Seven Bends State Park Access Study

Final Report
November 5, 2021

VDOT
Virginia Department of Transportation

Michael Baker
INTERNATIONAL

Seven Bends State park Access Study

Final Report

November 5, 2021

Prepared for:

Virginia Department of Transportation

Prepared By:

Michael Baker International

Contents

List of Tables

List of Figures

Appendices

1. Introduction

1.1 Project Information

Seven Bends State Park is a day-use park located in the geographically unique Seven Bends area of the North Fork of the Shenandoah River. Seven Bends State Park provides public access to the North Fork of the Shenandoah River and features two hand-carry boat launches, picnic areas, one single family-sized picnic shelter, vault restrooms, and 8 miles of hiking trails. The park provides water and land based outdoor recreational and educational opportunities while protecting and interpreting the spectacular scenic viewshed and geological, natural and historical resources of the storied seven bends area.

Seven Bends State Park has two access points. To the north is the Lupton Road entrance, where the existing low-water bridge over the North Fork of the Shenandoah River was recently repaired by VDOT to remove the previous weight restriction. To the south is the S. Hollingsworth Road entrance, which includes a low-water bridge with a 10-ton vehicle weight restriction. Both low-water bridges are prone to flooding. In 2008, the park's master plan included a proposed future connector road within the park to join the Lupton Road entrance to the S. Hollingsworth Road entrance. The proposed connection road was eliminated from the 2017 revised master plan due to steep slopes, natural heritage assets, and important natural habitat and ecosystem diversity located along the proposed roadway path. At the time this report was written, the draft Master Plan for the park includes multiple amenities that cannot be accomplished without improved access to the S. Hollingsworth Road entrance. To meet the need for improved access, the purposes of this study include:

- Providing technical transportation alternative access support to the Department of Conservation and Recreation (DCR) for the S. Hollingsworth Road entrance
- Ensure local citizens can access residences safely
- Develop intermediate and long-term park access options for DCR to include in their Master Plan for the park

1.2 Study Area

The study area is shown in Figure 1 and includes the areas adjacent to the Seven Bends State Park as well as the highlighted roadways:

- S. Water Street
- E. Reservoir Road
- Hollingsworth Road
- Lupton Road
- S. Hollingworth Road

1.3 Public Involvement Process

This study was guided by a series of stakeholder meetings and workshops that were conducted to solicit comments on alignment locations, fatal flaws, and potential changes to preliminary alignments. These meetings and workshops were attended by the core stakeholder working group while a citizen information meeting was held to inform the public of the results of the study and to engage citizen stakeholders to receive their input and ideas.

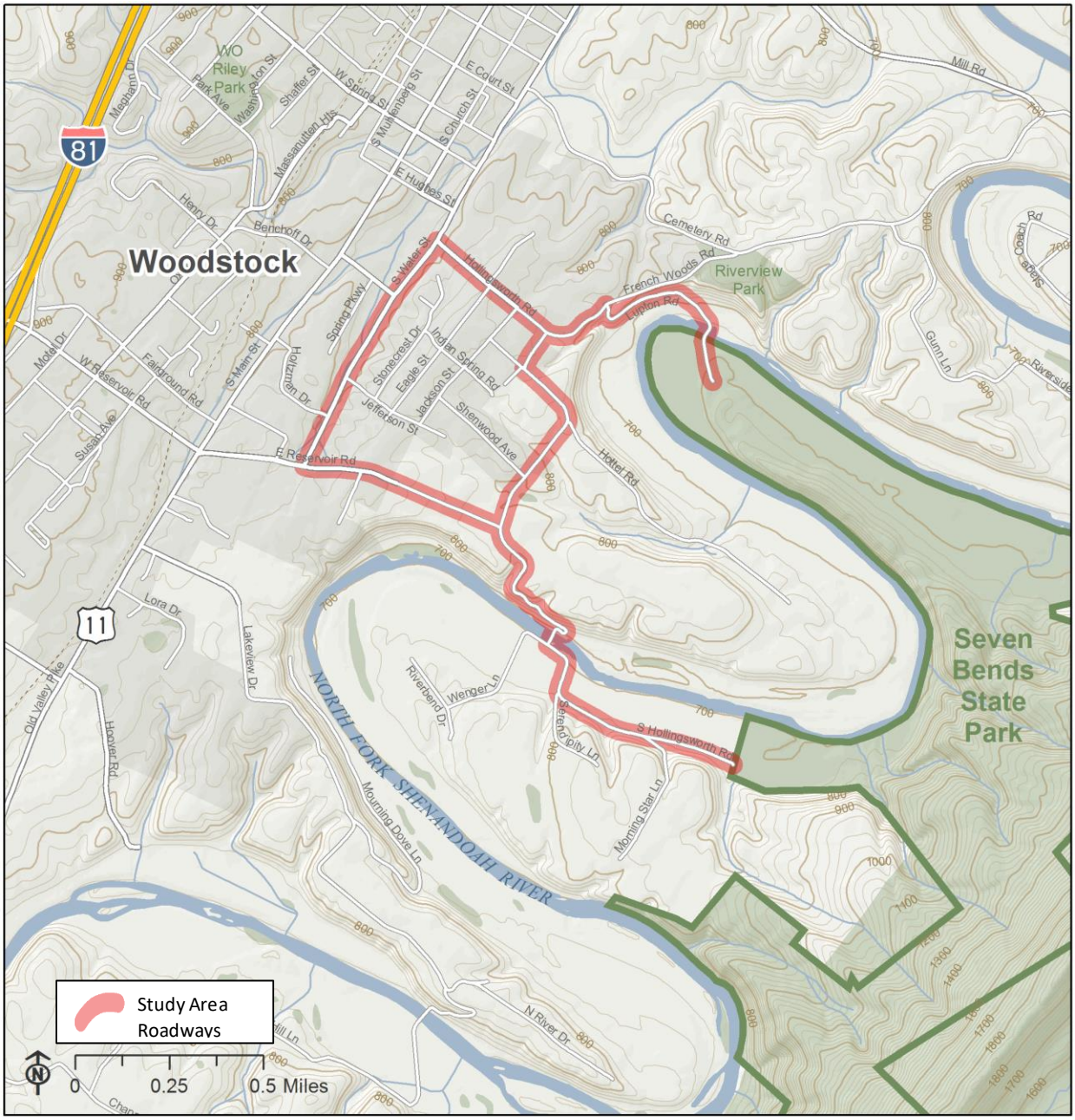
1.3.1 Stakeholder Working Group

The public involvement process began with the November 19, 2019 project kick-off meeting with the core stakeholder working group at the Shenandoah County Government Center. Items presented during the meeting included the environmental constraints in the area, crash history on the study area roadways, and existing traffic volumes. As part of this meeting, stakeholders were given large format plots of the study area and asked to place stickers at possible alignment locations, areas that should be avoided, and fatal flaw items. The core stakeholder working group consisted of staff-level representatives from each of the organizations listed in Table 1. This group met at key milestones throughout the study to review progress and results.

Table 1: Core Stakeholder Working Group

Shenandoah County
Town of Woodstock
The Virginia Department of Transportation
The Virginia Department of Conservation and Recreation (DCR)
Northern Shenandoah Valley Regional Commission (NSVRC)
EMS providers

Figure 1: Study Area



On February 5, 2020, a meeting was held with the core stakeholder working group at the Shenandoah County Government Center to present and discuss preliminary alternatives. Again, stakeholders were given large format plots of the study area and preliminary alternatives and were asked to place stickers on the plots at items of concern.

Picture from Stakeholder Meeting

A virtual review meeting was held with DCR on July 13, 2020 to provide updates on the study and discuss the schedule and next steps in the study process. Due to the COVID-19 pandemic, the study was put on hold and this meeting served as a "catch-up" on the work completed to date.

Another preliminary alternative review meeting was held virtually with the core stakeholder group on August 14, 2020. Again, this meeting was held to update the group on the work done to date because of the delay due to the COVID-19 pandemic.

On November 5, 2020, a virtual meeting was held with the core stakeholder group to review the preferred alternative preliminary alignments. During this meeting, the three preliminary alignments were presented to the group along with the preliminary cost estimates and earthwork quantities.

A final virtual meeting was held with the core stakeholder group on July 7, 2021 to review the comments received from property owners on the preliminary alignments of the preferred alternative and the resulting modifications to alternative alignment 3. The property owner comments and alignment modifications are discussed further in the Public Outreach section of this report. Table 2 presents the dates and locations of the stakeholder meetings and the public information meeting.

Table 2: Stakeholder and Public Information Meetings

Meeting	Date	Location
Stakeholder kick-off meeting	November 19, 2019	Shenandoah County Government Center
Stakeholder Preliminary Alternatives Meeting	February 5, 2020	Shenandoah County Government Center
Review Meeting with DCR	July 13, 2020	Virtual
Stakeholder Alternative Review Meeting	August 14, 2020	Virtual
Stakeholder Preferred Alternative Review Meeting	November 5, 2020	Virtual
Stakeholder Coordination Meeting	July 7, 2021	Virtual
Public Information Meeting	August 17, 2021	Virtual

1.3.2 Public Outreach

As part of the public outreach process, an online survey was conducted from November 2019 to February 2020. The public survey asked to rank four categories by importance as they related to potential access improvements to the Seven Bends State Park. The ranking results from the 115 responses are shown in Table 3.

