permitting agencies will be better prepared to anticipate potential environmental issues and mitigation requirements. U.S. Environmental Protection Agency (EPA) maps in “EJView” were reviewed as well as Federal Emergency Management Authority (FEMA) Flood Insurance Rate Maps (FIRMs) and National Wetland Inventory (NWI) maps. Preliminary known environmental resources are shown on an environmental constraints map in Figure 5.

### TDOT Early Environmental Screening (EES) Report

TDOT performed an EES on July 7, 2011. The areas included in the EES and the report results are listed below. Copies of the TDOT EES reports are provided in Appendix F.

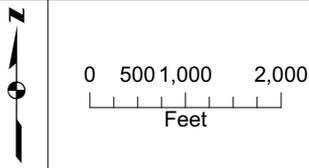
#### Within 1000 Feet of Study Area

- Cemetery Sites & Cemetery Properties
  - No impacts are anticipated.
- Institutions & Sensitive Community Populations
  - EES Found:
    - ✓ No population present
    - ✓ Linguistically isolated populations
    - ✓ Populations below poverty – State average 13%
- Threatened & Endangered Species (Bat)
  - A substantial impact on the project is probable as there is a known occurrence of Indiana or Gray bats within four (4) miles of the proposed transportation study area or corridor. It is anticipated that (a) avoidance/minimization of potential impacts to species will be needed, (b) surveys for the species for the project may be required, (c) coordination with U.S. Fish and Wildlife Service (USFWS) and established Section 7 biological conclusions for the project will be needed, and (d) seasonal construction limitations will likely be necessary.
- Railroads
  - There is a low/minimal chance for impacts on railroads to the project. There are railroads within or abutting the project study corridor. Impacts to the railroad can be avoided, and the proposed project will be greater than 200 feet from the railroad. There is the remote possibility of minor involvement on the railroad property to accommodate drainage, but there will be no grade crossing.

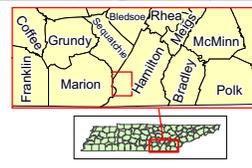


**Legend**

- Project Area
- Local Road
- State Route
- Creeks and Streams
- Cemetery
- Church
- School
- Wetlands
- Flood Plain
- Federal Park
- State and Local Park
- Golf Course
- Chattanooga City Boundary
- Red Bank City Boundary
- Signal Mountain Town Boundary
- Hamilton County Boundary



**ENVIRONMENTAL  
CONSTRAINTS MAP**  
SR-8 FROM SR-27 (SUCK CREEK RD.)  
TO PALISADES DRIVE  
HAMILTON COUNTY, TENNESSEE



**FIGURE  
5**

#### Within 2000 Feet of Study Area

- National Register of Historic Places (NRHP) Sites
  - No impacts are anticipated.
- TWRA Lakes and Other Public Lands
  - Several public lands appear to be adjacent to the road right-of-way. These public lands include portions of Rainbow Lake Park and Natural Preserve, Shoal Creek Wilderness Park, James Park, and Adams Square Park. As the project progresses and alternatives are more fully developed, care will need to be taken to assure that the project alternatives do not acquire additional right of way from these public lands.
- Pyritic Rock
  - Moderate/medium impacts are anticipated for the project due to the presence of pyritic material. Formations that may contain acid producing rock are most likely present in small quantities. It is anticipated that geotechnical studies and containment measures will be needed in order to minimize disturbance/movement of pyritic rock during construction. These containment measures may include measures to identify additional right of way to stockpile material prior to disposal, secure permits, and design project blending of pyritic materials. These geotechnical studies and containment measures will be developed as the project progresses.
- Superfund Sites
  - No impacts are anticipated.

#### Within 4000 Feet of Study Area

- Terrestrial Species
  - No impacts are anticipated.
- TDEC Conservation Sites & TDEC Scenic Waterways
  - No impacts are anticipated.
- Large Wetland Impacts
  - A substantial impact to the project is probable as there are greater than two (2) acres of wetlands within the project study area or corridor. Compensatory mitigation will be required. Design efforts will be needed to avoid and minimize impacts to wetlands to the maximum extent practicable. If a floodplain is crossed by the project, floodplain culverts may be necessary.
- Tennessee Natural Areas Program
  - No impacts are anticipated.

- Wildlife Management Areas
  - No impacts are anticipated.

#### Within 10,000 Feet of Study Area

- Aquatic Species
  - Minimal impact on the project is likely as there is a known occurrence of a rare or state protected aquatic species located within the project study area. A survey for the species is likely to be required.
- Caves
  - No impacts are anticipated.

### **Flood Zone Review**

Executive Order No. 11988, *Floodplain Management* was enacted May 24, 1977. Its purpose is “to avoid to the extent possible the long-term and short-term adverse impacts associated with the occupancy and modifications of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable Option.” The executive order requires each agency to investigate floodplain conditions for a proposed federally financed (or assisted) action to reduce the risk of flood loss, minimize the impact of floods on human safety, and to preserve the natural and beneficial values served by floodplains.

A preliminary flood zone review for the project was performed. The Federal Emergency Management Authority (FEMA) Flood Insurance Rate Maps (FIRMs) for the City of Chattanooga, Hamilton County, City of Red Bank, and Town of Signal Mountain, Tennessee, were reviewed to determine if the proposed project area is located in the base flood zone. The following FIRM maps were referenced and are included in Appendix G.

- Panel 326 of 530, Map # 47065C0326F, Effective Date 11/7/2002
- Panel 327 of 530, Map # 47065C0327F, Effective Date 11/7/2002

The base flood zone is defined as the area located in the 100-year floodplain and is the area subject to a one (1) percent chance of flooding on an annual basis. The proposed project area is not located in a base flood zone area.

### **Waters of the U.S. (Jurisdictional Waters) and Wetlands**

Waters of the U.S. (jurisdictional waters), including wetlands, as defined by 33 CFR Part 328.3(b), are protected by Section 404 of the Federal Clean Water Act (33 USC 1344), and by the Tennessee Water Quality Control Act (T.C.A. 69-3-108(b)) in the state of Tennessee. Impacts and alterations to jurisdictional waters in Tennessee are regulated by the U.S. Army Corp of Engineers (USACE) and the Tennessee Department of Environment and Conservation (TDEC).

Alterations to streams or other aquatic sites designated as waters of the state, or waters of the U.S. require individual or general Aquatic Resource Alteration Permits (ARAP) from the state of Tennessee, individual or Nationwide 404 U.S. Army Corp

of Engineers permits, and, where applicable, a TVA 26A permit or letter of no objection. Construction projects disturbing one (1) or more acres of land require storm water control permits issued by the state of Tennessee pursuant to the National Pollutant Discharge Elimination System (NPDES).

A preliminary investigation to determine the presence of jurisdictional waters or wetlands was performed for the proposed SR-8 (US-127) improvements. Available remote sensing data, including the U.S. Geological Survey (USGS) and USFWS National Wetlands Inventory (NWI) maps, were referenced. In addition, the TDEC Division of Water Pollution Control 303(d) list of impaired streams and list of Known Exceptional Tennessee Waters were referenced.

The proposed project crosses three (3) streams:

- Shoal Creek
- Two (2) Unnamed Tributaries of the Tennessee River

### **TDEC 303(d) List**

The streams crossing the project are shown on Figure 5. Shoal Creek appears on the TDEC 2010 303(d) List of Impaired Waters for Hamilton County, which was published in August 2010. TDEC states, "The 303(d) List is a compilation of the streams and lakes in Tennessee that are 'water quality limited' or are expected to exceed water quality standards in the next two (2) years and need additional pollution controls. Water quality limited streams are those that have one (1) or more properties that violate water quality standards. They are considered impaired by pollution and not fully meeting designated uses."

Shoal Creek is listed in the 303(d) List as a Category 5 stream, which means that it is impaired for one (1) or more uses. The 303(d) lists 5.4 miles of Shoal Creek as high for *Escherichia coli*. The pollutant source is discharges from MS4 area septic tanks and collection system failures. The following information is provided for Shoal Creek.

Waterbody ID – TN06020001087-1000  
County – Hamilton  
Miles/Acres Impaired – 5.4  
Cause/TMDL Priority – *Escherichia coli* – High (H)  
Pollutant Source – Discharges from MS4 Area  
    Septic Tanks  
    Collection System Failure  
Comments – Stream is Category 5. (One or more uses impaired.)

### **TDEC Known Exceptional Tennessee Waters**

Shoal Creek is also listed on the TDEC Known Exceptional Tennessee Waters and Outstanding National Resource Waters list. The basis for including Shoal Creek on this list is that it is home to the White Fringeless Orchid, a Tennessee state endangered species. The following information is provided for Shoal Creek.

HUC	06020001
Watershed Name	Nickajack, Chickamauga Reservoirs (Lower Tennessee)
Waterbody	Shoal Creek
County	Hamilton
Description	From Nickajack Reservoir to origin.
Basis for Inclusion	State endangered White Fringeless Orchid

Because Shoal Creek is included on TDEC's 303(d) List and the list of Known Exceptional Tennessee Waters, special consideration will be required during further environmental investigations, project design, and project construction.

### National Wetlands Inventory (NWI)

The USFWS NWI maps identified no wetland areas that would be impacted by the proposed project. An NWI map for the study area is provided in Appendix H. The project is located on Signal Mountain in Hamilton County. There are some small wetland areas at the foot of the mountain as well as the Tennessee River in the valley next to Signal Mountain.

As previously discussed, the TDOT EES report concluded that the proposed project would have large wetland impacts. It states that there are more than two (2) acres of wetlands in the project area and compensatory mitigation would be required. However, with TDOT standard practices for construction of projects, these wetlands should not be impacted by this project. Based on the topography of the project area and preliminary field visits, it is anticipated that any impacts to wetlands due to the proposed project improvements would be minor. A more thorough field visit will be conducted in the next stage of environmental documentation in order to verify this finding. If wetlands are identified, a delineation will be conducted in accordance with US Army Corps of Engineer and TDEC guidelines.

### Threatened and Endangered Species Review



The USFWS was not consulted as part of this report. However, the TDOT EES Report concluded that there is a known occurrence of the Indiana or Gray bat within four (4) miles of the proposed project. Project impacts to these species should be addressed in the next stage of environmental documentation for this project.

With Shoal Creek in the project area, the state endangered White Fringeless Orchid (*Platanthera integrilabia*) could exist in or close to the project area. The USFWS should be contacted regarding the presence of this endangered species in the next phase of environmental documentation for this project.

TN Endangered White Fringeless Orchid, Thomas G. Barnes @ USDA-NRCS PLANTS Database

In a project stakeholders' meeting held on August 24, 2011, it was brought to TDOT's attention by a stakeholder that the federally threatened Large-flowered Skullcap (*Scutellaria montana*) could exist in the proposed project area. This

information should be verified in the next phase of environmental documentation for this project.

### **Pyritic Rock**

A geologic assessment for this project determined that acid producing materials occur in the project area. Three potential sources of acid producing material were noted:

1. Minor coal seams in Signal Point Shale which may be encountered in the road cut between LM 16.7 and 16.9.
2. Minor coal seams in the Raccoon Formation, which are encountered in outcrop in the road cut between LM 15.85 and 15.9.
3. Chattanooga Shale, which is a known source of pyritic, acid producing material, and is located at SR-27 (Suck Creek Road).

Additional information about these materials and a map showing their locations can be found in the geologic assessment section. Pyritic rock and acid producing materials will need to be addressed in the next phase of environmental documentation for this project.

### **Historic Properties Review**

As stated above in the TDOT EES report, no historic properties are anticipated to be impacted by the proposed project. Signal Mountain is known to contain some properties listed on the National Register of Historic Places (NRHP). However, coordination with Town of Signal Mountain officials confirmed that no historic properties are anticipated to be impacted.

### **Unique Area Feature**



A unique feature within the study area is a home known as “The Spaceship House” that is designed to look like a spaceship. This two (2) bedroom two (2) bathroom home was built in 1972 and is located directly off of SR-8 (US-127). It was privately owned until its latest owner decided to open it to the public for overnight accommodations to visitors looking for a unique lodging experience. The home has been featured on HGTV and has appeared on several “Most Unusual House” lists.

<http://www.vrbo.com/241542>

### **Stakeholder Meeting**

A stake holder meeting with TDOT and local officials was held on August 24, 2011 to discuss the improvement project for SR-8 (US-127). Topics discussed were as follows:

- Rockslides along SR-8 (US-127)
- 1990 TDOT proposed five (5) lane roadway project
- Reconstruct existing SR-8 (US-127)
- New Route to Signal Mountain
- Spot Improvements along SR-8 (US-127)

The stakeholder meeting minutes are provided in the Appendix I.

## **Purpose and Need**

The development of the purpose and need for improvement to the SR-8 (US-127) corridor was based on the findings and analysis of the route's existing physical conditions.

The primary transportation need for this location is to provide a safer, more reliable and shortest possible route between Signal Mountain and Chattanooga.

## **Options for Improvement**

In consideration of the need for an improved connection between Signal Mountain and Chattanooga, four (4) options have been developed and should be considered during the NEPA environmental analysis phase of this study.

Additional studies must be completed to verify the initial recommendations. These recommendations are to be used for planning purposes only, not for construction.

### **Option 1 – No Build**

The No-Build Option assumes no modifications or improvements will be made over the planning horizon. Routine maintenance related activities as well as scheduled resurfacing, signing, and possible safety improvements may occur. This Option, however, does not support the project's stated purpose and need for addressing areas of insufficient drainage and roadway stability concern areas. Without roadway stability improvements, failures of the existing roadway, such as rockslides and cracking, will become more pronounced.

### **Option 2 – Reconstruct SR-8 (US-127)**

Option 2 consists of reconstructing SR-8 (US-127) for the length of the study area with improved horizontal and vertical curves, 45-mph design speed, drainage improvements, rock stabilization, and improved shoulders. The reconstruction will provide two (2), twelve (12) foot travel lanes with an additional twelve (12) foot truck climbing lane from LM 14.00 to LM 15.65 and from LM 16.59 to LM 16.92. It will also improve the reliability and safety of the existing alignment, and will decrease travel time. Figure 6 provides the typical sections of the proposed improvements.

SR-8 (US-127) reconstruction will require route closure for approximately 2.5 years (two (2) consecutive years closed and the potential of a half year of partial closings). Possible detour routes are the W Road and Roberts Mill Road. The combined excess capacity of these two roadways cannot provide an adequate LOS

with the SR-8 (US-127) traffic. Additionally, both roads are often closed during severe winter weather. Large cut and fill slopes will cause considerable impacts to adjacent property owners and significant visual impacts to the route. Figure 7 denotes the 1,000-foot-wide study corridor.

Cost estimates for reconstructing SR-8 (US-127) from SR-27 (Suck Creek Road) (LM 13.96) to Palisades Drive (LM 17.01) are approximately \$25 million per mile for a total of \$75 million.

### **Option 3 – New Alignment**

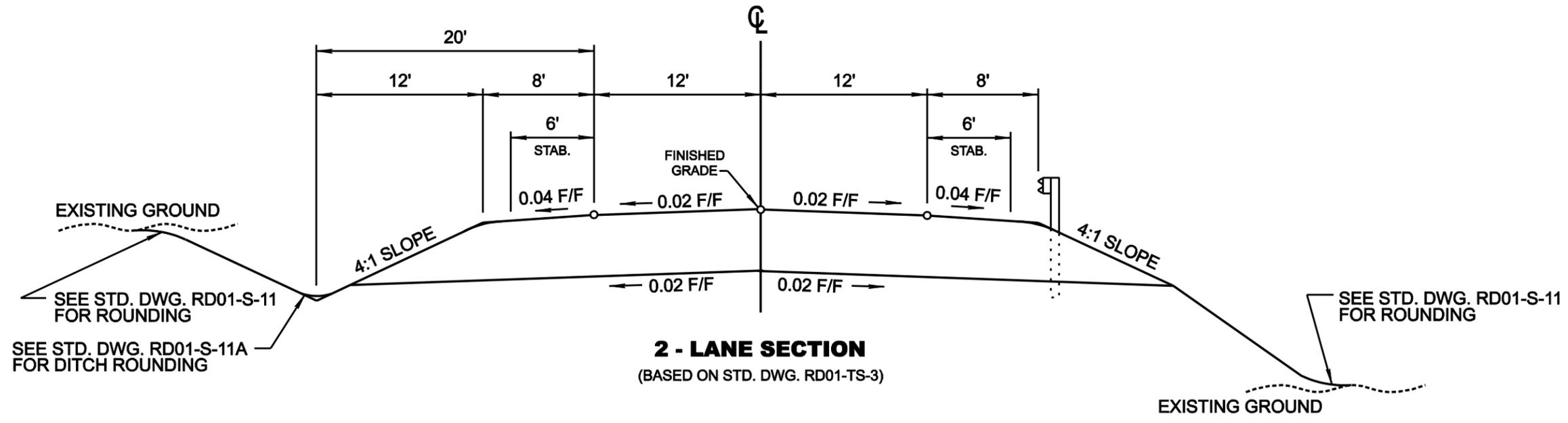
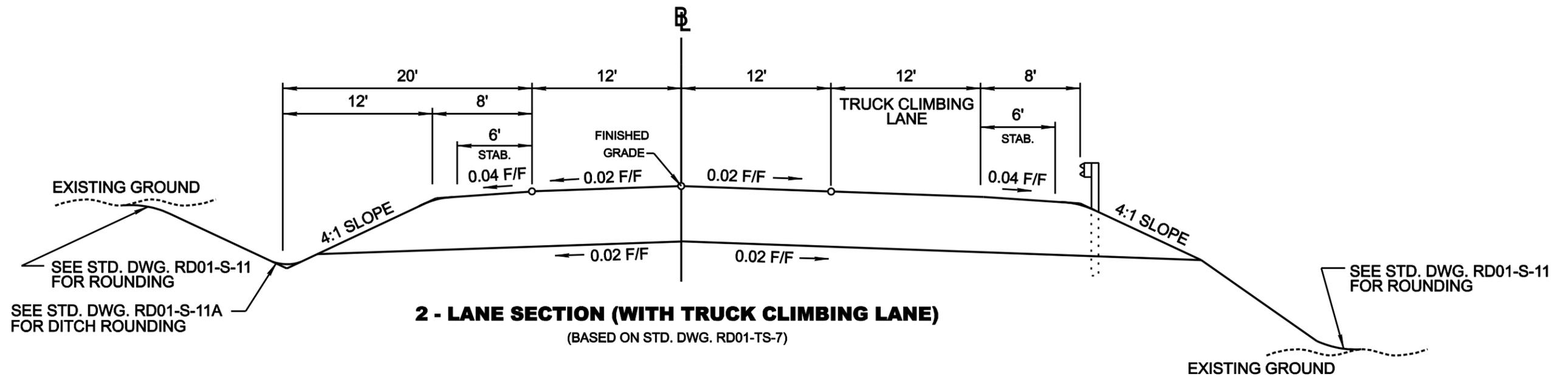
Option 3 proposes constructing an entirely new alignment that would follow the existing Mountain Creek Road, W Road and Anderson Pike from SR-8 (US-127) to Taft Highway (4.4 miles). The W Road would have improved horizontal and vertical curves, 45-mph design speed, provide two (2), twelve (12) foot travel lanes with a twelve (12) foot truck climbing lane along the W Road from Mile 0.6 to Mile 1.8 and from Mile 3 to Mile 4.4. Drainage improvements, rock stabilization, and improved shoulders would also be completed. Reconstructing W Road will improve the traffic flow, may reduce crashes and provide a more reliable route. SR-8 (US-127) will remain open during construction which minimizes construction delays for existing SR-8 (US-127) users. However, the existing W Road traffic is expected to shift to SR-8 (US-127) increasing the traffic volume on the study corridor during construction. At the completion of construction, SR-8 (US-127) would follow Mountain Creek Road and the W Road. The existing SR-8 (US-127) would be relinquished to the local government. This reduces the State Highway System by approximately one (1) mile.

