DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL

M NATURAL RESOURCES TECHNICAL REPORT

D.C. TO RICHMOND SOUTHEAST HIGH SPEED RAIL

September 2017

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SOUTHEAST HIGH SPEED RAIL

Natural Resources Technical Report

DRPT
Virginia Department of Rail and Public Transportation

U.S. Department of Transportation
Federal Railroad Administration

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1 INTRODUCTION

The Federal Railroad Administration (FRA) and Virginia Department of Rail and Public Transportation (DRPT) propose passenger rail service and rail infrastructure improvements in the north-south travel corridor between Washington, D.C. and Richmond, VA. These passenger rail service and rail infrastructure improvements are collectively known as the Washington, D.C. to Richmond Southeast High Speed Rail (DC2RVA) project. The Project will increase capacity to deliver higher speed passenger rail, improve conventional speed passenger service, expand commuter rail, and accommodate growth of freight rail service, in an efficient and reliable multimodal rail corridor. The increased capacity will improve passenger rail service frequency, reliability and travel time in a corridor shared by growing volumes of passenger, commuter, and freight rail traffic, thereby providing a door-to-door time-competitive option for travelers between Washington, D.C. and Richmond and those traveling to and from adjacent connecting corridors. The Project is part of the larger Southeast High Speed Rail (SEHSR) corridor, which extends from Washington, D.C. through Richmond, and continues east to Hampton Roads (Norfolk), VA, and south to Raleigh, NC, and Charlotte, NC, and then continues west to Atlanta, GA and south to Florida. The Project connects to the National Railroad Passenger Corporation (Amtrak) Northeast Corridor (NEC) at Union Station in Washington, D.C.

The purpose of the SEHSR program, as stated in the 2002 Tier I Final Environmental Impact Statement (EIS) completed for the full SEHSR corridor, is to provide a competitive transportation choice to travelers within the Washington, D.C. to Charlotte travel corridor. The current DC2RVA project carries forward the purpose of the SEHSR Tier I EIS within the Washington, D.C. to Richmond segment of the larger SEHSR corridor by identifying the infrastructure improvements necessary to provide a competitive transportation choice for current and future conditions. The Purpose of the DC2RVA project is to increase the capacity between Washington, D.C. and Richmond to deliver higher speed passenger rail, improve conventional speed passenger rail, expand commuter rail, and accommodate growth of freight rail service in an efficient and reliable multimodal rail corridor. This Project will enable passenger rail to be a competitive transportation choice for intercity travelers between Washington, D.C. and Richmond and beyond.

The purpose of this Natural Resources Technical Report is to identify the natural environment along the DC2RVA corridor and analyze potential effects that could result from implementation of the build alternatives. Information in this Technical Report supports discussions presented in the Draft EIS.

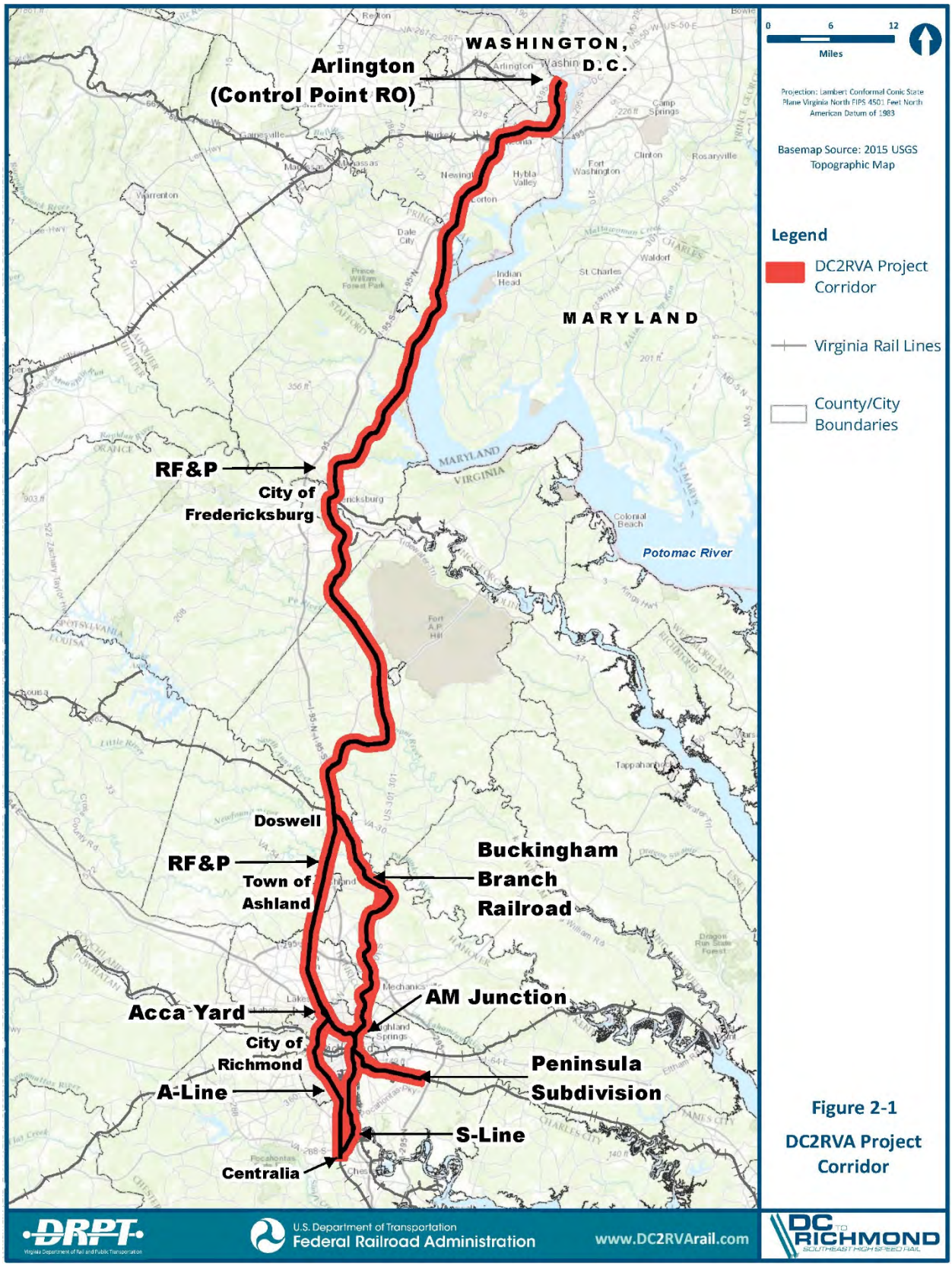
2 PROJECT OVERVIEW

The Washington, D.C. to Richmond corridor spans 123 miles along an existing rail corridor owned by CSXT between Control Point Rosslyn (RO) at milepost (MP) CFP 110 in Arlington County, VA to the junction of the CSXT North End Subdivision (referred to as the A-Line) between West Acca Yard in Richmond and Centralia, VA, and the CSXT Bellwood Subdivision (referred to as the S-Line) between Control Point Hermitage in Richmond and Centralia, VA (CE) at MP A-11 in Chesterfield County, VA (Figure 2-1). At the northern terminus in Arlington County, the Project limit is marked by the southern approach to Long Bridge, a double-track rail bridge connecting the rail corridor over the Potomac River to Washington, D.C. The Project corridor follows the CSXT Richmond, Fredericksburg & Potomac (RF&P) Subdivision from the Potomac River to Richmond. The southern terminus in Centralia is the junction of two CSXT routes (the A-Line and the S-Line) that begin in Richmond and rejoin approximately 11 miles south of the city.

Additional sections evaluated as part of the Project included approximately 8.3 miles of the CSXT Peninsula Subdivision CA-Line from Beulah Road (MP CA-76.1) in Henrico County, VA east of Richmond to AM Junction in downtown Richmond, and the approximately 26-mile Buckingham Branch Railroad (BBR) from AM Junction to the RF&P Crossing (MP CA-111.8) north of Richmond in Doswell, VA.

In Arlington, the Project connects to existing CSXT track extending across the Potomac River on the Long Bridge into Washington, D.C. and Union Station, the southern terminus of Amtrak's NEC. In downtown Richmond and at Centralia, the Project connects to both the Richmond to Raleigh segment of the SEHSR corridor and the Richmond to Hampton Roads segment of the SEHSR corridor. The Washington, D.C. to Richmond segment is an integral part of the overall Washington, D.C. to Charlotte SEHSR corridor and provides a critical link between high speed passenger service from Boston to Washington, D.C. and the southeastern United States (U.S.).

Long Bridge Over the Potomac River


WASHINGTON, D.C.
Arlington
(Control Point RO)
MARYLAND
RF&P
City of Fredericksburg
Potomac River
Doswell
RF&P
Town of Ashland
Buckingham Branch Railroad
AM Junction
Acca Yard
City of Richmond
A-Line
Peninsula Subdivision
S-Line
Centralia
0 6 12
Miles
Projection: Lambert Conformal Conic State Plane Virginia North FIPS 4501 Feet North American Datum of 1983
Basemap Source: 2015 USGS Topographic Map
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County/City Boundaries
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DC2RVA Project Corridor
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2.1 PROJECT DESCRIPTION

Alternatives developed as part of the DC2RVA Project include two elements: proposed train service that would run throughout the corridor (see Section 2.1.1), and physical improvements along the rail alignment. The Project will include specific rail infrastructure improvements and service upgrades to deliver higher speed passenger rail, expand commuter rail, and accommodate growth of freight rail service in an efficient and reliable multimodal rail corridor. The increased capacity will improve passenger rail service frequency, reliability, and door-to-door competitive travel time in a corridor shared by growing volumes of passenger, commuter, and freight rail traffic. Specific improvements to the existing rail infrastructure between Arlington, VA, and Centralia, VA, include:

- Corridor-wide improvements to train operating capacity to accommodate efficient operation of passenger, commuter, and freight rail service with increased frequency, reliability, and speed, including an additional main track along most of the corridor, additional sidings, crossovers, yard bypasses and leads, and other capacity and reliability improvements at certain locations.
- Corridor-wide upgrades to existing track and signal systems to achieve higher operating speeds, including curve realignments, higher-speed crossovers between tracks, passing sidings, and grade crossing improvements.
- New or replacement station, platform, and parking improvements at intercity passenger stations in the corridor to improve the efficiency of railroad operations, improve quality of service, and accommodate increased ridership.
- Safety improvements to roadway crossing treatments, to include median treatment, grade separations, and/or closure of existing at-grade crossings of the rail corridor.

The environmental impacts of these improvements and measures to avoid, minimize, or otherwise mitigate such impacts are described in the EIS.

Studies in support of the Project addressed passenger and freight rail operations and service between Union Station in Washington, D.C. and Richmond and beyond, but the Project will not include physical improvements to the Long Bridge across the Potomac River or to rail infrastructure within Washington, D.C. Other projects will address these improvements as well as improvements to the rail infrastructure north of Arlington and south of Centralia along the SEHSR corridor.

2.1.1 Passenger Rail Service in Project Corridor

Amtrak operates four types of passenger service in the DC2RVA corridor:

- Northeast Regional (Virginia) Amtrak service provides regional passenger rail service along the length of the Northeast Corridor from Boston and New York and continues south to serve routes in Virginia. Trains make local station stops.
- Interstate Corridor (Carolinian) Amtrak operates between New York and North Carolina (one single daily round trip) through Virginia, making fewer stops in the DC2RVA corridor than the Northeast Regional service.
- Long Distance Amtrak service operates from New York and continues through Washington, D.C. and Virginia to other out-of-state locations. Long distance trains serve the fewest of Amtrak station stops within the DC2RVA corridor.

- Auto Train Amtrak service operates as a daily nonstop, overnight train between dedicated station facilities in Lorton, VA and Florida, and carries passengers and their automobiles.

DRPT is proposing to add nine daily roundtrip SEHSR intercity passenger trains to the corridor:

- Four new roundtrips of Northeast Regional (SEHSR) service, to provide additional frequencies on the same routes of existing Amtrak Northeast Regional (Virginia) services, terminating within Virginia (either Newport News, Norfolk, or Richmond).
- Five new roundtrips of Interstate Corridor (SEHSR) service, to complement Amtrak's current Interstate Corridor (North Carolina) service, by providing additional frequencies to North Carolina. The SEHSR trains have slightly different service patterns in the DC2RVA corridor than the existing Amtrak service, and use different routes south of the DC2RVA corridor, where SEHSR trains are expected to provide a faster and more direct route to Raleigh and Charlotte, NC.

From Washington, D.C., all new SEHSR trains would continue on to Philadelphia, New York, and Boston. The plan is to incorporate this service in to Amtrak's regional and long-distance intercity passenger rail network. Refer to Chapter 2 of the Draft EIS for full summary of proposed service and ridership.

2.1.2 Tier II EIS Planning Dates

For this EIS, FRA and DRPT established two important planning dates. The first planning date is 2025, which is FRA and DRPT's current best estimate of when construction of the DC2RVA infrastructure could be completed and the new DC2RVA service would be placed in operation. FRA and DRPT's estimate of the year 2025 as the "opening day" is dependent on many factors, not the least of which is finalizing the EIS and Record of Decision. The date also assumes that federal funding in addition to other funding sources will be available at the level required to build all of the proposed infrastructure improvements and acquire the necessary equipment and train-sets. DRPT based this date on an aggressive but potentially achievable schedule assumption that all necessary permits, approvals, agreements, and funding could be finalized by 2020, final design would take one year (2021), right-of-way acquisition (if needed) would take one year (2022), and construction would take three years (2023 – 2025). FRA and DRPT also used 2025 as the date when the physical impacts associated with DC2RVA Project construction would take place. Thus, all of the physical impact analyses within this Draft EIS on human and natural resources are estimated for 2025, and compared to the No Build Alternative conditions projected for 2025.

The second key planning date established by FRA and DRPT is the planning horizon date of 2045, 20 years after the projected implementation of the new rail service in 2025. Both the Passenger Rail Investment and Improvement Act (PRIIA) and FRA guidance require that DRPT demonstrate that the proposed project is sufficient to deliver the proposed passenger rail benefits and an efficient and reliable multimodal rail corridor over a 20-year time horizon following the completion of the passenger project. DRPT uses operational simulations analysis, as discussed in Section 2.6.2, to test the proposed alternatives to determine if the rail capacity is adequate for both the opening day (2025) levels of projected freight, commuter and passenger rail traffic and to determine if the infrastructure remains adequate over the 20 year planning horizon or until 2045. DRPT also used the 2045 planning horizon date to estimate some of the longer term effects of the proposed service such as ridership, energy use, and effects on air quality, as well as indirect and cumulative effects.

2.2 PROJECT ALTERNATIVES

Developing potential rail alignments was an iterative process. DRPT relied on previous studies and public scoping comment as the starting point for developing potential rail alignments. Rail alignment modifications were made to avoid or minimize potential adverse effects on environmental resources and existing infrastructure, and to minimize the need for additional new infrastructure, while preserving the ability of that alignment to meet the Project's Purpose and Need. The final screening evaluation—to determine the Build Alternatives to be carried forward for evaluation in the Draft EIS—focused on each rail alignment's ability to reduce trip times based on increased track design speed and to increase the reliability of rail operations based upon added capacity, with the least potential environmental impact and consideration of cost to construct.

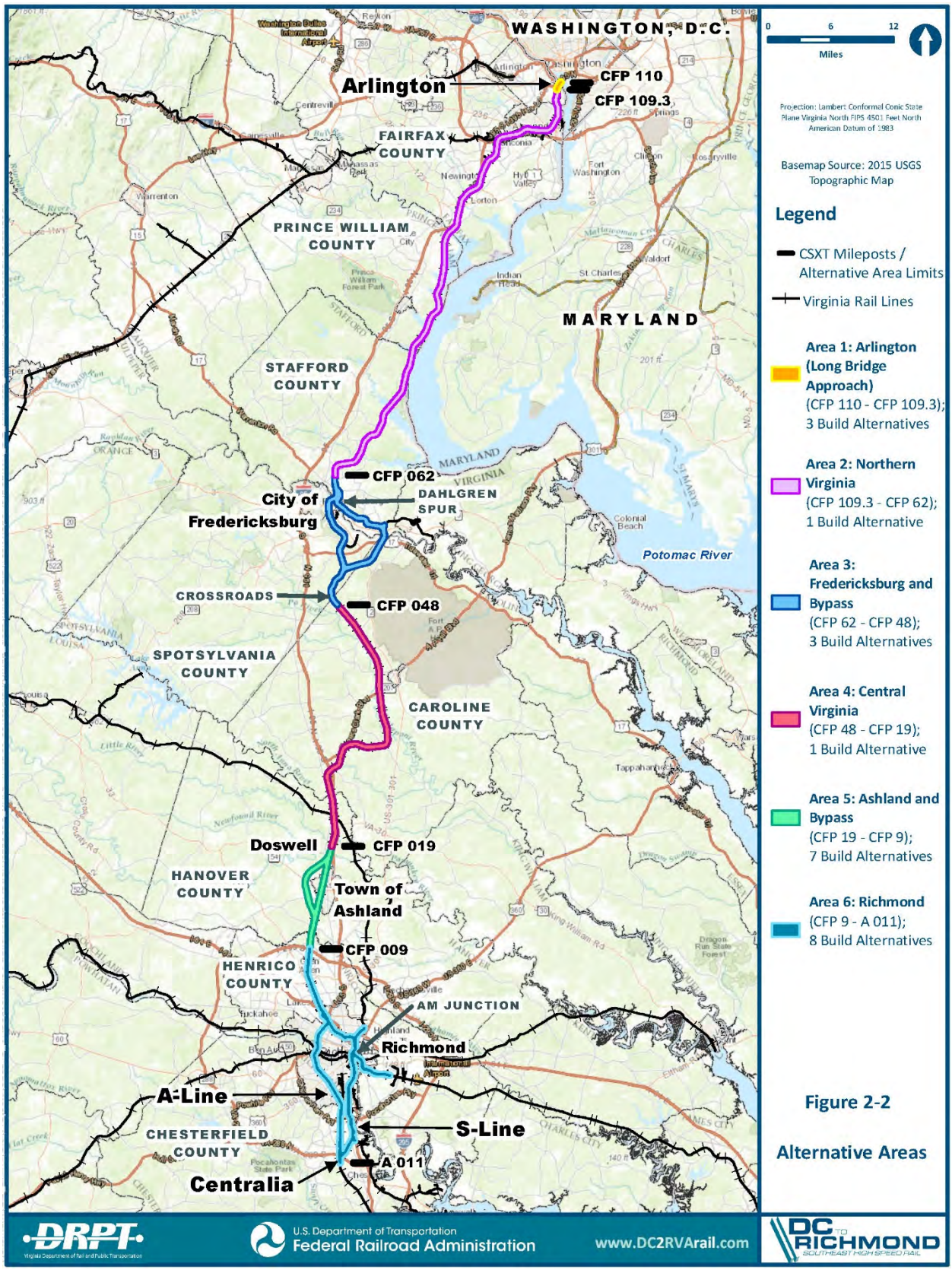
As part of the Build Alternatives, DRPT evaluated both existing and potential new passenger rail stations in the DC2RVA corridor. DRPT plans to incorporate the DC2RVA SEHSR passenger train service into Amtrak's regional and long distance intercity passenger rail network; along the DC2RVA corridor, these existing stations include: Alexandria, Woodbridge, Quantico, Fredericksburg, Ashland, and Staples Mill Road and Main Street in Richmond. Additionally, in Richmond, DRPT is considering two proposed new locations under some Build Alternatives: Boulevard Station and Broad Street Station. However, not all proposed trains would necessarily serve all existing or proposed stations.

For evaluation in the Tier II Draft EIS, DRPT combined and categorized Build Alternatives into six alternative areas along the corridor (Figure 2-2):

- Alternative Area 1: Arlington (Long Bridge Approach): 1-mile section that includes approach alignments to the Long Bridge, which crosses the Potomac River between VA and DC.
- Alternative Area 2: Northern Virginia: 47-mile section that includes additional track within existing railroad right-of-way.
- Alternative Area 3: Fredericksburg (Dahlgren Spur to Crossroads): 14-mile section that includes alignments through or around the city.
- Alternative Area 4: Central Virginia (Crossroads to Doswell): 29-mile section that includes additional track primarily within the existing railroad right-of-way.
- Alternative Area 5 Ashland: Ashland (Doswell to I-295): 10-mile section including alignments through or around the town.
- Alternative 6 Richmond (I-295 to Centralia): 23-mile section including different station locations and routing options along the A-Line and/or S-Line.

Project Build Alternatives were developed separately, specific to the existing conditions, constraints, and/or needs of each of the six areas, and will be linked to form a single DRPT Recommended Preferred Alternative for the corridor, to be confirmed in the Final EIS and Record of Decision (ROD).

Refer to Chapter 2 of the Draft EIS for full summary of the alternatives development process and description of Build Alternatives, and Chapter 7 of the Draft EIS for description of the DRPT Recommended Preferred Alternative.


WASHINGTON, D.C.
Arlington
CFP 110
CFP 109.3
FAIRFAX COUNTY
PRINCE WILLIAM COUNTY
MARYLAND
STAFFORD COUNTY
CFP 062
City of Fredericksburg
DAHLGREN SPUR
Potomac River
CROSSROADS
CFP 048
SPOTSYLVANIA COUNTY
CAROLINE COUNTY
Doswell
CFP 019
HANOVER COUNTY
Town of Ashland
CFP 009
HENRICO COUNTY
AM JUNCTION
Richmond
A-Line
S-Line
CHESTERFIELD COUNTY
A 011
Centralia
0 6 12
Miles
Projection: Lambert Conformal Conic State Plane Virginia North FIPS 4501 Feet North American Datum of 1983
Basemap Source: 2015 USGS Topographic Map
Legend
CSXT Mileposts / Alternative Area Limits
Virginia Rail Lines
Area 1: Arlington (Long Bridge Approach) (CFP 110 - CFP 109.3); 3 Build Alternatives
Area 2: Northern Virginia (CFP 109.3 - CFP 62); 1 Build Alternative
Area 3: Fredericksburg and Bypass (CFP 62 - CFP 48); 3 Build Alternatives
Area 4: Central Virginia (CFP 48 - CFP 19); 1 Build Alternative
Area 5: Ashland and Bypass (CFP 19 - CFP 9); 7 Build Alternatives
Area 6: Richmond (CFP 9 - A 011); 8 Build Alternatives
Figure 2-2
Alternative Areas
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In general, the DC2RVA Project proposes to increase capacity by adding one additional main track. In most areas, the Project will add a new third track in addition to two existing tracks. The determination of the location of the new track on the east or west of existing trackage varies by location within the corridor based on physical constraints and minimization of impacts. For each alternative, DRPT also evaluated the potential to realign the tracks to improve speeds. The proposed Build Alternatives vary within the City of Fredericksburg and the Town of Ashland, where alignments outside of the existing right-of-way were considered (i.e., bypass alignments around the downtown areas); the typical section of the new bypass alignments consists of two tracks.

From a wide range of options that were considered during the alternatives development process, 23 Build Alternatives, which vary within each alternative area, were included for evaluation in the Draft EIS (Table 2-1).

Table 2-1: Build Alternatives

Alternative Area	Alternative	Description
Area 1: Arlington (Long Bridge Approach)	1A	Add Two Tracks on the East
	1B	Add Two Tracks on the West
	1C	Add One Track East and One Track West
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	Add One Track/Improve Existing Track
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	Maintain Two Tracks Through Town
	3B	Add One Track East of Existing
	3C	Add Two-Track Bypass East
Area 4: Central Virginia (Crossroads to Doswell)	4A	Add One Track/Improve Existing Track
Area 5: Ashland (Doswell to I-295)	5A	Maintain Two Tracks Through Town
	5A–Ashcake	Maintain Two Tracks Through Town (Relocate Station to Ashcake)
	5B	Add One Track East of Existing
	5B–Ashcake	Add One Track East of Existing (Relocate Station to Ashcake)
	5C	Add Two-Track West Bypass
	5C–Ashcake	Add Two-Track West Bypass (Relocate Station to Ashcake)
	5D–Ashcake	Three Tracks Centered Through Town (Add One Track, Relocate Station to Ashcake)
Area 6: Richmond (I-295 to Centralia)	6A	Staples Mill Road Station Only
	6B–A-Line	Boulevard Station Only, A-Line
	6B–S-Line	Boulevard Station Only, S-Line
	6C	Broad Street Station Only
	6D	Main Street Station Only
	6E	Split Service, Staples Mill Road/Main Street Stations
	6F	Full Service, Staples Mill Road/Main Street Stations
	6G	Shared Service, Staples Mill Road/Main Street Stations

As shown in the table, the eight Build Alternatives in Richmond include four single-station options that would consolidate passenger service to one station, and three two-station alternatives that offer combinations of services and rail line routes using Main Street Station and Staples Mill Road Station. These Richmond station options drive the corridor-wide operations of the DC2RVA Project. Ridership, travel time, and on-time performance vary by Build Alternative

based on the different Richmond station options. Estimated travel time between Washington, D.C. and Richmond is dependent on the number and location of station stops as well as the track design.

Each Build Alternative includes build-alternative-specific improvements to features such as stations and at-grade roadway crossings, as applicable. The following sections provide details of each of these Build Alternatives, as well as the No Build Alternative.

2.2.1 No Build Alternative

The No Build Alternative defines the future infrastructure and service levels that will result from planned investments in the Washington, D.C. to Richmond rail corridor, independent of the improvements planned by the DC2RVA Project.

Information about planned physical improvements and rail service additions in the corridor was gathered from fiscally-constrained Metropolitan Planning Organization (MPO) planning documents, Commonwealth multiyear improvement programs, and from transit agency planning documents. If a project was under construction, fully-funded, or was the focus of advanced collaborative planning (evidenced by partial funding, board-level commitments, or interagency agreements), it was assumed to be complete by 2025 for the purposes of the Draft EIS evaluation. Chapter 2 of the Draft EIS provides full description of elements included in the No Build Alternative.

The purpose of the No Build Alternative is to serve as a baseline for comparison of potential effects and impacts of the DC2RVA Build Alternatives. The No Build alternative was fully evaluated and dismissed by the FRA in the 2002 SEHSR Tier I ROD because it does not meet the SEHSR Purpose and Need. Although previously dismissed as not a viable alternative, it is fully considered as part of the Tier II Draft EIS for the DC2RVA Project because the baseline is required by the National Environmental Policy Act (NEPA).

2.2.2 Build Alternatives

The 23 Build Alternatives that are evaluated in the Tier II EIS for the DC2RVA Project are summarized below. Chapter 2 of the Draft EIS provides full information, including lists of specific improvements for track and station improvements, for each Build Alternative.

Figures 2-3 through 2-23 show the proposed rail alignment improvements by alternative. Figures 2-24 through 2-40 show the proposed station improvements. Note that all figures are provided at the end of this section.

2.2.2.1 Build Alternatives in Area 1: Arlington (Long Bridge Approach)

There are three Build Alternatives in Area 1, which are described in Table 2-2. Build Alternative 1A, 1B, and 1C are shown in Figure 2-3. There are no stations within this alternative area.

Table 2-2: Arlington Area Build Alternatives: 1A, 1B, and 1C

TRACK
All three Build Alternatives would: ▪ Equally support expanded intercity passenger service (all types), expanded VRE commuter service, and expanded CSXT freight service

Table 2-2: Arlington Area Build Alternatives: 1A, 1B, and 1C

▪ Add two main tracks, with minor shifts to improve speed ▪ Be constructed within existing railroad right-of-way
The difference between the alternatives is on which side(s) of the existing track the new track is added (as indicated in Build Alternative names): two tracks on the east (1A); two tracks on the west (1B); one track east and one track west (1C)
Final decision deferred to the completion of the Long Bridge Study (separate study by DDOT)
Track maximum authorized speed: ≤ 45 mph
STATIONS
No stations within area
CROSSINGS
No changes to existing public roadway crossings

2.2.2.2 Build Alternatives in Area 2: Northern Virginia

There is one Build Alternative in Area 2, which is described in Table 2-3. Build Alternative 2A is shown in Figure 2-4.

Table 2-3: Northern Virginia Build Alternative 2A

TRACK
One main track would be added, with realignment of some curves to improve speed, to create: ▪ Fourth track from Alexandria to Crystal City ▪ Third track from Spotsylvania to Alexandria
Improvements are generally within existing right-of-way
Track maximum authorized speed: ≤ 79 mph
STATIONS
Station improvements are mainly platform improvements and to be performed by VRE
Proposed new DC2RVA service includes: ▪ Alexandria: Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) *(Figure 2-24)* ▪ Woodbridge: Northeast Regional (SEHSR) *(Figure 2-25)* ▪ Quantico: Northeast Regional (SEHSR) *(no figure)* ▪ All other stations: VRE service only *(no figure)*
No changes to the locations of Amtrak (Interstate Corridor (Carolinian), Northeast Regional (Virginia), Long Distance, or Auto Train) or VRE commuter stations served
CROSSINGS
Close one existing public roadway crossing (Mount Hope Church Road), with alternate access provided; no grade separations of at-grade crossings
All other public roadway crossings would remain at-grade, with safety improvements
Major water crossings at Occoquan River, Neabsco Creek, and Aquia Creek

2.2.2.3 Build Alternatives in Area 3: Fredericksburg

There are three Build Alternatives in Area 3, which are described in Table 2-4, Table 2-5, and Table 2-6. Build Alternative 3A, 3B, and 3C are shown in Figure 2-5, Figure 2-6, and Figure 2-7

respectively. All three Build Alternatives would support expanded intercity passenger (all types), VRE commuter, and CSXT freight service, without change to stations served by existing Amtrak Interstate Corridor (Carolinian), Northeast Regional (Virginia), and Long Distance passenger service or VRE commuter service. Due to constraints of the geography through this location, the maximum authorized speed in this section is designed for 79 mph where feasible. Build Alternative 3B is consistent with the City of Fredericksburg Comprehensive Plan (2015).

Table 2-4: Fredericksburg Area Build Alternative 3A

TRACK
No construction of new track / no additional rail capacity within Fredericksburg ▪ Existing two main tracks would be maintained, which are used by freight, passenger, and commuter trains, similar to existing conditions ▪ Tracks would be shifted in some areas to improve speed Construction of one additional track, with some track shifts to improve speed, north and south of the city All improvements are within existing right-of-way Track maximum authorized speed: ≤ 79 mph
STATIONS
Improvements to Fredericksburg Station would include a new station building, side platform improvements, and a new parking structure *(Figure 2-26)* Proposed new DC2RVA service at Fredericksburg Station: Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) The other station in this alternative area is located in Spotsylvania County and provides VRE service only
CROSSINGS
All public roadway crossings would remain at-grade, with safety improvements (no roadway crossing closures or grade separations of public at-grade crossings) Improvements to major rail bridge over the Rappahannock River

Table 2-5: Fredericksburg Area Build Alternative 3B

TRACK
One main track would be added in most areas, with track shifts to improve speed ▪ Within Fredericksburg, the additional track would be added east of the existing two tracks ▪ A third track already exists between Fredericksburg and Spotsylvania stations; therefore, no improvements are required in this section Improvements are generally within existing right-of-way Track maximum authorized speed: ≤ 79 mph
STATIONS
Improvements to Fredericksburg Station would include a new station building, a new elevated railway, side and center platform improvements, and a new parking structure *(Figure 2-27)* Proposed new DC2RVA service at Fredericksburg Station: Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) The other station in this alternative area is located in Spotsylvania County and provides VRE service only

Table 2-5: Fredericksburg Area Build Alternative 3B

CROSSINGS
Proposed new DC2RVA service at Fredericksburg Station: Northeast Regional (SEHSR) and Interstate Corridor (SEHSR)
The other station in this alternative area is located in Spotsylvania County and provides VRE service only
Improvements to major rail bridge over the Rappahannock River

Table 2-6: Fredericksburg Area Build Alternative 3C

TRACK
Existing two-track corridor through the city would be maintained, with some track shifts to improve speed
New two-track bypass would be constructed east of the city ▪ Would serve all freight rail as well as some or all of Interstate Corridor (SEHSR) and Amtrak Interstate Corridor (Carolinian), Long Distance, and Auto Train passenger trains ▪ Would require new right-of-way
Construction of one additional track, with some track shifts to improve speed, north and south of the bypass
Track maximum authorized speed: ≤ 79 mph
STATIONS
Improvements to Fredericksburg station would include a new station building, side platform improvements, and a new parking structure *(Figure 2-26)*
Proposed new DC2RVA service at Fredericksburg Station: Northeast Regional (SEHSR) and Interstate Corridor (SEHSR)
The other station in this alternative area is located in Spotsylvania County and provides VRE service only
CROSSINGS
Public roadway crossings along existing Dahlgren Spur would remain at-grade, with safety improvements
All new public roadway crossings on the bypass would be grade-separated
All other public roadway crossings would remain at-grade, with safety improvements
Improvements to major rail bridge over the Rappahannock River

2.2.2.4 Build Alternatives in Area 4: Central Virginia

There is one Build Alternative in Area 4, which is described in Table 2-7. Build Alternative 4A is shown in Figure 2-8. Based on geography throughout this area, this section is most suitable for higher speed passenger rail service, and therefore provides the greatest contiguous section along the DC2RVA corridor with a maximum authorized speed up to 90 mph. There are no stations within this alternative area.

Table 2-7: Central Virginia area Build Alternative: 4A

TRACK
One main track would be added, with track shifts to improve speed
Improvements are generally within existing right-of-way
Supports expanded intercity passenger service (all types) and CSXT freight service
Track maximum authorized speed: ≤ 90 mph

Table 2-7: Central Virginia area Build Alternative: 4A

STATIONS
No stations within the area
Would not preclude the development of a proposed future station at Carmel Church (not included as part of this study)
CROSSINGS
Close one existing public roadway crossing (Colemans Mill Road); no grade separations of at-grade crossings
All other public roadway crossings would remain at-grade, with safety improvements
Multiple crossings of small waterways and wetlands

2.2.2.5 Build Alternatives in Area 5: Ashland

There are seven Build Alternatives in Area 5, which are described in Table 2-8 through Table 2-11 below. Build Alternative 5A, 5A–Ashcake, 5B, 5B–Ashcake, 5C, 5C–Ashcake, and 5D–Ashcake are shown in Figure 2-9, Figure 2-10, Figure 2-11, Figure 2-12, Figure 2-13, Figure 2-14, and Figure 2-15, respectively.

The Ashland Build Alternatives include different station locations: either maintaining the station at the existing downtown station with improvements (Build Alternatives 5A, 5B, and 5C) or relocating the station to south of Ashcake Road (all Build Alternatives with "–Ashcake" in their name). The Build Alternatives with the same letter, with and without the "–Ashcake" designation, are otherwise similar in terms rail alignment through Ashland and identical north and south of Town. For ease of comparison, they are presented together in the tables below.

Due to constraints of the geography through this location, the maximum authorized speed in this section is designed for 79 mph where feasible, with an existing 35 mph municipal slow order through the Town of Ashland.

Table 2-8: Ashland Area Build Alternatives: 5A and 5A–Ashcake

TRACK
Both alternatives would maintain two existing tracks (no construction of new track/no additional rail capacity) within Ashland
Both alternatives would construct one additional track, with some track shifts to improve speed, north and south of the town
All rail improvements are generally within existing right-of-way
STATIONS
Both alternatives would provide Northeast Regional (SEHSR and Virginia) service at different station locations: ▪ 5A: Would maintain existing station location with improvements, including 850-foot platforms, which would require closure of the existing roadway crossing at College Avenue; use of shorter, 350-foot platforms is an option to minimize impacts *(Figure 2-28 A & B)* ▪ 5A–Ashcake: Would close the existing station location and relocate service to a new the station south of Ashcake Road *(Figure 2-29)*
CROSSINGS
Both alternatives include the grade separation of two existing at-grade roadway crossings in Ashland: West Vaughan Road and Ashcake Road
All other existing public roadway crossings would remain at-grade, with safety improvements

Table 2-9: Ashland Area Build Alternatives: 5B and 5B–Ashcake

TRACK
Both alternatives would maintain two existing tracks and construct one additional track east of the existing tracks within Ashland ▪ The addition of a third track through town would require closure of a short portion of Railroad Avenue/Center Street ▪ New right-of-way would be required for rail improvements within the town Both alternatives would construct one additional track, with some track shifts to improve speed, north and south of the town ▪ Rail improvements north and south of the town are generally within existing right-of-way
STATIONS
Both alternatives would provide Northeast Regional (SEHSR and Virginia), with different station locations: ▪ 5B: Would maintain existing station location with improvements, including 850-foot platforms, which requires closure of the existing roadway crossing at College Avenue; use of shorter, 350-foot platforms is an option to minimize impacts *(Figure 2-30 A & B)* ▪ 5B–Ashcake: Would close the existing station location and relocate service to a new the station south of Ashcake Road *(Figure 2-29)*
CROSSINGS
Both alternatives include the grade separation of two existing at-grade roadway crossings in Ashland: West Vaughan Road and Ashcake Road All other existing public roadway crossings would remain at-grade, with safety improvements

Table 2-10: Ashland Area Build Alternatives: 5C and 5C–Ashcake

TRACK
Both alternatives would construct a two-track bypass, west of Ashland, to serve all freight rail as well as all Interstate Corridor (SEHSR) and Amtrak Interstate Corridor (Carolinian), Long Distance, and Auto Train passenger trains ▪ New right-of-way would be required on bypass alignment Both alternatives would maintain the existing two-track corridor through town ▪ No additional right-of-way needed in town Both alternatives would construct one additional track, with some track shifts to improve speed, north and south of the bypass ▪ Rail improvements north and south of the town are generally within existing right-of-way
STATIONS
Both alternatives would provide Northeast Regional (SEHSR and Virginia) service at different station locations: ▪ 5C: Would maintain existing station location with improvements, including 850-foot platforms, which requires closure of the existing roadway crossing at College Avenue; use of shorter, 350-foot platforms is an option to minimize impacts *(Figure 2-28 A & B)* ▪ 5C–Ashcake: Would close the existing station location and relocate service to a new the station south of Ashcake Road *(Figure 2-29)*
CROSSINGS
All new roadway crossings on the bypass would be grade-separated All existing public roadway crossings within town would remain at-grade, with safety improvements

Table 2-11: Ashland Area Build Alternatives: 5D–Ashcake

TRACK
One additional main line track, with centering of all main line tracks on the existing alignment, would be constructed through the entire area, which generally requires additional railroad right-of-way, especially within the town of Ashland ▪ The addition of a third track through town would require closure of a short portion of Railroad Avenue/Center Street
STATIONS
This rail alignment would require removal of the existing station building and platforms, resulting in the relocation of service to a new station south of Ashcake Road, to provide Northeast Regional (SEHSR and Virginia) service *(Figure 2-29)*
CROSSINGS
Includes the grade separation of two existing at-grade roadway crossings in Ashland: West Vaughan Road and Ashcake Road All other existing public roadway crossings within town would remain at-grade, with safety improvements

2.2.2.6 Build Alternatives in Area 6: Richmond

There are eight Build Alternatives in Area 6. All Build Alternatives generally add one main track (though they vary whether they use the A-Line or S-Line through the city), and they vary in whether they consolidate passenger train service to a single station (including two potential new stations at Boulevard Station or Broad Street Station) or provide combinations of service at two stations. There are no changes to CSXT freight service routes due to proposed changes to passenger train routes as part of the DC2RVA Project. The Amtrak Auto Train does not stop in Richmond.

Five of the Richmond area Build Alternatives are single-station alternatives, which are presented in Table 2-12 through Table 2-16. The single station alternatives are Build Alternative 6A, 6B–A-Line, 6B–S-Line, 6C, and 6D, which are shown in Figure 2-16, Figure 2-17, Figure 2-18, Figure 2-19, and Figure 2-20, respectively. All single-station alternatives consolidate Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) service, as well as all Amtrak Long Distance, Interstate Corridor (Carolinian), and Northeast Regional (Virginia) service, to one station.

Three of the Richmond area Build Alternatives are two-station alternatives, which are presented in Table 2-17 through Table 2-19. All two station alternatives use the existing Staples Mill Road and Main Street Stations. The two station Build Alternatives are Build Alternatives 6E, 6F, and 6G, which are shown in Figure 2-21, Figure 2-22, and Figure 2-23, respectively. All two-station alternatives provide Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) service to at least one station, and serves Amtrak Long Distance, Interstate Corridor (Carolinian), and Northeast Regional (Virginia) to one or both stations.

Table 2-12: Richmond Single Station Build Alternative: 6A (Staples Mill Road Station Only)

TRACK
One main track would be added along portions of RF&P (north of Richmond) and A-Line (through Richmond), with track shifts to improve speed
STATIONS
Existing Main Street Station would be closed to passenger rail service, and all service consolidated at Staples Mill Road Station Staples Mill Road Station would be improved and becomes the one passenger rail station to serve Richmond *(Figure 2-31)*

Table 2-12: Richmond Single Station Build Alternative: 6A (Staples Mill Road Station Only)

▪ Does not meet FRA requirement for CBD location ▪ Would be served by all passenger trains, including new proposed Interstate Corridor (SEHSR) and Northeast Regional (SEHSR) service Freight and passenger rail service operating together on the A-Line, CSXT's principal freight corridor, would increase rail congestion/delay
CROSSINGS
Close four existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-13: Richmond Single Station Build Alternative: 6B–A-Line (Boulevard Station Only)

TRACK
One of two Boulevard Station-Only alternatives in Area 6 One main track would be added along portions of existing RF&P (north of Richmond) and A-Line (through Richmond), with track shifts to improve speed Elevated loop track at new station
STATIONS
Main Street and Staples Mill Road stations would be closed to passenger rail service and all service relocated and consolidated to a new station at Boulevard Road New Boulevard Road Station would be the one passenger rail station to serve Richmond *(Figure 2-32)* ▪ May not meet FRA requirement for CBD location ▪ Would be served by all passenger trains, including new proposed Interstate Corridor (SEHSR) and Northeast Regional (SEHSR) service Freight and passenger rail service operating together on the A-Line, CSXT's principal freight corridor, would increase rail congestion/delay
CROSSINGS
Close four existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-14: Richmond Single Station Build Alternative: 6B–S-Line (Boulevard Station Only)

TRACK
Second of two Boulevard Station-Only alternatives in Area 6 One main track would be added along portions of existing RF&P (north of Richmond) and S-Line (through Richmond), with track shifts to improve speed
STATIONS
Existing Main Street and Staples Mill Road stations would be closed to passenger rail service and all service relocated and consolidated to a new station at Boulevard Road New Boulevard Road Station would be the one passenger rail station to serve Richmond *(Figure 2-32)* ▪ May not meet FRA requirement for CBD location ▪ Would be served by all passenger trains, including new proposed Interstate Corridor (SEHSR) and Northeast Regional (SEHSR) service Locating all passenger train service (except Auto Train, which does not stop in Richmond) to S-Line, separate from CSXT's principal freight corridor through Richmond (the A-Line), would reduce rail congestion/delay
CROSSINGS
Close five existing public roadway crossings; grade separate four at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-15: Richmond Single Station Build Alternative: 6C (Broad Street Station Only)

TRACK
One main track would be added along portions of existing RF&P (north Richmond) and A-Line (through Richmond), with track shifts to improve speed At-grade loop track at new station
STATIONS
Existing Main Street and Staples Mill Road stations would be closed to passenger rail service New Broad Street Station would be the one passenger rail station to serve Richmond *(Figure 2-33)* ▪ May not meet FRA requirement for CBD location ▪ Would be served by all passenger trains, including new proposed Interstate Corridor (SEHSR) and Northeast Regional (SEHSR) service Freight and passenger rail service operating together on the A-Line, CSXT's principal freight corridor, would increase rail congestion/delay
CROSSINGS
Station location would require two new at-grade crossings on West Leigh Street adjacent to proposed station, which would require a variance from state code and/or coordination with VDOT Close four existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-16: Richmond Single Station Build Alternative: 6D (Broad Street Station Only)

TRACK
One main track would be added along portions of existing RF&P (north of Richmond) and S-Line (through Richmond), with track shifts to improve speed
STATIONS
Existing Staples Mill Road Station would be closed to passenger rail service and all service consolidated at Main Street Station Main Street Station would be improved and be the one passenger rail station to serve Richmond *(Figure 2-34)* ▪ Meets FRA requirement for CBD location ▪ Would be served by all passenger trains, including new proposed Interstate Corridor (SEHSR) and Northeast Regional (SEHSR) service ▪ Potential increases in passenger and freight delay may occur as proximity to I-95 prevents adding sufficient station platforms / track on the west side of the station Locating all passenger train service (except Auto Train, which does not stop in Richmond) to S-Line, separate from CSXT's principal freight corridor through Richmond (the A-Line), would reduce rail congestion/delay
CROSSINGS
Close five existing public roadway crossings; grade separate three at-grade crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-17: Richmond Two Station Build Alternative: 6E (Split Service)

TRACK
One main track would be added along portions of existing RF&P (north of Richmond) and A-Line (through Richmond), with track shifts to improve speed
STATIONS
Both existing stations would remain operational. All passenger trains would serve Staples Mill Road Station; trains to and from Newport News would additionally serve Main Street Station. ▪ Staples Mill Road Station would be expanded and would be served by all passenger trains that stop in Richmond, including new proposed Northeast Regional (SEHSR) to Norfolk and Interstate Corridor (SEHSR) trains *(Figure 2-35)*

Table 2-17: Richmond Two Station Build Alternative: 6E (Split Service)

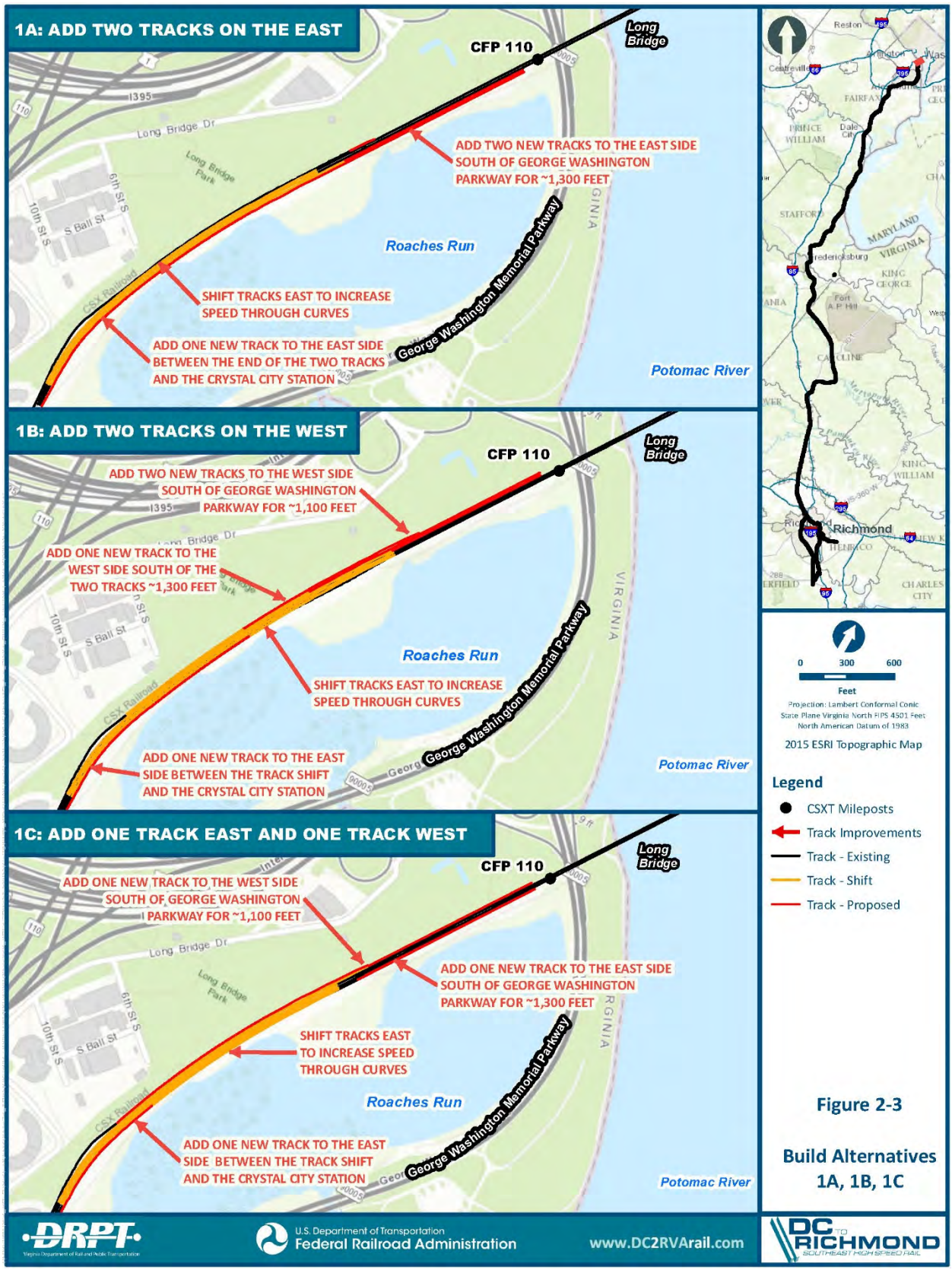
▪ Main Street Station would have platform and parking improvements and would be served by all Northeast Regional (SEHSR and Virginia) passenger trains to Newport News *(Figure 2-36)* Freight and passenger rail service operating together on the A-Line, CSXT's principal freight corridor, would increase rail congestion/delay
CROSSINGS
Close four existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

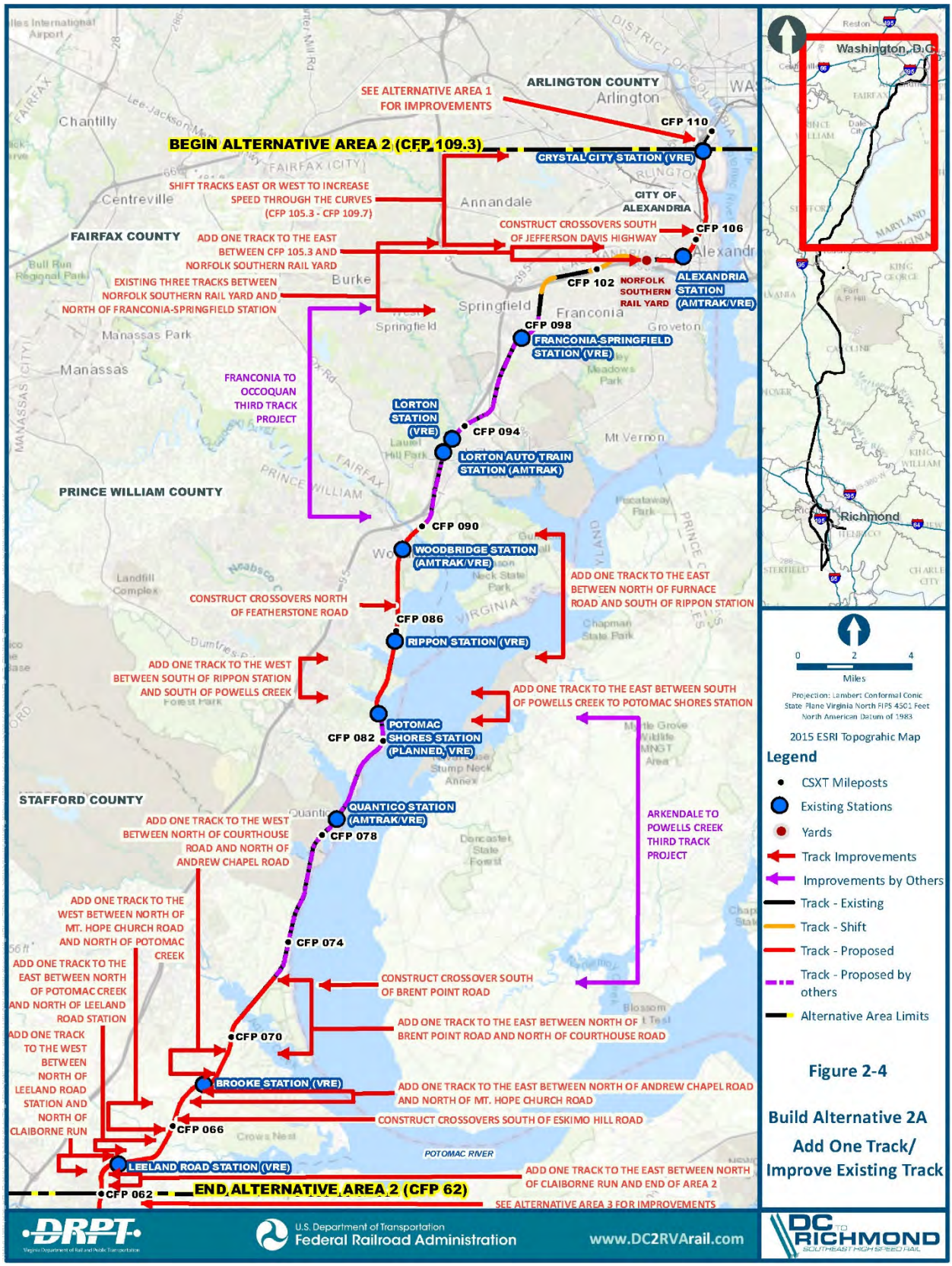
Table 2-18: Richmond Two Station Build Alternative: 6F (Full Service)

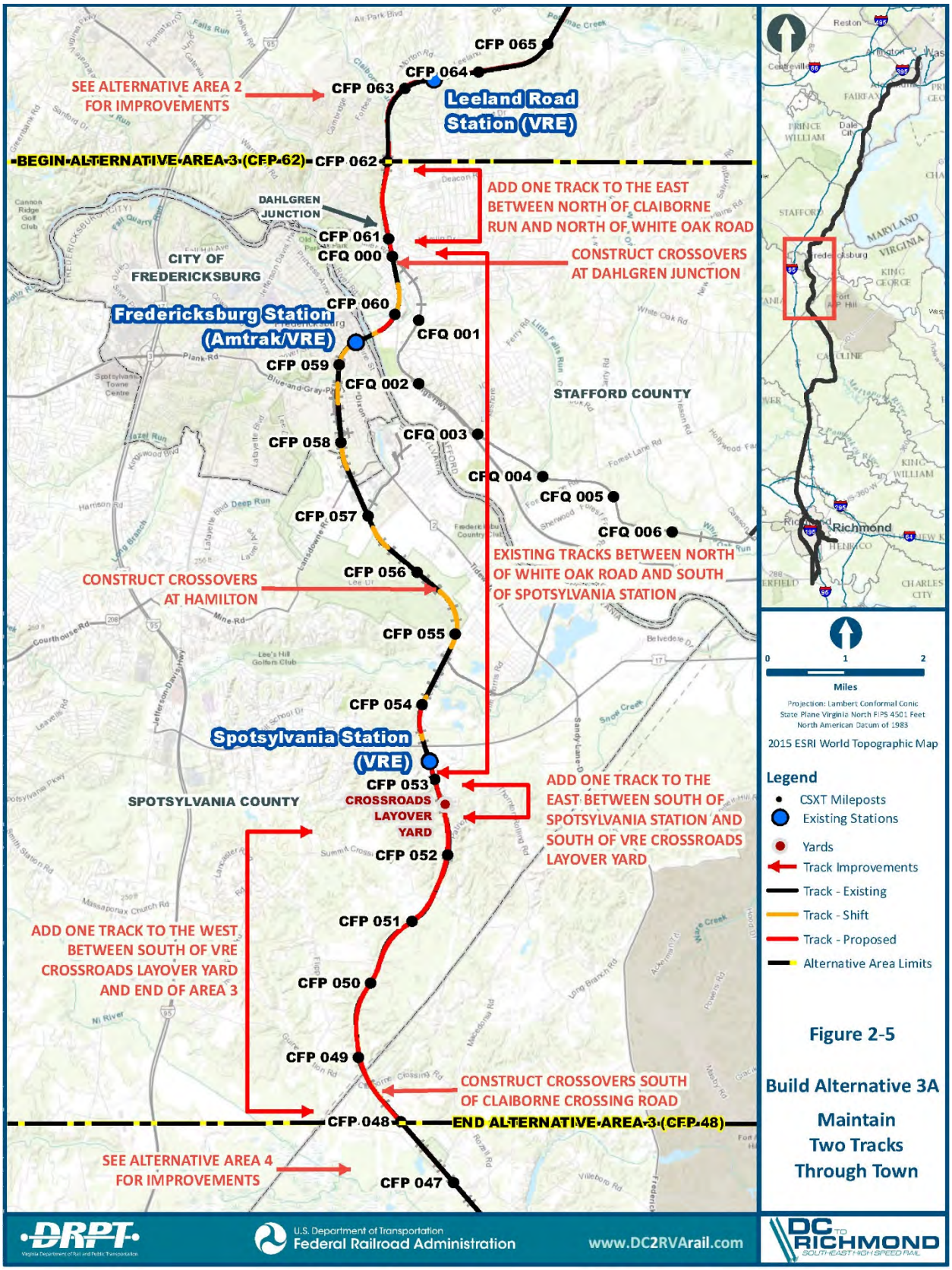
TRACK
One main track would be added along portions of existing RF&P (north of Richmond) and S-Line (through Richmond), with track shifts to improve speed
STATIONS
Both existing stations would remain operational, with all passenger trains serving both stations. ▪ Both stations would be improved, including new/modified station buildings, platforms, and parking *(Figure 2-37 and Figure 2-38)* ▪ Both stations would be served by all passenger trains that stop in Richmond, including new proposed Northeast Regional (SEHSR) and Interstate Corridor (SEHSR) service Locating all passenger train service (except Auto Train, which does not stop in Richmond) to S-Line, separate from CSXT's principal freight corridor through Richmond (the A-Line), would reduce rail congestion/delay
CROSSINGS
Close five existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River

Table 2-19: Richmond Two Station Build Alternative: 6G (Shared Service)

TRACK
One main track would be added along portions of existing RF&P (north of Richmond) and the S-Line (through Richmond), with track shifts to improve speed ▪ The A-Line is used for service but does not require proposed track
STATIONS
Both existing stations would remain operational, with both stations being served by all new proposed SEHSR service and other Amtrak passenger train services to either one or both stations. ▪ Both stations would be improved, including new/modified station buildings, platforms, and parking *(Figure 2-39 and Figure 2-40)* ▪ Both stations would be served by all Interstate Corridor (SEHSR) and Northeast Regional (SEHSR and Virginia) trains ▪ Long Distance (Amtrak) and Interstate Corridor (Carolinian) would serve Staples Mill Station only Freight and passenger rail service operating together on the A-Line, CSXT's principal freight corridor, would increase rail congestion/delay
CROSSINGS
Close five existing public roadway crossings; grade separate three at-grade roadway crossings All other public roadway crossings would remain at-grade, with safety improvements Major waterway crossing of James River


1A: ADD TWO TRACKS ON THE EAST
CFP 110
Long Bridge
ADD TWO NEW TRACKS TO THE EAST SIDE SOUTH OF GEORGE WASHINGTON PARKWAY FOR ~1,300 FEET
SHIFT TRACKS EAST TO INCREASE SPEED THROUGH CURVES
ADD ONE NEW TRACK TO THE EAST SIDE BETWEEN THE END OF THE TWO TRACKS AND THE CRYSTAL CITY STATION
Roaches Run
George Washington Memorial Parkway
Potomac River
1B: ADD TWO TRACKS ON THE WEST
CFP 110
Long Bridge
ADD TWO NEW TRACKS TO THE WEST SIDE SOUTH OF GEORGE WASHINGTON PARKWAY FOR ~1,100 FEET
ADD ONE NEW TRACK TO THE WEST SIDE SOUTH OF THE TWO TRACKS ~1,300 FEET
SHIFT TRACKS EAST TO INCREASE SPEED THROUGH CURVES
ADD ONE NEW TRACK TO THE EAST SIDE BETWEEN THE TRACK SHIFT AND THE CRYSTAL CITY STATION
Roaches Run
George Washington Memorial Parkway
Potomac River
1C: ADD ONE TRACK EAST AND ONE TRACK WEST
CFP 110
Long Bridge
ADD ONE NEW TRACK TO THE WEST SIDE SOUTH OF GEORGE WASHINGTON PARKWAY FOR ~1,100 FEET
ADD ONE NEW TRACK TO THE EAST SIDE SOUTH OF GEORGE WASHINGTON PARKWAY FOR ~1,300 FEET
SHIFT TRACKS EAST TO INCREASE SPEED THROUGH CURVES
ADD ONE NEW TRACK TO THE EAST SIDE BETWEEN THE TRACK SHIFT AND THE CRYSTAL CITY STATION
Roaches Run
George Washington Memorial Parkway
Potomac River
Richmond
0 300 600
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI Topographic Map
Legend
CSXT Mileposts
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Figure 2-3
Build Alternatives
1A, 1B, 1C
DRPT
U.S. Department of Transportation
Federal Railroad Administration
www.DC2RVArail.com
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


SEE ALTERNATIVE AREA 1 FOR IMPROVEMENTS
ARLINGTON COUNTY
CFP 110
BEGIN ALTERNATIVE AREA 2 (CFP 109.3)
CRYSTAL CITY STATION (VRE)
SHIFT TRACKS EAST OR WEST TO INCREASE SPEED THROUGH THE CURVES (CFP 105.3 - CFP 109.7)
CITY OF ALEXANDRIA
CONSTRUCT CROSSOVERS SOUTH OF JEFFERSON DAVIS HIGHWAY
CFP 106
FAIRFAX COUNTY
ADD ONE TRACK TO THE EAST BETWEEN CFP 105.3 AND NORFOLK SOUTHERN RAIL YARD
EXISTING THREE TRACKS BETWEEN NORFOLK SOUTHERN RAIL YARD AND NORTH OF FRANCONIA-SPRINGFIELD STATION
CFP 102
NORFOLK SOUTHERN RAIL YARD
ALEXANDRIA STATION (AMTRAK/VRE)
CFP 098
FRANCONIA-SPRINGFIELD STATION (VRE)
FRANCONIA TO OCCOQUAN THIRD TRACK PROJECT
LORTON STATION (VRE)
CFP 094
LORTON AUTO TRAIN STATION (AMTRAK)
PRINCE WILLIAM COUNTY
CFP 090
WOODBRIDGE STATION (AMTRAK/VRE)
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF FURNACE ROAD AND SOUTH OF RIPPON STATION
CONSTRUCT CROSSOVERS NORTH OF FEATHERSTONE ROAD
CFP 086
RIPPON STATION (VRE)
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF RIPPON STATION AND SOUTH OF POWELLS CREEK
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF POWELLS CREEK TO POTOMAC SHORES STATION
POTOMAC SHORES STATION (PLANNED, VRE)
CFP 082
STAFFORD COUNTY
QUANTICO STATION (AMTRAK/VRE)
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF COURTHOUSE ROAD AND NORTH OF ANDREW CHAPEL ROAD
CFP 078
ARKENDALE TO POWELLS CREEK THIRD TRACK PROJECT
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF MT. HOPE CHURCH ROAD AND NORTH OF POTOMAC CREEK
CFP 074
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF POTOMAC CREEK AND NORTH OF LEELAND ROAD STATION
CONSTRUCT CROSSOVER SOUTH OF BRENT POINT ROAD
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF LEELAND ROAD STATION AND NORTH OF CLAIBORNE RUN
CFP 070
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF BRENT POINT ROAD AND NORTH OF COURTHOUSE ROAD
BROOKE STATION (VRE)
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF ANDREW CHAPEL ROAD AND NORTH OF MT. HOPE CHURCH ROAD
CONSTRUCT CROSSOVERS SOUTH OF ESKIMO HILL ROAD
CFP 066
POTOMAC RIVER
LEELAND ROAD STATION (VRE)
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF CLAIBORNE RUN AND END OF AREA 2
CFP 062
END ALTERNATIVE AREA 2 (CFP 62)
SEE ALTERNATIVE AREA 3 FOR IMPROVEMENTS
Washington, D.C.
Richmond
0 2 4
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI Topograhic Map
Legend
CSXT Mileposts
Existing Stations
Yards
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Track - Proposed by others
Alternative Area Limits
Figure 2-4
Build Alternative 2A
Add One Track/
Improve Existing Track
DRPT
U.S. Department of Transportation
Federal Railroad Administration
www.DC2RVArail.com
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


CFP 065
CFP 064
CFP 063
Leeland Road Station (VRE)
SEE ALTERNATIVE AREA 2 FOR IMPROVEMENTS
BEGIN ALTERNATIVE AREA 3 (CFP 62)
CFP 062
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF CLAIBORNE RUN AND NORTH OF WHITE OAK ROAD
DAHLGREN JUNCTION
CFP 061
CFQ 000
CONSTRUCT CROSSOVERS AT DAHLGREN JUNCTION
CITY OF FREDERICKSBURG
CFP 060
Fredericksburg Station (Amtrak/VRE)
CFQ 001
CFP 059
CFQ 002
STAFFORD COUNTY
CFP 058
CFQ 003
CFQ 004
CFQ 005
CFP 057
CFQ 006
EXISTING TRACKS BETWEEN NORTH OF WHITE OAK ROAD AND SOUTH OF SPOTSYLVANIA STATION
CONSTRUCT CROSSOVERS AT HAMILTON
CFP 056
CFP 055
CFP 054
Spotsylvania Station (VRE)
CFP 053
CROSSROADS LAYOVER YARD
SPOTSYLVANIA COUNTY
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF SPOTSYLVANIA STATION AND SOUTH OF VRE CROSSROADS LAYOVER YARD
CFP 052
CFP 051
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF VRE CROSSROADS LAYOVER YARD AND END OF AREA 3
CFP 050
CFP 049
CONSTRUCT CROSSOVERS SOUTH OF CLAIBORNE CROSSING ROAD
CFP 048
END ALTERNATIVE AREA 3 (CFP 48)
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 047
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Yards
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-5
Build Alternative 3A
Maintain Two Tracks Through Town
DRPT
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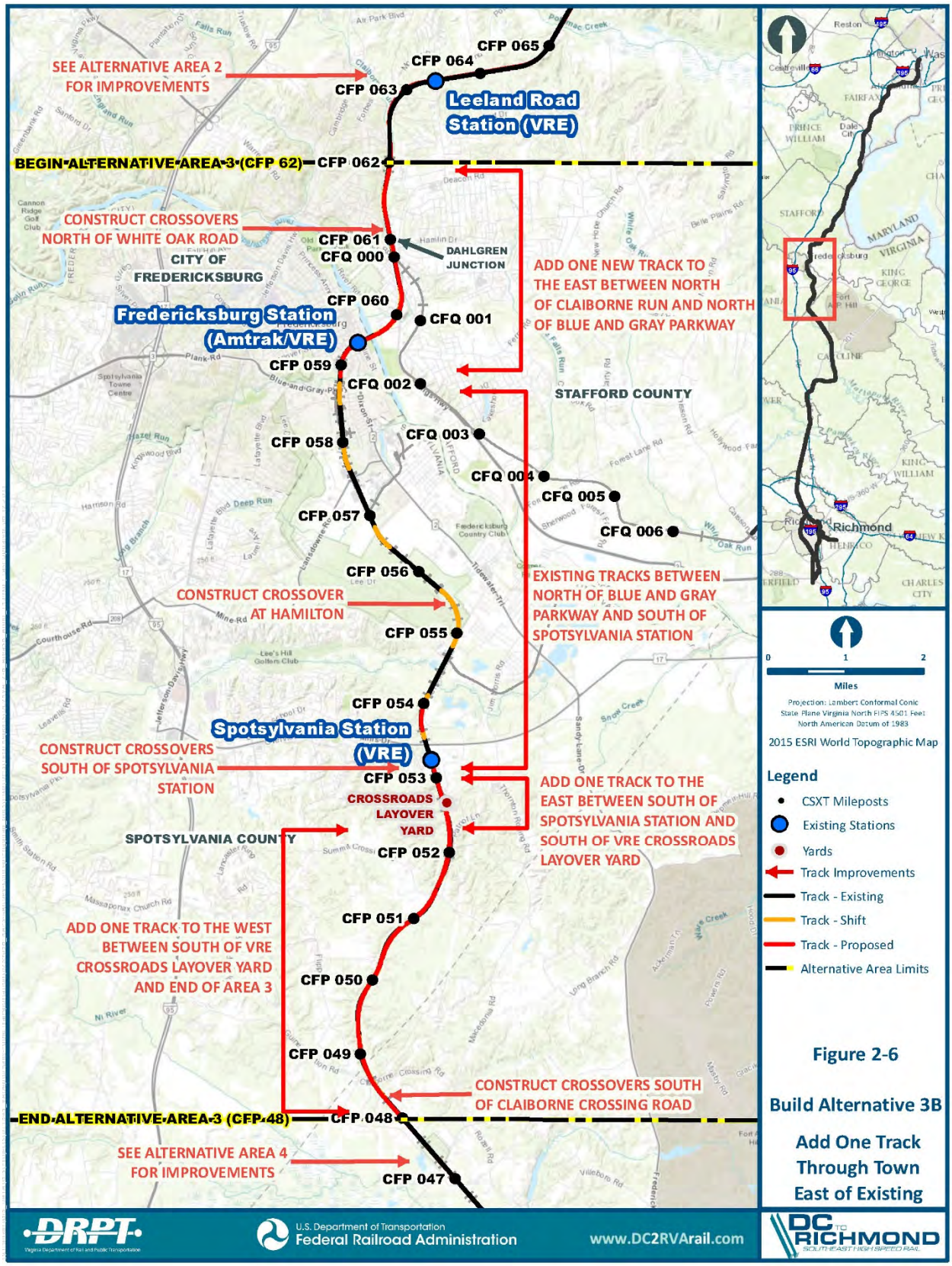
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


SEE ALTERNATIVE AREA 2 FOR IMPROVEMENTS
CFP 065
CFP 064
CFP 063
Leeland Road Station (VRE)
BEGIN ALTERNATIVE AREA 3 (CFP 62)
CFP 062
CONSTRUCT CROSSOVERS NORTH OF WHITE OAK ROAD
CFP 061
CFQ 000
DAHLGREN JUNCTION
CITY OF FREDERICKSBURG
ADD ONE NEW TRACK TO THE EAST BETWEEN NORTH OF CLAIBORNE RUN AND NORTH OF BLUE AND GRAY PARKWAY
CFP 060
CFQ 001
Fredericksburg Station (Amtrak/VRE)
CFP 059
CFQ 002
STAFFORD COUNTY
CFP 058
CFQ 003
CFQ 004
CFQ 005
CFP 057
CFQ 006
CFP 056
EXISTING TRACKS BETWEEN NORTH OF BLUE AND GRAY PARKWAY AND SOUTH OF SPOTSYLVANIA STATION
CONSTRUCT CROSSOVER AT HAMILTON
CFP 055
CFP 054
Spotsylvania Station (VRE)
CONSTRUCT CROSSOVERS SOUTH OF SPOTSYLVANIA STATION
CFP 053
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF SPOTSYLVANIA STATION AND SOUTH OF VRE CROSSROADS LAYOVER YARD
CROSSROADS LAYOVER YARD
SPOTSYLVANIA COUNTY
CFP 052
CFP 051
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF VRE CROSSROADS LAYOVER YARD AND END OF AREA 3
CFP 050
CFP 049
CONSTRUCT CROSSOVERS SOUTH OF CLAIBORNE CROSSING ROAD
END ALTERNATIVE AREA 3 (CFP 48)
CFP 048
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 047
Reston
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Yards
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-6
Build Alternative 3B
Add One Track Through Town East of Existing
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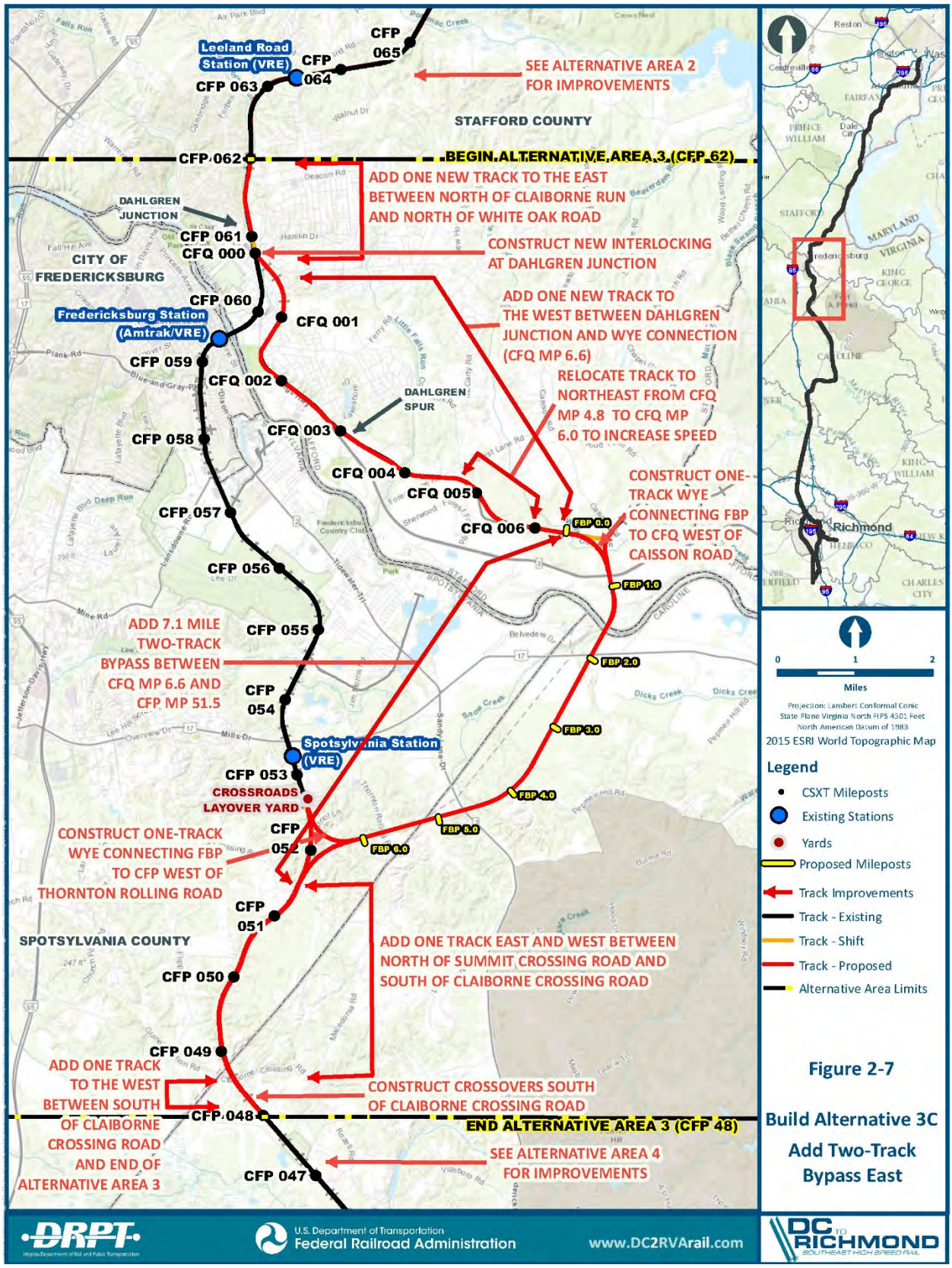
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