Table 3: Online Survey Results

Rank	Category	Description
1	Safety and Travel Time	Safety, EMS response, and congestion
2	Environmental Impacts	Natural resource area impacts, stream impacts, cultural resource impacts, and protected species impacts
3	Right-of-Way Impacts	Residential and commercial private property impacts and impacts to utilities/easements
4	Community Impacts	Travel times to local homes and businesses, local road impacts

VDOT and Shenandoah County staff conducted a public outreach effort to discuss the preferred alternative alignment with adjacent property owners including the Muse Vineyards. All property owners acknowledged the preferred alternative and the Muse Vineyards expressed concern about impacts to the property regarding the current locations of their grape vines. Alignment 3 was modified slightly to tie into the existing S. Hollingsworth Road on the west side of the river, depicted in Figure 12 later in this report.

A virtual public information meeting was held on August 17, 2021 to present the findings of the study and the preferred alternative alignment. Members of the public were invited to ask questions and provide comments. During the meeting there were also several polling questions conducted, the results of which are shown in Appendix B. The comments and responses were posted on the VDOT website and are also included in Appendix A.

2. Background Data

2.1 Crash History

Crash data was collected for the years 2013 through 2018 for the roadways included in the study area. This crash severity data is presented in Figure 2 and the crash types are presented in Figure 3. As shown in the figures, there have been approximately nine crashes on study area roadways over the five-year period, most at intersections. There were two angle crashes, two rear-end crashes, and two crashes involving a fixed object. Two of the crashes included a visible injury and seven crashes were property damage only.

2.2 Environmental Constraints

Environmental constraints in the study are were mapped using existing GIS databases for archaeological constraints, architectural constraints, wetlands, conservation lands, and flood plains, presented in Figure 4. The topography of the study area, presented in Figure 5, shows that steep slopes (>15%) exist within the study area, mostly confined to areas adjacent to the North Fork of the Shenandoah River.

2.3 Traffic Data

Traffic counts, including heavy vehicle percentages and vehicle speeds, were conducted during the week of June 7 to June 13, 2019 along the study area roadways, presented in Figure 6. The daily traffic volumes on roadways within the study area are relatively low along the percentages of heavy vehicles. Average vehicle speeds are also within the expected range for each roadway. The traffic volumes on Lupton Road collected as part of this study was compared to traffic data collected by DCR at the park entrance on Lupton Road to confirm that the traffic volumes from both sources were accurate. Future traffic volumes were developed from these traffic counts and are discussed in Section 4. The raw traffic counts are presented in Appendix C.

2.4 Site Visit

A field review was conducted in June 2019 to review roadway and intersection configurations, identify unique roadway features, investigate the two entry points to the park, and observe traffic operations along the study area roadways. Below are some pictures taken of the existing S. Hollingsworth Road low-water bridge and approach to the bridge.

Pictures of the existing S. Hollingsworth low-water bridge and approach

Figure 2: Crash Severity (2013-2018)

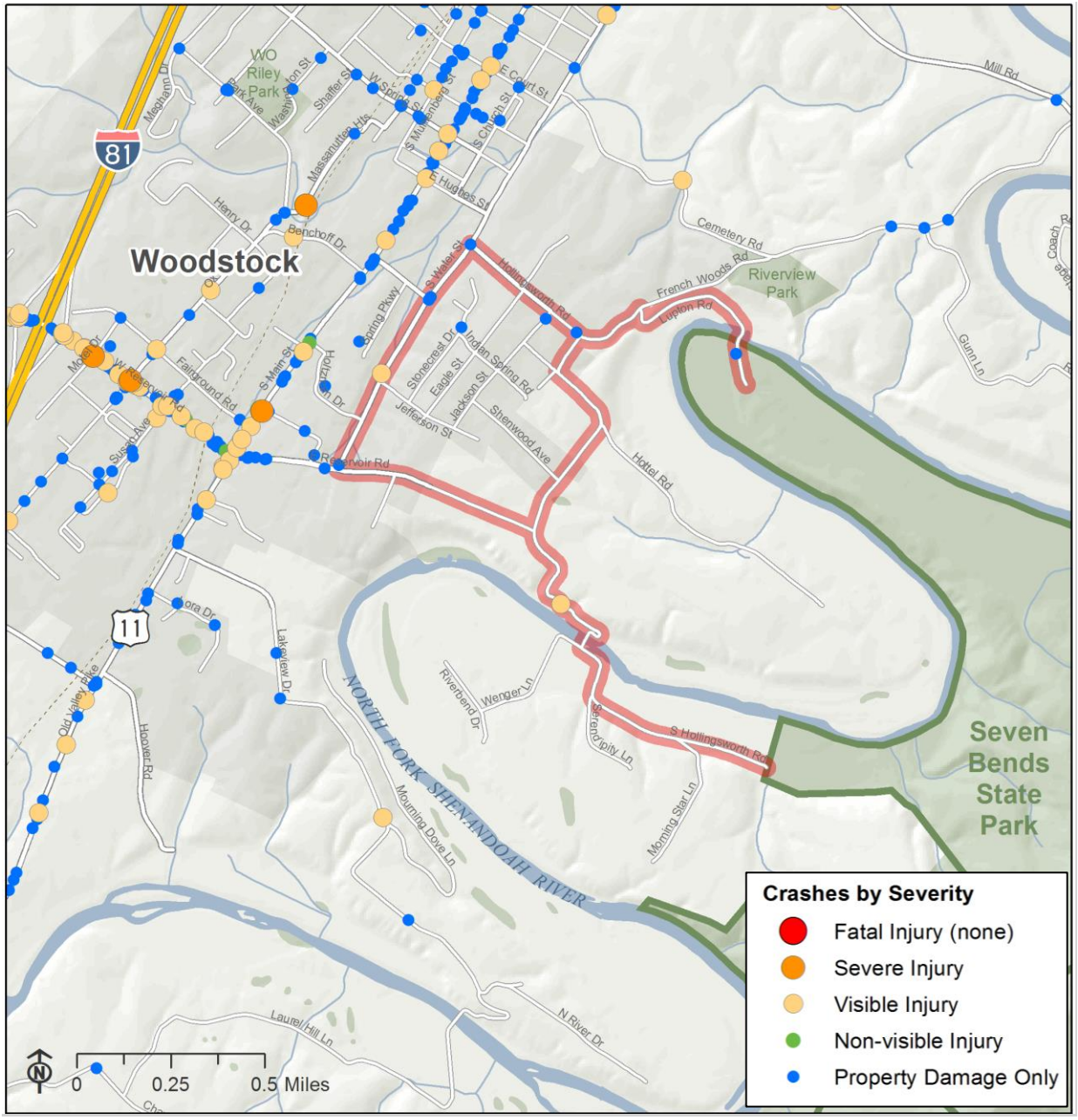


Figure 3: Crash Type (2013-2018)

