OCTOBER 2014

INTERSTATE 64 / HIGH RISE BRIDGE CORRIDOR STUDY

CITY OF CHESAPEAKE, VA | STATE PROJECT #: 0064-131-783 | UPC: 104366

ALTERNATIVES DEVELOPMENT TECHNICAL REPORT

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Acronym List

American Association of State Highway and Transportation Officials	AASHTO
Atlantic Intracoastal Waterway	AICW
Collector-Distributor	C-D
City of Chesapeake, Virginia	Chesapeake
Constrained Long Range Plan	CLRP
Corridor of Statewide Significance	CoSS
Environmental Assessment	EA
Federal Highway Administration	FHWA
Fiscal Year	FY
General Purpose	GP
Highway Capacity Software	HCS
G.A. Treakle Memorial Bridge	High Rise Bridge
High Occupancy Toll	HOT
High Occupancy Vehicle	HOV
Interchange Modification Report	IMR
Hampton Roads Transportation Planning Organization	TPO
Interstate 264	I-264
Interstate 464	I-464
Interstate 64	I-64
Interstate 664	I-664
Limit of Disturbance	LOD
Level of Service	LOS
National Environmental Policy Act	NEPA
National Highway System	NHS
National Marine Fisheries Service	NMFS
National Oceanic and Atmospheric Administration,	NOAA
National Marine Fisheries Service	NMFS
Single Occupancy Vehicle	SOV
Strategic Highway Network	STRAHNET
Six-Year Improvement Program	SYIP
Transportation Demand Management	TDM
Transportation System Management	TSM

Route 13 / Military Highway	Route 13
Route 17 / George Washington Highway	Route 17
U.S. Army Corps of Engineers	USACE
U.S. Coast Guard	USCG
U.S. Environmental Protection Agency	USEPA
U.S. Fish and Wildlife Service	USFWS
Great Bridge Boulevard	Route 190
Virginia Department of Transportation	VDOT

1.0 INTRODUCTION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA) as the lead federal agency, and the United States Coast Guard (USCG) as a cooperating agency, is evaluating options to improve transportation conditions along the Interstate 64 (I-64) corridor between the Interstate 464 (I-464) interchange and the Interstate 664 (I-664) and Interstate 264 (I-264) interchanges at Bowers Hill (I-264/I-664) in the City of Chesapeake, Virginia (Chesapeake).

VDOT has considered a broad range of alternatives during the planning stage of the Interstate 64 / High Rise Bridge Corridor Study. The purpose of this report is to:

- Describe the alternatives development process along with detailed descriptions of the preliminary Alternatives which have been investigated for this Corridor Study; and
- Summarize the data and methodologies that were utilized in preparing the different alternatives.

1.1 Project Description

The study area for the I 64/High Rise Bridge Corridor Study is located in the southwestern quadrant of the Hampton Roads Beltway, which is formed by a loop of I-64 and I-664 (**Figure 1**). The study area encompasses approximately eight-miles of I-64, consisting of two travel lanes in each direction, between the I-464 interchange and the I-664 and I-264 interchanges at Bowers Hill. It includes interchanges along I-64 at Military Highway (Route 13), George Washington Highway (Route 17), and Great Bridge Boulevard (Route 190). The G.A. Treakle Memorial Bridge (High Rise Bridge), a mile-long double-leaf bascule bridge that spans I-64 across the Southern Branch of the Elizabeth River also is included in the study area.

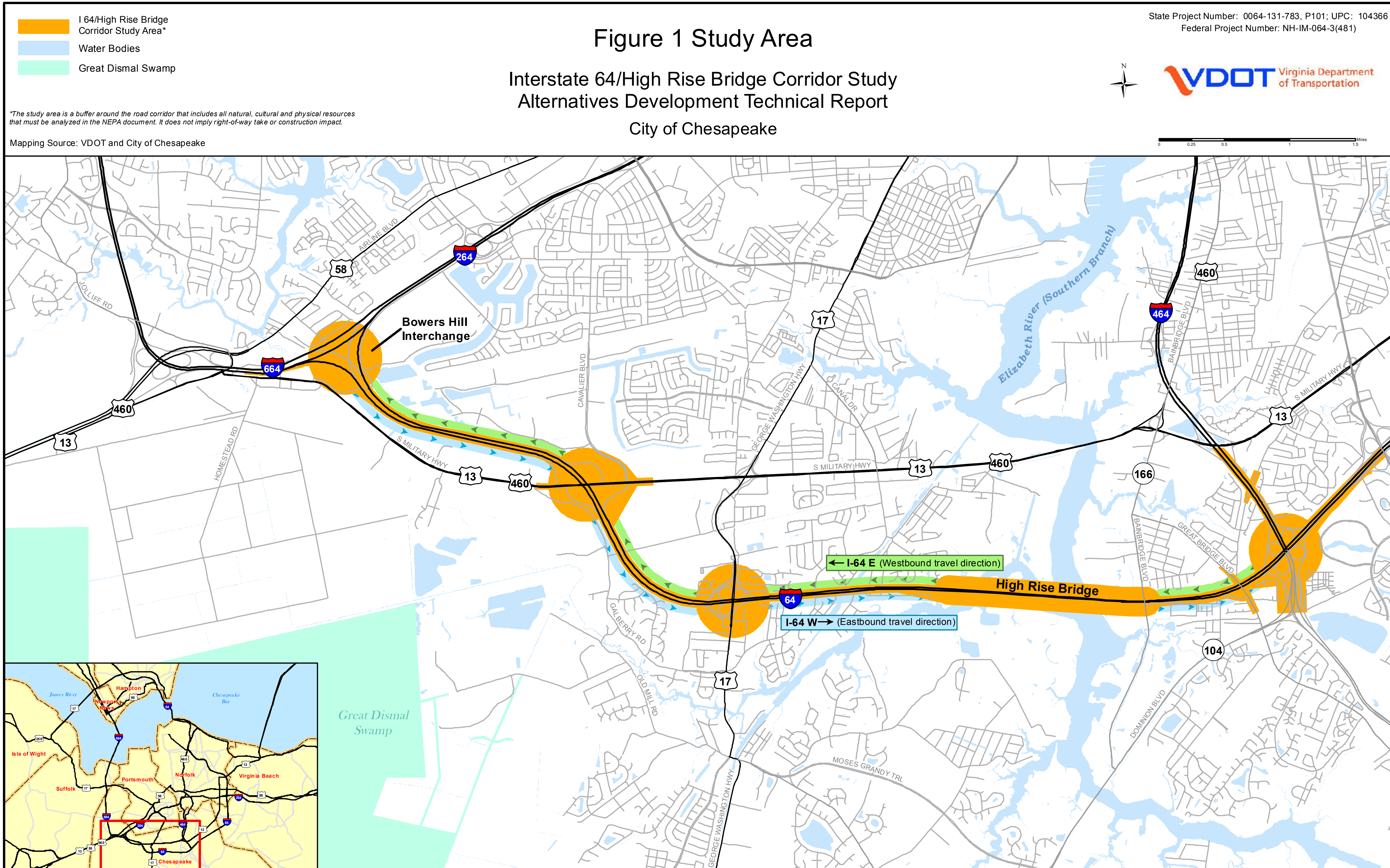
Within the study area, I-64 provides access to numerous businesses, homes, schools, and recreational locations throughout Chesapeake. Due to the loop that I-64 follows through the Hampton Roads region of the Commonwealth of Virginia (Virginia), I-64 West travels in an easterly direction and I-64 East travels westerly through the study area. For the purpose of this Technical Report and associated Environmental Assessment (EA), I-64 will be described in terms of the road name and not the direction of the road.

1.2 Location Study Area

The study area extends beyond the interchanges described above to ensure any of the proposed transportation improvements properly tie back in with the existing facility and is used as a boundary for the inventory of environmental resources. The Location Study Corridor consists of (**Figure 1**):

- Four interchanges (estimated at 3,000 feet in diameter/1,051 acres combined)[1];
- Mainline along I-64 (100 feet on each side from existing edge of pavement – estimated at 327 acres); and,
- High Rise Bridge (600 feet from the center line for a total of 1,200 feet – estimated at 308 acres).

[1] Due to its proximity with the I-464 interchange, Great Bridge Boulevard interchange area is included within the I-464 interchange bubble.


I 64/High Rise Bridge Corridor Study Area*
Water Bodies
Great Dismal Swamp
*The study area is a buffer around the road corridor that includes all natural, cultural and physical resources that must be analyzed in the NEPA document. It does not imply right-of-way take or construction impact.
Mapping Source: VDOT and City of Chesapeake
Figure 1 Study Area
Interstate 64/High Rise Bridge Corridor Study
Alternatives Development Technical Report
City of Chesapeake
State Project Number: 0064-131-783, P101; UPC: 104366
Federal Project Number: NH-IM-064-3(481)
VDOT Virginia Department of Transportation
Bowers Hill Interchange
High Rise Bridge
I-64 E (Westbound travel direction)
I-64 W (Eastbound travel direction)
Elizabeth River (Southern Branch)
Great Dismal Swamp
S MILITARY HWY
GEORGE WASHINGTON HWY
CAVALIER BLVD
HOMESTEAD RD
AIRLINE BLVD
JOLLIFF RD
CANAL DR
GALBERRY RD
OLD MILL RD
MOSES GRANDY TRL
BAINBRIDGE BLVD
GREAT BRIDGE BLVD
DOMINION BLVD
Hampton
Newport News
Isle of Wight
Suffolk
Portsmouth
Norfolk
Virginia Beach
Chesapeake
James River
Chesapeake Bay

Additionally, as discussed in **Section 2.3.2** below, potential or estimated environmental impacts of the alternatives retained for detailed study were estimated based on the alternative's limit of disturbance (LOD)[2]. The LOD has been estimated for alternative comparison purposes and decision-making during the National Environmental Policy Act (NEPA) process, but would be further refined during final design.

1.3 Interstate 64 Corridor Background

I-64 traverses approximately 300 miles between Hampton Roads region and the Virginia and West Virginia state line, just west of the City of Covington in Allegheny County. I-64 is part of the National Highway System (NHS)[3], the Strategic Highway Network (STRAHNET)[4], and was designated as a Corridor of Statewide Significance (CoSS)[5] in Virginia's Multimodal Long-Range Transportation Policy Plan (Office of Intermodal Planning and Investment, 2010). Additionally, Chesapeake is the mid-Atlantic terminus for the Norfolk Southern Corporation and CSX Transportation Corporation Railroads. According to the Hampton Roads Transportation Planning Organization (TPO) Regional Performance Measures, Values and Targets report (2012), sixty-six percent of all freight from the Port of Virginia is transported via truck. I-64 is the only interstate highway providing access into and out of Hampton Roads for the approximately 1.7 million people living in the region (Weldon Cooper Center, 2012). In addition, I-64 provides access to numerous tourist destinations and over 15 military installations in the region.

1.4 Existing Conditions

Within the study area, I-64 is predominantly two lanes in each direction, with auxiliary lanes (acceleration and deceleration lanes) at the interchanges listed below. Variations in this two lane configuration occur at four locations. At Bowers Hill, I-64 West begins as a three lane section, with two lanes generated from I-664 and one lane generated from I-264. This third lane is dropped on the left, east of the bridge over Rotunda Avenue. The second location where there is a variation in the two lane alignment is on I-64 West, east of the Great Bridge Boulevard partial interchange. At this location, two lanes are added on the right side as a Collector-Distributor (C-D) Road approaching the I-464 interchange. The third location where there are more than two lanes in each direction occurs on I-64 East under the I-464 bridge. At this location, I-64 East functions as a three-lane facility. Prior to reaching the High Rise Bridge, this third lane is dropped on the left side. The fourth location where I-64 deviates from its two-lane configuration occurs prior to the interchange at Bowers Hill on I-64 East. At this location, a third lane is added on the right which exits onto I-264 and the two left lanes exit onto I-664.

The mainline typical section (excluding the High Rise Bridge) includes 12-foot travel lanes, a 10-foot paved outside shoulder and a 3-foot paved median or left shoulder. The existing median or left shoulder does not meet current standards under the American Association of State Highway and Transportation Officials (AASHTO) [*A Policy on the Geometric Design of Highways and Streets, 2011*] (Green Book) or

[2] LOD also is referred to as the "Area of Impact" and potential or estimated impacts for the proposed transportation improvements are based on these limits.

[3] NHS consists of major roadways important to the nation's economy, defense, and mobility. The NHS includes the interstate highway system as well as other roads connecting to major ports, airports, public transportation facilities, or other intermodal transportation services.

[4] STRAHNET is a system of highways important to the United States' strategic defense policy providing defense, access, continuity and emergency capabilities for defense purposes.

[5] CoSS are considered to be integrated, multimodal systems of transportation facilities that connect activity centers within the Commonwealth.

the VDOT Road Design Manual (July, 2014) which recommend a 4-foot median or left paved shoulder. The posted speed limit is 60 miles per hour.

The following interchanges are located within the study area:

- Exit 297 – Military Highway (Route 13) – Diamond interchange with all ramp terminals offset from one another along Route 13;
- Exit 296 – George Washington Highway (Route 17) – Modified cloverleaf interchange with loop ramps in the northwest, northeast and southwest quadrants only;
- Exit 292 - Great Bridge Boulevard (Route 190) – Partial Diamond interchange with only one exit ramp from I-64 West onto Great Bridge Boulevard; and
- Exit 290 – I-464 – Cloverleaf interchange with a C-D roadway along I-64 West.

A key component of the I-64 corridor within the study area is the High Rise Bridge. Originally constructed in 1969, the High Rise Bridge is a four lane double-leaf bascule span bridge with a 65-foot unopened vertical clearance. The bridge carries a mile long portion of the I-64 corridor across the Southern Branch of the Elizabeth River at mile marker 7.1 of the Atlantic Intracoastal Waterway (AICW). Owned and operated by VDOT, the bridge opens upon vessel demand approximately 25 times per year[6]. The bridge includes four, 12-foot wide travel lanes with three-foot wide right and left shoulders. The shoulders do not meet current standards under the American Association of State Highway and Transportation Officials (AASHTO) [*A Policy on the Geometric Design of Highways and Streets, 2011*] (Green Book) or the VDOT Road Design Manual (July, 2014). VDOT standards require a four-foot paved left shoulder and a twelve-foot paved right shoulder. Further information on the High Rise Bridge and navigational characteristics are presented in the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b).

2.0 ALTERNATIVES CONSIDERED

2.1 Alternatives Development Process

The alternatives development process began with the development of the Purpose and Need of the study. Engineering design criteria was then established, which were utilized in identifying a reasonable range of alternatives based on the Purpose and Need of the study. Additionally, project scoping through agency and public involvement was initiated early in this process to solicit input in the development of alternatives and included consultation between VDOT and FHWA:

- VDOT initiated consultation with the USCG in August 2013 to identify the appropriate bridge height to be included in the study. The outcome of this early consultation was direction from USCG that a navigational evaluation should be completed to document the vertical clearance required to meet the reasonable needs of navigation for the Southern Branch of the Elizabeth River. Once VDOT had completed the necessary video monitoring, surveys, and desktop analysis, the USCG issued a Preliminary Public Notice requesting public comment on a 95-foot

[6] The Navigational Evaluation Technical Memorandum documented a higher level of openings than has historically been experienced at the High Rise Bridge. This increase was attributed to Dominion Boulevard Bridge and the Midtown and Downtown Tunnel projects. These independent construction projects increased the use and movement of several large cranes that operate on the river.

bridge. This height was based on the preliminary findings of the navigational evaluation. Through the subsequent comment period, USCG received support for a 95-foot bridge as well as a 135-foot bridge. Based on these comments and subsequent meetings, USCG recommended analyzing both vertical heights in the EA. See ***Navigational Evaluation Technical Memorandum***, Appendices A-D (VDOT, 2014b) for further public involvement information pertaining to this evaluation;

- Throughout the course of the study, VDOT and FHWA have consulted with their federal partnering agencies. This consultation has been conducted through a formal process whereby complex projects sponsored by FHWA and VDOT are presented at a series of Partnering Meetings with federal resource and regulatory agencies (United States Fish Wildlife Service [USFWS], United States Environmental Protection Agency [USEPA], United States Army Corp of Engineers [USACE], USCG, and the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service [NMFS]). Through this process, partner agencies were afforded an opportunity to provide early and continued input on scoping, purpose and need, and concept development. This study was presented to the partnering agencies at four meetings in May 2013, November 2013, February 2014, and May 2014. During the May 2014 meeting, VDOT presented several conceptual options under consideration for the mainline and bridge improvements. The meeting attendees reviewed the concepts and discussed potential preliminary impacts associated with each option. At this meeting, USACE indicated that impacting the Chesapeake Land Development Tidal Bank would be preferential from a regulatory perspective to impacting naturally occurring tidal wetlands along Hodges Creek. USACE and the other federal partners also provided comments on some of the other options which led to them being dismissed from further consideration. These options are discussed in **Section 4.0**. See also **Section 4.0 (Coordination and Comments)** of the EA for further discussion on Partnering meetings; and
- In addition to coordinating with the federal partners, technical experts at FHWA and VDOT have served as members of the Study Team. These members assisted in development, review, and modifications of the conceptual options under consideration.

Based on the input described in the preceding paragraphs, the following describes the process used to develop the various alternatives for this study.

2.1.1 Purpose and Need

Prior to the development of any alternatives, the Purpose and Need of the study was clearly defined to establish why improvements are needed and shape the range of alternatives that could be considered to address the identified needs. The Purpose and Need included consideration of both the base year 2013 and future year 2040 conditions along the I-64 corridor:

- Improve capacity by addressing congestion, system linkage and lane continuity, and intermodal connectivity;
- Enhance corridor safety by addressing conditions that contribute to vehicular crash incidences;
- Improve the ability of the corridor to function as a key emergency evacuation route; and,
- Address the High Rise Bridge improvements.

2.1.2 Establishment of Design Criteria

Alternatives were developed using current design guidelines and structural design parameters. All guidelines were based on the AASHTO [*A Policy on the Geometric Design of Highways and Streets, 2011*] (Green Book), the VDOT Road Design Manual (July, 2014) and VDOT Bridge Design Manual

(VDOT, 2014a). Detailed tables showing the Design Criteria that were used for the mainline and bridge options considered in this study is found in **Appendix A**. Overall, the design criteria are based on the functional classification of the roadway as an urban freeway (VDOT, 2005).

2.2 Initial Range of Alternatives

After defining the study Purpose and Need, along with establishing the design criteria, a reasonable range of alternatives were developed. These alternatives met the specific elements of the purpose and need, as well as the design criteria for the study. Given the existing four lane I-64 facility, Six Lane, Eight Lane, and Ten Lane Build Alternatives were identified for consideration. These mainline alternatives were accompanied by different bridge options and interchange configurations. The interchange configurations were developed to a higher level of detail than the mainline improvements to ensure that the proposed improvements fit within the Location Study Corridor. The interchange configurations considered as part of this planning study do not represent the ultimate solution for that specific interchange, but rather a worst case scenario to document the greatest potential impacts. An Interchange Modification Report (IMR) would be developed during subsequent project phases to determine the most reasonable solution for the interchanges and more detailed engineering analysis and design would need to be conducted if and when this project moves into the design phase.

It should be noted that each of the alternatives described below would improve stormwater management, since the existing facility was constructed prior to the passage of the Clean Water Act and does not have adequate stormwater facilities to treat and remove roadway generated pollutants. Should an alternative advance to the design phase, the proposed facilities would be designed to comply with both federal and state stormwater requirements in place at that time.

2.2.1 No Build Alternative

In accordance with the regulations implementing NEPA (40 CFR § 1502.14(d)), the No Build Alternative has been included for evaluation to serve as a benchmark for the comparison of future conditions and impacts. The No Build Alternative would retain the existing I-64 interstate, associated interchanges, and the High Rise Bridge in their present configurations, and allow for routine maintenance and safety upgrades. This alternative also assumes that the projects currently programmed and funded in VDOT's Fiscal Year (FY) 2015-2020 Six-Year Improvement Program (SYIP) and the Hampton Roads TPO Constrained Long Range Plan (CLRP) would be implemented. The roadway and transit projects listed in the SYIP and TPO CLRP within the study area are shown in **Table 1**.

Table 1: No Build Projects within Chesapeake

VDOT UPC / TPO ID	Description
92556	I-464 – Resurfacing/guardrail upgrades
98454	I-664 – Install median guardrail and shoulder rumble strips
93600	Military Highway – Upgrade existing signal
56187	Route 17 – Widen from 2 to 4 lanes and replace river crossing bridge
58428	Route 17 – Install rubber rail seal and asphalt
86607	Knells Ridge Road – Redesign intersection
86614	Proactive Safety Projects within City of Chesapeake – various locations
105621	Pavement overlay within City of Chesapeake – various locations
1904	Route 13 – Bridge Replacement
84359	Mount Pleasant Road – Widen to 4 lanes
18591	Route 337 – Widen to 4 lanes
VDOT Structure and Bridge estimates over 70 million dollars in maintenance will be needed for the High Rise bridge/approaches. These costs include traffic control, electronic/mechanical systems, fire detection/suppression, drainage/plumbing, structural, waterway/navigation, security, and general maintenance.	

