June 2024

Marina Way Extension (UPC 120778)

Draft Environmental Assessment

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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
and
VIRGINIA DEPARTMENT OF TRANSPORTATION

Draft Environmental Assessment

Marina Way Extension

Prince William County, Virginia
State Project No.: 0639-076-348, C501, P101, R201
Federal Project No.: STP-5B01(441)
From: Marina Way at Annapolis Way
To: VA Route 123 (Gordon Boulevard) at Horner Road

Submitted Pursuant to 42 U.S.C. 4332(2)(C)

Approved for Public Availability

June 24, 2024
Date

Federal Highway Administration

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Section 1 - Purpose and Need

1.1. Introduction

The Prince William County (County) Department of Transportation, in coordination with the Virginia Department of Transportation (VDOT) and Federal Highway Administration (FHWA), is preparing an Environmental Assessment (EA) to analyze the potential environmental effects associated with the proposed Marina Way Extension project (Project) between Annapolis Way and Gordon Boulevard (Route 123) in Woodbridge, Virginia. The EA is being prepared pursuant to the National Environmental Policy Act of 1969 (NEPA) and in accordance with FHWA regulations for implementing NEPA (23 CFR 771).

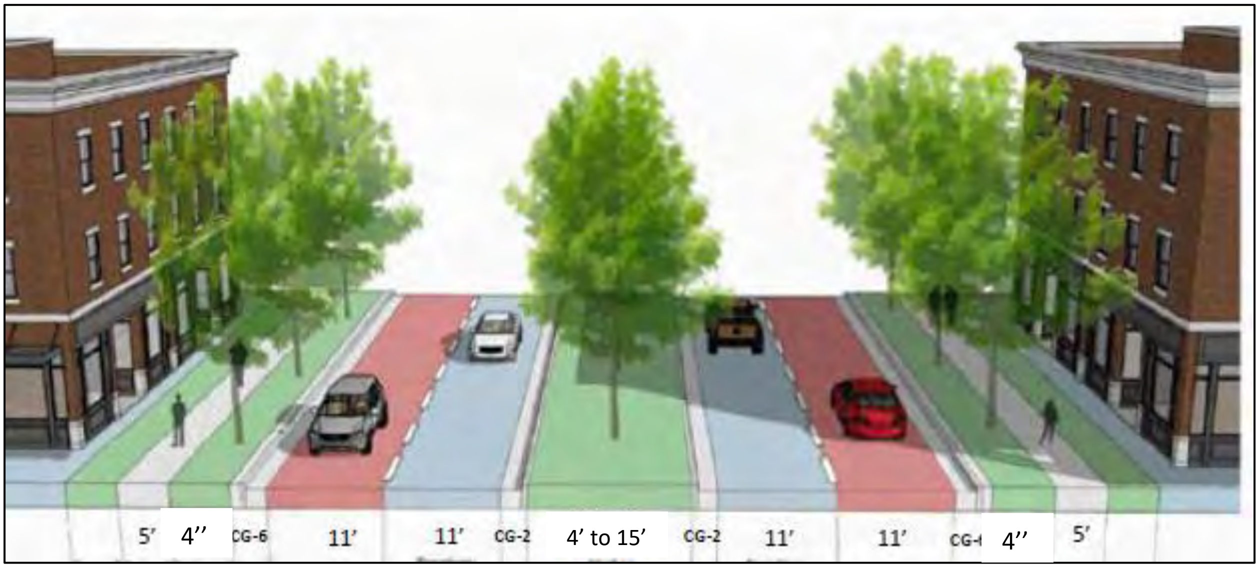
1.2. Study Area

The Project's study area is in Woodbridge, Virginia northwest of the Jefferson-Davis Highway (Route 1) and Gordon Boulevard (Route 123) intersection and east of the Interstate-95 (I-95)/Route 123 interchange. As shown in **Figure 1-2**, Annapolis Way borders the northern portion and Route 123 borders the southern portion of the study area. The existing land use in the study area is commercial/retail properties in the southern half and undeveloped property in the northern half. Gordon Plaza is in the southern half of the study area. The northern portion of the study area is mostly forested with a small business park west of the Annapolis Way and Marina Way intersection. and it includes Home Depot, Aldi, and other retail stores. The project is located within a federally designated metropolitan organization (MPO). The MPO for the metropolitan Washington, D.C. area is the National Capital Region Transportation Planning Board (TPB).

The Commonwealth of Virginia designated North Woodbridge as an Opportunity Zone in 2018 under the Federal Tax Cuts and Jobs Act of 2017 (TCJA). The TCJA provides tax benefits for potential developers and investors in North Woodbridge. In 2006 the Metropolitan Washington Council of Governments (MWCOG) identified Woodbridge as an Emerging Employment Center. These centers help guide transportation planning decisions to grow the economy in the area.

Recognizing the growth opportunity for the North Woodbridge area, the County has focused on planning revitalization efforts for this area. A major component of this planned revival is the North Woodbridge Town Center. A town center allows for mixed-use development within a small area that promotes walkability and bikeability. Mixed-use development typically includes residential, office, civic, and retail spaces. Town centers include a main street. For North Woodbridge, the intended main street is the Marina Way Extension.

Figure 1-1: Proposed Project Roadway Typical Section



1.3. Project History

In 2005, the County prepared the North Woodbridge Urban Mixed Use Master Zoning Plan to identify a vision for North Woodbridge to be a mixed-use area. The plan's key element for this area was to extend Horner Road to Marina Way to provide connectivity between local shopping and the medium to high-density residential condominium and apartments planned for the area. (County, 2005)

The Prince William Board of County Supervisors adopted the North Woodbridge Small Area Plan on October 8, 2019. This small area plan is part of the County's Comprehensive Plan and puts significant focus on revitalization and redevelopment for the North Woodbridge area. A key element in the Plan is providing a connection between Horner Road and Marina Way. This connection is intended to be a main street surrounded by commercial, residential, retail, and walkable streets. The Plan indicates that the main street would provide a pedestrian spine through the town center connecting to a future Fast Ferry Terminal and a proposed waterfront boardwalk. (County 2019)

The Mobility Plan states that the Marina Way extension termini is Annapolis Way to Route 123, and the roadway would be a multi-modal, through boulevard. The Plan asserts that the North Woodbridge Town Center should include a network of streets that provides an extension of Horner Road across Route 123 to intersect Annapolis Way which provides access to the Occoquan Harbor Marina, as well as the Annapolis Way extension as it is already planned. The Plan also indicates that the "roadways cannot be evaluated through traditional capacity measures, such as Level of Service for intersections and road segments." (County 2019) The Plan identifies proposed functional classification for the Marina Way extension as a boulevard with a UB-1 typical section that includes four lanes and 5-foot sidewalks on each side. The Mobility Plan also identifies a proposed trail, blueways, bicycle, and pedestrian network. This network of facilities is referred to as the Woodbridge Pedestrian and Bicycle Loop and consists of a system of trails and sidewalks that will allow residents and visitors to explore the area.

Figure 1-2: Study Area

The TPB approved the update to Visualize 2045 on June 15, 2022. Visualize 2045 is the federally mandated regional long-range transportation plan that identifies the region's transportation agencies' projects that are expected to be funded between now and 2045.

The Project is included in the air quality conformity analysis of the 2022 update to Visualize 2045 approved on June 15, 2022. The project is programmed in both the FY2023-2026 Transportation Improvement Plan (TIP) and the draft FY2024-2027 Statewide Transportation Improvement Program (STIP), Virginia's federally required four-year transportation improvement program. Therefore, the Project meets fiscal constraint requirements.

1.4. Needs

1.4.1. Existing Conditions

Access and Connectivity in the North Woodbridge Area

The study area consists of a roadway network composed of streets and principal arterials. Each of these roadways provide pedestrian access to the study area via sidewalks and shared-use path (SUP). Marina Way is a two-lane avenue/street that has an unsignalized intersection with Annapolis Way and a sidewalk along the southbound lane. It serves as the only connection to a marina at Occoquan Harbor, Vulcan Materials Company Woodbridge sand yard, and the Rivergate apartments. Marina Way does not provide pedestrian or vehicle access to the proposed North Woodbridge Town Center and points south of the study area such as the VRE station and I-95/Route 123 Commuter Lot. The only way pedestrians and vehicles can access these destinations from Marina Way is if they travel along eastbound Annapolis Way to Route 1 and head south to Route 123 at Route 1 intersection. At that point they can utilize Route 123 to access the proposed North Woodbridge Town Center at the Route 123 at Horner Road intersection, access the I-95/Route 123 Commuter Lot from the Route 123 and Annapolis Way intersection, or continue traveling south along Route 1 to the VRE Station. The average annual daily traffic (AADT) for Marina Way is not available.

Marina Way's southern terminus is at its intersection with Annapolis Way in the northern portion of the study area. Annapolis Way is a four-lane divided street with sidewalks along the eastbound lanes that provides access from Route 1 to the Viridium apartment complex, a church, and business park. The business park and church access Annapolis Way through the southside of the Annapolis Way and Marina Way intersection. Annapolis Way is the only way vehicles and pedestrians can access Marina Way from Route 1 and destinations north and south of the study area. Currently, access is restricted along Annapolis Way west of the Marina Way intersection because it dead ends at the Viridium apartments. The AADT for this section of Annapolis Way is not available. There is a separate section of Annapolis Way that intersects with Route 123 just east of the I-95/Route 123 interchange. This section of Annapolis Way between Route 123 and Destination Place provides access to the I-95/Route 123 Commuter Lot and has sidewalks on both sides of the roadway from Route 123 to just north of Hampton Inn where the sidewalk along the northbound lanes terminates at the entrance into The Landing at Mason's Bridge apartment complex. This section of Annapolis Way has an AADT of 2,700 (VDOT, 2019).

Route 123 is located along the southern boundary of the study area. It is a four-lane divided principal roadway with a sidewalk along the northside of Route 123 between Annapolis Way and approximately

200 feet beyond the Horner Road intersection arterial that terminates at its signalized connection with Route 1. There is also a sidewalk along the southside of Route 123 between Route 1 and Horner Road. Route 123 has signalized intersections with Route 1, Horner Road, and Annapolis Way and the AADT between Route 1 and I-95 is 19,000. (VDOT, 2019) The Route 123 at Horner Road intersection provides direct access to a parking lot at the existing Gordon Plaza shopping center which is the same area as the proposed North Woodbridge Town Center.

Route 1 or Richmond Highway is a six-lane principal arterial with a SUP along the southbound lanes that is located east of the study area. Route 1 intersects with Annapolis Way and Route 123 and is recognized as a major thoroughfare that serves the eastern portion of Prince William County. Vehicles and pedestrians utilizing Marina Way that want to access the proposed North Woodbridge Town Center, I-95/Route 123 Commuter Lot, VRE Station, and destinations north and south of the study area have to utilize Route 1 and it's SUP, respectively. This section of Route 1 has an AADT of 39,000. (VDOT, 2019)

In summary, if pedestrians or vehicles on Marina Way want access to destinations north and south, including the VRE Station, the Occoquan River waterfront, the I-95/Route 123 Commuter Lot, and the proposed North Woodbridge Town Center, they need to utilize the other roadways. There is not direct access to these destinations from Marina Way. The need for the connection is supported by its continued inclusion in the TIP and other transportation planning and County's programming documents.

Traffic Forecasts and Travel Demand

Table 1-1 shows the operating condition for each Level of Service (LOS) category and criteria for stop-control, signalized, and interchange ramps as identified in the 2010 Highway Control Manual (HCM).

Table 1-1 LOS Definition

Level of Service	**Operating Condition**	**MOEs Criteria**		
		Delay (seconds/vehicle)		**Density (pc/mile/lane)**
		Intersection		**Ramp**
		Signalized	**Stop-control**	**Merge/Diverge**
A	Free-flow condition	<10	0-10	<10
B	Little congestion	10-20	>10-15	>10-20
C	Moderate congestion	20-35	>15-25	>20-28
D	Approaching heavy congestion	35-55	>25-35	>28-35
E	Unstable flow, congested condition	55-80	>35-50	>35
F	Severe congestion	>80	>50	Demand exceeds capacity

Source: HCM 2010

Traffic analysis completed for this study indicates existing traffic conditions (year 2023) at Marina Way and the Annapolis Way stop-control intersection has a LOS A for both the AM and PM peak periods. The AM delay is 5.5 seconds per vehicle (s/veh). The PM delay is 4.1 s/veh. The Route 123 at Horner Road signalized intersection has a LOS D during the AM peak period and a LOS F during the PM peak period. It experiences a 35.5 s/veh in the AM and 301.8 s/veh in the PM. This intersection is severely congested during the PM peak period and operates at over capacity. The LOS for Route 123 at Route 1, Route 1 at Annapolis Way, and Route 123 at Annapolis Way is not available.

Key issues identified in the traffic analysis confirmed what the travelers experience in the North Woodbridge area. The heavily traveled corridors of Route 123 and Route 1 have heavy congestion at their various intersections in the North Woodbridge area.

1.4.2. Future Conditions

Future Access and Connectivity in the North Woodbridge Area

The County's Mobility Plan identified a proposed network of trails, bicycles, and pedestrian facilities for the North Woodbridge area in the "Woodbridge Pedestrian and Bicycle Loop." Elements of this loop include the preferred trail connection of the Potomac Heritage National Scenic Trail (PHNST) that would provide the trails connection to the waterfront of the Occoquan River. Also, the pedestrian network includes constructing sidewalks on both sides of all streets and including high-visibility crosswalks at appropriate intersections in the North Woodbridge area. It also identifies a proposed pedestrian bridge crossing from the Woodbridge VRE to the west side of Route 1 allowing for safer pedestrian access between the proposed Woodbridge Town Center and the VRE station. Therefore, there is a need to improve pedestrian connectivity throughout the North Woodbridge area and to achieve the goals of the County's Mobility Plan by making destinations such as the Occoquan River waterfront, the VRE Station, and the I-95/Route 123 Commuter Lot more accessible for pedestrians.

Economic Development and Transportation Plans and Initiatives

The North Woodbridge area is one of the County's six designated regional activity centers. The Metropolitan Washington Council of Governments (MWCOG) defines a regional activity center as a location to "accommodate majority of the region's future growth and play a vital role in achieving the Region Forward Vision's prosperity, sustainability, accessibility, and livability goals. They include existing urban centers, priority growth areas, traditional towns, and transit hubs." (MWCOG, 2019)

Future Traffic Forecasts and Travel Demand

In 2020, the Marina Way Extension Traffic Analysis was prepared by Kittleson for VDOT. The analysis assessed the study area's intersections' level of service (LOS) for the year 2030. The traffic impact results for this scenario were taken directly from the Route 1 and the Route 123 Intersection Strategically Targeted Affordable Roadway Solutions (STARS) study. The STARS study models and results are used because this study used a travel demand model to project future demand based on the proposed land use from the Woodbridge Small Area Plan.

Utilizing the STARS study and models, the Marina Way Extension Traffic Analysis accounted for all signal timing changes reflecting new lane configurations and the following projects:

Table 1-2: 2030 LOS for Intersections

Intersection	AM Peak Hour		PM Peak Hour	
	LOS	Delay (s/veh)	LOS	Delay (s/veh)
Route 1 and Annapolis Way	C	26	D	48.9
Route 1 and Route 123	E	65.8	D	43.8
Horner Road and Route 123	F	128	F	80.2
Annapolis Way and Route 123	F	108.5	C	20.2

Except for the AM Peak Hour at the Route 1 and Annapolis Way intersection and the PM Peak Hour at the Annapolis Way at Route 123 intersection, most of the intersections in the study area would be in an unstable flow, congested condition, or severely congested condition by the time the North Woodbridge Town Center opens.

The MWCOG Traffic Demand Model that utilized in the Route 1 and the Route 123 Intersection STARS study and the Marina Way Extension Traffic Analysis, indicates Route 1 and 123, the principal arterials that serve the North Woodbridge area, will continue to become congested with future traffic demand (**Table 1-3**).

Future Economic Development and Transportation Plans and Initiatives

MWCOG Round 9.1 forecasts between 2015 and 2040, the population of the North Woodbridge area will grow from 14,000 to 58,200, a 315.7% increase. During the same period, employment in the North Woodbridge area will increase from 3,700 to 19,000 jobs. This significant growth in jobs and population over the next 25 years will continue to place stress on traffic operations for the existing roadway network.

The Visualize 2045 plan identifies the construction of the Marina Way extension to connect with Horner Road at Route 123. The plan indicates that this extension will create an internal roadway network in the North Woodbridge area that will enhance multimodal access to the Route 123 Park and Ride lot, the potential Fast Ferry Terminal at the Occoquan Harbor Marina, and the Woodbridge VRE Station along Route 1. The Aspirational Initiatives component was included with the update. Under this component, the Marina Way Extended (CE3756) project was identified under the “Bring Jobs and Housing Closer Together” initiative because it included a boulevard section of roadway with pedestrian facilities on both sides to support nonmotorized transportation. The initiative is focused on bringing people closer to their work and other frequented destinations in the hopes of reducing travels times and trips while providing other modes of travel. (TPB 2022)

The development of the North Woodbridge Town Center is part of the County’s planned revitalization effort for the North Woodbridge area. The town center would include a mix of commercial and residential development served by a muti-modal, four-lane boulevard. Currently, the existing roadway network does not have the ability to provide this service. If the North Woodbridge Town Center were to be constructed today, vehicles would be able to enter or exit the town center directly onto Route 1 or

Route 123, changing localized travel patterns and vehicle demand on the adjacent roads and impacting the intersection delays. **Table 1-3 Future ADT Growth in the Area**

Roadway Name	Limits	ADT		
		2019	**2045**	**Percent Increase**
Route 123	Route 1 to I-95	20,000	29,600	48%
Route 1	Opitz Blvd to I-95	41,000	56,500	38%

Source: Kimley Horn, 2020

1.5. Summary

The future traffic demands, and planned revitalization of the North Woodbridge area has created the need to extend Marina Way to mitigate traffic delays across multiple intersections in the area. The purpose of the proposed project improvements will be to provide an adequate multi-modal transportation system that:

- Provides safe pedestrian accessibility and connectivity in the North Woodbridge area.
- Provides traffic congestion relief for traffic demand on local roads and intersections.
- Provides access to local businesses and homes in the North Woodbridge area and is consistent with existing and planned local development.

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Section 2 – Alternatives Analysis

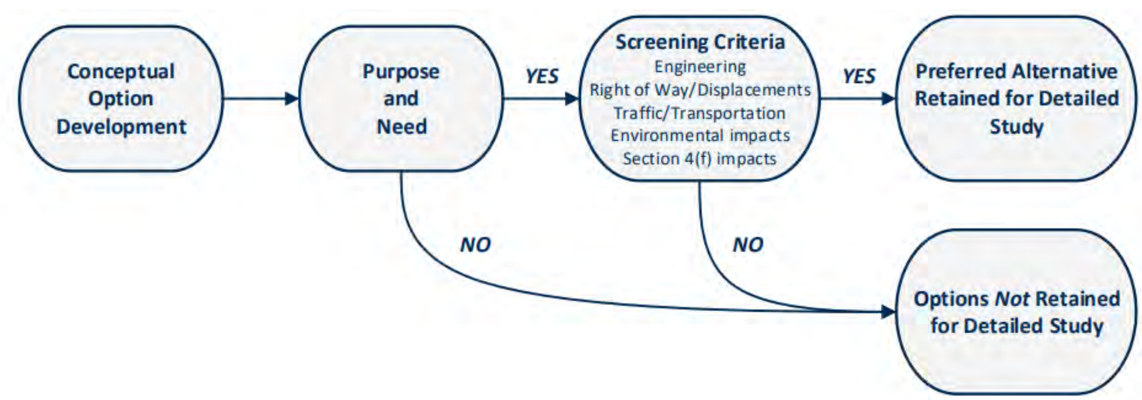
2.1. Introduction

This section details the conceptual roadway alignment options that were developed and reviewed for this project. These options were developed to meet the roadway classification criteria, minimize right-of-way impacts and acquisitions, minimize impacts to future development, maintain consistency with the transportation plan, and reduce or eliminate impacts to natural resources. There were only two alignment options developed and reviewed because the study area is highly constrained due to existing and proposed development. The section will identify the preliminary options eliminated from further consideration and the No Build and Build Alternative that will be carried forward for detailed study in this Environmental Assessment (EA).

2.2. Options Development and Screening Process

The development and screening process, as represented in **Figure 2-1**, was used to determine which option can adequately address the purpose and need and be carried forward as part of the Preferred Alternative for further analysis in this EA. The following is a brief explanation of the steps involved in the development and screening process used for this project:

Figure 2-1 Options Screening Process



2.2.1. Conceptual Options Development

The County's engineering, traffic, and environmental disciplines used the following planning documents, studies, data, and technical guidance to develop the conceptual options for this project:

- A key element of the North Woodbridge Small Area Plan's Illustrative Plan is providing a connection between Horner Road and Marina Way. This connection is intended to be a main street surrounded by businesses, homes, and walkable streets. The North Woodbridge Small Area Plan's Mobility Plan provides additional details about the proposed termini for the project and the proposed functional classification for the roadway. In addition, the

Aspirational Initiatives component of the Visualize 2045 plan update includes the Marina Way Extended project which is defined as a boulevard with pedestrian facilities on both sides. Please go to **Sections 1.2 and 1.3 of this EA** for additional information about these plans and the proposed typical section for the roadway.

- In June 2023, a wetland delineation was performed to determine the boundaries of the jurisdictional wetlands and other waters of the US within the study area as part of the environmental documentation for the EA. The locations of these features informed the development of conceptual alignment options, and avoidance and minimization of impacts to these resources was considered to the extent practicable. Additional details on the delineation and the waters within the project area can be found in **Section 2.3**.
- A Phase I Archaeological and Historic Architecture survey was conducted for the study area. The study identified any structures eligible for listing of the National Register of Historic Places as well as any potentially eligible archaeology sites in the area. There were no archaeological and historical architectural resources found within or adjacent to the study area.
- A field review and desktop survey were conducted utilizing GIS data from sources such as the US Fish and Wildlife Service (USFWS) National Wetland Inventory data, Federal Emergency Management Agency (FEMA) 100-years floodplain maps, and Virginia Department of Wildlife Resources (DCR) Wildlife Environmental Review Map Service tool. These reviews and surveys were considered when assessing conceptual designs. See **Section 2.2.2.** for a discussion of the environmental and physical constraints that were discovered during these studies.
- The Prince William Transportation Systems – Planning and Design standards were utilized during the development of the options. These standards considered access points, traffic demand, land use developments, and visual aesthetics throughout the corridor.
- In addition to this Project's traffic forecast analysis that identified level of service (LOS) for the Marina Way at Annapolis Way and Route 123 at Horner Road intersections, traffic data from the Route 1 at Route 123 Intersection Analysis that was completed under the STARS program was used for the options' development. The traffic forecasting utilized data from the Prince William County Travel Demand Model (PWCTDM) and considered the adopted North Woodbridge Small Area Plan.
- VDOT previously funded a pre-scoping planning study for SMART SCALE, 'North Woodbridge Mobility Improvements', and considered extending Marina Way with the addition of a roundabout near the Gordon Plaza shopping center. VDOT removed the roundabout because it did not improve traffic operations and had significant ROW costs. The study was not completed due to the project not receiving funding.

2.2.2. Existing Constraints

Several engineering, design, environmental, and development considerations and constraints influenced the development of the options. These considerations are shown in **Figure 2-2** on the following page.

Future Transportation Projects

In addition to the Marina Way Extension project, there are other projects such as the Annapolis Way Extension identified in the County's Mobility Plan as well as funded projects in VDOT's Six-Year Improvement Program that are planned for the North Woodbridge area. The proposed improvements associated with these projects presented several engineering and constructability constraints that restricted the number of and how the preliminary roadway alignment options could traverse the study area. Future projects and proposed improvements within and immediately adjacent to the study area that could restrict the options include:

- Route 1 and Route 123 Interchange Widening – The project includes construction of an interchange at the intersection of Route 1 and Route 123. The project also includes widening Route 1 to six lanes from Mary's Way to Annapolis Way, constructing bridge over CSX railroad to provide new access point to Belmont Bay, and widening Route 123 to six lanes from Annapolis Way to Route 1. This project is programmed in the FY2023-2026 Transportation Improvement Plan (TIP).
- Route 123 widening – The County's Mobility Plan proposes widening Route 123 to six lanes from Route 1 to Annapolis Way. It includes a shared use path along the westbound lanes and a sidewalk along the eastbound lanes.
- Annapolis Way Extension – The project includes the construction of 0.28-mile segment of roadway between existing segments of Annapolis Way to create a connection between Route 1 and Route 123. The project extends between the entrance to the Route 123 Commuter Lot to just west of the Marina Way terminus at Annapolis Way. This project is programmed in the FY2023-2026 TIP.

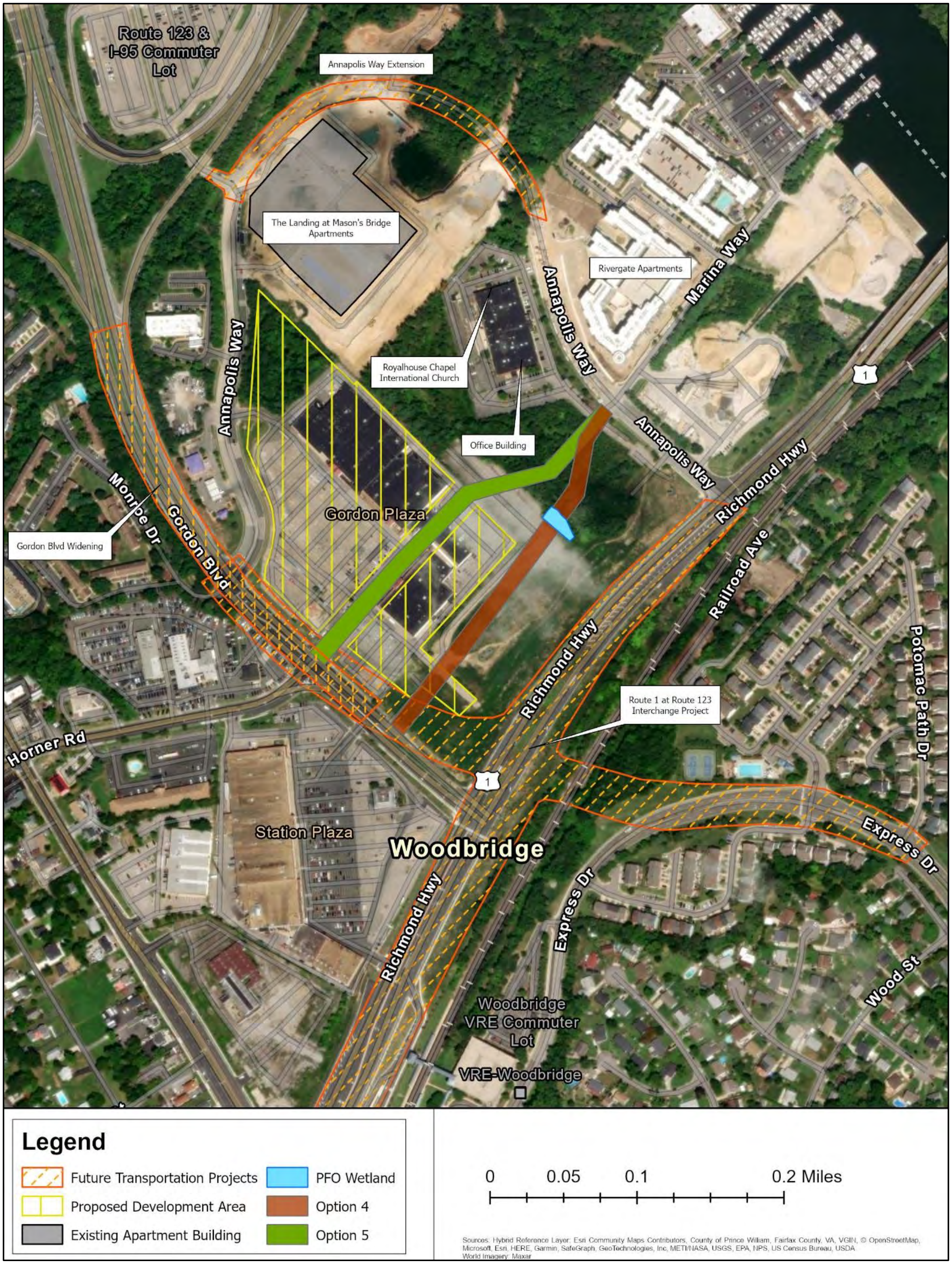
Existing and Planned Development

Some of the physical constraints related to existing and planned development in the study area include the future Gordon Plaza development (i.e., North Woodbridge Town Center), existing businesses and apartment complexes aligning Annapolis Way, and the existing location of the two intersections which heavily controlled the most practical alignment.

Figure 2.2 shows the pending Gordon Plaza development that is in the center portion of the study area. The pending Gordon Plaza development is referred to as the North Woodbridge Town Center in the North Woodbridge Small Area Plan. This future development has recognized the County's desire to build the Marina Way Extension project, and therefore has accommodated for a future roadway alignment – Marina Way Extension. The County's Urban Mixed-use Master Zoning Plan which identified the North Woodbridge Town Center and commercial and residential areas within the surrounding study area, also incorporated the Marina Way Extension project in its illustrative master zoning plan. (County, 2005)

There is the Rivergate apartment complex at the intersection of Annapolis Way and Marina Way and the Landing at Mason's Bridge apartment complex is located along Annapolis Way and can be accessed from Annapolis Way where it terminates at the Route 123 Commuter Lot. Also, there is an office building with an outside eating area located along the west side of Annapolis Way with two separate access points to Annapolis Way. Any roadway and pedestrian improvements along Annapolis Way would require additional ROW acquisition from these apartment complexes and businesses along Annapolis Way as well as potential altering their existing access to the street.

Figure 2-2: Options Analysis Constraints



Environmental and Physical Constraints

There is forested land and a forested wetland in the northern portion of the study area. Impacting the forests may require additional coordination with the US Fish and Wildlife Service (USFWS) regarding potential impacts to the endangered Northern long-eared bat and proposed endangered Tri color bat. Impacts to these federal threatened and endangered (T&E) bat species habitats may require time-of-year restrictions to be implemented for the project which could potentially cause delays which leads to increased project costs. Also, there is a forested wetland in the northern portion of the study area. Impacts to wetlands require permitting and implementing of additional avoidance and minimization measures into the design to reduce or avoid impacts. This change to schedule and design, as well as the addition of the wetland mitigation cost, adds to overall project costs. A field review verified the presence of the Landing at Mason's Bridge, which is under construction, and the Royalhouse Chapel International Church at the terminus on Annapolis Way. Constructing the roadway within 500 feet of the new apartment complex and church would require additional traffic and noise studies and additional remediation per FHWA guidance.

All of the existing constraints identified were avoided to the maximum extent possible to reduce project costs, stakeholder coordination, and schedule.

2.3. Options Not Retained for Analysis

A Basis of Elimination for the options eliminated from additional analysis is provided in **Table 2-1**. The Basis of Elimination will discuss why the options were eliminated based on the constraints and considerations identified above and why the options did not adequately address the purpose and need.

Table 2-1: Options Eliminated from Detailed Study

Options	Basis for Elimination
Transportation System Management (TSM) Option	TSM strategies consist of actions that increase the efficiency of existing facilities; they are actions that increase the number of vehicle trips a facility can carry without increasing the number of through lanes. Examples of TSM strategies include: ramp metering, auxiliary lanes, turning lanes, reversible lanes, and traffic signal coordination. TSM also encourages automobile, public, and private transit, ridesharing programs, and bicycle and pedestrian improvements as elements of a unified urban transportation system. Modal options integrate multiple forms of transportation modes, such as pedestrian, bicycle, automobile, rail, and transit. This option doesn't address the purpose and need and was eliminated from further consideration.
Mass Transit Option	Per guidance from FHWA, the Mass Transit Option should be considered on all major projects that have a cost greater than $500,000. The anticipated cos of this project is $25.3 million. This is not considered a major project and therefore a Mass Transit Option was not developed.

Options	Basis for Elimination
Intersection Improvements Options	
Intersection Options	In addition to the roadway alignment options, two intersection options were developed. The Route 1 at Annapolis Way Intersection option considered short term improvements to accommodate future traffic demand. The intersection option provided additional queuing lengths for the turn lanes. It was determined that this option did not meet the purpose and need for the project. The option didn't provide a connection between Annapolis Way and Route 123, it conflicted with future planned transportation improvements in the area, and there were conflicts with pedestrian mobility and access at the intersection. Short term improvements in the Route 123 and Horner Road Intersection option were also considered to accommodate future traffic demand. The improvements associated with this option included extending the turn lanes for added que lengths. It was determined that this option did not meet the purpose and need for the project. The option didn't provide a connection between Annapolis Way and Route 123 and it conflicted with future planned transportation improvements in the area. Both intersection options were eliminated from further analysis.
Roadway Alignment Options	
Southern Roadway Alignment	This option provides a connection from the Marina Way at Annapolis Way intersection to Route 123. This four-lane roadway alignment option would be located on the vacant property behind the Gordon Plaza development (**Figure 2-3**). Although this option avoids the businesses at Gordon Plaza, it directly impacts a forested wetland, potential T&E species habitat, and impacts a portion of the proposed development area shown in the illustrative Gordon Plaza development (i.e., North Woodbridge Small Area Plan). In addition, due to engineering constraints associated with shifting the southern portion of the roadway alignment, this option would require a new intersection with Route 123. This would create major access management issues and cause inadequate full access intersection spacing from both Horner Road and Route 123. This would in turn create more congestion, present significant safety concerns, and deteriorate traffic operations within this vicinity. In addition, this option would directly impact the design of the future Route 1 at Route 123 intersection widening. Because of these issues, this option does not meet the purpose and need of the project.