Option 3 increases the route length from Mountain Creek Road (LM 13.52) to Laurel Street (LM 17.55) by approximately two (2) miles. Large cut and fill slopes will cause considerable impacts to adjacent property owners and substantially alter the existing landscape. This Option costs an estimated \$30 million per mile with a total cost of \$132 million. The new alignment typical sections and the W Road study corridor are shown on Figures 8 and 9.

### **Option 4 – Spot Improvements**

Option 4 involves improvements to select areas along SR-8 (US-127) to improve the stability of the existing route. Several locations have been identified based on the geological and drainage assessment. This Option would maintain the existing alignment and typical section. Completing spot improvements along the route would improve the route reliability. Roadway closures of one (1) to two (2) lanes would be expected during the improvements.

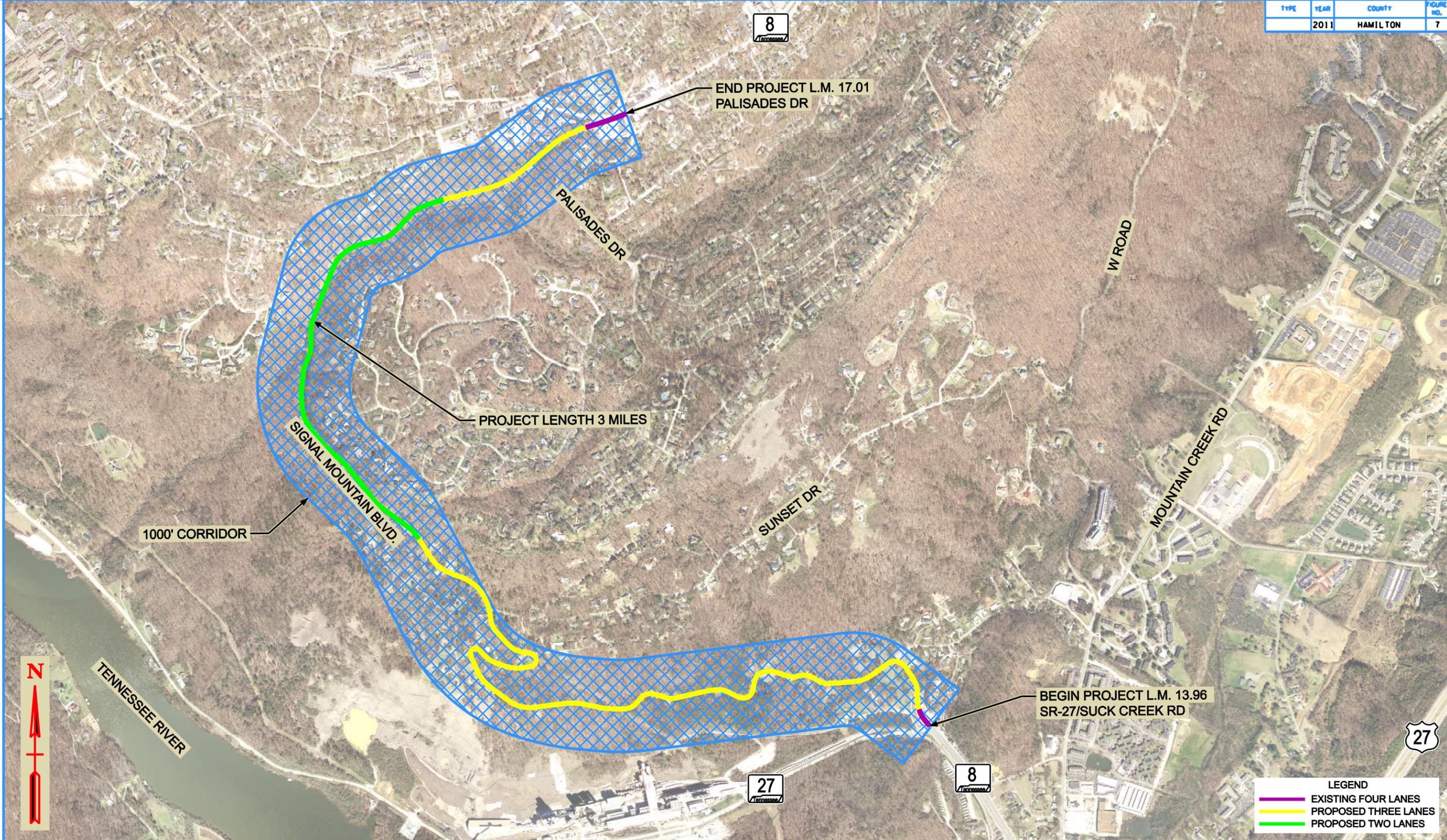
The estimated cost varies depending on spot improvement options selected, with the maximum being \$50 million. However, a possible spot improvement scenario along the roadway would cost \$5.5 million. Option 4 would meet the majority of the stated purpose and need by creating a more reliable and direct route between Signal Mountain and Chattanooga. The reliability improves by reducing closures due to roadway failures and rock slides. However, Option 4 maintains the existing alignment, shoulders and lanes, so it would not significantly reduce crashes or improve efficiency along the route.



**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

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TYPE	YEAR	COUNTY	FIGURE NO.
	2011	HAMILTON	7



LEGEND

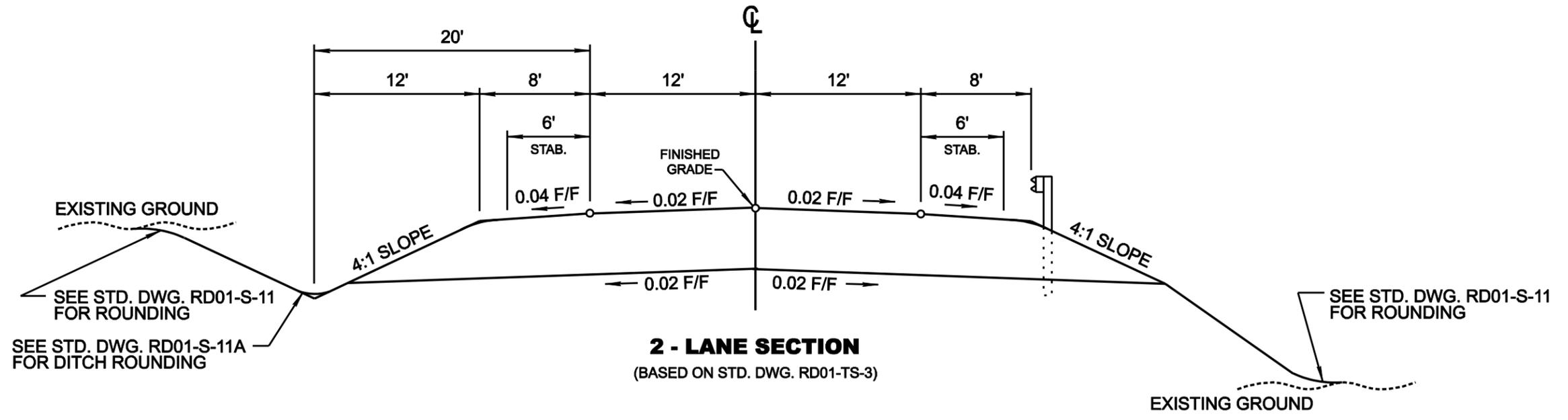
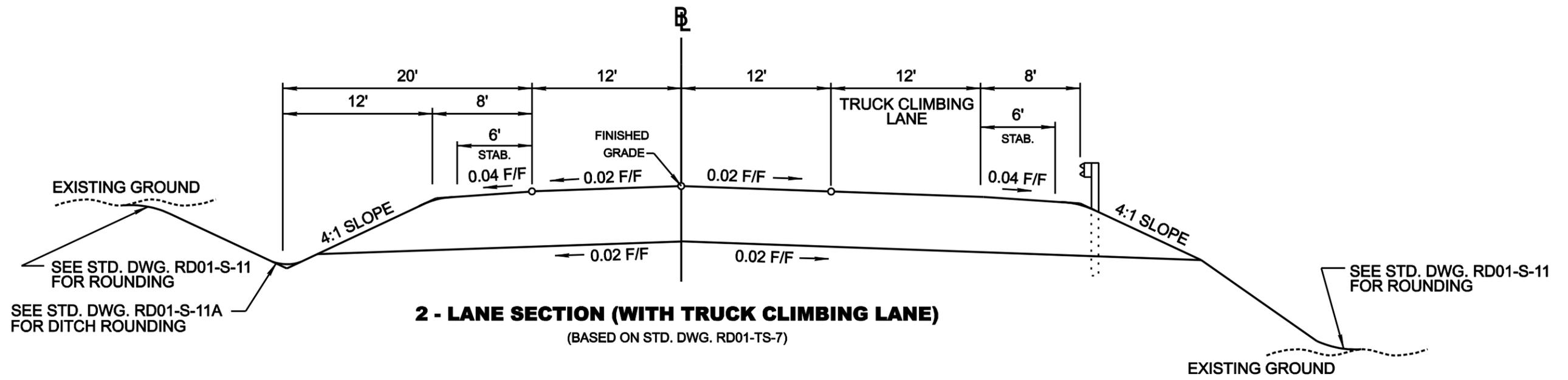
	EXISTING FOUR LANES
	PROPOSED THREE LANES
	PROPOSED TWO LANES

**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

FIGURE 7  
RECONSTRUCTION  
SR-8/SIGNAL MTN BLVD

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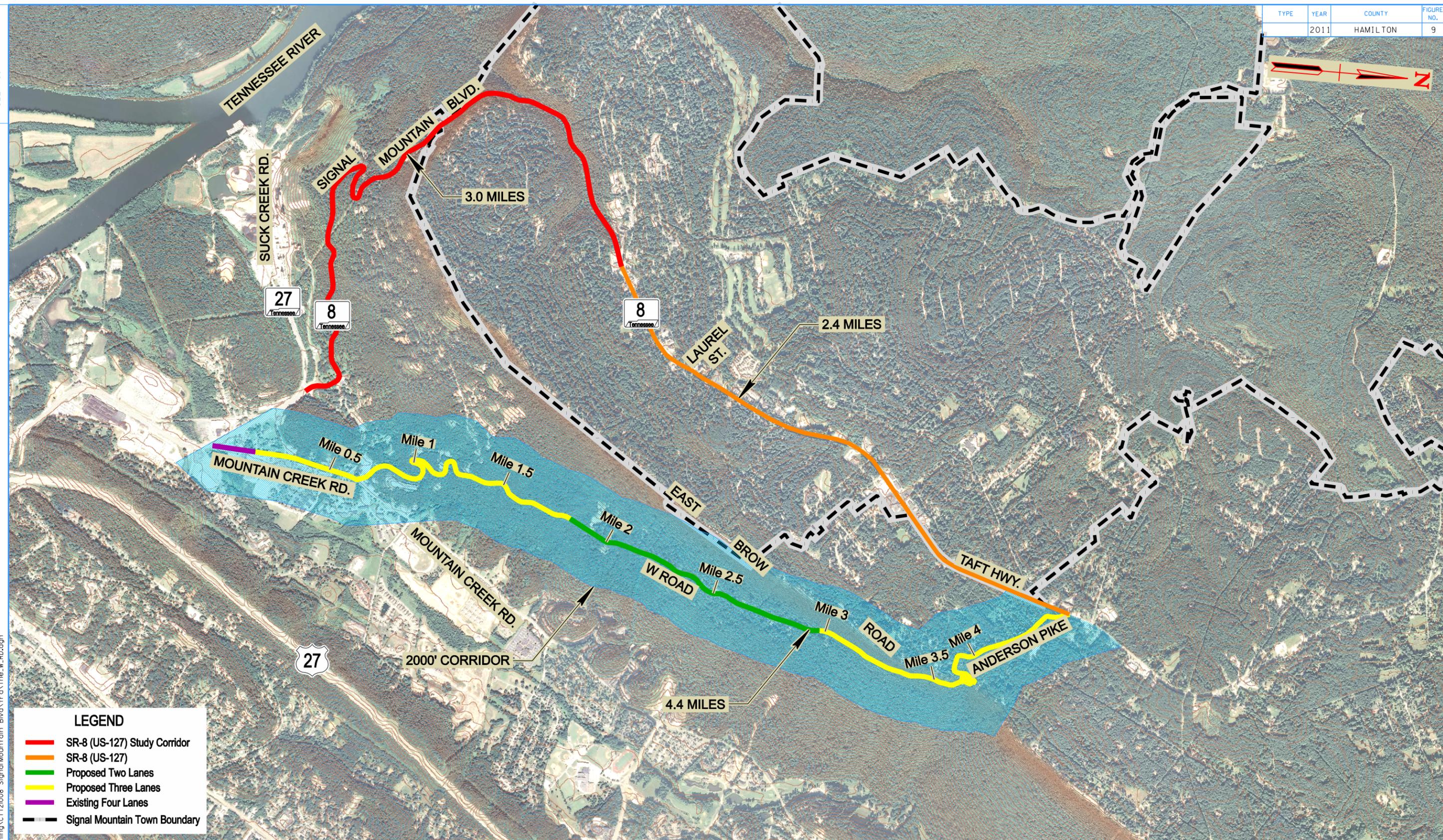


**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**

FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

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TYPE	YEAR	COUNTY	FIGURE NO.
	2011	HAMILTON	9



**LEGEND**

- SR-8 (US-127) Study Corridor
- SR-8 (US-127)
- Proposed Two Lanes
- Proposed Three Lanes
- Existing Four Lanes
- Signal Mountain Town Boundary



## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

FIGURE 9  
NEW ALIGNMENT  
(W ROAD)

## **Proposed Geologic Spot Improvements**

### **Rock Fall Mitigation**

Several improvement options have been developed in order to mitigate the potential rockfall hazards threatening motorists traveling on the study corridor. Further detailed field investigations should follow this study in order to find the most suitable Option. A summary of the rock fall mitigation improvements is listed below.

- Improvement Option 1. Remove all vegetation from the rock slope face between LM 16.1 and 15.85 from the edge of the roadway road up to the right-of-way line. The rock slope face should be scaled of loose rock and debris.
- Improvement Option 2. Install rock bolts and shotcrete in addition to Option 1. Rock bolts are large anchor bolts drilled into the rock mass that transfer the unstable exterior load to the much more stable interior. Rock bolts are installed in a grid pattern along the rock face to aid in stabilizing the rock mass. Shotcrete is concrete that is conveyed through a hose and projected onto the rock face. The concrete is typically reinforced with steel rods, steel mesh or fibers.
- Improvement Option 3. Install rock fall barriers and catch fences in addition to Option 1. Rock fall fencing or catch fencing is high tensile fencing placed at the base of the slope to act as a barrier or it can be draped over the entire rock face and secured by the rock bolts (nail and net).
- Improvement Option 4. Modifying the rock slope face by laying it back, this will likely require purchase of additional right-of-way and blasting.

All improvement options will require at least one (1) lane closure, some will require two (2) lanes to be closed. Possible bypass routes are the W Road and Roberts Mill Road. Both of these roadways would not handle the additional traffic load and are closed during severe winter weather. Typical photos of these options are provided in Photos 23 through 27 in Appendix B.

### **Roadway Stability Spot Improvement**

Multiple options have been developed to stabilize the nine (9) roadway stability concern areas. Some potential causes of the instability could be over steepened slopes, lack of stormwater management (see drainage assessment section), aging retaining walls or combinations of these. An undercut area along the south bound lane between LM 16.4 and LM 16.6 should also be improved.

Following are proposed improvement options for the roadway stability concern areas. Each improvement will require additional analysis and design prior to implementation.

- Improvement Option 1. Stabilize the steep fill slopes by installing soil nails (with netting), rock bolts and drains. Soil nailing involves grouting solid bars into predrilled holes along the slope. A reinforcing mesh (netting) can then be tied to each of the head plates. The combination of nails and netting should aid in stabilizing the slope. Rock bolts are large anchor bolts drilled into the rock mass that transfer the unstable exterior load to the much more stable interior. Rock bolts are installed in a grid pattern along the rock face to aid in stabilizing the rock mass. Slope drains involve drilling and installing perforated pipes into the slope to aid in the removal of water from the subgrade.
- Improvement Option 2. Stabilize the steep fill slopes by repairing, modifying or installing mechanically stabilized earth (MSE) walls. MSE walls incorporate multiple layers of tensile reinforcing elements placed roughly perpendicular to the slope face. An adequate facing material is added to the slope face to prevent soil from unraveling between the reinforcing elements.
- Improvement Option 3 Construct a viaduct to avoid the stability concern area between LM 15.8 and LM 16.1. A viaduct is a continuous bridge structure composed of several small spans.

Mitigating the undercut area along the southbound lane between LM 16.4 and LM 16.6 will require mechanical excavation and granular backfill to properly stabilize the area.

All improvement options require SR-8 (US-127) lane/roadway closures for some duration forcing the public to use alternate routes such as W Road and Roberts Mill Road. Both of these roadways would not handle the additional traffic load and are closed during severe winter weather.