CFP 065
Leeland Road Station (VRE)
CFP 064
CFP 063
SEE ALTERNATIVE AREA 2 FOR IMPROVEMENTS
STAFFORD COUNTY
CFP 062
BEGIN ALTERNATIVE AREA 3 (CFP 62)
ADD ONE NEW TRACK TO THE EAST BETWEEN NORTH OF CLAIBORNE RUN AND NORTH OF WHITE OAK ROAD
DAHLGREN JUNCTION
CFP 061
CFQ 000
CONSTRUCT NEW INTERLOCKING AT DAHLGREN JUNCTION
CITY OF FREDERICKSBURG
CFP 060
Fredericksburg Station (Amtrak/VRE)
CFQ 001
ADD ONE NEW TRACK TO THE WEST BETWEEN DAHLGREN JUNCTION AND WYE CONNECTION (CFQ MP 6.6)
CFP 059
CFQ 002
DAHLGREN SPUR
RELOCATE TRACK TO NORTHEAST FROM CFQ MP 4.8 TO CFQ MP 6.0 TO INCREASE SPEED
CFP 058
CFQ 003
CFQ 004
CFQ 005
CONSTRUCT ONE-TRACK WYE CONNECTING FBP TO CFQ WEST OF CAISSON ROAD
CFP 057
CFQ 006
FBP 0.0
CFP 056
FBP 1.0
ADD 7.1 MILE TWO-TRACK BYPASS BETWEEN CFQ MP 6.6 AND CFP MP 51.5
CFP 055
FBP 2.0
CFP 054
FBP 3.0
Spotsylvania Station (VRE)
CFP 053
CROSSROADS LAYOVER YARD
FBP 4.0
CONSTRUCT ONE-TRACK WYE CONNECTING FBP TO CFP WEST OF THORNTON ROLLING ROAD
CFP 052
FBP 5.0
FBP 6.0
CFP 051
SPOTSYLVANIA COUNTY
ADD ONE TRACK EAST AND WEST BETWEEN NORTH OF SUMMIT CROSSING ROAD AND SOUTH OF CLAIBORNE CROSSING ROAD
CFP 050
CFP 049
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF CLAIBORNE CROSSING ROAD AND END OF ALTERNATIVE AREA 3
CONSTRUCT CROSSOVERS SOUTH OF CLAIBORNE CROSSING ROAD
CFP 048
END ALTERNATIVE AREA 3 (CFP 48)
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 047
Reston
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Yards
Proposed Mileposts
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-7
Build Alternative 3C
Add Two-Track Bypass East
DRPT
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Federal Railroad Administration
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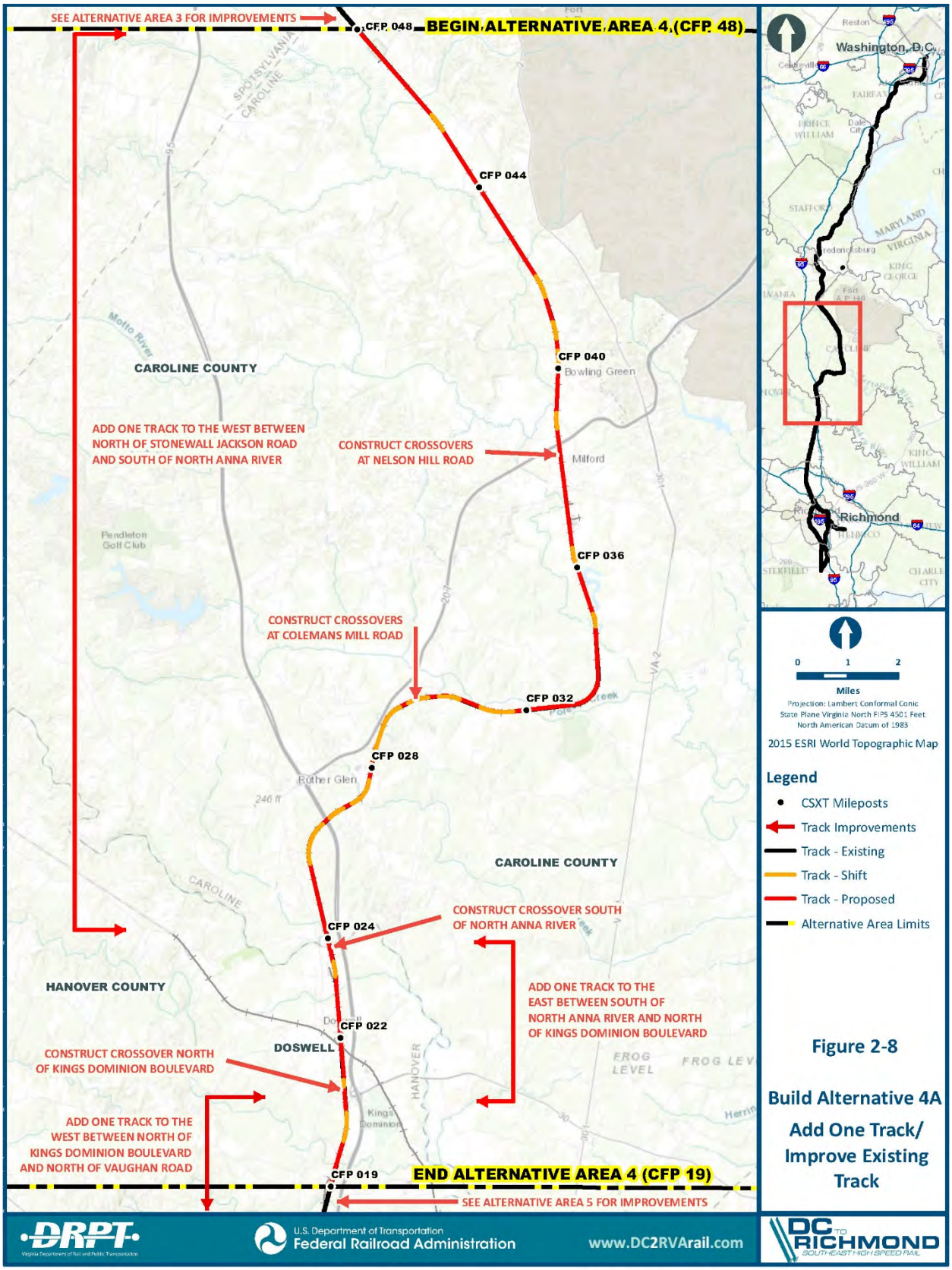
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


SEE ALTERNATIVE AREA 3 FOR IMPROVEMENTS
CFP 048
BEGIN ALTERNATIVE AREA 4 (CFP 48)
CFP 044
CFP 040
Bowling Green
CAROLINE COUNTY
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF STONEWALL JACKSON ROAD AND SOUTH OF NORTH ANNA RIVER
CONSTRUCT CROSSOVERS AT NELSON HILL ROAD
Milford
CFP 036
CONSTRUCT CROSSOVERS AT COLEMANS MILL ROAD
CFP 032
CFP 028
Ruther Glen
CAROLINE COUNTY
CFP 024
CONSTRUCT CROSSOVER SOUTH OF NORTH ANNA RIVER
HANOVER COUNTY
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF NORTH ANNA RIVER AND NORTH OF KINGS DOMINION BOULEVARD
CFP 022
DOSWELL
CONSTRUCT CROSSOVER NORTH OF KINGS DOMINION BOULEVARD
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND NORTH OF VAUGHAN ROAD
CFP 019
END ALTERNATIVE AREA 4 (CFP 19)
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
Washington, D.C.
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-8
Build Alternative 4A
Add One Track/ Improve Existing Track
DRPT
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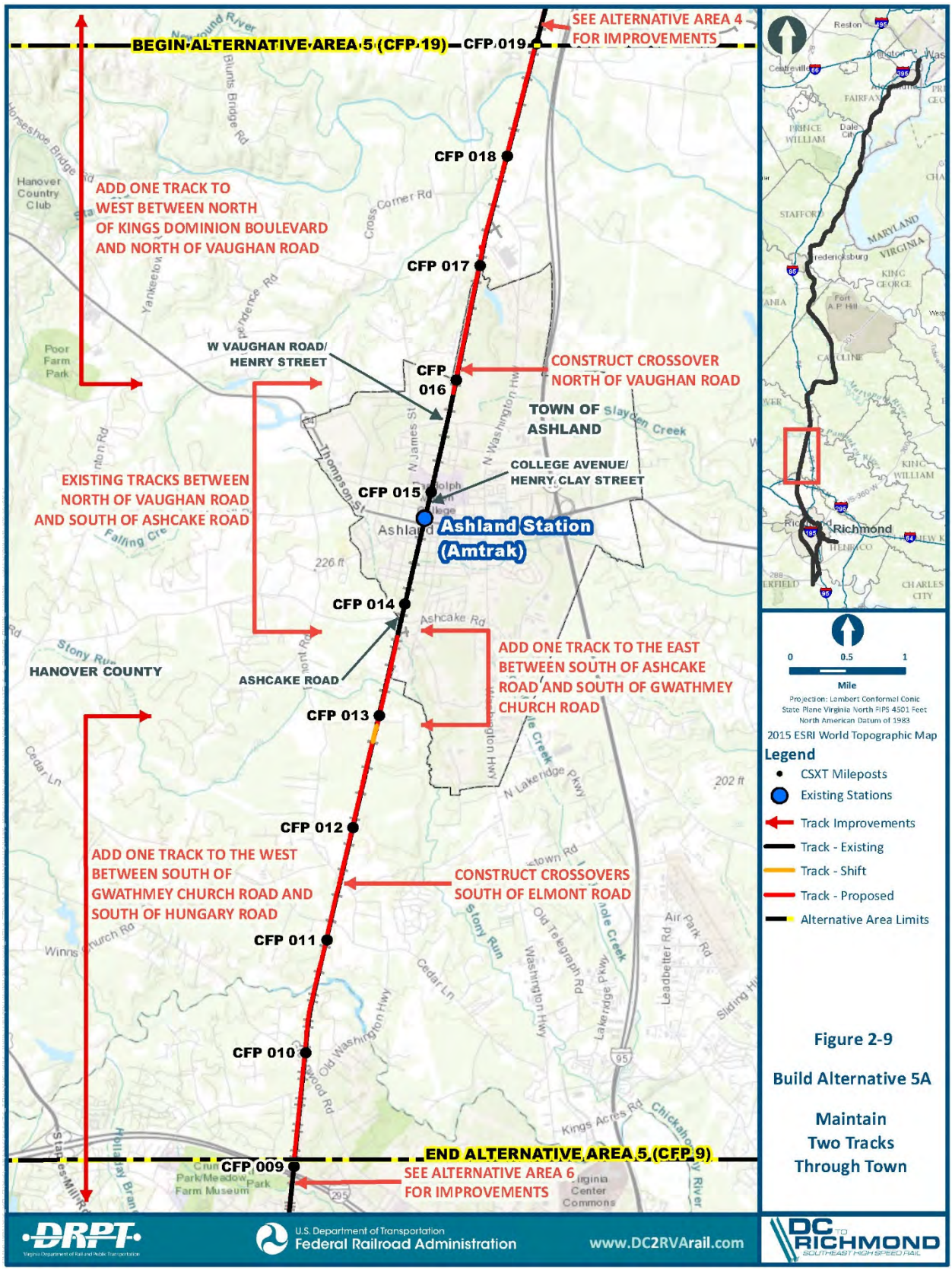
Federal Railroad Administration
www.DC2RVArail.com
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 5 (CFP 19)
CFP 019
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 018
ADD ONE TRACK TO WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND NORTH OF VAUGHAN ROAD
CFP 017
W VAUGHAN ROAD/ HENRY STREET
CFP 016
CONSTRUCT CROSSOVER NORTH OF VAUGHAN ROAD
TOWN OF ASHLAND
COLLEGE AVENUE/ HENRY CLAY STREET
EXISTING TRACKS BETWEEN NORTH OF VAUGHAN ROAD AND SOUTH OF ASHCAKE ROAD
CFP 015
Ashland Station (Amtrak)
CFP 014
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF ASHCAKE ROAD AND SOUTH OF GWATHMEY CHURCH ROAD
HANOVER COUNTY
ASHCAKE ROAD
CFP 013
CFP 012
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF GWATHMEY CHURCH ROAD AND SOUTH OF HUNGARY ROAD
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
CFP 010
END ALTERNATIVE AREA 5 (CFP 9)
CFP 009
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-9
Build Alternative 5A
Maintain Two Tracks Through Town
DRPT
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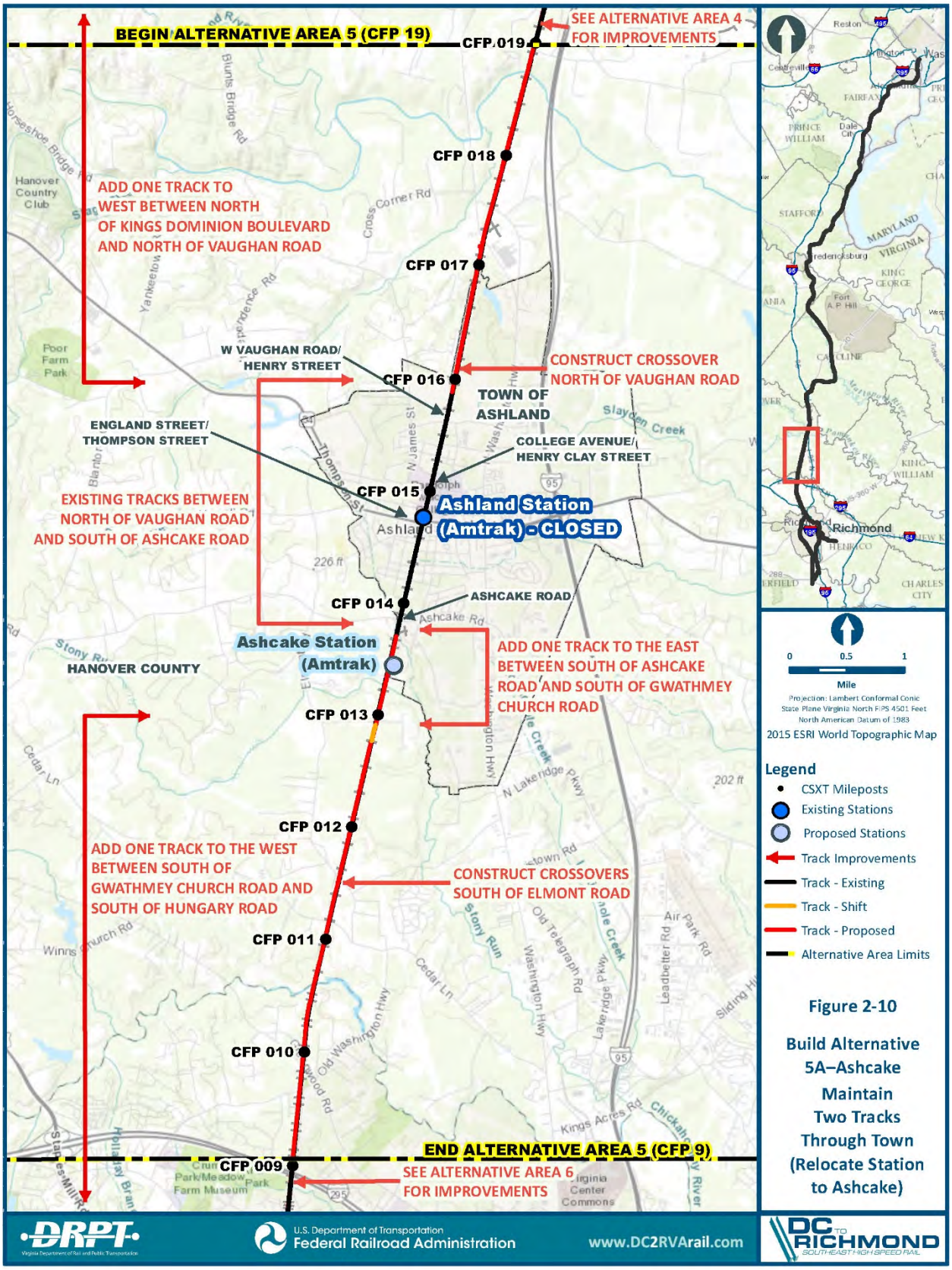
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 5 (CFP 19)
CFP 019
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 018
ADD ONE TRACK TO WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND NORTH OF VAUGHAN ROAD
CFP 017
W VAUGHAN ROAD/ HENRY STREET
CONSTRUCT CROSSOVER NORTH OF VAUGHAN ROAD
CFP 016
TOWN OF ASHLAND
ENGLAND STREET/ THOMPSON STREET
COLLEGE AVENUE/ HENRY CLAY STREET
EXISTING TRACKS BETWEEN NORTH OF VAUGHAN ROAD AND SOUTH OF ASHCAKE ROAD
CFP 015
Ashland Station (Amtrak) - CLOSED
ASHCAKE ROAD
CFP 014
Ashcake Station (Amtrak)
HANOVER COUNTY
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF ASHCAKE ROAD AND SOUTH OF GWATHMEY CHURCH ROAD
CFP 013
CFP 012
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF GWATHMEY CHURCH ROAD AND SOUTH OF HUNGARY ROAD
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
CFP 010
END ALTERNATIVE AREA 5 (CFP 9)
CFP 009
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-10
Build Alternative 5A–Ashcake Maintain Two Tracks Through Town (Relocate Station to Ashcake)
DRPT
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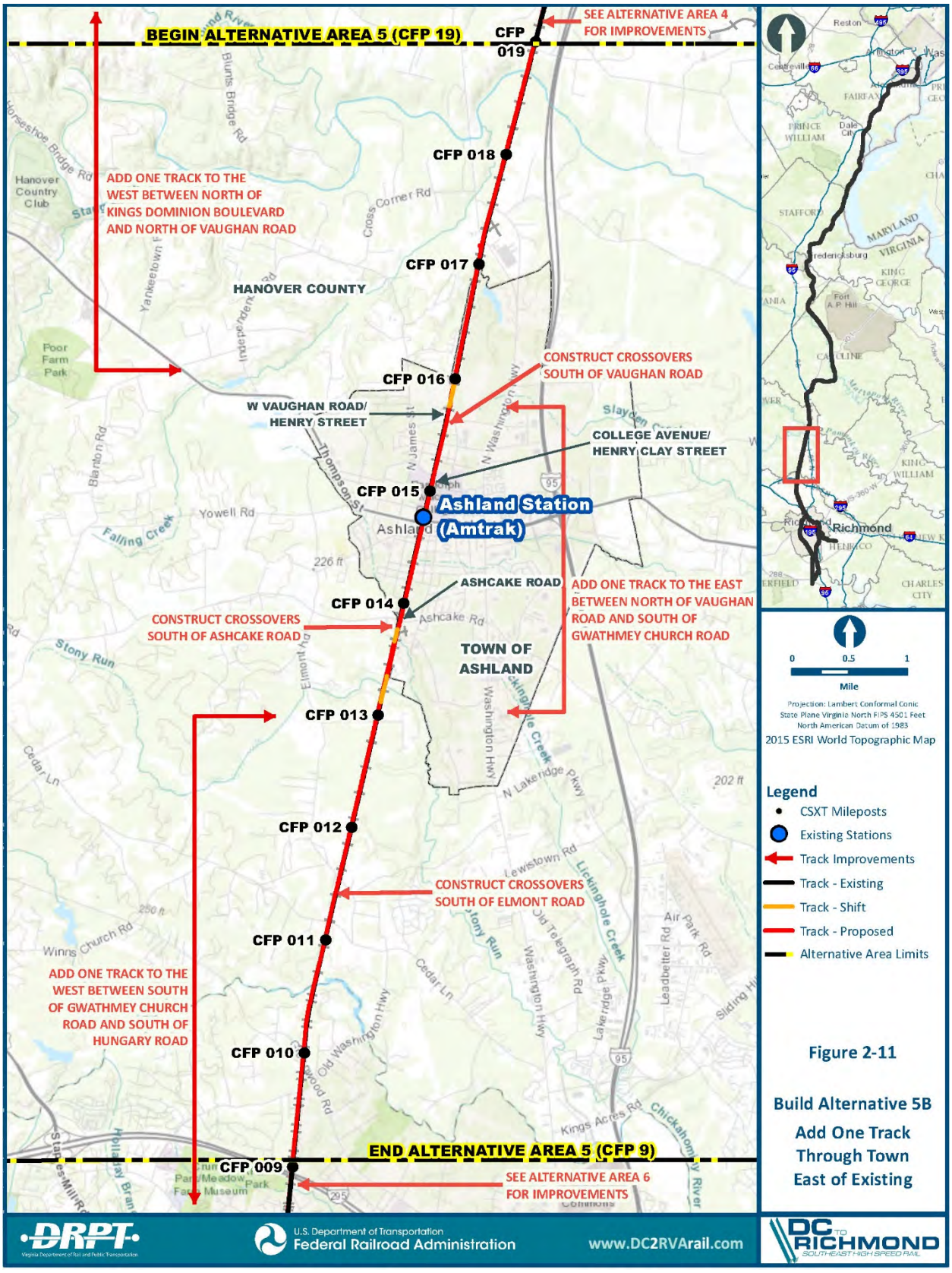
BEGIN ALTERNATIVE AREA 5 (CFP 19)
CFP 019
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 018
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND NORTH OF VAUGHAN ROAD
CFP 017
HANOVER COUNTY
CONSTRUCT CROSSOVERS SOUTH OF VAUGHAN ROAD
CFP 016
W VAUGHAN ROAD/ HENRY STREET
COLLEGE AVENUE/ HENRY CLAY STREET
CFP 015
Ashland Station (Amtrak)
ASHCAKE ROAD
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF VAUGHAN ROAD AND SOUTH OF GWATHMEY CHURCH ROAD
CFP 014
CONSTRUCT CROSSOVERS SOUTH OF ASHCAKE ROAD
TOWN OF ASHLAND
CFP 013
CFP 012
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF GWATHMEY CHURCH ROAD AND SOUTH OF HUNGARY ROAD
CFP 010
END ALTERNATIVE AREA 5 (CFP 9)
CFP 009
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-11
Build Alternative 5B
Add One Track
Through Town
East of Existing
DRPT
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Federal Railroad Administration
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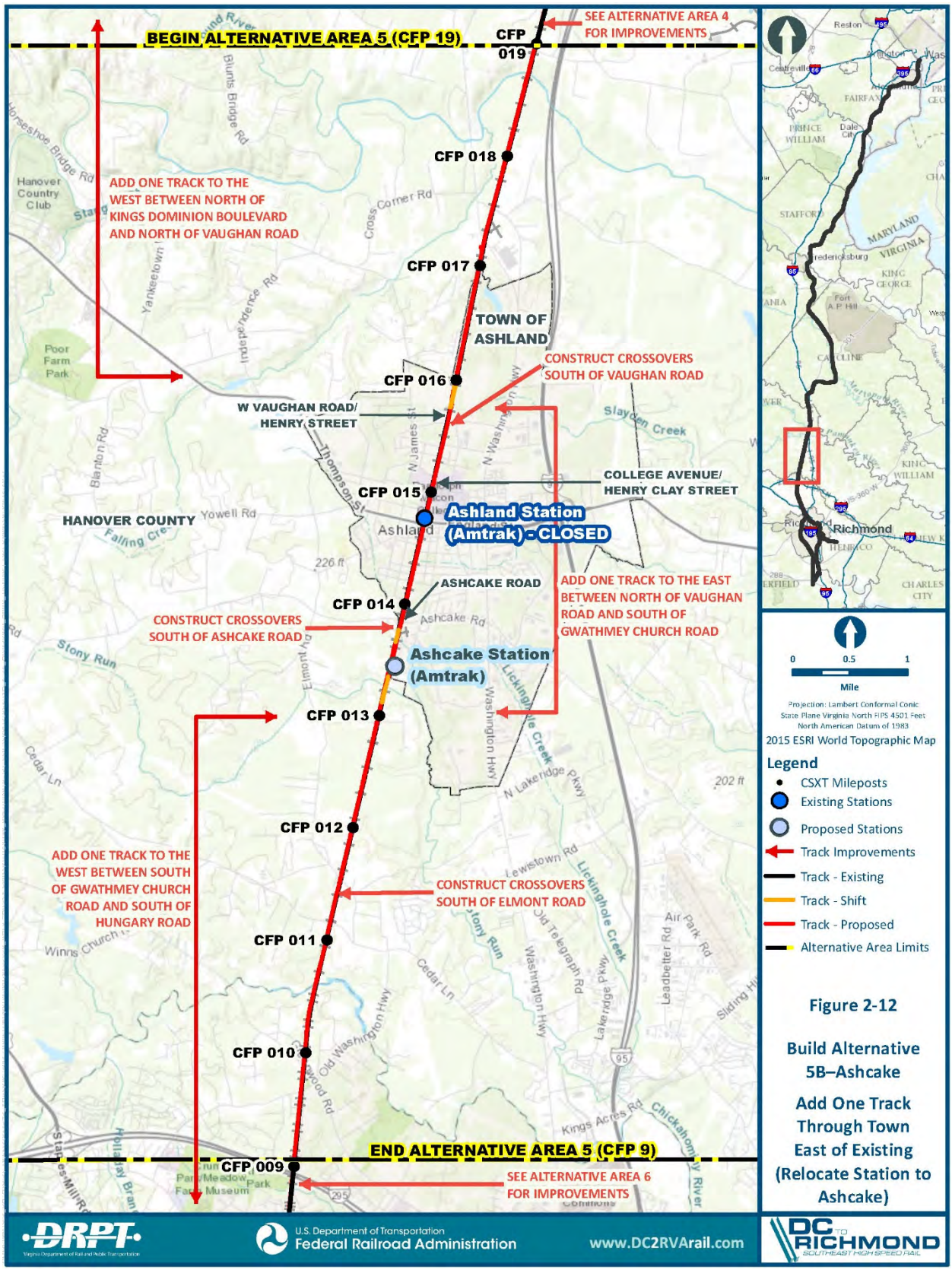
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 5 (CFP 19)
CFP 019
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 018
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND NORTH OF VAUGHAN ROAD
CFP 017
TOWN OF ASHLAND
CONSTRUCT CROSSOVERS SOUTH OF VAUGHAN ROAD
CFP 016
W VAUGHAN ROAD/ HENRY STREET
COLLEGE AVENUE/ HENRY CLAY STREET
CFP 015
Ashland Station (Amtrak) - CLOSED
HANOVER COUNTY
ASHCAKE ROAD
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF VAUGHAN ROAD AND SOUTH OF GWATHMEY CHURCH ROAD
CFP 014
CONSTRUCT CROSSOVERS SOUTH OF ASHCAKE ROAD
Ashcake Station (Amtrak)
CFP 013
CFP 012
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF GWATHMEY CHURCH ROAD AND SOUTH OF HUNGARY ROAD
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
CFP 010
END ALTERNATIVE AREA 5 (CFP 9)
CFP 009
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-12
Build Alternative 5B–Ashcake
Add One Track Through Town East of Existing (Relocate Station to Ashcake)
DRPT
U.S. Department of Transportation Federal Railroad Administration
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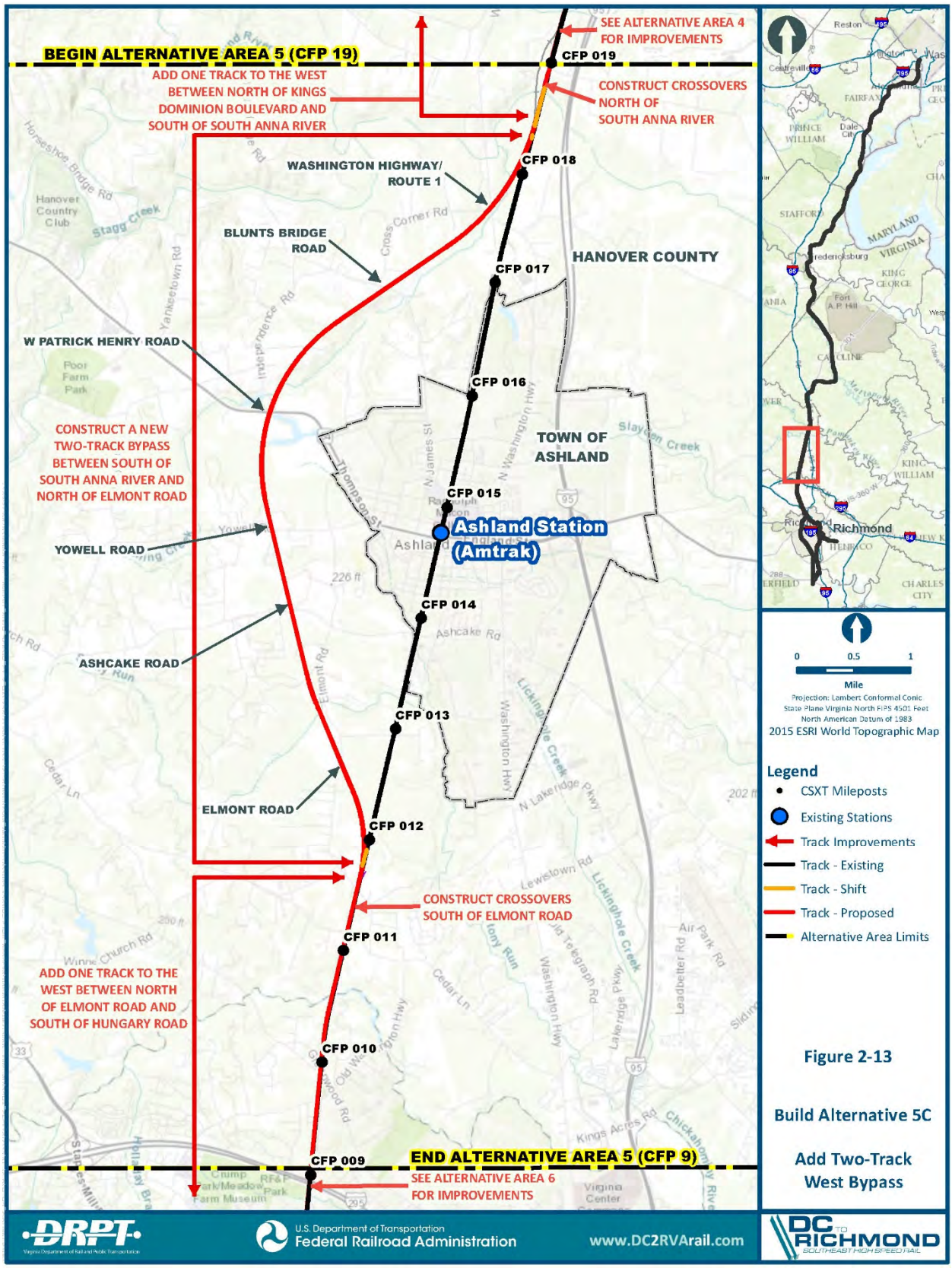
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 5 (CFP 19)
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND SOUTH OF SOUTH ANNA RIVER
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 019
CONSTRUCT CROSSOVERS NORTH OF SOUTH ANNA RIVER
CFP 018
WASHINGTON HIGHWAY/ ROUTE 1
BLUNTS BRIDGE ROAD
HANOVER COUNTY
CFP 017
W PATRICK HENRY ROAD
CFP 016
CONSTRUCT A NEW TWO-TRACK BYPASS BETWEEN SOUTH OF SOUTH ANNA RIVER AND NORTH OF ELMONT ROAD
TOWN OF ASHLAND
CFP 015
Ashland Station (Amtrak)
YOWELL ROAD
CFP 014
ASHCAKE ROAD
CFP 013
ELMONT ROAD
CFP 012
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF ELMONT ROAD AND SOUTH OF HUNGARY ROAD
CFP 010
CFP 009
END ALTERNATIVE AREA 5 (CFP 9)
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-13
Build Alternative 5C
Add Two-Track West Bypass
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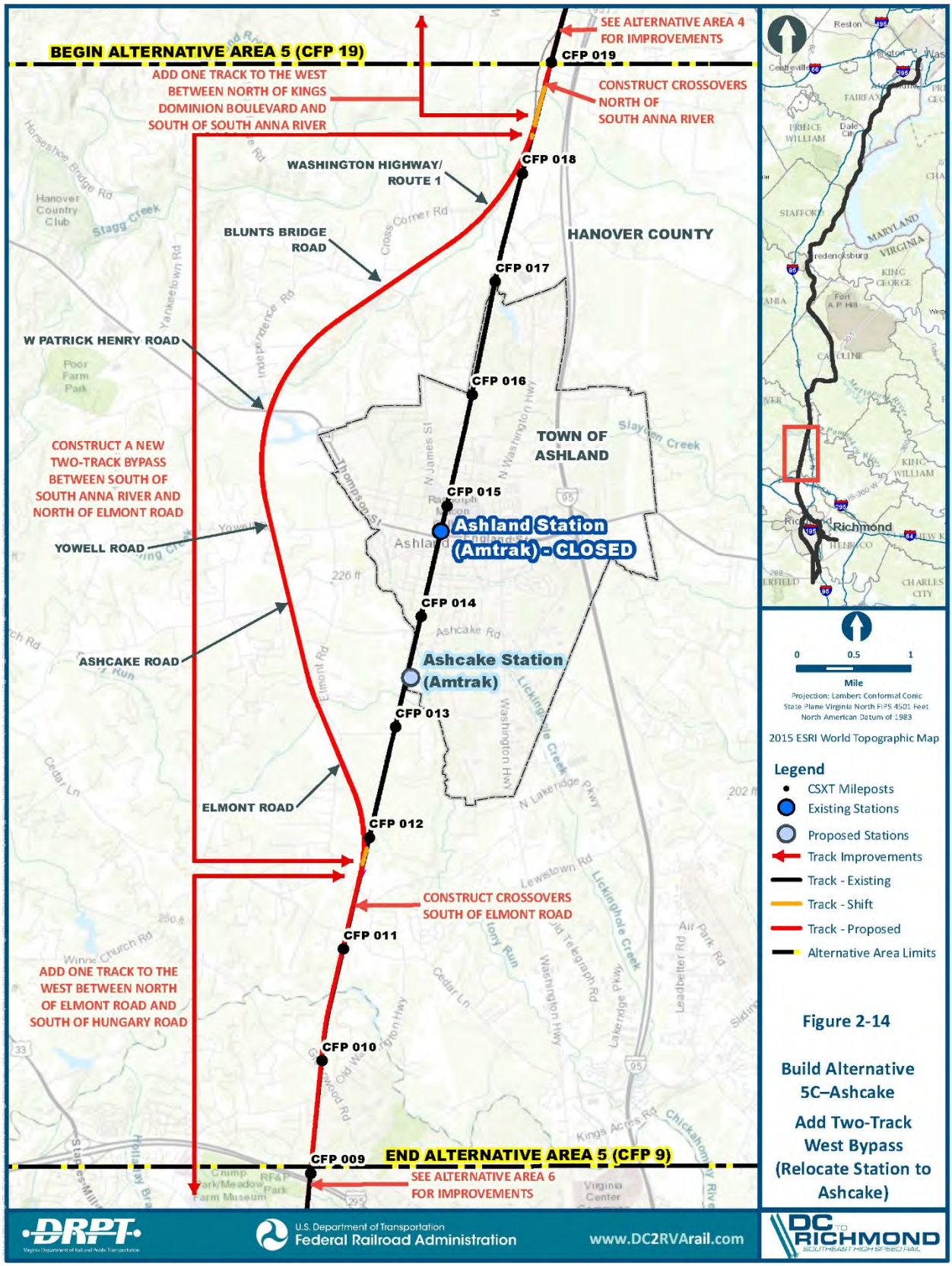
BEGIN ALTERNATIVE AREA 5 (CFP 19)
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND SOUTH OF SOUTH ANNA RIVER
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 019
CONSTRUCT CROSSOVERS NORTH OF SOUTH ANNA RIVER
CFP 018
WASHINGTON HIGHWAY/ ROUTE 1
BLUNTS BRIDGE ROAD
HANOVER COUNTY
CFP 017
W PATRICK HENRY ROAD
CFP 016
TOWN OF ASHLAND
CONSTRUCT A NEW TWO-TRACK BYPASS BETWEEN SOUTH OF SOUTH ANNA RIVER AND NORTH OF ELMONT ROAD
CFP 015
Ashland Station (Amtrak) - CLOSED
YOWELL ROAD
CFP 014
Ashcake Station (Amtrak)
ASHCAKE ROAD
CFP 013
ELMONT ROAD
CFP 012
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF ELMONT ROAD AND SOUTH OF HUNGARY ROAD
CFP 010
CFP 009
END ALTERNATIVE AREA 5 (CFP 9)
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-14
Build Alternative 5C–Ashcake
Add Two-Track West Bypass (Relocate Station to Ashcake)
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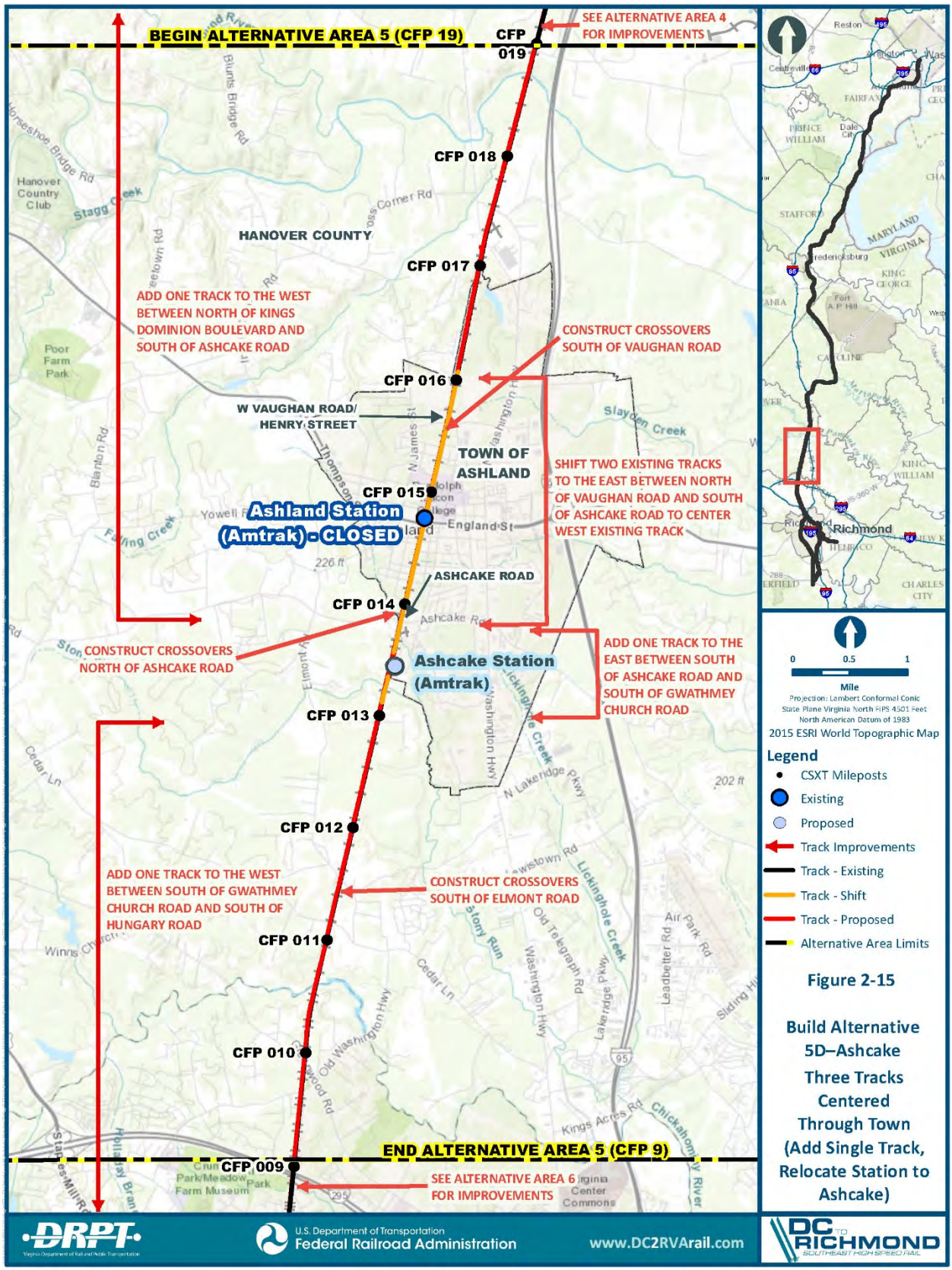
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 5 (CFP 19)
CFP 019
SEE ALTERNATIVE AREA 4 FOR IMPROVEMENTS
CFP 018
HANOVER COUNTY
CFP 017
ADD ONE TRACK TO THE WEST BETWEEN NORTH OF KINGS DOMINION BOULEVARD AND SOUTH OF ASHCAKE ROAD
CONSTRUCT CROSSOVERS SOUTH OF VAUGHAN ROAD
CFP 016
W VAUGHAN ROAD/ HENRY STREET
TOWN OF ASHLAND
SHIFT TWO EXISTING TRACKS TO THE EAST BETWEEN NORTH OF VAUGHAN ROAD AND SOUTH OF ASHCAKE ROAD TO CENTER WEST EXISTING TRACK
CFP 015
Ashland Station (Amtrak) - CLOSED
ASHCAKE ROAD
CFP 014
CONSTRUCT CROSSOVERS NORTH OF ASHCAKE ROAD
Ashcake Station (Amtrak)
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF ASHCAKE ROAD AND SOUTH OF GWATHMEY CHURCH ROAD
CFP 013
CFP 012
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF GWATHMEY CHURCH ROAD AND SOUTH OF HUNGARY ROAD
CONSTRUCT CROSSOVERS SOUTH OF ELMONT ROAD
CFP 011
CFP 010
END ALTERNATIVE AREA 5 (CFP 9)
CFP 009
SEE ALTERNATIVE AREA 6 FOR IMPROVEMENTS
Richmond
0 0.5 1
Mile
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing
Proposed
Track Improvements
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Figure 2-15
Build Alternative 5D–Ashcake Three Tracks Centered Through Town (Add Single Track, Relocate Station to Ashcake)
DRPT
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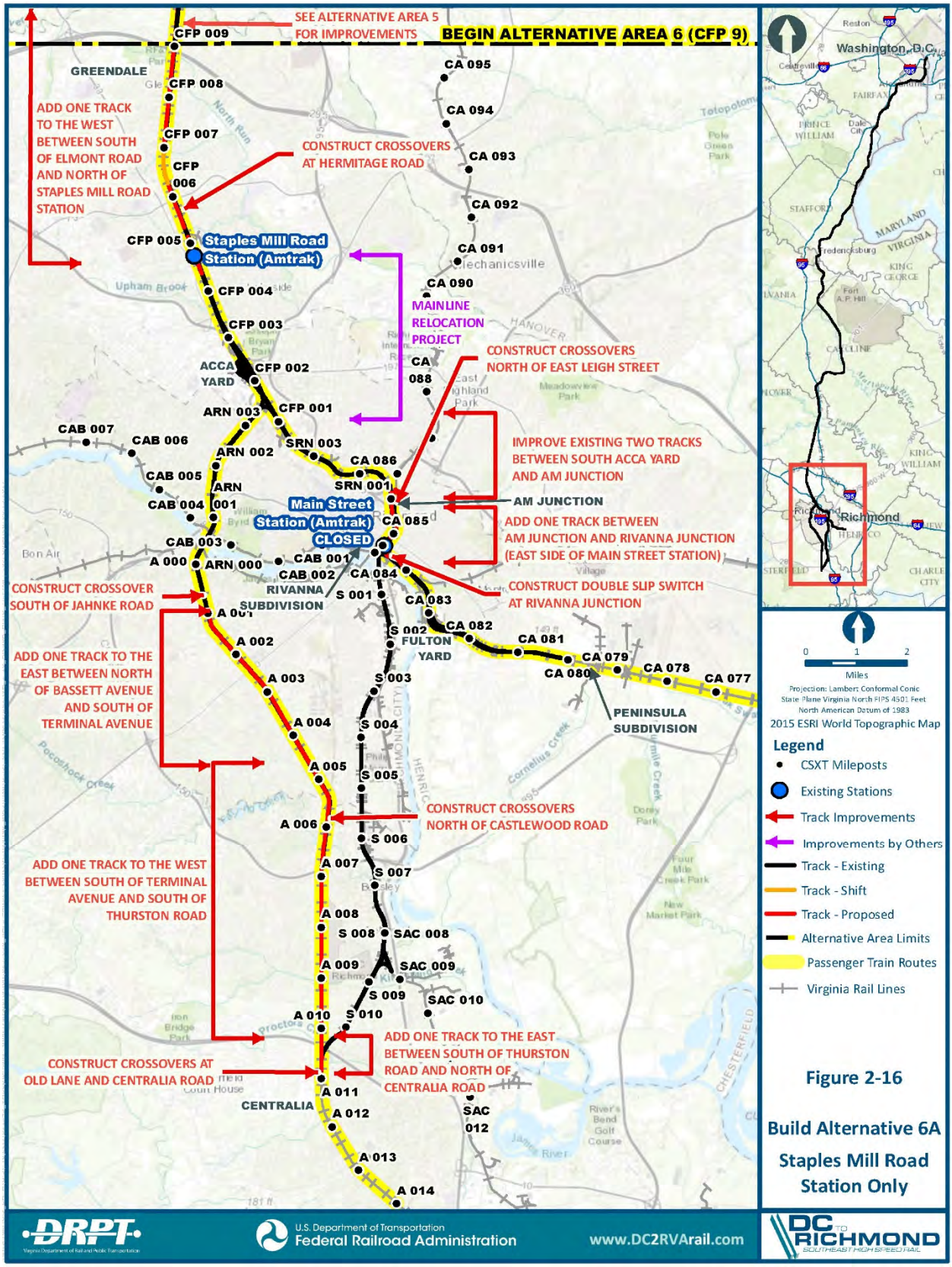
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
BEGIN ALTERNATIVE AREA 6 (CFP 9)
CFP 009
GREENDALE
CFP 008
CFP 007
CFP 006
CFP 005
Staples Mill Road Station (Amtrak)
CFP 004
CFP 003
ACCA YARD
CFP 002
CFP 001
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF ELMONT ROAD AND NORTH OF STAPLES MILL ROAD STATION
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
MAINLINE RELOCATION PROJECT
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
IMPROVE EXISTING TWO TRACKS BETWEEN SOUTH ACCA YARD AND AM JUNCTION
AM JUNCTION
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
CONSTRUCT CROSSOVER SOUTH OF JAHNKE ROAD
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF BASSETT AVENUE AND SOUTH OF TERMINAL AVENUE
CONSTRUCT CROSSOVERS NORTH OF CASTLEWOOD ROAD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF TERMINAL AVENUE AND SOUTH OF THURSTON ROAD
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF THURSTON ROAD AND NORTH OF CENTRALIA ROAD
CONSTRUCT CROSSOVERS AT OLD LANE AND CENTRALIA ROAD
CENTRALIA
Main Street Station (Amtrak) CLOSED
RIVANNA SUBDIVISION
FULTON YARD
PENINSULA SUBDIVISION
CA 095
CA 094
CA 093
CA 092
CA 091
CA 090
CA 088
CA 086
CA 085
CA 084
CA 083
CA 082
CA 081
CA 080
CA 079
CA 078
CA 077
SRN 003
SRN 001
ARN 003
ARN 002
ARN 001
ARN 000
CAB 007
CAB 006
CAB 005
CAB 004
CAB 003
CAB 002
CAB 001
A 000
A 001
A 002
A 003
A 004
A 005
A 006
A 007
A 008
A 009
A 010
A 011
A 012
A 013
A 014
S 001
S 002
S 003
S 004
S 005
S 006
S 007
S 008
S 009
S 010
SAC 008
SAC 009
SAC 010
SAC 012
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-16
Build Alternative 6A
Staples Mill Road Station Only
DRPT
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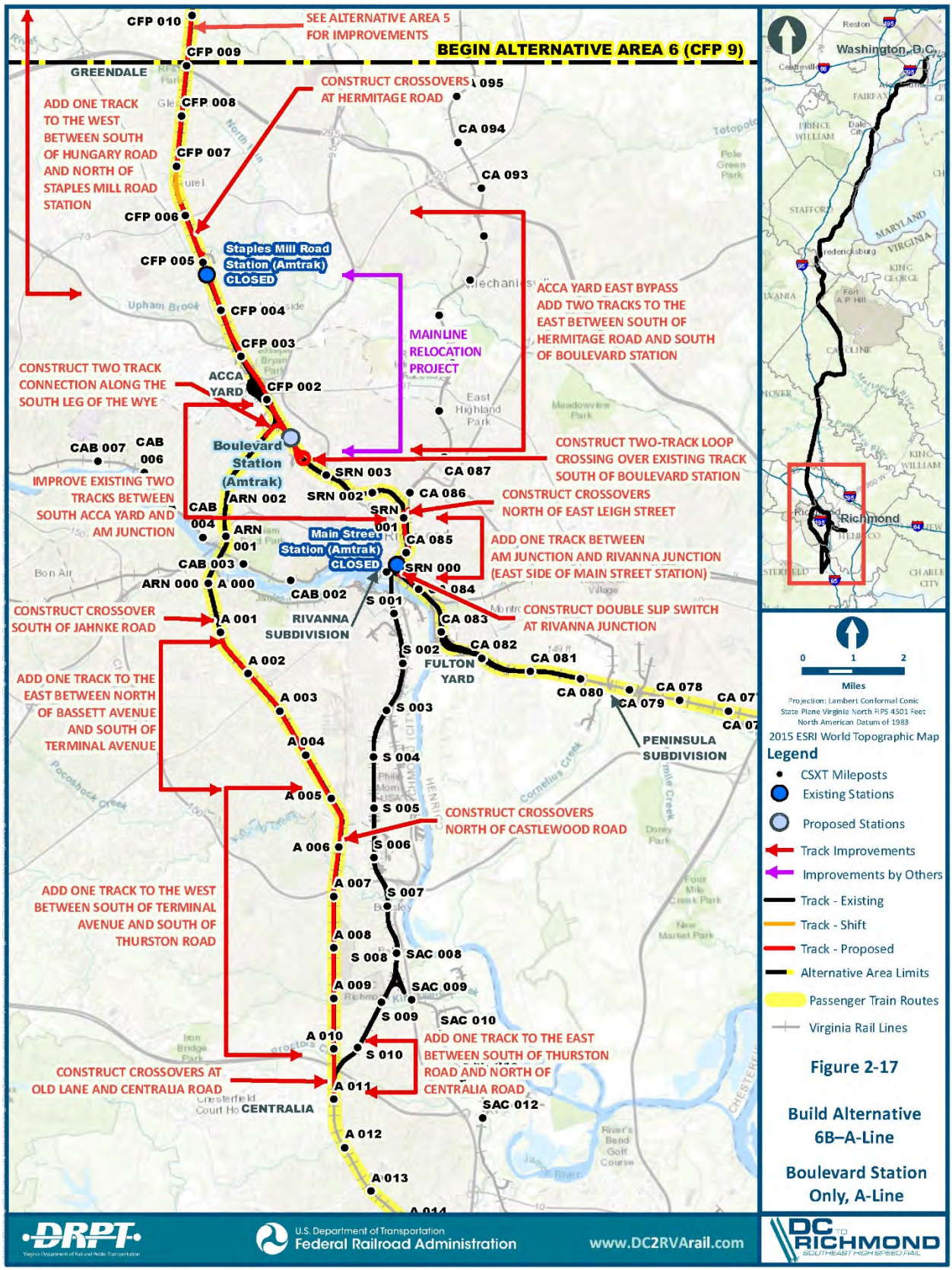
BEGIN ALTERNATIVE AREA 6 (CFP 9)
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
CFP 010
CFP 009
CFP 008
CFP 007
CFP 006
CFP 005
CFP 004
CFP 003
CFP 002
GREENDALE
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND NORTH OF STAPLES MILL ROAD STATION
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
Staples Mill Road Station (Amtrak) CLOSED
MAINLINE RELOCATION PROJECT
ACCA YARD EAST BYPASS ADD TWO TRACKS TO THE EAST BETWEEN SOUTH OF HERMITAGE ROAD AND SOUTH OF BOULEVARD STATION
CONSTRUCT TWO TRACK CONNECTION ALONG THE SOUTH LEG OF THE WYE
ACCA YARD
Boulevard Station (Amtrak)
CONSTRUCT TWO-TRACK LOOP CROSSING OVER EXISTING TRACK SOUTH OF BOULEVARD STATION
IMPROVE EXISTING TWO TRACKS BETWEEN SOUTH ACCA YARD AND AM JUNCTION
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
Main Street Station (Amtrak) CLOSED
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT CROSSOVER SOUTH OF JAHNKE ROAD
RIVANNA SUBDIVISION
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
FULTON YARD
PENINSULA SUBDIVISION
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF BASSETT AVENUE AND SOUTH OF TERMINAL AVENUE
CONSTRUCT CROSSOVERS NORTH OF CASTLEWOOD ROAD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF TERMINAL AVENUE AND SOUTH OF THURSTON ROAD
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF THURSTON ROAD AND NORTH OF CENTRALIA ROAD
CONSTRUCT CROSSOVERS AT OLD LANE AND CENTRALIA ROAD
CENTRALIA
SAC 008
SAC 009
SAC 010
SAC 012
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-17
Build Alternative 6B–A-Line
Boulevard Station Only, A-Line
DRPT
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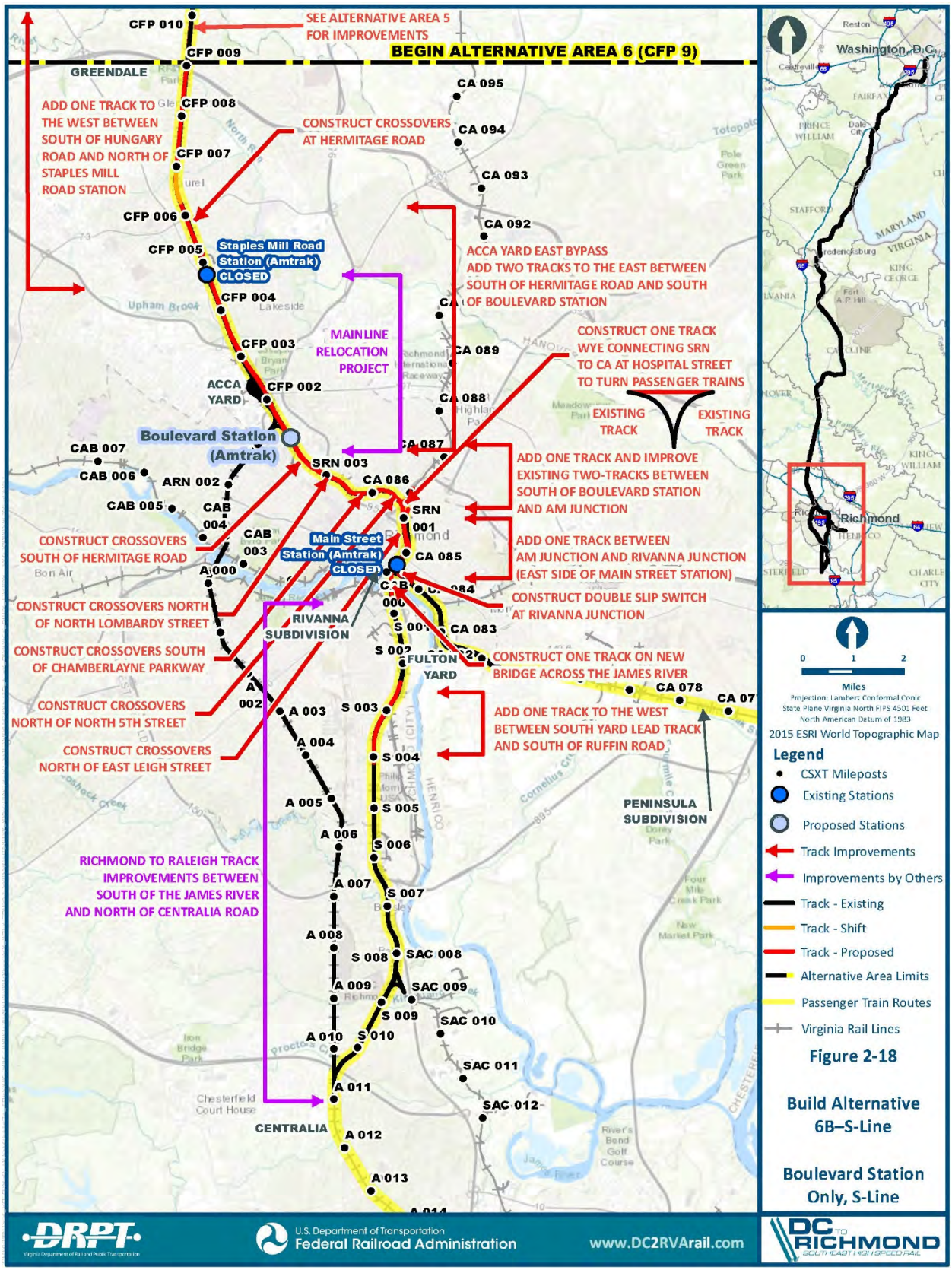
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
BEGIN ALTERNATIVE AREA 6 (CFP 9)
GREENDALE
CFP 010
CFP 009
CFP 008
CFP 007
CFP 006
CFP 005
CFP 004
CFP 003
CFP 002
CA 095
CA 094
CA 093
CA 092
CA 089
CA 088
CA 087
CA 086
CA 085
CA 083
CA 078
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND NORTH OF STAPLES MILL ROAD STATION
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
Staples Mill Road Station (Amtrak) CLOSED
ACCA YARD EAST BYPASS ADD TWO TRACKS TO THE EAST BETWEEN SOUTH OF HERMITAGE ROAD AND SOUTH OF BOULEVARD STATION
MAINLINE RELOCATION PROJECT
CONSTRUCT ONE TRACK WYE CONNECTING SRN TO CA AT HOSPITAL STREET TO TURN PASSENGER TRAINS
EXISTING TRACK
EXISTING TRACK
ACCA YARD
Boulevard Station (Amtrak)
CAB 007
CAB 006
CAB 005
CAB 004
CAB 003
ARN 002
A 000
SRN 003
SRN 001
ADD ONE TRACK AND IMPROVE EXISTING TWO-TRACKS BETWEEN SOUTH OF BOULEVARD STATION AND AM JUNCTION
CONSTRUCT CROSSOVERS SOUTH OF HERMITAGE ROAD
Main Street Station (Amtrak) CLOSED
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT CROSSOVERS NORTH OF NORTH LOMBARDY STREET
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
RIVANNA SUBDIVISION
CONSTRUCT CROSSOVERS SOUTH OF CHAMBERLAYNE PARKWAY
FULTON YARD
CONSTRUCT ONE TRACK ON NEW BRIDGE ACROSS THE JAMES RIVER
CONSTRUCT CROSSOVERS NORTH OF NORTH 5TH STREET
ADD ONE TRACK TO THE WEST BETWEEN SOUTH YARD LEAD TRACK AND SOUTH OF RUFFIN ROAD
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
PENINSULA SUBDIVISION
RICHMOND TO RALEIGH TRACK IMPROVEMENTS BETWEEN SOUTH OF THE JAMES RIVER AND NORTH OF CENTRALIA ROAD
A 002
A 003
A 004
A 005
A 006
A 007
A 008
A 009
A 010
A 011
A 012
A 013
S 003
S 004
S 005
S 006
S 007
S 008
S 009
S 010
SAC 008
SAC 009
SAC 010
SAC 011
SAC 012
CENTRALIA
Chesterfield Court House
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-18
Build Alternative 6B–S-Line
Boulevard Station Only, S-Line
DRPT
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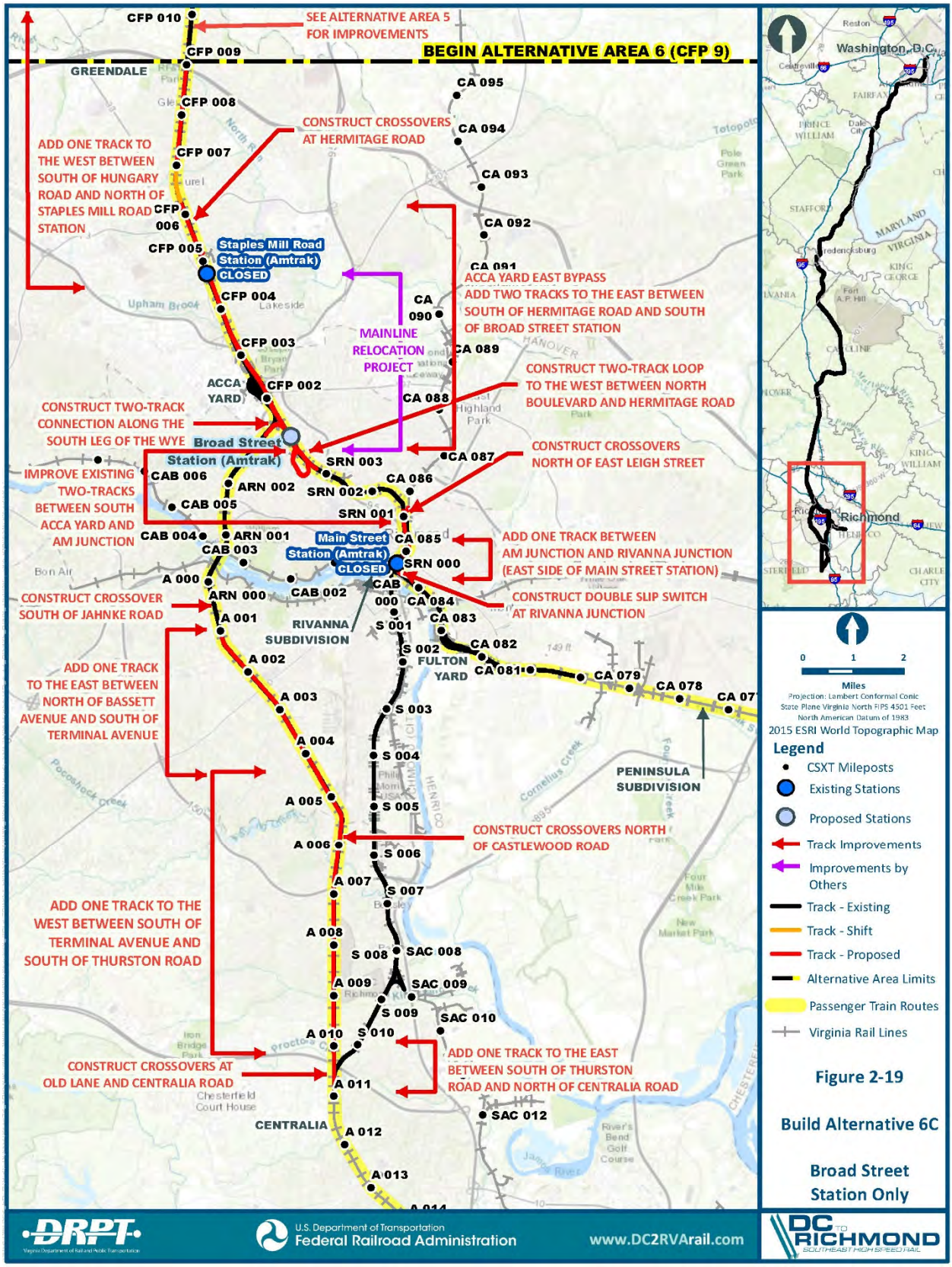
www.DC2RVArail.com
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


BEGIN ALTERNATIVE AREA 6 (CFP 9)
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND NORTH OF STAPLES MILL ROAD STATION
ACCA YARD EAST BYPASS
ADD TWO TRACKS TO THE EAST BETWEEN SOUTH OF HERMITAGE ROAD AND SOUTH OF BROAD STREET STATION
MAINLINE RELOCATION PROJECT
CONSTRUCT TWO-TRACK LOOP TO THE WEST BETWEEN NORTH BOULEVARD AND HERMITAGE ROAD
CONSTRUCT TWO-TRACK CONNECTION ALONG THE SOUTH LEG OF THE WYE
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
IMPROVE EXISTING TWO-TRACKS BETWEEN SOUTH ACCA YARD AND AM JUNCTION
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT CROSSOVER SOUTH OF JAHNKE ROAD
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF BASSETT AVENUE AND SOUTH OF TERMINAL AVENUE
CONSTRUCT CROSSOVERS NORTH OF CASTLEWOOD ROAD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF TERMINAL AVENUE AND SOUTH OF THURSTON ROAD
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF THURSTON ROAD AND NORTH OF CENTRALIA ROAD
CONSTRUCT CROSSOVERS AT OLD LANE AND CENTRALIA ROAD
GREENDALE
Staples Mill Road Station (Amtrak) CLOSED
Broad Street Station (Amtrak)
Main Street Station (Amtrak) CLOSED
ACCA YARD
RIVANNA SUBDIVISION
FULTON YARD
PENINSULA SUBDIVISION
CENTRALIA
Chesterfield Court House
CFP 010
CFP 009
CFP 008
CFP 007
CFP 006
CFP 005
CFP 004
CFP 003
CFP 002
CA 095
CA 094
CA 093
CA 092
CA 091
CA 090
CA 089
CA 088
CA 087
CA 086
CA 085
CA 084
CA 083
CA 082
CA 081
CA 079
CA 078
SRN 003
SRN 002
SRN 001
SRN 000
ARN 002
ARN 001
ARN 000
CAB 006
CAB 005
CAB 004
CAB 003
CAB 002
CAB
A 000
A 001
A 002
A 003
A 004
A 005
A 006
A 007
A 008
A 009
A 010
A 011
A 012
A 013
S 001
S 002
S 003
S 004
S 005
S 006
S 007
S 008
S 009
S 010
SAC 008
SAC 009
SAC 010
SAC 012
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Proposed Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-19
Build Alternative 6C
Broad Street Station Only
DRPT
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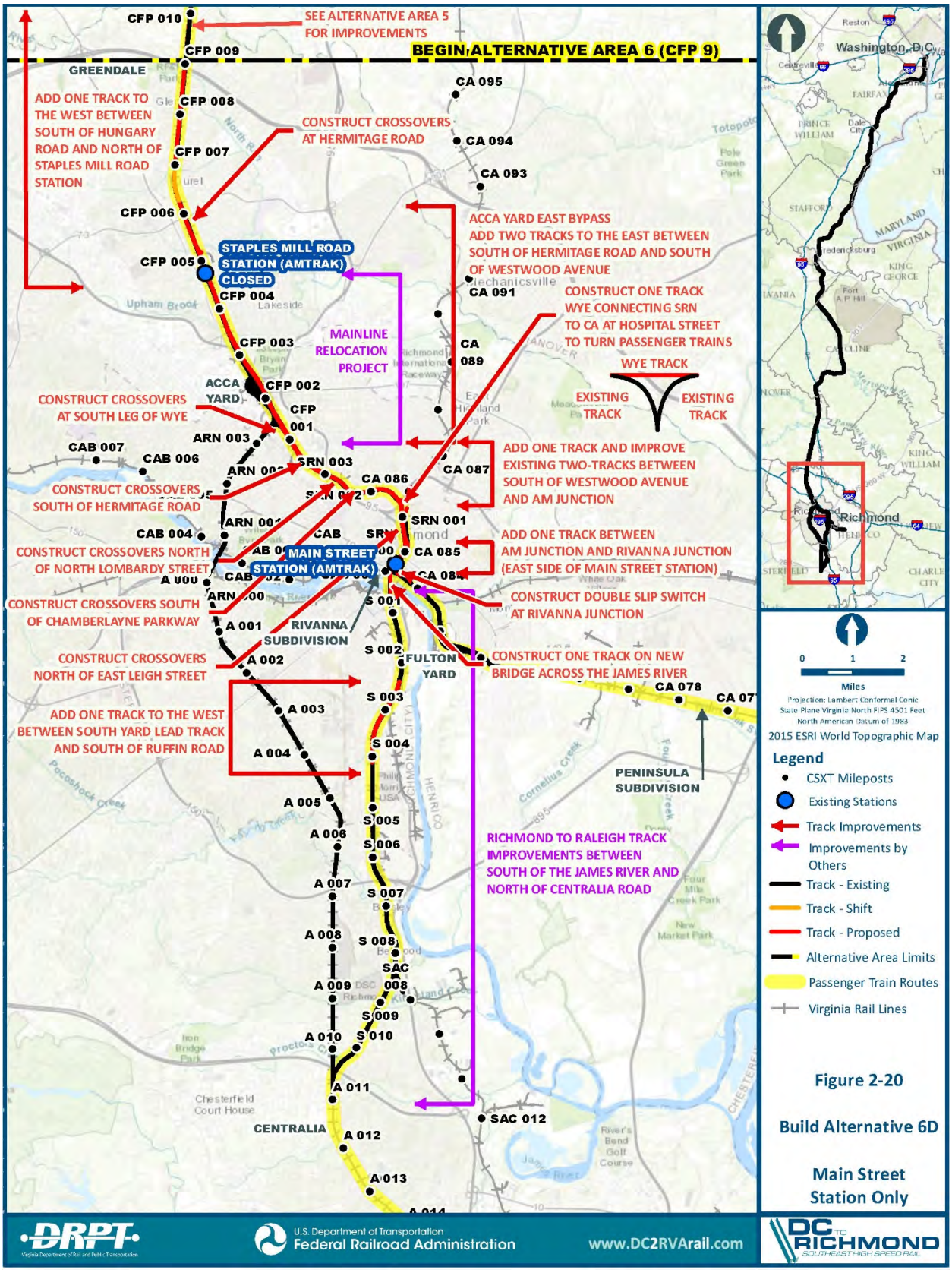
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