2.4. Alternatives Carried Forward

2.4.1. No Build Alternative

Description. The No Build Alternative will be carried forward into the EA. It will provide a baseline for comparison against the Build Alternative in the NEPA analysis. The No Build Alternative assumes the Marina Way Extension roadway and associated improvements are not constructed but considers proposed development and transportation projects in the area will continue as planned. These projects include:

- North Woodbridge Town Center
- Annapolis Way Extension
- Route 1 and Route 123 Interchange
- Route 123 widening

Ability to Meet Needs

The No Build Alternative does not meet the purpose and need of this project. This alternative does not provide the roadway between Annapolis Way and Route 123 to manage the traffic expected from the County's planned revitalization effort in the area. The No Build Alternative would fail to achieve the goals of the North Woodbridge Small Area Plan and objectives under the "Bring Jobs and Housing Closer Together" initiative in NCR TRB's Visualize 2045.

2.4.2. Build Alternative – Preferred Alternative (Marina Way Extension)

Description. The Preferred Alternative assumes a 0.26-mile extension of Marina Way as described below in the Typical Section.

Typical Section. The Preferred Alternative typical section is classified as an Urban Minor Collector (GS-7) geometric standard. It would be a four-lane median-divided roadway with curb and gutter, a 4-foot buffer, and 5-foot-wide sidewalks on both sides of the road. Lane widths will be 11 feet wide with turn lanes present at the Route 123 intersection and main entrances into Gordon Plaza where the future Home Depot and Aldi grocery store is located. (Figure 2-2) The proposed ROW is set at 1 foot behind the sidewalk with County building setback requirements 20 feet from the ROW. The proposed raised grass median will be 15 feet in width and will transition down to 4 feet at intersections where turn lanes are needed. The horizontal alignment of the Preferred Alternative, identified as the Marina Way Extension during the options development process, is described below from north to south and shown on **Figure 2-2**. The proposed section would tie into the existing Marina Way at the Annapolis Way intersection and continue south towards the vacant parcel behind the Gordon Plaza development on new alignment.

Alignment. The horizontal alignment of the Preferred Alternative, which includes the Marina Way Extension roadway alignment, is described below, from north to south:

- The proposed alignment will connect to the existing Marina Way roadway at Marina Way and Annapolis Way.

- The proposed section between Horner Road and Route 123 Intersection will be constructed on new alignment through the Gordon Plaza. The alignment strategically curves through the Gordon Plaza Development to split the future Home Depot and Aldi grocery store to connect to the existing Horner Road and Route 123 Intersection.
- The alignment will provide a continuous four-lane divided section and continuous 5-foot-wide sidewalks on both sides of the road from Annapolis Way to the Horner Road and Route 123 Intersection. Sharrows have been identified in the Mobility Plan for this section of roadway and will be assessed during the design process. The alignment would require new ROW for the entire proposed section and be required to meet building setback requirements.
- The alignment was designed to meet a 30 MPH design speed and will utilize urban low-speed design characteristics making it full crown for the entire corridor.
- The reverse curve is set at 355 feet radius which exceeds the minimum geometric design standards to keep the roadway at full crown. This simplifies the cross section of the roadway as well as drainage design and will allow for easier construction.
- Landscaping is anticipated on the raised grass median to implement streetscape aesthetics to this new roadway. Low-growth vegetation or ground cover will also be installed within the buffer strip to add to this streetscape appeal.
- There would be new access provided for the business park, including the church, directly to Annapolis Way. The current access for the business park uses a dead-end street on the southside of the Marina Way and Annapolis Way intersection to access Annapolis Way. This access point would be closed off as part of the project as it would be an access management safety concern once Marina Way extension is completed. In addition, full access would become only partial access if it were to remain open. Therefore, a new full access entrance was proposed further north to retain full access to Annapolis Way for this property owner.

Intersections. The intersection improvements include a four-way stop controlled at the Marina Way and Annapolis Way intersection, and a signal rebuild (including new pedestrian crossings) Marina Way Extension, Horner Road, and Route 123 intersection.

Right of Way Impacts. Most of the proposed alignment will require ROW acquisitions given that the four-lane median divided roadway will be primarily on new alignment through the middle of the Gordon Plaza development.

Drainage Design. Drainage and Stormwater Management on this project will consist of water quality facilities, retention, and erosion control measures. The design will meet applicable VDOT and County requirements but will seek to minimize construction costs, ROW impacts, and long-term maintenance costs. A stormwater pond is anticipated on the northern end of the project in the existing green space that is available. The design will also seek to maximize the use of nutrient credits to meet water quality requirements and will include best management practices (BMPs) at each outfall to meet water quantity requirements as well.

Project Costs. The anticipated cost for the project is estimated at $25,310,279. This is the amount that is programmed in the National Capital Region TPB FY 2023-2026 Transportation Improvement Program to design, acquire ROW, and construct the project.

Ability of the Preferred Alternative to Meet Needs

The Preferred Alternative supports the goals of the TPB's Visualize 2045 Aspirational Initiatives. It provides the connection between Annapolis Way to Horner Road with a four-lane divided roadway and associated pedestrian facilities. It also allows residents at the Viridium and The Landing at Mason's Bridge apartment complexes, as well as other visitors to the North Woodbridge area, pedestrian and vehicular access to the future North Woodbridge Town Center. The Preferred Alternative allows for these residents to have safe, unrestricted access to the businesses and VRE station to the south of the study area. The Preferred Alternative provides the ability for the residents of North Woodbridge to be closer to their jobs and frequented visited areas; therefore, it supports the goals of the Visualize 2045 Aspirational Initiatives.

The North Woodbridge Small Area Plan's Mobility Plan identified the need for a future "Woodbridge Pedestrian and Bicycle Loop". The Loop includes the preferred trail connection of the Potomac Heritage National Scenic Trail (PHNST) that would provide the trails connection to the waterfront of the Occoquan River. It also identifies the need for a pedestrian network which includes constructing sidewalks on both sides of all streets and including high-visibility crosswalks at appropriate intersections in the North Woodbridge area, and a proposed pedestrian bridge crossing from the Woodbridge VRE to the west side of Route 1 allowing for safer pedestrian access between the proposed Woodbridge Town Center and the VRE station. The Preferred Alternative includes five-foot sidewalks along each side of the roadway. It also provides a connection to the existing sidewalks along Annapolis Way as well as a connection to the sidewalks located along Route 123 at Horner Road.

The 2020 Marina Way Extension Traffic Analysis indicates that most of the intersections will be at a LOS D or worse during either the AM or PM peak hour by the year 2030 when the North Woodbridge Town Center opens. The Annapolis Way at Route 123 and Horner Road at Route 123 will be at LOS F in the am peak hour, severe congestion. The Preferred Alternative reduces traffic delays across multiple intersections, including critical segments and intersection of Route 1 and Route 123, by providing additional access points within the proposed North Woodbridge Town Center area as well as to improve safe pedestrian accessibility and connectivity. **Table 2-3** shows the 2030 Level of Service (LOS) for the intersections for the No Build and Build conditions. The 2030 condition assumes that the future Gordon Plaza development (i.e., North Woodbridge Town Center) is open.

Table 2-3: Preferred Alternative Level of Service for Intersections

Intersection	2030 No Build LOS		2030 Preferred Alternative LOS	
	AM Peak	PM Peak	AM Peak	PM Peak
Route 1 and Annapolis Way	C	D	B	C
Route 1 and Route 123	E	D	E	D
Horner Road and Route 123	F	F	E	D
Annapolis Way and Route 123	F	C	D	B

The following is some additional analysis for the intersections identified in Table 2-3.

Route 1 and Annapolis Way intersection – During the AM and PM peak hours, vehicles are using Preferred Alternative to access Route 1 without traveling onto Route 123, helping to reduce the delays at all other intersections in the study area, including Route 1 and Route 123.

Route 1 and Route 123 intersection – During the AM and PM peak hours, the overall intersection and approach delays improve with the Preferred Alternative. Specifically, during the AM peak hour, Route 1 northbound through movement delay is reduced from 60 seconds to 36 seconds and the southbound through movement delay is reduced from 80 seconds to 60 seconds.

Horner Road and Route 123 intersection – For the AM peak hour, the overall intersection and approach delays for all movements are reduced. The Route 123 eastbound delay decreases by approximately 20 seconds and the Horner Road southbound delay decreases by 10 seconds because vehicles are using the Preferred Alternative and Annapolis Way to directly access Route 1. This reduces demand for these approaches, which in turn reduces approach delays. During the PM peak hour, overall intersection and Route 123 approach delays remain similar between the No Build and the Preferred Alternative conditions. This indicates the intersection is under capacity and the baseline demands can be processed without capacity improvements (i.e., turn lanes).

Route 123 and Annapolis Way intersection – During the AM peak hour, the overall intersection delay is reduced by 20 seconds. The PM peak hour delays are nominally reduced. Little to no changes in delay indicates that the intersection is under capacity and the Build traffic conditions can be processed without adding turn lanes.

A summary of the traffic analysis indicates that the Preferred Alternative minimizes vehicle delays of the intersections within the study area because it provides additional access points into and out of the future North Woodbridge Town Center. The additional access points allow for a distribution of traffic demands across multiple intersections which alleviates focused congestion onto overburdened intersections along Route 123 and Route 1.

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Section 3 – Environmental Consequences

3.1. Overview of Environmental Issues

This section describes the affected environment and potential direct, indirect, and cumulative environmental consequences of the proposed project. Potential direct environmental impacts are described and estimated based on the limits of disturbance (LOD) of the Preferred Alternative described in Section 2. The LOD consists of the proposed roadway footprint and associated infrastructure as well as the areas required for construction, including but not limited to construction access; grading (cut/fill); temporary and permanent erosion and sediment control and stormwater management measures; landscaping, and signage and lighting.

Table 3-1 summarizes environmental issues and their relevance to the project. Table 3-2 quantifies and compares the impacts between the No Build and Preferred Alternative. Issues that are pertinent to the project's study corridor are discussed further following the tables. For resources that are either not impacted or that do not have a reasonable possibility for individually or cumulatively significant environmental impacts, no further discussion is required. 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 site visits to the project's study corridor. Additional information about data and/or studies conducted for the environmental analysis is provided in the technical reports listed in the Table of Contents of this Environmental Assessment (EA).

Table 3-2 Environmental Issues

Resources/Issue	Comments
Land Use & Socioeconomics	In the 2005 North Woodbridge Urban Mixed Use Master Zoning Plan, the County has designated the entire North Woodbridge area as current and future mixed use (i.e., commercial and residential). The plan identifies the future North Woodbridge Town Center to be constructed in the center of the study area where the Gordon Plaza Shopping Center is located. The study area is surrounded by the Woodbridge Square, Station Plaza, Woodbridge Center, and Potomac Plaza commercial areas. The central portion of the study area consists of the Gordon Plaza Shopping Mall. There are businesses immediately adjacent to the southern and norther portions of the study area as well as two apartment complexes located just north of the study area. The Preferred Alternative is expected to provide improved access to the future North Woodbridge Town Center as well as improve pedestrian connectivity and traffic along the local roadway network. According to the 2022 American Community Survey (ACS) and 2020 Decennial census data, the population growth of the study area has outpaced the growth of the County by 11.6% (32.7% and 21.1%,

Resources/Issue	Comments
	respectively). The population of the County is expected to grow another 51.7% from 2030 to 2050. See **Section 3.2.** for more information**.**
Environmental Justice	The Preferred Alternative will not displace any homes or businesses and the transportation benefits of the project would be realized by minority populations just as members of the overall population in the North Woodbridge area. Considering the benefits of this project to all users, this project will not have a disproportionate and adverse effect on any minority or low-income populations in accordance with the provisions of Executive Order 12898 and FHWA Order 6640.23A. See **Section 3.2.3** for more information.
Right of Way/Relocations	The No Build Alternative requires no right of way (ROW) acquisition and therefore requires no relocations of residences, businesses, or nonprofit organizations. The Preferred Alternative requires no relocations; however. acquisition of ROW from five parcels would be required to construct the project. See **Section 3.3**.
Air Quality	The proposed improvements were assessed for potential air quality impacts and compliance with applicable air quality regulations and requirements. All models, methods/protocols and assumptions applied in modeling and analyses were made consistent with those provided or specified in the VDOT Resource Document. The assessment indicates that the project would meet all applicable air quality requirements of the National Environmental Policy Act (NEPA) and federal and state transportation conformity regulations. As such, the project will not cause or contribute to a new violation of the NAAQS established by EPA. For more information, see **Section 3.4**.
Noise	The apartment complexes to the immediate north of the study area are subject to FHWA Noise Abatement Criteria (NAC), Category B for residential land use. There are three common noise environments (CNE) within the study area. The noise-sensitive receptors at these locations are not predicted to be exposed to 2023 traffic-noise levels that approach or exceed the applicable NAC impact threshold. Also, the Preferred Alternative traffic-noise levels by the year 2050 are predicted to be below the applicable NAC threshold for all locations. See **Section 3.5** for more information.
Water Quality	The Occoquan River, located approximately 1,150 linear feet northeast of the project's study area, is listed as impaired for aquatic life, fish consumption, and open water uses on the Virginia Department of Environmental Quality's (VDEQ's) Final 2022 305(b)/303(d) Water Quality Assessment Integrated Report (VDEQ, 2022). The impairment causes include insufficient dissolved oxygen and polychlorinated

Resources/Issue	Comments
	biphenyl (PCB) in fish tissues. This segment is included in the *Chesapeake Bay TMDL* and the *Tidal Potomac River PCB TMDL* Plans. Runoff from the study area drains into the Occoquan River, which flows into the Potomac River approximately 5 miles southeast of the project. The construction of the Preferred Alternative will increase impervious surface area and stormwater runoff volumes into impaired surface waters. Potential short-term impacts during construction include increased sedimentation and turbidity downstream, and possible spills or non-point source pollutants entering groundwater or surface water through storm runoff. VDOT's practice is to maintain both water quality and quantity post-development equal to or better than pre-development. There are no EPA-designated sole source aquifers within 1.0 mile of the project site. A scoping response received from the VDH indicated that there would not be any apparent impacts to public drinking water sources because of the proposed project (VDH, 2024). No further discussion is warranted in the EA. Under Prince William County's Chesapeake Bay Preservation Ordinance, public roads and their associated structures are conditionally exempt from regulation. Given the exemption for public roads, if the necessary requirements are followed, the proposed project would be consistent with the Chesapeake Bay Preservation Act and enabling state regulations. See more information in **Section 3.6**.
Parks and Recreation	The project corridor was examined for any existing publicly owned parks, recreation areas, wildlife and waterfowl refuges, and open-space easements, including those associated with public schools. No publicly owned parks are present within or immediately adjacent to the LOD. As part of the project scoping and environmental analysis, it was determined that this action does not have the potential for impacts to this resource. No further discussion is included in the document.
Section 4(f)	Use of park and recreation lands, wildlife and waterfowl refuges, and historic sites is subject to the requirements set forth in Section 4(f) of the US Department of Transportation Act of 1966. The project would not require use of land from any Section 4(f) properties. No further discussion is included in the document.
Sections 6(f)	Properties that were acquired or improved with the use of Land and Water Conservation Funds are subject to the requirements of Section 6(f) of the Land and Water Conservation Fund Act of 1965. The project

Resources/Issue	Comments
	would not require conversion of land from any Section 6(f) properties. No further discussion is included in the document.
Floodplains	The Preferred Alternative would have no impact of the 100-year FEMA floodplain that is associated with the Occoquan River, however ROW for the proposed alignment is within 1000 ft of the 100-year floodplain. Per Executive Order 11988, and the amendments including in Executive Order 13690 and VDOT roadway design standards, effects on floodplains would be minimized. There would be no encroachments on Federal Emergency Management Agency (FEMA) designated floodplains because of the Preferred Alternative. The identification of FEMA 100-year floodplains is included on **Section 3.6.**
Waters of the US (WOUS), including Wetlands and anticipated permits	The study area is located within the Middle Potomac-Anacostia-Occoquan 8-digit hydrologic unit code (HUC) boundaries (HUC 02070010). Approximately 0.64 acre of wetlands, comprised of 0.42 acre of palustrine forested wetlands and 0.22 acre of palustrine emergent wetlands, are within the Study area. There would be no stream or wetland impacts resulting from the Preferred Alternative. See **Section 3.6** for more details.
Agricultural and Forestal Districts, Prime Farmland and Soils	There are no agricultural or forestal districts within the study area. Land within the LOD is not currently in agricultural use. There is no further discussion in this document.
Threatened and Endangered Species	Review of the Virginia Department of Wildlife Resources (DWR) Virginia Fish and Wildlife Information Service (VaFWIS) database and the US Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) databases were completed to determine if species have been recorded or have the potential to occur within the vicinity of the study area. Details on wildlife and habitat that were observed and/or have the potential to occur within the study area are described in **Section 3.7**. Additionally, forested communities within the study area were evaluated and classified according to The Natural Communities of Virginia: Ecological Groups and Community Types publication from the Virginia Department of Conservation and Recreation (VDCR), Division of Natural Heritage, Natural Heritage Technical Report 17-07 dated April 2017.
Cultural Resources	A Phase I cultural resources study indicated there was no historic architecture or archaeological *sites identified with the Area of Potential Effect (APE). The study presented the results of an archaeological survey and indicated that t*here were no archaeological sites identified and no further testing recommended. The Department of Historic Resources (DHR) issued a “No Historic Properties Affected” finding under Section 106 of the National Historic Preservation Act (NHPA). **Section 3.8** has

Resources/Issue	Comments
	additional information about cultural resources study conducted for the project.
Pedestrian and Bicycle Connectivity	There is a network of pedestrian facilities (i.e., sidewalks) and shared use paths (SUPs) within and adjacent to the study area. Also, according to the 2023 Countywide Trails Plan, there are planned bike lanes, SUPs, and sharrows lanes within and immediately adjacent to the study area. The No Build Alternative would not impact the existing or planned pedestrian facilities and SUPs. Although it would limit future bike connectivity in the area because it can't accommodate the proposed sharrows lanes along the Marina Way Extension. The Preferred Alternative would not impact existing and future pedestrian facilities or SUPs and would include the sharrows lanes as they are identified in the North Woodbridge Mobility Plan and 2023 Countywide Trails Plan. There would be some minor, short-term impacts to the pedestrian facilities during construction of this alternative.
Hazardous Materials	A Phase I Environmental Site Assessment (ESA) was performed for the study area in accordance with the American Society of Testing and Materials (ASTM) Standard Practice for the Phase I Environmental Site Assessment Process (ASTM Designation: E1527-21) and the United States Environmental Protection Agency Standard Practice for All Appropriate Inquiries (AAI) (40 CFR Part 312). The results of the Phase I ESA indicate that one recognized environmental condition (REC), the former Gordon Plaza Dry Cleaner, located at 13276 Gordon Boulevard, is within the study area. No Controlled or Historical Recognized Environmental Conditions (CRECs and HRECs, respectively) were identified in association with the former Gordon Plaza Dry Cleaner site. The Phase I ESA recommended collecting and reviewing all available information regarding the observed groundwater monitoring wells to assess if the former drycleaning operation has negatively impacted groundwater underlying the property. Cleanup and disposal of solid waste (if necessary) by a waste management firm would be completed at time of purchase of the property. See **Section 3.10.8.** for more information.

Table 3-3 Summary of Impacts

Category	Build	No Build
Limits of Disturbance (acres)	3.9	0
Residential Relocations	0	0

Category	Build	No Build
Business Relocations	0	0
School Relocations	0	0
Non-Profit Business (tenant)	0	0
Other Community Facilities	0	0
Section 4(f) Properties	0	0
Section 6(f) Properties	0	0
Impacted Noise Receptors	0	0
Wetland Impacts (acres)	0	0
Stream impacts (linear feet)	0	0
Floodplains (acres)	0	0
Farmland Displaced (acres)	0	0
Forest Impacts (acres)	1.1	0
Threatened and Endangered Species (acres of habitat)	1.1	0
Hazardous Materials Sites	1	0
Historic Properties	0	0

3.2. Land Use & Socioeconomics

The Project proposes a connection between existing Marina Way and Horner Road in North Woodbridge, VA. The Project is located within Prince William County, at the Gordon Plaza shopping center located between Gordon Boulevard (Route 123) and Annapolis Way. The study area is positioned northwest of Jefferson-Davis Highway (Route 1) and Route 123 intersection and east of the I-95/Route 123 interchange. The Project is near the Route 123 Commuter Lot and Occoquan River Marina, as well as the Woodbridge VRE Station on the other side of Route 1 (**Figure 3-1**). The area surrounding the study area consists of mostly residential and commercial developments. There are no agricultural lands within or immediately around the study area. The North Woodbridge area is expected to experience significant growth and development.

3.2.1. Communities and Neighborhoods

In the 2005 North Woodbridge Urban Mixed Use Master Zoning Plan, the County identified North Woodbridge as a future mixed-use area. Based on Google aerial imagery, the study area is partially within the Gordon Plaza Shopping Mall off Gordon Blvd and extends into a forested area northeast of Gordon Plaza. The area surrounding the study area contains multiple commercial areas - Woodbridge Square, Station Plaza, Woodbridge Center, and Potomac Plaza. These are the local shopping centers within Census Tract (CT) 9002.01. These shopping centers are all located along Gordon Blvd or Route 1. (**Figure 3-2**).

Marumsco Village is a community of single-family homes that is partially within CT 9002.01 bounded by Horner Road and Marumsco Creek. The community is located southwest of the study area, right off Occoquan Road. Additionally, Greenwich Hill and Occoquan Village are communities of townhomes located near the study area, along Occoquan Road. Rivergate and Viridium are apartment complexes accessed from Marina Way and Annapolis Way northeast of the study area, The Landing at Mason's Bridge apartment complex is under construction and located directly north of the study area.

No Build Alternative

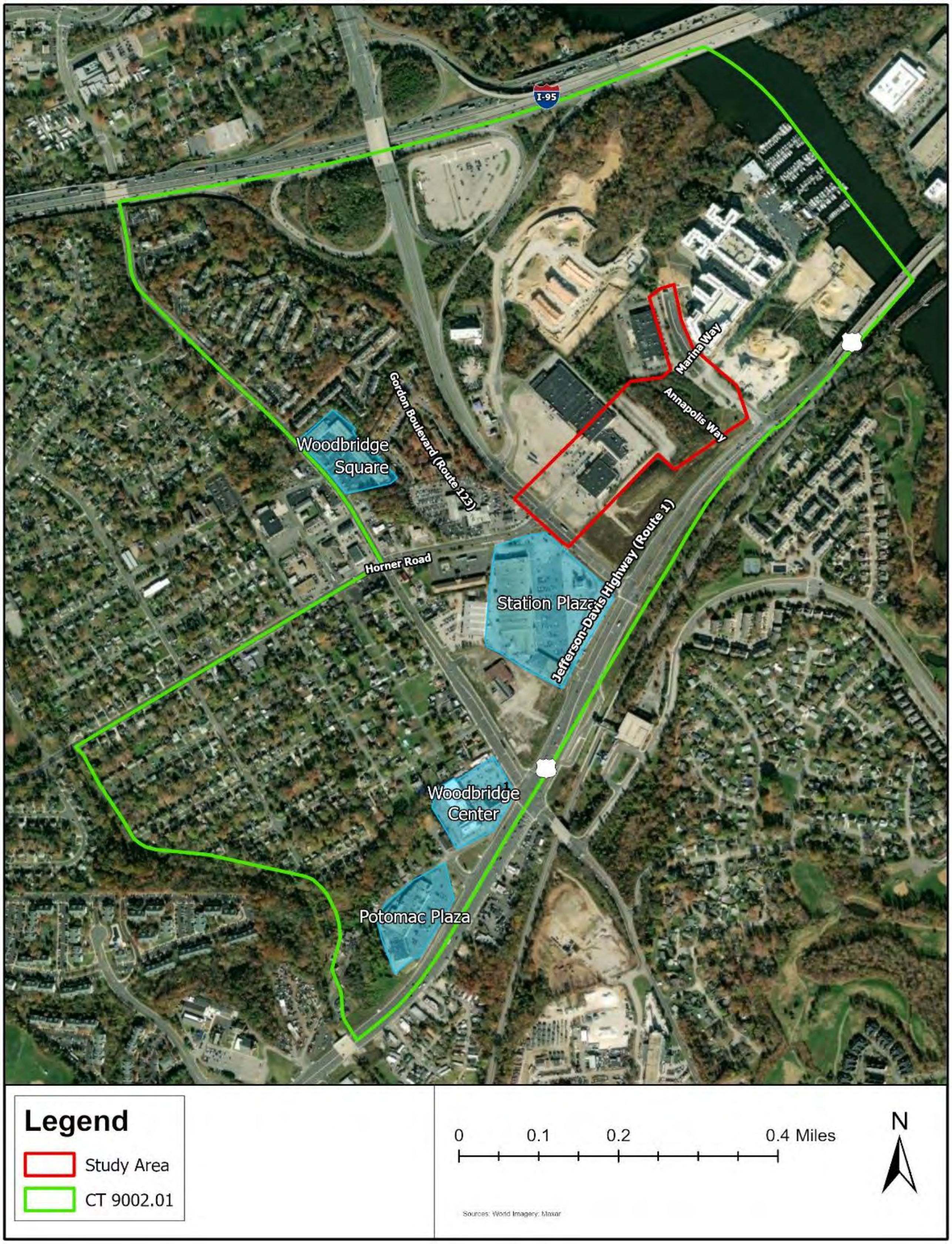
The No Build Alternative assumes the continuation of the North Woodbridge area, but the extension of Marina Way would not be constructed, limiting connectivity between commercial and residential areas. Access to the pending North Woodbridge Town Center would be restricted to Route 1 and Route 123 access points. The merging and diverging traffic to and from the North Woodbridge Town Center would lead to additional traffic congestion and delays on Route 1 and Route 123. This would adversely affect access to the surrounding communities.

Preferred Alternative

The Preferred Alternative provides direct access to the future North Woodbridge Town Center. The purpose of this alternative is to reduce traffic congestion from Routes 1 and 123, provide safe pedestrian connectivity in the area, ensure County – planned and local development, and provide improved access to residential and businesses in the area. The improvements associated with this alternative will have long term beneficial effects on the surrounding communities and neighborhoods in the North Woodbridge area.

Figure 3-1: Study Area

Figure 3-2: Census Tract



3.2.2. Population and Employment

Demographic data for the study area was gathered from the 2022 American Community Survey (ACS) and the Decennial Census. The study area is entirely within CT 9002.1 in Prince William County. CT 9002.1 includes multiple shopping centers in North Woodbridge as well as residential homes. This CT is located immediately southwest of Occoquan River, between I-95 and Route 1. The southwest limits of the CT extend to Occoquan Road and Marumsco Creek.

The population of the County has grown significantly from 1990 to 2020, with an overall increase of 123% during this period (**Table 3-3**). The percent increase in the County's population from 2010 to 2020 was just over 21%. The County experienced the largest increase in population between 2000 and 2010. Data for CT 9002.01 is not available for 1990 and 2000. The population percent increase for CT 9002.01, from 2010 to 2020, is slightly larger than the County's population percent increase during this same time period (**Table 3-3**). Based on the 2022 ACS 1-Year Estimates, 3.3% of the population aged 16 years or older in the County are unemployed.

Table 3-3 Population Over Time

County/Census Tract	1990	2000	2010	2020	Change 1990-2020	Change 2010-2020
Prince William County	215,686	280,813	402,002	482,204	123.6%	21.1%
Census Tract 9002.01	Data unavailable		2,042	2,710	N/A	32.7%

Source: U.S. Census Bureau: 1990, 2000, 2010, 2020; Prince William County 2020 Redistricting Data

Table 3-4 shows the projected population estimates for the County based on data from the Demographics Research Group of the Weldon Cooper Center for Public Service. By 2050, the County is anticipated to grow by an additional 51.7%.

Table 3-4 Population Projections

County	2023	2030	2040	2050	Change 2023-2050
Prince William County	491,693	554,344	645,380	746,076	51.7%

Source: Prince William County Government, 2022; Weldon Cooper Center, 2022

According to the 2020 Decennial Census, the County had a minority population of 281,607, which accounts for more than half the total population. (**Table 3-5**) The CT that encompasses the study area has a minority population of 69.2%. The population of people under 18 years old in the County and CT 9002.1 (26.7% and 23.9% respectively) are both slightly higher than the percentages in the Commonwealth of Virginia (21.9%). Additionally, the population over 65 years of age in the County is 10.5% while the percentage in CT 9002.01 is 7.3. This percentage of the 65 years and over population in both the County and CT is lower than the percentage of the total population of the Commonwealth that is 65 years of age or older.

Table 3-5 Demographics in 2020

County/Census Tract	Total Population	Minorities (%)	Under 18 Years (%)	Over 65 Years (%)
Prince William County	482,204	58.4%	26.7%	10.5%
Census Tract 9002.01	2,710	69.2%	23.9%	7.3%

Source: U.S. Census Bureau 2020 Decennial Census Data

No Build Alternative

The No Build Alternative assumes the continued growth of the North Woodbridge area. It would have no impact on the population growth or employment within the area.

Preferred Alternative

The Preferred Alternative would provide improved access to residential and commercial areas and improve pedestrian connectivity in the area. This alternative would have long term beneficial effects because the improvements associated with this alternative are designed to accommodate the anticipated population and economic growth in the North Woodbridge area.

3.2.3. Environmental Justice

Executive Order (EO) 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* directs federal agencies to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Similarly, EO 14096 *Revitalizing Our Nation's Commitment of Environmental Justice for All* was issued in April of 2023 directing agencies to "consider measures to address and prevent disproportionate and adverse environmental and health impacts on communities, including the cumulative impacts of pollution and other burdens like climate change." Based on EO 14096, the use of "high" has been removed from the term "disproportionately and adverse effects" in evaluating the effects of agency activities on Environmental Justice populations.

The FHWA provided guidance on implementing environmental justice (EJ) requirements provided in USDOT Order 5610.2C dated May 2021. The guidance states that "it is the policy of [US]DOT to promote the principles of environmental justice (as embodied in the Executive Order) through the incorporation of those principles in all [US] DOT programs, policies, and activities."

The FHWA issued Order 6640.23A - FHWA Actions to Address Environmental Justice in Minority Populations and Low- Income Populations (June 14, 2012). This order outlines approaches to ensure compliance with existing EJ regulations.

Demographic data for the County, Commonwealth, and the United States were analyzed to identify minority or low- income populations as defined by EO 12898. This data was used to determine whether the Project would have disproportionate and adverse human health or environmental effects on minority and low- income populations. Minority populations, as defined by FHWA Order 6640.23A, include citizens or lawful permanent residents of the US who are:

- Black: a person having origins in any of the black racial groups of Africa;
- Hispanic or Latino: a person of Mexican, Puerto Rican, Cuban, Central, or South American, or other Spanish culture or origin, regardless of race;
- Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent;
- American Indian and Alaskan Native: a person having origins in any of the original people of North America or South America (including Central America) and who maintains cultural identification through tribal affiliation or community recognition; or
- Native Hawaiian and Other Pacific Islander: a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

Any adverse effects must be investigated to determine if they are disproportionate and adverse to minority populations.

The US Department of Health and Human Services (HHS) issues poverty guidelines each year as a federal poverty measure. If a population's median household income is below that defined by the guidelines, the population is considered to be low-income (HHS, 2021). Median household income data for CT 9002.01 was acquired from the 2022 ACS 1-Year Estimates. The data were compared to the HHS 2021 Poverty Guidelines (HHS, 2021) and no minority populations were identified. In some situations, a high median household income can mask people living in poverty. Therefore, the proportion of people in poverty in CT 9002.01 was also examined to determine the presence of low-income populations. However, no low-income populations were identified as being present or adversely impacted as part of this Project.

Table 3-6. Minority and Low-Income Data in 2022

County/Census Tract	Total Population	Minority Population (%)	Median Household Income	Persons in Poverty (%)	Limited English Proficiency* (%)
Prince William County	482,804	281,973 (58%)	$120,398	33,093 (6.9%)	61,717 (13.6%)
Census Tract 9002.01	2,710	1,876 (69%)	$85,089	251 (10.8%)	409 (18.5%)

Source: U.S. Census Bureau, 2022 American Community Survey 1-Year Estimates
*Based on population 5 years old and over

No Build Alternative

This alternative would not provide improvements that would relieve traffic congestion and improve the overall accessibility of the North Woodbridge area. All residents and visitors of the North Woodbridge area would continue to experience the traffic congestion in the area. There is no disproportionate burden on the EJ population.

Preferred Alternative

There are no displacements because of this project. There is a small business park at 991 Annapolis Way that includes the Royalhouse Chapel International Church, Breakthrough Center. Royalhouse Chapel is a Bible based, multicultural church with a majority, minority congregation. The access to this business park will be modified because of the project. The County has been in coordination with the owner of the business park to ensure full access to Annapolis Way is permanently maintained. The modification to access to the Church does not represent an adverse effect to minority/low-income populations as long as the County assures full access to the church is maintained for the duration of the project.