### **Proposed Drainage Spot Improvements**

Two improvement options have been developed in order to increase the capacity of the existing drainage system. The first improvement option is to repair the existing drainage system and the second improvement option modifies the existing drainage structures to meet TDOT design standards and contain peak design flows. Repairing the existing drainage system would improve the existing drainage capacity; however, it wouldn't meet current TDOT design standards. System upgrades to meet TDOT design criteria has been provided for estimating purposes only. A detailed design based on a topographic survey and a complete hydrologic and hydraulic analysis would be required to validate pipe locations and diameters.

Regardless of the course of action, periodic maintenance should be implemented. The existing site conditions (i.e. steep slopes, large drainage areas, etc.) are problematic to any drainage system. Therefore, a periodic system inspection and maintenance plan should be developed. The plan should incorporate periodic inspections and site investigations after significant rainfall events to mitigate drainage issues and identify potential problem areas.

### Existing Drainage System Repair

Based on observations during the site visit and evaluating drainage patterns, it appears that the existing drainage system is in need of repair and maintenance. This lack of maintenance has resulted in damage to some of the system's features. Both the road side ditches and existing culverts are the primary components requiring repair.

Varying degrees of erosion were observed in the soil and vegetation lined ditch segments. It is recommended that a detailed ditch survey be performed to identify locations of concern and assign priority. Once problem areas are identified, a detailed engineering analysis should be performed and plans developed to repair these areas and/or add ditch armoring.

Damage was also observed at some of the culvert cross drains and parallel drains. Based on these observations, recommended repairs are summarized in Table 8.

**Table 8. Recommended Culvert Repairs**

Log Mile	Material	Diameter (in)	Culvert Orientation	Condition
14.01	RCP	48	Parallel	Repair erosion at outlet and provided armoring of channel between both culverts.
14.03	RCP	24	Parallel	Remove culvert and clear vegetation in the ditch. Culvert is not needed at this location.
14.26	CMP	24	Crossing	Remove siltation
14.37	Clay	18	Crossing	Replace culvert. Clear vegetation, sediment and debris at the inlet.
14.42	CMP	24	Crossing	Remove vegetation obstructing the inlet.
14.54	RCP	18	Crossing	Remove sediment and debris at the inlet. Clear vegetation at the inlet. Armor inlet to minimize erosion.
14.69	CMP	24	Crossing	Replace culvert. Armor inlet to minimize erosion.
14.75	RCP	24	Crossing	Remove sediment and debris at the inlet. Armor inlet to minimize erosion.
15.2	RCP	18	Parallel	Remove debris from the grate and inlet.
15.25	RCP	18	Parallel	Remove debris from the grate and inlet.
15.29	CMP-arch	18x12	Parallel	Remove obstructions from the culvert inlet.
15.43	RCP	18	Parallel	Remove material that has obstructed the culvert outlet.

Log Mile	Material	Diameter (in)	Culvert Orientation	Condition
15.58	CMP	18	Parallel	Repair damaged inlet. Remove debris obstructing the inlet.
15.66	RCP	36	Crossing	Remove debris from the inlet
16.27	RCB	120x90	Crossing	Fair condition
16.46	RCP	18	Crossing	Inlet is collapsed, partially obstructed
16.56	RCP	24	Crossing	Remove debris that has completely obstructed the inlet. Place a ditch block downstream of inlet to route all flow into the culvert.
16.69	RCP	18	Crossing	Place a ditch block downstream of inlet to route all flow into the culvert.
16.79	RCP	30	Crossing	Place a ditch block downstream of inlet to route all flow into the culvert.
16.86	RCP	2-24	Crossing	Fair condition

### Modified Drainage Improvements

A preliminary system layout based on TDOT design criteria has been provided for planning purposes only and should not be used for construction. A detailed design based on a topographic survey and a complete hydrologic and hydraulic analysis would be required to validate pipe locations and diameters. Proposed ditch and culvert modifications have been developed that increase drainage system capacity and should minimize roadway flooding and potential roadway failures (due to flooding). Plans noting the proposed modifications have been provided in Appendix E. Tables 9 and 10 summarize improvements to the roadside ditches and culverts. The improvements have been listed in relationship to the corresponding roadway stability concern area(s).

**Table 9. Summary of Proposed Ditch Modifications**

Roadway Stability Concern Areas (Ranked by Severity)	Log Miles		Section	Ditch Lining	Proposed Ditch Cross Section			
	From	To			Depth (ft)	Top Width (ft)	Bottom Width (ft)	Side Slope
N/A	14.01	14.09	Trapezoidal	Riprap	2		5	2
9, 8, & 7	14.12	15.1	Parabolic	Concrete	2	4		
7, 4, 3 & 5	15.3	15.66	Parabolic	Concrete	2	4		
5 & 6	15.66	15.8	Parabolic	Concrete	3.5	5.5		
1, 2 & 6	15.8	16.26	Parabolic	Concrete	2.5	4.5		
1 & 2	16.3	16.9	No modification proposed					

**Table 10. Summary of Proposed Culvert Modifications**

LM	Pipe Location	Material	Shape	Drop Inlets	Diameter (in)	Roadway Stability Concern Areas (Ranked by Severity)
13.99	Cross Drain	Concrete	Elliptical		76x48	N/A
14.01	Parallel	Concrete	Round		60	
14.09	Parallel	Concrete	Elliptical		68x43	
14.12	Cross Drain	Concrete	Elliptical		68x43	
14.37	Cross Drain	Concrete	Round		24	
14.42	Cross Drain	Concrete	Round		2—30	
14.54	Cross Drain	Concrete	Round		36	8
14.69	Cross Drain	Concrete	Round		30	
15.29	Cross Drain	Concrete	Round		2—24	7
15.43	Parallel	Concrete	Round		30 <sup>(1)</sup>	3
15.54	Parallel	Concrete	Round		30 <sup>(1)</sup>	
15.58	Parallel	Concrete	Round		30 <sup>(1)</sup>	
15.62	Parallel	Concrete	Round		30 <sup>(1)</sup>	
15.66	Parallel	Concrete	Round		30 <sup>(1)</sup>	5
15.66	Cross Drain	Concrete	Round	1	3—30	
15.8	Cross Drain	Concrete	Round	1	2—30	6
15.9	Cross Drain	Concrete	Round	1	30	1 & 2
16.08	Cross Drain	Concrete	Round	1	30	
16.18	Cross Drain	Concrete	Round	1	30	
Shoal Cr. Rd.	Cross Drain	Concrete	Round	1	24	
16.46	Cross Drain	Concrete	Round	1	30	
16.56	Cross Drain	Concrete	Round	1	2—36	
16.69	Cross Drain	Concrete	Round	1	2—36	
16.79	Cross Drain	Remove				
16.86	Cross Drain	Concrete	Round	1	2—30	

(1) Parallel drains that may require a closed storm sewer system

## Spot Improvement Costs

Cost estimates have been developed based on the previous spot improvement options. Drainage repair costs have not been included based on the assumption state and local forces would complete the repairs. The following estimates are provided for planning level purposes only. Additional surveying and analysis would be required to develop construction costs.

An undercut area along the south bound lane between LM 16.4 and LM 16.6 and nine (9) roadway stability concern areas were identified during the geologic assessment. Three options were developed to stabilize the nine (9) concern areas. Lack of proper drainage was a root cause associated with the roadway instability. Table 11 provides planning level costs for the roadway stability improvement options and associated drainage modifications. Drainage modification costs shown are to improve the drainage system upstream of the nine (9) roadway stability concern areas.

A rock fall mitigation area was identified during the geologic assessment. Four improvement options were developed to mitigate the potential rockfall hazards. Additional field investigations and analysis should follow this study in order to determine the most suitable option. Planning level costs based on the data collected during this study are provided in Table 12.

**Table 11. Roadway Stability Concern Areas and Drainage Modification Costs**

Slope Stability Concern Areas (Ranked by Severity)	From Log Mile	To Log Mile	Improvement Option 1 Drill and Install Soil Nails, Anchors and Drains	Improvement Option 2 MSE Retaining Wall	Improvement Option 3 Viaduct	Proposed Culvert Modifications	Proposed Ditch Modifications	Undercut Mitigation
N/A	13.96	14.32	N/A	N/A	N/A	\$330,000	\$169,000	N/A
9	14.32	14.37	\$52,500	\$97,500	N/A	N/A	\$33,000	N/A
8	14.37	14.69	\$75,000	\$150,000	N/A	\$174,000	\$209,000	N/A
7	14.69	15.37	\$120,000	\$240,000	N/A	\$91,000	\$311,000	N/A
4	15.37	15.42	\$157,500	\$315,000	N/A	N/A	\$31,000	N/A
3	15.42	15.65	\$52,500	\$105,000	N/A	\$165,000	\$142,000	N/A
5	15.65	15.72	\$37,500	\$75,000	N/A	\$113,000	\$63,000	N/A
6	15.72	15.85	\$22,500	\$45,000	N/A	\$107,000	*\$315,000	N/A
1 & 2	15.85	17.01	\$1,050,000	\$2,400,000	\$35,000,000	\$593,000	*\$981,000	\$25,000
<b>Rounded Totals</b>			<b>\$1,600,000</b>	<b>\$3,500,000</b>	<b>\$35,000,000</b>	<b>\$1,300,000</b>	<b>*\$2,254,000</b>	<b>\$25,000</b>

\*Ditch modification includes cost of lowering 12-inch cast iron sewer pipe two (2) feet between LM 15.63 and LM 16.3.

**Table 12. Rock Fall Mitigation Costs – Rock Fall Mitigation Area (LM 15.85-16.1)**

Action	Improvement Option	Total Cost
Vegetation Removal	1	\$110,000
Scaling	1	\$170,000
Excavation of Scaled Rock	1	\$45,000
<b>Total</b>		<b>\$325,000</b>
Shotcrete	2	\$160,000
Rock Bolting	2	\$215,000
Improvement Option 1	*2	\$325,000
<b>Total</b>		<b>\$700,000</b>
Nail and Net	3	\$555,000
Improvement Option 1	*3	\$325,000
<b>Total</b>		<b>\$880,000</b>
Drill, Blast and Excavation (1H:0.5V Slope)	4	\$8,000,000
Drill, Blast and Excavation (1H:1V Slope)	4	\$12,000,000
*Improvement option 1 should be performed with improvement options 2 and 3.		

### Possible Roadway Spot Improvement Scenario

Based on the previously noted costs a possible spot improvement scenario has been developed. This scenario is only shown as a guide to develop the total estimated costs based on future selected improvement options.

Roadway Stability Concern Areas Improvement Option 1	\$1.6 Million
Rock Fall Mitigation Improvement Option 1	\$325,000
Modify Culverts and Ditches	\$3.6 Million
<b>Total Estimated Cost of Possible Spot Improvement Scenario</b>	<b>\$5.5 Million</b>

### Summary

Improvements to SR-8 (US-127) are needed to address the local and regional needs of the area by improving the safety and reliability of the route. The geologic and drainage assessment identified the need for major drainage improvements, slope improvements and roadway stability improvements along the route.

SR-8 (US-127) has been experiencing significant degradation for several years causing large rockslides, roadway failures, and traffic delays. The study corridor contains one of the ten most hazardous rock fall sites in the state of Tennessee. TDOT is seeking to ensure motorists have a safe, efficient and reliable route between Signal Mountain and Chattanooga.

In consideration of the need for an improved connection between Signal Mountain and Chattanooga, four Options have been developed and should be considered during the NEPA environmental analysis phase of this study:

### **Option 1 (No-Build)**

The No-Build Option assumes no modifications or improvements will be made over the planning horizon. Routine maintenance related activities as well as scheduled resurfacing, signing, and possible safety improvements may occur. This Option, however, does not support the project's stated Purpose and Need for addressing the inadequate drainage and roadway stability concern areas.

### **Option 2 (Reconstruction)**

Option 2 consists of reconstructing SR-8 (US-127) for the length of the study area with improved horizontal and vertical curves, 45-mph design speed, drainage improvements, rock stabilization, and improved shoulders. The reconstruction will provide two (2), twelve (12) foot travel lanes with an additional twelve (12) foot truck climbing lane from LM 14.00 to LM 15.65 and from LM 16.59 to LM 16.92. It will also improve the reliability and safety of the existing alignment, and will decrease travel time. Figure 6 provides the typical sections of the proposed improvements.

### **Option 3 (New Alignment)**

Option 3 consists of constructing an entirely new alignment that would follow the existing Mountain Creek Road, W Road and Anderson Pike from SR-8 (US-127) to Taft Highway (4.4 miles), providing a 45 miles per hour minimum design speed, with two (2) lanes and a truck climbing lane along the W Road from Mile 0.6 to Mile 1.8 and from Mile 3 to Mile 4.4. The estimated cost of Option 3 is \$132 million. This Option would meet the majority of the stated purpose and need by creating a safer and more reliable route between Signal Mountain and Chattanooga. The route length from Mountain Creek Road (LM 13.52) to Laurel Street (LM 17.55) increases by approximately two (2) miles. However, Option 3 reduces the State Highway System by approximately (1) mile. The new alignment typical sections and the W Road study corridor are shown on Figures 8 and 9.

### **Option 4 (Spot Improvements)**

Option 4 would maintain the existing alignment and lanes along SR-8 (US-127), with improvements to select areas. Twenty (20) locations were identified as needing culvert repairs. It is assumed that these repairs will be complete by state and local forces and therefore no cost are included. Twenty-five (25) locations were identified as needing culvert modifications, one area needing rock fall mitigation, one area of undercut roadway and nine areas of roadway stability concern. Four (4) concepts were developed for the rock fall mitigations and three concepts developed to stabilize the roadway stability concern areas. Estimated costs were developed for all improvement concepts. The estimated cost varies depending on spot improvement options selected, with the maximum being \$50 million. However, a possible improvement option along the roadway would be \$5.5 million. This Option would meet the majority of the stated purpose and need by creating a more reliable and direct route between Signal Mountain and Chattanooga. The reliability

improves by reducing closures due to roadway failures and rock slides. However, Option 4 maintains the existing alignment, shoulders and lanes, so it would not significantly reduce crashes or improve efficiency along the route.

The following graphic provides a summary of each option as they relate to the purpose, needs, and goals of this study.

Goals	Option 1 (No-Build)	Option 2 Reconstruction	Option 3 New Alignment	Option 4 Spot Improvements
Improve Safety				
Enhance Mobility				
Improve Reliability				
Cost		 \$75 Million	 \$132 Million	 \$ Varies

ACHIEVES OBJECTIVE

SOMEWHAT ACHIEVES OBJECTIVE

DOES NOT ACHIEVE OBJECTIVE

## **Appendix A**

Crash Rate Calculations

COUNTY : Hamilton Date: 12/23/2011  
 Route : SR 8  
 Location : From Jasper City Limits To Sequatchie Mountain Road  
 Highway Type : Urban Minor Arterial  
 FUNCTIONAL CLASS STP State Rural  
 DATA YEARS : 2005 - 2007  
 ADT YEARS USED 2011 TRIMS  
 COMMENTS =  
 ANALYZED BY = CTB

SECTION = MORE THAN 0.10 MILE / SPOT = LESS THAN 0.10 MILE

BLM	ELM	Length	Average AADT	VMT
13.96	17.01	3.05	11,980	36,539
0.00		0.00		0
0.00		0.00		0
0.00		0.00		0
0.00		0.00		0
0.00		0.00		0
0.00		0.00		0

3.05 11,980 36,539

INTERSECTION

Log Mile = 0

Leg Traffic AADT  
 North = 0  
 East = 0  
 South = 0  
 West = 0

Entering AADT 0

2011 Trims

Urban Minor Arterial

2005 - 2007

	Total	Fatal	Incap. Injury	*Severe Crashes	Other Injury
No. of Crashes =	97	2	2	4	23
No. of Years =	3				
SW avg. rate =	2.419	0.013	0.080	0.093	0.625
<b>05-07 S/W Rates</b>					
Exposure (E) =	40.0102				
Crash Rate (A) =	2.424	0.050	0.050	0.100	0.575
Critical Rate (C) =	3.003				
Severity Index (SI) =	0.3608				
Actual Rate/SW Average =	1.00	3.97	0.62	1.08	0.92
Ratio of A/C =	0.81				

\* Severe Crashes are the sum of fatal and incapacitating injury crashes

Revised 4/3/2007

## **Appendix B**

Geology Photos

Geology Photos  
State Route 8  
Hamilton County, TN

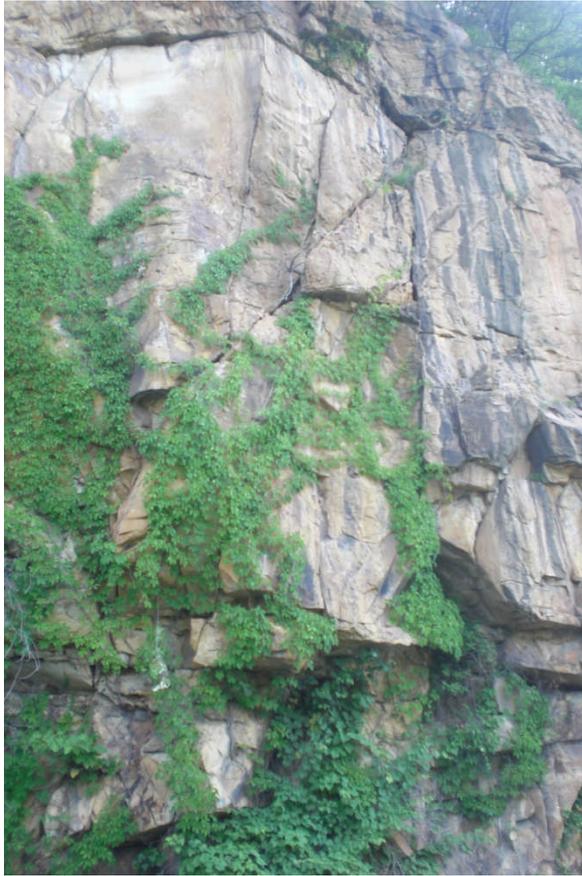


Geology Photo 1 LM 15.85  
Coal seam in the Raccoon  
Formation.