CFP 010
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
BEGIN ALTERNATIVE AREA 6 (CFP 9)
CFP 009
GREENDALE
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND NORTH OF STAPLES MILL ROAD STATION
CFP 008
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
CFP 007
CFP 006
CFP 005
STAPLES MILL ROAD STATION (AMTRAK) CLOSED
CFP 004
CFP 003
MAINLINE RELOCATION PROJECT
ACCA YARD
CFP 002
CFP 001
CONSTRUCT CROSSOVERS AT SOUTH LEG OF WYE
ARN 003
CAB 007
CAB 006
SRN 003
CONSTRUCT CROSSOVERS SOUTH OF HERMITAGE ROAD
CA 086
SRN 001
CAB 004
CONSTRUCT CROSSOVERS NORTH OF NORTH LOMBARDY STREET
MAIN STREET STATION (AMTRAK)
CA 085
CONSTRUCT CROSSOVERS SOUTH OF CHAMBERLAYNE PARKWAY
A 000
A 001
RIVANNA SUBDIVISION
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
A 002
S 002
FULTON YARD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH YARD LEAD TRACK AND SOUTH OF RUFFIN ROAD
A 003
S 003
A 004
S 004
A 005
S 005
A 006
S 006
A 007
S 007
A 008
S 008
SAC
A 009
S 009
A 010
S 010
A 011
CENTRALIA
A 012
A 013
SAC 012
CA 095
CA 094
CA 093
ACCA YARD EAST BYPASS
ADD TWO TRACKS TO THE EAST BETWEEN SOUTH OF HERMITAGE ROAD AND SOUTH OF WESTWOOD AVENUE
CA 091
CONSTRUCT ONE TRACK WYE CONNECTING SRN TO CA AT HOSPITAL STREET TO TURN PASSENGER TRAINS
WYE TRACK
EXISTING TRACK
EXISTING TRACK
CA 089
CA 087
ADD ONE TRACK AND IMPROVE EXISTING TWO-TRACKS BETWEEN SOUTH OF WESTWOOD AVENUE AND AM JUNCTION
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
CONSTRUCT ONE TRACK ON NEW BRIDGE ACROSS THE JAMES RIVER
CA 078
CA 07
PENINSULA SUBDIVISION
RICHMOND TO RALEIGH TRACK IMPROVEMENTS BETWEEN SOUTH OF THE JAMES RIVER AND NORTH OF CENTRALIA ROAD
Washington, D.C.
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-20
Build Alternative 6D
Main Street Station Only
DRPT
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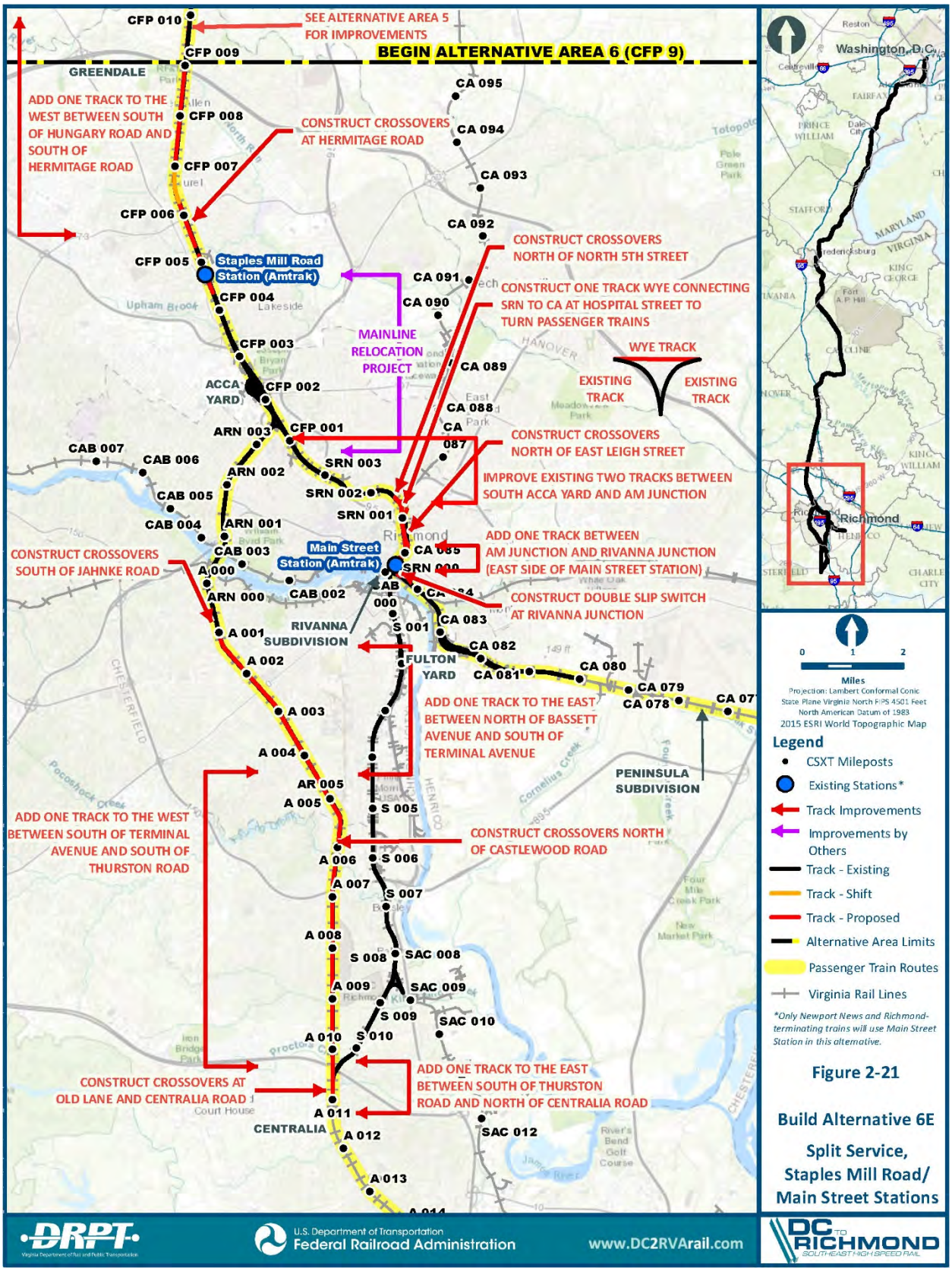
BEGIN ALTERNATIVE AREA 6 (CFP 9)
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
GREENDALE
CFP 010
CFP 009
CFP 008
CFP 007
CFP 006
CFP 005
CFP 004
CFP 003
CFP 002
CFP 001
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND SOUTH OF HERMITAGE ROAD
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
Staples Mill Road Station (Amtrak)
ACCA YARD
MAINLINE RELOCATION PROJECT
CONSTRUCT CROSSOVERS NORTH OF NORTH 5TH STREET
CONSTRUCT ONE TRACK WYE CONNECTING SRN TO CA AT HOSPITAL STREET TO TURN PASSENGER TRAINS
WYE TRACK
EXISTING TRACK
EXISTING TRACK
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
IMPROVE EXISTING TWO TRACKS BETWEEN SOUTH ACCA YARD AND AM JUNCTION
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
Main Street Station (Amtrak)
CONSTRUCT CROSSOVERS SOUTH OF JAHNKE ROAD
RIVANNA SUBDIVISION
FULTON YARD
ADD ONE TRACK TO THE EAST BETWEEN NORTH OF BASSETT AVENUE AND SOUTH OF TERMINAL AVENUE
PENINSULA SUBDIVISION
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF TERMINAL AVENUE AND SOUTH OF THURSTON ROAD
CONSTRUCT CROSSOVERS NORTH OF CASTLEWOOD ROAD
CONSTRUCT CROSSOVERS AT OLD LANE AND CENTRALIA ROAD
ADD ONE TRACK TO THE EAST BETWEEN SOUTH OF THURSTON ROAD AND NORTH OF CENTRALIA ROAD
CENTRALIA
Richmond
Washington, D.C.
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations*
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
*Only Newport News and Richmond-terminating trains will use Main Street Station in this alternative.
Figure 2-21
Build Alternative 6E
Split Service, Staples Mill Road/ Main Street Stations
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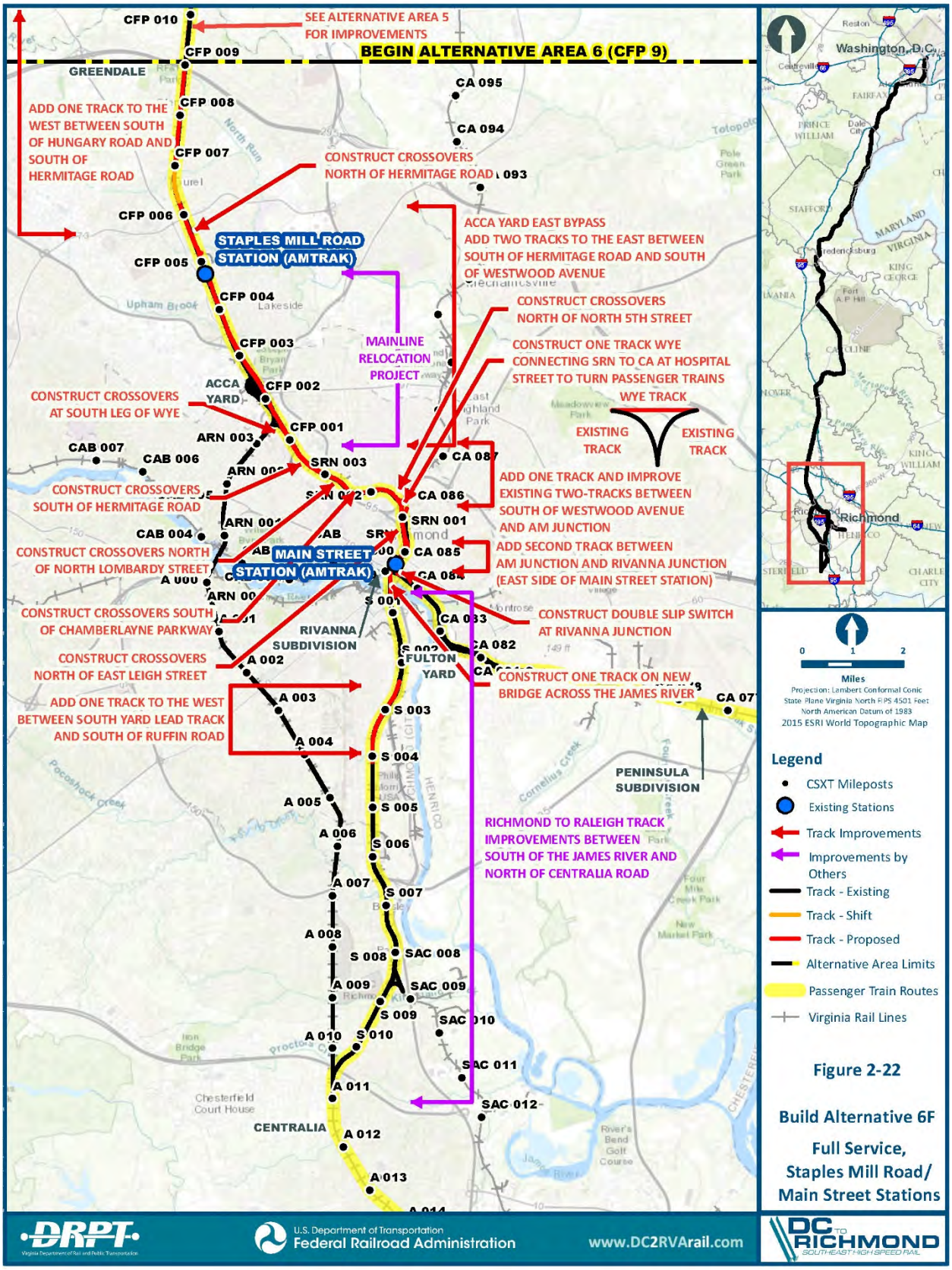
BEGIN ALTERNATIVE AREA 6 (CFP 9)
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND SOUTH OF HERMITAGE ROAD
CONSTRUCT CROSSOVERS NORTH OF HERMITAGE ROAD
ACCA YARD EAST BYPASS ADD TWO TRACKS TO THE EAST BETWEEN SOUTH OF HERMITAGE ROAD AND SOUTH OF WESTWOOD AVENUE
STAPLES MILL ROAD STATION (AMTRAK)
CONSTRUCT CROSSOVERS NORTH OF NORTH 5TH STREET
MAINLINE RELOCATION PROJECT
CONSTRUCT ONE TRACK WYE CONNECTING SRN TO CA AT HOSPITAL STREET TO TURN PASSENGER TRAINS
WYE TRACK
EXISTING TRACK
EXISTING TRACK
CONSTRUCT CROSSOVERS AT SOUTH LEG OF WYE
ACCA YARD
ADD ONE TRACK AND IMPROVE EXISTING TWO-TRACKS BETWEEN SOUTH OF WESTWOOD AVENUE AND AM JUNCTION
CONSTRUCT CROSSOVERS SOUTH OF HERMITAGE ROAD
CONSTRUCT CROSSOVERS NORTH OF NORTH LOMBARDY STREET
MAIN STREET STATION (AMTRAK)
ADD SECOND TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT CROSSOVERS SOUTH OF CHAMBERLAYNE PARKWAY
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
RIVANNA SUBDIVISION
FULTON YARD
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
CONSTRUCT ONE TRACK ON NEW BRIDGE ACROSS THE JAMES RIVER
ADD ONE TRACK TO THE WEST BETWEEN SOUTH YARD LEAD TRACK AND SOUTH OF RUFFIN ROAD
PENINSULA SUBDIVISION
RICHMOND TO RALEIGH TRACK IMPROVEMENTS BETWEEN SOUTH OF THE JAMES RIVER AND NORTH OF CENTRALIA ROAD
CENTRALIA
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
Figure 2-22
Build Alternative 6F
Full Service, Staples Mill Road/ Main Street Stations
DRPT
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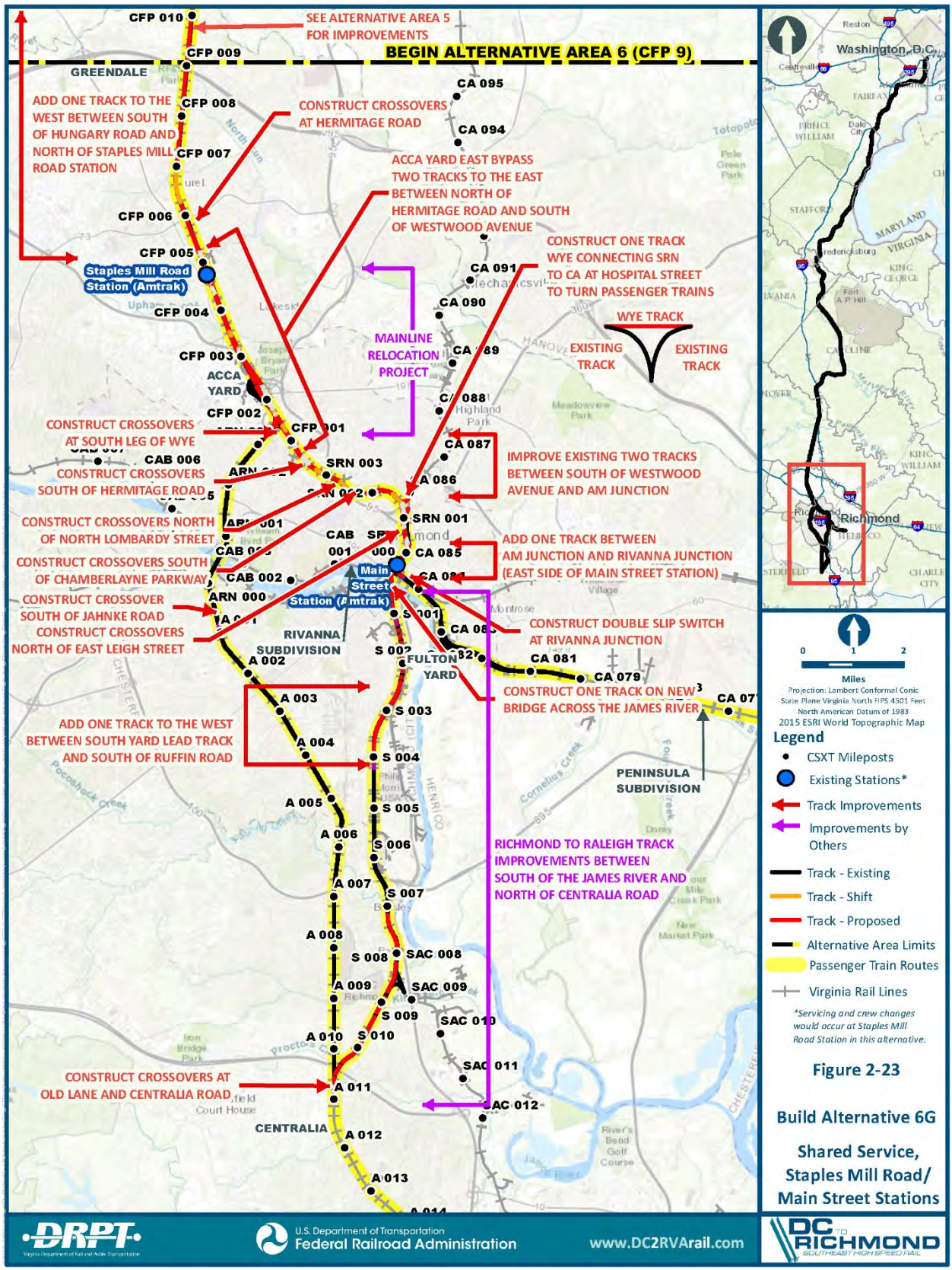
DC TO RICHMOND SOUTHEAST HIGH SPEED RAIL


CFP 010
SEE ALTERNATIVE AREA 5 FOR IMPROVEMENTS
BEGIN ALTERNATIVE AREA 6 (CFP 9)
CFP 009
GREENDALE
CA 095
CFP 008
CONSTRUCT CROSSOVERS AT HERMITAGE ROAD
ADD ONE TRACK TO THE WEST BETWEEN SOUTH OF HUNGARY ROAD AND NORTH OF STAPLES MILL ROAD STATION
CA 094
CFP 007
ACCA YARD EAST BYPASS TWO TRACKS TO THE EAST BETWEEN NORTH OF HERMITAGE ROAD AND SOUTH OF WESTWOOD AVENUE
CFP 006
CONSTRUCT ONE TRACK WYE CONNECTING SRN TO CA AT HOSPITAL STREET TO TURN PASSENGER TRAINS
CFP 005
Staples Mill Road Station (Amtrak)
CA 091
CA 090
CFP 004
WYE TRACK
EXISTING TRACK
EXISTING TRACK
MAINLINE RELOCATION PROJECT
CFP 003
CA 089
ACCA YARD
CA 088
CFP 002
CONSTRUCT CROSSOVERS AT SOUTH LEG OF WYE
CFP 001
CA 087
CAB 006
SRN 003
IMPROVE EXISTING TWO TRACKS BETWEEN SOUTH OF WESTWOOD AVENUE AND AM JUNCTION
CONSTRUCT CROSSOVERS SOUTH OF HERMITAGE ROAD
A 086
SRN 001
CONSTRUCT CROSSOVERS NORTH OF NORTH LOMBARDY STREET
CAB 001
CA 085
ADD ONE TRACK BETWEEN AM JUNCTION AND RIVANNA JUNCTION (EAST SIDE OF MAIN STREET STATION)
CONSTRUCT CROSSOVERS SOUTH OF CHAMBERLAYNE PARKWAY
CAB 002
Main Street Station (Amtrak)
ARN 000
CONSTRUCT CROSSOVER SOUTH OF JAHNKE ROAD
CONSTRUCT CROSSOVERS NORTH OF EAST LEIGH STREET
CONSTRUCT DOUBLE SLIP SWITCH AT RIVANNA JUNCTION
RIVANNA SUBDIVISION
A 002
FULTON YARD
CA 081
CA 079
CONSTRUCT ONE TRACK ON NEW BRIDGE ACROSS THE JAMES RIVER
A 003
S 003
ADD ONE TRACK TO THE WEST BETWEEN SOUTH YARD LEAD TRACK AND SOUTH OF RUFFIN ROAD
A 004
S 004
PENINSULA SUBDIVISION
A 005
S 005
A 006
S 006
RICHMOND TO RALEIGH TRACK IMPROVEMENTS BETWEEN SOUTH OF THE JAMES RIVER AND NORTH OF CENTRALIA ROAD
A 007
S 007
A 008
S 008
SAC 008
A 009
SAC 009
S 009
SAC 010
A 010
S 010
SAC 011
CONSTRUCT CROSSOVERS AT OLD LANE AND CENTRALIA ROAD
A 011
SAC 012
CENTRALIA
A 012
A 013
Washington, D.C.
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
2015 ESRI World Topographic Map
Legend
CSXT Mileposts
Existing Stations*
Track Improvements
Improvements by Others
Track - Existing
Track - Shift
Track - Proposed
Alternative Area Limits
Passenger Train Routes
Virginia Rail Lines
*Servicing and crew changes would occur at Staples Mill Road Station in this alternative.
Figure 2-23
Build Alternative 6G
Shared Service, Staples Mill Road/ Main Street Stations
DRPT
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Federal Railroad Administration
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DC TO RICHMOND

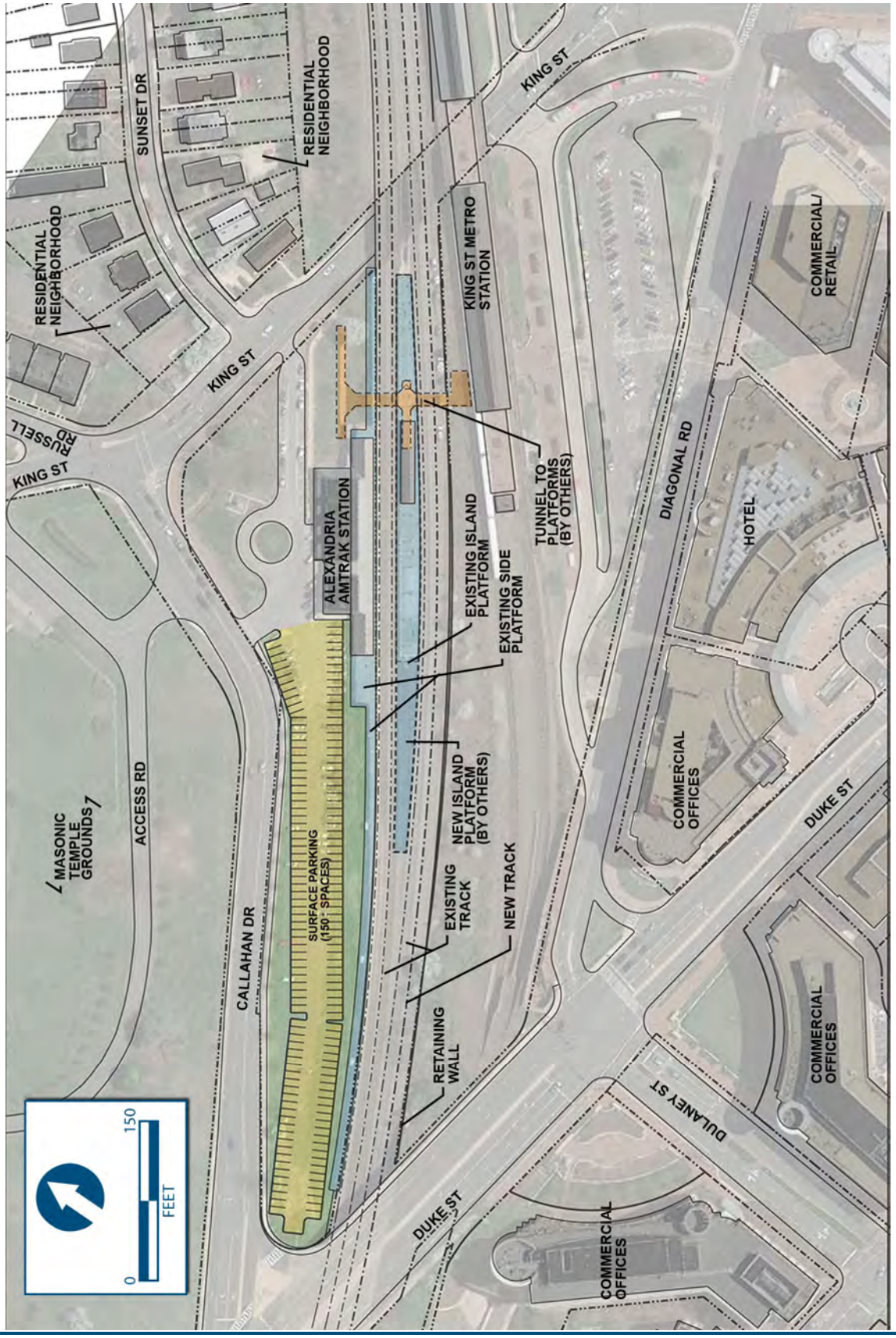


Figure 2-24: Alexandria Station Improvements for Build Alternative 2A

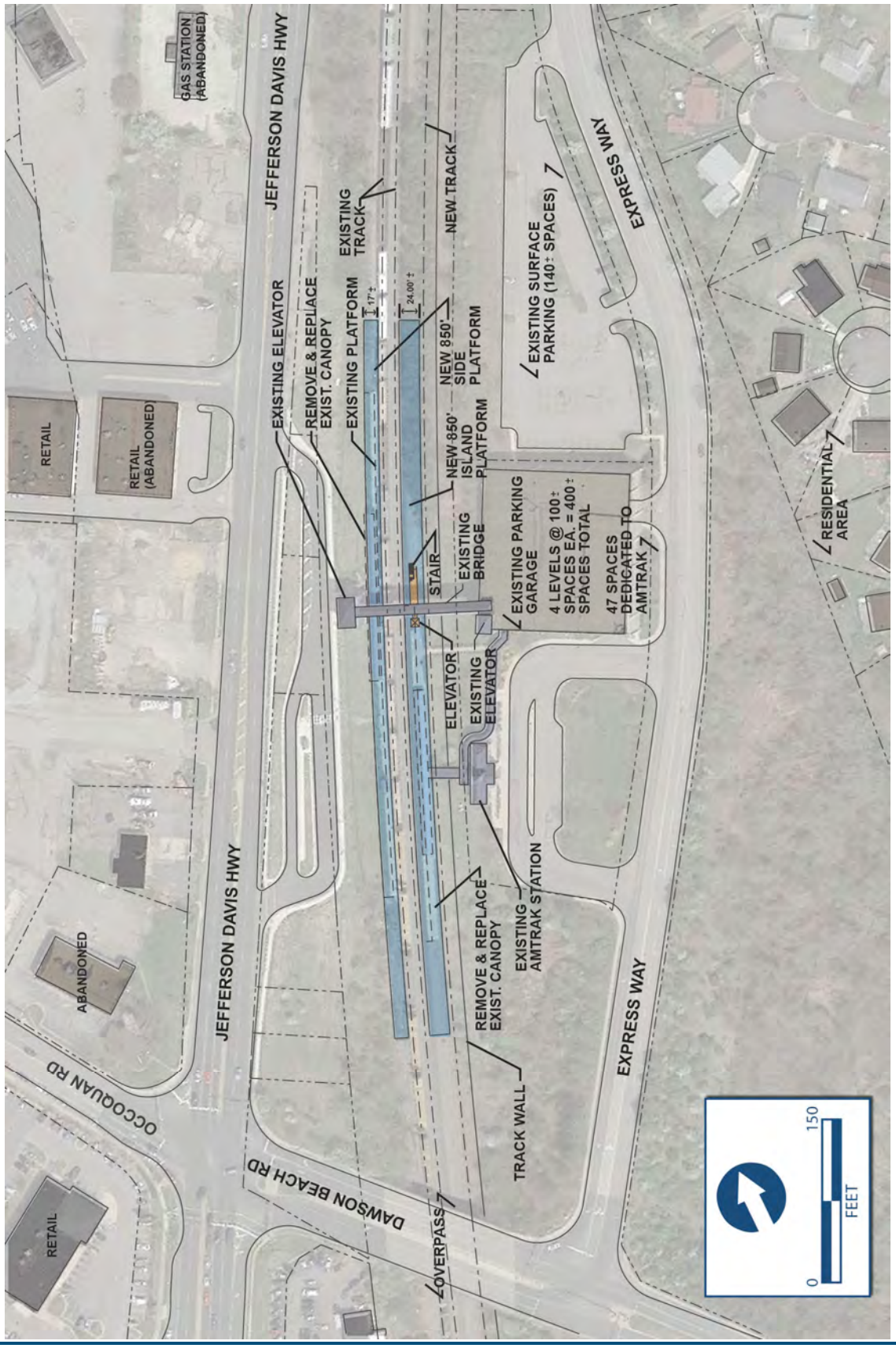


Figure 2-25: Woodbridge Station Improvements for Build Alternative 2A

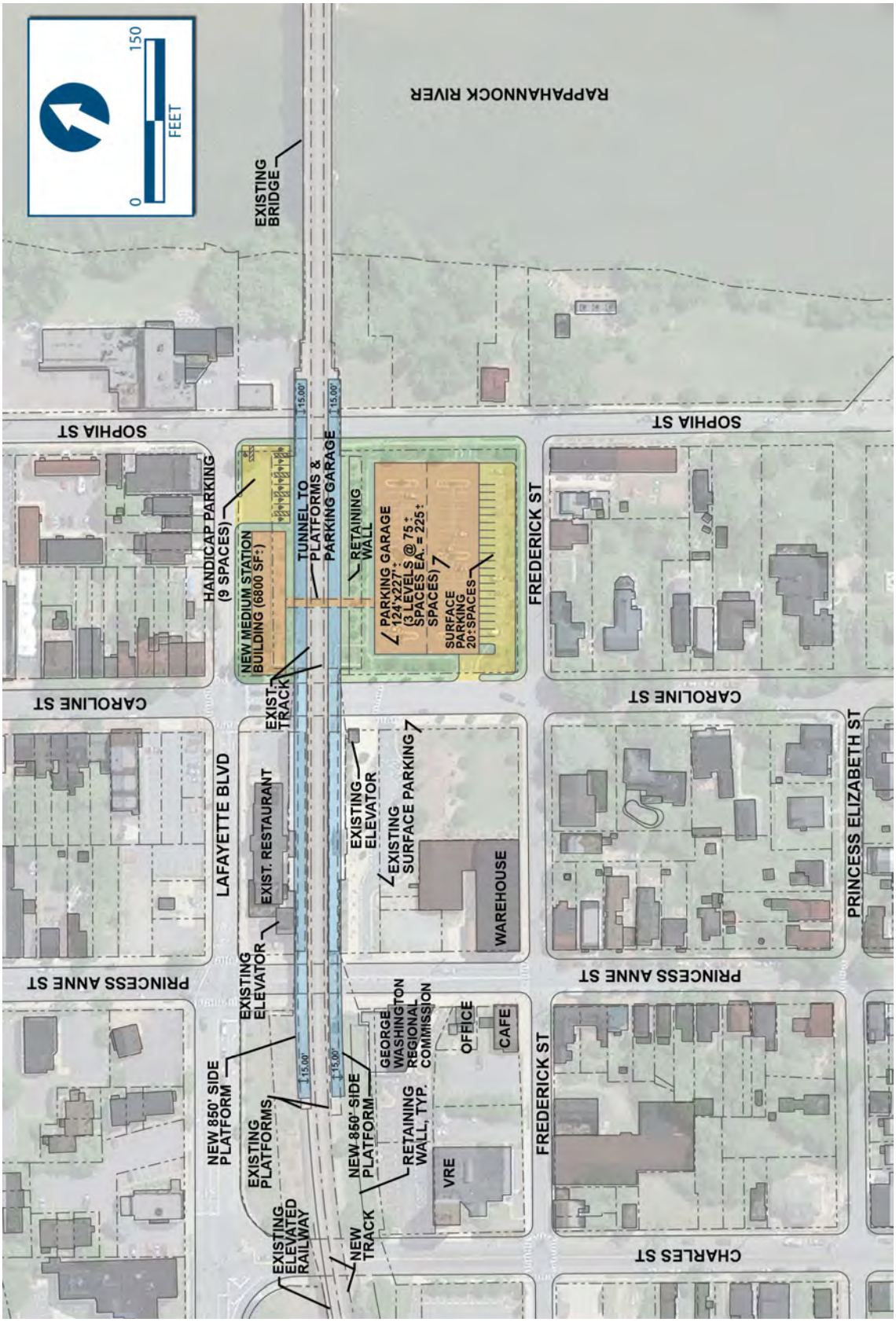


Figure 2-26: Fredericksburg Station Improvements for Build Alternatives 3A and 3C

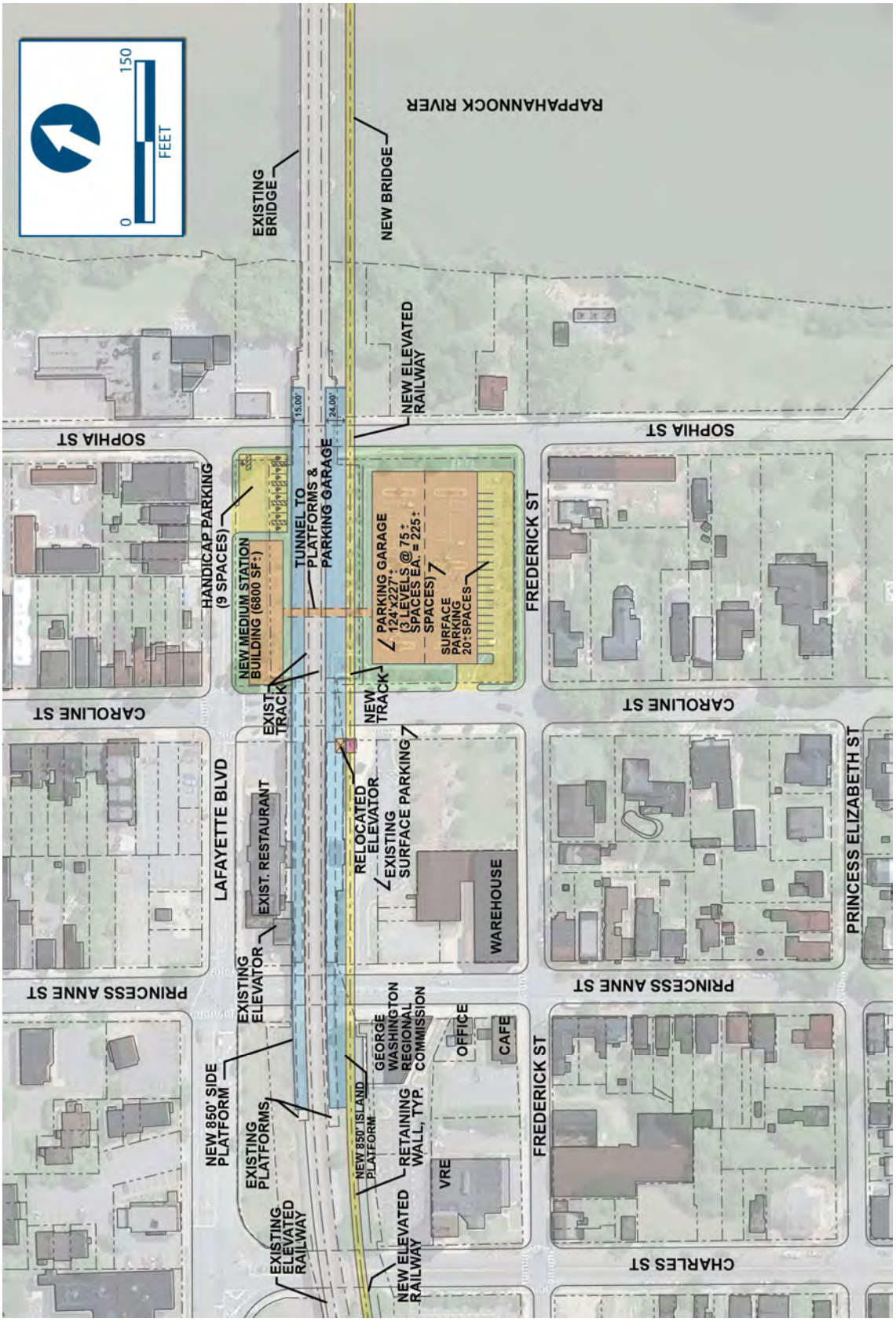


Figure 2-27: Fredericksburg Station Improvements for Build Alternative 3B

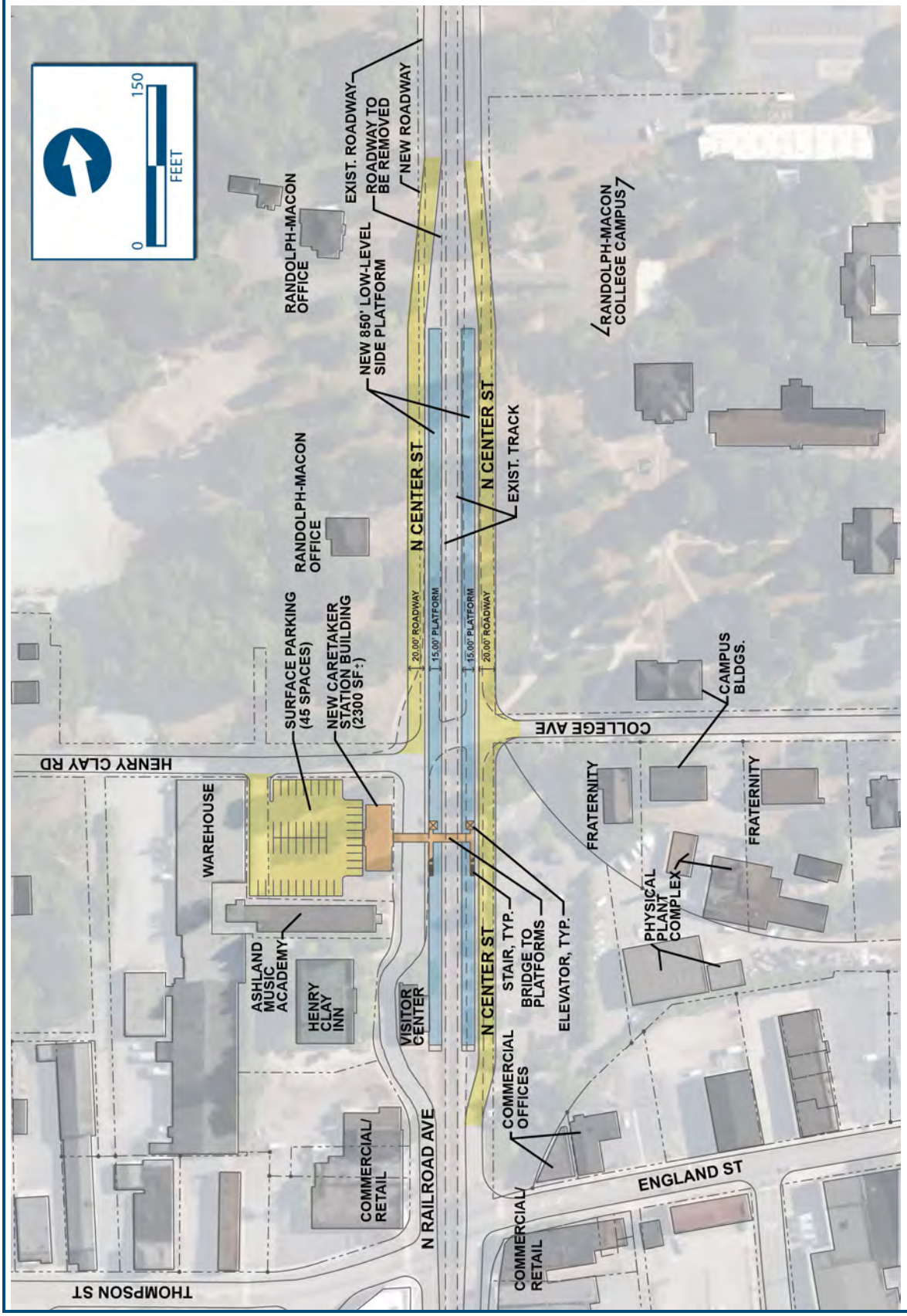


Figure 2-28A: Ashland Station Improvements for Build Alternatives 5A and 5C (Two-Track/850-Foot Platforms)

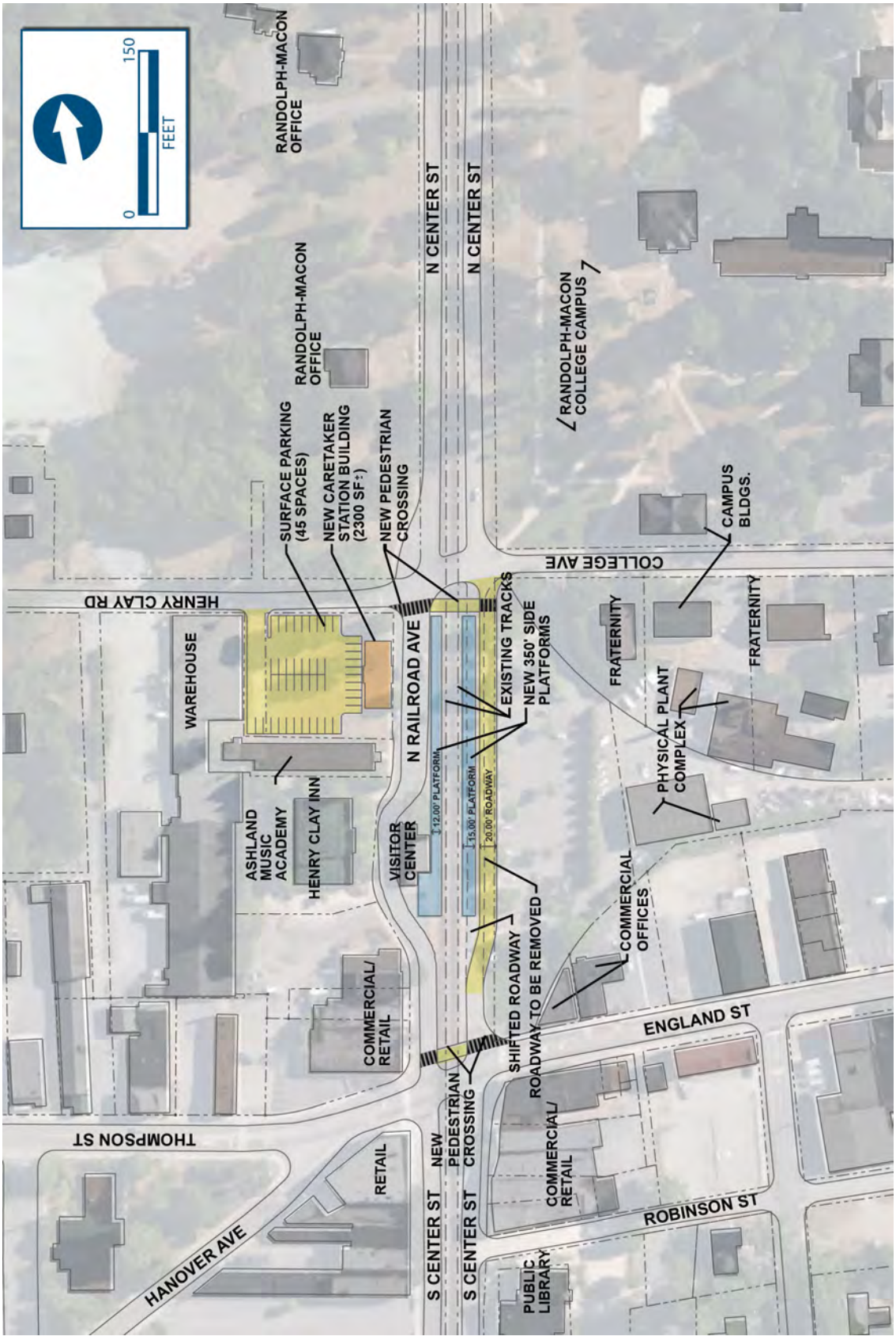


Figure 2-28B: Ashland Station Improvements for Build Alternatives 5A and 5C (Two-Track/350-Foot Platforms)

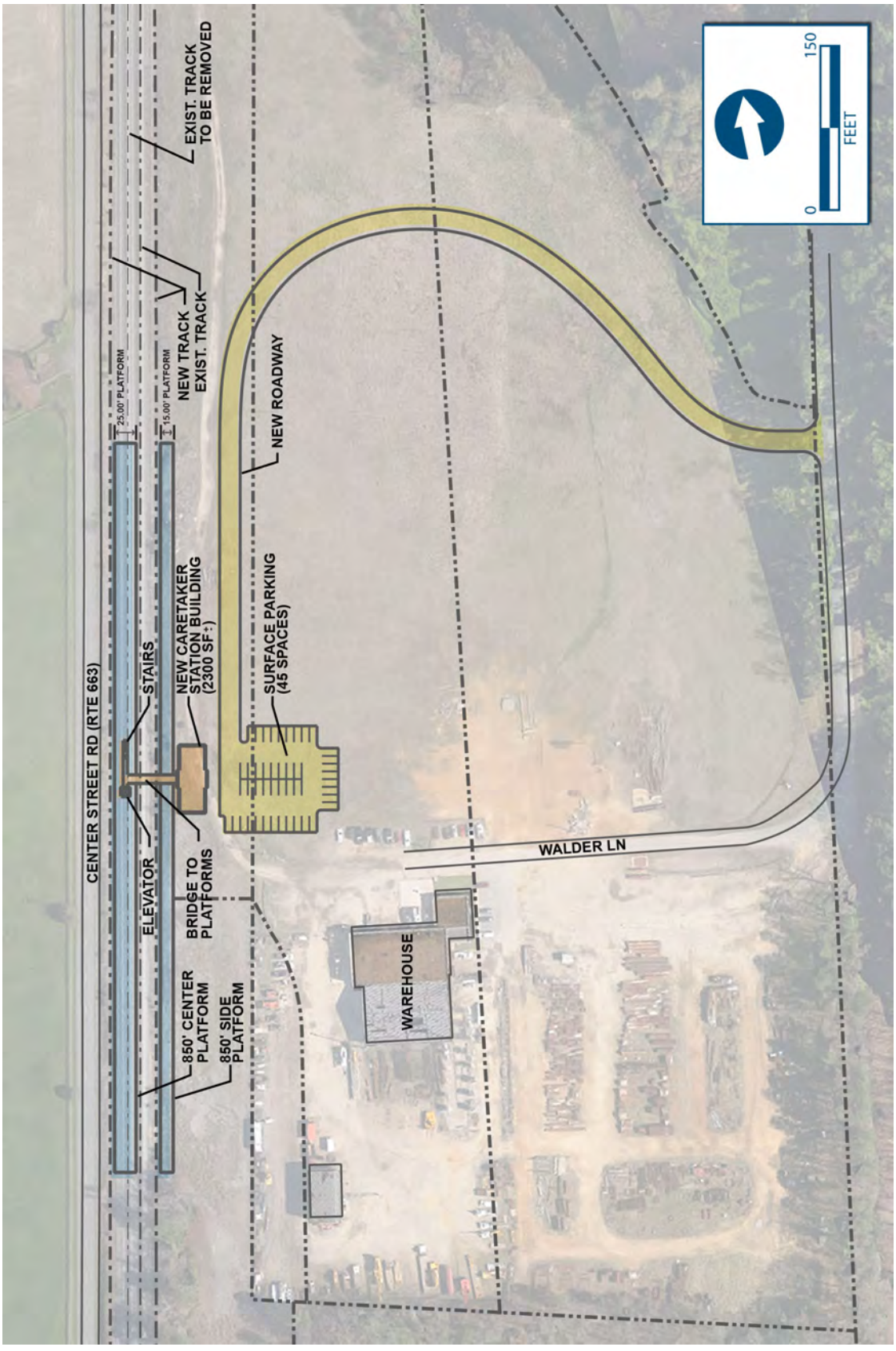


Figure 2-29: Ashcake Station Improvements for Build Alternatives 5A–Ashcake, 5B–Ashcake, 5C–Ashcake, and 5D–Ashcake

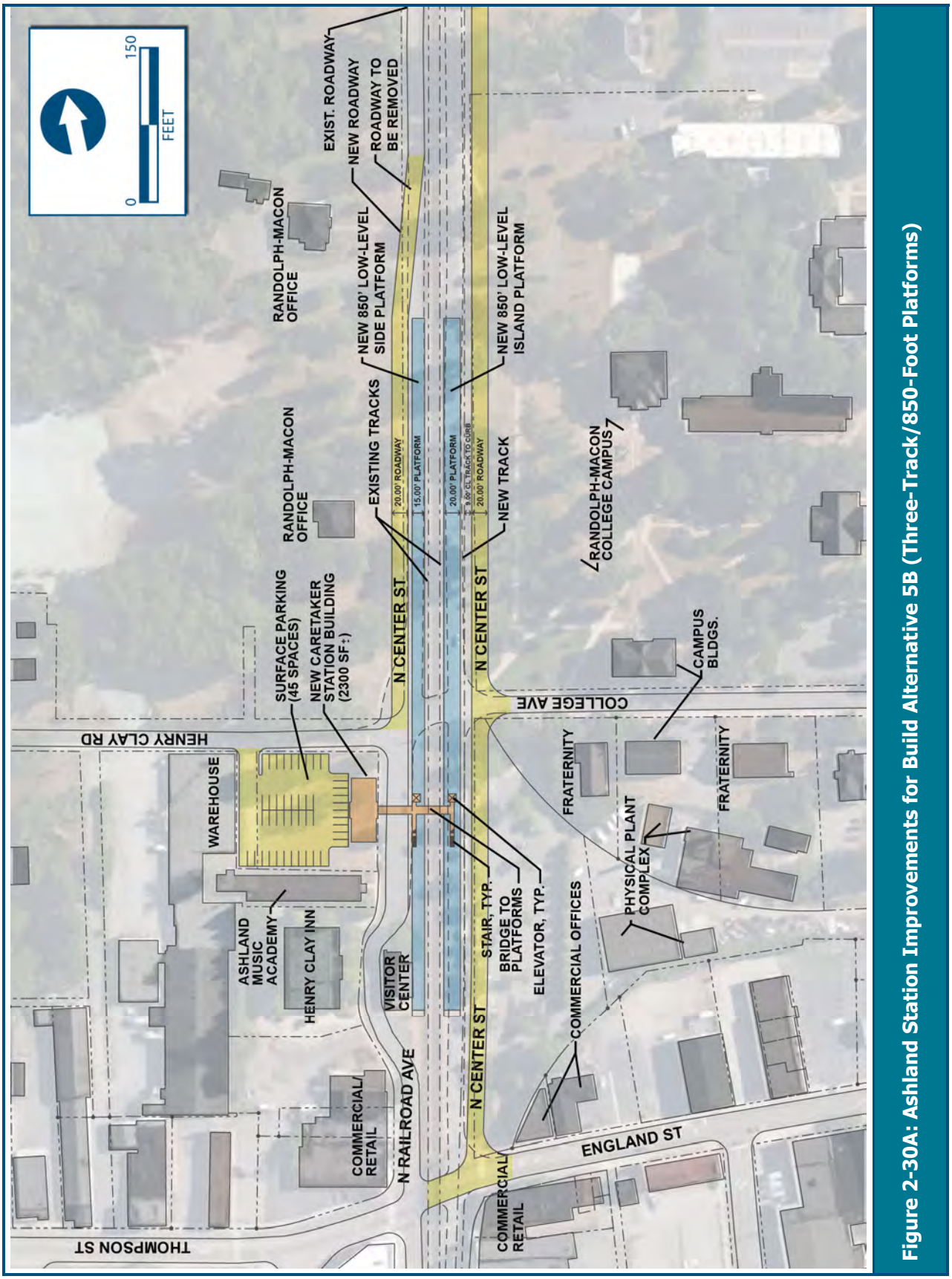


Figure 2-30A: Ashland Station Improvements for Build Alternative 5B (Three-Track/850-Foot Platforms)

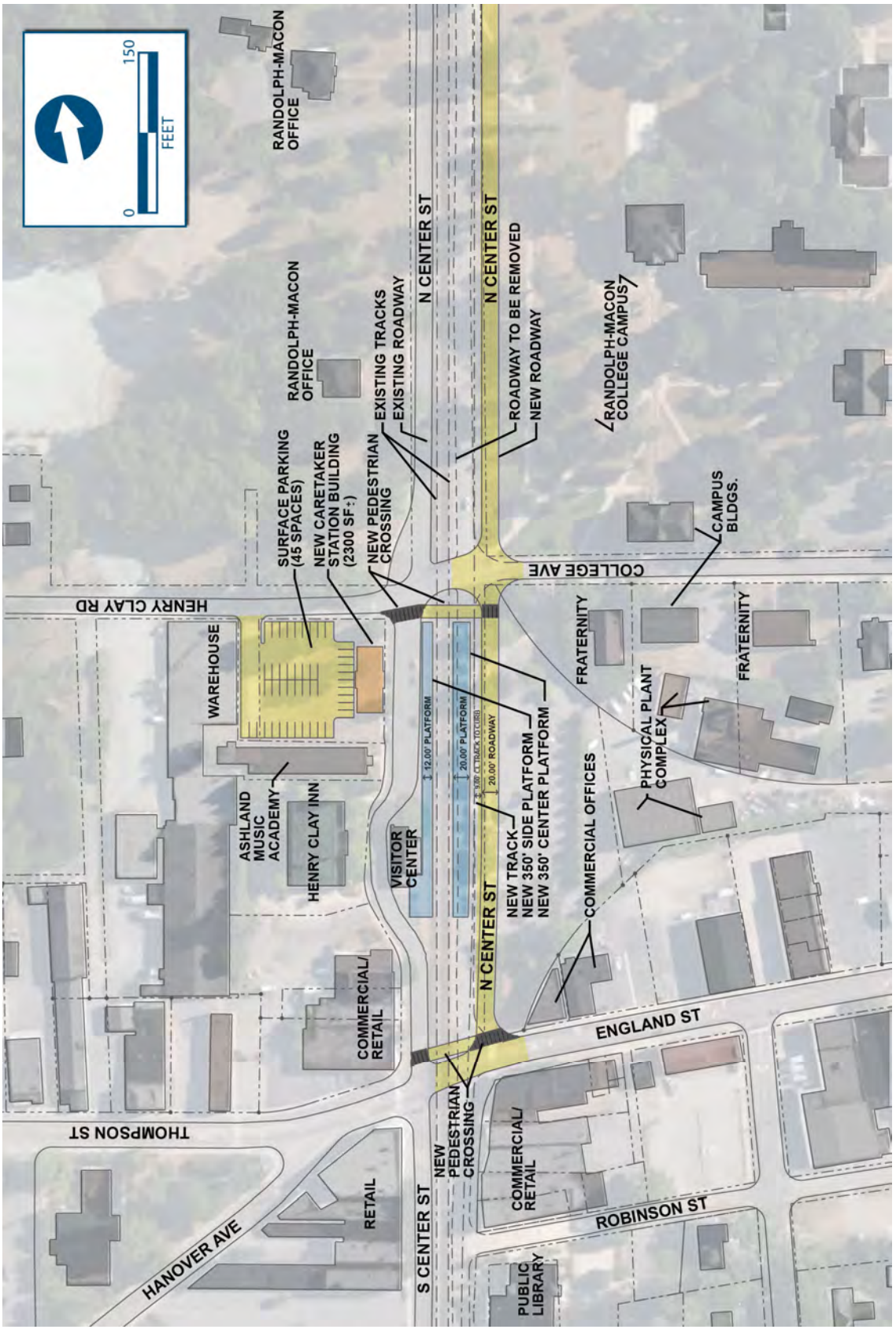


Figure 2-30B: Ashland Station Improvements for Build Alternative 5B (Three-Track/350-Foot Platforms)

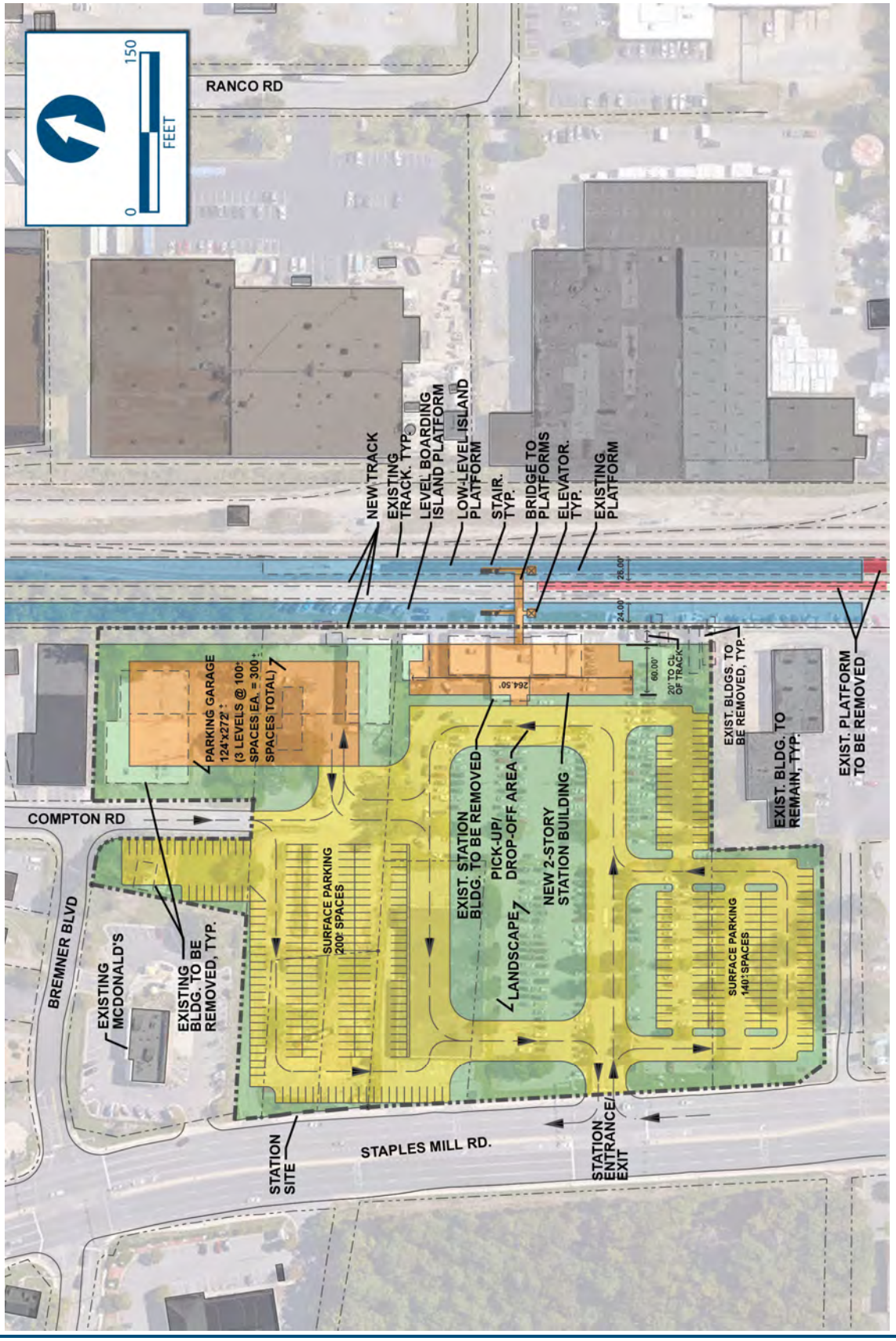


Figure 2-31: Staples Mill Road Station Improvements for Build Alternative 6A

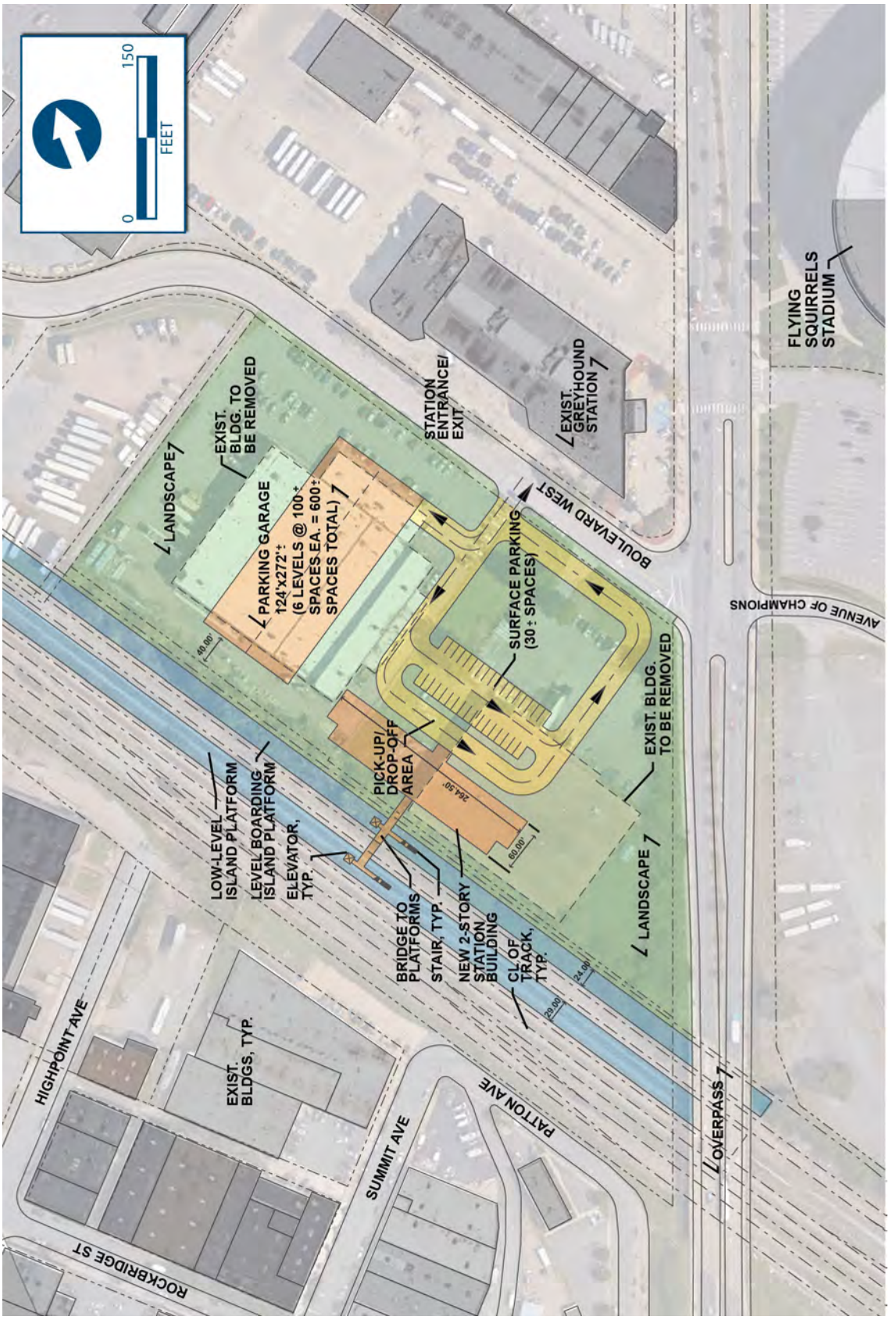


Figure 2-32: Boulevard Station Improvements for Build Alternatives 6B–A-Line and 6B–S-Line

