ALTERNATIVES DEVELOPMENT TECHNICAL MEMORANDUM

for

Route 28 Corridor Environmental Assessment

Prince William County
Department of Transportation

Contract Number: 5019843

From: Sudley Road in Prince William County
To: Compton Road in Fairfax County

Prince William County, the City of Manassas, the City of Manassas Park, and Fairfax County

DRAFT

December 27, 2019

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INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The Prince William County Department of Transportation (PWC DOT), in coordination with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA), is preparing an Environmental Assessment (EA) to evaluate the potential social, economic, and environmental effects associated with proposed highway improvements in the Route 28 (Centreville Road) corridor between Sudley Road (Business Route 234) in Prince William County and Compton Road (Route 658) in Fairfax County. The improvements being considered involve an extension of Godwin Drive that would serve as a bypass of a congested portion of Route 28. Alternatively, widening of Route 28 to add travel capacity is being considered.

The EA is being prepared in accordance with the National Environmental Policy Act (NEPA); Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508); FHWA's Environmental Impact and Related Procedures (23 CFR 771); and FHWA's Technical Advisory Guidance for Preparing and Processing Environmental and Section 4(f) Documents (T6640.8A) (FHWA, 1987). Under the umbrella of the NEPA process, compliance with other multiple laws, regulations, and executive orders is being evaluated. For example, this study also includes the evaluation of potential effects to waters of the United States under the Clean Water Act, effects on air quality under the Clean Air Act, effects on historic properties under Section 106 of the National Historic Preservation Act (NHPA), effects to threatened and endangered species under the Endangered Species Act, and many others.

1.2 STUDY AREA

The Route 28 corridor that is the subject of this study lies within four political jurisdictions: Prince William County, Fairfax County, the City of Manassas, and the City of Manassas Park. From south to north, the study area shown in **Figure 1-1** generally extends along Route 28 from Sudley Road in the City of Manassas, through the City of Manassas Park, through a portion of Prince William County, across Bull Run, and ends at Compton Road in Fairfax County. On the west, the study area encompasses the intersection of existing Godwin Drive and Sudley Road and continues northward parallel to Flat Branch between Sudley Road and Bull Run. On the east, the study area parallels Route 28.

Within the study area Route 28 generally has four through lanes, with northbound and southbound lanes separated in some sections by a center bi-directional left turn lane and in other sections by a raised grass or concrete median. Numerous left-turn lanes and right-turn lanes serve intersecting streets between (and including) Sudley Road and Compton Road: there are ten signalized intersections and fourteen unsignalized intersections with public streets. Sidewalks line both sides of the road, as do various utility lines, and there are no dedicated bike facilities within the study corridor. The posted speed limit is 25 miles per hour (mph) between Sudley Road and Liberia Avenue, 35 mph between Liberia Avenue and Old Centreville Road, and 45 mph from Old Centreville Road to Compton Road and beyond to the north. There are three OmniRide bus routes serving Route 28.

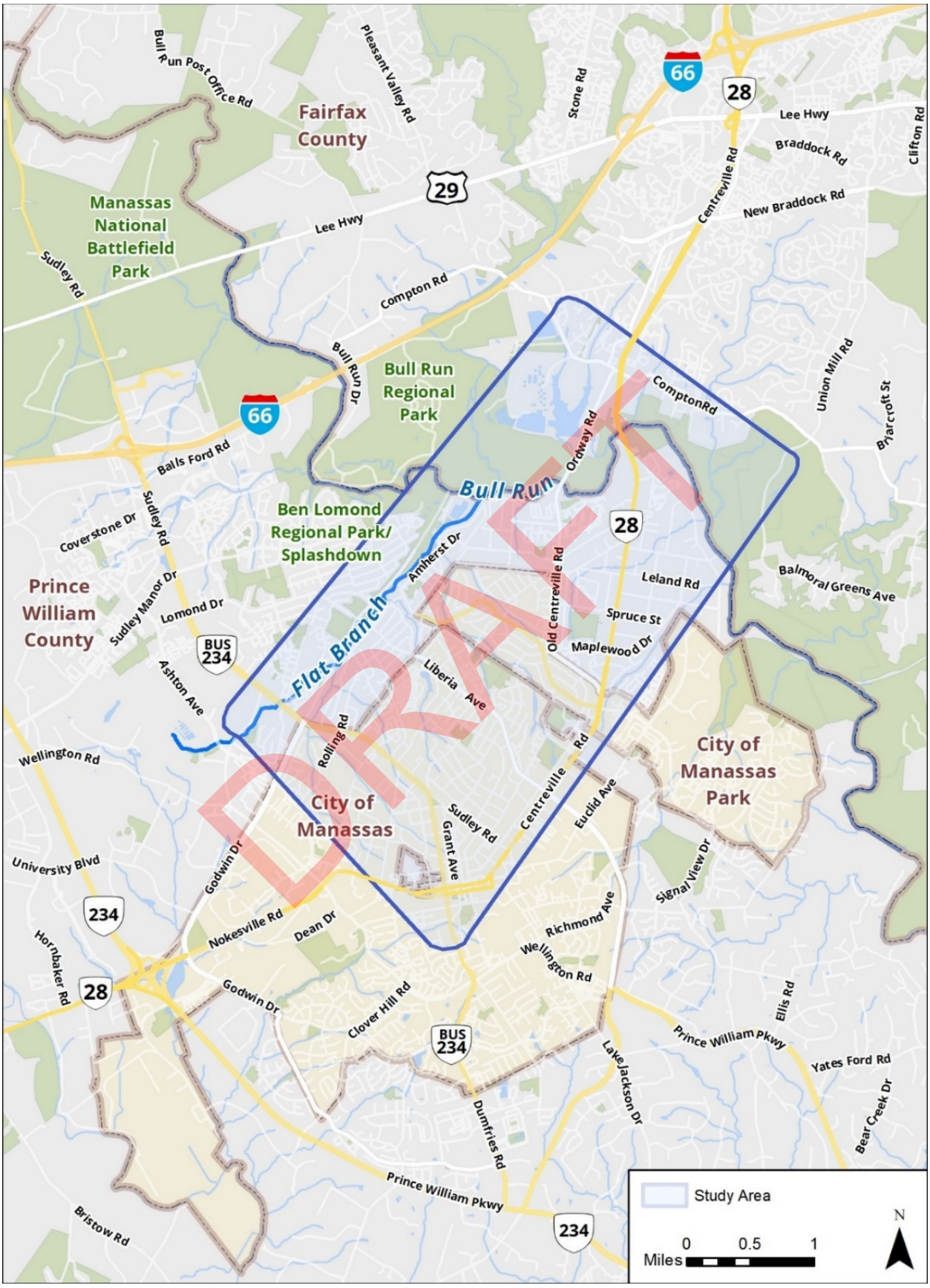


Figure 1-1. Project Location

Land uses fronting Route 28 south of Bull Run are almost entirely commercial. Numerous and closely spaced access and egress points serve the extensive commercial development on both sides of the road. Commercial development includes an assortment of shopping centers, retail shops, auto shops, gas stations, convenience stores, and fast food and sit-down restaurants. Land uses fronting Route 28 in Fairfax County between Bull Run and Compton Road are largely residential. Additional description of these existing conditions/ environmental constraints in the study area that guided the development of alternatives is presented in Section 2.4.1. Additional details of traffic conditions and operations are presented in Section 5.

1.3 REFERENCE DOCUMENTS

Previous studies have recommended various solutions in the corridor, but only short-term spot improvements have been constructed to date. The remainder of this section summarizes precursor studies to the EA and provides background on the evolution of the project and the alternatives identified for providing additional capacity in the Route 28 corridor. The following documents were used as references for consideration during the alternatives development process. Data within these sources were reviewed and utilized as appropriate for purposes of this study, as described further in Section 2 and Section 3.

1.3.1 *Prince William County Comprehensive Plan*

Long-term, high-capacity solutions to facilitate travel between Prince William County and the Cities of Manassas and Manassas Park and Fairfax County, I-66, and locations north have been sought for decades. A Route 28 Bypass was mentioned as early as the 1964 Prince William County Comprehensive Plan, the first plan of record for the county. The deed of dedication for much of the right-of-way required for the Prince William County portion of this bypass, or Godwin Drive extended, was signed in August 1969. By 1990, the Comprehensive Plan referred to the right-of-way required for the facility as "previously acquired." In the 2008 Comprehensive Plan, the Tri-County Parkway/Route 28 Bypass was identified as part of the Thoroughfare Plan to "provide substantial relief to the sections of Route 28 within Prince William County, the City of Manassas, and Fairfax County, as well as provide relief to I-66." The Plan also noted that the recommended right-of-way corresponds with existing right-of-way already acquired by Prince William County for the new road. As described further in Section 1.3.2 below, the location study conducted for the Tri-County Parkway culminated in VDOT approval of an alternative different from the Tri-County Parkway concept. However, the County's Comprehensive Plan continues to carry a listing for the Tri-County Parkway/Route 28 Bypass (i.e., the extension of Godwin Drive).

With regard to existing Route 28, the current comprehensive plan (2016) states that, given the extent and nature of existing development along the "traditional commercial corridor" of Route 28, a standard principal arterial typical section is not recommended for improvements between Fairfax County and the City of Manassas, and instead proposes a minor arterial standard. The minor arterial standard provides a narrower typical section that would be less disruptive to adjacent development.

1.3.2 *Tri-County Parkway Location Study (2005)*

In March 2005, VDOT and FHWA published a Draft Environmental Impact Statement (DEIS) for the Tri-County Parkway Location Study. The Tri-County Parkway would provide a new north-south transportation link to connect the City of Manassas with I-66 and the Dulles Airport corridor. The purpose of the proposed Tri-County Parkway involved the following key elements: improve transportation mobility and access; enhance linkage of communities; accommodate social demands, environmental goals, and economic development needs; and improve safety on the

roadway network. The initial concept for the Tri-County Parkway was based on an alignment that followed the alignment shown for the new roadway in the Comprehensive Plans of Prince William, Fairfax, and Loudoun Counties (hence the name "Comprehensive Plan Candidate Build Alternative"). That alignment would extend Godwin Drive from the existing Godwin Drive/ Sudley Road intersection and then traverse north across Bull Run Regional Park to intersect with I-66 and ultimately Route 50 in Loudoun County. Several other alternatives also were included in the study. Ultimately, FHWA concluded that it could not support the Comprehensive Plan Candidate Build Alternative because of its impacts to public parks (primarily Bull Run Regional Park) and historic properties, given the legal standard established by Section 4(f) of the Department of Transportation Act of 1966. Further, in their reviews of the Draft EIS, the US Army Corps of Engineers (the Corps) and the US Environmental Protection Agency (EPA) expressed concerns about the ability to permit the Comprehensive Plan Candidate Build Alternative under Section 404 of the Clean Water Act, given the least environmentally damaging practicable alternative (LEDPA) standard by which the Corps is bound.

In November 2005, the Commonwealth Transportation Board approved the location of the Tri-County Parkway on the West 2 Alternative, later renamed the Bi-County Parkway. The Bi-County Parkway, located in Prince William and Loudoun Counties only, would be a new 10.4-mile-long north-south transportation link between the I-66 / Route 234 interchange and Route 50 in Loudoun County. However, on March 15, 2016, the Prince William Board of County Supervisors voted to remove the Bi-County Parkway from the County's Comprehensive Plan (listed separately from the Tri-County Parkway in the Comprehensive Plan as Route 234 Bypass North). VDOT and FHWA suspended work on completion of a Final EIS and Record of Decision.

1.3.3 *VDOT Route 28 Corridor Safety and Operations Study (2015)*

This 2015 study, the first of two phases, recommended short-term, low-cost safety and operational improvements on Route 28 between Liberia Avenue in Prince William County to just south of I-66 in Fairfax County. Over 100 safety and congestion-related candidate improvements were screened down to five for advancement to design, as further described in Section 3.2. The second of the two phases was intended to study a wider range of long-term solutions for the corridor and is described below.

1.3.4 *Route 28 Corridor Feasibility Study (2017)*

The Northern Virginia Transportation Authority (NVTA)[1] funded a feasibility study to identify infrastructure improvements that would improve travel times and network reliability within the Route 28 corridor (the "2017 Feasibility Study"). The limits of the study were from the intersection of Godwin Drive and Route 28 in the City of Manassas on the south to Route 29 in Fairfax County on the north, and from Flat Branch on the west to Bull Run on the east. At the time, Prince William County and the City of Manassas had already initiated projects to widen Route 28 south of Godwin Drive and Fairfax County had initiated a project to widen Route 28 between Bull Run and Route 29, as shown in **Figure 1-2**. Therefore, the section of Route 28 between Godwin Drive and Bull Run would remain unimproved with recurring daily congestion, which the 2017 Feasibility Study would address. To do so, the Feasibility Study identified several key goals and objectives aimed primarily at reducing congestion and improving network reliability.

[1] The NVTA was created by the Virginia General Assembly to be responsible for long range transportation planning for regional transportation projects in Northern Virginia, to advocate for transportation needs in the area, and to allocate funds for transportation projects in the area using dedicated funding sources established by legislation.

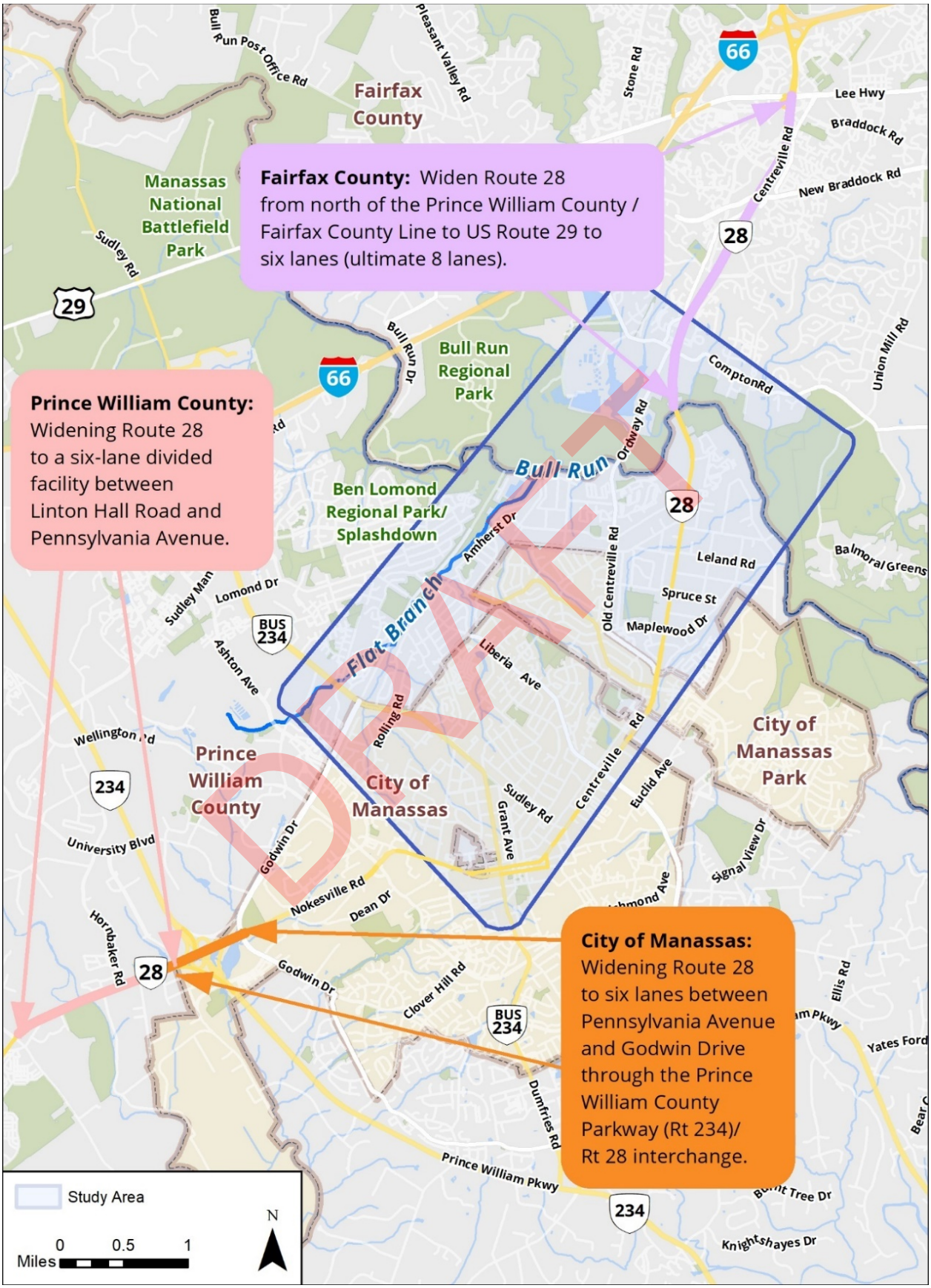


Figure 1-2. Other Nearby Projects (as Noted in 2017 Feasibility Study)

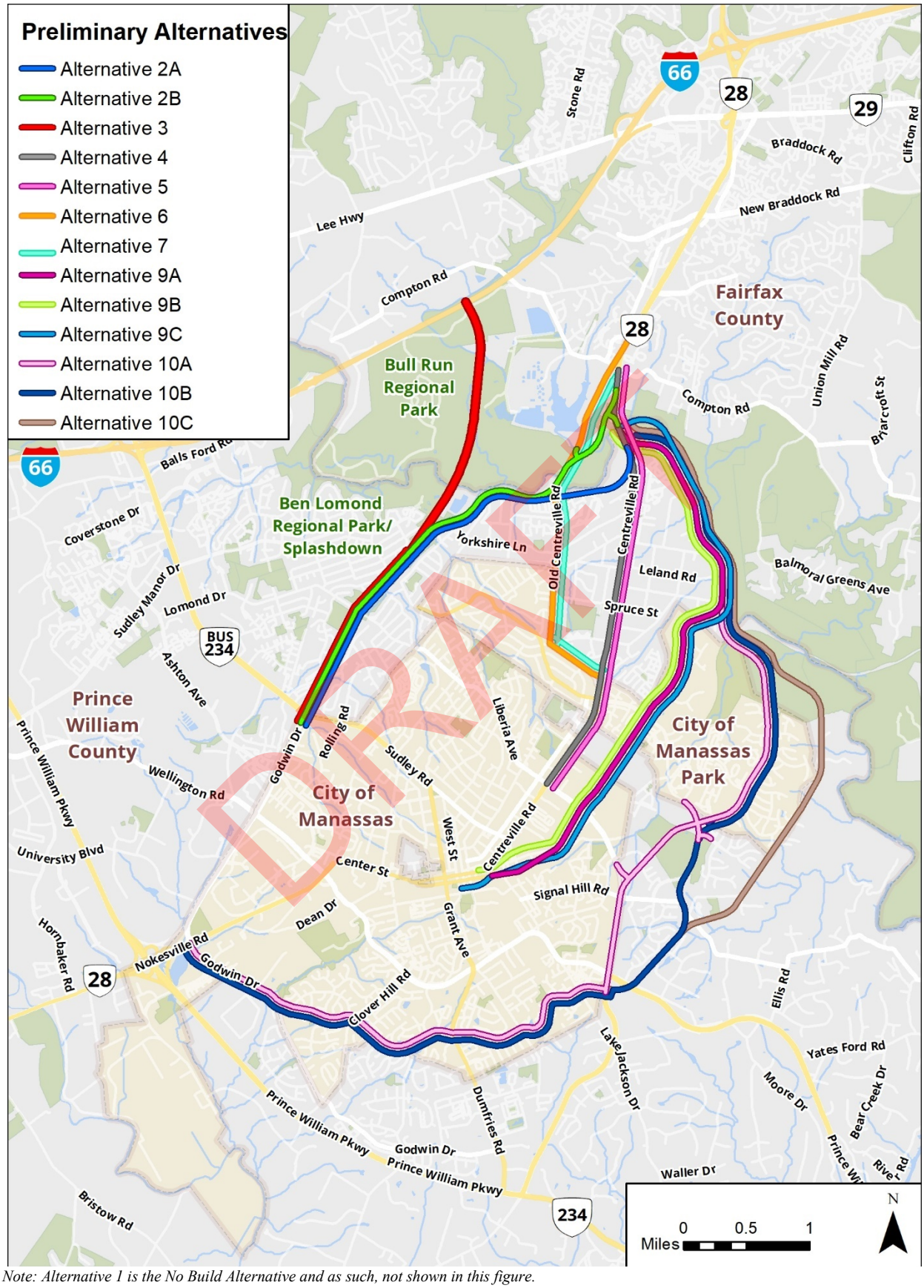
The Feasibility Study was jointly managed by the City of Manassas and Prince William County, and was guided by a Technical Committee made up of technical staff from affected jurisdictions, transportation agencies, and other governmental agencies including: City of Manassas, Prince William County, Fairfax County, City of Manassas Park, FHWA, VDOT, Virginia Department of Rail and Public Transportation (DRPT), NVTA, Virginia Railway Express (VRE), Potomac and Rappahannock Transportation Commission (PRTC), and Bull Run Regional Park. Recommendations from the Technical Committee were vetted at key milestones in the study process with an Executive Committee comprised of members of the Virginia General Assembly, local elected officials, members from modal agencies, and Commonwealth Transportation Board members. Additionally, two public information meetings were held to gain input and present study findings and recommendations.

Ten preliminary alternatives[2] were identified in the 2017 Feasibility Study as shown in **Figure 1-3**, including concepts proposed in the past by elected officials, local transportation staff or citizens, as well as the No Build alternative. These ten alternatives were put through two levels of screening analysis. All data collection and evaluation tools and methods, as well as screening metrics and measures of effectiveness, were developed and approved by the Technical and Executive Committees. Both screenings were based on existing and future build and no build traffic conditions. Consideration of environmental features included streams and wetlands, floodplains and floodways, archaeology and historic architectural structures, hazardous materials, environmental justice populations, public recreation areas, conservation easements, residential and business relocations, consistency with local planning, and, during the second screening, battlefields and noise receptors. Environmental resources were mapped within a 250-foot-wide study corridor for each alternative, although the corridor was widened at intersections or locations where topography would increase construction limits. The 250-foot-wide study corridor was intended to be greater than the footprint that would be needed for proposed improvements to allow for flexibility of avoiding and minimizing impacts to environmental resources within the corridor during future phases of more detailed alternatives development.

In the first screening, all ten alternatives were preliminarily assessed using evaluation criteria related to traffic, policy considerations, environmental, and socioeconomic/right-of-way impacts. Each screening criterion had one or more metrics that were used to evaluate how each alternative met (or did not meet) the key objectives of the study. Four alternatives were advanced to the second, more refined level of screening that compared each alternative to determine a single, highest-ranked alternative, i.e., the alternative that is most feasible and cost-effective and best meets the study goals and objectives. Similar to the first screening, the comparison was based on four screening criteria, each with one or more factors: planning level costs, traffic impacts, environmental impacts, and socioeconomic/right-of-way impacts. Based on this evaluation, Alternative 2B (Godwin Drive extended to existing Route 28 north of Bull Run) was determined to be the highest-ranked alternative in the 2017 Feasibility Study.

The preliminary alternatives identified in the 2017 Feasibility Study form the basis of the alternatives development process of the EA, as described in Section 2.2. Alternatives 2A, 2B, and 4 (along with the No Build Alternative, designated as Alternative 1 in the 2017 Feasibility Study) are being carried forward in the EA for further development and analysis (Section 4), while all other alternatives have not been retained for further evaluation (Section 3). Refer to these sections for descriptions and evaluations of each alternative.

[2] Several of the alternatives (Alternatives 2, 9, and 10) had portions of their alignments where there are optional alignments/variations. These were labeled A, B, and/or C (e.g., 2A, 2B).



Note: Alternative 1 is the No Build Alternative and as such, not shown in this figure.

Figure 1-3. Preliminary Alternatives (2017 Feasibility Study)

1.3.5 Route 28 in Other Current Planning Documents

Fairfax County Comprehensive Plan. The most recent Fairfax County Comprehensive Plan recognizes that the County has experienced unprecedented growth in a relatively short timeframe that has affected multiple aspects of community life: housing stock, economic growth, business development, public facilities, infrastructure, and mobility. The Comprehensive Plan calls for Route 28 to be an eight-lane facility from the Prince William County line to Route 29. The Fairfax County Department of Transportation is currently procuring a design-build contract to widen the existing Route 28 to six lanes; the additional two lanes would be added later. The Fairfax County project was endorsed by the Fairfax County Board of Supervisors as part of the County's Transportation Priorities Plan (TPP) on January 28, 2014.

City of Manassas Comprehensive Plan/Transportation Master Plan. The City of Manassas Comprehensive Plan notes that the City "nears build-out of all land" in the jurisdiction, and that land use, transportation, and public facilities will continue to be "evaluated to assure continued success." Accordingly, the City of Manassas is developing a Transportation Master Plan (TMP),[3] as part of its ongoing Comprehensive Plan Update, in order to "address the rising need to comprehensively address transportation planning issues" including, but not limited to, citywide traffic modeling/forecasting and analysis to the year 2040, complete street designs and policy needs, bicycle and pedestrian connectivity, and engaging stakeholders and the public.

As stated in the draft TMP, the ongoing Route 28 planning process has a "direct effect on the City's transportation landscape, as the alternative selected will determine the volume and path of traffic going to, through, and around the City." The City assumed 2017 Feasibility Study Alternative 2B for the purposes of the TMP documentation, evaluation, and analysis. The TMP additionally lists the projects included in the Adopted Fiscal Year 2019 Five-Year Capital Improvement Program (CIP). Along the Route 28 corridor, they include the following three projects:

- Widen Route 28 to six lanes between Pennsylvania Avenue and Godwin Drive, as identified in the 2017 Feasibility Study (as described in Section 1.3.3 above).
- At the intersection of Sudley Road and Route 28, replace the existing signalized intersection with a two-lane roundabout and associated improvements.
- At the intersection of Route 28 and Liberia Avenue and north on Route 28: install southbound Route 28 dual left-turn lanes at Liberia Avenue; restripe the northbound Route 28 continuous right-turn lane to a shared through/right north of Liberia Avenue; and install pedestrian improvements.

City of Manassas Park Comprehensive Plan. The City of Manassas Park Comprehensive Plan notes that the city is "largely built out". The City is therefore focusing on smart growth principles to continue to improve the quality of life for both residents and businesses. Route 28 is seen as "one of the major transportation corridors within the region." Route 28 is noted as an area of primary concern regarding congestion within the city. One of the transportation action strategies is to "work with the City of Manassas, Prince William County, and VDOT to improve traffic flow along VA 28 by widening and adding additional lanes."

Visualize 2045 (CLRP). Visualize 2045 is the federally mandated, long-range transportation plan for the National Capital Region. The financially constrained long range plan (CLRP) element of

[3] https://www.manassascity.org/DocumentCenter/View/34114/71819-DRAFT-TMP-Report-for-City-of-Manassas_Reduced-for-Web

Visualize 2045 identifies all the regionally significant capital improvements to the region's highway and transit systems that transportation agencies expect to make and to be able to afford through 2045. The Route 28 project is included in the current CLRP (October 17, 2018) as the Route 28 Manassas Bypass;[4] its listing states that the alignment of the improvements will be determined as part of the ongoing environmental documentation.