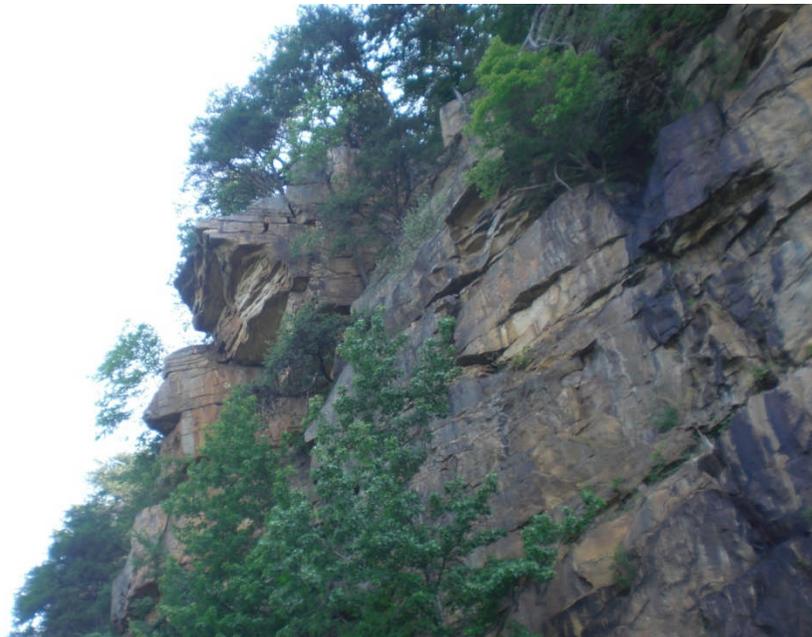


Geology Photo 2 LM 15.9  
Discontinuous coal seam in the  
Raccoon Formation.

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 3 LM 15.95  
Joint dipping at approximately 45 degrees.



Geology Photo 4 LM 16.0  
Over-hang

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 5 LM 15.99  
Over-hang



Geology Photo 6 LM 15.99  
Wedge failure

Geology Photos  
State Route 8  
Hamilton County, TN

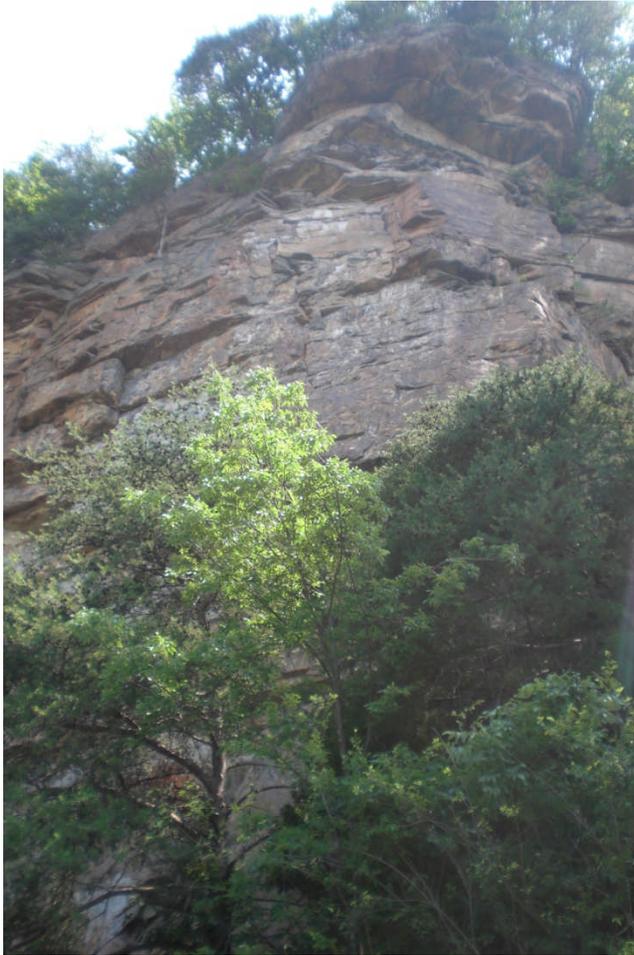


Geology Photo 7 LM 15.9  
Block failure over-hang



Geology Photo 8 LM 15.9  
Block failure over-hang.

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 9 LM 15.89  
Over-hang



Geology Photo 10 LM 15.9  
Roadway Stability Concern Area 1

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 11 LM 15.9  
Roadway Stability Concern Area 1



Geology Photo 12 LM 16.02  
Roadway Stability Concern Area 2

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 13 LM 15.42  
Roadway Stability Concern Area 3



Geology Photo 14 LM 15.42  
Roadway Stability Concern Area 3

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 15 LM 15.37  
Roadway Stability Concern Area 4



Geology Photo 16 LM 15.65  
Roadway Stability Concern Area 5

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 17 LM 15.65  
Roadway Stability Concern Area 5



Geology Photo 18 LM 15.72  
Roadway Stability Concern Area 6

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 19 LM 14.69  
Roadway Stability Concern Area 7



Geology Photo 20 LM 14.37  
Roadway Stability Concern Area 8

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 21 LM 14.37  
Roadway Stability Concern Area 8



Geology Photo 22 LM 14.32  
Roadway Stability Concern Area 9

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 23  
Rock bolting example. Acquired  
from <http://www.tdot.state.tn.us/>



Geology Photo 24  
Rock fall fencing example. Acquired  
from:  
[http://www.dot.ca.gov/hq/esc/geotech/  
photos/north/index.htm](http://www.dot.ca.gov/hq/esc/geotech/photos/north/index.htm)  
Caption

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 25  
Rock fall fencing example. Acquired from <http://www.tdot.state.tn.us/>



Geology Photo 26  
Mechanically stabilized earth (MSE) Wall example. Acquired from <http://www.tdot.state.tn.us/>

Geology Photos  
State Route 8  
Hamilton County, TN



Geology Photo 27  
Rock cut example. SR 28



Geology Photo 28  
Rock cut example. SR 28

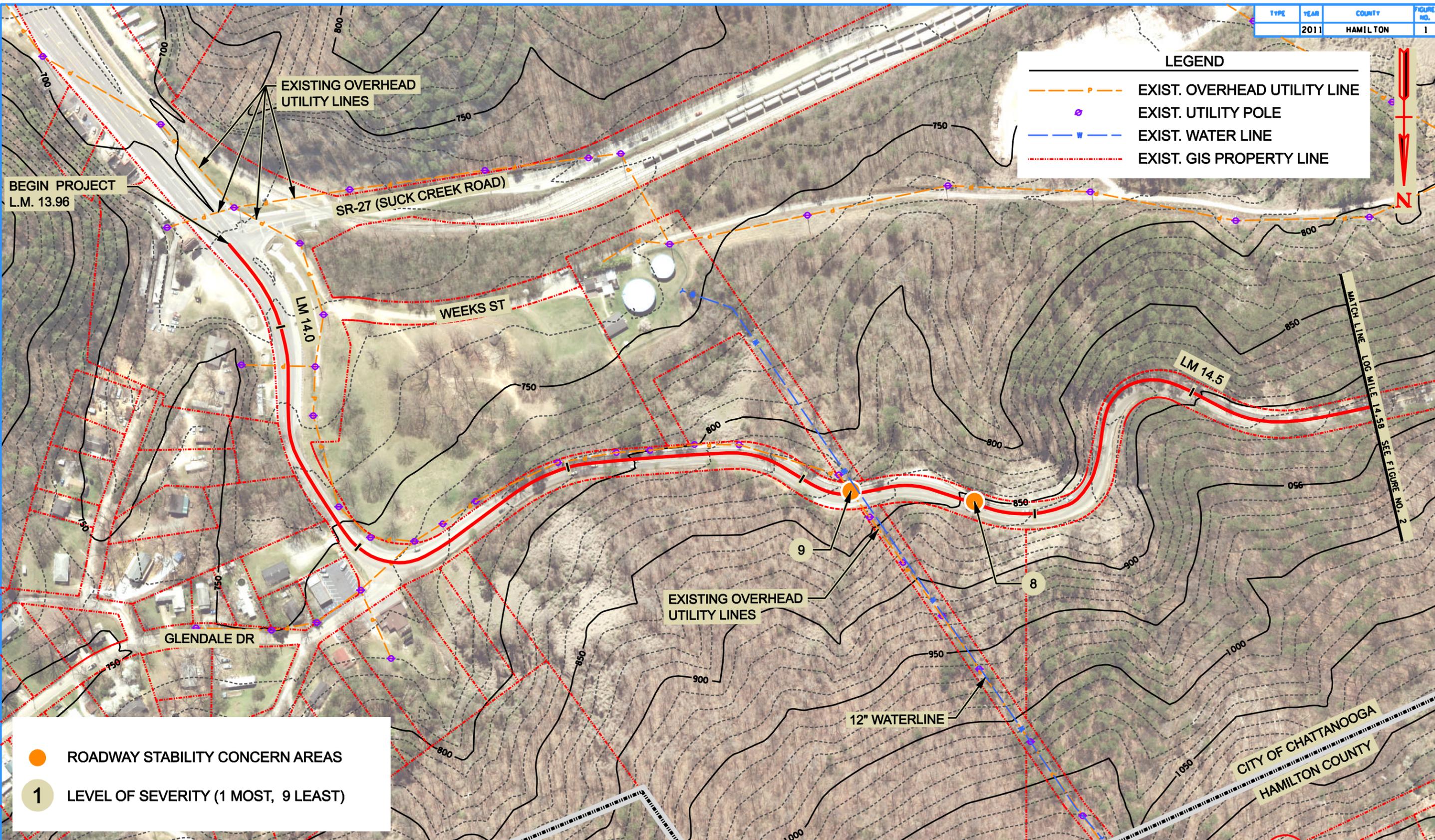
## **Appendix C**

Geology Assessment Figures

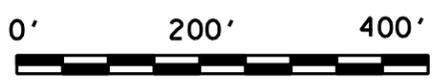
TYPE	YEAR	COUNTY	FIGURE NO.
	2011	HAMILTON	1

**LEGEND**

- EXIST. OVERHEAD UTILITY LINE
- EXIST. UTILITY POLE
- EXIST. WATER LINE
- EXIST. GIS PROPERTY LINE



- ROADWAY STABILITY CONCERN AREAS
- LEVEL OF SEVERITY (1 MOST, 9 LEAST)



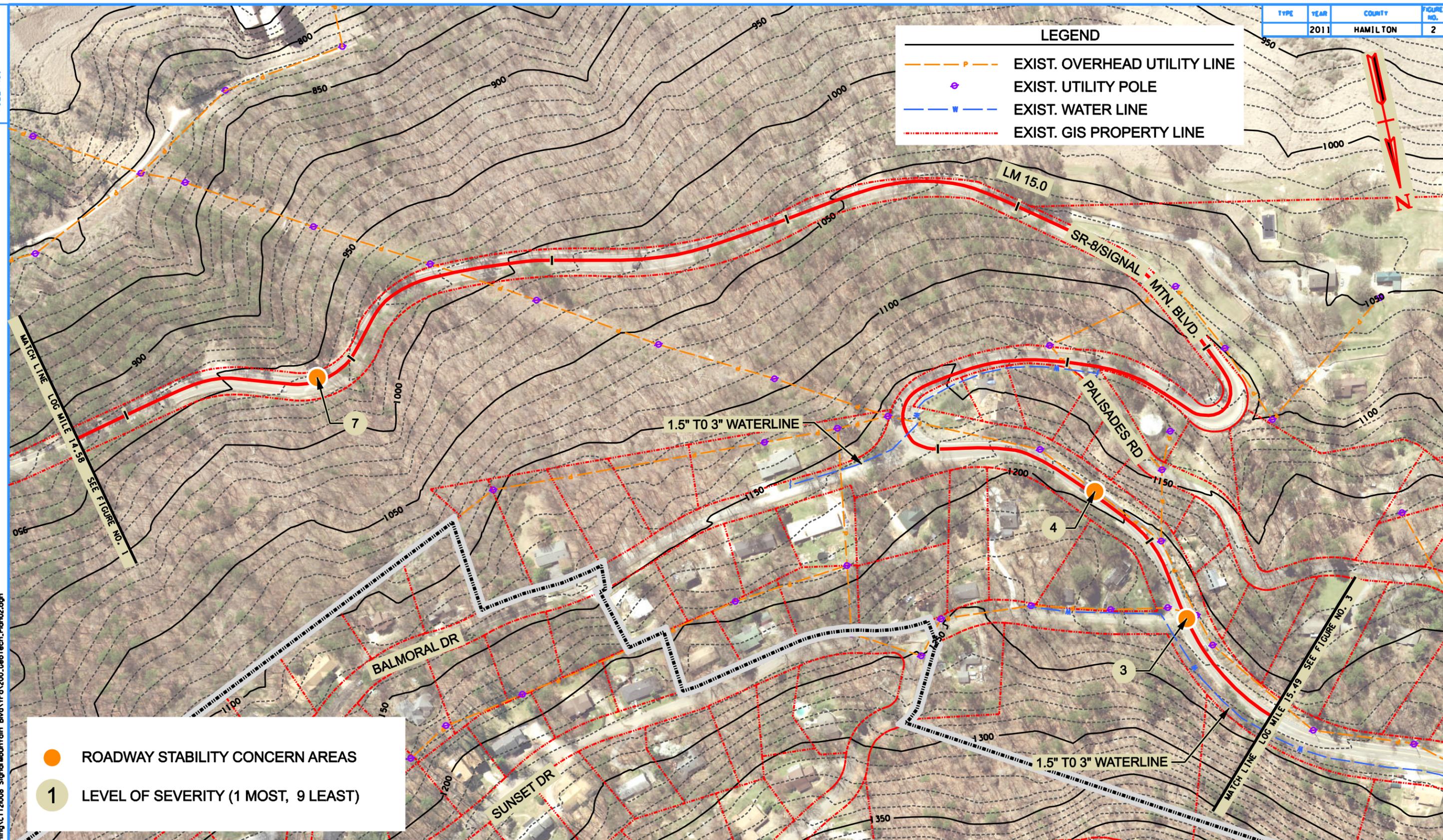
**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION  
**GEOLOGY FIGURE 1**  
SR-8/SIGNAL MTN BLVD  
L.M. 13.96 to  
L.M. 14.58

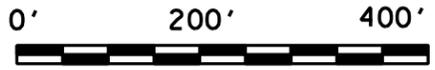
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**LEGEND**

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- EXIST. UTILITY POLE
- EXIST. WATER LINE
- EXIST. GIS PROPERTY LINE



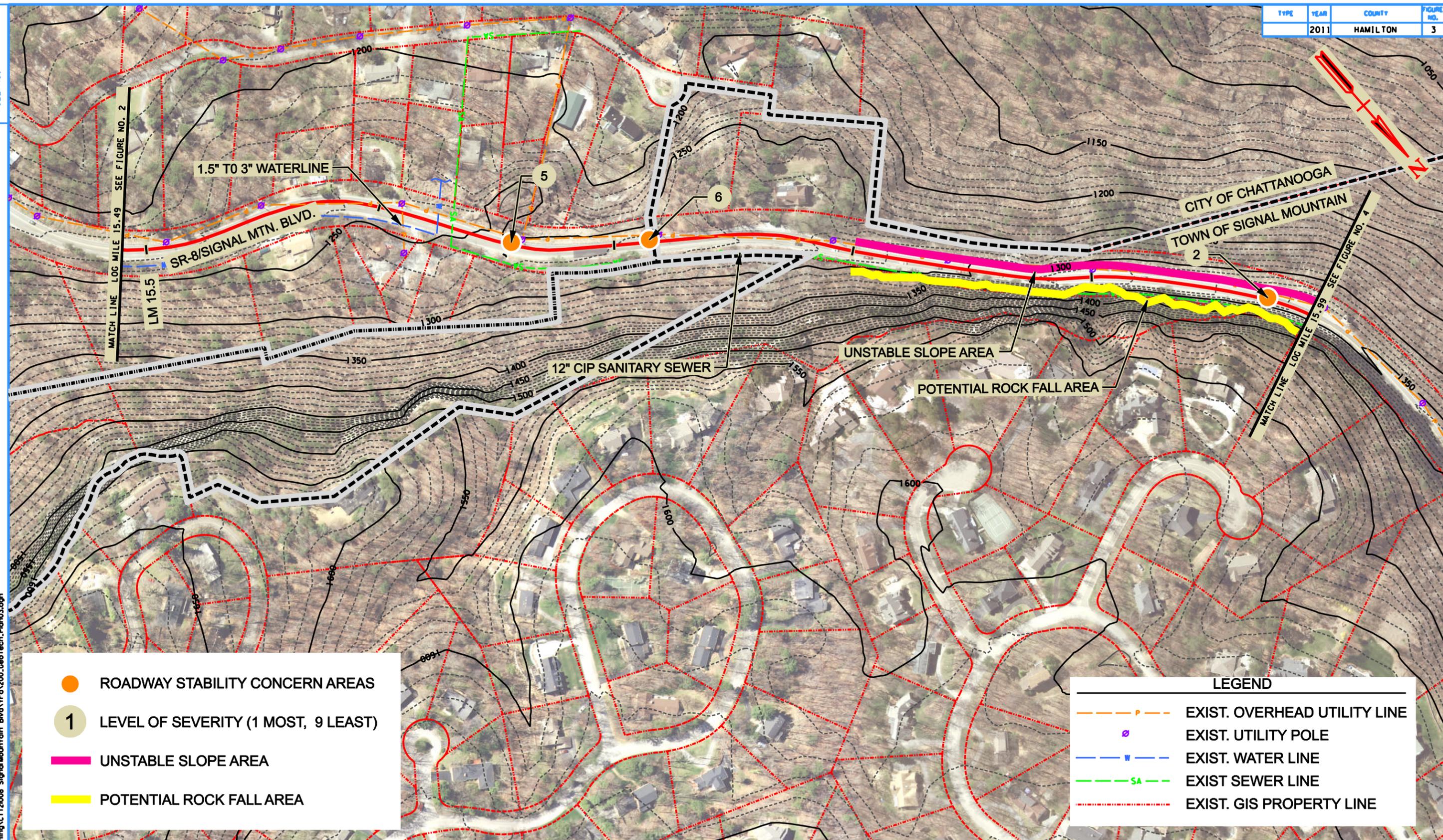
- ROADWAY STABILITY CONCERN AREAS
- LEVEL OF SEVERITY (1 MOST, 9 LEAST)



**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

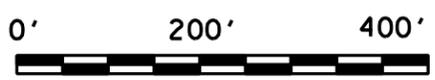
STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION  
GEOLOGY FIGURE 2  
SR-8/SIGNAL MTN BLVD  
L.M. 14.58 to  
L.M. 15.49

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- ROADWAY STABILITY CONCERN AREAS
- 1 LEVEL OF SEVERITY (1 MOST, 9 LEAST)
- UNSTABLE SLOPE AREA
- POTENTIAL ROCK FALL AREA