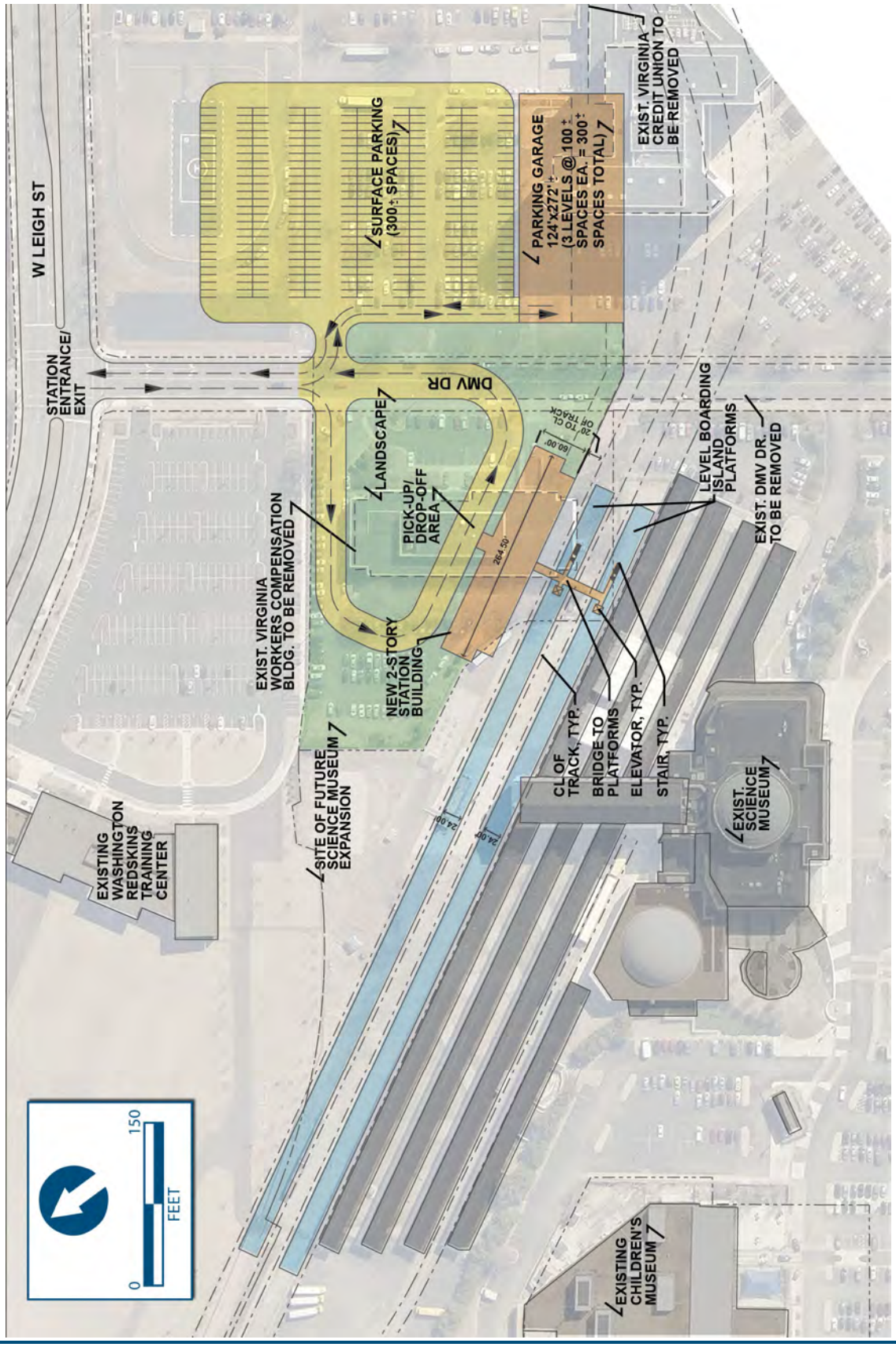


Figure 2-33: Broad Street Station Improvements for Build Alternative 6C

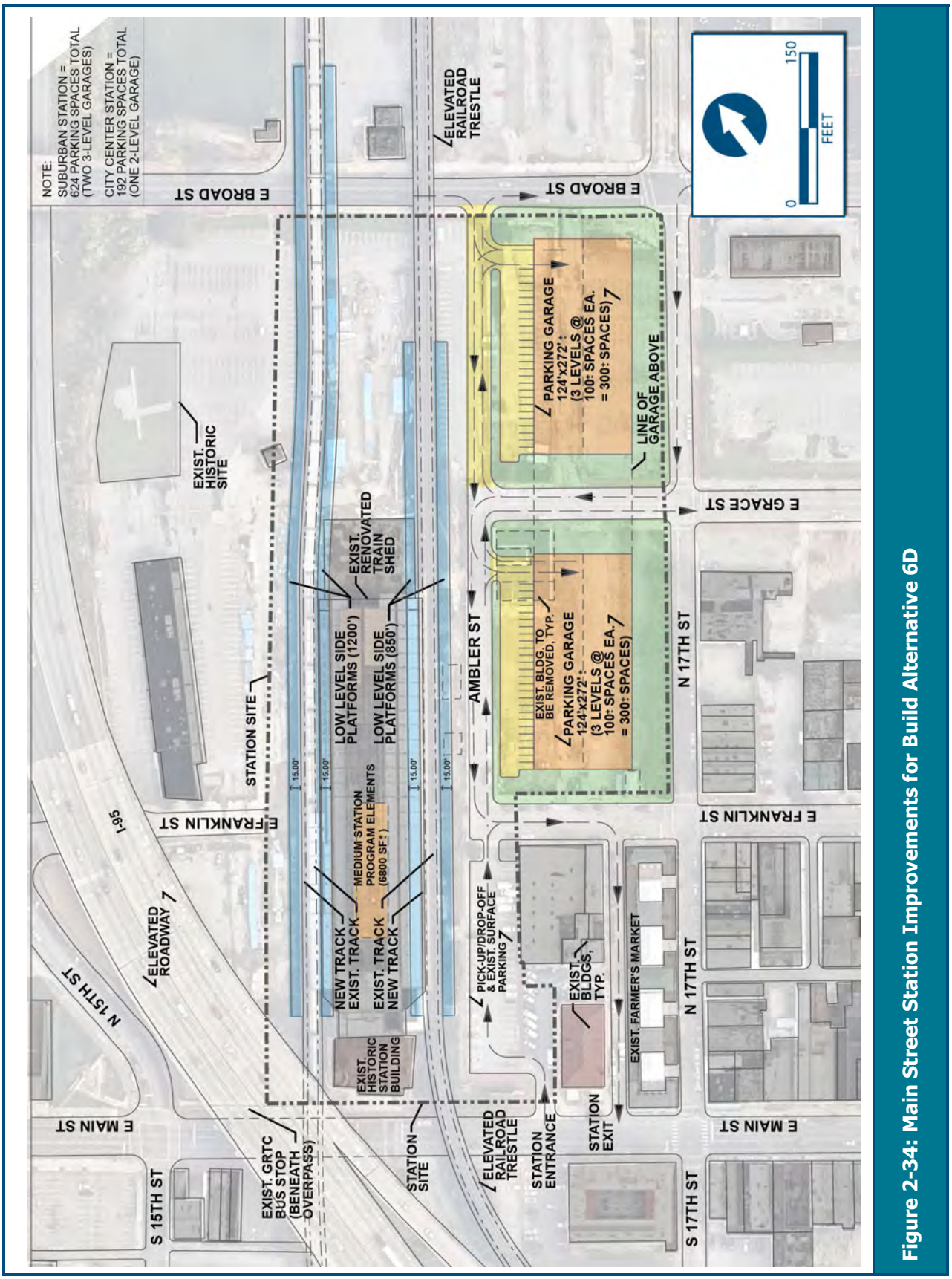


Figure 2-34: Main Street Station Improvements for Build Alternative 6D

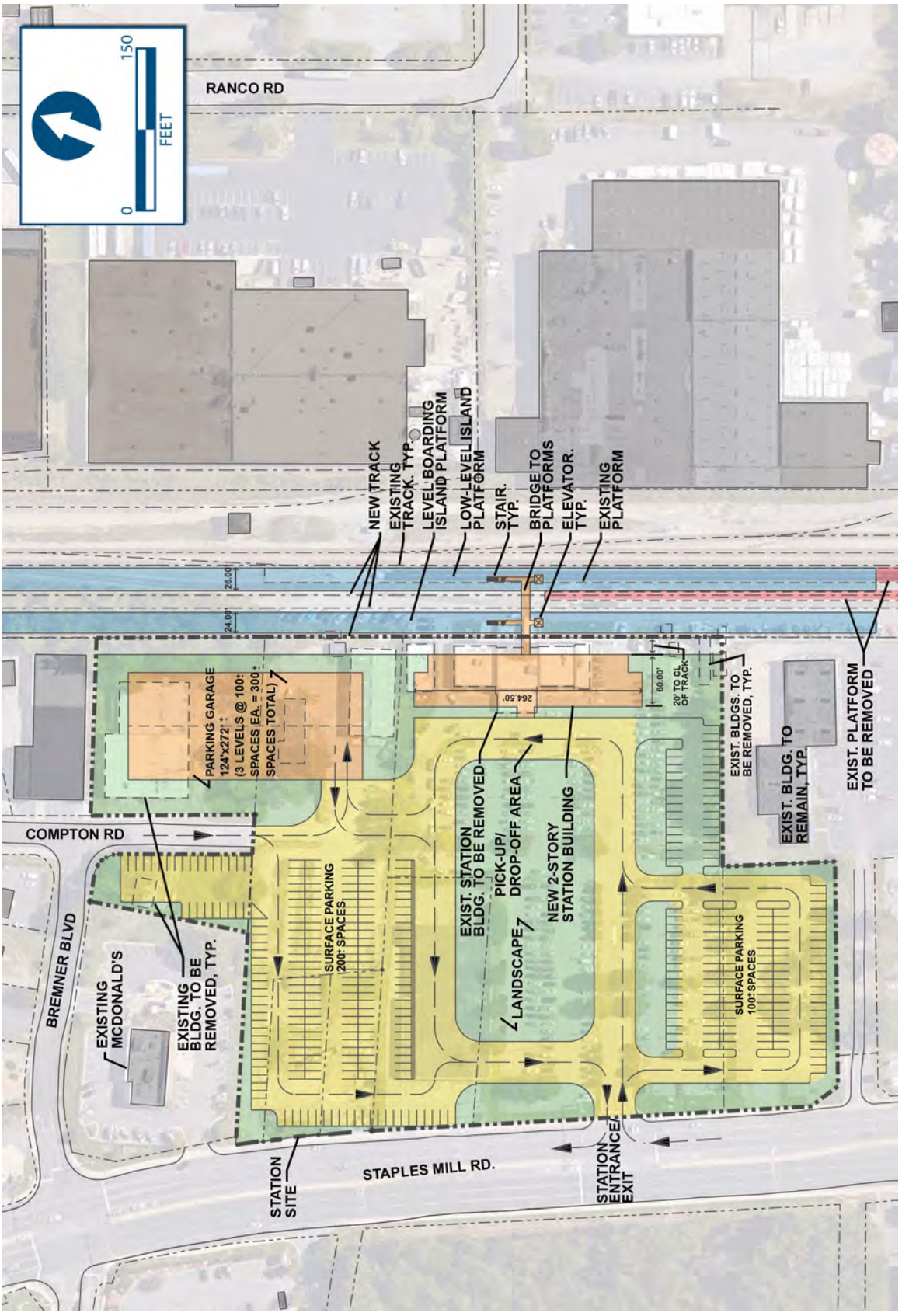


Figure 2-35: Staples Mill Road Station Improvements for Build Alternative 6E

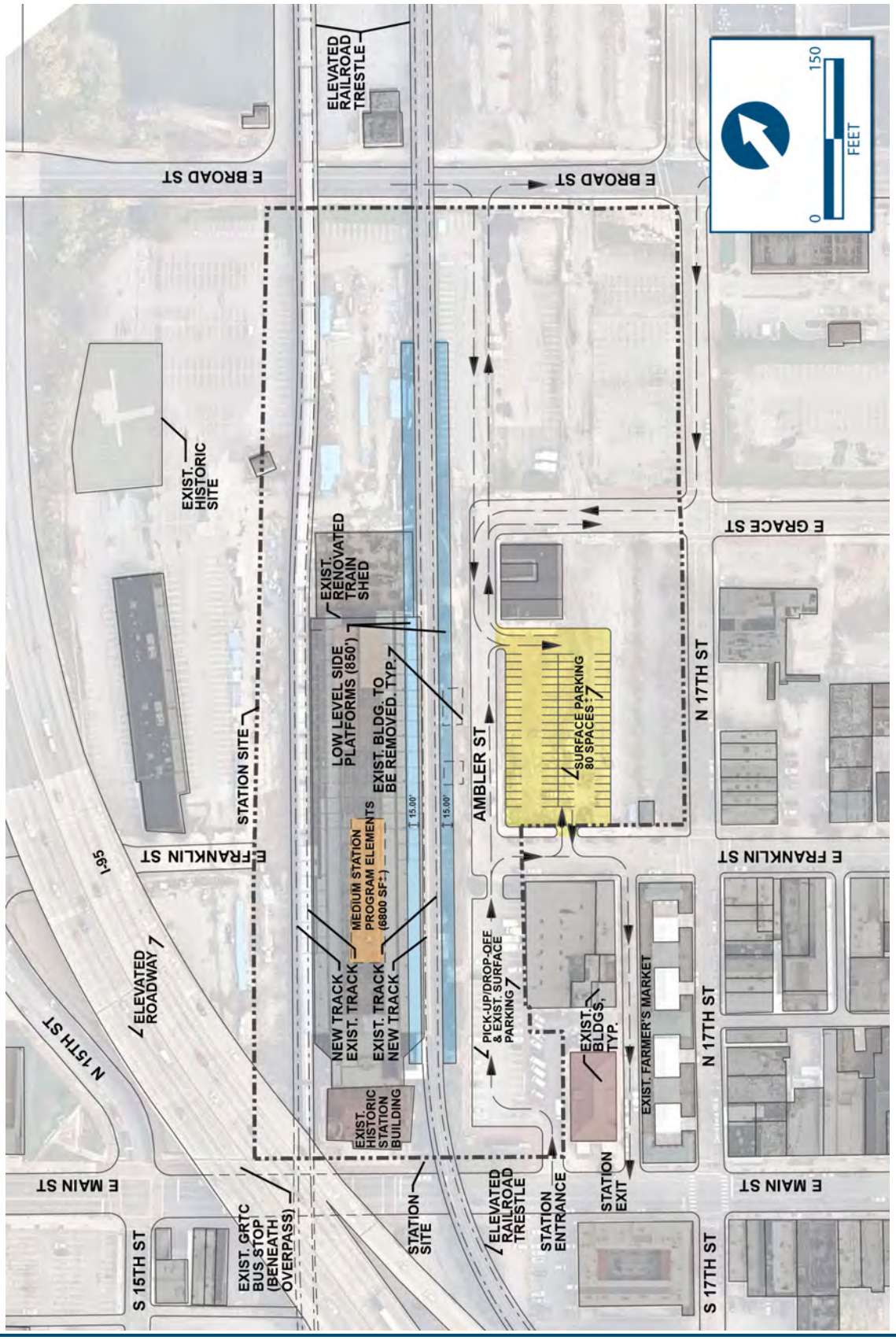


Figure 2-36: Main Street Station Improvements for Build Alternative 6E

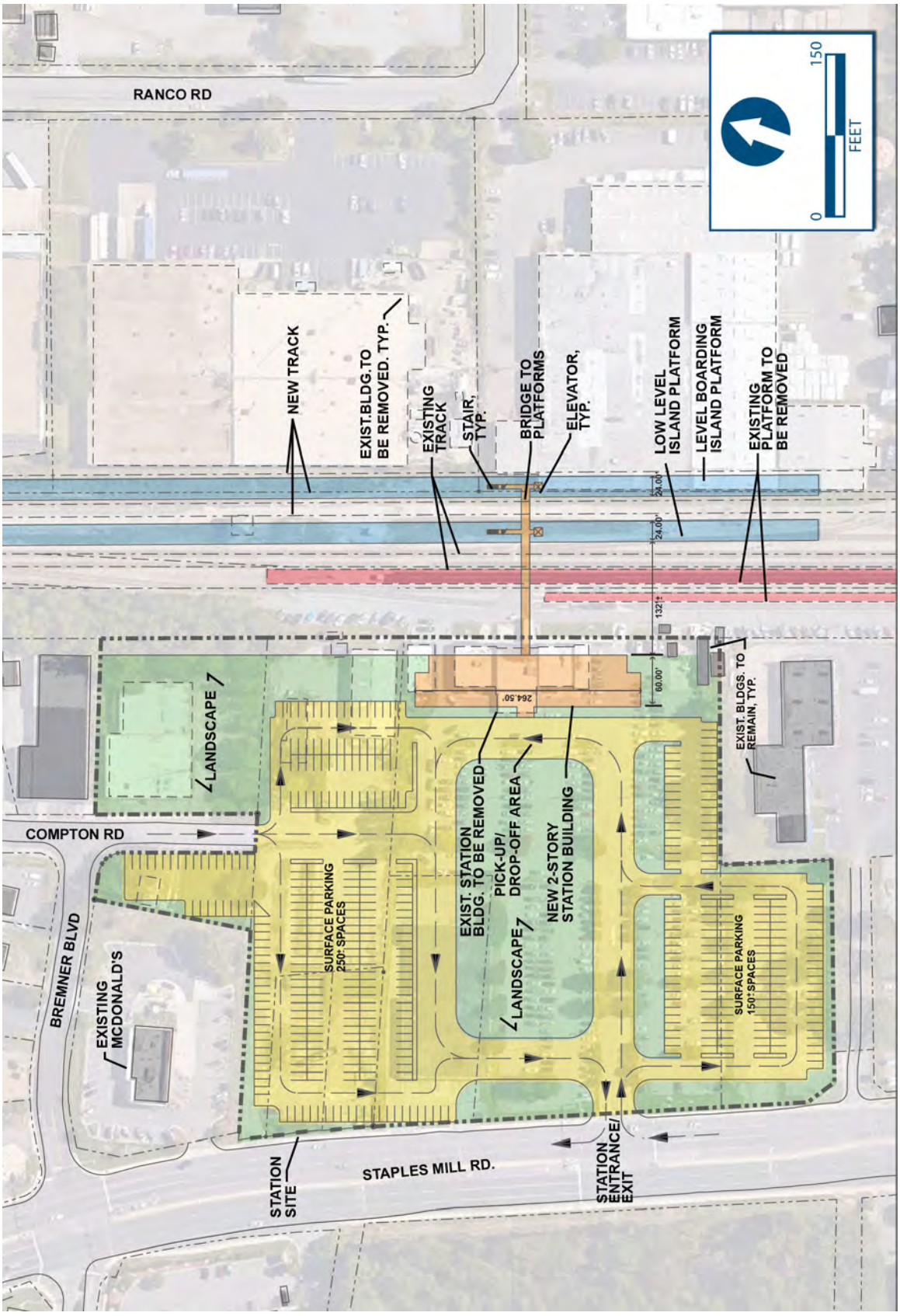


Figure 2-37: Staples Mill Road Station Improvements for Build Alternative 6F

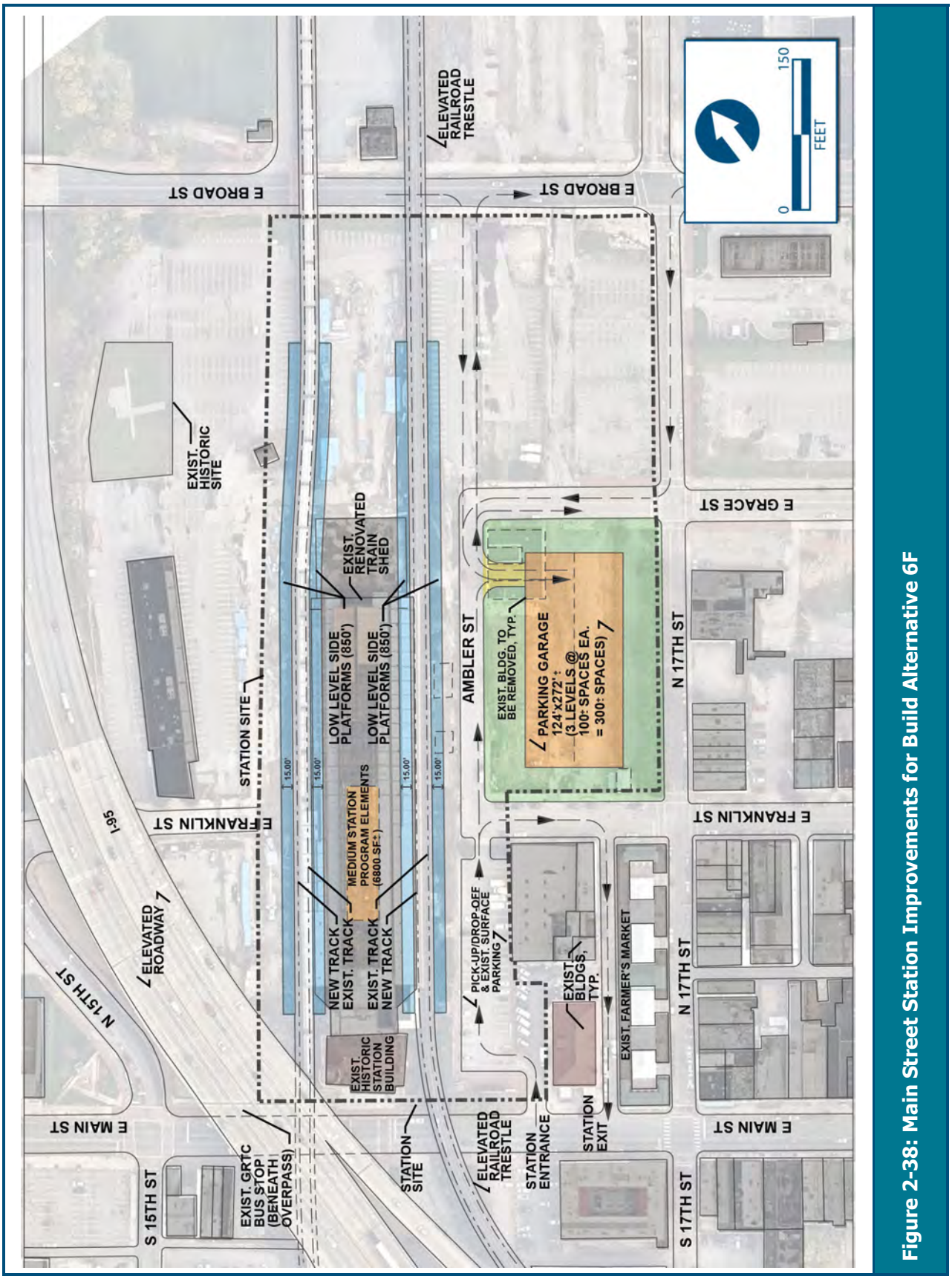


Figure 2-38: Main Street Station Improvements for Build Alternative 6F

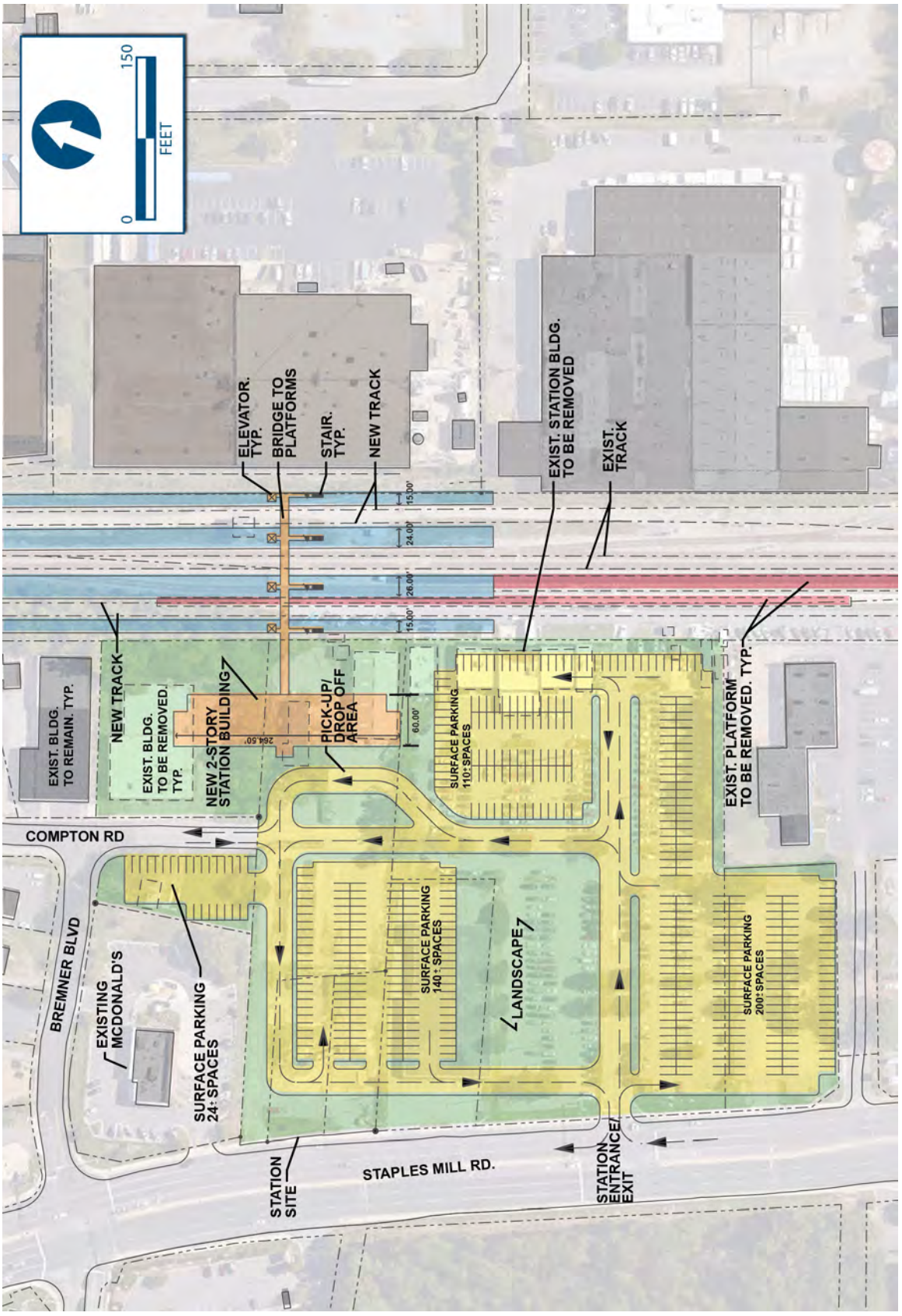


Figure 2-39: Staples Mill Road Station Improvements for Build Alternative 6G

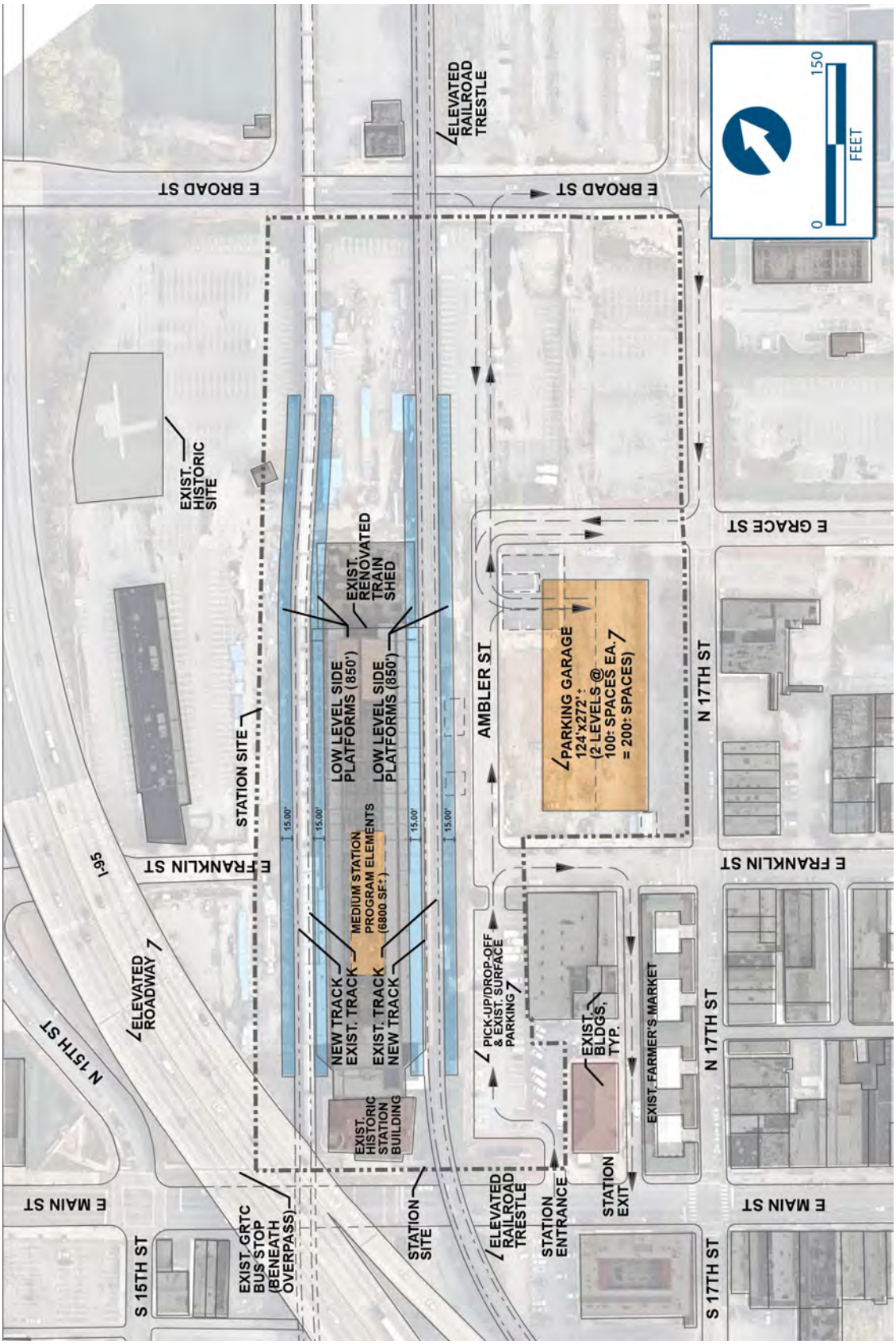


Figure 2-40: Main Street Station Improvements for Build Alternative 6G

3 AFFECTED ENVIRONMENT

3.1 WATER RESOURCES

Water resources are regulated by the United States Environmental Protection Agency (EPA) and the United States Army Corps of Engineers (USACE) according to the Water Pollution Control Act of 1972 (Clean Water Act [CWA]) and the Water Quality Act of 1987. Section 404 of the CWA regulates activities affecting Waters of the United States (WOUS). WOUS can be generally defined as all navigable waters and waters that have been or can be used for interstate or foreign commerce, their tributaries, and any waters that, if impacted, could affect the former. WOUS include surface waters (e.g., streams, lakes, bays) and their associated wetlands (i.e., inundated or saturated areas that support vegetation adapted for life in wet soils). EPA, USACE, the United States Coast Guard (USCG), the Virginia Department of Environmental Quality (DEQ), and the Virginia Marine Resources Commission (VMRC) all issue permits for various activities in, under, and over WOUS.

3.1.1 Methods

Virginia DEQ administers the Virginia Water Protection Permit program (9 VAC 25-210), Section 401 of the CWA, and the State Water Control Law for activities affecting jurisdictional wetlands, streams, and other water bodies. In July 2000, Virginia DEQ authority was modified by the Virginia General Assembly to develop a non-tidal wetlands program and to provide regulations to protect fish and wildlife resources. While waters that are considered "isolated" do not fall under federal CWA permitting, they are regulated by Virginia DEQ.

VMRC is authorized to permit activities in, on or over state-owned subaqueous lands in Virginia (Code of Virginia Chapter 2, Title 62.1). In addition, VMRC is responsible for managing and regulating the use of Virginia's tidal wetlands and coastal primary sand dunes in conjunction with Virginia's local wetlands boards, where established. VMRC also protects and regulates those areas designated as non-vegetated and vegetated tidal wetlands and state-owned subaqueous bottom land.

Virginia's WOUS, including wetlands, are also regulated under the Virginia Wetlands Act and through Subtitle III of Title 28.2 of the Code of Virginia. These laws include oversight of areas and activities, such as isolated wetlands or Tulloch ditching, that are not covered by the Federal wetland program. Through this framework, each County's Local Wetlands Board regulates activities in tidal wetlands within their Counties.

Streams, wetlands, and floodplains within a 500-foot-wide study area centered on the DC2RVA corridor were identified by reviewing aerial photographs and topographic maps, Virginia Wetlands Catalog maps from the Virginia Department of Conservation and Recreation (VDCR)–Division of Natural Heritage, wetlands digitized by the City of Richmond, National Hydrography Dataset (NHD) maps from the United States Geological Survey (USGS), National Wetlands Inventory (NWI)

maps from the United States Fish and Wildlife Service (USFWS), Virginia Department of Transportation's (VDOT) "Comprehensive Environmental Data and Reporting System" (CEDAR) Geographic Information System (GIS) data (VDOT, no date), VDOT mitigation sites and Flood Insurance Rate Maps (FIRM) from the Federal Emergency Management Agency (FEMA).

The Virginia Department of Rail and Public Transportation (DRPT) conducted field surveys in September 2015 through September 2016 to verify the existence of potential ephemeral, intermittent, and perennial streams and wetlands within 100 feet of the existing rail on the side of the track where improvements are proposed. The field survey findings augmented and updated the NHD and NWI mapping. These water resources are discussed in greater detail in the sections below. Streams and wetlands mapped within the study areas are shown in Appendices A through F. Lengths of streams and areas of wetlands within the study corridor were calculated using GIS.

Due to the DC2RVA corridor being located in two geographic regions, DRPT confirmed with USACE at a meeting held prior to fieldwork that two different regional supplements of the USACE delineation manual and its forms would be used for the delineation of wetlands along the corridor. The Eastern Mountains and Piedmont–Version 2.0 would be used for all wetlands delineated west of I-95, and the Atlantic and Gulf Coastal Plane Region–Version 2.0 would be used for all wetlands delineated east of I-95. All stream channels with the potential to be impacted by the DC2RVA project were assessed using the Unified Stream Methodology (USM) form. In Virginia, the USM is the approved assessment methodology for existing stream condition and the necessary mitigation requirements for stream impacts. Field reviews by USACE and Virginia DEQ, spot checks with the field crews at several intervals during the field survey, ensured methods were conducted according to agency expectations. Additional information was obtained through the scoping process, participating agency meetings, and consultation with regulatory agencies, including:

- National Oceanic and Atmospheric Administration, National Marine Fisheries Service
- United States Army Corps of Engineers (USACE), Norfolk and Baltimore Districts
- United States Department of Interior, National Park Service (NPS)
- United States Department of Interior, United States Fish and Wildlife Service (USFWS)
- United States Department of Agriculture, National Resource Conservation Service
- United States Department of Agriculture, Wildlife Services
- United States Department of Homeland Security, United States Coast Guard (USCG), Fifth Coast Guard District
- United States Department of Homeland Security, Federal Emergency Management Agency, Region III
- United States Environmental Protection Agency (EPA), Region III
- Virginia Department of Forestry
- Virginia Department of Conservation and Recreation (VDCR)
- Virginia Department of Environmental Quality (DEQ)
- Virginia Department of Game and Inland Fisheries (VDGIF)
- Virginia Port Authority
- Virginia Marine Resources Commission (VMRC)

Lengths of streams and areas of wetlands along the DC2RVA corridor were calculated using GIS. This report uses an abbreviated version of the classification system developed by the USFWS, also known as the Cowardin System (Cowardin et. al, 1979), for identifying wetlands. Wetlands found in the study area include palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) systems. These are freshwater systems dominated by emergent herbaceous plants (plants with no woody stem present from year to year), shrubs, and trees or forest.

3.1.2 Drainage Basins

For permitting purposes, regulatory agencies prefer that mitigation take place within the same Hydrologic Unit Code (HUC) 8 watershed as the project. The DC2RVA corridor crosses seven USGS Subbasins or HUC 8, in addition to many wetland and stream resources:

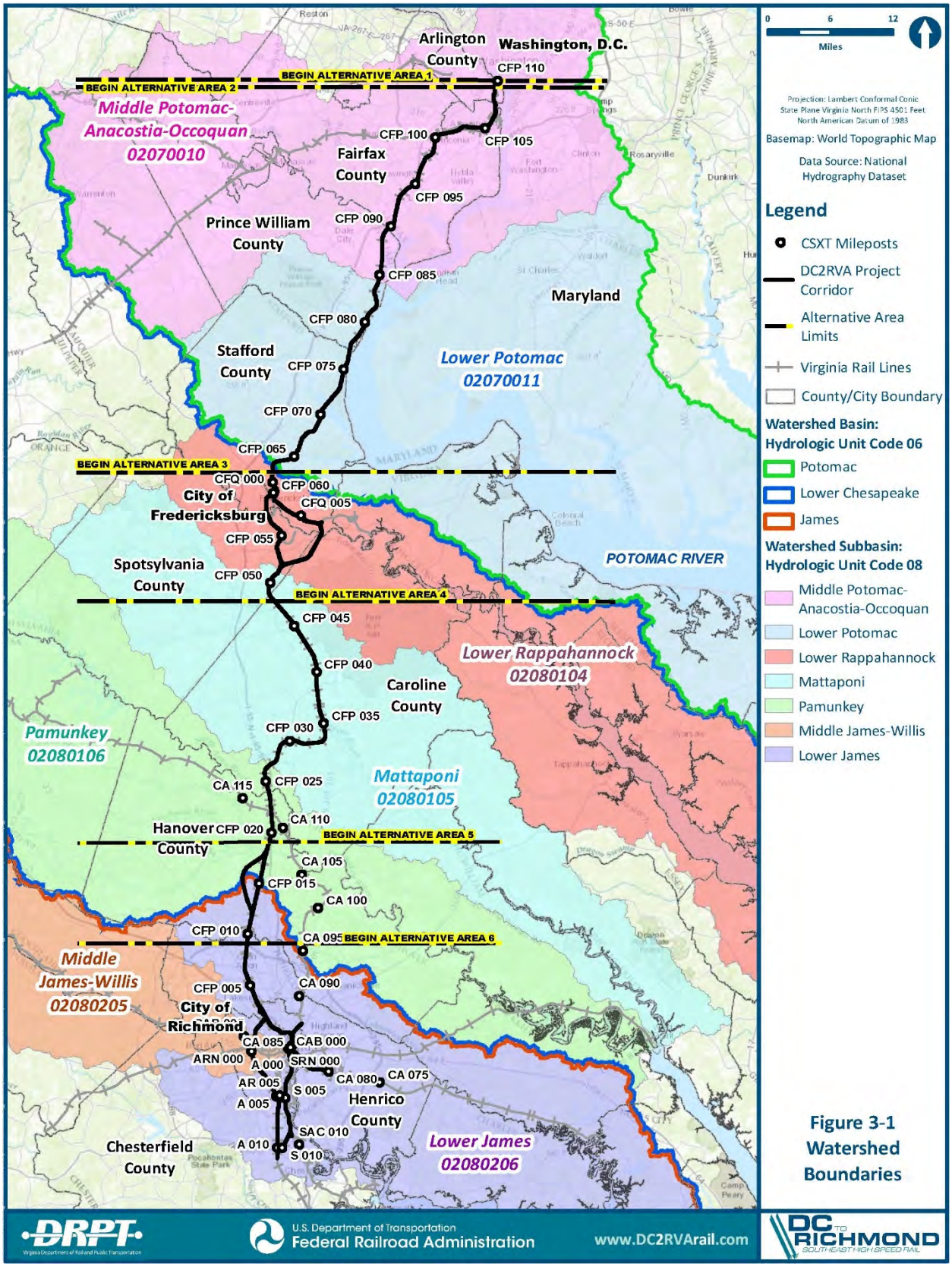
- Middle Potomac–Anacostia–Occoquan (HUC 02070010);
- Lower Potomac River (HUC 02070011)
- Lower Rappahannock (HUC 02080104)
- Mattaponi (HUC 02080105)
- Pamunkey (HUC 02080106)
- Middle James–Willis (HUC 02080205)
- Lower James (HUC 02080206)

Figure 3-1 shows these watersheds.

Middle Potomac–Anacostia–Occoquan Watershed (HUC 02070010)
This watershed encompasses approximately 831,483 acres in Alexandria, Arlington, Fairfax, Prince William, Loudoun, Fauquier, and Stafford counties. It is one of the most polluted watersheds in Virginia with approximately 27 percent of the surface waters reporting reduced water quality, even though roughly 45 percent of the watershed is forested.

Lower Potomac River Watershed (HUC 02070011)
Prince William, Westmoreland, King George, Northumberland, Richmond, Fauquier, and Stafford counties contain a portion of this watershed. Most of the 1,160,160 acres is forested (i.e., deciduous, evergreen, and mixed).

Lower Rappahannock Watershed (HUC 02080104)
This watershed drains directly to the Chesapeake Bay, and supplies important coastal habitat to waterfowl and migratory birds along the Eastern Flyway (USDA, 2004). The Lower Rappahannock Watershed encompasses approximately 738,446 acres in Stafford, Spotsylvania, Caroline, King George, Richmond, Westmoreland, Lancaster, Essex, and Middlesex counties. Half of the area is forested with a mixture of hardwood and pines. Of the remaining area, agriculture makes up approximately 21 percent of the land use, producing mainly soybeans, corn, and hay; 14 percent has been developed.


Arlington County
Washington, D.C.
CFP 110
BEGIN ALTERNATIVE AREA 1
BEGIN ALTERNATIVE AREA 2
Middle Potomac-Anacostia-Occoquan 02070010
CFP 100
CFP 105
Fairfax County
CFP 095
Prince William County
CFP 090
CFP 085
Maryland
CFP 080
Stafford County
CFP 075
Lower Potomac 02070011
CFP 070
CFP 065
BEGIN ALTERNATIVE AREA 3
CFQ 000
CFP 060
City of Fredericksburg
CFQ 005
CFP 055
POTOMAC RIVER
Spotsylvania County
CFP 050
BEGIN ALTERNATIVE AREA 4
CFP 045
Lower Rappahannock 02080104
CFP 040
Caroline County
CFP 035
CFP 030
Pamunkey 02080106
CA 115
CFP 025
Mattaponi 02080105
CA 110
Hanover County
CFP 020
BEGIN ALTERNATIVE AREA 5
CA 105
CFP 015
CA 100
CFP 010
CA 095
BEGIN ALTERNATIVE AREA 6
Middle James-Willis 02080205
CA 090
CFP 005
City of Richmond
CA 085
CAB 000
ARN 000
A 000
SRN 000
CA 080
CA 075
AR 005
S 005
Henrico County
A 005
SAC 010
Chesterfield County
A 010
S 010
Lower James 02080206
0
6
12
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: National Hydrography Dataset
Legend
CSXT Mileposts
DC2RVA Project Corridor
Alternative Area Limits
Virginia Rail Lines
County/City Boundary
Watershed Basin: Hydrologic Unit Code 06
Potomac
Lower Chesapeake
James
Watershed Subbasin: Hydrologic Unit Code 08
Middle Potomac-Anacostia-Occoquan
Lower Potomac
Lower Rappahannock
Mattaponi
Pamunkey
Middle James-Willis
Lower James
Figure 3-1
Watershed Boundaries
DRPT
U.S. Department of Transportation
Federal Railroad Administration
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DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL

Mattaponi Watershed (HUC 02080105)
This watershed encompasses approximately 582,426 acres in Orange, Spotsylvania, Caroline, King and Queen, and King William counties. Most of the land (approximately 70 percent) in this watershed is forested with a mixture of hardwood and pines. Roughly 14 percent of the land is used for agriculture, and 10 percent of the land has been developed. This watershed drains to the York River and eventually the Chesapeake Bay.

Pamunkey Watershed (HUC 02080106)
This watershed is located in Hanover, Louisa, King William, Spotsylvania, Caroline, and New Kent counties. Approximately 941,032 acres drain to the York River and eventually to the Chesapeake Bay. The area is predominantly wooded with irregular plains and low, rolling hills. Elevations downstream are very low, stream flow is slow, and stained water is common. Land use in the drainage area is mostly forested (approximately 64 percent), pasture and crop land account for approximately 13 percent of the area, and about 4 percent is developed or barren.

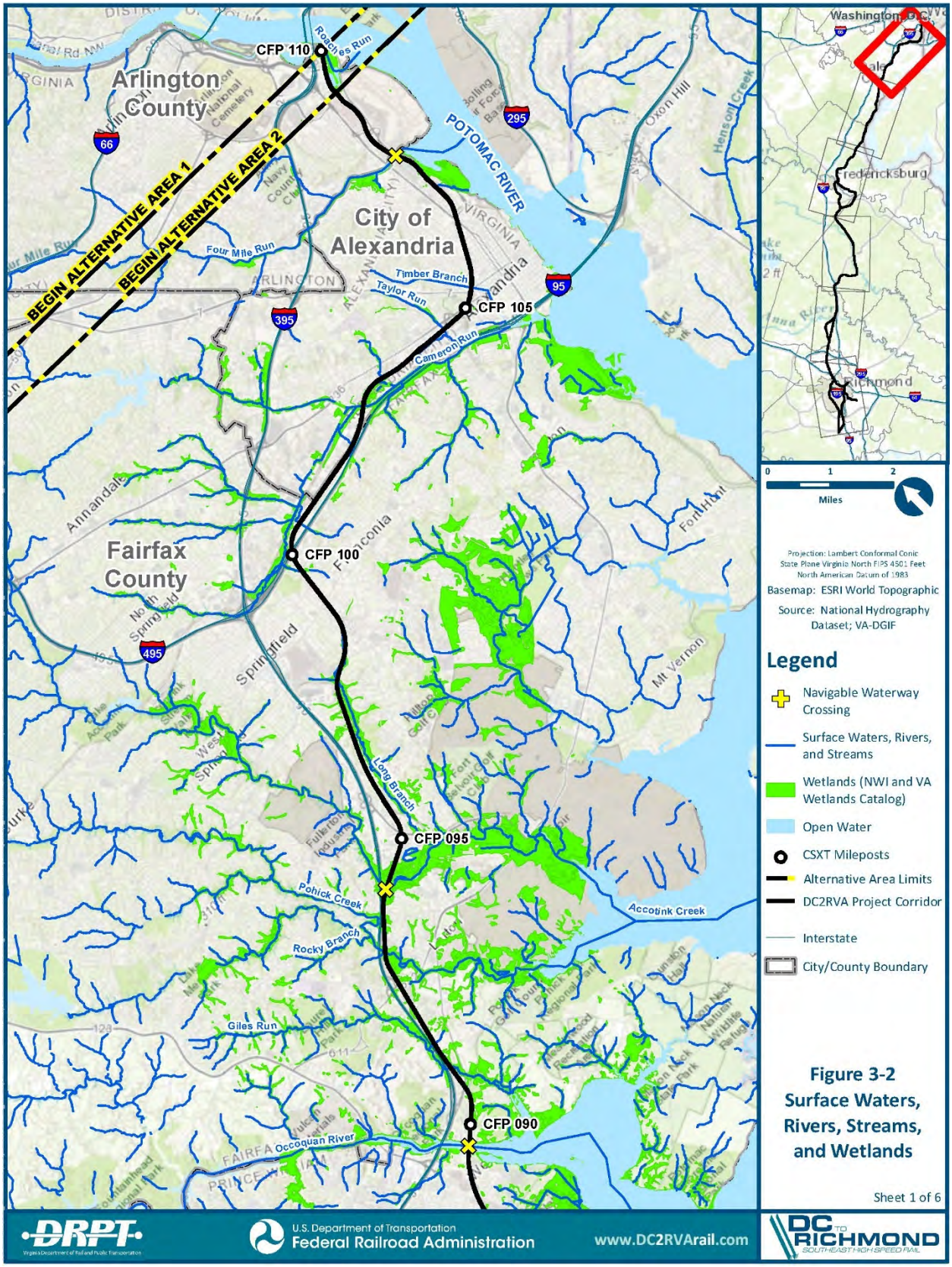
Middle James–Willis Watershed (HUC 02080205)
This watershed contains approximately 615,449 acres in a portion of 6 counties—Buckingham, Cumberland, Fluvanna, Goochland, Henrico, and Powhatan—and the city of Richmond.

Lower James Watershed (HUC 02080206)
Land use in this approximately 1,135,000-acre watershed is mostly urban and suburban (48 percent), with only 31 percent forested and 12 percent agricultural. It is known for its large military installations, port facilities, and manufacturing. The watershed covers part or all of Hanover, Henrico, Prince George, New Kent, Surry, Isle of Wight, and York counties.

3.1.3 Surface Waters, Rivers, and Streams

The 500-foot-wide study area along the DC2RVA corridor includes more than 350 rivers, streams, and other surface waters (Figure 3-2), including approximately 204,563 linear feet, and 632 acres of surface waters, including rivers and streams (Table 3-1). Most of the surface waters are small perennial or intermittent streams. Eight of the waters are classified as navigable.

Occoquan River


CFP 110
CFP 105
CFP 100
CFP 095
CFP 090
BEGIN ALTERNATIVE AREA 1
BEGIN ALTERNATIVE AREA 2
Arlington County
City of Alexandria
Fairfax County
POTOMAC RIVER
Four Mile Run
Timber Branch
Taylor Run
Cameron Run
Long Branch
Pohick Creek
Rocky Branch
Giles Run
Accotink Creek
Occoquan River
Springfield
Annandale
Mt Vernon
Fredericksburg
Richmond
Washington, D.C.
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
Source: National Hydrography Dataset; VA-DGIF
Legend
Navigable Waterway Crossing
Surface Waters, Rivers, and Streams
Wetlands (NWI and VA Wetlands Catalog)
Open Water
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Interstate
City/County Boundary
Figure 3-2
Surface Waters, Rivers, Streams, and Wetlands
Sheet 1 of 6
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U.S. Department of Transportation
Federal Railroad Administration
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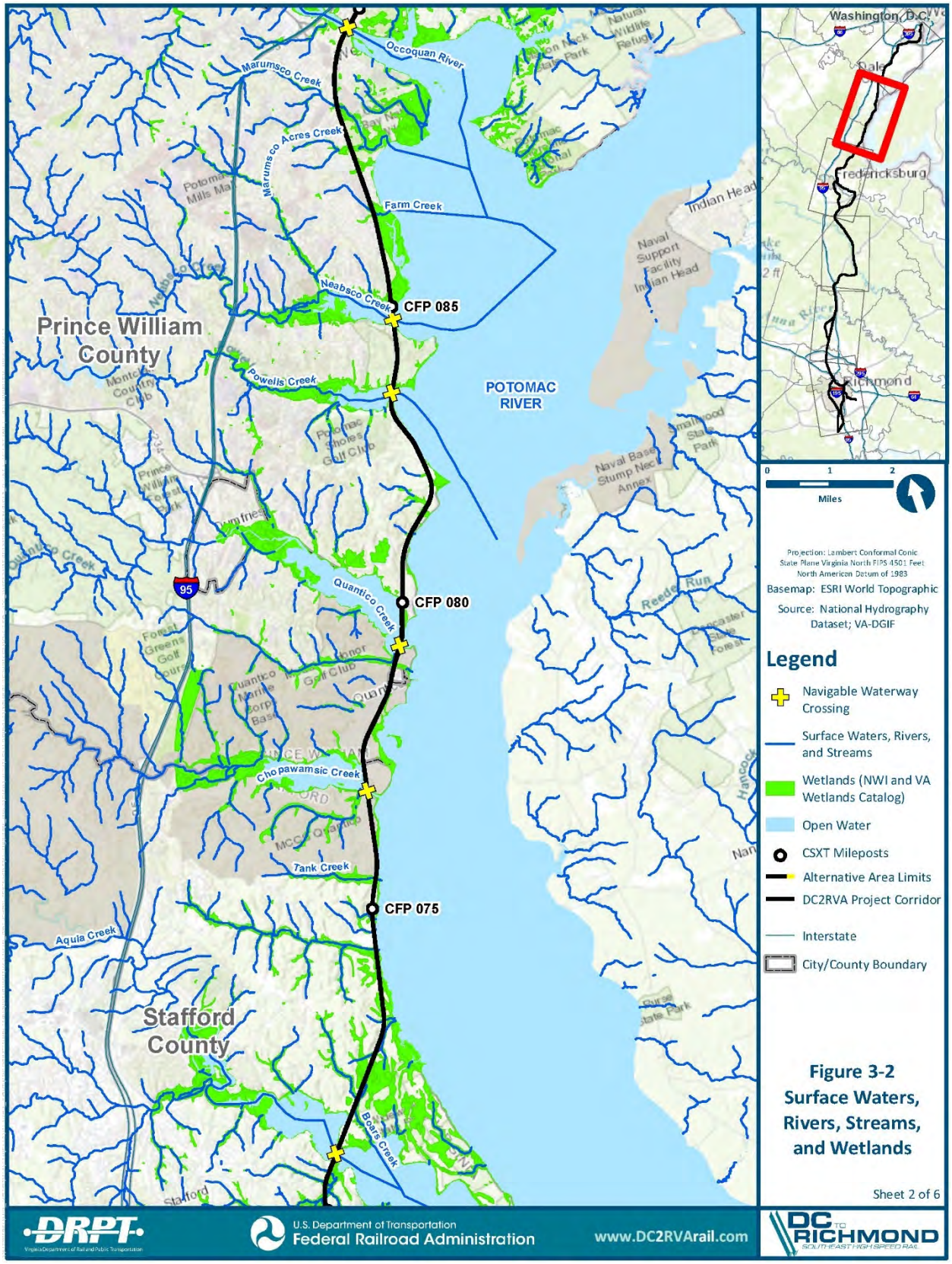
Occoquan River
Marumsco Creek
Marumsco Acres Creek
Farm Creek
Neabsco Creek
CFP 085
Prince William County
Powells Creek
POTOMAC RIVER
Quantico Creek
CFP 080
Chopawamsic Creek
Tank Creek
CFP 075
Aquia Creek
Stafford County
Indian Head
Naval Support Facility Indian Head
Naval Base Stump Neck Annex
Washington, D.C.
Fredericksburg
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
Source: National Hydrography Dataset; VA-DGIF
Legend
Navigable Waterway Crossing
Surface Waters, Rivers, and Streams
Wetlands (NWI and VA Wetlands Catalog)
Open Water
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Interstate
City/County Boundary
Figure 3-2
Surface Waters, Rivers, Streams, and Wetlands
Sheet 2 of 6
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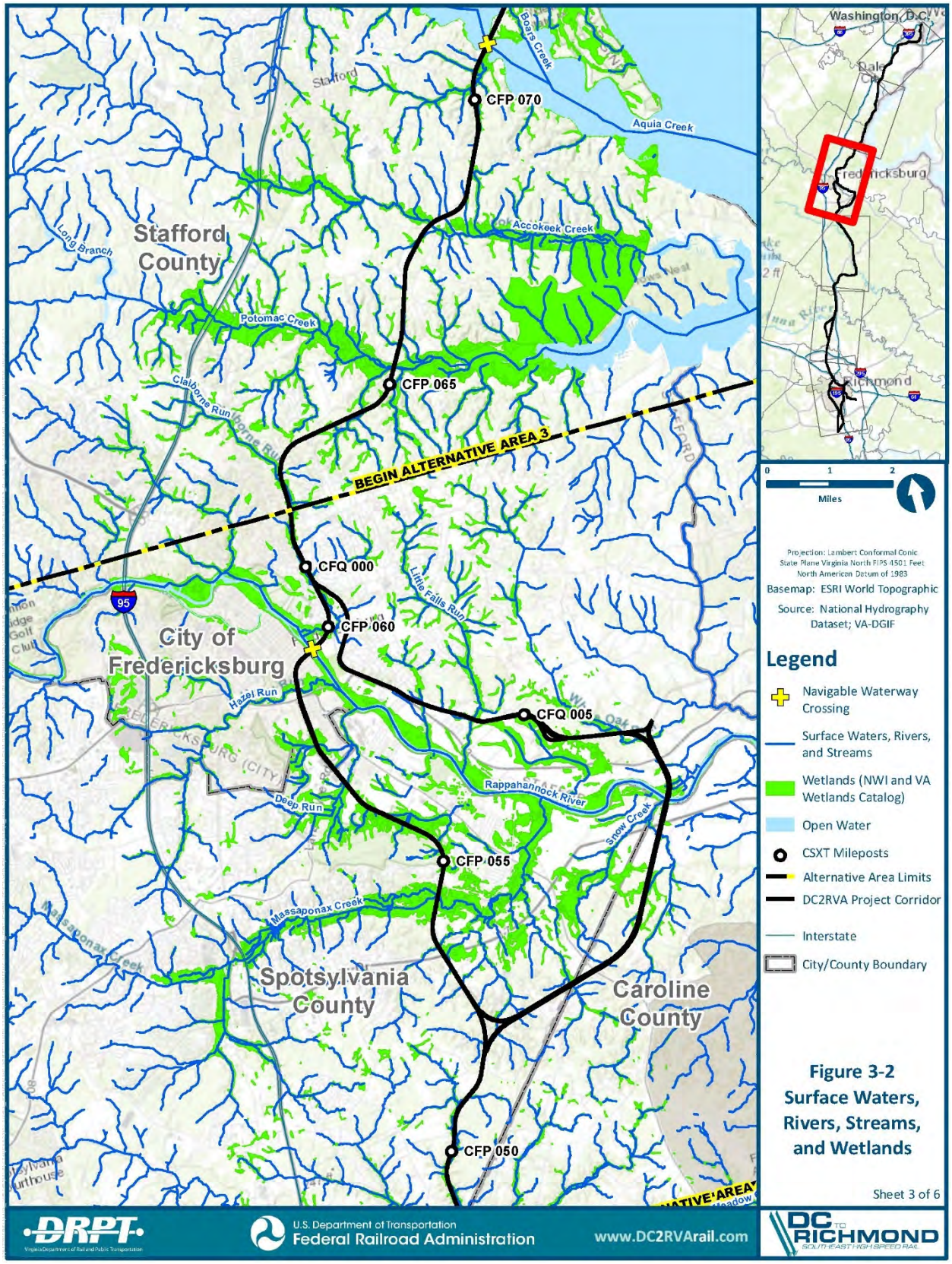
Stafford County
City of Fredericksburg
Spotsylvania County
Caroline County
CFP 070
CFP 065
CFQ 000
CFP 060
CFQ 005
CFP 055
CFP 050
BEGIN ALTERNATIVE AREA 3
Aquia Creek
Accokeek Creek
Potomac Creek
Claiborne Run
Little Falls Run
Hazel Run
Deep Run
Rappahannock River
Snow Creek
Massaponax Creek
Long Branch
Boars Creek
Washington, D.C.
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
Source: National Hydrography Dataset; VA-DGIF
Legend
Navigable Waterway Crossing
Surface Waters, Rivers, and Streams
Wetlands (NWI and VA Wetlands Catalog)
Open Water
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Interstate
City/County Boundary
Figure 3-2
Surface Waters, Rivers, Streams, and Wetlands
Sheet 3 of 6
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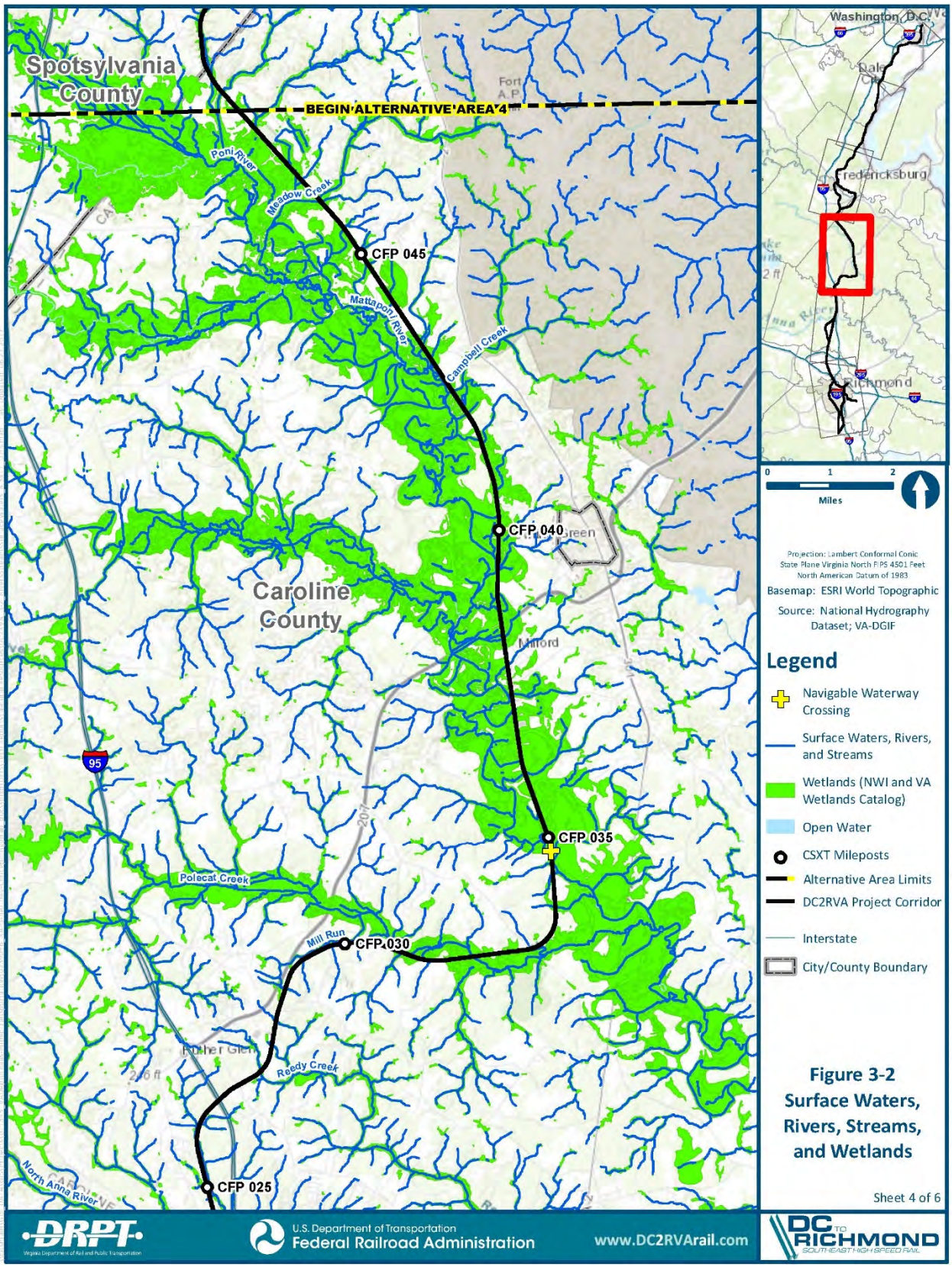
Spotsylvania County
BEGIN ALTERNATIVE AREA 4
Poni River
Meadow Creek
CFP 045
Mattaponi River
Campbell Creek
CFP 040
Caroline County
Milford
CFP 035
Polecat Creek
Mill Run
CFP 030
Ready Creek
CFP 025
North Anna River
Washington, D.C.
Fredericksburg
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
Source: National Hydrography Dataset; VA-DGIF
Legend
Navigable Waterway Crossing
Surface Waters, Rivers, and Streams
Wetlands (NWI and VA Wetlands Catalog)
Open Water
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Interstate
City/County Boundary
Figure 3-2
Surface Waters, Rivers, Streams, and Wetlands
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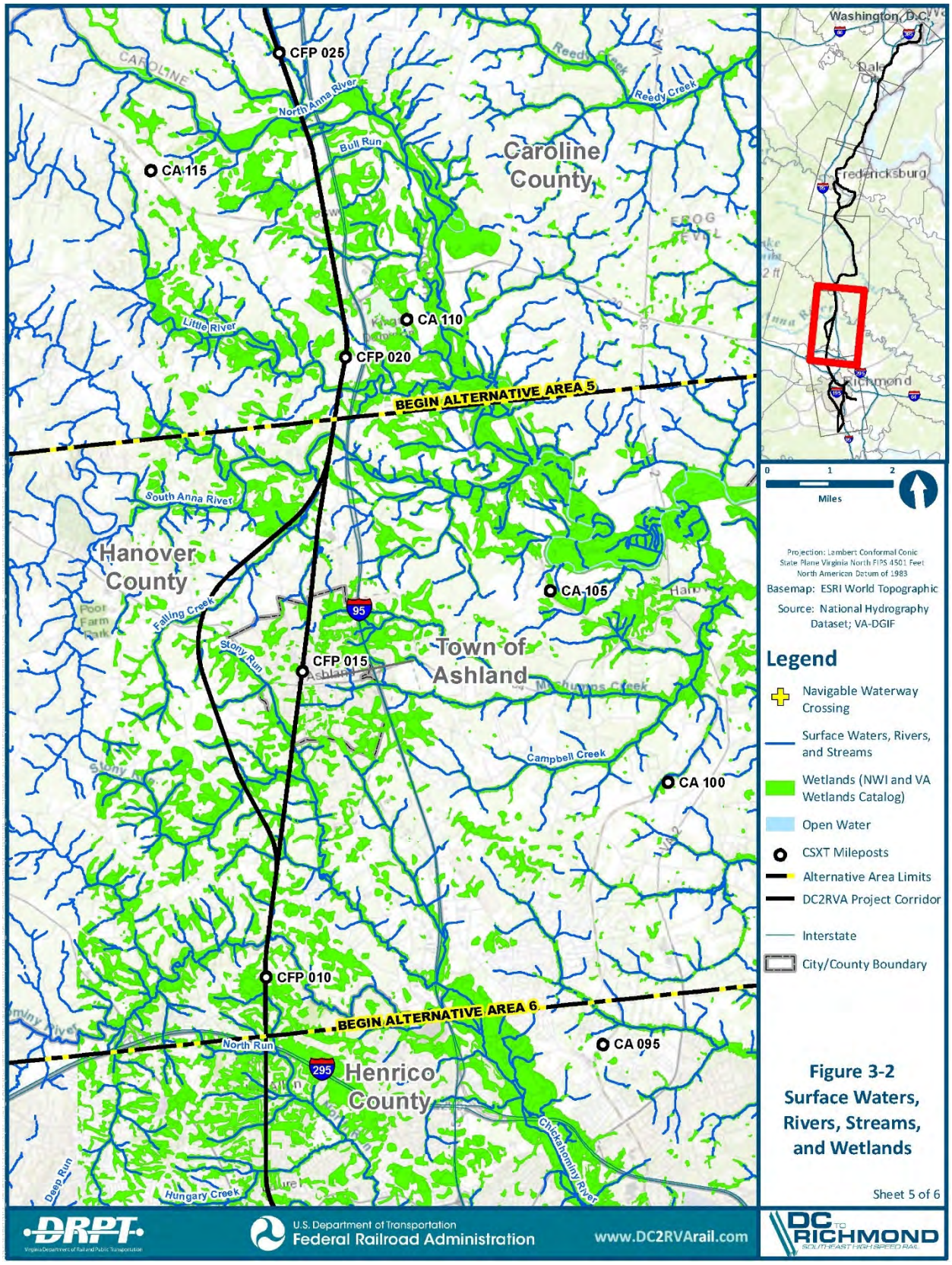
CFP 025
CA 115
CA 110
CFP 020
CFP 015
CFP 010
CA 105
CA 100
CA 095
BEGIN ALTERNATIVE AREA 5
BEGIN ALTERNATIVE AREA 6
Caroline County
Hanover County
Town of Ashland
Henrico County
North Anna River
Reedy Creek
Bull Run
Little River
South Anna River
Falling Creek
Stony Run
Campbell Creek
North Run
Deep Run
Hungary Creek
Chickahominy River
Washington, D.C.
Fredericksburg
Richmond
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
Source: National Hydrography Dataset; VA-DGIF
Legend
Navigable Waterway Crossing
Surface Waters, Rivers, and Streams
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City/County Boundary
Figure 3-2
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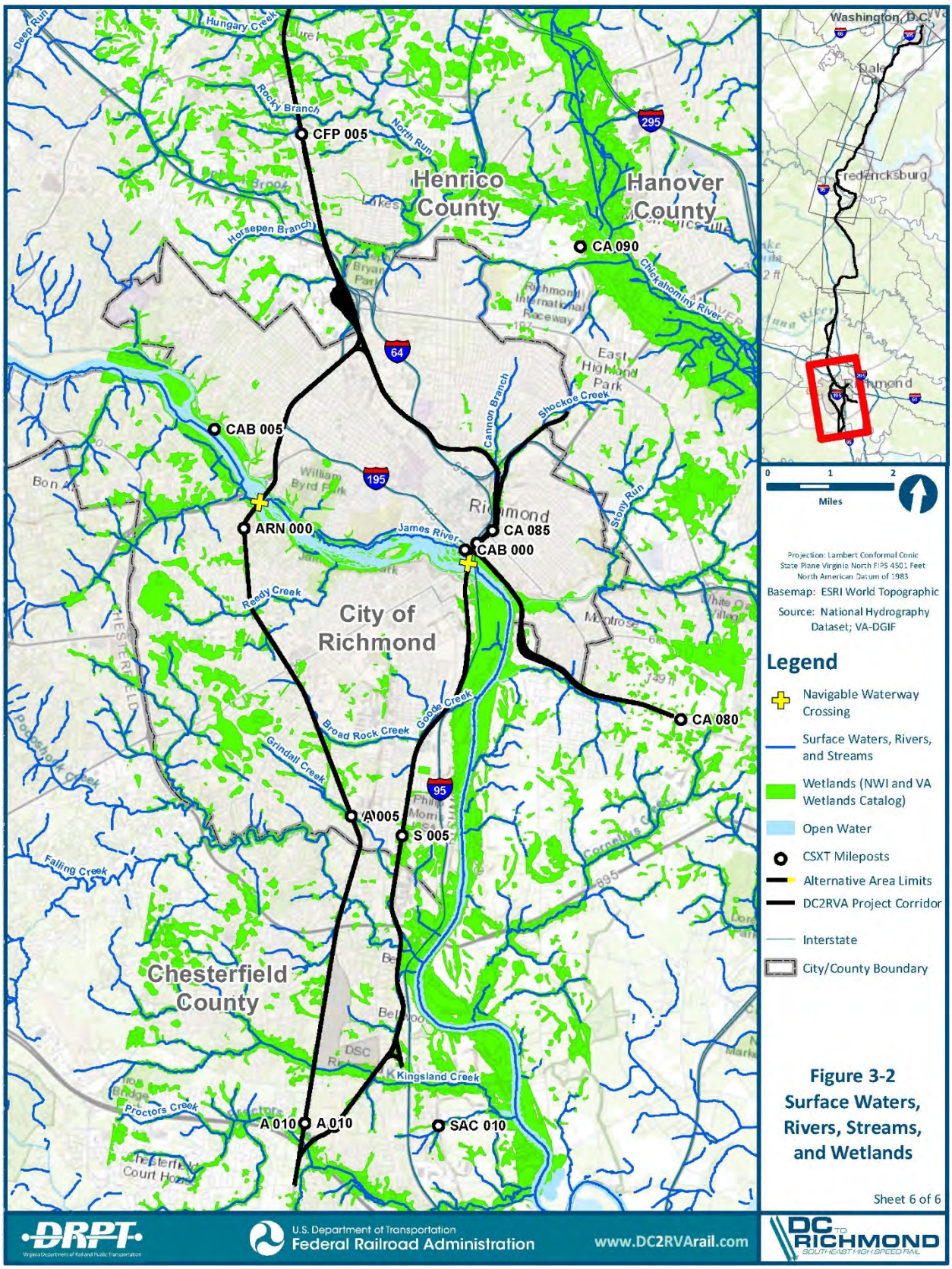
Hungary Creek
Deep Run
Rocky Branch
North Run
CFP 005
Henrico County
Hanover County
295
Horsepen Branch
CA 090
Chickahominy River
64
East Highland Park
Shockoe Creek
Cannon Branch
CAB 005
195
Stony Run
ARN 000
James River
CA 085
CAB 000
Reedy Creek
City of Richmond
Goode Creek
CA 080
Broad Rock Creek
Grindall Creek
95
A 005
S 005
Falling Creek
Chesterfield County
Kingsland Creek
Proctors Creek
A 010
A 010
SAC 010
Washington, D.C.
Fredericksburg
Richmond
0 1 2
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: ESRI World Topographic
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Table 3-1: Surface Waters, Rivers, And Streams

Alternative Area	Major Water Bodies[1]	Number of Streams Delineated	Linear Feet in Study Area[2]	Acres Surveyed
Area 1: Arlington (Long Bridge Approach)	Roaches Run	1	214	*
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur))	- Roaches Run - Four Mile Run - Timber Branch (piped underground) - Taylor Run - Cameron Run - Long Branch - Accotink Creek - Pohick Creek - Giles Run - Occoquan River** - Marumsco Creek - Marumsco Acres Creek/Lake - Farm Creek - Neabsco Creek** - Powells Creek** - Boars Creek - Aquia Creek** - Accokeek Creek - Potomac Creek - Claiborne Run	112	49,147	382
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	- Claiborne Run - Rappahannock River** - Hazel Run** - Deep Run - Little Falls Run - Snow Creek - Meadow Creek	67	46,778	21
Area 4: Central Virginia (Crossroads to Doswell)	- Mattaponi River** - Campbell Creek - Polecat Creek - Reedy Creek - North Anna River - Bull Run - Little River	60	25,734	12
Area 5: Ashland (Doswell to I-295)	- South Anna River - Falling Creek - Stony Run - Chickahominy River	45	31,129	4
Area 6: Richmond (I-295 to Centralia)	- North Run - Hungry Creek - Rocky Branch - Horsepen Branch - Jordans Branch - Cannon Branch & Shockoe Creek (piped underground in some locations) - Goode Creek - Grindall Creek - Falling Creek	69	51,561	213

Table 3-1: Surface Waters, Rivers, And Streams

Alternative Area	Major Water Bodies[1]	Number of Streams Delineated	Linear Feet in Study Area[2]	Acres Surveyed
	- James River** - Kingsland Creek - Proctors Creek - Reedy Creek - Broad Rock Creek			

Source: Field Surveys, 2015-2016.

Notes: *Field survey access restricted. **Listed as navigable by USACE and/or USCG.

1. Major water bodies are listed. Statistics for number of streams, linear feet, and acres include unnamed tributaries.

2. Lengthwise measurement of streams and rivers (i.e., the width of the study area across larger river crossings)

3.1.4 Designated Waters

Table 3-2 identifies special status streams and other special waterway designations in the DC2RVA corridor. Figure 3-2 shows these designated waters.

Table 3-2: Special Stream Designations

DESIGNATION	ORGANIZATION	WATER BODY	ALTERNATIVE AREA
Navigable Waters	USACE/USCG	Occoquan River	Northern Virginia
		Neabsco Creek	Northern Virginia
		Powells Creek	Northern Virginia
		Aquia Creek	Northern Virginia
		Rappahannock River	Fredericksburg
		Hazel Run	Fredericksburg
		Mattaponi River	Central Virginia
		James River	Richmond
State Scenic River	VDCR	Occoquan River[1]	Northern Virginia
		Rappahannock River	Fredericksburg
		North Anna River[1]	Central Virginia
		South Anna River[1]	Ashland
		James River	Richmond
Wild and Scenic Rivers	Bureau of Land Management (BLM), National Park Service (NPS), USFWS, U.S. Forest Service	There are no Federally listed Wild or Scenic Rivers in Virginia.	n/a
Nationwide Rivers Inventory[2]	NPS	North Anna River	Central Virginia
		South Anna River	Ashland
Exceptional State Waters[3]	Virginia DEQ	No Exceptional State Waters are located in the study area.	n/a

Table 3-2: Special Stream Designations

DESIGNATION	ORGANIZATION	WATER BODY	ALTERNATIVE AREA
Chesapeake Bay Preservation Areas	VDCR	The study area includes 1,760 acres of Chesapeake Bay Resource Protection Areas (RPA). The remainder of the land located within the study location is considered to be Resource Management Area (RMA).	All
Virginia Coastal Zone Management Areas	Virginia DEQ	The entire project area is located within Virginia's coastal zone.	All
Fisheries Management Areas	VMRC	No Fisheries Management Areas are located in the study area.	n/a
Shellfish Areas	VMRC	No commercial shellfish sites, Baylor Grounds (public oyster grounds), private oyster grounds, or State constructed oyster reef areas are located in the study area.	n/a

Source: USACE, 2016, VDCR, 2011, VDCR, 2013, DOI, et al., 2014, NPS, 2009, Virginia DEQ, 2014, VMRC, 2012, USCG.

Notes: 1. Identified as worthy of future study (not yet a legislatively designated river); 2. More than 3,400 free-flowing river segments determined to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance; 3. Waters with outstanding qualities in which activities such as discharge and the temporary lowering of water quality are regulated to protect and maintain their exceptional status.

3.1.4.1 Navigable Waters

According to USACE and USCG, the following waters crossed by the existing rail line are navigable:

- Occoquan River
- Neabsco Creek
- Powells Creek
- Aquia Creek
- Rappahannock River
- Hazel Run
- Mattaponi River
- James River

USCG has jurisdiction over navigable waters. Navigable waters are defined by 33 Code of Federal Regulations (CFR) 2.05-25 as waters subject to the ebb and flow of tide; or any water that is presently used, was previously used, or is susceptible to use in its natural condition, or by reasonable improvement, as a means to transport substantial interstate or foreign commerce. Work in or near such a water may require consultation with or permits from USCG and USACE. Figure 3-2 identifies the navigable waters.

3.1.4.2 State Scenic Rivers

The Virginia Scenic Rivers Act of 1970, §10.1-400 requires state and federal agencies to take into consideration how projects and programs affect state scenic rivers. The DC2RVA corridor crosses five scenic rivers (Table 3-3 and Figure 3-2).

Table 3-3: State Scenic Rivers Crossed by the Project

RIVER	DESIGNATED REACH	ALTERNATIVE AREA	STATUS
Occoquan River	Entire River	Northern Virginia	Potential Components—Identified as being worthy of future study
Rappahannock River	Headwaters to Route 3 at Ferry Farm	Fredericksburg	Scenic River—Legislatively designated component
North Anna River	Route 1 at Chandler Crossing to Pamunkey River	Central Virginia	Potential Components—Identified as being worthy of future study
South Anna River	Route 686 to Pamunkey River	Ashland	Potential Components—Identified as being worthy of future study
James River	West limits of Richmond to Orleans Street (extended)	Richmond	Scenic River—Legislatively designated component

Source: VDCR, 2011.

3.1.4.3 Nationwide Rivers Inventory

The Nationwide Rivers Inventory (NRI) is a listing of more than 3,400 free-flowing river segments in the United States, maintained by the National Park Service, that are believed to possess one or more "outstandingly remarkable" natural or cultural values (ORVs) judged to be of more than local or regional significance. ORVs include: scenic, recreational, geologic, fish, wildlife, historic, cultural, or other. Under a 1979 Presidential Directive, and related Council on Environmental Quality (CEQ) procedures, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI reaches. Table 3-4 lists the resources within the DC2RVA corridor that are listed on the NRI.

Table 3-4: Designated Nationwide River Reaches

RIVER	DESIGNATED REACH	ORVS
North Anna River	1.5 miles above Morris Bridge to Lake Anna	Historic—Historic mill sites and ruins, Civil War Battlefields and breastworks, Indian artifact sites Recreational—Popular whitewater canoe run noted for smallmouth bass fishing
South Anna River	North Anna River to Gouldin	Historic—Historic mill sites and ruins, Civil War Battlefields and breastworks, Indian artifact sites Recreational—Unique proximity to Richmond and Fredericksburg, noted for smallmouth bass fishing

Source: NPS, 2009.

3.1.4.4 Chesapeake Bay Preservation Areas

The *Chesapeake Bay Preservation Act* (CBPA) was enacted by the Virginia General Assembly in 1988 to protect and manage Virginia's "coastal zone." The CBPA requires local governments to include

water quality protection measures in their zoning and subdivision ordinances and in their comprehensive plans. A state-local cooperative program administered by DEQ's Water Division and 84 localities regulates activities in Chesapeake Bay Resource Management Areas and Resource Protection Areas (RPA) in Tidewater, Virginia. Executive Order (EO) 13508, *Chesapeake Bay Protection and Restoration*, issued in 2009, requires DRPT to consider goals for restoring clean water by reducing nitrogen, phosphorus, sediment, and other pollutants; recovering habitat by restoring a network of land and water habitats to support priority species and other public benefits; sustaining fish and wildlife; and conserving land and increasing public access.

The entire DC2RVA corridor is located within the Chesapeake Bay Preservation Area. RPAs include tidal wetlands; tidal shores; non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or perennial water bodies; and highly erodible soils, as well as a 100-foot-wide vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow within the Chesapeake Bay watershed. When preserved in their natural condition, RPAs protect water quality; filter and reduce the volume of runoff; prevent erosion; and perform other important biological and ecological functions. These areas are subject to local CBPA requirements to minimize land disturbance, preserve indigenous vegetation, minimize impervious surfaces, control stormwater runoff, and implement erosion and sediment control plans for land disturbances. The DC2RVA project is conditionally exempt from additional avoidance or minimization of impacts to RPAs provided it is constructed in accordance with the *Erosion and Sediment Control Law* (§10.1-560 *et seq.* of the Code of Virginia) and the *Stormwater Management Act* (§10.1-603. 1 *et seq.* of the Code of Virginia).

DRPT mapped RPAs by including a 100-foot-wide buffer to the edge of perennial streams and adjacent wetlands. Approximately 1,760 acres of RPAs are associated with delineated wetlands and streams (Table 3-5). All additional land within the DC2RVA corridor is considered a Resource Management Area (RMA). The RMA includes all land outside the RPA that, if improperly used or developed, has the potential to degrade water quality or diminish functions of the RPA.

Table 3-5: DC2RVA Resource Protection Areas

AREA	ACRES	PERCENT OF THE TOTAL STUDY AREA
1. Arlington	11	1%
2. Northern Virginia	415	24%
3. Fredericksburg	356	20%
4. Central Virginia	384	22%
5. Ashland	237	13%
6. Richmond	357	20%
Total	**1,760**	**100%**

3.1.4.5 Virginia Coastal Zone Management Area

Pursuant to Section 307 of the Coastal Zone Management Act of 1972 (CZMA), as amended, and National Oceanic and Atmospheric Administration (NOAA) *Federal Consistency Regulations* (15

CFR Part 930), federal agency projects occurring within, or with reasonably foreseeable likelihood to affect, Virginia's coastal uses or resources must be conducted in a manner that is consistent to the maximum extent practicable with the Virginia Coastal Zone Management Program (CZMP) and require a consistency determination.

Virginia DEQ administers the Virginia CZMP through a network of state agencies and local governments, which share responsibility for administering the enforceable policies as follows: Fisheries Management (VMRC and VDGIF), Subaqueous Lands Management (VMRC), Wetlands Management (VMRC and Virginia DEQ), Dunes Management (VMRC), Non-point Source Pollution Control (Virginia DEQ), Point Source Pollution Control (Virginia DEQ, State Water Control Board), Shoreline Sanitation (VDH), Air Pollution Control (Virginia DEQ, Air Pollution Control Board), and Coastal Lands Management (Virginia DEQ).

According to Virginia DEQ, Virginia's coastal zone "encompasses the 29 counties, 17 cities, and 42 incorporated towns in 'Tidewater Virginia,' as defined in the *Code of Virginia* 28.2-100" (Virginia DEQ, no date) (Figure 3-3). The entire DC2RVA corridor is located within Virginia's coastal zone. Any development within this area must be consistent with the applicable Enforceable Regulatory Programs that comprise Virginia's CZMP (Table 3-6).