TransAction Plan. TransAction is the multimodal transportation master plan for Northern Virginia produced by NVTA. It is a long range plan addressing regional transportation needs through 2040. The Plan is not bound to any budget and proposes more projects than can realistically be funded. However, TransAction is used to inform the NVTA's Six Year Program for capital funding, guiding decisions about which transportation improvements NVTA should prioritize for investment. NVTA's FY2018-2023 Six Year Program includes funds for planning, design, and construction of Route 28 corridor improvements.

[4] http://www1.mwcog.org/clrp/projects/clrp-report.asp?PROJECT_ID=1865

SECTION 2
ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

2.1 INTRODUCTION

Using the previous studies and planning documents outlined in Section 1, input from the public and other stakeholders, updated traffic studies, and other information, an alternatives screening process, as outlined in **Figure 2-1**, was used to identify which alternatives should be carried forward for detailed analysis in the EA and which alternatives would not be carried forward. A key step in the process is to assess whether an alternative meets the identified transportation purpose and need. Other factors that can be used in determining whether an alternative merits further consideration include physical and environmental constraints, engineering and design obstacles, and traffic operations issues. The screening process ensures that a full range of alternatives is considered, including those identified in previous studies that could potentially address the identified purpose and need, and that environmental concerns are taken into account in decision-making. Each of these steps is detailed in the remainder of this section.

Alternatives that would not address the stated purpose and need or that were dismissed due to other considerations during the screening process are described in Section 3. The No Build Alternative is described in Section 4, as are the Build Alternatives that emerged from the screening process and were carried forward for further consideration in the EA. The ability of these Build Alternatives to meet the established needs for the project are described in Section 5.

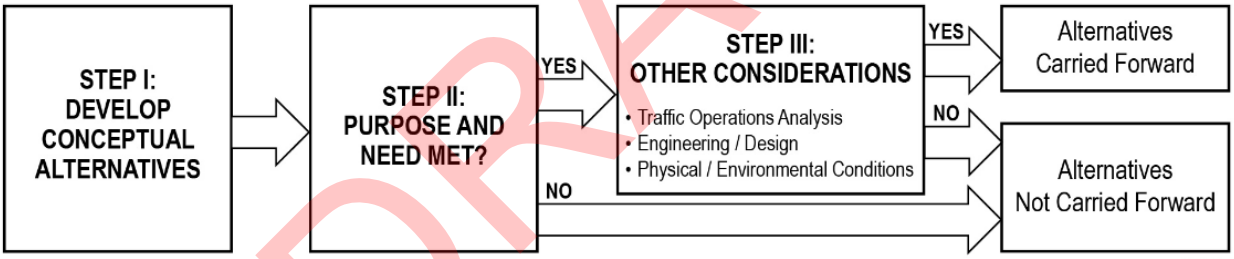


Figure 2-1. Alternatives Screening Process

2.2 STEP I. DEVELOP CONCEPTUAL ALTERNATIVES

2.2.1 Establish Purpose and Need

Prior to the development of alternatives, the purpose and need for the project was defined to establish why improvements are needed and to shape the range of alternatives that would be considered to address the identified needs. The precursor studies to the EA in the Route 28 corridor, as described previously in Section 1.3, provided background for developing the purpose and need of this study, as did input received during early agency and public scoping, as described in Section 2.2.2 below. The existing conditions within the Route 28 corridor, as summarized below, provided the context for developing the purpose and need as well as establishing how the conceptual alternatives meet the established needs.

Context. Route 28 is a major north-south corridor that serves four counties and two cities in Northern Virginia: from Remington in Fauquier County to Route 7 in Loudoun County, connecting Route 29, Route 234, I-66, Route 50, Dulles International Airport, Route 267, Route 7, and areas in between. Route 28 south of Interstate I-66 experiences heavy peak hour congestion as evidenced

by traffic queuing in the northbound direction in the morning peak periods and similar queuing in the southbound direction during the afternoon/evening peak period. Route 28 also represents one of only a few roadway crossings of Bull Run from Prince William County into Fairfax County and other major activity and employment centers in the Washington metropolitan area: upstream of the Route 28 crossing, I-66 and Ordway Road (a two-lane minor arterial that intersects Route 28) cross Bull Run, and downstream of Route 28, the closest crossing is Yates Ford Road (Route 612, a two-lane secondary road) approximately 6 miles south (straight line distance) that does not directly serve the same routes as Route 28. The limited number of crossings, as well as the distances and limited connections between them, results in substantial pressure on Route 28 to accommodate heavy travel demands, creating congestion. The limited number of options in this area also results in challenges when crashes or other emergencies result in closures of roadway lanes or full roadway closures.

While Route 28 is a four-lane primary arterial and operates as such south of the City of Manassas and north of Bull Run, it functions as a local street and commercial corridor with many signals through the City of Manassas, the City of Manassas Park, and the portion of Prince William County between Manassas Park and Bull Run. Numerous business parcels have direct access to Route 28 and they generate numerous vehicle trips throughout the day while pass-through traffic uses Route 28 to reach the I-66 corridor or beyond. The current congestion is anticipated to increase in future years.

Purpose and Need. Based on the existing and future context of the Route 28 corridor between Sudley Road in Prince William County and Compton Road in Fairfax County, the specific purpose of the proposed project is to:

1) **Reduce traffic congestion and travel delays** on roadway segments and intersections on Route 28,
2) **Improve overall travel times** within and through the Route 28 corridor, and
3) **Enhance network reliability** to increase the consistency and daily reliability of travel speeds in and through the Route 28 corridor.

Section 5 of this report contains more details on each of these needs, including the ability of each alternative carried forward to meet these needs.

2.2.2 Review Previous Studies

Initially, previous studies, as documented in Section 1.3, were reviewed in order to gain an understanding of the range of improvement concepts that have been examined to date. Of the wide range of potential solutions in the corridor, only short-term spot improvements have been constructed to date. As previously summarized, the 10 preliminary alternatives identified and analyzed in the 2017 Feasibility Study set the foundation of the alternatives development process for the EA. In that previous study, a first screening assessed the 10 alternatives and advanced four alternatives (2A, 2B, 4, and 9) to a second level of more detailed screening. That second screening compared the alternatives to one another, as well as to the No Build Alternative, to rank the alternatives. Alternative 2B was determined to rank highest in regard to being most feasible and cost effective and best meeting the study goals and objectives.

Notwithstanding the results of that evaluation, the alternatives development process of the EA revisited the alternatives identified in the 2017 Feasibility Study to consider whether they should be carried forward for analysis in the EA. The preliminary alternatives that were not retained for analysis in the EA, and the basis for their elimination, are described in Section 3. The three build

alternatives that are carried forward in the EA – Alternatives 2A, 2B, and 4 – align with the top three highest-ranked alternatives in the second screening from the 2017 Feasibility Study and are summarized below and described in detail in Section 4.

- Alternatives 2A and 2B would create a four-lane bypass of existing Route 28 by extending Godwin Drive north from the existing Godwin Drive/Sudley Road intersection, paralleling Flat Branch, then turning east and joining existing Route 28. These two alternatives differ only in the location where they would join Route 28: Alternative 2A would join south of Bull Run and Alternative 2B would join north Bull Run.
- Alternative 4 would widen Route 28 to add two lanes to the existing four lanes on existing alignment between Liberia Avenue and the Fairfax County Line.

2.2.3 Agency and Public Scoping

Following review of the previous studies, two public scoping meetings were held to provide the public and federal, state, and local agencies an opportunity to provide suggestions on the proposed project and the scope of issues to be addressed in the EA.[5] Input was solicited on the **purpose and need** (confirming the transportation problem(s) to be solved); **alternatives** (providing input on the alternatives proposed or other potential improvement concepts); and **environment** (reporting natural, cultural, and human environment considerations). Additionally, during this time, early coordination was conducted with EPA, the Corps, Fairfax County, NOVA Parks, the Virginia Department of Environmental Quality (DEQ), and the Virginia Department of Historic Resources (DHR). Comments received during the public and agency scoping meetings, as summarized below, were taken into consideration during the development, evaluation, and documentation of the alternatives.

Public Comments. During the public information meetings, when asked about the purpose and need statement, approximately half of the respondents agreed with the statement; the remainder suggested additional elements to be included in the statement, such as specific multimodal/travel mode improvements, sustainability, and environmental considerations. Additionally, approximately half of respondents indicated specific resources that should be considered in the EA, either in general or related to specific alternatives: cultural resources and visitor experience in Bull Run Regional Park including the Battles of Blackburn's Ford and First Manassas; multimodal accessibility, including access to Bull Run Occoquan Trail and along Flat Branch and Bull Run; noise impacts; and residential impacts.

Additional narrative comments, provided either in writing or during the question-and-answer portions, covered a range of topics both related to the EA and outside the scope of the study, as summarized below:

- Elements of the purpose and need, suggesting inclusion of multimodal considerations and other smart growth principles
- Inclusion of/support for specific alternatives or options, including managed/toll lanes, reversible lanes, additional through lanes, bus/transit service, bicycle/pedestrian facilities and connections, and park and ride facilities
- Section 4(f) and Section 6(f) evaluations, particularly in regard to Alternatives 2A and 2B

[5] Public Scoping Meetings were held in Manassas and Chantilly in December 2018 (see *Summary of Public Scoping Meeting and Comments* for full details). Scoping letters were sent to EPA, USACE, and DEQ on January 17, 2019.

- Traffic demand, modeling, and ability of alternatives to meet needs
- Permitting requirements
- Project schedule, construction timing, timing related to other projects/developments, and potential interim/spot improvement solutions
- Property owner impacts and notifications
- Opposition to the project as a whole

Agency Comments/Coordination. Early coordination was initiated with EPA, the Corps, and DEQ in January 2019 to present information about the project and receive input for use in the early development stages of the EA, with a focus on water resources (streams and wetlands). Following an online conference presenting the project (background, goals, alternatives, and summary of environmental activities completed to date), the three agencies submitted scoping comments.

Both EPA and the Corps stated that regular coordination with the appropriate state and federal agencies would be necessary as the project moves forward. With regard to alternatives development and analysis, EPA and the Corps requested inclusion in any alternatives analysis discussions and stated that the EA should include documentation of any alternatives considered in the 2017 Feasibility Study and not retained, with justifications on the reasons on why they did or did not meet the purpose and need and/or why they were not deemed practicable (or, if no practicable alternatives exist, avoidance and minimization must be examined). Further, they stated that information provided should describe the criteria against which alternatives were evaluated. EPA also stated that the NEPA document should include a clear and robust justification of the underlying purpose and need and that the alternatives analysis should include those not carried forward.

The Corps recommended that, in jurisdictional areas, cyclist/pedestrian accommodations only be located on one side of a roadway to minimize potential impacts. Further, both EPA and the Corps enumerated specific recommendations/regulations of environmental resources and suggested methodologies and data sources to record potential impacts to the natural and human environment. The Corps also designated FHWA as the lead federal agency to fulfill the collective federal requirements for Section 106 and for consultation as appropriate with the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). DEQ agreed with other agency comments.

Additionally, prior to the public scoping meetings, a coordination meeting with Fairfax County Department of Transportation and NOVA Parks representatives was held. The purpose of the meeting was to provide an update on early project activities, including the FHWA concurrence on preparation of an EA and information-gathering on environmental resources including threatened and endangered species; streams and wetlands, cultural resources; and traffic.

During the meeting, NOVA Parks indicated that they would like to be a consulting party in the Section 106 process. Additionally, NOVA Parks confirmed their comments submitted during the 2017 Feasibility Study that expressed concerns about a portion of Alternative 2B (as laid out in the 2017 Feasibility Study) that would traverse a part of Bull Run Regional Park that is also within the Blackburn's Ford Battlefield.

Finally, Section 106 consultation[6] was formally initiated with DHR by letter dated June 4, 2019, the purpose of which was to introduce the area of potential effects (APE)[7] and the historic properties contained therein, and to solicit assistance in identification of potential Section 106 consulting parties.

2.3 STEP II. PURPOSE AND NEED ADDRESSED?

As described above in Section 2.2.1, the specific purpose of the project is to address existing traffic volume and projected 2040 travel demand in order to reduce congestion and improve travel times and network reliability. As described further in this memorandum, site-specific traffic studies were completed, including the development of 2040 traffic forecasts and the operational analysis of existing and future no build and build conditions, the latter to assess the ability of the alternatives considered to address the project purpose and need. The updated traffic analyses have confirmed the deficiencies in traffic level of service due to volumes exceeding available capacity on Route 28 and reaffirmed the need to provide additional north-south capacity in the study area.

As part of the alternatives development process, the preliminary alternatives were evaluated against their ability to meet the established purpose and need of the project; those that would not satisfy the purpose and need were dismissed from further consideration. The alternatives that were not retained, and the reason(s) for their dismissal (i.e., how they did not meet the purpose and need), are detailed in Section 3 of this memorandum. The three alternatives (Alternatives 2A, 2B, and 4) carried forward for detailed study were further evaluated based on additional considerations, as described below. The ability of those three alternatives to meet the purpose and need are presented in Section 5.

2.4 STEP III. OTHER CONSIDERATIONS

As previously stated, the 2017 Feasibility Study generally utilized 250-foot-wide study corridors to evaluate alternatives and estimate impacts. Part of the purpose of the EA is to estimate impacts for the alternatives based on estimated limits of disturbance (i.e., conceptual construction limits that include sufficient space for building the project as well as accommodating utility adjustments), as well as shifts of the alignments to minimize impacts to sensitive environmental resources. This section presents those environmental constraints (Section 2.4.1), and then details the design criteria (Section 2.4.2) and the methodology for refining the typical sections (Section 2.4.3) and making adjustments to the alignments (Section 2.4.4). The results of these modifications – i.e., the descriptions of Alternatives 2A, 2B, and 4, including graphics depicting their typical sections and alignments – are presented in Section 4 of this memorandum. A summary of estimated environmental impacts for the chief environmental constraints are presented in Section 6.

2.4.1 Environmental Constraints

The study area is predominately developed with residential, commercial, and some industrial development, interspersed with parklands, battlefields, and stream corridors and floodplains. These elements all represent environmental constraints; however, some receive greater legal

[6] Under regulations implementing Section 106 of the National Historic Preservation Act, federal agencies are to consult with agencies, organizations, and individuals with a demonstrated interest in an undertaking that may affect historic properties.

[7] The APE for archaeology is defined by the limits of the proposed infrastructure improvements associated with Alternatives 2A, 2B, and 4 and encompasses approximately 420 acres over the three alternatives. The APE for architecture is defined by any parcels that are within or intersect the limits of the 250-foot-wide study corridors associated with the three alternatives.

protections than others under federal law. For example, impacts to streams and wetlands are to be avoided and minimized to the extent practicable. The use of land from public parks and historic properties is to be avoided unless there is no feasible and prudent alternative. Therefore, certain environmental constraints were drivers of the early alternatives development process and guided potential refinements to typical sections and alignments to avoid or minimize impacts, as detailed below.

Cultural resources and parklands are critical constraints due to federal regulations protecting these resources. **Historic properties** (i.e., cultural resources that are listed on or eligible for listing on the National Register of Historic Places [NRHP]) are protected under Section 106) of the NHPA[8] and its implementing regulations (36 CFR 800). Section 106 provides a process for identification and evaluation of historic properties, assessment of effects, and resolution of adverse effects. The portions of two Civil War battlefields, Blackburn's Ford Battlefield and the First Battle of Manassas, and the Mitchell's Ford Entrenchments are located in the northern portion of the study area along Bull Run. Alternatives 2A, 2B, and 4 involvements with elements of the Civil War battlefields and entrenchments are summarized in **Table 2-1**.

The NRHP-eligible battlefield boundaries are based on the Potential NRHP (PotNR) boundaries defined by the American Battlefield Protection Program as the surviving landscape and features that convey the historic sense of place, with several minor adjustments to exclude certain areas that have lost integrity due to disturbance and development. An architectural survey found no NRHP-eligible resources within the area of potential effects. DHR concurred on October 23, 2019 with the battlefield boundaries noted above and agreed with the findings of the architectural survey. [Note: additional architectural survey work is being conducted in the area where the north end of the alignment of Alternative 2B was shifted.] An archaeological survey will be done once an alternative is selected.

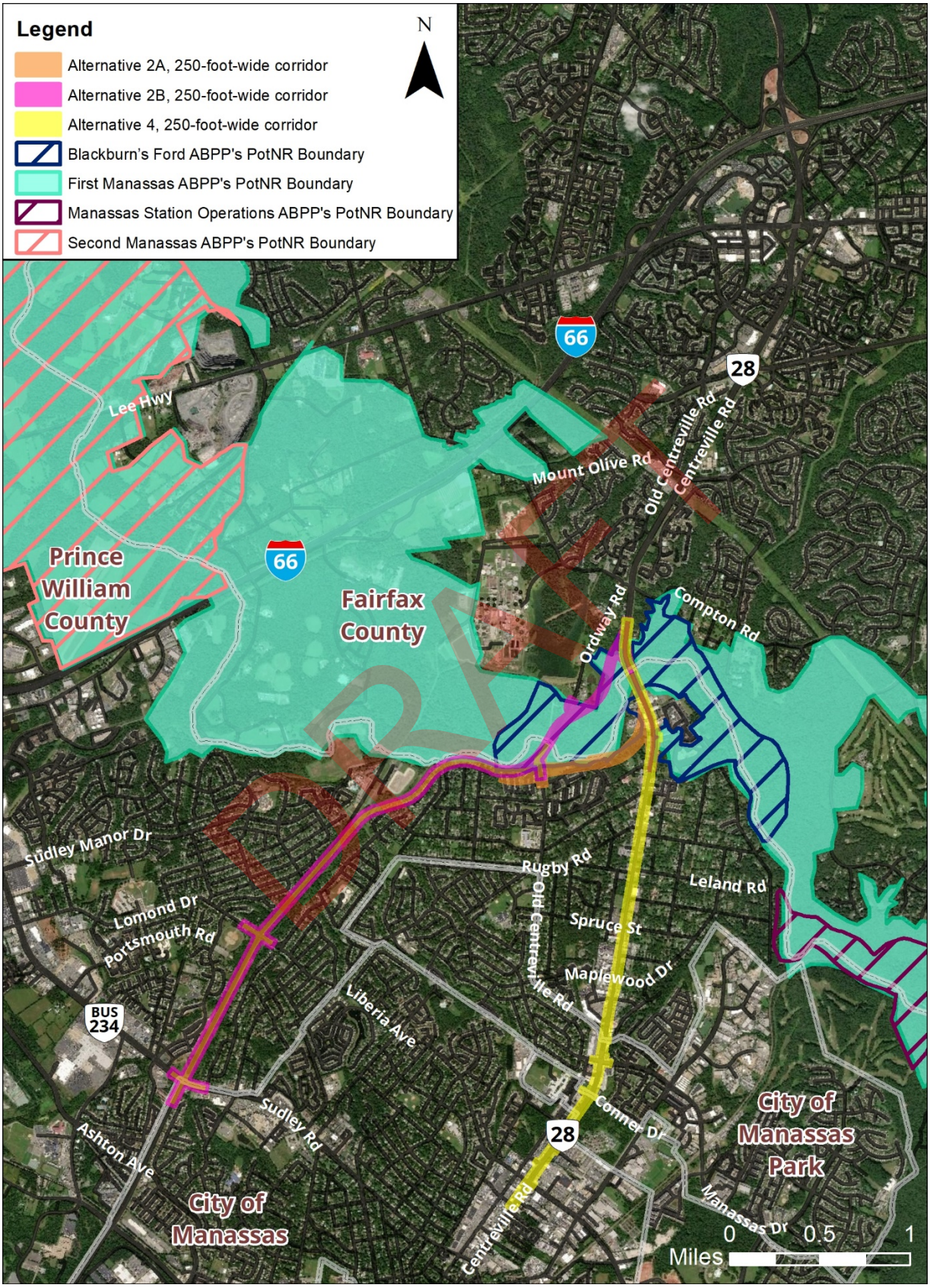
The historic properties in the area of potential effects are shown[9] in **Figure 2-2**, which also shows the 250-foot-wide corridors from the 2017 Feasibility Study, which are being modified as part of this study to minimize and avoid impacts to the extent practicable.

Table 2-1. Historic Properties Potentially Impacted

Cultural Resource	NRHP Status	Alternative 2A	Alternative 2B	Alternative 4
Blackburn's Ford Battlefield	Potentially Eligible by DHR	X	X	X
First Battle of Manassas (Battlefield)	Listed	X	X	X
Mitchell's Ford Entrenchments	Listed	X		

[8] Section 106 (54 USC 306108) of the National Historic Preservation Act requires federal agencies to take into account the effects of federally funded projects on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on such projects.

[9] Locations for archaeological resources are not provided in public documents per guidelines set forth in the Archeological Resources Protection Act of 1979 and other applicable legislation; accordingly, Mitchell's Ford Entrenchments is not shown on any public mapping as part of this study.



Note: Location of Mitchell's Ford Entrenchments redacted in accordance with the Archeological Resources Protection Act of 1979

Figure 2-2. Historic Properties Potentially Impacted (2017 Feasibility Study Alignments)

Historic properties also are protected under provisions of Section 4(f) of the US Department of Transportation Act of 1966 (49 USC 303(c)). For a federal-aid transportation project, FHWA may approve the use of land from publicly owned public parks or recreation areas, publicly owned wildlife or waterfowl refuges, or historic sites that are listed in, or eligible for listing in, the NRHP if it determines that there is no feasible and prudent avoidance alternative and the action includes all possible planning to minimize harm to the property. FHWA also may approve the use of land from such properties if it determines that the use of the property, including any measure(s) to minimize harm (such as any avoidance, minimization, mitigation, or enhancement measures) committed to by the applicant, will have a *de minimis* impact, as defined in 23 CFR 774.17, on the property. A "use" of Section 4(f) property occurs: (1) When land is permanently incorporated into a transportation facility; (2) When there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose; or, (3) When there is a constructive use of a Section 4(f) property.

Public parks and recreation areas are also a critical constraint as they too are protected under Section 4(f). Known public parks that would potentially be impacted by the previously-defined Alternatives 2A, 2B, and/or 4 are summarized in **Table 2-2**.

Table 2-2. Public Parks Potentially Impacted

Public Park/ Recreation Facility	Size	Owner	Facilities	Alternative 2A	Alternative 2B	Alternative 4
Bull Run Regional Park	1,500 acres	NOVA Parks	Waterpark, special events center, campgrounds/cabins, soccer fields, picnic areas, hiking trails.	X	X	X
Bull Run Occoquan Trail	19.7 miles	NOVA Parks	Hiking and biking trails, interpretive signage	X	X	X
Ben Lomond Regional Park/ Splashdown	240.6 acres	Prince William County	Waterpark, Soccer and softball fields; tennis, basketball and volleyball courts, pavilions and playground	X	X	

Waters of the US (streams, wetlands, and floodplains), are critical constraints because federal regulations under the Clean Water Act require consideration of practicable alternatives with less impact before discharges of fill material can be permitted (40 CFR 230). The US Army Corps of Engineers (USACE) is constrained by regulations to approve for permitting only the least environmentally damaging practicable alternative (LEDPA) that meets the purpose and need. Therefore, refinements to the alternatives will need to ensure that all efforts were made to avoid and minimize impacts to streams and wetlands. Alternatives 2A, 2B, and 4 are located within the Bull Run and Flat Branch drainages. Potential impacts to water resources are greatest along the new alignment sections of Alternatives 2A and 2B. Alternatives 2A and 4 would follow the existing Route 28 crossing of Bull Run and Alternative 2B would follow the existing Old Centreville Road/Ordway Road crossing of Bull Run.

Minimization of impacts to water resources would be accomplished by crossing streams on bridges where practicable, by selectively shifting alignments where practicable, and by utilizing design measures such as minimized typical section elements and retaining walls where practicable while also balancing potential impacts to other resources, such as residences and businesses. A stream

and wetland delineation was completed in Summer 2018 as part of the environmental documentation for the EA, from which stream and wetland impacts for alternatives are determined. A preliminary jurisdictional determination from USACE is part of the EA process.

Concentrations of residential and business properties are critical constraints because of the potential for displacements and community disruptions. Most of the study area is a densely populated and developed urban/suburban environment. Based on input from early public and agency scoping, avoiding and minimizing impacts to or displacements homes and businesses through these areas is a guiding factor when considering design or alignment changes of Alternatives 2A, 2B, or 4 from the 2017 Feasibility study.

There are approximately 201 developed and vacant parcels that directly abut Route 28 and its cross-streets within the study area.[10] Multiple adjacent parcels may be owned/used by a single business or property owner. On these parcels are approximately 195 buildings: approximately 170 business/commercial buildings, approximately 20 homes, and 2 public/community buildings. The businesses include restaurants, gas stations, public storage facilities, automobile sales/repair centers, and other services typical within dense development along a commercial corridor, and also include several shopping center plazas that contain multiple businesses under one roof. The public/community buildings include a community library and a church; however, there are several additional churches and a private school that are located on parcels adjacent to, but not directly abutting, the Route 28 corridor, nor do they have direct access to Route 28. The residential properties are generally single-family homes with private driveways intersecting Route 28, and are limited to the northern end of the Route 28 corridor near Bull Run within the study area. Parcels generally have direct access to/from Route 28, and most buildings, as well as their parking facilities, particularly for businesses, are located with minimal set-back to the existing roadway. Therefore, any widening of Route 28 has the potential to impact many properties and their operations. Additionally, high-voltage power transmission lines on large steel poles traverse the Route 28 corridor from the Manassas Park Substation located just north of Conner Drive to the northern limits of the study area. The transmission lines cross Route 28 five times in the study area: running initially along the east side of the roadway northward from the power substation, the lines cross to the west side of Route 28 just south of the intersection with Browns Lane; then cross back to the east side just north of the Patton Lane intersection, then cross to the west side just south of Bull Run, cross back to east side roughly 1,500 feet south of Compton Road, and then, finally, cross again to the west side of the intersection of Compton Road, from where they continue westward along Compton Road out of the study area.

Along Alternatives 2A and 2B, residential neighborhoods abut both sides of Flat Branch and the County-owned right-of-way from Sudley Road north to the Prince William County Service Authority east of Ben Lomond Regional Park/Splash Down Waterpark. East of Flat Branch, Alternatives 2A and 2B traverse single family neighborhoods along Alleghany Road and Boundary Avenue and a portion of the Bull Run Mobile Home Community on the west side of Old Centreville Road. East of Old Centreville Road, Alternative 2A traverses the Quail Hollow townhouse community and continues eastward to join Route 28 south of Bull Run in an area with several single-family homes and small businesses. Alternative 2B turns northward along Old Centreville Road, which becomes Ordway Road after crossing Bull Run into Fairfax County. Along Ordway Road are a veterinary business and several single family homes. The Upper

[10] Parcel and buildings data within Fairfax and Prince William Counties accessed via Open Data (accessed September 2019). GIS parcel data received directly from City of Manassas (August 2019) and City of Manassas Park (September 2019).