The purpose of the project is to relieve the burden of future traffic congestion and improve vehicle and pedestrian accessibility to residences and businesses in the North Woodbridge area. Although there are EJ populations present, there is no disproportionate burden on the EJ population. No low-income populations have been identified that would be adversely impacted by the proposed project. Therefore, in accordance with the provisions of E.O. 12898 and FHWA Order 6640.23 no further EJ analysis is required; the project does not have a disproportionate and adverse effect on low income or minority populations.

In addition to Census data, the EPA's environmental justice mapping and screening tool (EJScreen) was used to identify environmental justice populations around the study area. Refer to **Appendix A** Environmental Justice for a summary of this information.

3.2.4. Limited English Proficiency and Age Demographics

EO 13166 directs federal agencies to address the access to services for people with Limited English Proficiency (LEP). The Department of Justice issued guidance under EO 13166 for implementing the LEP analysis. The guidance states to "examine the services they provide, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them." Data from the US Census Bureau was collected to determine the presence of persons with LEP has occurred as a part of this Project.

The percentages of people in the County and CT 9002.01 that are of LEP can be found in **Table 3-6**. The proportion of people with LEP is provided by the US Census Bureau as the number of people in that population who can speak English less than "very well". The population of the census tract has a higher proportion of people in this group than the county (18.5 % and 13.6%, respectively). According to the data, the most common language spoken, other than English, in both the CT and the County is Spanish. According to 2021 ACS 5-Year Estimates, just over 27% of the CT population of 5 years old and over speak Spanish. Additionally, more than 6% of this same population are proficient in either Asian or Pacific Island languages. These proportions indicate the presence of minority populations within CT 9002.01.

3.3. Right of Way/Relocations

No Build Alternative

The No Build Alternative does not require ROW acquisition and as a result, does not require relocations and has no direct adverse impacts to residences, businesses, and environmental justice populations.

Preferred Alternative

The Preferred Alternative has no relocations associated with the proposed alignment. Multiple businesses exist in the location of the proposed alignment for Marina Way; however, relocations of these businesses are proposed during construction of the North Woodbridge Plaza. The relocations would occur before the construction of the Preferred Alternative. The relocations are the responsibility of a private developer.

A portion of the proposed alignment will require ROW acquisition due to the roadway being on a new alignment that goes through the existing Gordon Plaza Shopping Center. There will be about 2.5 acres of land acquired for right of way for the proposed alignment. **Figure 3-3** depicts the five parcels from which permanent and/or temporary easements would need to be acquired. As design progresses, additional refinements to the project footprint could occur and the ROW acquisition estimates would be updated.

All efforts would be made to avoid or minimize ROW impacts. The acquisition of ROW would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Under the law, the purchase price for property acquired would be fair market value as determined by an appraisal prepared by a qualified appraiser.

3.4. Air Quality

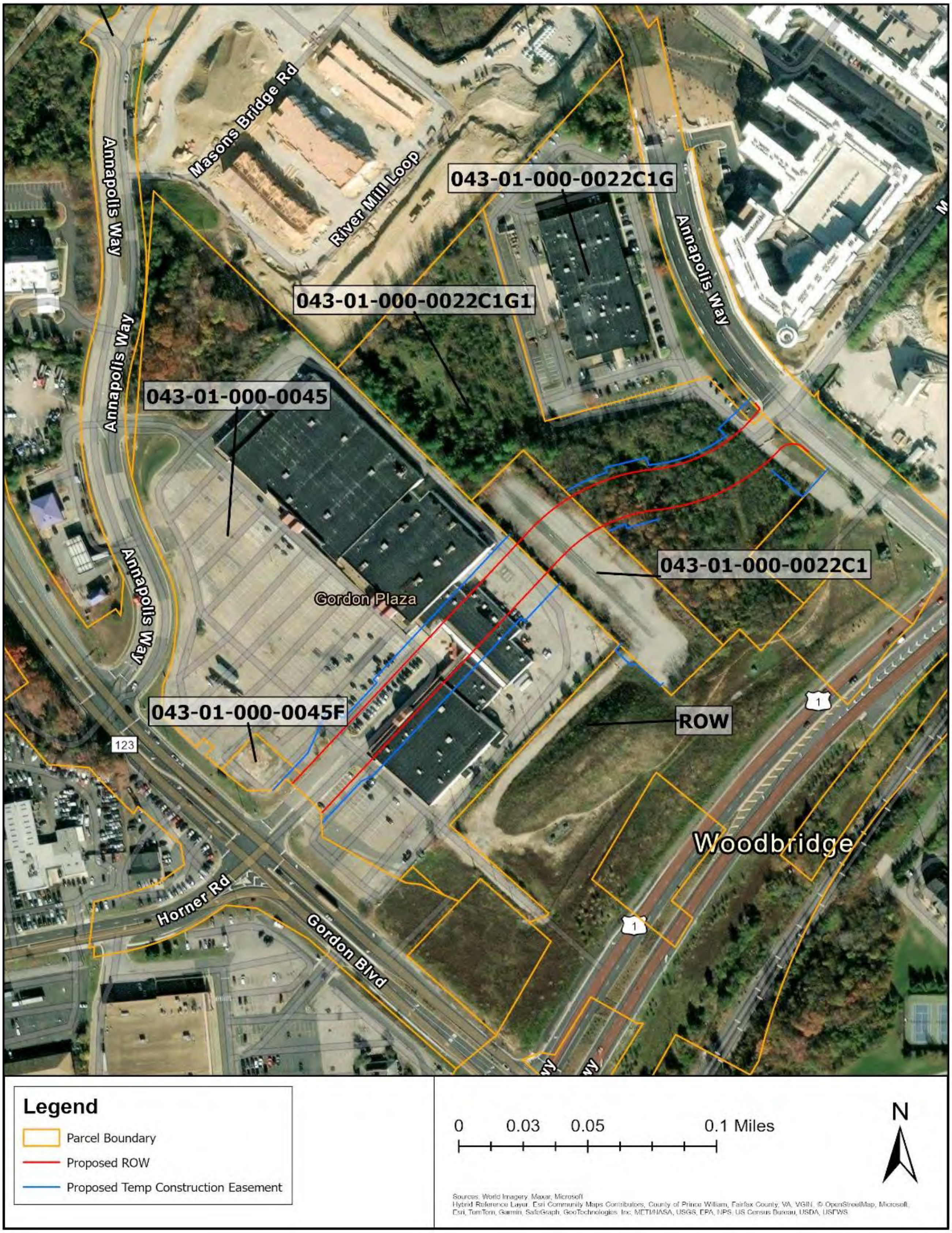
In accordance with NEPA, air quality impacts of transportation improvement projects must be considered at both the regional and local level. The project is in Prince William County, which has been designated by the EPA as nonattainment for the 8-hour ozone NAAQS and attainment for all other NAAQS. The air quality analysis completed for the Preferred Alternative indicates that the project would not cause or contribute to a new violation, increase the frequency or severity of any violation, or delay timely attainment of the NAAQS established by EPA.

The findings for the air quality analysis are summarized below and described in detail in the Air Quality Technical Report included as **Appendix B**.

Carbon Monoxide (CO) Analysis. As the project is in a region that is in attainment of the CO NAAQS, EPA project-level (“hot-spot”) transportation conformity requirements do not apply. As only NEPA applies, a project-specific analysis and/or assessment for CO is not needed under the terms of the programmatic agreement between FHWA and VDOT for project-level air quality analyses for CO. As documented in that agreement, which is based on the analysis and information presented in the template Programmatic Agreement and Technical Support Document (TSD) developed in the National Cooperative Highway Research Program (NCHRP) 25- 25 Task 104 study (2020), the weight-of-evidence shows that it may reasonably be concluded that the NAAQS for CO will be met for all projects given:

- Continued implementation of effective emission control technology, increasingly more stringent motor vehicle emission and fuel quality standards implemented over the past few decades by the EPA that have had the combined effect of substantially reducing CO emission rates nationwide, resulting in long-term downward trends in emissions and near-road ambient concentrations of CO despite increasing VMT;

Figure 3-3: Property Boundaries



- Extensive experience in project-specific modeling for CO for a wide variety of project types, configurations and operating conditions in which compliance with the NAAQS established by EPA for CO is readily demonstrated given the substantially reduced CO emission rates, and despite the use of multiple worst-case assumptions for emission and dispersion modeling that have a compounding effect such that emissions and near-road ambient concentrations are substantially over-estimated;
- Extensive experience in programmatic agreements for project-level agreements for CO that establish ever-increasing thresholds for such analyses given the substantially reduced emission rates; and
- The results of worst-case modeling conducted for this PA for typical highway project types, configurations and operating conditions in which compliance with the NAAQS is readily demonstrated, and by a substantial safety margin.

Fine Particulate Matter (PM2.5) Analysis. The project is in an attainment area for PM and therefore is not subject to a PM conformity assessment.

MSAT Analysis. FHWA guidance (2023) states that "…EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA). These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter." Following FHWA guidance for projects with low potential impacts based on forecast traffic volumes and other technical criteria, a qualitative assessment of potential MSAT impacts was conducted for this project.

Based on that assessment, best available information indicates that, nationwide, regional levels of MSATs are expected to decrease in the future due to ongoing fleet turnover and the continued implementation of increasingly more stringent emission and fuel quality regulations. Nonetheless, technical shortcomings of emission and dispersion models and uncertain science with respect to health effects effectively limit meaningful or reliable estimates of MSAT emissions and effects of this project at this time. While it is possible that localized increases in MSAT emissions may occur as a result of this project, emissions will likely be lower than present levels in the design year of this project as a result of EPA's national control programs that are projected (in the FHWA 2023 Guidance) to reduce annual MSAT emissions by 76 percent between 2020 and 2060 while VMT are expected to increase on a national level by 31 percent. Although local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

No Build Alternative

The No Build Alternative would not have any impacts to air quality.

Preferred Alternative

The air quality assessment of the Preferred Alternative indicates that the project would meet all applicable air quality requirements of the NEPA and federal and state transportation conformity regulations. As such, the Preferred Alternative will not cause or contribute to a new violation of the NAAQS established by EPA.

GHG Qualitative Assessment. For each alternative in this EA, the amount of GHGs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. Because the estimated VMT under each of the alternatives are nearly the same, it is expected there would be no appreciable difference in overall GHG emissions among the various alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of fuel efficiency improvements and electrification policies that are projected to reduce annual statewide GHG emissions from on-road sources by nearly 50 percent between 2015 and 2040 (VDOT, Statewide Planning-Level GHG Assessment, December 2021).

Regional Conformity Considerations. Federal conformity requirements, including specifically 40 CFR 93.114 and 40 CFR 93.115, apply as the area in which the project is located is designated as nonattainment for ozone. Accordingly, there must be a currently conforming transportation plan and program at the time of project approval, and the project must come from a conforming plan and program (or otherwise meet criteria specified in 40 CFR 93.109(b)).

As of the date of preparation of this analysis, the project is included in the currently conforming FY 2023-2026 Transportation Improvement Program (TIP) and 2045 Long Range Transportation Plan (LRTP). The LRTP and TIP are developed by the metropolitan planning organization (MPO) for the region, whose members include VDOT (Metropolitan Washington Council of Governments, 2024).

3.5. Noise

The Project’s noise analysis details the noise impact assessment for the Existing (2023) condition and the future design-year (2050) of the Preferred Alternative. The No Build Alternative was not evaluated because there are no Section 4(f) resources in the study area and the project is not related to an interstate system. The noise analysis was performed in accordance with current Federal Highway Administration (FHWA) regulations contained in 23 CFR 772 and Virginia Department of Transportation (VDOT) Noise Abatement Policy.

Noise abatement was evaluated to determine if the potential abatement measure satisfies VDOT criteria to be considered warranted, feasible and reasonable. Predicted noise levels in the Design Year 2050 were evaluated for three CNEs using FHWA’s Traffic Noise Model (TNM) version 2.5. The CNEs include:

- **CNE A** is located in the north corner of the Marina Way and Annapolis Way intersection. It is comprised entirely of residences and associated areas of exterior use within the Viridium Apartments Woodbridge community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a rooftop common area and outdoor pool area are also part of the complex.
- **CNE B** is located north of Annapolis Way and west of Marina Way. It is comprised entirely of residences and associated areas of exterior use within the Rivergate Apartments community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a common outdoor area with a pool is also part of the complex.
- **CNE C** is located west of the Marina Way and Annapolis Way intersection. This CNE includes the Royalhouse Chapel International place of worship.

The noise modeling of existing and future design-year noise conditions in the study area was completed using FHWA TNM version 2.5. The geometric modeling of the study area accounted for all relevant terrain features, buildings, and existing and proposed roadway improvements. Traffic data utilized consisted of the projected worst-case loudest-hour traffic volumes. The predicted estimates of existing noise levels are then used as the baseline against which future noise levels are compared and potential noise impacts assessed (**Table 3-7**).

Table 3-7. Predicted Noise Levels

CNE	Land use- Description	Activity Categories	Range of Predicted Exterior & Interior Noise Levels for the Worst Hour (PM)	
			2023 Existing	2050 Build
A	Residential – West of Marina Way, between Annapolis Way and Rivergate Place. Comprised entirely of residences within the Viridium Woodbridge Apartments community.	B	50 – 58	50 - 61
B	Residential – West of Marina Way, north of Rivergate Place. Comprised entirely of residences within the Rivergate Apartments community.	B	50 – 54	50 - 56
C	Institutional – West of Marina Way, south of Annapolis Way. Includes the Royalhouse Chapel International.	D	26 – 26	31 - 31

No Build Alternative

The No Build Alternative would not introduce any new noise generators to the project corridor. This alternative would also not result in any noise impacts.

Preferred Alternative

In summary, noise impact would occur wherever project noise levels are expected to approach within one decibel or exceed 67 dBA Leq at noise-sensitive land uses in Activity Categories B (exterior residential) or approach within one decibel or exceed 52 dBA Leq at noise-sensitive land uses in Activity Category D (interior institutional) during the loudest hour of the day. Noise impact also would occur wherever project noise levels cause a substantial increase over existing noise levels—an increase of 10 dB or more is considered substantial by VDOT.

In the 2023 Existing condition, noise-sensitive receptors are not predicted to be exposed to traffic-noise levels that approach or exceed the applicable NAC impact threshold for all locations. Likewise, in the 2050 Build alternative, traffic-noise levels at noise-sensitive receptors are predicted to be below the applicable NAC threshold for all locations. Additionally, increases in traffic-noise levels are predicted to range between one and seven decibels. Therefore, no impacts due to substantial increases are predicted. Since no noise impact is predicted to occur because of the project, no further analysis is required and noise mitigation would not be warranted.

The *Preliminary Noise Analysis Technical Report* in **Appendix C** provides additional detail on analysis methodology, findings, and abatement considerations.

3.6. Water Resources

Water resources are federally, and state regulated under the federal Clean Water Act (CWA) (33 USC 1251 et seq.) and the Virginia State Water Control Law. Section 404 of the CWA regulates discharges of dredged or fill material into Waters of the United States (WOUS). WOUS is 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 (streams, lakes, bays, etc.) and their associated wetlands (inundated or saturated areas that support vegetation adapted for life in wet soils). US Army Corps of Engineers (USACE), VDEQ, and Virginia Marine Resource Commission (VMRC) all have permit authority for various activities in, under, and over WOUS in Virginia.

3.6.1. Streams and Wetlands

The project is located within the Potomac-Shenandoah watershed. The major tributaries to this watershed include the Potomac River, S. Fork Shenandoah River, and N. Fork Shenandoah River. The watershed covers 5,702 square miles in portions of Virginia, West Virginia, Maryland, and Pennsylvania. Within the Potomac-Shenandoah major watershed, the project falls within the Middle Potomac-Anacostia-Occoquan 8-digit hydrologic unit code (HUC 02070010) boundary. The entire study area is located within the Belmont Bay-Occoquan River 12-digit HUC watershed boundary (HUC 020700100803), as shown on **Figure 3-4**.

No Build and Preferred Alternatives

No streams or open water bodies were identified within the study area during the WOUS delineation. For this reason, the No build Alternative and Preferred Alternative would not require alteration of any streams or open water. No compensation would be required.

EO 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 defined by USACE (33 CFR § 328.3[c]) and EPA (40 CFR § 120.2[3]) as:

> *…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.*

The WOUS delineation identified one palustrine forested (PFO) wetland located along the southwest edge of the undeveloped, vegetated area located in the central portion of the study area. The wetland is 0.15 acre and falls outside the LOD for the proposed roadway alignment. The delineated wetland is shown in **Figure 3-5**.

No Build Alternative and Preferred Alternative

The No Build Alternative and Preferred Alternative would have no impact on wetlands.

See **Appendix D** Waters of the US and Wetland Delineation Report for more information.

3.6.2. Water Quality

Impaired Waters

VDEQ's Final 2022 305(b)/303(d) Water Quality Assessment Integrated Report includes impairment designations for the Occoquan River (VDEQ, 2022). The report details the pollutant responsible for the impairment, and the suspected cause and source of the pollutant. All impaired waters in Virginia are placed on a federally mandated 303(d) impaired waters list. Waters that are impaired due to human activities require a plan to restore water quality and associated designated use(s). VDEQ schedules each of these waters for development of a Total Maximum Daily Load (TMDL), which is a reduction plan that defines the limit of a pollutant(s) that a water can receive and still meet water quality standards. A TMDL Implementation Plan is developed after a TMDL is approved by the EPA. Once fully implemented, the TMDL Implementation Plan would restore the impaired waters and maintain its water quality.

The type of water quality data or parameters collected is determined by the waterbody's classification and corresponding Water Quality Standards. The information gathered from the monitoring stations determines the "use support" status of waterbodies, or how well a waterbody supports its designated uses. The Occoquan River, located approximately 1,150 linear feet northeast of the study area, is currently listed as impaired for aquatic life, fish consumption, and open water uses under 303(d) due to insufficient dissolved oxygen and PCB in fish tissues (Category 4A).

Category 4A indicates "water is impaired or threatened for one or more designated uses but does not require a TMDL because the TMDL for specific pollutant(s) is completed and USEPA approved" (VDEQ, 2022). The Occoquan River is included in the Chesapeake Bay TMDL (Total Suspended Solids, Total Nitrogen, and Total Phosphorus) and the Tidal Potomac River TMDL Implementation Plan (PCBs).

No Build Alternative and Preferred Alternative

The No Build and Preferred Alternatives are not expected to increase bacteria levels within the Occoquan River as sources typically include permitted point sources, sanitary sewer and septic systems, wildlife, and pets. The proposed project would not introduce or cause an increase in any of these sources.

Figure 3-4: Watershed Boundaries

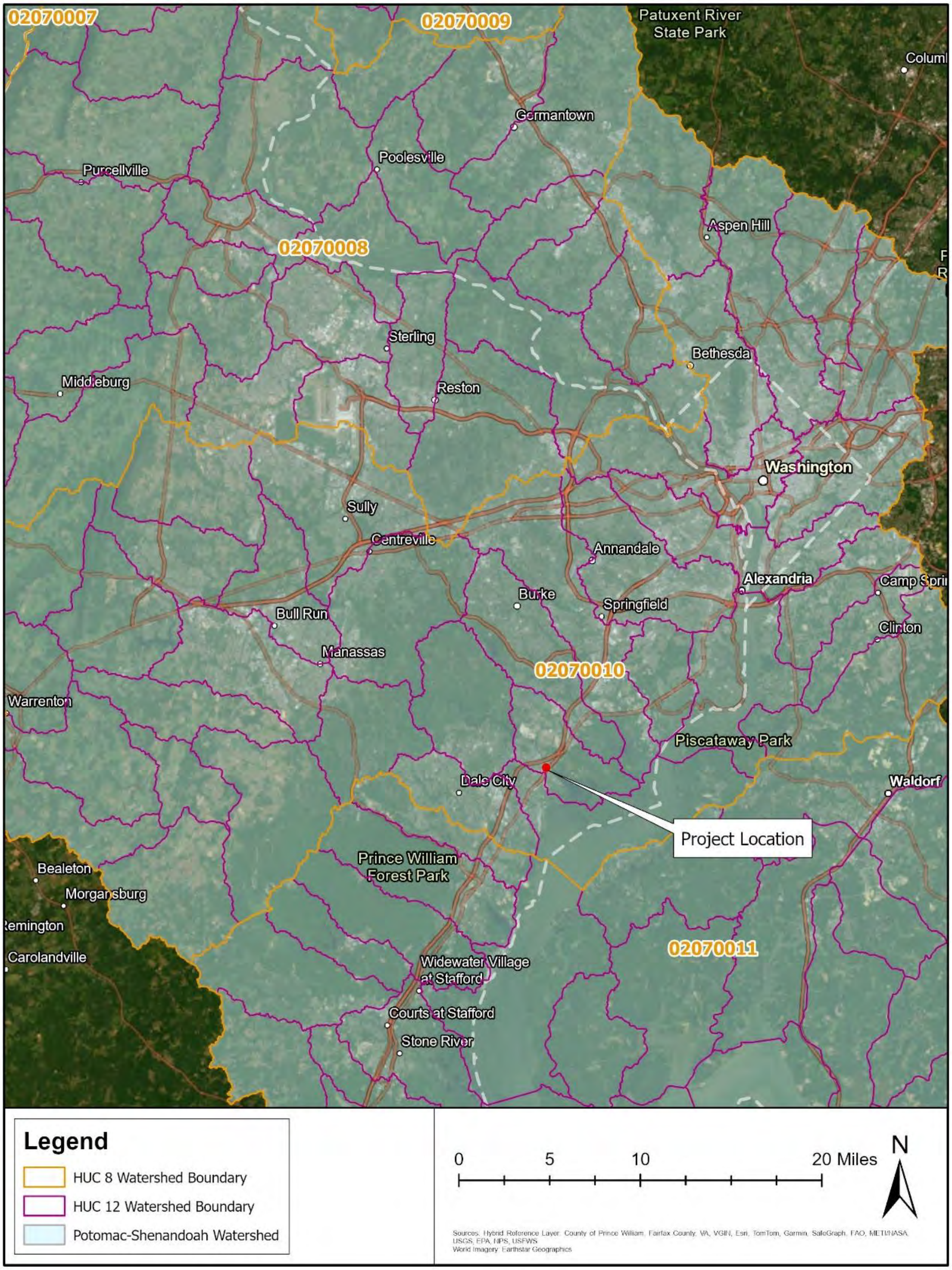


Figure 3-5: Water Resources

Preferred Alternative The Preferred Alternative may incur short-term impacts relating to runoff from ground disturbing activities during construction. These potential impacts would be minimized with implementation of appropriate erosion and sediment control practices in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. The potential long-term impacts associated with the Preferred Alternative include increases in impervious surfaces and increase in traffic volumes leading to subsequent increases in pollutants washed from the road surface into receiving water bodies. The increases in impervious surface can also potentially increase stormwater flows, thus increasing sedimentation and turbidity problems in downstream waters.

To mitigate potential long-term impacts, the County will maintain both water quality and quantity post-construction equal to or better than preconstruction as outlined in the *Minimum Requirements for the Engineering, Plan Preparation and Implementation of Post Development Stormwater Management Plans, Instructional and Information Report Number: IIM-LD-195.12* (VDOT, 2019). Stormwater management measures, such as detention basins, vegetative controls, and other measures, would be implemented in accordance with federal, state, and local regulations to minimize potential water quality impacts. Also, the implementation of the guidance restricts contractors from discharging contaminants that may affect water quality. The guidance outlines the process the contractor should take in reporting a spill and appropriate actions 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.

Chesapeake Bay Preservation Act

Excessive nutrients in the Chesapeake Bay and its tidal tributaries promote a number of undesirable water quality conditions, such as excessive algal growth, low dissolved oxygen, and reduced water clarity, which impacts the necessary conditions for healthy aquatic life. The excessive amounts of nutrients (nitrogen and phosphorus) and sediment washing into the Bay from its major tributaries result from agricultural operations, urban and suburban stormwater runoff, wastewater facilities, air pollution, and other sources including onsite septic systems.

Since the 1987 Chesapeake Bay Agreement, EPA, the District of Columbia, and the six states in the Chesapeake Bay watershed have implemented various programs to improve the health of the Chesapeake Bay so that it will meet the requirements of the Clean Water Act. However, despite continuing efforts, the Bay remains significantly impaired, and cleanup plans failed to meet the 2010 deadline for pollutant reductions stipulated in the 2000 Chesapeake Bay Agreement. In addition, the EPA reached a settlement in a 2009 lawsuit filed by Bay advocacy groups claiming that the EPA failed to take adequate measures to protect and restore the Bay.

Virginia's Chesapeake Bay Preservation Act of 1988, as locally implemented and required conformance with performance criteria, protects Prince William County. To protect and improve the quality of waterways, sensitive areas along streams have been designated as Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). RPAs include tidal wetlands, certain nontidal wetlands and tidal shores, and a minimum 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all remaining areas. RPAs that have been designated by Prince William

County are shown in **Figure 3-5**. By managing land uses within these areas, local governments help reduce the water quality impacts of nonpoint source pollution and improve the health of the Chesapeake Bay. The regulation of activities within RMAs and RPAs has been incorporated into the enforceable policies of Virginia's Coastal Zone Management Program.

No Build and Preferred Alternatives

Both the No Build and Preferred Alternatives would not impact RPAs.

3.6.3. Drinking Water and Groundwater

There are no EPA-designated sole source aquifers within 1.0 mile of the project site.

Water and sewer services for the study area are provided by the Prince William County Service Authority. Water is drawn from the Occoquan Reservoir and treated at the Frederick P. Griffith Water Treatment Plant in Fairfax. The Occoquan Reservoir is an approximately 1,700-acre impoundment which forms part of the northern border of Prince William County with Fairfax County. The reservoir regularly supplies water to approximately 40% of Northern Virginia but can supply all of Northern Virginia in an emergency (Prince William Conservation Alliance, 2003). Fairfax Water owns and maintains the dam at the southern boundary of the reservoir, in addition to having protective riparian buffer easements along the entire reservoir in both counties. The reservoir is susceptible to nonpoint source pollution as development occurs in the region. The primary water quality concern for the reservoir is increasing salinity from road salts, water treatment processes, industrial discharge, and consumer products. Other current water quality concerns include endocrine disrupting compounds (EDCs) and per- and poly fluorinated alkyl substances (PFAS), both of which appear to originate from treated wastewater (County Department of Public Works, 2021). The reservoir is approximately 3 miles northwest of the study area.

The study area is located at the eastern edge of the Piedmont Crystalline-rock aquifer, which consists of mostly crystalline metamorphic and igneous rock covered in unconsolidated material called regolith. Groundwater recharge varies significantly due to local precipitation, topography, and the capacity of the land surface to allow water to infiltrate. Most recharge occurs in the areas between streams, where precipitation enters the aquifer through the porous regolith. The water then moves laterally and discharges into nearby streams or depressions during or after precipitation events, with a small portion flowing downward into fractures in the bedrock. Well yields are typically small, and groundwater is generally suitable for drinking, with some localized areas of elevated iron, manganese, and sulfate. Most of the water withdrawn from the aquifer is for domestic and commercial supplies, with the remainder going towards industrial, mining, thermoelectric, and agricultural uses (USGS, 2016).

No Build and Preferred Alternatives

Both the No Build and Preferred Alternative would not impact any drinking water or groundwater in the study area.

3.7. Wildlife and Threatened & Endangered Species

Species that have the potential to occur or have potential habitat within the study area according to the Virginia Department of Wildlife Resources (VDWR) Wildlife Environmental Review Map Service (WERMS) database, the VDCR Natural Heritage Data Explorer database, and the USFWS IPaC database are included in **Table 3**-8. Note that the six federally and state-listed threatened and endangered species or species of concern included in **Table 3-8** are discussed further in this section.

The USFWS is responsible for listing, protecting, and managing federally listed threatened and endangered species under the Endangered Species Act of 1973, as amended (ESA). The ESA defines an endangered species 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 (16 USC 1532).

The results from a query of the USFWS IPaC on-line system in December 2023 identified one federally listed species (northern long-eared bat [Myotis septentrionalis]) and one federally proposed endangered species (tri-colored bat [*Perimyotis subflavus*]) with the potential to occur in the study area (USFWS, 2023). One of the goals of the IPaC system is to streamline the environmental review process associated with Section 7 of the ESA. The official species list also included the monarch butterfly (*Danaus plexippus*) as a candidate species. In addition, the bald eagle (*Haliaeetus leucocephalus*), which is protected by the Bald and Golden Eagle Protection Act (16 USC 669 et seq.), was mentioned in the USFWS IPaC response.

The Commonwealth of Virginia also maintains a database for occurrences of natural heritage resources, which are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations, as well as a database of state endangered or threatened species. The VDCR database identified one state listed endangered species (Brook floater [*Alasmidonta varicosa*]) within the 12-digit HUC (PL-48; Lower Occoquan River-Belmont Bay) containing the study area (DCR, 2024).

The Virginia Department of Wildlife Resources (VDWR) is responsible for listing, protecting, and managing state listed threatened and endangered species. A review of the VDWR database (i.e., WERMS) indicates that neither federally nor state-listed threatened and endangered species have been documented within a two-mile radius of the study area. The VDWR database identified one species (spotted turtle [*Clemmys guttata*]), as a collection concern. Additionally, Occoquan River and Marumsco Creek were identified as anadromous fish use streams, however, both streams are outside of the study area. The WERMS database identified no trout streams in the study area (DWR, 2023).

Table 3-8. Species and/or Habitat That May Occur Within Study Area

Species Common Name	Species Scientific Name	Status	Habitat
Northern long-eared bat[1]	*Myotis septentrionalis*	Federally Listed Endangered and State Endangered	Caves and cave-like structures (hibernacula), forests, trees.

Species Common Name	Species Scientific Name	Status	Habitat
Monarch butterfly[1]	*Danaus plexippus*	Federal Candidate	Abundance of milkweed (Asclepias spp.) for breeding populations; abundance of nectar-producing flowering plants for breeding and migrating populations.
Bald Eagle[1,3]	*Haliaeetus leucocephalus*	Not Listed, Protected by Bald and Golden Eagle Protection Act	Nest in tall trees with open canopies near water bodies where they forage.
Brook Floater[2]	*Alasmidonta varicosa*	State Listed Endangered	Prefers stable flowing water habitats, small to mid-size creeks and small rivers with gravel substrates, riffles and moderate rapids with or gravel bottoms.
Bat, tri-colored[1]	*Perimyotis subflavus*	Federally Proposed Endangered and State Endangered	Caves, mines, road-associated culverts, forests, trees, manmade structures
Turtle, spotted[3]	*Clemmys guttata*	Collection Concern	Shallow waterbodies with abundant vegetation, wetlands, flooded fields, woodland streams, pools, and ponds.

[1]USFWS IPaC
[2]VA DCR NHDE
[3]VA DWR WERMS

Information regarding the potential for each of these species to be present within and/or adjacent to the project site is provided below.

3.7.1. Northern Long-eared Bat.

The northern long-eared bat (NLEB) may occur within the study area. During the winter, the NLEB occupies caves and mines with constant temperatures, high humidity, and no air currents. Summer habitat for this species consists of living trees or dead snags where the bats roost singly or in colonies under the bark. The primary threat cited for listing the NLEB is white-nose syndrome, an infectious disease caused by the fungus *Pseudogymnoascus destructans*. However, other threats do exist, such as modifications or destruction of hibernacula and forest conversions or modifications.

No Build Alternative

This alternative would have no impact on this species.

Preferred Alternative

The tree removal associated with the Preferred Alternative would disturb potential summer roosting habitat for the NLEB and habitat for the Tri-colored bat. Utilizing the USFWS Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat (dated February 2018, amended March 23, 2023), it was determined the Preferred Alternative would “May Affect Likely to Adversely Affect” the NLEB. The limited tree clearing associated with the Preferred Alternative would be performed outside the April 1st to November 14th TOYR. It was determined that the Preferred Alternative would have a May Effect, Likely to Adversely Affect the NLEB. See **Appendix E** for more details.

3.7.2. Monarch Butterfly

The monarch butterfly is currently a “Candidate” species and is not yet proposed for listing; however, the USFWS intends to develop a proposed rule to list the monarch butterfly as its priorities allow (85 FR 81813).

Adult monarch butterflies are large and conspicuous, with bright orange wings with black veins, surrounded by a black border with a double row of white spots. The North American populations of monarch butterflies breed throughout the United States and parts of Canada and Mexico and overwinter in Mexico and along the coast of California (USFWS, 2020). Monarch butterflies require healthy and abundant milkweed and other nectar-producing flowers during breeding and migration, and groves of roosting trees with proximity to nectar sources during migration and overwintering.

Primary threats to the North American populations of monarch butterflies include loss and degradation of habitat (from conversion of grasslands to agriculture, widespread use of herbicides, logging or poor management of overwintering sites, urban development, and drought), continued exposure to insecticides, and effects of climate change (USFWS, 2020).

Potential habitat for the monarch butterfly is present within the study area, however habitat conditions are marginal. Potential habitat includes areas of herbaceous vegetation that could potentially support milkweed and other nectar-producing plants. Within the study area, non-forested herbaceous vegetation is limited to maintained medians and ridges around Gordon Plaza which are periodically mown and maintained. There are no known occurrences of the monarch butterfly in the vicinity of the study area (DWR, 2022).

No Build and Preferred Alternatives

These alternatives would have no impact on this species.

3.7.3. Tri-colored Bat

Tri-colored bats are small insect-eating bats. During the winter, tri-colored bats hibernate in caves and abandoned mines. In the southern U.S., they may also roost in culverts and emerge to forage on warmer nights. Spring, summer, and fall habitat for this species consists of forested habitats where they roost among the leaves of live or recently dead deciduous hardwood trees, and occasionally in Spanish moss, pine trees, and human structures. Tri-colored bats exhibit high site fidelity, meaning they are known to return to the same summer roosting and hibernation sites each year. The primary threat facing the tri-colored bat is white-nose syndrome, however, habitat loss and fragmentation due to forest conversions or modifications also contribute to population declines.

