

5

Environmental Consequences

This chapter discusses the potential impacts of the improvement concepts on the natural and human environment. Within each section of this chapter, potential quantitative impacts and, where appropriate, potential qualitative impacts are described. Because the number of improvement concepts for I-81 is so large, two footprints with a variable number of lanes were created for the purpose of illustrating potential impacts along I-81: 1) a narrow-sized highway footprint (Minimum Width), and 2) a wide-sized highway footprint (Maximum Width). During Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced, the impacts along I-81 that occur as a result of specific alternatives should be equal to, or somewhere in between, the potential impacts calculated for the Minimum Width and Maximum Width footprints. In addition, a footprint was developed to assess potential impacts associated with Rail Concept 3. The potential impacts associated with Rail Concept 3 can be added to the potential impacts associated with the I-81 “Build” concepts. A discussion of the footprints used for the Tier 1 analysis is provided after the summary below.

For comparative purposes, potential impacts were also calculated for a consistent Add 2-Lane concept and a consistent Add 8-Lanes concept. The result of this analysis are provided in Section 5.19, *Potential Impacts for Consistent Corridor Length Concepts*.

It should be noted that the potential impacts in this Tier 1 study are preliminary since they are based largely on available Geographic Information Systems (GIS) resource data and concept-level analysis. The numbers would likely change, and may decrease, during Tier 2 as a result of more detailed field investigations and highway and/or rail design, if a “Build” concept (or portion of a “Build” concept) is advanced.

This chapter is organized similar to Chapter 4, *Affected Environment* in that the reader can either read the brief summary of environmental consequences below, or they may read individual sections that have more specific information for each resource. In addition, figures referenced in Chapter 5 can be found in a separate chapter near the end of the Tier 1 DEIS, Chapter 8, *Figures*.

Summary of Environmental Consequences

Consistent with a tiered approach, potential impacts in the I-81 corridor are presented in terms of potential impacts from the narrowest highway footprint and the widest highway footprint. Referred to as Minimum Width and the Maximum Width, these footprints represent concepts that were based on transportation needs identified in Chapter 2, *Purpose and Need*. The width of the variable Minimum Width footprint ranges from roughly 240 feet to 430 feet depending on the location. In comparison, the Maximum Width footprint ranges from 240 feet to 540 feet. For comparative purposes, potential impacts were also calculated for the Add 2-Lanes concept footprint and Add 8-Lanes concept footprint.

In addition, a footprint was developed to assess potential impacts associated with Rail Concept 3. The footprint, generally 100 feet wide, represents the limits of potential rail construction for the 13 rail improvement sections that comprise Rail Concept 3. The potential impacts associated with Rail Concept 3 can be added to the Minimum Width and Maximum Width footprints, or the Add 2-Lane and Add 8-Lanes footprints for I-81 to consider the total potential effects of highway plus rail improvements (see *Impact Footprint* section below).

Potential impacts were calculated by superimposing the footprints, over Geographical Information System (GIS) data available for each resource. Each footprint represents the potential limits of construction. Where the footprint and GIS data overlapped, an impact was assumed. Appropriate for Tier 1, the analysis of impacts for this study used readily available information supplemented with some preliminary field surveys.

Figures 5-6 through 5-9 (see Chapter 8, *Figures*) show the location of potential impacts to land uses, the man-made environment, and natural resources as a result of highway and rail improvements. The direct impacts, as presented in Table 5-1, may decrease because of design refinements that would occur in Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced.

No-Build

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements. Because most of these improvements are relatively minor safety improvements, the No-Build Concept would have minimal potential impacts on social, economic, natural resources and cultural resources within the I-81 corridor. Furthermore, since the improvements are federally funded, potential impacts have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*.

“Build” Concepts

Overall, potential impacts for the “Build” concepts on I-81 are similar, and in many cases do not vary substantially. The primary reason for this is that a large percent of impacts occur within the 91 interchange areas, and the footprints at interchanges do not vary substantially

between “Build” concepts. The Minimum Width footprint generally has less potential impacts than the Maximum Width because the Minimum Width template is slightly narrower in those areas where more than two additional lanes are needed. Some potential effects, however, such as air quality, noise, energy, and economics, may be influenced by other considerations than just the physical footprint of the “Build” concepts. As a result, the Minimum Width footprint has slightly higher potential negative impacts to air quality, energy consumption, and economics because there are fewer travel lanes, resulting in more congestion and less efficient travel.

The potential impacts associated with Rail Concept 3 are substantially less than either the Minimum Width or Maximum Width footprints on I-81.

Land Uses and Man-Made Environment

The Minimum Width and Maximum Width footprints are generally consistent with most local comprehensive plans. Implementation of the “Build” concepts would potentially affect existing development, primarily around interchanges. Overall, improvements would benefit planned development around existing interchanges, since traffic operations on and access to I-81 would be improved. The type of land use most impacted by the Minimum Width and Maximum Width footprints is developed land. As shown in Table S-1, the acreage of impacts to developed land is considerably higher than either forest cover or agricultural land.

Approximately 25 percent of the agricultural lands that would be potentially affected by both footprints are prime farmland. If Rail Concept 3 were implemented along with highway improvements, an additional 140 acres of forest land cover and 140 acres of agricultural land (including 51 acres of prime farmland) would potentially be affected.

The Minimum Width and Maximum Width footprints would also affect over 20 publicly-owned parks and recreation areas, with the Maximum Width footprint impacting approximately 20 more acres than the Minimum Width footprint (see Table 5-1). In addition to being Section 4(f) properties, at least four of these parks and recreation areas are also Section 6(f) properties. Based on the Tier 1 estimate of impacts, the difference in Section 4(f) impacts between the Minimum Width footprint and Maximum Width footprint is relatively minor. Since I-81 carries relatively large volumes of traffic, including heavy truck traffic, parks along I-81 already experience noise levels commonly associated with an interstate facility. While noise levels would increase with any “Build” concept, this increase is not expected to substantially impair the features that qualify the parks for consideration under Section 4(f).

The Minimum Width footprint would potentially displace approximately 1,600 homes and businesses, while the Maximum Width footprint would potentially displace approximately 2,400. Displacements of community facilities, homes, and business would occur in large part at interchanges where development is concentrated, or along the mainline where development is close to the I-81 right-of-way. Impacts to low-income or minority populations are not expected to be disproportionate relative to the impacts to other households.

The Minimum Width and Maximum Width footprints would potentially have negative and positive impacts on the local economy. Negative effects would occur as a result of business displacements and/or encroachment onto sparse undeveloped land at interchanges that would otherwise be developed. Positive effects would occur as a result of improved access to and from I-81 and improved transportation conditions enhancing the movement of goods and services. In general, the “Build” condition would have positive effects on economic indicators (*e.g.*, increase in employment growth, gross regional product, etc.) when compared to the No-Build condition (see Table 5-1). This holds true even under the various toll scenarios. The amount of incremental economic growth is largely determined by the improved efficiency of the interstate. As roadway efficiency increases, the greater the potential for positive impacts over the baseline projections. The traffic analysis indicates that roadway efficiency gains are similar among “Build” concepts. As such, potential economic benefits are very similar.

Visual Resources

The Minimum Width and Maximum Width footprints would potentially affect a minimum of 28 visual resources that have views of I-81. The addition of highway lanes or improvements to the interchanges on I-81 would not appreciably change the visual character of I-81. Since I-81 and the rail line already exist, the degree to which the landscape would change for viewers of the road or rail would be minimal, irrespective of the concept. Since Tier 1 is evaluating conceptual-level improvements, the effect of specific structures (*e.g.*, noise walls) on views from the road would be considered during Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced.

Historic Properties

The Minimum Width and Maximum Width footprint would potentially affect 35 or 36 historic properties either listed or eligible for listing on the National Register of Historic Places, respectively. The majority of impacts are to battlefields (see Table 5-1). If Rail Concept 3 were implemented along with highway improvements, approximately 26 additional acres of NHRP listed or eligible historic properties would potentially be affected.

Air and Noise Environment

When compared to the No-Build condition, potential air quality emissions for VOCs, NO_x, and particulates increase slightly for the Minimum Width footprint. In contrast, potential emissions decrease for the Maximum Width footprint because the higher number of lanes in the eight-lane cross section (four additional lanes in each direction with barrier separation) provides more travel efficiencies (*i.e.*, reduced congestion). If Rail Concept 3 were combined with the Minimum Width footprint highway improvements, potential emissions would increase slightly. For the Maximum Width footprint combined with Rail Concept 3, potential emissions would decrease for VOCs, and increase for NO_x and particulates.

Both the Minimum Width and Maximum Width footprints would potentially impact a large number of noise sensitive receptors (see Table 5-1). If added to highway improvements, Rail Concept 3 would potentially result in impacts to approximately 120 additional noise sensitive receptors.

Natural Environment

The greatest potential for impacts to the natural environment (*e.g.*, wetlands, streams, endangered species' habitat) exists at the many streams along I-81. Streams may be directly affected by stream channel modifications, the placement of fill in the stream, or bridging. Over 20 miles of stream would potentially be impacted by the footprints (see Table 5-1).

Erosion, sedimentation, and highway run-off would potentially affect the water quality of streams. Since the Maximum Width footprint would have the largest amount of additional pavement and, therefore, the largest increase in runoff, it would have the greatest potential for impacting water quality in streams and lakes.

Many of the 13 previously recorded threatened and endangered species potentially affected by the "Build" concepts are aquatic species, such as fish and mussels, many of which are found in the Middle Fork of the Holston River and the North Fork of the Roanoke River. Generally, the Minimum Width and Maximum Width footprint would result in similar potential impacts to threatened and endangered species areas. However, the Maximum Width footprint would potentially affect almost four times as much linear footage of the Middle Fork of the Holston River and the North Fork of the Roanoke River as the Minimum Width footprint.

Overall, potential impacts to emergent, forested and scrub-shrub wetland systems are relatively minor along I-81 (see Table 5-1). Not only are impacts at individual wetlands relatively small (the average impact size per wetland is between 0.1 and 0.2 acres), but most of the wetland systems along the I-81 corridor do not appear to provide high functional values. In contrast, the wetlands in the rail corridor generally do provide higher functional values. If combined with highway options, Rail Concept 3 would potentially impact approximately 8 additional acres of wetlands.



Table 5-1 Summary of Potential Environmental Consequences¹

Resource / Issue	No-Build	Minimum Width	Maximum Width	Add 2-Lanes	Add 8-Lanes	Rail Concept 3
Consistency with Local Plans	Varies	Varies	Varies	Varies	Varies	Varies
Developed Land Use (acres)	N/E ²	7,409	7,556	7,247	8,105	45
Prime Farmland Impacts (acres)	N/E ²	1,062	1,420	1,022	1,580	51
Agricultural/Forestral District Impacts (acres)	N/E ²	31	141	31	176	21
Residential Displacements (#)	N/E ²	926	1,595	944	2,068	0
Business Displacements (#)	N/E ²	662	763	684	897	1
Community Facilities Impacted (#)	N/E ²	5	5	5	5	0
Minority Population Impacts (# of block groups affected)	N/E ²	20	20	20	20	0
Low-Income Population Impacts (# of block groups affected)	N/E ²	27	27	27	27	0
2035 Employment Growth (increase from 2005)	0%	4.7% ³	---	---	---	---
2035 Gross Regional Product Growth (increase from 2005)	0%	4.2% ³	---	---	---	---
Parks and Recreation Area Impacts (acres)	N/E ²	51	69	51	84	2
Open Space Easement Impacts (acres)	0	12	29	12	34	0
Visual Impacts (# of visual resources with view of the road/rail)	N/E ²	28	28	28	28	5
Potential Contamination Sites (#)	N/E ²	9	9	9	9	0
Battlefield Impacts (acres)	N/E ²	1,238	1,481	1,213	1,622	13
Impacts to NHRP Listed/Eligible Historic Districts (acres)	N/E ²	51	58	52	60	1
Impacts to NHRP Listed/Eligible Historic Structures (#)	N/E ²	19	20	19	20	2
NHRP Listed Archaeological Sites Impacted (#)	N/E ²	1	1	1	1	0
Wetland Impacts (acres)	N/E ²	33	51	33	62	8
Stream Impacts (miles)	N/E ²	23.1	29.1	23	35	1.4
100-Year Floodplains Impacted (acres)	N/E ²	361	458	354	530	50
Threatened and Endangered Species Impacted (# of species)	N/E ²	12	12	12	12	0
Volatile Organic Compounds (VOCs) (tons/day)	7.43	+ 0.36 ⁴	- 1.24 ⁴	+0.36 ⁴	-1.24 ⁴	+ 0.28 ⁵
Nitrogen Oxides (NO _x) (tons/day)	8.78	+ 0.81 ⁴	- 1.15 ⁴	+0.81 ⁴	-1.15 ⁴	+ 5.13 ⁵
Particulate Matter (PM2.5) (tons/day)	0.33	+ 0.02 ⁴	- 0.05 ⁴	+0.02 ⁴	-0.05 ⁴	+ 0.17 ⁴
Noise Sensitive Receptors Impacted (# increase over No-Build)	-----	+ 4,015	+ 5,090	+3,034	+5,538	+ 137

1 The potential effects in this Tier 1 study are preliminary since they are based largely on available GIS resource data and concept-level analyses. The actual numbers may decrease during Tier 2 as a result of more detailed investigations and highway and/or rail design, if a "Build" concept is advanced.

2 NE = Not Evaluated for Tier 1. Each roadway improvement project included in the No-Build has either completed or is currently undertaking the NEPA process independent of the I-81 Corridor Improvement Study. All impacts to resources either have been or will be addressed through those separate documents.

3 While economic effects from the range of "Build" concepts differ, the range of economic effects is extremely small. Therefore, potential economic effects are only reported for the No-Build and the Minimum Width template (with an No Toll scenario and with Rail Concept 3) because it can be considered to be representative of the economic effects from the "Build" concepts in general.

4 Change in emissions from 2035 No-Build highway condition.

5 Change in emissions from 2035 No-Build rail condition. These emissions are based on rail improvements only.

Impact Footprints

I-81 Minimum Width and Maximum Width

Consistent with a tiered approach, potential impacts in the I-81 corridor are presented for the narrowest highway footprint and the widest highway footprint. Referred to as Minimum Width and the Maximum Width, these footprints represent concepts that were based on transportation needs identified in Chapter 2, *Purpose and Need*. Both impact footprints have a variable number of additional lanes for the length of I-81 (ranging from two additional lanes to eight additional lanes) depending on the transportation needs along the corridor.

On sections of I-81 that need one additional lane in each direction, both footprints add a total of two lanes (one lane in each direction). On sections of I-81 that need two lanes in each direction, the need can be met by different means: 1) a total of four additional lanes can be added, or 2) various operational scenarios can be implemented (*e.g.* separation of general purpose lanes and truck lanes) that would meet the needs but would require the construction of up to eight additional lanes in order to operate efficiently. Where at least four lanes are needed, the Minimum Width footprint provides a total of four additional lanes (two lanes in each direction), and the Maximum Width footprint provides a total of eight additional lanes (four in each direction).

When evaluating the number of lanes needed to address the needs along I-81, a “no toll” and “no rail” base condition was assumed for the purpose of developing the footprints. This base condition represents the highest traffic volumes and therefore the greatest number of lanes that may be needed on I-81. Tolling and rail improvements could decrease the number of lanes needed on I-81. If a “Build” concept (or portion of a “Build” concept) is advanced, the footprint of any of the improvements is anticipated to fall between the limits of the Minimum Width and Maximum Width footprints. The width of the variable Minimum Width footprint ranges from roughly 240 feet (where a total of two lanes are added) to 430 feet (where a total of four lanes are added) depending on the location. In comparison, the variable Maximum Width footprint ranges from 240 feet (where a total of two lanes are added) to 540 feet (where a total of eight lanes are added). These widths include existing pavement and new pavement. For the Minimum Width footprint, widening occurs in the median of I-81 to the extent possible. Conversely, the Maximum Width footprint widens to the outside right edge of I-81.

Approximately 37 percent of the total lane miles along I-81 need only two additional lanes (one in each direction) as discussed in the *I-81 Corridor Improvement Study Transportation Technical Report*. Both the Minimum Width and Maximum Width footprint have a total of two additional lanes (one lane in each direction) in those locations where two additional lanes are needed. As shown in Figure 5-1, the typical 2-lane widening cross section used for impact analysis adds two new lanes in the median of I-81 to the extent possible.

Approximately 61 percent of the total lane miles along I-81 need at least four additional lanes (two in each direction) as discussed in the *I-81 Corridor Improvement Study Transportation Technical Report*.¹ In these sections, two different cross sections were developed for the impact analysis to reflect various types of highway improvement concepts under consideration with different operating conditions (e.g., separation of cars from commercial vehicles, non-separated lanes, etc.): 1) four additional lanes (4-lane widening cross section), and 2) eight additional lanes (8-lane widening cross section).

The 4-lane cross section, shown in Figure 5-1, adds two additional lanes in each direction, widening in the median of I-81 as much as possible. This cross section, which does not provide a physical separation between vehicle types, is used for the Minimum Width footprint in those locations where more than two lanes are needed (one lane in each direction). It reflects the smallest potential construction footprint. The 8-lane cross section adds four additional lanes in each direction as shown in Figure 5-1. It is used for the Maximum Width footprint in those locations where more than two lanes are needed. It provides barrier separated lanes, with all of the widening occurring to the outside of the I-81 travel lane to reflect the largest potential construction footprint.

The impacts represented by 4-lane and 8-lane cross section templates approximate the narrowest highway concept and the widest concept under consideration for areas that need two lanes in each direction. When coupled with the 2-lane section (adding one additional lane in each direction where needed), the Minimum Width and the Maximum Width footprint are derived for the mainline of I-81. The width of the variable Minimum Width footprint ranges from roughly 240 feet (where a total of two lanes are added) to 430 feet (where a total of four lanes are added). In comparison, the Maximum Width footprint ranges from 240 feet (where a total of two lanes are added) to 540 feet (where a total of eight lanes are added).

Finally, based on future travel patterns and traffic volumes at each interchange, either a diamond or full cloverleaf interchange was considered in the analysis of potential impacts. Depending on the number of lanes on the mainline of I-81, different footprints were developed for each interchange design. Figures 5-2 through 5-5 show two footprints (a minimum and a maximum) for a typical diamond and cloverleaf interchange design.

Table 5-2 below summarizes the elements that comprise the Minimum Width and Maximum Width impact footprints.

¹ The remaining two percent of total lane miles (37 percent + 61 percent = 98 percent) does not need any additional lanes. This occurs between Milepost 0 and 7.



Table 5-2 Elements of Impact Footprints

Footprint	Areas Where 2 New Lanes Needed	Areas Where 4 New Lanes Needed	Interchanges
Minimum Width	2-lane Cross Section	4-lane Cross Section	Minimum Cloverleaf / Minimum Diamond
Maximum Width	2-lane Cross Section	8-lane Cross Section	Maximum Cloverleaf / Maximum Diamond

I-81 Consistent “Add 2-Lane” and “Add 8-Lane”

Potential impacts were also calculated for concepts that add a consistent number of lanes the entire length of I-81 in Virginia. Unlike the Minimum Width and Maximum Width footprints that both add a total of two lanes where needed, and add a total of four or more lanes where needed, the Add 2-Lane concept consistently adds two lanes (one lane in each direction) the entire length of I-81. The Add 8-Lanes concept consistently adds eight additional lanes (four in each direction).

Rail Concept 3

Many of the improvement concepts included in this study involve rail improvements. Therefore, an impact footprint was developed for the 13 rail improvement sections that comprise Rail Concept 3. Rail Concept 3 was chosen as the most appropriate rail concept to combine with roadway concepts because it provides the most diversion of freight from truck to rail per dollar of investment (see Chapter 3, *Improvement Concepts*). The rail footprint, generally 100 feet wide, represents the limits of potential rail construction.



5.1 Land Use

This section describes the extent to which the improvement concepts are consistent with local comprehensive plans, and the specific transportation objectives within those plans. This section also addresses the potential direct impacts to the predominant land uses, and potential impacts on planned growth. Potential indirect land use impacts are discussed in Section 5.14, *Indirect Impacts*. Figures 5-6 and 5-7 (see Chapter 8, *Figures*) illustrate impacts to land uses and the man-made environment for the I-81 corridor and rail corridor, respectively.

5.1.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. Since they involve federal funding, potential impacts to land use associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*.

In general, however, the No-Build Concept would have minimal potential impacts on predominant land uses in the I-81 study area. While the No-Build Concept is consistent with Roanoke County's goal to limit widening of I-81, it would not be consistent with the transportation objectives of Pulaski, Botetourt, and Shenandoah Counties, all of which support increasing capacity on I-81 and/or improving exits along I-81. Even with the No-Build Concept, planned development would continue to occur along I-81 in accordance with local plans.

5.1.2 "Build" Concepts

Both the Minimum Width and Maximum Width footprints would have effects on land use in the I-81 corridor that is both positive and negative. Loss of additional forested land and agricultural land could have negative economic effects to agriculture- and forest-related industries. However, improved access to business along I-81 and potential induced growth could benefit the overall economy. Since the majority of the localities in the I-81 corridor encourage growth and development along I-81, the Minimum Width and Maximum Width footprints would be consistent with this approach.

Rail would have minimal effects on existing or planned land uses in the rail corridor. This is in large part due to the fact that the rail improvements are relatively minor when compared to highway improvements, and therefore little land is directly impacted. In addition, based on coordination with planning officials in the counties that comprise the rail corridor, there are no planned developments within the rail improvement sections associated with Rail Concept 3.



Consistency with Comprehensive Plans

As presented in Section 4.1.1, the localities’ comprehensive plans largely seek to preserve rural character and focus commercial and industrial development along I-81. Based on communication with planning officials in each county and city in the I-81 study area, the “Build” concepts are generally consistent with most comprehensive plans. Each “Build” concept increases capacity and improves interchanges on I-81, resulting in benefits to businesses and residents through improved access to and from the interstate.

Table 5.1-1 summarizes the consistency of the Minimum Width and Maximum Width footprints with specific transportation objectives (included within the Comprehensive Plans) adopted by some of the localities. For localities with plans for new interchanges, modifications to the mainline of I-81 for the Minimum Width and Maximum Width footprints would potentially require modifications to any planned interchange designs. The planned interchanges would need to take into account the cross section on the I-81 mainline.