Occoquan Service Authority operates a large water reclamation plant on the west side of Ordway Road.

Residential relocations are more of a critical concern for Alternatives 2A and 2B and business relocations are more of a critical concern for Alternative 4.

2.4.2 Design Criteria

In order to avoid and/or minimize environmental impacts and reduce cost, the typical sections and alignments developed as part of the 2017 Feasibility Study for Alternatives 2A, 2B, and 4 have been reevaluated and refined. These modifications to the roadway typical sections and horizontal and vertical alignments for Alternatives 2A, 2B, and 4 were prepared in accordance with the VDOT *Road Design Manual (Issued January 2005 – Revised July 2018)*. Key design criteria, features, and assumptions are presented in **Table 2-3**. Conceptual engineering was performed to support comparative analysis of the alternatives in order to provide a basis of impacts for environmental evaluation. The previously developed alignments and cross section information were utilized and refined to avoid or minimize impacts to sensitive environmental features. Additionally, for Alternatives 2A and 2B, the previous study evaluated the limited-access bypass alignment with intersections at three intermediary roadways, which were not changed as part of the design refinements: Sudley Road, Lomond Drive, and Old Centreville Road/Ordway Road. All alternatives would tie into the separate Fairfax County project that would widen Route 28 to six lanes from Compton Road to the interchange at Route 29.

Table 2-3. Design Criteria for Refined Typical Sections and Adjustments to Alignments

CATEGORY	CRITERIA
Design Speed	50 mph
Posted Speed	45 mph
Minimum Lane Width	11 feet
Shared Use Path Width	10 feet
Sidewalk Width	5 feet
Median Width	14 feet (includes 2-foot-wide barrier)
Shoulder Width (Roadway)	8 feet (outside)
Shoulder Width (Bridge)	10 feet (outside) / 6 feet (inside)
Noise Barrier Width *(if warranted)*	1.5 feet wide with 5 feet maintenance area
Minimum Horizontal Curve Radius	929 feet
Cut/Fill Slope	2:1
Construction Zone	10 feet
Retaining Wall	2 feet

2.4.3 Refined Typical Sections

This section presents how the typical sections developed as part of the 2017 Feasibility Study for Alternatives 2A, 2B, and 4 have been reevaluated and refined to avoid and/or minimize

environmental impacts and reduce cost, per the design criteria stated above. The overall methodology is described, followed by alternative-specific assumptions for typical sections. Application of these typical sections to development of horizontal alignments/limits of disturbance are presented in Section 2.4.4. Revised typical section figures and descriptions are presented in Section 4.

Overall Methodology. In the 2017 Feasibility Study, 250-foot-wide study corridors were used for determination of environmental impacts. Consequently, there was no need to determine specific construction limits and as a result, roadside elements were not developed or depicted on the typical sections. Therefore, as part of this conceptual design effort and to identify a more realistic estimate of impacts for the purposes of the EA, limits of disturbance tied to typical section refinements were developed. The typical sections were refined to include side slopes (cut/fill) sections along areas where topography and/or right-of-way allow for reasonable limits and retaining walls in areas with sensitive resources to avoid or minimize impacts. In the absence of project-specific geotechnical information, cut and fill slopes were assumed to be 2:1, consistent with standard practice. Additionally, construction zones on each side of the roadway are provided to allow for construction activity and placement of future erosion and sediment control measures, as are utility easements where necessary; these elements are described in further detail for each alternative below.

In addition to the refinements to the previous roadway typical sections for Alternatives 2A, 2B, and 4, bridge typical sections were prepared for the portions of the alignments that require a bridge, which were not prepared as part of the 2017 Feasibility Study. This includes bridges at the existing Route 28 crossing of Bull Run for Alternatives 2A and 4, and at the existing Ordway Road crossing of Bull Run for Alternative 2B. For the purposes of this evaluation, it was also assumed that Alternative 2A/2B would span Flat Branch on a bridge crossing. Bridges would span streams to the extent possible to reduce impacts. However, bridge piers are not designed as a part of this conceptual design and would be based on future bridge design and a river mechanics analysis (the existing Route 28 bridge over Bull Run has 12 piers and the existing Ordway Road bridge over Bull Run has six piers).

Alternatives 2A/2B Refined Typical Sections. The typical section developed in the 2017 Feasibility Study was designed to parkway standards with two lanes in each direction, a 40-foot wide raised landscaped median, curb and gutter, and a 10-foot shared use path on the east side of the roadway. This typical section was reevaluated with the intent of minimizing the overall footprint while continuing to use a four-lane divided roadway and provide pedestrian/bicycle facilities. In coordination with Prince William County and VDOT, the typical section was revised from a parkway design with a wide median and a closed section (i.e., curb and gutter) to a design with a narrow median and open section (i.e., shoulders).

For Alternatives 2A/2B, the typical sections now include side slopes (cut/fill) sections along the existing County-owned right-of-way and use of retaining wall along the remainder of the corridor to avoid or minimize impacts to sensitive resources. A 10-foot-wide construction zone on each side of the right-of-way was provided to allow for construction activity and future placement of erosion and sediment control measures. An overhead utility easement is depicted to be used where needed. Based on the current level of utility information, this easement would be needed along existing Old Centreville/Ordway Road north of Bull Run for Alternative 2B, but not elsewhere for Alternatives 2A/2B.

In addition to the roadway typical section for Alternatives 2A/2B, bridge typical sections were prepared for the segments of the alignment that require a bridge, which were not prepared as part of the 2017 Feasibility Study. The typical section for Alternatives 2A/2B for the bridge over Flat

Branch and for Alternative 2B for the bridge over Bull Run were developed in coordination with the County. The typical section for Alternative 2A for the bridge over Bull Run after the bypass alignment merges with existing Route 28 was developed in accordance with the VDOT Manual of the Structure and Bridge Division.

Refer to Section 4.3.2 and 4.3.3 for full details, including graphics of the typical sections.

Alternative 4 Refined Typical Sections. Existing Route 28 is a four-lane divided facility, as described in Section 1.2. The typical section developed in the 2017 Feasibility Study is a commonly-used suburban section throughout Virginia. It is a closed (i.e., curb and gutter) section which provides three travel lanes in each direction, a median which provides width for a single left turn lane, and pedestrian and bicycle facilities. This typical section was reevaluated with the intent of minimizing the overall footprint while continuing to use a six-lane divided roadway and providing pedestrian/bicycle facilities. However, after evaluation, it was determined that this section is optimized for the level of design development and is therefore unchanged, except as noted below to accommodate estimates of construction limits/easements.

For Alternative 4, the typical sections now include side slopes (cut/fill) sections. Because there is little deviation from the existing roadway elevation, the amount of cut/fill is small. A maximum 2 foot elevation difference is assumed. Using 2:1 slopes, this results in 4 foot width for side slopes. Because of the low heights of cut and fill, 2:1 slopes would be appropriate without further geotechnical evaluation. A 6-foot construction zone on each side of the right-of-way is provided to allow for construction activity and placement of future erosion and sediment control measures.

Figure 2-3. Existing Route 28 Utilities (Looking Southbound)
High voltage power transmission lines (on steel poles, right side) and low voltage distribution line and communication lines (on wooden poles, both sides)

An easement for overhead utilities is provided to accommodate the power distribution lines and communication lines on Route 28 (see **Figure 2-3**). This easement assumes that existing lines that are on both sides can be co-located to a single side of the roadway, but changes sides to minimize potential for relocating the existing high voltage power transmission lines.

In addition to the standard typical section, some intersections warrant dual left turn lanes and/or a right turn lane. A separate typical section showing the added width for these lanes at intersections was created. **Table 2-4** below shows the existing intersection configurations at signalized intersections along Route 28, which were accommodated in the intersection typical section.

Table 2-4. Signalized Intersections Along Route 28 (North to South)

Intersecting Roadway	Southbound Number of Lanes			Northbound Number of Lanes			Maximum Total Number of Lanes
	Right	Thru	Left	Left	Thru	Right	
Ordway Rd/ Compton Road	1	2	1	1	2	1	8
Orchard Bridge Drive	0	2	2	1	2	1	7
Patton Lane	0	2	0	0	2	0	5
Yorkshire Lane/ Falls Grove Drive	0	2	1	1	2	1	6
Leland Road	0	2	1	1	2	0	5
Maplewood Drive	0	2	1	1	2	0	5
Browns Lane	1	2	1	1	2	0	6
Manassas Drive	1	3	2	2	2	1	8
Liberia Avenue	1	2	2	1	2	1	8
Sudley Road	1	2	1	1	2	0	7

Also, a bridge typical section was prepared for the segment of the alignment that crosses over Bull Run, which was not prepared as part of the 2017 Feasibility Study, which showed the lane widths and features of the roadway from which the bridge typical section was created. Refer to Section 4.3.4 for full details, including figures of the typical sections.

2.4.4 Adjustments to Alignments

The 2017 Feasibility Study alignments were each separately adjusted to minimize impacts to resources throughout the corridor, as detailed for each alternative below. For example, there are two roadways – Ordway Road and Route 28 – that cross over/through the primary environmental resources and therefore, trying to constrain improvements to existing right-of-way was an opportunity to minimize impacts. Once the horizontal and vertical alignments were set, a planning-level limits of disturbance was developed for each alternative based on the typical section limits of construction (cut/fill) and the roadside design as described in the previous section. The purpose of these limits of disturbance are to quantify environmental impacts, a summary of which is provided in Section 6. **Figures and descriptions of the adjusted alignments and limits of disturbance are presented in Section 4 for all alternatives.**

Any adjustments made to the alignment were prepared in accordance with the VDOT Road Design Manual (Issued January 2005 – Revised July 2018), see Table 2-3 above for criteria. Note that detailed stormwater management (SWM) plans are outside the scope of this NEPA effort and would occur during future phases of design. However, based on preliminary review of estimated right-of-way acquisitions and adjacent County-owned right-of-way, particularly for Alternatives

2A/2B, it is assumed that there will be sufficient opportunity to provide appropriate SWM and erosion and sediment control.

Alternative 2A. Horizontal Alignment: For the portion of the alignment that is in the existing County-owned right-of-way, the adjusted horizontal alignment closely follows the 2017 Feasibility Study alignment, with minor shifts to keep the project limits of disturbance within the existing right-of-way.

For the portion of the alignment to the east of the existing County owned right-of-way, the alignment was shifted south to balance avoiding some battlefield historic properties and parklands while minimizing impacts to other resources including floodplains, wetlands, and residential properties. In locations where residential displacements were unavoidable, additional adjustments were made to shift the alignment to prioritize utilizing more of an already-displaced property to avoid additional impacts to other resources, such as floodplains, wetlands, or other residential properties. See Section 4.3.3 for details.

Vertical Alignment: The roadway profile in the 2017 Feasibility Study generally follows the existing ground. This profile is considered optimized for the current level of engineering development and therefore was not revised.

Determination of limits of disturbance: For the portion of the alignment within the existing County-owned right-of-way, cut or fill side slopes were used. Cut and fill limits were determined by comparing the existing ground elevations to the proposed roadway profile at 100-foot intervals. Existing ground elevations were developed using the terrain model and contour lines from the 2017 Feasibility Study, as analyzed in MicroStation Power InRoads V8i (SS4). The width of the proposed cut and fill sections range between 10 feet to 40 feet. While there were a few localized areas where the cut and fill limits may exceed the existing County owned right-of-way at this high-scale level of analysis, it is assumed that short lengths of low height retaining walls could be placed 5 feet from the existing right-of-way to avoid exceeding it, if it is determined that the conservative estimates for limits of disturbance cannot be further minimized during future phases of design.

East of the existing County-owned right-of-way, retaining walls were used to minimize impacts to areas with sensitive resources (as detailed in Section 4.3). Due to varying topography, the corridor would require differing levels of cut and fill along the corridor. For purposes of this study, it was assumed that locations that require a retaining wall would require fill since that typical section is wider than if it required cut. The retaining wall section would continue until the corridor merges with existing Route 28, where it transitions from retaining wall to cut and fill with the existing topography.

Limits of disturbance at intersections along the corridor were assumed to be the same as those determined in the 2017 Feasibility Study, and the provided lane configurations/operations were verified to match existing conditions.

Alternative 2B. Horizontal Alignment: For the portion of the alignment that is in the existing County-owned right-of-way, the adjusted horizontal alignment closely follows the 2017 Feasibility Study alignment, with minor shifts to keep the project limits of disturbance within the existing right-of-way.

East of the County-owned right-of-way, the 2017 Feasibility Study alignment traveled along existing Ordway Road for about 1,700 feet and then turned east through (i.e., impacting) Bull Run Regional Park and historic battlefield properties to connect to existing Route 28. The original alignment was adjusted to a new alignment to avoid the extent of those original impacts. While the modifications to this alignment cannot avoid impacts to surrounding resources, the amount of

impacted area is minimized without unduly impacting other resources. Where the adjusted alignment begins to turn north to transition to utilizing Old Centreville Road/Ordway Road, impacts to the battlefield properties and Bull Run Regional are unavoidable because the existing right-of-way for Ordway Road is not wide enough to fully contain the roadway. The adjusted alignment utilizes existing Ordway Road for about 4,200 feet and then turns east to merge with existing Route 28. Along the northern part of Ordway Road, the adjusted alignment balances avoidance and minimization of impacts to battlefield historic properties, floodplains, wetlands, and residential/commercial properties. See Section 4.4.3 for details.

Vertical Alignment: A profile was not provided from the 2017 Feasibility Study; therefore, one was created for this study. The profile for Alternative 2B is the same as Alternative 2A along the existing County-owned right-of-way and along Alleghany Road. The vertical alignment for Alternative 2B differs from Alternative 2A at the intersection of Boundary Avenue and Bull Run Road through to where it ties into existing Route 28. The new profile follows the trends of existing topography based on the terrain model (locations in Prince William County) and LiDAR elevation data (locations in Fairfax County), as analyzed in MicroStation Power InRoads V8i (SS4).

Determination of limits of disturbance: For the portion of the alignment within the existing County owned right-of-way, cut or fill side slopes were used. Cut and fill limits were determined by comparing the existing ground elevations to the proposed roadway profile at 100-foot intervals. Existing ground elevations were developed using the terrain model and contour lines from the 2017 Feasibility Study. The width of the cut and fill sections range from 10 feet to 40 feet. There are a few locations where the cut and fill limits exceed the existing County owned right-of-way and at these locations it is assumed that short lengths of low height retaining walls will be placed 5 feet from the existing right-of-way to avoid exceeding it.

East of the existing County-owned right-of-way near sensitive areas, retaining walls were used to minimize impacts to adjacent properties. Due to varying topography, the corridor would require differing levels of cut and fill along the corridor. For purposes of this study, it is assumed that in locations that require a retaining wall would require fill since that typical section is wider than if it required cut. By using a retaining wall in these sensitive areas, impacts to the parks, floodplains, and wetlands were minimized and impacts to the pond and the veterinary clinic were avoided. The retaining wall section continues until the new alignment merges with existing Route 28, where it transitions from retaining wall to cut and fill with the existing topography.

Limits of disturbance at intersections along the corridor were assumed to be the same as those determined in the 2017 Feasibility Study.

Alternative 4. Horizontal Alignment: The alignment used in the 2017 Feasibility Study does not widen the existing roadway evenly about the centerline. Instead, the alignment is offset from the existing centerline to minimize impacts to the existing high voltage transmission lines. This alignment is considered optimized for the current level of engineering development and therefore was not revised. See Section 4.5.3 for details.

Vertical Alignment: The proposed widening will match the existing roadway profile, consequently, there is no need to develop a profile.

Determination of limits of disturbance: Because the cut and fill heights are short, the limits of disturbance are consistent throughout the corridor, except for additional turn lanes as previously discussed. Limits of disturbance at intersections were assumed to be the same as those determined in the 2017 Feasibility Study and provide for the turn operations as previously shown in Table 2-4.

SECTION 3
ALTERNATIVES NOT RETAINED FOR DETAILED ANALYSIS

3.1 INTRODUCTION

The ten preliminary alternatives identified and analyzed in the 2017 Feasibility Study are the foundation of the alternatives development process for the EA, as previously described in Section 2.2. While that feasibility study carried forward four of the ten alternatives into detailed screening and ultimately determined a highest-ranked alternative, all ten alternatives from that study were reviewed as part of the EA and the reasons for their dismissal and/or ranking are herein reaffirmed.

Of the ten preliminary alternatives considered in that feasibility study, the seven alternatives that were considered but not retained for analysis in the EA are summarized in **Table 3-1** and detailed in the following subsections. Additionally, per VDOT's Environmental Assessment Outline and Guidance (revised January 25, 2018), consideration of a Transportation System Management alternative is considered. These alternatives, as stand-alone concepts, were found to not satisfy the purpose and need. The three alternatives that are carried forward for further evaluation are described in Section 4.

Table 3-1. Alternatives Eliminated from Detailed Study

Alternative	Basis for Elimination
Transportation System Management	Subject of separate, previous precursor study to the EA that identified over 100 short-term low-cost safety and operational improvements, 5 of which are under construction. Also subject of a separate, ongoing operational improvements study. Eliminated as a stand-alone concept.
Alternative 3: Godwin Drive extended to I-66 near the existing Compton Road crossing (the former Tri-County Parkway alignment)	Not supported by FHWA due to Section 4(f) impacts on park property and likely not permittable by the Corps due to impacts on waterways/wetlands.
Alternative 5: Reversible Lanes between Liberia Avenue and the Fairfax County Line	Not consistent with local and regional plans. Access, safety, and circulation impacts during hours of operation of reversible lanes.
Alternative 6: Widening Old Centreville Road/Ordway Road	Impacts to neighborhoods including residential relocations and loss of continuity. Political opposition from jurisdictions, transportation agencies, and/or other governmental agencies.
Alternative 7: Converting Old Centreville Road/Ordway Road to a Reversible Facility	Access and circulation impacts during hours of operation of reversible lanes.
Alternative 8: Transit Alternatives to include BRT and/or VRE expansion along the corridor / Mass Transit Alternative	Area lacks sufficient population density required to attract enough ridership to warrant a dedicated travel lane for transit. Eliminated as a stand-alone concept.
Alternative 9: Euclid Avenue extension north to Route 28 near Bull Run and south to Sudley Road/Route 28 intersection.	Increased traffic in Historic Downtown Manassas. Impacts to hazardous materials sites. Noise impacts. Not consistent with the Prince William County's Comprehensive Plan.
Alternative 10: A new southern alignment (Hasting Drive/Signal View Drive)	Increased traffic in Historic Downtown Manassas. Impacts to wetlands/floodways/streams and residential properties. Potential right-of-way restrictions.

3.2 TRANSPORTATION SYSTEM MANAGEMENT (TSM)

As previously described in Section 1.3, VDOT's Route 28 Corridor Safety and Operations Study in 2015 recommended over 100 safety and congestion-related candidate improvements on Route 28 between Liberia Avenue in Prince William County to just south of I-66 in Fairfax County, which were screened by local agencies and the steering committee for the project. Study analysis elements included development of traffic forecasts/operations, preliminary design sketches, and a cost-benefit ratio for recommendation of improvements. Five were advanced to design as an immediate series of action items along Route 28:

1) Additional northbound lane(s) from Bull Run bridge to Upperridge Drive/Old Centreville Road to add capacity and improve operations
2) Addition of sidewalk/path and related roadway improvements, on the east side of Route 28 near Bull Run bridge, to increase pedestrian/bicycle safety and continuity
3) Addition of 1,400 feet of sidewalk/path, on the west side of Route 28 between Spruce Street and Leland Road, to increase safety and operations by removing pedestrians/ bicycle conflicts from the roadway and adding accessibility to parcels
4) Southbound left-turn bay extension at Liberia Avenue intersection to improve operations and increase safety
5) Roundabout intersection improvement at Ordway/Compton Road to address intersection spacing, operations, and congestion

Additionally, an Operational Improvements Study[11] for approximately two miles along Centreville Road (Route 28) from Blooms Quarry Lane to the Fairfax County Line in Prince William County is currently ongoing. VDOT initiated the study in July 2019 through their Strategically Targeted Affordable Roadway Solutions (STARS) program, which aims to identify cost-effective measures aimed at improving safety and reducing congestion. The concepts being studied include the following elements:

- Innovative intersections such as roundabouts and overpasses
- Improved traffic signal timing and operations
- Turn lane improvements
- Access management for properties along the corridor including new medians
- Pedestrian enhancements including crosswalks and new sidewalks

As TSM improvements, i.e., short-term and low-cost safety and operational improvements, have already been identified in a precursor study and are underway, they were removed from further consideration as a stand-alone concept as part of the EA.

[11] http://www.virginiadot.org/projects/northernvirginia/centreville_rd_study.asp

3.3 ALTERNATIVE 3. GODWIN DRIVE EXTENDED TO I-66 (THE FORMER TRI-COUNTY PARKWAY ALIGNMENT)

Alternative 3 (**Figure 3-1**) follows the previously studied Tri-County Parkway alignment: extending Godwin Drive north from the existing Godwin Drive/Sudley Road intersection parallel to Flat Branch, crossing Bull Run and Bull Run Regional Park to tie into I-66. The bypass would be designed to parkway standards with two lanes in each direction and a 40-foot raised landscape median, including a shared-use path.

However, the Tri-County alignment has been deemed unsupportable by FHWA and non-permittable by the Corps in the past due to park impacts and potential floodway/floodplains/ streams/wetland impacts. During the first screen analysis, the 2017 Feasibility Study determined that reopening the same type of review on this alignment would not yield any different determinations from FHWA or the Corps. Therefore, Alternative 3 was removed from further evaluation.

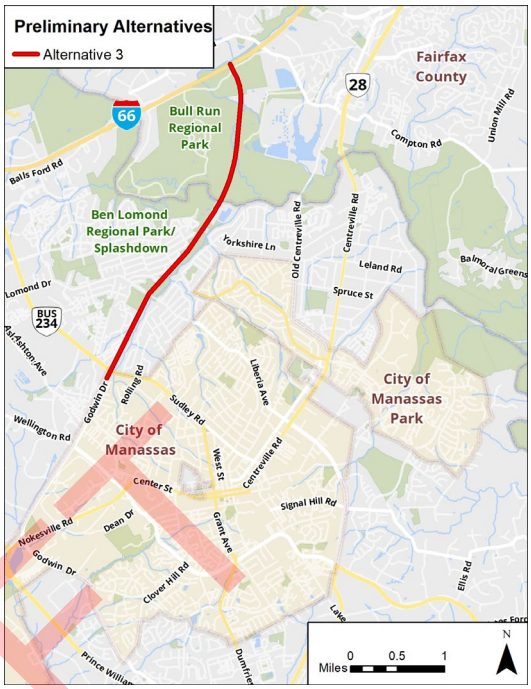


Figure 3-1. Alternative 3

3.4 ALTERNATIVE 5. REVERSIBLE LANES BETWEEN LIBERIA AVENUE AND THE FAIRFAX COUNTY LINE

Alternative 5 (**Figure 3-2**) widens the existing Route 28 alignment to provide barrier-separated reversible lanes between Liberia Avenue and the Prince William County Line, which would serve three lanes of dedicated northbound traffic in the morning peak period and in the evening peak period, would switch to serve three lanes of dedicated southbound traffic. As part of widening of the existing roadway to accommodate the additional shoulders and barriers associated with the reversible lane, curb and gutter would be provided as well as a five-foot sidewalk on the west side of Route 28 and a 10-foot shared use path on the east side. During the first screening in the 2017 Feasibility Study, it was determined that Alternative 5 was not consistent with local and regional plans, and that the operation of the reversible lane would negatively impact access to existing development and circulation within the study area. Due to the median barriers, no left turns from Route 28 would be permitted from just north of Manassas Drive to Bull Run. Therefore, Alternative 5 was removed from further consideration.

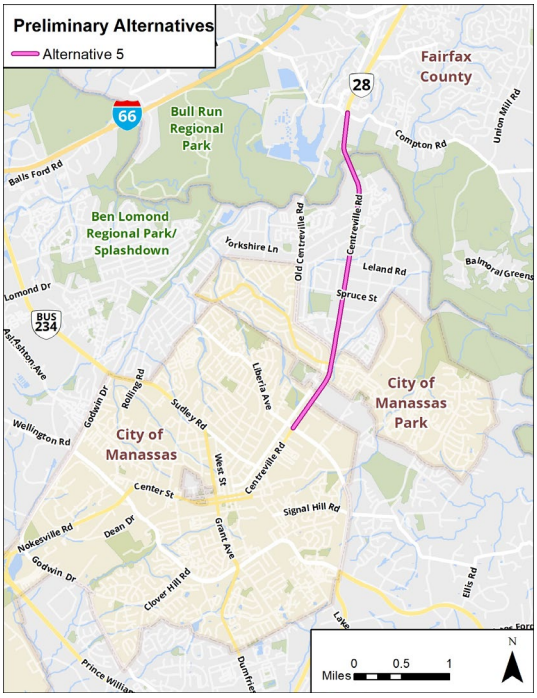


Figure 3-2. Alternative 5

3.5 ALTERNATIVE 6: WIDENING OLD CENTREVILLE ROAD/ORDWAY ROAD

Alternative 6 **(Figure 3-3)** widens Old Centreville Road by one lane in each direction with a 16-foot raised median and adds one lane in each direction on Route 28 between Liberia Avenue and Old Centreville Road. While converting a collector street to a principal arterial would serve a higher volume of peak period traffic, it was determined during the first screening in the 2017 Feasibility Study that the new road configuration would disrupt the continuity of neighborhoods in both Prince William County and the City of Manassas Park. Alternative 6 would also impact residential properties within the neighborhoods that border the improvements, particularly along Old Centreville Road. There was also opposition to this alternative by members of the Executive Committee for the 2017 Feasibility Study, which consisted of technical staff from jurisdictions, transportation agencies, and other governmental agencies. Therefore, Alternative 6 was removed from further consideration.