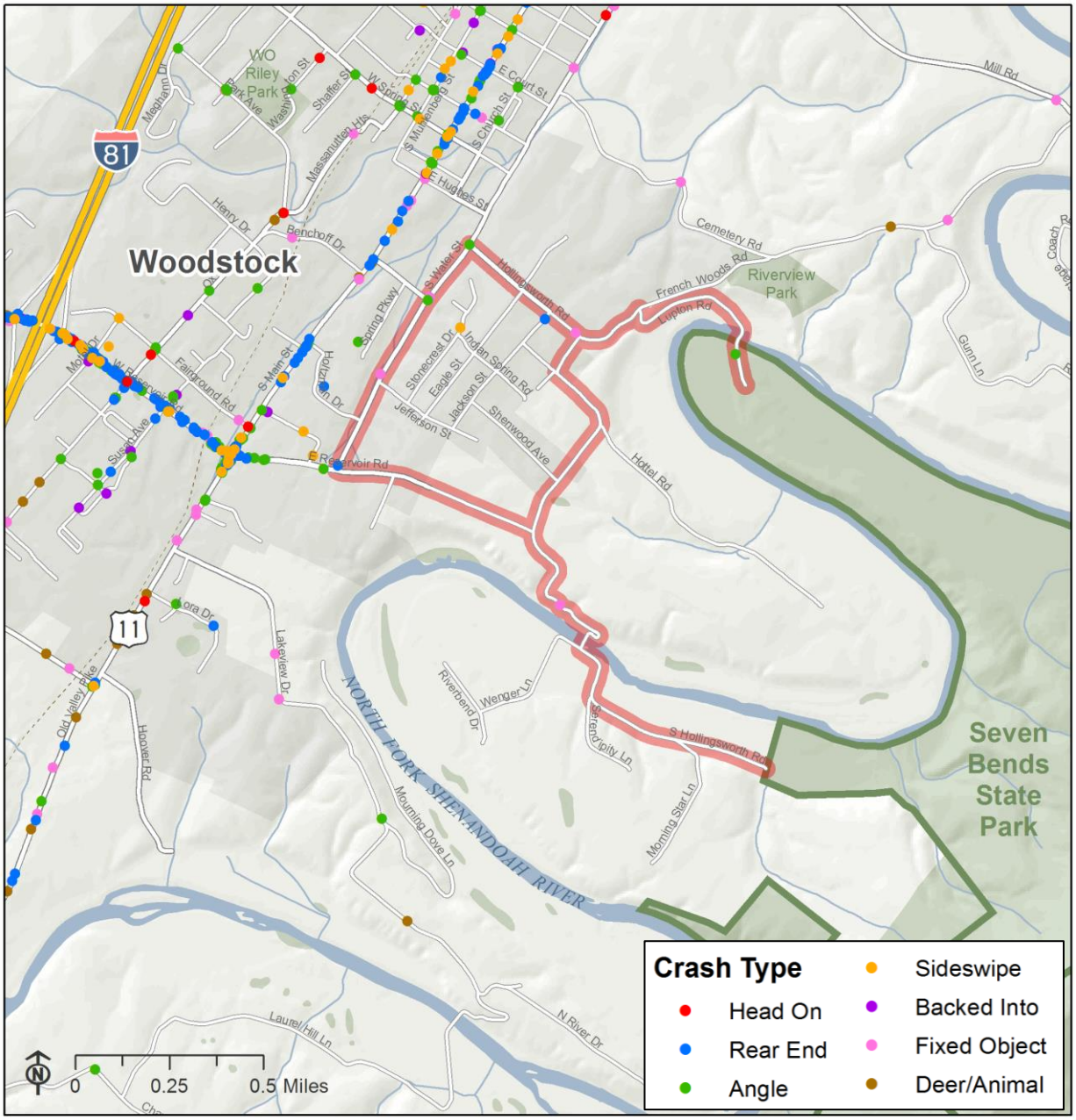


Figure 4: Environmental Constraints

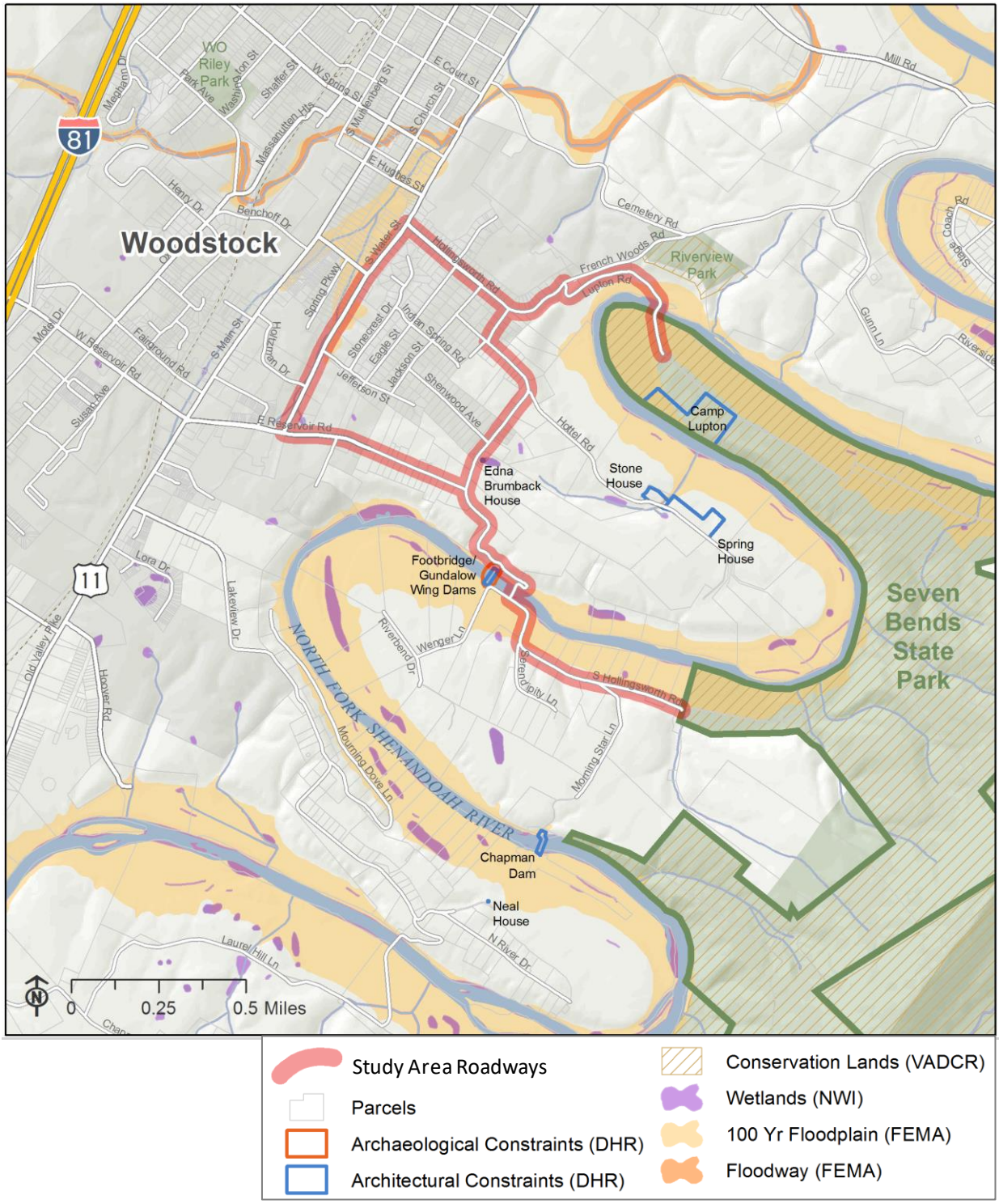


Figure 5: Study Area Topography and Steep Slopes

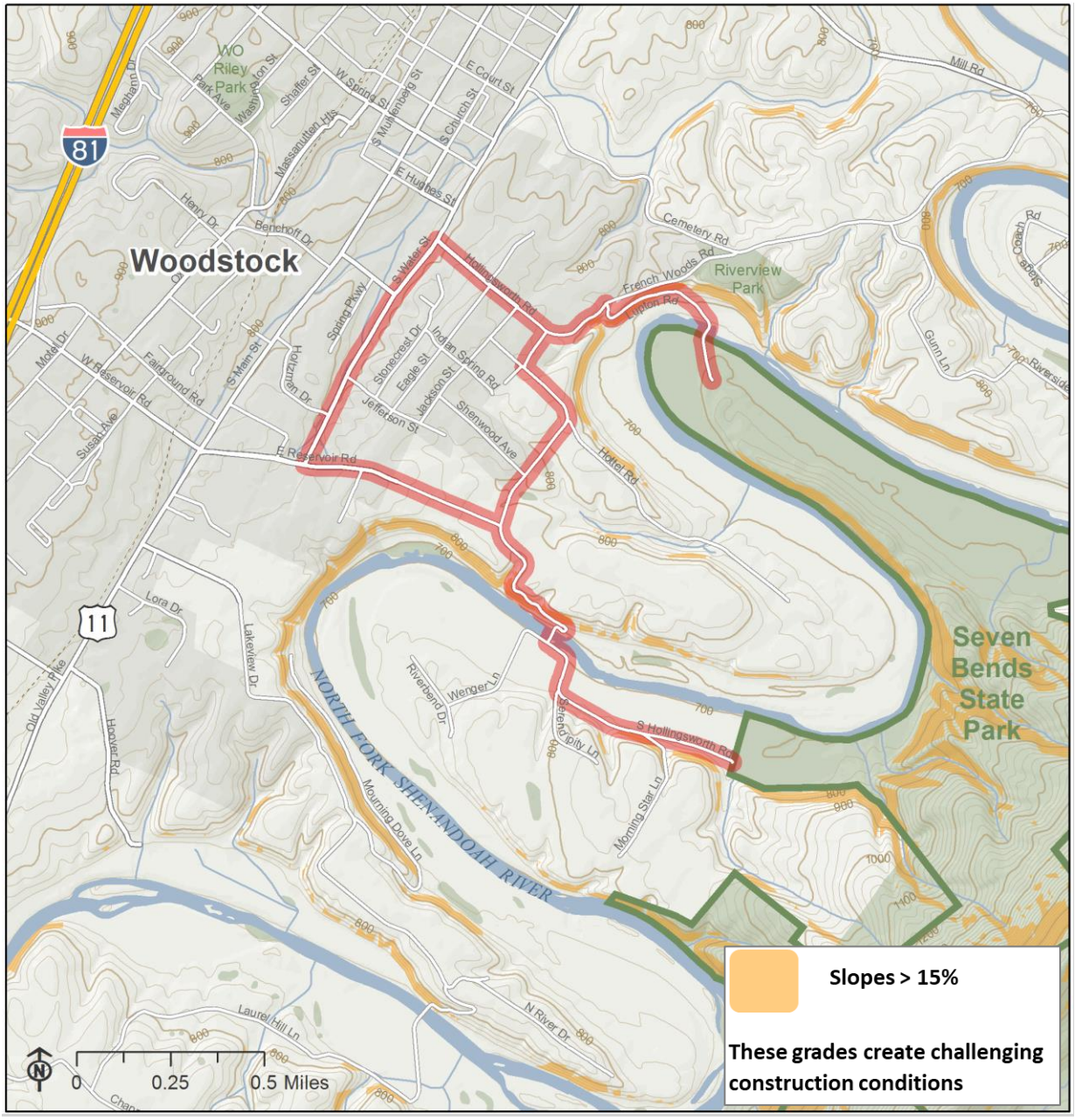
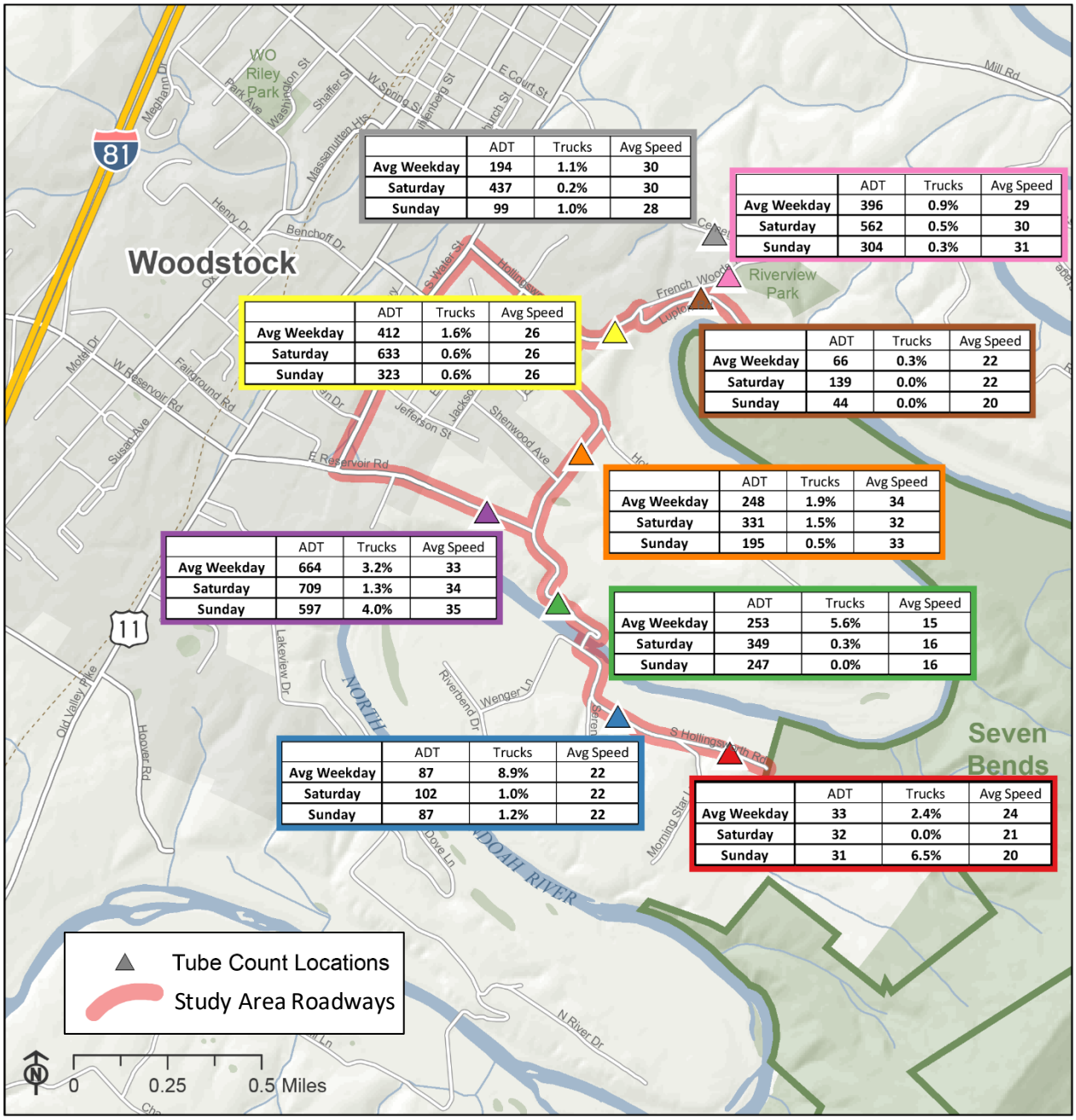