- LEGEND**
- P — EXIST. OVERHEAD UTILITY LINE
  - ⊙ EXIST. UTILITY POLE
  - W — EXIST. WATER LINE
  - SA — EXIST. SEWER LINE
  - - - EXIST. GIS PROPERTY LINE

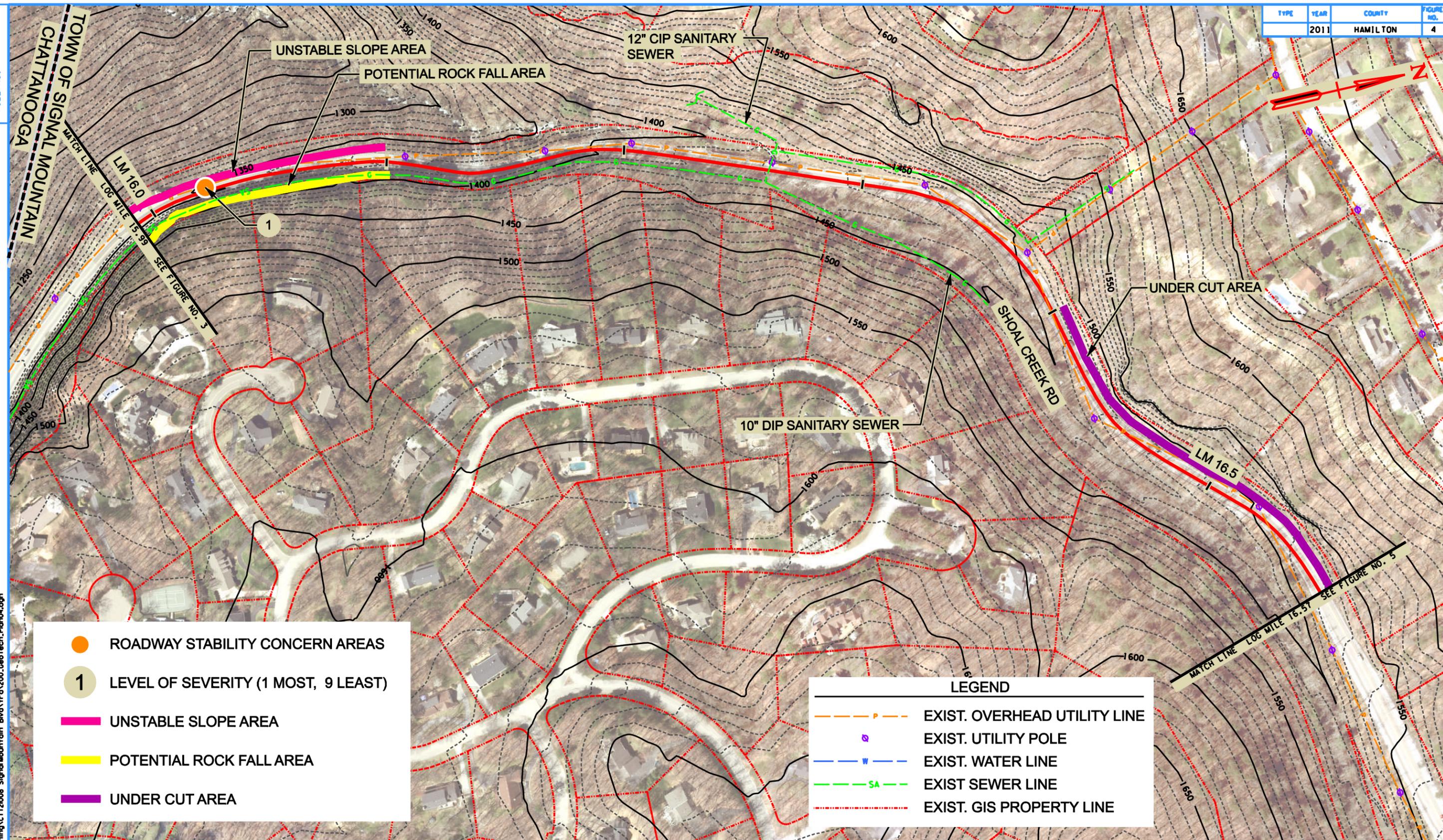


## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

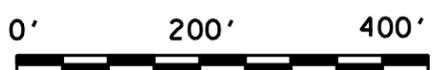
STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

GEOLOGY FIGURE 3  
SR-8/SIGNAL MTN BLVD  
L.M. 15.49 to  
L.M. 15.99



- ROADWAY STABILITY CONCERN AREAS
- 1 LEVEL OF SEVERITY (1 MOST, 9 LEAST)
- UNSTABLE SLOPE AREA
- POTENTIAL ROCK FALL AREA
- UNDER CUT AREA

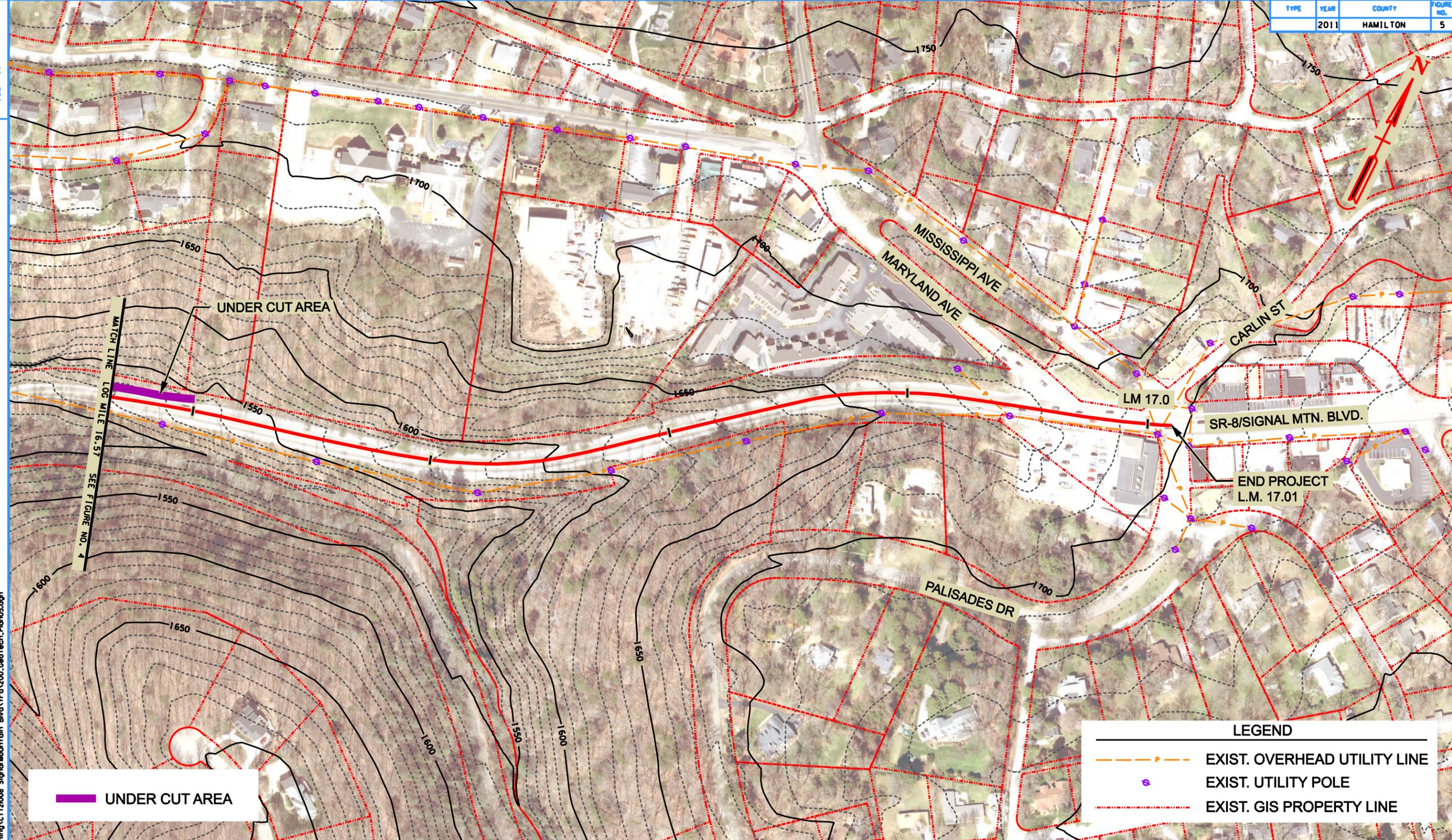
- LEGEND**
- - - EXIST. OVERHEAD UTILITY LINE
  - EXIST. UTILITY POLE
  - - - EXIST. WATER LINE
  - - - EXIST SEWER LINE
  - - - EXIST. GIS PROPERTY LINE



**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION  
  
GEOLOGY FIGURE 4  
SR-8/SIGNAL MTN BLVD  
L.M. 15.99 to  
L.M. 16.57

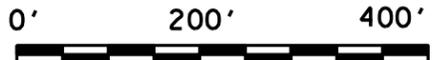
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**UNDER CUT AREA**

**LEGEND**

- EXIST. OVERHEAD UTILITY LINE
- EXIST. UTILITY POLE
- EXIST. GIS PROPERTY LINE



**SR-8 / SIGNAL MOUNTAIN BLVD STUDY**  
FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

## **Appendix D**

Drainage Photos

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 1 LM 14.26  
Location of 24" CMP, inlet side



Drainage Photo 2 LM 14.37  
Location of 18" clay pipe, inlet side,  
partially obstructed with debris

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 3 LM 14.42  
24" CMP, inlet side



Drainage Photo 4 LM 14.42  
Concrete lined conveyance near  
24" CMP culvert

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 5 LM 14.54  
18" RCP  
Partially silted in



Drainage Photo 6 LM 14.54  
Rip rap lined conveyance near  
18" RCP culvert

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 7 LM 14.65  
Concrete wall with  
Concrete lined conveyance



Drainage Photo 8 LM 14.65  
Concrete wall with  
Concrete lined conveyance

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 9 LM 14.69  
24" CMP, inlet damaged,  
completely obstructed



Drainage Photo 10 LM 14.69  
Unprotected drainage conveyance  
at 24" CMP, with significant erosion

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 11 LM 14.69  
Significant erosion at 24" CMP inlet

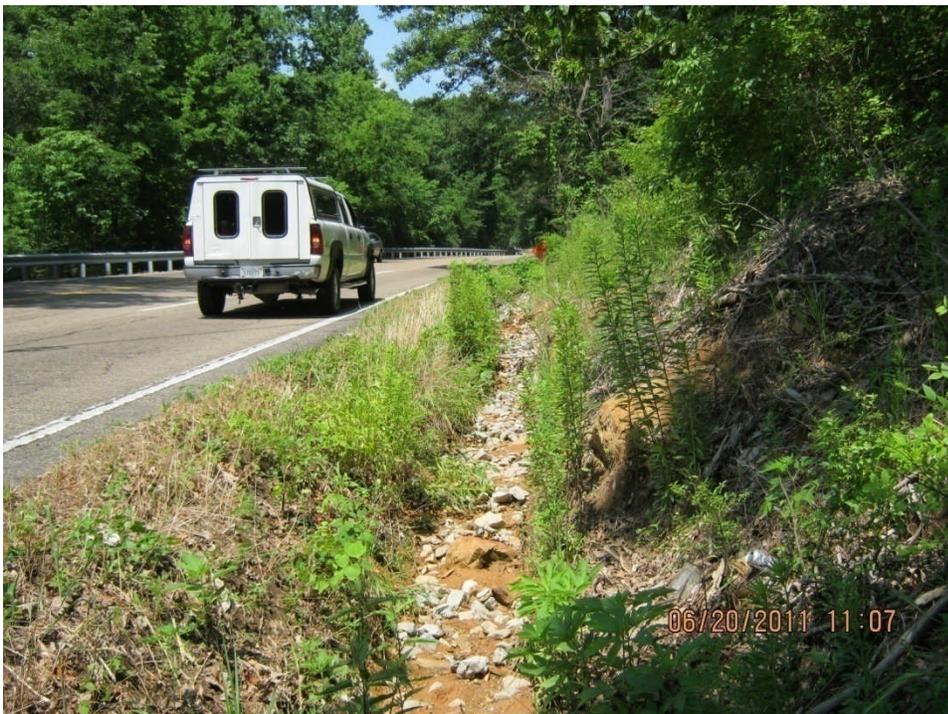


Drainage Photo 12 LM 14.69  
24" CMP outlet side

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 13 LM 14.75  
24" RCP, inlet side, partially  
obstructed with debris



Drainage Photo 14 LM 14.75  
Rip rap conveyance ditch  
at 24" RCP culvert

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 15 LM 15.20  
18" RCP culvert outlet,  
runs parallel to Signal Mtn Blvd.



Drainage Photo 16 LM 15.25  
Inlet grate located at Palisades Rd.

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 17 LM 15.29  
Inlet grate with catch basin,  
looking down slope



Drainage Photo 18 LM 15.29  
Inlet grate with catch basin,  
looking up slope

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 19 LM 15.29  
Location of 18"x12" CMP crossing  
Balmoral Dr., with concrete lined  
conveyance, inlet partially obstructed



Drainage Photo 20 LM 15.29  
18"x12" CMP culvert outlet at  
Balmoral Dr.

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 21 LM 15.43  
18" RCP culvert inlet  
crossing Sunset Dr.



Drainage Photo 22 LM 15.54  
18" CMP culvert with conc. ditch,  
parallel to Signal Mtn Blvd.

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 23 LM 15.58  
18" CMP culvert inlet,  
runs parallel to Signal Mtn. Blvd.



Drainage Photo 24 LM 15.58  
18" CMP culvert outlet

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 25 LM 15.62  
18" CMP culvert at Mountain  
Townhomes entrance, runs parallel  
to Signal Mtn. Blvd.



Drainage Photo 26 LM 15.66

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 27 LM 16.27  
10ft x 7.5ft RCB at Shoal Creek  
crossing



Drainage Photo 28 LM 16.27  
10ft x 7.5ft RCB at Shoal Creek  
crossing

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 29 LM 16.27  
10ft x 7.5ft RCB at Shoal Creek  
crossing



Drainage Photo 30 LM 16.27  
10ft x 7.5ft RCB at Shoal Creek  
crossing

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 31 LM 16.46  
18" RCP inlet side



Drainage Photo 32 LM 16.46  
18" RCP inlet side,  
partially obstructed



Drainage Photos  
State Route 8  
Hamilton County, TN

Drainage Photo 33 LM 15.42  
Piping Under Roadway



Drainage Photo 34 LM 15.42  
Piping Under Roadway

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 35 LM 15.42  
Piping Under Roadway



Drainage Photo 36 LM 15.65  
Inlet clogging

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 37 LM 15.65  
Undercutting of the Roadway



Drainage Photo 38 LM 15.72  
Undercutting along Concrete  
Conveyance

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 39 LM 15.87  
Undercutting along Concrete  
Conveyance



Drainage Photo 40 LM 15.87  
Rock Scouring and Undercutting  
along Concrete Conveyance

Drainage Photos  
State Route 8  
Hamilton County, TN



Drainage Photo 41 LM 15.98  
Concrete Conveyance Breached  
by Sewer Caps



Drainage Photo 42 LM 15.99  
Narrowing of Concrete  
Conveyance



Drainage Photos  
State Route 8  
Hamilton County, TN

Drainage Photo 43 LM 16.02  
Concrete Conveyance does not  
Extend to the Cut Face of the  
Slope



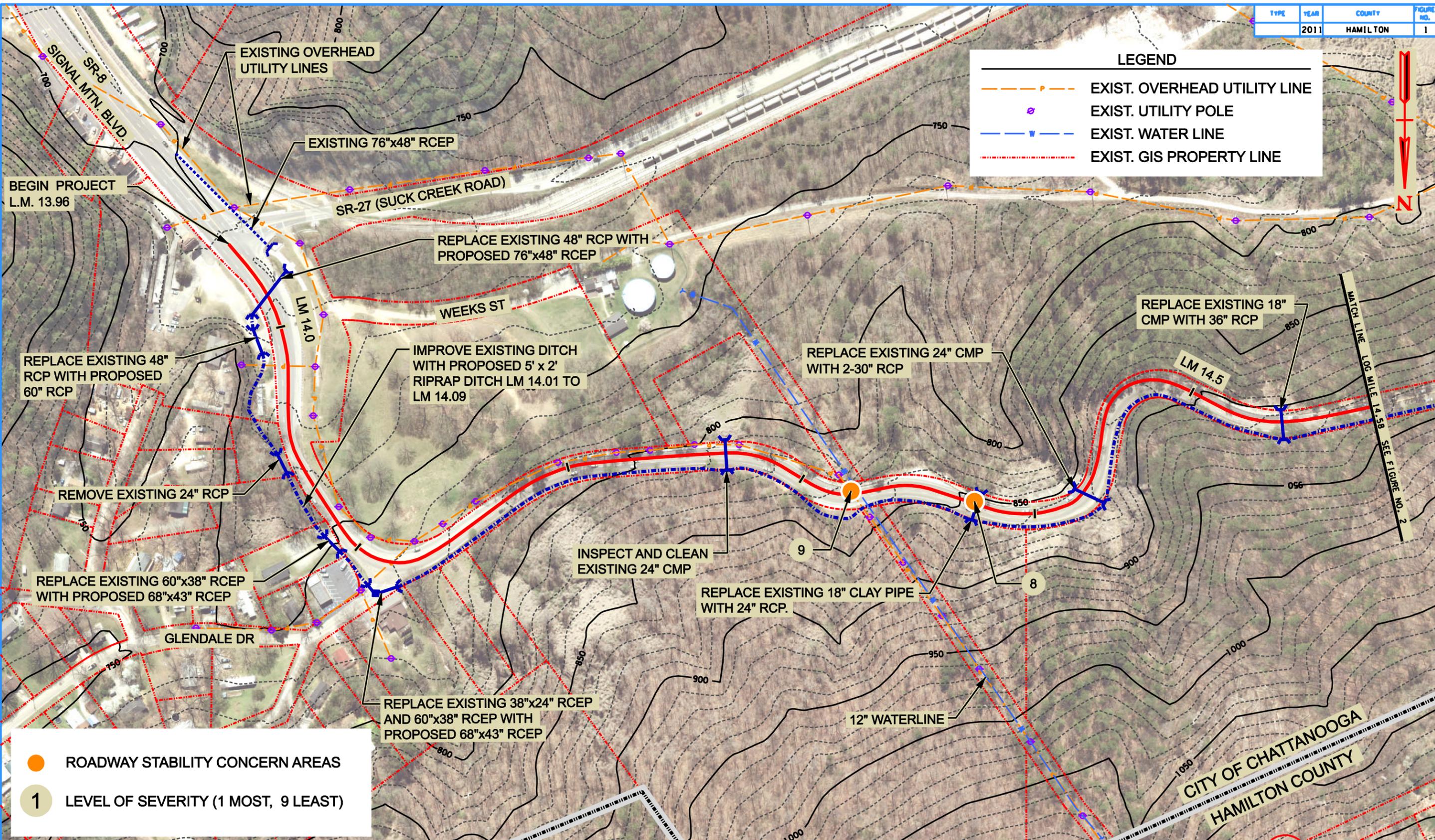
Drainage Photo 44 LM 16.20  
Concrete Conveyance does not  
Extend to the Cut Face of the  
Slope

## **Appendix E**

Drainage Assessment/Modification  
Figures

**LEGEND**

- EXIST. OVERHEAD UTILITY LINE
- EXIST. UTILITY POLE
- EXIST. WATER LINE
- EXIST. GIS PROPERTY LINE



BEGIN PROJECT  
L.M. 13.96

EXISTING OVERHEAD  
UTILITY LINES

EXISTING 76"x48" RCEP

SR-27 (SUCK CREEK ROAD)

REPLACE EXISTING 48" RCP WITH  
PROPOSED 76"x48" RCEP

WEEKS ST

IMPROVE EXISTING DITCH  
WITH PROPOSED 5' x 2'  
RIPRAP DITCH LM 14.01 TO  
LM 14.09

REPLACE EXISTING 24" CMP  
WITH 2-30" RCP

REPLACE EXISTING 18"  
CMP WITH 36" RCP

REPLACE EXISTING 48"  
RCP WITH PROPOSED  
60" RCP

REMOVE EXISTING 24" RCP

INSPECT AND CLEAN  
EXISTING 24" CMP

REPLACE EXISTING 18" CLAY PIPE  
WITH 24" RCP.