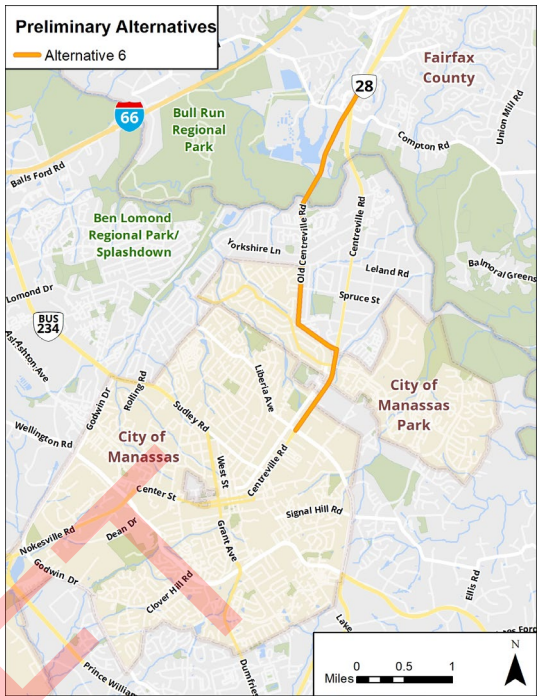


Figure 3-3. Alternative 6

3.6 ALTERNATIVE 7: CONVERTING OLD CENTREVILLE ROAD/ORDWAY ROAD TO A REVERSIBLE FACILITY

Alternative 7 (**Figure 3-4**) maintains the existing Old Centreville Road/Ordway Road alignment (i.e., no widening improvements) between the Route 28/Blooms Quarry Road intersection and Compton Road, but converts it to a fully reversible facility. Both lanes of the existing two-lane roadway would be open during the peak periods for the peak traffic direction (i.e., northbound traffic only during the morning peak period and southbound traffic only during the evening peak period). During off-peak hours two-way traffic would occur with one lane in each direction. Additionally, Route 28 between Liberia Avenue and Old Centreville Road would be widened by one lane in each direction. During the first screening in the 2017 Feasibility Study, it was determined that the operations of the fully reversible lanes would create access and circulation impacts throughout the study area due to the reversible lanes and would increase cut-through traffic through neighborhoods during those hours as there is not a parallel route to handle non-peak traffic. Additionally, the alternative impacts bus circulation for schools and also results in increased traffic on Route 28 due to the traffic being restricted from Old Centreville Road in one direction during the peak periods. Therefore, Alternative 7 was removed from further consideration.

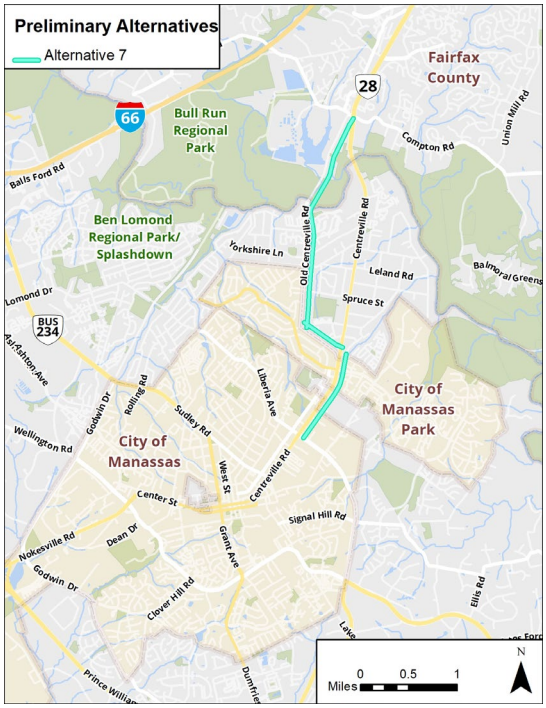


Figure 3-4. Alternative 7

3.7 ALTERNATIVE 8: TRANSIT ALTERNATIVES TO INCLUDE BRT AND/OR VRE EXPANSION ALONG THE CORRIDOR

Alternative 8 is a stand-alone transit alternative and involves providing a dedicated right-of-way or lane for Bus Rapid Transit (BRT) on Route 28 and/or extending Virginia Railway Express (VRE) to accommodate corridor travel. During the first screening in the 2017 Feasibility Study, it was determined that mass transit as a standalone alternative for the corridor was not feasible as the corridor area does not have the population density required to attract enough ridership to warrant such improvements. Therefore, Alternative 8 was removed from further consideration. Elimination of this alternative does not preclude mass transit, but it does not adequately meet the purpose and need as a stand-alone alternative.

3.8 ALTERNATIVE 9: EUCLID AVENUE EXTENSION NORTH TO ROUTE 28 NEAR BULL RUN AND SOUTH TO SUDLEY ROAD/ROUTE 28 INTERSECTION

Alternative 9 (**Figure 3-5**) creates a bypass of existing Route 28 by extending existing Euclid Avenue to the south and north. It would extend south from Quarry Road to the Route 28/Sudley Road intersection, widened to urban principal arterial standards with two lanes in each direction and a 16-foot wide raised landscaped median. Access to existing cross streets and properties would remain; however, some existing turn movements may be restricted as a raised median with limited access breaks will replace the existing sections of two-lane road, such as at Prescott Avenue. It would extend to the north from near Manassas Park High School along the west bank of Bull Run until joining with existing Route 28, which would "tee" into the new bypass. Route 28 would be widened from this point north to tie into the improvements planned by Fairfax County, and the existing Route 28 bridge over Bull Run would be replaced with a wider and longer bridge across the floodway. The bypass north would be designed to parkway standards with two lanes in each direction and a 40-foot wide raised landscaped median and a 10-foot shared use path. Access would be restricted along the northern portion of the bypass to Lake Drive. Note that in the first screening analysis in the 2017 Feasibility Study, three connections options (9A/9B/9C) at the southern terminus were considered but were replaced in favor of one southern terminus at Sudley Road.

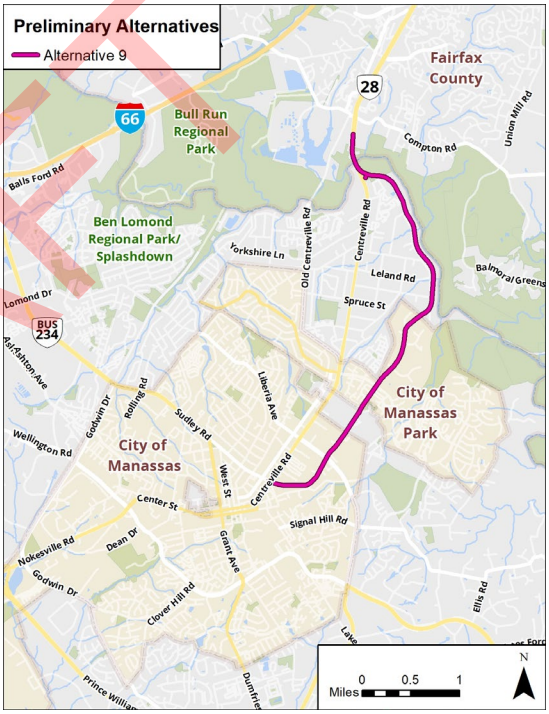


Figure 3-5. Alternative 9

In the 2017 Feasibility Study, Alternative 9 was one of four alternatives carried forward to the second, more detailed, screening of alternatives. The second screening was divided into and scored each alternative on four criteria – planning level costs, traffic benefits, environmental impacts, and socioeconomic/right-of-way impacts – to determine a highest-rank alternative. Of the four alternatives evaluated in the second screening, Alternative 9 received the lowest average ranking due to: highest estimated cost; 3rd fewest traffic benefits in 2040; and 3rd highest environmental/socioeconomic/right-of-way impacts. Specifically, with regard to traffic,

Alternative 9, like all four alternatives in the second screening, would reduce the number of intersections that operate at failing levels of service as compared to No Build conditions and provide some travel times savings on Route 28; however, it would increase traffic in Historic Downtown Manassas. While the bypass of Alternative 9 provides an additional route for commuters, it will also add turn restrictions along Euclid Avenue due to the raised median.

Environmental, socio-economic, and right-of-way impacts were evaluated based on a 250-foot wide corridor, centered on the alignment, with extensions at intersections, using publicly-available databases. Alternative 9 had comparable impacts to the other three second-level-screening alternatives for various resources, such as Section 4(f) properties, wetlands and streams, and floodplains and floodways, and potential residential or business relocations. However, also in comparison to those other alternatives, Alternative 9 would have high impacts to hazardous materials sites and the highest negative noise impact (i.e., greatest number of potential clusters impacted by noise). Additionally, Alternative 9 is not consistent with Prince William County's Comprehensive Plan, which calls for improvement on the west side of Route 28 via the Tri-County Parkway/Route 28 Bypass (i.e., Alternative 2A/2B). This combination of low corridor benefits with high impacts resulted in Alternative 9 receiving the lowest ranking in the second screening of the 2017 Feasibility Study, which was intended to identify which alternative was the best long-term solution for Route 28 by meeting future traffic demands. Therefore, Alternative 9 was removed from further consideration in the EA.

3.9 ALTERNATIVE 10: A NEW SOUTHERN ALIGNMENT (HASTING DRIVE/SIGNAL VIEW DRIVE)

Alternative 10 (**Figure 3-6**) creates an arterial bypass of existing Route 28, following Godwin Drive/Hastings Drive from Route 28 to Liberia Avenue. Three options to the north were developed between Liberia Avenue and the General's Ridge Golf Course: Alternative 10A (the most westward alignment) generally following Liberia Avenue and Manassas Drive, Alternative 10B generally following Signal View Drive and Manassas Drive, and Alternative 10C (the most eastward alignment) generally following Birmingham Drive and the east edge of Manassas Park. North of the General's Ridge Golf Course, all three options come together, cross the railroad tracks, and then follow the west bank of Bull Run to join with existing Route 28. The bypass would be two lanes in each direction with a 40-foot raised landscaped median.

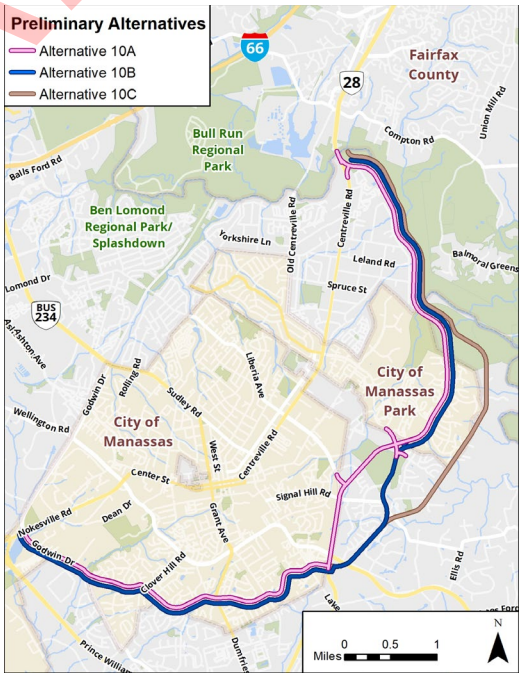


Figure 3-6. Alternative 10

During the first screening in the 2017 Feasibility Study, it was determined that Alternative 10A/10B/10C would increase traffic in Historic Downtown Manassas and would not meet future traffic demands of the corridor. Access would be restricted along the northern section of the bypass to Lake Drive. Additionally, it would impact one of the largest amounts of wetlands/ floodways/streams of all ten alternatives and has deed restrictions for the crossing of the General's Ridge Golf Course. It is not included in either the County's or the City's Comprehensive Plans. Therefore, Alternative 10 was removed from further consideration.

4.1 INTRODUCTION

This section describes the three build alternatives – Alternative 2A, 2B, and 4 – that are carried forward for analysis in the EA, which align with the top three highest-ranked alternatives from the second screening analysis in the 2017 Feasibility Study (**Figure 4-1)**. The elements of each alternative, as evaluated in that previous feasibility study, are described and the subsequent refinements to each that have been developed as part of this study are detailed. These modifications include refinements to typical sections and adjustments to alignments, which were developed in coordination with Prince William County and are based on comments received from the public and local, state, and federal agencies during scoping (Section 2.2) in order to minimize impacts and costs as well as account for realistic limits of construction. The methodology to develop these refinements was presented in Sections 2.4.2 through 2.4.4.

Included for evaluation in accordance with 23 CFR §1502.14(d), the no action or No Build condition serves as a baseline for comparison against alternatives and is described in Section 4.2 below. The ability of each alternative to meet the purpose and need is presented separately in Section 5, and summary of environmental impacts are presented in Section 6.

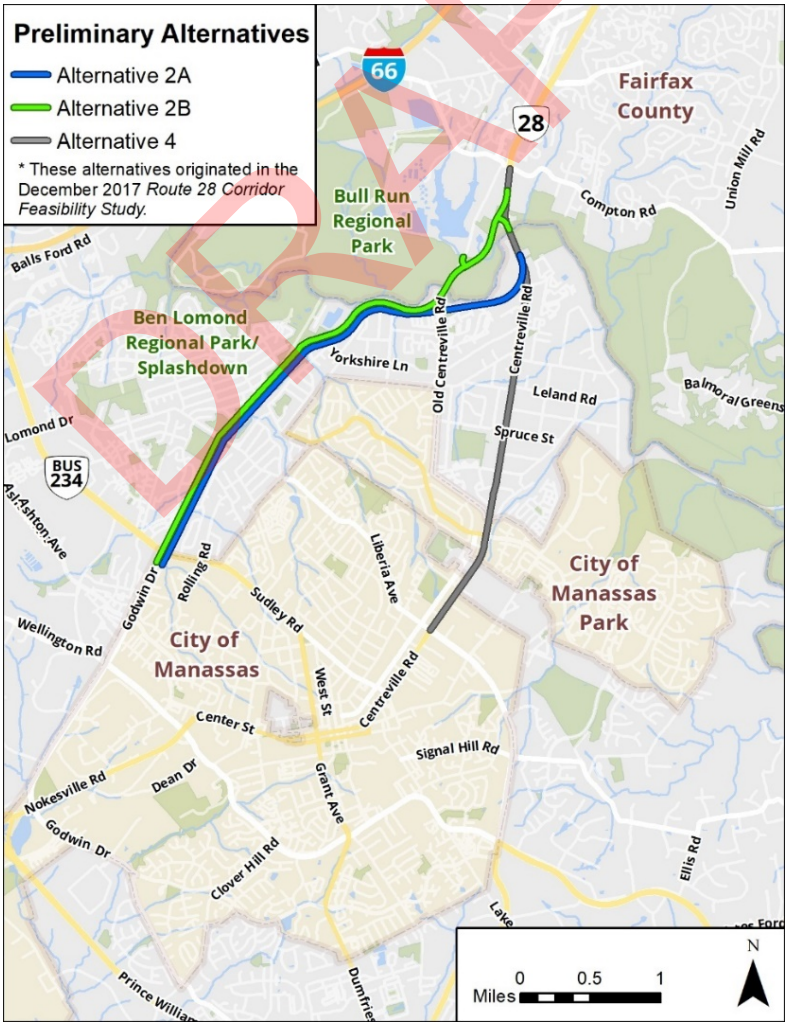


Figure 4-1. Alternatives Carried Forward – 2A, 2B, and 4

4.2 ELEMENTS OF THE NO BUILD (NO ACTION) ALTERNATIVE

Included for evaluation in accordance with 23 CFR §1502.14(d), the no action or No Build condition serves as a baseline for comparison against build alternatives and assumes that no project improvements are built. Other planned projects are, however, assumed to be constructed and in operation by the year 2040. It was assumed that the transportation network would include improvements within the study area that are programmed in the Prince William County Travel Demand Model[12] that incorporates future planned/programmed projects from the Prince William County Comprehensive Plan and the City of Manassas Six Year Plan. **Table 4-1** includes the projects that are expected to be completed and open to traffic by 2040 and are in vicinity to the project study area, i.e., the No Build condition.

Table 4-1. No Build Condition

Project	From	To	Change
Prince William County Comprehensive Plan			
Manassas Battlefield Bypass	Sudley Road	Fairfax County Line	4 Lane Principal Arterial Road (New)
North/South Connector	Wellington Road	University Boulevard	4 Lane Minor Arterial (New)
Rollins Ford Road	Linton Hall Road	Wellington Road	4 Lane Minor Arterial (New)
University Boulevard	Godwin Drive	Wellington Road	4 Lane Minor Arterial (New)
Williamson Boulevard	Lomond Drive	Portsmouth Road	4 Lane Major Collector (New)
Ashton Avenue	Rosemary Drive	Balls Ford Road	Widen to 4 lanes
Balls Ford Road	Wellington Road	Sudley Road	Widen to 4 Lane Minor Arterial
Balls Ford Road	Sudley Road	Coppermine Drive	Widen to 4 Lanes
Coverstone Drive	Ashton Avenue	Sudley Road	Widen to 4 Lane Major Collector
Devlin Road	Linton Hall Road	Wellington Road	Widen to 4 Lane Minor Arterial
Dumfries Road	Brentsville Road	Country Club Drive	Widen to 6 Lane Principal Arterial
Dumfries Road	Godwin Drive	Hastings Drive	Widen to 4 Lanes
Freedom Center Boulevard	University Boulevard	Wellington Road	Widen to 4 Lanes
Hornbaker Road	Braden Drive	Wellington Road	Widen to 4 Lanes
I-66	Route 29	Fauquier County Line	Widen to 8 Lanes (3-2-3) (HOV Lanes are Reversible)
Nokesville Road	Relocated Vint Hill Road	Manassas City Line	Widen to 6 Lane Principal Arterial
Old Centreville Road	Centreville Road	Fairfax Line	Widen to 4 Lanes
Prince William Parkway	I-66	Brentsville Road	Widen to 6 Lanes
Prince William Parkway	Liberia Ave	Minnieville Road	Widen to 6 Lanes
Signal Hill Road	Liberia Avenue	Signal View Drive	Widen to 4 Lanes

[12] The Prince William County Travel Demand Model 2016 Version 2.4, as provided by the County, was reviewed and adjustments were made, in coordination with the County, to account for changes since that time.

Table 4-1. No Build Condition

Project	From	To	Change
Sudley Manor Drive	Ashton Avenue	Prince William Parkway	Widen to 6 Lanes
Sudley Road	US 15	Manassas Battlefield Parkway	Widen to 4 Lane Minor Arterial
Sudley Road	Balls Ford Road	I-66	Widen to 6 Lanes
University Boulevard	Prince William Parkway	Godwin Drive	Widen to 4 Lanes
Vint Hill Road	Fauquier Line	Nokesville Road	Widen to 4 Lane Minor Arterial;
Wellington Road	Linton Hall	Prince William Parkway	Widen to 6 Lanes
Wellington Road	Prince William Parkway	Godwin Drive	Widen to 4 Lanes
Williamson Blvd.	Sudley Manor Drive	Lomond Drive	Widen to 4 Lanes
City of Manassas Six Year Plan			
Centreville Road	Liberia Avenue	Sudley Road	Add center two-way turn lane
Wellington Road	Godwin Drive	Nokesville Road	Widen to 4 Lanes
Cockrell Road	Ashton Avenue	Center Street	Upgrade to Town Street
Sudley Road	Digges Road	Godwin Drive	Add 3rd lane to northwest-bound
Prince William Street	Grant Avenue	Wellington Road	Upgrade to Town Street
Nokesville Road	Manassas City Line	Godwin Drive	Widen to 6 Lanes
Liberia Avenue	Centreville Road	Quarry Road	Widen to 6 Lanes

Source: Prince William County Travel Demand Model

4.3 ELEMENTS OF BUILD ALTERNATIVE 2A

4.3.1 Alternative 2A Description (2017 Feasibility Study)

As shown in **Figure 4-2**, Alternative 2A creates a bypass of existing Route 28 by extending Godwin Drive north from the existing Godwin Drive/Sudley Road intersection, paralleling Flat Branch, then turning east to follow the south side of Bull Run until joining existing Route 28 just south of Bull Run. North of the tie-in point, Route 28 would be widened to align with the improvements planned by Fairfax County. Access would be restricted along the bypass to signalized intersections at: Sudley Road; Lomond Drive; Old Centreville Road; and existing Route 28 which would "tee" into the new bypass at an at-grade signalized intersection.

The typical section, as evaluated in the 2017 Feasibility Study, is shown in **Figure 4-3** and required 128 feet of right-of-way. The bypass is shown designed to parkway standards with two lanes in each direction, a 40-foot wide raised landscaped median, curb and gutter, and a 10-foot shared use path on the east side of the roadway.

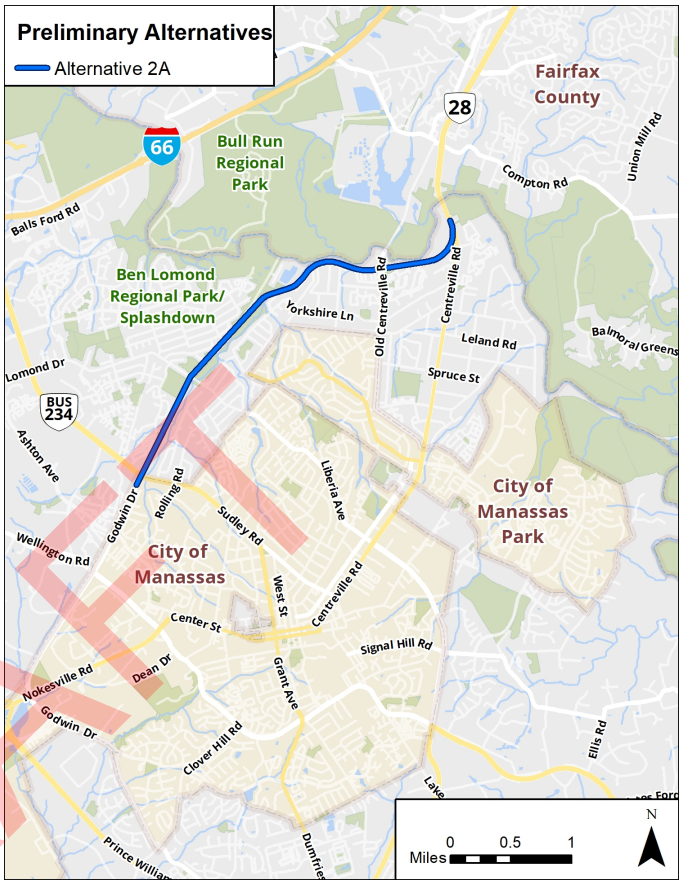


Figure 4-2. Alternative 2A Alignment from 2017 Feasibility Study

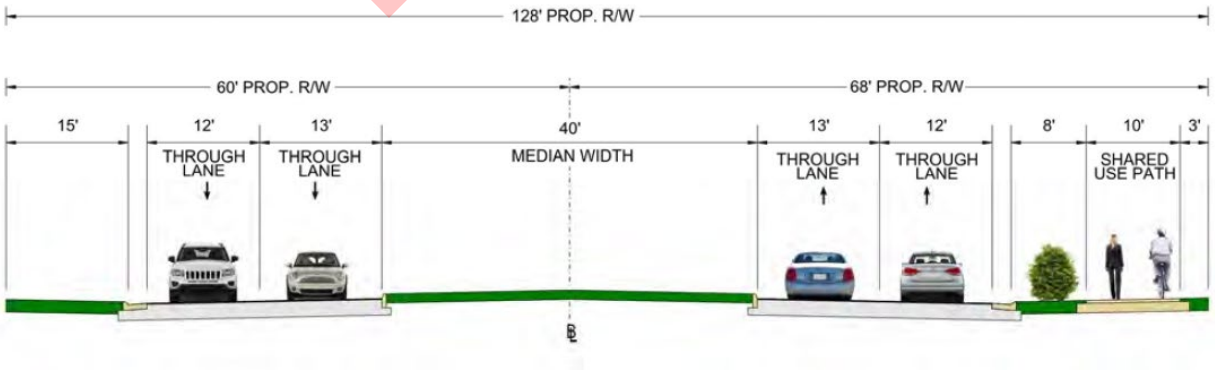


Figure 4-3. Typical Section for Alternatives 2A/2B from 2017 Feasibility Study

4.3.2 Alternative 2A Typical Section Refinements

Roadway Typical Sections. Using the design standards from VDOT's Road Design Manual (Section 2.4.2) and in coordination with Prince William County and their Design and Construction Standards Manual (DCSM), refined typical sections were developed as described in Section 2.4.3. Limits of disturbance (LOD) were developed for two areas: a 148-foot LOD within resource-sensitive areas and between 156 feet to 200 feet along the County-owned right-of-way, as shown in **Figures 4-4 and 4-5**. The median within the LOD has been reduced from 40 feet to 14 feet to allow for wider shoulders and buffers and to allow for the construction of a noise wall (if required). The inside lanes have been reduced from 13 feet to 12 feet. Also, per direction from the County, the location of the shared use path was placed on the west side of the roadway. The typical sections have been created to accommodate noise walls, if warranted during future phases of design. Note that these are north facing typical sections and the measurements have been rounded to the nearest foot.

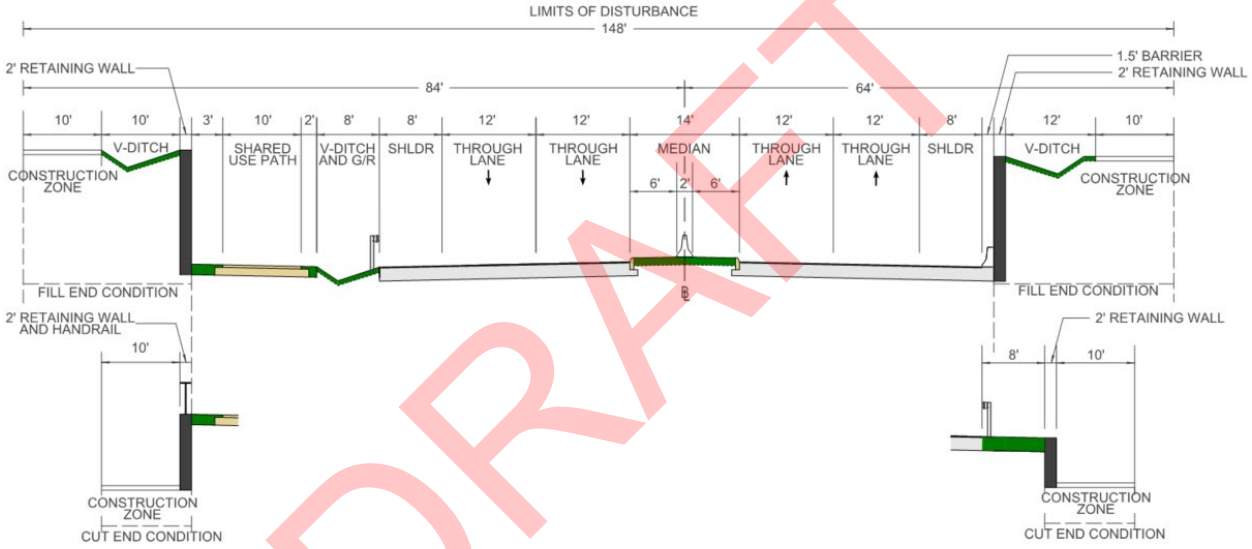


Figure 4-4. Alternative 2A/2B Modified Typical Roadway Section within Sensitive Areas

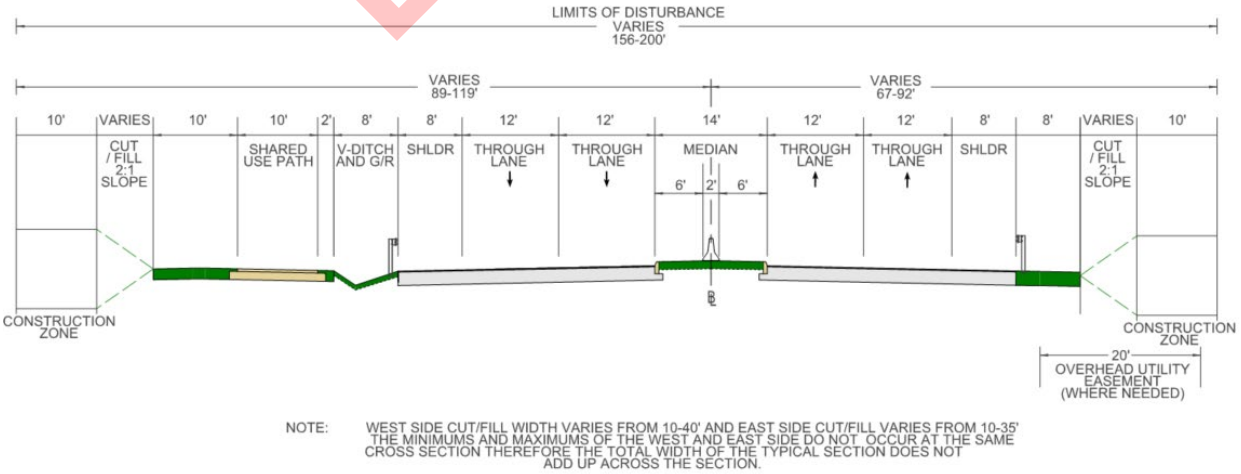


Figure 4-5. Alternative 2A/2B Modified Typical Roadway Section Along County ROW

Bridge Typical Sections. In the 2017 Feasibility Study, there were no bridge typical sections shown for the proposed bridges over Flat Branch and Bull Run; therefore, for the bridge segments of Alternatives 2A and 2B, typical sections were designed according to VDOT standards and per direction from the County and their DCSM. For the bridge over Flat Branch in Alternatives 2A/ 2B and the bridge over Bull Run in Alternative 2B, as shown in **Figure 4-6**, there would be two parallel bridges, one in each direction of travel. The west bridge, or southbound direction, also contains the shared use path that is separated from the travel lanes by a 13-foot-wide shoulder and a 1-foot-wide safety barrier.