Figure 6: 2019 Traffic Data



	ADT	Trucks	Avg Speed
Avg Weekday	194	1.1%	30
Saturday	437	0.2%	30
Sunday	99	1.0%	28

	ADT	Trucks	Avg Speed
Avg Weekday	396	0.9%	29
Saturday	562	0.5%	30
Sunday	304	0.3%	31

	ADT	Trucks	Avg Speed
Avg Weekday	412	1.6%	26
Saturday	633	0.6%	26
Sunday	323	0.6%	26

	ADT	Trucks	Avg Speed
Avg Weekday	66	0.3%	22
Saturday	139	0.0%	22
Sunday	44	0.0%	20

	ADT	Trucks	Avg Speed
Avg Weekday	248	1.9%	34
Saturday	331	1.5%	32
Sunday	195	0.5%	33

	ADT	Trucks	Avg Speed
Avg Weekday	664	3.2%	33
Saturday	709	1.3%	34
Sunday	597	4.0%	35

	ADT	Trucks	Avg Speed
Avg Weekday	253	5.6%	15
Saturday	349	0.3%	16
Sunday	247	0.0%	16

	ADT	Trucks	Avg Speed
Avg Weekday	87	8.9%	22
Saturday	102	1.0%	22
Sunday	87	1.2%	22

	ADT	Trucks	Avg Speed
Avg Weekday	33	2.4%	24
Saturday	32	0.0%	21
Sunday	31	6.5%	20

3. Preferred Alternative Development Process

3.1 Options for Preliminary Alignments

Preliminary alternatives were developed for improving southern access to the S. Hollingsworth Road park entrance and a connector roadway to potentially link the S. Hollingsworth Road entrance to the Lupton Road entrance. The preliminary alternatives were developed to minimize impacts to surrounding parcels while using existing roads to the greatest extent possible. The preliminary alternatives were presented to the stakeholder working group on February 5, 2020 for feedback and comments. The preliminary alternatives for improving access to the S. Hollingsworth Road Entrance are presented in Figure 7 and the preliminary alternatives for the potential connector roadway are presented in Figure 8.

South Entrance Alternative 1 (dark blue in Figure 7)

This alternative is primarily along the existing S. Hollingsworth Road alignment approaching the river crossing but includes a relocated bridge across the North Fork of the Shenandoah River before tying into the existing roadway on the south side of the river. The relocated bridge would be a low-water bridge similar to the existing crossing, albeit at a slightly higher elevation to provide some protection during smaller flooding events.

South Entrance Alternative 2 (light blue in Figure 7)

This alternative utilizes existing Broadview Lane, just south of the intersection with E. Reservoir Road and Water Street to travel west toward the water treatment plant. This alternative would continue south along a new roadway that bisects the water treatment plant parcel and the parcel to the east. A new bridge would cross the North Fork of the Shenandoah River and a new roadway would be constructed along the west bank of the river before tying into existing S. Hollingsworth Road near the existing bridge.

South Entrance Alternative 3 (dark purple in Figure 7)

This alternative is all on new alignment, extending southeast from existing S. Hollingsworth Road, parallel to the river for approximately 0.5 miles before turning south to cross the river via a new low-water bridge and tying into existing S. Hollingsworth Road just west of the Park entrance.

Potential Connection Alternative 1 (teal in Figure 8)

This connector roadway alternative is entirely within the park boundaries, connecting existing Lupton Road to existing S. Hollingsworth Road. This new facility would be constructed along the mountainous terrain on the east side of the North Fork of the Shenandoah River.

Potential Connection Alternative 2 (light purple in Figure 8)

This connector roadway alternative would provide the most direct connection between the two entrances to the park. This alternative would be a new roadway traveling southwest from the existing Lupton Road entrance to the park, over a new bridge, then continuing southwest to tie into the existing bridge leading to the S. Hollingsworth Road entrance to the park.

Potential Connection Alternative 3 (red in Figure 8)

This connector roadway alternative would be a new roadway connecting to existing Lupton Road and traveling along the west bank of the North Fork of the Shenandoah River, just west of the 100-year floodplain. For this alternative to be viable, the river crossing of the South Entrance Alternative 3 (purple) would also need to be constructed.

Potential Connection Alternative 4 (green in Figure 8)

This connector roadway alternative would utilize the existing Hottel Road facility to connect the two entrances to the park. This alternative would also require segments of other alternatives to be constructed including the river crossing of the South Entrance Alternative 3 (dark purple).

Figure 7: Preliminary Alternatives for Improving Access to South Hollingsworth Road Entrance