Table 5.1-1 Potential Consistency With Local Transportation Goals

Locality	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3
Wythe County	Yes - Support widening I-81 and improving interchanges	Yes - Support widening I-81 and improving interchanges	
Washington County	No - New interchanges planned on I-81	No - new interchanges planned on I-81	
Pulaski County	Yes - Support widening I-81 and improving interchanges	Yes - Support widening I-81 and improving interchanges	
Botetourt County	Yes - Support widening I-81 and improving interchanges	Yes - Support widening I-81 and improving interchanges	
Shenandoah County	Yes - Support widening I-81 and improving interchanges No - New interchanges planned on I-81	Yes - Support widening I-81 and improving interchanges No - New interchanges planned on I-81	
Roanoke County	Limit widening of I-81	Limit widening of I-81	Support freight/passenger rail service parallel to I-81
City of Winchester	No - Support CD roads	No - Support CD roads	Support rail service
Frederick County	No- New interchanges planned on I-81	No - New interchanges planned on I-81	

CD – collector distributor roads

Land Use Impacts

Potential impacts to land use were calculated by overlaying the impact footprints for I-81 and Rail Concept 3 over the land use GIS data. The Minimum Width footprint would minimize impacts to predominant land uses along I-81 when compared to the Maximum Width footprint. Table 5.1-2 summarizes the potential impacts to the three predominant land uses in the I-81 and rail corridors.

Developed land is the most potentially impacted land use as a result of highway widening. In large part this is due to the fact that development tends to occur in the vicinity of interchanges and a large portion of potential impacts are associated with interchange improvements. It is also due to the fact that numerous towns and cities are close to the interstate, with development in these towns occurring near I-81. Conversely, rail improvements would result in more impacts to forest cover and agricultural lands within the rail corridor since the rail improvement sections tend to be in more undeveloped areas.

Table 5.1-2 Potential Impacts to Land Use

Land Use Category	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3
Forest Cover	1,501	2,505	136
Agricultural/Pasture	3,714	5,095	139
Developed Land	7,409	7,556	45
Total	12,624	15,156	320

Developed Land

At the county level, Shenandoah and Rockingham Counties would experience the most potential impacts to developed land. In Shenandoah County, there would be over 750 acres potentially impacted by each footprint, with most potential impacts occurring between Exit 283 near the Town of Front Royal and Exit 291 near the Town of Tom’s Brook. In Rockingham County, which includes the heavily developed area around the City of Harrisonburg, over 900 acres would potentially be impacted. Some of these impacts (246 acres for the Minimum Width footprint and 252 acres for the Maximum Width footprint) would occur at Exit 245 near James Madison University.

Agricultural/Pasture

The majority of the total agricultural/pasture land acreage potentially impacted in the I-81 corridor would occur in the Shenandoah Valley, north of Rockbridge County. From Rockbridge County to the West Virginia state line, the Minimum Width footprint would potentially impact 1,412 acres of agricultural/pasture land, while the Maximum Width footprint would potentially impact 1,878 acres. At the county level, Shenandoah and Frederick Counties would experience the most potential impacts to agricultural/pasture land.



Forest Cover

Forest cover is the least potentially impacted land use category within the I-81 corridor, with the majority of impacts occurring south of Rockbridge County. From Botetourt County to the Tennessee state line, the Minimum Width footprint would potentially impact 766 acres and the Maximum Width footprint would potentially impact 1,126 acres. At the county level, Frederick County would experience the most impacts to forest cover.

Planned Development

Coordination with local planning officials along I-81 identified specific planned development activities that may be impacted by improvements to I-81. In accordance with local land use plans, planned commercial, industrial, and residential growth is principally targeted along I-81, including near Exits 73, 80, 118, 150, 243; 245 in Harrisonburg; 313 in Winchester; and 317. In many cases there is limited available land for expansion at these interchanges.

Each I-81 impact footprint would potentially impact planned development by encroaching on currently undeveloped land that is slated for development, or by potentially impacting existing access roads. Similar to potential impacts to existing development, the Maximum Width footprint is likely to have greater impacts to planned development than the Minimum Width footprint. Overall, interchange improvements associated with each I-81 footprint would also potentially benefit planned development in and around existing interchanges since operations and access to I-81 would likely be improved. If a "Build" concept (or portion of a "Build" concept) is advanced, specific design measures to avoid or reduce potential impacts to planned development would occur in Tier 2.

5.2 Human Environment

There are a number of cities and towns along I-81 that have concentrations of development within several hundred feet of the roadway. Improvements to I-81 would potentially have an impact on these towns, cities, and communities. Displacements of community facilities, homes, and businesses would potentially occur, particularly in interchange areas where development is concentrated or along the mainline where development is close to the I-81 right-of-way.

5.2.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 except for the addition of the 16 fully-funded roadway improvements described in Chapter 3, *Improvement Concepts*. Since they are federally funded, potential impacts to communities (including displacements) associated with these improvements, have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. Since limited right-of-way would be required for these improvements, it is assumed that the No-Build Concept would not displace homes or businesses and would not otherwise affect communities in the I-81 corridor.

5.2.2 "Build" Concepts

Residential and Business Displacements

Residential and business displacements were estimated by overlaying the impact footprints on top of GIS data for individual buildings within the study areas that were digitized by the study team from 2000 aerial photography. The estimated number of potential displacements associated with the Minimum Width and Maximum Width footprints are summarized in Table 5.2-1 below. Only one potential displacement was identified for Rail Concept 3, a commercial facility near the Town of Marion in Smyth County. If a "Build" concept (or portion of a "Build" concept) is advanced, additional right-of-way investigations would occur in Tier 2 in accordance with federal and state guidelines¹.

¹ The VDOT Manual of Instructions, Right of Way Division, Volume 1, Section 404 and the Federal Uniform Relocation Assistance and Property Acquisition Policies Act of 1970 and Title IV of the Civil Rights Act of 1964, as amended in 1968.

Table 5.2-1 Potential Displacements

"Build" Concepts	Residential	Business	Total
Minimum Width	926	662	1,588
Maximum Width	1,595	763	2,358
Rail Concept 3	0	1	0

Although potential impacts would occur along most of the I-81 corridor, the areas with the highest residential impacts are in the City of Salem and Roanoke where over 200 residences would potentially be displaced by both of the impact footprints. For the Maximum Width footprint, other areas with a relatively high number of potential residential displacements occur near Harrisonburg (between Exits 245 and 251), and in the Stephens City and Winchester areas (between Exits 302 and 317). The Maximum Width footprint also has a particularly high number of potential residential displacements in the Christiansburg area between Exits 109 and 118. The greatest concentration of potential commercial displacements occurs in Frederick County between Exits 302 and 317 where approximately 150 to 160 businesses would potentially be displaced by the Minimum Width and Maximum Width footprints, respectively. Within this same area, between 160 and 270 residences would be potentially displaced. If a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2, further design refinements may reduce the number of displacements.

Relocation Assistance

If a "Build" concept (or portion of a "Build" concept) is advanced, following completion of the Tier 1 and Tier 2 NEPA processes, VDOT would assist displaced families, businesses, and non-profit facilities to relocate into replacement facilities with minimal disruption. VDOT assures that adequate, decent, safe, and sanitary housing would either be available or provided. Each person would have sufficient time to negotiate for and obtain replacement housing or business space. All housing would be fair housing and available to all persons, regardless of race, color, sex, religion, or national origin. The acquisition and relocation program would be conducted in accordance with the Uniform Relocation Assistance and Property Acquisition Policies Act of 1970, as amended.

Environmental Justice

Minority and low-income populations were identified at the census block group level as described in Section 4.2, *Social Environment*. This is the smallest geographic unit for which census data was readily available. For purposes of this analysis, it was assumed that all households within block groups identified as having a concentration of minorities or low-income households (greater than 15 percent), are either low-income or minority households. Fifteen percent was chosen because it is greater than the average for the region. Also for purposes of this study, only potential displacements were considered. If a block group with a concentration of environmental justice households was intercepted by the impact footprints, either in whole or in part, an impact was assumed.

If implemented with highway improvements, Rail Concept 3 would not displace any homes, including households within block groups identified as having a concentration of minorities or low-income households (greater than 15 percent). Therefore, the following sections focus on environmental justice issues within the I-81 corridor.

Low-Income Households

Households classified as living at or below the poverty level in 2000 (as defined by the U.S. Department of Health and Human Services) were considered low-income households for purposes of this study. If more than 15 percent of the households within a Census block group were low-income, that block group was considered to have a concentration of low-income households above the average for the region.

The Minimum Width and Maximum Width footprints would potentially affect 27 Census block groups with over 15 percent of the households below poverty, which for this study are assumed to be low-income households.

Low-income households within block groups at the following locations would potentially experience the highest number of displacements in the I-81 corridor:

1. Between Mileposts 138 and 141 in the Cities of Roanoke and Salem,
2. Between Mileposts 245 to 247 in Harrisonburg, and
3. Between Mileposts 312 and 318 in Frederick County around the City of Winchester.

These areas are also the most well-populated areas along I-81, and are subject to the greatest overall potential displacements. Compared to the Maximum Width footprint, the Minimum Width footprint would likely result in less displacements within these block groups since it has a smaller footprint. The number of individual low-income households potentially displaced was not determined at the Tier 1 level of analysis, but would be investigated in detail during Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced.

The number of displaced low-income households in the corridor is not expected to be disproportionate to the number of potentially displaced households in the corridor that are not below the poverty level. A more refined quantitative analysis would be performed if a “Build” concept (or portion of “Build” concept) is advanced into Tier 2, to verify whether the actual site specific impacts to low-income households are disproportionate. The Tier 2 analysis would, as appropriate, consider noise impacts and any disproportionate impacts to low-income populations as a result of tolling, as well as mitigation for those impacts.

Minority Population

Both the Minimum Width and Maximum Width footprints would potentially affect 20 Census block groups that have a concentration of minority households (over 15 percent) that is above the region’s average. Many of these are also low-income block groups. In fact, the



locations that would potentially experience the highest number of displacements are the same as described above for low-income households: the Roanoke/Salem area, the City of Harrisonburg, and the City of Winchester. In addition, the two minority block groups in Pulaski County (Mileposts 89 and 102) may also be potentially affected.

The number of potentially displaced minority homes is not expected to be disproportionate relative to the number of potentially displaced non-minority homes. A more refined quantitative analysis would be performed if a “Build” concept (or portion of “Build” concept) is advanced into Tier 2, to verify whether the site specific actual impacts to minority households are disproportionate. The Tier 2 analysis would, as appropriate, consider noise impacts and any disproportionate impacts to minority populations as a result of tolling, as well as mitigation for those impacts.

Community Facilities

Potential impacts to community facilities were estimated by overlaying the impact footprints over GIS data for community facilities. An impact was assumed in the two overlapped in whole or in part. Potential impacts to community facilities are summarized in Table 5.2-2. No libraries or airports would be potentially be impacted. In addition, none of the impact footprints would potentially change access between neighborhoods or cause a potential community cohesion impact to any individual neighborhoods along I-81 or rail corridors.

Table 5.2-2 Potential Impacts to Community Facilities

“Build” Concept	Schools	Universities	Fire and Rescue	Total
Minimum Width	1	2	2	5
Maximum Width	1	2	2	5
Rail Concept 3	0	0	0	0



Schools

Both I-81 impact footprints would potentially displace the Pleasant Valley Elementary School in Rockingham County east of I-81 on Pleasant Valley Road at Exit 243.

Colleges and Universities

The Minimum Width and the Maximum Width footprints would potentially impact James Madison University between Exit 245 and 247 in Harrisonburg and at Shenandoah University in Winchester off Exit 313. James Madison University has a number of athletic facilities, parking lots, and academic/administrative facilities along the interstate. Rockingham Hall is northeast of Exit 245, as is the University Recreation Center with its tennis courts. At Exit 313 in Winchester, Shenandoah University has several parking lots and buildings near the interstate including the Alison Smith, Jr. Library and parking lot. At both universities, impacts may occur from right-of-way acquisition and changes in access between school facilities and parking lots. It would be important to both universities to maintain access across I-81.

Fire and Rescue

Both the Woodstock Volunteer Rescue facility off Exit 283 and the Stephens City Fire Station in Frederick County near Exit 307 would potentially be displaced by the I-81 impact footprints.

5.3 Economic Effects

This section discusses two categories of potential economic effects: 1) the potential effects on local business and economic development plans as a result of the No-Build Concept, and the Minimum Width and Maximum Width footprints, and 2) the potential effects on the regional economy within the I-81 Corridor Economic Study Region as forecasted by the REMI economic models. The potential effects for the latter category are represented by effects on the following economic indicators: population and employment growth, gross regional product, real disposable income, and delivered price. More detailed information is also provided in the *I-81 Corridor Improvement Study Economics Technical Report*.

5.3.1 Effects on Local Businesses and Economic Development Plans

Potential negative economic effects on local businesses were assumed, for purposes of this Tier 1 study, to occur as a result of potential business displacements or partial right-of-way acquisition. Potential effects on local economic development plans were identified by local planners and officials in interviews conducted for this study (see Section 4.3, *Economic Conditions*).

No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. It was assumed that these projects would be constructed by 2035. Potential impacts to local businesses or development plans, including displacements, associated with these improvements, have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. For purposes of this Tier 1 Draft EIS, it is assumed that the No-Build Concept would not displace businesses and would not otherwise have an effect on businesses in the I-81 corridor.

"Build" Concepts

As described in Section 5.2, *Community Impacts*, approximately 662 to 763 businesses within the I-81 corridor would be potentially displaced by the Minimum Width footprint and Maximum Width footprint, respectively. These include potential displacements at several industrial parks and commercial centers in the I-81 corridor including the largest commercial center in the corridor, Apple Blossom Mall in Winchester. In comparison, Rail Concept 3 potentially impacts one commercial facility, near the Town of Marion in Smyth County. While many of the potentially displaced businesses are likely to continue operating in a new location, some businesses may permanently close, resulting in a loss of tax base and loss of jobs. If a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2, further



design refinements may reduce the number of potential displacements, especially in the I-81 corridor.

Economic Development Plans

Table 5.3-1 summarizes information from interviews with local officials. Based on these interviews, Rail Concept 3 would not potentially impact any proposed development in the rail corridor. Therefore, Table 5.3-1 focuses on the I-81 corridor.

Table 5.3-1 Potential Impacts on Economic Development Plans

County	Potential Impact on Proposed Development
Smyth	A major employment base exists between Exits 47 and 50. Expansion of the highway in this area could have impacts on existing and future industrial development.
Wythe	Widening of the interstate could affect service roads and some businesses along the overlap of Interstates 77 and 81. A relocation of I-81 to the north of the current overlap could provide direct access to the industrial park.
Pulaski	There are right-of-way issues at Exit 101 for commercial businesses and at Exit 98 for the Super 8 Hotel.
Montgomery	Falling Branch Industrial Park would expand around Exit 118 and could be affected.
Roanoke	Widening I-81 at Exit 132 could require relocating an access road that serves the 456-acre Center for Research and Technology. However, improving the level of service along I-81 in this location may attract additional Center tenants.
Botetourt	Exit 150 is an important part of the county's economy, and expansion or other improvements that could affect businesses would affect the tax base in this area.
Rockbridge	There is a narrow tract of 130 acres at Raphine that could be affected.
Augusta	Expanding I-81 may affect commercial districts in downtown Staunton and its two industrial parks.
Shenandoah	Expansion of I-81 could affect access to both of the County's industrial parks.
Warren	No major impacts are anticipated, but several employers (Family Dollar Store, Ferguson Enterprises, and Sysco Foods) could be affected.
Frederick	Impacts to Exit 313 would affect the city's economy as there is almost no land left for commercial expansion.

5.3.2 Regional Economic Effects

Three economic “study regions” were defined for economic analysis purposes: 1) the I-81 Corridor Economic Study Region, 2) the Commonwealth of Virginia, and 3) the I-81 Trade Area. The I-81 Corridor Economic Study Region is comprised of the counties and cities through which I-81 travels as well as 14 additional neighboring jurisdictions that play a major factor in car and truck trips along the interstate. For interstate travel, I-81 connects markets in Canada to the mid-southern states as well as to other routes that connect to the Mexican border. The I-81 Trade Area is comprised of 26 eastern states stretching from Texas to Maine.



Potential regional economic effects are reported in this Tier 1 DEIS only for the I-81 Corridor Economic Study Region because it is the only one of the three regions in which effects would be appreciable compared to the size of the economy. As an example, the Minimum Width and Maximum Width footprints would increase the gross regional product of Virginia in the I-81 Trade Area by only 0.7 percent and 0.03 percent, respectively. While the impact footprints would have effects on the other two regions, the effects would be negligible when compared to the much larger overall economies of Virginia and the I-81 Trade Area. Detailed information on the economic effects on the Commonwealth of Virginia and the I-81 Trade Area are provided in the *I-81 Corridor Improvement Study Economics Technical Report*.

For purposes of the economics impact analysis, it was assumed that the I-81 Corridor Economic Study Region reflects economic conditions within the counties and cities along I-81, as described in Section 4.3, *Economic Conditions*. In addition, since the population and employment data at the census block group level (for census blocks along I-81) are very similar to the data for the counties and cities as a whole, the potential effects to the I-81 Corridor Economic Study Region are comparable to the potential effects on more local economic conditions as well.

To evaluate the regional economic effects of the improvement concepts, two econometric models, developed by Regional Economic Models, Inc. (REMI), were used in combination. The first model (Policy Insight) accounts for the construction and operation spending effects, while the second model (Transight) provides the link between the potential transportation improvements along I-81 and the economic vitality of the region by converting change in travel efficiency into economic output. The *I-81 Corridor Improvement Study Economics Technical Report* provides a detailed description of the REMI models and how they were used to forecast the economic changes. Similar to the method used for the Consumer Price Index, the REMI models express monetary effects in 1996 dollars that are already adjusted for inflation.

No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3. It was assumed that these projects would be constructed by 2035. For purposes of this Tier 1 Draft EIS, the No-Build condition serves as the baseline for comparing potential impacts to the regional economy, as represented by effects on economic indicators previously mentioned.

“Build” Concepts

Initially, potential economic effects for were evaluated by the REMI models for various “Build” concepts under consideration (combinations of highway, rail, and tolling scenarios). While economic effects from these “Build” concepts differed, the range of economic effects was extremely small. This is primarily due to the economic effects being spread over a 30-year period. Over time, the differences in economic effects that result from differences among the “Build” concepts (primarily from tolls but also construction spending and transportation efficiency gains) become smaller and smaller when compared to the overall growth of the region’s economy.



As a result, potential regional economic effects are only reported for the No-Build condition and for the Minimum Width footprint, including no toll and with Rail Concept 3. Based on previous model runs, this was considered to be representative of the “Build” concepts in general, including the Maximum Width footprint. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, the economic effects from those “Build” concepts would be analyzed in more detail.

The data presented in this section compare the projected demographic and economic growth effects on the economy of the I-81 Corridor Economic Study Region from the Minimum Width footprint (no toll and with Rail Concept 3) compared to the No-Build condition.

Employment

As illustrated in Table 5.3-2, the Minimum Width footprint is projected to attract additional employment opportunities to the I-81 Corridor Economic Study Region by 2035. The incremental growth rate translates into a 4.7 percent increase along the I-81 corridor by the year 2035 compared to the No-Build condition.

Table 5.3-2 Projected Employment Growth (in Thousands)

Improvement Concept	Jobs			Difference			Percent Difference		
	2005	2020	2035	2005	2020	2035	2005	2020	2035
No-Build	540.8	561.0	577.3	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Width Including No Toll and Rail Concept 3	540.8	578.9	604.6	0.0	17.9	27.3	0.0%	3.2%	4.7%

Source: REMI and RKG Associates, 2005

In general, “Build” concepts with tolls could potentially limit potential employment growth compared to the “Build” concepts without tolls, however, employment growth would still be positive as compared to the No-Build condition. The “Build” concepts with tolls could potentially constrain employment growth because of the added cost that tolls would impose on businesses along the I-81 corridor.

Population

Because of the projected employment growth, the Minimum Width footprint, including no toll and with Rail Concept 3, would potentially result in additional population growth as compared to the No-Build condition (see Table 5.3-3). By 2035, the population within the I-81 Corridor Economic Study Region is expected to increase by approximately 1,289,000 people, which is over 38,000 people (or 3 percent) over the No-Build condition. Generally, tolls would constrain job creation and, since population changes are linked to employment growth, lower job creation results in less population gain. However, the variation between “Build” concepts with a high toll and “Build” concepts with no toll is very slight.

Table 5.3-3 Projected Population Growth (in Thousands)

Concept	Forecast (Persons)			Difference			Percent Difference		
	2005	2020	2035	2005	2020	2035	2005	2020	2035
No-Build	1,121	1,187	1,251	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Width Including No Toll and Rail Concept 3	1,121	1,203	1,289	0.0	16.4	38.3	0.0%	1.4%	3.1%

Source: REMI, RKG Associates, and Jack Faucett Associates, 2005

Gross Regional Product

Gross regional product (GRP) is a measure of total economic output, analogous to gross domestic product, which is used to describe regional economic activity. The REMI model forecasts GRP for each study region.

Table 5.3-4 compares the gross regional product of the I-81 Corridor Economic Study Region for the Minimum Width footprint, including no toll and with Rail Concept 3, and for the No-Build condition. The table shows that improving I-81 would contribute modestly to the region’s economic growth over the 30-year projection period. However, while not modeled, in practical terms, the decline in levels of service on I-81 with the No-Build condition could eventually create a disincentive for individuals and companies to locate in the corridor or cause others to relocate from the corridor. Under such a scenario, individuals and companies that are most dependent on the interstate could potentially be affected. These could include some of the region’s larger and old-line industries (e.g., furniture manufacturing and chemical production) who operate in very price competitive, global markets.

Table 5.3-4 Projected Growth in Gross Regional Product (in Fixed 1996 Billions)

Concept	Forecasts			Difference			Percent Difference		
	2005	2020	2035	2005	2020	2035	2005	2020	2035
No-Build	\$41.8	\$59.1	\$77.0	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Width, Including No Toll and Rail Concept 3	\$41.8	\$60.8	\$80.3	\$0.0	\$1.7	\$3.3	0.0%	2.9%	4.2%

Source: REMI and RKG Associates, 2005.