Source: Hampton Roads TPO 2034 CLRP; Virginia Department of Transportation Final FY 2015-2020 SYIP and VDOT Structure and Bridge

2.2.2 Transportation System Management / Transportation Demand Management

Transportation System Management/Transportation Demand Management (TSM/TDM) strategies would involve minor improvements to the I-64 corridor. TSM typically consists of strategies that improve traffic flow, improve signalization, convert existing general purpose (GP) lanes to managed lanes, improve intersections, and implement information programs. TDM typically consist of strategies that encourage new driving habits through staggered commuting hours, telecommuting, car and vanpooling, ridesharing and the utilization of park and ride facilities. Possible TSM/TDM opportunities for the I-64 corridor could include:

- Encourage commuters to carpool/vanpool to work;
- Expand park and ride lots, using educational campaigns to promote carpooling to work, and work with major regional employers to promote staggered work hours and/or telecommuting;
- Encourage transit as an alternative mode, by enhancing existing transit options within the corridor;
- Preserve and improve pedestrian/bicyclist accommodations for roads crossing over or under I-64; and,
- Optimize traffic signal timing along signalized arterials in the study area and pursuing strategies to better coordinate traffic signals such as adaptive signal control.

2.2.3 Six Lane Build Alternative

This alternative would include construction of two additional lanes of capacity (one lane in each direction) within the study area. The six lanes under this alternative are GP Lanes and are available for use without any restrictions or tolls. Wherever possible, the additional lanes would be constructed towards the existing median of I-64. A grass median would be maintained west of the Route 17 interchange based on existing median width and spacing needs. In order to comply with VDOT's Road Design Manual (July 2014), the typical section would include 12-foot travel lanes and 12-foot inside and outside paved shoulders. Approaching the Route 17 interchange, as the grass median narrows, the eastbound and westbound directions would be separated by a concrete traffic barrier.

Along I-64 West, the three lanes generated from the I-664/I-264 interchange would continue through the length of the study area beyond the I-464 interchange to maintain lane continuity. The flyover ramp from I-464 southbound would tie in with the flyover ramp from the Oak Grove Connector. These two lanes would then merge in with the three mainline lanes and the five lanes would tie in with the existing five lane section west of Battlefield Boulevard, similar to the interchange concept shown in **Appendix B** for the Eight Lane Alternative. Along I-64 East, the existing three lane section west of the I-464 interchange would continue and tie into the existing three lane section east of the Rotunda Avenue bridge. A new flyover ramp from the Oak Grove connector to I-64 East would be included. The widening of I-64 to six lanes would also require the following:

- Route 13 – Military Highway
    - Widening of I-64 bridges over Route 13
    - Geometric improvements to ramps at Route 13 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Yadkin Road
- Route 17 – George Washington Highway
    - Reconstruction of Route 17 bridge over I-64
    - Geometric improvements to ramps at Route 17 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Shell Road
- Extension of culvert along Gilmerton Cut
- Reconstruction of High Rise Bridge to accommodate three travel lanes in each direction– See High Rise Bridge (see **Section 2.2.8**) for more information on bridge options
- I-464
    - Reconstruction of I-464 bridges over I-64
    - Geometric and capacity improvements to ramps at I-464 interchange
    - Addition of flyover ramps from I-464 to I-64 West and from the Oak Grove Connector to I-64 West and I-64 East as described above

The initial assessment of traffic operations projected for this alternative indicated that it would not meet the goal established by VDOT and FHWA to generally achieve a LOS C through the study area. Therefore mapping was not developed for this alternative.

2.2.4 Eight Lane Build Alternative

As shown in the Alternatives Mapping in **Appendix B,** this alternative would include construction of four additional lanes of capacity (two lanes in each direction) within the study area. The eight lanes under this alternative are GP Lanes and are available for use without any restrictions or tolls. Wherever possible the additional lanes would be constructed towards the existing median of I-64. A grass median would be maintained west of the Route 17 interchange based on existing median width and spacing needs. In order to comply with VDOT's Road Design Manual (July 2014), the typical section would include 12-foot travel lanes and 12-foot inside and outside paved shoulders. Typical Sections for this Alternative are shown in **Appendix C**. Approaching the Route 17 interchange, as the grass median narrows, the eastbound and westbound directions would be separated by a concrete traffic barrier. Along I-64 West, a third lane would be generated on the ramp from I-664 which ties into the one lane ramp from I-264. This four lane section would continue to the I-464 interchange where an additional one lane would be generated on the right. The one lane being generated would function as a C-D road approaching the I-464 interchange and replace the existing C-D road on the south side of the roadway. The flyover ramp from I-464 southbound would tie-in with the flyover ramp from the Oak Grove Connector. These two lanes would then merge in with the four mainline lanes and the right lane would be dropped prior to tying in with the existing five lane section west of Battlefield Boulevard. Along I-64 East, the existing four lane section west of the Battlefield Boulevard interchange would continue towards the I-664/I-264 interchange with one lane dropped along the ramp to I-664.

The widening of I-64 to eight lanes would also require the following:

- Reconstruction of I-264 ramp bridge over I-64 East to I-664 ramp
- Widening of I-64 bridges over Rotunda Avenue
- Route 13 – Military Highway
    - Widening of I-64 bridges over Route 13
    - Geometric improvements to ramps at Route 13 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Yadkin Road
- Route 17 – George Washington Highway
    - Reconstruction of Route 17 bridge over I-64
    - Geometric and capacity improvements to ramps at Route 17 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Shell Road
- Extension of culvert along Gilmerton Cut
- Reconstruction of High Rise Bridge to accommodate four travel lanes in each direction– See High Rise Bridge (see **Section 4.5**) for more information on bridge options
- Reconstruction of the Route 190 bridge over I-64
- I-464
    - Reconstruction of I-464 bridges over I-64
    - Geometric and capacity improvements to ramps at I-464 interchange
    - Addition of flyover ramps from I-464 to I-64 West and from the Oak Grove Connector to I-64 West and I-64 East as described above

The initial assessment of traffic operations projected for this alternative indicated that it would meet the goal established by VDOT and FHWA to generally achieve a LOS C through the study area. Therefore mapping was developed for this alternative.

All of these improvements would require additional right-of-way for construction. Additional right-of-way areas required for these improvements are shown in **Appendix E**.

2.2.5 Eight Lane Build – Managed Alternative

The Eight Lane Build – Managed Alternative would be similar to the Eight Lane Build Alternative, providing four continuous mainline lanes in each direction of I-64. However, some or all of the travel lanes would be managed using tolls and/or vehicle occupancy. Additionally, expanded local/express bus service or bus rapid transit could be accommodated with this alternative in the GP or the managed lanes.

Numerous managed lane scenarios are possible depending on the type of strategy selected including, but not limited to, high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, or time of day/day of week restrictions. The following three operational scenarios were evaluated to identify a sample range of potential conditions for this Build Alternative:

- <u>High Occupancy Vehicle:</u> Within the region, I-64 currently contains an HOV operation from the I-564 interchange to Battlefield Boulevard, approximately one mile from the eastern limit of the study area. Within the study area, one lane in each direction could be converted to an HOV lane. HOV lanes would only be open to vehicles with multiple occupants, motorcycles and qualified hybrid vehicles during HOV hours. The specific operation and characteristics of the HOV facility would be defined as part of later studies, including occupancy restrictions (HOV 2+ or 3+), time of day/day of week restrictions, location of access points to and from the HOV facilities, type of separation between the HOV lanes and GP lanes, and permitting buses within the HOV lanes. Additional analysis would also be performed as part of later studies to assess the impacts of connecting the existing HOV facility along I-64 that begins in the vicinity of Battlefield Boulevard with a potential future HOV facility. The same bridge and interchange improvements proposed under the Eight Lane Build Alternative would occur under this managed lane scenario.

  Based on data collected by VDOT at existing HOV facilities within the region, it is assumed that 15 percent of the total peak hour traffic would utilize the HOV facility in the 2040 design year. As such, the remaining 85 percent of traffic would be spread across the three remaining GP lanes. The study area includes space for the potential for the HOV lane to be two feet wider to accommodate an HOV operation as recommended on the VDOT Bridge Design Manual (VDOT, 2014a).

- <u>All Lanes Tolled:</u> Under this option, all users of I-64 would be required to pay a toll. The tolls could be varied to maintain a desired Level of Service (LOS) on I-64, with higher tolls during periods of higher demand and lower tolls during periods of lower demand. Additional analysis would be performed as part of later studies to determine the appropriate toll rates. All toll collection would be done by overhead gantries with all-electronic tolling used to collect all tolls at highway speeds and not through traditional toll booth operations (this report does not prescribe where toll gantries would be placed and/or where tolling might occur). Since I-64 would be fully tolled, access and egress would be accommodated via the proposed interchange modifications identified as part of this study under the Eight Lane Build Alternative. The proposed gantries would fall within the footprint of the study area, as additional widening would not be needed to accommodate toll booths. A toll diversion analysis was performed as part of this study and is included in the ***Traffic and Transportation Technical Report*** (VDOT, 2014c). The purpose of this analysis was to quantify the daily diversion of traffic to alternative routes due to an all lanes tolled scenario within the study area. The results of the analysis indicate that an estimated 22 to 34 percent of traffic would divert from I-64 after the implementation of tolling depending on the toll rate. The largest shift in traffic from I-64 after the implementation of tolling is estimated to utilize the nearby untolled Route 13 / Gilmerton Bridge, due to its nearby location and its numerous direct connections to the I-64 corridor including Route 17 and I-464.

If a tolling scenario is advanced, VDOT would cooperate with FHWA to implement one of the tolling programs available under the Federal Tolling Programs (FHWA, 2014b). Because tolling could be a possible option in the future, it was considered in the range of alternatives evaluated.

- Two HOT Lanes + Two GP Lanes (2 HOT / HOV-2 "free" + 2 GP): This scenario would include two GP lanes and two HOT lanes in each direction. The HOT lanes would be restricted to HOV 2+ vehicles that would travel for free and single occupancy vehicles (SOV) that would pay a toll to use the lane. Further studies would be required to determine the extent of the HOT lanes and locations of access and egress into the facility. These studies could not only result in additional ramps being required but could also affect the proposed interchange concept identified as part of this study under the Eight Lane Build Alternative.

  A toll diversion analysis, similar to the previous scenario, was performed as part of this study and is included in the ***Traffic and Transportation Technical Report*** (VDOT, 2014c). The results of the analysis indicate that there would be minimal traffic diversion from I-64 for the Managed Lanes scenario due to the shifting of some traffic to the Managed Lanes and the remaining available capacity on the I-64 facility itself.

  If a tolling scenario is advanced, VDOT would cooperate with FHWA to implement one of the tolling programs available under the Federal Tolling Programs (FHWA, 2014b). Because tolling could be a possible option in the future, it was considered in the range of alternatives evaluated.

  Similar to the Eight Lane Build Alternative, the typical section would include 12-foot travel lanes and 12-foot paved shoulders. As shown in **Appendix D**, the typical section for the HOT Lanes Scenario would also include a four foot buffer separation between the GP lanes and any managed lanes. This four foot buffer in each direction would make the typical section of the Eight Lane Build – Managed Alternative (HOT Lane scenario), eight feet wider than the Eight Lane Build Alternative. The eight feet is not discernible at the scale of the mapping provided and therefore is the same as the mapping show in **Appendix B** for the Eight Lane Build Alternative.

This study does not identify what type of managed lane would be constructed. Moreover, if this alternative is identified as the Preferred Alternative, subsequent studies would be required to refine the specifics of the managed lanes throughout the study area. These subsequent studies could result in the identification of additional costs and impacts not quantified as part of this study, including those associated with providing access between the GP and managed lanes at interchanges and/or between interchanges.

2.2.6 Ten Lane Build Alternative

This alternative would include construction of six additional lanes of capacity (three lanes in each direction) within the study area. The ten lanes under this alternative are GP Lanes and are available for use without any restrictions or tolls. Wherever possible the additional lanes would be constructed towards the existing median of I-64. A grass median would be maintained west of the Route 17 interchange based on existing median width and spacing needs. In order to comply with VDOT's Road Design Manual (July 2014), the typical section would include 12-foot travel lanes and 12-foot inside and outside paved shoulders. Approaching the Route 17 interchange as the grass median narrows, the eastbound and westbound directions would be separated by a concrete traffic barrier. Along I-64 West, a third lane is constructed along I-664 and the fourth lane would be constructed on the ramp from I-664 which ties into the one lane ramp from I-264. This five lane section would continue towards the I-464 interchange and split before reaching the interchange with four lanes on the mainline and one lane becoming a C-D road. Since there is not enough distance to drop two mainline lanes east of the I-464 interchange where the flyovers tie-in, only four lanes would be carried on the mainline to avoid the reconstruction of the Battlefield Boulevard interchange. If the fifth lane is carried through the I-464 interchange, the Battlefield Boulevard interchange would have had to be unnecessarily reconstructed. The flyover ramp from I-464 southbound would tie in with the flyover ramp from the Oak Grove Connector. These two lanes would then merge in with the four mainline lanes and the right lane would be dropped prior to tying in with the existing five lane section west of Battlefield Boulevard. This interchange configuration is similar to the interchange concept shown in **Appendix B** for the Eight Lane Alternative. Along I-64 East, the existing four lane section west of the Battlefield Boulevard interchange would continue and an additional lane would be generated at the ramp from I-464 southbound. The five lane section would continue towards the I-664/I-264 interchange with two lanes dropped along the ramp to I-664. The widening of I-64 to ten lanes would also require the following:

- Reconstruction of I-264 ramp bridge over I-64 East to I-664 ramp
- Widening of I-64 bridges over Rotunda Avenue
- Route 13 – Military Highway
    - Widening of I-64 bridges over Route 13
    - Geometric improvements to ramps at Route 13 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Yadkin Road
- Route 17 – George Washington Highway
    - Reconstruction of Route 17 bridge over I-64
    - Geometric and capacity improvements to ramps at Route 17 interchange
    - Capacity improvements at intersections with ramp terminals
- Widening of I-64 bridges over Shell Road
- Extension of culvert along Gilmerton Cut
- Reconstruction of High Rise Bridge to accommodate four travel lanes in each direction– See High Rise Bridge (see **Section 2.2.8**) for more information on bridge options
- Reconstruction of the Route 190 bridge over I-64
- I-464
    - Reconstruction of I-464 bridges over I-64
    - Geometric and capacity improvements to ramps at I-464 interchange
    - Addition of flyover ramps from I-464 to I-64 West and from the Oak Grove Connector to I-64 West and I-64 East as described above

As indicated in **Section 4.3**, the ten lane alternatives were not advanced for consideration in the EA. Therefore, mapping of this alternative is not included in this report.

2.2.7 Ten Lane Build – Managed Alternative

The Ten Lane Build – Managed Alternative would be similar to the Ten Lane Build Alternative, providing five continuous mainline lanes in each direction of I-64. However, some or all of the travel lanes would be managed using tolls and/or vehicle occupancy. Additionally, expanded local/express bus service or bus rapid transit could be accommodated with this alternative in the GP or the managed lanes.

Similar to the Eight Lane Build – Managed Alternative, numerous managed lane scenarios are possible depending on the type of strategy selected including, but not limited to, HOV lanes, HOT lanes, or time of day/day of week restrictions. The following three operational scenarios were evaluated to identify a sample range of potential conditions for this Build Alternative:

- High Occupancy Vehicle: Within the study area, one lane in each direction could be converted to an HOV lane. HOV lanes would only be open to vehicles with multiple occupants, motorcycles and qualified hybrid vehicles during HOV hours. The specific operation and characteristics of the HOV facility would be defined as part of later studies. Additional analysis would also be performed as part of later studies to assess the impacts of connecting the existing HOV facility along I-64 that begins in the vicinity of Battlefield Boulevard with a potential future HOV facility.

- All Lanes Tolled: Similar to the Eight Lane Build – Managed Alternative (All Lanes Tolled scenario), all users of I-64 would be required to pay a toll.

  If a tolling scenario is advanced, VDOT would cooperate with FHWA to implement one of the tolling programs available under the Federal Tolling Programs (FHWA, 2014b). Because tolling could be a possible option in the future, it was considered in the range of alternatives evaluated.

- Three HOT Lanes + Two GP Lanes (3 HOT / HOV-2 "free" + 2 GP): This scenario would include two GP lanes and three HOT lanes in each direction. The HOT lanes would be restricted to HOV 2+ vehicles that would travel for free and single occupancy vehicles (SOV) that would pay a toll to use the lane. Further studies would be required to determine the extent of the HOT lanes and locations of access and egress into the facility.

  If a tolling scenario is advanced, VDOT would cooperate with FHWA to implement one of the tolling programs available under the Federal Tolling Programs (FHWA, 2014b). Because tolling could be a possible option in the future, it was considered in the range of alternatives evaluated. Similar to the Ten Lane Build Alternative, the typical section would include 12 foot travel lanes and 12 foot paved shoulders. The typical section would also include a four-foot buffer separation between the GP lanes and any managed lanes. This four foot buffer in each direction would make the typical section of the Ten Lane Build – Managed Alternative, eight feet wider than the Ten Lane Build Alternative.

This study does not identify what type of managed lane would be constructed. Moreover, if this alternative is identified as the Preferred Alternative, subsequent studies would be required to refine the specifics of the managed lanes throughout the study area. These subsequent studies could result in additional costs and impacts not quantified as part of this study including costs and impacts associated with providing access between the GP and managed lanes at interchanges and/or between interchanges.

2.2.8 Bridge Alternatives

Several bridge options were evaluated for both the type of bridge and the location of the proposed bridges with respect to the existing crossing. In addition to the type and location of the proposed structure, all bridge options also consider widening the horizontal clearance from 125 feet to 135 feet. Widening to 135 feet is based on a 1995 USACE vessel simulation study that was conducted to examine proposed improvements to the Southern Branch of the Elizabeth River. The study suggested increasing the horizontal clearance of the High Rise Bridge to a width of 135 feet (Webb, 1995).

Two separate structures are proposed for all of the bridge options considered, one to carry eastbound traffic and one to carry westbound traffic in order to increase the ability to perform bridge safety inspections by reducing the overall width of the bridge and for phasing or construction purposes. A 15 to 25 foot separation is being proposed between the two bridges. The 15 foot separation provides adequate space for constructability and maintenance purposes of the fixed span bridge type options. A wider separation of 25 feet is required for the bascule span bridge type in order to accommodate the operator's house. The bridge build options are discussed in greater detail below.

Bridge Location

Several locations for the new proposed structures were evaluated during this study. Once the general location of the proposed structures is determined the exact location of the bridge would be identified during subsequent phases after more detailed engineering and geotechnical studies are conducted. Even though this document includes several potential bridge locations and discussed in general the phasing of construction, the timing of the construction of the two bridges has not been determined and is beyond the scope of this study.

Northern Shift Option

This option would include the construction of two new bridges north of the existing bridge. The purpose of this option was to have the ability to build the two new structures simultaneously while maintaining traffic on the existing bridge. This option would require a realignment of I-64 to the north, of approximately 200 feet, along the approaches to the new bridges and would not utilize much of the existing roadway footprint along these approaches. Preliminary analysis indicated that the required realignment would result in excessive environmental and property impacts. These impacts would be greater than those of other bridge locations investigated that utilize the existing roadway alignment.

Southern Shift Option

This option is similar to the northern shift option, but would result in two new structures being built south of the existing bridge.

Split Option

This option would include the construction of a new bridge north of the existing bridge and a second bridge south of the existing bridge. The purpose of this option was to have the ability to build the two new structures simultaneously while maintaining traffic on the existing bridge. The proposed roadway approaches would be shifted north and south respectively, by approximately 100 feet in each direction, to tie in with the proposed location of the new bridges. Preliminary analysis indicated that the required realignment of I-64 along the approaches to the new bridges would result in excessive environmental and property impacts. These impacts would be greater than those of other bridge locations investigated that utilize the existing roadway alignment.

Partial Northern Shift Option

This option would include the construction of a new bridge north of the existing bridge. The proposed roadway approach would be shifted north, by approximately 100 feet, to tie in with the proposed location of the new bridge. All traffic would be diverted to the new bridge upon its completion and the High Rise Bridge would be demolished. The second bridge would be built on the same alignment as the recently demolished High Rise Bridge, therefore minimizing environmental and property impacts. Upon completion of the second bridge, traffic would be diverted back to the new bridge.

Preliminary analysis indicated that the partial northern shift option would result in excessive environmental and property impacts. These impacts would be greater than the southern shift option.

Partial Southern Shift Option

This option would include the construction of a new bridge south of the existing bridge. The proposed roadway approach would be shifted south, by approximately 100 feet, to tie in with the proposed location of the new bridge. All traffic would be diverted to the new bridge upon its completion and the High Rise Bridge would be demolished. The second bridge would be built on the same alignment as the recently demolished High Rise Bridge, therefore minimizing environmental and property impacts. Upon completion of the second bridge, westbound traffic would be diverted back to the new bridge.