No Build Alternative

This alternative would have no impacts on this species.

Preferred Alternative

The limited tree clearing associated with the Preferred Alternative would be performed outside the April 1st to November 14th TOYR. It was determined that the Preferred Alternative would have a May Effect, Not Likely to Adversely Affect the Tri-colored bat.

3.7.4. Brook Floater

The brook floater is a small to medium sized, elliptically shaped mussel which inhabits clean, gently flowing streams along the U.S. East coast. They are sensitive to high water flows and require substrates which allow them to anchor to the stream bottom, such as gravel or sandy shoals, but are not usually found in very slow flow conditions. The greatest threat to the species results from wastewater and effluent from domestic, urban, agricultural, and forestry sources. Additional threats to the species include habitat degradation, residential development, and predation. Brook floaters are particularly vulnerable to pollution, competition with invasive species such as the Zebra Mussel, and changes to temperature and precipitation patterns due to climate change.

No streams were identified in the study area; therefore, the species is not likely to be present.

No Build and Preferred Alternatives

These alternatives would have no impact on this species.

3.7.5. Spotted Turtle

The spotted turtle is a small semi-aquatic turtle with yellow dots on a dark shell. They are found throughout the U.S. east coast and Great Lakes region, favoring shallow aquatic habitats with abundant vegetation, including wetlands, flooded fields, and woodland streams and ponds. Individuals, particularly males, will wander across land between wetlands within a home range of one to eight acres. They are omnivorous, consuming other animals such as worms, insects, amphibian eggs, mollusks, and crustaceans in addition to aquatic vegetation and algae. Spotted turtles overwinter in muddy wetland bottoms, emerging in early spring. Females nest in open, sunny locations with moist, well-drained soils until their eggs hatch in August or September. Spotted turtle populations are threatened by collection for the pet trade, predation, habitat fragmentation and loss, pollution, and declining water quality.

Due to the presence of wetlands and the proximity to nearby water bodies, habitat for the spotted turtle may be present in the study area.

No Build and Preferred Alternatives

These alternatives would have no impact on this species.

3.7.6. Bald Eagle

The bald eagle is not federally listed as threatened or endangered but is nevertheless protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 669 et seq). Therefore, it is often included, as here, in discussions of threatened and endangered species. In Virginia, bald eagles are mostly found along the James, Rappahannock, and Potomac Rivers. This species builds nests in tall hardwood trees with open canopies near water bodies, where they forage. The USFWS recommends a buffer of 660 feet around bald eagle nests for proposed clearing, construction, and landscaping activities (USFWS, 2007).

There are no bald eagle concentration areas in the study area (USFWS, 2023) and the nearest known bald eagle nest is approximately 1.5 miles from the project site (Center for Conservation Biology, 2024).

No Build and Preferred Alternatives

These alternatives would have no impact on this species.

3.8. Cultural Resources

The *Phase IA Archaeological Reconnaissance Survey and Historic Architecture Assessment, Marina Way Extension Project, Prince William County, Virginia (July 2023)* report was prepared for the project. The study area for the report measures 18.7 acres and is located between Route 123 on the west, and Route 1 on the East; the 18.7 acres are considered the APE. The intention of the survey and assessment was to determine the effect of the proposed work on historic properties per Virginia Department of Historic Resources (DHR) guidelines. The results of the survey and assessment indicated that the wooded area located in the central portion of the APE has moderate potential for archaeological resources. This portion of the APE was tested systematically per DHR Guidelines, with shovel test pits (STPs) excavated at intervals of 50 ft (15m) throughout the wooded area. Areas that exhibited excessive prior disturbance, slope greater than 20 percent, or standing water were not recommended for subsurface testing, but were visually inspected. The testable area totaled approximately 3.45 acres. The report also indicated that there is one previously identified aboveground resource within the APE, Gordon Plaza (076-6114). According to the Virginia Cultural Resources Information System (VCRIS), the resource has been recommended not eligible for listing in the NRHP.

No Build Alternative

These alternatives would have no impact on cultural resources.

Preferred Alternative

In response to the recommendation identified in the Phase IA report and concurrence on the recommendation from DHR, the *Phase IB Archaeological Survey, Marina Way Extension Project, Prince William County, Virginia (February 2024)* report was prepared for the project. The criteria established for significance or potential significance established in 36 CFR 60.4 was utilized in evaluating artifacts and potential archaeological sites. The fieldwork was conducted from August 14 – 18, 2023. Archaeological testing methods within the APE included visual inspection, pedestrian survey, and the systematic use of STPs. Overall, the soil encountered varied levels of disturbance and there were no archaeological sites identified and no further testing recommended. DHR concurred with these findings and issued a “No Historic Properties Affected” finding for the Preferred Alternative under Section 106 of the NHPA on October 13, 2023. See **Appendix F** for the Phase IB report.

3.9. Pedestrian and Bicycle Connectivity

There are pedestrian sidewalks provided along the roadway network within and adjacent to the study area. Also, there is a shared-use path (SUP) located along the west side of Route 1. According to the 2023 Countywide Trails Plan, this SUP provides access along Route 1 through the North Woodbridge area. (County, 2023). In addition, the Plan identifies a SUP along Marina Way north of the study. This SUP is located along the west side of Marna Way and provides connectivity between Annapolis Way and the Occoquan Marina. The County has also identified the following planned bike lanes, SUPs, and sharrows lanes within and immediately adjacent to the study area:

- Planned bike lanes along Annapolis Way between Route 1 and Route 123.
- Planned sharrows lanes from the Marina Way and Annapolis Way intersection to Occoquan Road. Sharrows lanes are planned for the Marina Way Extension project.
- Planned SUP along Route 123 from Route 1 to I-95.

All existing pedestrian sidewalks, SUPs, planned SUPs, planned bike lanes, and planned sharrows lanes are illustrated in **Figure 3-6**.

No Build Alternative

The No Build Alternative would not impact existing pedestrian sidewalks and SUPs. The planned pedestrian and bicycle connectivity in North Woodbridge could continue as planned except for the planned sharrows lanes. Sharrows lanes could not be constructed because there would be no Marina Way Extension roadway to accommodate the lanes.

Preferred Alternative

The Preferred Alternative would not directly impact existing or future pedestrian facilities or SUPs. This alternative would also include the sharrows lanes as they are identified in the Mobility Plan. During construction of the Preferred Alternative, there would be minor, short-term impacts to the pedestrian facilities. These impacts are associated with temporarily closing portions of the sidewalks to ensure pedestrian safety during construction. Detours to pedestrians would be provided to maintain connectivity and use of the facilities (i.e., sidewalks).

3.10. Construction Impacts

During construction, temporary environmental impacts usually can be controlled, minimized, or mitigated through careful attention to prudent construction practices and methods. Potential temporary construction impacts and preventative practices are summarized below.

3.10.1. Air Quality

Temporary air quality Impacts associated with emissions from construction equipment and vehicles that travel to and from the project site may occur during construction. Also, fugitive dust generated from ground disturbing and earthmoving activities may occur but would be short term and temporary. To minimize and mitigate these impacts, all applicable local, state, and federal regulations would be complied with, and measures would be implemented per VDOT's most current *Road and Bridge Specifications* to minimize air pollution.

3.10.2. Noise

During construction, noise generated from various construction activities would be present within the study area. All construction noise would be temporary and would stop when construction is completed. The contractor would be required to conform to the specifications found in VDOT's *Road and Bridge Specifications*. Adherence to this policy of establishing a maximum level of noise that construction operations can generate would reduce the potential impact of construction noise on the surrounding community.

3.10.3. Water Resources

During construction, the potential erosion of soils during ground-disturbing activities (e.g., excavation for the road, use of staging areas, etc.) may lead to non-point source pollutants possibly entering groundwater or surface water from storm water runoff. Also, there is potential for hazardous chemicals contamination of groundwater or surface water due to possible fuel spills or leaks from hazardous chemicals storage on the project site.

To minimize these possible short-term impacts, appropriate erosion and sediment control practices would be implemented in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's *Road and Bridge Specifications*. These regulations and specifications also prohibit contractors from discharging any contaminant that may affect water quality. In the event of accidental spills, 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.

3.10.4. Wildlife including Threatened and Endangered Species

Potential wildlife impacts that may occur during construction includes temporary disturbance or displacement of wildlife due to construction noise, removal of habitat, wildlife collision with construction equipment and vehicles, and sedimentation of aquatic habitats.

All disturbance to potential wildlife habitat has been minimized to the maximum extent possible. Best management practices (BMPs) for erosion and sediment control would be implemented to prevent disturbance to any potential aquatic habitat and all disturbed areas would be revegetated after construction. These activities would be done in accordance with the latest version of VDOT's Road and Bridge Specifications.

The No Build Alternative would have no effect on the northern long-eared bat or its habitat, the tri-colored bat or its habitat, the monarch butterfly or its habitat, the brook floater or its habitat, or on the spotted turtle or its habitat.

The Preferred Alternative would impact 1.1 acres of forest which includes potential summer roosting and foraging habitat. By applying an April 1st to November 14th Time of Year Restriction (TOYR) on tree removal, the Preferred Alternative activity may result in an effect determination of May Affect Likely to Adversely Affect for the NLEB and Not Likely to Adversely Affect Not for the Tri-colored bat. This determination is dependent upon compliance with VDOT's Special Provision for Tree Removal Time of Year Restriction for Roosting Bat Habitat (SP522-000130-02, effective December 22, 2022) which states that no trees greater than or equal to 3 inches diameter at breast height (DBH) shall be removed from

April 1 to November 14 unless otherwise allowed by the County and the VDOT Engineer as approved by the VDOT District Environmental Manager.

The Preferred Alternative would have no effect on the brook floater as no suitable habitat is present within the study area or within the downstream area that may be affected by sedimentation or runoff resulting from the project. Compliance with applicable state and local erosion and sediment control/storm water management laws and regulations would minimize adverse impacts to the aquatic ecosystem because of activities associated with the Preferred Alternative.

The Preferred Alternative may affect but would not likely adversely affect the monarch butterfly. The monarch butterfly is not expected within the study area due to marginal breeding and foraging habitat conditions.

Mitigation measures for this project could include restricting vegetation removal to outside the nesting and summer roosting seasons, minimizing clearing and grubbing, and prompt reseeding of disturbed areas with native vegetation.

3.10.5. Health and Safety

There is potential for construction of the Preferred Alternative to present health and safety risks to construction workers and members of the public attempting to cross the work zone. Additionally, the response time of local emergency services could be affected by traffic delays during construction.

Emergency vehicle access to residences and businesses within the surrounding community would continue via the existing roadway network. Further information on potential air quality and noise impacts during construction can be found in this section.

Construction of the Preferred Alternative would be performed in compliance with FHWA's Work Zone Safety and Mobility Rule (23 CFR Part 630, Subpart J), with the of the goal of expanding work zone impacts management beyond traffic safety and control by employing transportation management strategies, as applicable to the project.

The contractor would develop and implement a transportation management plan (TMP) to reduce traffic and mobility impacts, improve safety, and promote coordination within and around the work zone. Emergency vehicle access would be considered in the Traffic Management Plan (TMP) and Temporary Traffic Control (TTC) plans.

3.10.6. Utilities and Infrastructure

During the detailed design stage, utilities designation (mapping) would be conducted at a Quality Level B in accordance with the VDOT Utility Manual of Instructions to determine the approximate horizontal and subsurface utility locations within the project corridor. Potential conflicts would be further evaluated by performing utility location services (test holes – Quality Level A services) to determine the exact horizontal and vertical locations of potential utility conflicts. Continuous coordination with utility companies during design and construction would also be provided to avoid utilities conflicts, to protect-in-place, and to minimize relocations or adjustments to the extent practicable.

Figure 3-6: Existing and Proposed Pedestrian Facilities

If existing utilities are impacted during construction, temporary relocations or mitigations will be implemented to maintain service and limit utility down time. All existing utilities would be protected in accordance with each utility's design standards. Utility impacts would be limited to the project's LOD during the period of construction. All relocations, adjustments, or upgrades of utilities would be incorporated into the project improvements prior to construction.

3.10.7. Traffic and Transportation

A TMP will be prepared for the project. The TMP will define the approach to mitigate for work zone impacts on local traffic and identify traffic safety and control measures. Also, a TTC Plan will be prepared. It will identify the temporary sign and pavement marking, and the sequence of construction. The preparation of the TTC plan will include the information outlined in VDOT Instructional and Informational Memorandum (IIM) LD-241.7 and IIM TE-351.5, which relate to work zone safety and mobility TMP requirements. All traffic control would be accomplished in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). There are no detours planned for construction of this project.

Transportation mitigation measures considered as part of a TMP may include the following:

- Evaluating local traffic conditions to adjust signal operations, if needed, to ensure appropriate flow of traffic.
- Encouraging travelers to modify their routes and avoid the study area during major construction operations along Annapolis Way and Route 123.
- Informing citizens and businesses about the duration of construction activities, including any periods of traffic diversions, if applicable, and notifying the public through social media, County website, and "pardon our dust" meetings with local business owners and other groups.
- Installing appropriate temporary signage.
- Utilizing Intelligent Transportation Systems (ITS) along Route1, Route 123, Horner Road, and Annapolis Way to advise drivers of potential construction-related delays.

All traffic control elements identified in the TMP will be accomplished in accordance with the Manual on Uniform Traffic Control Devices (MUTCD). There are no detours planned for construction of this project.

3.10.8. Solid Wastes and Hazardous Materials

This assessment was performed in accordance with the American Society of Testing and Materials (ASTM) Standard Practice for the Phase I Environmental Site Assessment Process (ASTM Designation: E1527-21) and the United States Environmental Protection Agency Standard Practice for All Appropriate Inquiries (AAI) (40 CFR Part 312). In accordance with ASTM, AAI does not mean an exhaustive assessment of a property, nor does it eliminate uncertainty regarding environmental conditions.

ASTM E1527-21 defines RECs as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment.

This assessment has identified one REC, the former Gordon Plaza Dry Cleaner, located at 13276 Gordon Boulevard, associated with the site. No CRECs or HRECs were identified in association with the site. This site is currently being evaluated by the landowner and multiple groundwater wells are installed at a depth of 30 feet around the property. It is unknown currently what environmental concerns exist with this property. Coordination with the property owner is ongoing to determine the concerns.

The Gordon Plaza Dry Cleaner property would not be impacted by this project. The developer that is building the proposed North Woodbridge Town Center will be demolishing the building and constructing new businesses at this location before this project is constructed. All solid waste material resulting from clearing and grubbing, demolition, or other construction operations would be removed from the project and disposed of in an appropriate manner. If contaminated soils are encountered during construction, the County would develop and implement appropriate procedures for their proper management and coordinate the removal, disposal, and/or treatment of the soil, as necessary. If contaminated groundwater is encountered during construction, the County would implement appropriate specifications for proper management and treatment of the water, as necessary.

For further information, please refer to the Phase I Environmental Site Assessment included in **Appendix G**.

3.11. Indirect Effects

As defined by the Council on Environmental Quality (CEQ) in 40 CFR 1508.8, Indirect effects as those that are caused by the proposed action but occur later in time or farther in distance than the direct impacts but are still reasonably foreseeable. The most common indirect effects associated with highway projects have to do with induced development, that is, development and the impacts of such development that would not otherwise occur if the project were not constructed. All the surrounding land is either already developed or in the planning stages of development; therefore, the project would not be the direct cause of induced development. The project is consistent with local comprehensive planning regarding land use goals in the surrounding area.

No-Build Alternative

Under the No Build Alternative, the population and employment in the area is expected to continue to grow. This growth will continue to put pressure on the traffic congestion of the roadways throughout the area. Also, accessibility to local businesses and residential communities would continue to be limited in the North Woodbridge area. With the increase in traffic congestion along the major feeder roads to the area, the area would experience impacts to air quality and noise to the surrounding area. Also, the lack of direct access to the proposed North Woodbridge Town Center would require drivers to access the shopping center from Route 123. The increase in traffic movements along congested roadways can lead to safety issues for the travelers.

Wildlife habitat within the study area is fragmented and previously disturbed by Route 1 (Richmond Highway), other roadways, and commercial and residential development. The No Build Alternative would not result in further fragmentation of wildlife habitats however, present and planned future development and transportation projects would continue to reduce habitat areas. Under the No Build Alternative, wildlife, including threatened and endangered species, which occupy nearby forested habitats would continue to experience disturbance from degradation of habitat from soil erosion, traffic noise, collision with vehicles, and introduction of invasive plants.

Preferred Alternative

The project is located between I-95 and Richmond Highway (US Route 1) and adjacent to Gordon Boulevard (Route 123). Route 1 is considered a major thoroughfare that serves the eastern portions of

Prince William and Fairfax Counties. Annapolis Way intersects Route 1 at the northern terminus of the project and Route 123 intersects Route 1 at the southern terminus of the project. Route 1 experiences heavy traffic volume due to vehicles accessing the I-95/Route 123 Commuter Lot, VRE Station, and daily commuting patterns. The existing Marina Way serves as the only connection to a marina at Occoquan Harbor, Vulcan Materials Company Woodbridge sand yard, and the Rivergate apartments. The extension of Marina Way would reduce congestion on surrounding roads and provide pedestrian access to the proposed North Woodbridge Town Center. These improvements represent incremental improvements to access within an area that is already planned to be developed. Therefore, the potential for the project to induce growth due to increased accessibility is anticipated to be low.

The attractiveness of a location and the strength of the regional economy are positively correlated with the potential for growth in that area. Predictions for continued population growth in Prince William County (see **Section 3.2** of the EA) support a high level of attractiveness and a strong economy. A portion of the anticipated future employment in North Woodbridge is centered around the development of the North Woodbridge Town Center (Prince William County, 2019). The Preferred Alternative would reduce congestion and improve pedestrian access and mobility in and around the Town Center.

Population growth and development rate within a locality depends upon land availability and local political conditions as well as land use controls. Most of North Woodbridge is zoned for general commercial development which allows for a wide range of commercial uses. Also, a sizable portion of the North Woodbridge area is within the Redevelopment Overlay District. The purpose of this district is to promote redevelopment and the economic viability of older commercial neighborhoods that have experienced economic decline (Prince William County, 2019).

In conclusion, it is not anticipated that the Preferred Alternative would encourage any changes in land use that are not already expected. The extension of Marina Way has been identified in the transportation section of the North Woodbridge Small Area Plan which makes the Preferred Alternative consistent with the future condition of land use that is already anticipated and planned for by Prince William County.

The Preferred Alternative alignment would allow for the County to construct its planned, direct access to the North Woodbridge Town Center. The proposed roadway will carry travelers directly to the businesses and avoid using the congested Route 1 and Route 123 to access the town center. This would remove future congestion from the Route 1 and 123 corridors which could improve travel reliability, safety, and emergency vehicle response times. By the time the Preferred Alternative is constructed, local businesses at the Gordon Plaza would have relocated to accommodate the roadway. The business relocations are separate from this project and have already been planned. Also, the County’s North Woodbridge Small Area Plan has identified the extension of Marina Way as a priority for the economic growth of the area. The County’s future land use and zoning plans are designed to accept this new roadway.

The Preferred Alternative is not expected to cause changes to current and future land use and zoning designations. Also, the County has already defined areas in North Woodbridge for growth and development. With no induced growth anticipated for the Preferred Alternative, it would not have indirect effects on socioeconomic resources.

The Preferred Alternative would require the removal of trees from a forested area within the proposed alignment of the roadway. These forest communities may provide summer roosting and foraging habitat for wildlife including federally listed threatened Northern long-eared bat and Tricolored bat. Vehicular traffic on the proposed Marina Way is expected to introduce an additional source of noise for the remaining forest habitats adjacent to the roadway. The new roadway is expected to interfere with wildlife movements of terrestrial animals across the roadway. Although these direct impacts occur, no induced growth is expected because of the alternative. Therefore, the Preferred Alternative would have no indirect effects.

The increased impervious surface associated with the Preferred Alternative can increase runoff from roadways which can contain heavy metals, salt, organic compounds, and nutrients. This could facilitate the degradation of nearby waterbodies and wetlands through deposition of sediments or contamination from chemical pollutants. Potential indirect impacts to water quality and wetlands during construction include erosion and sedimentation or accidental spills of hazardous materials from construction equipment. Please refer to Section 3.10.3 for the erosion control practices that minimize risks of potential degradation of water quality due to increased impervious surface and drainage alteration.

For more detailed information regarding this section, please refer to the ICE Analysis included in **Appendix H**.

3.12. Cumulative Effects

CEQ defines cumulative effects as the incremental effects of the action when added to other past, present, and reasonably foreseeable future actions. The assessment of cumulative effects requires an assessment of the impact that past and present actions have had on the environmental resources in the study area that would also be impacted by the project. Additionally, a review of cumulative effects requires an assessment of how reasonably foreseeable future actions may affect the same environmental resources that would be directly affected by the project. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time. The cumulative effects analysis is based on the geographic area affected; time span; affected resources; past, present, and reasonably foreseeable actions; impacts of those actions and the overall impact on the identified resources from the accumulation of these actions.

Geographic Area and Time Span. The geographic limits of the resource specific study areas used for the cumulative effects analysis are the same as those used for the indirect effects analysis. The time span for the analysis is from the mid-1980s (when the development of eastern Prince William County began) to 2050, which is the design year for the project.

Affected Resources. The resources that are affected by the proposed project are those discussed in section 3.11.

Past, Present, and Reasonably Foreseeable Actions. The past, present and reasonably foreseeable future actions that contribute to cumulative effects are described below. The focus of the discussion is North Woodbridge, which encompasses the cumulative study area for socioeconomic resources and natural resources.

Past Actions:

Prior to World War II, most of the land area in Woodbridge was dedicated to agriculture. Between 1950 and 1960, improvements to widen Route 1 between Richmond to Woodbridge and the construction of I-95 in eastern Prince William County contributed to the development of suburbs and self-contained shopping centers including the construction of Gordon Plaza in the early 1970s. Based on historic Google imagery, the park and ride located at 1100 Annapolis Way was constructed in the late 1990s.

More recently, multiple apartment buildings have been constructed in North Woodbridge close to the study area. These new developments include the Rivergate Apartments in 2017, the Viridium Apartments in 2022, and the Landing at Mason's Bridge in 2023.

Present and reasonably Foreseeable Future Actions:

The Annapolis Way Extension project has secured funding through the Northern Virginia Transportation Authority in July 2020 (NVTA, 2020). The project is the extension of Annapolis Way to connect the intersections of Annapolis Way and Route 1, and Annapolis Way Route 123.

The Route 1 widening project includes widening Route 1 to six lanes from Mt. Pleasant Drive to the Occoquan River. This project included improvements to the following intersections:

- Route 1 at Occoquan Road/ Dawson Beach Road – Improvements included dual left turns from northbound and southbound Route 1.
- Route 1 at Route 123 - Improvements include the addition of two left turn lanes along Route 1 for the northbound vehicles turning left onto Route 123.
- Route 1 at Annapolis Way – Improvements include two additional left turn lanes along Annapolis Way vehicles turning left onto Route 1.

The Route 1 at Route 123 Interchange project is in the design stage and includes widening of Route 123 as well as intersection improvements to Route 1 at Annapolis Way.

No-Build Alternative

The No-Build Alternative would have a minor adverse cumulative effect on communities, businesses, and the population that lives in the area. The population is expected to grow over the next few decades. This growth will contribute partly to the ever expanding economic and residential development that the County has planned for the area. The growth in the area is expected to put stress on the local roadway network regarding traffic congestion. Under this alternative, the traffic in the North Woodbridge area would continue to worsen which would negatively affect local businesses, residential access, and commute times. Therefore, the alternative would have negative cumulative effects communities, community cohesion, and EJ populations.

Preferred Alternative

Past and present actions have urbanized the area. Access to communities and businesses has increased through the urbanization but the traffic that has followed the growth has hindered growth in the area due to lowering accessibility and desirability due to traffic. The Preferred Alternative would extend an existing roadway and improve pedestrian facilities in this urban area which in turn improves accessibility to communities and local businesses in an area that has been designated as an EJ community. The Preferred Alternative could have short-term minor adverse effects while the roadway and associated improvements are under construction. The long-term beneficial effect is associated with accessibility and community cohesion for the area.

The Preferred Alternative's impacts to wildlife and threatened and endangered species habitat would contribute to the cumulative effects that have occurred in the past to these resources within the study area. These effects should be minimized by the implementation of best management practices such as implementation of TOYRs. Construction and post-construction of the Preferred Alternative would potentially contribute to short-term, minor, localized increases in pollutants and nutrients causing impairment to waterways. Since construction of the Preferred Alternative would upgrade and replace current stormwater management systems, implementation of the Preferred Alternative could improve roadway runoff water quality from current conditions.

Past and present actions have affected the current state of socioeconomic, natural, and historic resources within the associated ICE Study Areas, and future actions would continue to affect these resources regardless of this project. The region is already developed, therefore cumulative effects of the Preferred Alternative are expected to be minimal. In addition, current regulatory requirements and planning practices are expected to help avoid or minimize the contribution of present and future actions to adverse cumulative effects for socioeconomic, natural, and historic resources.

For more detailed information regarding this section, please refer to the ICE Analysis included in **Appendix H**.

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Section 4 – Coordination & Comments

4.1. Agency Coordination

Early and continuing coordination with the public and appropriate public agencies is an essential part of the environmental process to determine the scope of environmental documentation, the level of analysis, potential impacts and mitigation measures and related environmental requirements. Agency consultation and public participation for this project have and will continue to be accomplished through a variety of formal and informal methods, including project development team meetings, agency scoping, interagency coordination meetings, and a public hearing. This section summarizes the results of the County's efforts to fully identify, address, and resolve project-related issues through early and continuing coordination. The following is a list of agencies that have been contacted regarding the project.

- Prince William County government agencies
- Virginia Marine Resources Commission*
- Virginia Department of Historic Resources (VDHR)
- Virginia Outdoors Foundation
- Virginia Department of Health
- Virginia Department of Forestry*
- Virginia Department of Wildlife Resources
- Virginia Department of Environmental Quality*
- Virginia Department of Conservation and Recreation*
- Virginia Department of Energy
- Virginia Department of Agriculture and Consumer Services*
- US Army Corps of Engineers
- US Fish and Wildlife Service

During the scoping process, the agencies were requested to provide feedback on any issues or concerns regarding the work associated with the proposed project. Agencies that did not send a response to the scoping letters are marked with an asterisk.

Information obtained through scoping and identified in this EA included the project's proximity to public drinking water sources including groundwater wells and surface water intakes. Also, the assurance that best management practices will be utilized during construction which should include erosion and sediments controls and spill prevention controls and countermeasures throughout the project site. Please refer to **Section 3.6.** about water quality and the best management practices that have been integrated into the project.

All agency responses can be found in **Appendix I**. The input received was used to determine what would be appropriate for study in the EA. Accordingly, each of the issues and concerns have been addressed in the Environmental Consequences section of this EA (Section 3) and/or in the detailed technical reports prepared in support of the EA.

4.2. Public Involvement

Notifications were sent to property owners with the study area prior to fieldwork completed as part of the environmental and design studies. Additionally, the County, in coordination with VDOT, will hold a location and design public hearing for this project in the summer of 2024. The purpose of the hearing will be to present the preliminary project design and findings of this Environmental Assessment (EA), provide a discussion forum between the public and project team, and obtain input and comments from the community. In addition, there will be a minimum of 30-day public comment period following notice of availability of the EA. Any comments received during the public hearing and public comment period will become part of the public hearing record. All information obtained from the public will be considered during FHWA's NEPA decision process.

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Appendix A – Environmental Justice Memo

MEMORANDUM

TO: Virginia Department of Transportation – NOVA District Environmental
DATE: March 1, 2024
FROM: Steven Swarr, JMT
PROJECT: Marina Way Extension
RE: Environmental Justice Analysis

The following is a memorandum documenting the Environmental Justice (EJ) analysis that was conducted for the Marina Way Extension project. This analysis was completed per the guidelines identified in VDOT's IIM-ED-714.1: Environmental Justice Identification and Outreach document. This analysis was done in addition to the detailed EJ analysis included in the Marina Way Environmental Assessment (EA).

The Environmental Justice (EJ) study area for the Marina Way Extension project in Woodbridge, VA is entirely within one Census Tract (51153900201). Minority populations, limited English speaking households, and low-income households are used to identify EJ populations. Data was collected for Census Tract 51153900201 and Prince William County is from the Environmental Protection Agency's (EPA) EJ Screen Environmental Screening and Mapping Tool and summarized in the table above. Full EJScreen reports for Census Tract 51153900201 and Prince William County are attached to this summary.

Index	Census Tract 51153900201	Prince William County, VA
Total Population:	2,338	477,224
People of Color:	77%	59%
Population of one race:	98%	96%
White alone	23%	41%
Black or African American alone	25%	20%
American Indian	0%	0%
Asian alone	7%	9%
Hispanic alone	40%	25%
Native Hawaiian and Pacific Islander alone	0%	0%
Some Other Race alone	2%	0%
Population of 2 or more races:	2%	4%
Limited English Speaking:	11%	6%
Low Income:	23%	17%

*Data from EJScreen: Environmental Justice Screening and Mapping Tool

Minority Populations

The EPA defines minority populations based on the percentage of people of color which is individuals in a block group/census tract who "list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino". The word "alone" indicates that a person is not multiracial and identifies as one single race. As indicated in the reports, the state and national averages for minority population percentage are 38% and 39% respectively. Census Tract 51153900201 has a minority population percentage of 77% which is higher than both the state and national averages. Additionally, this number is higher than the minority population percentage in Prince William County (59%). This data indicates the presence of an EJ population.

Limited English-Speaking Households

As defined by the EPA, Limited English Speaking is the percent of people within a block group who live in a household in which all members aged 14 and older speak a non-English language and also have difficulty with English. The state average for Limited English-Speaking Households is 2% while the national average is 5%. The population of people in a Limited English-Speaking Household in Census Tract 51153900201 is 11% while the percentage of the population in Prince William County is 6%.

Low-Income Households

The EPA defines low-income as households in which the household income is less than or equal to twice the federal "poverty level." The state average for households below this income is 25% and the national average is 31%. The percentage of people in Census Tract 51153900201 that live in a low-income household is 23% which is lower than state and national averages. This does not indicate the presence of an EJ population.

Impact to EJ Populations

The project will require the acquisition of new right-of-way (ROW) but does not require the displacement or relocation of any residences or businesses. The result of the project is to relieve the burden of future traffic congestion and improve vehicle and pedestrian accessibility to residences and businesses in the North Woodbridge area. Although there are EJ populations present, the Project is not anticipated to have disproportionate and adverse human health or environmental effects on these populations. No low-income populations have been identified that would be adversely impacted by the proposed project.