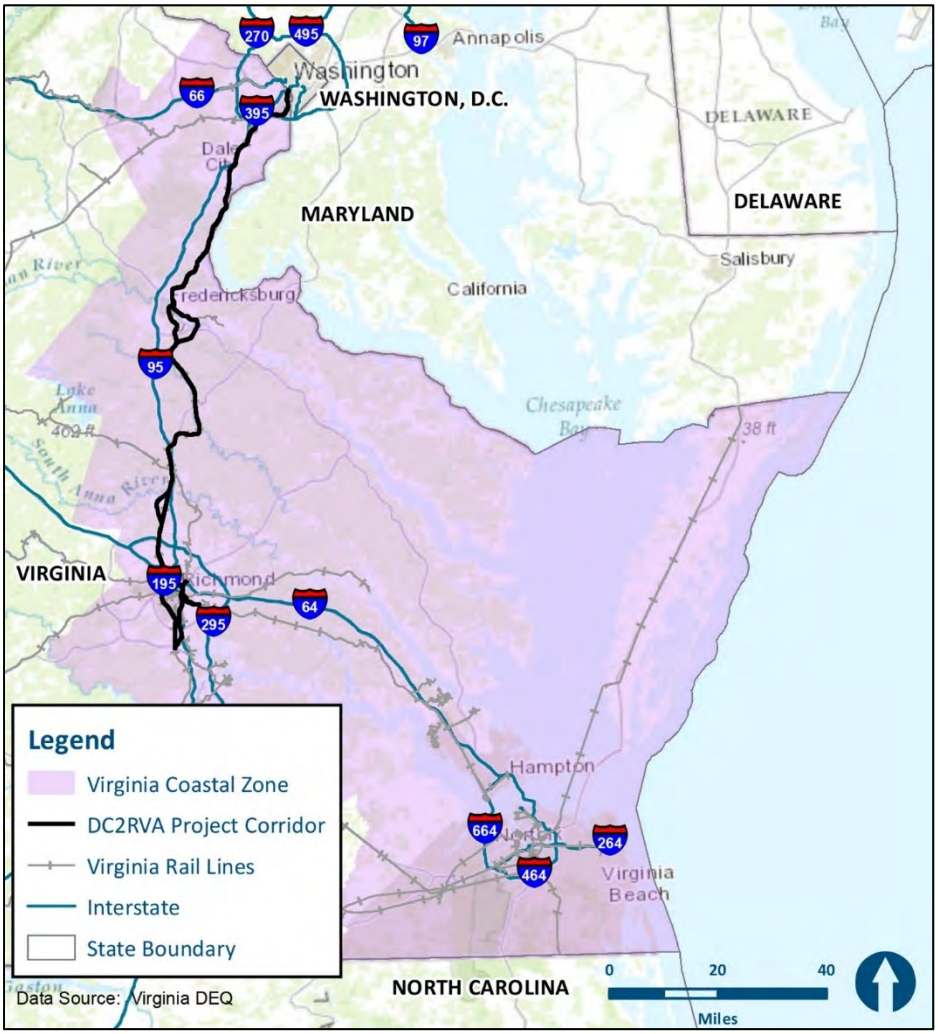


Figure 3-3: Virginia's Coastal Zone

Table 3-6: Virginia Coastal Zone Enforceable Regulatory Programs

REGULATORY PROGRAM	RESOURCE	VIRGINIA CODE	REGULATORY AGENCY
Fisheries Management	Conservation and enhancement of finfish and shellfish	28.2-200 to 28.2-713 29.1-100 to 29.1-570	VMRC VDGIF
Subaqueous Lands Management	Establishes conditions for granting or denying permits to use State owned bottomlands	28.2-1200 to 28.2-1213	VMRC
Wetlands Management	Preserve wetlands and prevent their despoliation	28.2-1301 to 28.21320 621-44.15:5	VMRC Virginia DEQ
Dunes Management	Prevent destruction or alteration of primary dunes	28.2-1400 to 28.2-1420	VMRC
Non-point Source Pollution	Reduce soil erosion and decrease inputs of chemicals and sediments	10.1-560 *et seq.*	VDCR
Point Source Pollution Control	Regulates discharges into State waters through Virginia Pollutant Discharge Elimination System and Virginia Pollution Abatement permits	62.1-44.15	Virginia DEQ
Shoreline Sanitation	Septic tank placement	32.1-164 to 32.1-165	Dept. of Health
Air Pollution	Attainment and maintenance of National Ambient Air Quality Standards	10-1.1300 to 10.1-1320	Air Pollution Control Board
Coastal Lands Management	Virginia's Chesapeake Bay Preservation Area cooperative program	10.1-2100 to 10.1-2114 9 VAS 10-20 *et seq.*	VDCR

3.1.5 Wetlands

Wetlands provide valuable habitat for fish and wildlife; improve water quality; perform important hydrologic functions, such as regulating storm flow; maintain food chain and nutrient cycling functions; serve socioeconomic roles; and may support rare and endangered species. Executive Order 11990, *Protection of Wetlands*, mandates that each federal agency take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance their natural values.

Wetlands are currently defined by the USACE (33 CFR 328.3[b]) and the EPA (40 CFR 230.3[t]) as:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetlands observed in the study area were generally associated with freshwater riparian corridors, railway ditches, and some tidal waterways along riparian corridors in the north. Their functions include groundwater discharge, groundwater recharge, nutrient removal, sediment/toxin retention, and wildlife habitat. Most of the emergent wetlands are railside ditches and include vegetation such as Japanese stiltgrass (*Microstegium vimineum*), Asian spiderwort (*Murdannia keisak*), cattails (*Typha latifolia* and *angustifolia*), rice cut-grass (*Leersia oryzoides*), deertongue (*Dichanthelium clandestinum*), greenbrier (*Smilax rotundifolia*), soft rush (*Juncus effusus*), several species of *Carex*, woolgrass (*Scirpus cyperinus*), and panic grass (*Dichanthelium dichotomum*) with a large variety of other non-dominant species. The most common tree species found in the palustrine forested wetlands set back from the railroad in rural areas include: red maple (*Acer*

rubrum), sweetgum (*Liquidambar styraciflua*), willow oak (*Quercus phellos*), loblolly pine (*Pinus taeda*), and river birch (*Betula nigra*).

A small portion of the wetlands in the northern section of the alignment occur along tidal waterways and are tidally-influenced. Tidally influenced wetlands can provide unique habitat due to fluctuating water levels and varying salinities. These areas provide a difficult environment for most plants; however, some have adapted. Tidal wetlands offer important habitat to migratory waterfowl, provide nurseries for aquatic species of the Chesapeake Bay, are important for shoreline stabilization, and serve as a filter removing excess nutrients and pollutants from connected waters. The acreage of tidally-affected wetlands in the DC2RVA corridor is very small (approximately 23.2 acres), and the tidally-affected wetlands adjacent to the railway had low overall functional values.

DRPT used an abbreviated version of the classification system developed by the USFWS, also known as the Cowardin System (Cowardin, *et al.*, 1979), for identifying wetlands. The study area includes palustrine emergent wetlands (PEM), palustrine scrub–shrub wetlands (PSS), and palustrine forested wetlands (PFO) (Table 3-7 and Figure 3-2). Most wetlands adjacent to the existing rail have a PEM component because during railroad maintenance, herbicides are often applied or trees are removed to ensure that proper clearances for railroad vehicles are maintained. If the herbicides and mechanical treatments were ceased there would be natural succession to PFO.

Table 3-7: Wetlands (acres)

Alternative Area	PEM	PEM/PSS	PEM/PFO	PEM/PSS /PFO	PSS	PSS/PFO	PFO	Total
Area 1: Arlington (Long Bridge Approach)	–	–	–	–	9.0	–	–	**9.0**
Area 2: Northern Virginia	13.4	1.2	23.4	15.3	0.8	–	18.7	**72.8**
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	9.6	1.8	19.5	–	8.6	0.0	93.2	**132.7**
Area 4: Central Virginia (Crossroads to Doswell)	14.6	4.5	106.0	13.1	2.2	11.4	36.6	**188.4**
Area 5: Ashland (Doswell to I-295)	10.3	0.1	13.6	–	0.0	1.9	24.3	**50.2**
Area 6: Richmond (I-295 to Centralia)	14.7	0.5	3.8	0.8	1.7	0.2	15.4	**37.1**
Total	**62.6**	**8.1**	**166.3**	**29.2**	**22.3**	**13.5**	**188.2**	**490.2**

Source: Field Surveys, 2015-2016.

3.1.6 Floodplains and Floodways

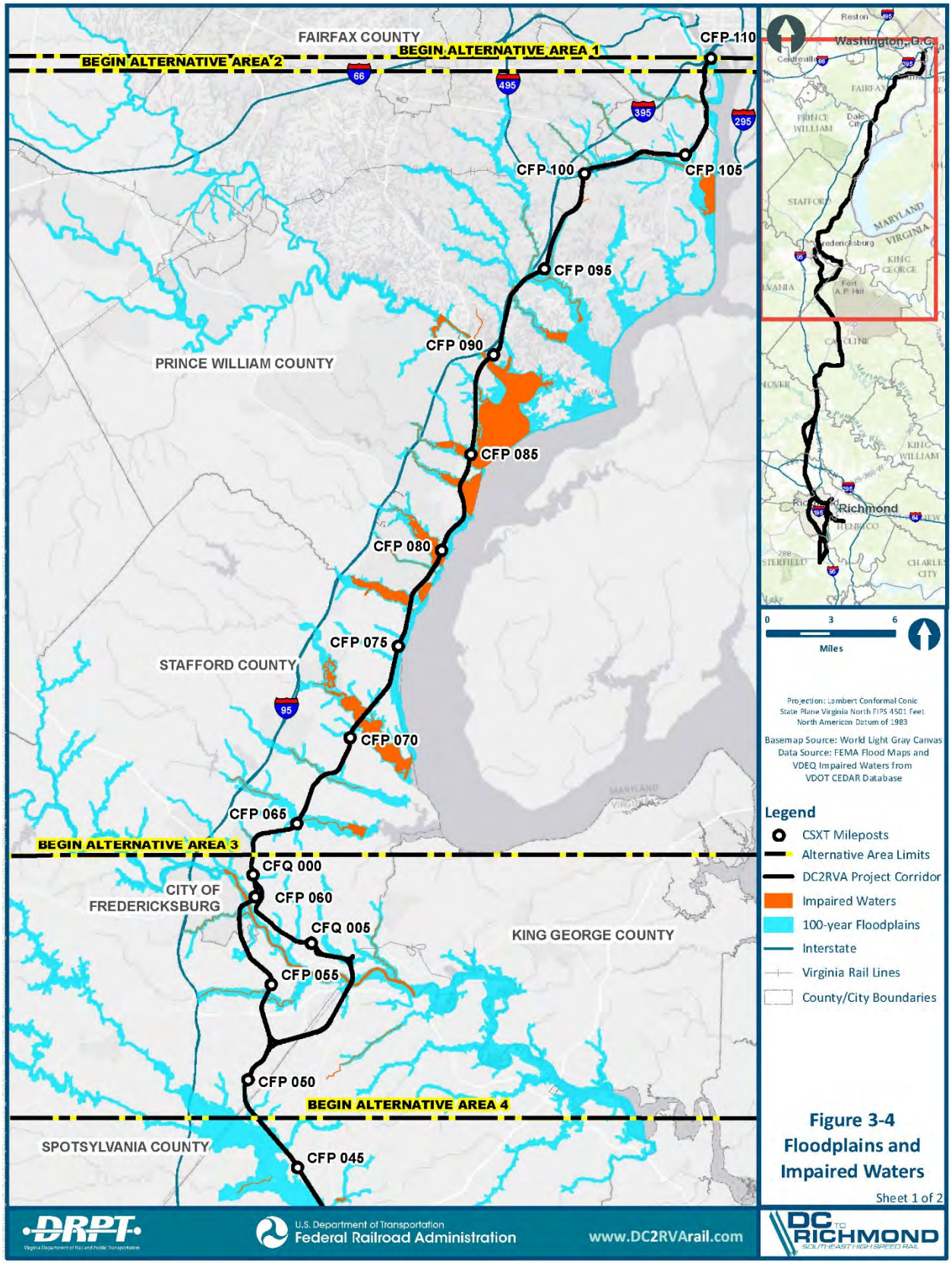
A floodplain is an area of low-lying ground near waterways subject to flooding. Floodplains have many natural and beneficial values, including flood flow moderation, water quality maintenance, and wildlife habitat. The *National Flood Insurance Act of 1968* established the National Flood Insurance Program, under which FEMA maps the nation's flood-prone areas on the FIRM. The FIRM identifies the 100- and 500-year flood boundaries. The 100-year flood boundary is the area

that will be inundated by a flood event having a 1.0 percent chance of being equaled or exceeded in any given year. The 500-year flood boundary is the area that will be inundated by a flood event having a 0.2 percent chance of being equaled or exceeded in any given year.

EO 11988, *Floodplain Management*, requires federal agencies to avoid to the extent possible the long- and short-term adverse effects associated with the occupancy and modification of floodplains. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities."

According to the FIRM produced by FEMA, approximately 3,574 acres of 100-year floodplains are within a 500-foot-wide study area along the DC2RVA corridor, as shown in Figure 3-4. Mapped floodplains include those associated with 51 waterways in the study area as listed below. Table 3-8 summarizes the acres of floodplain by alternative area. DRPT also learned of localized flooding in Stafford County at the Brooke Fire Station and at Claiborne Run during the scoping process.

- Taylor Run
- Backlick Run
- Cameron Run
- Long Branch
- Farm Creek
- Marumsco Creek
- Giles Run
- Little Creek
- Tank Creek
- Boars Creek
- Accokeek Creek
- Potomac Creek
- Claiborne Run
- Hazel Run
- Deep Run
- Massaponax Creek
- Campbell Creek
- Meadow Creek
- Mill Run
- Polecat Creek
- Reedy Creek
- Long Creek
- Bull Run
- Mechumps Creek
- Falling Creek
- Stony Run
- Hungary Creek
- North Run
- Upham Brook
- Jordans Branch
- Rocky Branch
- Horsepen Branch
- Rocky Branch
- Cannon Branch
- Shockoe Creek
- Goode Creek
- Kingsland Creek
- Grindall Creek
- Proctors Creek
- Broad Rock Creek
- Cannon Branch
- Kingsland Creek
- Great Branch
- Reedy Creek
- Broad Rock Creek
- Almond Creek
- Little Falls Run
- Snow Creek
- White Oak Run
- Falling Creek
- Stony Run


FAIRFAX COUNTY
BEGIN ALTERNATIVE AREA 2
BEGIN ALTERNATIVE AREA 1
CFP 110
CFP 100
CFP 105
CFP 095
CFP 090
PRINCE WILLIAM COUNTY
CFP 085
CFP 080
CFP 075
STAFFORD COUNTY
CFP 070
CFP 065
BEGIN ALTERNATIVE AREA 3
CFQ 000
CITY OF FREDERICKSBURG
CFP 060
CFQ 005
KING GEORGE COUNTY
CFP 055
CFP 050
BEGIN ALTERNATIVE AREA 4
SPOTSYLVANIA COUNTY
CFP 045
Washington, D.C.
Richmond
0 3 6
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap Source: World Light Gray Canvas
Data Source: FEMA Flood Maps and
VDEQ Impaired Waters from
VDOT CEDAR Database
Legend
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Impaired Waters
100-year Floodplains
Interstate
Virginia Rail Lines
County/City Boundaries
Figure 3-4
Floodplains and
Impaired Waters
Sheet 1 of 2
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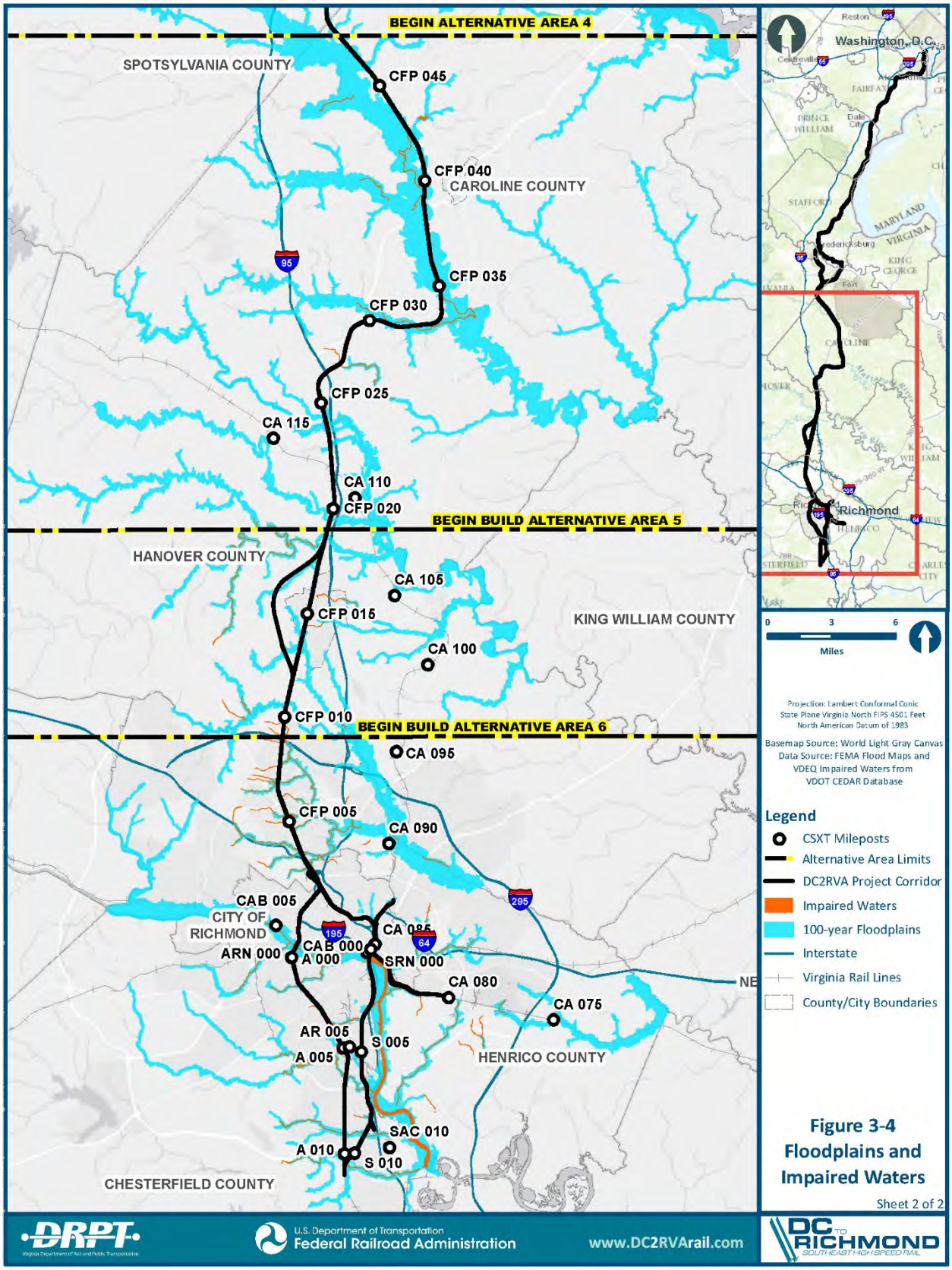
BEGIN ALTERNATIVE AREA 4
SPOTSYLVANIA COUNTY
CFP 045
CFP 040
CAROLINE COUNTY
CFP 035
CFP 030
CFP 025
CA 115
CA 110
CFP 020
BEGIN BUILD ALTERNATIVE AREA 5
HANOVER COUNTY
CA 105
CFP 015
KING WILLIAM COUNTY
CA 100
CFP 010
BEGIN BUILD ALTERNATIVE AREA 6
CA 095
CFP 005
CA 090
CAB 005
CITY OF RICHMOND
CA 085
CAB 000
ARN 000
A 000
SRN 000
CA 080
CA 075
AR 005
S 005
A 005
HENRICO COUNTY
SAC 010
A 010
S 010
CHESTERFIELD COUNTY
Washington, D.C.
Richmond
0 3 6
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap Source: World Light Gray Canvas
Data Source: FEMA Flood Maps and
VDEQ Impaired Waters from
VDOT CEDAR Database
Legend
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Impaired Waters
100-year Floodplains
Interstate
Virginia Rail Lines
County/City Boundaries
Figure 3-4
Floodplains and
Impaired Waters
Sheet 2 of 2
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SOUTHEAST HIGH SPEED RAIL

Table 3-8: Floodplains

ALTERNATIVE AREA	ACRES	PERCENT OF STUDY AREA
Area 1: Arlington (Long Bridge Approach)	47	1%
Area 2: Northern Virginia	954	27%
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	251	7%
Area 4: Central Virginia (Crossroads to Doswell)	1,171	33%
Area 5: Ashland (Doswell to I-295)	386	11%
Area 6: Richmond (I-295 to Centralia)	765	21%
Total	**3,574**	**100%**

3.1.7 Water Quality

In compliance with Sections 303(d), 305(b), and 314 of the federal CWA and the *Safe Drinking Water Act*, Virginia DEQ has developed a prioritized list of water bodies that currently do not meet water quality standards. Virginia DEQ monitors streams for a variety of water quality parameters, including temperature; dissolved oxygen; pH; fecal coliform; *Escherichia coli*; *Enterococci*; total phosphorus; chlorophyll a; benthic invertebrates; metals and toxins in the water column; suspended sediments; and fish tissues.

Water quality standards designate uses for waters. In Virginia, the six designated uses include aquatic life, fish consumption (i.e., the ability of humans to eat fish from the water body), public water supplies (where applicable), recreation (swimming), shell fishing, and wildlife, with some additional subcategories in aquatic life adopted for the Chesapeake Bay and its tributaries (SAV – Submerged Aquatic Vegetation, Open Water – for aquatic life, Migration – fish spawning and nursery, deep-water – aquatic life). If a water body contains more contamination than allowed to support one or more of its designated uses, the waters are labeled "impaired." A cleanup plan to restore waters to their intended uses is developed for these impaired waters. The maximum amount of pollutant a water body can receive and still meet its intended use is known as the Total Maximum Daily Load (TMDL).

The Section 303(d) list includes those water bodies and watersheds that exhibit levels of impairment requiring investigation and restoration. Not all parameters are monitored at each ambient water quality monitoring station. Citizen groups and federal agencies also monitor some streams and provide their data to Virginia DEQ for compilation. The DC2RVA corridor crosses 62 assessed water bodies included on the Section 303(d) list, 51 of which are impaired (Table 3-9).

Table 3-9: 303(d) Assessed Water Bodies (Water Quality)

WATER BODY	AREA	USES SUPPORTED[1]	USES IMPAIRED[1]	IMPAIRMENT
Four Mile Run	Northern Virginia	SAV[2] Wildlife Migration[2] - I	Aquatic Life Fish Consumption Open Water[2] Recreation	Chlordane, Escherichia coli, Dissolved Oxygen, PCB in Fish Tissue
Backlick Run	Northern Virginia	Aquatic Life Wildlife	Recreation	*Escherichia coli*
Long Branch	Northern Virginia	Aquatic Life Fish Consumption Wildlife	Recreation	*Escherichia coli*
Accotink Creek	Northern Virginia	Wildlife	Aquatic Life Fish Consumption Recreation	Benthic-Macroinvertebrate Bioassessments, *Escherichia coli*, PCB in Fish Tissue
Pohick Creek	Northern Virginia	Aquatic Life Fish Consumption Wildlife	Recreation	*Escherichia coli*
Giles Run	Northern Virginia	Wildlife	Recreation	Benthic-Macroinvertebrate Bioassessments, Escherichia coli, PCB in Water Column
Occoquan River	Northern Virginia	SAV[2] Wildlife Recreation Migration[2] - I	Aquatic Life Fish Consumption Open Water[2]	Dissolved Oxygen, PCB in Fish Tissue
Marumsco Creek	Northern Virginia	Aquatic Life	Recreation	*Escherichia coli*
Neabsco Bay	Northern Virginia	SAV[2] Wildlife Migration[2] - I	Aquatic Life Fish Consumption Open Water[2] Recreation	*Escherichia coli*, Dissolved Oxygen, PCB in Fish Tissue
Powells Creek	Northern Virginia	SAV[2] Migration[2] - I	Aquatic Life Fish Consumption Open Water[2]	Benzo[k]fluoranthene, Dissolved Oxygen, PCB in Fish Tissue
Powells Creek (confluence with Potomac)	Northern Virginia	SAV[2] Migration[2] - I	Aquatic Life Fish Consumption Open Water[2]	Benzo[k]fluoranthene, Dissolved Oxygen, PCB in Fish Tissue
Quantico Creek	Northern Virginia	Recreation SAV[2] Wildlife Migration[2] - I	Aquatic Life Fish Consumption Open Water[2]	Dissolved Oxygen, PCB in Fish Tissue

Table 3-9: 303(d) Assessed Water Bodies (Water Quality)

WATER BODY	AREA	USES SUPPORTED[1]	USES IMPAIRED[1]	IMPAIRMENT
Little Creek	Northern Virginia	Aquatic Life Recreation Wildlife	None Listed	N/A
Potomac River	Northern Virginia	Open Water[2] SAV[2] Aquatic Life Migration[2] - I	Fish Consumption	PCB in Fish Tissue
Chopawamsic Creek	Northern Virginia	Open Water[2] SAV[2] Wildlife Aquatic Life Migration[2] - I	Fish Consumption	PCB in Fish Tissue
Unnamed tributary to Potomac River	Northern Virginia	Wildlife	Aquatic Life Recreation	*Escherichia coli*, pH
Aquia Creek	Northern Virginia	Aquatic Life Open Water[2] Recreation SAV[2] Wildlife Migration[2] - I	Fish Consumption	PCB in Fish Tissue
Accokeek Creek	Northern Virginia	Aquatic Life Wildlife	Recreation	*Escherichia coli*
Potomac Creek	Northern Virginia	Aquatic Life	Recreation	*Escherichia coli*
Claiborne Run	Northern Virginia, Fredericksburg	Aquatic Life Wildlife	Fish Consumption Recreation	*Escherichia coli*, PCB in Fish Tissue
Rappahannock River	Fredericksburg	SAV[2] Wildlife Migration[2] - I	Aquatic Life Fish Consumption Open Water[2] Recreation	*Escherichia coli*, Dissolved Oxygen, PCB in Fish Tissue
Hazel Run	Fredericksburg	Wildlife	Aquatic Life Fish Consumption Recreation	Benthic-Macroinvertebrate Bioassessments, *Escherichia coli*, PCB in Fish Tissue
Little Falls Run	Fredericksburg	Aquatic Life - I	None Listed	N/A
Massaponax Creek	Fredericksburg	Wildlife	Aquatic Life Recreation	*Escherichia coli*, pH

Table 3-9: 303(d) Assessed Water Bodies (Water Quality)

WATER BODY	AREA	USES SUPPORTED[1]	USES IMPAIRED[1]	IMPAIRMENT
Mattaponi River	Central Virginia	Aquatic Life Recreation Wildlife	None Listed	N/A
Mattaponi River	Central Virginia	Aquatic Life Fish Consumption Wildlife	Recreation	*Escherichia coli*
Polecat Creek	Central Virginia	Fish Consumption Recreation Wildlife	Aquatic Life	Benthic-Macroinvertebrate Bioassessments, Oxygen, Dissolved
Reedy Creek	Central Virginia	Wildlife	Aquatic Life Fish Consumption Recreation	Benthic-Macroinvertebrate Bioassessments, Escherichia coli, Mercury in Fish Tissue
Unnamed tributary to North Anna River	Central Virginia	Public Water Supply Wildlife Fish Consumption - I	Aquatic Life	pH
Little River	Central Virginia	Aquatic Life Wildlife	Recreation	*Escherichia coli*
South Anna River	Ashland	Aquatic Life	Recreation	*Escherichia coli*
Mechumps Creek	Ashland	None listed	Aquatic Life Recreation	*Escherichia coli*, Dissolved Oxygen, pH
Stony Run and Tributaries	Ashland	Fish Consumption	Aquatic Life Recreation	*Escherichia coli*, Dissolved Oxygen, pH
Unsegmented rivers in G05 (Unnamed tributary to Chickahominy)	Ashland	Fish Consumption	None Listed	N/A
Chickahominy River	Ashland	Aquatic Life Fish Consumption	Recreation	*Escherichia coli*
North Run	Richmond	Fish Consumption	Aquatic Life Recreation	Benthic-Macroinvertebrate Bioassessments, *Escherichia coli*, pH
Upham Brook Tributaries	Richmond	Fish Consumption Aquatic Life - I	Recreation	*Escherichia coli*
Upham Brook	Richmond	Aquatic Life Fish Consumption	Recreation	*Escherichia coli*
Jordan Branch	Richmond	Aquatic Life Fish Consumption Wildlife	Recreation	*Escherichia coli*

Table 3-9: 303(d) Assessed Water Bodies (Water Quality)

WATER BODY	AREA	USES SUPPORTED[1]	USES IMPAIRED[1]	IMPAIRMENT
Unsegmented rivers in G01 (Unnamed tributary to James River)	Richmond	Fish Consumption	None Listed	N/A
James River	Richmond	Wildlife Migration[2] - I	Aquatic Life Fish Consumption Recreation SAV[2]	Chlorophyll-a, *Escherichia coli*, Estuarine Bioassessments, PCB in Fish Tissue, Aquatic Plants (Macrophytes)
Manchester Canal (aka Walker Creek)	Richmond	Aquatic Life Fish Consumption - I Wildlife - I	Recreation	*Escherichia coli*
Goode Creek	Richmond	Aquatic Life Wildlife	Fish Consumption Recreation	*Escherichia coli*, PCB in Water Column
XBG–Unnamed tributary to Goode Creek	Richmond	Fish Consumption Aquatic Life - I Wildlife - I	None Listed	N/A
Broad Rock Creek	Richmond	Fish Consumption	Recreation	*Escherichia coli*
Unsegmented rivers in G01(Unnamed tributaries to Goode Creek)	Richmond	Aquatic Life Fish Consumption Wildlife - I	Recreation	*Escherichia coli*
Grindall Creek	Richmond	Aquatic Life Fish Consumption Wildlife	None Listed	N/A
Unsegmented estuaries in G01 (Falling Creek)	Richmond	Fish Consumption Open Water[2] Migration[2] - I	Aquatic Life SAV[2]	Aquatic Plants (Macrophytes)
XSZ - James River, UT (aka No Name Creek)	Richmond	Fish Consumption	Recreation	*Escherichia coli*
Kingsland Creek	Richmond	Fish Consumption Wildlife - I	Aquatic Life Recreation	*Escherichia coli*, pH
Unsegmented rivers in G01 (Unnamed tributary to Kingsland Creek)	Richmond	Fish Consumption	None Listed	N/A
Proctors Creek	Richmond	Fish Consumption Wildlife	Aquatic Life Recreation	Benthic-Macroinvertebrate Bioassessments, *Escherichia coli*
Reedy Creek	Richmond	None listed	Aquatic Life Recreation	*Escherichia coli*, Oxygen, Dissolved
XCK–Unnamed tributary to Powhite Creek	Richmond	Aquatic Life	Recreation	*Escherichia coli*

Table 3-9: 303(d) Assessed Water Bodies (Water Quality)

WATER BODY	AREA	USES SUPPORTED[1]	USES IMPAIRED[1]	IMPAIRMENT
Falling Creek	Richmond	Aquatic Life Fish Consumption Recreation Wildlife	None Listed	N/A
Unsegmented rivers in G01 (Unnamed tributary to James River)	Richmond	Fish Consumption	None Listed	N/A
Gillies Creek	Richmond	Wildlife	Aquatic Life Fish Consumption Recreation	*Escherichia coli*, pH, PCB in Water Column
Unsegmented estuaries in G01 (Gillies Creek)	Richmond	Fish Consumption Open Water[2] Migration[2] - I	Aquatic Life SAV[2]	Aquatic Plants (Macrophytes)
Unsegmented rivers in G01 (Unnamed tributary to Almond Creek)	Richmond	Fish Consumption	None Listed	N/A
Almond Creek	Richmond	Aquatic Life Wildlife	Fish Consumption Recreation	*Escherichia coli*, PCB in Water Column
XVO–Unnamed tributary to Almond Creek	Richmond	Fish Consumption	Aquatic Life	pH
XVP–Unnamed tributary to Almond Creek	Richmond	Fish Consumption	Aquatic Life Wildlife	Copper, Zinc, pH

Source: VDEQ, 2015.

Notes: 1. Not all uses are investigated at each water body; 2. additional subcategories adopted for the Chesapeake Bay and its tributaries

I = Insufficient Information

3.1.8 Drinking Water/Aquifers/Water Supply

In 1974, the Safe Drinking Water Act (SDWA) was passed by Congress to regulate the public drinking water supply. Amendments in 1986 and 1996 further protect the water supply by requiring actions that protect drinking water and its sources. The 1996 Amendments mandate that states assess, delineate, and map protection areas for their public drinking water sources, and determine potential risks to those sources. Source water protection is not specifically mandated by the SDWA; however, states, tribes, and communities are encouraged to use this information to protect the sources from pollution of major concern and may pass local regulations.

This Project is located in the Coastal Plain province, which is composed of mostly unconsolidated deposits/layers of sand, gravel, shell rock, silt, and clay. These pervious unconsolidated layers store more groundwater than Virginia's other provinces in two separate groundwater systems—one shallow and one deep. The shallow groundwater system sits on top of a relatively impermeable clay layer and provides water for many domestic and smaller capacity wells. Due to the permeability of the soil above these shallow systems, they have a high potential for contamination (Virginia Tech, 2011). Release of chemicals during construction; release of transported chemicals; salts and chemicals used for snow and ice removal; and chemicals used

for the removal of vegetation are the main sources of contamination to public water supplies along rail lines.

As a result of the 1996 SDWA amendments, Virginia adopted a 1-mile wellhead protection zone around all groundwater public sources (Zone 2). Zone 1 includes a 1,000-foot radius in which land use activities should be assessed for their potential to contaminate water supplies (Virginia DEQ, 2005). Seven public wellheads are located within Zone 1 of the existing rail corridor, and an additional six are located outside Zone 1 but within Zone 2. This does not include private wells, which also have the potential to be affected by this Project. Private wells serving fewer than 25 individuals are not regulated by the SDWA (EPA, 2014).

CEDAR GIS mapping from VDOT and mapping of wells from the Department of Mines, Minerals, and Energy (DMME) indicates two public and eight private water wells located within 100 feet of the DC2RVA corridor.

Reservoir Protection Overlay Districts are areas of zoning restricting use and require best management practices (BMPs) and other protective measures in areas critical to the integrity of public water supplies, rivers, streams, and other sensitive features. The existing rail corridor does not cross near any Reservoir Protection Overlay Districts (VDOT, no date).

The Project falls within SDWA Zone 1 (5-mile radius) of three public surface water supply intakes—Fairfax County Water Authority, Hanover Suburban Water System, and City of Richmond. Fairfax County Water and City of Richmond water supplies are located upstream of the existing rail corridor.

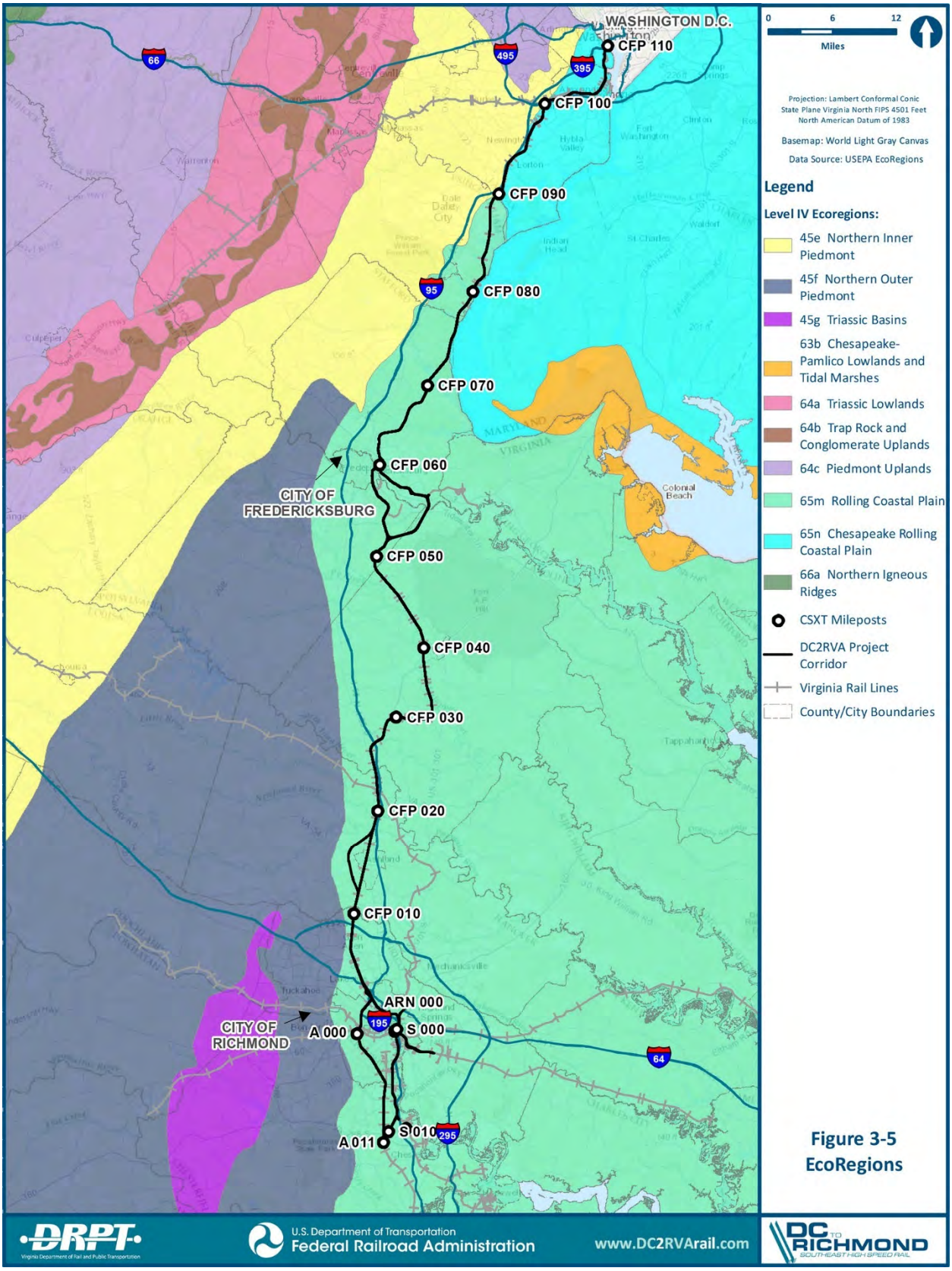
No sole source aquifers (EPA, no date), source protection areas, or water supply reservoirs are located near the DC2RVA corridor.

3.2 BIOLOGICAL RESOURCES

EPA defines ecoregions as areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. Ecoregions serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and their components. There are four different hierarchical levels of ecoregions, ranging from general regions to more detailed:

- Level I—12 ecoregions in the continental United States
- Level II—25 ecoregions in the continental United States
- Level III—105 ecoregions in the continental United States
- Level IV—967 ecoregions in the conterminous United States

Most of the DC2RVA corridor is located in EPA Level III Ecoregion 65–Southern Plains (Figure 3-5). This ecoregion is composed of irregular plains covered by cropland, forest, and pasture. Natural vegetation consists of mostly Oak–Hickory–Pine Forest (dominants: hickory *[Carya]*, longleaf pine *[Pinus palustris]*, shortleaf pine *[Pinus echinata]*, loblolly pine, white oak *[Quercus alba],* and post oak *[Quercus stellata]*) and, in the northeast, Appalachian Oak Forest (dominated by white oak and red oak *[Quercus rubra]*). The Southern Plains area crossed by the Project is split further into two level IV ecoregions: Chesapeake Rolling Coastal Plain (65n) (north of Occoquan River) and Rolling Coastal Plain (65m) (from Occoquan River south).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Level IV Ecoregions:
45e Northern Inner Piedmont
45f Northern Outer Piedmont
45g Triassic Basins
63b Chesapeake-Pamlico Lowlands and Tidal Marshes
64a Triassic Lowlands
64b Trap Rock and Conglomerate Uplands
64c Piedmont Uplands
65m Rolling Coastal Plain
65n Chesapeake Rolling Coastal Plain
66a Northern Igneous Ridges
CSXT Mileposts
DC2RVA Project Corridor
Virginia Rail Lines
County/City Boundaries
Figure 3-5
EcoRegions
DRPT
Virginia Department of Rail and Public Transportation
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The **Chesapeake Rolling Coastal Plain** is a hilly upland, with local relief ranging from 25 to 225 feet in elevation, narrow stream divides, incised streams, and well-drained loamy soils. Stream margins can be swampy, and it common for water to be stained by tannic acid from decaying vegetation. Soils are low in nutrients and require amendments to be productive for agriculture. Urbanization is extensive along corridors connecting Baltimore, Washington D.C., Wilmington, and Annapolis. In other areas, less-intensive agriculture, general farming, or part-time agriculture occurs.

The **Rolling Coastal Plain** is more forested than the Chesapeake Rolling Coastal Plain and is comprised of a mosaic of woodland and farmland with elevations ranging from 30 to 250 feet. Soils in this area tend to have good drainage. Stream margins can be swampy, and stained water can occur. The westernmost portion includes parts of the Fall Zone, where aquatic habitats include islands, pools, swampy streams, and cascades. The Fall Zone or Fall Line is the geomorphologic break between an upland region of relatively hard rock and a coastal plain of softer sedimentary rock.

The existing track occasionally crosses into EPA Ecoregion 45–Piedmont to the west, which is separated from the Southern Plains by the fall line (generally along I-95). This transitional area between the mountains and the coast is a mostly wooded area of irregular plains, low hills and ridges, shallow valleys, and scattered monadnocks (isolated hills of bedrock). This area traditionally supported Oak–Hickory–Pine forest (dominants: hickory, shortleaf pine, loblolly pine, white oak, and post oak); however, it has since been cultivated and is now a mixture of farmland and fields that are reverting to pine and hardwoods. The Piedmont area crossed by the Project is split further into one level IV ecoregion: Northern Inner Piedmont (45e) (north of Fredericksburg).

The **Northern Inner Piedmont** ranges in elevation from 200 to 1,000 feet including landforms such as hills, irregular plains, and isolated ridges and mountains, and monadnocks far more common than in the Northern Outer Piedmont. Streams have silt, sand, gravel, and rubble bottoms with low to moderate gradients. The landscape is comprised of forests of loblolly—shortleaf pine, agricultural activity, and in the northeast, urban and suburban areas.

3.2.1 Methods

A general map of habitats within a 500-foot-wide study area along the DC2RVA corridor was developed by reviewing the aerial photographs and topographic maps; Virginia Wetlands Catalog maps from the VDCR–Division of Natural Heritage; Wetlands digitized by the City of Richmond; field verified wetlands and streams; Northeast Terrestrial Habitat Map (TNC, 2014); Urban Tree Canopy Land Cover (VGEP, 2008); Municipality land cover data; NHD maps from USGS; VDOT GIS data (VDOT, 2014); and VDOT mitigation sites. A more-detailed display of the streams and wetlands mapping within the study area is provided in Appendices A through F.

Table 3-10 summarizes the general habitat types along the Project in a 500-foot-wide study area.

Table 3-10: General Habitat Types (acres)

Alternative Area	Aqueous Habitat (wetlands/ streams/open water)	Agriculture (pasture/ row crop/ grassland)	Shrub Area/Old Field	Upland Forest	Riparian/ Bottomland Forest/PFO	Urban/ Developed Lands	Total
Area 1: Arlington (Long Bridge Approach)	32 28%	0.0 0%	0.0 0%	0.0 0%	1 1%	81 71%	114 100%
Area 2: Northern Virginia	488 8%	196 3%	9 0%	1,890 32%	228 4%	3,059 52%	5,870 100%
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	191 5%	666 19%	0.0 0%	1,527 43%	359 10%	765 22%	3,508 100%
Area 4: Central Virginia (Crossroads to Doswell)	342 10%	619 17%	144 4%	1,360 38%	651 18%	451 13%	3,567 100%
Area 5: Ashland (Doswell to I-295)	26 1%	279 14%	72 4%	1,014 49%	91 4%	577 28%	2,059 100%
Area 6: Richmond (I-295 to Centralia)	103 2%	62 1%	22 0%	950 17%	316 6%	4,083 74%	5,536 100%
Total	**1,182** **6%**	**1,822** **9%**	**247** **1%**	**6,741** **32%**	**1,646** **8%**	**9,016** **44%**	**20,654** **100%**

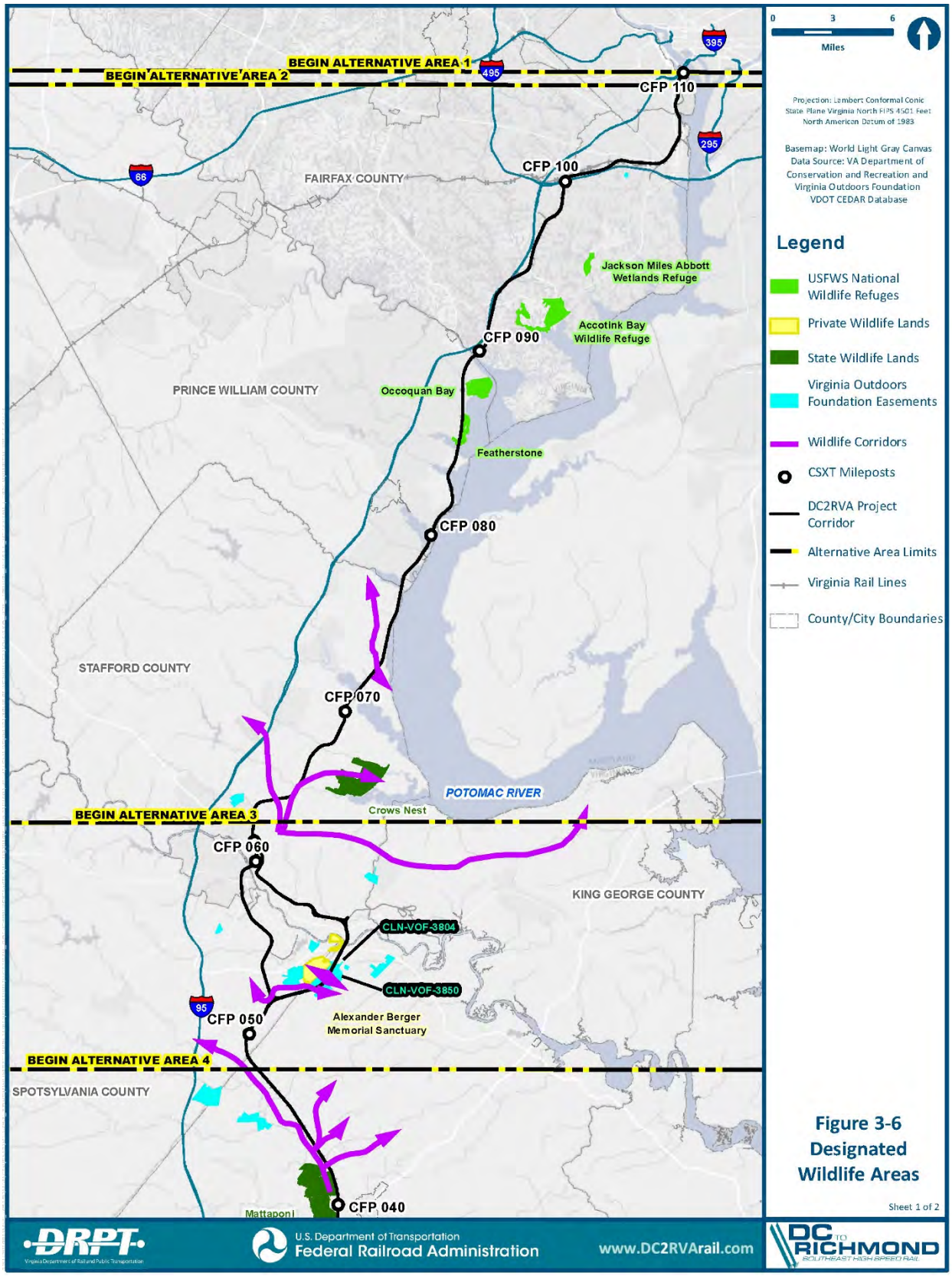
Source: VDCR, 2014, TNC, 2014, VGEP, 2008, USGS, 2014, and VDOT, 2014.

3.2.2 Regulated Natural Communities

The communities described below are areas intended for the preservation of habitat, plants, or wildlife. They are maintained to different degrees by regulatory agencies. These communities can be publicly or privately owned. Figure 3-6 shows these communities.

3.2.2.1 National Wildlife Refuges

A requirement of the Secretary of the Interior is to maintain the biological integrity, diversity, and environmental health of National Wildlife Refuges, which are managed by the U.S. Fish and Wildlife Service for the protection and conservation of our nation's wildlife resources. This network of diverse and strategically located habitats is protected by Section 4(f) of the Department of Transportation Act of 1966.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STAFFORD COUNTY
KING GEORGE COUNTY
SPOTSYLVANIA COUNTY
Jackson Miles Abbott Wetlands Refuge
Occoquan Bay
Featherstone
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Basemap: World Light Gray Canvas
Data Source: VA Department of Conservation and Recreation and Virginia Outdoors Foundation
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USFWS National Wildlife Refuges
Private Wildlife Lands
State Wildlife Lands
Virginia Outdoors Foundation Easements
Wildlife Corridors
CSXT Mileposts
DC2RVA Project Corridor
Alternative Area Limits
Virginia Rail Lines
County/City Boundaries
Figure 3-6
Designated Wildlife Areas
Sheet 1 of 2
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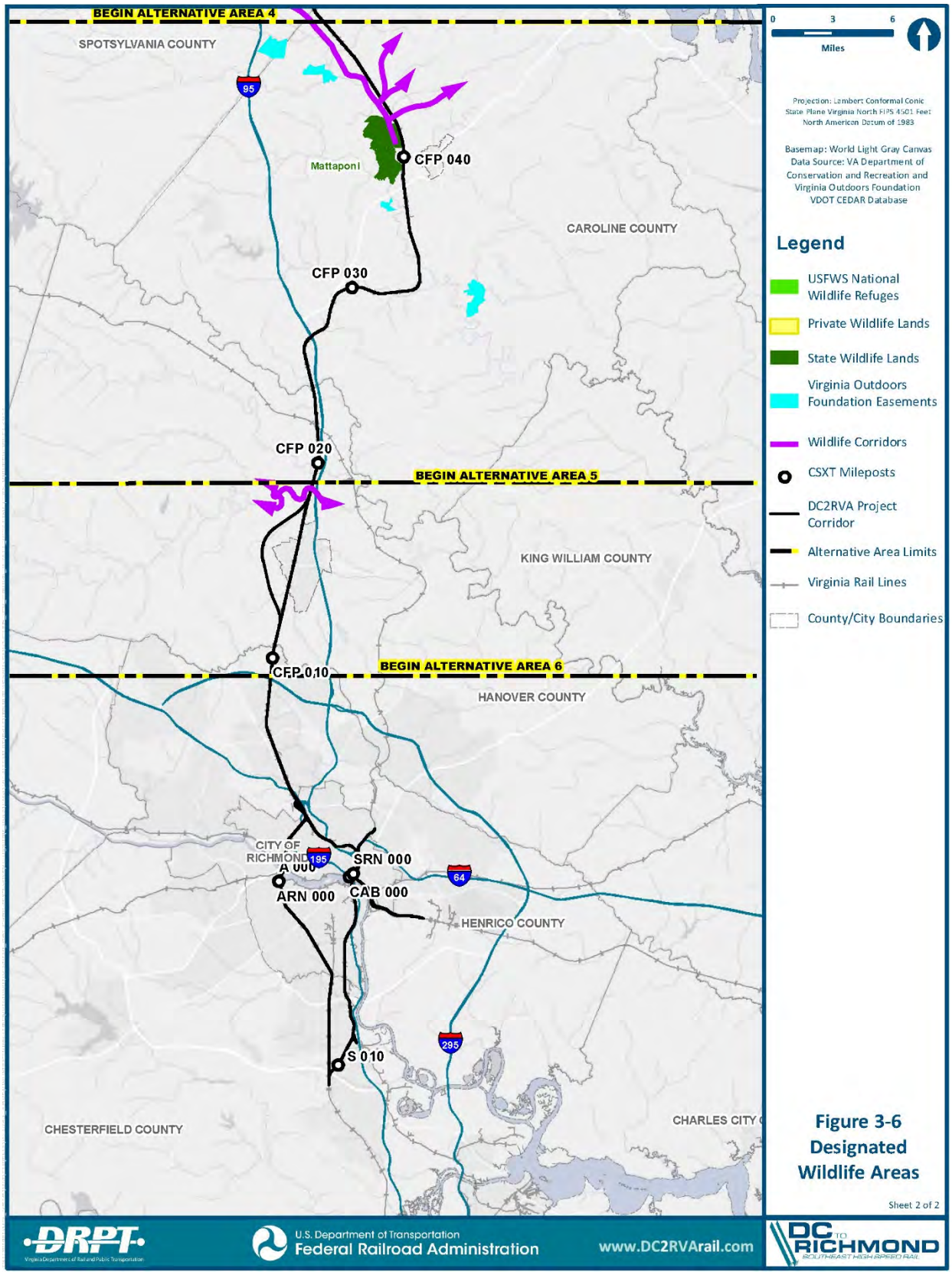
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North American Datum of 1983
Basemap: World Light Gray Canvas
Data Source: VA Department of Conservation and Recreation and Virginia Outdoors Foundation
VDOT CEDAR Database
Legend
USFWS National Wildlife Refuges
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Roaches Run Waterfowl Sanctuary. This sanctuary a part of the George Washington Memorial Parkway. It is located near the northern terminus of the DC2RVA corridor. The sanctuary consists of a tidal open water wetland that provides important wintering habitat for waterfowl. Osprey *(Pandion haliaetus)*, green heron *(Butorides virescens)*, red-winged blackbird *(Agelaius phoeniceus)*, and mallards *(Anas plathyrhynchos)* are all common during the summer, along with other wetland wildlife.

Occoquan Bay National Wildlife Refuge. Located on the south side of the Occoquan River where it meets Belmont Bay, this refuge offers important grassland and wetland habitats in a highly urbanized area. The purpose of this refuge is to provide a sanctuary and breeding area for migratory birds and endangered species; provide a wildlife education center to the public; and support other recreational uses, where possible. One-square mile of a variety of habitat types is accessible by trails offering visitors the opportunity to view the many types of wildlife.

Featherstone National Wildlife Refuge. Established with the purpose of protecting contiguous wetland habitat, this refuge contains 325 acres of upland woodland and freshwater tidal marsh along the mouth of Neabsco Creek and Occoquan Bay. This area provides important habitat for migrating birds, wintering waterfowl, and many other wildlife species. Access to the refuge is limited to a nonmotorized boat ramp; however, it is open to the public.

3.2.2.2 State Wildlife Lands

This network of diverse and strategically located habitats is protected by Section 4(f) of the Department of Transportation Act of 1966.

Crow's Nest Natural Area Preserve. Located northeast of Fredericksburg, Crow's Nest preserves 2,872 acres of natural area and habitat managed by VDCR. This resource consists of approximately 750 acres of tidal and nontidal wetlands; 21 miles of stream, riparian, and wetland buffer; and 2,200 acres of mature hardwood forest, including two forest types that are recognized as globally rare by VDCR's Natural Heritage Program. This habitat supports bald eagles *(Haliaeetus heucocephalus)*; federally listed shortnose sturgeon *(Acipenser brevirostrum)*; 22 plant species that are significant for the Coastal Plain of Virginia; approximately 60 species of Neotropical migratory songbirds; spawning, nursery, and/or feeding habitat for 49 species of interjurisdictional (involving more than 1 political or management unit) fish; and 7 species of mussels and commercially valuable shellfish. This site has a biodiversity ranking from the VDCR of B2–very high significance.

Mattaponi State Wildlife Management Area. Nestled between nearly 6.5 miles of the Mattaponi and South rivers, this area conserves important upper coastal plain wildlife habitat managed by VDGIF. Diverse natural communities provide important habitat, including mature upland hardwood and mixed forests, managed loblolly pine stands, wetlands, and rivers. Wildlife-related recreation is allowed on this land including, hunting, trapping, primitive camping, fishing, hiking, and birding.

3.2.2.3 County Wildlife Lands

Pohick Seeps Conservation Site. Located adjacent the east side of the tracks and south side of Pohick Creek in Area 2, parcels owned by Fairfax County are set aside in a Permanent Wildlife Conservation Easement. The site contains a Northern Coastal Plain Terrace Gravel Bog, a saturated woodland known to occur in fewer than 10 places in the world, all of which are located

just east of the fall line in Maryland and Northern Virginia. The site has been given a Biodiversity Ranking of B2–Very High Significance by VDCR and a Global Status of G1–Critically Imperiled due to its limited distribution in the Mid-Atlantic fall-line zone existing in fewer than 20 sites rangewide occurring in very small patches subject to multiple disturbances.

3.2.2.4 Private Wildlife Lands

Alexander Berger Memorial Sanctuary. Approximately 10 miles south of Fredericksburg along the proposed Fredericksburg Bypass alignment, the DC2RVA corridor bisects the larger of two areas encompassed by this approximately 868-acre preserve owned and managed by The Nature Conservancy. The sanctuary consists of mature, second-growth forest that has remained relatively undisturbed since 1864, when it was used by the Confederate army as an encampment. The two wooded parcels that were donated in 1963 were originally part of the historic Belvedere Peony Farm. The area contains trails that are open to the public year-round.

Virginia Outdoors Foundation (VOF). VOF open-space easements restrict property use to protect certain conservation values including, but not limited to, productive agricultural or timberlands, scenic vistas, rare species, caves, unique geologic features, rivers or streams, wetlands, wildlife habitat and corridors, and/or historic resources. For a property to be considered for a VOF easement, it must also have significant public benefits, which may include protection of water quality, retaining productive farm and timber land, and protecting scenic views enjoyed by travelers along public roads, rivers, or from parks. The proposed Fredericksburg Bypass alignment bisects two VOF properties (CLN-VOF-3804, CLN-VOF-03850) totaling approximately 894 acres and comes within 1,000 feet of a third property (SPT-VOF-1597). All areas are privately owned, managed with conservation easements, and closed to the public.

3.2.2.5 Priority Conservation Areas

Priority Conservation Areas are lands identified by VDGIF as a priority for preservation, protection, or specific management action for conservation of Virginia's wildlife, plants, and natural communities.

VDGIF—Priority Wildlife Diversity Conservation Areas. VDGIF created the Priority Wildlife Diversity Conservation Areas (PWDCA) dataset to identify habitat for conservation that is important for nongame wildlife. These areas are based on recommendations from VDGIF biologists, Virginia's Wildlife Action Plan, and other sources. Areas include mapped species' habitats and recommended conservation actions to conserve riparian buffers, large blocks of habitat and forest and wetland buffers. This mapping is part of an effort between VDGIF, VDCR–Division of Natural Heritage (DNH), and Virginia Commonwealth University's Center for Environmental Studies.

The **South Anna River** in the vicinity of the DC2RVA corridor is a PWDCA and has been designated a "Threatened and Endangered Water" for the dwarf wedgemussel *(Alasmidonta heterodon)*.

VDCR-DNH—Natural Heritage Plan Conservation Sites and Stream Conservation Units. Conservation sites represent landscape worthy of protection and stewardship action because of natural heritage resources, such as the habitat of rare, threatened, or endangered plant and animal species; unique or exemplary natural communities; and significant geologic formations. Terrestrial conservation sites are designed to include one or more rare plant, animal, or natural community and, where possible, its associated habitat and buffer or other adjacent land needed

for the element's conservation. Stream Conservation Units (SCUs) include stream reaches and tributaries that contain aquatic natural heritage resources, including upstream and downstream buffer. Conservation sites and SCUs are given a biodiversity significance ranking based on the rarity, quality and number of natural heritage resources they contain. The Natural Heritage Conservation Sites and SCUs are listed in Table 3-11.

Table 3-11: Natural Heritage Conservation Areas

Conservation Site/SCU	Alternative Area/Location	VDCR Biodiversity Ranking*	Description
Pohick Seeps Conservation Site	Northern Virginia East side of the tracks and south side of Pohick Creek	B2 Very high significance	Northern Coastal Plain Terrace Gravel Bog–A saturated woodland known to occur in less than 10 places just east of the fall line in Maryland and Northern Virginia
Brent Marsh Conservation Site	Northern Virginia Outside the right-of-way on the east side of the tracks north of and including part of Widewater State Park	B3 High significance	Association with sensitive joint-vetch, a federally listed species
Arkendale Flatwoods Conservation Site	Northern Virginia Including a portion of the existing tracks and to the east, much of the area includes a portion of Widewater State Park	B5 General significance	Coastal Plain Depression Swamp–A seasonally flooded forest located in depressions of the Chesapeake Bay Region
Lower Aquia Creek Conservation Site	Northern Virginia Adjacent to the west side of the tracks, on the north side of Aquia Creek	B4 Moderate significance	Associated with Parker's pipewort *(Eriocaulon parkeri)*, a rare plant to Virginia
Claiborne Run SCU	Northern Virginia and Fredericksburg Adjacent to and crossed by the DC2RVA corridor four times (once in the Northern Virginia area and three times in the Fredericksburg area)	B4 Moderate significance	
Hazel Run SCU	Fredericksburg Route 1 to Route 2, crossed by the tracks	B3 High significance	Aquatic natural community
Little Falls Run SCU	Fredericksburg East of the existing tracks; however, does not drain the existing track vicinity	B4 Moderate significance	Aquatic natural community
South Fredericksburg Conservation Site	Fredericksburg Including existing tracks along the east side of the conservation site, site located mostly within the Fredericksburg Battlefield	B2 Very high significance	Non-Riverine Wet Hardwood Forest (Northern Coastal Plain Type)–Contains seasonally to nearly permanently saturated forest located in ancient floodplains on wide flat terraces

Table 3-11: Natural Heritage Conservation Areas

Conservation Site/SCU	Alternative Area/Location	VDCR Biodiversity Ranking*	Description
White Oak Run SCU	Fredericksburg Crossed by the proposed bypass	B3 High significance	
Snow Creek Ravine Conservation Site	Fredericksburg Crossed by the proposed bypass, site includes Snow Creek just south of its confluence with Rappahannock River	B4 Moderate significance	
Summit Railroad Tracks Conservation Site	Fredericksburg Just south of Summit Crossing Road, adjacent to the east side of and including the existing tracks	B4 Moderate significance	
Polecat Creek–Penola SCU	Central Virginia Crossed by existing tracks, west of Penola Road	B5 General significance	Association with the fine-lined emerald *(Somatochlora filose)*, a state rare dragonfly
South Anna River–Falling Creek SCU	Ashland Crossed by existing tracks three times and the proposed bypass alignment two times	B3 High significance	Aquatic natural community and association of the yellow lance *(Elliptio lanceolata)*, a freshwater mussel
Centralia Conservation Site	Richmond Adjacent to the west side of the tracks south of Old Lane at the southern terminus of the Project	B4 Moderate significance	

* Rating of the significance of the conservation site based on presence and number of natural heritage resources

Source: VDCR, 2014a and CEDAR.

VDCR-DNH–Ecological Cores. The Virginia Natural Landscape Assessment (VaNLA) is a landscape-scale GIS analysis tool developed to identify unfragmented natural habitats called Ecological Cores. Ecological Cores are prioritized according to their ecological value, notably their value as habitat for interior-dependent species. The habitat is ranked from Outstanding (C1) to General (C5). Most forested areas in Virginia are rated with this tool, including most of the areas along the DC2RVA corridor. This tool was used to locate core habitat and the corridors that connect them in the Project vicinity.

Wildlife Corridors. Wildlife corridors are corridors of habitat connecting larger similar areas of core habitat (i.e., large areas of similar habitat not broken up by other habitat types or urbanization) that facilitate the movement of species and genetic material between habitats. Corridors have the potential to reduce the negative genetic effects of habitat fragmentation (i.e., the breaking up of core habitat into smaller patches), such as reduced population and genetic diversity. In Virginia, core habitat and wildlife corridors generally refer to intact forested areas,

many times along riparian corridors, that tend to have had fewer human alterations. These areas facilitate the movement of less common wildlife species that do not do well in areas of human alteration and species that prefer interior forested habitat away from edge dwelling predators. Wildlife corridors were located using a combination of VDCR-DNH ecological core mapping and aerial photographs of the Project vicinity. Table 3-12 lists the wildlife corridors identified within the DC2RVA corridor.

Table 3-12: Wildlife Corridors

Corridor	Alternative Area	Corridor Description
Marine Corps Base Quantico (MCBQ) to Widewater State Park	Northern Virginia	The rail line in this location crosses a corridor approximately 8 miles long, generally over 1 mile wide and a minimum 0.5 mile wide, connecting C2 ecological core habitat on MCBQ to C3 to C4 habitat at Widewater State Park.
I-95/Route 17 to C1 Habitat east of Route 2	Fredericksburg	The corridor is a minimum of 2,000 feet wide and connects C5 C5 ecological core habitat southeast of I-95/Route 17 to C3 habitat to a very large area of C1 (outstanding) ecological core habitat east of Route 2.
Fort A. P. Hill	Fredericksburg	The proposed Fredericksburg Bypass alignment and connection to main tracks crosses a large wildlife corridor consisting of a minimum of 1,000 feet connecting C1 habitat at Fort A. P. Hill to C2 and C3 habitat cores through C4 and C5 habitat areas.
I-95 to Milford	Central Virginia	This wildlife corridor connects patches of C4-C2 habitat roughly following the Mattaponi River and one of its tributaries from I-95 northeast of Thornburg to north of Milford. The corridor width varies from 1,500 feet to over 1 mile in some places and remains on the west side of existing tracks. East of the tracks and Route 2 is a large patch of C1 (outstanding) ecological core habitat.
South Anna River	Ashland	The riparian corridor along the South Anna River could also serve as a wildlife corridor. The forested area narrows to 500 feet in many places; however, it does provide a lengthy corridor that connects several larger habitat areas.

Source: VDCR-DNH, 2015. Google Maps, 2015.
Notes: 1. C1: Outstanding, C2: Very High, C3: High, C4: Moderate, C5: General

Forest Legacy Program. To protect environmentally important private forests that are threatened by conversion into non-forest uses, USDA Forest Service, in partnership with the states, created the Forest Legacy Program (FLP). FLP is a voluntary program that uses federal grant funds to purchase land, or conservation easements, to conserve lands that provide public benefits including sustainable forest resources, clean water, clean air, wildlife habitat, and forested scenic views, as well as protecting sensitive sites and habitats used by threatened and endangered species. As of January 2012, 9,750 acres have been protected in Virginia through this program. No FLP land is located in the Project vicinity.

3.2.3 Invasive Species

EO 13112, *Invasive Species*, defines invasive species as non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm or harm to human health. State and local governments have also set up several laws and regulations to prevent the spread of noxious weeds and plants deemed to be detrimental to crops; surface waters, including lakes; or other desirable plants, livestock, land, or other property or to be injurious to public health or the economy. Furthermore, noxious weeds are plants designated by federal, state, or

county government as detrimental to public health, agriculture, recreation, wildlife, economy, or property. The Project corridor crosses suburban and urban areas where disturbed ground depends on colonization by invasive species.

Table 3-13 lists the invasive species noted in the DC2RVA corridor while conducting field investigations. The table includes the VDCR ranking for invasiveness. VDCR ranks invasive species to reflect the level of threat to forests and other natural communities and native species. The ranks used are high, medium, and low, where species ranked high pose a substantial threat to native species, natural communities, or the economy.

Table 3-13: Invasive Species Observed in the Study Area

Scientific Name	Common Name	Invasiveness Rank
Lonicera maackii	Amur Honeysuckle	High
Ligustrum sinense	Chinese Privet	High
Dioscorea polystachya	Cinnamon Vine	High
Phragmites australis ssp. australis	Common Reed	High
Myriophyllum spicatum	Eurasian Water-milfoil	High
Alliaria petiolata	Garlic Mustard	High
Hydrilla verticillata	Hydrilla	High
Lonicera japonica	Japanese Honeysuckle	High
Reynoutria japonica	Japanese knotweed	High
Microstegium vimineum	Japanese Stiltgrass	High
Sorghum halepense	Johnson Grass	High
Pueraria montana var. lobata	Kudzu	High
Murdannia keisak	Marsh dewflower	High
Persicaria perfoliata	Mile-a-minute	High
Rosa multiflora	Multiflora Rose	High
Celastrus orbiculatus	Oriental Bittersweet	High
Ampelopsis brevipedunculata	Porcelain-berry	High
Lythrum salicaria	Purple Loosestrife	High
Lespedeza cuneate	Sericea Lespedeza	High
Centaurea stoebe ssp. micranthos	Spotted Knapweed	High
Ailanthus altissima	Tree-of-heaven	High
Iris pseudacorus	Yellow Flag	High
Cirsium vulgare	Bull Thistle	Medium
Pyrus calleryana	Callery Pear	Medium
Agrostis capillaris	Colonial bent-grass	Medium

Table 3-13: Invasive Species Observed in the Study Area

Scientific Name	Common Name	Invasiveness Rank
Hedera helix	English ivy	Medium
Akebia quinata	Five-leaf Akebia	Medium
Glechoma hederacea	Gill-over-the-ground	Medium
Persicaria longiseta	Long-bristled Smartweed	Medium
Albizia julibrissin	Mimosa	Medium
Paulownia tomentosa	Royal Paulowina	Medium
Euonymus fortune	Winter Creeper	Medium
Commelina communis	Asiatic Dayflower	Low
Perilla frutescens	Beefsteak Plant	Low
Securigera varia	Crown-vetch	Low
Phleum pratense	Timothy	Low
Morus alba	White Mulberry	Low

Source: Field Surveys, 2015-2016.

3.2.4 Wildlife

Sensitive wildlife populations can be found throughout Virginia. These populations were taken into consideration in addition to important natural communities to ensure the least disruption practicable with the implementation of proposed improvements. Sensitive wildlife populations located in the Project vicinity are discussed below.

3.2.4.1 Colonial Waterbirds

Colonial waterbirds are birds that nest in large groups during the nesting season. These groups are called rookeries or colonies. Coordination with VDGIF is required for waterbird colonies documented in the Project vicinity. Several great blue heron *(Ardea herodias)* colonies are in the study area (Table 3-14); no other waterbird colonies are known to be present.

Table 3-14: Colonial Waterbird Colonies

Location	Distance from Existing Tracks	Closest Area	Species	Colony ID	Year Observed
South of Mason Neck Park on Occoquan Bay	~ 3 miles	Northern Virginia	Great Blue Heron	210,199.00	2003
South of Mason Neck Park on Occoquan Bay	< 3 miles	Northern Virginia	Great Blue Heron	201,198.00	2003
South of Mason Neck Park on Occoquan Bay	< 3 miles	Northern Virginia	Great Blue Heron	211,455.00	1984
South side of Chopawamsic Creek upstream of tracks	~2.5 miles	Northern Virginia	Great Blue Heron	210,513.00	2003

Table 3-14: Colonial Waterbird Colonies

Location	Distance from Existing Tracks	Closest Area	Species	Colony ID	Year Observed
Potomac Creek downstream of tracks, north side of creek	~1.25 miles	Northern Virginia	Great Blue Heron	211,358.00	1993
Potomac Creek downstream of tracks, north side of creek	~ 1.3 miles	Northern Virginia	Great Blue Heron	210,514.00	2003
Potomac Creek downstream of tracks, south side of creek	~2.2 miles	Northern Virginia	Great Blue Heron	211,751.00	1988
East of James river on the north side between Cornelius Creek and Coles Run (Henrico County)	~1.3 miles	Richmond	Great Blue Heron	210,229.00	2003

Source: CEDAR-VDGIF, 2014.

3.2.4.2 Migratory Birds

Migratory birds are birds that fly long distances annually, often north-south, between breeding (summer) and wintering habitat; often driven by food. The Migratory Bird Treaty Act of 1918 (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit. This includes disturbances to trees and structures used for nesting at the time they are occupied, or to cause a disturbance resulting in an adult abandoning its nest. The protection does not extend to preventing birds from building nests in structures. EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, requires federal agencies to take action to implement the MBTA. Such actions include evaluating and identifying the potential measureable negative effects a project may have on migratory bird populations. If any such effects could occur, the federal agency must consult with USFWS before the action and mitigate the effects.

Migratory species are generally funneled into specific routes by natural barriers, causing migration patterns called fly-ways. The Project is located along the landward edge of the Atlantic Flyway (Figure 3-7), which stretches from the northeastern side of Canada, Iceland, and the western side of Greenland, along the Atlantic Coast, and down to South America. Many migratory bird species pass through the study area; however, some reside in Virginia either seasonally or year round. Coastal Virginia is an important area for Neotropical birds that breed in North America and spend winter in the Caribbean, Mexico, and Central and South America (tanagers, warblers, hummingbirds, and vireos), as well as temperate migrants (American robin, kinglests, sparrows, finches), and the birds of prey or raptors that follow them (bald eagle, peregrine falcon, merlin, hawks, American kestrel).