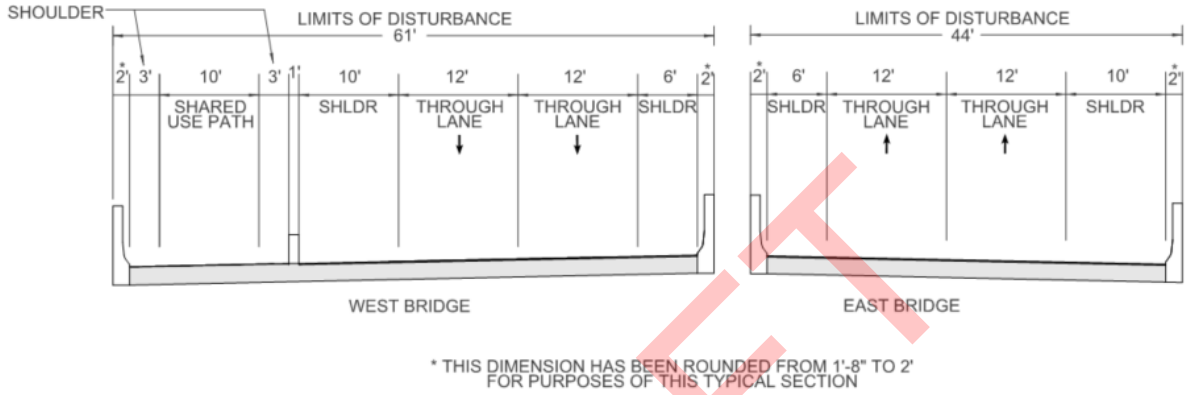


Figure 4-6. Alternative 2A/2B New Bridge Typical Section (Flat Branch)
Alternative 2B New Bridge Typical Section (Bull Run)

The location of the bridge over Bull Run for Alternative 2A is located at the intersection of the new bypass and existing Route 28. The configuration of this merge area results in two lanes traveling northbound from the bypass, combining with two lanes traveling northbound from existing Route 28 to create a four-lane roadway northbound. For the southbound roadway, there are three lanes traveling southbound. There is a shared use path for pedestrian and bicyclists on the west side of the bypass, which is assumed to be carried forward to the merge with Route 28, leaving a sidewalk on the east side after the merge. The typical section for this bridge, as shown in **Figure 4-7**, is consistent with the roadway design and to the north, would tie into the separate Fairfax County project to widen Route 28 to six lanes from Bull Run to Route 29.

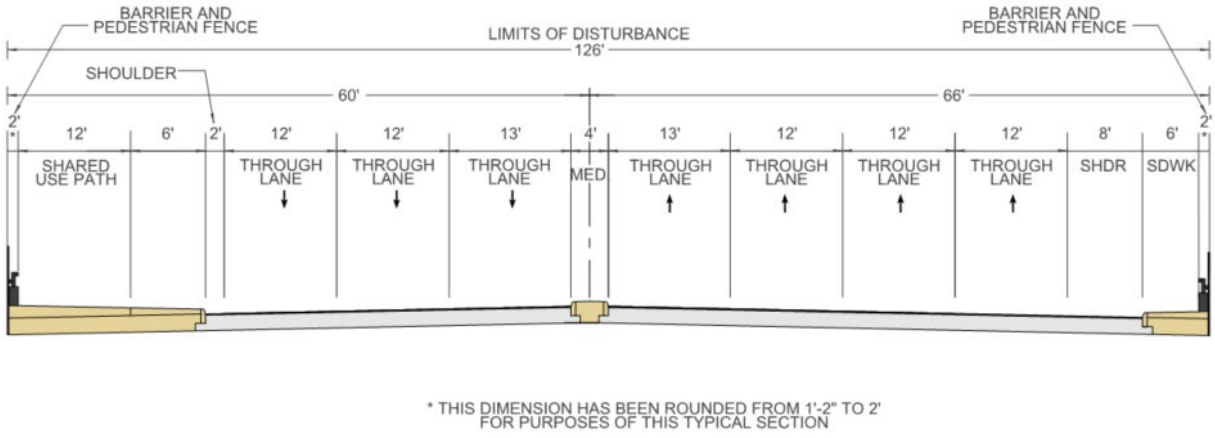


Figure 4-7. Alternative 2A New Bridge Typical Section (Bull Run)

4.3.3 Alternative 2A Alignment Adjustments

The 2017 Feasibility Study horizontal alignment was modified to minimize impacts to resources throughout the corridor, as described below. Along the County-owned right-of-way, the adjusted alignment remains similar to the 2017 Feasibility Study with minor shifts near the intersection of the new bypass roadway and Lomond Drive to ensure that the corridor stays within the right-of-way reserved by Prince William County.

Transitioning from the County-owned right-of-way to the bridge over Flat Branch, the alignment impacts the parcel limits for Ben Lomond Park for about 1,500 feet. As the alignment crosses over Flat Branch to Boundary Road, it was shifted south to continue in line with and adjacent to the northern curb of Allegheny Road and Boundary Avenue (see **Figure 4-8**). This minimizes impacts to floodplains and wetlands in this area while not displacing residential properties that are located along the southern side of Allegheny Road and Boundary Avenue, nor impacting their property access. However, avoiding these additional residential displacements encroaches on a sliver of First Manassas Battlefield on the south side of Bull Run.

Note that all impacts as described above through the County-owned right-of-way to the intersection with Boundary Road/Bull Run Road are identical for Alternatives 2A and 2B.

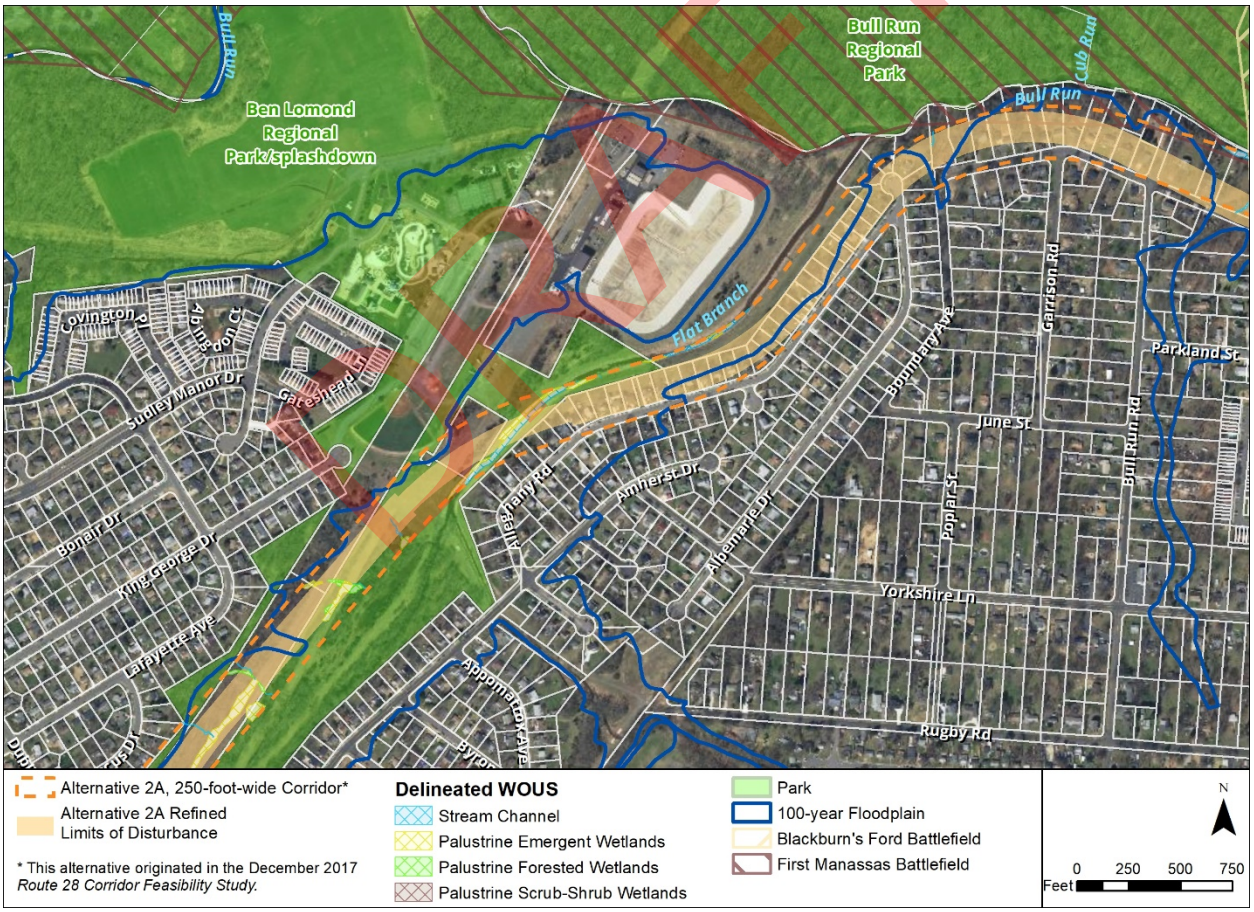


Figure 4-8. 2A Alignment Shift from County-Reserved Right-of-Way to Bull Run Road

East of the existing intersection of Boundary Avenue/Bull Run Road to the intersection with existing Old Centreville Road/Ordway Road, the alignment was shifted south by approximately 80 feet to avoid Bull Run Regional Park, First Manassas Battlefield, and Blackburn's Ford Battlefield in this area. In doing so, the adjusted alignment encroaches on floodplains and wetlands,

and has residential displacements to the Bull Run Mobile Home Community (west of Old Centreville Road). The adjusted alignment intersects with Old Centreville Road/Ordway Road about 50 feet south of the 2017 Feasibility Study alignment. See **Figure 4-9** for a map of this area. Note that portions of the adjusted alignment would go outside the 250-foot Feasibility Study corridor in this area.

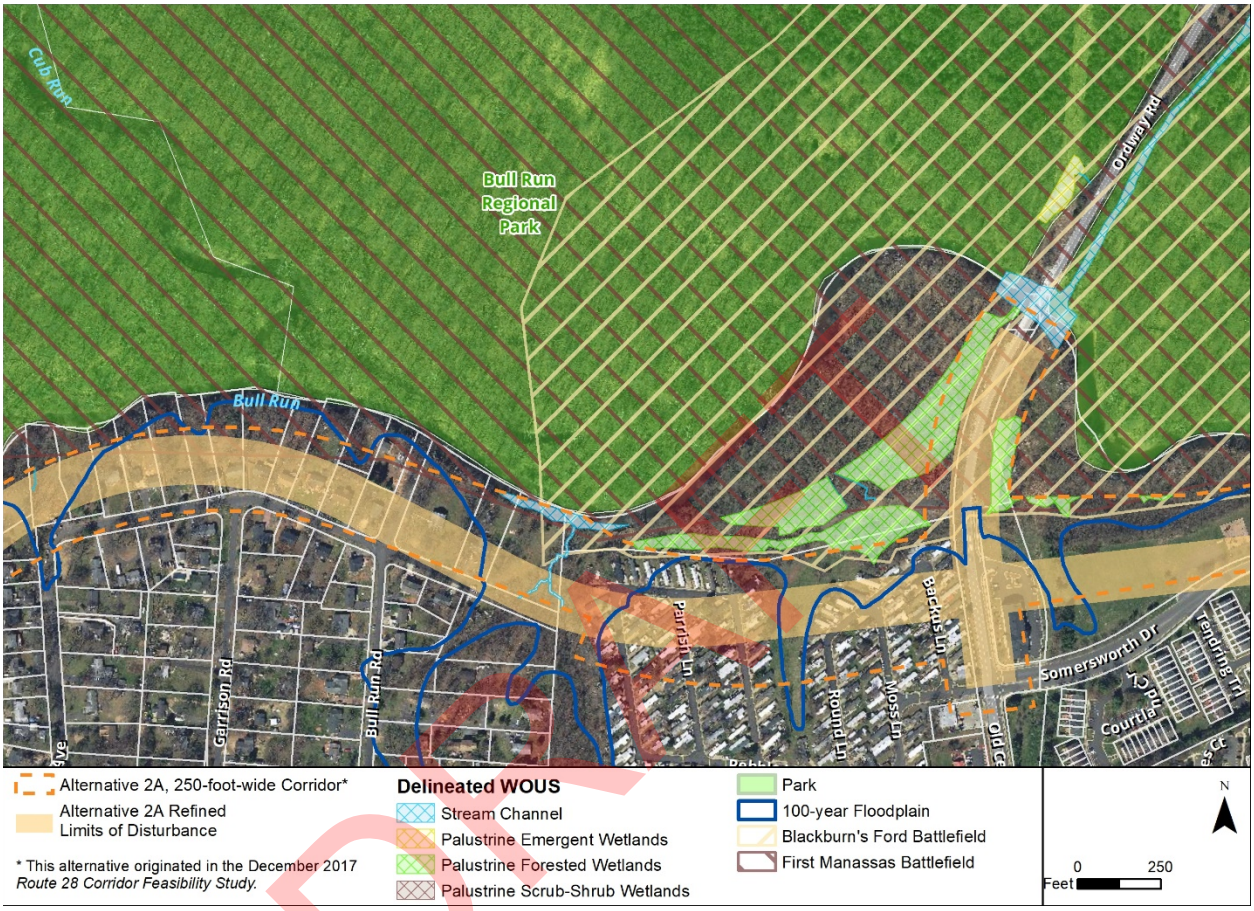


Figure 4-9. 2A Alignment Shift from Bull Run Road to Old Centreville/Ordway Road

Continuing east towards the merge with existing Route 28, the adjusted alignment remains shifted south/southeast to avoid Mitchell's Ford Entrenchments as well as the other battlefield properties, and to minimize impacts to wetlands and floodplains. This avoidance results in residential displacements to the townhome properties (east of Old Centreville Road). See **Figure 4-10** for a map of this area.

The Alternative 2A refined limits of disturbance, as a result of typical section refinements and alignment adjustments to minimize impacts, is shown in **Figure 4-11**. A detailed mapbook of Alternative 2A is provided in Attachment A.

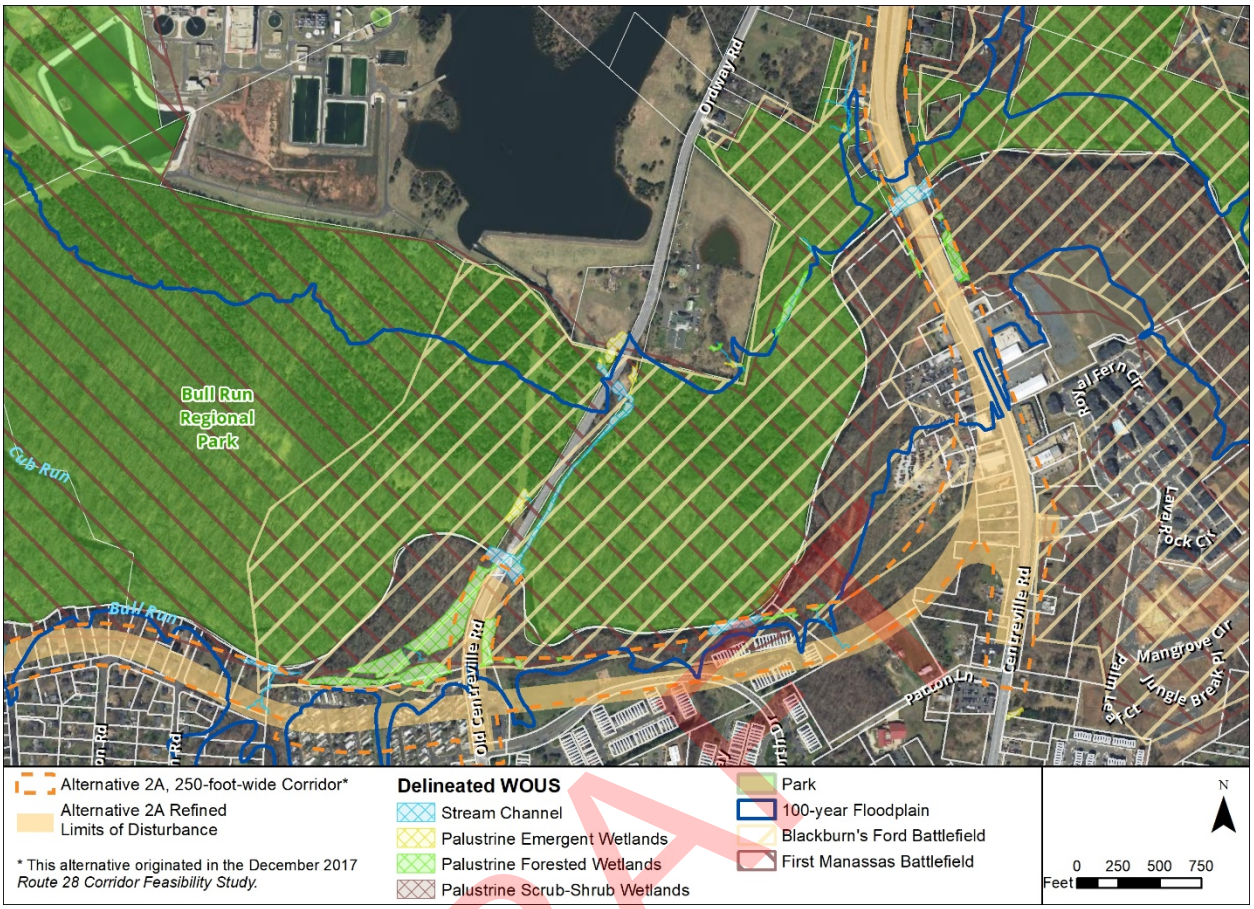


Figure 4-10. 2A Alignment Shift from Old Centreville/Ordway Road to Existing Route 28

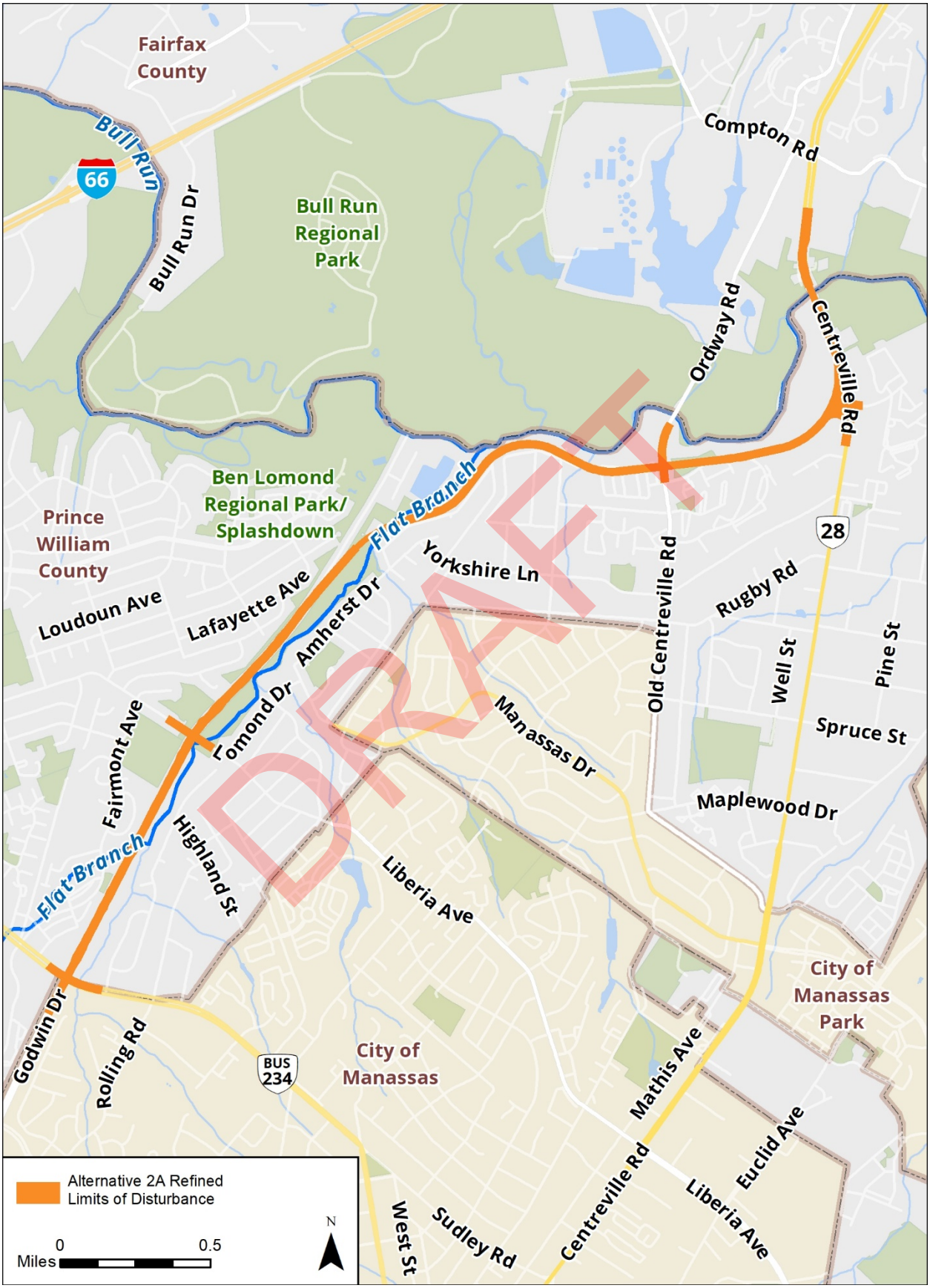


Figure 4-11. Alternative 2A Refined Limits of Disturbance

4.4 ELEMENTS OF BUILD ALTERNATIVE 2B

4.4.1 Alternative 2B Description (2017 Feasibility Study)

As shown in **Figure 4-12**, Alternative 2B creates a bypass of existing Route 28 that passes through Prince William County, the City of Manassas Park, and the City of Manassas in the same manner as Alternative 2A as described in Section 4.3.1 above; however, the two alternatives differ in the location where they tie back into existing Route 28. At this northern terminus, while Alternative 2A rejoins Route 28 south of the existing Bull Run crossing, Alternative 2B rejoins Route 28 north of the existing Bull Run crossing. Alternative 2B follows the south side of Bull Run until Centreville Road where it crosses Bull Run at the existing crossing of Old Centreville Road/ Ordway Road on two new bridges (northbound and southbound), and ties into existing Route 28 north of Bull Run at an at-grade signalized intersection. All other elements of Alternative 2B, including the typical section as shown in Figure 4-4, are the same as previously described for Alternative 2A.

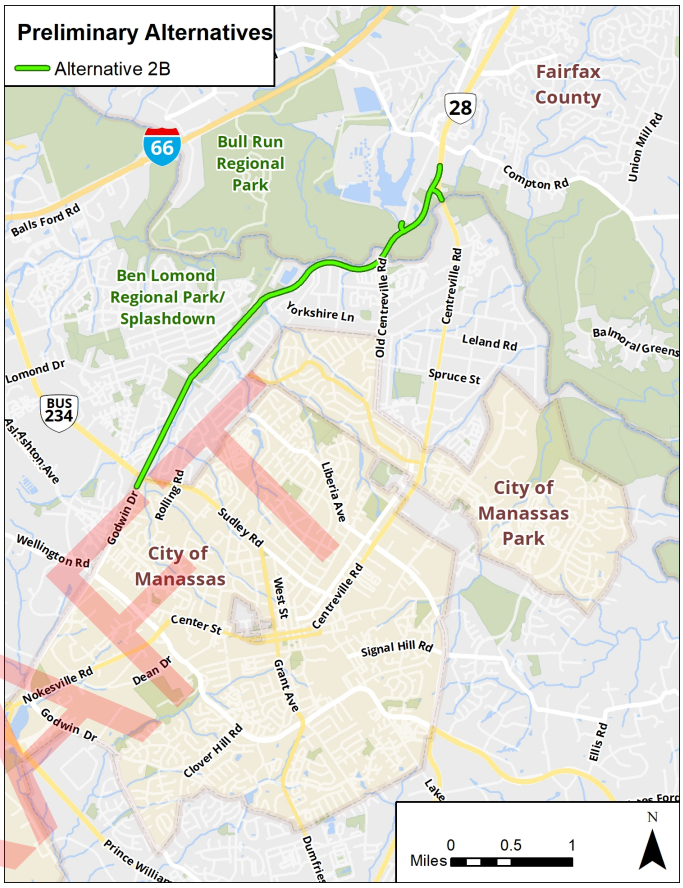


Figure 4-12. Alternative 2B Alignment from 2017 Feasibility Study

Alternative 2B was determined to be the highest-ranked alternative in the 2017 Feasibility Study for the following reasons:

- Greatest traffic benefits, including:
  - Greatest reduction in traffic in Historic Manassas
  - Shortest Travel time between Godwin Drive and Route 29 in 2040
  - Greatest travel time savings on Business Route 28 in 2040
- Second least environmental impacts
- Least socioeconomic and right of way impacts, including no required business relocations
- Lowest estimated cost

4.4.2 Alternative 2B Typical Section Refinements

Using the design standards from VDOT's *Road Design Manual* and in coordination with Prince William County and their DCSM, refined typical sections were developed as previously described in Section 2.4.2. Since the typical sections do not differ for Alternatives 2A and 2B, refer to Section 4.4.1 above for description of the refinements that were made to Alternative 2A/2B typical sections, including figures.