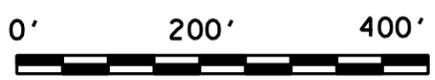
REPLACE EXISTING 60"x38" RCEP  
WITH PROPOSED 68"x43" RCEP

GLENDALE DR

REPLACE EXISTING 38"x24" RCEP  
AND 60"x38" RCEP WITH  
PROPOSED 68"x43" RCEP

12" WATERLINE

- ROADWAY STABILITY CONCERN AREAS
- LEVEL OF SEVERITY (1 MOST, 9 LEAST)



## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

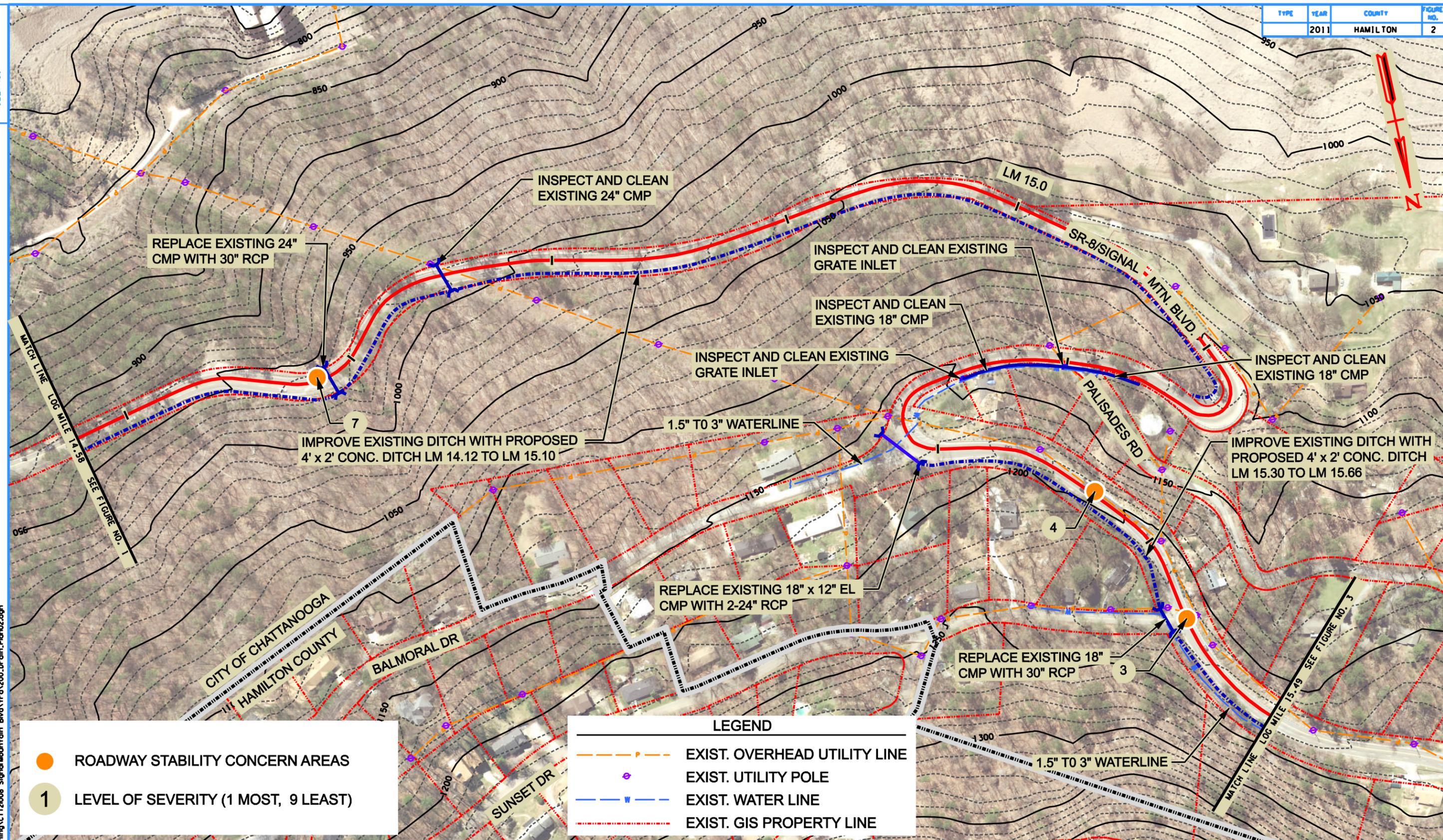
FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

DRAINAGE FIGURE 1  
SR-8/SIGNAL MTN BLVD  
L.M. 13.96 to  
L.M. 14.58

12/23/2011 8:36:58 AM G:\110\CT12-100T Project Planning\CT12008 Signal Mountain Blvd\110\200.Dr\dm.Plan01.dgn

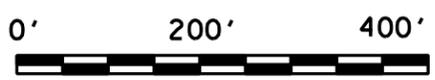
TYPE	YEAR	COUNTY	FIGURE NO.
	2011	HAMILTON	2



- ROADWAY STABILITY CONCERN AREAS
- 1 LEVEL OF SEVERITY (1 MOST, 9 LEAST)

**LEGEND**

- EXIST. OVERHEAD UTILITY LINE
- EXIST. UTILITY POLE
- |— EXIST. WATER LINE
- - - EXIST. GIS PROPERTY LINE



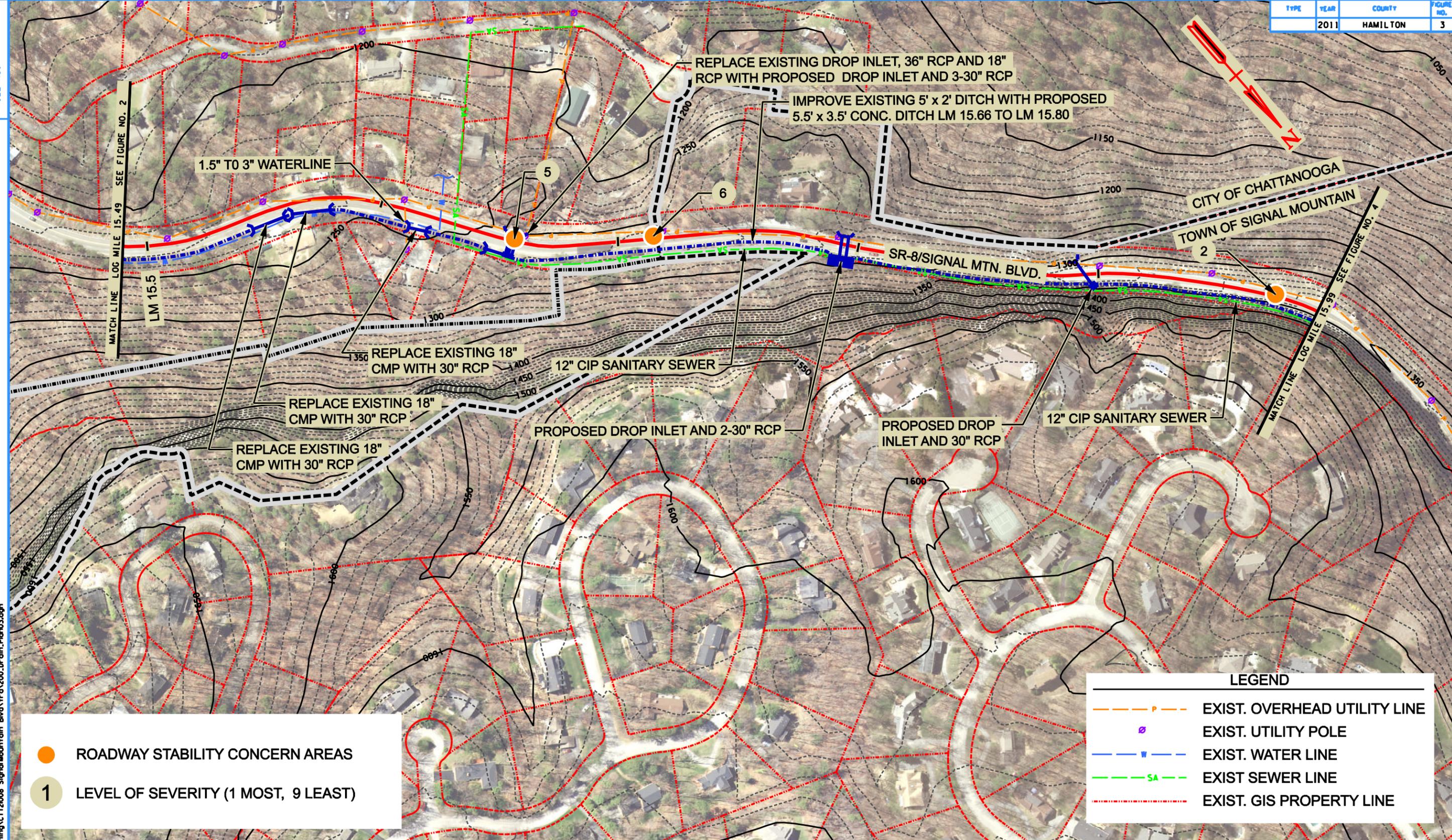
## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION

DRAINAGE FIGURE 2  
SR-8/SIGNAL MTN BLVD  
L.M. 14.58 to  
L.M. 15.49

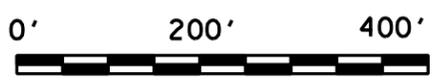
12/23/2010 8:37:35 AM G:\110\CT12-1001 Project Planning\CT12008 SignalMountain Blvd\110\200.Dr\in.Plan02.dgn



- ROADWAY STABILITY CONCERN AREAS
- 1 LEVEL OF SEVERITY (1 MOST, 9 LEAST)

**LEGEND**

- EXIST. OVERHEAD UTILITY LINE
- EXIST. UTILITY POLE
- EXIST. WATER LINE
- EXIST SEWER LINE
- - - EXIST. GIS PROPERTY LINE

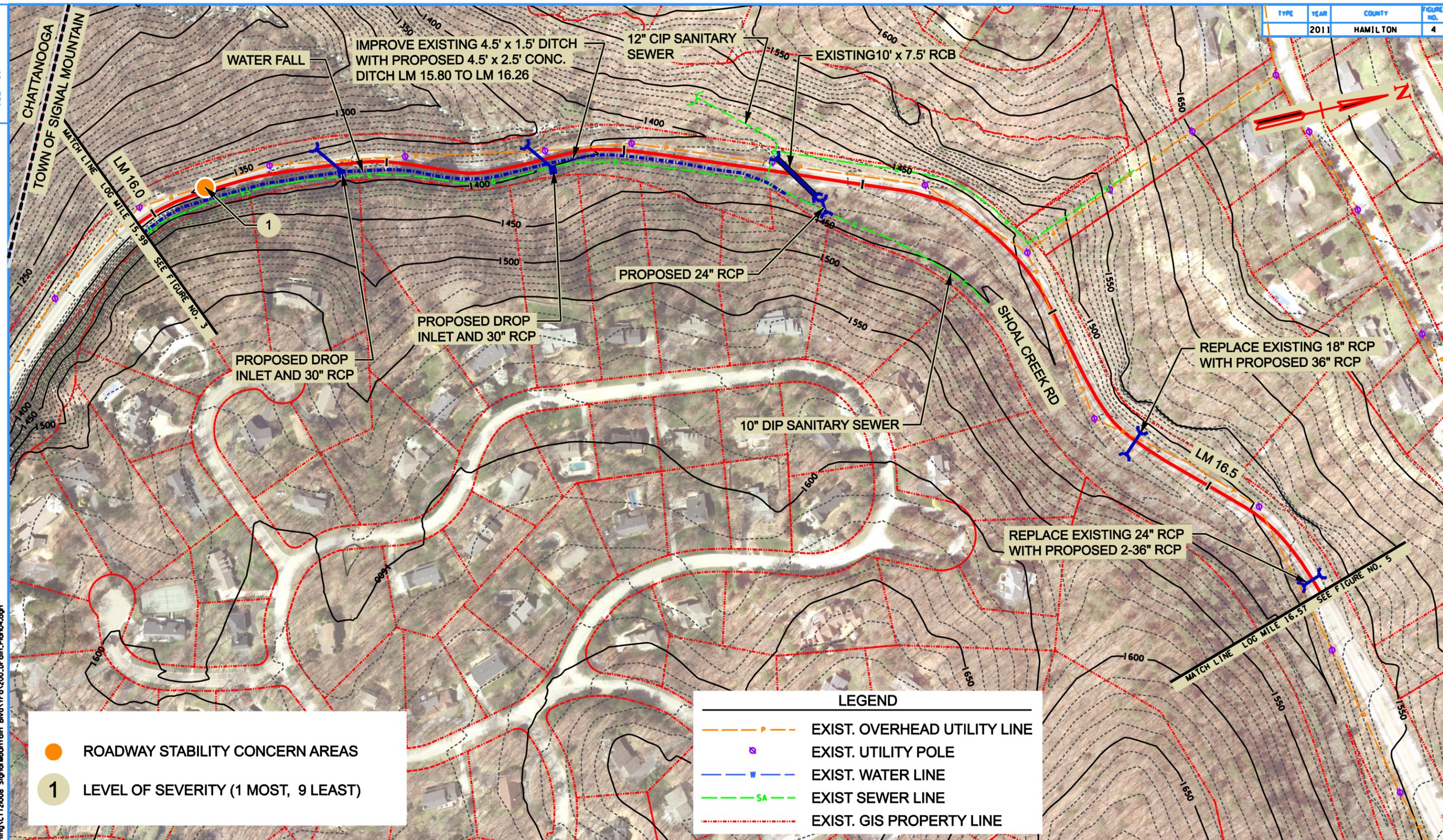


## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

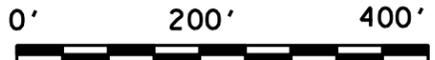
STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION  
  
DRAINAGE FIGURE 3  
SR-8/SIGNAL MTN BLVD  
L.M. 15.49 to  
L.M. 15.99

12/23/2011 8:38:57 AM C:\p\o\CT12-100T Project Planning\CT12008 Signal Mountain Blvd\1701\200.Dr.pln.Plan03.dgn



● ROADWAY STABILITY CONCERN AREAS  
1 LEVEL OF SEVERITY (1 MOST, 9 LEAST)

LEGEND	
	EXIST. OVERHEAD UTILITY LINE
	EXIST. UTILITY POLE
	EXIST. WATER LINE
	EXIST. SEWER LINE
	EXIST. GIS PROPERTY LINE