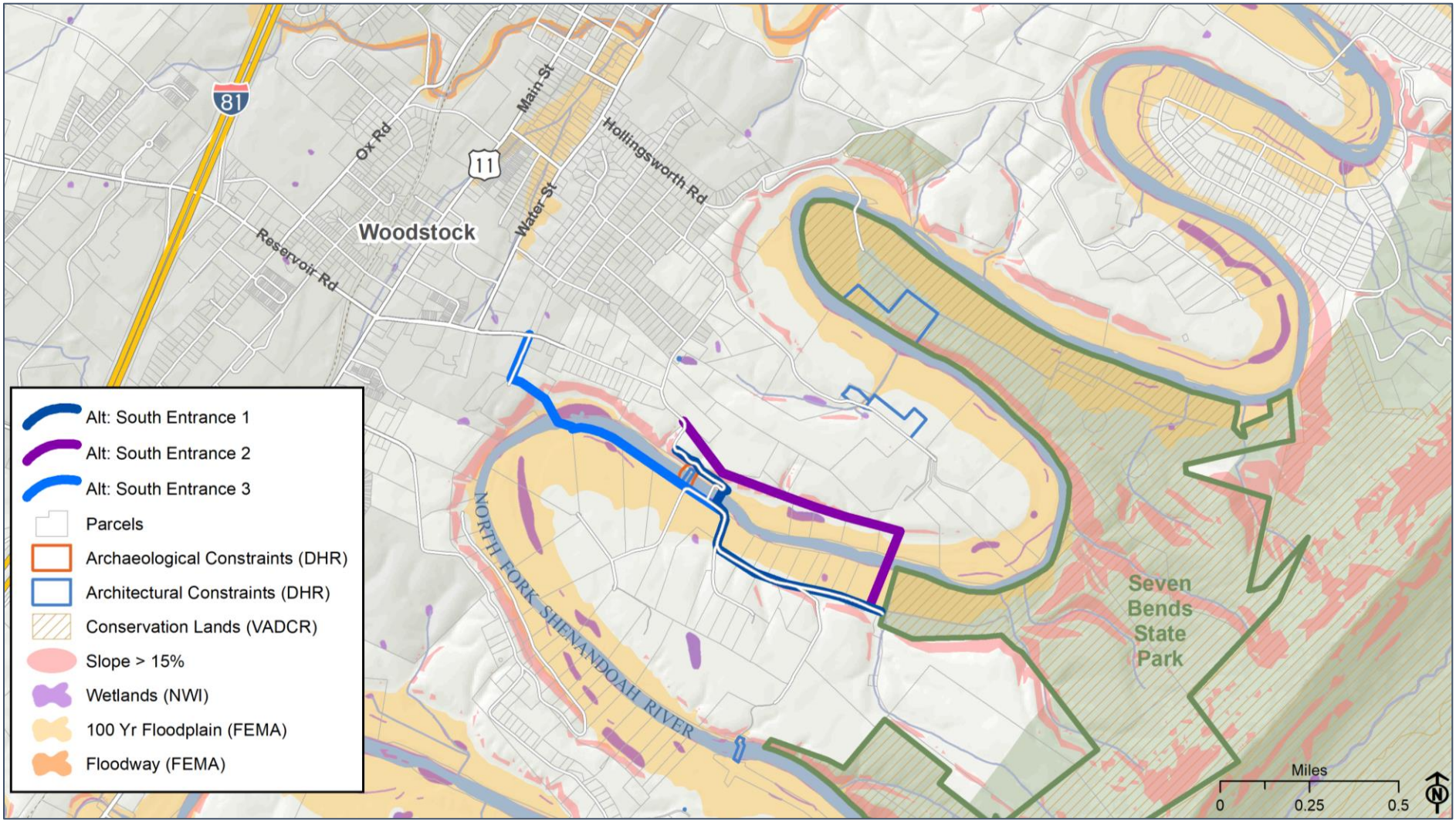
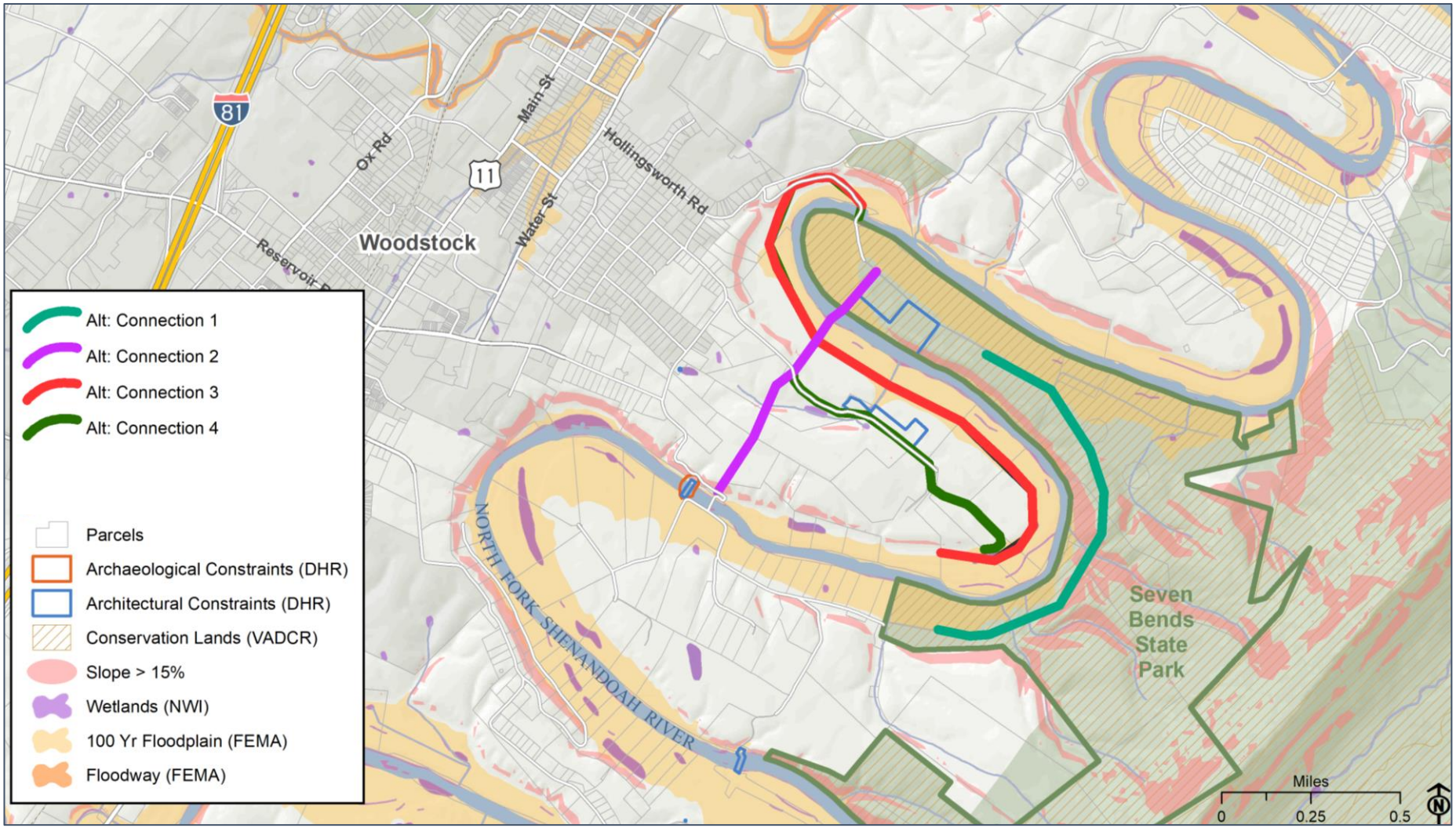


Figure 8: Preliminary Alternatives for Potential Connector Roadway



3.2 Preferred Alternatives

Based on feedback and comments from DCR and the stakeholder working group, a combination of South Entrance Alternative 1 and South Entrance Alternative 3 was selected as the preferred alternative for improving access to the S. Hollingsworth Road entrance to the park. Three preliminary alignments were developed for the preferred alternative alignment and low-water bridge, presented in Figure 11. It is important to note that the new bridge is proposed as a low-water bridge to reduce overall project costs. A new bridge located outside of the floodplain would require additional earthwork, increase impacts to adjacent properties, and extend the limits of disturbance. The new bridge would still be constructed at a slightly higher elevation than the existing low-water bridge, reducing impacts from minor flooding events. Figure 11 also includes detailed roadway profiles based on available USGS topography. A roadway profile shows the existing topography compared to the grade of a proposed roadway and assists in determining the amount of earthwork required for construction. Based on the profiles of each of the alignments, Alignment 3 was selected as the preferred alternative alignment.

A typical section was developed for the preferred alternative based on the surrounding area and anticipated usage of the roadway. The design standards in the VDOT Roadway Design Manual for a rural local road (GS-4) were referenced during the development of the typical section, presented in Figure 9. As shown in the figure, the typical section has a total width of 36 feet, with 10-foot travel lanes and 2-foot graded shoulders. Due to the potential for bicycle access, a second typical section was developed that adds 5-foot paved shoulders on each side for safe bicycle travel, presented in Figure 10.

Figure 9: Rural Local Road Typical Section

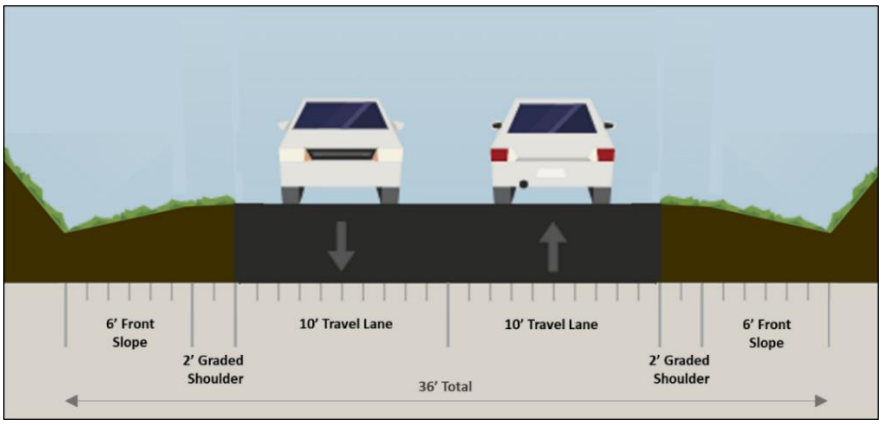


Figure 10: Rural Local Road Typical Section with Shoulders for Bikes

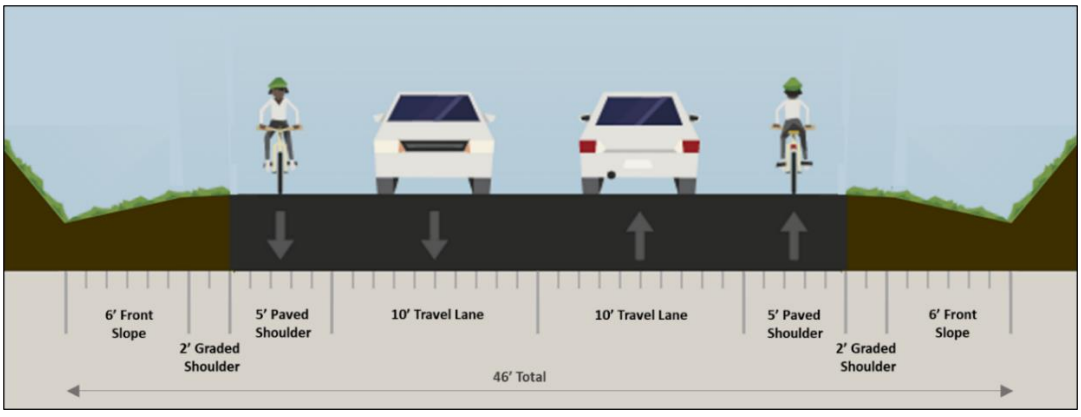
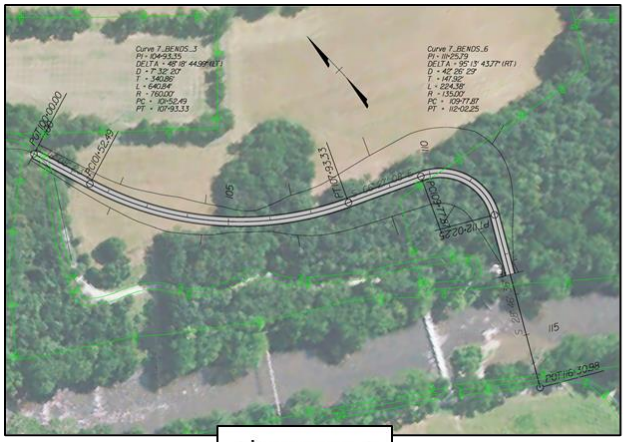
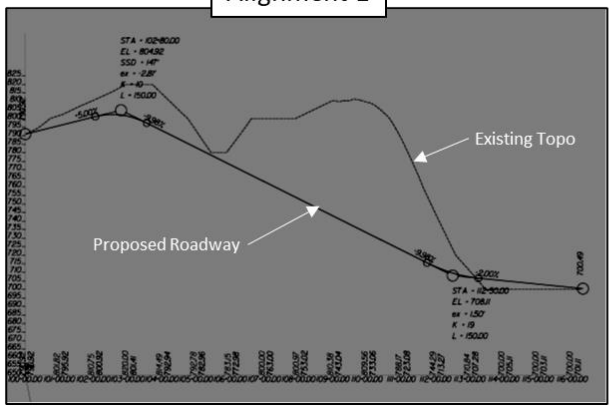