Attachments

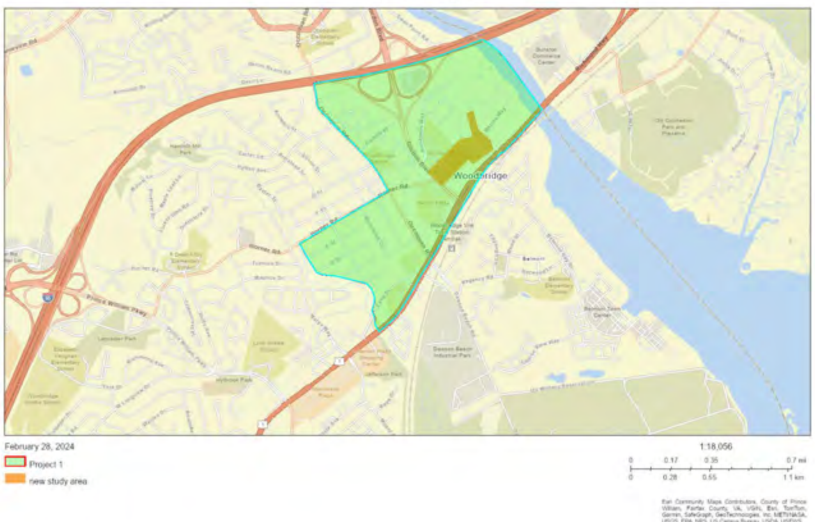
EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

Woodbridge, VA

Tract: 51153900201
Population: 2,338
Area in square miles: 0.63

A3 Landscape



LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	57%
Spanish	27%
French, Haitian, or Cajun	2%
Other Indo-European	1%
Chinese (including Mandarin, Cantonese)	3%
Vietnamese	2%
Tagalog (including Filipino)	1%
Other Asian and Pacific Island	1%
Other and Unspecified	5%
Total Non-English	43%

COMMUNITY INFORMATION

Low income: 23 percent
People of color: 77 percent
Less than high school education: 14 percent
Limited English households: 11 percent
Unemployment: 8 percent
Persons with disabilities: 7 percent
Male: 46 percent
Female: 54 percent

76 years
Average life expectancy

$45,708
Per capita income

Number of households: 880

Owner occupied: 52 percent

BREAKDOWN BY RACE

White: 23%
Black: 25%
American Indian: 0%
Asian: 7%
Hawaiian/Pacific Islander: 0%
Other race: 2%
Two or more races: 2%
Hispanic: 40%

BREAKDOWN BY AGE

From Ages 1 to 4	6%
From Ages 1 to 18	24%
From Ages 18 and up	76%
From Ages 65 and up	6%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	85%
Speak Other Indo-European Languages	0%
Speak Asian-Pacific Island Languages	15%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

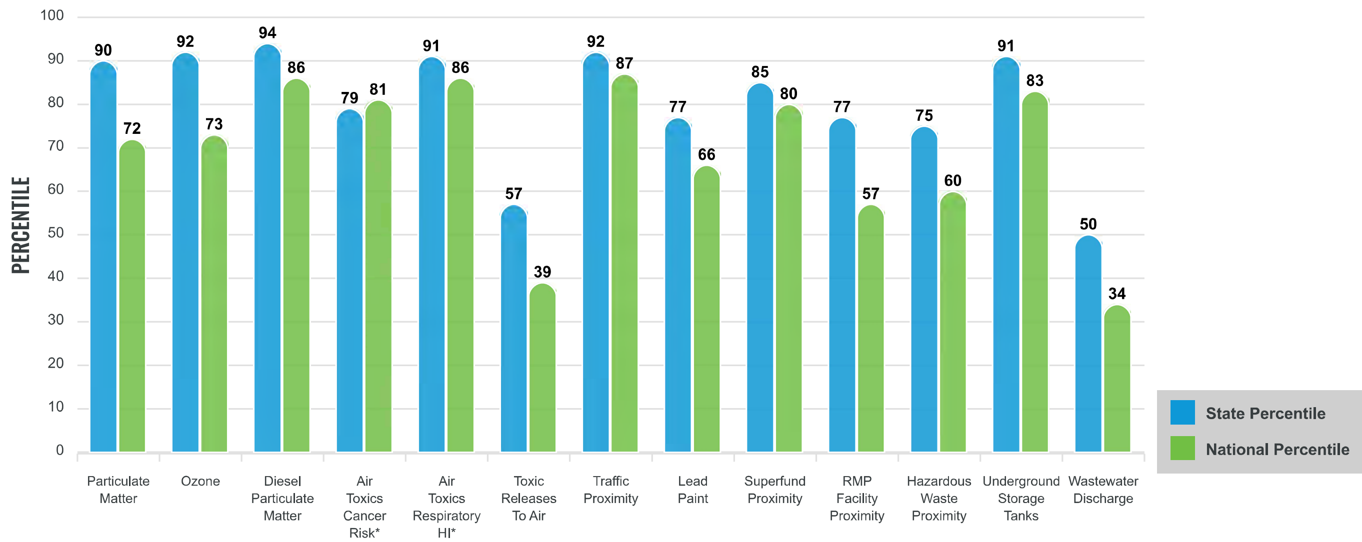
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

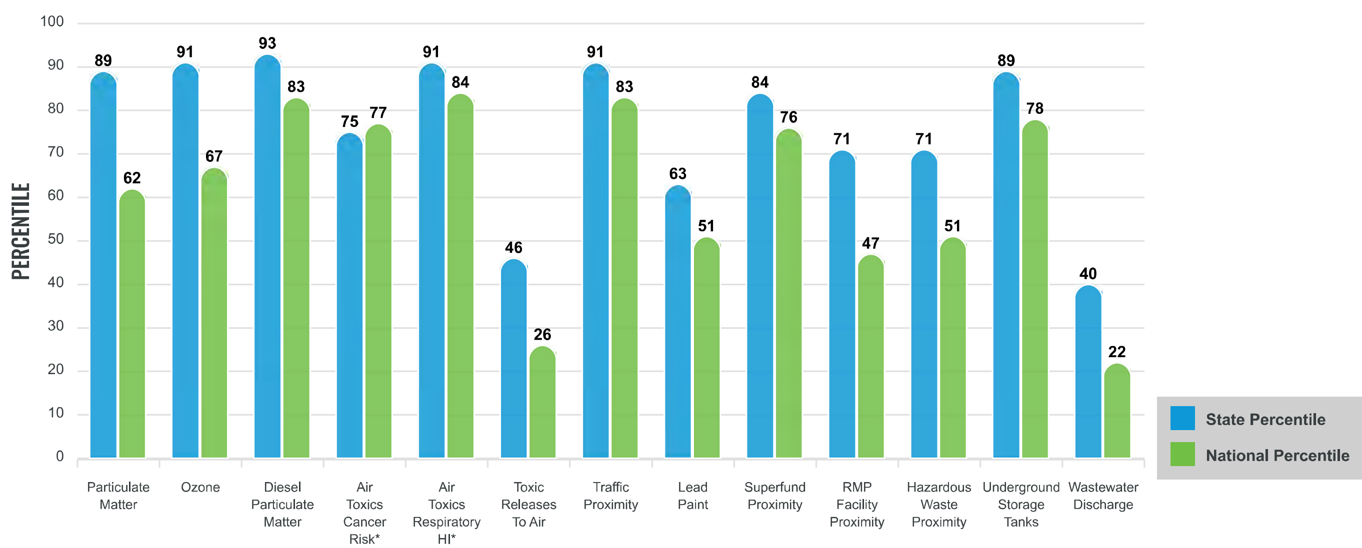
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for Tract: 51153900201

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter ($\mu g/m^3$)	8.13	7.53	75	8.08	48
Ozone (ppb)	61.2	59.1	81	61.6	51
Diesel Particulate Matter ($\mu g/m^3$)	0.435	0.209	98	0.261	86
Air Toxics Cancer Risk* (lifetime risk per million)	30	29	26	25	52
Air Toxics Respiratory HI*	0.4	0.33	62	0.31	70
Toxic Releases to Air	47	4,300	28	4,600	17
Traffic Proximity (daily traffic count/distance to road)	670	150	95	210	93
Lead Paint (% Pre-1960 Housing)	0.12	0.22	48	0.3	38
Superfund Proximity (site count/km distance)	0.094	0.11	68	0.13	65
RMP Facility Proximity (facility count/km distance)	0.11	0.21	52	0.43	31
Hazardous Waste Proximity (facility count/km distance)	0.2	0.61	49	1.9	35
Underground Storage Tanks (count/km^2)	5.1	1.9	90	3.9	78
Wastewater Discharge (toxicity-weighted concentration/m distance)	6.3E-06	7.2	24	22	15
SOCIOECONOMIC INDICATORS					
Demographic Index	50%	31%	83	35%	74
Supplemental Demographic Index	16%	12%	73	14%	63
People of Color	77%	38%	89	39%	81
Low Income	23%	25%	53	31%	42
Unemployment Rate	8%	5%	81	6%	75
Limited English Speaking Households	11%	2%	93	5%	86
Less Than High School Education	14%	10%	75	12%	70
Under Age 5	6%	6%	58	6%	57
Over Age 64	6%	17%	15	17%	13
Low Life Expectancy	22%	20%	72	20%	72

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
Water Dischargers 3
Air Pollution 4
Brownfields 0
Toxic Release Inventory 1

Other community features within defined area:

Schools 0
Hospitals 0
Places of Worship 0

Other environmental data:

Air Non-attainment .... Yes
Impaired Waters .... Yes

Selected location contains American Indian Reservation Lands* .... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community .... Yes
Selected location contains an EPA IRA disadvantaged community .... Yes

Report for Tract: 51153900201

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	22%	20%	72	20%	72
Heart Disease	3.8	5.5	21	6.1	9
Asthma	9.1	9.6	35	10	27
Cancer	3.8	6.1	10	6.1	9
Persons with Disabilities	6.3%	12.6%	16	13.4%	9

CLIMATE INDICATORS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	11%	9%	77	12%	70
Wildfire Risk	0%	2%	0	14%	0

CRITICAL SERVICE GAPS

INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	2%	13%	19	14%	14
Lack of Health Insurance	4%	8%	28	9%	30
Housing Burden	Yes	N/A	N/A	N/A	N/A
Transportation Access	Yes	N/A	N/A	N/A	N/A
Food Desert	No	N/A	N/A	N/A	N/A

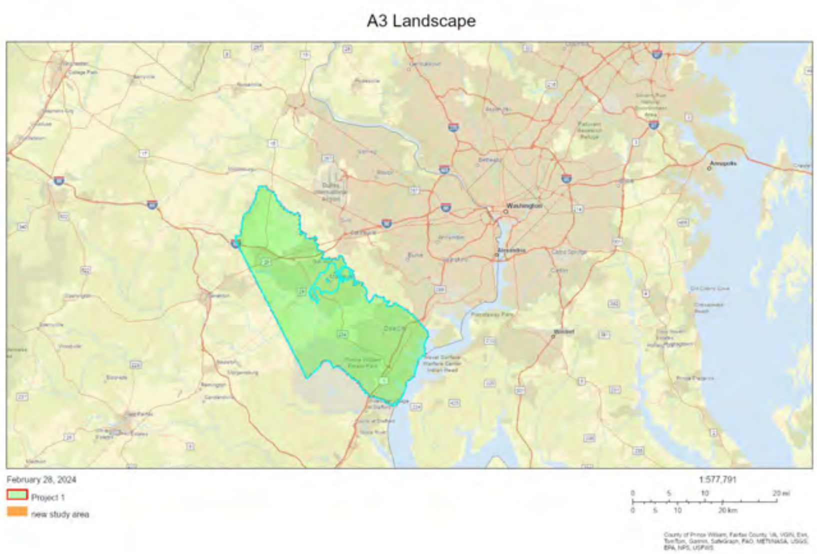
Report for Tract: 51153900201

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

XX

County: Prince William
Population: 477,224
Area in square miles: 347.16



COMMUNITY INFORMATION

Low income: 17 percent

People of color: 59 percent

Less than high school education: 10 percent

Limited English households: 6 percent

Unemployment: 5 percent

Persons with disabilities: 8 percent

Male: 50 percent

Female: 50 percent

79 years — Average life expectancy

$45,240 — Per capita income

Number of households: 150,488

Owner occupied: 74 percent

BREAKDOWN BY RACE

White: 41%

Black: 20%

American Indian: 0%

Asian: 9%

Hawaiian/Pacific Islander: 0%

Other race: 0%

Two or more races: 4%

Hispanic: 25%

BREAKDOWN BY AGE

From Ages 1 to 4	7%
From Ages 1 to 18	27%
From Ages 18 and up	73%
From Ages 65 and up	10%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	65%
Speak Other Indo-European Languages	9%
Speak Asian-Pacific Island Languages	17%
Speak Other Languages	8%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race.
Source: U.S. Census Bureau, American Community Survey (ACS) 2017 -2021. Life expectancy data comes from the Centers for Disease Control.

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	65%
Spanish	20%
French, Haitian, or Cajun	1%
Other Indo-European	5%
Korean	1%
Chinese (including Mandarin, Cantonese)	1%
Vietnamese	1%
Tagalog (including Filipino)	1%
Other Asian and Pacific Island	1%
Arabic	1%
Other and Unspecified	3%
Total Non-English	35%

Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low-income, percent linguistically isolated, percent less than high school education, percent unemployed, and low life expectancy with a single environmental indicator.

These percentiles provide perspective on how the selected block group or buffer area compares to the entire state or nation.

Report for County: Prince William

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
POLLUTION AND SOURCES					
Particulate Matter (μg/m^3)	XX	XX	XX	XX	XX
Ozone (ppb)	XX	XX	XX	XX	XX
Diesel Particulate Matter (μg/m^3)	XX	XX	XX	XX	XX
Air Toxics Cancer Risk* (lifetime risk per million)	XX	XX	XX	XX	XX
Air Toxics Respiratory HI*	XX	XX	XX	XX	XX
Toxic Releases to Air	XX	XX	XX	XX	XX
Traffic Proximity (daily traffic count/distance to road)	XX	XX	XX	XX	XX
Lead Paint (% Pre-1960 Housing)	XX	XX	XX	XX	XX
Superfund Proximity (site count/km distance)	XX	XX	XX	XX	XX
RMP Facility Proximity (facility count/km distance)	XX	XX	XX	XX	XX
Hazardous Waste Proximity (facility count/km distance)	XX	XX	XX	XX	XX
Underground Storage Tanks (count/km^2)	XX	XX	XX	XX	XX
Wastewater Discharge (toxicity-weighted concentration/m distance)	XX	XX	XX	XX	XX
SOCIOECONOMIC INDICATORS					
Demographic Index	XX%	XX%	XX	XX%	XX
Supplemental Demographic Index	XX%	XX%	XX	XX%	XX
People of Color	XX%	XX%	XX	XX%	XX
Low Income	XX%	XX%	XX	XX%	XX
Unemployment Rate	XX%	XX%	XX	XX%	XX
Limited English Speaking Households	XX%	XX%	XX	XX%	XX
Less Than High School Education	XX%	XX%	XX	XX%	XX
Under Age 5	XX%	XX%	XX	XX%	XX
Over Age 64	XX%	XX%	XX	XX%	XX
Low Life Expectancy	XX%	XX%	XX	XX%	XX

*Diesel particulate matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund XX
Hazardous Waste, Treatment, Storage, and Disposal Facilities XX
Water Dischargers XX
Air Pollution XX
Brownfields XX
Toxic Release Inventory XX

Other community features within defined area:

Schools XX
Hospitals XX
Places of Worship XX

Other environmental data:

Air Non-attainment XX
Impaired Waters XX

Selected location contains American Indian Reservation Lands* XX
Selected location contains a "Justice40 (CEJST)" disadvantaged community XX
Selected location contains an EPA IRA disadvantaged community XX

Report for County: Prince William

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	15%	20%	10	20%	10
Heart Disease	3.8	5.5	21	6.1	9
Asthma	9.1	9.6	35	10	27
Cancer	4.6	6.1	21	6.1	18
Persons with Disabilities	8%	12.6%	26	13.4%	18

CLIMATE INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	3%	9%	30	12%	30
Wildfire Risk	0%	2%	0	14%	0

CRITICAL SERVICE GAPS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	4%	13%	31	14%	24
Lack of Health Insurance	11%	8%	73	9%	70
Housing Burden	XX	N/A	N/A	N/A	N/A
Transportation Access	XX	N/A	N/A	N/A	N/A
Food Desert	XX	N/A	N/A	N/A	N/A

Report for County: Prince William

Appendix B – Air Quality Technical Report

AIR QUALITY TECHNICAL REPORT

Marina Way Extension
0639-076-348

Annapolis Way to Gordon Boulevard
0639-076-348, P-101, C-501, R-201
UPC 120778

Northern Virginia District

Prepared for:

Virginia Department of Transportation

Environmental Division

Prepared by:

JMT

March 2024

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ACRONYMS

AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
CAA	Clean Air Act
CEQ	Council of Environmental Quality
CF	Categorical Finding
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FY	Fiscal Year
FTA	Federal Transit Administration
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
HEI	Health Effects Institute
HOT	High-Occupancy Toll
HRTPO	Hampton Roads Transportation Planning Organization
I-	Interstate-
IECI	Indirect Effects and Cumulative Impacts
IRIS	Integrated Risk Information System
L&D	Location & Design Division (VDOT)
LOS	Level of Service
LRTP	Long Range Transportation Plan
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
MSATs	Mobile Source Air Toxics
MTPY	Metric Tons per Year
NAAQS	National Ambient Air Quality Standards
NCHRP	National Cooperative Highway Research Program
NCRTPB	National Capital Region Transportation Planning Board
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NO_2	Nitrogen Dioxide

NO_x	Nitrogen Oxides
OIPI	Office of Intermodal Planning and Investment
O_3	Ozone
PA	Programmatic Agreement
Pb	Lead
PM	Particulate Matter
$PM_{2.5}$	Fine inhalable particulate matter, with diameters that are generally 2.5 micrometers and less
PM_{10}	Inhalable particulate matter, with diameters that are generally 10 micrometers and less
POM	Polycyclic Organic Matter
PPM	Parts per million
Ppb	Parts per billion
RTP	Long-Range Transportation Plan
SIP	State Implementation Plan
S&B	Structure & Bridge Division (VDOT)
SLR	Sea Level Rise
SO2	Sulfur Dioxide
TIP	Transportation Improvement Program
TMPD	Transportation Mobility and Planning Division (VDOT)
TPY	Tons per Year
TSD	Technical Support Document
USACE	U.S. Army Corps of Engineers
USDOT	US Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VA	Virginia
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VDOT	Virginia Department of Transportation
VDRPT	Virginia Department of Rail and Public Transportation
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VPHPL	Vehicles per Hour per Lane
VTRC	Virginia Transportation Research Council

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Executive Summary

The Prince William County (County) Department of Transportation, in coordination with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA), is proposing to construct the Marina Way Extension between Annapolis Way and Gordon Boulevard (Route 123) in Woodbridge, Virginia. The proposed four-lane, 0.26-mile roadway would be on new alignment. It would be a four-lane median-divided roadway with curb and gutter, a 4-foot buffer, and 5-foot-wide sidewalks on both sides of the road. Lane widths will be 11 feet wide with turn lanes present at the Route 123 intersection and main entrances into the Home Depot and Aldi grocery store. The proposed raised grass median will be 15 feet in width and will transition down to 4 feet at intersections where turn lanes are needed. The project does not involve additional capacity on existing Marina Way.

The proposed improvements were assessed for potential air quality impacts and compliance with all applicable air quality regulations and guidance. All models, methods and assumptions applied in modeling and analyses were made consistent with those provided or specified in the VDOT Resource Document.[1] Based on the assessment, the project would meet all applicable federal and state transportation conformity regulatory requirements as well as air quality guidance under the National Environmental Policy Act (NEPA). As such, the project would not cause or contribute to a new violation of the national ambient air quality standards (NAAQS) established by the Environmental Protection Agency (EPA).

Mobile Source Air Toxics (MSATs) Federal Highway Administration (FHWA) guidance (2023)[2] states that "*…EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[3] These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter*." Following FHWA guidance for projects with low potential impacts based on forecast traffic volumes and other technical criteria, a qualitative assessment of potential MSAT impacts was conducted for this project.

Based on that assessment, best available information indicates that, nationwide, regional levels of MSATs are expected to decrease in the future due to ongoing fleet turnover and the continued implementation of increasingly more stringent emission and fuel quality regulations. Nonetheless, technical shortcomings of emission and dispersion models and uncertain science with respect to health effects effectively limit meaningful or reliable estimates of MSAT emissions and effects of this project at this time. While it is possible that localized increases in MSAT emissions may occur as a result of this project, emissions will likely be lower than present levels in the design year of this project as a result of EPA's national control programs that are projected (in the FHWA 2023 Guidance) to reduce annual MSAT emissions by 76 percent between 2020 and 2060 while vehicle-miles-travelled (VMT) are expected to increase on a national level by 31 percent. Although local conditions may differ from these national

1 The latest version of the VDOT Resource Document, Scoping Guidelines, and Template Report along with a link to the associated online data repository for modeling inputs are available on or via the Environmental Division website: https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/environmental/

2 FHWA, "*INFORMATION: Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*", January 18, 2023. See: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/

3 See: https://www.epa.gov/national-air-toxics-assessment

projections in terms of fleet mix and turnover, VMT growth rates, and local control measures, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

Greenhouse Gases (GHGs)

For each alternative in this EA, the amount of GHGs emitted would be proportional to the vehicle miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for a Build Alternative therefore may be slightly higher than that for the No-Build Alternative, because additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT could lead to higher GHG emissions for the build alternative along a highway corridor, along with a corresponding decrease in GHG emissions along the parallel routes. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of fuel efficiency improvements and electrification policies that are projected to reduce annual statewide GHG emissions from on-road sources by nearly 50 percent between 2015 and 2040 (VDOT, Statewide Planning-Level GHG Assessment, December 2021).

Climate Change: Considerations Relating to the Affected Environment

Greenhouse gas emissions have accumulated rapidly as the world has industrialized. According to the U.S. Global Climate Change Research Program,[4] if emissions continue, projected changes in global average temperature could range from to 0.4° — 2.7°F (0.2°–1.5°C) under a very low emissions scenario, to 4.2°–8.5°F (2.4°–4.7°C) under a higher scenario by the end of the 21st century. Based on information developed by the Georgetown Climate Center,[5] Virginia's transportation infrastructure faces risks from a changing climate including increased levels of coastal flooding, inland flooding, and extreme heat.

Resiliency is an important consideration for VDOT when planning and designing future infrastructure investments. Resiliency considerations include siting and design of facilities both to minimize risk to the facility, and to minimize impacts on natural resiliency features such as wetlands, forests, and floodplains. Resiliency strategies that are cost-effective and can be adopted during the planning, project development, construction, and/or maintenance phases of a given infrastructure project are supported.

VDOT, and regional and local agency partners in the Commonwealth, have already engaged in efforts to plan for resiliency. As part of the development of VTrans, Virginia's transportation plan, the Commonwealth Transportation Board (CTB) has developed a Policy for the Development and Monitoring of VTrans Long-term Risk & Opportunity Register, which allows for quantification of impacts of ten macrotrends, including long-term flooding risk due to sea-level rise, storm surge, and inland/riverine flooding, as well as a Long-term Risk & Opportunity Register based on an assessment of these impacts. The CTB has also adopted strategic actions to mitigate the identified long-term risks and maximize opportunities, including collecting data to accurately assess flooding risks for the state- and locally-maintained roadways that can be used to identify funding needs and prioritize investment; developing policies based on robust data collection and

4 U.S. Global Climate Change Research Program (2018). Fourth National Climate Assessment.

5 Georgetown Climate Center (undated). "Understanding Virginia's Vulnerability to Climate Change." See: https://www.georgetownclimate.org/files/report/understanding-virginias-vulnerability-to-climate-change.pdf (accessed September 2021)

analysis to ensure flooding risks are reflected in transportation asset life-cycle and/or transportation project planning processes; and collaborating with state and regional agencies to systematically identify solutions that facilitate consistent and systematic prioritization and support the allocation of state resources to address flooding risks. Finally, the Office of Intermodal Planning and Investment (OIPI) is required to track trends related to all macrotrends, including the flooding risk, and report annually.

Indirect Effects and Cumulative Impacts (IECI)

A qualitative assessment of the potential for indirect effects and cumulative impacts attributable to this project was conducted. It concluded that the potential effects or impacts are not expected to be significant given available information from pollutant-specific analyses (CO and MSATs) and regional conformity analyses.

First, regarding the potential for indirect effects, the quantitative assessments conducted for programmatic CO, qualitative analyses for MSAT impacts and the regional conformity analysis conducted for ozone can all be considered indirect effects analyses because they look at air quality impacts attributable to the project that occur in the future. These analyses demonstrate that, in the future: 1) air quality impacts from CO will not cause or contribute to violations of the CO NAAQS, 2) MSAT emissions will be significantly lower than they are today, and 3) conformity requirements for the transportation plan and program will be met, including the mobile source emissions budgets established for the region for purposes of meeting the ozone NAAQS.

Second, regarding the potential for cumulative impacts, the annual conformity analysis conducted by the National Capital Region (NCR) Transportation Planning Board (TPB, which is the Metropolitan Planning Organization or MPO for the Washington, D.C. metropolitan area) represents a cumulative impact assessment for purposes of regional air quality.

- The existing air quality designations for the region are based, in part, on the accumulated mobile source emissions from past and present actions, and these pollutants serve as a baseline for the current conformity analysis.
- The conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment/maintenance that will result from the implementation of all reasonably foreseeable regionally significant transportation projects in the region (i.e., those proposed for construction funding over the life of the region's transportation plan).
- The most recent conformity analysis was completed in June 2022. FHWA/FTA issued a conformity finding on June 15, 2022 for the Transportation Improvement Program (TIP) and Constrained Long Range Plan (CLRP) covered by that analysis. This analysis demonstrated that the incremental impact of the proposed project on mobile source emissions, when added to the emissions from other past, present, and reasonably foreseeable future actions, is in conformance with the SIP and will not cause or contribute to a new violation, increase the frequency or severity of any violation, or delay timely attainment of the NAAQS established by EPA.

Mitigation:

Emissions may be produced in the construction of this project from heavy equipment and vehicle travel to and from the site, as well as from fugitive sources. Construction emissions are short term or temporary in nature. To mitigate these emissions, all construction activities are to be performed in accordance with VDOT *Road and Bridge Specifications.*[6]

The Virginia Department of Environmental Quality (VDEQ) provides general comments for projects by jurisdiction that in part address mitigation. For Prince William County, VDEQ stated that[7] "*…all reasonable precautions should be taken to limit the emissions of VOC and NOx. In addition, the following VDEQ air pollution regulations must be adhered to during the construction of this project: 9 VAC 5-130, Open Burning restrictions*[8]*; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions*[9]*; and 9 VAC 5-50, Article 1, Fugitive Dust precautions.*[10]"

Project Status in the Regional Transportation Plan and Program: Federal conformity requirements at 40 CFR 93.114[11] and 40 CFR 93.115[12] (as incorporated by reference into the Virginia conformity SIP) apply as the area in which the project is located is designated as nonattainment for ozone. Accordingly, there must be a currently conforming transportation plan and program at the time of project approval, and the project must come from a conforming plan and program or otherwise meet the criteria specified in 40 CFR 93.109(b).[13] As of the date of preparation of this analysis, the project is included in the currently conforming FY 2023-2026 Transportation Improvement Program (TIP) and 2045 Long Range Transportation Plan (LRTP) developed by the designated metropolitan planning organization (MPO) for the region, the National Capital Region Transportation Planning Board (TPB).[14]

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6 https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/technical-guidance-documents/road-and-bridge-specifications/

7 Spreadsheet entitled: "DEQ SERP Comments rev8b", March 2017, downloaded from the online data repository for the VDOT Resource Document. The repository may be accessed via the Environmental Division webpage: https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/environmental/

8 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter130/

9 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter45/

10 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter50/

11 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.114

12 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.115

13 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.109

14 See: http://www.mwcog.org/transportation/tpb/

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Project Background

This section presents background information including the project purpose and need, description, alternatives, summary traffic data and the project status in the regional transportation plan and program (for areas subject to conformity).

Purpose and Need

The extension of Marina Way within Prince William County (County) from Annapolis Way to the intersection of Gordon Boulevard (Route 123) and Horner Road was initially identified as part of the Marina Way Extension Environmental Assessment (EA) (County, 2023). The Final EA documented the need for an extension to mitigate traffic delays across multiple intersections in the area which are anticipated based on future traffic demands and the planned revitalization of the North Woodbridge area. Prior to the completion of the EA, Prince William County completed a traffic analysis which identified congestion and safety issues in this corridor. The traffic analysis is included in Appendix A.

The purpose of the proposed extension of Marina Way is to provide an adequate multi-modal transportation system that:

- Provides traffic congestion relief for traffic demand on local roads and intersections.
- Provides access to local businesses and homes in the North Woodbridge area and is consistent with existing and planned local development.
- Provides safe pedestrian accessibility and connectivity in the North Woodbridge area.

Project Description

The Prince William County (County) Department of Transportation, in cooperation with the Virginia Department of Transportation (VDOT) and the Federal Highway Administration (FHWA), is proposing to construct an extension of Marina Way between Annapolis Way and Route 123 in Woodbridge, Virginia.

Exhibit 1.2.1 provides an overview of the study corridor for the proposed project and Exhibit 1.2.2 provides an aerial of the project area. The proposed four-lane, 0.26-mile roadway would be on new alignment. It would be a four-lane median-divided roadway with curb and gutter, a 4-foot buffer, and 5-foot-wide sidewalks on both sides of the road. Lane widths will be 11 feet wide with turn lanes present at the Route 123 intersection and main entrances into the Home Depot and Aldi grocery store. The proposed raised grass median will be 15 feet in width and will transition down to 4 feet at intersections where turn lanes are needed. The project does not involve additional capacity on the existing Marina Way.

Exhibit 1.2.1: Project Location Map

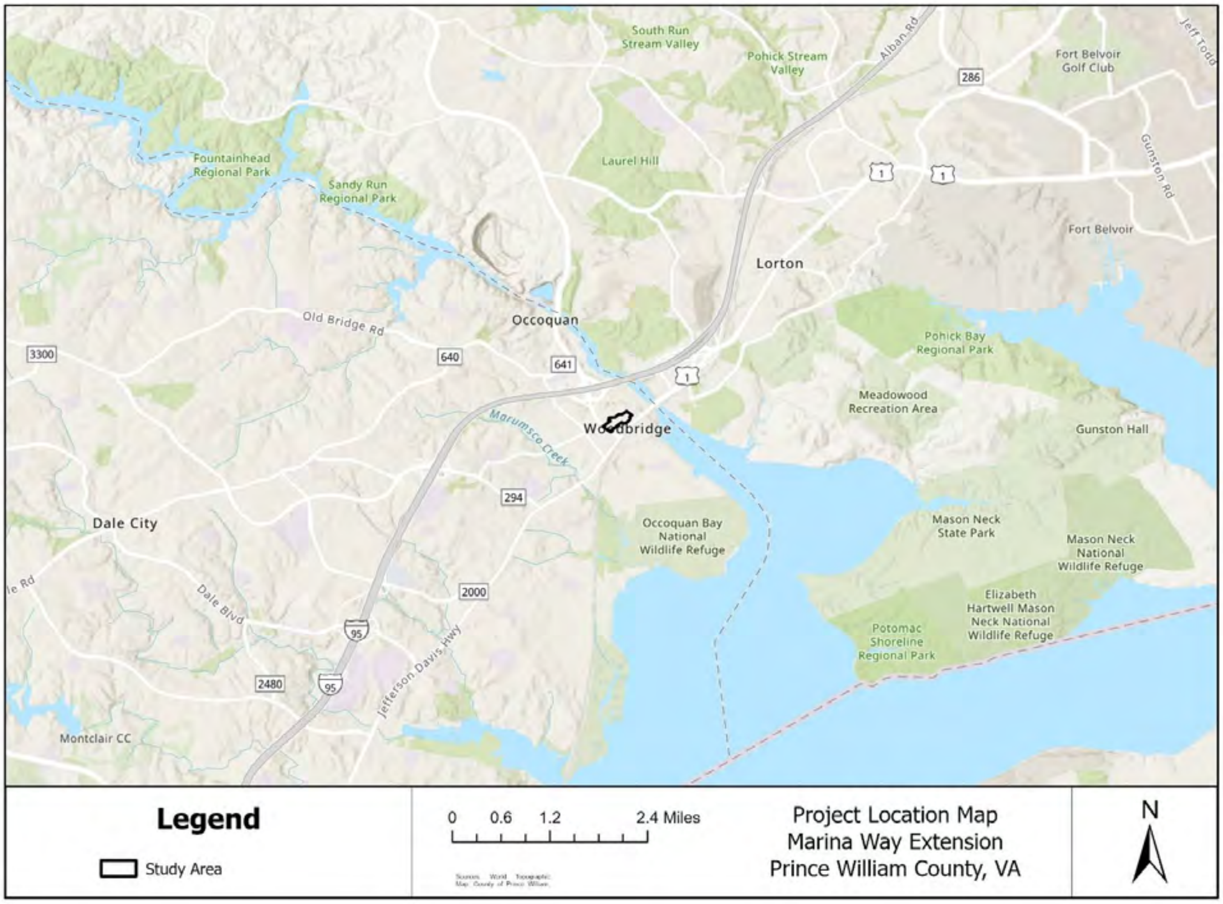


Exhibit 1.2.2: Aerial Imagery Map

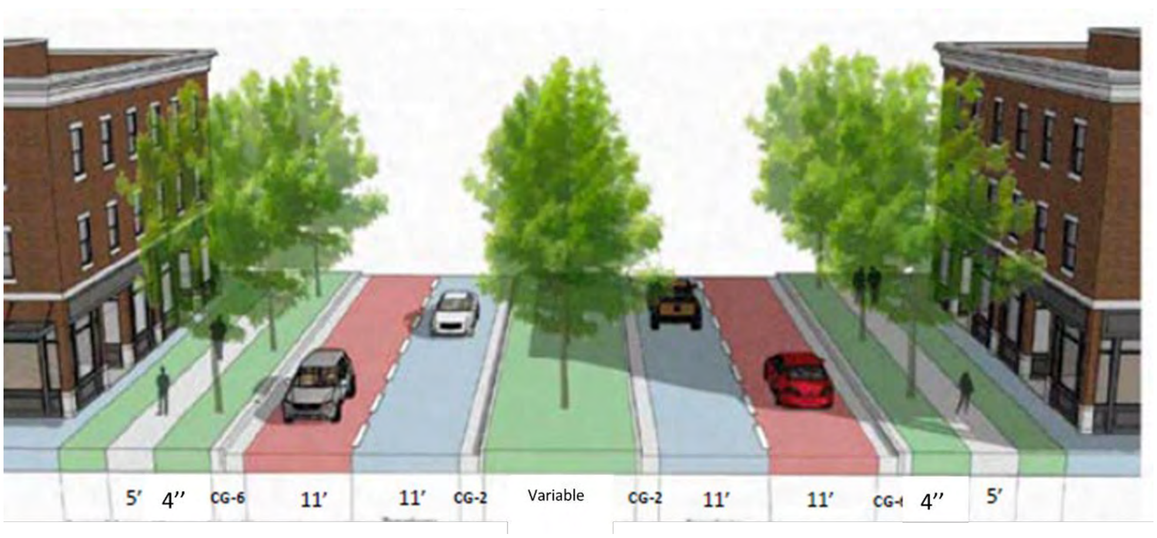
Alternatives

Based on the project purpose and need, Prince William County developed two alternatives: a Build Alternative and the No-Build alternative. The Build Alternative includes the proposed extension of Marina Way. The No-Build Alternative assumes that Prince William County takes no action to address the project purpose and need, other than those typically completed as part of existing system preservation (i.e., resurfacing, landscape management, sign replacement, etc.).