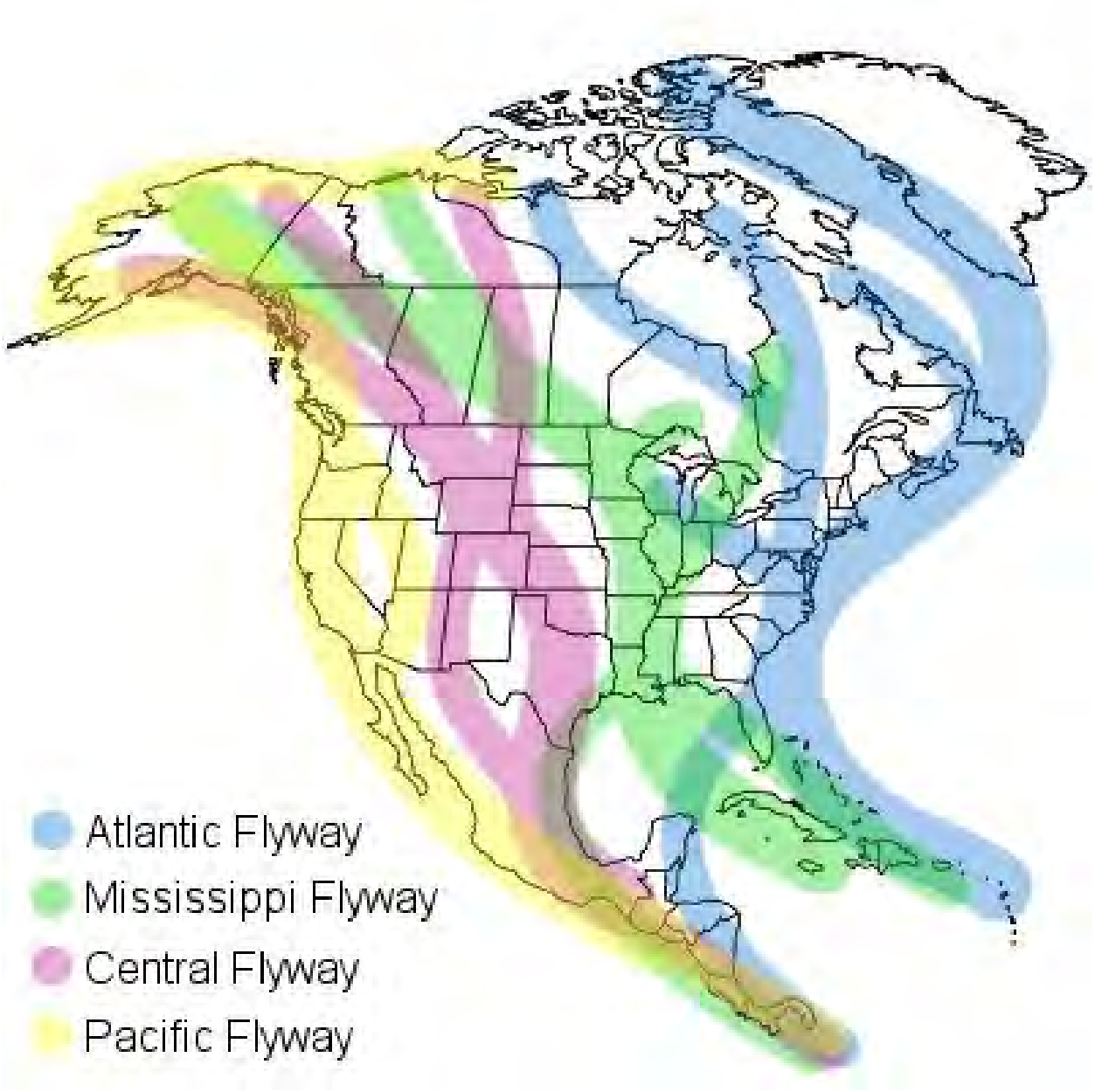


Figure 3-7: North American Flyways

3.2.5 Aquatic and Marine Life

3.2.5.1 Fisheries, Anadromous Fish, and Trout Waters

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a mandate for federal agencies to identify and protect important marine and anadromous fish habitat. Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Act as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802 [10]). EFH regulations apply largely to marine fisheries but are also applicable to freshwater spawning waters for anadromous species. Any action funded, permitted, or carried out by federal agencies that may adversely impact EFH are

required to consult with NOAA–National Marine Fisheries Service (NMFS) and respond in writing to NMFS or regional fishery management councils.

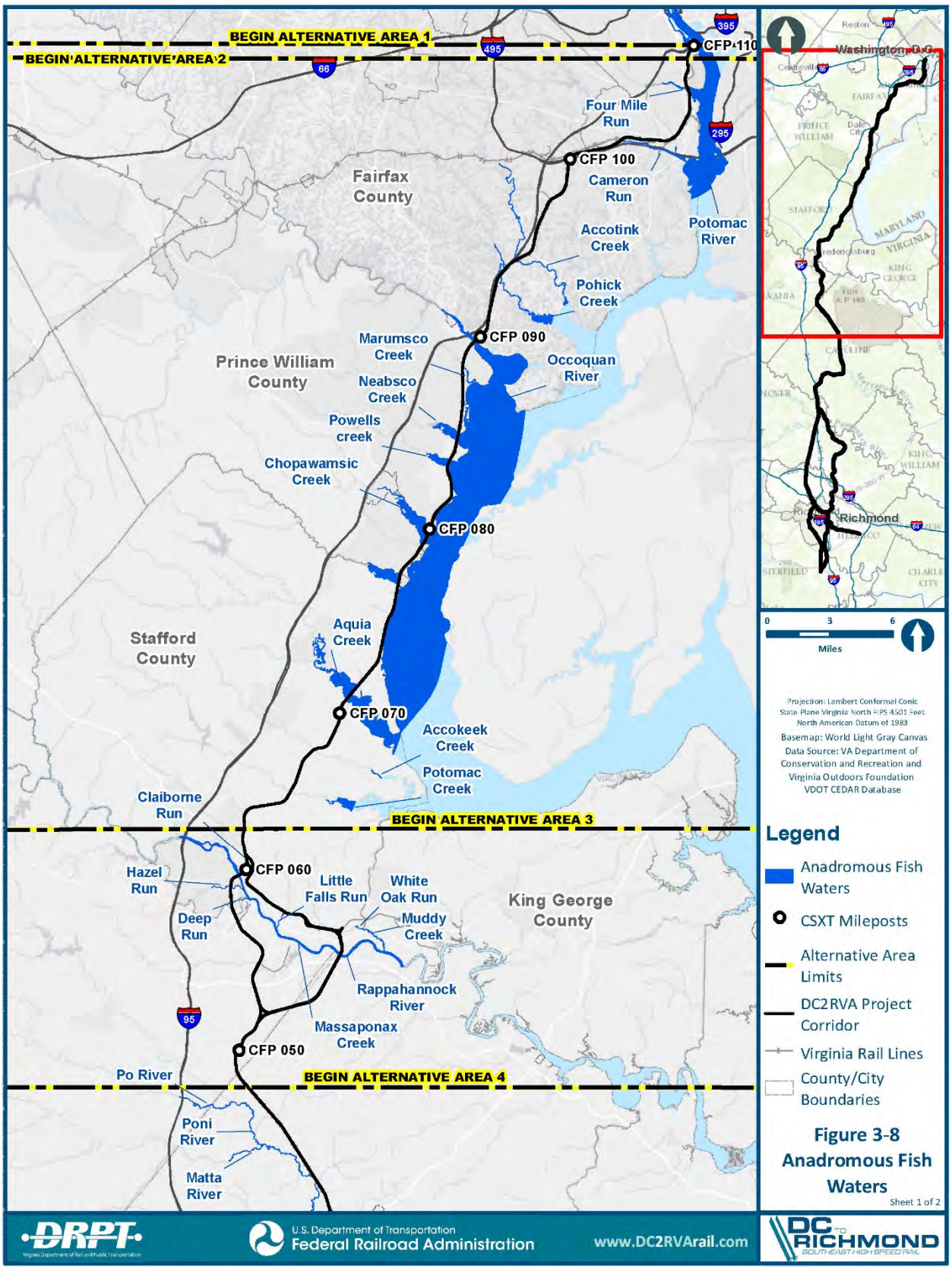
Fisheries. EFH waters include aquatic areas and their associated physical, chemical, and biological properties; substrates (natural and unnatural bottoms, structures, and biological communities); and necessary habitat required to support a sustainable fishery. No EFH waters are mapped by NOAA within the DC2RVA corridor (NOAA, 2015).

According to the Virginia Coastal Geospatial and Educational Mapping System (GEMS) and the Virginia Institute of Marine Science (VIMS), no fisheries management areas or aquaculture sites are located in the study area, and it is an area of low occurrence for clams, mussels, and crabs. No private oyster ground leases are located in the study area.

Trout. Coordination with VDGIF is required any time a Stocked Trout Water is documented within a project area. According to VDGIF mapping of trout waters, only one stocked trout water is located in the study area: Cook Lake in Cameron Run Regional Park (VDGIF, 2015b).

Anadromous Fish. Anadromous Fish Use Areas are migration pathways, spawning grounds, or nursery areas identified by VDGIF as having been used or have the potential to be used by anadromous fish. Confirmed Anadromous Fish Use Areas are those waters known to provide migratory and spawning habitats for anadromous fish. Coordination with VDGIF is required for projects in the vicinity of these waters (Figure 3-8). Table 3-15 provides a list of confirmed and potential Anadromous Fish Use Areas within the study area, which include the following species:

- **Alewife** (*Alosa pseudoharengus*) —Alewives are on the Virginia Wildlife Action Plan under Tier IV, "Moderate Conservation Need." Their main food sources are plankton, insects, and crustaceans. Many are now landlocked in the Great Lakes region, and several landlocked waters in Virginia contain alewives. They have a strong physical resemblance to the blueback herring (*Alosa aestivalis*).
- **American Shad** (*Alosa sapidissima*) —American shad are listed on Virginia's Wildlife Action Plan under Tier IV with "Moderate Conservation Need." They are considered a 'sport fish' and support sport and commercial fisheries. American shad spawn in tidal freshwater, near the mouths of creeks. When not spawning, they appear in schools on the continental shelf. Their diet consists of plankton, microcrustaceans, insects, worms, and small fish.
- **Blueback Herring** (*Alosa aestivalis*) —Blueback herring are not endangered or threatened or a species of concern in Virginia. They are native to Virginia. Their diet consists of plankton, copepods, pelagic shrimp, small fish, and insects. Blueback herring very rarely spawn above the tidewater. They have a wide tolerance for different salinity levels.
- **Hickory Shad** (*Alosa mediocris*) —Hickory shad are sport and commercial fish not listed as a species of concern in Virginia. Their diet is made up mostly of small fish. They live in marine waters close to land and in tidal rivers and tributaries during spawning.
- **Striped Bass** (*Morone saxatilis*) —The Chesapeake striped bass are sport and commercial fish not listed as a species of concern in Virginia; however, it is "beleaguered" or under stress. Their diet consists of fish, mollusks, and crustaceans. They depend heavily on water quality within their habitat.


BEGIN ALTERNATIVE AREA 1
BEGIN ALTERNATIVE AREA 2
CFP 110
Four Mile Run
CFP 100
Cameron Run
Fairfax County
Potomac River
Accotink Creek
Pohick Creek
CFP 090
Marumsco Creek
Prince William County
Occoquan River
Neabsco Creek
Powells creek
Chopawamsic Creek
CFP 080
Aquia Creek
Stafford County
CFP 070
Accokeek Creek
Potomac Creek
Claiborne Run
BEGIN ALTERNATIVE AREA 3
Hazel Run
CFP 060
Little Falls Run
White Oak Run
Deep Run
Muddy Creek
King George County
Rappahannock River
Massaponax Creek
CFP 050
Po River
BEGIN ALTERNATIVE AREA 4
Poni River
Matta River
Washington, D.C.
Richmond
0 3 6
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Light Gray Canvas
Data Source: VA Department of Conservation and Recreation and Virginia Outdoors Foundation
VDOT CEDAR Database
Legend
Anadromous Fish Waters
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Virginia Rail Lines
County/City Boundaries
Figure 3-8
Anadromous Fish Waters
Sheet 1 of 2
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Federal Railroad Administration
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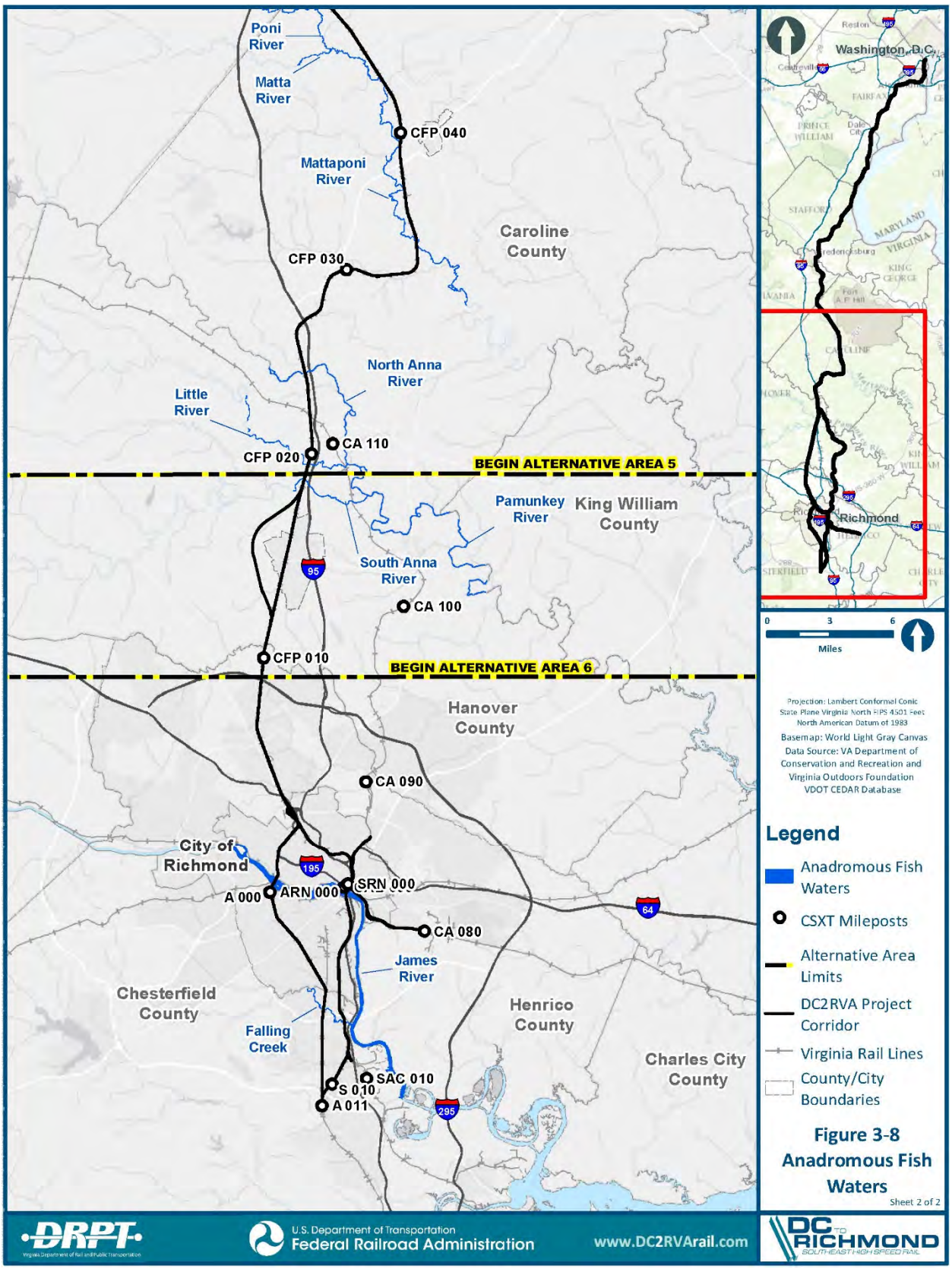
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


Poni River
Matta River
Mattaponi River
CFP 040
Caroline County
CFP 030
North Anna River
Little River
CA 110
CFP 020
BEGIN ALTERNATIVE AREA 5
Pamunkey River
King William County
South Anna River
95
CA 100
CFP 010
BEGIN ALTERNATIVE AREA 6
Hanover County
CA 090
City of Richmond
195
A 000
ARN 000
SRN 000
64
CA 080
James River
Chesterfield County
Henrico County
Falling Creek
Charles City County
SAC 010
S 010
A 011
295
Washington, D.C.
Richmond
0 3 6
Miles
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Light Gray Canvas
Data Source: VA Department of Conservation and Recreation and Virginia Outdoors Foundation
VDOT CEDAR Database
Legend
Anadromous Fish Waters
CSXT Mileposts
Alternative Area Limits
DC2RVA Project Corridor
Virginia Rail Lines
County/City Boundaries
Figure 3-8
Anadromous Fish Waters
Sheet 2 of 2
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Federal Railroad Administration
www.DC2RVArail.com
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL

- **Yellow Perch** (*Perca flavescens*) —Yellow perch are important sport and commercial fish that are not a species of concern in Virginia. Younger yellow perches eat insects and plankton, and the adults eat mainly fish and can even be cannibalistic. Other food sources include crustaceans, copepods, algae, amphipods, and chironomids. They usually live in still or slightly turbid lakes, reservoirs, and rivers that are large and cool.

Table 3-15: Confirmed and Potential Anadromous Fish Use Waters

Water	Upstream Boundary	Confirmed Species	Alternative Area
Four Mile Run	Approximately 1,600 feet upstream of Arlington Ridge Rd	Striped Bass, Yellow Perch	Northern Virginia
Cameron Run	CSX railroad crossing in Alexandria City	Potential anadromous fish use waters	Northern Virginia
Accotink Creek	Road crossing 2,600 feet above Field Lark Branch	Alewife, Yellow Perch	Northern Virginia
Pohick Creek	At confluence with unnamed tributary in Pohick Stream Valley Park between Pohick Road and Kings Point Court, 300 feet above powerline	Alewife, Blueback Herring, Yellow Perch	Northern Virginia
Occoquan River	Lower Occoquan Dam	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	Northern Virginia
Neabsco Creek	Approximately 2,300 feet below Route 1	Striped Bass	Northern Virginia
Powells Creek	Approximately 5,600 feet below Route 1	Striped Bass, Yellow Perch	Northern Virginia
Potomac River	Great Falls	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	Northern Virginia
Quantico Creek	No upstream boundary listed	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	Northern Virginia
Chopawamsic Creek	Approximately 9,000 feet below Route 1	Blueback Herring, Yellow Perch	Northern Virginia
Aquia Creek	Aquia Creek Dam, confluence with Beaverdam Run	American Shad, Blueback Herring, Striped Bass, Yellow Perch	Northern Virginia
Claiborne Run	Raised culvert at Route 218	Potential anadromous fish use waters	Fredericksburg
Rappahannock River	Embrey Dam	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	Fredericksburg
Hazel Run	Business U.S. Route 1/Route 208	Alewife, Blueback Herring	Fredericksburg
Mattaponi River	Route 301	American Shad, Blueback Herring, Striped Bass, Yellow Perch	Central Virginia

Table 3-15: Confirmed and Potential Anadromous Fish Use Waters

Water	Upstream Boundary	Confirmed Species	Alternative Area
North Anna River	Approximately 2.5 miles above Route 1 at 'fall hole'	American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	Central Virginia
Little River	Route 685 crossing	Yellow Perch	Central Virginia
South Anna River	Ashland Mill Dam	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass	Ashland
James River	Boshers Passage	American Shad, Blueback Herring, Striped Bass, Yellow Perch	Richmond
Falling Creek	Falling Creek Reservoir Dam	Potential anadromous fish use waters	Richmond

Source: CEDAR-VDGIF, 2014.

3.2.5.2 Submerged Aquatic Vegetation

Submerged Aquatic Vegetation (SAV) are widely regarded as keystone species and primary indicators of water quality conditions in the Potomac River and Chesapeake Bay. According to 4 VAC 20-337-10 *et seq.* SAV Transplantation Guidelines, any removal of SAV from state bottom would require prior approval by VMRC (VMRC, 2000).

SAV includes any of a diverse assemblage of underwater plants found in the shoal areas of Chesapeake Bay, Virginia coastal bays, and river tributaries, primarily eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*), and including, but not limited to redhead grass (*Potamogeton perfoliatus*), wild celery (*Vallisneria americana*), common elodea (*Elodea canadensis*), water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), water-weed (*Egeria densa*), muskgrass (*Najas minor*), pondweeds (*Potamogeton sp.*), and naiads (*Najas sp.*) (VMRC, 2000).

VIMS has an online interactive mapper with downloadable GIS files that shows historic SAV beds in the Chesapeake Bay and its tributaries dating back to 1971. Vegetation can change from year to year due to environmental factors and annual fluctuations in nutrient levels and water clarity. For this Project, SAV documented within 500 feet of the existing rail in any year within the most recent 5 consecutive years (2011 to 2015) is considered an existing SAV habitat/bed. Existing SAV beds are shown in Figure 3-9. Areas that have not had populations mapped in the last 5 years, yet have had SAV mapped before 2011, were considered 'historic beds.' Historic beds are important because they are potential mitigation and restoration sites and have the potential of supporting SAV beds naturally in the future. According to SAV mapping provided by the VIMS SAV monitoring program, approximately 55.0 acres of existing (2011 to 2015) SAV beds and an additional 247.1 acres of historic (1971 to 2009) beds occur within the study area (Table 3-16).

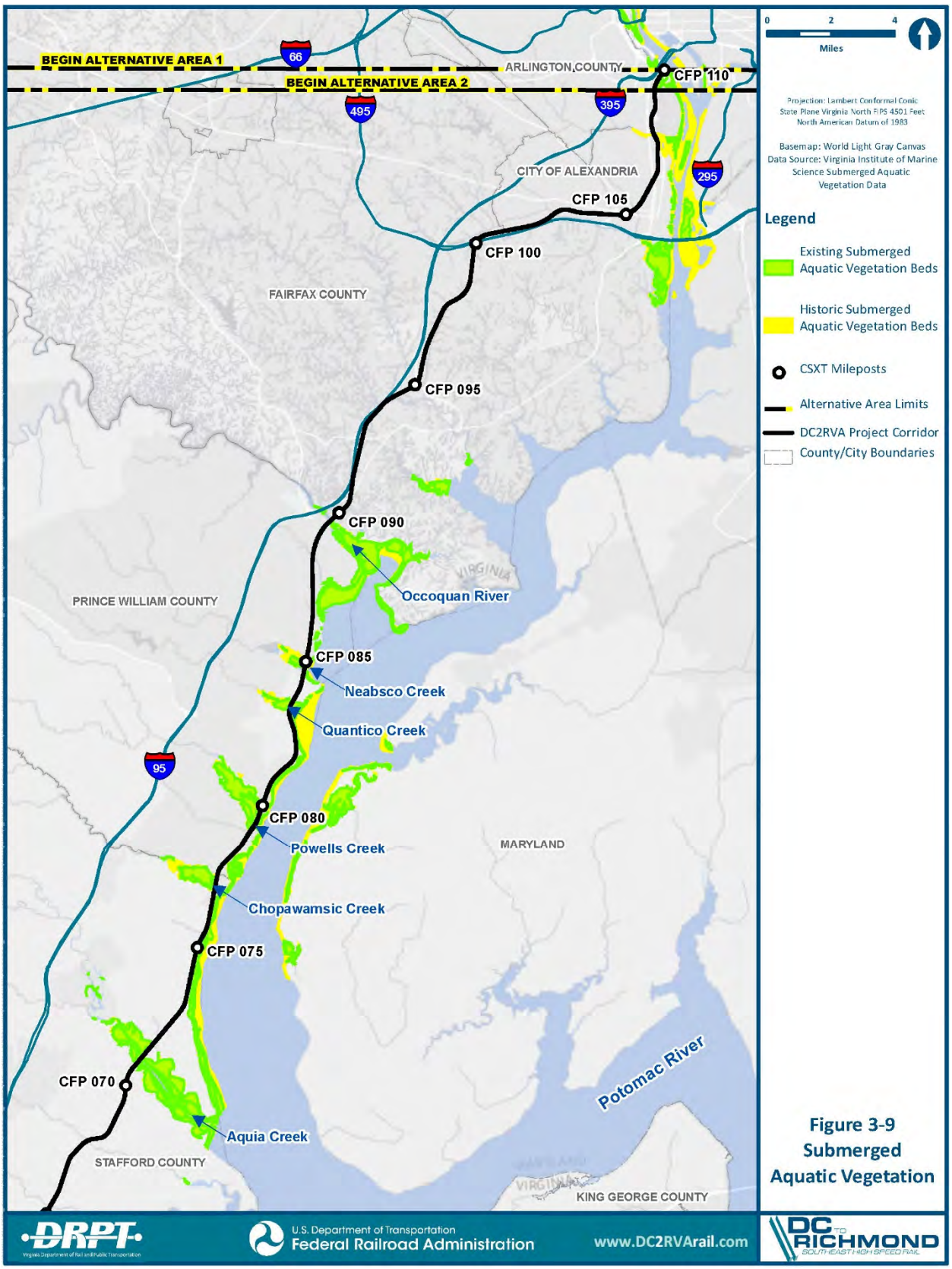


Figure 3-9 Submerged Aquatic Vegetation

Table 3-16: Mapped Existing SAV Beds

Water Body	Boundaries	Alternative Area	Year(s)	Acres Within 500 Feet of Existing Rail
Roaches Run	Adjacent to the existing tracks	Area 1: Arlington (Long Bridge Approach)	2012, 2013, 2014, 2015	12.74
Four Mile Run	Downstream from tracks	Area 2: Northern Virginia	2015	—
Occoquan River	From existing tracks continuing downstream	Area 2: Northern Virginia	2012, 2013. 2014, 2015	3.19
Occoquan Bay	Multiple locations along the western shore	Area 2: Northern Virginia	2011, 2012, 2013. 2014, 2015	7.52
Neabsco Creek	From 0.75 mile upstream of the existing track to Occoquan Bay	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	2.82
Powells Creek	From 1 mile upstream of the existing track to the Potomac River	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	12.73
Potomac River	Multiple locations along the western shore from Occoquan Bay continuing downstream	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	118.66
Quantico Creek	From 2.5 miles upstream of the existing track to the Potomac River	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	55.4
Chopawamsic Creek	From existing track to 2 miles upstream	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	10.58
Aquia Creek	Multiple locations from 3 miles upstream of existing track to the Potomac River	Area 2: Northern Virginia	2011, 2012, 2013, 2014, 2015	23.44

Source: VIMS, 1979-2015.

3.2.6 Threatened and Endangered Species

USFWS and NMFS are responsible for listing, protecting, and managing federally listed threatened and endangered species under the Endangered Species Act of 1973 (ESA), as amended. VDCR and VDGIF are responsible for listing, protecting, and managing state-listed threatened and endangered species. The Virginia Department of Agriculture and Consumer Services is the regulatory authority for the conservation and preservation of threatened and endangered plant and insect species. The Department of Game and Inland Fisheries has legal authority for preservation of vertebrate and other invertebrate endangered and threatened species. The Department of Conservation and Recreation Division of Natural Heritage produces an inventory of the Commonwealth's natural resources, and maintains a database of ecologically significant sights. An endangered species is defined as one that is in danger of extinction throughout all or in a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future.

3.2.6.1 Methods

Information regarding federally listed threatened and endangered species that may be impacted by the Project was obtained from USFWS via the Information, Planning, and Conservation (IPaC) system. The IPaC system is an online conservation planning tool used by USFWS to streamline the environmental review process associated with Section 7 of the ESA. Section 7 is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any federally listed threatened, endangered, or candidate species. IPaC provides lists of federally protected species in defined study areas, as well as links to information about identified species.

3.2.6.2 Existing Conditions

Seven federally listed threatened or endangered species are reported to occur or potentially occur within the study area based on habitat requirements and information gathered from USFWS, VDGIF, Virginia Fish and Wildlife Information Service (VaFWIS), and/or VDCR. An additional five state-listed threatened or endangered species are listed as occurring in the vicinity of the study area. Four additional state endangered species were initially indicated as potentially occurring in the Project vicinity, but based on additional review of habitat in the study area, DRPT determined they were not present: Appalachian springsnail *(Fontigens bottimeri),* brook floater *(Alasmidonta varicose),* tiger salamander *(Ambystoma tigrinum)*, and Virginia Piedmont water boatman *(Sigara depressa).* These species are further discussed in the *Natural Resources Technical Report* (Appendix M). Table 3-17 indicates which areas each of the 13 federally and state-listed species have the potential of occurring in based on this research and coordination with regulatory agencies. Brief, general descriptions of the species that may occur within the study area and their habitat requirements are provided following the table. No critical habitat is present within the study area.

Table 3-17: Federal and State-Listed Threatened and Endangered Species that may occur within the Vicinity of the Study Area

Species / Resource Name	RTE Status*	Alternative Area					
		Area 1: Arlington (Long Bridge Approach)	Aera 2: Northern Virginia	Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	Area 4: Central Virginia (Crossroads to Doswell)	Area 5: Ashland (Doswell to I-295)	Area 6: Richmond (I-295 to Centralia)
Dwarf Wedgemussel (*Alasmidonta heterodon*)	FE		Y	Y	Y	Y	
Harperella (*Ptilimnium nodosum*)	FE		Y	Y			
Indiana bat *(Myotis sodalis)*	FE			Y	Y		
Northern Long-eared Bat (*Myotis septentrionalis*)	FT		Y	Y	Y	Y	Y
Sensitive Joint-vetch (*Aeschynome virginica*)	FT/ST		Y				Y

Table 3-17: Federal and State-Listed Threatened and Endangered Species that may occur within the Vicinity of the Study Area

Species / Resource Name	RTE Status*	Alternative Area					
		Area 1: Arlington (Long Bridge Approach)	Aera 2: Northern Virginia	Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	Area 4: Central Virginia (Crossroads to Doswell)	Area 5: Ashland (Doswell to I-295)	Area 6: Richmond (I-295 to Centralia)
Small Whorled Pogonia (*Isotria medeoloides*)	FT/SE		Y	Y			
Swamp-pink (*Helonias bullata*)	FT/SE			Y	Y		
Appalachian Springsnail (*Fontigens bottimeri*)	SE	Y	Y				
Barking Treefrog (*Hyla gratiosa*)	ST						Y
Brook Floater (*Alasmidonta varicosa*)	SE		Y				
Green Floater (*Lasmigona subviridis*)	ST			Y	Y	Y	
New Jersey Rush (*Juncus caesariensis*)	ST			Y	Y		
Peregrine Falcon (*Falco peregrinus*)	ST		Y				Y
Tiger Salamander (*Ambystoma tigrinum*)	SE				Y	Y	
Virginia Piedmont Water Boatman (*Sigara depressa*)	SE		Y		Y		
Wood Turtle (*Glyptemys insculpta*)	ST		Y				
** River bulrush (*Bolboschoenus fluviatilis*)	S2		Y				
Critical Habitat	--	**No Critical Habitat is Present** Project does not occur within Bland, Lee, Scott, Smyth, Russell, Tazewell, Washington, Wise, or Wythe counties in Virginia.					

Source: USFWS, 2015 & 2016.

* FE=Federal Endangered; PFE=Proposed Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; S2=Imperiled (not listed state threatened or endangered)

**State-listed species identified during field surveys

Note: "Y" in cells above indicates the presence of the species in the specified alternative area. Blank cells indicate that no species location data were identified from referenced sources.

References: (CEDAR-VDGIF; 12-2014 CCB–VaEagle Nest Locator; 12-2014 USFWS Bald Eagle Concentration Areas- Virginia; 11-2014 VDCR-NHD Subwatershed Search; 2016 USFWS–Official Species List).

Federally Endangered (FE)

Dwarf wedgemussel (*Alasmidonta heterodon*) is a small freshwater mussel, generally less than 2 inches and yellowish brown in color. They require oxygen-rich, low silt, pollution free rivers with

slow to moderate flow. This species is sensitive to pollution. They prefer sand, firm muddy sand, and gravel bottoms found in shallow riffle and shoal areas. Channelization, removal of shoreline vegetation, development, and road and dam construction threaten some populations.

Harperella (*Ptilimnium nodosum*) is an annual herbaceous plant occurring in rocky/gravelly shoals or cracks in bedrock outcrops beneath the water surface in clear, swift-flowing streams; edges of intermittent pineland ponds or low, wet savannah meadows on the Coastal Plain; and granite outcrop seeps. It is always found on saturated substrates and tolerates moderate flooding. Broad clusters of small white flowers generally bloom in July and August (USFWS, 1991a). This species is listed as federally endangered in the United States, critically imperiled in Virginia, and globally imperiled.

Indiana bat (*Myotis sodalis*) is a small bat with dark-brown to black fur and small mouse-like ears. In the winter, these bats hibernate in humid caves with cool, stable temperatures under 50 degrees Fahrenheit, but above freezing (USFWS, 2015). During summer, they prefer loose bark on dead or dying trees near streams in mature forests with 50 to 100 percent canopy cover. Shagbark hickory (*Carya ovate*) and large white oaks are known preferred tree species for roosting (VDGIF, 2014b). The males roost alone in summer, while the females roost in groups of 100 bats or more.

Federally Threatened (FT)

Northern long-eared bat (*Myotis septentrionalis*) is a medium-sized (3 to 3.7 inches) bat generally associated with old-growth forests composed of trees 100 years old or older. It relies on intact interior forest habitat, with low edge-to-interior ratios (NatureServe, 2014); however, it has been found within city limits. They are frequently found between the shrub layer and the canopy. Males and nonreproductive females tend to prefer caves, while reproductive females roost under tree bark in spring and summer (VDGIF, 2014b). This species prefers to hibernate in very high humidity caves with little or no air flow (USFWS, 2014). Potential bat habitat was noted in Carter Park in the Ashland area while conducting wetland delineations.

Sensitive joint-vetch (*Aeschynomene virginica*), an annual herbaceous plant in the pea family, generally grows 3 to 6 feet tall and produces yellow flowers streaked with red July through September, and a fruit pod that turns dark brown when ripe (USFWS, 2014a). It is found in fresh to slightly brackish tidal river shores and estuarine-river marsh borders. It usually grows within 2 meters of low water mark on raised banks, and in peaty, sandy, or gravelly substrates. Sensitive joint-vetch typically grows in the intertidal zone of coastal marshes where plants are flooded twice daily. The species seems to prefer the marsh edge at an elevation near the upper limit of tidal fluctuation. It is usually found in areas where plant diversity is high (50 species per acre) and annual species predominate. Bare to sparsely vegetated substrates appear to be a habitat feature of critical importance to this plant (USFWS, 2011). In North Carolina, sensitive joint-vetch has been found in a few ditches and wet fields, but these are not considered stable populations. Associated species include *Zizania aquatica*, *Petlandra virginica*, *Pontederia cordata*, *Bidens laevis*, *Polygonum arifolium*, *P. saggitatum*, and *Leersia oryzoides* (NatureServe, 2014). In Virginia, populations are found along the Potomac, Mattaponi, Pamunkey, Rappahannock, Chickahominy, and James rivers and their tributaries. It is sensitive to pollution (USFWS, 2014a). This species is also listed as threatened in Virginia and imperiled globally. Potential habitat was noted in several locations in the Northern Virginia area while conducting wetland delineations, and the Brent Marsh Conservation Site north of and including part of Widewater State Park is noted for its association with sensitive joint-vetch.

Small whorled pogonia (*Isotria medeoloides*) is a small (up to 12 inches tall) orchid, with five to six leaves in a whorl near the top of the stem, under greenish-yellow flowers that bloom from May, in the southern part of its range, to mid-June in the northern part of its range. It requires damp woods and is generally found on acidic, sloping, fragipan soils in 'second growth' or successional forest communities. This species can be found in deciduous and evergreen forests. Small whorled pogonia is listed as federally threatened, endangered in Virginia, and imperiled globally (NatureServe, 2014). The small whorled pogonia occurs on upland sites in mixed-deciduous or mixed deciduous/coniferous forests that are generally in second- or third-growth successional stages. Characteristics common to small whorled pogonia sites include sparse to moderate groundcover in the species' microhabitat, a relatively open understory canopy, and proximity to features that create long persisting breaks in the forest canopy. Soils at most sites are highly acidic and nutrient poor, with moderately high soil moisture values. Light availability could be a limiting factor for this species (USFWS, 1992). Many professionals have noted a prevalence of decaying logs and a well-developed detritus layer on the forest floor, although the exact mechanisms associated with this affinity is not understood (Ware, 1991). During the field surveys, DRPT utilized previous experience with approximately 10 known small whorled pogonia sites, six of which were in Virginia, to supplement the published data of the species and its likely habitat preference. The list of certain indicator species was slightly modified/expanded based on previous survey experience. Potential habitat was noted in several locations in the Northern Virginia area and the Fredericksburg area while conducting field surveys for natural resources, and specific mileposts for likely small whorled pogonia habitat are presented below in Section 4.2.3 and the associated summary tables.

Swamp-pink (*Helonias bullata*) is an obligate wetland species restricted to forested wetlands that are groundwater influenced and are perennially water-saturated with a low frequency of inundation. These habitats include emergent portions of hummocks in and along stream channels in Atlantic white cedar (*Chamaecyparis thyoides*) swamps, headwater seepage wetlands, red maple (*Acer rubrum*) swamps, mixed hardwood/evergreen swamps, and (rarely) black spruce-tamarack (*Picea mariana-Larix laricina*) bogs. The species appears to be somewhat shade tolerant and needs enough canopy to minimize competition with other more aggressive species and herbivory by deer. It is often found at stream sources. Swamp-pink is listed as federally lthreatened, endangered in Virginia, and vulnerable globally (NatureServe, 2014). The major threat to the species is loss and degradation of its wetland habitat due to encroaching development, sedimentation, pollution, succession, and wetland drainage. The species also exhibits extremely low seedling establishment, which appears to be a significant limitation to the colonization of new sites. Other threats include plant collection and trampling (USFWS 1991b).

State Endangered (SE)

Appalachian springsnail (*Fontigens bottimeri*) is a freshwater mussel found under small stones in riffle areas of caves. They can be found anywhere from the entrance of caves, to very deep underground. This species is known to occur in the Potomac River Basin in the District of Columbia and Maryland and the Shenandoah River basin in northwest Virginia (NatureServe, 2014).

The **brook floater** (*Alasmidonta varicosa*) is a medium sized (approximately 3 inches) freshwater mussel found in the gravel and sandy shoals of clean perennial creeks and small rivers. It is more commonly found in the upper portions of large watersheds with intact upland forest

(NatureServe, 2014). This species is not federally listed in the United States; however, it is listed as endangered in Virginia and vulnerable globally.

The **tiger salamander** (*Ambystoma tigrinum*) is the largest mole salamander in Virginia reaching a maximum total length of 13 to 14 inches. It is a robust species with a broad head and relatively small eyes. The back is dark brown to black with olive-yellow to brownish-yellow spots or blotches on the back, sides, and belly. The blotches continue laterally and blend into the olive-yellow center creating a jagged-edged lateral line. This species breeds from December to February in temporary or permanent aquatic habitats, including ditches, vernal ponds, and rarely, sluggish streams. Mating activities reach a peak during rain, and the adults remain in the breeding pond for about three weeks. The eggs average 52 per mass. The adults are terrestrial, and the larvae are aquatic. Larvae consume a variety of aquatic invertebrates. Adults are voracious predators of both terrestrial and aquatic insects and occasionally eggs or young of amphibians and reptiles. Four Virginia sites are known—two from York and Mathews Counties, one from Hanover County, and one from Augusta County. The Hanover County site was known to have a large fish population and is probably extirpated. Therefore, this species can be considered extant in only two sites in Virginia. Breeding habitats include limestone sinkhole ponds and coastal plain vernal pools associated with wetlands. The terrestrial habitat may be bottomland hardwood forest, conifer forests, or open fields. In Virginia this species is listed as endangered (VDGIF, 2015)

The **Virginia Piedmont water boatman** (*Sigara depressa*) is a freshwater insect that lives in ponds streams and lakes with aquatic plants. It is approximately ½-inch long with two oar-shaped legs that help it to swim and occasionally leap out of the water. They are mostly herbivores. This species is listed as endangered in Virginia and critically imperiled globally. The Virginia Piedmont water boatman is historically known to occur in only 3 sites in northeastern Virginia and is thought to have been eliminated from all but the Rivanna watershed in Fluvanna County (NatureServe, 2014). It is only known or likely to occur in the Ballinger Creek (JR21) subwatershed in Virginia (VDGIF, 2014b).

State Threatened (ST)

Barking treefrog (*Hyla gratiosa*) is the United States' largest native tree frog, ranging from 2 to 2.8 inches in length. They can vary in color, including bright or dull green, brown, yellowish, or gray with dark round markings on its back. As indicated by its name, it is distinguishable by its loud barking call. This species is associated with Oak–Hickory–Pine forests, preferring sandy areas in pine savannas and low wet woods and swamps. It is state listed as threatened due to the conversion of native pine habitat to monocultures of loblolly pine. It does not hold a federal designation and is ranked globally as "secure."

Green floater (*Lasmigona subviridis*) is a species of freshwater mussel that is usually found in fast-flowing, clean water in substrates that contain relatively firm rubble, gravel, and sand substrates swept free from siltation. The green floater is able to occupy very small creeks and streams, where other mussels are not generally found. This species is not federally listed ; however, it is state threatened and globally ranked as "vulnerable."

New Jersey rush (*Juncus caesariensis*) is a perennial rush growing 2 to 3 feet tall in very acidic wetland habitats such as pine barrens and cedar swamps. The largest populations of New Jersey rush are found in the pine barrens of New Jersey; in Virginia, it can be found in sphagnous seepages along the coastal plain (NatureServe, 2014). New Jersey rush is not federally listed; however, it is state threatened and globally ranked as "imperiled."

Peregrine falcon (*Falco peregrinus*) is not federally listed and is ranked globally as "apparently secure;" however, they are listed on Tier I of the Virginia Wildlife Action Plan for "Critical Conservation Need." They generally nest on rocky cliffs near river gorges; however, they can also be found on manmade structures such as bridges/underpasses, bridge piers, utility poles, and skyscrapers. Reintroduction efforts have succeeded in establishing breeding at several coastal sites, and now efforts are focused on reintroducing breeding populations to mountains in Virginia. It is believed to breed between late May and early August (VDGIF, 2014b). Peregrine falcons generally mate for life and return to the same nest year after year. Peregrine falcons lay three to four eggs in March or April, and the eggs incubate for 33 days. They nest on rocky cliffs near river gorges and will occasionally nest in trees. Their usual prey is pigeons and small birds such as blue jays (*Cyanocitta cristata*), flickers, and meadowlarks (*Sturnella*). Coastal and aquatic areas are their main habitats. They winter in coastal estuaries or intertidal mudflats along the Pacific coast, Gulf coast, and southern Florida.

Wood turtle (*Glyptemys insculpta*) is a primarily terrestrial species during the warm part of the year, making it easily accessible and a collection concern. This species has been seriously impacted by illegal collection (NatureServe, 2014). It is generally found in woodland habitat near clean ponds, streams, and bogs; it is intolerant of water pollution. Although they are highly terrestrial, they must remain near a water source, as they can easily dry out (VDGIF, 2014b). Wood turtles are approximately 5.5 to 8 inches long and have a distinct ringed pyramidal pattern on its upper shell. This species is ranked globally as vulnerable (NatureServe, 2014).

Although not listed in database searches for the project area, **river bulrush** (*Bolboschoenus fluviatilis*), a species ranked S2 (imperiled), was identified in a cattail marsh wetland (02-WTL-46) in the Neabsco Creek embayment in the Northern Virginia area by a botanist during the natural resources field surveys (Parsons, 2016). The species can be found in freshwater tidal marshes in the Coastal Plain and riverside gravel bars in the mountains. It is known from intertidal zones on the Potomac, Rappahannock, Piankatank, and James rivers (VBA, 2016). River bulrush is typically found in marshes, openings in swamps, edges of ponds and streams, fresh tidal marshes, and inland salt marshes and ponds. It is often in large extensive marshes and mostly not associated with saline or brackish water, and it sometimes occurs in large stands but more frequently occurs as small patches. The patches are often comprised predominantly of vegetative individuals with only a few or no reproductive culms present (VBA, 2016).

Bald eagle *(Haliaeetus leucocephalus)* is listed under Tier II of the Virginia Wildlife Action Plan for "Very High Conservation Need." The Bald eagle is no longer listed as threatened, but this discussion was left in this section since it is still protected under some laws. The James, Rappahannock, and Potomac rivers are where they are most commonly found in Virginia. Bald eagles build their nests in tall hardwood trees with open canopies near water bodies where they forage. They prefer undeveloped areas with little human activity. In Virginia, eggs are laid from January to March and incubated for 34 to 38 days. Bald eagles prey primarily on fish, but they may also eat carrion, waterfowl, rabbits, and some turtles. Their eggs are preyed on by bobcats, owls, and raccoons. Twenty-five (25) known bald eagle nest locations are near the DC2RVA corridor (Table 3-18).

Table 3-18: Known Bald Eagle (*Haliaeetus Leucocephalus*) Nest Locations

*Nest Code	Year Last Occupied	Year Last Checked	Area	Within 660' of Existing Rail
PW1301	2015	2015	Northern Virginia	Yes
PW1402	2015	2015	Northern Virginia	
PW0701	2015	2015	Northern Virginia	Yes
PW0602	2011	2011	Northern Virginia	
PW0601	2011	2011	Northern Virginia	
PW0902	2011	2011	Northern Virginia	
FF1602	2016	2016	Northern Virginia	
PW0801	2011	2011	Northern Virginia	Yes
PW0903	2011	2011	Northern Virginia	Yes
PW0201	2015	2015	Northern Virginia	
PW1501	2015	2015	Northern Virginia	
PW1101	2015	2015	Northern Virginia	Yes
PW1103	2015	2015	Northern Virginia	
PW1102	unknown	2011	Northern Virginia	
PW1001	2011	2011	Northern Virginia	
PW1104	2011	2011	Northern Virginia	
ST0801	2009	2011	Northern Virginia	
ST1001	2011	2011	Northern Virginia	
ST0001	2011	2011	Northern Virginia	
ST1002	2011	2011	Northern Virginia	
ST1003	2011	2011	Northern Virginia	Yes
ST0501	2011	2011	Northern Virginia	
ST1101	2011	2011	Northern Virginia	
RM1001	2015	2015	Richmond	
HE0802	2015	2015	Richmond	

Source: Mapping Portal-VaEagles Nest Locater. http://www.ccbbirds.org/maps/#eagles. Last Updated 2016. Accessed 5/2016.

Notes: * Nest surveys are completed during the breeding season and updated yearly.

4 ENVIRONMENTAL CONSEQUENCES

According to the Council on Environmental Quality (CEQ) guidelines (40 CFR Section 1500-1508), the determination of a significant impact is a function of both context and intensity. Significance of an action is analyzed within the setting of an action, or context, including regional, local, or site-specific. Intensity refers to severity of an impact which is analyzed in terms of type, quality, and sensitivity of particular resource. The appropriate class of environmental documentation is determined by level of significance, which is established through impact analysis of each resource. This "Environmental Consequences" chapter addresses the potential impacts to each of the resource areas (i.e., impact topics) discussed under the "Affected Environment" chapter for the No Action, Preferred Action, and Candidate Build Alternatives

As stated in 40 CFR 1508.27(a), the analysis of significance as used in NEPA requires both the context and intensity of an action.

(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a

cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

4.1 WATER RESOURCES

Several federal laws protect water resources, which include the Clean Water Act (CWA), Safe Drinking Water Act (SDWA), and the Rivers and Harbors Act (RHA). These laws protect water resources from pollutants, discharges, fill materials, dredging, and encroachments. Water resources are regulated by the United States Environmental Protection Agency (EPA), the United States Army Corps of Engineers (USACE), the United States Coast Guard (USCG), and state departments of environment.

Under the No Build Alternative, CSX Transportation (CSXT) would continue maintenance and repairs of the existing infrastructure, and infrastructure improvements that are already planned for the DC2RVA corridor would move forward. Anticipated effects of the No Build Alternatives are discussed below in comparison with the Build Alternatives, including potential permits required. Existing factors that affect water quality, such as impervious surfaces and pollutants washed from the existing surfaces into receiving water bodies, would continue with the No Build Alternative. No changes to floodplains or hydraulic conditions are anticipated with the No Build Alternative.

Due to the linear nature and length of the DC2RVA corridor, each Build Alternative would include unavoidable effects to water resources. Effects were calculated in Geographic Information system (GIS) based on the limits of disturbance (LOD) developed for each Build Alternative. Permanent effects include all areas where infrastructure would physically replace existing conditions. Temporary effects are areas required for construction of the Build Alternatives, such as for movement, access, or storage of equipment, that would be regraded and seeded with an approved seed mixture by the contractor and allowed to renaturalize after completion of the Project. Water resources potentially affected by the Build Alternatives are shown in (Appendices A through F).

4.1.1 Surface Waters, Rivers, Streams, and Floodplains

Effects to surface waters resulting from construction of the proposed improvements are similar between the Build Alternatives. Typical effects would include:

Temporary

- Increased erosion from disturbed areas, resulting in increased sedimentation and decreased water clarity
- Disturbance of in-stream habitat and aquatic species from in-stream construction

Long-Term Temporary

- Clearing and grubbing of stream banks, resulting in increased erosion, decreased bank stabilization, and potential slope failure
- Removal of riparian canopy, resulting in increased water temperatures

Permanent

- Decreased groundwater recharge due to increased impervious surfaces
- Increased nutrient loading from increased runoff and fertilizer application during the replanting process
- Increased potential for toxic compounds entering the water system from construction equipment, increased train traffic, application of snow and ice removal chemicals, and application of herbicides to keep tracks clear of vegetation
- Altered stream locations (including intentional stream relocations), flow patterns, and morphology
- Use of resource (culverted streams and filled wetlands) for infrastructure placement

The extent of effects is generally related to the length or area of the resource affected. The extent of potentially permanent and temporary encroachments on the water resources identified in the DC2RVA corridor are listed in Table 4-1. The more severe impacts are associated with new or rehabilitated structures spanning major waterways. These types of crossings would require several spans and new piers or substructure to be constructed in the waterway itself. For smaller waterway crossings, single-span bridges or bottomless or properly embedded culverts are recommended. In most cases, the short-term or temporary nature of the effects caused by construction would allow renaturalization of the resource. The locations of all water crossings and the approximate LOD associated with each are presented in detail in Appendices A through F. Depending on the combination of Build Alternatives, between 152 and 191 streams would be permanently affected by the proposed improvements. Linear and parallel encroachments to these streams are estimated between 26,377 and 35,422 linear feet.

Table 4-1: Stream Resource Effects

Alternative Area	Alternative	Number of Streams	Stream Length (Linear Feet)	Navigable Waters (Linear Feet)	State Scenic Rivers (Linear Feet)	Nationwide Rivers Inventory (Linear Feet)	Chesapeake Bay RPA (Acres)	Floodplains (Acres)
Area 1: Arlington (Long Bridge Approach)	1A	–	–	–	–	–	P: 4.0 T: 1.2	P: 0.3 T: 1.0
	1B	–	–	–	–	–	P: 4.8 T: 1.5	P: 0.1 T: 0.3
	1C	–	–	–	–	–	P: 6.0 T: 0.6	P: 0.1 T: 0.4
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: 52 T: 68	P: 7,198 T: 4,022	P: 205.7 T: 232.9	P: 44.4 T: 50.2	–	P: 67.9 T: 50.2	P: 15.1 T: 18.1

Table 4-1: Stream Resource Effects

Alternative Area	Alternative	Number of Streams	Stream Length (Linear Feet)	Navigable Waters (Linear Feet)	State Scenic Rivers (Linear Feet)	Nationwide Rivers Inventory (Linear Feet)	Chesapeake Bay RPA (Acres)	Floodplains (Acres)
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	P: 16 T: 21	P: 1,101 T: 1,771	–	–	–	P: 36.9 T: 17.7	P: 7.7 T: 5.7
	3B	P: 20 T: 26	P: 1,506 T: 1,894	P: 45.0 T: 50.1	P: 45.0 T: 50.1	–	P: 41.0 T: 17.9	P: 10.5 T: 6.4
	3C	P: 43 T: 45	P: 4,597 T: 1,693	P: 44.5 T: 102.7	P: 44.5 T: 102.7	–	P: 57.9 T: 18.6	P: 8.0 T: 3.8
Area 4: Central Virginia (Crossroads to Doswell)	4A	P: 32 T: 43	P: 3,627 T: 2,798	P: 64.8 T: 265.9	P: 40.5 T: 20.8	P: 40.5 T: 20.8	P: 69.7 T: 31.9	P:17.2 T: 17.3
Area 5: Ashland (Doswell to I-295)	5A	P: 23 T: 25	P: 6,928 T: 1,623	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 16.6 T: 12.9	P: 5.9 T: 2.5
	5A–Ashcake	P: 22 T: 25	P: 6,928 T: 1,623	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 17.7 T: 12.8	P: 7.1 T: 2.4
	5B	P: 24 T: 27	P: 9,114 T: 2,151	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 19.4 T: 14.4	P: 6.5 T:3.3
	5B–Ashcake	P: 23 T: 28	P: 9,101 T: 2,132	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 23.4 T: 14.7	P: 10.7 T:3.8
	5C	P: 26 T: 26	P: 9,005 T: 1,410	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 31.6 T: 13.9	P:9.2 T: 2.4
	5C–Ashcake	P: 26 T: 26	P: 9,005 T: 1,410	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 32.6 T: 13.9	P: 10.4 T: 2.4
	5D–Ashcake	P: 28 T: 31	P: 8,163 T: 2,958	–	P: 40.1 T: 15.7	P: 40.1 T: 15.7	P: 25.7 T: 15.4	P: 11.5 T: 4.0
Area 6: Richmond (I-295 to Centralia)	6A	P: 30 T: 30	P: 7,523 T: 3,384	–	–	–	P: 53.5 T: 15.5	P: 8.1 T: 3.5
	6B–A-Line	P: 34 T: 34	P: 9,650 T: 3,609	–	–	–	P: 59.3 T: 17.4	P: 11.3 T: 6.1
	6B–S-Line	P: 36 T: 30	P: 8,819 T: 2,333	P: 31.7 T: 49.5	P: 31.7 T: 49.7	–	P: 55.1 T: 11.5	P: 48.6 T: 12.4
	6C	P: 35 T: 34	P: 10,886 T: 3,349	–	–	–	P: 63.3 T: 17.0	P: 16.1 T: 5.8
	6D	P: 36 T: 30	P: 8,819 T: 2,333	P: 31.7 T: 49.5	P: 31.7 T: 49.5	–	P: 55.0 T: 11.5	P: 51.9 T: 13.0

Table 4-1: Stream Resource Effects

Alternative Area	Alternative	Number of Streams	Stream Length (Linear Feet)	Navigable Waters (Linear Feet)	State Scenic Rivers (Linear Feet)	Nationwide Rivers Inventory (Linear Feet)	Chesapeake Bay RPA (Acres)	Floodplains (Acres)
	6E	P: 30 T: 30	P: 7,952 T: 3,169	–	–	–	P: 55.3 T: 15.4	P: 22.2 T:20.2
	6F	P: 36 T: 31	P: 8,869 T: 2,333	P: 29.2 T: 51.9	P: 29.2 T: 51.9	–	P: 57.2 T: 11.3	P: 50.7 T: 13.1
	6G	P: 34 T: 29	P: 8,235 T: 2,288	P: 29.2 T: 51.9	P: 29.2 T: 51.2	–	P: 57.8 T: 11.1	P: 48.1 T: 13.1

Notes: P = Permanent Effect; T=Temporary Effect.

4.1.1.1 Designated Waters

Navigable Waters. Although construction of the proposed project would not have any effect on this designation, work in navigable waters requires special consideration under Section 9 and Section 10 of the Rivers and Harbors Act (see Permits 4.1.5). Depending on the Build Alternative, the LOD would cross five to seven of the eight navigable waters within the study area:

- Occoquan River
- Neabsco Creek
- Powells Creek
- Aquia Creek
- Rappahannock River
- Mattaponi River
- James River

State Scenic Rivers and Nationwide Rivers Inventory. The existing rail corridor was in place long before much of the surrounding development in the DC2RVA corridor; as such, new construction would be consistent with existing land uses and controlling regulations for designated waters. The most notable changes due to the proposed improvements would be the construction of new bridges built adjacent to and/or replacing existing bridges. However, the new bridges would generally reflect the horizontal and vertical profiles of existing structures; therefore, the Virginia Department of Rail and Public Transportation (DRPT) anticipates that the landscape and viewsheds from designated waters will be similar in context to existing conditions. The Fredericksburg Bypass (Build Alternative 3C) would require a new bridge over the Rappahannock River in a new location; however, the new bridge would not be in an area where the Rappahannock River is designated a State Scenic River. The State Scenic River designation ends north of the proposed bypass near Ferry Farm. Consistent with the guidelines for protecting designated waters, the use of best management practices (BMPs) would ensure the preservation

of the ecological resources within the waterways and their local watersheds. The DC2RVA Project is not expected to affect river designations.

Chesapeake Bay Preservation Act (CBPA). Transportation projects, including rail lines, are conditionally exempt from the Chesapeake Bay Preservation Area Designation and Management Regulations. By constructing improvements in accordance with the Virginia Erosion and Sediment Control Law (§10.1-560 *et seq.* of the Code of Virginia), the Stormwater Management Act (§10.1-603. 1 *et seq.* of the Code of Virginia), and the terms and conditions of water quality permits required by USACE, Virginia Department of Environmental Quality (Virginia DEQ), and Virginia Marines Resources Commission (VMRC), and an erosion and sediment control plan and a stormwater management plan approved by Virginia DEQ, all of the Build Alternatives would be consistent with the CBPA and its implementing regulations.

Virginia Coastal Zone Management Act (CZMA). Each Build Alternative would be consistent with the established Virginia Coastal Zone Enforceable Policies as related to fisheries management, subaqueous lands management, wetlands management, dunes management, nonpoint source pollution control, point source pollution control, shoreline sanitation, air pollution control, and coastal lands management. The Federal Railroad Administration (FRA) would submit a Federal Consistency Determination for the recommended Preferred Alternative that analyzes the coastal effects of the Project in light of the enforceable policies of the Virginia CZMA program and provides commitment to comply with those policies. The recommended Preferred Alternative would be designed and constructed in accordance with the Virginia Erosion and Sediment Control Law and the terms and conditions of water quality permits required by USACE, Virginia DEQ, and VMRC, and an erosion and sediment control plan and a stormwater management plan approved by by Virginia DEQ. Implementation of proposed mitigation measures and any required permits would ensure consistency with the enforceable policies of the Virginia CZMA program.

Fisheries Management

Any construction in and around wetlands and water bodies would reasonably be expected to have an effect on commercial and recreational fishing resources and their associated habitats as discussed in Section 4.2.2.3 Fisheries, Anadromous Fish, and Trout Waters and 4.2.1.3 Submerged Aquatic Vegetation (SAV). According to Virginia DEQ's online Geospatial and Educational Mapping System (GEMS) and Virginia Institute of Marine Science, no fisheries management areas or aquaculture sites are located in the study area, and it is an area of low occurrence for clams, mussels, and crabs. No private oyster ground leases are located in the study area.

Subaqueous Lands Management

The Project would be constructed in a manner consistent with all applicable federal, state, and local water regulations. See Section 4.1.1.1 Navigable Waters for more information.

Wetlands Management

The Virginia Water Protection Permit program includes protection of wetlands, both tidal and non-tidal. The Project would be constructed in a manner consistent with all applicable federal, state, and local wetland regulations. See Section 4.1.2 Wetlands for more information.

Non-point Source Pollution Control

Soil-disturbing activities associated with construction would reasonably be expected to have an effect on nonpoint source pollution. Increased train activity and potential chemicals associated

with trains, their maintenance, and maintenance of the infrastructure could also have an effect on nonpoint source pollution.

Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. BMPs will be followed which could include design to avoid riparian and wetland zones to the fullest possible, maintenance plan to reduce potential contamination, sediment traps located down-gradient from construction areas, proper maintenance of construction equipment, materials stockpiles, and storage of equipment located outside of floodplain, wetland, and riparian areas. Section 3.1.7 Water Quality and Section 4.1.3 Water Quality provide additional information..

Point Source Pollution Control

Construction activity could have a temporary effect on point source pollution due to soil disturbance. Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion during and after construction. Typical BMPs will be followed, including design to avoid riparian and wetland zones to the fullest extent possible, maintenance plan to reduce potential contamination, sediment traps located down-gradient from construction areas, proper maintenance of construction equipment, materials stockpiles and storage of equipment located outside of floodplain, wetland, and riparian areas. Section 3.1.7 Water Quality and Section 4.1.3 Water Quality provide additional information.

Shoreline Sanitation

If relocation or removal of existing systems is required during construction of the Project, there is an increased potential for release and contamination.

Air Pollution Control

During construction, the Project would reasonably be expected to have an effect on air pollution through vehicle emissions, fugitive dust, and construction emissions. All construction activities would be performed in accordance with federal and state regulations. While the proposed Project would increase diesel locomotive emissions, these increases would be offset by decreases in regional mobile source auto VMT. The Project-generated net increases in predicted annual pollutant emissions, from high speed rail passenger service, in nonattainment areas would all be below general conformity de minimis threshold values. Pursuant to the General Conformity Rule, EPA considers project-generated emissions below these de minimis values to be minimal. Such projects do not require formal conformity determinations. With regard to GHG emissions, the build alternatives would reduce CO2 emissions versus the No Build Alternative. As a result, the program is not anticipated to result in significant adverse effects to public health related to air pollutants and air toxics or contributions to GHG emissions (See Air Quality Sections in the EIS for further detail).

Coastal Lands Management

These areas are subject to local CBPA requirements to minimize land disturbance, preserve indigenous vegetation, minimize impervious surfaces, control stormwater runoff, and implement erosion and sediment control plans for land disturbances. Activities within RPAs are further restricted to water dependent or redevelopment related activities. This Project is conditionally exempt from regulation because it will be constructed in accordance with the Erosion and Sediment Control Law (§10.1-560 *et seq.* of the Code of Virginia) and the Stormwater Management

Act (§10.1-603. 1 *et seq.* of the Code of Virginia). In addition, if a build alternative is selected, the Project would be constructed according to an approved erosion and sediment control plan and a stormwater management plan.

Dunes Management

This Project is not anticipated to have any reasonably foreseeable effect on jurisdictional dunes. No jurisdictional dunes are listed in the study area. Shoreline protection measures and storm surge protection measures would be taken along the Potomac River.

4.1.1.2 Floodplains and Floodways

As indicated in Table 4-1, each Build Alternative would potentially affect Federal Emergency Management Agency (FEMA) 100-year floodplains. There is considerable variation in the acres of encroachments (both longitudinal and parallel) among the various combinations of the Build Alternatives—ranging from 62.4 to 124.8 acres. None of the floodplain encroachments would represent a "significant encroachment" (as defined in 23 Code of Federal Regulations [CFR] 650.105[q]) because of the following reasons:

- **It would pose no significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route**. These rail lines are not considered the only emergency evacuation route, nor do they support emergency vehicles.
- **It would not pose a significant flooding risk**. The Build Alternatives would be designed consistent with procedures for the location and hydraulic design of encroachments on floodplains contained in 23 CFR 650 Subpart A. Accordingly, the Build Alternatives are not expected to increase flood height elevations, the probability of flooding, or the potential for property loss and hazard to life.
- **It would not have significant adverse effects on natural and beneficial floodplain values**. Avoidance and minimization efforts, including spanning floodplains where practicable and minimizing wetland impacts, would be made during design to avoid or minimize impacts on natural and beneficial floodplain values.

Portions of the study area are also vulnerable to tidal flooding from major storms, such as hurricanes and northeasters. Both types of storms produce winds that push large volumes of water against the shore. Hurricanes, with their high winds and heavy rainfall, are the most severe storms to which the study area is subjected and can produce local to widespread flooding in the study area. The study area also contains numerous tidally influenced waters that are subject to tidal flooding in their lower reaches and fluvial flooding on the upper reaches

Each Build Alternative is consistent with the transportation elements of local comprehensive plans and are not projected to either encourage or accelerate any growth or changes in land use that are not already expected. The Project would not encourage, induce, allow, serve, support, or otherwise facilitate incompatible base floodplain development.

4.1.1.3 Stormwater/Drainage

Increased stormwater runoff from construction of the Project improvements can impact receiving streams and associated land surfaces in two forms: long-term impacts caused by runoff from increased impervious surfaces and short-term impacts caused by land disturbance during

construction. Stormwater from railroad corridors can potentially carry increased quantities of silt; heavy metals; petroleum products from railroad equipment; chemicals associated with snow and ice removal; herbicides associated with vegetation maintenance; and other chemicals associated with railroad cars and machinery. The proposed Build Alternatives would increase impervious surfaces by constructing additional rail bed and track, as well as ancillary facilities associated with stations, grade crossings, and bridges. The increase in stormwater runoff could increase erosion, silt, and chemicals entering the waterways. These materials can potentially degrade water quality and aquatic habitat integrity. The effects on water quality depend on the size of the receiving waterways crossed and the number of such crossings (see Table 4-1). Streams with low flow are more severely affected because they have less volume to dilute the runoff.

Additional runoff as a result of the Build Alternatives would be minimal because the increases in impervious surface are small. Stormwater runoff from railways is generally less pronounced than that from roadways, because much of the rail bed is permeable to rainfall (i.e., ballast and side slopes). Impervious surfaces have a runoff coefficient of 0.80, or about 80 percent runoff and about 20 percent infiltration. Roadways have runoff coefficients of 0.85 to 0.95, while the runoff coefficient for ballasted track is calculated between 0.50 to 0.55. Although ballast is considered to be permeable, some runoff would collect in adjacent drainage ditches and may carry similar pollutants to and have similar effects to surface waters as runoff associated with paved roadways.

Short-term adverse impacts on water quality within the study area may result from soil erosion and sedimentation because of land-disturbing activities during construction. Land-disturbing activities include construction of the rail bed, tracks, bridges, signal and communication facilities, and other related structures and facilities of the railroad, including grade crossings, clearing of right-of-way, staging areas, access roads, and borrow/spoil areas. Construction-related effects are likely to be similar for road and rail. Uncontrolled erosion and sedimentation can affect aquatic algae and submerged aquatic vegetation, benthic macroinvertebrate habitat, and fish spawning habitat, and it can remove food resources for some stream species.

The recommended Preferred Alternative would be designed and constructed in accordance with the Virginia Erosion and Sediment Control Law (§10.1-560 *et seq.* of the Code of Virginia), the Stormwater Management Act (§10.1-603. 1 *et seq.* of the Code of Virginia), and the terms and conditions of water quality permits required by USACE, Virginia DEQ, and VMRC. By upgrading older stormwater facilities along the DC2RVA corridor, the Project could improve drainage in the study area.

4.1.2 Wetlands

Various wetland systems are located along extensive stretches throughout the 123-mile railroad corridor. Many of these systems pre-date the rail corridor and are bisected by the rail line itself. Existing drainage facilities beneath the rail bed have maintained hydraulic connections between the systems and, in many cases, allowed the persistence of these systems on both sides of the rail line. Preliminary designs to widen the rail bed attempted to minimize encroachments on these resources by widening on sides opposite of wetlands when practicable. However, complete avoidance could not be achieved, and DRPT anticipates permanent impacts to wetlands, where direct fill reduces the wetland size, with any of the Build Alternatives. Permanent impacts resulting from such encroachments range from 22.14 to 49.64 acres depending on the combination of Build Alternatives (see Table 4-2). Temporary impacts during construction would be similar between the Build Alternatives, ranging from 25.25 to 30.86 acres. The most measurable difference in effects among

the alternatives is found in the effects associated with construction of the Fredericksburg and Ashland bypasses on green-field alignments that cross rural areas less altered by human activities (Alternatives 3C and 5C, respectively). The approximate limits of disturbance and locations of potential wetlands effects for each alternative are shown in detail in Appendices A through F.

Table 4-2: Wetland Effects (acres)

Alternative Area	Alternative	PEM[1]	PEM/ PSS	PEM/ PFO	PEM/ PSS/ PFO	PSS[2]	PSS/ PFO	PFO[3]	Total
Area 1: Arlington (Long Bridge Approach)	1A	–	–	–	–	P: 0.02 T: 0.67	–	–	P: 0.02 T: 0.66
	1B	–	–	–	–	P: — T: 0.01	–	–	– T: 0.01
	1C	–	–	–	–	P: 0.01 T: 0.11	–	–	P: 0.01 T: 0.11
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: 1.36 T: 0.62	P: 0.15 T: 0.19	P: 1.71 T: 1.53	P: 0.67 T: 0.37	–	–	P: 1.31 T: 0.83	P: 5.19 T: 3.54
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	P: 1.57 T: 1.11	P: 0.42 T: 0.21	P: 2.40 T: 1.30	–	P: 0.13 T: 0.34	P: 0.04 –	P: 0.70 T: 1.49	P: 5.24 T: 4.45
	3B	P: 1.61 T: 1.16	P: 0.42 T: 0.21	P: 2.39 T: 1.29	–	P: 0.13 T: 0.34	P: 0.04 –	P: 0.71 T: 1.52	P: 5.29 T: 4.52
	3C	P: 1.92 T: 0.92	P: 0.54 T: 0.10	P: 3.92 T: 0.90	–	P: 0.42 T: 0.36	–	P: 17.03 T: 4.24	P: 23.82 T: 6.53
Area 4: Central Virginia (Crossroads to Doswell)	4A	P: 2.51 T: 1.66	P: 0.78 T: 0.17	P: 2.67 T: 7.55	P: 0.71 T: 1.15	P: 0.04 –	P: 0.25 T: 0.90	P: 1.43 T: 3.31	P: 8.39 T: 14.74
Area 5: Ashland (Doswell to I-295)	5A	P: 0.16 T: 0.08	–	P: 0.21 T: 0.46	–	–	P: — T: 0.08	P: 0.04 T: 0.86	P: 0.41 T: 1.48
	5A–Ashcake	P: 0.16 T: 0.08	–	P: 0.21 T: 0.46	--	–	P: — T: 0.08	P: 0.04 T: 0.86	P: 0.41 T: 1.48
	5B	P: 0.16 T: 0.08	–	P: 0.21 T: 0.51	–	–	P: — T: 0.08	P: 0.04 T: 0.86	P: 0.41 T: 1.53
	5B–Ashcake	P: 0.20 T: 0.05	–	P: 0.21 T: 0.51	–	–	P: — T: 0.08	P: 0.04 T: 0.86	P: 0.45 T: 1.50
	5C	P: 2.66 T: 0.78	–	P: 2.10 T: 0.92	–	–	P: — T: 0.08	P: 3.69 T: 1.70	P: 8.44 T: 3.47
	5C–Ashcake	P: 2.70 T: 0.78	–	P: 2.10 T: 0.92	–	–	P: — T: 0.08	P: 3.69 T: 1.70	P: 8.48 T: 3.47
	5D–Ashcake	P: 0.20 T: 0.05	–	P: 0.21 T: 0.46	–	–	P: — T: 0.08	P: 0.04 T: 0.93	P: 0.45 T: 1.51

Table 4-2: Wetland Effects (acres)

Alternative Area	Alternative	PEM[1]	PEM/ PSS	PEM/ PFO	PEM/ PSS/ PFO	PSS[2]	PSS/ PFO	PFO[3]	Total
Area 6: Richmond (I-295 to Centralia)	6A	P: 1.59 T: 0.29	–	P: 1.07 T: 0.33	P: 0.36 T: 0.10	P: 0.01 T: 0.40	–	P: 0.18 T: 0.77	P: 3.21 T: 1.89
	6B–A-Line	P: 1.30 T: 0.31	–	P: 1.07 T: 0.33	P: 0.36 T: 0.10	P: 0.01 T: 0.40	–	P: 0.18 T: 0.77	P: 2.91 T: 1.91
	6B–S-Line	P: 2.48 T: 0.64	P: 0.20 T: 0.01	P: 0.28 T: 0.05	P: 0.13 T: 0.06	P: 0.08 T: 0.05	–	P: 0.30 T: 0.22	P: 3.47 T: 1.03
	6C	P: 1.37 T: 0.30	–	P: 1.07 T: 0.33	P: 0.36 T: 0.10	P: 0.01 T: 0.40	–	P: 0.18 T: 0.77	P: 2.99 T: 1.90
	6D	P: 2.48 T: 0.64	P: 0.20 T: 0.01	P: 0.28 T: 0.05	P: 0.13 T: 0.06	P: 0.08 T: 0.05	–	P: 0.30 T: 0.22	P: 3.47 T: 1.03
	6E	P: 1.59 T: 0.29	–	P: 1.18 T: 0.33	P: 0.36 T: 0.10	P: 0.01 T: 0.40	–	P: 0.18 T: 0.77	P: 3.31 T: 1.89
	6F	P: 2.53 T: 0.64	P: 0.20 T: 0.01	P: 0.28 T: 0.05	P: 0.13 T: 0.06	P: 0.08 T: 0.05	–	P: 0.30 T: 0.22	P: 3.52 T: 1.03
	6G	P: 2.75 T: 0.64	P: 0.20 T: 0.01	P: 0.28 T: 0.05	P: 0.13 T: 0.06	P: 0.08 T: 0.05	–	P: 0.30 T: 0.22	P: 3.74 T: 1.03

Notes: 1. PEM=Palustrine Emergent (freshwater emergent wetland); 2. PSS=Palustrine Scrub-Shrub (freshwater shrub wetland); 3. PFO = Palustrine Forested (freshwater forested wetland); P = Permanent Effect, T=Temporary Effect.