Structure Type

In addition to the location of the proposed bridges, two bridge types (bascule and fixed span) were evaluated as part of the alternative analysis. In addition, two vertical clearance options over the existing maritime crossing were evaluated for the fixed span bridge type. Any other structural details of the proposed structure are beyond the scope of this study.

Bascule Span Bridge – 65-Foot Vertical Clearance

The Bascule Span Bridge Option would consist of the construction of two new bascule span bridges over the Southern Branch of the Elizabeth River. It is assumed that these bridges would be similar in style and height to the existing bridge. At the highest point over the channel, the new bridges would provide 65 feet of vertical clearance over the mean high water elevation. It is assumed that the proposed bascule span bridges would continue to open upon request and would require traffic on I-64 to stop. As noted in the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b), bridge openings can result in interstate traffic being halted for an average of 17 minutes to allow for the passage of a single vessel.

The typical section (**see Appendix C and D**) would vary to match the mainline alternative selected (Six, Eight, or Ten Lane Build Alternative or Eight or Ten Lane Build – Managed Alternative), but would include 14 foot wide shoulders on the inside and outside to meet current VDOT design criteria which requires two foot wider shoulders where truck traffic exceeds 250 vehicles per hour (VDOT, 2014a). For additional information on design Criteria see **Appendix A**.

A new operator house would be constructed between the two parallel structures to control the new bridges. The two bridges would be 25 feet apart to accommodate the operator's house and provide sufficient space for construction of the bascule span bridges.

Fixed-Span Bridge – 95 Foot-Vertical Clearance

The ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b) identified a fixed bridge with a 95 foot vertical clearance at mean high water as adequate to meet the reasonable needs of navigation along the Southern Branch of the Elizabeth River. This finding was a result of the information presented in the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b).

The typical section (**see Appendix C and D**) would vary to match the mainline alternative selected (Six, Eight, or Ten Lane Build Alternative or Eight or Ten Lane Build – Managed Alternative), but would include 14 foot wide shoulders on the inside and outside to meet current VDOT design criteria, which requires two foot wider shoulders where truck traffic exceeds 250 vehicles per hour, VDOT Bridge Design Manual (VDOT, 2014a). Because a fixed span bridge does not require an operator house between the two structures, the two bridges would only be 15 feet apart to allow adequate spacing for construction and maintenance. For additional information on Design Criteria see **Appendix A.**

Fixed Span Bridge – 135-Foot Vertical Clearance

In addition to the 95 foot vertical clearance, the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b) stated that a fixed bridge with a 135 foot vertical clearance would be considered. Similar to the 95 foot vertical clearance, this option also considers widening the horizontal clearance from 125 feet to 135 feet.

The typical section (**see Appendix C and D**) would vary to match the mainline alternative selected (Six, Eight, or Ten Lane Build Alternative or Eight or Ten Lane Build – Managed Alternative), but would include 14 foot wide shoulders on the inside and outside to meet current VDOT design criteria which requires two foot wider shoulders where truck traffic exceeds 250 vehicles per hour (VDOT, 2014a). Because a fixed span bridge does not require an operator house between the two structures, the two bridges would only be 15 feet apart to allow adequate spacing for construction and maintenance. For additional information on Design Criteria see **Appendix A.**

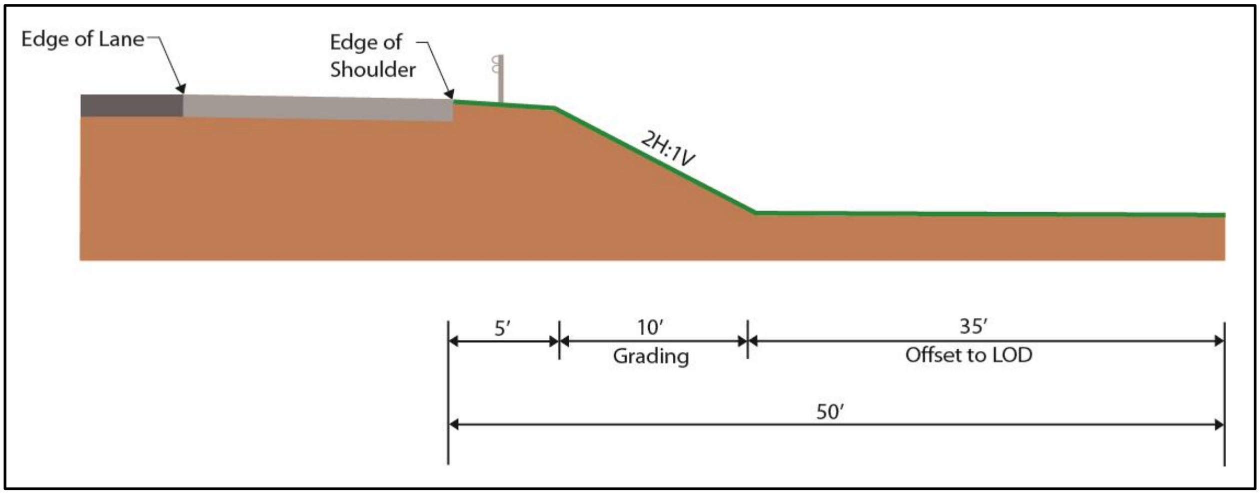
2.3 Engineering Details of Alternatives

The initial range of alternatives includes elements that create the end-to-end alternatives including the roadside design. These elements are explained below:

2.3.1 Roadside Design

As shown in **Figure 2**, in order to minimize impacts to the surrounding environment, the roadside design for the mainline would include guardrails that would allow for a two–to-one slope to tie to existing ground and a 35-foot offset to the LOD to accommodate stormwater management and temporary construction easements. Due to the flat terrain of the study area, and to determine an approximate width of roadside grading, it was conservatively assumed that I-64 mainline sits five feet above the surrounding grade. The roadside grading, along with the other roadside design criteria, would result in a total distance of approximately 50 feet from the outside edge of shoulder to the LOD for the mainline segments of I-64.

Figure 2: Establishment of LOD



In order to account for additional grading necessary at a grade separated crossing or interchange, it was assumed that I-64 was approximately 25 feet above the surrounding ground. In these cases a 45 foot offset to the LOD was used to accommodate stormwater management and temporary construction easements. The roadside grading, along with the other roadside design criteria would result in total distance of approximately 100 feet from the outside edge of the proposed shoulder to the LOD for the grade separated segments of I-64.

The overall offset from the edge of the pavement to the LOD for both the mainline and grade separated segments of I-64 was meant to be a realistic offset that could for the most part capture all of the potential or estimated impacts of the proposed alternative. During final design, however, it may be determined that some segments may require additional space and some segments may require less.

2.3.2 Limit of Disturbance

The proposed LOD was developed for the initial range of alternatives using the proposed pavement width and the preliminary roadside design as described in **Section 2.3.1** above. All of the potential or estimated impacts for this study were calculated using the proposed distance from the edge of the proposed shoulder to the LOD and fall within the study area.

The LOD was assumed to be the proposed right-of-way line where it was located outside of the existing right-of-way line. The LOD for the retained alternatives is shown on the plan sheets in **Appendix B** and is referred to as the Area of Impact within the mapping. The environmental impact analysis completed for this study assumes the entire area within the LOD would be impacted.

2.3.3 Interchanges

Preliminary concepts were investigated for the four interchanges within the study area to accommodate the build alternatives. The interchange concepts could include adjustments to ramp gore areas to tie-in to the wider mainline, addition of lanes to accommodate future traffic volumes, realignment of ramps to meet current VDOT and AASHTO design standards, and the removal of ramps to eliminate mainline weaving areas.

The plan sheets in **Appendix B** present a potential edge of pavement and LOD for the preliminary interchange concepts considered as part of this analysis. These concepts were used to develop approximate interchange LOD's that would allow enough flexibility during the design stage to accommodate future traffic needs. However, it is important to note that during the IMR process, each of the interchange configurations will serve as a starting point for further study and a more in-depth examination of the needs at each location. The interchange assumptions were intended for environmental impact analysis and should not be considered specific proposals for design.

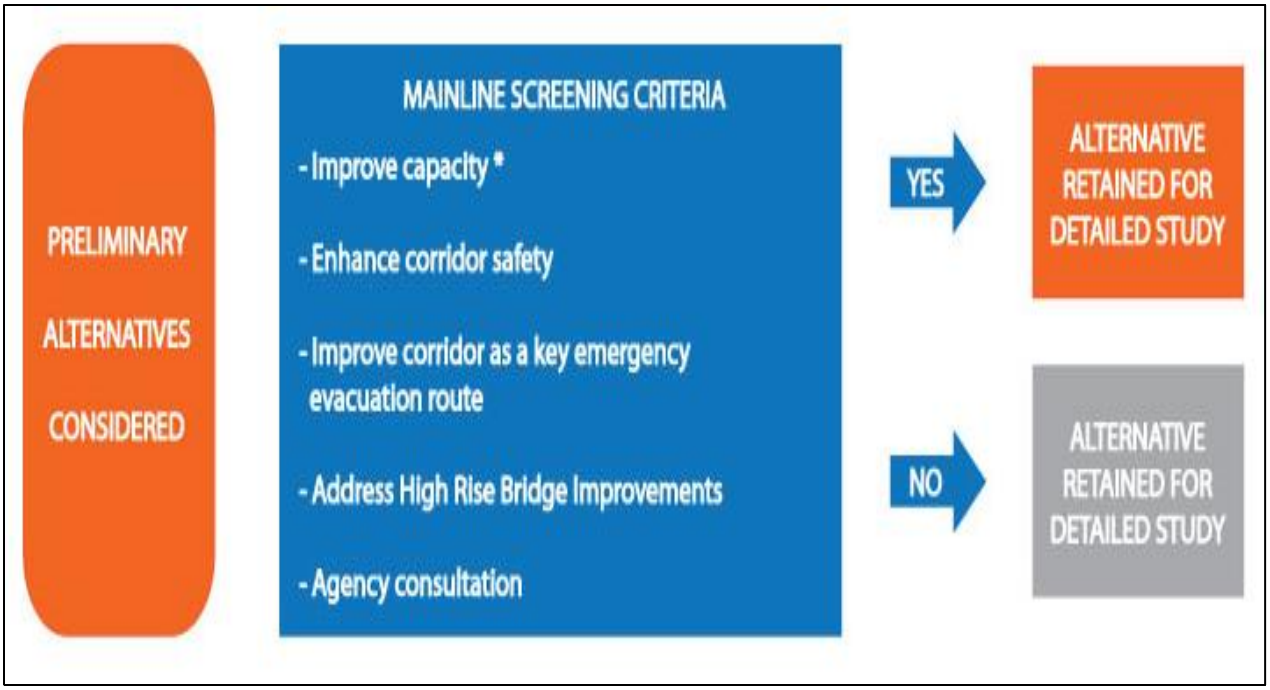
3.0 ALTERNATIVES SCREENING APPROACH AND CRITERIA

The I-64/High Rise Bridge Corridor Study focuses on four primary need items: improving capacity, enhancing corridor safety, improving the corridor to function as a key emergency evacuation route, and addressing the High Rise Bridge improvements. Screening criteria were derived from each of these need elements. In addition to the screening criteria derived from the Purpose and Need of the study, agency consultation during the development of the alternatives presented a unique opportunity to screen alternatives based on input from FHWA's federal partners. The screening criteria are described in the following sections.

Except for the No Build Alternative, if an alternative was deemed not feasible or reasonably capable of meeting the needs, then consideration of the alternative ceased and the alternative was not retained for detailed study, the remaining alternatives were retained for further analysis.

As shown in **Figure 3**, the current and future needs identified in the Purpose and Need were used to guide the alternative development process in determining the initial range of alternatives and as a first line of screening criteria by which to evaluate the different alternatives. The project Purpose and Need is described in detail in **Section 1 (Purpose and Need)** of the EA.

Figure 3: Alternative Design and Screening Process



*VDOT and FHWA established a goal to generally achieve a LOS C through the study area

3.1 Improve Capacity

The screening criteria to measure capacity include LOS and Lane Continuity.

3.1.1 Level of Service

LOS is a measure of the quality of the traffic flow, and is one measure of the ratio between roadway capacity and traffic volume. LOS ranges in grade from A to F. LOS A indicates free-flow conditions where the effects of incidents or breakdowns are easily absorbed; traffic operates well below capacity and at or close to free flow speeds without delay in time. LOS F indicates stop and go conditions with queues forming behind bottlenecks. Traffic operates at or above capacity and is substantially below free flow speeds, which subsequently causes a substantial delay in travel time. Adding capacity to I-64 would result in an improved LOS which in turn would reduce congestion, and improve intermodal connectivity.

LOS was identified using Highway Capacity Software (HCS) and is established using generally accepted analysis methods to determine roadway capacity. VDOT and FHWA established a goal to generally achieve a LOS C through the study area. Based on this goal, FHWA provided concurrence that the eight lane facility generally achieved this goal and that eight lane facilities were considered in the EA.

3.1.2 Lane Continuity

The flow (or operation) of vehicles along a freeway is influenced by many design features, including lane continuity, lane balance and roadway design. These features affect whether motorists have time to make smooth transitions into adjacent lanes and ramps without impeding the progress of other vehicles on the roadway. As described in the **Section 1.3**, I-64 within the study area is comprised of two lanes in each direction; however, just east and west of the study area there are three or more lanes in each direction. By adding lanes along I-64, lane continuity would be more consistent within the study area and prevent bottleneck conditions that increase congestion. If an alternative did not improve lane continuity, it was not retained for detailed study.

3.2 Enhancing Corridor Safety

The screening criteria to measure corridor safety include LOS, shoulders and lane continuity.

3.2.1 Level of Service

Rear end crashes represent the majority of crashes in the study area and are significantly higher than the regional averages along some sections, ***Traffic and Transportation Technical Report*** (VDOT, 2014c). High levels of congestion lead to stop and go conditions, which increases the potential for these types of crashes. By improving the LOS along the corridor, these types of crashes should diminish as free flow speeds increase. VDOT and FHWA established a goal to generally achieve a LOS C through the study area. Based on this LOS goal, FHWA provided concurrence that the eight lane facility generally achieved this goal and that eight lane facilities were therefore considered in the EA.

3.2.2 Shoulders

Each alternative was evaluated for its ability to provide shoulder widths that meet current design criteria. Along I-64, the median or left paved shoulder is three feet wide and does not meet interstate design standards provided by AASHTO in [*A Policy of Geometric Design of Highway and Street*] (Green Book) and VDOT Road Design Manual (July, 2014). In addition, along the High Rise Bridge, shoulders are generally three feet wide and do not meet these standards either. The lack of adequate shoulder widths along mainline I-64 and on the High Rise Bridge result in roadway congestion and management problems during incidents or minor construction/inspection because one or more travel lanes must be closed to through traffic. Providing adequate shoulder widths that meet design guidelines would allow emergency vehicles to use shoulders to access incidents, allow vehicles involved in an incident to pull out of the travel lane, and allow additional roadway width for maintenance of traffic during construction, maintenance and inspection activities.

3.2.3 Lane Continuity

As discussed above, the flow (or operation) of vehicles along a freeway is influenced by many design features, including lane continuity, lane balance, and roadway design. The lack of lane continuity conditions contributes to crashes within the study area. By adding lanes along I-64, lane continuity would be more consistent within the study area and prevent bottleneck conditions that increase the potential for crashes. If an alternative did not improve lane continuity, it was not retained for detailed study.

3.3 Improve the Ability of the Corridor to Function as a Key Emergency Evacuation Route

The screening criteria to measure enhancing the function of I-64 within the study area as a key emergency evacuation route include increase capacity, lane continuity and shoulders.

3.3.1 Increase Capacity

In an emergency evacuation situation, the increase in capacity from the existing four lane section would improve travel times and reliability along the mainline through the study area. If an alternative did not increase capacity it was not retained for detailed study.

3.3.2 Lane Continuity

As mentioned above, the flow (or operation) of vehicles along a freeway is influenced by many design features, including lane continuity, lane balance and roadway design. The lack of lane continuity contributes to congestion and bottlenecks within the study area. By adding lanes along I-64, lane continuity would be more consistent within the study area and prevent bottleneck conditions that would delay any emergency evacuation. If an alternative did not improve lane continuity, it was not retained for detailed study.

3.3.3 Shoulders

Along I-64, the median or left paved shoulder is three feet wide and does not meet interstate design standards provided by AASHTO in [*A Policy of Geometric Design of Highway and Street*] (Green Book) and VDOT Road Design Manual (July, 2014). In addition, along the High Rise Bridge, shoulders are generally three feet wide and do not meet these standards either. The lack of a wide median shoulder would require the closure of the inside lane for traffic incidents. The lack of adequate shoulder widths result in roadway congestion and management problems which could occur during emergency evacuation situations. Providing adequate shoulder widths that meet design standards would allow emergency vehicles to use shoulders to access incidents and allow vehicles involved on an incident to pull out of the travel lane. Each alternative was evaluated for its ability to provide shoulder widths that meet current design standards to enhance the ability of the corridor as an emergency evacuation route.

3.4 Address the High Rise Bridge Improvements

The screening criteria to measure addressing the High Rise Bridge improvements include LOS and FHWA guidelines on moveable span bridges.

3.4.1 Level of Service

Within the study area the section of I-64 with the highest traffic volumes occurs between Route 17 and I-464, including the High Rise Bridge.

3.4.2 FHWA Guidelines on Moveable Span Bridges

According to 23 CFR 650 Subpart H, "A fixed bridge shall be selected wherever practicable. If there are social, economic, environmental or engineering reasons which favor the selection of a moveable bridge, a cost benefit analysis to support the need for the moveable bridge shall be prepared as part of the preliminary plans." To address this criterion, information was gathered through the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b) to determine if conditions existed that would require a movable bridge. In the absence of these conditions, a bascule span option would not be retained for detailed study.

3.4.3 Agency Consultation

In Virginia, a formal process is in place whereby complex projects sponsored by FHWA and VDOT are presented at a series of Partnering Meetings with federal resource and regulatory agencies. Through this process, partner agencies are afforded an opportunity to provide early and continued input on scoping, purpose and need, and alternative concept development. This study was presented to the partner agencies at four meetings in May 2013, November 2013, February 2014, and May 2014; see **Section 4.0 (Comments and Coordination)** of the EA. Based on consultation during these meetings, USACE and other partnering agencies provided valuable insight and guidance on alternatives that would meet regulatory requirements. Several options were not retained for detailed study based on the input obtained during the Partnering Meetings as noted in **Section 2.1**.

4.0 ALTERNATIVES NOT RETAINED FOR DETAILED STUDY

At the conclusion of the screening process two alternatives and several bridge options were not retained for detailed study. The justification for the elimination of the alternatives and options is summarized below.

4.1 TSM/TDM Alternative

The TSM/TDM Alternative does not include capacity improvements and, therefore, does not meet the Purpose and Need of the study. It was not retained as an individual stand- alone alternative because it does not address the capacity, safety, or evacuation needs of the corridor. The retained Build Alternatives do not preclude TSM/TDM elements should they be considered in the future.

4.2 Six Lane Build Alternative

The Six Lane Build Alternative would not provide adequate congestion relief for current or future traffic within the safety corridor. The traffic analysis conducted for this study projected a LOS D and LOS E throughout the study area. This LOS does not meet the goal established by VDOT and FHWA to generally achieve a LOS C through the study area and was therefore not retained for detailed study.

4.3 Ten Lane Build Alternative

This alternative would include construction of six additional lanes of capacity (three additional lanes in each direction) within the study area. The ten lanes under this alternative are GP Lanes and are available for use without any restrictions or tolls. The Ten Lane Build Alternative was not retained for detailed study because the additional capacity provided by the Ten Lane Build Alternative would result in unnecessary increases in costs, environmental and right-of-way impacts not realized by the Eight Lane Build Alternative and Eight Lane Build – Managed Alternative.

4.4 Ten Lane Build – Managed Alternative

Similar to the Ten Lane Build Alternative, this Alternative was not retained for detailed study because it would result in unnecessary project elements at a greater cost and greater potential impacts than the other build alternatives.

4.5 High Rise Bridge

4.5.1 Bridge Location

Northern Shift Option
This option would include the construction of two new bridges north of the existing bridge. The purpose of this option was to have the ability to build the two new structures simultaneously while maintaining traffic on the existing bridge. This option would require a realignment of I-64 to the north, of approximately 200 feet, along the approaches to the new bridges and would not utilize much of the existing roadway footprint along these approaches. Preliminary analysis indicated that the required realignment would result in excessive environmental and property impacts. These impacts would be greater than those of other bridge locations investigated that utilize the existing roadway alignment. During the May 2014 Federal Partnering meeting, the United States Army Corps of Engineers (USACE) concurred that the potential impacts appeared to be excessive. Therefore this option was not retained for detailed study; see **Chapter 4.0 (Coordination and Comments)** of the EA.

Southern Shift Option
This option is similar to the northern shift option, but would result in two new structures being built south of the existing bridge. Given the similar environmental impacts and property impacts, this option was not retained for detailed study; see **Chapter 4.0 (Coordination and Comments)** of the EA.