The No Build Alternative assumes the Marina Way Extension roadway and associated improvements are not constructed but considers proposed development and transportation projects in the area will continue as planned including North Woodbridge Town Center, Annapolis Way Extension, Route 1 and Route 123 Interchange, and Route 123 widening.

The proposed alignment will connect the existing Marina Way roadway at Marina Way and Annapolis Way. The proposed section between Horner Road and Route 123 Intersection will be constructed on new alignment through the Gordon Plaza. The alignment will provide a continuous four-lane divided section and continuous 5-foot-wide sidewalks on both sides of the road from Annapolis Way to the Horner Road and Route 123 Intersection. Sharrows have been identified in the Mobility Plan for this section of roadway and will be assessed during the design process. The alignment would require new ROW for the entire proposed section and be required to meet building setback requirements. Exhibit 1.3.1 shows the proposed typical section for the new alignment.

Exhibit 1.3.1: Proposed Typical Section



Source: Marina Way Environmental Assessment, 2024

Exhibit 1.3.2: Build Alternative

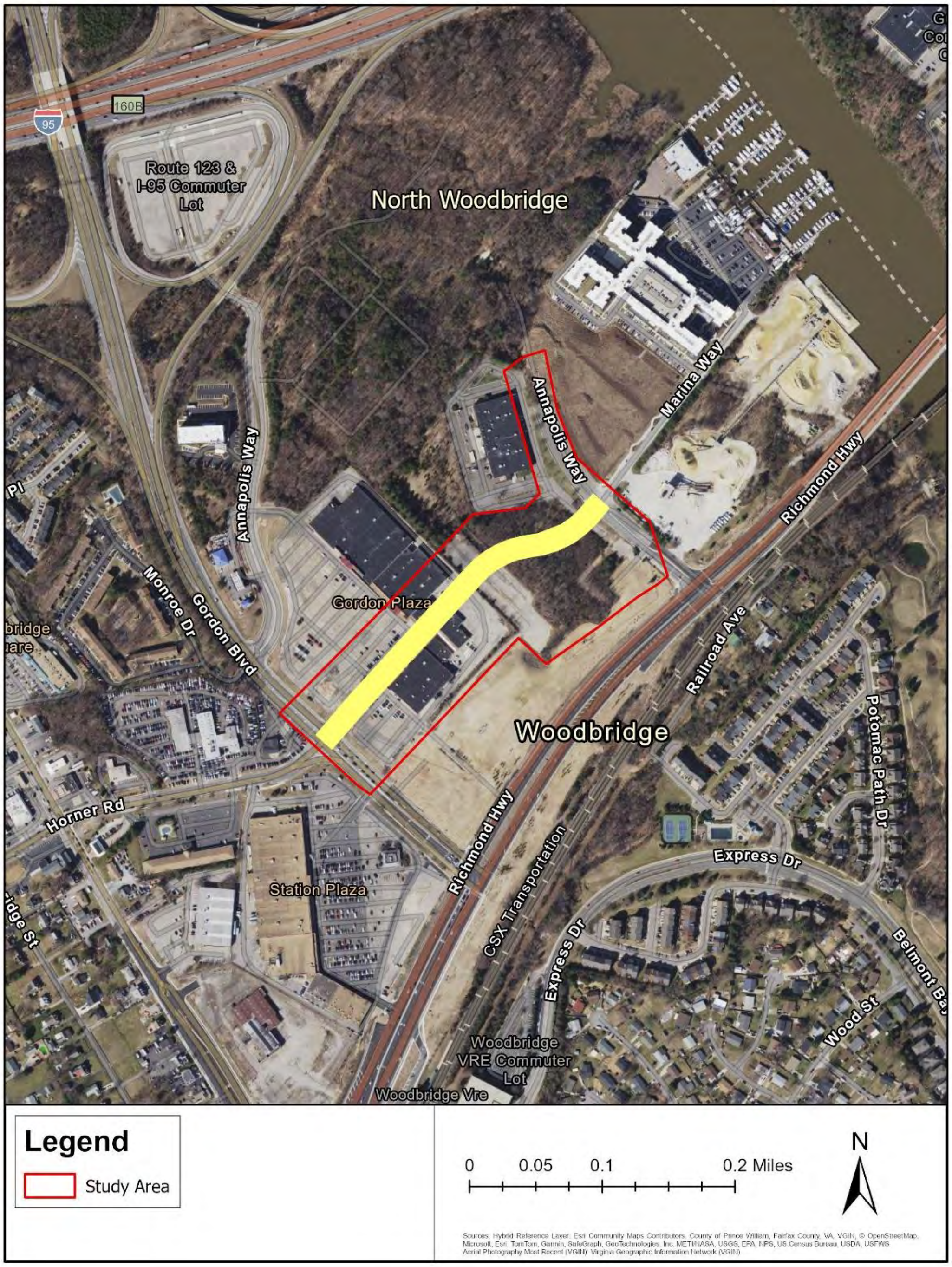


Exhibit 1.3.3: Plan and Profile

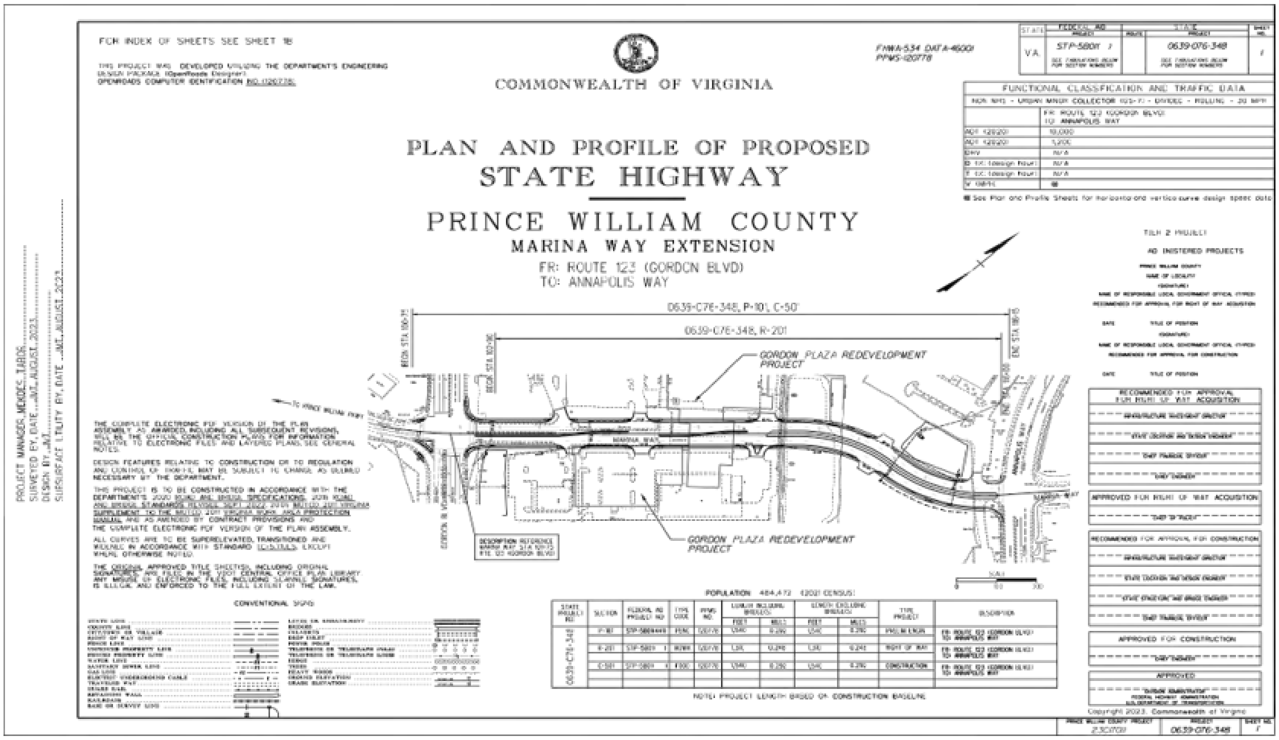


Exhibit 1.3.4: Roadway Grades (Existing Contours)

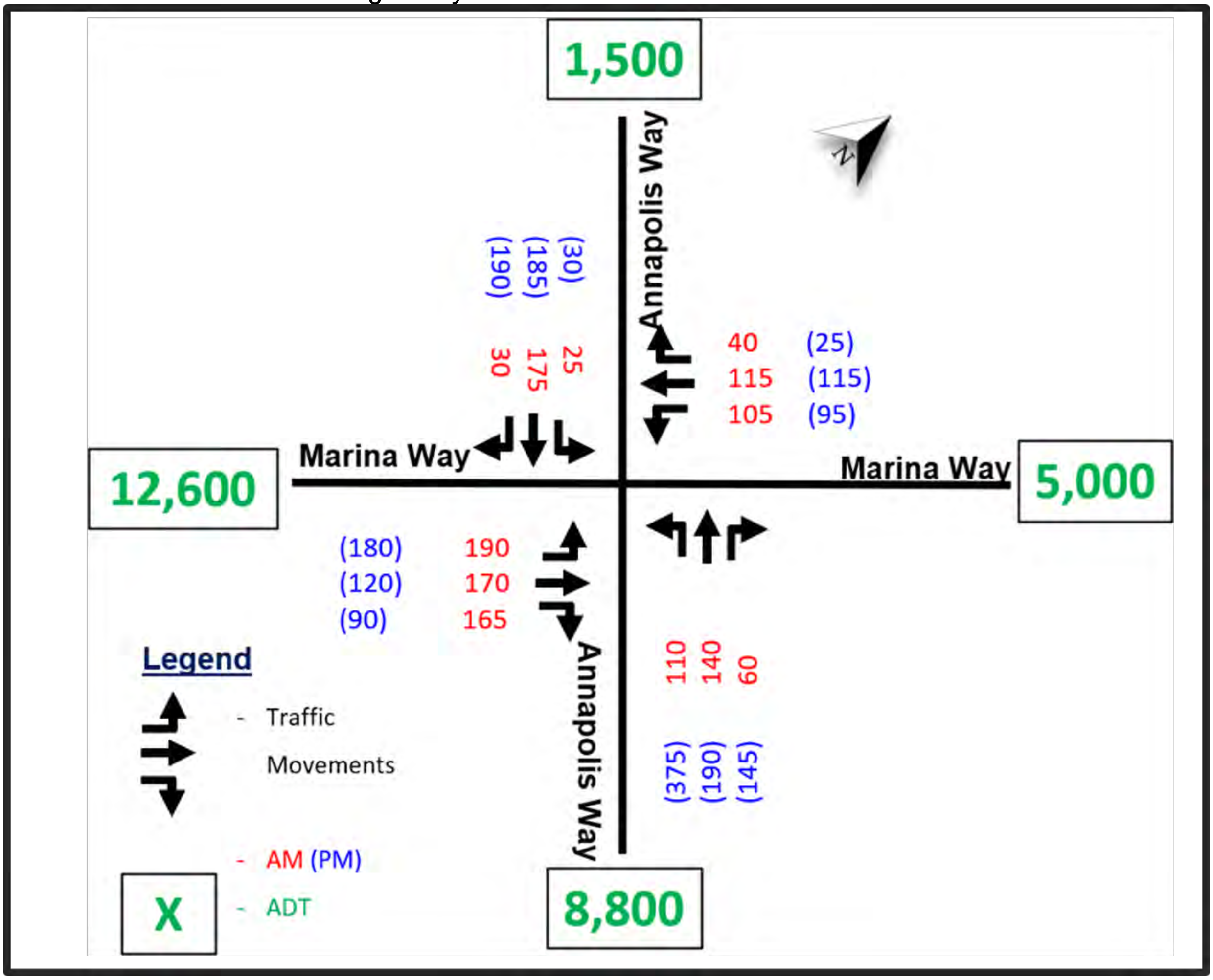
Source: JMT Survey, 2024

Summary of Traffic Data and Forecasts

Environmental traffic data for the Study Area include peak period volumes for each intersection for the build and no build conditions. In situations where design-operational speeds were not available, posted speed limits were used. The detailed traffic data and forecasts are provided in the Preliminary Noise Analysis Report, July 2022. Exhibit 1.4.1 presents a summary of the mainline segments' base (2023) and design year (2050) average daily traffic (ADT) forecasts for the project. As shown in the exhibit, the peak ADT forecast for the design year is 12,600. The corresponding no-build forecast not available. Truck percentages for Marina Way are displayed in Exhibit 1.4.2.

Traffic forecasts are provided in Appendix A to this report.

Exhibit 1.4.1: Average Daily Traffic Forecasts for Boulevard and Other Local Roads



Source: Marina Way and Annapolis Way Alternative Intersection Report, November 22, 2023

Exhibit 1.4.2: Truck Percentages for Marina Way (Combined with Local Roads)

	Truck Percentages	
	2X-6T	3X+
Daily	2%	0.2%
AMPH	1%	0.2%
PMPH	1%	0.0%

Source: Marina Way and Annapolis Way Alternative Intersection Report, November 22, 2023

Project Status in the Regional Transportation Plan and Program

As of the date of preparation of this analysis, the project is included in the currently conforming FY 2023-2026 Transportation Improvement Program (TIP) and 2045 Long Range Transportation Plan

(LRTP).[15] The LRTP and TIP are developed by the metropolitan planning organization (MPO) for the region.[16]

Ambient Air Quality and Attainment Status

National Ambient Air Quality Standards (NAAQS)

Exhibit 2.1.1 presents the national ambient air quality standards (NAAQS) established by the EPA for criteria air pollutants, namely: carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), and lead (Pb). There are two types of NAAQS—primary and secondary: "*Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings*."[17]

As a requirement of the Clean Air Act, EPA periodically reviews the NAAQS and revises them as needed, e.g., to make them more stringent and/or, on occasion, to revoke previous standards that were less stringent.[18] For example, EPA revoked the 1997 annual primary $PM_{2.5}$ NAAQS effective October 24, 2016, with the implementation of the more stringent 2012 $PM_{2.5}$ NAAQS.[19]

Areas that have never been designated by EPA as nonattainment for one or more of the NAAQS are classified as attainment areas, while areas that do not meet one or more of the NAAQS may be designated by EPA as nonattainment areas for that or those criteria pollutants. Areas that have failed to meet the NAAQS in the past but have since re-attained them may be re-designated as attainment (maintenance) areas, which are commonly referred to as maintenance areas.

Exhibit 2.1.1: National Ambient Air Quality Standards (US EPA Tabulation)

Pollutant [links to historical tables of NAAQS reviews]	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3 month average	0.15 μg/m^3 (1)	Not to be exceeded

15 TIP: https://projectinfotrak.mwcog.org/projects/?includeControls=false&planCycleId=242&page=1&pageSize=100 Plan: https://visualize2045.org/plan-update/approved-2022-plan/

16 See: https://www.mwcog.org/committees/transportation-planning-board/

17 From the preamble to the EPA NAAQS table: https://www.epa.gov/criteria-air-pollutants/naaqs-table

18 On January 27, 2023, EPA issued a proposed rule for "Reconsideration of the National Ambient Air Quality Standards for Particulate Matter" (18 FR 5558). At the time of preparation of this report, that rule has not been finalized. The NAAQS table presented here may be updated for PM when the rule is finalized.

19 On August 24, 2016, EPA issued a final rule (81 FR 58010), effective October 24, 2016, on "*Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements*" that stated, in part: "*Additionally, in this document the EPA is revoking the 1997 primary annual standard for areas designated as attainment for that standard because the EPA revised the primary annual standard in 2012.*" See: https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf .

Note the revocation of the 1997 annual primary NAAQS for $PM_{2.5}$ also eliminated the associated conformity requirements. For example, conformity requirements for that NAAQS were eliminated for northern Virginia, which until then had been in attainment (maintenance) for that standard.

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 μg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 μg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O3 standards are not revoked and remain in effect for designated areas. Additionally, some areas may have certain continuing implementation obligations under the prior revoked 1-hour (1979) and 8-hour (1997) O3 standards.

(4) The previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a SIP call under the previous SO2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Source: Excerpted from: https://www.epa.gov/criteria-air-pollutants/naaqs-table, accessed 1/23/2024.

Air Quality Attainment Status of the Project Area

The EPA Green Book[20] lists non-attainment, maintenance, and attainment areas across the nation. It lists the jurisdictions within the area in which the project is located as being in attainment for all of the NAAQS except ozone.

As noted in Section 6 on consultation, the Virginia Department of Environmental Quality (VDEQ) provides general comments by jurisdiction on proposed projects. With regard to attainment status for the area in which project is located, their comment[21] is: "*This project is located within a Marginal 8-hour Ozone Nonattainment area, and a volatile organic compounds (VOC) and nitrogen oxides (NOx) Emissions Control Area …*"

20 EPA Green Book: https://www.epa.gov/green-book

21 Spreadsheet entitled: "DEQ SERP Comments rev8b", March 2017

Ambient Air Quality Monitoring Data and Trends

VDEQ issues an annual report summarizing air quality monitoring data for the previous year, covering criteria pollutants (those for which EPA has established NAAQS) and other pollutants including air toxics.[22] Excerpts of the monitoring data from that report are presented below.

Criteria Pollutants

For transportation sources, the criteria pollutants of primary interest are CO, PM, and NO_2. As the region was previously in maintenance for the 1997 ozone NAAQS, the trend in ozone levels relative to current (more stringent) NAAQS is also of interest.

Carbon Monoxide

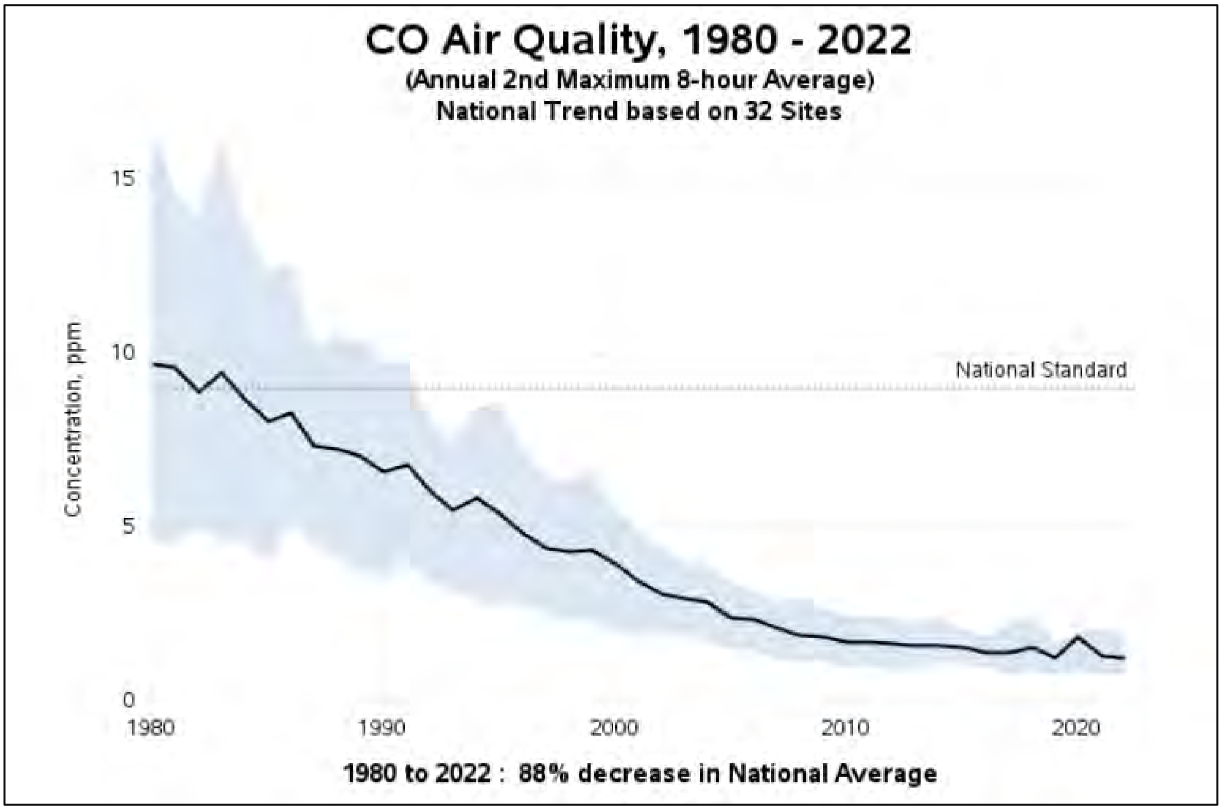
EPA provides the following background information on CO:[23]

> *"CO is a colorless, odorless gas that can be harmful when inhaled in large amounts. CO is released when something is burned. The greatest sources of CO to outdoor air are cars, trucks and other vehicles or machinery that burn fossil fuels. A variety of items in your home such as unvented kerosene and gas space heaters, leaking chimneys and furnaces, and gas stoves also release CO and can affect air quality indoors."*

As shown in Exhibit 2.3.1, and due primarily to the implementation of more stringent vehicle emission and fuel quality standards, the national trend in ambient concentrations of CO over the past few decades has decreased to a level substantially below the current eight-hour NAAQS of nine parts per million (ppm). The national trend is reflected in the very low ambient CO concentrations currently observed in Virginia, which are presented in Exhibits 2.3.2 and 2.3.3. As noted above, Virginia is in attainment for both the one- and eight-hour NAAQS for CO.

22 https://www.deq.virginia.gov/our-programs/air/reports
23 https://www.epa.gov/co-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution#What%20is%20CO

Exhibit 2.3.1: National Trend in Ambient CO Concentrations



Source: https://www.epa.gov/air-trends/carbon-monoxide-trends, accessed March 6, 2024

Exhibit 2.3.2: Ambient Concentrations of Carbon Monoxide in Virginia

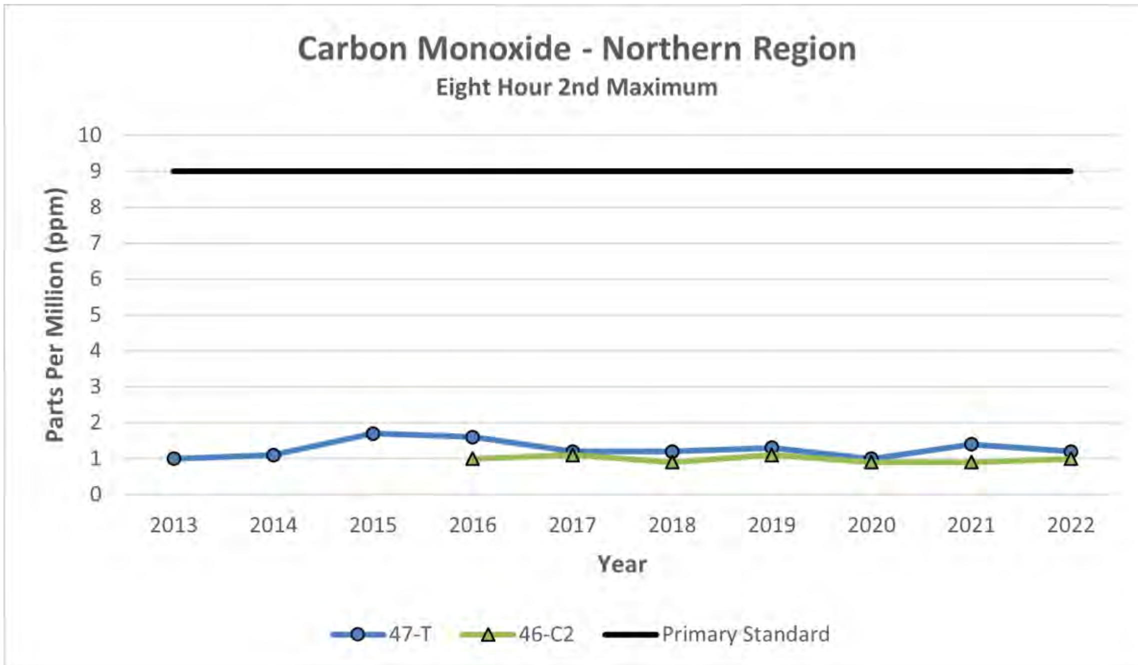
Primary NAAQS: 35 ppm (1-hour) and 9 ppm (8-hour)

Site	2021			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(19-A6) Roanoke Co.	0.8	0.8	0.7	0.6
(72-M) Henrico Co.	1.2	1.1	0.8	0.8
(158-X) Richmond	1.3	1.2	1.1	1.0
(179-K) Hampton	0.7	0.7	0.6	0.6
(181-A1) Norfolk	1.2	1.2	1.1	0.8
(46-C2) Fairfax Co.	1.4	1.3	1.0	0.9
(47-T) Arlington Co.	1.7	1.6	1.5	1.4

Eight Hour Averages stated as Ending Hour

Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See: https://www.deq.virginia.gov/our-programs/air/reports

Exhibit 2.3.3: Trend in Ambient CO Concentrations



*Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See:*http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx
https://www.deq.virginia.gov/our-programs/air/reports

Particulate Matter

EPA provides the following background information on particulate matter (PM):[24]

"PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.

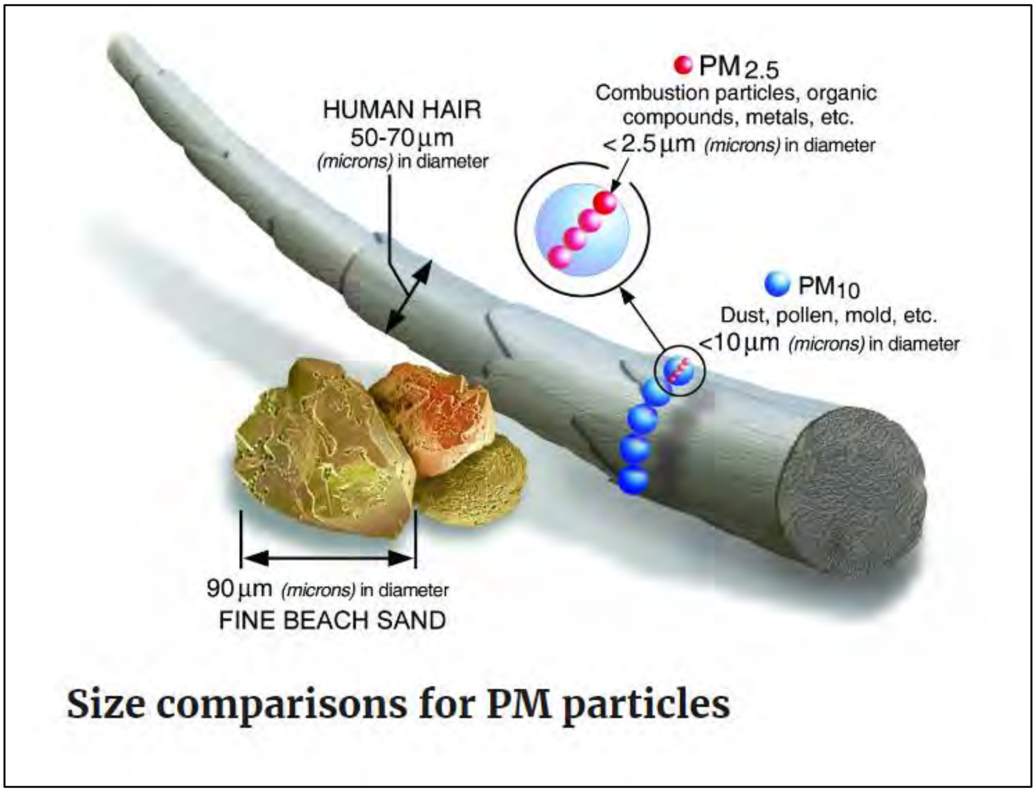
Particle pollution includes:

- *PM_{10} : inhalable particles, with diameters that are generally 10 micrometers and smaller; and*
- *$PM_{2.5}$: fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller."*

Exhibit 2.3.4 from EPA shows the size of $PM_{2.5}$ and PM_{10} particles relative to a human hair and to fine beach sand.

24 See: https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

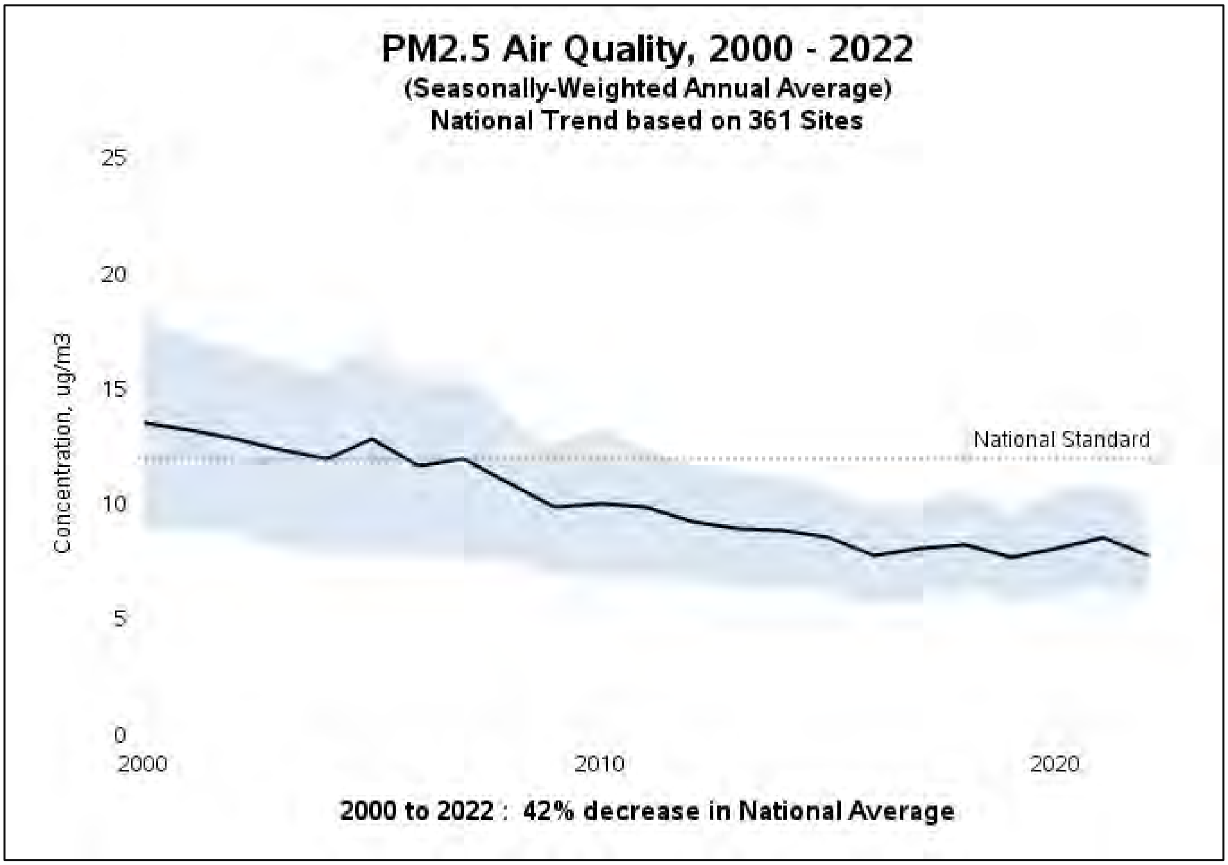
Exhibit 2.3.4: EPA Size Comparisons for PM Particles



Source: US EPA website accessed March 6, 2024. See:
https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

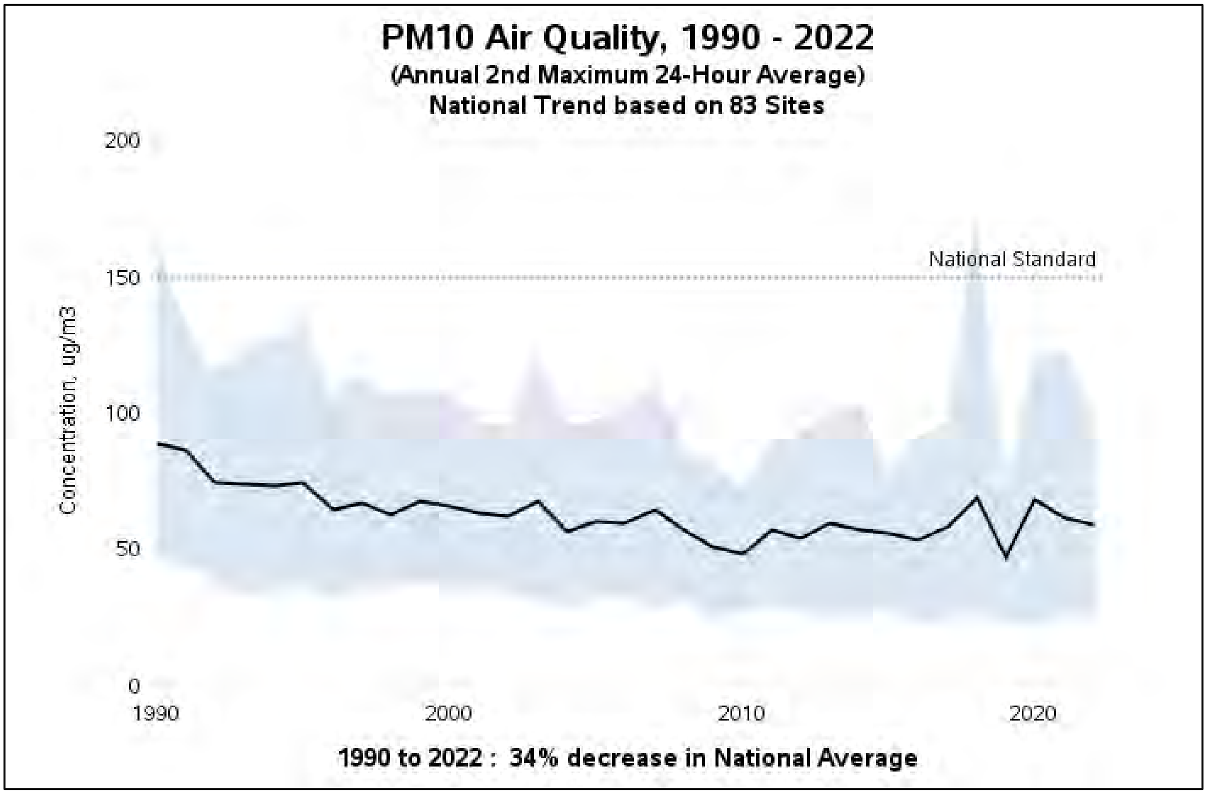
Exhibits 2.3.5 and 2.3.6 present the national trends in $PM_{2.5}$ and PM_{10} levels respectively.