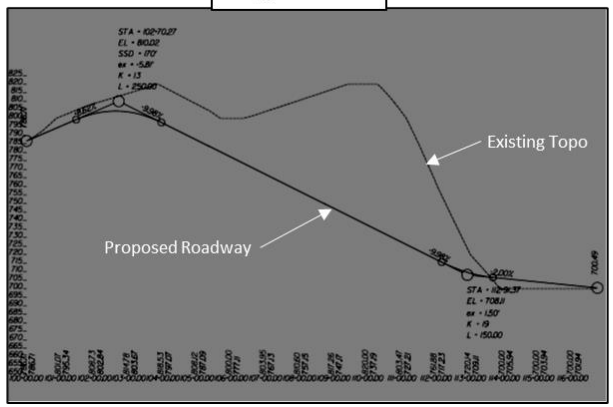
Figure 11: Preliminary Alignments for Preferred Alternative

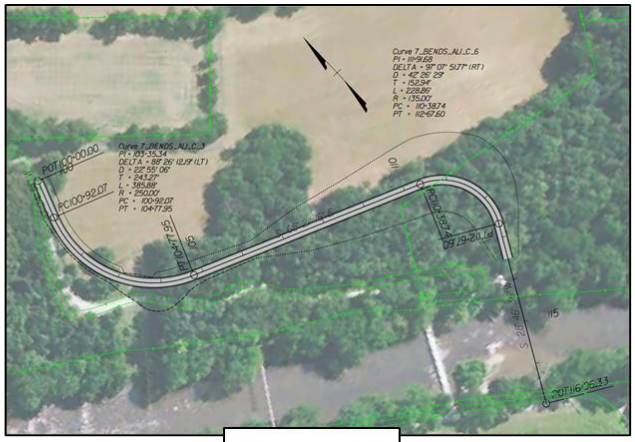


Alignment 1

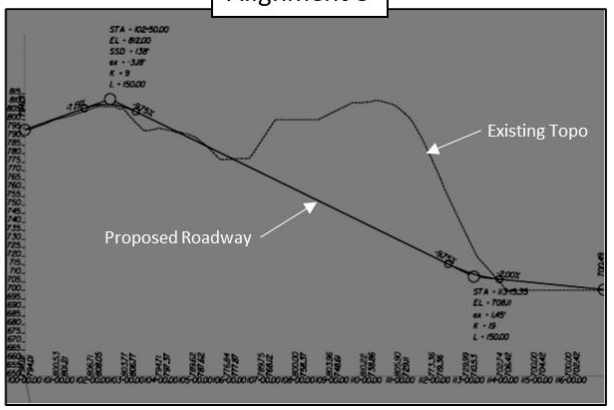


Alignment 2



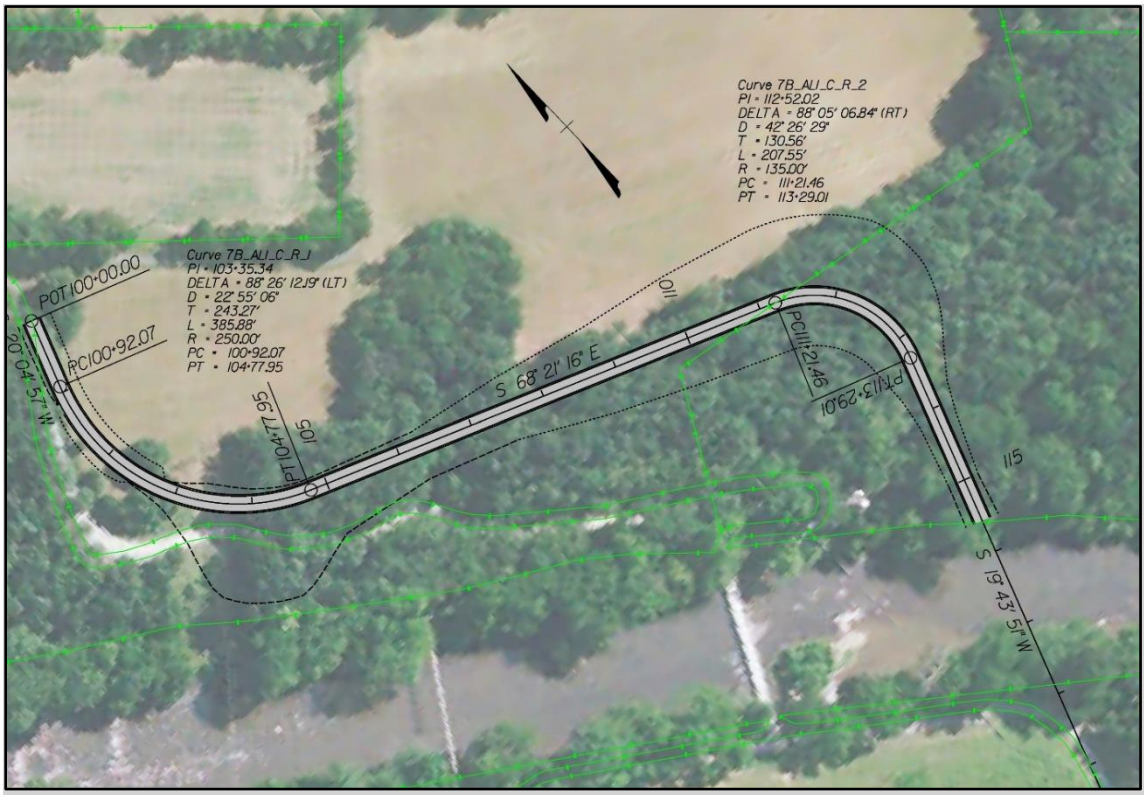


Alignment 3



VDOT and Shenandoah County staff conducted a public outreach effort to discuss the preferred alternative alignment with adjacent property owners including the Muse Vineyards. All property owners acknowledged the preferred alternative and the Muse Vineyards expressed concern about impacts to the property regarding the current locations of their grape vines. Alignment 3 was modified slightly to tie into the existing S. Hollingsworth Road on the west side of the river, depicted in Figure 12. Also included in Figure 12 is a summary of the planning level cost estimate that was developed using VDOT Staunton District average unit prices for construction and earthwork items. The detailed cost estimate is available in Appendix D. It is important to note that there is an existing pedestrian swinging bridge over the North Fork of the Shenandoah River just west of the existing low-water bridge. This pedestrian bridge is on private property but maintained by VDOT. Access to the pedestrian bridge will be evaluated further in the project development process if funding is obtained for the overall project.