Real Disposable Personal Income

Real disposable personal income measures the amount of net income remaining for all employed persons who live within a particular region after adjusting for taxes and cost of living. Changes in real disposable personal income indicate whether the wages of residents are increasing faster, slower, or at the same rate as their basic expenses. Increases in average real



disposable personal income is generally an indicator of positive job growth and improved living conditions (increases in salaries and wages above basic expenses). Conversely, a decrease in real disposable personal income indicates that taxes and cost of living are increasing faster than salaries and wages.

Table 5.3-5 illustrates that, by 2035, as a result of the employment growth from the Minimum Width footprint including no toll and Rail Concept 3, real disposable personal income within the I-81 Corridor Economic Study Region is projected to increase 3 percent, as compared to the No-Build condition.

Table 5.3-5 Projected Growth in Real Disposable Personal Income (in Fixed \$1996 Billions)

Concept	Real Disposable Personal Income			Difference			Percent Difference		
	2005	2020	2035	2005	2020	2035	2005	2020	2035
No-Build	\$24.3	\$33.0	\$43.6	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Width Including No Toll and Rail Concept 3	\$24.3	\$33.6	\$44.9	\$0.0	\$0.6	\$1.3	0.0%	1.9%	3.0%

Source: REMI and RKG Associates, 2004

Delivered Price

The relative delivered price ratio measures what all producers within a particular region charge (including transportation costs) for their goods, as compared to the national average. A region with a relative delivered price of 1.00 indicates that the region is price competitive with the national average. In other words, the costs relating to labor, fuel, capital, and transportation are similar to the national average. A delivered price ratio below 1.00 indicates the region has a competitive cost advantage in delivering goods. The opposite is true for regions with ratios above 1.00. Analyzing the changes in delivered price for a region reveals how inputs, such as transportation costs, are affecting the local economy.

As seen in Table 5.3-6, companies within the I-81 Corridor Economic Study Region already benefit from being price competitive (having lower costs to get goods to market) with companies elsewhere in Virginia and the United States.

The data indicate that the Minimum Width footprint, including no toll and with Rail Concept 3, would not greatly affect the projected cost to deliver goods to the marketplace, only adding a 0.2 percent competitive advantage over the projected No-Build delivered price in 2035. The analysis found that the competitive delivered price was lowered uniformly for the I-81 Corridor Economic Study Region with or without tolls. Delivered price is more heavily affected by improvements in traffic flow along I-81 than it is by tolls.

These findings suggest that the cost of transporting goods along I-81, although an important consideration to many companies, is a fairly small portion of the overall cost of production for



local companies. As such, improving I-81 would provide a more competitive market, on average, for local businesses regardless of whether tolls are implemented. Therefore, the imposition of tolls should not create an unfavorable economy for the region’s businesses. Detailed information on the economic effects of the Minimum Width footprint including no toll and Rail Concept 3, on the I-81 Corridor Economic Study Region are provided in the *I-81 Corridor Improvement Study Economics Technical Report*.

Table 5.3-6 Delivered Price Ratio (Against National Average)

Concept	Delivered Price Ratio			Difference			Percent Difference		
	2005	2020	2035	2005	2020	2035	2005	2020	2035
No-Build	0.964	0.962	0.964	N/A	N/A	N/A	N/A	N/A	N/A
Minimum Width Including No Toll	0.964	0.961	0.962	0.000	-0.001	-0.002	0.0%	-0.1%	-0.2%

Source: Jack Faucett Associates, VHB, REMI and RKG Associates, 2004

Conclusions

Transportation efficiency gains are the greatest determinant of economic benefit. As roadway efficiency increases, the greater the positive economic effects over the baseline projections.

The traffic analysis indicates that roadway efficiency gains, compared to the No-Build condition, are similar among the “Build” concepts regardless of toll scenarios. As such, the economic benefits, regardless of the implementation of tolls, are very similar (typically within 5 percent). For example, the projected 2035 gross regional product for the I-81 Corridor Economic Study Region ranged from a low of \$80.2 billion (\$3.1 billion above the No-Build) to a high of \$80.3 billion (\$3.3 billion above the No-Build).

It is important to note that these projections do not include the potential impacts that may be generated by the need to pay for these improvements from other than traditional funding sources. As such, it is impossible to estimate the magnitude of impacts from having to repay bonds that may be needed to build the project. Rather, this analysis provides a comparative review to show relative effects from changes in highway efficiency and tolls.

The Effect of Tolls on Businesses

Companies within the I-81 Corridor are already price competitive with companies elsewhere in Virginia and the United States. The cost of transporting goods, although an important consideration to many companies, is a fairly small portion of the overall cost of production. As such, there is very little variation found between the No-Build condition and the “Build” concepts (including those with tolls) in the cost to deliver goods. For the most part, the “Build” concepts would not greatly affect the projected cost to deliver goods to the marketplace, regardless of the whether tolls are implemented or not. Therefore, the imposition



of tolls should not create an unfavorable economy for the region's businesses.

The Effect on of Tolls on Individuals

The data indicate that all the "Build" concepts would have a positive, but minor, effect on local residents. Real disposable personal income is projected to increase at a faster rate than if no improvements were made to I-81.

Individual impacts on local residents from tolling are relatively small. The percentage difference in real disposable personal income between the concept with the minimum economic benefit and the concept with the maximum economic benefit is in line with the percentage difference in total employment. This indicates that the difference in real disposable personal income is largely attributable to the effects of job creation rather than the loss of income to toll charges. Stated another way, tolling would have a negative influence on the overall potential economic benefits that can be derived from improvements to I-81, but would not necessarily have a substantial economic impact on local individuals who use I-81.

5.4 Agricultural Land

For this Tier 1 study, potential impacts to agricultural resources are defined as the acreage of a resource that may be converted from an agricultural land use to a non-agricultural use (*i.e.*, highway or rail use). This was determined by overlaying the Minimum Width and Maximum Width footprints over the available GIS data for farmland resources and calculating the area of overlap. The relative magnitude of the potential impacts, as determined through coordination with the Natural Resources Conservation Service through the farmland conversion impact process, would be assessed if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

5.4.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. Based on available GIS data, prime farmland and soils of statewide importance are in the vicinity of several of these projects: at Exit 142 in Roanoke County, at Milepost 162 in Botetourt County, and near Milepost 313 in Frederick County. The only agricultural/forestal district near any of the federally-funded highway improvements is the Fancy Hill District in Rockbridge County at Mileposts 183 and 184.

Since they involve federal funding, potential impacts to agricultural land associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. Since limited right-of-way would be required for these improvements, it is assumed for purposes of this Tier 1 study that the No-Build Concept would have minimal potential impacts to agricultural land.

5.4.2 “Build” Concepts

Potential impacts to prime farmland, soils of statewide importance, and agricultural/forestal districts are presented in Table 5.4-1. In addition, Figures 5-6 and 5-7 (see Chapter 8, *Figures*) show impacts to prime farmland, and agricultural and forestal districts within the I-81 corridor and rail corridor, respectively.

Table 5.4-1 Potential Impacts to Farmland Resources

Agricultural Land Resource	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3 (Acres)
Prime Farmland	1,062	1,420	51
Soils of Statewide Importance	9,218	10,814	109
Agricultural/Forestal Districts	31	141	21

Prime Farmland

Potential impacts to prime farmland along I-81 occur in Smyth, Montgomery, Roanoke, Botetourt, Augusta, Rockingham, Shenandoah, Warren, and Frederick Counties (see Figure 5-6, Chapter 8, *Figures*). Prime farmland would potentially also be impacted in Washington, Wythe, Pulaski, and Rockbridge Counties but could not be quantified since mapping is not available.

Based on available mapping for prime farmland, more than 75 percent of the total acreage potentially impacted would occur north of Rockbridge County, particularly in Augusta and Frederick Counties where the Minimum Width footprint would impact a combined total of 543 acres and the Maximum Width footprint would impact a combined total of 672 acres.

If Rail Concept 3 were also implemented, with improvements within the 13 identified rail improvement sections along the Piedmont and Shenandoah lines, an additional 51 acres of prime farmland would be impacted. These impacts would occur in Smyth, Prince William, and Pittsylvania Counties as shown in Figure 5-7 (see Chapter 8, *Figures*).

If a “Build” concept (or portion of a “Build” concept) is advanced, Tier 2 would include coordination with the Natural Resources Conservation Service pursuant to the Farmland Protection Policy Act.

Farmland of Statewide Importance

The Minimum Width and Maximum Width footprints would potentially result in substantial impacts to soils of statewide importance, which are assumed to represent farmland of statewide importance. Potential impacts along I-81 occur in Washington, Smyth, Montgomery, Roanoke, Botetourt, Rockingham, Shenandoah, Warren, and Frederick Counties. The majority of potential impacts would occur south of Rockbridge County, particularly in Shenandoah, Rockingham, and Washington Counties. The Minimum Width footprint would potentially impact 1,376 acres in Shenandoah County, 1,359 acres in Rockingham County, and 1,279 acres in Washington County. In comparison, the Maximum Width footprint would potentially impact an additional 600 acres of soils of statewide importance in these counties.



Soils of statewide importance would also potentially be impacted in Wythe, Pulaski, Rockbridge, and Augusta Counties, but could not be quantified due to unavailable mapping.

An additional 109 acres of soils of statewide importance would be potentially impacted by Rail Concept 3.

Agricultural/Forestal Districts

The Minimum Width footprint would potentially impact 11 agricultural and forestal districts within the I-81 corridor, while the Maximum Width footprint would impact 12 districts as illustrated in Figure 5-6 (see Chapter 8, *Figures*). In terms of total acreage, the Minimum Width footprint would potentially impact substantially less than the Maximum Width footprint. Table 5.4-2 summarizes the potential impacts to districts within each of the counties for the Minimum and Maximum Width footprints.

The majority of the potential impacts would occur in Shenandoah County where the largest numbers of districts are located. Shenandoah County's Tom's Brook Agricultural/Forestal District alone accounts for 60 percent (18.5 acres) of the total acreage potentially impacted by the Minimum Width footprint.

Table 5.4-2 Potential Impacts to Agricultural/Forestal Districts By County

<u>County</u>	<u>Minimum Width (Acres)</u>	<u>Maximum Width (Acres)</u>
Montgomery	0.6	33.0
Rockbridge	1.5	13.3
Augusta	2.8	11.1
Shenandoah	25.0	82.9
Total	29.9	140.3

If Rail Concept 3 were also implemented, an additional 21 acres of agricultural/forestal districts would be potentially impacted as shown in Figure 5-7 (see Chapter 8, *Figures*). For the rail, these potential impacts would occur mostly in Clarke and Fauquier Counties (see Table 5.4-3).

Table 5.4-3 Potential Impacts to Agricultural/Forestal Districts: Rail Concept 3

County	Agricultural / Forestal District Name	Acres Impacted
Clarke	Clarke County	9.9
Fauquier	Middleburg/Marshall	2.7
	The Plains	3.7
	Upperville Area	3.5
Warren	Rockland	1.4
Total		21.2

If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, analysis would fully comply with the Agricultural and Forestal Districts Act of the *Code of Virginia*, specifically Section 15.2-4313 (*Proposals as to land acquisition or construction within district*). Section 15.2-4313 requires that an evaluation be made of anticipated short-term and long-term adverse impacts on agricultural and forestal operations within the district and how such impacts are proposed to be minimized.

5.5 Visual Impacts

The potential visual impacts associated with each of the improvement concepts depends on the location of the visual resources, the qualities of the visual elements that are affected, the number of viewers, and the degree to which the landscape is permanently changed. For this Tier 1 analysis, potential impacts are discussed broadly, based on conceptual-level improvements to an existing interstate and/or rail facility. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, analyses would evaluate the effects on visual resources in more detail.

5.5.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 fully-funded roadway improvements described in Chapter 3, *Improvement Concepts*. Since they are federally funded, potential impacts to visual resources associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. Because most of these improvements are relatively minor in nature, it was assumed that the No-Build would have few impacts to visual resources.

5.5.2 “Build” Concepts

Potential visual impacts associated with the I-81 and rail impact footprints were evaluated based on potential changes to views of the road and rail, and views from the road. Views from the rail line were not considered since passenger service does not exist on the rail lines being evaluated and the number of viewers from the rail is very limited.

Views Of the Road or Rail

The views of road or rail improvements from visual resources may be important, especially for recreational users and tourists who may value the scenic quality of the viewshed while hiking, driving, or canoeing. The Minimum Width and Maximum Width footprints would both potentially impact all 28 visual resources with views of I-81 as listed in Table 4.5-2 (see Section 4.5, *Visual Quality*). If implemented with any of the highway improvements, Rail Concept 3 would potentially impact five additional visual resources with views of the rail as listed in Table 4.5-3 (see Chapter 4.5, *Visual Quality*). However, since I-81 and the rail line already exist, the degree to which the landscape would change for viewers of the road or rail would be minimal, regardless of which “Build” concept is advanced.

In those cases where people currently have unobstructed views of the I-81 or the rail corridor, the magnitude of impact is not expected to be great since viewers already see an interstate or a rail line while using these resources. The addition of highway lanes, rail improvements, or improvements to existing interchanges on I-81 would not appreciably change the visual

character of existing I-81 or the rail line. The greatest number of viewers that would potentially experience minor impacts would likely occur to motorists driving on scenic Virginia Byways in the study areas.

The greatest potential visual impacts would occur in those areas where people cannot currently see the road or rail from sensitive resources because views are currently obstructed by some type of visual buffer. Road and/or rail improvements may potentially involve the removal of a vegetative buffer or other barrier, resulting in new views of the road or rail line from sensitive resources. This would particularly occur for resources that do not currently involve a crossing of I-81 such as the George Washington and Jefferson National Forest. Such visual impacts would also be more prevalent for those historic properties that currently have some type of visual buffer. During Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced, a more detailed assessment of visual impacts would be completed that identifies specific areas where existing visual buffers would be removed.

Additional visual impacts may occur at historic properties either listed or eligible for listing on the National Register of Historic Places. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, visual impacts to historic properties would be evaluated in accordance with Section 106 of the National Historic Preservation Act.

Views From the Road

As previously noted in Section 4.5, *Visual Quality*, driving on I-81 is generally considered to be scenic by motorists. This is evidenced by comments heard during the scoping process for this study. Similar to views of the road, when considering views from the road, potential visual impacts are anticipated to be similar for the Minimum Width and Maximum Width footprints. In areas where the median is forested, maintaining trees in the median would continue to act as a buffer to views of oncoming traffic.

However, potential impacts to the visual quality of the corridor for motorists depends primarily on specific design elements (*e.g.*, noise walls, signs or other structures) that may obstruct views or detract from observing visual resources in the foreground, middleground, or background as described in Chapter 4, *Affected Environment*. Since Tier 1 is evaluating conceptual-level improvements, a detailed evaluation of impacts to views from the road would be completed if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, based on detailed roadway design. At that time, the effect of noise walls and other design structures on views from the road would be considered.

5.6 Parks, Recreation Areas and Open-Space Easements

This section discusses the potential impacts to federal, state, and local parks and recreation areas, and open-space easements. For this Tier 1 study, potential direct impacts to parks, recreation areas, and open-space easements are defined impacts that require the purchase of any land. The impact analysis used the inventory of public parks, recreation areas, and open-space easements described in Chapter 4, *Affected Environment*, which included available GIS mapping of approximate property boundaries. The I-81 Minimum Width and Maximum Width footprints and the rail impact footprint were overlaid on the GIS resource mapping in order to identify properties that may be potentially impacted, in whole or in part, by the improvement concepts. Figure 5-6 (see Chapter 8, *Figures*) illustrates the location of potentially impacted parks in the I-81 corridor. Section 5.8 discusses conceptual mitigation for potential direct impacts to all Section 4(f) resources including publicly-owned parks and recreation areas.

In addition to potential direct impacts, a preliminary assessment of potential “constructive use” impacts was completed. This refers to potential impacts (substantial impairment) to the features that qualify the park resource for Section 4(f) consideration, even if no land is acquired. More detailed investigations of constructive use impacts and coordination with park owners would occur during Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced.

5.6.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. Based on the data collection efforts performed for this study, there are no parks, recreation areas, or open-space easements in the vicinity of any of these highway improvements. Since they involve federal funding, potential impacts to parks and recreation area associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. For purposes of this Tier 1 study, it is assumed that the No-Build Concept would not affect public parks and recreation areas, or open-space easements.

5.6.2 “Build” Concepts

Based on the GIS analysis, Rail Concept 3 would potentially impact the George Washington and Jefferson National Forest along the Shenandoah rail line (see Figure 5-7, Chapter 8, *Figures*). However, since all rail improvements in this rail section are to occur within existing rail rights-of-way, no direct impacts are expected to actually occur. In addition, no constructive use impacts are anticipated to the Forest or the Appalachian National Scenic Trail (where it crosses the rail line at the far eastern limits of rail improvement section 8 in



Warren/Fauquier Counties) since the relatively small increase in train volumes is not likely to substantially impair the use of either resource.

The Minimum Width and Maximum Width footprints potentially impact a greater number of park resources in the I-81 corridor. These are summarized in Table 5.6-1 and shown in Figure 5-6, Chapter 8, *Figures*. Although potential impacts to trails are discussed in the text, a quantitative impact assessment of trails in the study area was not completed because the level of engineering design information for each concept (*i.e.*, overpass/underpass design) at the Tier 1 stage is not adequate for that analysis. This analysis would be completed during Tier 2 if a “Build” concept (or portion of a “Build” concept) is advanced.

Table 5.6-1 Summary of Potential Impacts to Parks and Recreation Areas

Resource Name	Resource Type	Minimum Width		Maximum Width	
		# of Potential Impact Locations	Impact Estimate (Acres)	# of Potential Impact Locations	Impact Estimate (Acres)
George Washington & Jefferson National Forest	4(f) and 6(f)	4	2.7	4	2.7
Appalachian National Scenic Trail (Right-of-Way)	4(f) and 6(f)	3	3.2	3	5.7
Virginia Creeper Trail	4(f)	1	n/a	1	n/a
New River Trail State Park	4(f)	1	0.9	1	1.2
Chilhowie Town Park	4(f)	1	0.5	1	0.5
Purcell Park	4(f) and 6(f)	1	5.6	1	5.6
Hanging Rock Battlefield Trail	4(f)	1	0.1	1	0.2
Ramblewood Fields Softball Complex	4(f)	1	4.4	1	4.4
Adjacent Parcel to Ramblewood Fields (proposed)	4(f)	1	1.1	1	1.1
Beverly Heights Park	4(f)	1	0.4	1	0.9
Fairview Park (proposed)	4(f)	1	16.1	1	18.8
New Market Town Park	4(f)	1	0.5	1	0.5
New Market Battlefield Park	4(f) and 6(f)	1	1.2	1	1.2
Mount Jackson Park	4(f)	0	0	1	0.7
Jim Barnett Park	4(f)	1	14.7	1	25.9
Total		19	51.4	20	69.4

State and Federal Parks and Recreation Areas

The Minimum and Maximum Width footprints would potentially impact the George Washington and Jefferson National Forest and several trails, including the Appalachian National Scenic Trail, as described below. No impacts would occur to the Pedlar Hills Natural Area Preserve.

George Washington and Jefferson National Forest

Implementation of any of the “Build” concepts would result in potential impacts to the National Forest along I-81 at Milepost 55. In addition to being managed for timber resources, the National Forest provides a variety of recreational activities including hiking and biking.

Appalachian National Scenic Trail

The Appalachian National Scenic Trail intersects the I-81 corridor, crossing in several locations. In Smyth County, the Appalachian National Scenic Trail travels across I-81 using an underpass at Exit 54. Further north in Botetourt County, the Trail also crosses I-81 via an underpass just east of Exit 150. At both of these crossings, expansion of the underpasses for highway improvements would potentially impact the Trail depending on the ultimate right-of-way needed at those locations. No permanent impacts to the Trail access across I-81 are expected to occur with either the Minimum Width or Maximum Width footprint, although access may be temporarily affected during highway construction.

In addition to the Trail crossing I-81 at Exit 150, the Trail parallels the western side of I-81 for approximately 4,400 feet in this location. Widening of the highway associated with either the Minimum Width or Maximum Width footprint would potentially impact portions of the Trail that parallel I-81, possibly requiring relocation of the Trail in some areas.

Another area where the Appalachian National Scenic Trail would be potentially impacted is where the Trail crosses Alternate 220 in the vicinity of Exit 150. Interchange improvements would require some type of improvements to Alternate 220, including where the Trail crosses Alternate 220. If additional right-of-way is required for these improvements, the Trail would be potentially impacted in this location as well. Future design efforts would evaluate avoidance measures (see the discussion of 4(f) resources in Section 5.9) of the Trail in these locations, if a “Build” concept (or portion of a “Build” concept) is advanced.

Because the Trail currently travels across the interstate in Smyth and Botetourt Counties, Trail users already experience temporary highway noise levels typically associated with high-speed interstate travel. Therefore, widening of the highway for the Minimum Width or Maximum Width footprints is not expected to result in a potentially constructive use of this Section 4(f) recreational resource since the features that qualify the Trail for Section 4(f) consideration would not be substantially impaired by additional traffic volumes.

Virginia Creeper Trail

The Virginia Creeper Trail also travels across I-81 via an underpass just north of Exit 17 in Washington County. Similar to the Appalachian National Scenic Trail crossings, expansion of the underpass for highway improvements may potentially result in minor impacts to the Virginia Creeper Trail depending on the ultimate right-of-way needed at that location. No permanent impacts to Trail access across I-81 are expected to occur, although access may be temporarily affected during highway construction. Widening of the highway for both the Minimum Width and Maximum Width footprint is not expected to result in a constructive use of this Section 4(f) recreational resource since the features that qualify the Trail for Section 4(f) consideration would not be substantially impaired by additional traffic volumes.

New River Trail State Park

The New River Trail State Park travels across I-81 via an underpass just north of Exit 94 in Pulaski County. Expansion of the underpass for highway improvements may potentially impact the Trail depending on the ultimate right-of-way needed at that location. No permanent impacts to Trail access across I-81 are expected to occur with the Minimum Width or Maximum Width footprints, although access may be temporarily affected during highway construction. Widening of the interstate is not expected to result in a constructive use of this Section 4(f) recreational resource since the features that qualify the Trail for Section 4(f) consideration would not be substantially impaired by additional traffic volumes.