Typical adverse impacts to wetlands from construction projects such as this include:

Temporary

- Increased erosion from disturbed areas, resulting in increased sedimentation and decreased water filtering abilities
- Increased nutrient loading from increased runoff and fertilizer application (during the replanting process)
- Disturbance of habitat and aquatic species

Long-Term Temporary

- Clearing and grubbing of vegetated wetland buffers
- Introduction of invasive species
- Decreased groundwater recharge due to increased impervious surfaces
- Increased potential for toxic compounds entering the wetland system from construction equipment, increased train traffic, application of snow and ice removal chemicals, and application of herbicides to keep tracks clear of vegetation
- Altered hydrologic patterns.

A small portion of the wetlands in the northern section of the alignment are tidally influenced. These wetlands mostly occur along larger waterways. Impacts to these waters would be minimized by designing water crossings to span waterways, placing as little infrastructure in the waters as practicable. All tidal wetlands crossed in the DC2RVA corridor are along Build Alternatives 1 and 2A.

4.1.3 Water Quality

Under the CWA, a permit is necessary to discharge any pollutant from a point source into Waters of the U.S. through EPA's National Pollutant Discharge Elimination System (NPDES) program, including pollutants carried by stormwater discharges. The permits contain industry-specific, technology-based, and/or water quality-based limits and establish pollutant monitoring and reporting requirements. Water quality-based limits and monitoring and reporting requirements could be stricter for those streams that do not meet water quality standards (on the Section 303[d] list) and already have regulated total maximum daily loads (TMDLs) of pollutants. Impaired waters crossed by the DC2RVA Project are listed in Table 3-9 and shown in Figure 3-4.

4.1.3.1 Temporary Effects

Despite protective measures, the Project could potentially result in short-term adverse effects such as increased sedimentation; increase in turbidity from in-stream work; increased likelihood of potential spills; and non-point source pollutants entering groundwater or surface water from stormwater runoff. Construction activities that could affect stormwater runoff include excavation to widen 'cut' sections and to remove unsuitable (organic) material from 'fill' sections; filling and placing ballast to support new track; relocating access roads; relocating or creating new trackside swales; and any substructure work required for the signal and communication equipment foundations, bridge or culvert installation, or station improvements. Construction-phase staging areas and haul roads, if needed, could also disturb the ground, potentially causing erosion and sedimentation.

4.1.3.2 Long-Term Effects

All Build Alternatives cross impaired waters, and DRPT assumes that the Project would have some effect on water quality. Minor long-term adverse water quality impacts could occur as a result of increases in impervious surfaces and consequent increases in pollutants washed from the railroad surface into receiving water bodies; leaking fluids from trains; and an increase in non-point source pollutants from infrastructure, grease, oil, metals, maintenance chemicals, vegetation management chemicals, and suspended solids and other elements associated with railways. The greatest effect would occur with the Fredericksburg and Ashland bypasses, which would convert green space to railroad facilities and put impervious surfaces in locations where none currently exist. The remaining alternatives would be located adjacent to existing facilities and incorporate BMPs and improved stormwater facilities, which would mitigate new conditions and may improve existing conditions.

4.1.3.3 Impaired Waters

The DC2RVA corridor includes 51 water crossings that have been assessed and found to have more contamination than allowed to support one or more of its designated uses. Most Build Alternatives cross the same water bodies; however, the Fredericksburg Bypass (Build Alternative

3C) would cross two fewer impaired water bodies than Build Alternatives 3A or 3B which pass through town. In the Richmond area, the S-Line crosses two more impaired water bodies than the A-Line. Table 4-3 lists impairments, probable causes, and the potential for the DC2RVA Project to add to these impairments. The potential for additional contaminants is similar for all waters; however, waters that are already impaired may have additional restrictions in the form of TMDLs in an effort to restore designated uses.

Table 4-3: Potential Effects to 303[d] Impairment from the DC2RVA Project

Impairment	Potential Cause	Potential Project Implications
Aquatic Plants (Macrophytes)	Noxious aquatic plants due to loss of riparian habitat, sewage discharges, sediment resuspension, excess nutrients	Temporary resuspension of sediments may occur if instream work is required, minor temporary and in some cases permanent loss of riparian habitat will occur within the Limits of Disturbance (LOD) adjacent waters
Benthic-Macroinvertebrate Bioassessments (low counts, variety, or quantity of sensitive aquatic, bottom-dwelling, invertebrate species)	Pollutants in urban stormwater, post-development erosion and sedimentation, streambank modifications/destabilization	Construction of the DC2RVA project may potentially increase runoff and therefore erosion and sediment in the receiving water bodies, build alternatives with greater land disturbance and impacts to wetlands and streams have a greater chance of affecting water quality
Benzo[k]fluoranthene	Found in pesticides	Use of pesticides is not required for the construction or operation of railroads; therefore, levels are not likely to increase due to the construction of the DC2RVA project
Chlordane (a broad spectrum contact insecticide that has been used on agricultural crops, now banned)	Washed in from contaminated soils, existing levels in bottom sediments of water body	This chemical has been banned and is not likely to increase due to the construction of the DC2RVA project
Chlorophyll-a (high algae levels)	Excess nutrients, often from lawn/agricultural fertilizers and nutrient-rich animal wastes, washed into the water cause algae blooms	Railroads are not a known source of excess nutrients in the form of fertilizers, animal wastes, or sewage; therefore, levels are not likely to increase due to the construction of the DC2RVA project
Copper	Urban-related runoff/stormwater, abandoned mine lands (inactive), antifouling paints, chromated copper arsenate (CCA) treated timbers	Construction of the DC2RVA project may potentially increase runoff and therefore erosion and sediment in the receiving water bodies, build alternatives with greater land disturbance and impacts to wetlands and streams have a greater chance of affecting water quality, the only build alternative with the potential to disturb inactive mine land is the Fredericksburg Bypass which crosses a former sand and gravel pit

Dissolved Oxygen (low levels of)	Excess nutrients, often from lawn/agricultural fertilizers and nutrient-rich animal wastes, washed into the water cause algae blooms which in turn kill vegetation which decays depleting oxygen	Railroads are not a known source of excess nutrients in the form of fertilizers, animal wastes, or sewage; therefore, levels are not likely to increase due to the construction of the DC2RVA project
Escherichia coli (bacteria)	Fecal matter washed into the water from domestic animals, livestock, or failing or overburdened sewage systems	Railroads are not a known source of fecal matter in the form of animal wastes or sewage; therefore, levels are not likely to increase due to the construction of the DC2RVA project
Estuarine Bioassessments (Impaired Biota)	Unknown, combination of total toxins in water supply	Construction of the DC2RVA project may potentially increase runoff and therefore undesirable elements in the receiving water bodies
Mercury in Fish Tissue (heavy metal)	Often entering the water through airborne particles some sources include: coal combustion, waste incineration, and metal processing	Construction of the DC2RVA project is not anticipated to increase the amount of airborne mercury
PCB in Fish Tissue and/or Water Column (used mainly in coolants and insulating fluids, banned in the US in the late 1970s)	Washed from contaminated soils often where they were historically used in the industrial process	This chemical has been banned and is not likely to increase due to the construction of the DC2RVA project
pH (acidity)	Landfills, waste sites, tanks, abandoned mine lands (inactive), naturally occurring	Construction of the DC2RVA project may disturb some HAZMAT sites. Section 4.5 of the EIS contains for more details. The only build alternative with the potential to disturb inactive mine land is the Fredericksburg Bypass which crosses a former sand and gravel pit
Zinc	Abandoned mine lands (inactive), sewage, road surface runoff, corrosion of zinc alloys and galvanized surfaces	The only build alternative with the potential to disturb inactive mine land is the Fredericksburg Bypass which crosses a former sand and gravel pit, corrosion of galvanized surfaces associated with the railroad may contribute to zinc in runoff

4.1.4 Drinking Water/Aquifers/Water Supply

Contamination of groundwater resources occurs when man-made chemicals, such as gasoline, oil, and road salts enter aquifers and render their water unsafe and unfit for human use. Some of the major sources of these contaminants include storage tanks, septic systems, hazardous waste sites, landfills, and the widespread use of road salts and chemicals. Release of chemicals during construction, release of transported chemicals, salts and chemicals used for snow and ice removal, and chemicals used for the maintenance of vegetation are the main sources of contamination to public water supplies along rail lines. These chemicals can leach through the soil and into the water table from which public water supplies are drawn.

In accordance with 1996 Safe Drinking Water Act (SDWA) amendments, Virginia adopted a protection zone around all groundwater public sources. Virginia Department of Health (VDH) recommends that private wells not be located within 100 feet of known contamination sources such as, but not limited to, sewage disposal systems, dump stations, abandoned wells, pesticide treated soils, underground storage tanks (USTs), and other sources of physical, chemical or biological contamination; any potential contamination sources within 200 feet should be investigated (VDH, 2012). The LOD for the Build Alternatives fall within the following prescribed protection zones:

- Zone 1 (5-mile radius) of 3 public surface water supply intakes: Fairfax County Water Authority, Hanover County Suburban Water System, and City of Richmond. Fairfax County Water Authority and City of Richmond water supplies are located upstream of the existing tracks.
- Zone 2 (1-mile wellhead protection zone) of 14 public groundwater sources.
- Zone 1 (1,000-foot radius in which land use activities should be assessed for their potential to contaminate water supplies) of three public groundwater sources.
- Within 100 feet of 14 private wells.

Although the existing railroad facilities that fall within the wellhead protection zones are exempt, work required for the DC2RVA Project would include new permanent and temporary impacts within the wellhead protection zones for public and private wells. Construction of the new facilities and subsequent operation within these protection zones have the potential to introduce contamination to existing wells. Before construction, DRPT will evaluate the potential for contamination. The area of each Build Alternative within these drinking water protection zones is shown in Table 4-4.

Table 4-4: Estimated Area within Drinking Water Protection Zones

Alternative Area	Alternative	Public Surface Water Zone 1[1] (acres)			Public Groundwater Sources (acres)		Private Wells (square feet)	
		Fairfax County*[2]	Hanover County[2]	City of Richmond*[2]	Zone 1[3]	Zone 2[4]	100-foot radius (31,416 square feet)	200-foot radius (125,664 square feet)
Area 1: Arlington (Long Bridge Approach)	1A	–	–	–	–	–	–	–
	1B	–	–	–	–	–	–	–
	1C	–	–	–	–	–	–	–
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: 32.75 T: 31.05	–	–	–	P: 26.37 T: 15.94	P: 7,822 T: 8,726	P: 72,243 T: 23,146

Table 4-4: Estimated Area within Drinking Water Protection Zones

Alternative Area	Alternative	Public Surface Water Zone 1[1] (acres)			Public Groundwater Sources (acres)		Private Wells (square feet)	
		Fairfax County*[2]	Hanover County[2]	City of Richmond*[2]	Zone 1[3]	Zone 2[4]	100-foot radius (31,416 square feet)	200-foot radius (125,664 square feet)
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	–	–	–	–	P: 16.91 T: 6.39	P: 3,343 T: 6,406	P: 57,106 T: 13,279
	3B	–	–	–	–	P: 16.91 T: 6.39	P: 16,365 T: 8,397	P:105,610 T: 16,996
	3C	–	–	–	–	P: 13.98 T: 9.72	P: 279 T: 414	P: 41,238 T: 3,762
Area 4: Central Virginia (Crossroads to Doswell)	4A	–	P: 42.48 T: 23.36	–	P: 0.81 T: 1.07	P: 37.55 T: 27.73	P: 4,117 T: 25,446	P: 18,088 T: 45,750
Area 5: Ashland (Doswell to I-295)	5A	–	P: 8.36 T: 6.08	–	–	P: 9.25 T: 5.52	–	P: 13,688 T: ———
	5A–Ashcake	–	P: 8.36 T: 6.08	–	–	P: 11.59 T: 5.32	–	–
	5B	–	P: 8.36 T: 6.08	–	–	P: 9.33 T: 6.04	P: 609 –	P: 26,018 T: 138
	5B–Ashcake	–	P: 8.36 T: 6.08	–	–	P: 15.21 T: 6.65	P: 609 –	P: 15,411 T: 2,727
	5C	–	P: 31.06 T: 9.59	–	P: 4.70 T: 1.51	P: 44.09 T: 11.24	P: 4,205 T: 1,693	P: 19,098 T: 2,181
	5C–Ashcake	–	P: 31.06 T: 9.59	–	P: 4.70 T: 1.51	P: 46.53 T: 11.24	P: 4,205 T: 1,693	P: 5,410 T: 2,181
	5D–Ashcake	–	P: 8.36 T: 6.08	–	–	P: 16.12 T: 7.07	–	P: 17,321 T: 251

Table 4-4: Estimated Area within Drinking Water Protection Zones

Alternative Area	Alternative	Public Surface Water Zone 1[1] (acres)			Public Groundwater Sources (acres)		Private Wells (square feet)	
		Fairfax County*[2]	Hanover County[2]	City of Richmond*[2]	Zone 1[3]	Zone 2[4]	100-foot radius (31,416 square feet)	200-foot radius (125,664 square feet)
Area 6: Richmond (I-295 to Centralia)	6A	–	–	P: 51.70 T: 17.53	–	–	–	P: 21,701 T: 3,275
	6B–A-Line	–	–	P: 121.10 T: 46.69	–	–	–	P: 16,364 T: 2,932
	6B–S-Line	–	–	P: 125.26 T: 31.24	–	–	P: 3.73 –	P: 28,214 T: 10,324
	6C	–	–	P: 153.22 T: 47.50	–	–	P: 23,773 T: 1,938	P: 55,761 T: 7,887
	6D	–	–	P: 119.50 T: 31.96	–	–	P: 3.73 –	P: 28,214 T: 10,324
	6E	–	–	P: 80.04 T: 40.18	–	–	–	P: 21,701 T: 3,275
	6F	–	–	P: 129.47 T: 32.53	–	–	P: 3.73 –	P: 28,214 T: 10,324
	6G	–	–	P: 129.84 T: 30.76	–	–	–	P: 31,558 T: 13,595

Source: VDOT-CEDAR, 2014; DMME, 2016.

Notes: *These public water supplies are located upstream from the study area; 1. 5-mile radius; 2. Fairfax County Water Authority, Hanover Suburban Water System, and City of Richmond; 3. Zone 1 includes a 1,000-foot radius (~72 acres) in which land use activities should be assessed for their potential to contaminate water supplies; 4. Zone 2 Virginia adopted a 1-mile wellhead protection zone around all groundwater public sources. P = Permanent Effect, T=Temporary Effect.

4.1.5 Permits

Wetland and water quality permits would be required for construction of any of the Build Alternatives. The controlling regulations and permits required at the local, state, and federal level are addressed below.

4.1.5.1 Section 401–Certification (Water Quality Certification [WQC])

Section 401 of the CWA states that "any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide

the licensing or permitting agency a certification from the state in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable waters at the point where the discharge originates or will originate." Section 401 of the CWA requires any applicant for a federal license or permit for any activity that may result in a discharge into waters to obtain a certification that discharge will not adversely affect water quality from the state in which the discharge will occur. Section 401 requires certification by Virginia that prospective permits comply with the state's applicable effluent limitations and water quality standards. Impacts to water resources would require a Joint Permit Application (JPA) to regulatory agencies. The JPA is submitted to VMRC who then distributes it to USACE, Virginia DEQ, and Local Wetlands Boards.

4.1.5.2 Section 402–National Pollutant Discharge Elimination System (NPDES)

Permits for the discharge of any pollutant or combination of pollutants into navigable waters are regulated by Virginia DEQ.

4.1.5.3 Section 404–Dredge and Fill Materials

Section 404 of the CWA regulates activities that may affect the chemical, physical, or biological integrity of Waters of the U.S. Permits for activities that result in the discharge of dredged materials or fill into jurisdictional waters are administered by USACE. Permits issued under Section 404 of the CWA must comply with the Section 404(b)(1) Guidelines developed by EPA.

4.1.5.4 Subaqueous Stream Bed Bottom

Subaqueous land is defined in Virginia as ungranted beds of the bays, rivers, creeks, and shores of the sea owned by the state. Through this regulatory framework, activities requiring permits include building, dumping, or otherwise trespassing upon or over, encroach upon, take or use any material from the beds of the bays, oceans, and jurisdictional rivers, streams, or creeks. VMRC issues permits for activities in, on, or over subaqueous lands in Virginia (Code of Virginia Chapter 2, Title 62.1).

4.1.5.5 Section 9–United States Coast Guard

Section 9 of the Rivers and Harbors Act prohibits construction of any dam, dike, bridge, or causeway across navigable waters without approval of the USCG.

4.1.5.6 Section 10–USACE

Section 10 of the Rivers and Harbors Act regulates dredging and filling activities related to construction of any structure or type of obstruction in navigable waters of the United States. Permits for these activities are administrated by USACE.

4.1.5.7 Virginia Water Protection Permit

The Virginia Water Protection Permit Program was designed to protect surface waters including tidal and non-tidal water bodies and wetlands. Virginia DEQ has regulatory authority over most activities affecting these waters. Virginia's authority to protect water resources is independent of other state and federal regulatory agencies.

4.1.5.8 MS4 Permit–Small Municipal Separate Storm Sewer Systems

Discharges from municipal separate storm sewer systems (MS4s) are regulated under the Virginia Stormwater Management Act, the Virginia Stormwater Management Program (VSMP) Permit regulations, and the CWA as point source discharges. MS4 programs must be designed and implemented to control the discharge of pollutants from their storm sewer system to the maximum extent practicable in a manner that protects the water quality in nearby streams, rivers, wetlands, and bays. MS4 permits are administrated by Virginia DEQ.

4.1.5.9 Joint Permit Application–USACE, VMRC, Virginia DEQ, Local Wetlands Board

In Virginia, for permitting involving water, wetlands, and dune/beach resources where fill, flooding, or alteration of flow occurs, USACE, VMRC, Virginia DEQ, and Local Wetlands Boards (LWB) use a joint permitting process. Non-tidal resources use a Standard Joint Permit Application (JPA) form, while a Tidewater JPA form is used for most projects involving tidal waters, tidal wetlands, and coastal primary sand dunes and beaches.

4.1.5.10 Chesapeake Bay Preservation Act

Projects located within "Tidewater Virginia" are subject to requirements of the CBPA. Land disturbance or vegetation removal in Resources Protection Areas (RPAs) require approval from local government and completion of Appendix C in the JPA. Individual localities are responsible for enforcing CBPA requirements. Local permits are not issued through the JPA process.

Transportation projects, including rail lines, are conditionally exempt from the Chesapeake Bay Preservation Area Designation and Management Regulations.

4.1.6 Avoidance, Minimization, and Mitigation Evaluation

4.1.6.1 Wetlands, Streams, and Water Resources

Efforts have been made throughout the planning and preliminary design process, and they will continue to be made in later designs to further avoid and minimize impacts to the extent practicable. Avoidance of impacts to water resources will be accomplished by selecting the alternative that best avoids such impacts and/or by routing a selected alignment around wetlands or by completely spanning streams rather than building through them. These measures will be made while also balancing potential impacts to other resources, such as residences and businesses. General minimization measures incorporated into the preliminary designs for the Build Alternatives include:

- Minor alignment shifts to avoid or minimize impacts
- Reduction of construction footprint to the extent practicable in areas with water resources
- Construction of bridges over wetland areas, substantially reducing impacts in comparison to causeways with culverts
- Use of bridges and open bottom culverts designed to the proper hydraulic opening to maintain stream morphology and integrity, and that are wide enough to carry baseflow without altering stream depth, facilitate passage of wildlife and aquatic species, and decrease erosion
- Use of stabilized side slopes and retaining walls to minimize encroachment
- Temporary and permanent stormwater management measures

- Use of natural stream design for unavoidable stream relocations, which means that the channel would mimic the characteristics of an appropriate reference stream
- Prompt revegetation of disturbed area, in particular stream banks, immediately after construction to stabilize soil and reduce erosion

Impacts to water resources would require submittal of a JPA to USACE, Virginia DEQ, and VMRC. Mitigation for unavoidable impacts would be developed in coordination with these agencies during the permitting process and incorporated into final design for both temporary and permanent impacts. Permanent impacts to wetlands and streams from construction activities will require compensatory mitigation. Guidance for compensatory mitigation from the regulatory agencies can be found in the July 2004 Joint USACE and Virginia DEQ *Recommendations for Wetland Compensatory Mitigation: Including Site Design, Permit Conditions, Performance Criteria, and Monitoring Criteria* and associated Mitigation Checklist; the March 2008 *Off-Site Mitigation Location Guidelines*; and the USACE and EPA jointly issued *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule* from June 2008. The mitigation rule indicates the agencies' preferred hierarchy for mitigation options as follows:

1. Purchase of compensatory mitigation bank credits.
2. Purchase of an approved in-lieu fee fund's credits.
3. Watershed approach-based mitigation by the permittee.
4. Onsite mitigation/in-kind mitigation by the permittee.
5. Offsite mitigation/out-of-kind mitigation by the permittee.

Virginia DEQ has also adopted this preferred sequence. Factors to be considered in deviating from the preference for banks include: the likelihood for ecological success and sustainability, the location of the compensation site(s) relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project. The final compensatory mitigation plan will be determined during the permitting process, in coordination with the regulatory agencies, and will likely include a combination of types of mitigation. Wetland mitigation requirements vary by wetland type. Typical replacement ratios of area disturbed are Palustrine Emergency Wetlands (PEM) (1:1), Palustrine Scrub-Shrub Wetlands (PSS) (1.5:1), and Palustrine Forested Wetlands (PFO) (2:1). Compensation is approved on a case-by-case basis, and requirements may vary.

Compensatory mitigation for unavoidable stream impacts would be based on the Unified Stream Methodology (USM) form. Impacts greater than 300 linear feet typically require compensation; however, for projects with multiple stream impacts, compensation for all impacts is often required regardless of the length of individual crossings. Although compensatory mitigation is generally not required for impacts to jurisdictional ditches or open waters, impacts will be reviewed on a case-by-case basis, and compensation will be determined during the permitting process.

4.1.6.2 Floodplains and Stormwater/Drainage

The design of this Project would include the use of stormwater management practices to address issues such as post-development storm flows and downstream channel capacity. The Project would be constructed in accordance with Executive Order (EO) 11988–Floodplain Management, the Virginia Erosion and Sediment Control Regulations, and the Virginia Stormwater Management Law and regulations and include an erosion and sediment control plan and a stormwater management plan approved by the Virginia DEQ, or local water quality protection criteria at least as stringent as the above state requirements.

Existing stormwater facilities would be upgraded and new stormwater facilities would be implemented to capture and treat run-off. Stormwater management measures, including detention basins, would be installed to reduce or detain discharge volumes, to compensate for increased impervious surfaces. Major bridge crossings built to accommodate the additional rail line are designed to match horizontal clearances of existing bridges and will be built in parallel to avoid altering hydraulics. Storm surge protection measures will be taken in areas along the Potomac River where practicable. During final design, a detailed hydraulic survey and study would evaluate specific impacts on stormwater discharges. This evaluation would adhere to the aforementioned specifications ensuring that no substantial increases to flooding would occur.

4.1.6.3 Water Quality

Minor long-term adverse water quality impacts could occur as a result of increases in impervious surfaces, increases in train traffic, and consequent increases in pollutants washed from the railroad and bridges into receiving water bodies. Stormwater management measures, including detention basins, vegetative controls, and other measures, would be implemented to minimize water quality impacts. These measures would reduce or detain discharge volumes and remove pollutants, thus avoiding substantial further degradation of impaired water bodies in the study area vicinity.

Appropriate erosion and sediment control practices would be implemented in accordance with the Virginia Erosion and Sediment Control Regulations and the Virginia Stormwater Management Law and regulations. Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion during and after construction. Implementation of BMPs would minimize increases in turbidity of waters downstream of construction activities. Pre-construction sediment quality assessments and water quality monitoring during construction may be conducted to address potential re-suspension of contaminants and nutrients into overlying water. Further efforts to avoid and/or minimize water quality impacts would be made during final design.

Such efforts to prevent impacts could include:

- Designing the project to minimize the LOD and subsequent impacts to water resources
- Silt fencing and measures to prevent soil erosion from earthwork entering water bodies
- Temporary and permanent stormwater management measures
- Conducting stream work in the dry
- Native revegetation of disturbed areas
- Taking practicable measures to prevent spills of fuels, lubricants, or other pollutants into water bodies
- Elimination of weep hole devices that allow runoff to drip directly into waterways from bridges
- Use of vegetated buffers and vegetated swales to intercept runoff
- Use of holding basins to reduce pollution content, temperature, and intensity of runoff entering the water supply

These laws have specifications that also prohibit contractors from discharging any contaminant that may impact water quality. If accidental spills occur, the contractor is required to immediately

notify all appropriate local, state, and federal agencies and to take immediate action to contain and remove the contaminant. Additionally, the requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents, so that the contractor would be required to comply with such conditions. The number, locations, and abatement capacities of stormwater management facilities will be determined during later phases of Project design. Pollutant removal efficiencies will be used as a factor in determining the location and design of stormwater management facilities.

Impaired Waters. DRPT will ensure that BMPs and other stormwater techniques would be employed to minimize further impacts on impaired waters. Construction techniques designed to reduce water quality impacts will be employed. Clearing practices should be limited to the greatest extent practicable around impaired waters to limit further degradation. The DC2RVA Project will adhere to additional restrictions in accordance with any TMDLs developed for impaired waters.

4.1.6.4 Drinking Water/Aquifers/Water Supply

Efforts would be made throughout the final design process to avoid and minimize impacts to drinking waters to the extent practicable. Minimization measures could involve modifications, such as further alignment shifts to avoid or minimize impacts; the use of BMPs; the use of retaining walls; and temporary and permanent stormwater management measures to reduce transportation of chemicals by stormwater, and they should include limited or avoidance of snow removal and vegetation maintenance chemicals near Source Protection Areas and well locations.

4.2 BIOLOGICAL RESOURCES

Under the No Build Alternative, CSXT would continue maintenance and repairs of the existing infrastructure, and infrastructure improvements that are already planned for the DC2RVA corridor would move forward. Anticipated effects of the No Build Alternative are discussed below in comparison with the Build Alternatives. All practicable measures would be taken to avoid and minimize impacts; however, due to the length and linear nature of the DC2RVA Project, impacts to habitats would be unavoidable. For this EIS, estimated impacts to habitats and natural communities are calculated using a conservative assumption and are categorized as permanent or temporary.

4.2.1 Habitat and Natural Communities

Construction of any of the Build Alternatives would result in effects to the general ecology of its surroundings. The Build Alternatives would affect terrestrial natural communities and associated wildlife habitat through conversion of existing land coverage to railroad structures and maintained right-of-way. Depending on the combination of Build Alternatives, between 31 and 264 acres of habitat are estimated to be permanently converted by the proposed improvements within and outside of the existing railroad right-of-way. This conversion would result in the loss of wildlife habitat. Permanent (converted to use by the railroad) and temporary (able to renaturalize after construction completion) impacts to general habitat types within the LOD of each Build Alternative are summarized in Table 4-5. Most of the area affected by the Build Alternatives, aside from the bypasses, is already developed. Habitats that would be affected are directly adjacent to the existing rail line and are already altered by local activities, including operation of the railroad, with the exception of the bypass alternatives (i.e., Build Alternatives 3B,

5C, and 5C—Ashcake). Disturbance or loss of these upland habitats adjacent to the existing railroad would not result in substantial impacts to wildlife due to their location and widespread availability of such habitats within the study area and the region.

Due to the new area crossed by the Build Alternatives that includes new bypasses, more habitat not already affected by human activities would be affected. A greater amount of all habitat types would be permanently converted, and larger areas of intact forested habitat would be bisected, removing a large portion of interior forest and fragmenting habitat. Interior forest habitats are located 300 feet or farther from the forest edge and are commonly composed of mature trees. These areas are important to forest interior dwelling species (FIDS), especially Neotropical migrant songbirds that utilize these habitats for foraging, breeding, and nesting. FIDS can also include certain mammals, especially certain species of bats, reptiles, and amphibians that prefer unbroken forested tracts.

The Fredericksburg Bypass (Build Alternative 3C) crosses crosses an area of 1,200+ acres of continuous forest southwest of the Rappahannock. This area includes Virginia Outdoors Fund Easements and the Alexander Berger Memorial Sanctuary, discussed in Section 3.2.2.4. This area also includes at least 750 acres of interior habitat defined as 'high' by the VDCR Ecological Core model that is connected to a very large area of 'outstanding' habitat associated with Fort A. P. Hill. The Virginia Outdoors Fund Easements and the Alexander Berger Memorial Sanctuary, including the majority of the forest mentioned above, would be cut off from the Fort A. P. Hill habitat by the construction of the Fredericksburg Bypass (Build Alternative 3C), and a large portion of the interior habitat would be lost and/or degraded due to the introduction of the railroad through the habitat.

The Ashland Bypass (Build Alternatives 5C and 5C–Ashcake) cross several smaller wildlife corridors associated with waterways, and three larger tracts of forested habitats (approximately 140, 380, and 180 acres) with interior habitat that would be bisected by the proposed alignment resulting in a decrease of interior habitat.

Station upgrades would occur in urban areas. Although the LODs are wider in these locations, only small additional amounts of urban tree canopy would be affected.

Table 4-5: Habitat Impacts (acres)

Alternative Area	Alternative	Agriculture (pasture/row crop/ grassland)	Aqueous Habitat (wetlands/streams/ open water)	Upland Forest	Crosses Internal Forest Habitat*	Shrub Area/Old Field	Riparian/Bottomland Forest/PFO	Urban/Developed Lands	Total
Area 1: Arlington (Long Bridge Approach)	1A	–	–	–	No	–	–	– T: 0.6	– T: 0.6
	1B	–	–	–	No	–	–	P: 1.5 T: 0.9	P: 1.5 T: 0.9
	1C	–	–	–	No	–	–	P: 0.4 T: 0.7	P: 0.4 T: 0.7

Table 4-5: Habitat Impacts (acres)

Alternative Area	Alternative	Agriculture (pasture/row crop/ grassland)	Aqueous Habitat (wetlands/streams/ open water)	Upland Forest	Crosses Internal Forest Habitat*	Shrub Area/Old Field	Riparian/Bottomland Forest/PFO	Urban/Developed Lands	Total
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: 2.1 T: 1.6	P: 1.1 T: 2.0	P: 15.0 T: 7.2	No	P: 0.2 T: 0.1	P: 1.3 T: 0.9	P: 13.2 T: 11.8	P: 32.9 T: 23.6
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	P: 0.1 T: 1.1	P: 0.1 T: 0.4	P: 0.4 T: 3.2	No	–	P: 0.1 T: 1.4	P: 1.5 T: 3.4	P: 2.2 T: 9.5
	3B	P: 2.3 T: 1.4	P: 1.9 T: 0.9	P: 2.1 T: 3.5	No	–	P: 0.1 T: 1.4	P: 13.4 T: 5.2	P: 19.8 T: 12.4
	3C	P: 32.7 T: 8.2	P: 8.5 T: 3.1	P: 66.9 T: 17.4	Yes	–	P: 13.2 T: 4.0	P: 19.3 T: 5.4	P: 140.6 T: 38.1
Area 4: Central Virginia (Crossroads to Doswell)	4A	P: 0.9 T: 7.4	P: 0.3 T: 5.1	P: 0.5 T: 10.1	No	P: 0.1 T: 1.0	P: 0.1 T: 9.4	P: 0.7 T: 7.6	P: 2.6 T: 40.6
Area 5: Ashland (Doswell to I-295)	5A	P: 1.2 T: 0.5	– T: 0.2	P: 2.4 T: 4.7	No	– T: 0.2	P: 0.2 T: 0.6	P: 18.1 T: 6.7	P: 21.9 T: 12.9
	5A–Ashcake	P: 1.2 T: 0.5	– T: 0.2	P: 2.4 T: 4.7	No	– T: 0.2	P: 0.2 T: 0.6	P: 16.4 T: 6.7	P: 20.2 T: 12.9
	5B	P: 1.2 T: 0.5	– T: 0.2	P: 2.4 T: 4.7	No	– T: 0.2	P: 0.6 T: 0.9	P: 25.6 T: 7.6	P: 29.4 T: 14.1
	5B–Ashcake	P: 1.2 T: 0.5	– T: 0.2	P: 2.4 T: 4.8	No	– T: 0.2	P: 0.6 T: 0.9	P: 25.9 T: 8.7	P: 29.7 T: 15.3
	5C	P: 29.3 T: 5.7	P: 2.3 T: 0.3	P: 64.0 T: 20.7	Yes	P: 11.0 T: 2.4	P: 4.7 T: 0.9	P: 36.5 T: 8.9	P: 147.8 T: 38.9
	5C–Ashcake	P: 29.3 T: 5.7	P: 2.3 T: 0.3	P: 64.0 T: 20.7	Yes	P: 11.0 T: 2.4	P: 4.7 T: 0.9	P: 34.8 T: 8.9	P: 146.1 T: 38.9
	5D–Ashcake	P: 1.2 T: 0.5	– T: 0.2	P: 2.0 T: 4.9	No	– T: 0.2	P: 0.2 T: 0.9	P: 32.3 T: 9.1	P: 36.1 T: 15.8

Table 4-5: Habitat Impacts (acres)

Alternative Area	Alternative	Agriculture (pasture/row crop/ grassland)	Aqueous Habitat (wetlands/streams/ open water)	Upland Forest	Crosses Internal Forest Habitat*	Shrub Area/Old Field	Riparian/Bottomland Forest/PFO	Urban/Developed Lands	Total
Area 6: Richmond (I-295 to Centralia)	6A	–	–	P: 3.7 T: 2.7	No	–	P: 1.5 T: 0.7	P: 70.8 T: 35.5	P: 76.0 T: 38.9
	6B–A-Line	–	–	P: 3.9 T: 2.8	No	–	P: 1.5 T: 0.7	P: 95.6 T: 48.3	P: 101.0 T: 51.8
	6B–S-Line	–	P: 0.7 T: 0.7	P: 6.5 T: 3.3	No	–	P: 2.5 T: 0.6	P: 68.9 T: 17.6	P: 78.6 T: 22.2
	6C	–	–	P: 4.4 T: 2.8	No	–	P: 1.5 T: 0.7	P: 122.1 T: 48.6	P: 128.0 T: 52.1
	6D	–	P: 0.7 T: 0.7	P: 6.5 T: 3.3	No	–	P: 2.5 T: 0.6	P: 63.9 T: 17.7	P: 73.6 T: 22.3
	6E	–	–	P: 6.4 T: 3.5	No	–	P: 2.2 T: 0.8	P: 80.5 T: 57.1	P: 89.1 T: 61.4
	6F	–	P: 0.6 T: 0.7	P: 6.7 T: 3.3	No	–	P: 2.5 T: 0.6	P: 73.1 T: 18.3	P: 82.9 T: 22.9
	6G	–	P: 0.6 T: 0.7	P: 6.3 T: 3.3	No	–	P: 2.5 T: 0.6	P: 71.5 T: 17.6	P: 80.9 T: 22.2

P = Permanent Impact, T=Temporary Impact.

*Areas of internal forest that are a minimum of 300 feet from the edge of the forested area.

4.2.1.1 Conservation Areas

DRPT have made efforts, to the extent practicable, to avoid impacts to existing conservation areas (federal and state) and priority conservation areas (areas of habitat designated as worthy of conservation). Aside from temporary impacts to Mattaponi Wildlife Management Area, the alternatives avoid existing conservation areas. Due to the linear nature of the Project and the location of the existing tracks through rural areas, some of the habitat areas adjacent to the DC2RVA corridor have been determined worthy of conservation for a variety of qualities. Unavoidable impacts to these areas are outlined below (Table 4-6). As previously mentioned, impacts listed are the total area of predicted temporary and permanent impacts within the proposed LOD, unless otherwise noted.

Table 4-6: Conservation Area Impacts (acres)

Alternative Area	Alternative	USFWS National Wildlife Refuges	State Wildlife Lands	County Wildlife Lands	Private Wildlife Lands	Priority Conservation Areas
Area 1: Arlington (Long Bridge Approach)	1A	–	n/a	n/a	n/a	n/a
	1B	–	n/a	n/a	n/a	n/a
	1C	–	n/a	n/a	n/a	n/a
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	–	–	– T: 0.55	n/a	P: 0.01 T: 0.78
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	n/a	n/a	n/a	–	P: 0.03 T: 1.52
	3B	n/a	n/a	n/a	–	P: 0.10 T: 1.61
	3C	n/a	n/a	n/a	P: 22.31 T: 5.69	P: 83.36 T: 18.63
Area 4: Central Virginia (Crossroads to Doswell)	4A	n/a	– T: 2.54	n/a	n/a	– T: 2.48
Area 5: Ashland (Doswell to I-295)	5A	n/a	n/a	n/a	n/a	P: 0.59 T: 0.01
	5A–Ashcake	n/a	n/a	n/a	n/a	P: 0.59 T: 0.01
	5B	n/a	n/a	n/a	n/a	P: 0.59 T: 0.01
	5B–Ashcake	n/a	n/a	n/a	n/a	P: 0.59 T: 0.01
	5C	n/a	n/a	n/a	n/a	P: 4.80 T: 21.13
	5C–Ashcake	n/a	n/a	n/a	n/a	P: 4.80 T: 21.13
	5D–Ashcake	n/a	n/a	n/a	n/a	P: 0.59 T: 0.01
Area 6: Richmond (I-295 to Centralia)	6A	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6B–A-Line	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6B–S-Line	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6C	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6D	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6E	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6F	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6G	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05

Source: VDOT-CEDAR, 2015.

P = Permanent Impact, T=Temporary Impact, n/a = no resources located in that Area

State Wildlife Lands. DRPT anticipates that Build Alternatives 4A would result in unavoidable temporary impacts to Mattaponi State Wildlife Management Area are anticipated to occur with Build Alternative 4A. Approximately 2.54 acres adjacent to existing railroad right-of-way would be disturbed for construction and then replanted and encouraged to renaturalize. Coordination with the Virginia Department of Game and Inland Fisheries (VDGIF) would be necessary.

County Wildlife Lands. DRPT anticipates that Build Alternative 2A would result in approximately 0.55 acre of temporary impacts to Pohick Seeps Conservation Area are anticipated to occur with Build Alternative 2A. The site is located on parcels owned by Fairfax County that have a Permanent Wildlife Conservation Easement. Depending on the type of impacts proposed, temporary impacts could potentially be considered permanent for the rare habitat located there. Proposed work in this area will require coordination with Fairfax County.

Private Wildlife Lands. Two parcels containing open-space easements managed by the Virginia Outdoors Foundation (VOF) are crossed by the Fredericksburg Bypass (Build Alternative 3C). DRPT anticipates that VOF conservation area CLN-VOF-3804 would have 1.22 acres of permanent impacts and 0.32 acre of temporary impacts, and area CLN-VOF-03850 would have 21.09 acres of permanent impact and 5.37 acres of temporary impact. The Fredericksburg Bypass (Build Alternative 3C) would bisect intact interior forested habitat in these locations. Coordination with VOF may be necessary.

Priority Conservation Areas including Wildlife Corridors. Unavoidable impacts to Priority Conservation Areas are listed in Table 4-7. These areas are recommended for preservation. Temporary impacts may be permanent depending on the type of impact and the potential to disrupt sensitive resources that may not have the ability to recover (e.g., clearing and grubbing of an area with a rare plant community).

Table 4-7: Conservation Area Impacts (acres)

Alternative Area	Alternative	Arkendale Flatwoods	Claiborne Run	South Fredericksburg	Summit Railroad Tracks	White Oak Run	Snow Creek Ravine	South Anna River–Falling Creek	Centralia
Area 1: Arlington (Long Bridge Approach)	1A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1B	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1C	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: – T: 0.06	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	n/a	P: 0.01 T: 0.01	P: 0.01 T: 0.25	P: 0.01 T: 0.39	–	–	n/a	n/a
	3B	n/a	P: 0.08 T: 0.02	P: 0.01 T: 0.25	P: 0.01 T: 0.39	–	–	n/a	n/a

Table 4-7: Conservation Area Impacts (acres)

Alternative Area	Alternative	Arkendale Flatwoods	Claiborne Run	South Fredericksburg	Summit Railroad Tracks	White Oak Run	Snow Creek Ravine	South Anna River–Falling Creek	Centralia
	3C	n/a	P: 0.06 T: 0.02	–	P: 0.09 T: 0.36	P: 0.10 T: 0.02	P: 4.61 T: 1.21	n/a	n/a
Area 4: Central Virginia (Crossroads to Doswell)	4A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Area 5: Ashland (Doswell to I-295)	5A	n/a	n/a	n/a	n/a	n/a	n/a	–	n/a
	5A–Ashcake	n/a	n/a	n/a	n/a	n/a	n/a	–	n/a
	5B	n/a	n/a	n/a	n/a	n/a	n/a	–	n/a
	5B–Ashcake	n/a	n/a	n/a	n/a	n/a	n/a	–	n/a
	5C	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.34 T: 0.05	n/a
	5C–Ashcake	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.34 T: 0.05	n/a
	5D–Ashcake	n/a	n/a	n/a	n/a	n/a	n/a	–	n/a
Area 6: Richmond (I-295 to Centralia)	6A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6B–A-Line	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6B–S-Line	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6C	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6D	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6E	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6F	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05
	6G	n/a	n/a	n/a	n/a	n/a	n/a	n/a	P: 0.15 T: 0.05

P = Permanent Impact, T=Temporary Impact, n/a = no resources located in that Area

Aside from the proposed Fredericksburg Bypass (Build Alternative 3C), which bisects a large forested area and wildlife corridor, all impacts to wildlife corridors would result from widening the existing railroad. In some of these areas, wildlife are able to use areas under bridges that span waterways and dry culverts. Larger animals may be able to successfully cross existing tracks if no fencing or other additional barriers exist; however, an increased track area and increased train traffic would result in a decreased ability for wildlife to cross and increased mortality rates. Direct mortality from increased train/wildlife collisions would be anticipated; however, the long-term adverse impacts would not be considered substantial. Impacts to wildlife corridors are listed in

Table 4-8. Figure 3-6 identifies the existing wildlife corridors. Overall, DRPT does not anticipate a substantial amount of wildlife crossing.

Table 4-8: Impacts to Wildlife Corridors (acres)

Alternative Area	Alternative	Permanent	Temporary
Area 1: Arlington (Long Bridge Approach)	1A	–	–
	1B	–	–
	1C	–	–
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	0.01	0.72
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	–	0.87
	3B	–	0.95
	3C	78.50	17.02
Area 4: Central Virginia (Crossroads to Doswell)	4A	–	2.48
Area 5: Ashland (Doswell to I-295)	5A	0.01	0.59
	5A–Ashcake	0.01	0.59
	5B	0.01	0.59
	5B–Ashcake	0.01	0.59
	5C	20.79	4.75
	5C–Ashcake	20.79	4.75
	5D–Ashcake	0.01	0.59
Area 6: Richmond (I-295 to Centralia)	6A	–	–
	6B–A-Line	–	–
	6B–S-Line	–	–
	6C	–	–
	6D	–	–
	6E	–	–
	6F	–	–
	6G	–	–

4.2.1.2 Invasive Species

The Build Alternatives could increase the spread of invasive species. Construction equipment used could carry seeds or propagative plant parts from other construction projects or infested areas. Removal of sediment and soil to offsite locations could spread invasive species, and placement of fill from borrow sites could introduce invasive species to the study area. Exposed soil also allows invasive species to spread, which could contribute to encroachment of invasive species on vegetation communities adjacent to the LOD.

In accordance with EO 13112, Invasive Species, the potential for the establishment of invasive plant species during construction of any Build Alternative would be minimized by prompt seeding of disturbed areas with seeds that are tested in accordance with the Virginia Seed Law to ensure that seed mixes are free of noxious species. To prevent the introduction of new invasive species and to prevent the spread of existing populations, BMPs would also be followed and could include washing machinery before it enters the area, minimizing ground disturbance, and reseeding disturbed areas. While the LOD is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species.

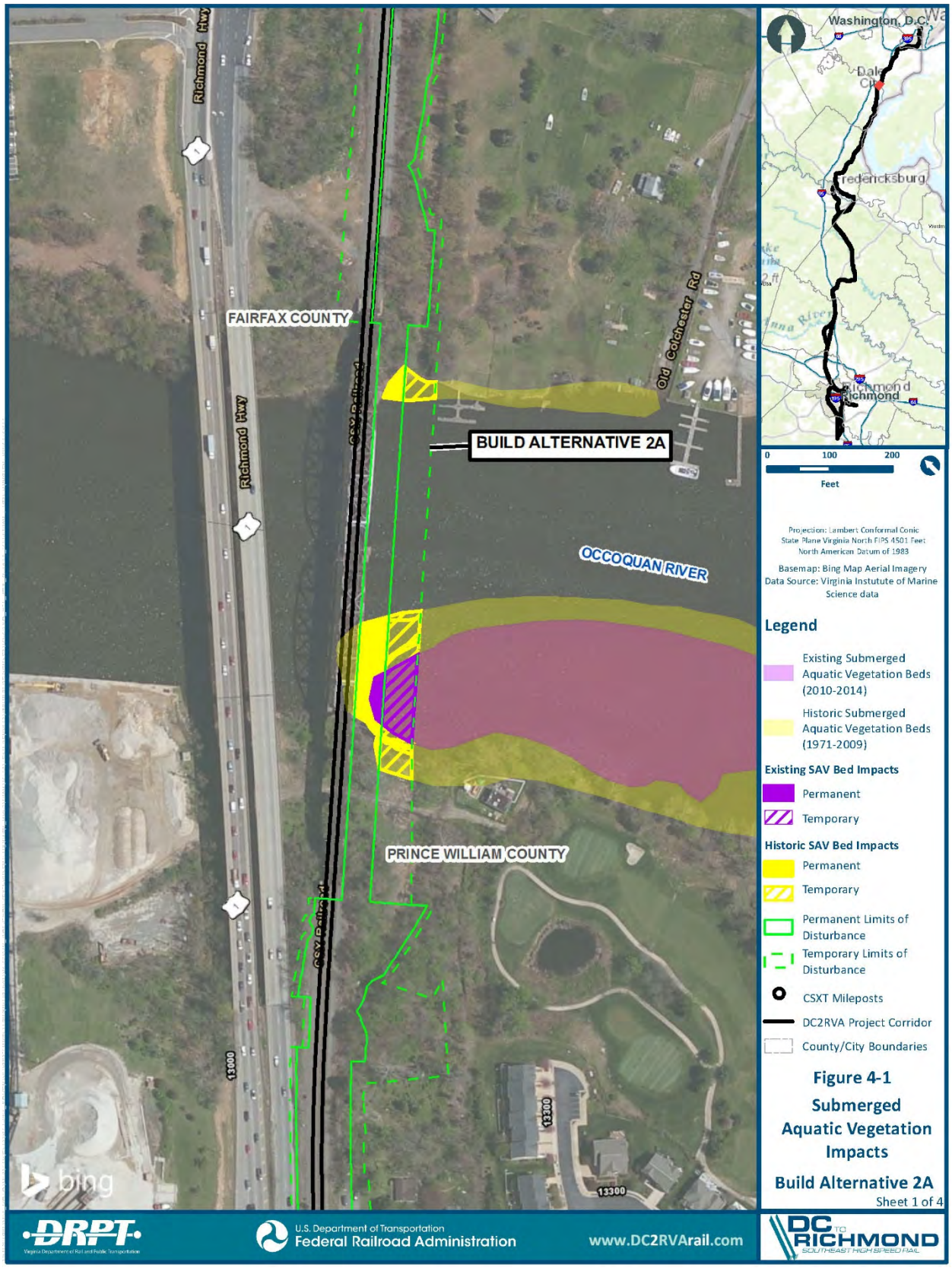
4.2.1.3 Submerged Aquatic Vegetation

Due to the need to expand existing bridge crossings of major waterways where submerged aquatic vegetation (SAV) exists, the proposed Project would have unavoidable impacts on these plant species. Permanent impacts would include areas converted for the use of piers or infrastructure, while temporary impacts would include disturbed areas with the ability to support SAV again after construction completion. Impacts to SAV are only anticipated to occur with Build Alternative 2A (Figure 4-1). No SAV beds occur in the DC2RVA corridor south of Aquia Creek, and proposed improvements included with Build Alternatives 1A, 1B, and 1C would not require work in waters containing SAV. Estimated acres of impacts to SAV are presented in Table 4-9. A request to remove SAV from or plant SAV on state-administered benthic surfaces would be submitted with a JPA to VMRC. In determining whether to grant approval for SAV removal or planting, VMRC shall be guided by §28.2-1205 of the Code of Virginia and the SAV Transplantation Guidelines, or any new and improved methodologies as approved by VMRC (VMRC, 2000).

Table 4-9: Submerged Aquatic Vegetation Impacts (acres)

Alternative Area	Alternative	Existing	Historic	Total
Area 1: Arlington (Long Bridge Approach)	1A	P: — T: 0.03	–	P: — T: 0.03
	1B	P: — T: 0.01	–	P: — T: 0.01
	1C	–	–	–
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	P: 1.33 T: 1.91	P: 0.37 T: 0.35	P: 1.70 T: 2.26

P=Permanent Impact, T=Temporary Impact.
There is no SAV south of Aquia Creek; therefore, there are no impacts listed for the Build Alternatives in Alternative Areas 3, 4, 5, and 6.


Richmond Hwy
FAIRFAX COUNTY
Old Colchester Rd
CSX Railroad
BUILD ALTERNATIVE 2A
Richmond Hwy
OCCOQUAN RIVER
PRINCE WILLIAM COUNTY
CSX Railroad
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13300
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Fredericksburg
Richmond
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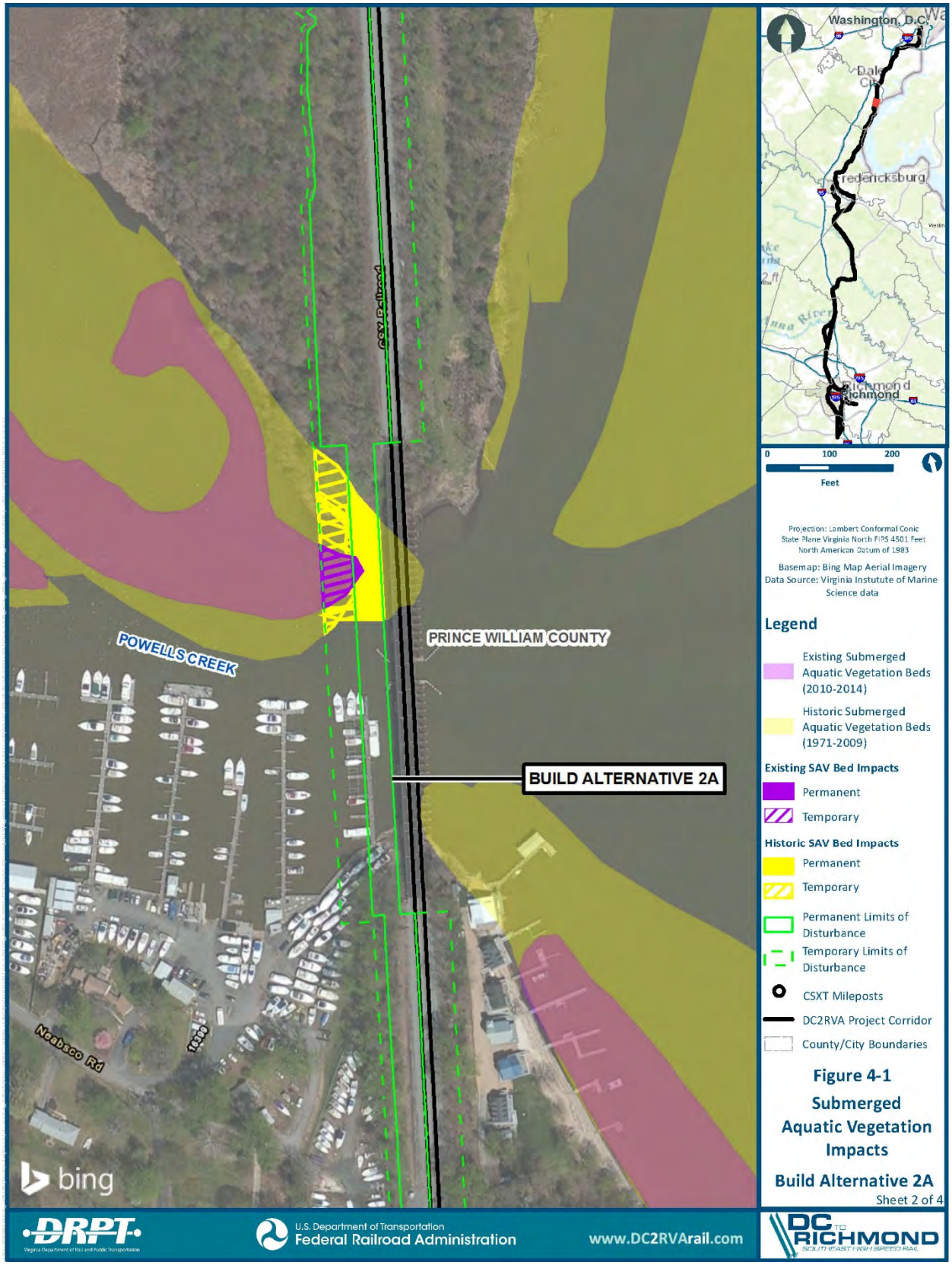
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: Bing Map Aerial Imagery
Data Source: Virginia Instutute of Marine Science data
Legend
Existing Submerged Aquatic Vegetation Beds (2010-2014)
Historic Submerged Aquatic Vegetation Beds (1971-2009)
Existing SAV Bed Impacts
Permanent
Temporary
Historic SAV Bed Impacts
Permanent
Temporary
Permanent Limits of Disturbance
Temporary Limits of Disturbance
CSXT Mileposts
DC2RVA Project Corridor
County/City Boundaries
Figure 4-1
Submerged Aquatic Vegetation Impacts
Build Alternative 2A
Sheet 1 of 4
DRPT
U.S. Department of Transportation
Federal Railroad Administration
www.DC2RVArail.com
DC to RICHMOND
SOUTHEAST HIGH SPEED RAIL


POWELLS CREEK
PRINCE WILLIAM COUNTY
BUILD ALTERNATIVE 2A
Neabsco Rd
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Fredericksburg
Richmond
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Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: Bing Map Aerial Imagery
Data Source: Virginia Instutute of Marine Science data
Legend
Existing Submerged Aquatic Vegetation Beds (2010-2014)
Historic Submerged Aquatic Vegetation Beds (1971-2009)
Existing SAV Bed Impacts
Permanent
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Historic SAV Bed Impacts
Permanent
Temporary
Permanent Limits of Disturbance
Temporary Limits of Disturbance
CSXT Mileposts
DC2RVA Project Corridor
County/City Boundaries
Figure 4-1
Submerged Aquatic Vegetation Impacts
Build Alternative 2A
Sheet 2 of 4
DRPT
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Federal Railroad Administration
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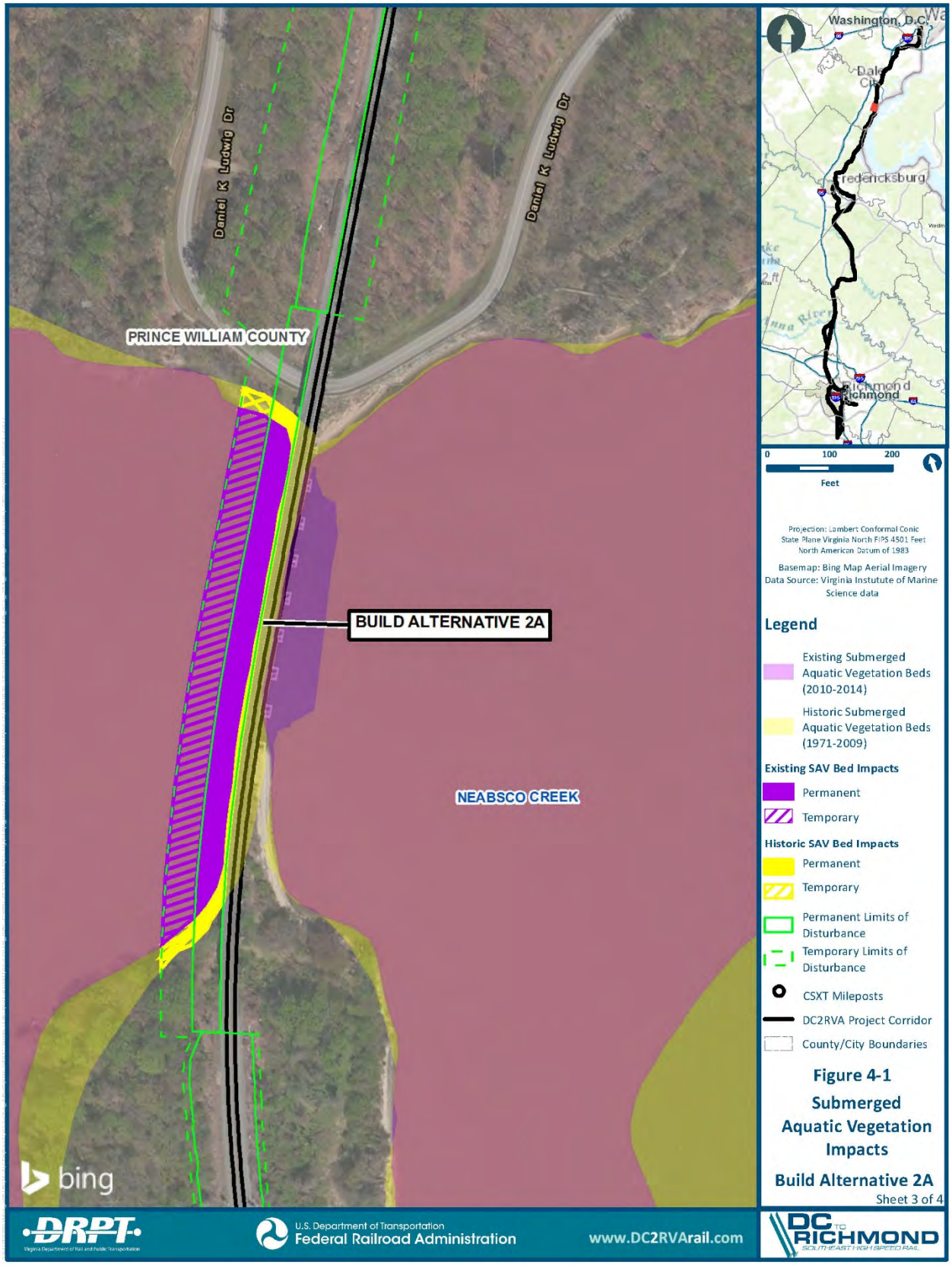
DC TO RICHMOND
SOUTHEAST HIGH SPEED RAIL


Daniel K Ludwig Dr
Daniel K Ludwig Dr
PRINCE WILLIAM COUNTY
BUILD ALTERNATIVE 2A
NEABSCO CREEK
bing
Washington, D.C.
Fredericksburg
Richmond
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100
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Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: Bing Map Aerial Imagery
Data Source: Virginia Institute of Marine Science data
Legend
Existing Submerged Aquatic Vegetation Beds (2010-2014)
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Existing SAV Bed Impacts
Permanent
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Historic SAV Bed Impacts
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Permanent Limits of Disturbance
Temporary Limits of Disturbance
CSXT Mileposts
DC2RVA Project Corridor
County/City Boundaries
Figure 4-1
Submerged Aquatic Vegetation Impacts
Build Alternative 2A
Sheet 3 of 4
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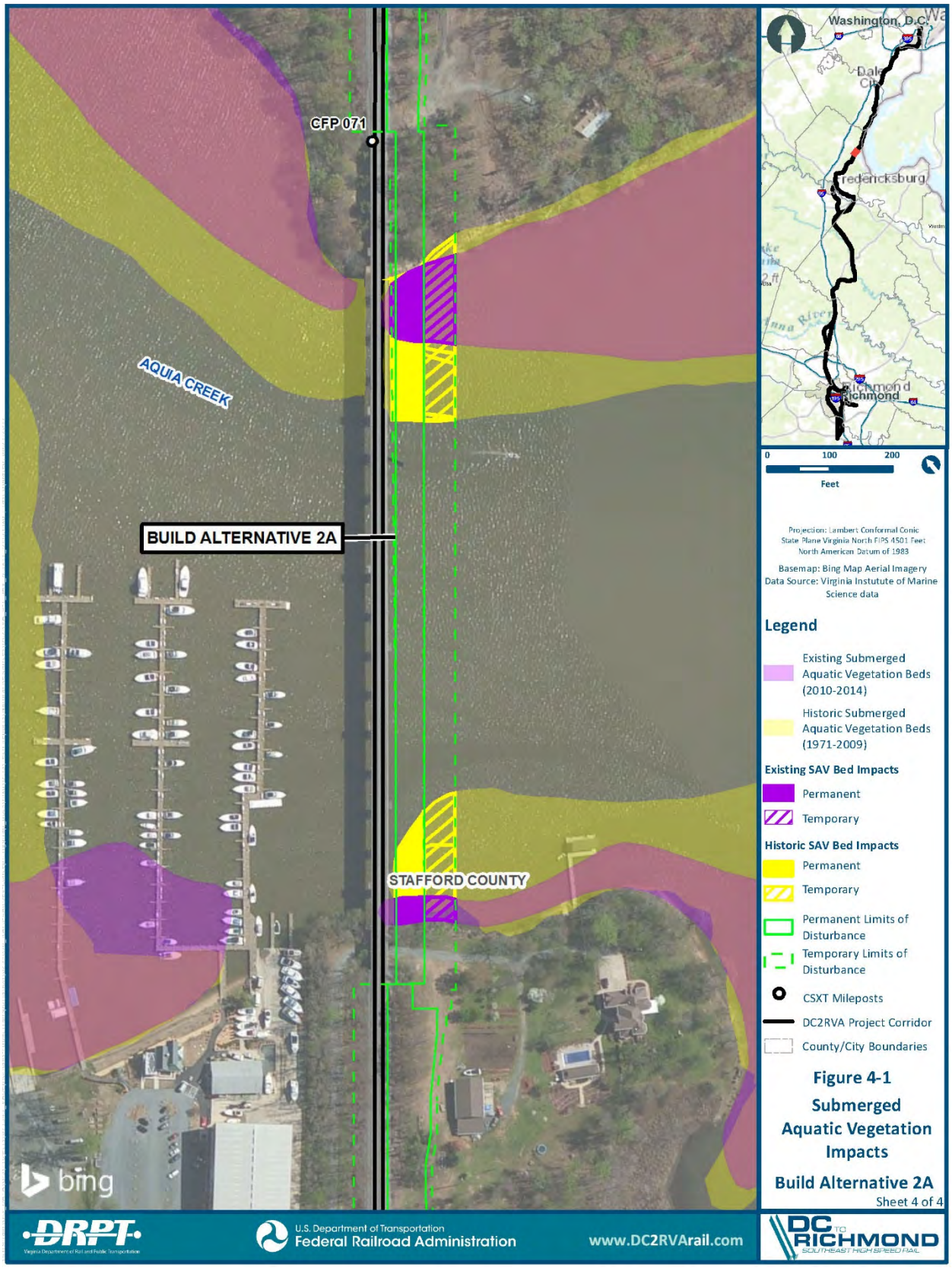
CFP 071
AQUIA CREEK
BUILD ALTERNATIVE 2A
STAFFORD COUNTY
bing
Washington, D.C.
Fredericksburg
Richmond
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Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: Bing Map Aerial Imagery
Data Source: Virginia Instutute of Marine Science data
Legend
Existing Submerged Aquatic Vegetation Beds (2010-2014)
Historic Submerged Aquatic Vegetation Beds (1971-2009)
Existing SAV Bed Impacts
Permanent
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Historic SAV Bed Impacts
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Permanent Limits of Disturbance
Temporary Limits of Disturbance
CSXT Mileposts
DC2RVA Project Corridor
County/City Boundaries
Figure 4-1
Submerged Aquatic Vegetation Impacts
Build Alternative 2A
Sheet 4 of 4
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4.2.1.4 Avoidance, Minimization, and Mitigation Evaluation

Minimization measures to protect natural habitats and communities could involve modifications to later designs such as:

- Minor alignment shifts to avoid or minimize impacts
- Minimizing clearing and grubbing, in particular in riparian areas
- Development of a mitigation plan that includes landscaping and planting detail for onsite replacement of any trees removed
- Native revegetation, including native shrub plantings, native reseeding of disturbed areas to prevent the spread of invasive species, and additional erosion controls during storm events due to exposed soil prevent
- Using bridges or open bottom culverts in streams to minimize the disruption of natural stream bottoms

Invasive Species. To avoid the introduction of new invasive species and prevent the spread of existing populations, BMPs should be followed, including washing machinery before it enters the area to prevent the spread of seeds and minimizing ground disturbance. Prompt seeding of disturbed areas with native seeds or seeds that are tested in accordance with the Virginia Seed Law to ensure that seed mixes are free of noxious species will decrease the ability for invasive species to take root and out competing native species.

Submerged Aquatic Vegetation. Mitigation for areas of temporary disturbance to SAV would be coordinated with VMRC. The following procedures are suggested by the Chesapeake Bay Program (Chesapeake Bay Program, 1995) for the protection of SAV areas:

- Protect existing, historic, and potential SAV areas from physical disruption
- Avoid or minimize dredging within SAV areas
- Avoid nearby construction activities that create additional turbidity
- Avoid reduction in Secchi depths (measure of water clarity) compared to predisturbance levels
- Establish an undisturbed buffer around SAV beds
- If construction must occur near or in beds, avoid activities during the growing season (April–October for most species)
- Preserve natural shorelines through stabilization with marsh plantings

Further efforts to avoid and/or minimize disturbance and removal of SAV would be made during final design design as part of obtaining the VMRC permit. Erosion and sediment control measures would minimize potential impacts to water quality within adjacent SAV areas. Construction within or adjacent to SAV areas would avoid the growing season for representative plant species to the extent practicable. Mitigation for SAV loss would be developed in coordination with VMRC and may include enhancement (increase aerial coverage of SAV beds or improvement in habitat quality) or restoration (return SAV to unvegetated bottom, which historically supported SAV) of SAV beds.

4.2.2 Wildlife

Construction activities associated with the build alternatives, including clearing and grubbing and direct use of adjacent habitat, could result in the disturbance of local wildlife species such as birds, reptiles and amphibians, deer, foxes, squirrels, rabbits, raccoons, groundhogs, and other common mammals associated with these areas. Mobile species, such as adult birds, mammals, and some reptiles, would be displaced during construction. Loss of less mobile animals may result from construction. These species would return and repopulate the area once construction has been completed.

Additional loss of wildlife may occur due to mortality from collisions with trains, increased habitat fragmentation (discussed further in Section 4.2.1 Habitat and Natural Communities), impacts to aqueous habitats due to decreased water quality (discussed further in Section 4.1.3 Water Quality), and habitat loss through the introduction of invasive species (discussed further in Section 4.2.1.2 Invasive Species). As noted in Section 4.2.1.1, DRPT does not anticipate a substantial amount of wildlife crossing.

4.2.2.1 Colonial Waterbirds

All mapped colonial waterbird colonies are located more than 1 mile from the proposed Project. Due to the distance of the rail corridor from known colonies, DRPT does not anticipate that any activities associated with the build alternatives would have any impact on colonial waterbirds.

4.2.2.2 Migratory Birds

The migratory birds of primary concern in the study area are migratory songbirds, commonly referred to as Neotropical migrants. Short-term adverse impacts from construction noise and disturbance may mask territorial vocalizations of birds andbreeding calls, and they may temporarily disturb breeding pairs. Important stopover habitat for migratory songbirds includes forested areas with dense undergrowth that provides cover from predators. Migratory birds could be affected through habitat degradation and loss associated with this Project. Most of the lost habitat associated with this Project, aside from proposed bypasses, would be directly adjacent to the existing rail line and is lower quality edge habitat already impacted by local activities. Nearby conservation areas such as federal, state, and private wildlife lands are more likely to provide optimal habitat for these species.

The proposed Fredericksburg Bypass (Build Alternative 3C) and Ashland Bypass (Build Alternative 5C and 5C–Ashcake) would use larger areas of habitat, each affecting approximately 80 acres of forested areas, and would bisect a large area of interior forested habitat (located 300 feet or farther from the forest edge and commonly composed of mature trees). These areas provide important habitat to many migratory species and protect them from predators that prefer the forest edge. The Fredericksburg Bypass would cut through two VOF easements, a large forested area including wildlife corridors, and may represent important sites for FIDS which need large, relatively unfragmented tracts of hardwood or mixed hardwood forest to successfully breed and maintain viable populations. FIDS prefer tracts in excess of 100 acres, or they require large contiguous linear tracts of hardwood or mixed hardwood forest that are a minimum of 600 feet wide, as many of these species prefer nest sites to be located greater than 300 feet from the forest edge. This diverse group includes Neotropical migrant songbirds such as tanagers, warblers, and vireos that breed in North America and winter in the Caribbean, Central America, and South America, as well as residents and short-distance migrants such as woodpeckers, some

raptors, and owls (Jones, et. al., 2001). Songbirds using these areas may be displaced and would disperse to nearby areas with suitable habitat, which may create greater competition.

4.2.2.3 Aquatic and Marine Life

Due to the number and type of water crossings involved, direct disturbance of aquatic communities would be unavoidable. In-stream work and use of wetland areas would result in the elimination of some aqueous habitat and species that would be unable to relocate. Additional impacts to aqueous habitats due to decreased water quality (discussed further in Section 4.1.3 Water Quality) and habitat loss through the introduction of invasive species could occur (discussed further in Section 4.2.1.2 Invasive Species).

Fisheries, Anadromous Fish, and Trout Waters. Cook Lake in Cameron Run Regional Park, the only mapped trout water in the Project vicinity (VDGIF, 2015b), is not located near the LOD and is not expected to be affected. Anticipated impacts to waters containing anadromous fish are dependent on the size of the water body and the type of crossing required. Depending on the combination of build alternatives selected, DRPT estimates there would be between 8,235 and 14,420 linear feet of permanent impacts to anadromous fish waters. Temporary and permanent impacts are detailed in Table 4-10.

Table 4-10: Confirmed Anadromous Fish Use Waters

Water	Build Alternative	Confirmed Species	Anticipated Impacts (Linear Feet)
Four Mile Run	2A	Striped Bass, Yellow Perch	P: 189 T: 692
Cameron Run	2A	Potential anadromous fish use waters	–
Accotink Creek	2A	Alewife, Yellow Perch	–
Pohick Creek	2A	Alewife, Blueback Herring, Yellow Perch	–
Occoquan River	2A	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	P: 1,161 T: 1,275
Neabsco Creek	2A	Striped Bass	P: 1,201 T: 1,332
Powells Creek	2A	Striped Bass, Yellow Perch	P: 1,592 T: 1,908
Potomac River	2A	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	–
Quantico Creek	2A	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	–
Chopawamsic Creek	2A	Blueback Herring, Yellow Perch	–
Aquia Creek	2A	American Shad, Blueback Herring, Striped Bass, Yellow Perch	P: 2,085 T: 3,641
Claiborne Run	3A	Potential anadromous fish use waters	P: 227 T: 318

Table 4-10: Confirmed Anadromous Fish Use Waters

Water	Build Alternative	Confirmed Species	Anticipated Impacts (Linear Feet)
	3B		P: 1,231 T: 682
	3C		P: 362 T: 507
Rappahannock River	3B	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	P: 914 T: 922
	3C		P: 1,034 T: 2,094
Hazel Run	3A, 3B, 3C	Alewife, Blueback Herring	–
Mattaponi River	4A	American Shad, Blueback Herring, Striped Bass, Yellow Perch	P: 715 T: 1,167
North Anna River	4A	American Shad, Blueback Herring, Hickory Shad, Striped Bass, Yellow Perch	P: 252 T: 386
Little River	4A	Yellow Perch	P: 179 T: 228
South Anna River	5A, 5A–Ashcake, 5B, 5B–Ashcake, 5C, 5C–Ashcake, 5D–Ashcake	Alewife, American Shad, Blueback Herring, Hickory Shad, Striped Bass	P: 230 T: 329
James River	6B–S-Line	American Shad, Blueback Herring, Striped Bass, Yellow Perch	P: 2,940 T: 6,162
	6D		P: 2,940 T: 6,162
	6F		P: 3,905 T: 5,197
	6G		P: 3,905 T: 5,197
Falling Creek	6A	Potential anadromous fish use waters	P: 242 T: 174
	6B–A-Line		P: 242 T: 174
	6C		P: 242 T: 174
	6E		P: 242 T: 174

P=Permanent Impact, T=Temporary Impact.

4.2.2.4 Avoidance, Minimization, and Mitigation Evaluation

Wildlife. DRPT will evaluate further minimization of impacts to wildlife during the final design process by decreasing LOD in habitat areas. This will include considering conservative use of staging areas and limiting access roads to reduce habitat loss. Wildlife passage can be facilitated through wildlife crossings. Wildlife crossings are man-made structures that allow animals to safely cross barriers. These crossings allow the connection or reconnection between habitats mitigating the impacts of habitat fragmentation, allow greater access to resources, and avoid wildlife/train collisions. DRPT will evaluate providing oversized culverts and extended bridges in areas where habitat fragmentation would occur. If pipes are used, they should be countersunk a minimum of 3 inches for pipes under 24 inches and a minimum of 6 inches for pipes 24 inches or greater.