Split Option
This option would include the construction of a new bridge north of the existing bridge and a second bridge south of the existing bridge. The purpose of this option was to have the ability to build the two new structures simultaneously while maintaining traffic on the existing bridge. The proposed roadway approaches would be shifted north and south respectively, by approximately 100 feet in each direction, to tie in with the proposed location of the new bridges. Preliminary analysis indicated that the required realignment of I-64 along the approaches to the new bridges would result in excessive environmental and property impacts. These impacts would be greater than those of other bridge locations investigated that utilize the existing roadway alignment. At the Study Team meeting held in April 2014, several study team members expressed their concern with this option given the additional environmental and property impacts. Furthermore, at the May 2014 Federal Partnering meeting, USACE concurred that the potential

impacts appeared to be excessive. Therefore this option was not retained for detailed study; see **Chapter 4.0 (Coordination and Comments)** of the EA.

Partial Northern Shift Option

This option would include the construction of a new bridge north of the existing bridge. The proposed roadway approach would be shifted north, by approximately 100 feet, to tie in with the proposed location of the new bridge. All traffic would be diverted to the new bridge upon its completion and the High Rise Bridge would be demolished. The second bridge would be built on the same alignment as the recently demolished High Rise Bridge, therefore minimizing environmental and property impacts. Upon completion of the second bridge, traffic would be diverted back to the new bridge.

Preliminary analysis indicated that the partial northern shift option would result in excessive environmental and property impacts. These impacts would be greater than the southern shift option. At the May 2014 Federal Partnering meeting, USACE stated that the impacts to a natural system, such as Hodges Creek, that could occur under this option would not be viewed favorably during the permitting process when compared to impacts that could occur to a manmade wetland mitigation bank under the Partial Southern Shift Option. Therefore this option was not retained for detailed study; see **Chapter 4.0 (Coordination and Comments)** of the EA.

4.5.2 Bridge Type

Bascule Span Bridge – 65-Foot Vertical Clearance

According to 23CFR 650.809, "A fixed bridge shall be selected wherever practicable. If there are social, economic, environmental or engineering reasons which favor the selection of a movable bridge, a cost benefit analysis to support the need for the movable bridge shall he prepared as a part of the preliminary plans". During the development of the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014b), neither VDOT nor USCG identified any reason that would require a movable bridge. Therefore, based on 23CFR 650.809, this option was not retained for detailed study.

5.0 ALTERNATIVES RETAINED FOR DETAILED STUDY

At the conclusion of the screening process two alternatives and four bridge options have been retained for detailed study. In addition, as a result of coordination with the City of Chesapeake, the mainline alternatives retained for detailed study were shifted slightly north along the Route 17 interchange to avoid permanent impacts to Deep Creek Middle School[7]. The justification for retaining these mainline alternatives and bridge options is summarized below.

5.1 No Build

The No Build Alternative would not address the Purpose and Need of the study because routine maintenance and other programmed projects would not improve capacity, safety or the corridor as an evacuation route. In accordance with the implementing regulations for NEPA (40 CFR § 1502.14(d)), the No Build Alternative has been retained for detailed study to serve as a benchmark for the comparison of future conditions and impacts.

[7] Shift was necessary due to requirements of Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 U.S.C. § 303(c)) and the FHWA implementing Section 4(f) regulations (23 CFR 774). See **Section 3.0 (Environmental Consequences)** of EA for additional information on Section 4(f).

5.2 Eight Lane Build Alternative

Ability to Meet Needs: The Eight Lane Build Alternative was retained for detailed study because it would meet the capacity needs of the study by providing two additional lanes in each direction. The additional lanes would generally meet the LOS criteria goal established by VDOT and FHWA. Based on this LOS goal, FHWA provided concurrence that the eight lane facility generally achieved this goal and that eight lane facilities were therefore considered in the EA. Lane continuity would also be improved by matching the number of lanes to the east of the study area. This would eliminate bottleneck conditions and improve overall safety along the corridor.

In addition, the Eight Lane Build Alternative would address geometric deficiencies by improving the I-64 roadway and High Rise Bridge to meet current design standards. In accordance with AASHTO [*A Policy on the Geometric Design of Highways and Streets, 2011*] (Green Book and VDOT Bridge Design Manual (VDOT, 2014a), shoulders would be 12 to 14 feet wide to allow space for breakdowns and incident management. In addition, lane continuity would be improved on the east side of the study area. Furthermore, all of these factors would improve the I-64 corridor as a key emergency evacuation route. Finally, this alternative eliminates inessential project elements proposed by the Ten Lane Build Alternative and avoids the excessive impacts associated with the Ten Lane Build Alternative.

5.3 Eight Lane Build – Managed Alternative

Ability to Meet Needs: The Eight Lane Build – Managed Alternative was retained for detailed study for similar reasons as the Eight Lane Build Alternative. The addition of travel lanes to provide a continuous eight lane facility through the study area allows it to meet the capacity needs of the study. Likewise, existing geometric deficiencies would be improved with the inclusion of wider shoulders. Finally I-64 will be enhanced as a key emergency evacuation route. However, as noted in **Section 2.2.5** additional analysis may be necessary should this alternative be selected as the Preferred Alternative.

5.4 High Rise Bridge

5.4.1 Bridge Location

Partial Southern Shift Option

This option would include the construction of a new bridge south of the existing bridge. The proposed roadway approach would be shifted south, by approximately 100 feet, to tie in with the proposed location of the new bridge. All traffic would be diverted to the new bridge upon its completion and the High Rise Bridge would be demolished. The second bridge would be built on the same alignment as the recently demolished High Rise Bridge, therefore minimizing environmental and property impacts. Upon completion of the second bridge, westbound traffic would be diverted back to the new bridge.

During a review of the different bridge options at the May 2014 Federal Partnering meeting, the use of the existing alignment was looked at favorably compared to the Partial Northern Shift Option. Therefore this option was retained for detailed study and is the only location being considered for further analysis. Even though this document investigated several potential bridge locations and discussed in general the phasing of construction, the timing between the construction of the new bridge and the demolition/construction of the existing bridge is beyond the scope of this study.

The Partial Southern Shift Option was retained for detailed study because it would meet the capacity needs of the study by providing two additional lanes in each direction. Under this Alternative, LOS would generally be LOS C. The additional lanes would generally meet the LOS goals established by VDOT and FHWA. Lane continuity also would be improved by matching the number of lanes to the east of the study area. This would eliminate bottleneck conditions and improve overall safety along the corridor.

In addition, this Option would address geometric deficiencies by improving the bridges to meet current design standards in accordance with *A Policy on the Geometric Design of Highways and Streets* (AASHTO, 2011) and VDOT Bridge Design Manual (VDOT, 2014e).

5.4.2 Bridge Type

Fixed-Span Bridge – 95 Foot-Vertical Clearance

The ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014j) identified a fixed bridge with a 95 foot vertical clearance at mean high water as adequate to meet the reasonable needs of navigation along the Southern Branch of the Elizabeth River. This option also considers widening the horizontal clearance from 125 feet to 135 feet. Widening to 135 feet is based on a 1995 USACE vessel simulation study that was conducted to examine proposed improvements to the Southern Branch of the Elizabeth River. The study suggested increasing the horizontal clearance of the High Rise Bridge to a width of 135 feet (Webb, 1995).

As part of the alternatives analysis this bridge was evaluated from an engineering standpoint to assess impacts and costs and to determine whether this bridge was a practicable solution. Furthermore, based on FHWA Guideline 23 CFR 650 Subpart H, a 95 foot fixed bridge span is a practicable solution for this crossing.

Fixed Span Bridge – 135-Foot Vertical Clearance

In addition to the 95 foot vertical clearance, the ***Navigational Evaluation Technical Memorandum*** (VDOT, 2014j) stated that a fixed bridge with a 135 foot vertical clearance would be considered in this EA. Similar to the 95 foot vertical clearance, this option also considers widening the horizontal clearance from 125 feet to 135 feet.

As part of the alternatives analysis this bridge was evaluated from an engineering standpoint to assess impacts and costs and to determine whether this bridge was a practicable solution. Furthermore, based on FHWA Guideline 23 CFR 650 Subpart H, a 135 foot fixed bridge span is a practicable solution for this crossing.

6.0 PRELIMINARY COST ESTIMATES

Construction costs were estimated using the VDOT 2009 Planning Level Cost Spreadsheet and are located in **Appendix H**. The following is a list of key assumptions used in developing these costs:

- Costs were developed using cost per mile unit costs for urban areas;
- I-64 mainline was assumed to be fully reconstructed;
- Build year used was 2018;
- Inflation rate was 3 percent per year;

- Right-of-way and utility costs were developed using a Residential / Suburban Low Density factor;
- The reconstruction of Route 13 and Route 17 interchanges were assumed to be improvements to a grade separated interchange. Respective bridge reconstruction costs were included as part of the lump sum;
- The I-64 / I-464 interchange was assumed to be a new grade separated interchange in an urban area;
- It was assumed that all mainline and overhead bridges would be replaced. Bridges were calculated separately if they are not part of an interchange;
- Wetland mitigation costs for tidal ($850,000) and non-tidal wetlands ($982,000) were estimated for each retained alternative based on the specific impacts of the alternative and are derived from the Virginia Aquatic Resources Trust Fund price guide for advanced wetland credits;
- Managed lanes costs were increased 4 to 6 percent between the different alternatives to account for the additional pavement and bridge costs associated with the wider typical section;
- No costs for toll gantries or ITS needs have been included as part of the managed lanes alternatives. Furthermore the managed lanes alternatives do not include any construction costs associated with any modifications to the proposed interchanges to provide access and egress from the managed lanes. These modifications could vary significantly by interchange and could not only require additional ramps but could also affect the proposed interchange concept identified as part of this study. Careful consideration should be given to the I-464 interchange which already contains many constraints that could make the inclusion of additional ramps very challenging and costly. These cost impacts could range in the tens to hundreds of millions of dollars; and
- Other items not included in the Planning Level Cost Estimate include stormwater management, rail coordination, retaining walls and noise walls.

The High Rise Bridge is the single highest cost element of the retained alternatives. The cost of the High Rise Bridge varies by alternative and by the vertical opening over the channel and is summarized in **Table 2** below:

Table 2: High Rise Bridge Costs

Alternative	Fixed Span – 95 Foot Vertical Clearance (cost per millions)	Fixed Span – 135 Foot Vertical Clearance (cost per millions)
Eight Lane Build Alternative	$405	$635
Eight Lane Build – Managed Alternative	$425	$670

The total estimated cost ranges for each alternative retained for detailed study with are listed in **Table 3** below. The costs represent high cost scenarios to be more conservative:

Table 3: Total Construction Costs

Alternative	Fixed Span – 95 Foot Vertical Clearance (cost per billions)	Fixed Span – 135 Foot Vertical Clearance (cost per billions)
Eight Lane Build Alternative	$1.86	$2.22
Eight Lane Build – Managed Alternative	$1.92	$2.30

7.0 REFERENCES

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APPENDIX A: DESIGN CRITERIA

Design Criteria
Urban Interstate

ROADWAY DESIGN	DESIGN SPEED	70 MPH
	LANE WIDTHS	12'-0" Travel Lanes
	SHOULDER WIDTHS[2]	Outside Shoulder
		Total (Paved and Graded):14’ in Cut, 17’ in Fill; Paved: 12'
		Inside Shoulder
		Total (Paved and Graded):14’ in Cut, 17’ in Fill; Paved: 12'
	MEDIAN WIDTHS	Minimum
		30'-0"
	TRAVEL WAY CROSS SLOPES (NORMAL CROWN OR SUPERELEVATED)	Minimum
		2.0%
		Maximum
		8.0%
	SHOULDER CROSS SLOPE	VDOT Road Design Manual Standard GS-11
	VERTICAL GRADES (Minimum)	0.50%
	VERTICAL GRADES (Maximum)[3]	3.0%
	VERTICAL CLEARANCE[4]	Minimum
		16'-6"
	HORIZONTAL CURVATURE[5]	Minimum Radius = 1821'
	VERTICAL CURVATURE[6]	Crest:
		K_{min} = 247
		Sag:
		K_{min}=181
	SIGHT DISTANCES	Horizontal Sight Distance[7]
		Minimum = 730'
	EMERGENCY VEHICLE CROSS OVER	Match Existing
	CLEAR ZONE WIDTHS[8]	Minimum = 30'
	SIDE SLOPES[9] (Desired)	1V:6H or Flatter
	SIDE SLOPES[9] (Minimum)	1V:2H with Barrier[10]
	INTERCHANGE & RAMPS	VDOT Road Design Manual Standard GS-5 / GS-R

1. Urban Interstate classification is based on FHWA definition of “urban area” in 23 U.S.C. Section 101 and most recent Bureau of Census data and VDOT functional classification: http://www.virginiadot.org/projects/resources/fxn_class/Hampton_Roads/City_of_Chesapeake.pdf
2. Both shoulders shall be 12'-0" paved where truck traffic exceeds 250 DDHV, VDOT Road Design Manual Standard GS-5.
3. Based on Level Terrain. AASHTO Table 8-1, pg. 8-4.
4. VDOT Manuals of the Structure and Bridge Division, Geometrics Road Classifications Freeways (Rural or Urban), File No. 06.02-1.
5. VDOT Road Design Manual Standard GS-5
6. 2011 AASHTO Green Book, Table 3-34, pg. 3-155 and 3-36, pg. 3-161
7. See 2011 AASHTO Green Book, Figure 3-1, pg. 3-4. For Stopping Sight Distance for High Rise Bridge, see Table 3-2, pg. 3-5.
8. Dependent on design speed, horizontal curvature, traffic volume, and roadside terrain. AASHTO Roadside Design Guide, Chapter 3.
9. Dependent on cut or fill, normal crown or superelevation, on tangent or on curve, traffic type, soil type, etc. See AASHTO Roadside Design Guide, Chapter 3.
10. Consult AASHTO Roadside Design Guide, Chapter 3, for use of side slopes less than 1V:4H.

INTERSTATE 64 / HIGH RISE BRIDGE CORRIDOR STUDY

Design Criteria
Urban Interstate

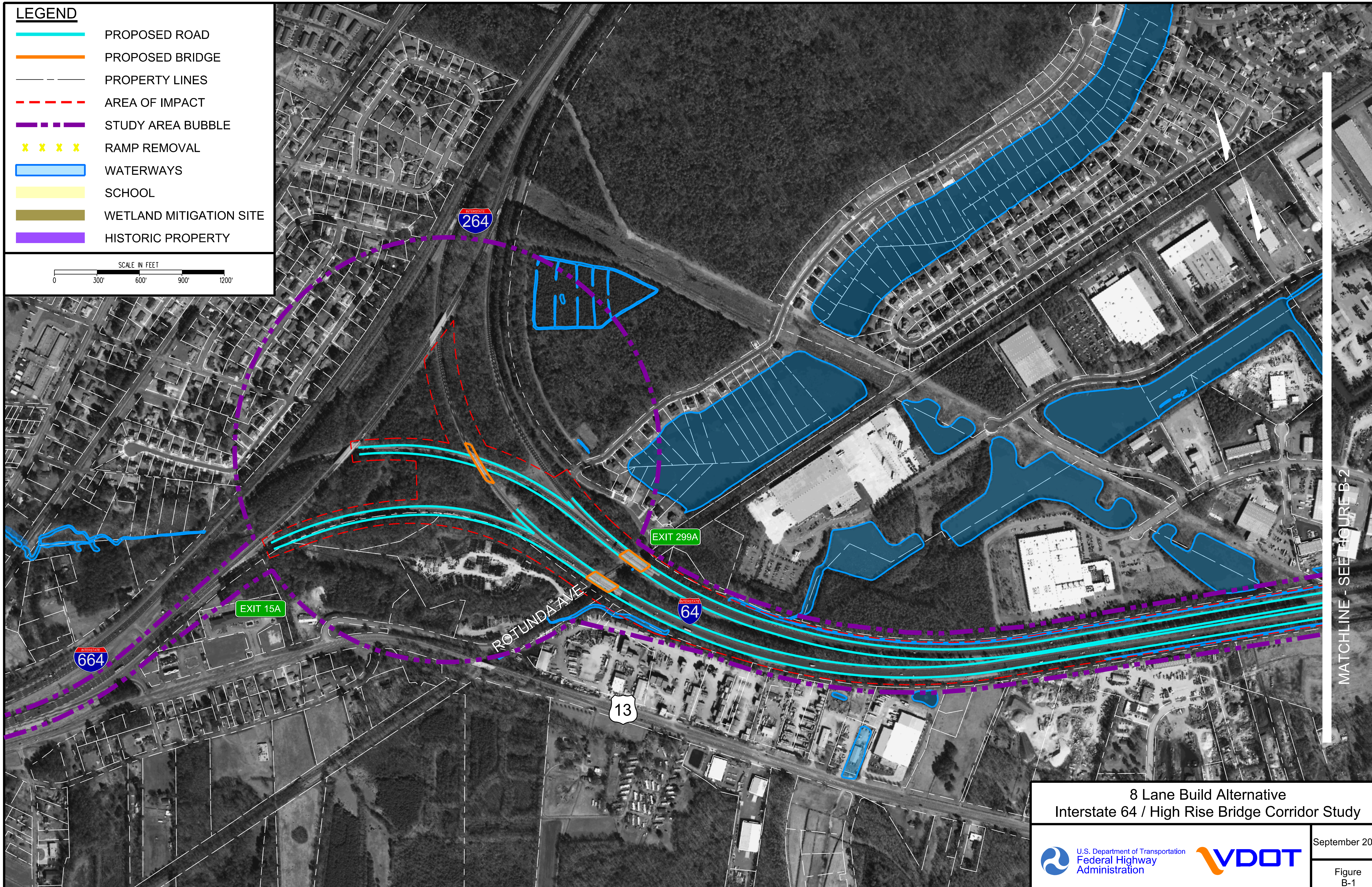
BRIDGE DESIGN	DESIGN SPEED	70 MPH	
	LANE WIDTHS	12'-0" Travel Lanes	
	SHOULDER WIDTHS[2]	Outside Shoulder	
		14’	
		Inside Shoulder	
		14’	
	TRAVEL WAY CROSS SLOPES (NORMAL CROWN OR SUPERELEVATED)	Minimum	
		2.0%	
		Maximum	
		8.0%	
	SHOULDER CROSS SLOPE	VDOT Road Design Manual Standard GS-11	
	VERTICAL GRADES (Minimum)	0.50%	
	VERTICAL GRADES (Maximum)[3]	3.0%	
	BRIDGE / HEIGHT CONSIDERATIONS	Bascule	Fixed Span
		65 Feet	95 Feet 135 Feet
	VERTICAL CLEARANCE[4]	Minimum	
		16'-6"	
	HORIZONTAL CURVATURE[5]	Minimum Radius = 1821'	
	VERTICAL CURVATURE[6]	Crest:	
		K_{min} = 247	
		Sag:	
		K_{min}=181	
	SIGHT DISTANCES	Horizontal Sight Distance[7]	
		Minimum = 771’	

1. Urban Interstate classification is based on FHWA definition of “urban area” in 23 U.S.C. Section 101 and most recent Bureau of Census data and VDOT functional classification: http://www.virginiadot.org/projects/resources/fxn_class/Hampton_Roads/City_of_Chesapeake.pdf
2. Both left and right shoulders shall be 14'-0" wide where truck traffic exceeds 250 DDHV.
3. Based on Level Terrain. AASHTO Table 8-1, pg. 8-4.
4. VDOT Manuals of the Structure and Bridge Division, Geometrics Road Classifications Freeways (Rural or Urban), File No. 06.02-1.
5. VDOT Road Design Manual Standard GS-5
6. 2011 AASHTO Green Book, Table 3-34, pg. 3-155 and 3-36, pg. 3-161
7. See 2011 AASHTO Green Book Table 3-2, pg. 3-5.

APPENDIX B: EIGHT LANE BUILD ALTERNATIVE MAPPING

Appendix B

The interchange configurations considered as part of this planning study and shown in the alternatives mapping do not represent the ultimate solution for that specific interchange, but rather a worst case scenario to document the greatest potential impact. An Interchange Modification Report (IMR) would be developed during subsequent phases to determine the most reasonable solution for the interchanges.