Local Parks and Recreation Areas

Potential impacts to local parks and recreation areas in the I-81 corridor are summarized in Table 5.6-1. The majority of the total acreage impacted for the Minimum and Maximum Width footprints occurs in the proposed Fairview Park in Shenandoah County and in Jim Barnett Park in the City of Winchester.

Table 5.6-1 does not include a quantitative assessment of potential impacts to two local parks for which park boundaries were not available (proposed Mendota Trail and Suncrest Park). Assuming that the proposed Mendota Trail would, when eventually built, cross I-81 via an overpass or underpass, no potential impacts to this proposed trail are expected. Potential impacts to Suncrest Park may occur with implementation of highway improvements depending on the ultimate right-of-way needed.

In Roanoke County, the Hanging Rock Battlefield Trail crosses under I-81 near Exit 142. Expansion of the underpass for each of the “Build” concepts may potentially result in minor impacts to the Trail depending on the ultimate right-of-way needed at that location. Widening of the highway is not expected to result in a constructive use of this Section 4(f) recreational resource since the features that qualify the Trail for Section 4(f) consideration would not be substantially impaired by additional traffic volumes. No permanent impacts to Trail access across the interstate are expected to occur with the Minimum Width or

Maximum Width footprints, although access may be temporarily affected during highway construction.

Open-Space Easements

Table 5.6-2 summarizes the potential impacts to open-space easements for the Minimum Width and Maximum Width footprints. The largest amount of these potential impacts occurs in Rockbridge County between Exits 180 and 188. Rail Concept 3 does not potentially impact any open-space easement based on available information.

Table 5.6-2 Potential Impacts to Open-Space Easements

County	Minimum Width		Maximum Width	
	Total # Impacted	Total Impacts (Acres)	Total # Impacted	Total Impacts (Acres)
Rockbridge	2	5.3	2	5.3
Augusta	1	2.8	1	8.1
Shenandoah	1	2.3	1	9.6
Frederick	2	2.1	2	6.3
Total	6	12.5	6	29.2

5.7 Historic Properties

The level of resource identification and impact analysis undertaken for this Tier 1 study does not fully satisfy the requirements of Section 106. Rather, if a “Build” concept (or portions of a “Build” concept) is advanced, compliance with Section 106 would occur during Tier 2 including additional investigations and analyses to 1) identify historic properties, 2) determine the effects on those historic properties, and 3) develop appropriate mitigation measures for unavoidable impacts to historic properties.

This section describes the potential impacts to listed and eligible historic properties that may occur as a result of each improvement concept. Similar to Chapter 4, Section 4.7, this section focuses primarily on historic properties that are either listed or determined eligible for listing on the Virginia Landmarks Register (VLR) or the National Register of Historic Places (NRHP) by VDHR. This section briefly describes potential impacts to historic properties that were, for purposes of this study, identified as potentially eligible for listing. More detailed information on impacts to historic properties, including potentially eligible properties, is provided in the *I-81 Corridor Improvement Study Historic Properties Technical Report*.

Boundaries of all historic properties, as defined on their NRHP nomination or on the records at VDHR, were used to create a GIS layer. The potential impacts to historic properties were examined by overlaying the Minimum Width and Maximum Width footprints over the GIS data. For the purposes of this Tier 1 study, only the potential direct impacts on historic properties were considered. A resource was considered to be directly impacted if the resource as represented in the GIS was wholly or partially inside the impact footprint.

In addition to direct impacts from construction, other types of effects to historic properties can occur including: the removal of a property from its historic location; changing the character of a property’s use or setting when it contributes to its significance; and introducing visual, atmospheric, or audible elements that diminish the integrity of the features that make a historic property significant. All or some of these effects may occur to historic properties as result of the improvement concepts, including visual impacts to architectural properties within view of the interstate and/or rail line as identified in Section 4.7, *Historic Properties*. The Tier 1 analysis, however, does not address these effects in part because the level of engineering available for the improvement concepts during Tier 1 is insufficient to evaluate these effects. In addition, the *I-81 Corridor Improvement Study* defines a program for improvements, not site-specific projects. This analysis also does not include an assessment of the type of potential effect on historic properties (no effect, no adverse effect, or adverse effect). Consultation with the VDHR and other consulting parties and the public concerning the full range of effects to historic properties would be undertaken if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

5.7.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of the 16 fully-funded minor roadway improvements as described in Chapter 3, *Improvement Concepts*. Historic properties may be in the vicinity of these roadway improvements. Since these improvements are federally funded, the NEPA process for each project has either been completed or is underway independent of the *I-81 Corridor Improvement Study*. Potential impacts to historic properties either have been or will be addressed through those separate documents. Specific impacts to historic properties as a result of these minor improvements were not quantified for this study.

5.7.2 “Build” Concepts

Table 5.7-1 summarized potential impacts to historic properties that are either listed or eligible for listing on the National Register of Historic Places in the I-81 and rail corridors. More specific information on potential impacts is provided in the sections below.

Table 5.7-1 Summary of Potential Impacts to Historic Properties

“Build” Concept	Historic Structures (Number)	NHL/Historic Easement ¹ (Number)	Historic Districts (Number)	Civil War Battlefields (Number)	Archaeological Sites (Number)	Total (Number)
Minimum Width	19	1	2	10	1	33
Maximum Width	20	1	2	10	1	34
Rail Concept	2	0	2	1	0	5

¹ Cedar Creek Battlefield

NHRP Listed and Eligible Architectural Resources

Potential impacts to structures and buildings as well as historic districts that are either listed or determined eligible are described in the following sections.

Buildings and Structures

Table 5.7-2 below lists specific buildings or structures that are potentially impacted by the impact footprints for I-81 and Rail Concept 3, as well as the estimated impacts in terms of acreage. The acreage of potential impact was calculated based on the entire property boundary for each building as defined on their NRHP nomination or on the records at VDHR.

While the Minimum Width and Maximum Width footprints potentially impact the same number of buildings and structures, the Maximum Width footprint has a larger potential impact in terms of total acreage. Both highway footprints have substantially greater impacts to historic building and structures than Rail Concept 3, which has minimal potential impacts.

Table 5.7-2 Potential Direct Impacts to NHRP Listed and Eligible Buildings and Structures

Name	VHDR#	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3 (Acres)
James Alexander House	007-0604	1.7	6.2	0
Valley Railroad Stone Bridge	007-0041	0.2	0.7	0
Bridge 1026	132-0045	0.7	0.7	0
H.L. Bonham House	189-0003	4.7	4.7	0
Brubaker House	080-0005	4.3	4.3	0
Carvin's Cove Water Filtration Plant	080-5096	1.0	1.4	0
Church Hill	081-0065	3.2	7.6	0
Contentment	082-0062	1.6	2.1	0
Fancy Hill	081-0015	4.8	4.8	0
Fort Bowman	085-0004	28.4	33.9	0
Pifer House	085-0470	0.6	0.7	0
Fort Chiswell Mansion	098-0005	9.5	9.5	0
Fort Chiswell Site	098-0026	6.2	6.2	0
James Madison University	115-0103	9.3	9.4	0
Maple Hall	081-0041	2.0	3.8	0
McGavock Family Cemetery	098-0022	0.3	0.3	0
NC Branch, N&W Rail	077-5068	2.4	3.2	0
Snapp House	085-0029	0	0.02	0
Springdale	081-0180	1.3	2.6	0
Zig-Zag Trenches	034-0314	3.2	4.8	0
Hillandale	034-0126	1.3	1.3	0
Linden House #2	076-0002	0	0	0.5
Beverley Mill	093-0114	0	0	0.1
TOTAL		86.7	108.2	0.6

Historic Districts

Table 5.7-3 summarizes potential impacts to NHRP listed or eligible historic districts in the I-81 and rail corridors. The Minimum Width and Maximum Width footprint both impact two districts. If implemented with highway improvements, Rail Concept 3 would impact two additional historic districts, one in Clarke County (rail section 5) and one at the Fauquier County/Prince William County line (rail section 11).



Table 5.7-3 Potential Direct Impacts to NHRP Listed and Eligible Historic Districts

Name	VDHR#	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3 (Acres)
Camp Russell	034-5036	27.5	28.4	0
Newtown/Stephens City	034-0001	24.5	29.5	0
Berryville	168-0012	0	0	1.8
Long Marsh Run	021-0967	0	0	10.3
TOTAL		51.0	57.9	12.1

Potentially Eligible Architectural Resources

Table 5.7-4 summarizes the potential impacts to architectural resources (buildings, structures, and historic districts) identified for this study as potentially eligible for listing on the VLR or NRHP. Rail Concept 3 has no impacts to potentially eligible architectural resources so Table 5.7-4 only includes potential impacts in the I-81 corridor.

Table 5.7-4 Potential Direct Impacts to Potentially Eligible Buildings and Structures

Name	VDHR#	Minimum Width (Acres)	Maximum Width (Acres)
Campbell McIntire House	095-0311	0.72	0.72
Meek, Joseph Sr., Brick House	095-0137	0.04	0.04
Hillcrest	077-0010	0.08	0.22
Kelley's Service Station	077-0177	0.44	0.61
Honaker, Henry, House	077-0011	0.0	0.18
House, Jct. Rt. 81/603	060-0414	0.0	0.08
Meadowview Farm	011-0136	0.71	0.71
Waskey's Mill House	011-0026	0.03	0.03
Barclay's Tavern	081-0002	0.0	0.32
Shafer House	081-0160	0.72	0.72
House at Fancy Hill	081-0161	0.72	0.72
Dod, W.T. House	081-0543	0.1	1.1
Fruit Hill Corn Crib	081-0381	0.01	0.54
Danner, M. R. House	007-0919	0.0	0.01
Elijah Pifer House	085-0073	0.0	0.07
Building, Western State Hospital	007-1210	0.72	0.72
Sycamore Hill	034-1003	0.0	0.04
TOTAL		4.29	6.83

Battlefields

Potential direct impacts to individual battlefields are listed in Table 5.7-5. The Minimum Width and the Maximum Width footprints for I-81 both potentially impact 10 battlefields, mostly in the northern portion of the corridor. If implemented along with highway improvements, rail improvements associated with Rail Concept 3 would potentially impact an additional 13 acres of Thoroughfare Gap Battlefield along rail section 11 in Fauquier County.

Table 5.7-5 Potential Direct Impacts to Specific Civil War Battlefields

Name	VDHR#	Minimum Width (Acres)	Maximum Width (Acres)	Rail Concept 3 (Acres)
Cedar Creek ¹	034-0303	325	436	0
Fisher's Hill	085-0001	127	173	0
Hanging Rock	080-5023	3.3	3.3	0
Kernstown 1	034-0007	10.7	11.1	0
Kernstown 2	None	61.1	65.5	0
Marion	None	51.5	51.5	0
New Market	269-5001	139	149	0
Opequon	034-0456	410	484	0
Tom's Brook	085-0045	119	153	0
Winchester 1	138-5005	191	230	0
Thoroughfare Gap	030-1016	0	0	13

¹ Also a National Historic Landmark

Since some of the battlefield boundaries in the I-81 corridor overlap, some of the acreage included in Table 5.7-5 for one battlefield is also included in the acreage for another battlefield. Therefore, Table 5.7-6 was created to summarize potential impacts to total battlefield areas as a whole (rather than per individual battlefields) in the I-81 corridor in order to avoid the double counting of acreage in areas of overlap.

Table 5.7-6 Summary of Potential Impacts to Total Battlefield Areas

"Build" Concept	Total Impacts for Dissolved Boundaries ¹ (Acres)
Minimum Width	1,238
Maximum Width	1,481

¹ Where battlefield boundaries overlap, impacts were counted only once



National Historic Landmarks

Approximately 325 to 436 acres of one National Historic Landmarks (NHL) property, Cedar Creek Battlefield, would potentially be directly impacted by the Minimum Width and Maximum Width footprints, respectively (see Table 5.7-5 above). Rail Concept 3 does not potentially impact any National Historic Landmarks.

Historic Easements

One historic preservation easement is potentially impacted within the I-81 corridor, Cedar Creek Battlefield. Potential impacts to Cedar Creek Battlefield are described above.

NHRP Listed and Eligible Archaeological Sites

The Fort Chiswell Site is the only previously recorded archaeological resource within the I-81 or rail corridors that has been either listed or determined eligible for the VLR or NRHP. This site has previously been adversely affected by construction of an entrance ramp from I-77. Widening to the outside lanes or the median would have a potential direct impact on this site. Based on the GIS impact analysis, potential impacts to this site would be approximately 6 acres for both the Minimum Width and Maximum Width footprints since the cross section for both footprints in this location are the same.

5.8 Section 4(f)/6(f)

Certain properties are subject to the regulatory requirements set forth pursuant to Section 4(f) of the Department of Transportation Act of 1966. These properties include public parks, recreation areas, wildlife refuges or lands of an historic site of national, state, or local significance. This law stipulates that land cannot be used from Section 4(f) properties unless 1) there is no prudent and feasible alternative to using that land, and 2) that all possible planning to minimize harm from use of these resources have been included during project development. Section 6(f) applies to parkland or recreation facilities that have used funds authorized under Section 6(f) of the Land and Water Conservation Fund Act. Resources that are subject to Section 4(f) of the Department of Transportation Act of 1966 and Section 6(f) of the Land and Water Conservation Fund Act are described in Chapter 4.

Potential impacts to public parks and recreation areas are discussed in Section 5.6 and potential impacts to known historic sites that on or eligible for the National Register are described in Section 5.7 above. This section specifically summarizes Section 4(f) and Section 6(f) issues relative to the Tier 1 level of analysis including the characterization of potential impacts and potential avoidance, minimization and mitigation measures at a conceptual level appropriate for this Tier 1 analysis.

5.8.1 Potential Impacts to Section 4(f) Resources

Parks and Recreation Areas

For purposes of Section 4(f), the significance of publicly owned parks, recreation, and wildlife refuges is determined in consultation with the national, state, or local officials having jurisdiction over the property. In the absence of a significance determination by such an official, the resource is assumed to be significant. For this study, officials with jurisdiction over the parks and recreation areas in the I-81 and rail study areas were not contacted regarding the significance of their properties. Therefore, each potentially impacted park and recreation area was assumed to be of either national, state, or local significance. Coordination regarding significance would occur if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2. In addition, during Tier 2 data collection, more detailed information on property boundaries would be obtained, particularly for local parks and public recreational facilities along I-81, such as those found at schools.

Under Section 4(f), impacts refer to the use of the land in one or more of the following forms:

1. property acquisition;
2. permanent easement (and sometimes temporary easement); and/or

3. constructive use whereby the property is not acquired in any way but the features that qualify the resource for Section 4(f) consideration are substantially impaired because of the proximity of proposed improvements.

The specific type of use of each affected property cannot be determined at this stage of the study although preliminary estimates of direct encroachment on some Section 4(f) properties have been provided for comparison. The highway improvements associated with the Minimum Width and Maximum Width footprints would potentially impact at least 20 existing or planned public parks and trails. At least four of these are also Section 6(f) properties. Based on the Tier 1 estimate of potential impacts, the difference in Section 4(f) impacts between the Minimum and Maximum Width footprints is relatively minor. Only one Section 4 (f) parkland resource property (the George Washington and Jefferson National Forest), a recreational area, is potentially impacted by Rail Concept 3.

Since I-81 carries relatively large volumes of traffic, including heavy truck traffic, parks along I-81 already experience noise levels commonly associated with an interstate facility. While noise levels would potentially increase with the Minimum Width, this increase is not expected to substantially impair the features that qualify the park for consideration under Section 4(f). Similarly, any increase in train volumes on the Shenandoah rail line is not expected to substantially impair use of the George Washington and Jefferson National Forest. While widening the road and/or rail line is not expected to result in a constructive use of parks and/or trails in the I-81 or rail corridors, a final determination of constructive use would be determined during Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced, in conjunction with input from the officials having jurisdiction over the property.

The ultimate assessment of impacts would depend on the specific location of the park or recreation facility property lines in relation to the proposed highway and rail rights-of-way, and the extent and type of encroachment on each property. Furthermore, during Tier 2, methods to avoid and minimize impacts would be evaluated if a “Build” concept (or portion of a “Build” concept) is advanced.

Historic Properties

For purposes of Section 4(f), the significance of historic properties is determined through the Section 106 process. Any property eligible for listing or listed on the National Register of Historic Places (NHRP) is considered significant. Archaeological sites eligible or listed on the NRHP are only considered Section 4(f) properties if they warrant preservation in place.

For Section 4(f) purposes, use of a historic property relates to direct impacts as well as constructive use whereby the historic integrity of the resource is substantially impaired. An adverse visual effect per Section 106 does not necessarily constitute a Section 4(f) use of the resource. The footprints for I-81 and Rail Concept 3 would potentially impact a number of historic sites including buildings and structures, historic districts, battlefields, and archaeological sites. Anticipated direct impacts to these resources are summarized in Section 5.7. The applicability of Section 4(f) to these resources and characterization of use of

these resources associated with roadway and rail improvements would be evaluated in detail if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

5.8.2 Avoidance and Minimization

For the Tier 1 analysis, preliminary avoidance and minimization measures have been evaluated by widening I-81 to the inside, in the median, for all sections of the Minimum Width footprint (to the extent practicable at this level of analysis). In order to represent the widest possible highway footprint, the Maximum Width concept only widens in the median for those sections of I-81 (37 percent of the total lane miles) that need one additional lane in each direction. The remaining sections widen to the outside of the existing right lane. While widening in the median may avoid and minimize potential impacts to most 4(f) properties, some 4(f) properties may potentially be located in the median (*e.g.*, battlefields and associated features).

If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, alternatives that completely avoid Section 4(f) resources would be developed and evaluated. Potential impacts to Section 4(f) resources along the mainline of I-81 may be further minimized and/or avoided by shifting the center line away from the resource, maximizing use of the median for widening, reducing the typical highway right-of-way adjacent to the resource, or applying construction techniques that minimize the extent of cut and fill activities. For Rail Concept 3, potential impacts to Section 4(f) resources may be avoided and/or minimized by strategically locating rail improvements (on one side of the rail line or the other depending on location of resource), as well as through construction techniques.

Given their proximity to I-81 or location on both sides of I-81, some parks, trails, and historic sites pose greater design constraints than others. Particularly constrained resource areas along the I-81 corridor are summarized in Table 5.8-1 below. During Tier 2, if a “Build” concept (or portion of a “Build” concept) is advanced, avoidance alternatives that may be evaluated in some of these constrained areas include additional bypasses or major alignment shifts.

Also, for Rail Concept 3, the George Washington and Jefferson National Forest is in close proximity to the Shenandoah rail line in the Wythe County/Pulaski County rail section where the forest abuts the existing rail line to the east. If rail improvements were to occur on the west side of the track, then potential impacts to the National Forest would be avoided altogether.



Table 5.8-1 Constrained Section 4(f) Areas: I-81 Corridor

Resource	Milepost	Type of Constraint
Appalachian Trail	55 and 152	Trail on both sides of I-81 and parallels I-81
Jefferson National Forest	55	On both sides of I-81 and large size
New River Trail State Park	95	On both sides of I-81
Mendota Trail (proposed)	4	On both sides of I-81
Virginia Creeper Trail	18	On both sides of I-81
Fort Chiswell Historic Site	82	On both sides of I-81 and in close proximity to road
Ramblewood Fields Softball Complex	245	Close proximity to I-81 and within 1 mile of Purcell Park on opposite side of road
Purcell Park	246	Close proximity to I-81 and within 1 mile of Ramblewood Fields on opposite side of road
New Market Battlefield	265 - 269	On both sides of I-81 and large size
New Market Town Park	265	Close proximity to I-81 and near interchange
New Market Battlefield Park	267	Close proximity to I-81
Proposed Fairview Park	286	On both sides of I-81
Various Battlefields	291 - 320	On both sides of I-81 and large in size

5.9 Natural and Geologic Resources

Impacts to natural and geologic resources are described below for the No-Build and “Build” concepts.

5.9.1 No-Build Concept

The No-Build Concept would generally maintain the existing roadway conditions on I-81 with the exception of 16 fully-funded minor roadway improvements as described in Chapter 3, *Improvement Concepts*. Three of these roadway improvements involve widening of existing bridges over streams:

- Bridge over Buffalo Creek at Milepost 185 in Rockbridge County;
- Bridge over Maury River at Milepost 191 in Rockbridge County; and
- Bridge over Abram’s Creek at Milepost 313 in Frederick County.

Based on the data used for the *I-81 Corridor Improvement Study*, it is anticipated that widening of the above noted bridges may potentially impact jurisdictional areas, wetlands and/or streams through the placement of fill in these areas. In addition, encroachment on 100-year floodplains may potentially occur. Since they involve federal funding, potential impacts to natural resources associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*.

5.9.2 “Build” Concepts

Potential impacts to natural resources in the I-81 and rail corridors are shown in Figures 5-8 and 5-9, respectively (see Chapter 8, *Figures*).

Geologic Resources

Topography

The relatively complex geology and varied topography of western Virginia have implications for road construction. All improvements in I-81 corridor entail appreciable earthmoving to achieve grades suitable for both passenger and commercial truck traffic. Steep passages would be reduced mechanically or via blasting, especially in the more southern portions of the corridor. The numerous stream crossings bisected by the Minimum Width and Maximum Width footprints would require culvert or bridge emplacements combined with filling.

Karst Topography

Karst features, such as sinkholes and cave entrances, are common throughout the I-81 corridor and the Shenandoah rail sections associated with Rail Concept 3, generally occurring in localized high-density “swarms”, such as the area north of Harrisonburg and northwest of Radford. However, the lack of GIS coverage precludes a detailed, quantitative analysis and comparison of impacts at the Tier 1 stage of analysis.

Generally, the construction of any “Build” concept may potential impact karst features. Because it has the smallest overall construction footprint, the Minimum Width footprint would have the least potential impacts. Because it is the widest, the Maximum Width footprint would have the greatest potential for impacts to karst features and would be more likely to intercept sinkholes and cave entrances, requiring spans or other means of avoidance. Rail improvements associated with Rail Concept 3 would also potentially impact karst features, particularly for those rail sections along the Shenandoah rail line.

Waters of the United States

Waters of the United States (WOUS), including wetlands and surface waters such as streams, ponds, and wetlands, are protected by a variety of local, state, and federal laws such as Executive Order 11990: *Protection of Wetlands*; the Clean Water Act; and the Virginia Water Protection Program. See *Permit Issues* below, and the *I-81 Corridor Improvement Study Wetlands and Water Resources Technical Report* for the regulatory framework related to wetlands.