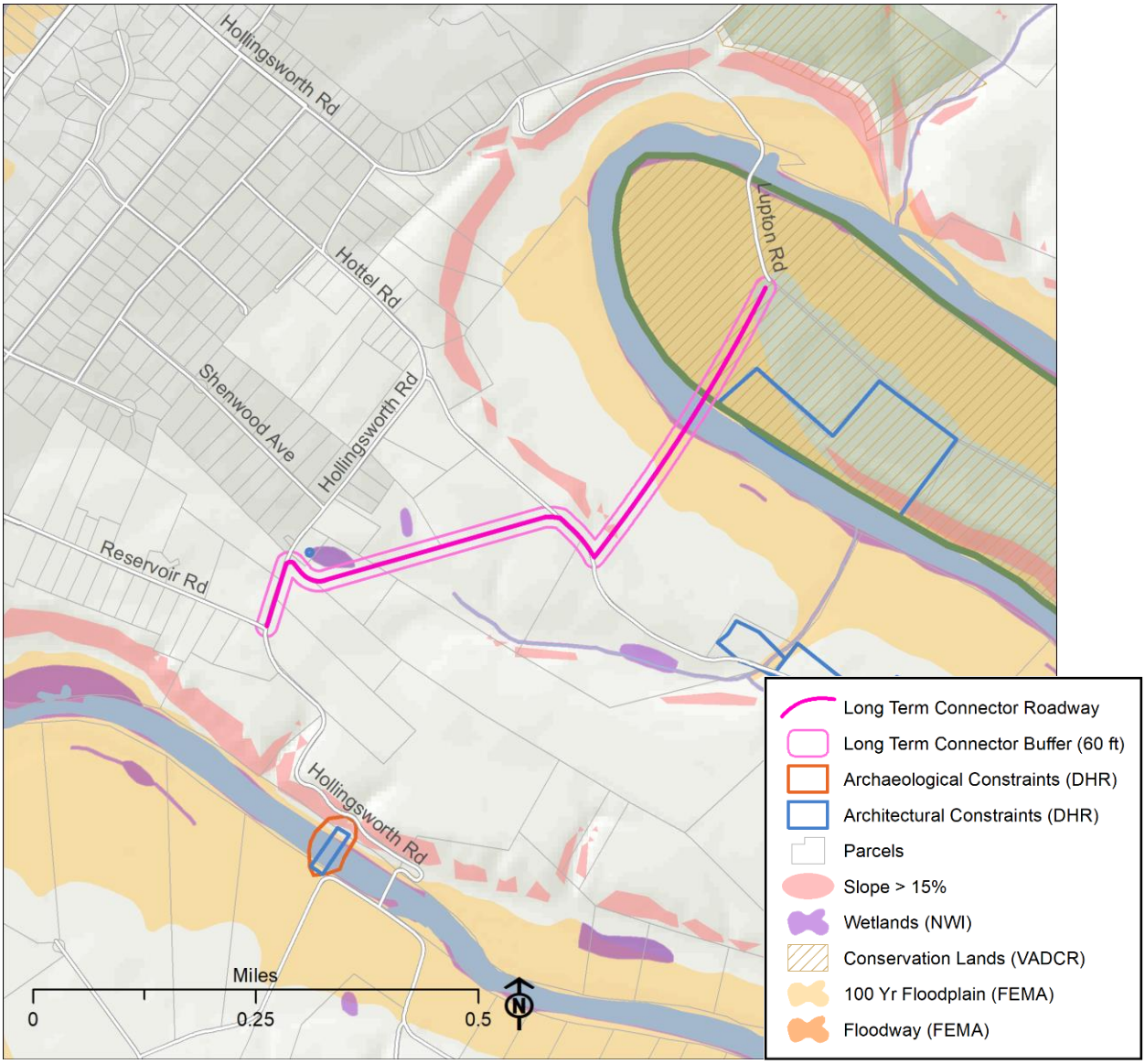
Figure 12: Preferred Alternative Alignment (Alignment 3-Modified)



Length of Alignment (feet)	1550
Average Grade	-10%
Earthwork (Cubic Yards)	109,200
Construction Cost	$12,300,000
Preliminary Engineering, ROW, Utilities, and Contingencies	$2,400,000
Total Project Cost	**$14,700,000**

The preliminary alternatives for the potential long-term connector roadway were modified based on the selection of the preferred alternative for improving the S. Hollingsworth Road access to the park. Potential Connection Alternative 2 (purple in Figure 8) was adjusted so that the western terminus tied into the intersection of Reservoir Road and Hollingsworth Road and the vehicles could use the proposed new access road to enter the park at the S. Hollingsworth Road entrance. The potential long-term connector roadway is presented in Figure 13. The typical section for this facility would be the same rural local road GS-4 standard as the preferred alternative for the southern access (shown in Figure 9 and Figure 10).

Figure 13: Potential Long-Term Connector Roadway



4. Future Conditions

4.1 Future Traffic Volumes

Future traffic volumes were developed for a scenario in which the Seven Bends State Park is fully built out using the following data sets:

1. Seven Bends State Park 2019 monthly and daily visitor data
2. National Park Service Visitor Statistics
3. The ITE Trip Generation Manual

The 2019 data from Seven Bends State Park revealed that Saturdays account for 23 percent of monthly visitors and data from the National Park Service Visitor Statistics showed that the month of July has more visitors than other months (12%-14%). Based on these data points, as well as trip generation statistics included in the ITE Trip Generation Manual, the existing and future visitors were calculated and are presented in Table 4.

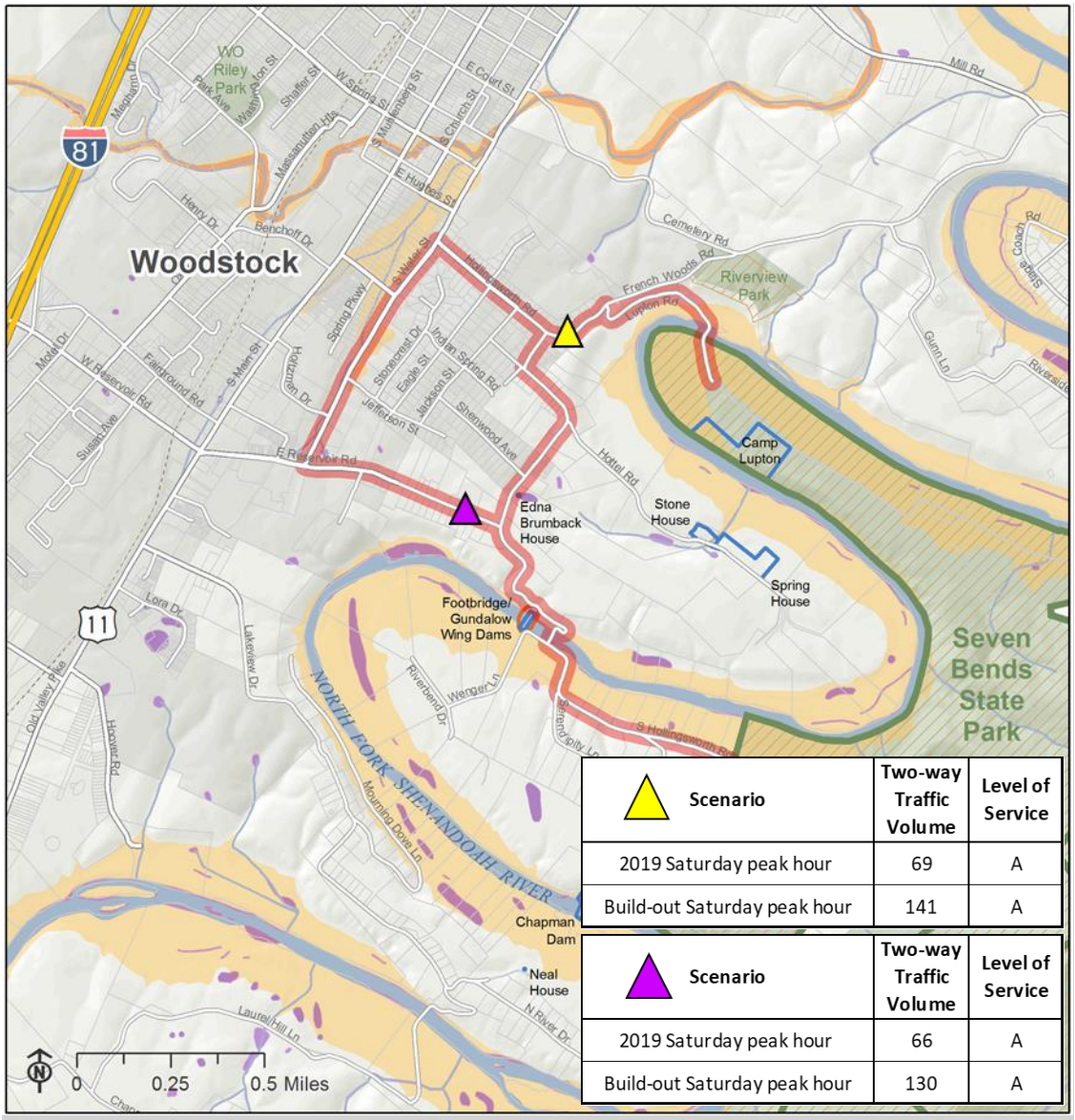
Table 4: Existing and Forecasted Visitor Data

Seven Bends 2019 Visitor Data		
Day	**Daily Visitors**	**Peak Hour Visitors**
Average July Weekday	31	5
Average July Saturday	64	11
Average July Sunday	52	10

Forecasted Visitors for Seven Bends State Park Full Build Out		
Day	**Daily Visitors**	**Peak Hour Visitors**
Average July Weekday	101-200	16-30
Average July Saturday	210-410	35-68
Average July Sunday	170-330	33-64

The worst case of the forecasted volumes for the peak hour of an average Saturday in July were added to the 2019 traffic volumes along Reservoir Road and Lupton Road and capacity analyses were conducted using the Highway Capacity Software (HCS). The results are presented in Figure 14. As shown in the figure, the Level of Service (LOS) is LOS A in 2019 and is expected to remain at LOS A once the park is fully built out.