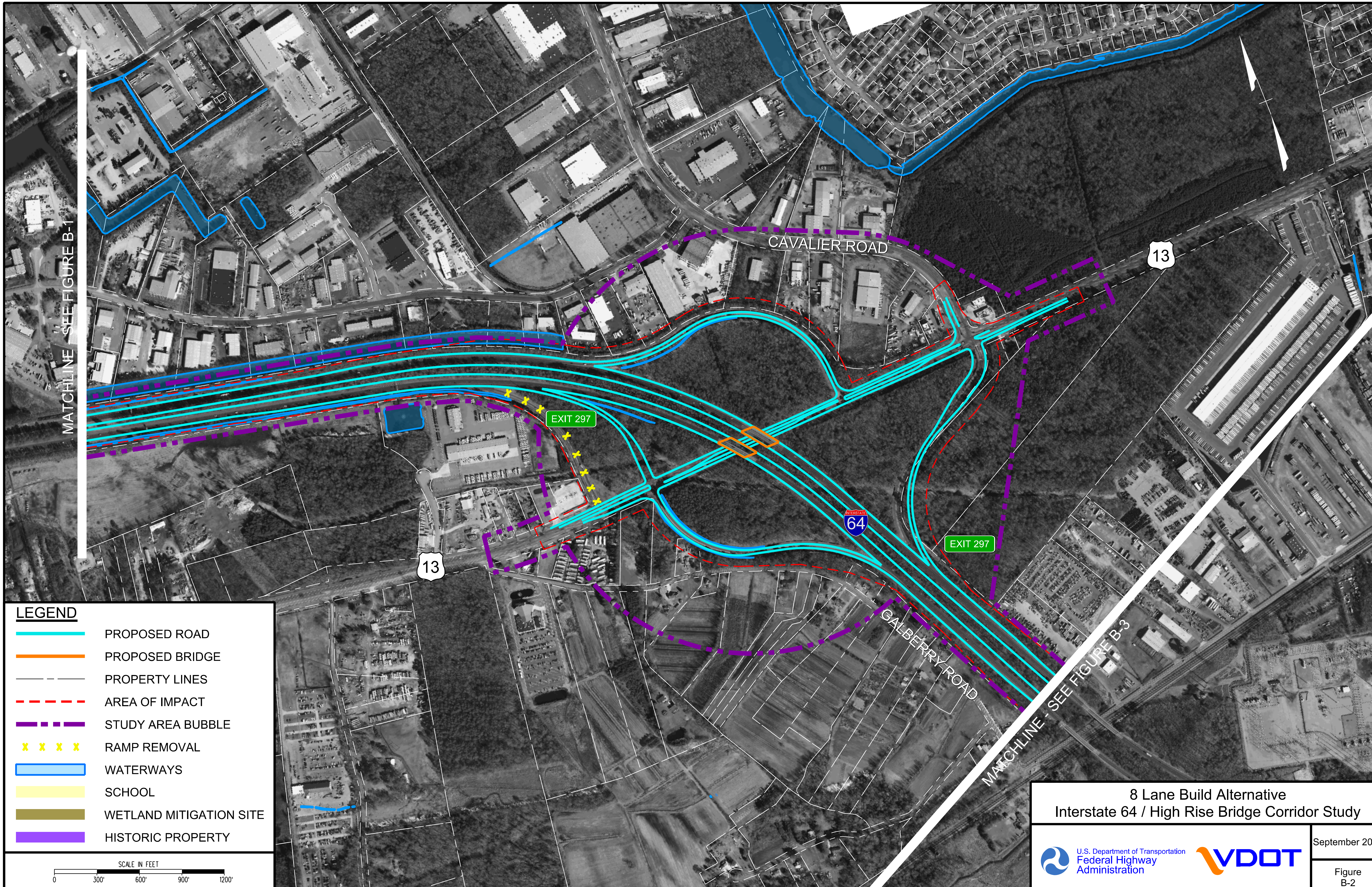
8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

U.S. Department of Transportation
Federal Highway Administration

VDOT

September 2014

Figure B-1



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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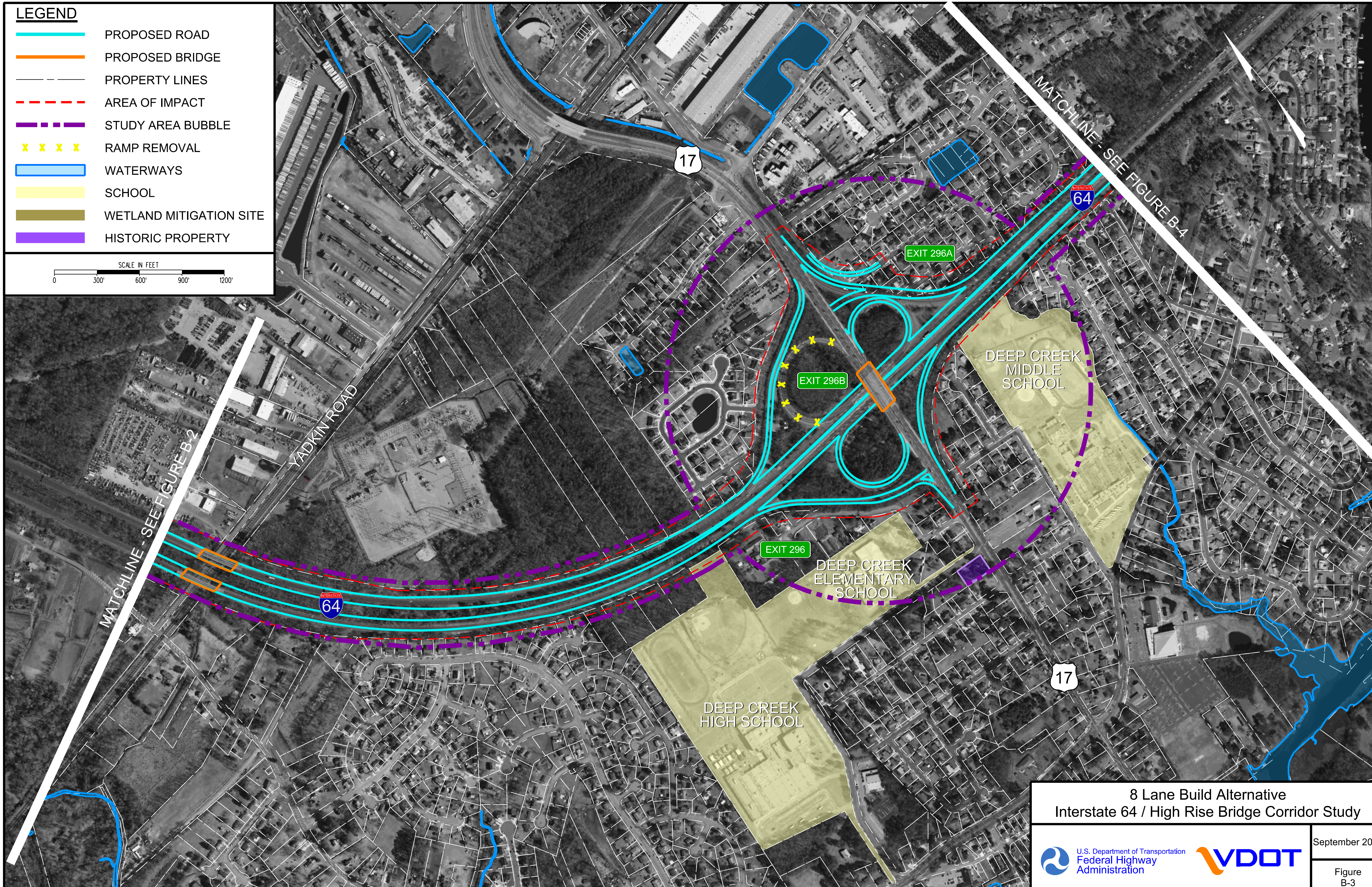
Figure B-2



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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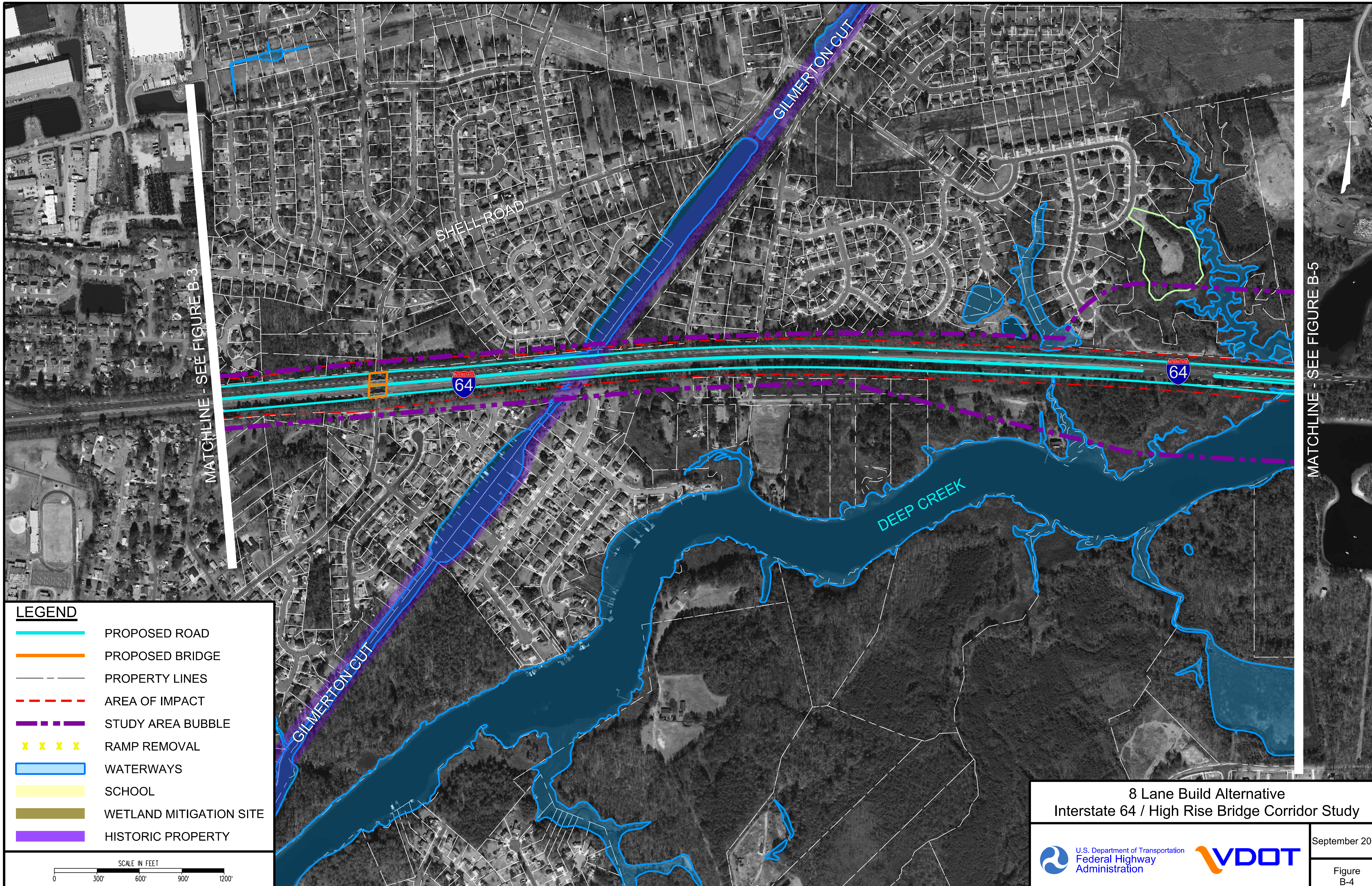
Figure B-3



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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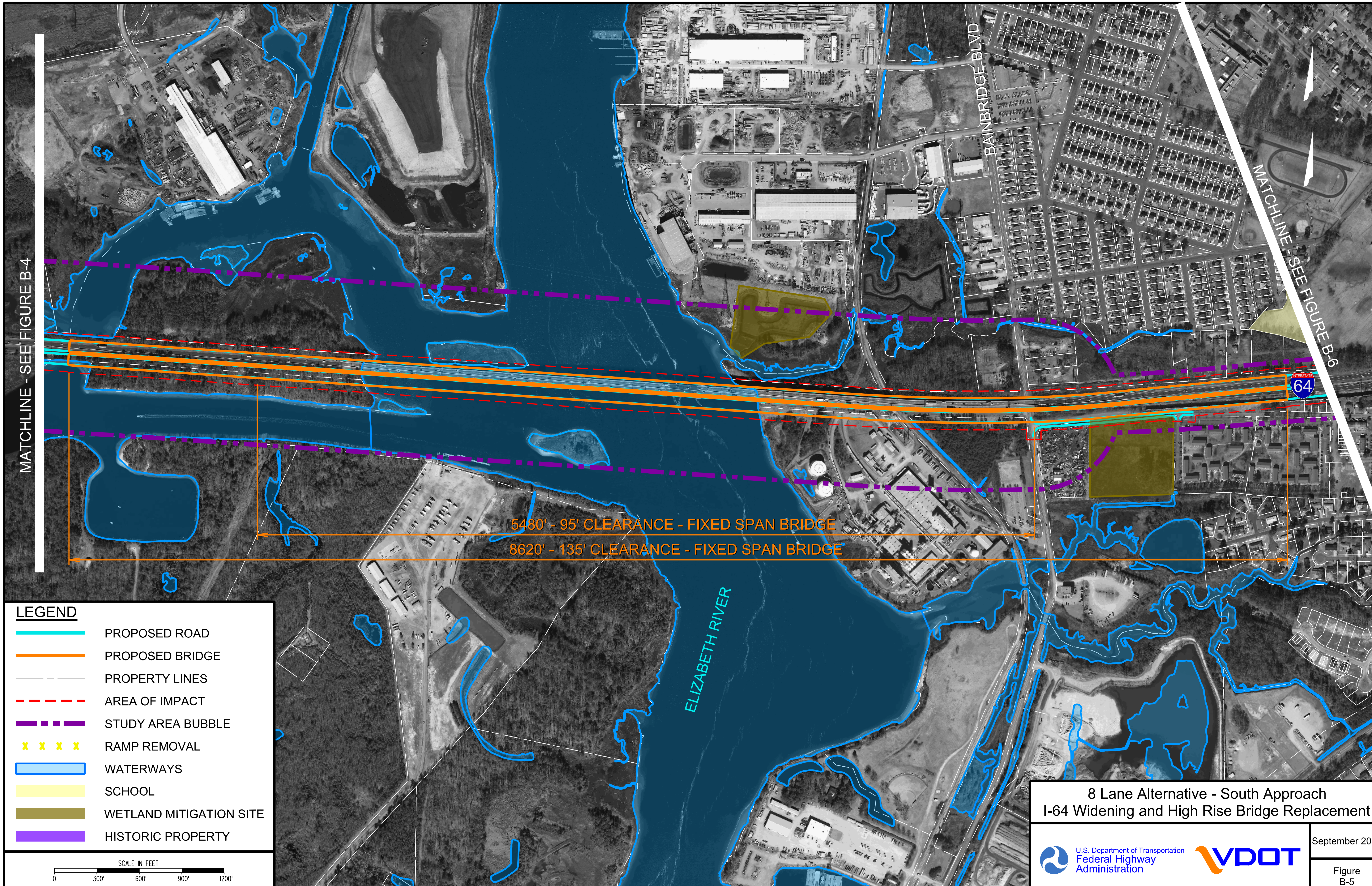
Figure B-4



8 Lane Alternative - South Approach
I-64 Widening and High Rise Bridge Replacement

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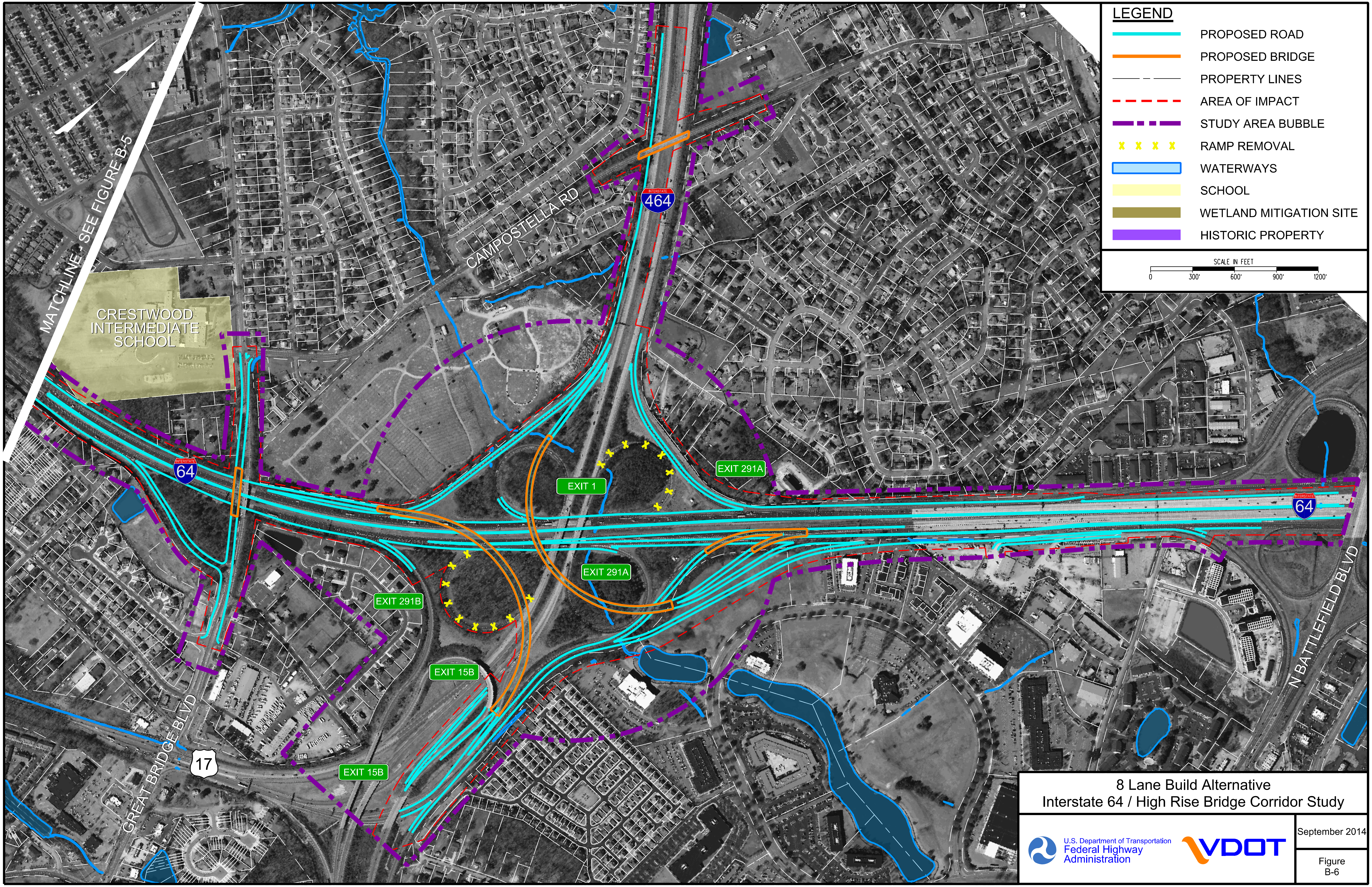
Figure B-5



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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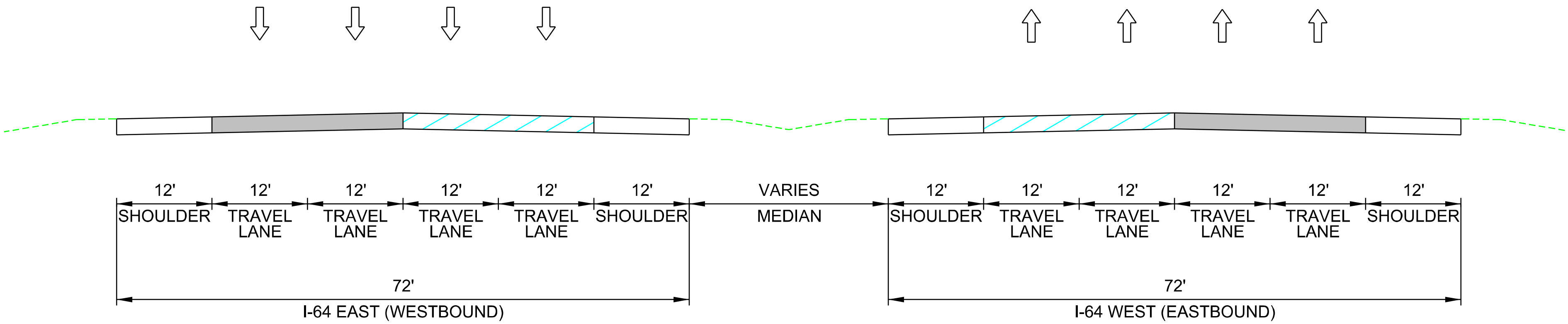
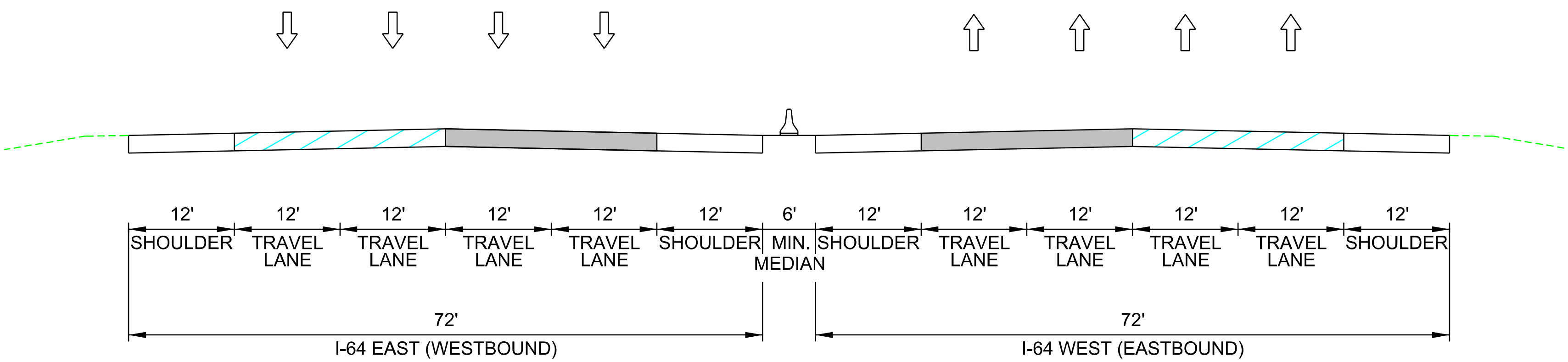
Figure B-6