The following sections describe the potential impacts to WOUS by the Minimum Width and Maximum Width footprints, as well the rail impact footprint for Rail Concept 3. Potential impacts may occur through such activities as placing fill material in WOUS, dewatering, modifying stream channels, or inundating vegetated wetlands. The potential impact numbers provided do not distinguish between temporary and permanent impacts, but simply indicate the combined total impact. For example, a potential impact was assumed when the impact footprints intercepted a stream. In reality, this potential impact would most likely be a temporary impact during construction since the existing method of crossing the stream (*i.e.*, culvert, pipe, bridge) would likely be reemployed. Relatively minor streams flowing through culverts or pipes would likely continue to be conveyed as such, whereas larger bridged streams would likely be spanned similarly. As such, it is assumed for this Tier 1 level study that navigation in navigable waters would not be affected by either highway or rail improvements. Temporary wetland impacts may also occur (*e.g.*, clearing and grubbing areas adjacent to wetlands, temporary dewatering, and equipment staging or access) and are discussed in Section 5.16, *Construction Impacts*. If a “Build” concept (or portion of a “Build” concept) is advanced to Tier 2, the analysis would segregate temporary and permanent stream impacts.

Stream Impacts

Calculations for potential impacts to perennial streams were generated by superimposing the Minimum Width footprint, Maximum Width footprint, and Rail Concept 3 footprint on top of GIS data for perennial streams. Where they overlap, streams may potentially be directly

impacted as a result of stream channel modifications, the placement of fill in the stream, or bridging. The water quality of streams may also be potentially impacted as a result of erosion and sedimentation, both within the overlap area and further downstream. Water quality impacts are discussed in the section below.

Table 5.9-1 summarizes potential stream impact per individual watershed. Between 23 and 32 miles of perennial streams would be impacted as a result of the highway improvements, fairly equally between the six watersheds through which I-81 travels. If implemented with highway improvements, Rail Concept 3 would potentially impact an additional 1.4 miles of perennial streams, mostly from improvements in rail sections between Front Royal and Manassas in northern Virginia.

Table 5.9-1 Potential Stream Impacts by Watershed

	Holston River (Linear Feet)	New River (Linear Feet)	Roanoke River (Linear Feet)	James River (Linear Feet)	Potomac- Shenandoah Rivers (Linear Feet)	Total (Linear Feet)	Total Impacts (Miles)
“Build” Concept							
Minimum Width	24,758	25,829	20,494	29,001	22,000	122,083	23.1
Maximum Width	26,116	31,038	29,012	37,099	30,604	153,870	29.1
Rail Concept 3	414	407	1,408	0	5,015	7,244	1.4

In the southern portion of the I-81 corridor, particularly in Washington, Smyth, and Wythe Counties, a number of streams (*e.g.*, Middle Fork of the Holston River) run adjacent to I-81 for appreciable distances. Wider construction footprints may, therefore, overlap long stream reaches, resulting in far greater impacts to these streams. During later stages of project development, if a “Build” concept (or portion of a “Build” concept) is advanced, additional engineering measures would be considered, as appropriate, to possibly shift the I-81 centerline landward to address Section 404 permitting requirements.

Although Table 5.9-1 does not include potential impacts to intermittent streams, each concept could impact at least 960 linear feet (0.2 miles) of intermittent streams. This number is likely to increase, however, since Tier 1 did not include the field analysis required to determine whether some water features in the I-81 corridor were intermittent (marked as “unknown”). The perenniality of “unknown” features would be determined during later stages of project development, if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

Lakes/Impoundments

Table 5.9-2 summarizes potential impacts to lakes and ponds in the I-81 and rail corridors. For ponds, potential impacts were calculated by overlaying each impact footprint on GIS data for ponds (Cowardin classification Wetlands with Unconsolidated Bottoms).

Table 5.9-2 Potential Impacts to Lakes and Ponds

"Build" Concept	Claytor Lake (Acres)	Ponds (Acres)	Total Impacts (Acres)
Minimum Width	2	10	12
Maximum Width	2	15	17
Rail Concept 3	0	4	4

The Minimum Width and Maximum Width footprint would require increasing the width of the I-81 bridge over Claytor Lake at Peak Creek, resulting in a potential impact to roughly two acres of open water for each footprint. Impacts may occur as result of additional fill for bridge abutments or pilings. Some quarries or ponds may be either partially or completely filled for roadway and/or rail construction.

Wetland Impacts

Similar to the analysis for stream impacts, the calculation of potential wetland impacts was approximated by overlaying the I-81 and Rail Concept 3 footprints over GIS-mapped wetland areas. The impact totals are combined temporary and permanent impacts as it is not possible at this stage to disaggregate the two. Bridges are a common feature along I-81 where the roadway crosses larger stream/wetland complexes. Bridging offers the opportunity to minimize the complete loss of wetlands that would otherwise result from the use of fill material, and would be incorporated where practical. However, the conversion of scrub-shrub or forested habitats to an emergent (early successional) vegetative stage may occur at these locations depending on the height of the bridge and/or the need to maintain an unforested area under the span. Determining this type of impact would occur if a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2.

Combined impacts to emergent, forested, and scrub-shrub wetlands are summarized in Table 5.9-3. In the I-81 corridor, the average impact size per wetland is approximately 0.2 acres. Because the majority of the existing I-81 right-of-way (ROW) has been disturbed and manipulated for purposes of improved drainage and ease of maintenance, few large wetland systems remain along I-81. For the most part, wetlands within the I-81 ROW occur as either narrow drainage patterns, man-made swales, ditches, or small depressional areas. Larger expanses of wetland areas occur outside of the ROW. For this reason, the total amounts for wetlands potentially impacted by improvements within the I-81 corridor are small considering the length of I-81 in Virginia.

Table 5.9-3 Potential Wetland Impacts

"Build" Concept	Number of	
	Impacted Wetlands	Total Impacts (Acres)
Minimum Width	230	32.7
Maximum Width	281	50.5
Rail Concept 3	41	8.2

Regardless of which impact footprint was used for I-81, the highest concentration of wetland impacts along I-81 occurs between Exits 300 and 313, between the I-66 interchange and Stephens City. The headwaters of numerous streams lie along this portion of the interstate, including Catlett Run, Molly Booth Run, Dry Run, West Run, and Stephens Run. Within this 12-mile span, the Minimum Width footprint potentially impacts 90 individual wetlands (9.8 acres) and the Maximum Width footprint potentially impacts 99 individual wetlands (13.8 acres).

The rail improvements associated with Rail Concept 3 would potentially impact approximately 8 additional acres of wetlands. Unlike the I-81 ROW, larger wetland systems are found within the existing rail ROW. In some cases the raised rail bed, located largely on fill material, traverses forested or emergent wetlands systems along rivers and floodplains.

Wetland Impacts by Type

Table 5.9-4 summarizes potential impacts to wetlands by type.

Table 5.9-4 Potential Wetland Impacts by Type

"Build" Concept	Emergent		Forested		Scrub-Shrub		Total (acres)
	Acres	%	Acres	%	Acres	%	
Minimum Width	26	80%	3.3	10%	3.4	10%	32.7
Maximum Width	39	76%	6.6	13%	4.9	10%	50.5
Rail Concept 3	2.9	35%	5.3	65%	0	0	8.2

Because they are the most common wetlands found along I-81, over 75 percent of potential impacts to wetlands in the I-81 corridor would occur to emergent wetlands, regardless of impact footprint. Many of these are small emergent wetland fringes around the edges of ponds, and in ditches and swales. These systems have relatively low functional value. In fact, based on the preliminary evaluation of wetland functional values done for Tier 1, potential impacts to wetlands that appear to have relatively high functional value are very small: 2 acres for the Minimum Width footprint and 5 acres for the Maximum Width footprint.

The majority of wetlands potentially impacted in the rail corridor are forested wetlands. Although the total acreage of potential impacts in the rail corridor is much smaller than the



I-81 total, all of the potentially impacted wetlands in the rail corridor were preliminarily identified as having relatively high functional values.

Wetland Impacts by Watershed

Federal and state regulations require that mitigation for unavoidable stream and wetland impacts be sought as close to the source of impact as possible and under most circumstances within the same watershed. As such, it is useful to consider wetland impacts in terms of the five major watersheds (see Table 5.9-5).

A large portion of I-81 travels through the Potomac-Shenandoah Rivers drainage basin. This watershed contains roughly 36 percent of the road segments by mileage and roughly 67 percent of the wetlands mapped within the I-81 study area. The same is true for the rail study area, as seven of the 13 rail improvement sections lie within this same watershed. Almost all of the acreage of potential wetland impacts found along the rail line occurs in this watershed. Potential wetland impacts in the I-81 corridor are also highest within this watershed.

Though the New River basin contains the second highest linear distance of I-81, the Holston River basin actually ranks second in terms of potential impacts to wetlands. This is primarily due to a landscape setting that promotes wetland development. The southern portion of the I-81 study area follows broad river valleys, such as the Middle Fork of the Holston River.

Table 5.9-5 Potential Wetland Impacts by Watershed

"Build" Concept	Holston River (Acres)	New River (Acres)	Roanoke River (Acres)	James River (Acres)	Potomac-Shenandoah Rivers (Acres)
Minimum Width	8	2	1	1	21
Maximum Width	8	3	2	5	33
Rail Concept 3	0	0	< 1	0	8

Permit Issues

Jurisdictional Status

The potential impacts to WOUS (including wetlands) presented herein are preliminary estimates and are not based on approved jurisdictional determinations made by any regulatory agency. The extent of jurisdictional areas would be confirmed later in project development if a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2. Potential impacts may be overestimated or underestimated in this Tier 1 study as a result of several factors. For example, ponds within the corridor classified as palustrine wetlands with unconsolidated bottoms (PUB) may or may not qualify as jurisdictional areas, depending in

large part on whether they were constructed in uplands. In addition, regulatory agencies may take jurisdiction over other water features, such as roadside ditches.

Type of Permits Needed

Streams and wetlands are considered jurisdictional waters of the United States. For a detailed discussion of federal and state regulations governing these waters, refer to the *I-81 Corridor Improvement Study Wetlands and Water Resources Technical Report*. Because each “Build” concept entails potential impacts to wetlands and streams, a variety of wetland and water quality permits would be required prior to construction, if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

These may include permits issued by the United States Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act for the placement of fill in wetlands. Under their program, the USACE also regulates activities that may affect Critical Resource Waters, including activities in wetlands adjacent to these waters. Critical Resource Waters include critical habitat for federally listed threatened and endangered species, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance. At the state level, permits would include Section 401 water quality certification from the Virginia Department of Environmental Quality (DEQ) carried out through the Virginia Water Protection Permit Program (VWPP).

Because many of the larger streams within the I-81 and rail corridors are considered “navigable waters”, they would also be regulated under Section 10 of the Rivers and Harbors Act. Permits may also be required from the U.S. Coast Guard to cross these navigable waters. Impacts to open-water bodies, such as Claytor Lake, would require a VWPP permit from the DEQ as well as a Subaqueous Lands permit from the Virginia Marine Resources Commission (VMRC) for those potential impact areas that were part of the original stream channel.

Because the Holston River watershed is within the larger Tennessee River watershed, the southern portion of I-81 is also under the purview of the Tennessee Valley Authority (TVA). Permits would also be required for activities that affect navigation, flood control or public lands along the shoreline of the Tennessee River or its tributaries in accordance with Section 26a of the Tennessee Valley Authority Act of 1933.

If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, the specific type of permits needed for construction would be identified.

Conceptual Mitigation

Tier 2 analyses would also evaluate avoidance and minimization measures if a “Build” concept (or portion of a “Build” concept) is advanced. During Tier 2, unavoidable impacts to jurisdictional waters of the United States (including wetlands) would be compensated as appropriate.

Appropriate for this Tier 1 analysis, mitigation was looked at conceptually. Compensatory mitigation can occur at the site of the impacts (on-site mitigation) or removed in distance from the impact site (off-site), typically in the same watershed. For areas within the larger Chesapeake Bay watershed, impacts would be mitigated within the Chesapeake Bay watershed in accordance with the Code of Virginia (§62.1-44.15:5). Mitigation can be in the form of ‘in-kind’ (mitigate with same kind of wetland being impacted) or ‘out-of-kind’ where the impacted wetland is replaced with a different kind of wetland.

A variety of options exist for providing compensatory mitigation including:

- the purchase of credits at a wetland mitigation bank;
- in-lieu fee contributions to the Wetland Trust Fund;
- joint partnerships for mitigation;
- wetland/stream preservation, enhancement, or restoration; and
- wetland creation.

While all of these options would be further explored during subsequent stages of project development if a ‘Build’ concept (or portion of a ‘Build’ concept) is advanced, a preliminary evaluation of potential stream and wetland mitigation sites was performed for this study. This was done during the windshield survey and via telephone interviews with representatives of the Natural Resources Conservation Service (NRCS) in field offices serving the study areas. Potential restoration sites identified during the windshield survey were selected based on observable characteristics alone. No attempt was made to determine if the landowner was amenable to mitigation efforts on his/her property. The purpose of this evaluation was to assess the general availability of potentially suitable mitigation opportunities described below.

Stream Restoration

Over 30 potential stream restoration sites were identified within the study areas, each with an estimated restorable length greater than 500 feet. Within the study area alone, these streams totaled 38,347 linear feet, or approximately 30 percent of the minimum amount of mitigation that would potentially be required. Stream bank instabilities in most of these streams continued beyond the limits of the study area. Extrapolating to the watershed level, these results suggest that substantial restoration potential is available. Discussions with NRCS officials confirmed this conclusion. Table 5.9-6 lists potential stream restoration sites identified during the windshield survey and through coordination with the NRCS. The total amount of compensation greatly exceeds the potential impacts in each watershed except the James River, but more detailed site searches may produce adequate compensation in this watershed as well.

Table 5.9-6 Potential Stream Restoration Sites by Watershed

Watershed	Potential Restoration Sites		Estimated Length of Potential Restoration (miles)	
	Field Survey	NRCS	Field Survey	NRCS
Holston River	Greever Branch Hall Creek Tattle Branch Unnamed (2)	Beaver Creek Cedar Creek Hutton Creek Spring Creek Wolf Creek	1.5	10 - 15
New River	Goose Creek Meadow Creek Mill Creek Pine Run Sloan Branch Unnamed (3)	N/A	2.7	0 - 100
Roanoke River	North Fork Roanoke River	N/A	0.2	0 - 5*
James River	Moore's Creek Renick Run	Big Calf Pasture River Little Calf Pasture River Maury River	0.5	0 - 10
Potomac- Shenandoah Rivers	Blacks Run Road Run Byers Branch Jordan Run Naked Creek Poague Run Pughs Run South Fork South River Town Run Unnamed (5)	Back Creek Middle River North River Opequon Creek South River	2.5	15 - 30
Total			7.4	25 - 160

* Estimate for Roanoke River watershed based on previous studies in Charlotte County

Wetland Creation, Restoration, Enhancement, and Preservation

According to coordination with NRCS officials, opportunities for wetland creation, restoration, enhancement and preservation exist in all the affected watersheds. More details on the opportunities within each watershed are included in the *I-81 Corridor Improvement Study Wetlands and Water Resources Technical Report*. In addition, during the windshield survey, nine sites deemed suitable for wetland mitigation were identified based on observable characteristics alone. Seven of the nine sites were classified as having between 5 and 20 acres of potential mitigation onsite or in lands immediately adjacent to an existing wetland. The remaining two sites were classified as having less than 5 acres of potential. This suggests between 45 and 140 acres suitable for compensation within the study area alone.

Each wetland was described in terms of the compensation opportunity it represents. These include wetland creation, restoration, enhancement, and preservation. The former two options usually result in both compensatory acreage and increases in functional values, whereas the latter two result in an increase in functional values alone. As such, 1 acre of wetland enhancement and preservation does not typically result in one unit of compensatory mitigation. Of the nine wetlands identified within the I-81 study area, it is estimated that 26 to 100 acres could be created or restored, producing the same number of credit acres. Between 21 and 80 acres of enhancement and preservation could be generated, each of which is likely worth less than 1 credit acre.

Table 5.9-7 summarizes the estimates of potential wetland mitigation acreage available in the affected watersheds. These results suggest that acquiring sufficient property for wetland compensation is possible within the impacted watersheds.

Table 5.9-7 Potential Wetland Mitigation Acreage by Watershed

Watershed	Windshield Survey			NRCS
	Sites Identified	Creation / Restoration Acreage	Enhancement / Preservation Acreage	Total Acreage
Holston River	3	8 – 30	8 – 30	20 – 40
New River	2	7 – 26	4 – 14	5 – 20
Roanoke River	0	0	0	20 – 30*
James River	1	5 – 20	0	0 – 50
Potomac-Shenandoah Rivers	3	6 – 24	9 – 36	100 – 300
Total	9	26 – 100	21 – 80	145 – 440

* Estimate for Roanoke River watershed based on previous studies in Charlotte County

Groundwater

Unmediated stormflow from road surfaces may contain heavy metals, road salts, nutrients, bacteria, and hydrocarbons (DMME, 2001) and may affect groundwater. All “Build” concepts would involve the addition of impermeable surfaces resulting in increased and potentially contaminated runoff. Since the Maximum Width footprint would have the largest amount of additional pavement and therefore the largest increase in runoff, it would have the greatest potential for affecting subsurface water quality. All improvements would require appropriate best management practices (BMPs) to attenuate stormflow and mediate pollutant loads. All such features would be designed and constructed in accordance with the *Virginia Erosion and Sediment Control Handbook, Third Edition* (DCR, 1992). Appropriate stormwater management to offset effects to groundwater would be addressed, if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

Much of I-81 lies within the Great Valley and follows the course of many major stream systems (e.g., Middle Fork of the Holston River, Beaver Creek, Peak Creek, and Purgatory Creek). “Build” concepts involving I-81 lie chiefly within “discharge” areas, where

groundwater is actively sustaining streamflow. This landscape position, coupled with the fact that these “Build” concepts involve the use of existing alignment to some degree, would result in comparatively minor impacts to groundwater recharge areas. The routing of any surface runoff into subsurface recharge points may be avoided and minimized to the maximum extent possible during subsequent design efforts.

“Build” concepts may also impact subsurface water quality if runoff is routed near a sinking stream or sinkhole. As underground karst features comprise the most productive aquifers in the I-81 study area, drainage outfalls should be carefully designed to avoid directly routing runoff into karstic features.

Railroad lines typically have negligible stormwater management infrastructure (with the exception of intermodal yards). If Rail Concept 3 is implemented in addition to highway improvements, impacts to subsurface water quality would be comparatively minor. This is because the ballast used as the foundation for rail tracks is permeable, allowing rapid infiltration of stormwater. However, the high porosity of the ballast results in low residence time for infiltrating water. It should not be assumed, however, that ballast filters potential contaminants in stormwater. If rail improvements are constructed, BMPs should be considered in areas where karst features lie near a rail line, particularly near areas where rolling stock is temporarily parked or trains are staged. Contaminants from leaky cars may accumulate in such areas.

The Piedmont rail sections are underlain primarily by relatively impermeable crystalline rock aquifers, composed of metamorphic rock. As groundwater is largely restricted to fracture flow and surfaces are not easily weathered, these aquifers are inherently less susceptible to groundwater contamination. Nevertheless, BMPs are recommended regardless of geologic setting, especially where train cars may be parked for long periods of time.

No sole-source aquifers would be impacted by any of the impact footprints in the I-81 or rail corridors.

Drinking Water Supplies

Groundwater Sources

Because groundwater is a primary source for drinking water along I-81, the potential impacts to groundwater noted in the preceding section apply herein. None of the “Build” concepts are expected to have substantial impacts to groundwater recharge areas or aquifers. An appreciable difference in impacts to groundwater drinking supplies is not expected between any of the “Build” concepts.

The Minimum and Maximum Width footprints would potentially impact a total of 15 public wells along I-81. The majority of the impacted wells are within the northern half of the corridor, particularly Rockbridge and Shenandoah Counties. Rail Concept 3 would not impact any additional public wells.

Impacts to public wells would be mitigated through direct replacement of active and functioning wells in another suitable location.

Surface Water Sources

Several of the streams that bisect I-81 are used for a source of drinking water to neighboring communities including the North River, Buffalo Creek, Maury River, New River, and the Middle Fork of the Holston River. No surface water intakes for these sources would be affected. Furthermore, instream flow quantities would not be permanently altered by any of the Minimum Width or Maximum Width footprints. Existing bridges over these streams would be widened where necessary and flows would be maintained in their current state.

In Smyth County, where the Middle Fork of the Holston River runs parallel to much of I-81, roadway widening associated with the Minimum Width and Maximum Width footprints avoids potential direct impacts to the river. However, the expanded roadway narrows the distance between the road and the river, reducing the width of the vegetated buffer that helps protect water quality in the river. During Tier 2 studies, if a “Build” concept (or portion of a “Build” concept) is advanced, additional design efforts may consider maximizing the distance between I-81 and the Middle Fork of the Holston River, particularly between Mileposts 35 and 40, and between Mileposts 47 and 48.

Two reservoirs are relatively close to I-81: Carvin Cove Reservoir and Claytor Lake. In Pulaski County, I-81 crosses over Peak Creek which is one of the upper reaches of Claytor Lake. I-81 also intersects several smaller streams that feed into the reservoir. For the I-81 impact footprints, widening of the interstate and its bridges over streams would not directly affect surface water flows for Claytor Lake although increased traffic volumes increase the potential for water quality impacts as a result of highway pollutant loads and possible contamination from accidental spills on the interstate. Similarly, I-81 crosses Carvin Creek, one of the tributaries to Carvin Cove Reservoir. While no direct impacts to stream flow are expected to occur as a result of widening I-81, improvements on I-81 increase the potential for additional pollutants reaching the reservoir.

The importance of surface waters for drinking water in the regions is evidenced by the fact that I-81 intersects 13 surface water protection zones for such drinking water supplies as the Middle Fork of the Holston River, Claytor Lake, New River, Roanoke River, and the South Fork of the Shenandoah River. If improvements are made, strict adherence to best management practices outlined in the *Virginia Erosion and Sediment Control Handbook, Third Edition* (DCR, 1992) should be implemented to protect surface waters along the I-81 corridor. Rail Concept 3 would potentially impact two surface water protection zones.