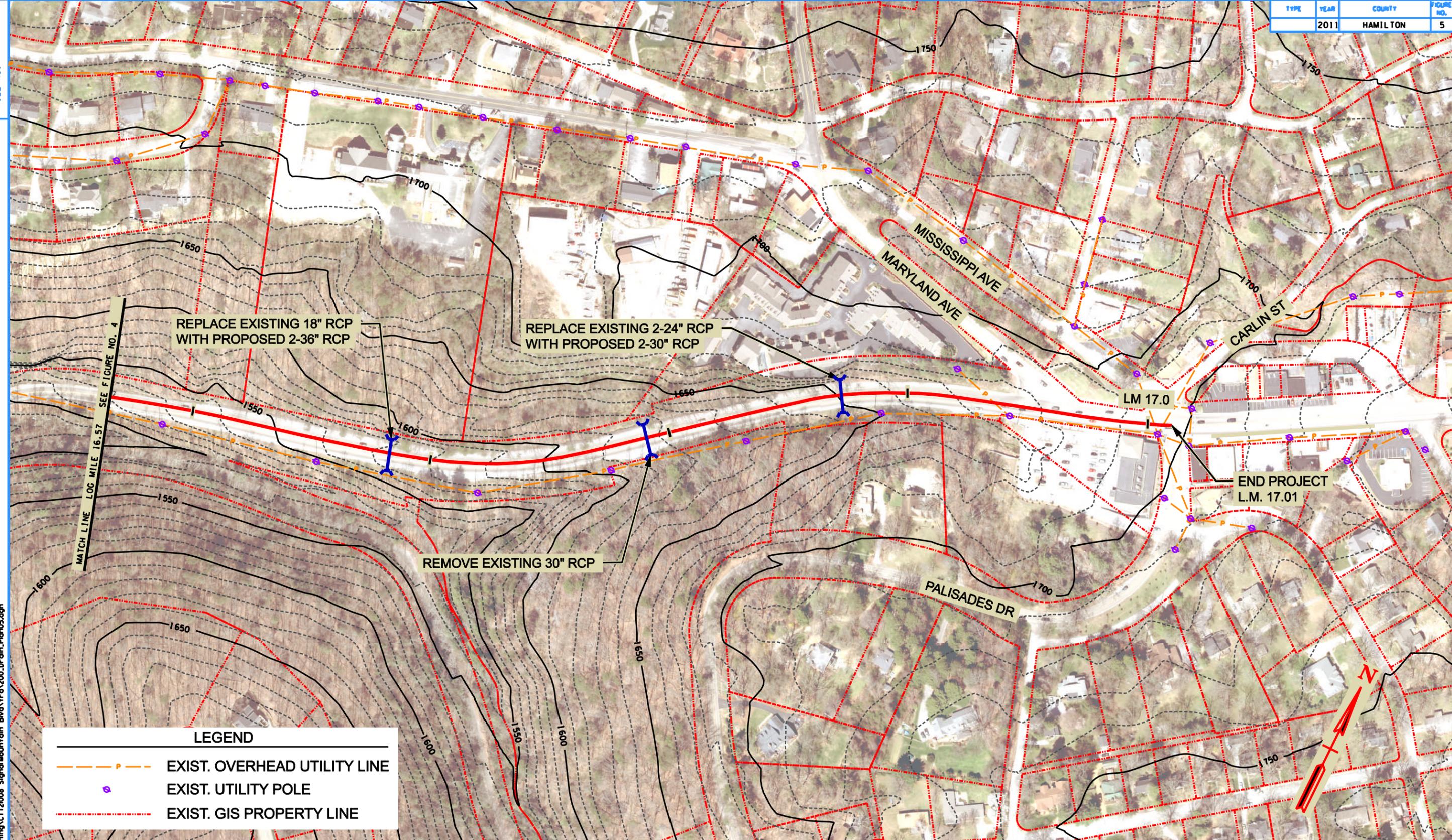


## SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO  
 PALISADES DRIVE  
 L.M. 13.96 TO L.M. 17.01  
 HAMILTON COUNTY

STATE OF TENNESSEE  
 DEPARTMENT OF TRANSPORTATION  
 PROJECT PLANNING DIVISION  
 DRAINAGE FIGURE 4  
 SR-8/SIGNAL MTN BLVD  
 L.M. 15.99 to  
 L.M. 16.57

TYPE	YEAR	COUNTY	FIGURE NO.
	2011	HAMILTON	5



LEGEND	
	EXIST. OVERHEAD UTILITY LINE
	EXIST. UTILITY POLE
	EXIST. GIS PROPERTY LINE



### SR-8 / SIGNAL MOUNTAIN BLVD STUDY

FROM SUCK CREEK ROAD TO  
PALISADES DRIVE  
L.M. 13.96 TO L.M. 17.01  
HAMILTON COUNTY

STATE OF TENNESSEE  
DEPARTMENT OF TRANSPORTATION  
PROJECT PLANNING DIVISION  
DRAINAGE FIGURE 5  
SR-8/SIGNAL MTN BLVD  
L.M. 16.57 to  
L.M. 17.01

## **Appendix F**

EES Report

# EES Report

PIN 115819.00  
1,000 Foot Corridor

Option: 115819\_3301V01  
Version Date: June 27, 2011  
Created by: JONATHAN ROGERS

---

## Cemetery Sites & Cemetery Properties

Cemeteries None were found  
Cemetery Property None were found

## Institutions & Sensitive Community Populations

Institutions None were found

### Populations:

No population present Present  
65 & older populations None were found  
Disability populations None were found  
Households without a vehicle None were found  
Minority populations 24% None were found  
Linguistically isolated populations Present  
Populations below poverty-State average-13% Present  
Populations below poverty-State average-27% None were found

### Bat

Myotis grisescens

Total= USESA SPROT

### Railroads

Present

# EES Report

PIN 115819.00  
2,000 Foot Corridor

Option: 115819\_3301V01  
Version Date: June 27, 2011  
Created by: JONATHAN ROGERS

---

National Register Sites None were found

Superfund Sites None were found

Pyritic Rock Classification Total= 2

**Contains Acid Producing Rock**

Crab Orchard Mountains Group: Contains Whitwell Shale

**May Contain Acid Producing Rock**

Gizzard Group

TWRA Lakes & Other Public Lands

TWRA Lakes None were found

Other Public Lands None were found

# EES Report

PIN 115819.00  
4,000 Foot Corridor

Option: 115819\_3301V01  
Version Date: June 27, 2011  
Created by: JONATHAN ROGERS

---

Terrestrial Species	None were found
TDEC Conservation Sites & TDEC Scenic Waterways	
TDEC Conservation Sites	None were found
TDEC Scenic Waterways	None were found
Large Wetland Impacts	<u>Total Acentage=</u> 36.94
L2AB3Hh	1.82 acres
PFO1C	33.08 acres
POWHx	0.90 acres
POWHx	1.14 acres
Tennessee Natural Areas Program	None were found
Wildlife Management Areas	None were found

# EES Report

PIN 115819.00

Option: 115819\_3301V01

10,000 Foot Corridor

Version Date: June 27, 2011

Created by: JONATHAN ROGERS

---

## Aquatic Species

Plethobasus cooperianus

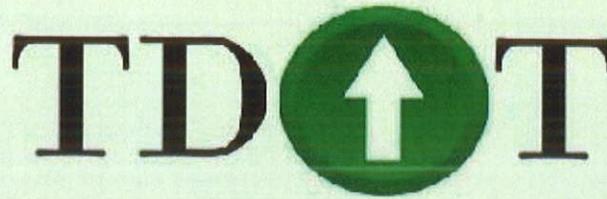
Total= 1

USES A S P R O T

LE E

## Caves

None were found



**Tennessee Department of Transportation**  
**EARLY ENVIRONMENTAL SCREENING PROCESS (EES)**  
**PROJECT SCORING**

**Project Score Factors**

	Total Impacts Evaluated	Total Impacts to Evaluate	EES Evaluation
<b>Project Impact Areas:</b>	<b>15</b>	<b>15</b>	<b>Complete</b>
<b>Date of Evaluation:</b>	July 07, 2011		
<b>Evaluation done by:</b>	Glenda Tyus		
	Trans Planner 4		
<b>County:</b>	Hamilton		
<b>Route:</b>	SR-8 from Palisades Rd. to Signal Mountain Blvd.		
<b>PIN:</b>	115819.00		
<b>Termini:</b>	SR 8 Signal Mountain from SR-27 (LM 13.96) to Palisades Road (LM 17.01)		

**Impact Ranking of Features Evaluated:                      Total by Rank**

<b>Features with No Impact</b>	<b>9</b>
Cemetery Sites & Cemetery Properties	
National Register Sites	
Terrestrial Species	
TDEC Conservation Sites & TDEC Scenic Waterways	
Superfund Sites	
Caves	
Tennessee Natural Areas Program	
Wildlife Management Areas	
TWRA Lakes & Other Public Lands	
<b>Features with Low Impact</b>	<b>2</b>
Aquatic Species	
Railroads	
<b>Features with Moderate Impact</b>	<b>1</b>

Pyritic Rock

**Features with Substantial Impact**

2

Bat

Large Wetland Impacts

**Community Impacts Present:**

**Institutions:**

**Populations:**

No population present

Linguistically isolated populations

Populations below poverty - State average- 13%

**EES Project Impact:**

Complete

**Impacts Evaluated Within 1,000 Ft of Study Area**

**CEMETERY SITES & CEMETERY PROPERTIES**

**Impact**

<p><b>Project Impact (Environmental, Time, Cost, Design, and Maintenance)</b></p>	<p><input checked="" type="checkbox"/> <b>None</b> - No impact on the project as there are no known cemetery sites within or abutting the project study area or corridor. It is anticipated that a 'normal' effort to complete this environmental review as part of NEPA.</p>
---	---

**INSTITUTIONS & SENSITIVE COMMUNITY POPULATIONS**

**Sensitive Populations Project Impact:**

Present

Not Present

<b>Institutions:</b>		
Hospital	<input type="checkbox"/>	<input checked="" type="checkbox"/>
School	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Church	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Public Building	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>Populations:</b>		
No population present	<input checked="" type="checkbox"/>	<input type="checkbox"/>
65 and older populations	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Disability populations	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Households without a vehicle	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Minority populations 24%	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Linguistically isolated populations	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Populations below poverty - State average - 13%	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Populations below poverty - State average - 27%	<input type="checkbox"/>	<input checked="" type="checkbox"/>

## BAT

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>Substantial</b> - A substantial impact on the project is probable as there is a known occurrence of Indiana or gray bats within 4 miles of the proposed transportation study area or corridor. It is anticipated that: a) avoidance/minimization of potential impacts to species will be needed, b) surveys for the species for the project may be required, c) coordination with USFWS and establish Section 7 biological conclusions for the project will be needed, and d) seasonal construction limitations will likely be necessary.
--	--

## RAILROADS

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>Low</b> – Minimal impact on the project is anticipated as there are railroads within or abutting the project study area or corridor. Impacts to the railroad can be avoided, and the proposed project will be greater than 200 feet from the railroad. There is the remote possibility of minor involvement on railroad property to accommodate drainage, but there will be no grade crossing.
--	---

## Impacts Evaluated Within 2,000 Ft of Study Area

## NATIONAL REGISTER SITES

### Impact

<b>Project Impact (Environmental, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No project impact is anticipated as there are no National Register listed properties abutting or within the project study area or corridor.
--	---

## SUPERFUND SITES

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No project impact is anticipated as there are no known contaminated land tracts abutting or within the project study area or corridor.
--	--

## PYRITIC ROCK

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>Moderate</b> – Medium project impact is anticipated in the project study area or corridor. Formations that may contain acid producing rock (symbolized as orange or pink in color) are anticipated in small quantities. A greater than normal design is anticipated to perform geotechnical studies and analysis and design (i.e., containment measures and minimize disturbance/ movement of pyritic rock during construction). More effort is likely needed to: identify additional right of way to 'waste' material, secure permits, and design project blending of pyritic materials. Minimal long term efforts are anticipated to ensure performance of containment measures.
--	---

## TWRA LAKES & OTHER PUBLIC LANDS

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No impact on the project is anticipated as there area no parks located within or abutting the project study area or corridor.
--	---

## Impacts Evaluated Within 4,000 Ft of Study Area

## TERRESTRIAL SPECIES

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> - No impact to the project is anticipated. There is no known occurrence of a rare, state, or federally-protected terrestrial species within the proposed transportation study area or corridor.
--	---

## TDEC CONSERVATION SITES & TDEC SCENIC WATERWAYS

### Impact

<b>Project Impact (Environment, Time, Cost, Design, Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No project impact is expected as there are no scenic waterways or TDEC Conservation Sites within project study area or corridor.
--	--

## LARGE WETLAND IMPACTS

### Impact

<b>Project Impact (Environment, Time, Cost, Design, Maintenance)</b>	<input checked="" type="checkbox"/> <b>Substantial</b> – Regions 1, 2, and 3: A substantial impact to the project is probable as there is greater than 2 acres of wetlands within the project study area or corridor. Compensatory mitigation will be required. Design effort will be needed to avoid and minimize impacts to wetlands to the maximum extent practicable. If a floodplain is crossed by the project, floodplain culverts may be necessary.
--	--

## TENNESSEE NATURAL AREAS PROGRAM

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No impact on the project is anticipated as the project study area or corridor does not include a Natural Area.
--	--

## WILDLIFE MANAGEMENT AREAS

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No project impact is anticipated as a WMA does not abut nor is located within the project study area or corridor.
--	---

## Impacts Evaluated Within 10,000 Ft of Study Area

## AQUATIC SPECIES

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>Low</b> – Minimal impact on the project is likely as there is a known occurrence of a rare or state protected aquatic species located within the project study area or corridor. A survey for the species is likely to be required.
--	--

## CAVES

### Impact

<b>Project Impact (Environment, Time, Cost, Design, and Maintenance)</b>	<input checked="" type="checkbox"/> <b>None</b> – No project impact is anticipated as there are no caves in the project study area or corridor.
--	---

## **Appendix G**

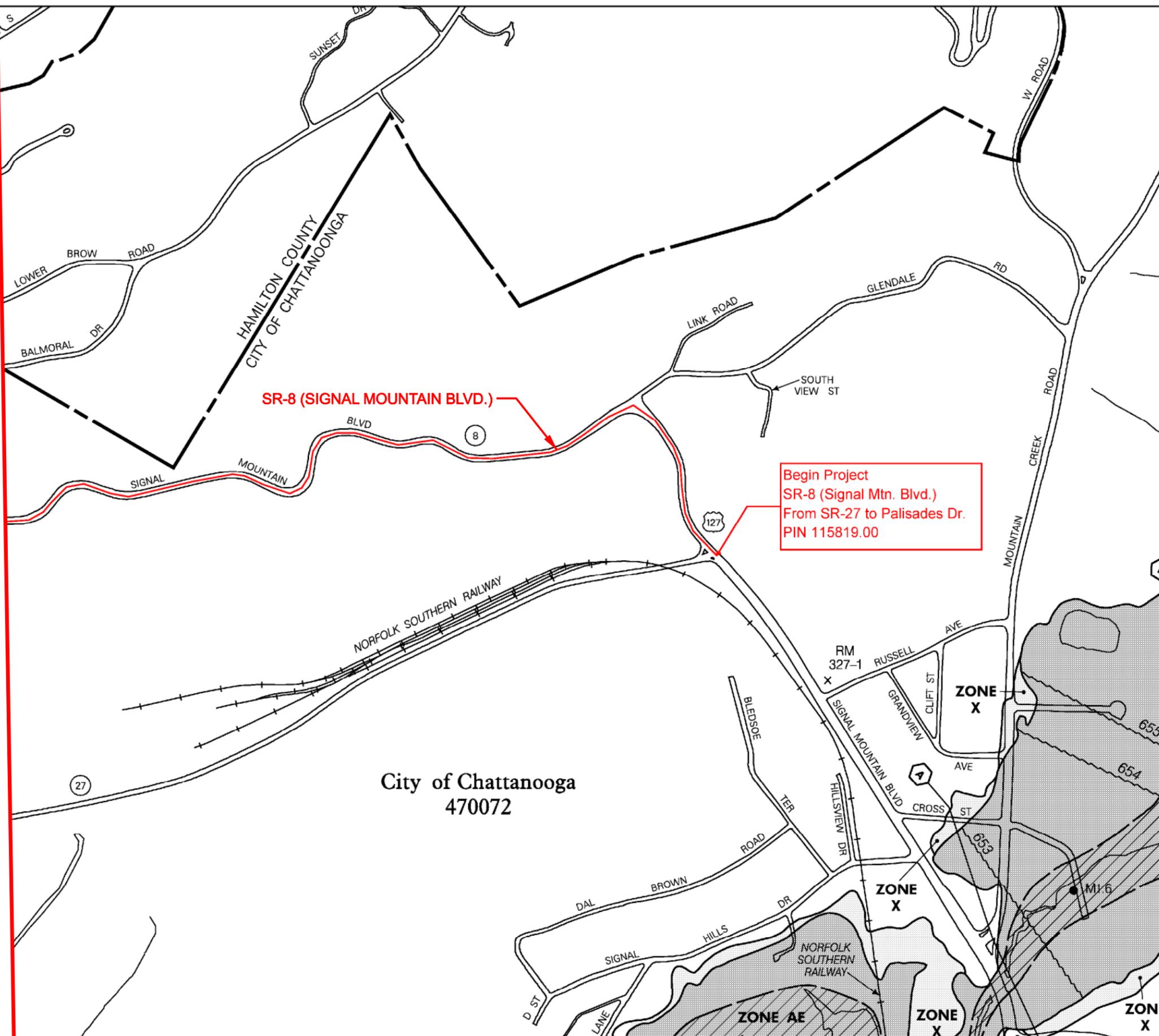
FIRM Maps

**MATCH LINE FIRM MAP 2**

JOINS PANEL 0326



APPROXIMATE SCALE  
500 0 500 FEET



**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM  
FLOOD INSURANCE RATE MAP  
HAMILTON COUNTY,  
TENNESSEE  
AND INCORPORATED AREAS**

**PANEL 327 OF 530**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
CHATTANOOGA, CITY OF	470072	0327	F
HAMILTON COUNTY	470071	0327	F
RED BANK, CITY OF	470075	0327	F
SIGNAL MOUNTAIN, TOWN OF	470078	0327	F