APPENDIX C: EIGHT LANE BUILD ALTERNATIVE TYPICAL SECTIONS



I-64 WEST OF US 17



I-64 EAST OF US 17

LEGEND

EXISTING LANES

PROPOSED LANES

SCALE: NTS

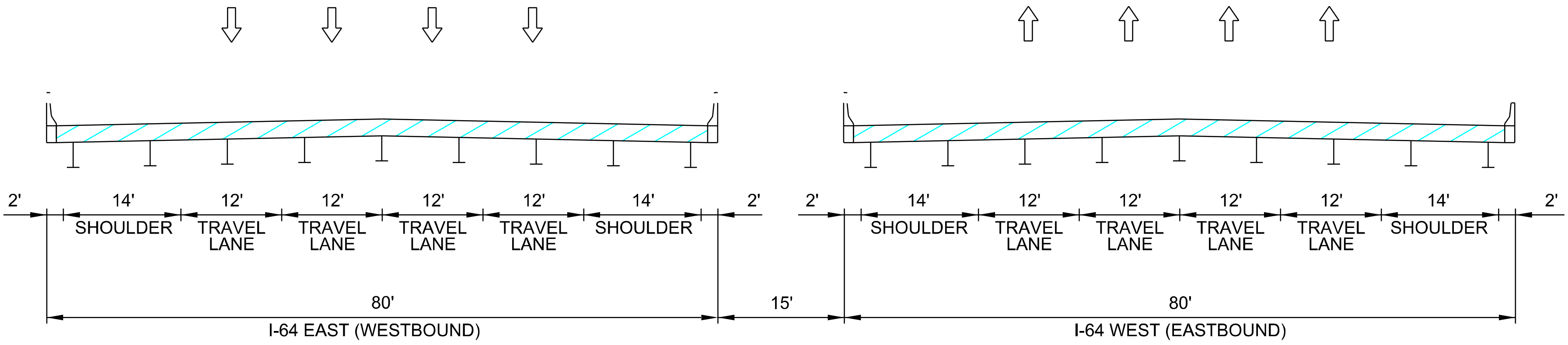
8 Lane Build Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

U.S. Department of Transportation
Federal Highway Administration

VDOT

September 2014

Figure C-1



8 LANE PARALLEL BRIDGE ALTERNATIVE

LEGEND

EXISTING LANES

PROPOSED LANES

SCALE: NTS

8 Lane Build Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

U.S. Department of Transportation
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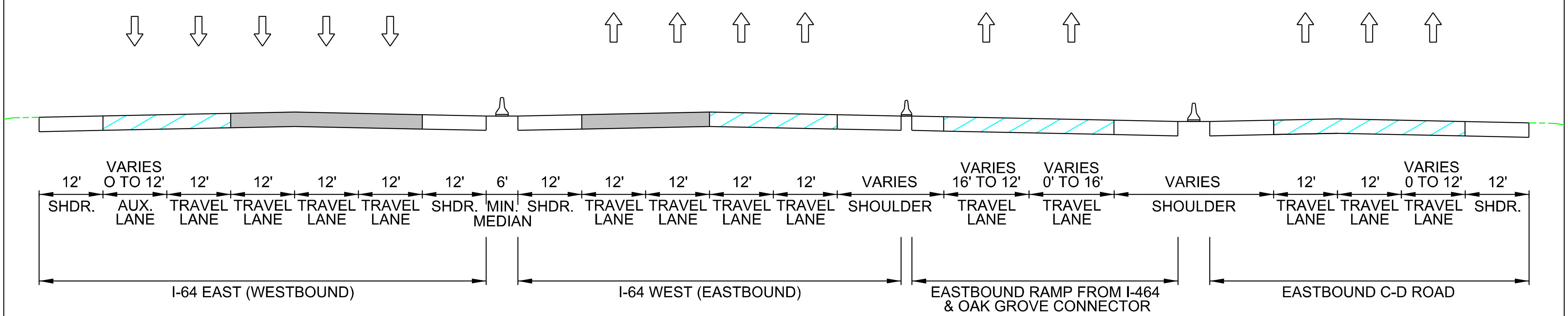
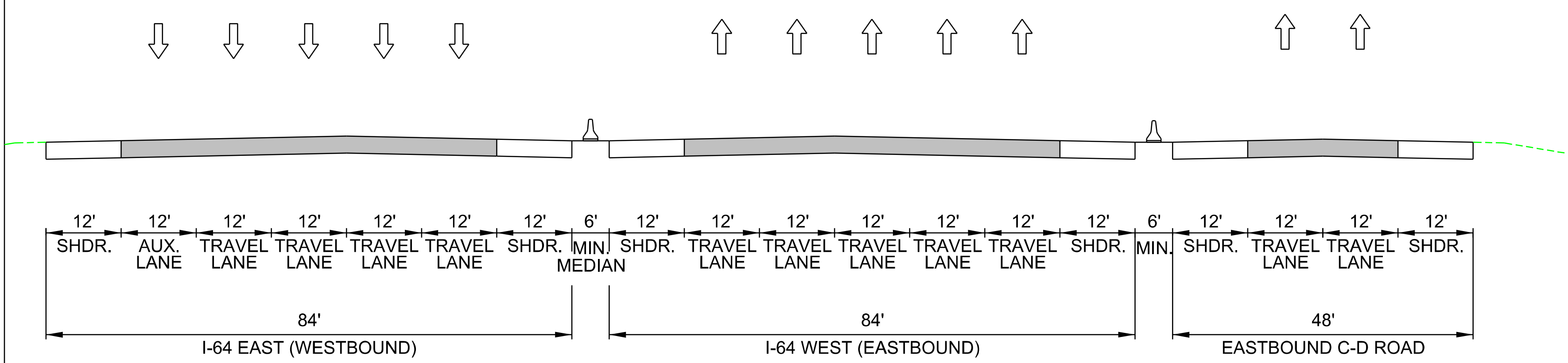
Figure C-2



I-64 BETWEEN I-464 INTERCHANGE AND BATTLEFIELD BLVD



I-64 AT BATTLEFIELD BLVD

LEGEND

EXISTING LANES

PROPOSED LANES

SCALE: NTS

8 Lane Build Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

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Federal Highway Administration

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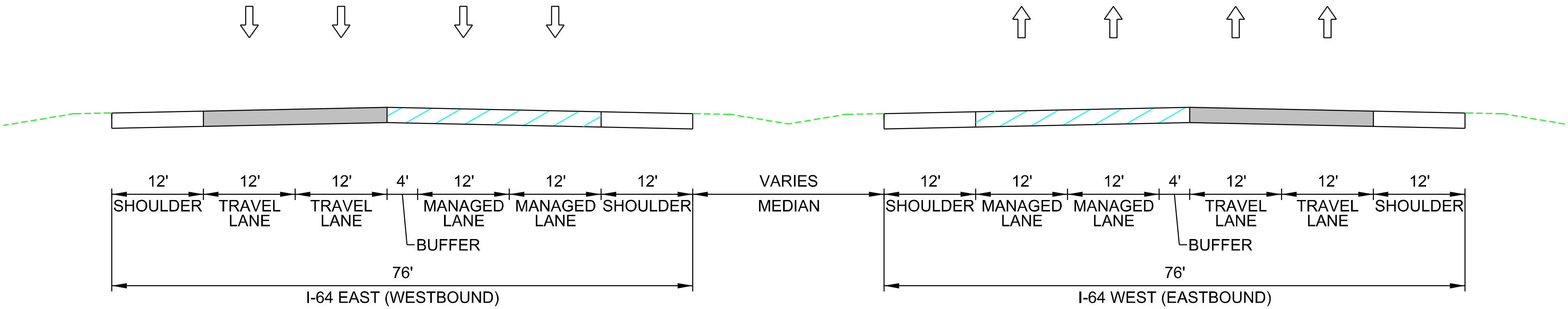
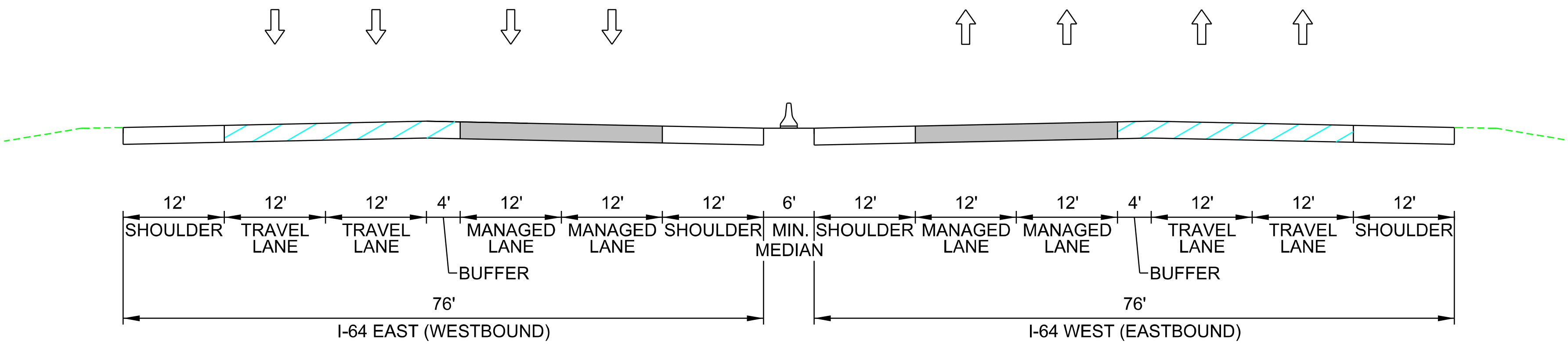
Figure C-3

APPENDIX D: EIGHT LANE BUILD – MANAGED ALTERNATIVE TYPICAL SECTIONS



I-64 WEST OF US 17



I-64 EAST OF US 17

LEGEND

EXISTING LANES

PROPOSED LANES

NOTE:
TYPICAL SECTION DEPICTS THE EIGHT LANE
BUILD - MANAGED ALTERNATIVE (HOT LANE SCENARIO)

SCALE: NTS

8 Lane Build Managed Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

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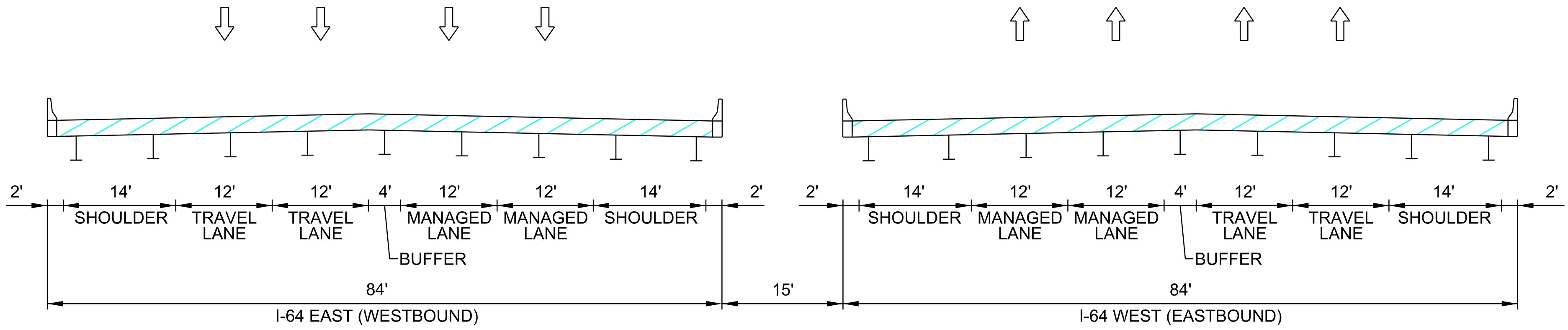
Figure D-1



8 LANE PARALLEL BRIDGE ALTERNATIVE

LEGEND

EXISTING LANES

PROPOSED LANES

NOTE:
TYPICAL SECTION DEPICTS THE EIGHT LANE
BUILD - MANAGED ALTERNATIVE (HOT LANE SCENARIO)

SCALE: NTS

8 Lane Build Managed Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

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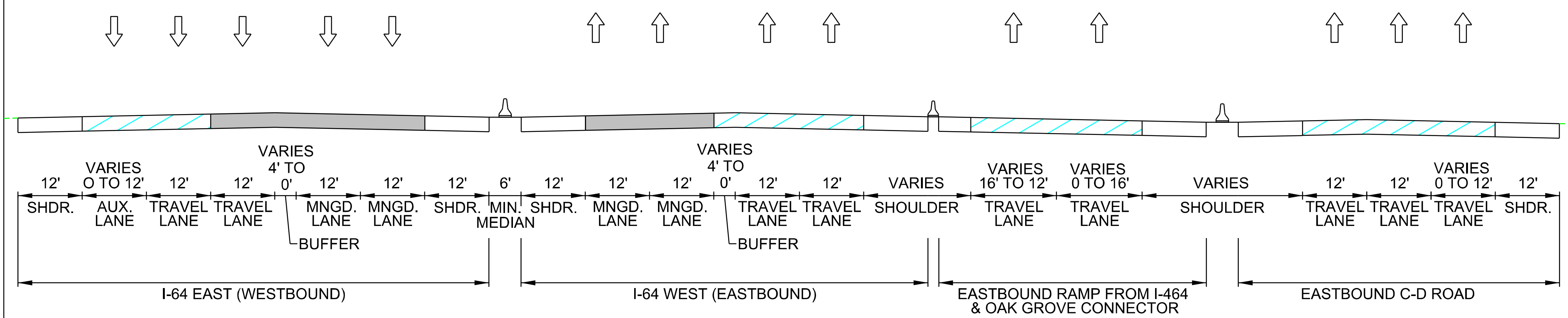
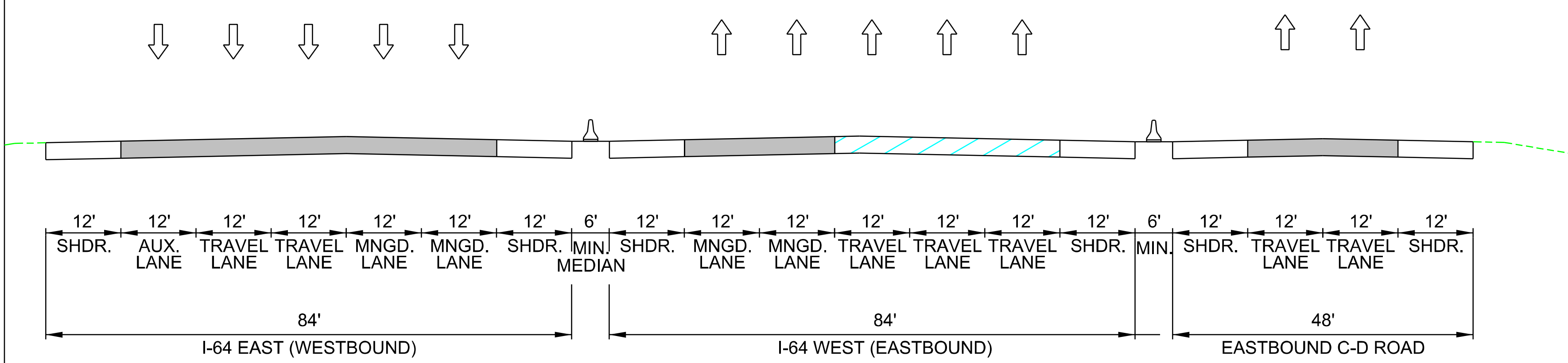
Figure
D-2



I-64 BETWEEN I-464 INTERCHANGE AND BATTLEFIELD BLVD



I-64 AT BATTLEFIELD BLVD

LEGEND

EXISTING LANES

PROPOSED LANES

NOTE:
TYPICAL SECTION DEPICTS THE EIGHT LANE
BUILD - MANAGED ALTERNATIVE (HOT LANE SCENARIO)

SCALE: NTS

8 Lane Build Managed Alternative Typical Sections
Interstate 64 / High Rise Bridge Corridor Study

U.S. Department of Transportation
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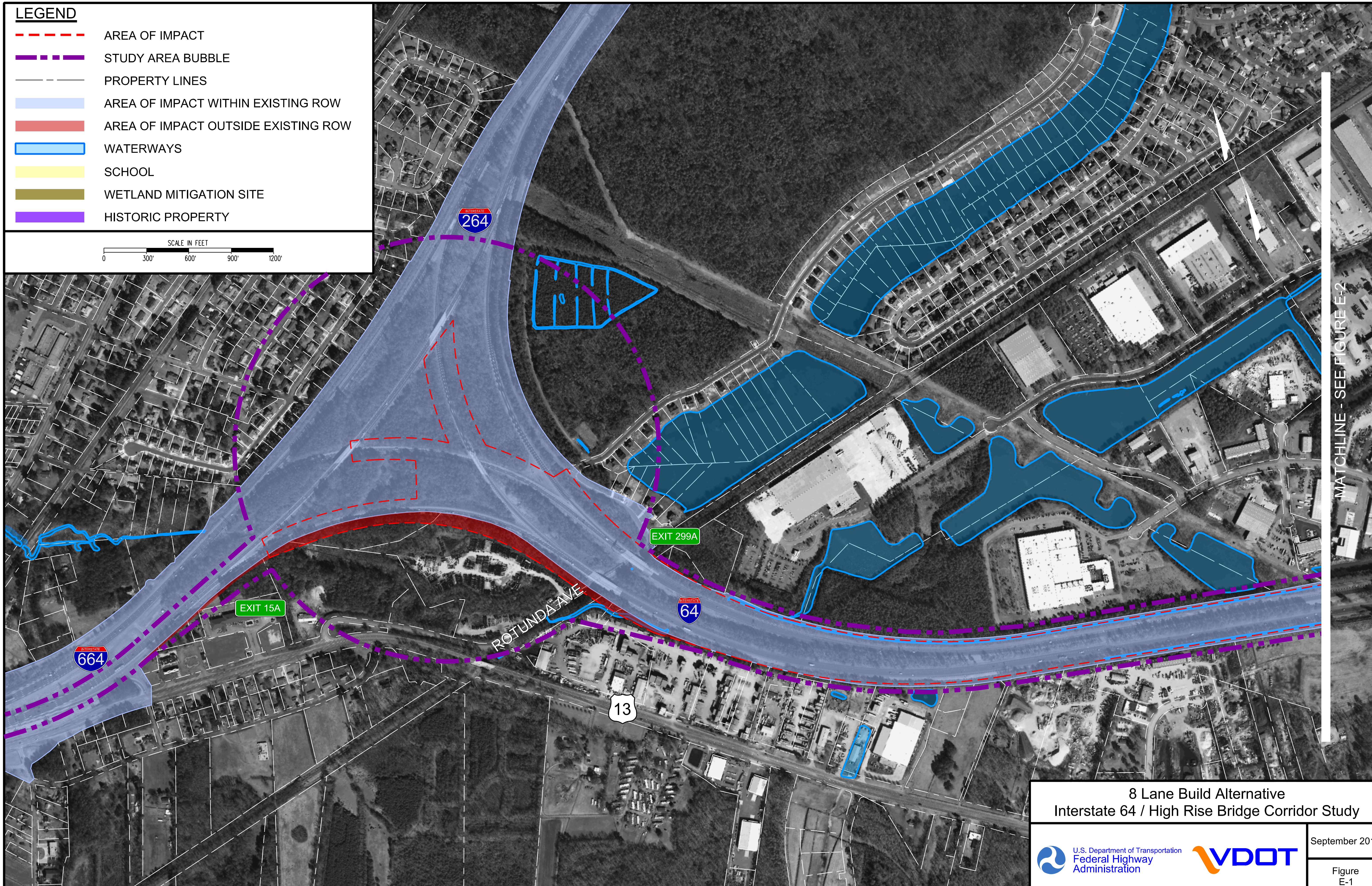
Figure
D-3

APPENDIX E: EIGHT LANE BUILD ALTERNATIVE ROW NEEDS

Appendix E

The area of impact outside existing right-of-way (ROW) identified as part of this study corresponds to the ROW needs for this analysis.