Both the Minimum Width and Maximum Width footprints would potentially impact four water facilities that treat, store, or pump drinking water supplies: the Washington County Service Authority pump/storage facility at Exit 14, the Pulaski County Public Service Authority water storage facility off of Exit 94, the Maury Service Authority pump facility at

Exit 205, and the Town of Mount Jackson pump facility south of Exit 273. Rail Concept 3 would not impact any additional water facilities.

Water Quality

Similar to groundwater quality, potential impacts to surface water quality would result from increased amounts of stormwater runoff from the expanded highway. Potential contaminants from road surfaces include toxic heavy metals such as copper, lead, and zinc; road salt and liquid calcium chloride; organic pollutants; suspended solids from tire and wear; sand applied to combat poor road conditions in the winter months; and others.

As noted in Chapter 4, some of the streams within the I-81 study area exhibit signs of having water quality above the state average because of their ability to support trout and other species that require good water quality conditions. The introduction of more stormwater runoff from additional highway surfaces would potentially result in a deterioration of water quality in the I-81 corridor. And, deterioration of water quality in these streams would potentially threaten the aquatic species in these streams that need good water quality conditions in order to survive.

Some of the streams, designated as impaired by DEQ, currently do not meet state standards for water quality. Two of these streams, Peak Creek and Carvin Creek, drain into water supply reservoirs (Claytor Lake and Carvin Cove Reservoir). Increased stormwater runoff from highway improvements could potentially result in further degradation of water quality in these streams.

Detailed impacts to water quality are dependent on specific engineering design details that have not been developed for this Tier 1 study. In general, water quality impacts would be similar for each "Build" concept. Since the Maximum Width footprint would have the largest amount of additional pavement and therefore the largest increase in runoff, it would have the greatest potential for affecting water quality in streams and lakes. The implementation of Rail Concept 3 along with highway improvements would slightly increase potential water quality impacts. More detailed analyses for water quality impacts to surface waters would be completed during Tier 2, if a "Build" concept (or portion of a "Build" concept) is advanced.

Water quality impacts would be minimized by proper erosion and sedimentation control practices in accordance with the *VDOT Erosion and Sediment Control (E & SC) and Stormwater Management (SWM) Program Manual (March 2004)*, and the Virginia Stormwater Management Program. BMPs would be required to treat waters before their release to streams or to retain them for slow infiltration to groundwater. If a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2, wherever possible, areas along I-81 or the rail lines having existing but antiquated BMPs, or areas altogether lacking BMPs, may be evaluated for updates during the design phase. With the implementation of appropriate stormwater management controls, relatively minor impacts to water quality are anticipated.

Floodplains

Floodplains are protected by Executive Order 11988: *Floodplain Management*. The purpose of this Executive Order is to prevent adverse impacts associated with the occupancy and modification of floodplains. The intent of these requirements is to ensure that work within the 100-year floodplain will not increase downstream flooding. Floodplains are regulated by the Federal Emergency Management Agency (FEMA) and administered by local floodplain management ordinances within individual localities. Potential effects on floodplains were completed at a level appropriate for Tier 1.

For this Tier 1 analysis, impacts to 100-year floodplains were calculated by overlaying the Minimum Width and Maximum Width footprint over GIS floodplain data. GIS data was available for six counties in the I-81 study area and three counties in the rail study area. This mapping was annotated by digitizing only major floodplains in the study areas for the remaining counties. Because floodplain limits were not available in GIS for all of the counties, impacts within the I-81 and rail corridors may be underestimated. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, future studies would refine these estimates.

Potential direct impacts to floodplains are assessed as the potential loss of floodplain area. Other impacts from the loss of flood storage or new obstructions within the floodplain could include an increase in depth or duration of flooding, or an increase in the lateral extent of flooding. The greatest potential impacts are anticipated where streams parallel the road or rail improvement areas, and the widening encroaches into floodplain areas. Impacts may also occur where new bridges are needed, especially at interchanges, and additional structures are placed into floodways. Fewer impacts are likely to occur at existing stream crossings, where existing bridges or structures would likely be widened. If a “Build” concept (or portion of a “Build” concept) is advanced, the type of impact at each specific floodplain would be characterized during Tier 2 when design features are more defined. In addition, appropriate compensation for floodplain impacts would be identified during Tier 2.

Table 5.9-8 summarizes potential floodplain impacts in the I-81 and rail corridors. Generally, the largest potential floodplain impacts along I-81 occur at those streams with the largest floodplains: the Middle Fork of the Holston River, Beckner Branch, and the Maury River. Rail improvements associated with Rail Concept 3 would potentially impact more than 50 acres of potential floodplain. The largest floodplain impacts are expected to occur in rail section 2 at the Middle Fork of the Holston River; rail section 7 at the confluence of the South Fork of the Shenandoah River and Happy Creek; rail section 8 and 9 at Goose Creek; and rail section 13 at White Oak Creek.



Table 5.9-8 Potential Impacts to 100-Year Floodplains¹

"Build" Concept	Total (Acres)	Major Rivers
Minimum Width	361	Middle Fork Holston River, New River, North Fork Roanoke River, Beckner Branch, James River, Maury River, South River, Middle River, Dry Fork
Maximum Width	458	Same as above
Rail Concept 3	50	Middle Fork Holston River, S. Fork of Shenandoah River, Banister River, White Oak Creek, Happy Creek, Goose Creek, Broad Run

¹ Based on limited GIS data

Wild and Scenic Rivers

There are no federally-designated Wild and Scenic Rivers in the I-81 or rail corridors.

In terms of the Virginia Scenic Rivers Program, the Minimum Width footprint and the Maximum Width footprint would potentially impact the five stream segments along I-81 that are designated as "worthy of further study" for acceptance into the Virginia Scenic Rivers Program. In addition, the one stream segment that has qualified for acceptance into the program, the New River south of I-81, would also be potentially impacted. If built in conjunction with highway improvements, Rail Concept 3 would not result in an appreciable increase in potential impacts to scenic rivers. It is not likely that minor rail improvements would compromise the scenic integrity of Goose Creek, the only potentially impacted river in the rail corridor designated as "worthy of further study" for acceptance into Virginia's Scenic Rivers Program.

Along I-81, approximately 5,000 linear feet of streams "worthy of further study" would be potentially impacted by both the Minimum Width and Maximum Width footprints. Potential impacts to the New River would be 1,800 and 2,300 linear feet for the Minimum Width and Maximum Width footprint, respectively. Because bridges currently span all relevant stream segments, it is not likely that the improvements would substantially reduce the scenic integrity of these rivers. For canoeists and others using the river, a wider bridge may be noticeable, but visual obstruction caused by a new bridge or additional lanes would be relatively minor compared to existing conditions. If impacts were experienced, they would be temporary in nature, occurring only in the vicinity of the existing bridge.

Wildlife and Habitat

Terrestrial Wildlife and Habitat

Each of the "Build" concepts would encroach upon habitats within the existing highway right-of-way as well as habitat within areas where additional right-of-way is required, particularly at interchanges. As discussed in Section 5.1, *Land Use*, up to 2,500 acres of forest cover and 5,100 acres of agricultural/pasture land cover would potentially be impacted as a

result of the Maximum Width footprints. Since it has the largest footprint, the Maximum Width footprint has the greatest potential for habitat disturbance along I-81. Forest cover and agricultural/pasture land are habitat types equally impacted by improvements in the rail corridor. Rail Concept 3 would potentially impact approximately 140 additional acres of each land cover.

Species preferring early successional habitat would incur the largest degree of habitat loss as a result of impacts to agricultural and pasture land in the I-81 and rail corridors. Species dependent on forest cover would be less impacted, such as the gray squirrel, striped skunk, box turtle, chipmunk, and white-tailed deer.

Because potential impacts to wetlands in the I-81 corridor are in large part associated with ditches, swales, and small pools, reptiles and amphibians would be the most affected wetland-dependent wildlife. Various frogs, water snakes, turtles, and salamanders utilize small pools and pond edges within these neighboring impact zones. Because they are sparse along I-81, species such as waterfowl and beavers that depend on higher quality wetland habitats are not expected to incur impacts. However, these species would potentially incur impacts in the rail corridor since wetlands potentially impacted by Rail Concept 3 provide higher functional values.

For the most part, the existing I-81 and rail right-of-way consists of previously disturbed areas maintained by crews. The habitat within these areas is dominated by grasses and woody forbs, open ditches and swales, and patches of hardwood forests. Habitat values for terrestrial wildlife immediately adjacent to the transportation corridors are low for most indigenous species because of maintenance activities, habitat alterations, and disturbances to animal behavior attributed to traffic as well as train noise. However, several species appear to show habituation to these transportation right-of-ways despite such disturbances. White-tailed deer, chipmunks, groundhogs, gray squirrels, cottontail rabbits, sparrows, slate-colored juncos, northern cardinals, turkey vultures, American crows, black rat snakes, and red-tailed hawks were commonly observed during field studies. Groundhogs, in particular, appeared to prefer the steep roadway embankments for burrowing and foraging.

Wildlife habitat would also be impacted where additional right-of-way is needed on I-81, particularly at interchanges. In some of these areas, highway improvements would infringe on previously undisturbed landscapes including upland forest and riparian forest cover. Near developed areas along I-81, including interchanges, potential impacts to wildlife habitat would be minimal.

Improvements to either I-81 or the rail lines are not expected to cause additional fragmentation of wildlife habitats since both transportation corridors already exist and have created a barrier for the movement of wildlife. If a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2, opportunities to enhance wildlife movement across improved transportation facilities would be considered as necessary.

During Tier 2 studies, if a “Build” concept (or portion of a “Build” concept) is advanced, opportunities to enhance wildlife and migratory bird habitat would be evaluated based on more detailed roadway and/or rail design efforts. Conceptually, such opportunities may include the protection and/or creation of natural areas (green zones), the restoration of upland forest habitat, as well as the establishment of forested riparian buffers next to streams and rivers.

Aquatic Habitat and Fisheries

Highway and rail improvements would potentially impact aquatic habitat and fisheries. In the I-81 corridor, the majority of potential impacts would occur in the numerous small man-made ponds that are in close proximity to I-81. Potential impacts would occur largely as a result of filling these ponds. The bridging of major streams and rivers would ensure that impacts to stream aquatic habitats are kept to a minimum.

Approximately 5,400 and 6,100 linear feet of stockable trout streams would be potentially impacted by the Minimum Width and Maximum Width footprints, respectively. These streams are:

- Beaver Creek: Mileposts 6 and 8
- Spring Creek: Milepost 13
- Berry Creek: Milepost 16
- Laurel Spring Creek: Milepost 43
- Folly Mills Creek: Milepost 220
- Opequon Creek: Milepost 310
- Redbud Run: Milepost 318

Rail improvements would potentially impact one wild trout stream segment, the Middle Fork of the Holston River in Smyth County.

Some bank stabilization and piling installation may be required at bridging points for all concepts, but the long-term effects of this work is not expected to impact fisheries populations. Likewise, the extension of culverts within existing fish habitat may cause the short-term loss of usable habitat; however, no changes in fisheries resources are expected provided culvert design does not impede fish migration. It is anticipated that pipes would be countersunk so as not to impede the movement of aquatic organisms. Of the 15 trout streams within the I-81 corridor, seven are spanned by bridges, seven are conveyed through culverts, and one does not intersect the current alignment. While it is more desirable to traverse trout streams with bridges, it may not be economically feasible to do so in all of these cases.

All “Build” concepts would require the scarification and exposure of soil during the construction phase. The potential for temporary impacts to fisheries habitat due to siltation and non-point source inputs generally remains the same for all concepts with highway improvements. The addition of rail improvements would add to the number of disturbed

areas, and in this respect, would add to the temporary impacts to fisheries resources. Nonetheless, if a “Build” concept (or portion of a “Build” concept) is advanced, all concepts would utilize proper sedimentation and control measures to include techniques such as silt fencing, hay bales, and temporary sediment basins.

Threatened and Endangered Species

This study evaluated the range of potential impacts to federal- and/or state-listed species. To determine potential impacts, the I-81 and rail impact footprints were overlaid on top of the various GIS data layers for previously identified threatened and endangered species to determine if any areas with listed species intersected the footprints. For purposes of this Tier 1 study, if the impact footprint overlapped any listed species areas, an impact was assumed.

The GIS analysis calculated the total number of threatened and endangered species potentially impacted; the number of times that individual populations of these species would potentially be impacted (occurrences); the acreage of potential impacts to natural heritage sites where state- and federal-listed species have previously been identified; and the linear feet of potential impacts to streams (“threatened streams”) with protected species. More detailed analysis of impacts would occur if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

Tables 5.9-9 and 5.9-10 present the potential impacts. Based on the analysis completed for this study, approximately 12 different threatened and endangered species would potentially be impacted by the Minimum Width and Maximum Width footprints. The largest number of impacts occur to aquatic fish and mussel species, many of which are found in the Middle Fork of the Holston River and the North Fork of the Roanoke River. Generally, the Minimum Width and Maximum Width footprints impact the same number of threatened and endangered species. In terms of threatened streams, however, the Maximum Width footprint would potentially impact almost three times as much of the Middle Fork of the Holston River and the North Fork of the Roanoke River as the Minimum Width footprint.

Based on the available information, it does not appear that Rail Concept 3 would directly impact known locations of listed species. However, potential impacts to listed species may be directly inferred from the fact that rail improvements would potentially impact less than 30 acres of natural heritage sites. Although the presence or absence of listed species cannot be confirmed in this database, it is possible that protected species are located in these natural heritage sites.

If a “Build” concept (or portion of a “Build” concept) is advanced, Tier 2 efforts would include Section 7 consultation with the USFWS to address avoidance and minimization measures in accordance with the Endangered Species Act, which requires agencies to consult with the USFWS to ensure that the proposed activities will not jeopardize any listed species or their critical habitat.

Table 5.9-9 Potential Impacts to Federal- and State-Listed Threatened and Endangered Species

Species and Location by County/City	Species Occurrence	
	Minimum Width	Maximum Width
Virginia Coil		
Pulaski/Montgomery/ City of Radford	1	1
Roanoke Logperch		
Montgomery/Roanoke/City of Salem	5	5
Orangefin Madtom		
Montgomery/Roanoke/City of Salem	16	16
James Spiny Mussel		
Botetourt	1	1
Little-wing Pearly Mussel		
Smyth	3	3
Slabside Pearly Mussel		
Washington/Smyth	1	1
Tan Riffleshell Mussel		
Washington/Smyth	3	3
Tennessee Heelsplitter Mussel		
Smyth/Wythe	3	3
Loggerhead Shrike		
Washington/Smyth/Botetourt	2	2
Smooth Coneflower		
Montgomery	1	1
Shaggy Coil Snail		
Rockbridge	1	1
Wood Turtle		
Rockbridge	1	1
TOTAL OCCURENCES	38	38
Streams With Threatened and Endangered Species		
Middle Fork of Holston River	4,152 linear feet	4,152 linear feet
North Fork of Roanoke River	567 linear feet	2,251 linear feet
Tinker Creek	679 linear feet	926 linear feet
Cedar Creek	367 linear feet	346 linear feet
TOTAL LENGTH OF STREAMS	5,765 linear feet	7,675 linear feet

Table 5.9-10 Potential Impacts to Natural Heritage Sites with Federal- and/or State-Listed Species

Site Name	"Build" Concept	
	Minimum Width	Maximum Width
Little Rock Glade (Exits 128-132)	0	0.5
Middle Fork Holston River-Sculpture Spring Creek SCU (Exits 32-39)	3.0	3.0
Middle Fork Holston River-Bear Creek SCU (Exits 45-54; rail section 2)	1.7	1.7
Unnamed site (Exits 213-222)	157	216
Unnamed site (Exits 247-257)	342	397
Unnamed site (Exits 257-273)	193	217
Unnamed site: Milepost 128	12.9	16.5
Unnamed site: Milepost 130	1.8	5.4
Unnamed site: Milepost 167	32.3	37.0
Total	744	894

SCU – Stream Conservation Unit

5.10 Air Quality

This section presents the results of an air quality study that evaluated the highest and lowest corridor-long air emissions from motor vehicle traffic and train trips associated with the improvement concepts. The air quality study's mesoscale (regional) analysis evaluated the change in volatile organic compounds (VOCs) and nitrogen oxides (NO_x), which are precursors to ozone, as well as particulate matter (PM_{2.5}) emissions in the study area for the Existing condition, the 2035 No-Build condition, and for the "Build" concepts in 2035.

If a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2, more detailed mesoscale and microscale analyses (for carbon monoxide concentrations) would be conducted, as appropriate. As discussed in Section 5.10.4, air quality conformity will be addressed in Tier 2, if a "Build" concept (or portion of a "Build" concept) is advanced into Tier 2.

5.10.1 No-Build and "Build" Concepts

The air quality study for motor vehicle emissions was performed in compliance with U.S. Environmental Protection Agency (EPA) modeling procedures. Traffic information (volumes, roadway lengths, and speeds) were developed for the Existing Year (2004) and the Design Year (2035) for the No-Build condition and for the Design Year (2035) for the "Build" concepts. The vehicle emission factors (*i.e.*, the amount of pollution attributed to each type of vehicle) used in the mesoscale analysis were obtained using the EPA's MOBILE6.2 emissions model.¹ MOBILE6.2 calculates emission factors from motor vehicles in grams per vehicle mile for existing and future conditions. The emission rates calculated were then adjusted to reflect Virginia-specific conditions, such as the vehicle age distribution and summer temperatures (because summer is the high ozone season).

The mesoscale analysis estimated the existing and design year VOC, NO_x, and PM_{2.5} emissions in the I-81 corridor based upon changes in vehicle miles of travel (VMT) and vehicle speeds. Table 5.10-1 presents the motor vehicle emission results for the Existing condition, the 2035 No-Build condition, and the 2035 "Build" concepts. The 2035 No-Build condition and the 2035 "Build" concept emissions of VOC, NO_x, and PM_{2.5} would be lower than the existing condition emissions because of the implementation of emission control programs, such as the Federal Motor Vehicle Emission Control Program.

The air quality study evaluated two "Build" concepts: 1) the Minimum Width footprint (with no toll) and 2) the Maximum Width footprint (with Rail 3 and high toll).

¹ MOBILE6.2 (Mobile Source Emission Factor Model), The May 2004 release from US EPA, Office of Mobile Sources, Ann Arbor, MI.

The Minimum Width footprint would increase motor vehicle volumes on I-81, which would result in small increases in VOC, NO_x, and PM_{2.5} emissions compared to the 2035 No-Build condition. The Maximum Width footprint (with Rail 3 and high tolls) would decrease VOC, NO_x, and PM_{2.5} emissions compared to the 2035 No-Build condition because it would reduce the number of vehicles traveling on I-81 either by diverting traffic to parallel roadways or by shifting freight traffic from trucks to rail.

Table 5.10-1 Potential I-81 Corridor Mesoscale Emissions

Condition	Emissions (tons/day)		
	VOC	NO _x	PM _{2.5}
Existing	12.92	36.57	0.51
2035 No-Build	7.43	8.78	0.33
2035 "Build" Concepts	Change in Emissions from 2035 No-Build (tons/day)		
Minimum Width (No Toll)	+0.36	+0.81	+0.02
Maximum Width (High Toll) with Rail 3	-1.24	-1.15	-0.05

5.10.2 Rail Corridor

The air quality study also evaluated locomotive emissions from train trips consistent with U.S. Environmental Protection Agency (EPA) modeling procedures. EPA has established emission factors (in grams per gallon of fuel used) for diesel powered locomotive.² The emission factors are based upon EPA's emission control requirements for locomotive engines. Locomotive emissions vary depending upon the size of engine, the size of the load being carried, the terrain over which the train is traveling, the age of the engine, and train operations. The emission rates calculated were adjusted to reflect EPA's emission standards for 2004 and 2035.

Train emissions of VOC, NO_x, and PM_{2.5} along the portions of the Shenandoah and Piedmont rail lines were estimated by using number of train trips, length of track, number of train engines, and locomotive engine emission rates for the 2035 No-Build condition and for the 2035 Rail Concept 3. Table 5.10-2 presents the mesoscale analysis results for the rail corridor for the Existing condition, the 2035 No-Build condition, and 2035 "Build" condition (Rail Concept 3). The No-Build VOC, NO_x, and PM_{2.5} emissions would be lower than the Existing condition emissions because of the implementation of EPA's national emission standards for newly manufactured and remanufactured locomotives. The 2035 "Build" condition rail emissions of VOCs, NO_x, and PM_{2.5} would be higher than the 2035 No-Build condition because additional trains would be necessary to carry the expected increases in freight that would result from freight being diverted from trucks on I-81 to rail.

² Environmental Protection Agency, *Emission Factors for Locomotives*, December 1997



Table 5.10-2 Potential Rail Corridor Mesoscale Emissions

Rail Corridor Section	Emissions (tons/day)		
	VOC	NOx	PM2.5
Existing No-Build			
Piedmont Line (Danville to Hagerstown, West Virginia):	0.96	19.52	0.61
Shenandoah Line (Bristol to Lynchburg):	1.42	29.08	0.90
Total	2.38	48.60	1.51
2035 No-Build			
Piedmont Line (Danville to Hagerstown, West Virginia):	0.43	7.75	0.26
Shenandoah Line (Bristol to Lynchburg):	0.64	11.53	0.39
Total	1.07	19.28	0.65
2035 "Build"			
Piedmont Line (Danville to Hagerstown, West Virginia):	0.63	11.35	0.38
Shenandoah Line (Bristol to Lynchburg):	0.72	13.06	0.44
Total	1.35	24.41	0.82

5.10.3 Combined Results

To properly evaluate the regional emission impacts from the range of "Build" concepts, the emissions from motor vehicles and locomotives must be summed. Table 5.10-3 presents the combined mesoscale analysis results for both the I-81 corridor and the rail corridor for the existing condition, the 2035 No-Build condition, the Minimum Width, and the Maximum Width footprints.

The Minimum Width footprint (no tolls) is expected to increase VOC, NOx, and PM2.5 emissions compared to the 2035 No-Build condition because of an increase in motor vehicles along I-81. The Maximum Width footprint (with Rail 3 and high tolls) would decrease VOC emissions but increase NOx and PM2.5 emissions as compared to the 2035 No-Build condition. The decrease in VOC emissions is caused by a decrease in motor vehicles along I-81. The increases in NOx and PM2.5 emissions is caused by the additional number of trains needed to carry the expected increase in freight resulting from the shift of freight traffic from trucks on I-81 to rail.