Figure 14: Future Traffic Conditions



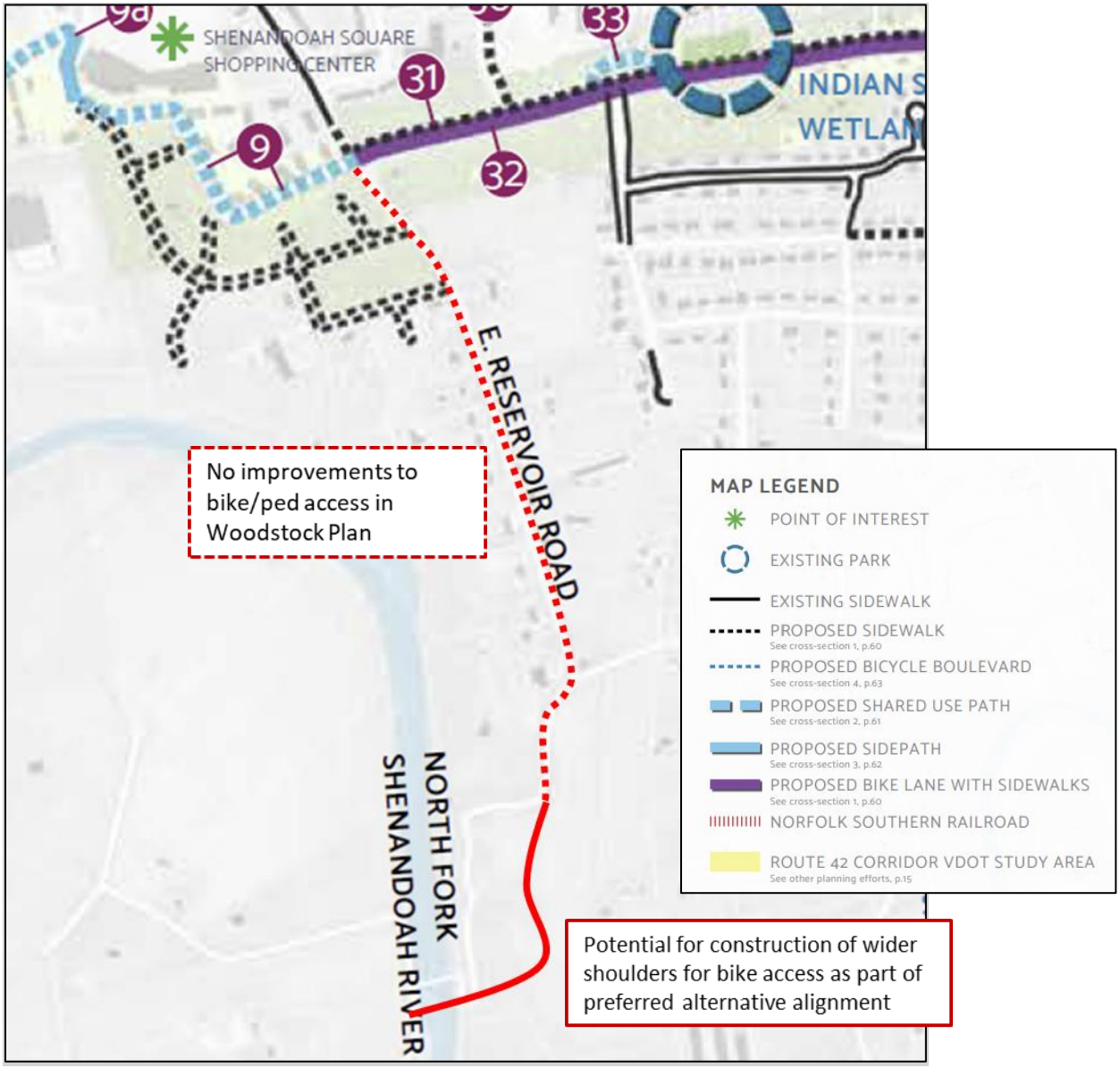
Scenario	Two-way Traffic Volume	Level of Service
2019 Saturday peak hour	69	A
Build-out Saturday peak hour	141	A

Scenario	Two-way Traffic Volume	Level of Service
2019 Saturday peak hour	66	A
Build-out Saturday peak hour	130	A

4.2 Potential Improvements to Bicycle Access

There is a potential to improve bicycle access to the park through the S. Hollingsworth Road entrance by constructing paved shoulders along the preferred alternative alignment as discussed in Section 3.2, but also by connecting to proposed bike lanes in the Town of Woodstock Bicycle and Pedestrian Plan (adopted 2019). Figure 15 shows a portion of that plan in the vicinity of the S. Hollingsworth Road entrance. As shown in the figure, bike lanes and shoulders are proposed along S. Water Street, however there are no improvements planned for the segment of Reservoir Road between S. Water Street and the preferred alternative alignment for improved access on S. Hollingsworth Road.

Figure 15: Inset from Woodstock Bike & Ped Plan

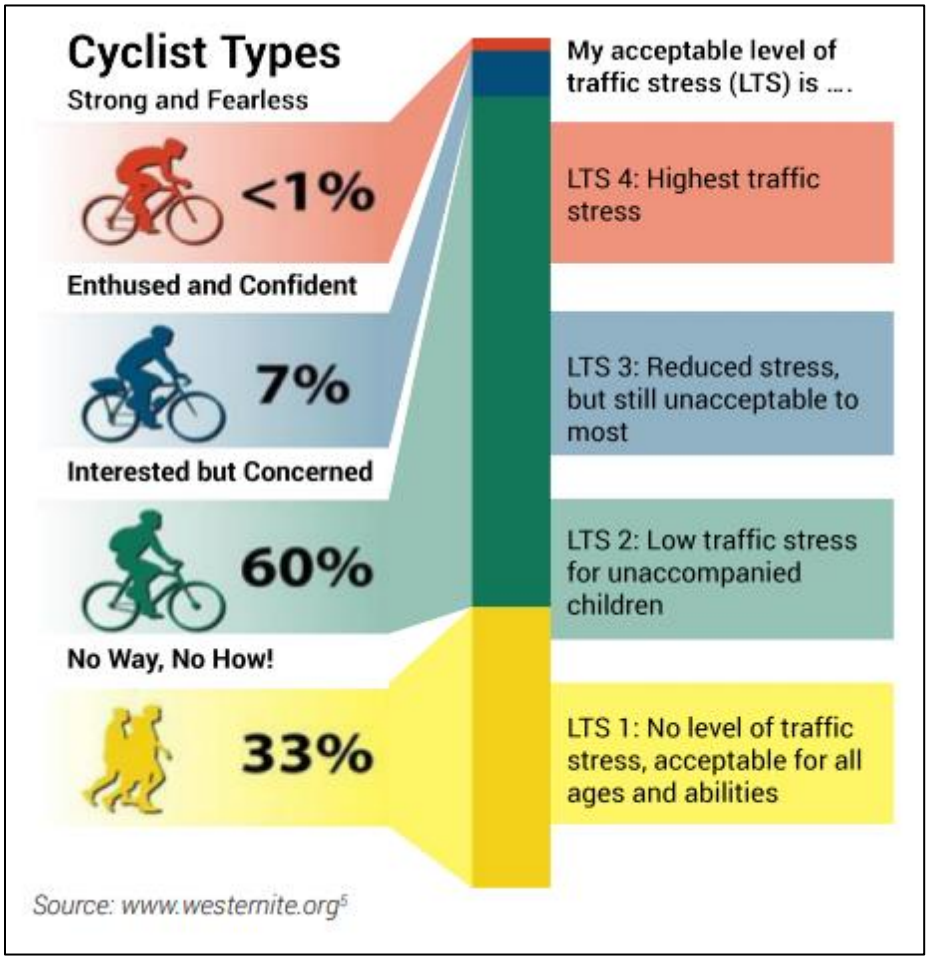


A bicycle Level of Traffic Stress (LTS) evaluation was conducted for the portion of Reservoir Road shown in Figure 15 where no improvements to bicycle and pedestrian access are planned. The LTS evaluates cyclist's level of comfort along a roadway based on vehicle speeds, number of lanes, buffers from the travel lanes, and bicycle access treatments. Pictures from the field visit showing the existing conditions along this segment of Reservoir Road are presented in Figure 16.

Figure 16: Field Visit Pictures of Existing Conditions on Reservoir Road

As shown in the pictures, the posted speed limit along Reservoir Road is 35 mph and there are very narrow lanes. Any cyclists must travel on the roadway in mixed traffic, meaning there is no buffer from the travel lanes. Figure 17 shows the four levels of traffic stress with LTS 1 being the most comfortable for all ages and abilities. The existing conditions along Reservoir Road indicate the least comfortable LTS 4.

Figure 17: Bicycle Level of Traffic Stress



Options for bicycle access that improve the LTS were investigated and are presented in Table 5 along with the range of cost and potential LTS if the posted speed limit on Reservoir Road was reduced from 35 mph to 25 mph. As shown in the table, assuming a goal of LTS 2 which accounts for 60 percent of cyclists, four-foot bicycle lanes would need to be constructed along Reservoir Road. Due to the existing constraints and utilities along Reservoir Road, the construction would need to include curb and gutter, as relocating the existing ditch would present right-of-way and construction challenges.

Table 5: Bicycle Level of Traffic Stress Evaluation Results

Option	Estimated Construction Cost Range		Bike Level of Traffic Stress (35 MPH)	Bike Level of Traffic Stress (25 MPH)	Ped Level of Traffic Stress (25 MPH)
	Low	High			
Existing	-	-	4	3	3
Shared Roadway Signage Only	-	<$10K	4	3	3
2' Wide Shoulder (Curb and Gutter)	$0.9M	$1.1M	3/4	2/3	3
4' Bike Lane (Curb and Gutter) VDOT St'd	$2.0M	$2.4M	2/3	2	3
6' Bike Lane (Curb and Gutter)	$3.2M	$3.5M	1	1	3

-Shared Roadway signage is assumed to be included in all options but existing and bike lanes
-Existing cross-section is ditch, any pavement widening will require reconfiguring ditch to curb and gutter
-Construction Estimates are presented (no preliminary engineering) and are based on the Statewide Planning
--Estimate Tool and are not to be used for application funding/construction
-Right-of-way (R/W) assumes any additional pavement plus minimum 10' easement from back of curb
-Level of stress is based on qualitative assessment using NATCO, ODOT, and Mineta Transportation Institute methodologies

5. Next Steps

This study, resulting in the selection of a preferred alternative for access to the park and a potential long term connector roadway, is the first step in the overall project development process. The next step is for DCR to incorporate the alternatives into the upcoming Seven Bends State Park Master Plan. Following this, the next step will be to secure funding to complete a detailed location study which includes the development of a NEPA document and a robust public involvement process. The overall project process also involves preliminary engineering, design and right-of-way acquisition, and construction; a typical project of this scale has an overall project timeline of six to ten years.