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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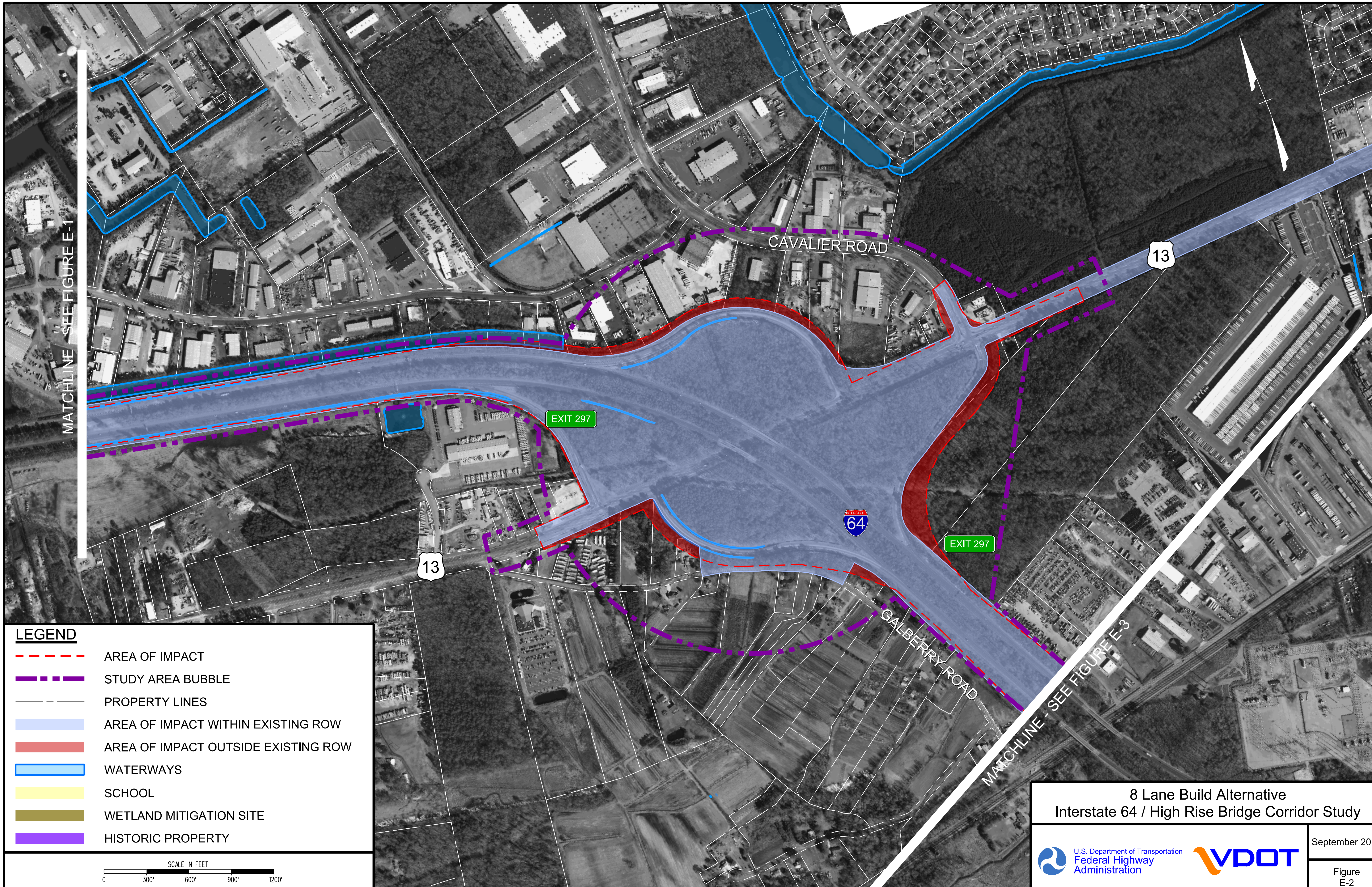
Figure E-1



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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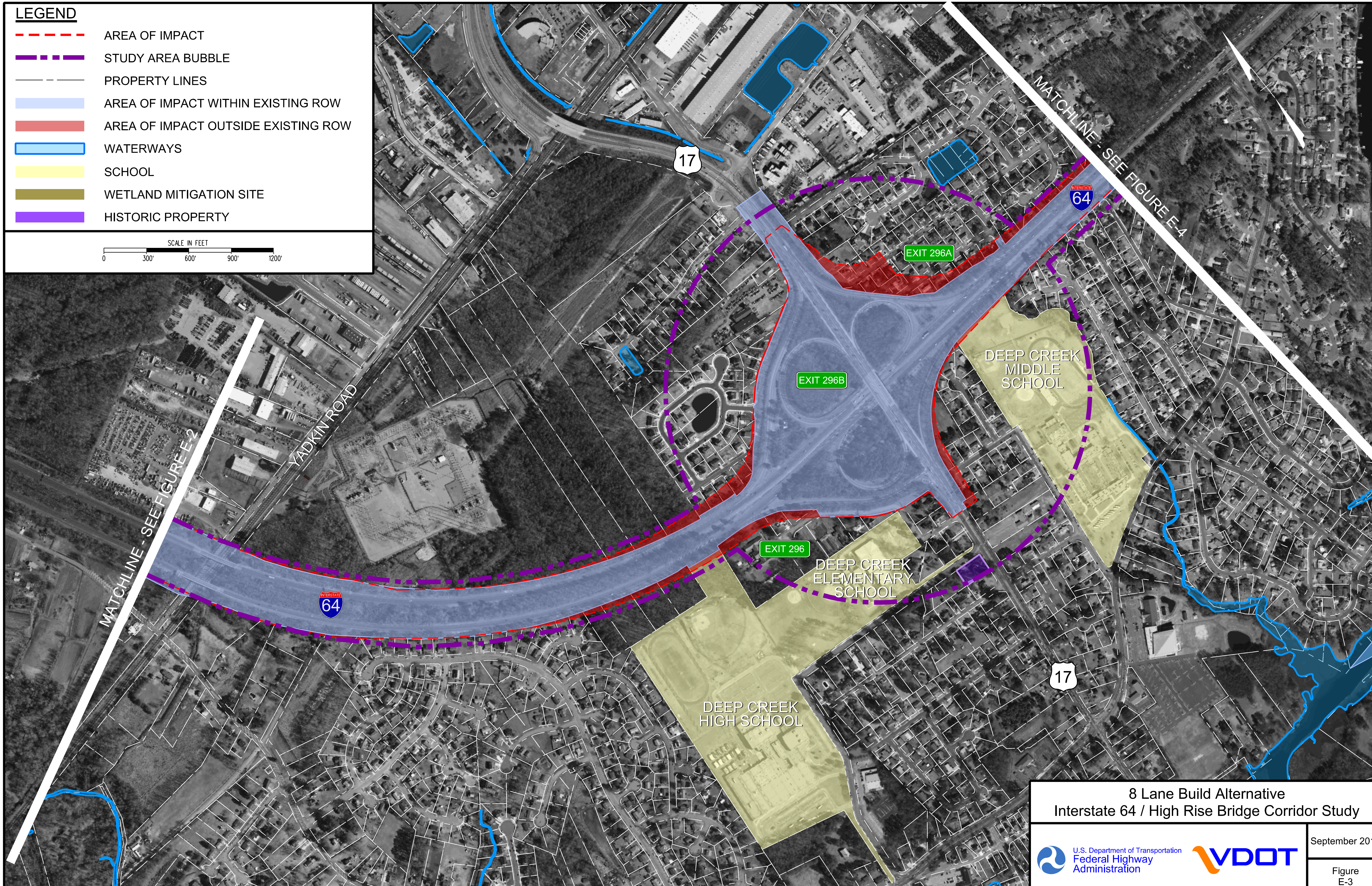
September 2014

Figure E-2



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

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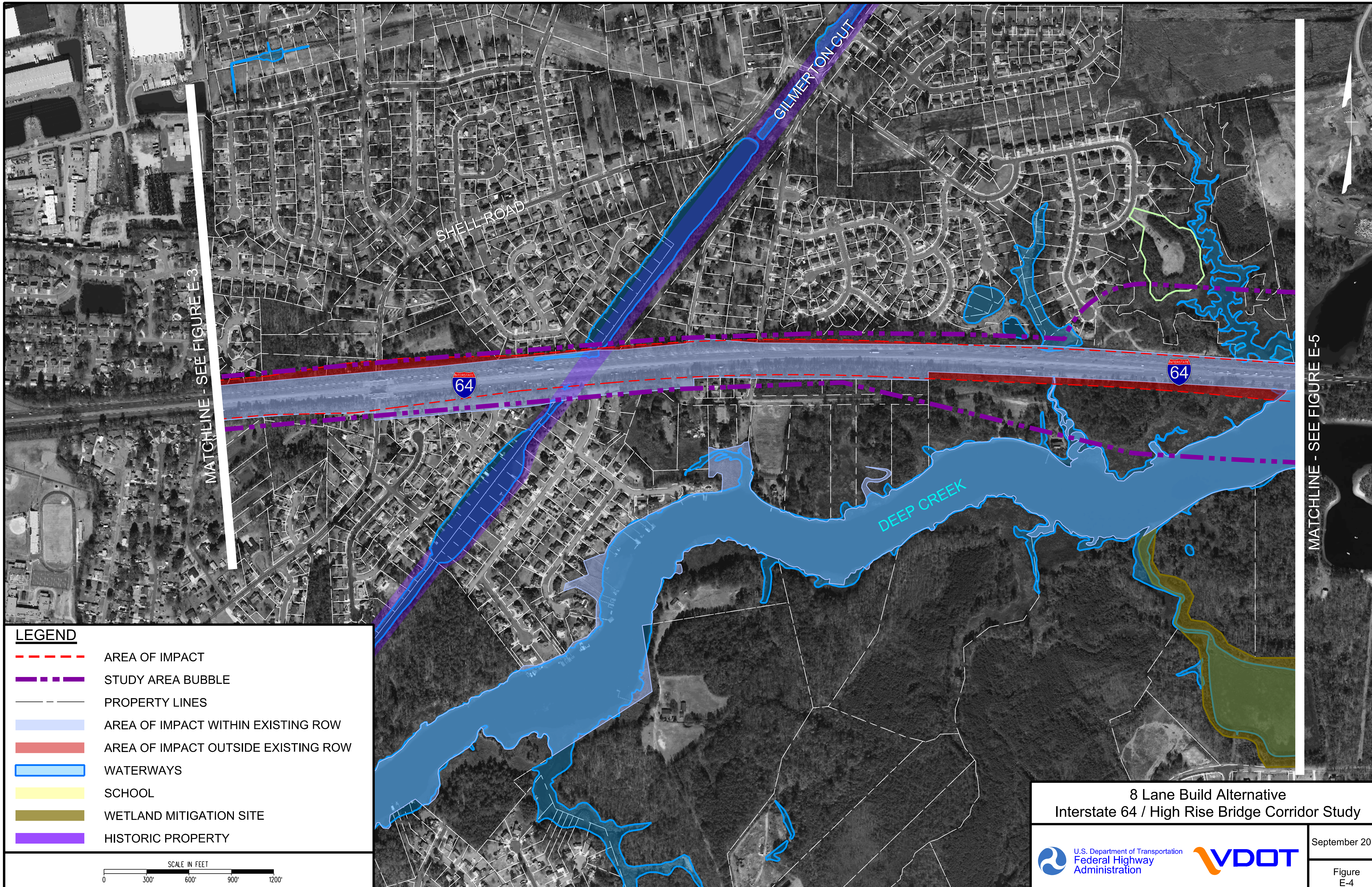
Figure E-3



8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study

U.S. Department of Transportation Federal Highway Administration

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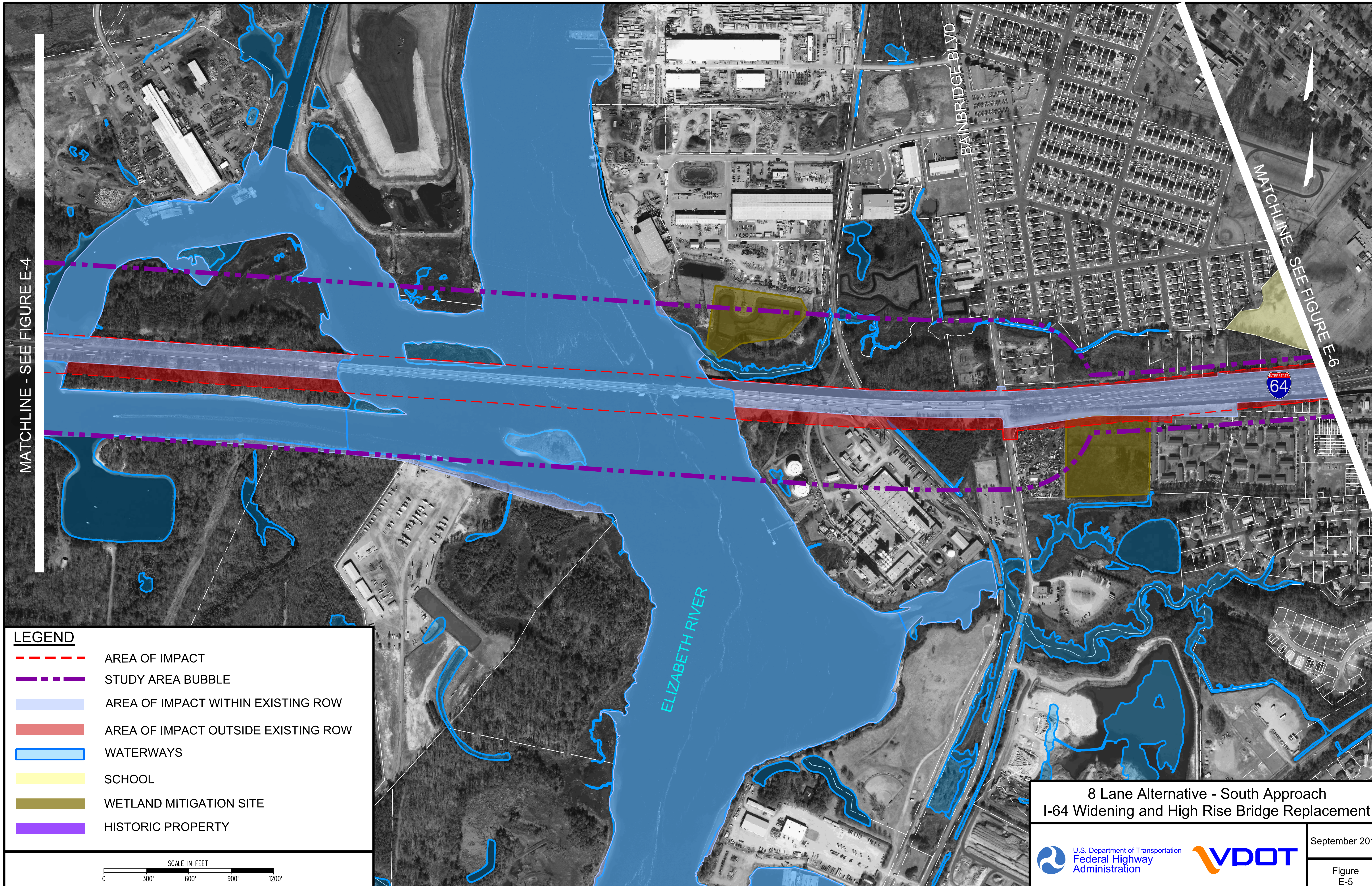
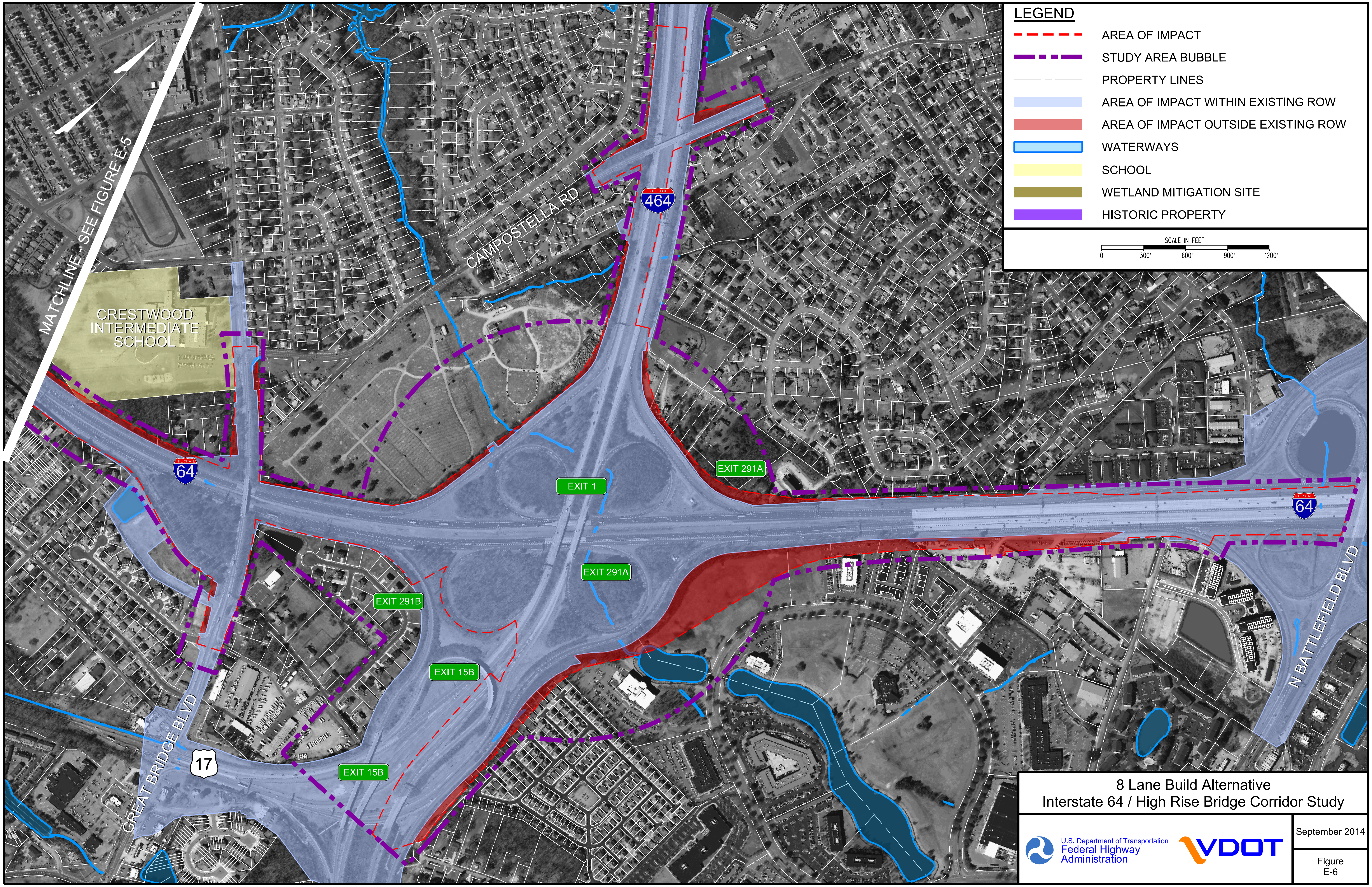
September 2014

Figure E-4


MATCHLINE - SEE FIGURE E-4
MATCHLINE - SEE FIGURE E-6
BAINBRIDGE BLVD
ELIZABETH RIVER
64
LEGEND
AREA OF IMPACT
STUDY AREA BUBBLE
AREA OF IMPACT WITHIN EXISTING ROW
AREA OF IMPACT OUTSIDE EXISTING ROW
WATERWAYS
SCHOOL
WETLAND MITIGATION SITE
HISTORIC PROPERTY
SCALE IN FEET
0 300' 600' 900' 1200'
8 Lane Alternative - South Approach
I-64 Widening and High Rise Bridge Replacement
U.S. Department of Transportation
Federal Highway Administration
VDOT
September 2014
Figure E-5


LEGEND
AREA OF IMPACT
STUDY AREA BUBBLE
PROPERTY LINES
AREA OF IMPACT WITHIN EXISTING ROW
AREA OF IMPACT OUTSIDE EXISTING ROW
WATERWAYS
SCHOOL
WETLAND MITIGATION SITE
HISTORIC PROPERTY
SCALE IN FEET
0
300'
600'
900'
1200'
MATCHLINE - SEE FIGURE E-5
CRESTWOOD INTERMEDIATE SCHOOL
CAMPOSTELLA RD
464
64
EXIT 1
EXIT 291A
EXIT 291B
EXIT 15B
GREAT BRIDGE BLVD
17
N BATTLEFIELD BLVD
8 Lane Build Alternative
Interstate 64 / High Rise Bridge Corridor Study
U.S. Department of Transportation
Federal Highway Administration
VDOT
September 2014
Figure E-6

APPENDIX F: CONSTRUCTION COSTS

Interstate 64 / High Rise Bridge Corridor Study
Preliminary Planning Level Cost Estimate

Alternative	LOW (Millions)	HIGH (Millions)
Eight Lane Build Alternative - South Approach - 95' Fixed Span Bridge	$1,182	$1,855
Eight Lane Build Alternative - South Approach - 135' Fixed Span Bridge	$1,420	$2,216
Eight Lane Build - Managed Alternative - South Approach - 95' Fixed Span Bridge	$1,224	$1,920
Eight Lane Build - Managed Alternative - South Approach - 135' Fixed Span Bridge	$1,473	$2,300

Construction Costs

Construction costs were calculated using the VDOT 2009 Planning Level Cost Spreadsheet which corresponds to a cost per mile assessment plus other improvement costs. The following is a list of key assumptions used in developing these costs:

1. Costs were developed using Cost Per Mile unit costs for urban areas
2. Costs were developed for "Low" and "High" Scenarios
3. Build Year used was 2018
4. Inflation Rate used was 3% per year
5. Right-of-way and Utility Costs were developed using a Residential / Suburban Low Density factor
6. The reconstruction of US 13 and US 17 interchanges were assumed to be Improvement to a Grade Separated Interchange. Respective bridge reconstruction costs are included as part of the lump sum.
7. The I-64 / I-464 Interchange was assumed to be a new grade separated interchange in an urban area. High Cost was assumed.
8. It is assumed that all mainline and overhead bridges would be replaced. Bridges were calculated separately if they are not part of an interchange.
9. A cost per mile for a ten lane facility was derived by using eight lane divided typical section cost per mile and adding the difference between the eight lane and six lane divided typical section unity costs.
10. Managed lanes costs were increased 4% to 6% between the different alternatives to account for the additional pavement and bridge costs associated with the wider typical section.