4.4.3 Alternative 2B Alignment Adjustments

The 2017 Feasibility Study horizontal alignment was modified to minimize impacts throughout the corridor, as described below. Along the County-owned right-of-way, the adjusted alignment remains similar to the 2017 Feasibility Study with minor shifts near the intersection of the new bypass roadway and Lomond Drive to ensure that the corridor stays within the right-of-way reserved by Prince William County.

Transitioning from the County-owned right-of-way to the bridge over Flat Branch, the alignment impacts the parcel limits for Ben Lomond Park for about 1,500 feet. As the adjusted alignment crosses over Flat Branch, it was shifted south to align with and be adjacent to the northern curb of Allegheny Road and Boundary Avenue (see **Figure 4-13**). This minimizes impacts to floodplains and wetlands in this area while not displacing residential properties that are located along the southern side of Allegheny Road and Boundary Avenue, nor impacting their property access. However, avoiding these additional residential displacements encroaches on a sliver of First Manassas Battlefield on the south side of Bull Run.

Note that all impacts as described above through the County-owned right-of-way to the intersection with Boundary Road/Bull Run Road are identical for Alternatives 2A and 2B.

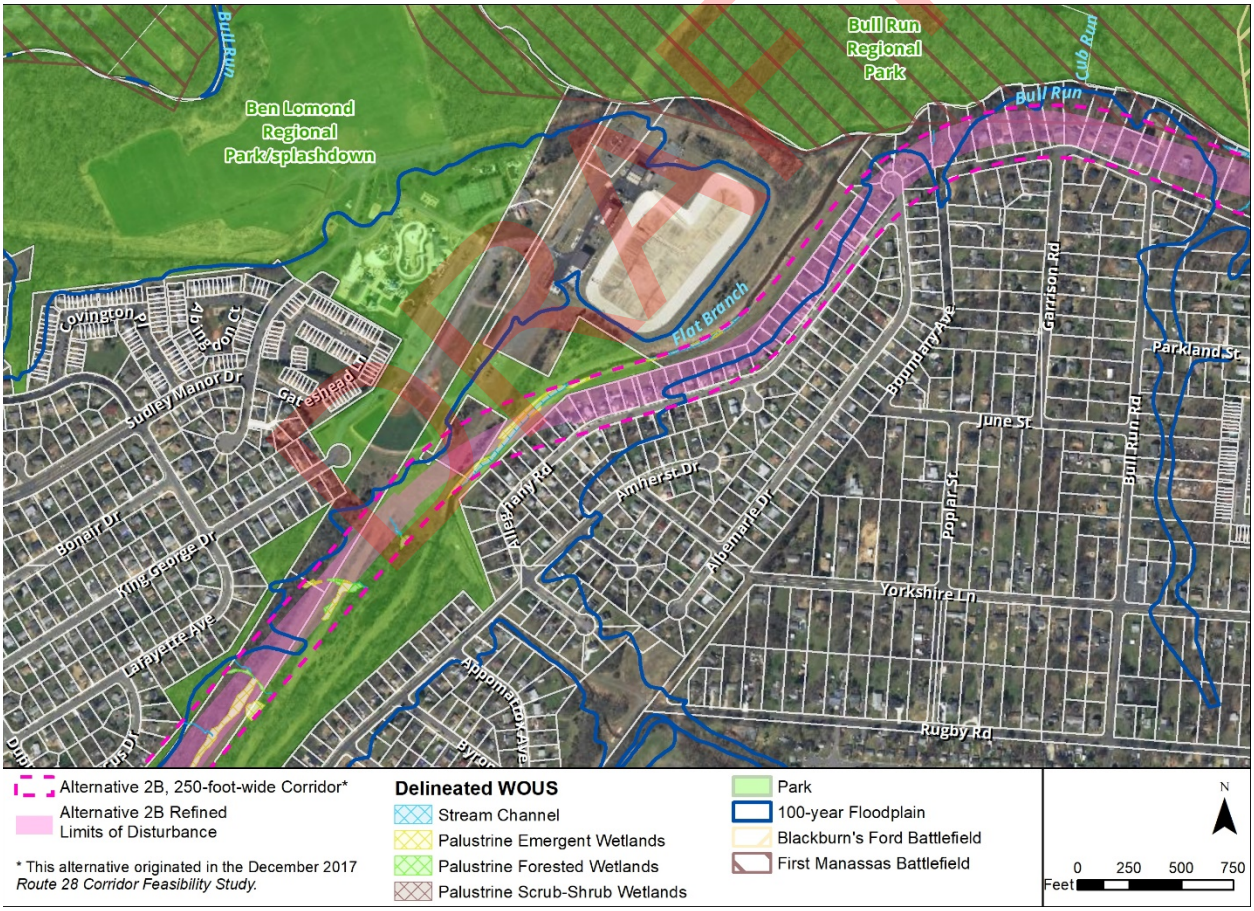


Figure 4-13. 2B Alignment Shift from County-Reserved Right-of-Way to Bull Run Road

East of the existing intersection of Boundary Avenue/Bull Run Road, the adjusted alignment turns north to connect to Ordway Road, with the southern edge of the adjusted alignment located adjacent to Jacobs Lane. This minimizes impacts to the Bull Run Mobile Home Community, wetlands, and floodplains, but encroaches on the Bull Run Regional Park and battlefield historic

properties are minimized (see **Figure 4-14**). Where the adjusted alignment begins to turn north to transition to utilizing the Old Centreville Road/Ordway Road right-of-way, impacts to the battlefield properties and parkland are unavoidable because the existing right-of-way is not wide enough to fully accommodate the roadway section.

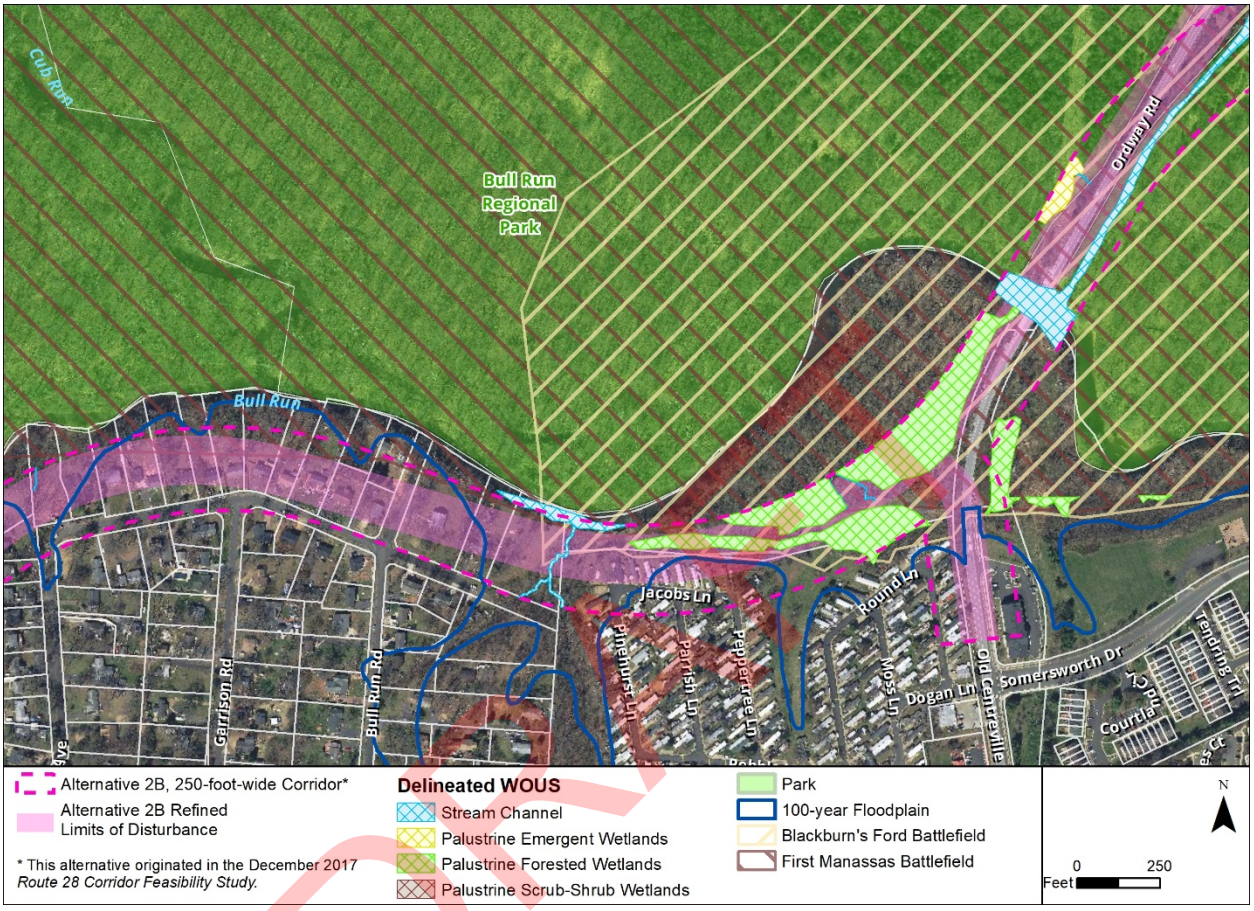


Figure 4-14. 2B Alignment Shift from Bull Run Road to Ordway Road

The 2017 Feasibility Study corridor for Alternative 2B traveled along Ordway Road for about 1,700 feet before veering east through a portion of Bull Run Regional Park and battlefield historic property to merge with existing Route 28. The adjusted alignment has been shifted to remain along the Ordway Road right-of-way for an additional 2,650 feet, thus avoiding the portions of the park and historic property lands previously crossed by Alternative 2B, before merging with existing Route 28. As such, the adjusted alignment deviates from the 250-foot 2017 Feasibility Study corridor in this area. North of the park along Ordway Road, the adjusted alignment avoids impacts to the battlefield properties, the Upper Occoquan Sewage Authority pond, and the Deepwood Veterinary Clinic, and minimizes residential displacements, but in doing so, impacts a sliver of Bull Run Regional Park in the parcel located closest to the houses (see **Figure 4-15**). The proposed intersection with Ordway Road is assumed to be operational, but Ordway Road could be designed as a cul-de-sac in final design if deemed appropriate at that time, due to its proximity to the existing intersection with Route 28. The adjusted alignment intersects with existing Route 28 about 800 feet north of the 2017 Feasibility Study corridor intersection. While the modifications to this alignment cannot avoid impacts to surrounding resources, the amount of impacted area is minimized without unduly impacting other resources.

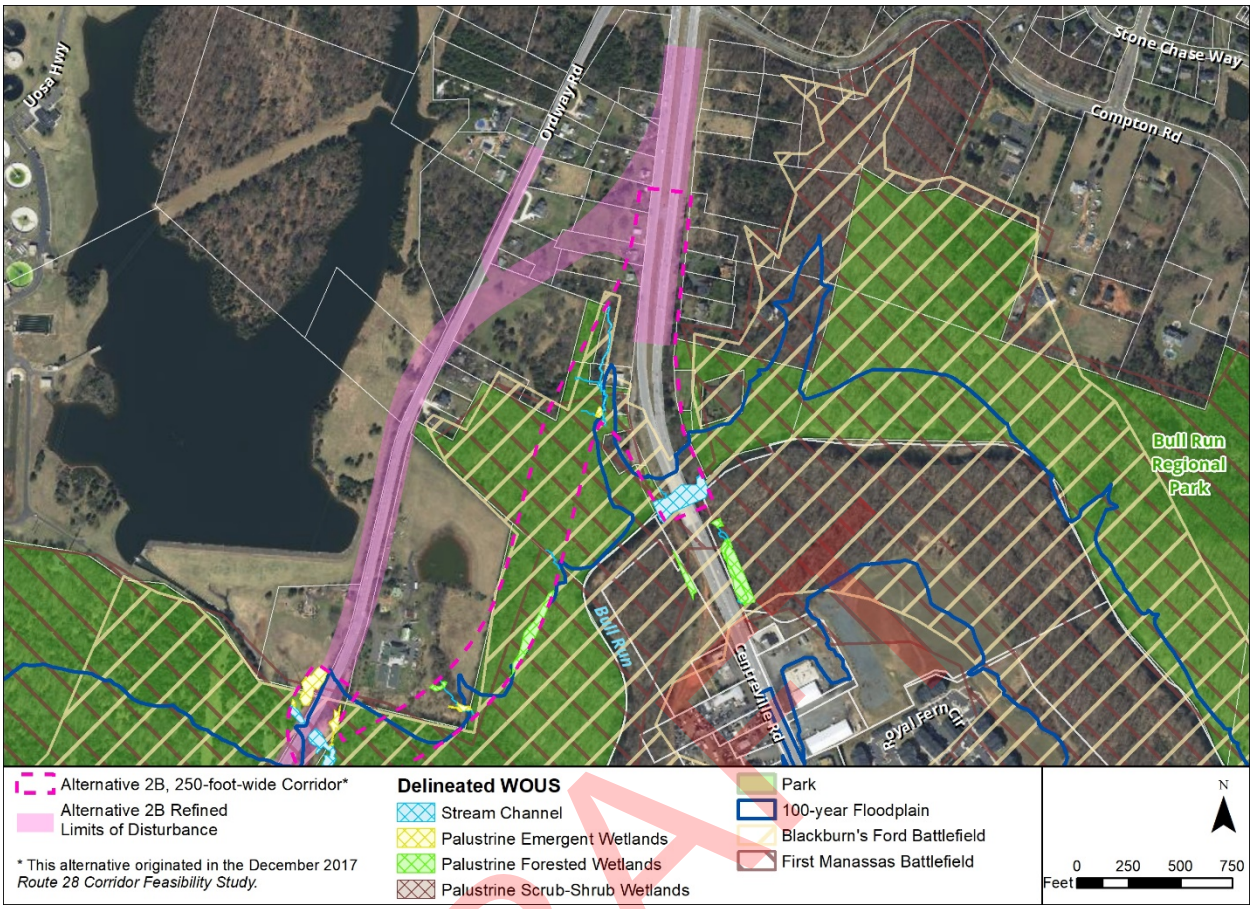


Figure 4-15. 2B Alignment Shift North of Bull Run to Existing Route 28

The Alternative 2B refined limits of disturbance, as a result of typical section refinements and alignment adjustments to minimize impacts, is shown in **Figure 4-16.** A detailed mapbook of Alternative 2B is provided in Attachment B.

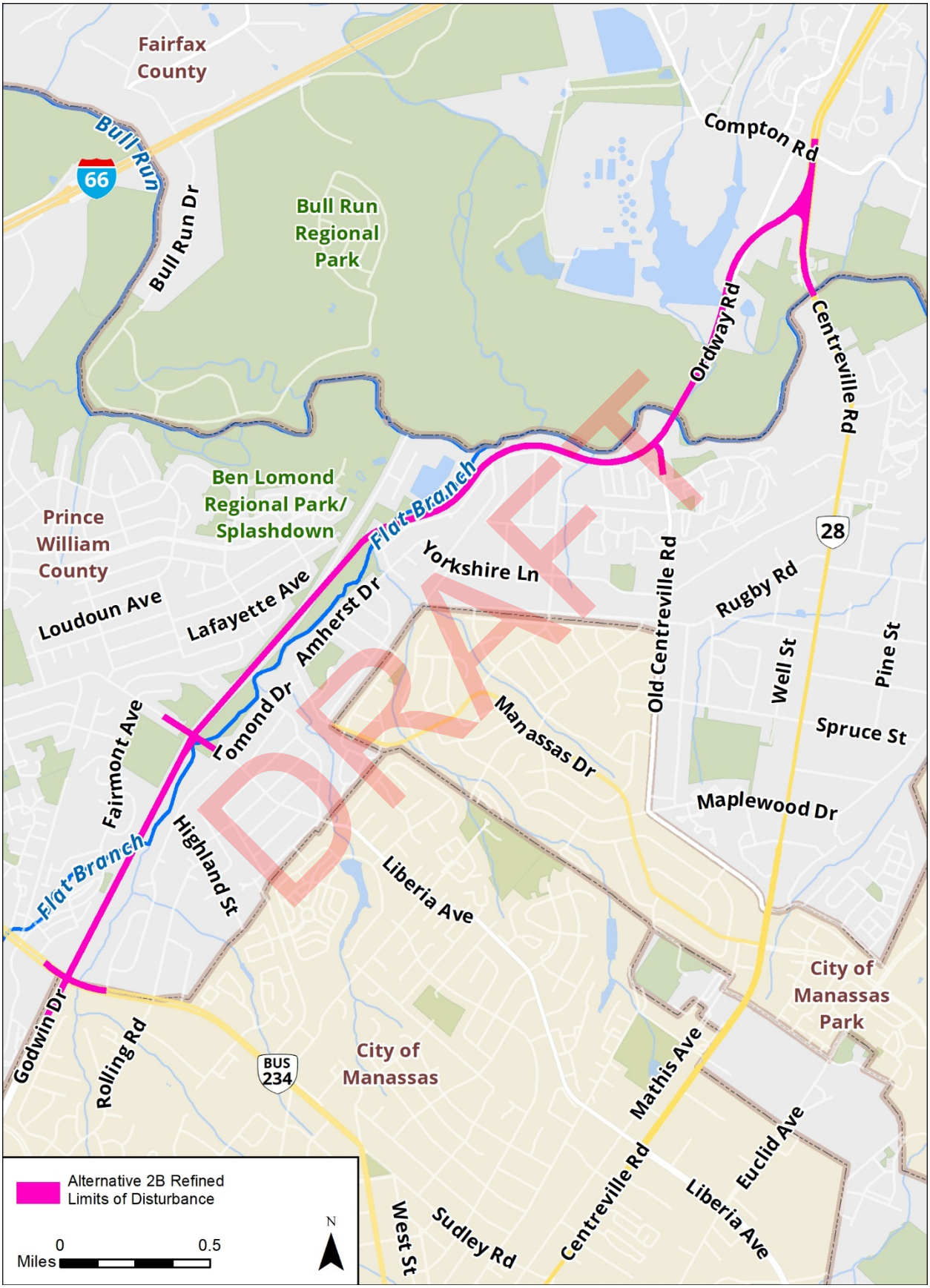


Figure 4-16. Alternative 2B Refined Limits of Disturbance

4.5 ELEMENTS OF BUILD ALTERNATIVE 4

4.5.1 Alternative 4 Description (2017 Feasibility Study)

Alternative 4 widens Route 28 on its existing alignment, between Liberia Avenue on the south and Compton Road/Old Centreville Road Fairfax County line on the north, as shown in **Figure 4-17**. The typical section of the widened roadway, as shown in **Figure 4-18**, would be designed to urban principal arterial standards and include: three lanes in each direction, a 16-foot wide raised landscaped median, curb and gutter, a five-foot sidewalk on the west side of Route 28, and a 10-foot shared use path on the east side. Reconstruction of existing pavement would occur the length of the widening, and the widening would shift to the side of Route 28 opposite of the existing high-voltage power lines.

At its southern terminus, the widening would provide an additional through lane through the Route 28/Liberia Avenue intersection in each direction. Access to existing cross streets and properties would remain; however, some existing turn movements may be restricted as the raised median with access break would replace the existing two-way left turn lane where it occurs on several sections of Route 28.

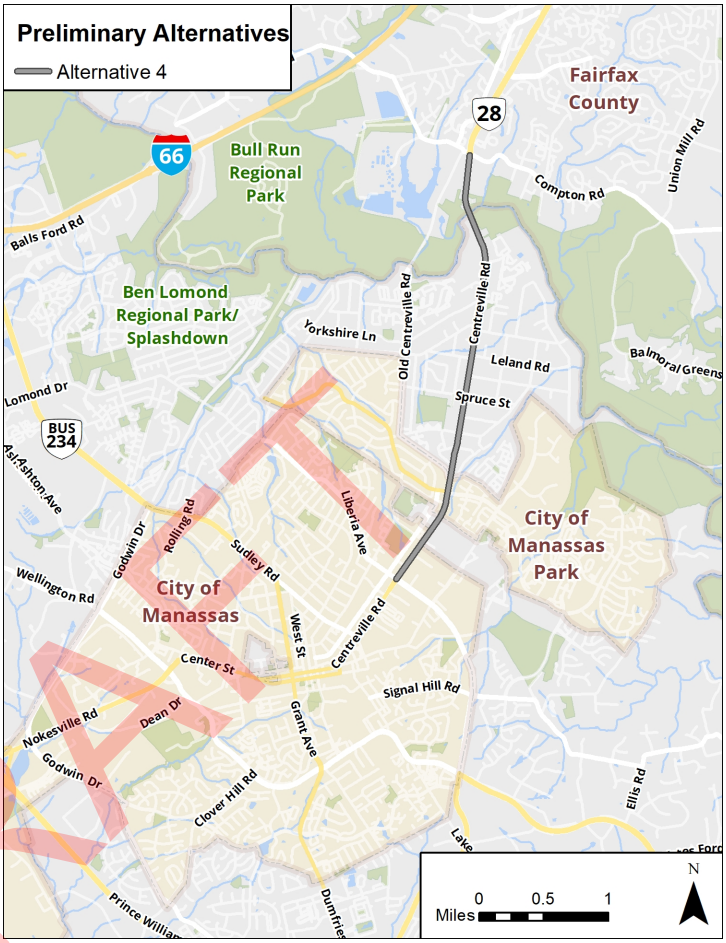


Figure 4-17. Alternative 4 Alignment from 2017 Feasibility Study

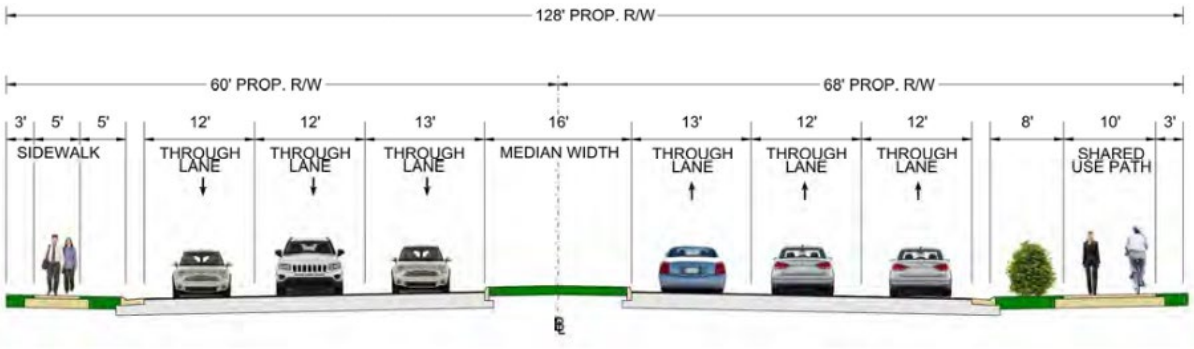


Figure 4-18. Typical Section for Alternative 4 from 2017 Feasibility Study

4.5.2 Alternative 4 Typical Section Refinements

Roadway Typical Section. This typical section was reevaluated with the intent of minimizing the overall footprint while continuing to use a six-lane divided roadway and providing pedestrian/bicycle facilities. However, after evaluation, it was determined that this section is considered optimized for the level of design development and is therefore unchanged. While the components of the typical section within the right-of-way are unchanged, to determine the limit of disturbance, cut and fill slopes, construction easements and overhead utility easements have been added (as previously described in Section 2.4.2). See **Figure 4-19** for the typical roadway section. In addition to a standard typical section, some intersections warrant dual left turn lanes and/or a right turn lane. A section showing the additional width for these lanes was created and is shown in **Figure 4-20**. The limits of disturbance for Alternative 4 range from 158 (along roadway sections) to 182 feet (at intersections with dual left turns lanes and a right turn lane). All typical sections are north-facing and the measurements have been rounded to the nearest foot.

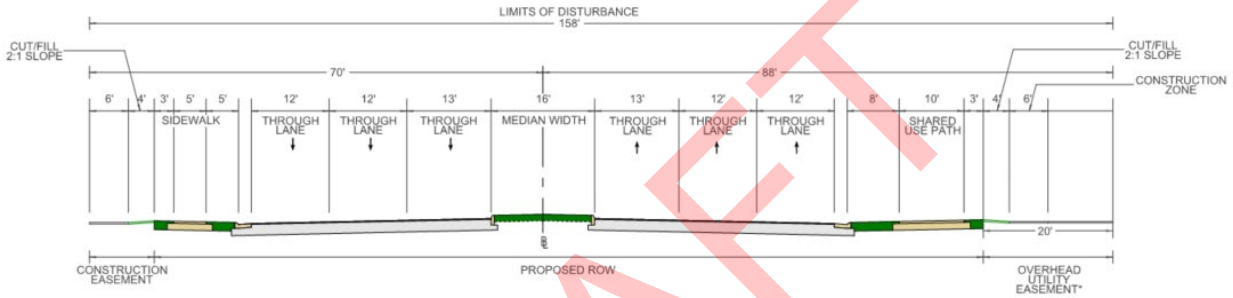


Figure 4-19. Alternative 4 Modified Typical Roadway Section

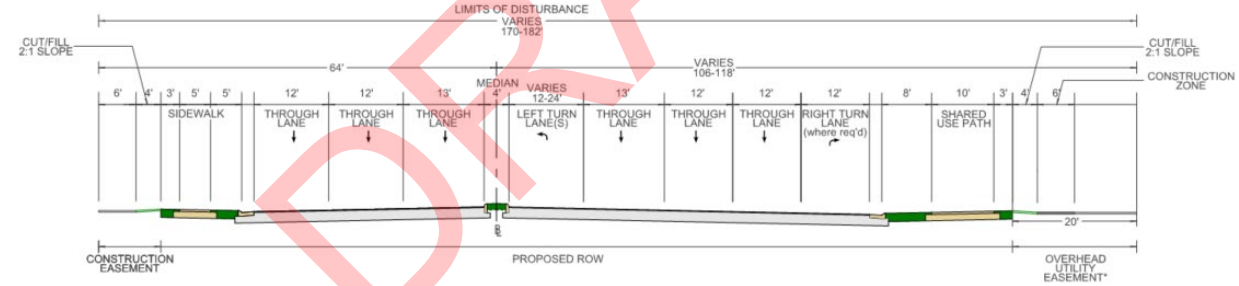


Figure 4-20. Alternative 4 Modified Typical Roadway Section - Intersections

Bridge Typical Section. A bridge typical section was prepared, as shown in **Figure 4-21**, for the segment of the alignment that crosses over Bull Run, which was not prepared as part of the 2017 Feasibility Study.