Migratory Birds. General time-of-year (TOY) restrictions on construction activities to avoid impacts on migratory and resident songbirds in Virginia are from mid-March through mid-August and for migrant passerines and non-passerines from the beginning of May through the end of July (VDGIF, 2016). To the maximum extent practicable, DRPT will avoid grading and construction during the breeding season. If construction is necessary during the breeding season, DRPT will conduct nest surveys, if necessary, and will avoid activities within 100 feet of active nests, where possible. DRPT will not plant food sources within the right-of-way, which will make the right-of-way less attractive to birds, decreasing the likelihood of collisions with trains.

Aquatic and Marine Life. DRPT will work with VDGIF, National Marine Fisheries Service (NMFS), and United States Fish and Wildlife Service (USFWS) during the design process to develop specific measures for avoidance, minimization, and mitigation of impacts to aquatic wildlife. DRPT will implement BMPs, including use of silt curtains and limiting overflow from dredging equipment, which will minimize increases in turbidity of waters downstream of in-water activities. Erosion and sediment control measures will also minimize potential impacts to water quality during construction.

Bottomless culverts and single-span bridges will be considered at smaller streams to maintain fish passage and channel morphology and to avoid instream work to the extent practicable. If pipes are used, they should be countersunk a minimum of 3 inches for pipes under 24 inches and a minimum of 6 inches for pipes 24 inches or greater. Preconstruction sediment quality assessments and water quality monitoring during construction will be considered to address potential resuspension of contaminants and nutrients into overlying waters.

TOY restrictions will be considered to avoid or minimize impacts on fish during early life stages. VDGIF typically recommends restrictions on all in-stream work within Anadromous Fish Use Areas and their tributaries between February 15 and June 30. Exact restrictions will vary depending on the species, type of work, and location location and will be developed with VDGIF. Stormwater management measures, including detention basins, vegetative controls, and other measures, will be implemented to minimize water quality impacts, if necessary. These measures will reduce or detain discharge volumes and remove pollutants, thus avoiding substantial further degradation of impaired water bodies in and downstream of the study area. With implementation of these BMPs, DRPT anticipates the proposed Project will not adversely affect downstream species.

4.2.3 Threatened and Endangered Species

Potential adverse impacts to federal or state-listed threatened or endangered species that may be present within the study area could occur for the build alternatives where planned improvements affect areas where species or their habitat may be found.

Based on research through regulatory agency online databases, agency input regarding threatened and endangered species that may be present within the study area, and field surveys of potentially suitable habitat, DRPT determined that the build alternatives could potentially impact seven federally endangered and/or threatened species and eight state-listed endangered and/or threatened species (Table 4-11 and 4-12). Potential impacts depend on the species and range, including, but not limited to, elimination of the species from the area, removal or alteration of habitat, elimination of access to important life stage areas, disruption of breeding season, or disturbance resulting in a species leaving the area. The build alternatives for the Fredericksburg Bypass (Build Alternative 3C) and Ashland Bypass (Build Alternatives 5C and 5C–Ashcake), which would bisect forested habitat, wildlife corridors, and use rural areas with far less alteration would have the greatest chance of impacting wildlife, including threatened and endangered species. All other alternatives would be in mostly urban or already disturbed, although in some cases naturalized, areas adjacent to the existing tracks.

Coordination with USFWS and NMFS pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended, for potential impacts to federally listed species would be conducted where required after the Draft EIS is published. Preliminary coordination with USFWS has consisted of obtaining the current list of federally listed threatened and endangered species that could potentially be found in the study area. DRPT anticipates that future coordination will cover the need for additional field surveys and discussion regarding the potential Project effects.

Table 4-11: Potential for Federally Listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
Build Alternatives 1A, 1B, and 1C			
No species indicated; however, the tidal wetland in the waterfowl sanctuary may provide suitable habitat for sensitive joint-vetch and is recommended for future surveys, if impacted by a build alternative.			
Sensitive Joint-vetch *(Aeschynome virginica)*	FT	Habitat present, and no current survey conducted; may affect.	One wetland (01-WTL-01) recommended for further sensitive joint-vetch survey
Build Alternative 2A			
Dwarf Wedgemussel *(Alasmidonta heterodon)*	FE	Potential habitat present, and no current survey conducted; may affect.	Known or likely to occur within the Lower Aquia Creek subwatershed (VDGIF, 2014); streams recommended for further study include 02-STR-70, 02-STR-69, 02-STR-68, 02-STR-66, and 02-STR-117
Harperella *(Ptilimnium nodosum)*	FE	Potential habitat does not appear to be present, and no suitable habitat was identified during field surveys; not likely to adversely affect.	Known or likely to occur only in Stafford County (USFWS, 2014a) in the Lower Potomac (02070011) watershed (NatureServe, 2014)

Table 4-11: Potential for Federally Listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
Northern Long-eared Bat *(Myotis septentrionalis)*	FT	Potential habitat present, and no current survey conducted; may affect.	It is generally agreed by the regulatory agencies that this species can be found throughout Virginia
Sensitive Joint-vetch *(Aeschynome virginica)*	FT	Habitat present, and no current survey conducted; may affect.	Four wetlands recommended for further sensitive joint-vetch survey, including 02-WTL-32, 02-WTL-47, 02-WTL-53, and 02-WTL-56
Small Whorled Pogonia *(Isotria medeoloides)*	FT	Habitat present, and no current survey conducted; may affect.	Habitat recorded during field surveys at the following locations: MP 97.3–96.6; 85.6–85.5; 83.8–83.6; 67.3–67.1; and 65.6–65.4
Build Alternatives 3A, 3B, and 3C			
Dwarf Wedgemussel (*Alasmidonta heterodon*)	FE	Potential habitat present, and no current survey conducted; may affect.	Existing populations in the Lower Rappahannock (02080104) watershed (NatureServe, 2014); additional streams recommended for survey include 03-STR-11, 03-STR-12, 03-STR-23, 03-STR-25, 03-STR-26, 03-STR-26, 03-STR-28, 03-STR-29, and 03-STR-29
Harperella (*Ptilimnium nodosum*)	FE	Species not known to be present, and no suitable habitat was identified during field surveys; not likely to adversely affect.	Not listed as occurring in the watershed crossed by this area (NatureServe, 2014)
Indiana bat *(Myotis sodalis)*	FE	Potential habitat present, and no current survey conducted; may affect.	Known or likely to occur in Caroline County (USFWS-ECOS, 2016)
Northern Long-eared Bat (*Myotis septentrionalis*)	FT	Potential habitat present, and no current survey conducted; may affect.	It is generally agreed by the regulatory agencies that this species can be found throughout Virginia
Small Whorled Pogonia (*Isotria medeoloides*)	FT	Habitat present, and no current survey conducted; may affect	Habitat recorded during field surveys at the following locations: MP 59.8–59.7; 52.6–51.9; and 51.1–50.9
Swamp-pink *(Helonias bullata*)	FT	Species not known to be present; not likely to adversely affect	There are no records of this species occurring in any of the subwatersheds crossed by this area (VDCR, 2014)
Build Alternative 4A			
Dwarf Wedgemussel (*Alasmidonta heterodon*)	FE	Species present; may affect	Existing populations in the Mattaponi (02080105) watershed (NatureServe, 2014); Po River, upstream of this Project, has been listed by VDGIF as endangered waters for the dwarf wedgemussel; this species is known or likely to occur within the Poni River subwatershed (VDGIF, 2014); this species is known or likely to occur within the South Anna River–Cedar Creek subwatershed (VDGIF, 2014 and VDCR, 2014); additional streams recommended for survey include 04-STR-01, 04-STR-09, 04-STR-10, 04-STR-11, 04-STR-18,

Table 4-11: Potential for Federally Listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
			04-STR-22, 04-STR-23, 04-STR-27, 04-STR-32, 04-STR-35, and 04-STR-45
Indiana bat *(Myotis sodalis)*	FE	Potential habitat present, and no current survey conducted; may affect.	Known or likely to occur in Caroline County (USFWS-ECOS, 2016)
Northern Long-eared Bat (*Myotis septentrionalis*)	FT	Potential bat habitat present, and no current survey conducted; may affect	It is generally agreed by the regulatory agencies that this species can be found throughout Virginia
Swamp-pink *(Helonias bullata*)	FT	Potential habitat present, and no current survey conducted; may affect	There are historic records or the potential of this species occurring in the Campbell Creek-Mattaponi River subwatershed (VDCR, 2014) in Caroline County (USFWS, 2014a) crossed crossed by this alternative area; there were 17 wetlands recommended for further survey, including 04-WTL-11, 04-WTL-14, 04-WTL-15, 04-WTL-16, 04-WTL-21, 04-WTL-22, 04-WTL-25, 04-WTL-26, 04-WTL-32, 04-WTL-33, 04-WTL-39, 04-WTL-40, 04-WTL-42, 04-WTL-43, 04-WTL-46, 04-WTL-48, and 04-WTL-50
Build Alternatives 5A, 5A–Ashcake, 5B, 5B–Ashcake, 5C, 5C–Ashcake, and 5D–Ashcake			
Dwarf Wedgemussel *(Alasmidonta heterodon)*	FE	Species present; may affect	South Anna River has been listed by VDGIF as endangered waters for the dwarf wedgemussel; this species is known or likely to occur within the South Anna River–Cedar Creek subwatershed (VDGIF, 2014 and VDCR, 2014); three streams were recommended for further survey/analysis including 05-STR-B-11, 05-STR-B-01, and 05-STR-02
Northern Long-eared Bat *(Myotis septentrionalis)*	FT	Potential bat habitat present, and no current survey conducted; may affect	Bat habitat was noted during field surveys in Carter Park; it is generally agreed by the regulatory agencies that this species can be found throughout Virginia
Build Alternatives 6A, 6B–A-Line, 6B–S-Line, 6C, 6D, 6E, 6F, and 6G			
Northern Long-eared Bat (*Myotis septentrionalis*)	FT	Potential habitat present, and no current survey conducted; may affect	It is generally agreed by the regulatory agencies that this species can be found throughout Virginia
Sensitive Joint-vetch (*Aeschynome virginica*)	FT	Species unlikely to be present in the project area	It is generally agreed by the different regulatory agencies that this species can be found throughout Virginia, but no habitat in in the Richmond area would be affected
Swamp-pink *(Helonias bullata*)	FT	Species potentially present in region, but no suitable habitat identified; not likely to affect	Species has historical occurrences in the region; however, no suitable habitat in the Richmond area was identified

*FE – Federal Endangered; FT – Federal Threatened.

Table 4-12: Potential for State-listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
Build Alternatives 1A, 1B, and 1C			
Appalachian Springsnail (*Fontigens bottimeri*)	SE	Species not known to be present; not likely to adversely affect	There are no records of this species occurring in the subwatershed crossed by this area (VDCR, 2014)
Sensitive Joint-vetch *(Aeschynome virginica)*	ST	Habitat present, and no current survey conducted; may affect.	One wetland (01-WTL-01) recommended for further sensitive joint-vetch survey
Build Alternative 2A			
Appalachian Springsnail (*Fontigens bottimeri*)	SE	Species not known to be present; not likely to adversely affect	There are no records of this species occurring in the subwatershed crossed by this area (VDCR, 2014)
Brook Floater (*Alasmidonta varicosa*)	SE	Species not known to be present, not likely to adversely affect	The brook floater is thought to be completely eliminated from the Middle Potomac - Anacostia–Occoquan (02070010) watershed (NatureServe, 2014)
Peregrine Falcon (*Falco peregrinus*)	ST	Species potentially present, and no current survey conducted; may affect	This species has been recorded in Huntly Meadows Park (CEDER-VDGIF); the Project is separated from Huntly Meadows Park by more than 1.5 miles of urban development
Virginia Piedmont Water Boatman (*Sigara depressa*)	SE	Species not known to be present; not likely to adversely affect	This species in only known or likely to occur in one watershed in Virginia; not located near the proposed Project (VDGIF, 2014b)
Sensitive Joint-vetch *(Aeschynome virginica)*	ST	Habitat present, and no current survey conducted; may affect.	Four wetlands recommended for further sensitive joint-vetch survey, including 02-WTL-32, 02-WTL-47, 02-WTL-53, and 02-WTL-56
Small Whorled Pogonia *(Isotria medeoloides)*	SE	Habitat present, and no current survey conducted; may affect.	Habitat recorded during field surveys at the following locations: MP 97.3–96.6; 85.6–85.5; 83.8–83.6; 67.3–67.1; and 65.6–65.4
Wood Turtle (*Glyptemys insculpta*)	ST	Species potentially present, and no current survey conducted; may affect	Known or likely to occur in the Cameron Run (VDGIF, 2014b) subwatershed and the Accotink Creek-Gunston Cove subwatershed (VDGIF, 2014b and VDCR-NHD, 2014)
River Bulrush (*Bolboschoenus fluviatilis*)	S2	Species present in wetland 02-WTL-46 in Northern Virginia area; not likely to be impacted due to distance from alignment	Previously unknown population in Neabsco Creek embayment identified during field surveys ; not likely to be impacted by Project
Build Alternatives 3A, 3B, and 3C			
Green Floater (*Lasmigona subviridis*)	ST	Species present; may affect; coordination with VDGIF required	The Rappahannock River has been listed by VDGIF as endangered waters for the green floater; coordination with VDGIF is required
New Jersey Rush (*Juncus caesariensis*)	ST	Potential habitat present, and no current survey conducted; may affect	There are historic records or the potential of this species occurring in the Poni River subwatershed (VDCR, 2014) in Caroline County (USFWS, 2014a

Table 4-12: Potential for State-listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
			and NatureServe, 2014) and the Lower Rappahannock (02080104) and Mattaponi (02080105) watersheds (NatureServe, 2014)
Small Whorled Pogonia (*Isotria medeoloides*)	SE	Habitat present, and no current survey conducted; may affect	Habitat recorded during field surveys at the following locations: MP 59.8–59.7; 52.6–51.9; and 51.1–50.9
Swamp-pink (*Helonias bullata*)	SE	Species not known to be present; not likely to adversely affect	There are no records of this species occurring in any of the subwatersheds crossed by this area (VDCR, 2014)
Build Alternative 4A			
Green Floater (*Lasmigona subviridis*)	ST	Species not known to be present; not likely to adversely affect	Thought to be completely eliminated from Hanover County and Pamunkey (02080106) watersheds (NatureServe, 2014)
New Jersey Rush (*Juncus caesariensis*)	ST	Potential habitat present, and no current survey conducted; may affect	There are historic records of the potential of this species occurring in the Poni River and Campbell Creek-Mattaponi River, Reedy Creek, and Polecat Creek subwatersheds (VDCR, 2014) in Caroline County (USFWS, 2014a and NatureServe, 2014) within the Mattaponi (02080105) watershed and the Lower Rappahannock (02080104) watershed (NatureServe, 2014)
Swamp-pink (*Helonias bullata*)	SE	Potential habitat present, and no current survey conducted; may affect	There are historic records or the potential of this species occurring in the Campbell Creek-Mattaponi River subwatershed (VDCR, 2014) in Caroline County (USFWS, 2014a) crossed by this this alternative area; there were 17 wetlands recommended for further survey, including 04-WTL-11, 04-WTL-14, 04-WTL-15, 04-WTL-16, 04-WTL-21, 04-WTL-22, 04-WTL-25, 04-WTL-26, 04-WTL-32, 04-WTL-33, 04-WTL-39, 04-WTL-40, 04-WTL-42, 04-WTL-43, 04-WTL-46, 04-WTL-48, and 04-WTL-50
Tiger Salamander (*Ambystoma tigrinum*)	SE	Species not known to be present; not likely to adversely affect	Thought to be completely eliminated from Hanover County and Pamunkey (02080106) watersheds (NatureServe, 2014)
Virginia Piedmont Water Boatman (*Sigara depressa*)	SE	Species not known to be present; not likely to adversely affect	This species in only known or likely to occur in one watershed in Virginia; it is not located near the proposed Project (VDGIF, 2014b)
Build Alternatives 5A, 5A–Ashcake, 5B, 5B–Ashcake, 5C, 5C–Ashcake, and 5D–Ashcake			
Green Floater (*Lasmigona subviridis*)	ST	Species not known to be present; not likely to adversely affect	Thought to be completely eliminated from Hanover County and Pamunkey (02080106) watersheds (NatureServe, 2014)
Tiger Salamander (*Ambystoma tigrinum*)	SE	Species not known to be present; not likely to adversely affect	Thought to be completely eliminated from Hanover County and Pamunkey (02080106) watersheds (NatureServe, 2014)

Table 4-12: Potential for State-listed Species to be Affected by Project

Species/ Resource Name	Status*	Conclusion	Notes
Build Alternatives 6A, 6B–A-Line, 6B–S-Line, 6C, 6D, 6E, 6F, and 6G			
Barking Treefrog (*Hyla gratiosa*)	ST	Potential habitat present. and no current survey conducted; may affect	This species is known or likely to occur in the Falling Creek (VDCR, 2014 and VDGIF, 2014b) and Proctors Creek-James River (VDGIF, 2014b) subwatersheds in Chesterfield County (NatureServe, 2014)
Peregrine Falcon (*Falco peregrinus*)	ST	Species present; may affect; coordination with VDGIF required	Several active nests were recorded in 2009 within 3 miles of this alternative area near River Front Plaza in Richmond
Sensitive Joint-vetch (*Aeschynome virginica*)	ST	Species unlikely to be present in the project area	It is generally agreed by the different regulatory agencies that this species can be found throughout Virginia, but no habitat in in the Richmond area would be affected
Swamp-pink *(Helonias bullata*)	SE	Species potentially present in region, but no suitable habitat identified; not likely to affect	Species has historical occurrences in the region; however, no suitable habitat in the Richmond area was identified

*SE – State Endangered; ST – State Threatened.

4.2.3.1 Bald Eagle and Golden Eagle Protection Act

Bald eagle (Haliaeetus leucocephalus) is listed under Tier II of the Virginia Wildlife Action Plan for "Very High Conservation Need." The Bald eagle is no longer listed as threatened, but this discussion was left in this section since it is still protected under some laws. Table 4-13 lists bald eagles nests that would have their buffer zones encroached on by proposed construction of the Build Alternatives (Figure 4-2). Disturbance of nesting bald eagles is unlikely to occur if the following guidelines are followed:

- Clearing, grubbing, and construction activities within 660 feet, but outside 330 feet, can be restricted to outside of the breeding season (mid-December to June), even if these activities are occurring within railroad right-of-way
- A buffer of at least 660 feet can be maintained between all activities and the nest (including active and alternate nests)
  - If a similar activity is closer than 660 feet, then a distance buffer as close to the nest as the existing tolerated activity may be maintained
- A buffer of at least 0.5 mile, or 1 mile in open areas, can be maintained for blasting and other activities that produce extremely loud noises, or restricted to outside the breeding season (USFWS, 2007)

Construction activities in Bald Eagle Concentration Areas may also negatively affect bald eagles. Bald eagles congregate in these locations for feeding and sheltering (roosting) because of their proximity to food sources. Construction activities may prevent bald eagles from foraging and roosting in these locations, resulting in disturbance that may stress or relocate the species to less optimal habitat. Permanent alterations at these sites can eliminate or reduce essential feeding and

sheltering habitat. Bald Eagle Concentration Areas are intersected near Aquia Creek, Potomac River, Quantico Creek, Powells Creek, Neabsco Creek, and Occoquan River.

Table 4-13: Number of Bald Eagle Nests within Buffer Zones

Alternative Area	Alternative	2,640 feet or up to 5,280 feet in open areas[1]	660 feet[2]	330 feet[3]
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	18	8	4
Area 6: Richmond (I-295 to Centralia)	6A	1	–	–
	6B–A-Line	1	–	–
	6B–S-Line	1	–	–
	6C	1	–	–
	6D	–	–	–
	6E	1	–	–
	6F	–	–	–
	6G	1	–	–

Source: CCB, 2016.

Notes:

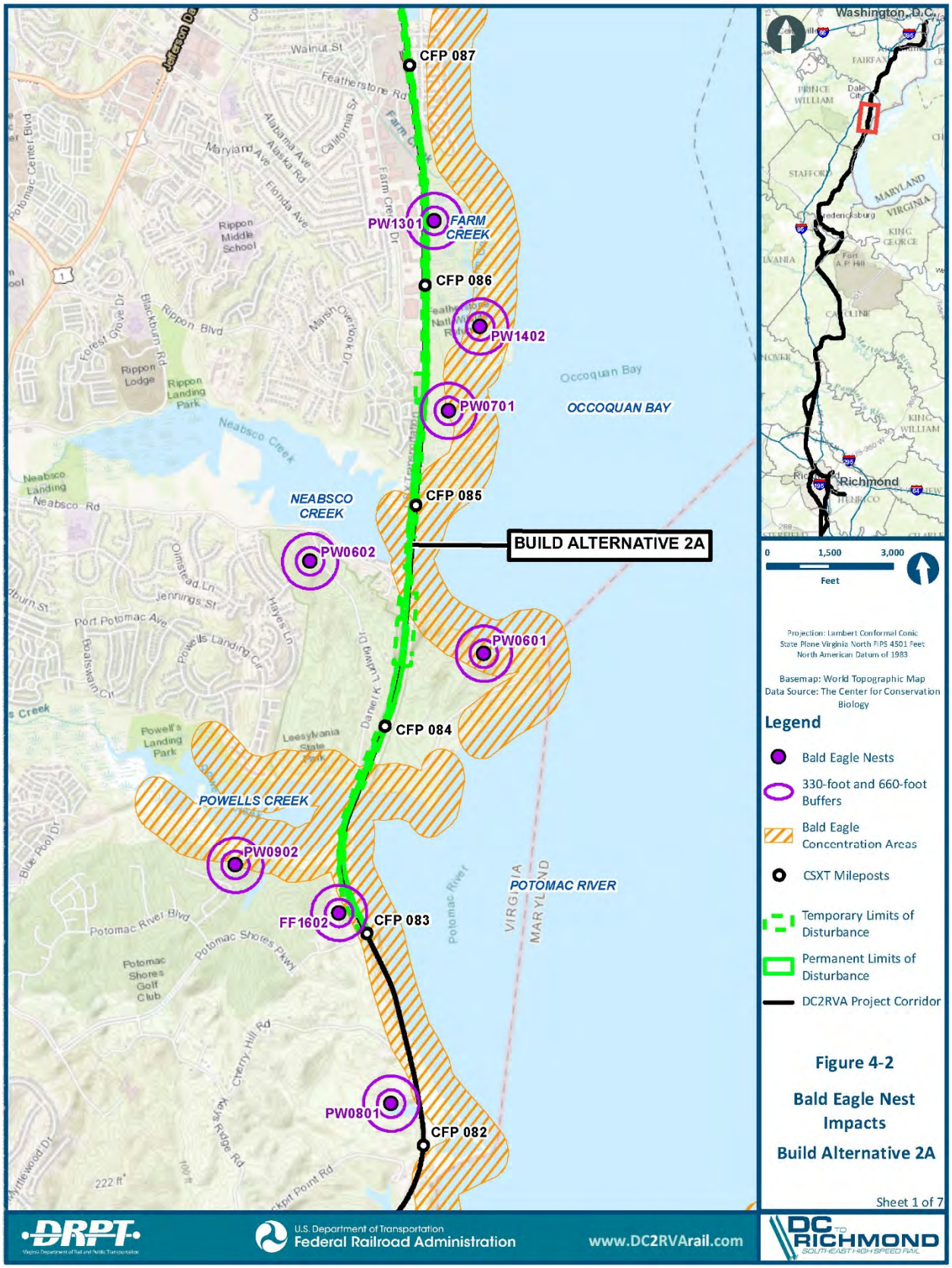
1. For projects that have blasting or other loud noise components
2. Clearing, external construction, and landscaping between 330 and 660 feet should be done outside breeding season (PW1301, PW0701, FF1602, PW0801, PW0903, PW1501, PW1101, and ST1003)
3. 330 feet, or as close as existing tolerated activity of similar scope (PW1301, PW0903, PW1101, FF1602)

None of the Build Alternatives are within bald eagle nest buffer zones in Alternative Areas 1, 3, 4, or 5

4.2.3.2 Avoidance, Minimization, and Mitigation Evaluation

DRPT will coordinate with USFWS, EPA, VDCR, VDGIF, and other regulatory agencies will continue regarding habitat and wildlife—rare, threatened, and endangered species, bald eagles, migratory birds, anadromous fish, and SAV in particular—to ensure impacts are avoided to the extent practicable through the final design process and appropriate mitigation is developed where impacts are unavoidable. DRPT will reduce the likelihood of adverse effects through use of these measures:

- Minimizing the LOD through design
- Following appropriate BMPs for sediment and erosion control during construction
- Using infiltration stormwater management
- Minimizing clearing and grubbing
- Prompt reseeding of disturbed areas with native vegetation
- TOY restrictions (Table 4-14)


CFP 087
CFP 086
CFP 085
CFP 084
CFP 083
CFP 082
PW1301
FARM CREEK
PW1402
PW0701
OCCOQUAN BAY
NEABSCO CREEK
PW0602
BUILD ALTERNATIVE 2A
PW0601
POWELLS CREEK
PW0902
FF1602
POTOMAC RIVER
PW0801
Occoquan Bay
Neabsco Creek
Potomac River
Washington, D.C.
Richmond
0 1,500 3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
Legend
Bald Eagle Nests
330-foot and 660-foot Buffers
Bald Eagle Concentration Areas
CSXT Mileposts
Temporary Limits of Disturbance
Permanent Limits of Disturbance
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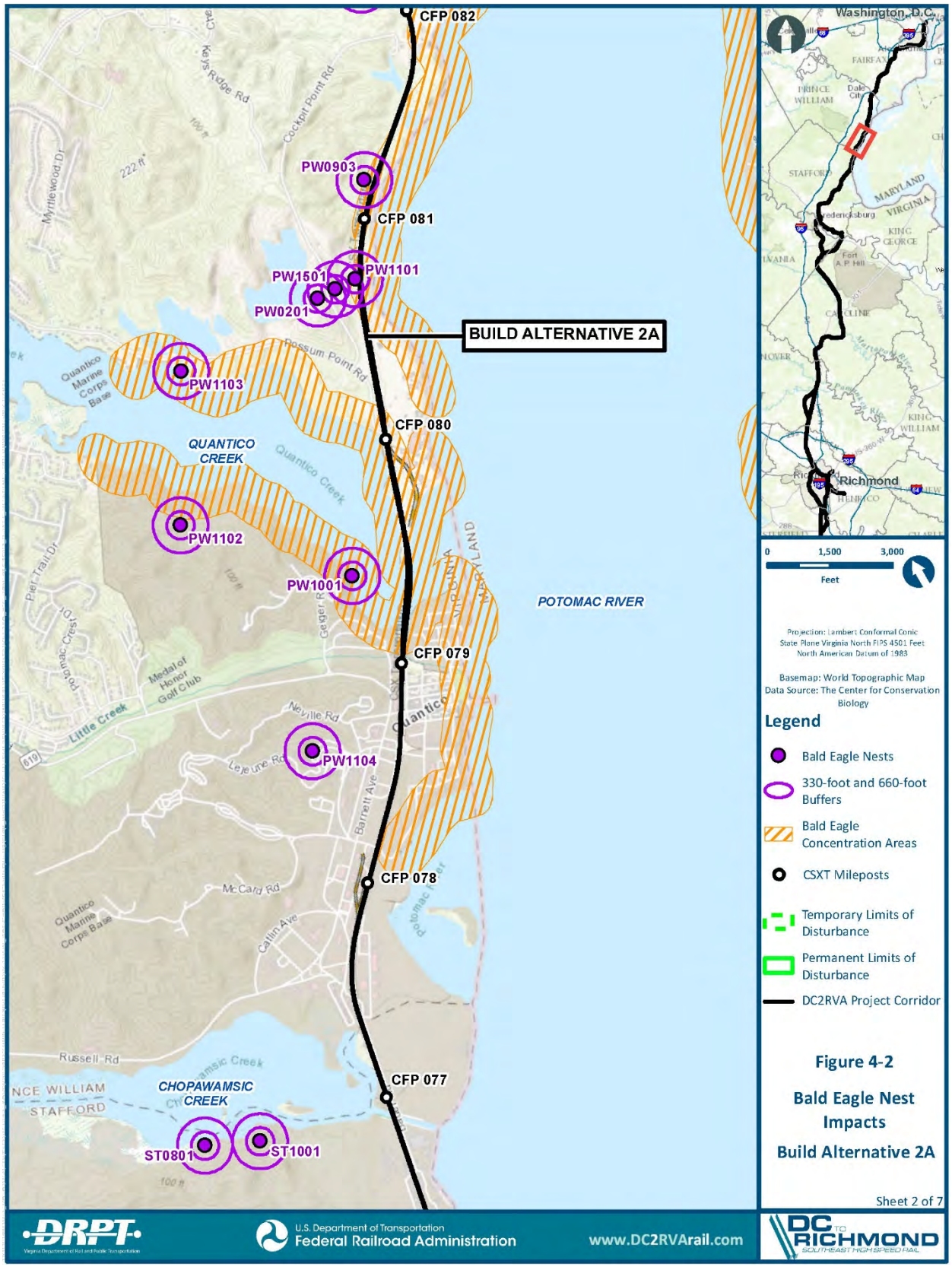
CFP 082
PW0903
CFP 081
PW1501
PW1101
PW0201
BUILD ALTERNATIVE 2A
PW1103
CFP 080
QUANTICO CREEK
PW1102
PW1001
POTOMAC RIVER
CFP 079
PW1104
CFP 078
CFP 077
CHOPAWAMSIC CREEK
ST0801
ST1001
Washington, D.C.
Richmond
0
1,500
3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
Legend
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330-foot and 660-foot Buffers
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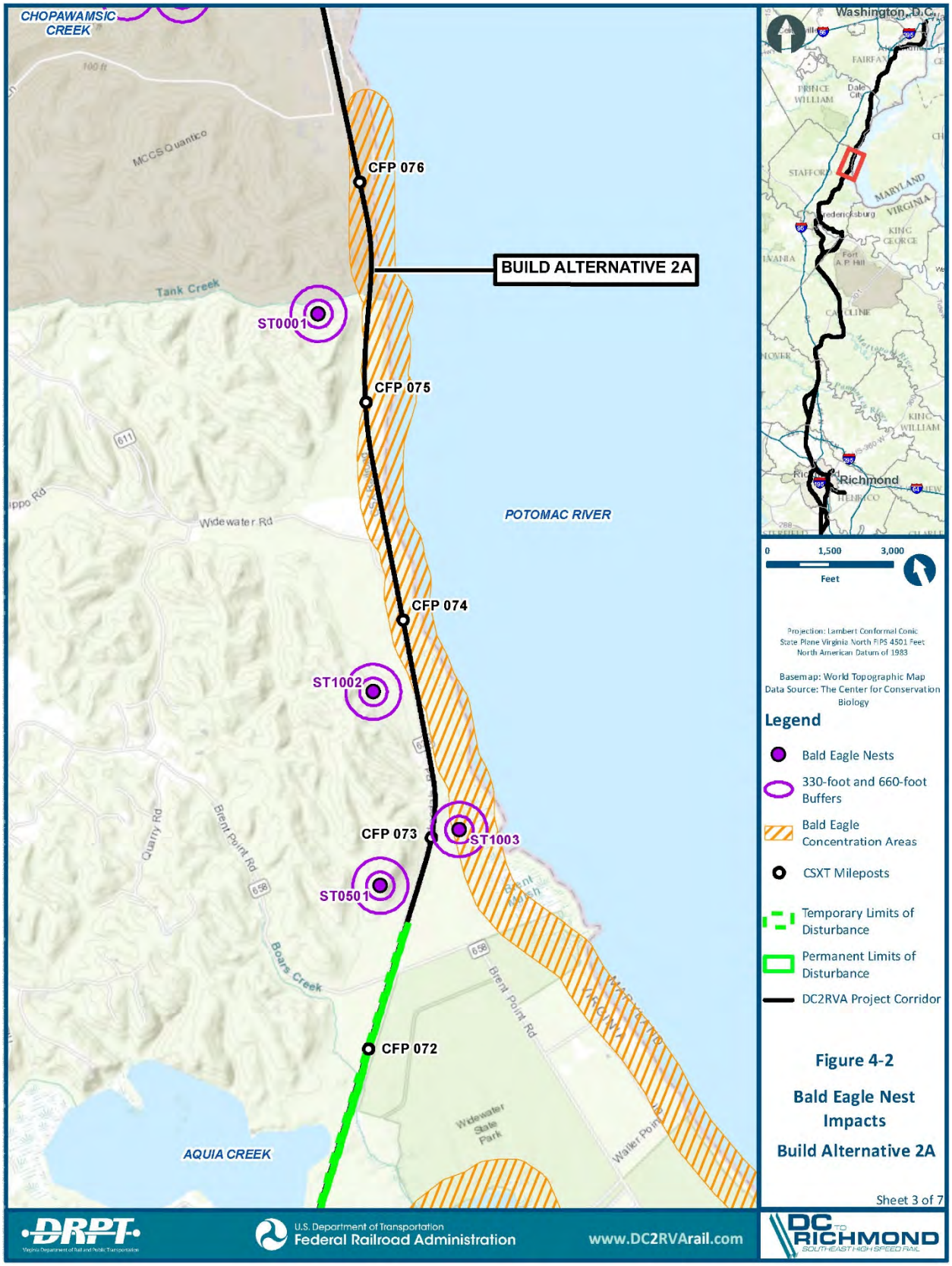
CHOPAWAMSIC CREEK
MCCS Quantico
CFP 076
BUILD ALTERNATIVE 2A
Tank Creek
ST0001
CFP 075
POTOMAC RIVER
Widewater Rd
CFP 074
ST1002
CFP 073
ST1003
ST0501
Quarry Rd
Brent Point Rd
Boars Creek
CFP 072
Widewater State Park
AQUIA CREEK
Washington, D.C.
Richmond
0
1,500
3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
Legend
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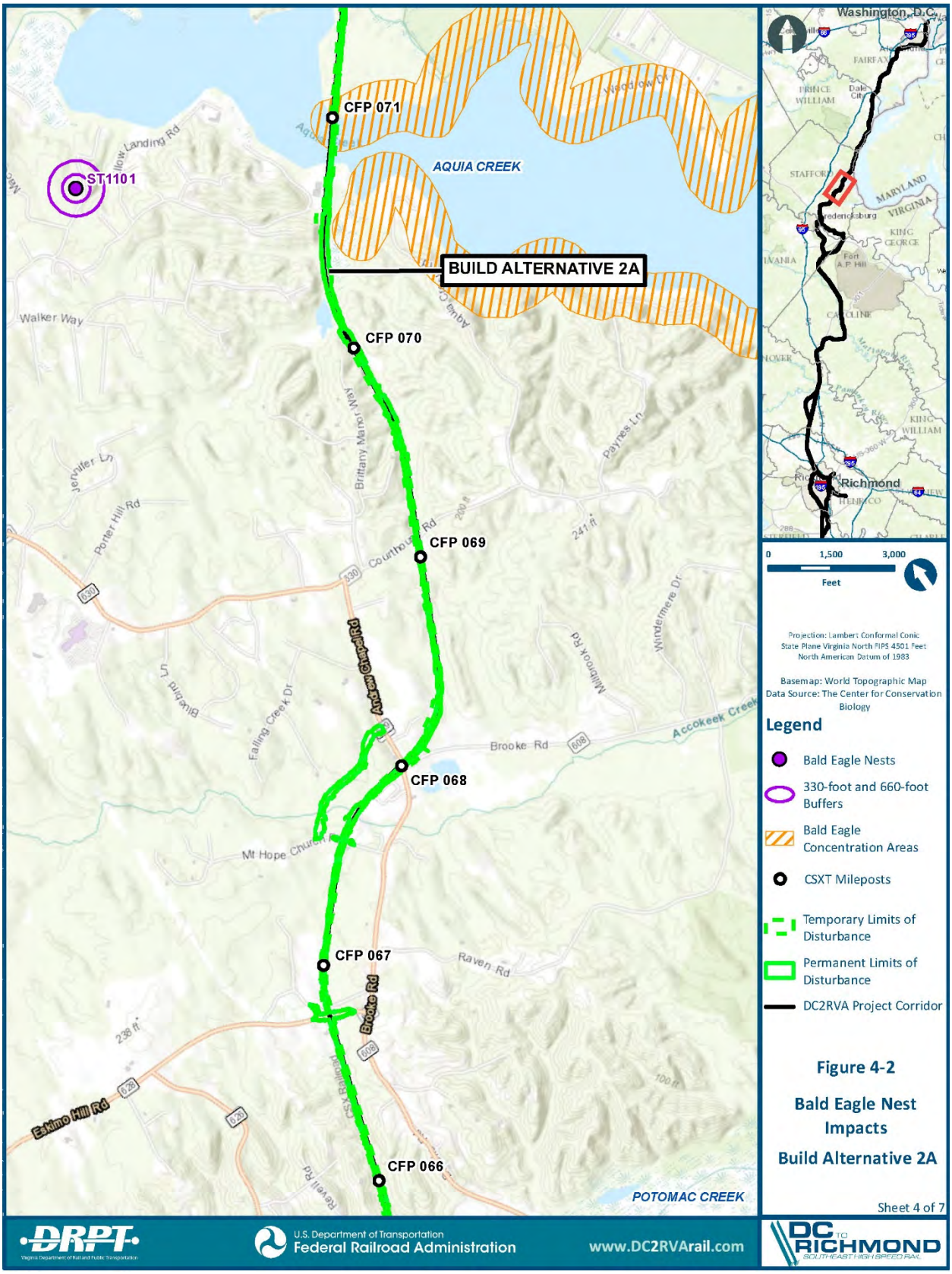
CFP 071
AQUIA CREEK
ST1101
BUILD ALTERNATIVE 2A
CFP 070
CFP 069
CFP 068
CFP 067
CFP 066
POTOMAC CREEK
Aquia Landing Rd
Walker Way
Brittany Manor Way
Porter Hill Rd
Courthouse Rd
Andrew Chapel Rd
Falling Creek Dr
Brooke Rd
Mt Hope Church
Raven Rd
Eskimo Hill Rd
Paynes Ln
Windermere Dr
Accokeek Creek
Washington, D.C.
Richmond
0 1,500 3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
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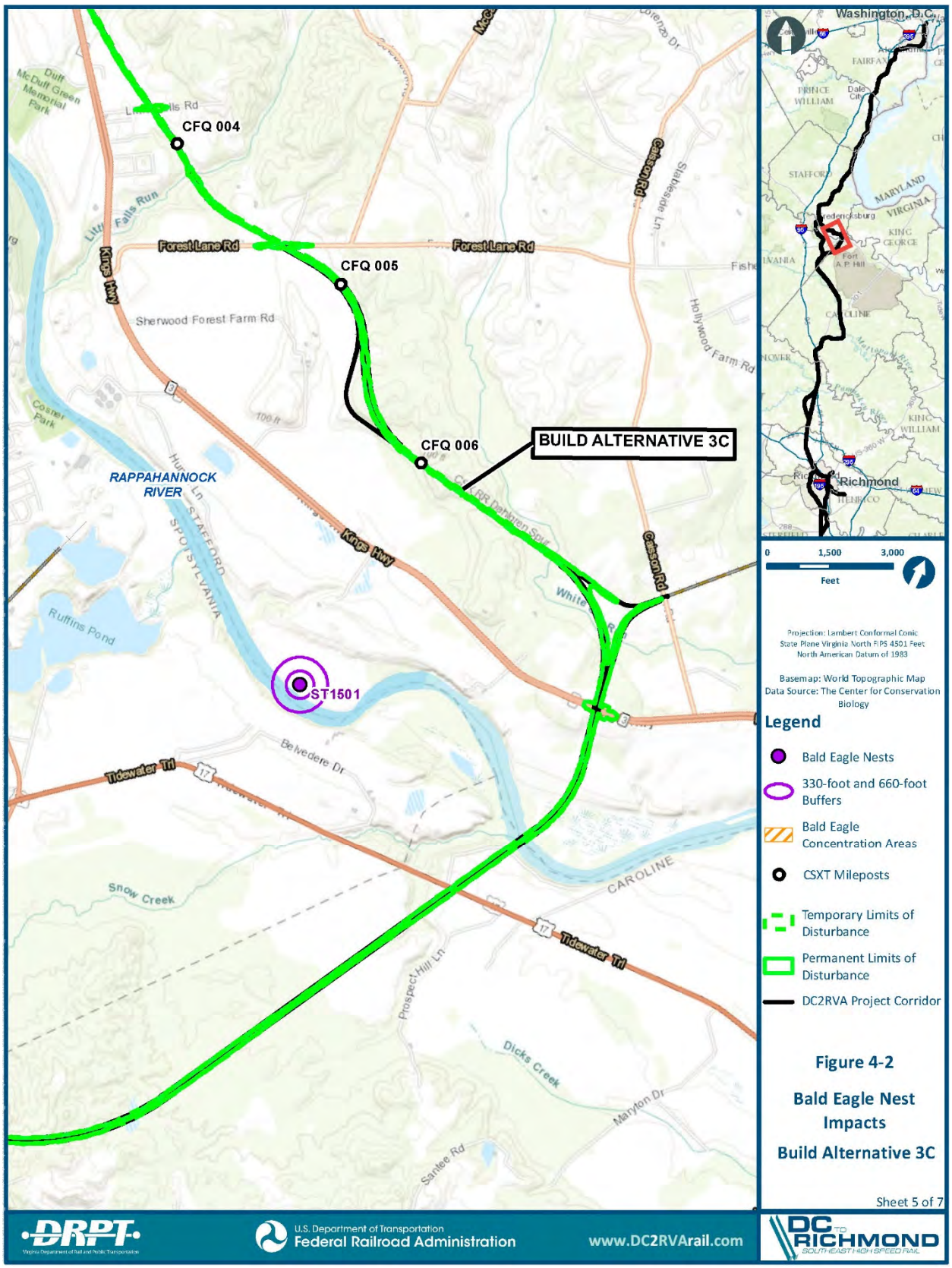
CFQ 004
CFQ 005
CFQ 006
BUILD ALTERNATIVE 3C
Forest Lane Rd
Forest Lane Rd
Sherwood Forest Farm Rd
Kings Hwy
Kings Hwy
RAPPAHANNOCK RIVER
ST1501
Ruffins Pond
Belvedere Dr
Tidewater Trl
Tidewater Trl
Snow Creek
Prospect Hill Ln
Dicks Creek
Marylon Dr
Santee Rd
Gaskon Rd
Gaskon Rd
Hollywood Farm Rd
Duff McDuff Green Memorial Park
Little Falls Run
Cosner Park
Washington, D.C.
Richmond
0
1,500
3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
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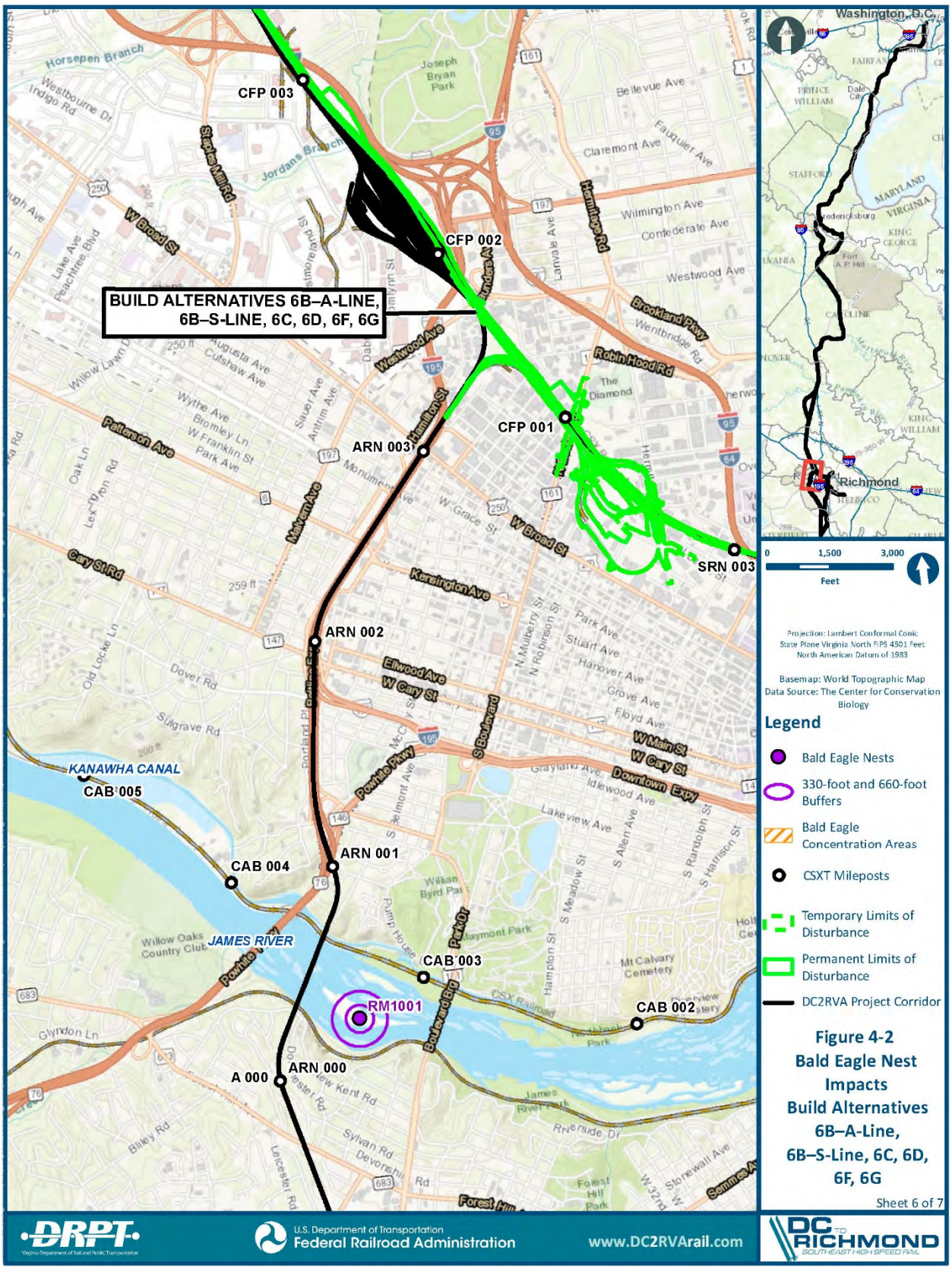
BUILD ALTERNATIVES 6B–A-LINE, 6B–S-LINE, 6C, 6D, 6F, 6G
CFP 003
CFP 002
CFP 001
ARN 003
ARN 002
ARN 001
ARN 000
A 000
SRN 003
CAB 005
CAB 004
CAB 003
CAB 002
RM1001
KANAWHA CANAL
JAMES RIVER
Washington, D.C.
Richmond
0 1,500 3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
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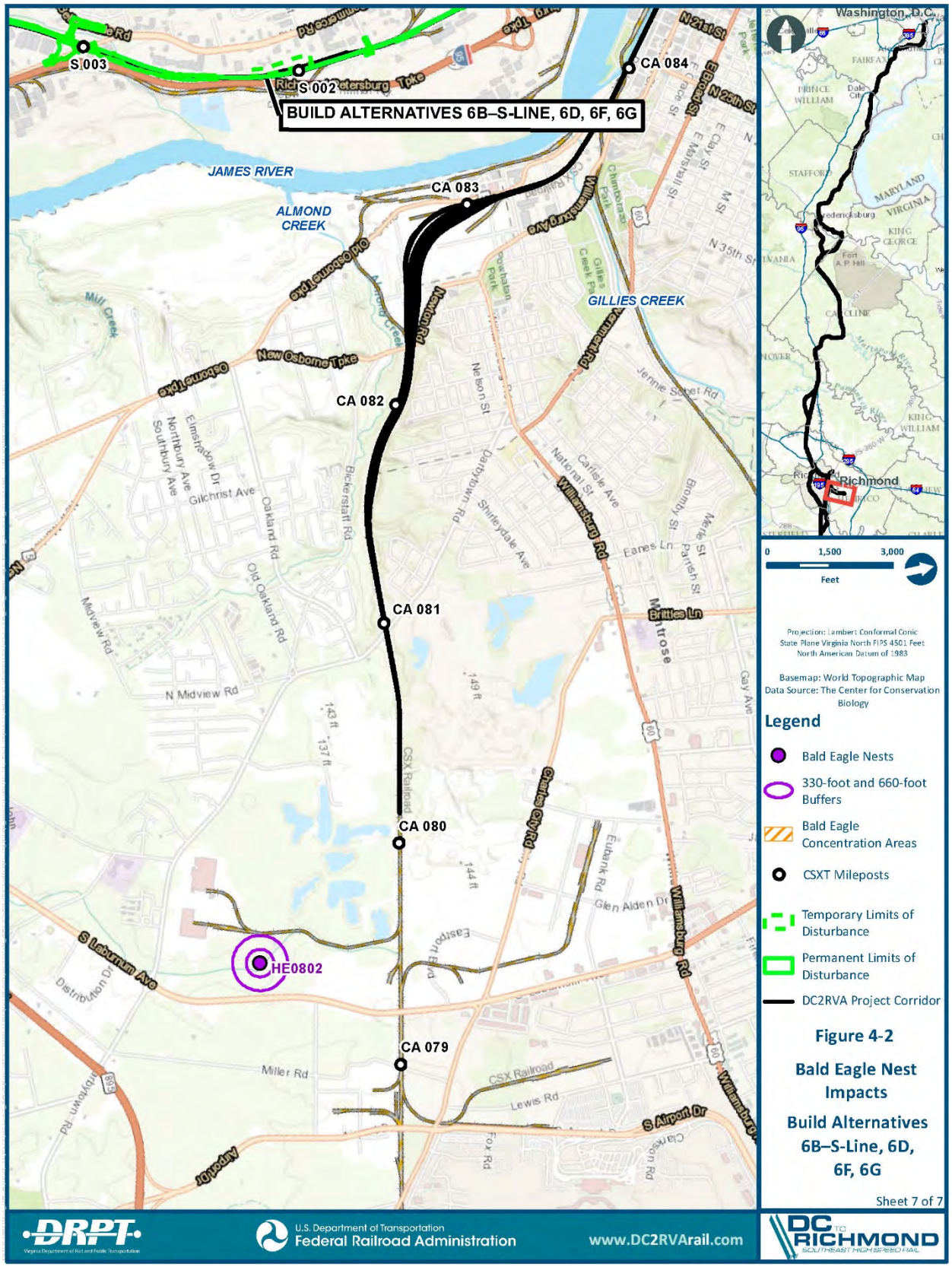
BUILD ALTERNATIVES 6B–S-LINE, 6D, 6F, 6G
S 003
S 002
CA 084
CA 083
CA 082
CA 081
CA 080
CA 079
HE0802
JAMES RIVER
ALMOND CREEK
GILLIES CREEK
Washington, D.C.
Richmond
0 1,500 3,000
Feet
Projection: Lambert Conformal Conic
State Plane Virginia North FIPS 4501 Feet
North American Datum of 1983
Basemap: World Topographic Map
Data Source: The Center for Conservation Biology
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Table 4-14: Potential Mitigation Measures for Threatened and Endangered Species with Potential to Occur in the DC2RVA Corridor

Species	Status	Potential Mitigation Measures
Dwarf Wedgemussel (*Alasmidonta heterodon*)	FE	Time-of-year restrictions; limit in-stream work to the extent practicable, limit removal of stream bank vegetation and prompt reestablishment of disturbed banks; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Harperella (*Ptilimnium nodosum*)	FE	Minimize construction LOD and avoid placing staging areas or entering areas of known or likely populations; prompt reestablishment of disturbed banks; transplanting or propagation of species; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Indiana bat *(Myotis sodalis)*	FE	Time-of-year restrictions; implement applicable guidance in the 2007 Draft Recovery Plan and Habitat Conservation Plans; minimization of construction, staging areas, or human disturbance along riparian corridors where this species prefers to forage
Northern Long-eared Bat (*Myotis septentrionalis*)	FT	Time-of-year restrictions; minimization of construction, staging areas, or human disturbance along riparian corridors where this species prefers to forage and rocky slopes used by this species for basking
Sensitive Joint-vetch (*Aeschynome virginica*)	FT/ST	Minimize of construction LOD and avoid placing staging areas or entering areas of known or likely populations; prompt reestablishment of native vegetation; transplanting or propagation of species; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Small Whorled Pogonia (*Isotria medeoloides*)	FT/SE	Minimize of construction LOD and avoid placing staging areas or entering areas of known or likely populations; prompt reestablishment of native vegetation; transplanting or propagation of species; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Swamp-pink *(Helonias bullata*)	FT/SE	Minimize of construction LOD and avoid placing staging areas or entering areas of known or likely populations; prompt reestablishment of native vegetation; transplanting or propagation of species; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Bald Eagle (*Haliaeetus leucocephalus*)	ST	Time-of-year restrictions; expanded discussion following this table
Barking Treefrog (*Hyla gratiosa*)	ST	Time-of-year restrictions; avoidance or minimization of impacts to fishless wetlands in the areas where this species is known or likely to occur; installation of small wildlife culverts in areas where this species is known to occur
Green Floater (*Lasmigona subviridis*)	ST	Time-of-year restrictions; limit in-stream work to the extent practicable; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
New Jersey Rush (*Juncus caesariensis*)	ST	Minimize of construction LOD and avoid placing staging areas or entering areas of known or likely populations; prompt reestablishment of native vegetation; transplanting or propagation of species; stormwater management to limit sediment and pollution to receiving waters known or likely to support this species
Peregrine Falcon (*Falco peregrinus*)	ST	Time-of-year restrictions; monitoring of nests if work is required during the nesting season to ensure construction activities are not disrupting breeding pairs
Wood Turtle (*Glyptemys insculpta*)	ST	Time-of-year restrictions; installation of small wildlife culverts in areas where this species is known to occur

Source: VDGIF, 2016.

Bald Eagle. According to the USFWS National Bald Eagle Management Guidelines to minimize disturbance, activities should be conducted outside of the breeding season, if possible, and kept as far away from nests as possible. Loud and disruptive activities should be limited to periods when eagles are not nesting, and activity between the nest and nearest foraging area should be avoided.

General guidance for Category A activities, such as constructing roads and other linear facilities, and Category H, such as blasting and other loud, intermittent noises, is outlined in Table 4-15 (USFWS, 2007). It may be necessary to also obtain a permit issued under the Bald and Golden Eagle Act (16 United States Code [U.S.C.] 668-668c, 54 Stat. 250), as amended, for activities located in Bald Eagle Concentration Areas. This would be determined during the design process. Specific avoidance, minimization, and mitigation would be developed in coordination with USFWS and VDGIF and may require development of an eagle conservation plan.

Table 4-15: Bald Eagle Management Guidelines

		If there is no similar activity within 1 mile of the nest	**If there is similar activity closer than 1 mile from the nest**
Category A activities, such as construction of roads and other linear facilities	If the activity will be visible from the nest	660 feet. Landscape buffers are recommended.	660 feet, or as close as existing tolerated activity of similar scope. Landscape buffers are recommended.
	If the activity will not be visible from the nest	330 feet. Clearing, external construction, and landscaping between 330 and 660 feet should be done outside breeding season.	330 feet, or as close as existing tolerated activity of similar scope. Clearing, external construction, and landscaping within 660 feet should be done outside breeding season.
Category H, such as blasting and other loud, intermittent noises	Avoid blasting and other activities that produce extremely loud noises within 0.5 mile of active nests (or within 1 mile in open areas), unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area.		

Source: USFWS, 2007.

5 SUMMARY OF IMPACTS

Table 5-1 summarizes environmental issues and their relevance to the project. Table 5-2 summarizes the impacts of the build alternatives. The environmental data and findings presented herein were gathered from federal, state, and local agencies; previous area studies; existing literature and websites; aerial photography; geographic information system (GIS) databases; and field surveys in the study area.

In Alternative Areas 1, 3, 5, and 6, there is more than one Build Alternative considered. In Alternative Areas 2 and 4, there is a single Build Alternative considered.

In Alternative Area 1 (Arlington), impacts to natural resources are limited and do not vary substantially between Build Alternatives 1A, 1B, and 1C.

In Alternative Area 3 (Fredericksburg), impacts to natural resources are generally greater along the Fredericksburg Bypass (Build Alternative 3C) than along the Build Alternatives through town (Build Alternatives 3A and 3B). Exceptions to this include drinking water and anadromous fish use waters.

In Alternative Area 5 (Ashland), impacts to natural resources are generally greater along the Ashland Bypass (Build Alternatives 5C and 5C–Ashcake) than along the Build Alternatives through town (Build Altenratives 5A, 5A–Ashcake, 5B, 5B–Ashcake, and 5D–Ashcake).

In Alternative Area 6 (Richmond), Build Alternative 6C has the greatest impacts for many of the natural resources; however, the Build Alternatives that use the S-Line (Build Alternatives 6B–S-Line, 6D, 6F, and 6G) have greater stream, aqueous habitat, and anadromous fish use waters impacts.

Table 5-1: Summary of Environmental Resources

Resource	Comment
Waters of the U.S., Including Wetlands	Water resources are regulated by the EPA, the USACE, the State Water Control Board, and the Virginia DEQ according to the Water Pollution Control Act of 1972 (Clean Water Act), the Water Quality Act of 1987, and the Resource Conservation and Recovery Act as amended in 1984. Approximately 490.2 acres of wetlands and 204,563 linear feet of streams are located within the DC2RVA survey area. **See Section 3.1.3 Surface Waters, Rivers, and Streams and Section 3.1.5 Wetlands**.
Navigable Waters	Work in or near navigable waters may require consultation with or permits from the USCG. According to the USACE, eight waters crossed by the DC2RVA alignment are navigable: Occoquan River, Neabsco Creek, Powells Creek, Aquia Creek, Rappahannock River, Hazel Run, Mattaponi River, and James River. **See Section 3.1.4.1 Navigable Waters.**

Table 5-1: Summary of Environmental Resources

Resource	Comment
State Scenic Rivers	State Scenic River designation constitutes official recognition of the natural, scenic, historic and recreational values of some of Virginia's most valuable riverine resources. Qualities of state designated rivers are considered for federal projects on that river. The DC2RVA alignment crosses five State Scenic Rivers: Occoquan River, Rappahannock River, North Anna River, South Anna River, and James River. **See Section 3.1.4.2 State Scenic Rivers.**
Nationwide Rivers Inventory	Under a 1979 Presidential Directive, and related Council on Environmental Quality procedures, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments. Two of the rivers crossed by the DC2RVA corridor are listed on the NRI: North Anna River and South Anna River. **See Section 3.1.4.3 Nationwide Rivers Inventory.**
Chesapeake Bay Preservation Areas	The Chesapeake Bay Preservation Act was enacted by the Virginia General Assembly in 1988 to protect and manage Virginia's "coastal zone." The study area includes 1,760 acres of Chesapeake Bay Resource Protection Areas (RPA). The remainder of the land located within the study location is considered to be Resource Management Area (RMA). The DC2RVA project is conditionally exempt from additional avoidance or minimization impacts to RPAs provided it is constructed in accordance with the Erosion and Sediment Control Law (§10.1-560 *et seq.* of the Code of Virginia) and the Stormwater Management Act (§10.1-603. 1 *et seq.* of the Code of Virginia.) **See Section 3.1.4.4 Chesapeake Bay Preservation Areas.**
Virginia Coastal Zone Management Areas	Pursuant to Section 307 of the Coastal Zone Management Act of 1972, as amended, and National Oceanic and Atmospheric Administration (NOAA) *Federal Consistency Regulations* (15 CFR Part 930), federal agency projects occurring within, or with reasonably foreseeable likelihood to affect Virginia's coastal uses or resources must be conducted in a manner which is consistent to the maximum extent practicable with the Virginia Coastal Zone Management Program (VCP); and require submittal of a Consistency Determination. The entire project area is located within Virginia's coastal zone. **See Section 3.1.4.5 Virginia Coastal Zone Management Areas.**
Floodplains and Floodways	Executive Order 11988 (Floodplain Management) requires Federal agencies to avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of flood plains. Approximately 3,574 acres of 100-year floodplains, as designated by the Federal Emergency Management Agency, are located within the planning level right of way limits. **See Section 3.1.6 Floodplains and Floodways**.
Water Quality	In compliance with Sections 303(d), 305(b), and 314 of the Federal Clean Water Act and the Safe Drinking Water Act, Virginia DEQ has developed a prioritized list of water bodies that currently do not meet water quality standards. According to the Virginia DEQ 2014 List of Impaired Waters, of the 62 assessed water bodies crossed by the DC2RVA alignment, 51 have been found to be impaired for one or more uses. **See Section 3.1.7 Water Quality**.
Drinking Water/Aquifers/Water Supply	Public water supplies are regulated directly by the 1974 Safe Drinking Water Act (SDWA) and indirectly by the same regulations governing surface waters. No Sole Source Aquifers (SSA) or Source Protection Areas (SPA) are located in the vicinity of the study area; however the Project falls within Zone 1 (greater than 5 miles into the watershed) of 3 public surface water supply intakes, within Zone 1 (1000 feet) of seven public wellheads, and within Zone 1 (100 feet) of two public and eight private wells. **See Section 3.1.8 Drinking Water/Aquifers/Water Supply**.
Terrestrial and Aquatic Habitat and Wildlife	Impacts to terrestrial and aquatic wildlife would include the elimination of habitat within the limits of construction. Approximately 1,182 acres of aqueous habitat, 1,822 acres of agricultural habitat, 247 acres of shrub area/old field, 6,741 acres of upland forest, 1,646 acres of riparian/bottomland forest/PFO, and 9,016 acres of urban/developed lands are located in the DC2RVA study corridor. **See Section 3.2 Biological Resources**.

Table 5-1: Summary of Environmental Resources

Resource	Comment
Preservation Areas	Communities intended for the preservation of habitat, plants, or wildlife. They are maintained to different degrees by the regulatory agencies and can be publically or privately owned. The DC2RVA study corridor includes three United States Fish and Wildlife Service (USFWS) National Wildlife Refuges, two State Wildlife Lands, one County Wildlife Land, four private wildlife lands, 14 VDCR-DNH - Natural Heritage Conservation Areas, and multiple wildlife corridors and ecological cores. **See Section 3.2.2 Natural Communities.**
Invasive Species	Invasive species are non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm or harm to human health (Executive Order 13112, Invasive Species). State and local governments have also set up several laws and regulations to prevent the spread of noxious weeds and plants deemed to be detrimental to crops, surface waters, including lakes, or other desirable plants, livestock, land, or other property or to be injurious to public health or the economy. Twenty-two (22) species ranked by Virginia Department of Conservation and Recreation (VDCR) as being highly invasive were observed along the corridor, in addition to 10 medium invasive and 5 low invasive species. **See Section 3.2.3 Invasive Species.**
Colonial Waterbirds	Coordination with Virginia Department of Game and Inland Fisheries (VDGIF) is required for waterbird colonies documented in the project vicinity. There are eight recorded Great Blue Heron colonies located within three miles of the DC2RVA corridor. All colonies are located greater than 1.3 miles from existing tracks. **See Section 3.2.4.1 Colonial Waterbirds**.
Migratory Birds	The Migratory Bird Treaty Act (MBTA) of 1918 makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, requires federal agencies to take action to implement the MBTA. The project is located along the landward edge of the Atlantic Flyway, which stretches from the north-eastern side of Canada, Iceland, and the western side of Greenland, along the Atlantic Coast, and down to South America and could disturb migratory species. A permit would be required from the local USFWS jurisdiction for the potential take, and it would include avoidance and minimization measures. **See Section 3.2.4.2 Migratory Birds**.
Fisheries, Anadromous Fish, and Trout Waters	The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a mandate for Federal agencies to identify and protect important marine and anadromous fish habitat. Essential Fish Habitat (EFH) is defined by the Magnuson-Stevens Act as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802 (10)). No Essential Fish Habitat is mapped by NOAA within the project vicinity. Coordination with VDGIF is required any time a Stocked Trout Water is documented within a project area. Only one stocked trout water is located in the project vicinity: Cook Lake in Cameron Run Regional Park. Confirmed Anadromous Fish Use Areas are those waters known to provide migratory and spawning habitats for anadromous fish. Coordination with VDGIF is required for projects in the vicinity of these waters. Twenty (20) Confirmed Anadromous Fish Use waters are crossed by the DC2RVA alignment. **See Section 3.2.5.1 Fisheries, Anadromous Fish, and Trout Waters**.
Submerged Aquatic Vegetation (SAV)	SAV are widely regarded as keystone species and primary indicators of water quality conditions in the Potomac and Chesapeake Bay. According to the Virginia Administrative Code (VAC), 4 VAC 20-337-10 *et seq.* SAV Transplantation Guidelines, any removal of SAV from State bottom would require prior approval by VMRC. Ten of the waters crossed by the DC2RVA project alignment contain SAV beds. **See Section 3.2.5.2 Submerged Aquatic Vegetation (SAV)**.

Table 5-1: Summary of Environmental Resources

Resource	Comment
Threatened and Endangered Species	An online search of records from the VDCR, the USFWS, and the VDGIF of potential species that may occur in the project vicinity, revealed seven federally-listed and an additional eight state-listed species with the potential of occurring in the DC2RVA project corridor. **See Section 3.2.6 Threatened and Endangered Species**.

Table 5-2: Summary of Environmental Impacts within Planning Level Right-of-Way Limits

Area	Alternative	Water Resources									Drinking Water					Habitat							Conservation Lands					Species of Concern			
		Number of Streams	Stream Length (linera Feet)	Stream Area (Acres)	Navigable Waters (linear Feet)	State Scenic Rivers (Linear Feet)	Nationwide Rivers Inventory (linear feet)	Chesapeake Bay RPA (Acres)	Floodplains (Acres)	Total Wetlands (acres)	Public Surface Water -Zone 1[1] (Acres)	Public Ground Water -Zone 1 (Acres)	Public Ground Water -Zone 2 (Acres)	Private Wells 100-foot radius (ft^2)	Private Wells 200-foot radius (ft^2)	Agricultural Habitat (Acres)	Aqueous Habitat (Acres)	Upland Forest (Acres)	Shrub Area/Old Field (Acres)	Riparian/Bottomland Forest/PFO (Acres)	Urban/Developed Lands (Acres)	Total Without Developed Lands (Acres)	USFWS National Wildlife Refuges (Acres)	State Wildlife Lands (Acres)	County Wildlife Lands (Acres)	Private Wildlife Lands (Acres)	Priority Conservation Areas (Acres)	Submerged Aquatic Vegetation (Acres)	Anadromous Fish Use Waters (linear feet)	Federally-Listed T&E Species Potentially Impacted	State-Listed T&E Species Potentially Impacted
Area 1: Arlington (Long Bridge Approach)	1A	–	—	—	—	—	—	4.0	0.3	0.02	–	–	–	–	–	–	–	–	–	–	–	–	–	n/a	n/a	n/a	n/a	–	–	–	–
	1B	–	–	–	–	–	–	4.8	0.1	–	–	–	–	–	–	–	–	–	–	–	1.5	1.5	–	n/a	n/a	n/a	n/a	–	–	–	–
	1C	–	–	–	–	–	–	6.0	0.1	0.01	–	–	–	–	–	–	–	–	–	–	0.4	0.4	–	n/a	n/a	n/a	n/a	–	–	–	–
Area 2: Northern Virginia (Long Bridge to Dahlgren Spur)	2A	52	7,198	3.0	205.7	44.4	–	67.9	15.1	5.19	32.75	–	26.37	7,822	72,243	2.1	1.1	15.0	0.2	1.3	13.2	32.9	–	–	–	n/a	0.01	1.70	6,228	5	5
Area 3: Fredericksburg (Dahlgren Spur to Crossroads)	3A	16	1,101	–	–	–	–	36.9	7.7	5.24	–	–	16.91	3,343	57,106	0.1	0.1	0.4	–	0.1	1.5	2.2	n/a	n/a	n/a	–	0.03	n/a	227	4	3
	3B	20	1,506	0.4	45.0	45.0	–	41.0	10.5	5.29	–	–	16.91	16,365	105,610	2.3	1.9	2.1	–	0.1	13.4	19.8	n/a	n/a	n/a	–	0.10	n/a	2,145	4	3
	3C	43	4,597	0.5	44.5	44.5	–	57.9	8.0	23.82	–	–	13.98	279	41,238	32.7	8.5	66.9	–	13.2	19.3	140.6	n/a	n/a	n/a	22.31	83.36	n/a	1,396	4	3
Area 4: Central Virginia (Crossroads to Doswell)	4A	32	3,627	0.2	64.8	40.5	40.5	69.7	17.2	8.39	42.48	0.81	37.55	4,117	18,088	0.9	0.3	0.5	0.1	0.1	0.7	2.6	n/a	–	n/a	n/a	–	n/a	1,146	4	2
Area 5: Ashland (Doswell to I-295)	5A	23	6,928	0.1	–	40.1	40.1	16.6	5.9	0.41	8.36	–	9.25	–	13,688	1.2	–	2.4	–	0.2	18.1	21.9	n/a	n/a	n/a	n/a	0.59	n/a	230	2	–
	5A–Ashcake	22	6,928	0.1	–	40.1	40.1	17.7	7.1	0.41	8.36	–	11.59	–	–	1.2	–	2.4	–	0.2	16.4	20.2	n/a	n/a	n/a	n/a	0.59	n/a	230	2	–
	5B	24	9,114	0.1	–	40.1	40.1	19.4	6.5	0.41	8.36	–	9.33	609	26,018	1.2	–	2.4	–	0.6	25.6	29.4	n/a	n/a	n/a	n/a	0.59	n/a	230	2	–

	5B–Ashcake	23	9,101	0.1	–	40.1	40.1	23.4	10.7	0.45	8.36	–	15.21	609	15,411	1.2	–	2.4	–	0.6	25.9	29.7	n/a	n/a	n/a	n/a	0.59	n/a	230	2	–
	5C	26	9,005	0.1	–	40.1	40.1	31.6	9.2	8.44	31.06	4.70	44.09	4,205	19,098	29.3	2.3	64.0	11.0	4.7	36.5	147.8	n/a	n/a	n/a	n/a	4.80	n/a	230	2	–
	5C–Ashcake	26	9,005	0.1	–	40.1	40.1	32.6	10.4	8.48	31.06	4.70	46.53	4,205	5,410	29.3	2.3	64.0	11.0	4.7	34.8	146.1	n/a	n/a	n/a	n/a	4.80	n/a	230	2	–
	5D–Ashcake	28	8,163	0.1	–	40.1	40.1	25.7	11.5	0.45	8.36	–	16.12	–	17,321	1.2	–	2.0	–	0.2	32.3	36.1	n/a	n/a	n/a	n/a	0.59	n/a	230	2	–
Area 6: Richmond (I-295 to Centralia)	6A	30	7,523	0.1	–	–	–	53.5	8.1	3.21	51.70	–	–	–	21,701	–	–	3.7	–	1.5	70.8	76.0	n/a	n/a	n/a	n/a	0.15	n/a	242	2	3
	6B–A-Line	34	9,650	0.1	–	–	–	59.3	11.3	2.91	121.10	–	–	–	16,364	–	–	3.9	–	1.5	95.6	101.0	n/a	n/a	n/a	n/a	0.15	n/a	242	2	3
	6B–S-Line	36	8,819	0.8	31.7	31.7	–	55.1	48.6	3.47	125.26	–	–	3.73	28,214	–	0.7	6.5	–	2.5	68.9	78.6	n/a	n/a	n/a	n/a	0.15	n/a	2,940	2	3
	6C	35	10,886	0.1	–	–	–	63.3	16.1	2.99	153.22	–	–	23,773	55,761	–	–	4.4	–	1.5	122.1	128.0	n/a	n/a	n/a	n/a	0.15	n/a	242	2	3
	6D	36	8,819	0.8	31.7	31.7	–	55.0	51.9	3.47	119.50	–	–	3.73	28,214	–	0.7	6.5	–	2.5	63.9	73.6	n/a	n/a	n/a	n/a	0.15	n/a	2,940	2	3
	6E	30	7,952	0.1	–	–	–	55.3	22.2	3.31	80.04	–	–	–	21,701	–	–	6.4	–	2.2	80.5	89.1	n/a	n/a	n/a	n/a	0.15	n/a	242	2	3
	6F	36	8,869	0.8	29.2	29.2	–	57.2	50.7	3.52	129.47	–	–	3.73	28,214	–	0.6	6.7	–	2.5	73.1	82.9	n/a	n/a	n/a	n/a	0.15	n/a	3,905	2	3
	6G	34	8,235	0.8	29.2	29.2	–	57.8	48.1	3.74	129.84	–	–	–	31,558	–	0.6	6.3	–	2.5	71.5	80.9	n/a	n/a	n/a	n/a	0.15	n/a	3,905	2	3

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A WATER RESOURCES IMPACTS

Area 1: Arlington

B WATER RESOURCES IMPACTS

Area 2: Northern Virginia

C WATER RESOURCES IMPACTS

Area 3: Fredericksburg

D WATER RESOURCES IMPACTS

Area 4: Central Virginia

E WATER RESOURCES IMPACTS

Area 5: Ashland

F WATER RESOURCES IMPACTS

Area 6: Richmond

G FIELD SURVEY DATA SHEETS

H SOILS WITH POTENTIAL CONSTRUCTION LIMITATIONS