Exhibit 2.3.5: National Trends in $PM_{2.5}$ Concentrations (Annual Average)



Source: US EPA website accessed March 6, 2024. See:
https://www.epa.gov/air-trends/particulate-matter-pm25-trends

Exhibit 2.3.6: National Trends in PM_{10} Concentrations (24-Hour Average)



Source: US EPA website accessed March 6, 2024. See: https://www.epa.gov/air-trends/particulate-matter-pm10-trends

Exhibits 2.3.7 through 2.3.9 respectively present tabulations of $PM_{2.5}$ (24-hour and annual standards) and PM_{10} (24-hour standard) concentrations, which were excerpted from the referenced VDEQ annual air quality monitoring report. As noted above, all of Virginia is in attainment of the NAAQS for both pollutants.

Exhibit 2.3.7: Ambient Concentrations of $PM_{2.5}$ (24-Hour Average)

2020-2022 $PM_{2.5}$ 24-hour Averages, 98th Percentile Values (µg/m^3, LC)				
Site	**2020**	**2021**	**2022**	**3-Year Average**
(101-E) **Bristol**	13.7	16.2	13.0	14.3
(26-F) **Rockingham Co.**	14.0	18.3	13.0	15.1
(28-J) **Frederick Co.**	16.2	21.2	19.2	18.9
(33-A) **Albemarle Co.**	12.3	17.9	15.0	15.1
(19-A6) **Roanoke Co.**	14.7	19.7	15.7	16.7
(110-C) **Salem**	13.5	18.8	12.6	15.0
(155-Q) **Lynchburg**	11.7	17.5	11.5	13.6
(71-H) **Chesterfield Co.**	11.4	18.9	11.9	14.1
(72-M) **Henrico Co.**	14.5	18.0	15.9	16.1
(72-N) **Henrico Co.**	12.7	17.2	11.1	13.7
(75-B) **Charles City Co.**	11.5	17.0	12.9	13.8
(158-X) **Richmond**	15.7*	17.6*	16.4	16.6
(179-K) **Hampton**	12.8	15.5	13.0	13.8
(181-A1) **Norfolk**	12.1*	15.4	12.8	13.4
(184-J) **Va. Beach**	15.1*	15.1	13.6	14.6
(38-I) **Loudoun Co.**	19.3*	16.0	13.0	16.1
(47-T) **Arlington Co.**	17.7	17.1	13.5	16.1
(46-B9) **Franconia, Fairfax Co.**	14.6	17.6	14.0	15.4
(46-C2) **Springfield, Fairfax Co.**	16.3	19.9*	15.7	17.3

Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See: https://www.deq.virginia.gov/our-programs/air/reports
http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx

Exhibit 2.3.8: Ambient Concentrations of $PM_{2.5}$ (Annual Average)

2020-2022 $PM_{2.5}$ Weighted Annual Arithmetic Means ($\mu g/m^3$, LC)				
Site	**2020**	**2021**	**2022**	**3-Year Average**
(101-E) **Bristol**	6.0	7.3	6.2	6.5
(26-F) **Rockingham Co.**	6.1	7.4	6.5	6.7
(28-J) **Frederick Co.**	6.6	8.6	7.7	7.6
(33-A) **Albemarle Co.**	6.5	7.7	7.7	7.3
(19-A6) **Roanoke Co.**	6.7	8.3	7.4	7.5
(110-C) **Salem**	5.9	7.1	6.4	6.5
(155-Q) **Lynchburg**	5.4	6.6	5.7	5.9
(71-H) **Chesterfield Co.**	5.5	7.0	5.8	6.1
(72-M) **Henrico Co.**	6.9	8.3	7.7	7.6
(72-N) **Henrico Co.**	5.6	7.2	6.0	6.3
(75-B) **Charles City Co.**	5.6	7.0	5.8	6.1
(158-X) **Richmond**	6.9*	8.3*	8.0	7.7
(179-K) **Hampton**	5.9	7.0	6.8	6.6
(181-A1) **Norfolk**	6.0*	7.2	6.3	6.5
(184-J) **Va. Beach**	6.2*	7.3*	6.5	6.7
(38-I) **Loudoun Co.**	6.2*	7.4	6.4	6.7
(47-T) **Arlington Co.**	6.6	7.9	6.7	7.1
(46-B9) **Franconia, Fairfax Co.**	6.6	7.9	7.2	7.2
(46-C2) **Springfield, Fairfax Co.**	7.9	9.1*	8.1	8.4

Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See: https://www.deq.virginia.gov/our-programs/air/reports
http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx

Exhibit 2.3.9: Ambient Concentrations of PM_{10} (24-Hour Average)

2020-2022 PM_{10} 24-Hour Average Concentrations (units in µg/m³ STD)							
Site	2020		2021		2022		>150 µg/m³
	1st Max	2nd Max	1st Max	2nd Max	1st Max	2nd Max	
(23-A) **Carroll Co.**	16	15	36	27	25	22	0
(28-J) **Frederick Co.***	-	-	51	46	45	42	0
(44-A) **Stafford Co.**	24	16	34	30	18	13	0
(46-B9) **Fairfax Co.***	17	16	45	27	30	23	0
(72-M) **Henrico Co.**	16	15	39	23	29	27	0
(154-M) **Hopewell@**	16	15	34	19	25	16	0
(179-K) **Hampton***	13	10	17	14	28	26	0
(181-A1) **Norfolk**	29	20	24	21	22	20	0

* Continuous monitoring started in 2022
@ Did not meet 4th quarter data completeness criteria in 2022
- No data

Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See: http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx*https://www.deq.virginia.gov/our-programs/air/reports*

Nitrogen Dioxide

EPA provides the following background information on NO_2:[25]

"Nitrogen Dioxide (NO_2) is one of a group of highly reactive gases known as oxides of nitrogen or nitrogen oxides (NO_x). Other nitrogen oxides include nitrous acid and nitric acid. NO_2 is used as the indicator for the larger group of nitrogen oxides.

NO2 primarily gets in the air from the burning of fuel. NO_2 forms from emissions from cars, trucks and buses, power plants, and off-road equipment."

and

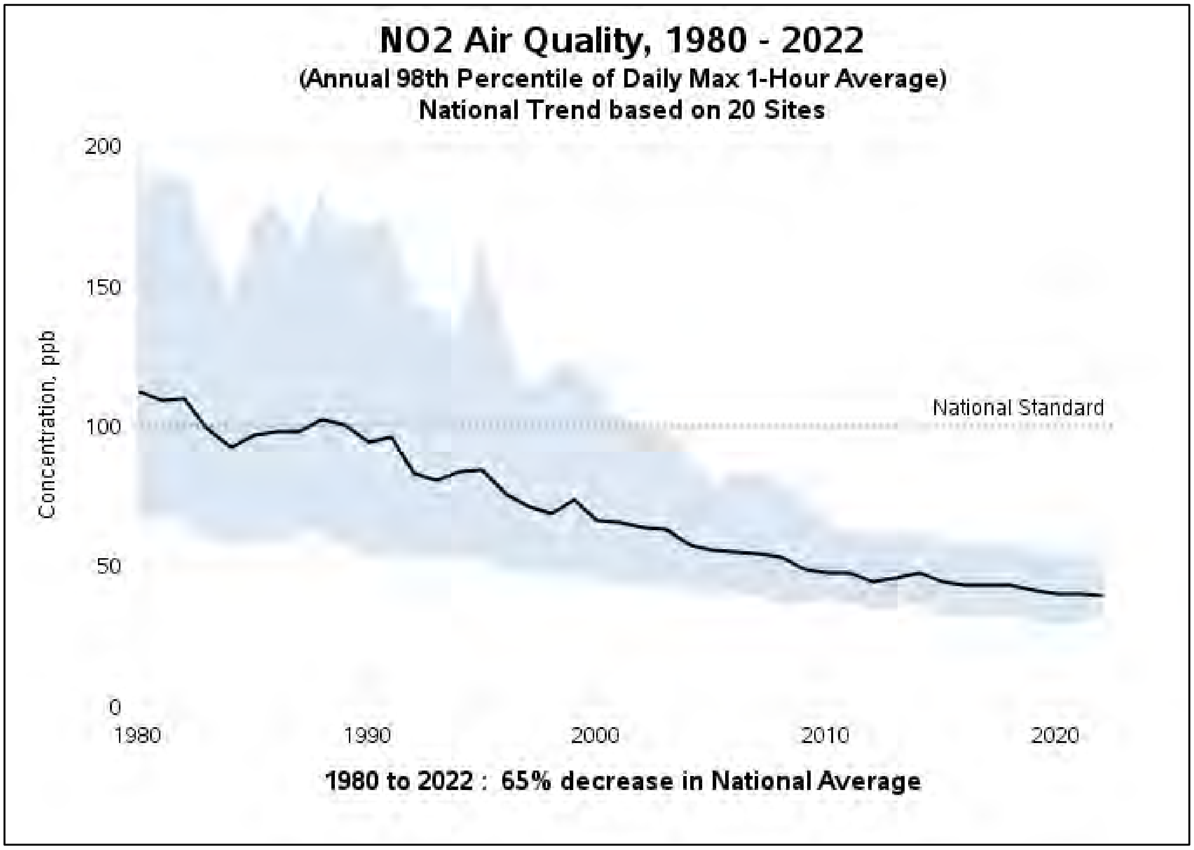
"Breathing air with a high concentration of NO_2 can irritate airways in the human respiratory system. Such exposures over short periods can aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions and visits to emergency rooms. Longer exposures to elevated concentrations of NO2 may contribute to the development of asthma and potentially increase susceptibility to respiratory infections. People with asthma, as well as children and the elderly are generally at greater risk for the health effects of NO_2.

NO_2 along with other NO_x reacts with other chemicals in the air to form both particulate matter and ozone. Both of these are also harmful when inhaled due to effects on the respiratory system."

Exhibits 2.3.10 and 2.3.11 present the trend in levels of NO_2 on a national level and for northern Virginia respectively.

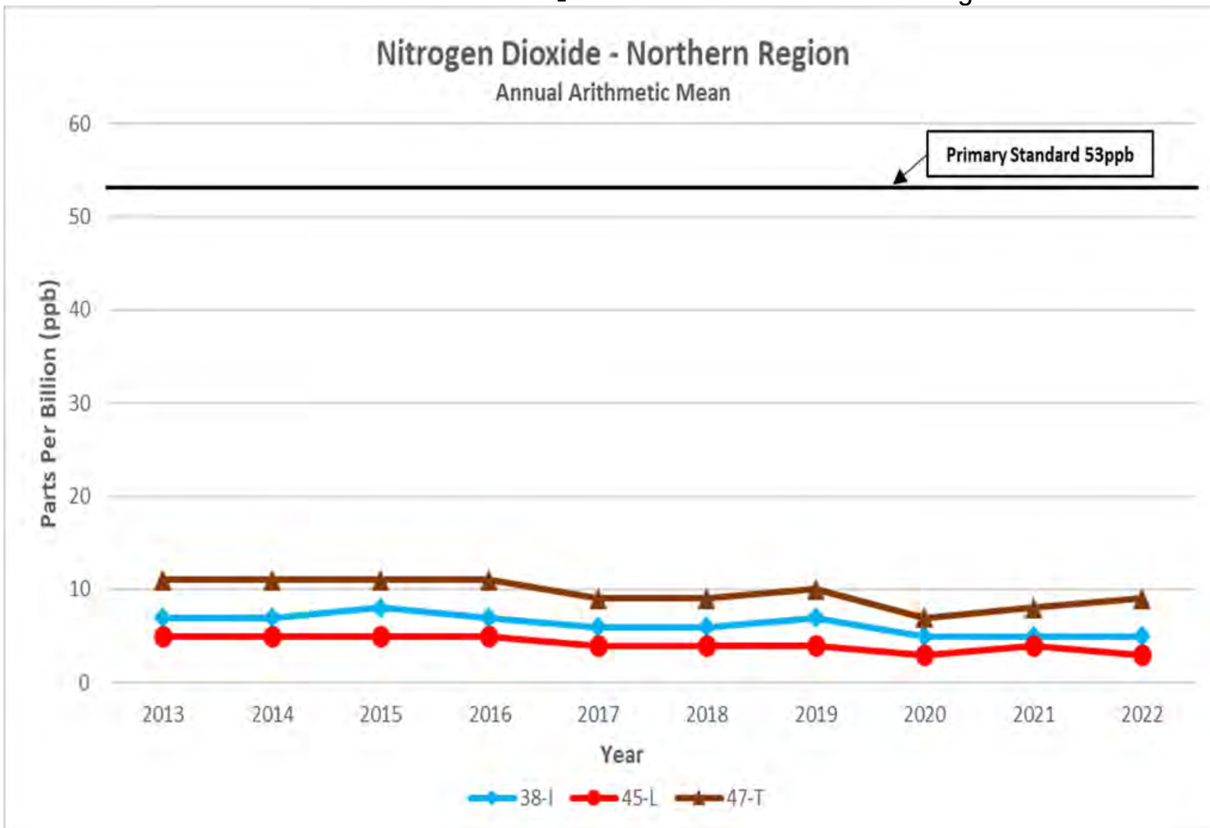
[25] See: https://www.epa.gov/no2-pollution/basic-information-about-no2#What%20is%20NO2

Exhibit 2.3.10: National Trends in NO_2 Concentrations



Source: US EPA website accessed March 6, 2024. See:
https://www.epa.gov/air-trends/nitrogen-dioxide-trends

Exhibit 2.3.11: Trends in NO_2 Concentrations in Northern Virginia

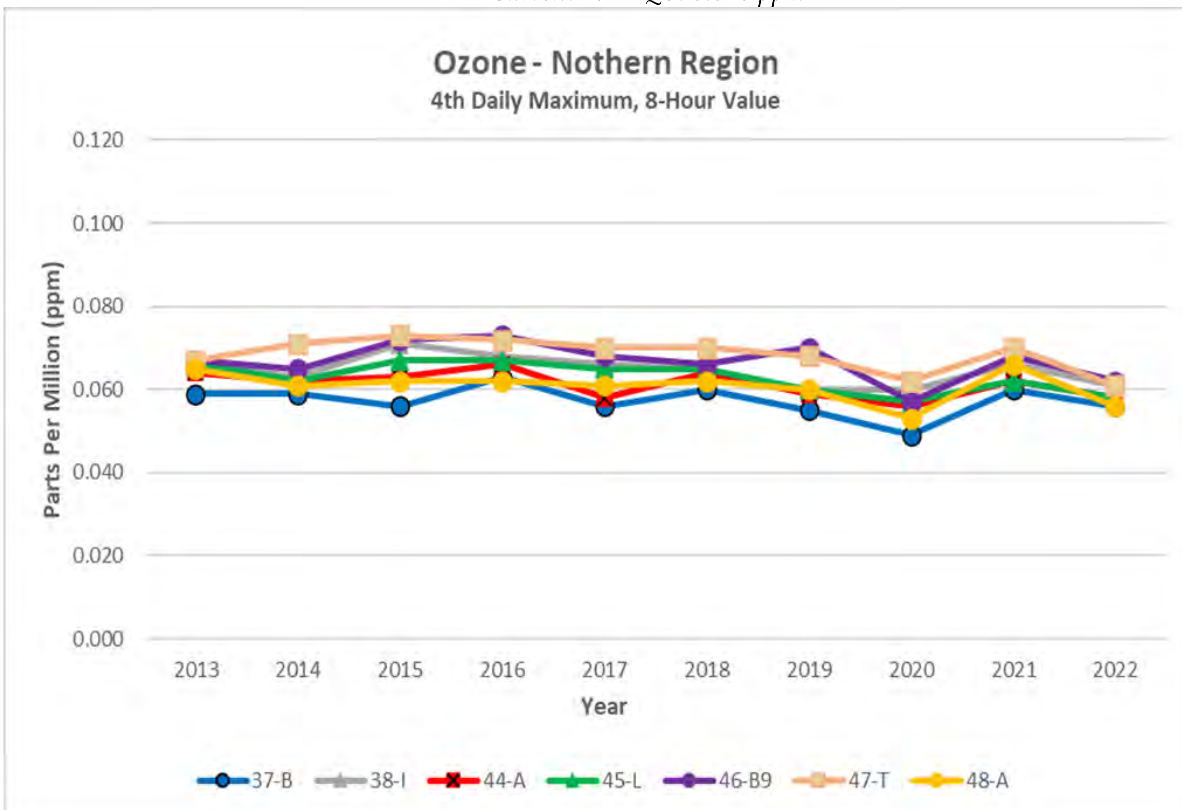


Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023.
See: http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx
https://www.deq.virginia.gov/our-programs/air/reports

Ozone

Exhibit 2.3.12 presents the trend in regional ozone levels for the eight-hour standard.

Exhibit 2.3.12: Trend for the Eight-Hour Ozone Standard – Northern Region
Current NAAQS: 0.070 ppm



Source: Virginia Department of Environmental Quality, "Virginia Ambient Air Monitoring 2022 Annual Report", 2023. See: http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx*https://www.deq.virginia.gov/our-programs/air/reports*

Air Toxics

From the VDEQ website:[26]

> *"Toxic air pollutants, also called Hazardous Air Pollutants or air toxics, are known or suspected to cause adverse health or environmental effects.*
>
> *DEQ maintains two air toxics monitoring sites: one in the Richmond area at the MathScience Innovation Center, and one in Hopewell. Among the principle objectives of these stations are assessing trends and emission reduction program effectiveness, assessing and verifying air quality models (e.g., exposure assessments, emission control strategy development, etc.), and as direct input to source-receptor models.*
>
> *At each of these sites, daily measurements are taken for dozens of pollutants, including volatile organic compounds (VOCs), carbonyls and metals, and the Richmond site also measures polyaromatic hydrocarbons (PAHs). The Hopewell site was placed in 2009 as part of a grant to study localized impacts from air toxics. The Richmond site is part of a national network to study air toxics trends. In addition to these sites, DEQ will begin collecting data as part of an air toxics study in Newport News and Norfolk in the summer of 2021.*
>
> *Find more information about these monitors in DEQ's Air Monitoring Network Plan. "*[27]

Mobile source air toxics and trends are addressed in more detail in the next section on project assessment.

[26] See: https://www.deq.virginia.gov/our-programs/air/monitoring-assessments/air-monitoring/pollutant-monitoring , accessed February 1, 2023

[27] Ibid

Project Assessment

Regulatory Requirements

The assessments presented in this section were conducted for purposes of the National Environmental Policy Act of 1969 (NEPA) and, where applicable, to meet transportation conformity rule requirements. FHWA posts guidance for NEPA on its website for project development,[28] and provides guidance specific to air quality (focusing on carbon monoxide) in its 1987 Technical Advisory 6640.8A, "*Guidance for Preparing and Processing Environmental and Section 4(f) Documents.*"[29] FHWA posts separate guidance for mobile source air toxics (MSATs) along with responses to "Frequently Asked Questions" (FAQs) on its air quality webpage.[30]

EPA transportation conformity rule requirements are specified in 40 CFR Parts 51 and 93,[31] which were issued pursuant to requirements in the Clean Air Act (CAA) as amended.[32] Copies of the EPA conformity regulation and associated guidance are available on the EPA website.[33] In general, the rule requires conformity determinations for transportation plans, programs and projects in "*non-attainment or maintenance areas for transportation-related criteria pollutants for which the area is designated nonattainment or has a maintenance plan*" (40 CFR 93.102(b)).

Corresponding Commonwealth of Virginia requirements for conformity are specified in 9 VAC-5-151, which is also referred to as the state "conformity SIP" or "conformity implementation plan."[34] Note, per the federal transportation conformity regulation, its requirements apply only in the absence of corresponding requirements in the state conformity regulation.[35] The Virginia regulation incorporates by reference most of the requirements in the July 1, 2012 federal rule from 40 CFR 923.101 to 93.129, with the notable exception of 40 CFR 93.105 which addresses consultation. The Virginia regulation provides detailed requirements for consultation that are specific to Virginia but otherwise reflect the consultation requirements in 40 CFR 93.105.

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28 See: https://www.environment.fhwa.dot.gov/nepa/nepa_projDev.aspx
29 See: https://www.environment.fhwa.dot.gov/projdev/impTA6640.asp
30 See: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/
31 *EPA Transportation Conformity Regulation and Guidance*:
- https://www.epa.gov/state-and-local-transportation/current-law-regulations-and-guidance-state-and-local-transportation.

Direct links:
- https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-51#subpart-T
- https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#part-93

32 See: http://www.epa.gov/air/caa/
33 See: https://www.epa.gov/state-and-local-transportation/transportation-conformity
34 *Virginia Regulation for Transportation Conformity (9 VAC5-151)*: https://law.lis.virginia.gov/admincode/title9/agency5/chapter151/
35 40 CFR 51.390*: "…The federal conformity rules under part 93, subpart A, of this chapter… establish the conformity criteria and procedures necessary to meet the requirements of Clean Air Act section 176(c) until such time as EPA approves the conformity implementation plan revision required by this subpart… The federal conformity regulations contained in part 93, subpart A, of this chapter would continue to apply for the portion of the requirements that the state did not include in its conformity implementation plan and the portion, if any, of the state's conformity provisions that is not approved by EPA."* https://ecfr.federalregister.gov/current/title-40/chapter-I/subchapter-C/part-51.390#51.390

Application of the VDOT Resource Document

In 2016, the Department created the "VDOT Resource Document" and associated online data repository to facilitate and streamline the preparation of project-level air quality analyses for purposes of NEPA and conformity.[36] Inter-agency consultation was conducted with FHWA Division and Headquarters and other agencies (including EPA) before the Resource Document was finalized. The Resource Document was most recently updated in 2023 to address changes in applicable regulations and guidance.

With regard to this project, the models, methods/protocols and assumptions as specified or referenced in the VDOT Resource Document were applied without change or without substantive change as defined in that document.

Mobile Source Air Toxics (MSATs) Assessment

FHWA most recently updated its guidance for the assessment of MSATs in the NEPA process for highway projects in 2023.[37] It states that "*…EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[38] These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter.*" It also specifies three possible categories or tiers of analysis, namely, 1) projects with no meaningful potential MSAT effects, or exempt projects (for which MSAT analyses are not required), 2) projects with low potential MSAT effects (requiring only qualitative analyses), and 3) projects with higher potential MSAT effects (requiring quantitative analyses).

Level of Analysis Determination

As this project involves an EA and is not exempt, it does not qualify as a Tier 1 project under FHWA MSAT Guidance. It also does not meet the criteria for a Tier 3 project in FHWA guidance, as total traffic is forecast to reach only 12 thousand ADT for the build scenario, which is below the 140-150 thousand ADT criteria specified in FHWA guidance for Tier 3 projects (i.e., ones for which quantitative analyses for MSATs would be required). Additionally, this project does not involve the creation or alteration of a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location.

This project may therefore be categorized as a Tier 2 project, i.e., one with "Low Potential MSAT Effects." Projects in this category are addressed with a qualitative analysis, which as FHWA guidance states provides a basis for identifying and comparing potential differences for MSAT emissions, if any, from the various alternatives.

A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below follows FHWA guidance. It is derived in part from a study conducted by FHWA

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36 See: https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/environmental/

37 FHWA, "*INFORMATION: Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents*", January 18, 2023. See: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/
Note: While the January 2023 FHWA updated guidance was based on modeling using MOVES3, which is reflected in the background information presented here, the current version of the emission model (MOVES4.0.1 at the time of preparation for this analysis) is used for any project-specific modeling.

38 See: https://www.epa.gov/national-air-toxics-assessment

entitled "*A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives.*"[39]

Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007), and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (IRIS).[40] In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment (NATA).[41] These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

Motor Vehicle Emissions Simulator (MOVES)

According to EPA, MOVES3 is a major revision to MOVES2014 and improves upon it in many respects. MOVES3 includes new data, new emissions standards, and new functional improvements and features. It incorporates substantial new data for emissions, fleet, and activity developed since the release of MOVES2014. These new emissions data are for light- and heavy-duty vehicles, exhaust and evaporative emissions, and fuel effects. MOVES3 also adds updated vehicle sales, population, age distribution, and vehicle miles travelled (VMT) data. MOVES3 incorporates the effects of three new Federal emissions standard rules not included in MOVES2014. These new standards are all expected to impact MSAT emissions and include Tier 3 emissions and fuel standards starting in 2017 (79 FR 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014-2018 (79 FR 60344), and the second phase of light-duty greenhouse gas regulations that phase in during model years 2017-2025 (79 FR 60344). In the November 2020 EPA issued MOVES3 Mobile Source Emissions Model Questions and Answers.[42] EPA states that for on-road emissions, MOVES3 updated heavy-duty (HD) diesel and compressed natural gas (CNG) emission running rates and updated HD gasoline emission rates. They updated light-duty (LD) emission rates for hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOx) and updated LD particulate matter rates, incorporating new data on Gasoline Direct Injection (GDI) vehicles.

Using EPA's MOVES3 model, as shown in Exhibit 3.3.1, FHWA estimates that even if VMT increases by 31 percent at a national level from 2020 to 2060 as forecast, a combined reduction of 76 percent in the total annual emissions for the priority MSAT is projected for the same time period. Diesel PM is the dominant component of MSAT emissions, making up 36 to 56 percent of all priority MSAT pollutants by mass, depending on calendar year. Users of MOVES3 will notice some differences in emissions compared with MOVES2014. MOVES3 is based on updated data on

39 https://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.cfm
40 https://www.epa.gov/iris
41 https://www.epa.gov/national-air-toxics-assessment
42 https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010M06.pdf

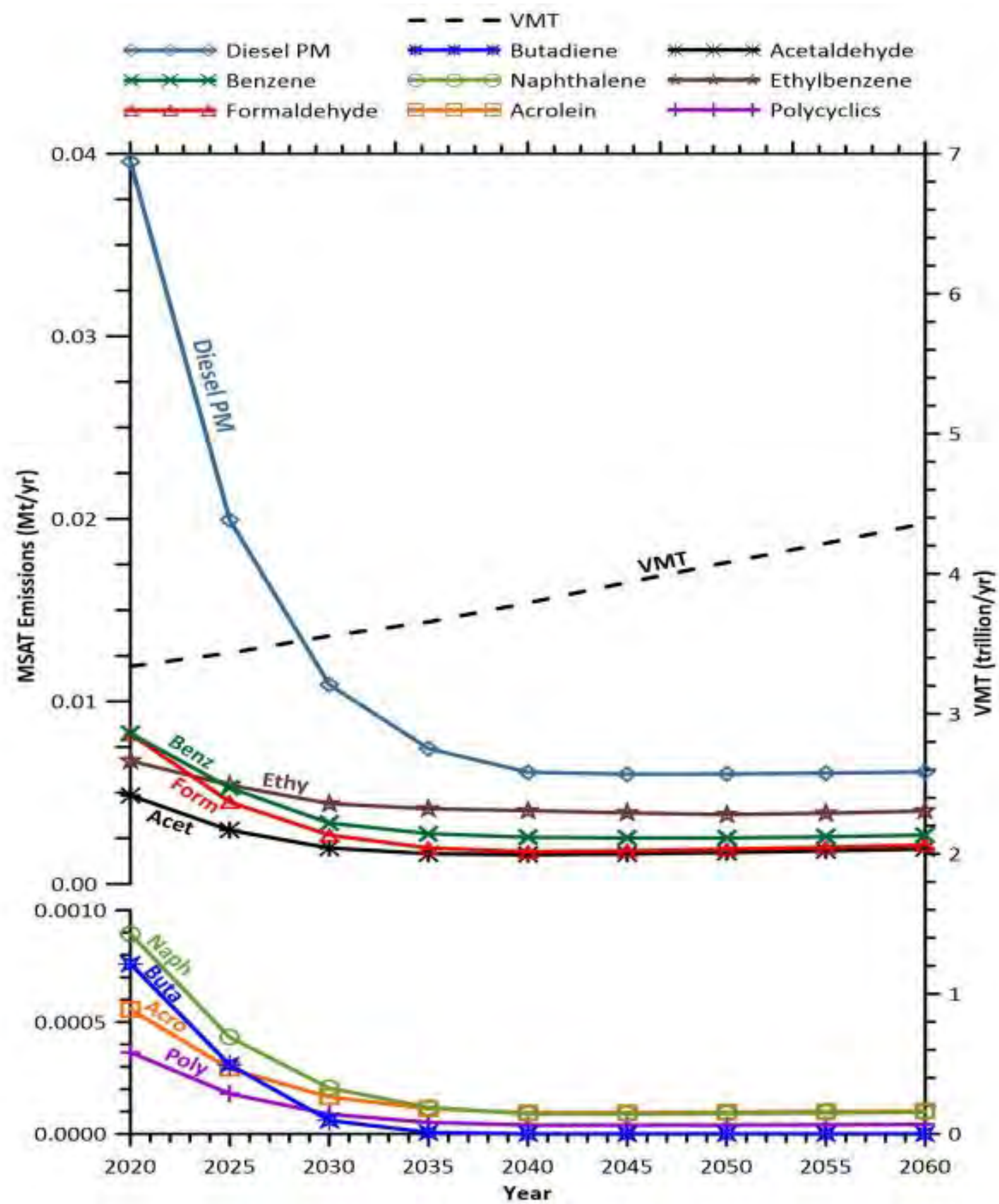
some emissions and pollutant processes compared to MOVES2014, and also reflects the latest Federal emissions standards in place at the time of its release. In addition, MOVES3 emissions forecasts are based on slightly higher VMT projections than MOVES2014, consistent with nationwide VMT trends.

MSAT Research

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how potential public health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxics concerns continue to arise on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect FHWA to address MSAT impacts in its environmental documents. The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this field.

Exhibit 3.3.1: FHWA Projected National MSAT Emission Trends 2020 – 2060 for Vehicles Operating on Roadways



Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

Source: EPA MOVES3 model runs conducted by FHWA, March 2021

Qualitative Analysis

Following FHWA guidance, this project has been determined to have low potential MSAT effects, thereby requiring a qualitative MSAT analysis. A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions among Transportation Project Alternatives*.[43]

The amount of MSATs emitted is proportional to vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for the Build Alternative(s) therefore may be slightly higher than that for the No-Build Alternative because additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network. This increase in VMT could lead to higher MSAT emissions for the preferred alternative along a highway corridor, along with a corresponding decrease in MSAT emissions along parallel routes. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to the EPA MOVES3 model, emissions of all of the priority MSAT decrease as speed increases.

There may also be localized areas where VMT would increase and other areas where it would decrease. Therefore, it is possible that localized increases and decreases in MSAT emissions may occur. However, even if these increases do occur, they too will be substantially reduced in the future due to implementation of EPA's vehicle and fuel regulations. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected in FHWA guidance to reduce annual MSAT emissions by over 76 percent between 2020 and 2060 even with a 31 percent increase in VMT on a national level. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases. Any additional travel lanes contemplated as part of the project may have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher for a Build Alternative than for the No-Build Alternative. However, the magnitude and the duration of these potential increases compared to the No-Build alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts.

In sum, when capacity is added, the localized level of MSAT emissions for the Build Alternative could be higher relative to the No-Build Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). In addition, MSAT emissions will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today.

[43] See: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.cfm

Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects."[44] Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations[45] or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI.[46] As a result, there is no national

44 See: https://www.epa.gov/iris/
45 HEI Special Report 16. See: https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects
46 Ibid

consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust: “[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (https://iris.epa.gov/static/pdfs/0642_summary.pdf).”

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an “acceptable” level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA’s approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.[47]

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities while improving access for emergency response, that are better suited for quantitative analysis.

Conclusions

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project at this time. While it is possible that localized increases in MSAT emissions may occur as a result of this project, emissions will likely be lower than present levels in the design year of this project as a result of EPA's national control programs that are projected in FHWA guidance (2023) to reduce annual MSAT emissions by 76 percent between 2020 and 2060 even as VMT increases nationally by 31 percent. Although local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

47 See: https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf

Greenhouse Gases (GHGs)

Level of Analysis Determination

The project meets the screening criteria specified in the VDOT Resource Document (Appendix K) for a Category 2 project as one with low potential GHG effects. As such, a brief qualitative assessment is presented below for this project.