TRANSPORTATION & MOBILITY PLANNING DIVISION
STATEWIDE PLANNING LEVEL COST ESTIMATES

Costs Reflected as of January 2009

Inflation Rate 3.0% annually

To inflate cost to year of expenditure, please enter year below
2018

Costs include 25% for PE and Construction Contingencies

The following typical section estimates do not include bridge, right-of-way (ROW) or other improvement costs. Use the bridge unit costs, ROW percentages and other improvement costs (highlighted in gray) figures provided below to add these additional costs to the planning level construction estimate.

				Cost Per Mile	**Bristol, Culpeper, Fredericksburg, Lynchburg, Richmond, Salem, Staunton** LOW	**Bristol, Culpeper, Fredericksburg, Lynchburg, Richmond, Salem, Staunton** HIGH	**NOVA Hampton Roads** LOW	**NOVA Hampton Roads** HIGH
Urban Typical Sections								
Bike Lanes		4' pavement both sides		CPM	$ 570,000	$ 860,000	$ 670,000	$ 1,010,000
2 lanes	U2	26'-30' pavement	Reconstruct or New	CPM	$ 4,700,000	$ 7,050,000	$ 5,870,000	$ 8,810,000
3 lanes	U3	36'-40' pavement	Reconstruct or New	CPM	$ 6,650,000	$ 10,050,000	$ 8,220,000	$ 13,050,000
4 lanes	U4	40'-48' pavement	Reconstruct or New	CPM	$ 10,960,000	$ 16,310,000	$ 13,310,000	$ 19,570,000
4 lanes divided	U4D	48' pavement w/16' raised median	Reconstruct or New	CPM	$ 11,610,000	$ 17,610,000	$ 13,830,000	$ 20,880,000
4 lanes divided	U4D	48' pavement w/28' raised median	Reconstruct or New	CPM	$ 12,660,000	$ 18,920,000	$ 15,140,000	$ 22,830,000
					$ -	$ -	$ -	$ -
6 lanes divided	U6D	72' pavement w/16' raised median	Reconstruct or New	CPM	$ 13,830,000	$ 18,530,000	$ 17,220,000	$ 26,100,000
6 lanes divided	U6D	72' pavement w/28' raised median	Reconstruct or New	CPM	$ 14,480,000	$ 19,180,000	$ 17,880,000	$ 27,400,000
					$ -	$ -	$ -	$ -
8 lanes divided	U8D	96' pavement w/16' raised median	Reconstruct or New	CPM	$ 15,660,000	$ 21,790,000	$ 19,180,000	$ 28,710,000
8 lanes divided	U8D	96' pavement w/ 28' raised median	Reconstruct or New	CPM	$ 16,310,000	$ 22,440,000	$ 19,830,000	$ 30,010,000
10 lanes divided		**Added Typical Section. Derived by: Using the 8 Lane divided typical section and adding the difference between the 8 lane divided section and the 6 lane divided section. {8 + (8-6) = 10}**					**$ 21,780,000**	**$ 32,620,000**
Rural Typical Sections								
Bike Lanes		4' pavement both sides		CPM	$ 570,000	$ 850,000	$ 670,000	$ 1,010,000
1 lane		12' pavement		CPM	$ 510,000	$ 780,000	$ 620,000	$ 910,000
2 lanes	R2	18' pavement	Reconstruct or New	CPM	$ 2,480,000	$ 3,910,000	$ 3,000,000	$ 4,570,000
2 lanes	R2	20' pavement	Reconstruct or New	CPM	$ 3,130,000	$ 4,570,000	$ 3,910,000	$ 5,870,000
10. Managed lanes	R2	22' pavement	Reconstruct or New	CPM	$ 4,180,000	$ 6,200,000	$ 5,220,000	$ 7,830,000
costs associated wi	R2	24' pavement	Reconstruct or New	CPM	$ 5,220,000	$ 7,830,000	$ 6,390,000	$ 9,460,000
3 lanes	R3	36' pavement	Reconstruct or New	CPM	$ 6,520,000	$ 9,790,000	$ 7,960,000	$ 11,740,000
4 lanes divided	R4D	48'pavement	Reconstruct	CPM	$ 7,180,000	$ 10,050,000	$ 9,130,000	$ 13,050,000
4 lanes divided	R4D	48' pavement	New	CPM	$ 9,130,000	$ 12,660,000	$ 11,610,000	$ 16,960,000
4 lanes divided	R4D	48' pavement	Parallel	CPM	$ 6,130,000	$ 7,180,000	$ 7,570,000	$ 8,480,000
4 lanes divided	R4D	48' pavement w/16' raised median	Reconstruct or New	CPM	$ 9,790,000	$ 13,180,000	$ 12,000,000	$ 16,180,000
4 lanes divided	R4D	48' pavement w/28' raised median	Reconstruct or New	CPM	$ 10,440,000	$ 13,830,000	$ 12,660,000	$ 16,830,000
6 lanes divided	R6D	72' pavement widen 4-6 lanes	Reconstruct	CPM	$ 7,570,000	$ 11,090,000	$ 8,740,000	$ 13,310,000
6 lanes divided	R6D	72' pavement w/depress median	New	CPM	$ 11,350,000	$ 17,090,000	$ 13,830,000	$ 21,010,000
8 lanes divided	R8D	96' pavement widen 6-8 lanes	Reconstruct	CPM	$ 7,570,000	$ 11,090,000	$ 8,740,000	$ 13,310,000
8 lanes divided	R8D	96' pavement widen 4-8 lanes		CPM	$ 12,790,000	$ 20,750,000	$ 14,870,000	$ 25,570,000

The following turn-lanes costs are for stand alone turn-lane projects. The standard typical section CPM figures above assume turn lanes - do not add these turn-lanes costs when developing a planning level estimate for a widening, reconstruction, or new location improvement.

				LOW	HIGH	LOW	HIGH
Right and Left Turn Lanes on a Four Lane Road							
Right turn lane	100' parallel and 100' taper		@	$ 230,000	$ 360,000	$ 290,000	$ 420,000
Left turn lane	200' parallel and 200' taper		@	$ 270,000	$ 400,000	$ 350,000	$ 520,000
Crossover			@	$ 210,000	$ 330,000	$ 260,000	$ 390,000
Provide new crossover with two right and two left turn lanes			@	$ 980,000	$ 1,630,000	$ 1,300,000	$ 1,960,000
Right and Left Center Turn Lane on a Two Lane Road							
	Design speed 55 M.P.H.						
One left turn lane	500' parallel and two 700' taper	0.36 mi.	@	$ 1,170,000	$ 1,830,000	$ 1,440,000	$ 2,090,000
Two left turn lanes	900' parallel and two 700' taper	0.44 mi.	@	$ 1,440,000	$ 2,280,000	$ 1,830,000	$ 2,610,000
Right and left turn lane			@	$ 1,440,000	$ 2,280,000	$ 1,830,000	$ 2,610,000
Two right and two left turn lanes			@	$ 1,830,000	$ 2,610,000	$ 2,220,000	$ 3,260,000

As noted above, bridge costs are not included in the typical section CPM figures above. Bridges represent a significant cost and it is important to use the figures below to estimate bridge costs for a planned improvement. Estimates are calculated based on the square footage of the bridge ->Bridge Cost = (total bridge length in feet x total bridge width in feet) x Square Footage Costs

			LOW	HIGH	LOW	HIGH
Bridge Cost						
Over 25' to 200' in length	Widen Reconst or New	per sq ft	$ 270	$ 400	$ 330	$ 460
Over 200' in length	Widen Reconst or New	per sq ft	$ 270	$ 400	$ 330	$ 460

When applicable, the costs highlighted in gray should be added to the construction costs when developing a planning level estimate. All other improvement costs (not highlighted in gray) are for developing stand alone improvement cost estimates.

Other Improvement Cost				

Estimate parking, restripe (both sides)		CPM	$ 130,000	$ 200,000	$ 130,000	$ 200,000
Provide signal at unsignalized intersection		@	$ 160,000	$ 260,000	$ 520,000	$ 780,000
Improve, replace signal at intersection		@	$ 210,000	$ 330,000	$ 260,000	$ 390,000
Improve phasing as system, signalized intersections		@	$ 100,000	$ 160,000	$ 130,000	$ 200,000
Provide pedestrian signal phase		@	$ 50,000	$ 50,000	$ 70,000	$ 100,000
Provide pedestrian crosswalk		@	$ 20,000	$ 20,000	$ 30,000	$ 50,000
Downtown signage		CPM	$ 50,000	$ 50,000	$ 70,000	$ 100,000
Close open ditch drainage and provide curb & gutter		CPM	$ 3,130,000	$ 3,130,000	$ 3,910,000	$ 5,870,000
Widen radius for truck turning		@	$ 100,000	$ 100,000	$ 130,000	$ 200,000
Install railroad warning lights (no gates)		@	$ 100,000	$ 100,000	$ 130,000	$ 200,000
Provide park & ride facility		COST PER PARKING SPACE	$ 10,000	$ 10,000	$ 10,000	$ 20,000
Provide 5 ft. sidewalk		CPM	$ 310,000	$ 310,000	$ 390,000	$ 590,000
Wide Curb Lane (2 additional feet of pavement in each directio		CPM	$ 310,000	$ 310,000	$ 390,000	$ 590,000
Paved Shoulder (4 foot wide paved shoulder in both directions)		CPM	$ 570,000	$ 570,000	$ 670,000	$ 980,000
Provide 10 ft. paved shared use path off road		CPM	$ 940,000	$ 940,000	$ 1,170,000	$ 1,700,000
Sound barrier wall (multiply height x length)		per sq ft	$ 90	$ 90	$ 90	$ 130
Improve grade separated interchange		@	$ 32,620,000	$ 52,190,000	$ 39,140,000	$ 78,290,000
Provide new grade separated interchange (Rural) LOW		@	$ 39,140,000	$ 39,140,000	$ 45,670,000	$ 45,670,000
Provide new grade separated interchange (Rural) HIGH		@	$ 71,760,000	$ 71,760,000	$ 84,810,000	$ 84,810,000
Provide new grade separated interchange (Urban) LOW		@	$ 45,670,000	$ 45,670,000	$ 52,190,000	$ 52,190,000
Provide new grade separated interchange (Urban) HIGH		@	$ 84,810,000	$ 84,810,000	$ 97,860,000	$ 97,860,000
Roundabouts 1 lane			$ 980,000	$ 1,630,000	$ 1,300,000	$ 1,960,000
Roundabouts 2 lanes			$ 2,280,000	$ 3,260,000	$ 2,610,000	$ 3,910,000

Once a planning level construction estimate has been developed using the information above, use the following figures to estimate ROW costs based on the prevalent land use adjecent to the project. ROW costs are shown as a percentage of construction costs.

Right of Way & Utilities Cost % of Cost Estimate				
Rural	25%	35%	30%	40%
Residential/Suburban low density	50%	65%	55%	70%
Outlying business/Suburban high density	60%	100%	75%	125%
Central business district	100%	125%	125%	150%

Planning Level Cost Estimate = ((Typical Section CPM x project length in miles) + (Other Improvement Costs) x (ROW%+1)); Bridge Costs =(Bridge 1 total square footage x bridge unit cost)+(Bridge 2 total square footage x bridge unit cost)…

In the 2006 session, the General Assembly passed a bill directing local governments to include cost estimates when planning road improvements. HB 1521 directs local governments to include in their comprehensive plans maps showing costs for road and transportation improvements as those costs are available from VDOT. The legislation becomes effective July 1, 2006. District planners will act as the point-of-contact in assisting local governments, at their request, to develop planning level cost estimates for proposed transportation improvements in local comprehensive plans.

The Project Cost Estimation System (PCES) is VDOT's tool for calculating the costs for transportation improvements, and is generally used after the project's scoping phase. PCES is not always an ideal tool for determining costs at the planning level, given the number of planned improvements and the limited amount of detailed information known at the planning stage.

The Statewide Planning Level Cost Estimate Sheet above has been updated from 2006 to reflect higher costs in all districts due to cost increases in construction materials. This sheet shall be used to provide consistent planning level cost estimates when planners are contacted by local governments pursuant to HB 1521. For extremely complex improvements or improvements with unique characteristics, please work with your district Location and Design section or TMPD's Project Planning Group to develop the cost estimate. It is also recommended that when displaying planning level cost estimates for public review use ranges. If enough information is available to derive cost estimates using PCES, then you are encouraged to use that method to develop the planning level estimate.

Cost Estimate - Detailed Breakdown

			LOW		HIGH	
Eight Lane Build Alternative - South Approach - 95' Fixed Span	Quantity	Unit	Unit Cost	Subtotal	Unit Cost	Subtotal
Mainline - West of HRB*	6.88	MI	$19,830,000	$136,471,021	$30,010,000	$206,530,275
Mainline - East of HRB*	1.48	MI	$21,780,000	$32,333,701	$32,620,000	$48,426,324
High Rise Bridge	876800	SF	$330	$289,344,000	$460	$403,328,000
Interchanges - US13 & US17	2	EA	$39,140,000	$78,280,000	$78,290,000	$156,580,000
Interchanges - I464	1	EA	$174,124,980	$174,124,980	$204,168,760	$204,168,760
Bridge Construction	135247	SF	$330	$44,631,510	$460	$62,213,620
Minor Cross Roads	0.83	MI	$5,870,000	$4,878,326	$8,810,000	$7,321,644
Wetland Mitigation - Tidal	3.01	AC	$500,000	$1,505,000	$500,000	$1,505,000
Wetland Mitigation - Non-Tidal	19.65	AC	$50,000	$982,500	$50,000	$982,500
Utility Relocation	0	EA	$1,000,000	$0	$1,000,000	$0
Subtotal				$762,551,038		$1,091,056,123
Right of Way and Utilities			55%	$419,403,071	70%	$763,739,286
Total				**$1,181,954,109**		**$1,854,795,409**

			LOW		HIGH	
Eight Lane Build Alternative - South Approach - 135' Fixed Span	Quantity	Unit	Unit Cost	Subtotal	Unit Cost	Subtotal
Mainline - West of HRB*	6.29	MI	$19,830,000	$124,663,158	$30,010,000	$188,660,684
Mainline - East of HRB*	1.48		$21,780,000	$32,333,701	$32,620,000	$48,426,324
High Rise Bridge	1379200	SF	$330	$455,136,000	$460	$634,432,000
Interchanges - US13 & US 17	2	EA	$39,140,000	$78,280,000	$78,290,000	$156,580,000
Interchanges - I464	1	EA	$174,124,980	$174,124,980	$204,168,760	$204,168,760
Bridge Construction	135247	SF	$330	$44,631,510	$460	$62,213,620
Minor Cross Roads	0.83	MI	$5,870,000	$4,878,326	$8,810,000	$7,321,644
Wetland Mitigation - Tidal	1.7	AC	$500,000	$850,000	$500,000	$850,000
Wetland Mitigation - Non-Tidal	19.65	AC	$50,000	$982,500	$50,000	$982,500
Utility Relocation	0	EA	$1,000,000	$0	$1,000,000	$0
Subtotal				$915,880,175		$1,303,635,532
Right of Way and Utilities			55%	$503,734,096	70%	$912,544,872
Total				**$1,419,614,271**		**$2,216,180,404**

Cost Estimate Managed Lanes - Detailed Breakdown

			LOW		HIGH	
Eight Lane Build - Managed Alternative - South Approach - 95' Fixed Spar	Quantity	Unit	Unit Cost	Subtotal	Unit Cost	Subtotal
Mainline - West of HRB*	6.88	MI	$19,830,000	$144,659,283	$30,010,000	$218,922,092
Mainline - East of HRB*	1.48	MI	$21,780,000	$34,273,723	$32,620,000	$51,331,903
High Rise Bridge	876800	SF	$330	$303,811,200	$460	$423,494,400
Interchanges - US13 & 17	2	EA	$39,140,000	$78,280,000	$78,290,000	$156,580,000
Interchanges - I464	1	EA	$174,124,980	$174,124,980	$204,168,760	$204,168,760
Bridge Construction	135247	SF	$330	$46,863,086	$460	$65,324,301
Minor Cross Roads	0.83	MI	$5,870,000	$4,878,326	$8,810,000	$7,321,644
Wetland Mitigation - Tidal	3.01	AC	$500,000	$1,505,000	$500,000	$1,505,000
Wetland Mitigation - Non-Tidal	19.65	AC	$50,000	$982,500	$50,000	$982,500
Utility Relocation	0	EA	$1,000,000	$0	$1,000,000	$0
Subtotal				$789,378,097		$1,129,630,600
Right of Way and Utilities			55%	$434,157,953	70%	$790,741,420
Total				**$1,223,536,051**		**$1,920,372,019**
			LOW		**HIGH**	
Eight Lane Build - Managed Alternative - South Approach - 135' Fixed Spar	Quantity	Unit	Unit Cost	Subtotal	Unit Cost	Subtotal
Mainline - West of HRB*	6.29	MI	$19,830,000	$132,142,947	$30,010,000	$199,980,325
Mainline - East of HRB*	1.48		$21,780,000	$34,273,723	$32,620,000	$51,331,903
High Rise Bridge	1379200	SF	$330	$477,892,800	$460	$666,153,600
Interchanges - US13 & US17	2	EA	$39,140,000	$78,280,000	$78,290,000	$156,580,000
Interchanges - I464	1	EA	$174,124,980	$174,124,980	$204,168,760	$204,168,760
Bridge Construction	135247	SF	$330	$46,863,086	$460	$65,324,301
Minor Cross Roads	0.83	MI	$5,870,000	$4,878,326	$8,810,000	$7,321,644
Wetland Mitigation - Tidal	1.7	AC	$500,000	$850,000	$500,000	$850,000
Wetland Mitigation - Non-Tidal	19.65	AC	$50,000	$982,500	$50,000	$982,500
Utility Relocation	0	EA	$1,000,000	$0	$1,000,000	$0
Subtotal				$950,288,362		$1,352,693,033
Right of Way and Utilities			55%	$522,658,599	70%	$946,885,123
Total				**$1,472,946,961**		**$2,299,578,157**

Planning Cost Estimate Worksheet - Quantities

8 Lane	**Mainline (Mile)**	**High Rise Bridge (SF)**	
95' Fixed - West of HRB - 8 Lane	6.88	876,800	* For the 8 Lane Build Alternative, the typical section west of the High Rise Bridge contains 8 lanes, where the typical section east of the High Rise Bridge becomes a 10 lane typical section due to the inclusion of the CD road/auxiliary lanes.
95' Fixed - East of HRB - 10 Lane*	1.48		
135' Fixed - West of HRB - 8 Lane	6.29	1,379,200	
135' Fixed - East of HRB - 10 Lane*	1.48		
Bridge Construction		**(SF)**	
Bowers Hill Bridge		11,143	
I-64 West over Rotunda		14,689	
I-64 East over Rotunda		14,650	
I-64 West over US 13			Included in interchange lump sum cost
I-64 East over US 13			Included in interchange lump sum cost
I-64 West over Yadkin		19,994	
I-64 East over Yadkin		20,116	
US 17 over I64			Included in interchange lump sum cost
I-64 West over Shell		10,319	
I-64 East Shell Road		10,894	
Great Bridge Blvd		16,284	
Campostella		17,158	
Total		**135,247**	
Interchange	**EA**	**(SF)**	
US 13	1		
US 17	1		
I464	1		
NB to WB (flyover)		110,075	
SB to EB (flyover)		81,470	
Tie-in (flyover)		39,561	
Total	**3**	**231,106**	
Minor Cross Roads		**(FT)**	
Ramp to Great Bridge		1,864	
Great Bridge		1,715	
Compostella Road		809	
Total (feet)		4,388	
Total (miles)		**0.83**	
Wetland Mitigation	**Tidal (Ac.)**	**Non-Tidal (Ac.)**	
95' Fixed - South Approach	3.01	19.65	
135' Fixed - South Approach	1.7	19.65	