Notice to User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

**MAP NUMBER  
47065C0327F**

**EFFECTIVE DATE:  
NOVEMBER 7, 2002**

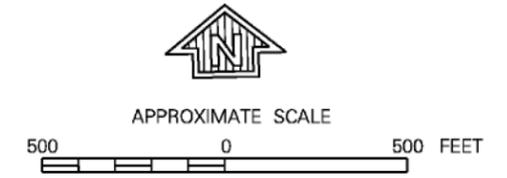
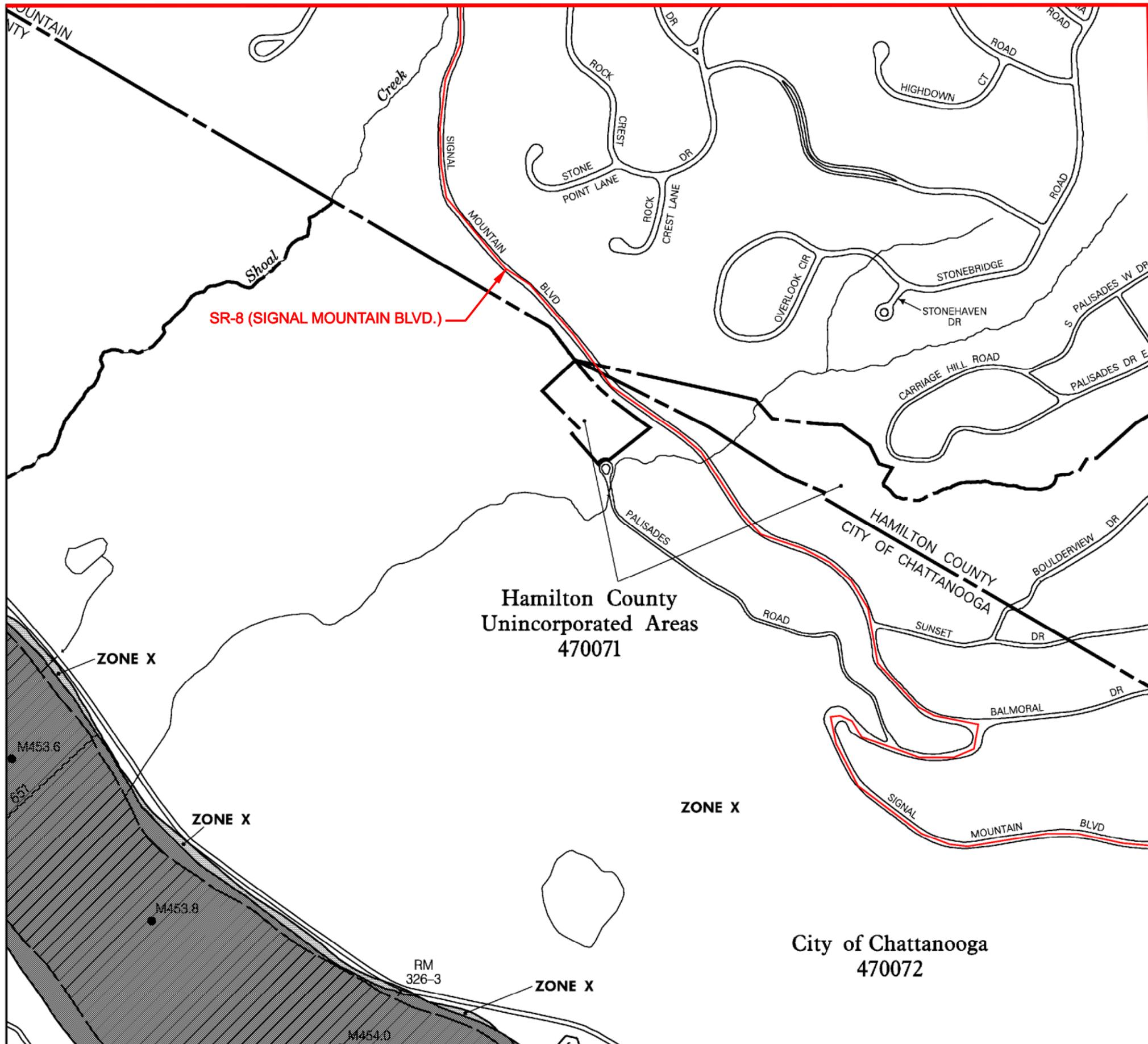


Federal Emergency Management Agency

**FIRM Map 1**

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

# MATCH LINE FIRM MAP 3



**NATIONAL FLOOD INSURANCE PROGRAM**

**FIRM  
FLOOD INSURANCE RATE MAP  
HAMILTON COUNTY,  
TENNESSEE  
AND INCORPORATED AREAS**

**PANEL 326 OF 530**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
CHATTANOOGA, CITY OF	470072	0326	F
HAMILTON COUNTY	470071	0326	F
SIGNAL MOUNTAIN TOWN OF	470078	0326	F

Notice to User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

**MAP NUMBER  
47065C0326F**

**EFFECTIVE DATE:  
NOVEMBER 7, 2002**



Federal Emergency Management Agency

**FIRM Map 2**

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

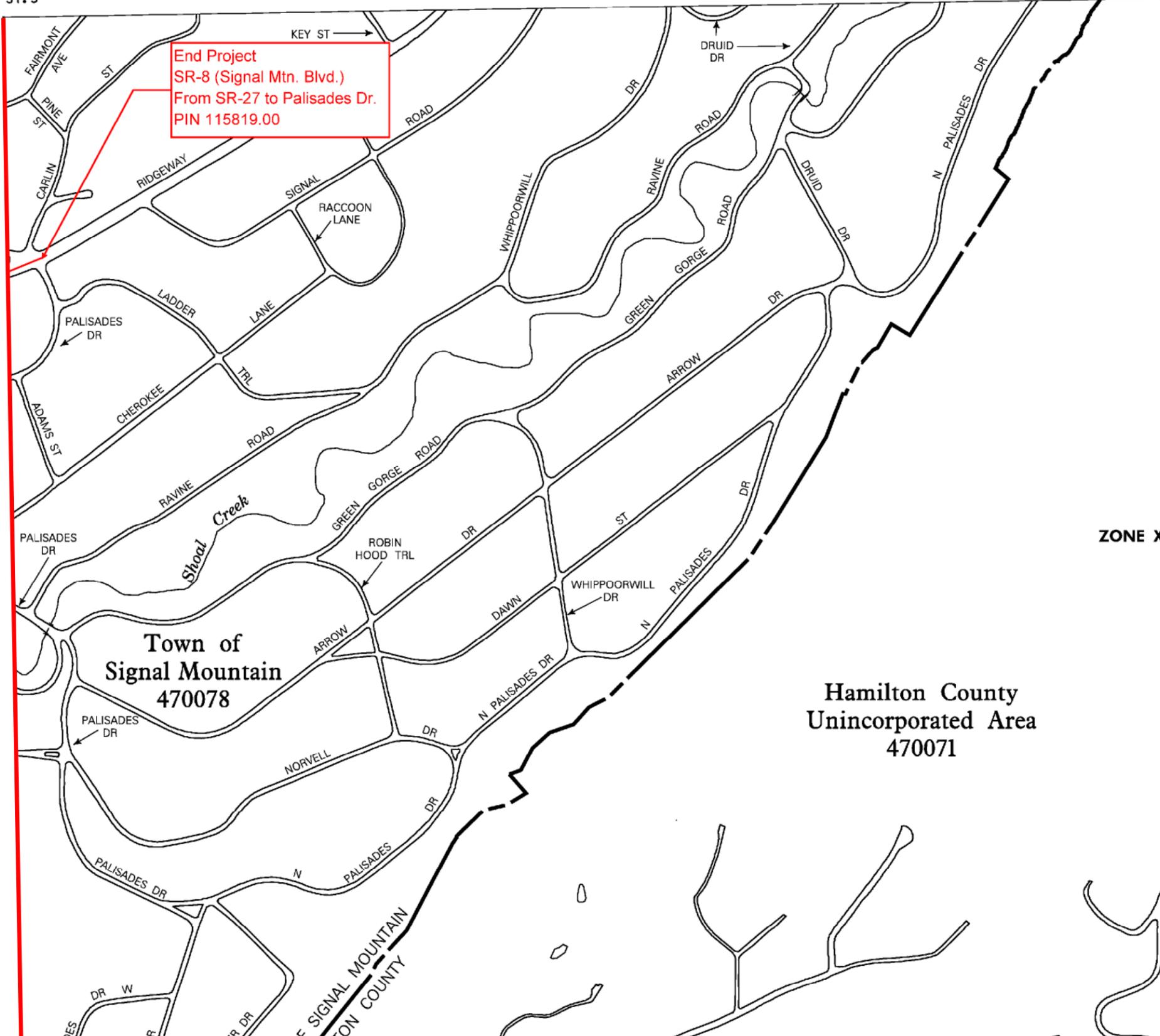


85° 20' 37.5"  
35° 07' 30"

JOINS PANEL 0214

MATCH LINE FIRM MAP 3

End Project  
SR-8 (Signal Mtn. Blvd.)  
From SR-27 to Palisades Dr.  
PIN 115819.00



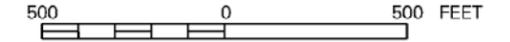
Town of  
Signal Mountain  
470078

Hamilton County  
Unincorporated Area  
470071

ZONE X



APPROXIMATE SCALE



NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP  
HAMILTON COUNTY,  
TENNESSEE  
AND INCORPORATED AREAS

PANEL 327 OF 530

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CHATTAHOOGA, CITY OF	470072	0227	F
HAMILTON COUNTY	470071	0227	F
RED BANK, CITY OF	470075	0227	F
SIGNAL MOUNTAIN, TOWN OF	470078	0227	F

Notice to User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

MAP NUMBER  
47065C0327F

EFFECTIVE DATE:  
NOVEMBER 7, 2002



Federal Emergency Management Agency

FIRM Map 4

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

## **Appendix H**

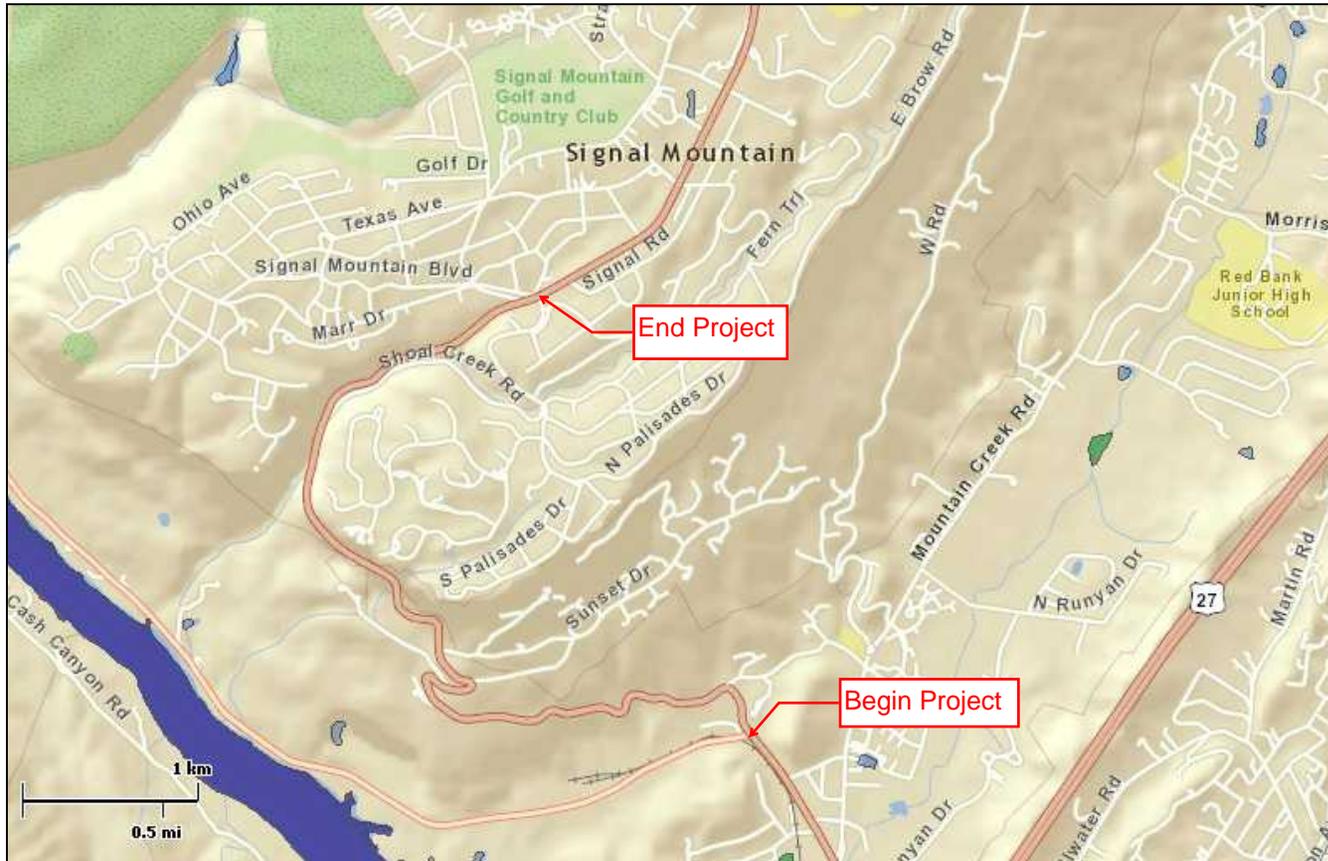
NWI Map



# U.S. Fish and Wildlife Service National Wetlands Inventory

## SR-8 (Signal Mtn. Blvd.) Wetlands Mapper

Jul 12, 2011



### Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

### Riparian

- Herbaceous
- Forested/Shrub

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

## **Appendix I**

Stakeholder Meeting Minutes



ARCADIS U.S., Inc.  
1210 Premier Drive  
Suite 200  
Chattanooga  
Tennessee 37421  
Tel 423 756 7193  
Fax 423 756 7197

## MEETING REPORT

Subject:

Work Order No. 8  
Agreement No. E1490  
Technical Report – SR 8 (Signal Mountain  
Boulevard), From SR 27 to Palisades Drive,  
LM 13.96 to 17.01  
Hamilton County, Tennessee

Department:

Infrastructure

ARCADIS Project No.:

CTT21008.0000

Place/Date of Meeting:

ARCADIS Office/August 24, 2011

Report No.:

1

Minutes by:

Clint Butler

Issue Date:

August 30, 2011

Participants:

Steve Allen, TDOT  
Nermine Nashed, TDOT  
Jennifer Flynn, TDOT  
Ken Flynn, TDOT  
Robert Rogers, TDOT  
Ray Rucker, TDOT  
Wes Hughen, TDOT  
Scott Medlin, TDOT  
Alan Wolfe, TDOT  
Gary M. Chapman, TDOT  
Barry McClendon, TDOT  
Chester Sutherland, TDOT  
Landon Castleberry, TDOT  
James Ball, TDOT  
Amber Thorton, TDOT

Present:

Mayor Bill Lusk, Town of Signal  
Mountain  
Honna Rogers, Town of Signal Mountain  
Dennis Malone, City of Chattanooga  
John Van Winkle, City of Chattanooga  
Harold Austin, Hamilton County  
Ben Wilson, Hamilton County  
Melissa Taylor, RPA –TPO  
Karen Rennich, RPA - TPO  
Brian Whitaker, ARCADIS  
Harvey McKaig, ARCADIS  
Clint Butler, ARCADIS  
Dewayne Ponds, ARCADIS  
Bryan Kyker, ARCADIS

Copies:

Bill Payne, City of  
Chattanooga

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Brian Whitaker opened the meeting with a safety moment and after introductions were made turned the presentation over to Steve Allen.

## **Project Schedule and Progress**

Steve Allen mentioned there is about one month left to complete the draft report.

Mayor Lusk stated that he felt the project is heading in the right direction.

## **2009 Slide Repair**

Ken Flynn stated it took 5 days to complete the 2009 slide repair and Ray Rucker further commented that the slide was caused by a water fall.

Mayor Lusk requested roadway stabilization repairs be performed in a similar fashion to the 2009 slide repair. He said the contractor did a good job on that project. Steve Allen responded by saying that was an emergency fix and would be cost prohibitive to perform the repairs that way. Ken Flynn added that it is not feasible to perform the repairs at such a fast pace and on such a compressed time line.

## **Report/Plans**

Steve Allen requested overhead utility lines be added to the plans.

Ken Flynn requested the cost be broken out by spot improvement area and to discuss how breaking the project up would limit duration of roadway closures.

Steve Allen mentioned the report would provide individual treatment costs.

Steve Allen mentioned adding a statement in the report about more residents being impacted along the W Road than SR 8.

Steve Allen requested a viaduct cost be added in the report.

## **1990 TDOT Design Project**

Robert Rogers stated TDOT had design plans from 1990 for an improved SR-8 from the base of the mountain to just beyond the space house. Clint Butler commented that ARCADIS has the 1990 plan set.

John Van Winkle questioned why the 1990 project was ruled out. Mayor Lusk stated at the time Signal Mountain did not want it and were opposed to the route following Palisades Drive. Robert Rogers mentioned that there was a lot of opposition to the project on Signal Mountain. Ray Rucker stated that the people on the mountain wanted to limit access not widen and improve the route.

## **Reconstruct Existing Route**

Ray Rucker mentioned the W Road and Roberts Mill Road both are closed during the winter and would not be adequate bypass routes.

John Van Winkle stated the public may be anticipating a viaduct along the bluff area near the top of the mountain. Mayor Lusk stated that a viaduct may allow the road to remain open during construction. Alan

Wolfe mentioned the viaduct may have icing problems.

Mayor Lusk stated that a 1 mile viaduct around the rock fall area would really help. Ray Rucker asked if the mayor would like to see two or three lane viaduct. Mayor Lusk requested 3 lanes. Ken Flynn stated that the viaduct does not eliminate the rock fall issues. You would still have to investigate stabilizing the rock fall area.

## **New Route**

Steve Allen stated if a new route is constructed up the mountain that the existing SR 8 would most likely be turned over to the locals.

A general comment was made that more residents would be impacted by constructing a new route along the W road than improving SR 8.

## **Spot Improvements**

John Van Winkle asked how many properties would be impacted by cutting back the slope near the top of the mountain. Dewayne Ponds suggested approximately 6.

Scott Medlin mentioned the difficulty of rock bolting the escarpment area. Crane location would be difficult and would most likely require shutting down the road. Ken Flynn agreed and further stated that the focus should be on removing the loose material.

Robert Rogers questioned if storm water detention had been evaluated. Brian Whitaker said it had not and may be difficult to provide on this project.

Ken Flynn raised concern over the utilities located in the existing ditch.

Ray Rucker questioned adding pipes and changing the flow of water could impact residents that live along the route. Bryan Kyker stated that all drainage improvement will need a thorough drainage analysis before installing any improvements. Brian Whitaker also stated the pipes can be day lighted at the toe of slope.

Ray Rucker questioned if guardrail was reviewed. Steve Allen stated it was not part of this project. Alan Wolfe mentioned if federal funds are involved the guardrail will need to be upgraded and improved to current standards. Steve Allen stated the project would be state funded.

Brian Whitaker stated that the immediate need is to provide adequate drainage and stabilize the roadway.

Ray Rucker mentioned there is a need to improve the route due to his forces having to perform maintenance on a regular basis.

Scott Medlin requested incorporating maintenance cost for the roadway in the report. Jennifer Flynn mentioned the MMS program. Scott Medlin said to contact Richard Howell about the maintenance cost for the roadway.

Steve Allen commented that the town should look at severe areas first and work on getting the long term type improvement coordinated with the TPO. Steve further stated he would recommend this as a "good

project” and that the commissioner would require public support.

Melissa Taylor stated that to place this project on the LRTP that a funding source would have to be identified and flushed out by mid to early 2013.

Steve Allen stated that he would present the project to the 7<sup>th</sup> floor at TDOT and they would decide how to address with programming.

Mayor Lusk mentioned stabilization areas 1 and 2 as shown on the maps were the most important.

Honna Rogers commented that there are other users of the route such as Sequatchie County and Waldens Ridge residents.

Mayor Lusk stated Signal Mountain would take the political heat during the construction process off of TDOT. They would be out in front during the repairs.

## **ARCADIS Action Items**

Obtain historical maintenance cost from Richard Howell.

Incorporate revisions as listed in the Report/Plans section.