Table 5.10-3 I-81 Corridor/Rail Corridor Mesoscale Emissions

Condition	Emissions (tons/day)		
	VOC	NOx	PM2.5
Existing	15.31	85.17	2.02
No-Build	8.50	28.05	0.98
Improvement Concepts	Change in Emissions from 2035 No-Build (tons/day)		
Minimum Width (No Toll)	+0.36	+0.81	+0.02
Maximum Width (High Toll) with Rail 3	-0.95	+4.0	+0.13

Additional air quality effects could occur on U.S. Route 11 throughout the study area as a result of changes in traffic volumes along I-81 and/or as a result of changes in rail traffic volumes along the Shenandoah and Piedmont rail lines (see Section 5.14, *Indirect Impacts*).

5.10.4 Air Quality Conformity

The 1990 Clean Air Act Amendments (CAAA) and the Virginia State Implementation Plan (SIP) require that a proposed project not cause any new violation of the National Ambient Air Quality Standards (NAAQS), or increase the frequency or severity of any existing violations, or delay attainment of any NAAQS. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, a detailed air quality analysis would be conducted. Any individual projects would have to conform to the NAAQS before they could be implemented.

5.11 Noise

The noise analysis for this Tier 1 study identified noise-sensitive areas that would be impacted by the No-Build and the range of “Build” concepts. For the analysis, noise-sensitive land uses were first identified (see Section 4.10, *Noise*). Second, future transportation-related noise levels were estimated using models developed by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), and impacts were identified following the impact criteria in VDOT’s State Noise Abatement Policy (1997) and FTA guidance. The Tier 1 noise analysis focuses on the Minimum Width footprint with low toll, and the Maximum Width footprint with no toll and with Rail Concept 3. The analyses of highway and rail noise are presented separately in the following sections, followed by an analysis of combined highway and rail noise at locations where the both the highway and rail facilities are close to each other.

5.11.1 Definition of Noise Impacts

Highway Noise Impacts

In interpreting FHWA policy, VDOT identifies noise impacts as noise levels that approach or exceed the federal Noise Abatement criterion of 67 dBA (contained in 23 CFR 772). Therefore, receptors receiving noise levels of 66 dBA or greater are considered to be impacted. For purposes of this study, noise impacts were assumed for those noise-sensitive receptors located within the 66 dBA contour for the No-Build and “Build” concepts. Highway Noise Modeling and Assumptions are discussed in detail in the *I-81 Corridor Study Noise Technical Memorandum*.

Rail Noise Impacts

In accordance with the General Noise Assessment method, rail noise impacts were defined by comparing No-Build rail traffic noise levels with future “Build” rail traffic noise levels. FTA defines a noise impact as occurring when noise levels exceed 65 dBA L_{dn}. Sensitive noise receptors that would be exposed to noise levels in excess of 65 dBA L_{dn} were identified. Rail Noise Modeling and Assumptions are discussed in detail in the *I-81 Corridor Study Noise Technical Memorandum*.

5.11.2 Impact Assessment

Highway Noise

Potential highway noise impacts were determined by plotting the distance to the 66 dBA L_{eq} contour for the No-Build and “Build” concepts in GIS and counting the noise-sensitive receptors between the highway and the contour. Generally, the “Build” concepts would create a highway facility with an increased number of traffic lanes that are closer to noise-sensitive receptors in the I-81 study area. Therefore, the “Build” concepts produce more



noise than the No-Build Concept and would result in 66 dBA Leq contours that are more distant from the highway centerline and would encompass greater numbers of noise-sensitive receptors. Table 5.11-1 presents the results of this analysis.

Table 5.11-1 Summary of Potentially Impacted Noise-Sensitive Receptors: 66 dBA Leq Noise Contour for I-81

Concept	FHWA Activity Category				Total ¹	Additional Impacts to Receptors Compared to No Build
	Residences (B)	Parks (B)	Schools/Colleges (B)	Historic Resources (B)		
No-Build	3,504	17	3	16	3,540	N/A
Minimum Width with Low Toll	7,512	19	7	17	7,555	4,015
Maximum Width with No Toll and with Rail 3	8,584	20	9	17	8,630	5,090

¹ Totals include impacts to sensitive receptors for I-81 only. Combined highway and rail impacts for the Maximum Width footprint are shown in Table 5.11-3.

A detailed summary of potentially impacted receptors by county and location is presented in the *I-81 Corridor Study Noise Technical Memorandum*.

Rail Noise

To identify potential noise impacts, noise-sensitive receptors within the 65 dBA L_{dn} noise contours for the No-Build and Maximum Width footprint were counted. Table 5.11-2 lists the noise receptors that would be within the 65 dBA L_{dn} contour and shows where additional impacts would occur from this footprint.

Table 5.11-2 Potential Impacts to Noise-Sensitive Receptors: 65 dBA L_{dn} Contour for Rail

Concept	FTA Land Use Category					Total
	Parks/Recreation (1)	Residence (2)	Schools/Colleges (3)	Cemetery(3)	Library(3)	
Noise Receptors within 65 dBA Contour for the No-Build Concept	44	6,048	7	1	2	6,102
Noise Receptors within 65 dBA Contour for the Maximum Width footprint	37	3,982	6	1	2	4,028
Additional Number of Receptors Impacted by Noise as Result of the Maximum Width footprint	0	137	0	0	0	137

A detailed summary of potentially impacted receptors by county and location is presented in the *I-81 Corridor Study Noise Technical Memorandum*.



5.11.3 Combined Highway and Rail Noise Analysis

Between the City of Bristol and Roanoke County, overlap areas exist along the Shenandoah line and I-81 where the highway and rail corridors are close enough to be additive. In this case, modeled highway and rail traffic-related noise levels were combined. Combined noise effects would occur with the Maximum Width footprint, which includes a rail component that results in increases in rail traffic in some sections of the rail corridor.

The distance to the 66 dBA contour for the combined effects of highway and rail traffic was determined for each area to identify potential additional impacts to noise-sensitive receptors not inventoried in the separate highway and rail analyses. One hundred twenty-three additional residential noise-sensitive receptors were identified within the expanded 66 dBA Leq noise contour that would result from the combined highway and rail noise in these locations. Nine of these potential impacts would occur between Exits 5 and 7, 113 between Exits 34 and 54, and one between Exits 118 and 128.

5.11.4 Noise Summary for All Concepts

Table 5.11-3 presents a consolidation of the potentially impacted sensitive receptors for the improvement concepts. This consolidation is presented because of the different evaluation criteria used for highway and transit projects. Table 5.11-3 details the potentially impacted receptors for the Minimum Width footprint similar to that previously presented in Table 5.11-2. However, the totals for the Maximum Width footprint in Table 5.11-3 include the combined number of potentially impacted receptors for both highway and rail improvements.

Table 5.11-3 Summary of Potentially Impacted Noise-sensitive Receptors: Combined I-81 and Rail

Concept	Activity Category (FHWA/FTA) ¹				Total	Additional Impacts to Receptors compared to No-Build
	Residences (B/2)	Parks ² (B/1)	Schools/ Library (B/3)	Historic Resources (B/1)		
No-Build	3,504	17	3	16	3,540	N/A
Minimum Width (Low Toll)	7,512	19	7	17	7,555	4,015
Maximum Width (No Toll) with Rail	12,566	57	17	17	12,657	9,118

¹ The Minimum Width footprint considers FHWA activity category; the Maximum Width footprint considers both FTA and FHWA Activity Categories.

² Parks include all recreational facilities such as golf courses, tennis courts, ballfields, and basketball courts.

³ Number of impacted receptors represents combined noise effects from road and rail sources.

Additional noise effects could occur on U.S. Route 11 throughout the study area as a result of changes in traffic volumes along I-81 and/or as a result of changes in rail traffic volumes along the railway Shenandoah and Piedmont rail lines, additional noise effects could accompany the changes in traffic volumes on parallel U.S. Route 11 throughout the study

area. The analysis of these indirect noise impacts would be investigated if a “Build” concept is selected to be advanced into Tier 2.

5.11.5 Noise Mitigation

FHWA’s guidelines require that noise mitigation measures be evaluated for the receptor locations where adverse noise impacts have been identified. These measures can include traffic management, alteration of horizontal and vertical alignment, acquisition of property to serve as a buffer zone, construction of a noise barrier, and noise insulation of public buildings. The feasibility of these mitigation measures would be investigated if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

5.12 Hazardous Materials

Sites with known potential hazardous materials concerns were analyzed by overlaying hazardous waste site GIS data on top of the I-81 and rail footprints. The following section describes the known contaminated or potentially contaminated sites that may be affected by each improvement concept.

Hazardous waste sites pose a potential liability concern. Purchasing contaminated properties may result in clean-up costs, as well as other liabilities including compensation to surrounding property owners that were impacted by the hazardous waste, all of which may result in increased construction costs. The presence of contaminated soils or groundwater may also affect worker health and safety, and would require preparation of a specific Health and Safety Plan.

For this Tier 1 study, hazardous materials concerns were based on previously identified hazardous waste sites. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, additional field investigations would be conducted prior to initiation of construction activities to identify suspected hazardous waste sites and to characterize the extent of possible contamination from all known or suspected sites.

5.12.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. Based on available GIS data, there are no CERCLA, TRI, solid waste landfills, or heavy industrial operations in the vicinity of the highway improvements. The only hazardous materials sites in the vicinity of the funded projects include two petroleum tanks in and around Exit 142 in Roanoke County, and one petroleum tank and one RCRA site both west of the I-81 study area at Milepost 313 in Frederick County.

Since they involve federal funding, potential effects from hazardous waste sites associated with these improvements have either been addressed or will be addressed in NEPA documents prepared independently of the *I-81 Corridor Improvement Study*. Since limited right-of-way would be required for these improvements, it is assumed for purposes of this Tier 1 study that the No-Build Concept would have minimal effects associated with hazardous materials.

5.12.2 “Build” Concepts

Potential impacts to RCRA and TRI sites are summarized in Table 5.12-1 below.



Table 5.12-1 Potential Impacts to Hazardous Materials

Hazardous Materials Concerns	Minimum Width	Maximum Width	Rail Concept 3
RCRA Sites	8	8	0
TRI Sites	1	1	0
Total	9	9	0

RCRA Sites

The Minimum Width and Maximum Width footprints would potentially impact eight RCRA sites in the I-81 corridor. They are: Cummins Cumberland, Inc. in Washington County, three sites on the western side of Exit 118 in Christiansburg (two gas stations and three properties that are part of a 55-acre automobile dealership), three sites in Harrisonburg at Exit 243 (Harrisonburg Auto Auction, Truck-Thermo King, Inc., and Truck and Equipment Corporation), and the Exxon at Exit 307 in Frederick County.

Available database information on hazardous materials would be queried again to update this information if a “Build” concept (or portions of a “Build” concept) is advanced into Tier 2. In addition, more detailed studies would be completed to more accurately characterize the extent of potential soil and/or groundwater contamination from any impacted RCRA sites. Discovery of such contamination would eventually result in the removal and proper disposal of contaminated soil and/or groundwater prior to initiation of construction activities.

Toxic Release Inventory Sites

The Minimum Width and Maximum Width footprints would potentially impact one TRI site, namely Stowe Woodward on Valley Pike in Frederick County. Based on the information used for this study, no other TRI sites would be impacted within either the I-81 or rail corridors. Data would be updated and additional investigations would be conducted as necessary if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.

5.13 Energy

The traffic diversion analysis indicated that the range of improvement concepts would result in changes to vehicle-miles-traveled (VMT). This section presents the changes to regional energy consumption related to these changes in VMT. The change in energy consumption was estimated by dividing the change in VMT by an average fuel efficiency figure for automobiles¹ and by estimating the fuel usage from changes in train volume and locomotive vehicle characteristics attributable to the range of improvement concepts. Energy consumption was evaluated for the Existing condition, the 2035 No-Build condition, and for the following 2035 “Build” conditions: Minimum Width footprint (no toll), Maximum Width footprint (high toll and with Rail Concept 3), and Rail Concept 3.

5.13.1 I-81 Corridor

The energy analysis estimated the future I-81 corridor fuel usage from changes in average daily traffic volume and vehicle mileage characteristics. Table 5.13-1 presents the results of the energy analysis for the Existing condition, No-Build condition and the “Build” concepts. The future No-Build condition fuel usage would be higher than the Existing condition because traffic is expected to grow over the time period.

The energy analysis evaluated the two footprints that result in the maximum and minimum energy impacts for the range of improvement concepts. The Minimum Width footprint with no tolls would result in the highest increase in energy usage because this concept would have the highest VMT and the lowest vehicle speeds. The Maximum Width footprint (with Rail Concept 3 and high toll) results in the lowest increase in energy usage because this concept would have the lowest VMT and the highest vehicle speeds.

The Minimum Width footprint with a no toll scenario would increase motor vehicle volumes on I-81, which, in turn, would increase fuel consumption compared to the No-Build condition. The Maximum Width footprint incorporating Rail Concept 3 and high tolls is expected to decrease fuel consumption as compared to the No-Build condition because of the reduction in the number of vehicles traveling on I-81 by shifting freight traffic from trucks to rail.

¹ Calculation assumed 27.5 miles per gallon for passenger vehicles as stated in the Corporate Average Fuel Efficiency standards set by the National Highway Traffic Safety Administration.



Table 5.13-1 Potential Energy Consumption on I-81 Corridor

Concept	Yearly VMT (in millions)	Total Gallons of Fuel per Year (in millions of gallons)
Existing	4,039	111,076
2035 No-Build	8,049	221,338
"Build" Concept	Change in Yearly VMT from 2035 No-Build (in millions)	Change in Fuel Usage from No-Build (in millions of gallons)
Minimum Width (No Toll)	+567	+15,588
Maximum Width (High Toll with Rail Concept 3)	-1,200	-33,004

5.13.2 Rail Corridor

Locomotive fuel consumption can vary depending upon the size of engine, the size of the load being carried, the terrain over which the train is traveling, the age of the engine, and train operations. Gallons of diesel fuel per mile were estimated from Federal Railroad Administration’s estimates of diesel fuel rates for diesel powered locomotives and were adjusted to reflect engine and fuel improvements for 2035.

Fuel consumption within the portions of the Shenandoah and Piedmont rail lines were estimated by using number of train trips, length of track, number of train engines, and fuel rates. Table 5.13-2 presents the energy analysis results for the rail corridor for the Existing condition, the 2035 No-Build condition, and Rail Concept 3. The future No-Build condition fuel usage would be lower than the Existing condition because expected improvements in engine performance over time.

For Rail Concept 3, fuel consumption would be higher than the No-Build condition because additional train trips would be necessary to carry the expected increase in freight.

Table 5.13-2 Potential Energy Consumption on Rail Corridor

Rail Corridor	Yearly VMT (in millions)	Total Gallons of Fuel per Year (in millions of gallons)
Existing		
Piedmont Line	2.47	29.64
Shenandoah Line	3.68	44.14
Total	6.15	73.79
2035 No-Build		
Piedmont Line	2.47	22.23
Shenandoah Line	3.68	33.11
Total	6.15	55.34
2035 "Build"		
Piedmont Line	3.62	32.60
Shenandoah Line	4.17	37.52
Total	7.79	70.12

5.13.3 Combined Results

To evaluate the total regional energy consumption from the "Build" concepts, the regional fuel consumption from motor vehicles and locomotives must be added. Table 5.13-3 presents the combined energy analysis results for both the I-81 corridor and the rail corridor for the Existing condition, the 2035 No-Build condition, the Minimum Width, and the Maximum Width footprints. Mobile source fuel consumption consists mainly of gasoline while the locomotive fuel consumption consists of diesel fuel only. For the purposes of this energy analysis, the fuel consumption from both sources were added as if they were equivalent.

The Minimum Width footprint with no tolls is expected to increase fuel consumption as compared to the No-Build condition because of the increase in VMT. The Maximum Width footprint (with Rail Concept 3 and high toll) is expected to decrease fuel consumption as compared to the No-Build condition because of the decrease in VMT along I-81.



Table 5.13-3 Potential Energy Consumption for Combined I-81 Corridor/Rail Corridor

Concept	Yearly VMT (in millions)	Total Gallons of Fuel per Year (in millions of gallons)
Existing	4,045	111,150
2035 No-Build	8,055	221,393
"Build" Concept	Change in Yearly VMT from 2035 No-Build (in millions)	Change in Fuel Usage from 2035 No-Build (in millions of gallons)
Minimum Width with No Toll	+567	+15,588
Maximum Width with High Toll and with Rail Concept 3	-1,199	-33,989

5.14 Indirect Impacts

This section examines the potential indirect impacts of the improvement concepts. Indirect impacts are “caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 CFR Section 1508.8).

Indirect impacts typically include impacts to human and natural systems from changes in land use patterns or growth rate accelerations that are induced by proposed plans. Assessing indirect impacts requires establishing time and geographic boundaries for the study. For purposes of this Tier 1 study, the project design year of 2035 is taken as the planning horizon. Potential indirect impacts were estimated for the I-81 study area and adjacent U.S. Route 11. Since the improvements along the rail study area are relatively minor, it is assumed for this Tier 1 study that potential indirect impacts associated with Rail Concept 3 would be minimal and are not included in this discussion.

For the Tier 1 study, potential indirect impacts were broadly considered because of the corridor-length decisions that may be made about highway alignment, construction footprints, and the amount of right-of-way that may be needed. If a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2, potential indirect impacts would be evaluated in greater detail commensurate with more detailed information on travel lane and interchange configurations. At that time, additional coordination would occur with officials in each county.

5.14.1 No-Build Concept

The No-Build Concept would generally maintain the existing conditions on I-81 with the exception of 16 federally-funded minor highway improvements as described in Chapter 3, *Improvement Concepts*. Since these projects are relatively minor, potential indirect impacts are not expected to occur with the No-Build Concept.

5.14.2 “Build” Concepts

The following paragraphs describe traffic volumes along U.S. Route 11 and its related effects on air quality and noise; and potential indirect impacts on land use, socioeconomic, natural resources, and historic properties. For purposes of this Tier 1 study, induced development is defined as development that would not occur simply as a result of implementing any of the “Build” concepts, but rather as development that *could be encouraged* if the facilities necessary for development are provided as a result of the “Build” concepts (*e.g.*, water and sewer lines, access to the interstate, and access to new growth areas).



Traffic Along U.S. Route 11 and Other Facilities

Traffic volumes on U.S. Route 11 and other facilities would potentially be affected as a result of the I-81 improvements. Detailed information is provided in the *I-81 Corridor Improvement Study Transportation Technical Report*.

Approximately 50 percent of the diverted traffic would use U.S. Route 11. For the “Build” concepts with high tolls, the greatest impacts (higher traffic volumes) are projected on U.S. Route 11 between Bristol and the Smyth County/Wythe County line. Areas with moderate traffic volume increases would be between the Smyth County/Wythe County line and Wytheville, between the Botetourt County/Rockbridge County line and Lexington, between Mauzy (Exit 257) and Woodstock, and between Middletown (Exit 302) and Kernstown (Exit 310).

For the “Build” concepts with low tolls, moderate traffic volume increases occur on U.S. Route 11 only at two segments near the two ends of the corridor: 1) between Bristol and the Smyth County/Wythe County line, and 2) between Middletown (Exit 302) and Kernstown (Exit 310).

Potential indirect impacts to air quality along U.S. Route 11, other local roads, or interstates, are not expected, despite the diversion of traffic to these roads from improvement concepts with tolls. This is because the number of vehicles traveling on U.S. Route 11 and other roads would not be substantially changed from 2035 No-Build conditions on those roadways. Similarly, potential indirect impacts to noise levels are not expected to occur because the number of vehicles traveling along U.S. Route 11 would not represent a substantial change from future No-Build conditions.

Approximately 50 percent of traffic diverted off of I-81 as a result of tolls would use U.S. Route 11. Based on a qualitative evaluation of the potential effects on the environment from traffic diverting to U.S. Route 11 and other local roads, the impacts are not anticipated to be substantial because the number of vehicles traveling on U.S. Route 11 would not be substantially changed from future conditions. The remaining diverted traffic would be spread out among the roadway network, including other interstates such as I-64 and I-95. About 14 percent of traffic diverted off of I-81 would use I-95 as an alternate route, and approximately 15 percent would use I-65/I-64/I-79. These diversions are not expected to have a measurable impact to traffic operations on parallel interstates. Therefore, the environmental impacts on parallel interstate facilities as a result of toll diversion would be inconsequential.

Land Use

For this Tier 1 study, the potential indirect impacts to land use are based largely on communication with local planning officials in each county in the I-81 study area. Planning officials were queried concerning two issues: the potential for any of the “Build” concepts to induce development along I-81, and whether tolls on I-81 would induce development on



U.S. Route 11 as a result of increased numbers of motorists using U.S. Route 11 as an alternate route to avoid tolls.

Generally, potential indirect impacts to land use would be limited because the “Build” concepts would not be creating a new transportation facility on a new location, but would be implementing improvements to an existing facility. Additionally, many of I-81’s access points are already developed. However, the land use category that may be most affected by induced development along both I-81 and U.S. Route 11 is agricultural land. Where the “Build” concepts encourage development, a possible indirect impact to land use includes a reduced value of agricultural land adjacent to newly-developed land. Despite any potential development pressures concerning agricultural land, local governing bodies control the land use within their jurisdictions. As such, any induced development would be regulated by the localities in the study area through their zoning ordinances and comprehensive plans.

As Table 5.14-1 below illustrates, communication with local planning officials revealed varying responses. Planning officials along I-81 agreed that the approach described above was appropriate for documenting county-specific potential indirect impacts to land use.

Socioeconomics

In considering the potential indirect impact on local and regional economies, the “Build” concepts are anticipated to have a similar potential for induced development along I-81. As Table 5.14-1 illustrates, many local planning officials do not anticipate development to occur along I-81 and U.S. Route 11, regardless of whether a “Build” concept is constructed. In many localities, the potential for induced development would be countered by comprehensive plans which seek to concentrate growth near existing development or near proposed growth areas. Thus, in many locations, the potential for induced development along I-81 and U.S. Route 11 to augment the local and regional economies would be reduced, if not eliminated.