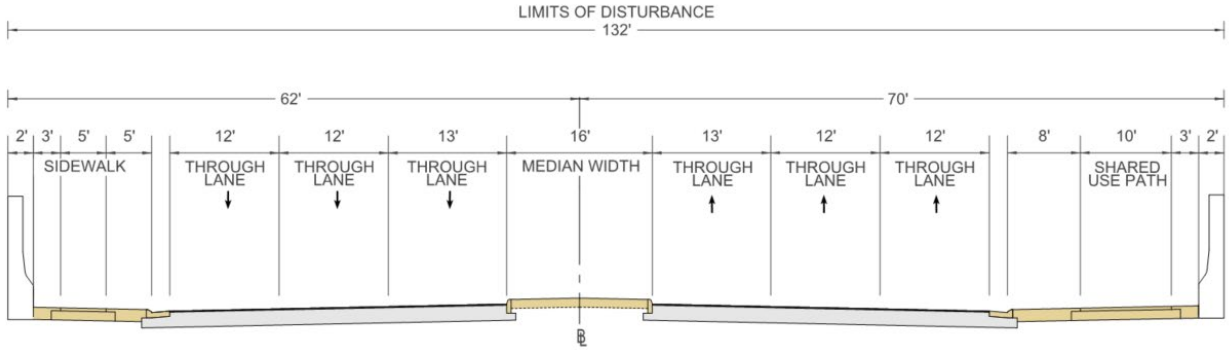


Figure 4-21. Alternative 4 Typical Roadway Section – Bridge over Bull Run

4.5.3 Alternative 4 Alignment Adjustments

The alignment used in the 2017 Feasibility Study did not widen the existing roadway evenly about the centerline, and instead offset the alignment to minimize impacts to the existing high voltage transmission lines. This alignment is considered optimized for the current level of engineering development and therefore was not revised. The limits of disturbance for Alternative 4 do not impact Bull Run Regional Park but have unavoidable encroachments on Blackburn's Ford and First Manassas Battlefields where they cross existing Route 28 (see **Figure 4-22**).

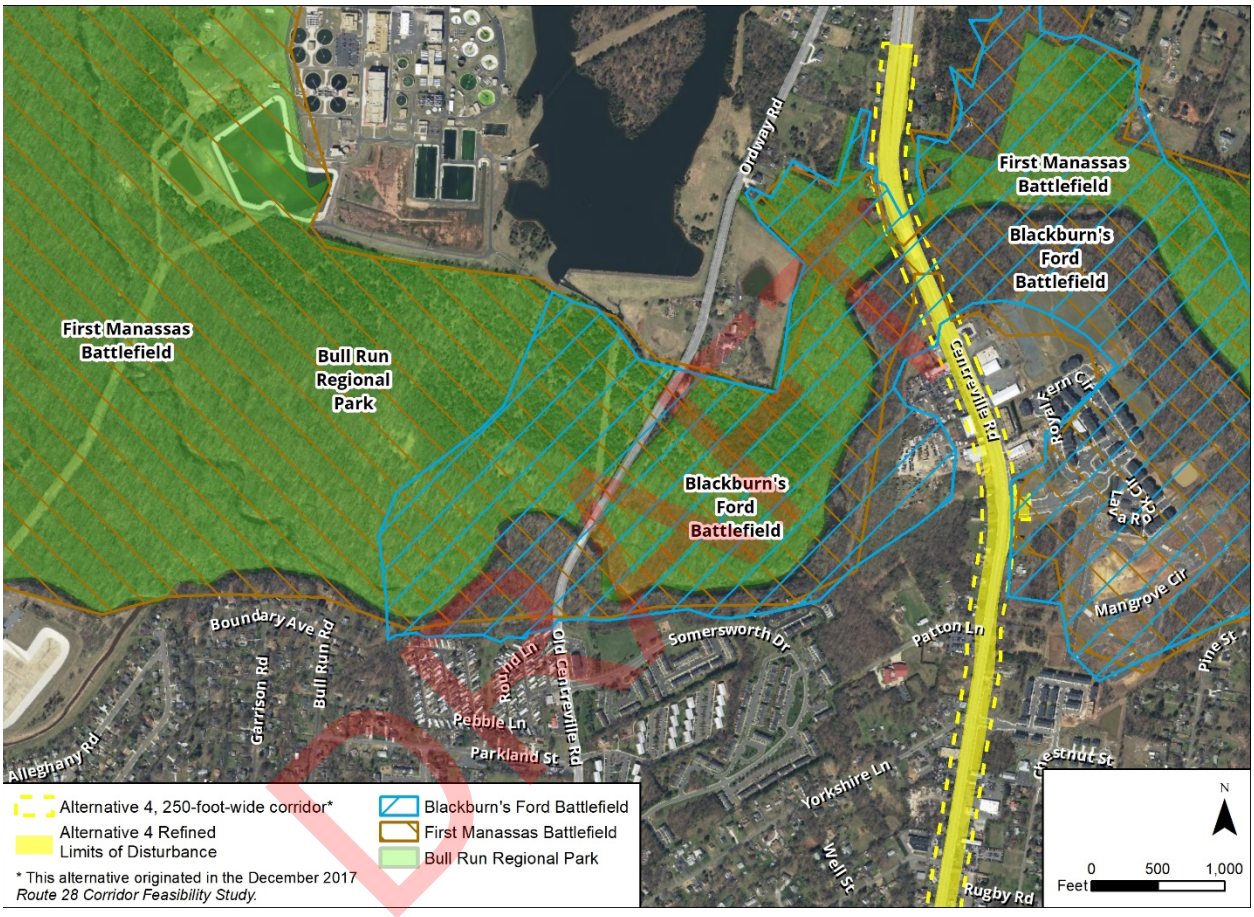


Figure 4-22. Alternative 4 Alignment through Sensitive Resources

The Alternative 4 refined limits of disturbance, as a result of typical section refinements and alignment adjustments to minimize impacts, is shown in **Figure 4-23.** A detailed mapbook of Alternative 4 is provided in Attachment C.

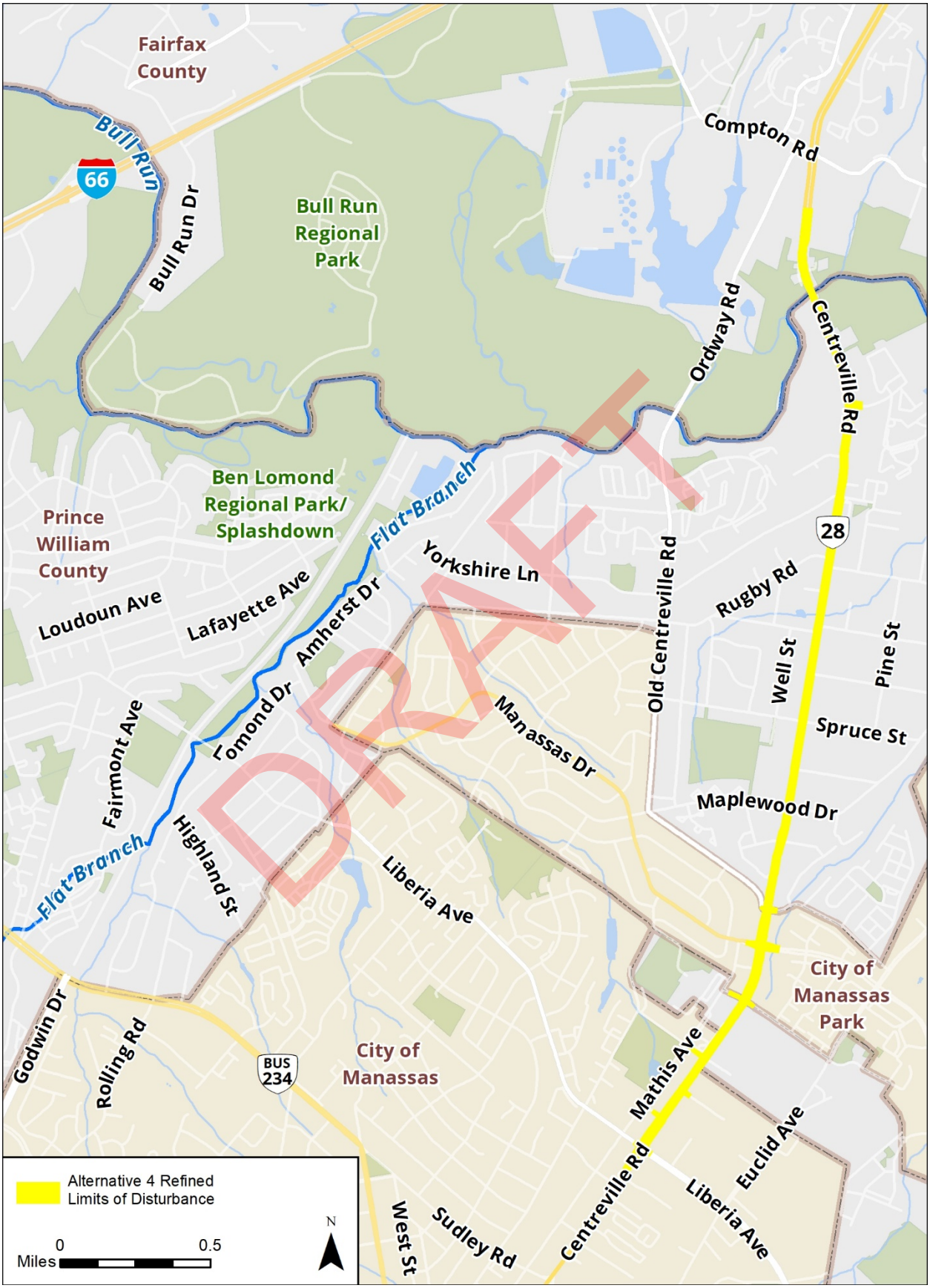


Figure 4-23. Alternative 4 Refined Limits of Disturbance

SECTION 5
ABILITY TO MEET NEEDS

5.1 INTRODUCTION

Section 2.2 documented the overall context of the existing and future transportation corridor in relation to establishing the purpose and need for the project between Sudley Road in Prince William County and Compton Road in Fairfax County. As stated there, the purpose of the proposed project is to:

- Reduce traffic congestion on Route 28
- Improve overall travel times
- Enhance network reliability

Accordingly, each of these three needs was verified by analyzing both existing and future no build conditions (Section 5.2), and then analysis was conducted for each of the three build alternatives (Section 5.3) to assess how the build alternatives addressed those needs. Full documentation of the traffic analysis and methodologies that were prepared in support of this EA are provided in the Traffic Technical Report. As indicated in the Traffic Technical Report, the traffic analysis encompasses a larger area than the study area in which the project improvements would physically occur, to account for the effects of changes in travel patterns between the No Build and three build alternatives.

5.2 NEEDS – EXISTING AND FUTURE NO BUILD CONDITION

Existing volumes are based on 2017 volumes from VDOT, with a yearly growth rate developed in coordination with the County (1% rate) to determine the 2018 volumes. The future horizon year for this analysis is 2040 and the Prince William County Travel Demand Model (2016 Version 2.4) was used to forecast these volumes for the No Build, as well as the three Build Alternatives.

Table 5-1 below summarizes the annual average daily traffic (AADT) volumes for the existing condition (2018) and future No Build condition (2040). The AADT on every segment along Route 28 is forecasted to increase from the 2018 existing condition to the 2040 No Build condition. Growth in the study area ranges from 26% to 85% by 2040, with an average of more than 50% increase in traffic.

Table 5-1. Existing and Future No Build Annual Average Daily Traffic (AADT) Volumes on Route 28

Segment		2018 Existing AADT	2040 No Build		
			AADT	Change from Existing	% Change
Parallel to Godwin Drive	Route 234 to Godwin Drive	32,320	45,260	+12,940	+40.0%
	Godwin Drive to Wellington Road	22,220	35,708	+13,488	+60.7%
	Wellington Road to Cockrell Road	22,220	30,964	+8,744	+39.4%
	Cockrell Road to Brinkley Lane	22,220	37,782	+15,562	+70.0%
	Brinkley Lane to Stonewall Road	22,220	37,782	+15,562	+70.0%
	Stonewall Road to W Court House Road	22,220	35,670	+13,450	+60.5%
	W Court House Road to Grant Avenue (Center Street)	21,210	36,490	+15,280	+72.0%

Table 5-1. Existing and Future No Build Annual Average Daily Traffic (AADT) Volumes on Route 28

Segment		2018 Existing AADT	2040 No Build		
			AADT	Change from Existing	% Change
Study Area	**Grant Avenue (Center Street) to Main Street (Center Street)**	**23,230**	**37,594**	**+14,364**	**+61.8%**
	Main Street (Center Street) to Zebedee Street (Center Street)	**23,230**	**42,958**	**+19,728**	**+84.9%**
	Zebedee Street (Center Street) to Sudley/Prescott Road	**27,270**	**34,430**	**+7,160**	**+26.3%**
	Sudley Prescott Road to Liberia Avenue	**27,270**	**42,064**	**+14,794**	**+54.3%**
	Liberia Avenue to Manassas Drive	**43,430**	**66,071**	**+22,641**	**+52.1%**
	Manassas Drive to Browns Lane	**50,500**	**83,925**	**+33,425**	**+66.2%**
	Browns Lane to Maplewood Drive	**50,500**	**76,853**	**+26,353**	**+52.2%**
	Maplewood Drive to Leland Road	**50,500**	**72,757**	**+22,257**	**+44.1%**
	Leland Road to Yorkshire Lane	**50,500**	**73,124**	**+22,624**	**+44.8%**
	Yorkshire Lane to Orchard Bridge Drive	**50,500**	**76,848**	**+26,348**	**+52.2%**
	Orchard Bridge Drive to Compton/Ordway Road	**58,580**	**76,488**	**+17,908**	**+30.6%**
North of Bull Run	Compton/Ordway Road to Green Trails/Old Mill	58,580	93,012	+34,432	+58.8%
	Green Trails/Old Mill to New Braddock Road	58,580	114,909	+56,329	+96.2%
	New Braddock Road to Machen Road	58,580	107,780	+49,200	+84.0%
	Machen Road to Upperridge/Old Centreville	58,580	107,780	+49,200	+84.0%

5.2.1 Traffic Congestion

Traffic congestion was analyzed by performing a Critical Lane Volume (CLV) analysis, which focuses on the total volume that passes through an intersection on each road. CLV was chosen as a measure of volume and capacity that is independent of both recurring events and signal operation details. CLV allows for a direct measurement of the effects of traffic volume and the addition of lane capacity. The critical volume for each road is the higher of the left plus through-right traffic (per lane) for each approach; these lane-volumes for each of the two roadways at the intersection are then summed to calculate the total CLV.

For most intersections, CLV values between 1500 and 1600 represent operations at or near capacity; traffic flow begins to be constrained at these values with motorist delays increasing exponentially.

Table 5-2 below details the Existing and 2040 No Build CLV. Overall, CLV values increase at each intersection between 2018 existing conditions to 2040 No Build conditions except for the Route 28 and Machen Road intersection (due to the Fairfax County Route 28 widening project).

Existing year traffic operations in Table 5-2 show operations ranging in value from 50 percent or less of capacity to at-capacity operations (CLV greater than 1500). It should be noted that traffic operations reflect the effect of traffic metering (whereby choke points at major intersections with high CLV values restrict, or "meter," the amount of traffic passing through to downstream intersections). As a result, CLV values vary substantially across intersections within the study area,

with intersections that meter traffic experiencing relatively high CLV values and intersections where traffic is metered upstream having relatively low CLV values.

CLV values are projected to increase by 30 to 120 percent between existing and 2040 No Build conditions. With increased volumes in 2040, the "benefits" of traffic being metered at upstream intersections are lessened by overall increases in travel demand. As a result, almost half of the studied intersections would operate at CLV values greater than 1500 during at least one peak period for the 2040 No Build.

Table 5-2. Route 28 Intersection Performance (Existing and No Build)

Intersection		Existing		2040 No Build	
		AM	PM	AM	PM
		CLV	CLV	CLV	CLV
Parallel to Godwin Drive	Route 28 and Godwin Drive	814	1002	958	1220
	Route 28 (Center St) and Grant Avenue	767	837	933	1136
	Route 28 (Church St) and Grant Avenue	580	833	841	1185
Study Area	**Route 28 (Center St) and Main Street**	**616**	**564**	**899**	**1211**
	Route 28 (Church St) and Main Street	**459**	**558**	**648**	**891**
	Route 28 and Sudley Road / Prescott Avenue	**662**	**1008**	**996**	**1425**
	Route 28 and Liberia Avenue	**1048**	**1202**	**1490**	**1770**
	Route 28 and Manassas Drive	**872**	**1272**	**1421**	**1953**
	Route 28 and Maplewood Drive	**1104**	**1438**	**1343**	**2032**
	Route 28 and Yorkshire Lane	**1331**	**1433**	**1509**	**1994**
	Route 28 and Orchard Bridge Drive	**1132**	**1206**	**1370**	**1729**
	Route 28 and Compton/Ordway Road	**1364**	**1462**	**1510**	**1942**
North of Bull Run	Route 28 and Green Trails Boulevard / Old Mill Road	1146	1449	1048	1278
	Route 28 and New Braddock Road	1423	1294	1886	1894
	Route 28 and Machen Road	1423	1093	835	1404

5.2.2 Travel Times

Travel times were analyzed using ARTPLAN, which is a tool to support planning/preliminary engineering decisions for signalized facilities based on roadway geometrics (number of lanes by movement type, turn lane storage lengths, etc.), traffic signal data such as cycle lengths, and

vehicle arrival type information. ARTPLAN analysis provides the estimated travel speeds for segments of each arterial roadway.

Table 5-3 summarizes the average speeds for Existing and 2040 No Build conditions. Overall, speeds operate below the posted speed limit in 2018 existing conditions, and speeds decrease along Route 28 from existing conditions to 2040 No Build conditions south of Bull Run. Since no additional capacity is being added to Route 28 between Route 234 and Compton/Ordway Road in this condition, the added volume over the years results in slower speeds and more congestion. Speeds increase north of Bull Run in the future due to the Fairfax County Route 28 widening project, which widens Route 28 to three lanes in each direction.

Travel speeds between Manassas Drive and the northern end of the study area are projected to be less than 10 mph in both the 2040 AM and PM peak periods; speed limits in this area are primarily posted at 45 mph. Most segments along Route 28 in the study area will operate 10 to 15 mph slower in 2040 than in existing conditions in the AM peak period, and the largest decrease compared to existing conditions is at Manassas Drive in the PM peak period, which is projected to decrease by more than 20 mph.

Table 5-3. Route 28 Existing and Future No Build Speeds

Segment along Route 28		Speed Limit (mph)	Existing Speed (mph)		2040 No Build			
					Speed (mph)		Change from Existing	
			AM	PM	AM	PM	AM	PM
Parallel to Godwin Drive	Godwin Drive to Wellington Road	45	43	42	41	39	-2	-3
	Wellington Road to Cockrell Road		30	28	28	18	-2	-10
	Cockrell Road to Brinkley Lane		18	16	16	2	-2	-14
	Brinkley Lane to Stonewall Road		28	26	27	3	-1	-23
	Stonewall Road to W Court House Road		20	19	18	15	-2	-4
	W Court House Road to Grant Ave (Center Street)		23	24	12	23	-11	-1
Study Area	**Grant Ave (Center Street) to Main St (Center Street)**	**25**	**18**	**19**	**8**	**19**	**-10**	**0**
	Liberia Avenue to Manassas Drive	**35**	**31**	**33**	**14**	**32**	**-17**	**-1**
	Manassas Drive to Browns Lane		**18**	**30**	**4**	**9**	**-14**	**-21**
	Browns Lane to Maplewood Drive	**45**	**8**	**3**	**2**	**1**	**-6**	**-2**
	Maplewood Drive to Leland Road		**23**	**9**	**8**	**4**	**-15**	**-5**
	Leland Road to Yorkshire Lane		**21**	**7**	**6**	**3**	**-15**	**-4**
	Yorkshire Lane to Orchard Bridge Drive		**15**	**5**	**4**	**2**	**-11**	**-3**
North of Bull Run	Compton/Ordway Road to Green Trails/Old Mill Road		16	8	34	10	+18	+2
	Green Trails/Old Mill Road to New Braddock Road		16	7	33	13	+17	+6
	New Braddock Road to Machen Road		6	4	16	4	+10	0
	Machen Road to Upperridge Drive /Old Centreville Road		8	4	22	10	+14	+6

Finally, the number and density of access points, including both intersections at public roads as well as commercial/residential driveways, also affects overall roadway travel times and speeds as vehicles entering and exiting the roadway interrupt the flow of traffic for through vehicles. Between Sudley Road and Compton/Ordway Road, there are 10 signalized intersections with public roadways in the study area corridor, with an additional 14 unsignalized intersections with public roadways in the northbound and/or southbound directions (i.e., some intersections are three-legged intersections with access to one direction of Route 28). There are more than 200 access points to properties (i.e., commercial or residential driveways) along Route 28 between Liberia Avenue and Compton Road (**Table 5-4**): approximately 85 along the eastern side of Route 28 and approximately 110 along the western side. While there are several community facilities, such as churches, in the vicinity of Route 28, none have direct access to Route 28 itself. Access to properties may be from one or both directions of northbound and/or southbound Route 28, and a single access point (driveway) may serve multiple businesses. Many of the access points are closely spaced with average spacing of 200 feet between access points in the northbound direction and average spacing of 150 feet in the southbound direction.

Table 5-4. Summary of Route 28 Access Points by Type

Intersecting Public Roadways		
Minor Arterial	5	
Collector/Local Road	19	
Property Access	**Northbound**	**Southbound**
Commercial Entrance	60	85
Residential Entrance	5	15
Community Facility Entrance	0	0
Unused/Vacant Lot	15	10
Total Property Access	**80**	**110**

Inventory between Ordway Road/Compton Road (northern limit) and Commerce Court (southern limit), based on Google Earth, Google Map/Streetview, and field verification. Roadway for minor arterials per VDOT approved functional classifications. Property access rounded to the nearest 5; a single access point may provide access to numerous buildings/businesses.

5.2.3 Network Reliability

A discussion of network reliability under existing, No Build, and Build conditions is presented in Section 5.3.3 to facilitate the comparison of the qualitative factors associated with this element of the purpose and need.

5.3 ABILITY TO MEET NEEDS – BUILD ALTERNATIVES 2A, 2B, AND 4

This section provides a comparison of the No Build Alternative and the Build Alternatives based on year 2040 intersection operations derived from the CLV analysis, year 2040 estimated travel speeds derived from the ARTPLAN analysis, and a qualitative analysis of network reliability.

Table 5-5 presents the AADT volumes for each build alternative, along with change from the No Build Alternative. Under Alternatives 2A and 2B, the annual average daily traffic volumes entering the system on Route 28 from the south near the intersection of Route 28 and Godwin Drive increase from the No Build condition and since the extension of Godwin Drive diverts cars from continuing on Route 28, the volumes on Route 28 decrease after Godwin Drive to Orchard Bridge Drive. Under Alternative 4, vehicles are added to the system north of Liberia Avenue since additional capacity is available with the widening.

With the construction of either Alternatives 2A or 2B, traffic volumes on Route 28 south of Bull Run are anticipated to be approximately 25,000 vehicles per day lower than they would be with Alternative 4, and 14,000 vehicles per day lower than they would be with the No Build. Volumes along Route 28 would generally increase compared to the No Build for Alternative 4. **Figure 5-1** shows a graphical representation of these changes in volume between the No Build Alternative and each of the build alternatives. As would be expected with the provision of an additional north-south route, the volumes along Route 28 would decrease with Alternatives 2A and 2B, but would increase along Godwin Drive to and from the new bypass.