Additionally, the ability to attract and retain new commercial and industrial development may be compromised along I-81 by the adverse effects that tolling may have on businesses and employment growth. Furthermore, technology-intensive industries are locating to metropolitan centers, a feature that is largely absent in the study area. Overall, the lack of high-paying, technology-driven employment centers hinders the ability of the localities’ to attract and retain a younger labor force that seeks to build a future in the communities that line the corridor.

Nevertheless, if a “Build” concept is constructed, positive short-term indirect impacts to the local and regional economies could be experienced in the form of construction spending. Improved highway accessibility and service levels may improve access to the western portions of Virginia and increase employment opportunities. Additionally, commercial development (particularly service-related) may increase at signalized intersections.



Table 5.14-1 Potential Indirect Impacts to Land Use

County	Potential for Induced Development Along I-81	Potential for Induced Development Along U.S. Route 11 Due to Tolls
Washington	The Bristol to Abingdon segment is a candidate for growth, though it is unclear if any growth would occur.	Tolls would further deteriorate LOS on U.S. Route 11; large disincentive for industrial and commercial development – particularly retail.
Smyth	Little developable land along the corridor because of steep slopes; however, “Build” concepts with rail improvements may aid companies that rely on rail for importing materials.	Development may include small businesses, but larger retailers would lack adequate space; traffic would not increase noticeably if tolls are waived for local traffic.
Wythe	Improvements could entice trucking companies.	From Smyth County line to Wytheville – development not expected to occur; from Wytheville east to Pulaski County line – U.S. Route 11 is approximately 100 feet from I-81 and would have to be relocated to accommodate the new I-81 footprint.
Pulaski	Commercial development may occur; tolling would be a deterrent to any new industries.	Potential for development because of access to infrastructure; but most traffic would only be passing through.
Montgomery	More commercial development would occur at interchanges if traffic levels on I-81 increase.	Additional development may occur in Shawsville and Elliston if tolls are implemented on I-81.
Roanoke	Commercial and industrial development would be assumed to occur along I-81.	Increased development on U.S. Route 11 due to tolls on I-81.
Botetourt	Development not expected to occur.	Availability of public infrastructure (water and sewer) would dictate development.
Rockbridge	Development not expected to occur.	Development not expected to occur.
Augusta	Development not expected to occur.	Development not expected to occur.
Rockingham	Development unlikely to occur because of strict agricultural zoning; would take a specific request to rezone land.	If the comprehensive plan is followed and infrastructure is available, development is likely regardless of tolls.
Shenandoah	Development not expected to occur if only adding one lane with no tolls; other concepts would affect battlefields and agricultural/forestral districts.	Development not expected to occur if no tolls are imposed; high and low tolls are expected to increase traffic and some development may occur.
Warren	Development not expected to occur.	Development not expected to occur.
Frederick	Industrial/manufacturing development may occur.	Development not expected to occur.

Natural Resources

Where it may occur, induced development along both I-81 and U.S. Route 11 has the potential to affect natural resources. Since U.S. Route 11 parallels I-81, indirect impacts to these resources that may occur as a result of induced development along U.S. Route 11 are likely to be similar to indirect impacts along I-81. Potential indirect impacts to water quality for



Carvin Cove Reservoir and Claytor Lake could include an increase in highway pollutant loads from increased traffic volumes on I-81, and along U.S. Route 11, if a “Build” concept with tolls is constructed. Additionally, accidental spills from increased truck traffic on I-81 may also indirectly affect the water quality of these resources. Furthermore, increased traffic along I-81 and U.S. Route 11 may indirectly affect threatened and endangered species found in the Middle Fork of the Holston River and the North Fork of the Roanoke River. The Roanoke logperch, orangefin madtom, and a variety of mussels species may be indirectly affected by diminished water quality from highway construction and increased pollutant loads being introduced to these rivers.

Historic Properties

Some historic properties may be determined to be noise-sensitive receptors. Potential indirect impacts to historic properties may occur as a result of increased traffic along U.S. Route 11. Although truck traffic along U.S. Route 11 is not expected to represent a substantial increase from current conditions, the noise generated by this traffic could potentially affect activities, features or attributes of some historic properties that qualify them for protection under Section 4(f). Additionally, the increase in truck traffic could alter the character of historic properties’ setting when that character contributes to the property’s significance.

5.15 Cumulative Impacts

Cumulative impacts are defined as “the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

Table 5.15-1 provides a listing of substantial improvement projects on I-81 (defined as those that required additional right-of-way), and other known projects that have occurred in the vicinity of I-81 and in the vicinity of the rail improvement areas since 1980, approximately 10 years after completion of the original I-81 construction. At that time, major highway improvements to I-81 were initiated to upgrade the interstate. The past projects include major improvements to I-81, as well as development that occurred along I-81, such as residential development near Salem and Harrisonburg and commercial development at numerous interchanges listed below. Since many of the 13 rail improvement areas are in undeveloped areas, major past projects are limited to residential and commercial development in northern Virginia after the completion of construction of I-66. Table 5.15-2 lists future projects foreseeable to the 2035 planning horizon and includes projects proposed by local planning departments along I-81.

The purpose of the cumulative impact analysis is to determine whether any of the improvement concepts, considered with previous and foreseeable impacts, would degrade a resource and biological diversity, or produce social or economic effects that would not occur if the improvement concepts were considered in isolation. Table 5.15-3 presents a comparison of the major past project effects, potential effects of future projects, and anticipated effects of the improvement concepts at a conceptual level. For this Tier 1 study, the comparison is qualitative; that is, impacts of past and future projects were not quantified. A more detailed and quantitative cumulative impact analysis would be performed if a “Build” concept (or portion of a “Build” concept) is advanced into Tier 2.



Table 5.15-1 Major Past Projects

Location	Approximate Date	Project Description
Mileposts 0 to 7	1997	Constructed an additional northbound and southbound lane
Mileposts 72 to 81	1984	Constructed a northbound and southbound lane at I-77 overlap
Exit 118	1996	Constructed Collector-Distributor road, extra lanes, and a new access point
Exit 140	1979	Construction of interchange
Milepost 140.5	1994	Widening of Mason Creek bridges
Exit 146	2000	Advanced purchase of right-of-way
Milepost 148.5	1987	Upgrading of truck weigh scales
Exit 150	1984 1990-2000	Reconfiguration of interchange and new ramps Development of commercial conveniences (hotel, gas stations, restaurants); construction of Route 220 Alternate
Exit 220	1979	Constructed interchange at Route 262
Exit 240	1993 2004	Relocated interchange Construction of Wal-Mart distribution facility at Mt. Crawford
Milepost 244	Late 1990's	Residential development and construction of the Ramblewood Fields Softball Complex along northbound I-81
Exit 245 and Surrounding Area	Mid-1980 – late 1990s	Construction of academic and residential buildings along northbound I-81 at James Madison University; apartment complexes constructed along northbound I-81 at interchange
Exit 296	1989	Constructed ramps
Exit 310	1977	Constructed interchange at southern end of Route 37
Exit 321	2001	Upgraded interchange
Rail Sections 8, 10, & 11	1980 - present	Residential and commercial development along I-66



Table 5.15-2 Future Projects

Location	Project Description
Exits 5, 7, and 14	Commercial development
Exits 35, 39, and 47	Industrial development
Exit 50	Residential development (retirement home)
Exit 60	Expansion of lumber operation
Exit 73	Establishment of 1,200-acre industrial park
Exits 73 to 77	Development of 40-acre inland port for rail shipments
Exit 105	Industrial and residential development
Milepost 109	Grade change at ramp termini
Milepost 142	Widen with signals at Route 419 ramps
Milepost 162	Widen northbound and southbound bridge
Milepost 180	Bridge and approaches
Milepost 185	Northbound and southbound approaches and bridges over Buffalo Creek; northbound truck climbing lanes
Milepost 191	Northbound and southbound approaches and bridges over Maury River
Exit 205	Industrial development along northbound I-81 at Raphine
Milepost 244	Replace and widen bridge (to 4 lanes) and improve safety
Exit 250	Commercial development (gas station and convenience stores)
Exit 296	Industrial expansion at Strasburg
Exits 307 and 310	Safety improvements
Milepost 313	Widen northbound and southbound bridges over Abram's Creek and extend acceleration and deceleration lanes; improve interchange safety
Exits 315 and 317	Safety improvements
Milepost 320	Extend southbound rest area acceleration lanes and improve safety
Milepost 323	Widen bridge and improve safety
Rail Sections 8, 10, & 11	Residential and commercial development



As shown in Table 5.15-3, the “Build” concepts are expected to add incremental impacts to the overall cumulative impacts of past and future actions to each of the resources considered. Cumulative impacts to natural resources, such as wetlands, threatened and endangered species, and farmlands, would be adverse, as the “Build” concepts would result in additional losses of these resources, particularly farmland. The level of loss caused by the potential highway improvements, however, would be relatively small when considered against the overall losses which can be attributed to past and future population growth and development throughout the corridor.

The “Build” concepts are expected to have both positive and negative socioeconomic impacts. While they would result in residential and business displacements, they are expected to have an overall positive impact on the regional economy from improved mobility and lower transportation/shipping costs for businesses (see Section 5.3, *Economic Effects*).



Table 5.15-3 Potential Cumulative Impacts

Resource	Effects of Past Actions	Potential Effects of Future Actions	Effects of "Build" Concepts
Land Use	Conversion of agricultural and forest cover to other uses. Loss of undeveloped land, especially at interchanges.	Additional loss of undeveloped land. Increase in developed land along I-81 would be consistent with many localities' plans.	Widening of I-81 consistent with some local plans. Loss of forest cover primarily south of Shenandoah Valley and conversion of agricultural/pasture land in Shenandoah Valley.
Agricultural Land	Loss of agricultural lands in Augusta and Shenandoah Counties.	Development along I-81 and rail will convert additional farmland.	Loss of prime farmland primarily north of Roanoke; loss of up to 12,500 acres of statewide important soils overall.
Social	Increased regional mobility and access to eastern U.S.	Minimal impacts anticipated.	Extensive residential and business displacements along I-81 particularly near interchanges.
Economics	Positive economic effects from increases in employment and tax revenues. Minor adverse effects caused by loss of land from tax rolls.	Positive economic effects from increases in employment, tax revenues, tourism spending, and university research funding.	Improved highway and rail service results in positive economic effects caused by increased employment and tax revenues.
Wetlands and Water Quality	Minor loss of wetlands and temporary deterioration of water quality.	Diminishment of water quality as a result of increased impervious surfaces from roads and development.	Minor impacts to wetlands and streams; potential temporary water quality impacts.
T&E Species	Unknown.	Impacts may occur as a result of diminished water quality.	Diminished water quality may affect threatened aquatic species.
Historic Properties	Impacts to various historic properties including battlefields.	Additional effects on historic properties.	Impacts to historic properties including battlefields.

5.16 Construction Impacts

Construction impacts associated with a transportation project are by definition those impacts that are temporary or short-term in nature and that occur only during construction. This section provides an overview of the types of construction impacts and compares the extent of impacts that may occur with each of the project elements.

5.16.1 Wetlands and Water Quality

All temporary and permanent impacts to wetlands and water resources, including those associated with construction activities, are regulated by the U.S. Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (DEQ) through Sections 404 and 401 of the Clean Water Act as well as the Virginia Water Protection Program.

Construction in the rail corridor would potentially result in temporary impacts to forested and emergent wetland systems, particularly near rivers and streams near the rail line. As wetlands identified within the I-81 study area average less than one-half acre in size, temporary impacts related to construction should be largely avoidable.

For construction within the I-81 and rail corridors, staging areas for heavy equipment and short-term field offices can be chosen carefully, situated away from sensitive areas within interchange loops or in previously cleared areas used for agriculture. Nevertheless, the scale of the projects would potentially result in some largely irreversible impacts to wetlands and waters of the U.S. Hydrophytic vegetation and wetland soils may be disturbed by adjacent work, or may be temporary receptors of stormwater and sediment while the site is cleared, grubbed, and graded. Culvert installation may require pump-around methods to be executed properly, resulting in a temporary cessation of flow through stream segments.

Erosion and sedimentation control plans for highway and rail improvements would be required for work that would include ground disturbance. It would describe the measures to be employed as erosion control, sedimentation control, temporary stormwater management measures, and dust control. Erosion control plans would also address in-water work at stream crossing locations. These plans must be approved before site construction could proceed and would be developed in accordance with regulations set forth by the Virginia Department of Conservation and Recreation.

Potential construction impacts to wetlands and water resources are temporary and typically are associated with stormwater runoff from the construction site. Stormwater runoff includes sediment resulting from inadequate erosion and sediment control (ESC) measures, chemical compounds and other debris such as litter. Stormwater discharges to jurisdictional wetlands and waterways, including discharges from construction sites, are regulated through the National Pollutant Discharge Elimination System (NPDES) Stormwater program. An NPDES Construction permit would be required for any construction site that disturbs more than one

acre (including sites that are smaller than one acre but are included as part of a larger project or development). Through issuance of an NPDES Stormwater permit, the regulating agency would ensure that sufficient erosion and sediment control measures are specified for the activity, and that impacts are further reduced by utilizing construction Best Management Practices (BMPs).

5.16.2 Wildlife

It is anticipated that construction would be regulated to adhere to a strict schedule to avoid disrupting the breeding or migrating patterns of threatened and endangered species. Agencies that may become involved in this process include the United States Army Corps of Engineers, the United States Fish and Wildlife Service, the Virginia Department of Environmental Quality, and the Virginia Department of Game and Inland Fisheries.

Human presence during construction and the associated construction noise related to passing equipment, piling emplacement, blasting of bedrock and so on may temporarily displace some species of wildlife from the edge of the road or rail right-of-way. The noises associated with construction may also mask territorial vocalizations of birds, interfering at least temporarily with breeding. Amphibians, which breed more commonly at dusk or night are less likely to be indirectly affected. Construction in forested areas may result in mortality of amphibians, reptiles and small mammals within the work zone, and the loss of nesting birds if construction is initiated during nesting season.

5.16.3 Air Quality

Air quality in the I-81 and rail corridors would not be substantially affected by construction because of the temporary nature of highway and rail construction and the confined right-of-way. Emissions from the operation of construction machinery (nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter) are short term and not generally considered substantial.

Mitigating fugitive dust emissions involves minimizing or eliminating its generation. Mitigation measures that may be used for construction include wetting and stabilization to suppress dust generation, cleaning paved roadways, and scheduling construction to minimize the amount and duration of exposed earth.

5.16.4 Noise

Construction impacts include noise generated by heavy equipment during construction. The potential for noise impacts during construction is correlated to the proximity of sensitive noise receptors to the proposed construction activity. The potential for noise impacts during construction typically increases in urban and suburban areas due to the higher population densities found in those areas; however, there are often small clusters of sensitive receptors in rural areas, and these receptors can be impacted more severely due to the relatively low ambient noise levels found in those areas.

Construction noise impacts are temporary and typically progress in a linear fashion along transportation corridor construction projects. As construction approaches an area, noise impacts to receptors in that area would begin to increase, reach a peak, and then dissipate as the construction moves past the area. While construction noise is unavoidable in most cases, steps can be taken to minimize the impact, such as the following:

- Keep all equipment well-maintained, tuned, and properly lubricated to minimize at-source noise production;
- Use sound attenuation devices on exhaust ports;
- Substitute the use of flag persons to control construction vehicle movements instead of using audible back-up alarms for vehicles;
- Minimize unnecessary idling of heavy equipment and machinery, especially diesel engines and generators, when not actively in use; and
- Prohibit construction during sensitive nighttime, early evening, and early morning hours.

5.17 Relationship between Local Short-Term Uses and Long-Term Productivity

Improvement concepts presented in this document are based on baseline daily and peak period traffic along the corridor, safety conditions, and future forecasted traffic and freight activities. The relationship between short-term uses of the environment and long-term productivity enabled by the improvement of the I-81 and rail corridor through Virginia is discussed in this section. Short-term impacts and uses of the environment are generally associated with the construction phase of the project. The impacts during the construction phase, listed below, would be offset by the benefits that improving I-81 and the Norfolk Southern rail lines would provide once they are complete. Although localized and temporary impacts would occur during construction, it would be consistent with the goals for improved long-term productivity and mobility for the study area, the region, and the Commonwealth of Virginia.

5.17.1 Localized Delays and Detours

Construction activities on I-81 would result in temporary and localized detours, modifications to access, and increases in truck traffic. These short-term impacts would be offset by the increased long-term mobility and decreased travel times associated with improved capacity. Localized delays and detours would be negligible during rail construction since the improvements are relatively minor.

5.17.2 Water Resources

Construction of I-81 would result in similar impacts on local short-term uses of water resources. These impacts would be typically associated with stormwater runoff, chemical compounds, and other debris such as litter. A short-term commitment of local raw water resources would also be required during construction for activities such as mixing aggregates, road wetting operations, and landscaping establishment. To a lesser extent, rail construction would also result in local short-term uses of water resources.

5.17.3 Air Quality

Emissions from reduced traffic speeds on I-81 through construction zones, combined with fugitive dust and smoke produced during burning, would result in a temporary degradation of air quality. Practices to minimize construction impacts on air quality would be in accordance with Section 107.14(c)(2) of VDOT's *Road and Bridge Specifications*. In most instances, once improvements are completed, emissions would decrease as traffic speeds are resumed to normal conditions. Train emissions should not increase appreciably during construction.

5.17.4 Noise

Noise impacts would be expected adjacent to the road and rail right-of-way as construction machinery is operating and as traffic is slowed and/or re-routed during construction on I-81. The contractor and/or VDOT would monitor noise generated during construction. Abatement measures may be implemented as needed, and long-term noise impacts may be minimized through the addition of abatement measures adjacent to the roadway. Practices to minimize the effects of construction noise would be in accordance with Section 107.14(c)(3) of VDOT's *Road and Bridge Specifications*.

5.18 Irreversible and Irrecoverable Commitments of Resources

The improvement of I-81 through Virginia would involve a commitment of land, construction materials, natural resources, capital resources, and labor that would be irreversible and irretrievable.

The commitment of land to the improvement of the I-81 right-of-way would render that land unusable for any other use. Although the existing land uses within the right-of-way could be relocated to an alternate location, this land would be dedicated to VDOT in perpetuity. This commitment of land would include existing rights-of-way, natural landscapes, and lands currently developed or planned for a variety of land use development.

The materials and energy used to improve I-81 would constitute an irretrievable commitment of resources. The materials, including but not limited to asphalt, steel, aggregates, sand, gravel, and cement, would be dedicated to improving the facility and would not be available for other uses. Similarly, fuels and electricity used in the construction process would be dedicated to the improvements. All applicable energy conservation measures would be utilized and energy resource consumption would not be excessive in terms of region wide usage. None of the natural resources associated with lands that would be committed to the improvements or used in preparation/fabrication of construction materials are in short supply nor would their use have an adverse effect on the continued availability of those resources.

Commitment of human and fiscal resources would also be required. During construction, members of the labor force, including construction crews, government staff, consultants, and engineers, would be dedicated to the project. Fiscal resources used to purchase construction materials and pay the labor force would also constitute an irretrievable commitment of resources.

The irreversible and irretrievable commitment of resources by the improvement of I-81 through Virginia would be offset by short and long-term improvements to the regional economic base and achievement of goals to improve mobility options and overall transportation services in the local areas, the regions, and the Commonwealth of Virginia.

5.19 Potential Impacts for Consistent Corridor-Length Concepts

In addition to evaluating the variable Minimum Width and Maximum Width footprints, the potential impacts from two consistent, corridor-long concepts were also evaluated for illustrative purposes. The Add 2-Lanes concept adds a total of two additional lanes (one lane in each direction) for the entire length of I-81, with the widening occurring in the median as much as possible. The consistent Add 8-Lanes concept adds a total of eight additional lanes (four lanes in each direction) for the entire length of I-81. For the Add 8-Lanes concept, four of the lanes are general purpose lanes for all vehicles, and the remaining four lanes are barrier-separated exclusive lanes for trucks. The potential impacts associated with these concepts are summarized in Table 5.19-1 below.

Generally, potential impacts to most resources are greater for the Add 8-Lane concept as a result of the consistently wider footprint. When compared to the Minimum Width and Maximum Width footprints, potential impacts as a result of the Add 2-Lane concept are similar to the Minimum Width footprint. The Maximum Width footprint has some impacts that are greater than the Add 8-Lanes concept, although the impacts are not substantially different given the length of the corridor.

Table 5.19-1 Summary of Potential Environmental Consequences: Consistent Corridor-Length Concepts

Resource / Issue	Add 2-Lanes	Add 8-Lanes
Consistency with Local Plans	Varies	Varies
Developed Land Use (acres)	7,247	8,105
Prime Farmland Impacts (acres)	1,022	1,580
Agricultural/Forestal District Impacts (acres)	31	176
Residential Displacements (#)	944	2,068
Business Displacements (#)	684	897
Community Facilities Impacted (#)	5	5
Minority Population Impacts (# of block groups affected)	20	20
Low-Income Population Impacts (# of block groups affected)	27	27
2035 Employment Growth (increase from 2005)	4.7%	4.7%
2035 Gross Regional Product Growth (increase from 2005)	4.2%	4.2%
Parks and Recreation Area Impacts (acres)	51	84
Open Space Easement Impacts (acres)	12	34
Visual Impacts (# of visual resources with view of the road/rail)	28	28
Potential Contamination Sites (#)	9	9
Battlefield Impacts (acres)	1,213	1,622
Impacts to NHRP Listed/Eligible Historic Districts (acres)	52	60
Impacts to NHRP Listed/Eligible Historic Structures (#)	19	20
NHRP Listed Archaeological Sites Impacted (#)	1	1
Wetland Impacts (acres)	33	62
Stream Impacts (miles)	23	35
100-Year Floodplains Impacted (acres)	354	530
Threatened and Endangered Species Impacted (# of species)	13	13
Volatile Organic Compounds (VOCs) (tons/day)	+0.36 ¹	-1.24 ¹
Nitrogen Oxides (NO _x) (tons/day)	+0.81 ¹	-1.15 ¹
Particulate Matter (PM _{2.5}) (tons/day)	+0.02 ¹	-0.05 ¹
Noise Sensitive Receptors Impacted (# increase over No-Build)	+3,034	+5,538

¹ Change in emissions from 2035 No-Build highway condition.