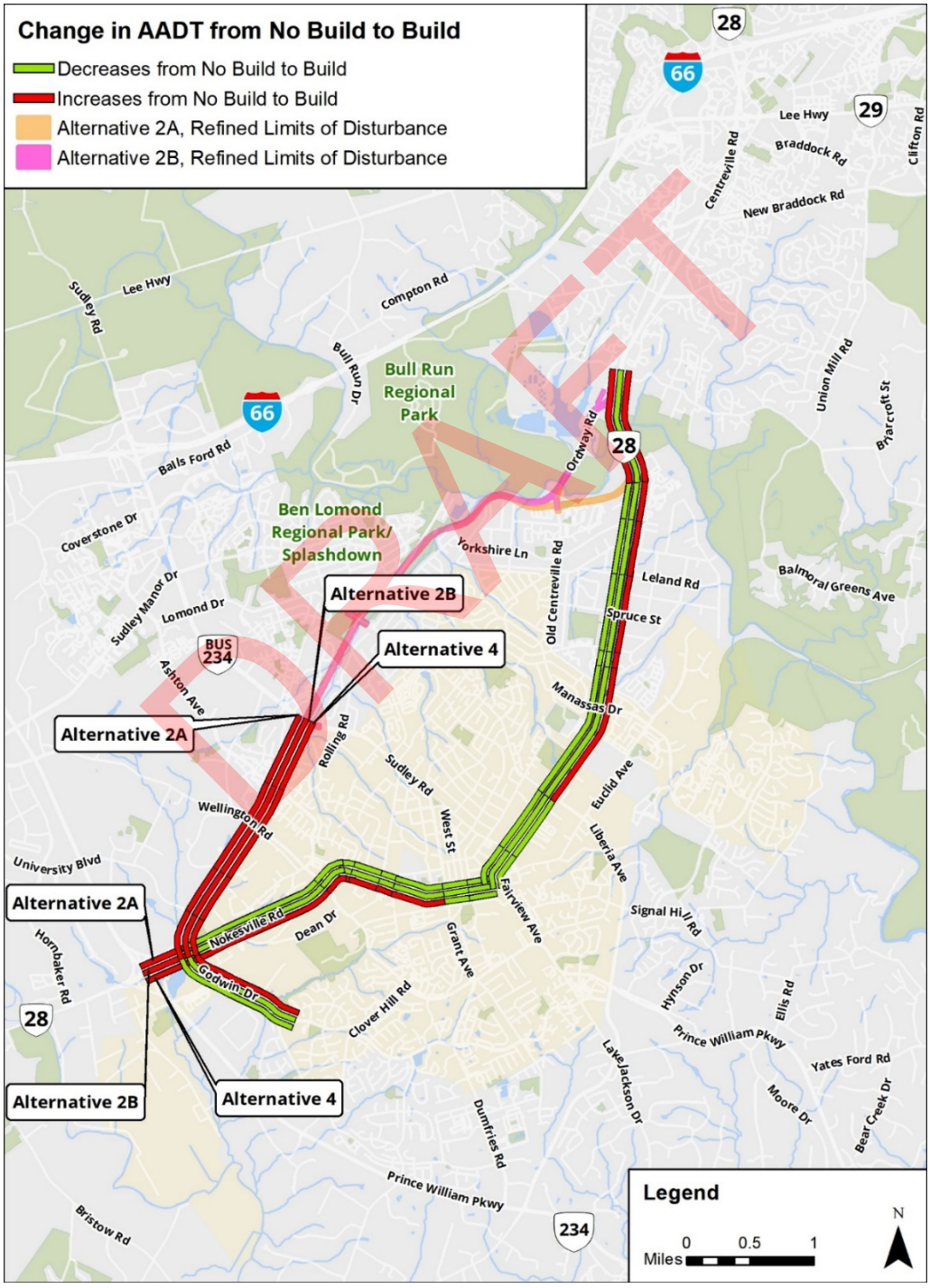


Figure 5-1. Change in Annual Average Daily Traffic Volumes, No Build to Build

Table 5-5. Future No Build and Build Annual Average Daily Traffic (AADT) Volumes on Route 28

Segment		2040 No Build AADT	2040 Build 2A			2040 Build 2B			2040 Build 4		
			AADT	Change from No Build	% Change	AADT	Change from No Build	% Change	AADT	Change from No Build	% Change
Parallel to Godwin Drive	Route 234 to Godwin Drive	45,260	56,309	+11,049	24.4%	58,685	+13,425	29.7%	45,700	+440	1.0%
	Godwin Drive to Wellington Road	35,708	29,582	-6,125	-17.2%	29,732	-5,976	-16.7%	36,171	+463	1.3%
	Wellington Road to Cockrell Road	30,964	24,574	-6,390	-20.6%	24,641	-6,323	-20.4%	31,403	+439	1.4%
	Cockrell Road to Brinkley Lane	37,782	30,447	-7,335	-19.4%	30,514	-7,268	-19.2%	38,242	+460	1.2%
	Brinkley Lane to Stonewall Road	37,782	30,447	-7,335	-19.4%	30,514	-7,268	-19.2%	38,242	+460	1.2%
	Stonewall Road to W Court House Road	35,670	28,697	-6,973	-19.5%	28,759	-6,911	-19.4%	36,211	+541	1.5%
	W Court House Road to Grant Avenue (Center Street)	36,490	29,656	-6,835	-18.7%	29,712	-6,778	-18.6%	37,011	+521	1.4%
Study Area	**Grant Avenue (Center Street) to Main Street (Center Street)**	**37,594**	**28,494**	**-9,101**	**-24.2%**	**28,485**	**-9,110**	**-24.2%**	**35,052**	**-2,543**	**-6.8%**
	Main Street (Center Street) to Zebedee Street (Center Street)	**42,958**	**35,525**	**-7,433**	**-17.3%**	**35,332**	**-7,626**	**-17.8%**	**42,111**	**-847**	**-2.0%**
	Zebedee Street (Center Street) to Sudley/Prescott Road	**34,430**	**27,241**	**-7,189**	**-20.9%**	**26,908**	**-7,522**	**-21.8%**	**33,337**	**-1,093**	**-3.2%**
	Sudley Prescott Road to Liberia Avenue	**42,064**	**29,779**	**-12,285**	**-29.2%**	**29,221**	**-12,843**	**-30.5%**	**38,428**	**-3,636**	**-8.6%**
	Liberia Avenue to Manassas Drive	**66,071**	**58,124**	**-7,947**	**-12.0%**	**56,797**	**-9,274**	**-14.0%**	**74,589**	**+8,518**	**12.9%**
	Manassas Drive to Browns Lane	**83,925**	**77,841**	**-6,084**	**-7.2%**	**75,255**	**-8,670**	**-10.3%**	**96,412**	**+12,487**	**14.9%**
	Browns Lane to Maplewood Drive	**76,853**	**65,140**	**-11,713**	**-15.2%**	**63,167**	**-13,686**	**-17.8%**	**87,195**	**+10,342**	**13.5%**

Table 5-5. Future No Build and Build Annual Average Daily Traffic (AADT) Volumes on Route 28

Segment		2040 No Build AADT	2040 Build 2A			2040 Build 2B			2040 Build 4		
			AADT	Change from No Build	% Change	AADT	Change from No Build	% Change	AADT	Change from No Build	% Change
	Maplewood Drive to Leland Road	**72,757**	**61,537**	**-11,221**	**-15.4%**	**59,183**	**-13,575**	**-18.7%**	**83,630**	**+10,873**	**14.9%**
	Leland Road to Yorkshire Lane	**73,124**	**61,574**	**-11,550**	**-15.8%**	**59,263**	**-13,861**	**-19.0%**	**83,878**	**+10,754**	**14.7%**
	Yorkshire Lane to Orchard Bridge Drive	**76,848**	**61,854**	**-14,994**	**-19.5%**	**59,942**	**-16,906**	**-22.0%**	**85,973**	**+9,125**	**11.9%**
	Orchard Bridge Drive to Compton/Ordway Road	**76,488**	**104,581**	**+28,093**	**36.7%**	**76,484**	**-4**	**0.0%**	**85,578**	**+9,090**	**11.9%**
North of Bull Run	Compton/Ordway Road to Green Trails/Old Mill	93,012	113,885	+20,873	22.4%	117,489	+24,477	26.3%	95,219	+2,207	2.4%
	Green Trails/Old Mill to New Braddock Road	114,909	134,985	+20,076	17.5%	138,511	+23,602	20.5%	117,042	+2,133	1.9%
	New Braddock Road to Machen Road	107,780	121,759	+13,979	13.0%	125,313	+17,533	16.3%	109,153	+1,373	1.3%
	Machen Road to Upperridge/Old Centreville	107,780	121,759	+13,979	13.0%	125,313	+17,533	16.3%	109,153	+1,373	1.3%

5.3.1 Traffic Congestion

Table 5-6 summarizes the CLV values at intersections. Because CLV values vary based on the traffic volumes and roadway geometrics unique to each alternative, intersection operations either improve or degrade based on where traffic volumes are accommodated. Overall, operations improve for all three alternatives as compared to the No Build Alternative.

Within the study area, Alternatives 2A and 2B reduce the CLV at more intersections during the AM and PM peak hours than Alternative 4, as represented by the green (lower CLV than No Build) and red (higher CLV than No Build) text in the table. While conditions are expected to improve as compared to the No Build Alternative, many intersections will continue to operate at or near capacity (i.e., CLV values between 1500 and 1600, as previously discussed) during the peak hours, regardless of which improvements are built (the length of the peak period, however, is expected to reduce, as discussed in the Network Reliability section). This is particularly true at the intersection of Compton/Ordway Road; while Alternative 4 provides some reduction in CLV as compared to the No Build Alternative, all three alternatives will operate over capacity. Improvements to existing intersections on Route 28 are most affected within the study area which, by adding travel lanes to Route 28 under Alternative 4 or on the alternate route under Alternatives 2A and 2B, reduces the volume of traffic within the core (with less benefit directly to the north and south).

It is important to note that traffic congestion is only one of several measures described in this report; other key measures include travel times and network reliability, which are discussed in the sections that follow.

Table 5-6. Route 28 Change in CLV from No Build to Build

Segment		Alternative	2040 AM Peak Hour	2040 PM Peak Hour
			CLV	CLV
Parallel to Godwin Drive	Route 28 and Godwin Drive	No Build	958	1220
		2A	1375	1737
		2B	1448	1830
		4	967	1227
	Route 28 (Center St) and Grant Avenue	No Build	933	1136
		2A	862	1007
		2B	861	1020
		4	934	1132
	Route 28 (Church St) and Grant Avenue	No Build	841	1185
		2A	731	1042
		2B	727	1036
		4	847	1190
Study Area	Route 28 (Center St) and Main Street	No Build	899	1211
		2A	807	1107
		2B	801	1090
		4	873	1189
	Route 28 (Church St) and Main Street	No Build	648	891
		2A	543	743
		2B	535	733
		4	640	877

Table 5-6. Route 28 Change in CLV from No Build to Build

Segment		Alternative	2040 AM Peak Hour	2040 PM Peak Hour
			CLV	CLV
	Route 28 and Sudley Road / Prescott Avenue	No Build	996	1425
		2A	828	1248
		2B	824	1244
		4	1033	1456
	Route 28 and Liberia Avenue	No Build	1490	1770
		2A	1400	1590
		2B	1365	1565
		4	1620	1827
	Route 28 and Manassas Drive	No Build	1421	1953
		2A	1220	1700
		2B	1180	1655
		4	1208	1710
	Route 28 and Maplewood Drive	No Build	1343	2032
		2A	1162	1762
		2B	1139	1738
		4	1107	1682
	Route 28 and Yorkshire Lane	No Build	1509	1994
		2A	1158	1535
		2B	1144	1515
		4	1199	1558
	Route 28 and Orchard Bridge Drive	No Build	1370	1729
		2A	1207	1467
		2B	1081	1356
		4	1078	1356
	Route 28 and Compton/Ordway Road	No Build	1510	1942
		2A	1689	2130
		2B	1911	2655
		4	1707	1912
North of Bull Run	Route 28 and Green Trails Boulevard / Old Mill Road	No Build	1048	1278
		2A	1167	1439
		2B	1236	1609
		4	1066	1277
	Route 28 and New Braddock Road	No Build	1886	1894
		2A	2023	2039
		2B	2059	2073
		4	1462	1749
	Route 28 and Machen Road	No Build	835	1404
		2A	937	1544
		2B	961	1580
		4	845	1416

5.3.2 Travel Times

Table 5-7 summarizes existing and future average speeds (as estimated by ARTPLAN) along Route 28. As with the traffic congestion at study intersections described in the previous section, improvements in travel times vary by location based on the alternative, with large increases in travel speed in the southern portion of the corridor from Godwin Drive to Manassas Drive (as compared to the No Build Alternative) for Alternatives 2A and 2B. North of Manassas Drive, however, Alternative 4 has a larger effect on travel times than Alternatives 2A and 2B.

Table 5-7 shows that all three alternatives result in more segments than not operating at speeds higher than the No Build Alternative. For Alternative 2A in the AM and PM peaks respectively, 11 and 10 of the 17 segments operate at speeds higher than the No Build and 5 and 3 segments operate at speeds equal to the No Build. For Alternative 2B in the AM and PM peaks respectively, 13 and 10 of the 17 segments operate at speeds higher than the No Build and 2 and 3 of the 17 segments operate at speeds equal to the No Build Alternative. For Alternative 4 in the AM and PM peaks respectively, 7 and 9 of the segments operate at speeds higher than the No Build and 9 and 3 segments operate at speeds equal to the No Build.

Alternatives 2A and 2B result in more travel speed improvements than Alternative 4.

Table 5-7. Route 28 Future No Build and Build Alternative Speeds

Segment		Speed Limit (mph)	2040 No Build		2040 Build 2A				2040 Build 2B				2040 Build 4			
			Speed (mph)		Speed (mph)		Change from No Build		Speed (mph)		Change from No Build		Speed (mph)		Change from No Build	
			AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Parallel to Godwin Drive	Godwin Drive to Wellington Road	45	41	39	42	38	+1	-1	42	38	+1	-1	41	40	0	+1
	Wellington Road to Cockrell Road		28	18	28	41	0	+23	29	41	+1	+23	28	26	0	+8
	Cockrell Road to Brinkley Lane		16	2	17	18	+1	+16	17	18	+1	+16	15	3	-1	+1
	Brinkley Lane to Stonewall Road		27	3	28	14	+1	+11	28	14	+1	+11	27	10	0	+7
	Stonewall Road to W Court House Road		18	15	19	26	+1	+11	19	26	+1	+11	18	8	0	-7
	W Court House Road to Grant Ave (Center Street)		12	23	20	20	+8	-3	20	21	+8	-2	12	22	0	-1
Study Area	**Grant Ave (Center Street) to Main St (Center Street)**	**25**	**8**	**19**	**17**	**24**	**+9**	**+5**	**17**	**24**	**+9**	**+5**	**11**	**16**	**+3**	**-3**
	Liberia Avenue to Manassas Drive	**35**	**14**	**32**	**22**	**21**	**+8**	**-11**	**23**	**22**	**+9**	**-10**	**29**	**31**	**+15**	**-1**
	Manassas Drive to Browns Lane		**4**	**9**	**5**	**15**	**+1**	**+6**	**5**	**18**	**+1**	**+9**	**4**	**25**	**0**	**+16**
	Browns Lane to Maplewood Drive	**45**	**2**	**1**	**6**	**3**	**+4**	**+2**	**1**	**3**	**-1**	**+2**	**3**	**2**	**+1**	**+1**
	Maplewood Drive to Leland Road		**8**	**4**	**8**	**1**	**0**	**-3**	**11**	**1**	**+3**	**-3**	**15**	**7**	**+7**	**+3**
	Leland Road to Yorkshire Lane		**6**	**3**	**7**	**6**	**+1**	**+3**	**9**	**6**	**+3**	**+3**	**12**	**5**	**+6**	**+2**
	Yorkshire Lane to Orchard Bridge Drive		**4**	**2**	**4**	**4**	**0**	**+2**	**6**	**5**	**+2**	**+3**	**8**	**4**	**+4**	**+2**
North of Bull Run	Compton/Ordway Road to Green Trails/Old Mill Road		34	10	33	17	-1	+7	31	17	-3	+7	35	7	+1	-3
	Green Trails/Old Mill Road to New Braddock Road		33	13	34	13	+1	0	34	13	+1	0	33	13	0	0
	New Braddock Road to Machen Road		16	4	16	4	0	0	16	4	0	0	16	4	0	0
	Machen Road to Upperridge Drive /Old Centreville Road		22	10	22	10	0	0	22	10	0	0	22	10	0	0

5.3.3 Network Reliability

While the reliability of a roadway is affected by the extent to which demand volumes are accommodated, it is also affected by the availability of alternate routes and route choices. By providing additional capacity, all three alternatives (Alternatives 2A, 2B, and 4) are expected to increase network reliability over the No Build Alternative, as described quantitatively in the previous sections and qualitatively below in terms of "peak spreading." However, Alternatives 2A and 2B would further enhance network reliability over the No Build Alternative and Alternative 4 with the provision of a separate roadway facility, thereby increasing the availability of alternate routes and overall connectivity options. This additional benefit is also described further below.

"Peak Spreading"

Traffic operations analysis is typically based on the analysis of peak hours, usually a single peak hour in the morning and a single peak hour in the afternoon/evening that mirrors typical commuter travel times. In congested networks such as the Route 28 corridor, peak hour travel demand matches total hourly capacity (i.e., the road is carrying the maximum volume for the hour). As travel demand continues to increase without corresponding increases in capacity, traffic volumes spill over into adjacent hours because of congestion, as well as motorists making conscious decisions to travel earlier or later to avoid sitting in traffic. This phenomenon, termed "peak spreading", is confirmed by traffic count data in congested areas.

Increased travel demand in the Route 28 corridor has resulted in longer periods in both the morning and evening commuting times where traffic experiences stop-and-go conditions. Peak spreading results in motorists spending more time on the road and having to leave home earlier and get home later based both on peak hour congestion and the need to modify schedules based on peak spreading. Increased demands without commensurate increases in capacity, as is anticipated with the No Build Alternative, will continue to increase the number of hours that motorists spend on the road. With either Alternatives 2A, 2B, and 4, however, the peak period would reduce as additional capacity is available to accommodate the peak travel demand.

Alternative Route Choices

The reliability of a roadway network relates to consistency/dependability of travel times, typically from day to day, and is independent of actual travel times and speeds. While congestion results in reduced average speeds, roadways that operate close to or over capacity are also more likely to experience reductions in reliability because of the effects of unanticipated/secondary events, such as disabled vehicles or vehicle crashes, weather, emergency vehicles, or traffic signal failures, all of which exacerbate traffic conditions in unpredictable ways. High levels of traffic often take longer to clear and affect more of the overall network, reducing the availability of viable alternate routes. The availability of alternate routes affects the recovery time of the network because fewer connections between destinations mean that drivers cannot depart from an unreliable route if such an event occurs. Generally, a roadway network needs to have both reliable capacity and reliable connectivity to allow drivers the ability of reaching their destination in the expected time. In the absence of this, the same trip may take 30 minutes one day and 75 minutes the next. Qualitatively, factors that affect reliability include roadway and system capacity (examples include traffic signal progression, density of driveway access, volume to capacity ratios, etc.) as well as the availability of alternate routes and/or travel modes as well as network connectivity.

One way to think about connectivity and the extent to which alternate routings are available is to consider a traditional grid roadway system. Traffic engineers have long recognized the importance of roadway spacing in providing transportation system flexibility and efficiency. Roadway systems

that resemble a grid system allow the transportation system to be able to absorb variations in traffic demands across the day, allow for travel that is concentrated during "peak" hours to be accommodated and cleared more quickly, and allow for the effects of events such as a crash or traffic signal malfunction to be absorbed more easily across multiple parallel roads in the system. Traffic peaking can also be more easily absorbed by the redundancies offered through a grid system. Finally, grid systems often also provide the opportunity for trips to be more direct, and to more effectively serve transit, bicycle, and pedestrian travel.

By serving as a parallel alternative route to Route 28, Alternatives 2A and 2B would provide more consistent and wide-ranging benefits by enhancing overall network reliability. These two alternatives would provide a separate roadway facility that enhances the availability of alternate routes and overall connectivity options. As a limited access facility, Alternatives 2A and 2B would also more efficiently and safely handle transit, bicycle, and pedestrian travel as well. As a link on the overall roadway network, Alternatives 2A and 2B provide opportunities for additional transit routes, including routes that provide for service at higher levels of reliability as well as more direct connections to residential areas where commuter trips start and end. Finally, existing Route 28 (and the No Build Alternative and Alternative 4) has a high density of traffic signals and access points (including unsignalized driveway access points). Alternatives 2A and 2B, on the other hand, provide an option for bicycle travel on a path that would not cross frequent intersections and driveways, particularly relatively high-volume commercial property driveways.

SECTION 6
SUMMARY OF PURPOSE & NEED, ENVIRONMENTAL IMPACTS, AND COSTS

6.1 SUMMARY OF PURPOSE AND NEED

Based on existing and future transportation needs, the purpose of the project is to reduce congestion and improve travel times and network reliability within a portion of the Route 28 corridor in Prince William and Fairfax Counties and the Cities of Manassas and Manassas Park. The updated traffic analyses (Section 5) have confirmed deficiencies due to volumes exceeding available capacity on Route 28 and reaffirmed the need to provide additional north-south capacity in the study area. The ability of each alternative to meet the purpose and need of the project is summarized in **Table 6-1**. The analysis indicates that by reducing volumes on Route 28, providing an alternative north-south travel route, and facilitating multimodal travel options, Alternatives 2A and 2B meet more elements of the purpose and need and provide benefits over a larger geographic area than Alternative 4. From a traffic perspective, Alternatives 2A and 2B differ in the location where they would rejoin Route 28 – Alternative 2A would join to the south of Bull Run and Alternative 2B to the north of Bull Run. Alternative 2A would provide improvements to a slightly shorter section of Route 28 and all traffic would cross Bull Run on Route 28 similar to today, though the crossing would be widened. Alternative 2B would add capacity on another crossing of Bull Run (i.e., Compton/Ordway Road), which would prove beneficial in the event of an accident or closure of the bridge on Route 28. Traffic operations at/through the existing intersection with Route 28 and Compton/Ordway Road would differ between the two alternatives, as well, with Alternative 2B requiring more complex intersection design.

Table 6-1. Ability of Alternatives to Meet Purpose and Need Elements

Purpose & Need	Alternative 2A	Alternative 2B	Alternative 4
Reduce Traffic Congestion on Route 28	+ Reduces traffic volumes on Route 28 compared to No Build and Alternative 4 + Reduces traffic congestion at more intersections during peak periods than Alternative 4 - Some intersections remain at/over capacity along Route 28	+ Reduces traffic volumes on Route 28 compared to No Build and Alternative 4 + Reduces traffic congestion at more intersections during peak periods than Alternative 4 - More complex intersection design at Compton/Ordway Road - Some intersections remain at/over capacity along Route 28	- Increases traffic volumes on Route 28 compared to No Build and Alternatives 2A/2B - Reduces traffic congestion at fewer intersections than Alternatives 2A/2B - Some intersections remain at/over capacity along Route 28
Improve Overall Travel Times	+ Travel speed improvements compared to No Build + More travel speed improvements compared to Alternative 4	+ Travel speed improvements compared to No Build + More travel speed improvements compared to Alternative 4	+ Travel speed improvements compared to No Build - Fewer travel speed improvements compared to Alternatives 2A and 2B

Table 6-1. Ability of Alternatives to Meet Purpose and Need Elements

Purpose & Need	Alternative 2A	Alternative 2B	Alternative 4
Enhance Network Reliability	+ Reduces spread of peak travel times + Provides an additional option for north-south travel + Fewer access points and traffic signals enhances bicycle, pedestrian, and transit options	+ Reduces spread of peak travel times + Provides an additional option for north-south travel + Provides alternate crossing of Bull Run + Fewer access points and traffic signals enhances bicycle, pedestrian, and transit options	+ Reduces spread of peak travel times - Does not provide new north-south connection - Multimodal travel would conflict with driveways and intersections along Route 28

+ Meets Purpose & Need / Improvement from No Build and/or other alternatives

- May not meet Purpose & Need / Degradation from No Build and/or other alternatives

6.2 SUMMARY OF ENVIRONMENTAL IMPACTS

Table 6-2 summarizes the potential environmental impacts within the estimated limits of disturbance (LOD) for each alternative, as described in Section 4 of this memorandum. As explained in Section 2.4.2, the refined LOD includes the area that would be permanently impacted by the improvements as well as a buffer to account for potential temporary impacts during construction and potential utility easements. Accordingly, the estimated impacts are conservative and serve as a measure to compare alternatives. The LOD is based on planning-level engineering and would be refined during future, more detailed levels of design at which time every effort would be made to further minimize impacts estimated in this study.

The intent of quantifying these impacts as part of the alternative development process is to compare the current refinements to the LOD against the original 250-foot-wide corridor (as reported in the 2017 Feasibility Study) to quantify avoidance and minimization of resources. This summary of impacts includes the critical environmental constraints that guided the development of alternatives, as described in Section 2.4.1: cultural resources and parklands, streams, wetlands, and floodplains, and concentrations of residential and business properties. A full summary of existing conditions and environmental consequences to all resources, as well as additional detail for resources shown in the below table and potential for mitigation to unavoidable impacts, will be included in the EA.

Table 6-2. Summary of Environmental Impacts – Comparison of 2017 Feasibility Study and Refined Alternative Limits of Disturbance[1]

Resource	Alternative 2A		Alternative 2B		Alternative 4	
	250' Corridor	LOD	250' Corridor	LOD	250' Corridor	LOD
Total Area (acres)	166	95	143	87	110	73
Total No. of Parcels with ROW Impacts[2]	--	142	--	101	--	185
Residential Displacements [3]	112	172	70	82	5	7
Commercial Displacements (no. of businesses)[4]	13	15	0	0	96	79
Community Displacements[5]	0	0	0	0	0	1
Public Parks & Recreation Facilities (acres)[6]	23.4	4.3	30.0	5.8	5.0	0
Historic Properties (acres)7	168	4.5	121	18.4	202	0.1
Streams (linear feet)[8]	7,370	2,080	7,050	2,460	2,050	175
Wetlands (acres)[8, 9]	5.4	3.1	6.2	5.1	0.9	0.1
Floodplains (acres)[8, 10]	66.7	31.9	55.7	34.1	9.3	5.7

Notes:

1: The 250-foot-wide corridor represents the impacts as reported in the 2017 Feasibility Study. The Limits of Disturbance (LOD) represents impacts as a result of modifications to the typical section and alignments as described in Section 4 of this memorandum.

2: Right-of-way (ROW) impacts by parcel were not part of the 2017 Feasibility Study. ROW impacts are calculated for parcels directly abutting Route 28 that are within the LOD, and generally vary from >1% to 40% of a total parcel for parcels without a building displacement.

3: Differences in displacements between the 250' corridor and the LOD, particularly for Alternative 2A, are due to alignment shifts to avoid impacts to other resources (as described in Section 4 of this memorandum), as well as differences in methodology. Residential displacements within the LOD include all single family homes as well as mobile homes and townhomes, which may have multiple homes on a single property and were counted separately.

4: Commercial relocations within the LOD are quantified total number of active/operating businesses based on field survey conducted in December 2019. A single building may contain multiple businesses.

5: One community impact within Alternative 4 LOD (Rock of Israel Church) based on field survey conducted in December 2019.

6: Alternatives 2A and 2B encroach on Ben Lomond Regional Park, and Alternative 2B also encroaches on Bull Run Regional Park.

7: The 2017 Feasibility Study quantified impacts to historic properties based on acreages associated with battlefield study areas and core areas. Impacts within the LOD are based on more well-defined Potential National Register (PotNR) boundaries, as described in Section 2.4.1 of this memorandum. The LOD of all three build alternatives encroach on Blackburn's Ford and First Manassas Battlefields.

8: Impacts exclude the extents of proposed bridges across Bull Run and Flat Branch as bridges would span streams to the extent possible to reduce impacts. Bridge piers are not designed as a part of this conceptual design and would be based on future bridge design and a river mechanics analysis. See Section 2.4.3.

9: Acreage of wetlands within the refined LOD are based on delineations that were completed as part of this study, as described in Section 2.4.1 of this memorandum, supplemented as necessary outside of the 250-foor corridor with National Wetlands Inventory (NWI) and National Hydrology Dataset (NHD) datasets.

10: Federal Emergency Management Agency (FEMA) - National Flood Hazard Layer (NFHL) (2018). Accessed 7/2/2018 at https://msc.fema.gov/portal

6.3 SUMMARY OF COSTS

Table 6-3 presents the planning-level cost estimates developed for the three build alternatives. These costs should be viewed as a relative comparison due to the planning level nature of the estimate. Costs are shown in current (2019) values.

Table 6-3. Comparison of Planning-Level Costs

Category	Alternative 2A	Alternative 2B	Alternative 4
Preliminary Engineering[1]	$7,000,000	$7,000,000	$5,000,000
Construction[1]	$94,000,000	$91,000,000	$67,000,000
Bridge Construction[1]	$65,000,000	$46,000,000	$35,000,000
Subtotal	*$166,000,000*	*$144,000,000*	*$107,000,000*
Right-of-Way[2]	$68,000,000	$36,000,000	$145,000,000
Utilities[3]	$6,000,000	$7,000,000	$17,000,000
Subtotal	*$240,000,000*	*$187,000,000*	*$269,000,000*
Contingency (25%)[4]	$60,000,000	$47,000,000	$67,000,000
Total	**$300,000,000**	**$234,000,000**	**$336,000,000**

All costs rounded up to the nearest million.

[1] Developed using the VDOT Project Cost Estimating System (PCES), Version 8.11 for preliminary engineering and construction and Version 1.4 for bridge construction. The PCES estimate includes all elements shown in project typical sections as well as other elements required for engineering and construction, such as: lighting, traffic signals/signage, MOT, soundwalls (if needed), and environmental investigation/mitigation.

[2] Includes displacements (total value + 50% relocation estimate) and partial property impacts (based on % of property in project limits). All estimates based on current total market value (or equivalent), available at time of estimate.

[3] Assumed $3.5 million/mile in existing corridors, with an additional $1 million per transmission power pole on Route 28 and an additional $275,000 for impacts to the Yorkshire Park Interceptor for Alternative 2A (based on drawings provided from Upper Occoquan Service Authority (UOSA)).

[4] Contingency applied to account for the uncertainties inherent with the planning-level design detail.