Qualitative Assessment

For each alternative in this EA, the amount of GHGs emitted would be proportional to the vehicle miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for each of the Build alternatives may be slightly higher than that for the No-Build alternative for each analysis year, because the additional capacity may increase the efficiency of the roadway and attract rerouted trips from elsewhere in the transportation network. An increase in VMT may lead to higher GHG emissions for the preferred action alternative compared to the No-Build alternative along the highway corridor, along with a corresponding decrease in GHG emissions along the parallel routes. The emissions increase may be offset somewhat by lower GHG emission rates due to increased speeds; according to the EPA MOVES model, emissions of GHG emissions decrease as speed increases (up to about 60 miles per hour). Because the estimated VMT under each of the alternatives are nearly the same, it is expected there would be no appreciable difference in overall GHG emissions among the various alternatives. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of fuel efficiency improvements and electrification policies that are projected to reduce annual statewide GHG emissions from on-road sources by nearly 50 percent between 2015 and 2040 (VDOT, Statewide Planning-Level GHG Assessment, December 2021).

Climate Change

Potential Climate Change Impacts

Greenhouse gas emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric CO_2 increasing from roughly 300 parts per million in 1900 to over 400 parts per million today according to the U.S. Global Climate Change Research Program. Over this timeframe, average temperatures have increased by roughly 1.8 degrees Fahrenheit (1 degree Celsius). If emissions continue, projected changes in global average temperature could range from 0.4°–2.7°F (0.2°–1.5°C) under a very low emissions scenario, to 4.2°–8.5°F (2.4°–4.7°C) under a higher scenario by the end of the 21st century.[48]

According to information prepared by the Georgetown Climate Center, Virginia's transportation infrastructure faces risks from a changing climate including coastal flooding, inland flooding, and extreme heat.

- Coastal Flooding—Sea level rise is occurring at an accelerating rate, and five Virginia water level stations appear in the Nation's top 20 highest sea level rise trends.[49] In the next 20 to 50 years, Virginia is likely to experience at least 1.5 feet of sea level rise, with the possibility of

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48 U.S. Global Climate Change Research Program (2018). Fourth National Climate Assessment.

49 City of Virginia Beach (2020). Sea Level Wise: Adaptation Strategy. https://pw.virginiabeach.gov/stormwater/sea-level-wise

even greater increases.[50] Storm surge presents major risks to Virginia's coastal areas, with over 300 bridges and structures that would face over two feet of storm surge inundation from a Category 2 hurricane.[51] By 2080, 10 percent of the roadway networks in Virginia Beach and Norfolk could be flooded by "king tides" (exceptionally high tide events) with four feet of sea level rise.[52]
- Inland Flooding—The southeastern U.S. has experienced an increase in flooding from heavy rainfall and extreme precipitation events. Virginia has seen heavy rainstorms increase by 33 percent in the last 60 years.[53] In the future, the southeastern U.S. is expected to see a continued increase in extreme rainfall events.
- Extreme Heat—Heat waves are a leading cause of weather-related deaths.[54] Anticipated more intense heat events pose dangers to human activity and human health. Extreme heat combined with drought conditions can also increase the risk of wildfires. Pavements may also contribute to heat island effects in urban locations.[55]

Project-Level Climate Strategies and Considerations

Resiliency is an important consideration for future infrastructure investments. Resiliency considerations include building in areas with minimal risk to the facility; designing infrastructure that is resilient to potential impacts that could affect its scope, function, and/or performance; and siting and designing projects to avoid or minimize impacts to natural resiliency features such as wetlands, forests, and floodplains. Resiliency strategies that are cost-effective and can be adopted during the planning, project development, construction, and/or maintenance phases of a given infrastructure project are supported. VDOT complies with all existing Federal and state laws and regulations and permitting requirements related to wetlands and water quality impacts.

VDOT, the County, and some regional and local agency partners in the state, have already engaged in efforts to plan for resiliency. As part of the development of VTrans, Virginia's Transportation Plan, the Commonwealth Transportation Board (CTB) has developed the Policy for the Development and Monitoring of VTrans Long-term Risk & Opportunity Register, which allows for quantification of impacts of 10 macrotrends, including long-term flooding risk due to sea-level rise, storm surge, and inland/riverine flooding.

The CTB has also developed a Long-term Risk & Opportunity Register, a policy document, based on an assessment of these impacts. The 2021 Risk & Opportunity Register includes the following risks and opportunities:

- Risk: A large number of the state's roadways are at risk of flooding.
- Risk: Several unknown and unquantified flooding risks are present.

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50 Georgetown Climate Center (undated). "Understanding Virginia's Vulnerability to Climate Change." Accessed September 2021 at https://www.georgetownclimate.org/files/report/understanding-virginias-vulnerability-to-climate-change.pdf.

51 Commonwealth of Virginia, Office of the Secretary of Transportation (2020). Vulnerability Assessment.

52 Sadler, Jeffer, Nicole Haselden, Kimberly Mellon, and Allison Hackel (2017). Impact of Sea-Level Rise on Roadway Flooding in the Hampton Roads Region, Virginia. Journal of Infrastructure Systems. Accessed at: https://ascelibrary.org/doi/pdf/10.1061/%28ASCE%29IS.1943-555X.0000397.

53 Georgetown Climate Center, *ibid.*

54 Georgetown Climate Center, *ibid.*

55 Georgetown Climate Center (2012). "Adapting to Urban Heat: A Tool Kit for Local Governments." https://www.georgetownclimate.org/files/report/Urban%20Heat%20Toolkit_9.6.pdf

- Risk: Impacts of increased flooding risk are disproportionately higher for certain geographic areas and populations.
- Opportunity: Proactively eliminate or mitigate identified flooding risks.
- Opportunity: Increase the state's preparedness to address other macrotrends associated with the climate megatrend.

The CTB has also adopted the following strategic actions to mitigate the identified long-term risks and maximize opportunities.

- Collect data (e.g., right-of-way mapping, precipitation, roadway elevation, etc.) to accurately assess flooding risks for the state- and locally-maintained roadways that can be used to identify funding needs and prioritize investment.
- Develop policies based on robust data collection and analysis to ensure flooding risks are reflected in transportation asset life-cycle and/or transportation project planning processes.
- Collaborate with state/regional agencies to systematically identify solutions that facilitate consistent and systematic prioritization and support the allocation of state resources to address flooding risks.

Finally, as part of the policy, the Office of Intermodal Planning and Investment (OIPI) is required to track trends related to all macrotrends, including flooding risk, and report annually.

The Metropolitan Washington Council of Governments developed a summary of potential climate change impacts, vulnerabilities, and adaptation strategies in the region. This report describes general impacts of climate change as well as vulnerability and strategies for the transportation sector.[56]

Conclusions

Greenhouse gas emissions have accumulated rapidly as the world has industrialized. According to the U.S. Global Climate Change Research Program,[57] if emissions continue, projected changes in global average temperature could range from to 0.4° — 2.7°F (0.2°–1.5°C) under a very low emissions scenario, to 4.2°–8.5°F (2.4°–4.7°C) under a higher scenario by the end of the 21st century. Based on information developed by the Georgetown Climate Center,[58] Virginia's transportation infrastructure faces risks from a changing climate including increased levels of coastal flooding, inland flooding, and extreme heat.

Resiliency is an important consideration for VDOT when planning and designing future infrastructure investments. Resiliency considerations include siting and design of facilities both to

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56 Metropolitan Washington Council of Governments. 2013. "Summary of Potential Climate Change Impacts, Vulnerabilities, and Adaptation Strategies in the Metropolitan Washington Region." https://www.mwcog.org/documents/2013/07/01/summary-of-potential-climate-change-impacts-vulnerabilities-and-adaptation-strategies-climate-change/.

57 U.S. Global Climate Change Research Program (2018). Fourth National Climate Assessment.

58 Georgetown Climate Center (undated). "Understanding Virginia's Vulnerability to Climate Change." Accessed September 2021 at https://www.georgetownclimate.org/files/report/understanding-virginias-vulnerability-to-climate-change.pdf.

minimize risk to the facility, and to minimize impacts on natural resiliency features such as wetlands, forests, and floodplains. Resiliency strategies that are cost-effective and can be adopted during the planning, project development, construction, and/or maintenance phases of a given infrastructure project are supported.

VDOT, and regional and local agency partners in the Commonwealth, have already engaged in efforts to plan for resiliency. As part of the development of VTrans, Virginia's transportation plan, the Commonwealth Transportation Board (CTB) has developed a Policy for the Development and Monitoring of VTrans Long-term Risk & Opportunity Register, which allows for quantification of impacts of ten macrotrends, including long-term flooding risk due to sea-level rise, storm surge, and inland/riverine flooding, as well as a Long-term Risk & Opportunity Register based on an assessment of these impacts. The CTB has also adopted strategic actions to mitigate the identified long-term risks and maximize opportunities, including collecting data to accurately assess flooding risks for the state- and locally-maintained roadways that can be used to identify funding needs and prioritize investment; developing policies based on robust data collection and analysis to ensure flooding risks are reflected in transportation asset life-cycle and/or transportation project planning processes; and collaborating with state and regional agencies to systematically identify solutions that facilitate consistent and systematic prioritization and support the allocation of state resources to address flooding risks. Finally, the Office of Intermodal Planning and Investment (OIPI) is required to track trends related to all macrotrends, including the flooding risk, and report annually.

Carbon Monoxide Assessment

EPA project-level (“hot-spot”) transportation conformity requirements for CO do not apply as the project is located in a region that is in attainment of the NAAQS. A project-specific analysis or assessment for CO is also not needed for NEPA per the programmatic approach specified in the VDOT Resource Document (Protocol 4.2.2.2). Based on the overall weight-of-evidence, it may reasonably be concluded that the CO NAAQS will be met given:

- Continued implementation of effective emission control technology, increasingly more stringent motor vehicle emission and fuel quality standards implemented over the past few decades by the Environmental Protection Agency (EPA) that have had the combined effect of substantially reducing CO emission rates nationwide, resulting in long-term downward trends in emissions and near-road ambient concentrations of CO despite increasing vehicle-miles-travelled (VMT)
- Extensive experience in project-specific modeling for CO for a wide variety of project types, configurations and operating conditions in which compliance with the national ambient air quality standards (NAAQS) established by EPA for CO is readily demonstrated given the substantially reduced CO emission rates, and despite the use of multiple worst-case assumptions for emission and dispersion modeling that have a compounding effect such that emissions and near-road ambient concentrations are substantially over-estimated; and
- Extensive experience in programmatic agreements for project-level agreements for CO that established ever-increasing thresholds for such analyses given the substantially reduced emission rates.

Indirect Effects and Cumulative Impacts (IECI) Assessment

Indirect effects are defined by the CEQ as "effects which are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water or other natural systems, including ecosystems" (40 CFR 1508.8(b)). For transportation projects, induced growth is attributed to changes in accessibility caused by the project that influences the location and/or magnitude of future development.[59]

Cumulative impacts are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7). According to the Federal Highway Administration's (FHWA) *Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process*, cumulative impacts include the total of all impacts to a particular resource that have occurred, are occurring, and will likely occur as a result of any action or influence, including the direct and reasonably foreseeable indirect impacts of a proposed project. Cumulative impacts include indirect effects. The potential for indirect effects or cumulative impacts to air quality that may be attributable to this project is not expected to be significant for two reasons.

First, regarding the potential for indirect effects, the quantitative assessments conducted for programmatic CO, qualitative analyses for MSAT impacts and the regional conformity analysis conducted for ozone can all be considered indirect effects analyses because they look at air quality impacts attributable to the project that occur in the future. These analyses demonstrate that, in the future: 1) air quality impacts from CO will not cause or contribute to violations of the CO NAAQS, 2) MSAT emissions will be significantly lower than they are today, and 3) conformity requirements for the transportation plan and program will be met, including the mobile source emissions budgets established for the region for purposes of meeting the ozone NAAQS.

Second, regarding the potential for cumulative impacts, the most recent conformity analysis conducted by the National Capital Region (NCR) Transportation Planning Board (TPB, which is the Metropolitan Planning Organization or MPO for the Washington, D.C. metropolitan area) represents a cumulative impact assessment for purposes of regional air quality.

- The existing air quality designations for the region are based, in part, on the accumulated mobile source emissions from past and present actions, and these pollutants serve as a baseline for the current conformity analysis.
- The conformity analysis quantifies the amount of mobile source emissions for which the area is designated nonattainment/maintenance that will result from the implementation of all reasonably foreseeable regionally significant transportation projects in the region (i.e., those proposed for construction funding over the life of the region's transportation plan).
- The most recent conformity analysis was completed in June 2022. FHWA/FTA issued a conformity finding on June 15, 2022, for the Transportation Improvement Program (TIP) and Constrained Long Range Plan (CLRP) covered by that analysis. This analysis

demonstrated that the incremental impact of the proposed project on mobile source emissions, when added to the emissions from other past, present, and reasonably foreseeable future actions, is in conformance with the SIP and will not cause or contribute to a new violation, increase the frequency or severity of any violation, or delay timely attainment of the NAAQS established by EPA.

Therefore, the indirect and cumulative effects of the project are not expected to be significant.

Project Status in the Regional Transportation Plan and Program

Federal conformity requirements at 40 CFR 93.114[60] and 40 CFR 93.115[61] (as incorporated by reference into the Virginia conformity SIP) apply as the area in which the project is located is designated as nonattainment for ozone. Accordingly, there must be a currently conforming transportation plan and program at the time of project approval, and the project must come from a conforming plan and program or otherwise meet the criteria specified in 40 CFR 93.109(b).[62] As of the date of preparation of this analysis, the project is included in the currently conforming FY 2023-2026 Transportation Improvement Program (TIP) and 2045 Long Range Transportation Plan (LRTP) developed by the designated metropolitan planning organization (MPO) for the region, the National Capital Region Transportation Planning Board (TPB).[63]

Mitigation

Historically, the continued implementation of increasingly more stringent motor vehicle emission, fuel quality and fuel economy standards has resulted in substantial reductions of emissions of both criteria pollutants and GHGs across the nation. These and other measures as identified below for GHGs that reduce VMT serve to minimize emissions across the nation.

Greenhouse Gases

The 2021 VDOT statewide GHG analysis included sixteen discrete planned state and regional rail and transit projects that will reduce automobile and truck travel and GHG emissions, as well as increases to existing service. VDOT and the Department of Rail and Public Transportation have also continued to fund other air quality and GHG mitigation strategies. These include bicycle and pedestrian projects, travel demand management (TDM) programs that seek to reduce the amount of commuting in single-occupancy vehicles, and investment in electric vehicles and charging infrastructure.

In December 2021, the Virginia State Air Pollution Control Board adopted regulations for Low-Emission Vehicle (LEV) and Zero-Emission Vehicle (ZEV) standards consistent with the California Advanced Clean Cars (ACC) program that would aggressively increase the light-duty vehicle ZEV market share beginning in 2025. California has the unique authority to maintain motor vehicle emission standards that are more stringent than federal standards. California's LEV standards control tailpipe emissions of criteria and greenhouse gas pollutants. California's ZEV program

60 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.114
61 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.115
62 See: https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-93#93.109
63 See: http://www.mwcog.org/transportation/tpb/

requires major manufacturers of passenger cars and light trucks to produce and deliver for purchase a certain number of ZEVs. Manufacturers must increase the average fuel efficiency for light- and medium-duty vehicles, as well as increase the number of electric vehicles for sale, beginning with model year 2025.

On December 30, 2021, the EPA issued a final rule in the Federal Register that revised national GHG emissions standards for passenger cars and light trucks for Model Years 2023-2026.[64] The final standards are expected to achieve significant GHG emissions reductions along with reductions in other criteria pollutants.[65] The program will result in avoiding more than 3 billion tons of GHG emissions through 2050 which is equivalent to more than half the total U.S. CO_2 emissions in 2019. Additional benefits include reduced impacts of climate change, improved public health from lower pollution, and cost savings for vehicle owners through improved fuel efficiency.

On October 25, 2016, the EPA and the DOT National Highway Traffic Safety Administration issued the final rule in the Federal Register for jointly finalized standards for medium- and heavy-duty vehicles that would improve fuel efficiency and cut carbon pollution to reduce the impacts of climate change, while bolstering energy security and spurring manufacturing innovation.[66] The final program promotes cleaner, more fuel-efficient trucks by encouraging the development and deployment of new and advanced cost-effective technologies. The vehicle and engine performance standards cover model years 2018-2027 for certain trailers and model years 2021-2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion metric tons, save vehicle owners fuel costs of about $170 billion, and reduce oil consumption by up to two billion barrels over the lifetime of the vehicles sold under the program.[67]

Construction

Emissions may be produced in the construction of this project from heavy equipment and vehicle travel to and from the site, as well as from fugitive sources. Construction emissions are short term or temporary in nature. To mitigate these emissions, all construction activities are to be performed in accordance with VDOT *Road and Bridge Specifications*.[68]

VDEQ Requirements

The VDEQ provides general comments for projects by county that in part address mitigation.[69] For the region in which the proposed project is located, their comment is:

64 https://www.govinfo.gov/content/pkg/FR-2021-12-30/pdf/2021-27854.pdf
65 https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and
66 https://www.govinfo.gov/content/pkg/FR-2016-10-25/pdf/2016-21203.pdf
67 https://www.govinfo.gov/content/pkg/FR-2016-10-25/pdf/2016-21203.pdf
68 https://www.vdot.virginia.gov/doing-business/technical-guidance-and-support/technical-guidance-documents/road-and-bridge-specifications/
69 Spreadsheet entitled: "DEQ SERP Comments rev8b", March 2017

"…all reasonable precautions should be taken to limit the emissions of VOC and NOx. In addition, the following VDEQ air pollution regulations must be adhered to during the construction of this project: 9 VAC 5-130, Open Burning restrictions[70]; 9 VAC 5-45, Article 7, Cutback Asphalt restrictions[71]; and 9 VAC 5-50, Article 1, Fugitive Dust precautions.[72]"

Consultation

Public Consultation

Public consultation is generally conducted and documented within the overall NEPA process, and not separately by subject area (including air quality). Please refer to the overall NEPA documentation for a summary of public consultation activities for this project.

Conclusions

The proposed improvements were assessed for potential air quality impacts and compliance with applicable air quality regulations and requirements. All models, methods/protocols and assumptions applied in modeling and analyses were made consistent with those provided or specified in the VDOT Resource Document. The assessment indicates that the project would meet all applicable air quality requirements of the National Environmental Policy Act (NEPA) and federal and state transportation conformity regulations. As such, the project will not cause or contribute to a new violation of the NAAQS established by EPA.

70 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter130/

71 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter45/

72 See: https://law.lis.virginia.gov/admincode/title9/agency5/chapter50/

Appendix A: Traffic

Marina Way and Annapolis Way

Alternative Intersection Report

Marina Way and Annapolis Way Alternative Intersection Report DRAFT

UPC 120778

Prince William County Project #: 23C17011

Contract #: 5053661

Prepared by

Johnson, Mirmiran & Thompson

February 27, 2024

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INTRODUCTION

JMT is designing the extension of Marina Way from Annapolis Way to Gordon Boulevard (Route 123) in Prince William County. This project, which will function as a main street for the proposed North Woodbridge Town Center currently under development, will connect the existing two-lane undivided Marina Way to Horner Road. The extension will be a four-lane divided roadway with pedestrian facilities. As part of the Marina Way extension project, JMT is determining the most feasible and practical-based intersection design at Marina Way extension and Annapolis Way given the available funding, right of way (ROW) constraints, lane capacity, and proximity to nearby intersections.

The purpose of this report is to evaluate the alternative designs and traffic control, including a conventional signal, for the study intersection of Marina Way and Annapolis Way. The opening year of the project is anticipated to be 2028, and the design year of the project is 2050. The opening year traffic volumes of 2028 were used for the signal warrant analysis and the design year volumes were used for the capacity analysis. To determine whether a signal is warranted, the analysis conducted in this report uses warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD, 2009 with Rev. 1 & 2), the Virginia Supplement to the MUTCD, and VDOT's IIM-TE-387.1.

BACKGROUND

The study intersection of Marina Way and Annapolis Way, located in the North Woodbridge area of Prince William County, VA, currently operates as an unsignalized intersection as two-way stop control (TWSC), with Annapolis Way operating as free flow, and Marina Way controlled by stop signs. The intersection is a four-leg intersection, as seen in **Figure 1**. In this report, Marina Way is referred to as an east-west facility, and Annapolis Way is referred to as a north-south facility.

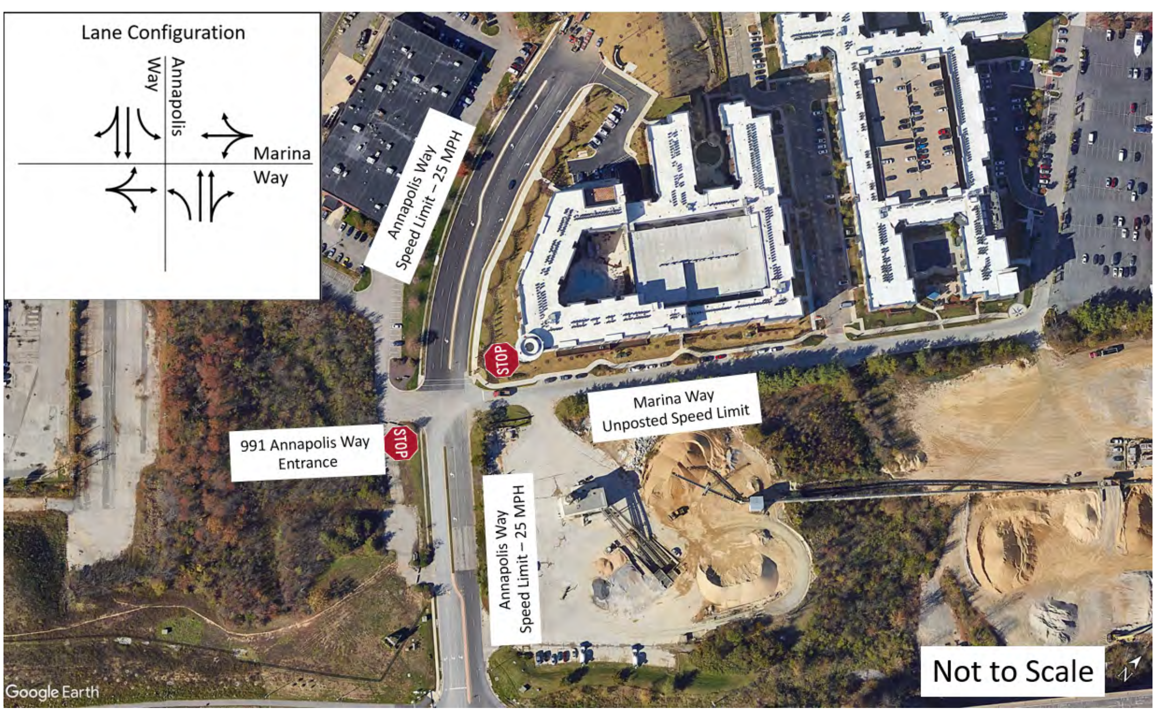


Figure 1: Study Intersection Location

For the study, Marina Way is considered the major road due to the anticipated traffic volume, and Annapolis Way is considered the minor road. The following sections details the characteristics of the intersecting roadways.

Marina Way

The existing Marina Way is a two-lane undivided roadway and classified as an avenue/street in the 2019 North Woodbridge Small Area Plan. The roadway speed limit is currently unposted. Marina Way forms the east leg of the intersection and serves as the only access point to Occoquan Harbor which includes a restaurant, the marina, apartment complexes and small businesses. Marina Way's approach to Annapolis Way (westbound approach) has a shared left/through/right lane entering the intersection.

The west leg of the intersection serves as the 991 Annapolis Way entrance. The approach (eastbound approach) has a shared left/through/right lane entering the intersection. The proposed Marina Way extension that will alter the existing west leg of the intersection will be a four-lane divided roadway with two lanes entering the intersection in the eastbound direction. It has a design speed of 30 MPH.

Annapolis Way (Route 673)

Annapolis Way is a four-lane divided roadway with a speed limit of 25 miles per hour (MPH) and classified as an avenue/street in the 2019 North Woodbridge Small Area Plan. The existing Annapolis Way in the study area extends north from Jefferson Davis Highway (US Route 1) to approximately 600 feet north of the study intersection. However, there is an on-going construction project that will connect the existing Annapolis Way alignment to another existing segment of Annapolis Way that has a signalized connection to Route 123 north of the Route 123/Horner Road intersection. Annapolis Way currently has three lanes entering the intersection in the northbound and southbound approaches. The approaches each consist of an exclusive left-turn lane, a through lane and a shared through and right lane. There is a crosswalk on the north leg of Annapolis Way at the intersection. Annapolis Way is state-maintained from Route 1 to its intersection with Marina Way and is assumed to be state-maintained (ultimately) all the way to the other Annapolis Way segment upon completion of its extension.

EXISTING CONDITION

A 24-hour turning movement count (TMC) from 12:00 AM to 12:00 AM was conducted at the study intersection on Thursday, June 8, 2023. The count collected volumes in 15-minute intervals for cars, trucks, bicycles, and pedestrians traversing the intersection. Based on the count data, the AM and PM peak hours for the intersection are 7:15 AM to 8:15 AM and 6:15 PM to 7:15 PM, respectively. Detailed counts, including total vehicles, total pedestrians, and a summary of peak hour volumes, are included in **Appendix A**. The existing peak hour traffic volumes for the intersection are shown in **Figure 2**.

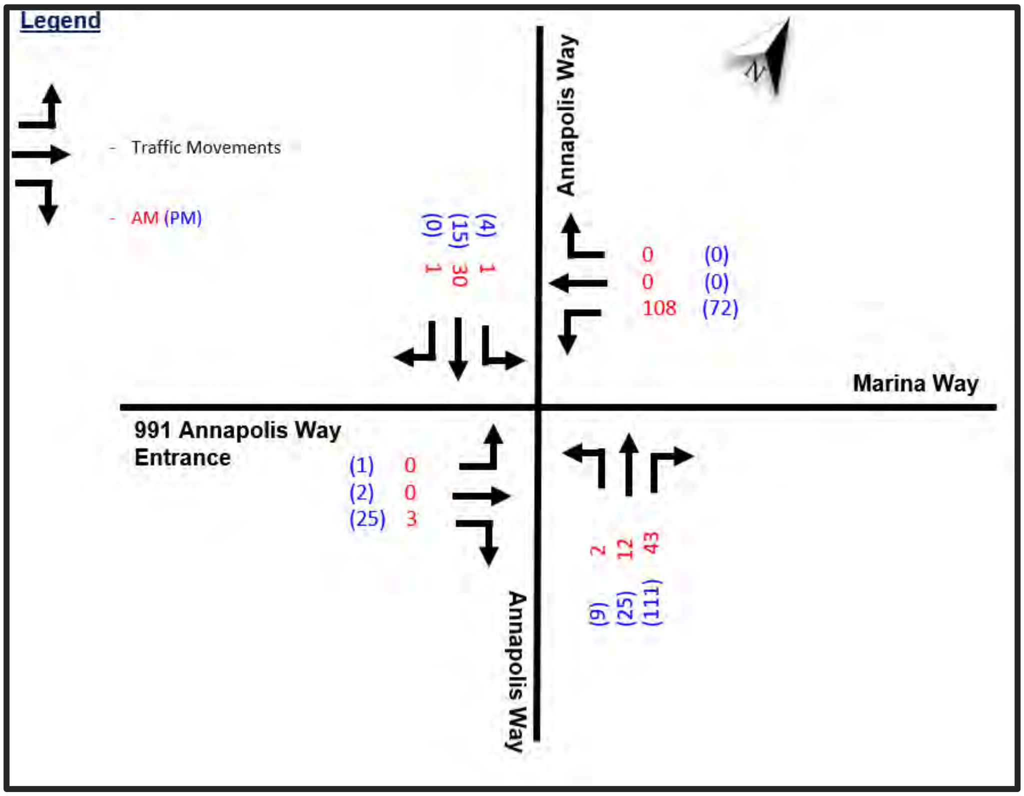


Figure 2: Existing Weekday Peak Hour Volumes

As previously mentioned, Marina Way does not extend to the west beyond the Annapolis Way intersection, therefore, the existing condition operational analysis was not needed for this study as the proposed conditions alter the 991 Annapolis Way entrance to a four-lane divided through roadway. The existing volumes were used to help develop the future volumes of the intersection with the proposed roadway alignment.

REPORT METHODOLOGY

The analysis documented in this report uses warrants outlined in the 2009 MUTCD (with Rev. 1 & 2), and the 2011 Virginia Supplement to the MUTCD (Revision 1), and VDOT's IIM-TE-387.1. Opening year 2028 volumes were used in the signal warrant analysis, and the derivation of these volumes is outlined in the following section of this report.

DEVELOPMENT OF FUTURE VOLUMES

JMT developed the future traffic volume forecasts for the anticipated Opening Year of 2028 and Design Year of 2050 using the Prince William County Travel Demand Model (PWCTD) and the approved land use data for PWC from the Metropolitan Washington Council of Governments (MWCOG) Round 10 cooperative land use forecast. The Round 10 land use data includes socio-economic/land use inputs for year 2050. In coordination with PWCDOT planning and programming division, it is assumed the PWC Round 10 cooperative land use forecasts include all the population and employment land use assumed in the North Woodbridge Small Area Plan that was approved in 2019. This includes the new developments coming into the North Woodbridge Area. The PWCTDM included a roadway network with a base year of 2015 and future year of 2045. The base year 2015 roadway network was updated to reflect the existing 2023 roadway. The Virginia Department of Transportation (VDOT) Travel Demand Modeling Policies and Procedures document was referenced to define the acceptable levels of deviation from average daily traffic (ADTs). The Percent Root Mean Square Error (%RMSE), *Table 10.5 of the travel demand modeling policies and procedures document*, was used to compare major links surrounding the study area to validate the model.

JMT ran two future models; the no-build and build model for the design year 2050. In the no-build model, the Marina Way extension was not coded in the model. For the build model, the Marina Way extension was coded in the model. The two future models were then compared to determine the traffic volume that will divert from surrounding roadways such as US 1, and Route 123 onto Marina Way. JMT also conducted a select link analysis along the centroid connector to the TAZ encompassing the North Woodbridge Area where the Marina Way extension is proposed. The select link was performed on the no-build condition to determine the distribution into and out of the centroid. The number of trips distributed was determined by performing the NCHRP Difference Method along the centroid. The AM and PM peak hour trips were then determined using the existing peak hour as a percentage of the existing daily volume. The AM and PM peak hour trips were then distributed through the network using the results of the select link analysis. JMT compared the No Build and Build conditions to divert traffic to Marina Way to determine the 2050 peak hour turning movement volume.

To develop the 2028 opening year volumes, JMT linearly interpolated between the 2025 land use and the 2030 land use provided by the County, to determine the 2028 land use. The 2028 model network was updated to reflect the conditions expected during the opening year and was sourced from the VDOT STARS study 2030 model. The updated 2028 build model was run using the interpolated 2028 land use. The 2028 build model output was compared to the 2050 build model output. The result shows that there were 30% fewer trips in the centroid representing the North Woodbridge area in 2028 as compared to 2050. Thus, a 30% reduction was applied to the developed 2050 peak hour volumes to arrive at the 2028 volumes.

The 2028 opening year and 2050 design year AM and PM peak hour volumes (along with average daily traffic (ADT) volumes) are presented in **Figure 3**, and **Figure 4**, respectively, and were approved by VDOT on October 30, 2023. The approved memorandum that details the methodology, assumptions, and traffic forecasts is in **Appendix B**.

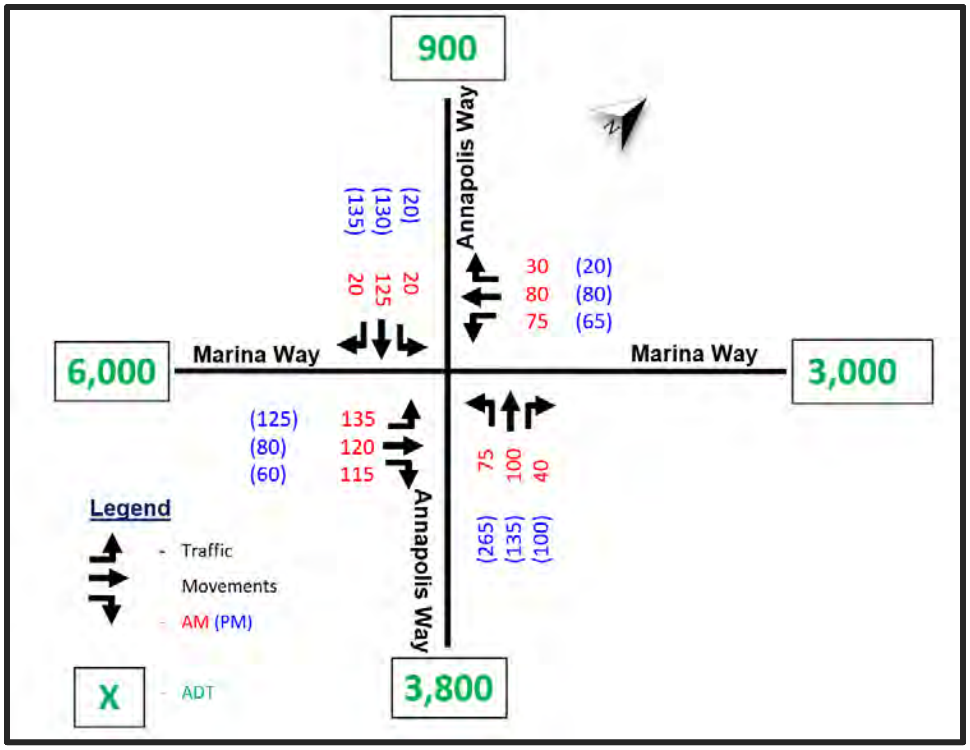


Figure 3: Opening Year 2028 Peak Hour Volumes

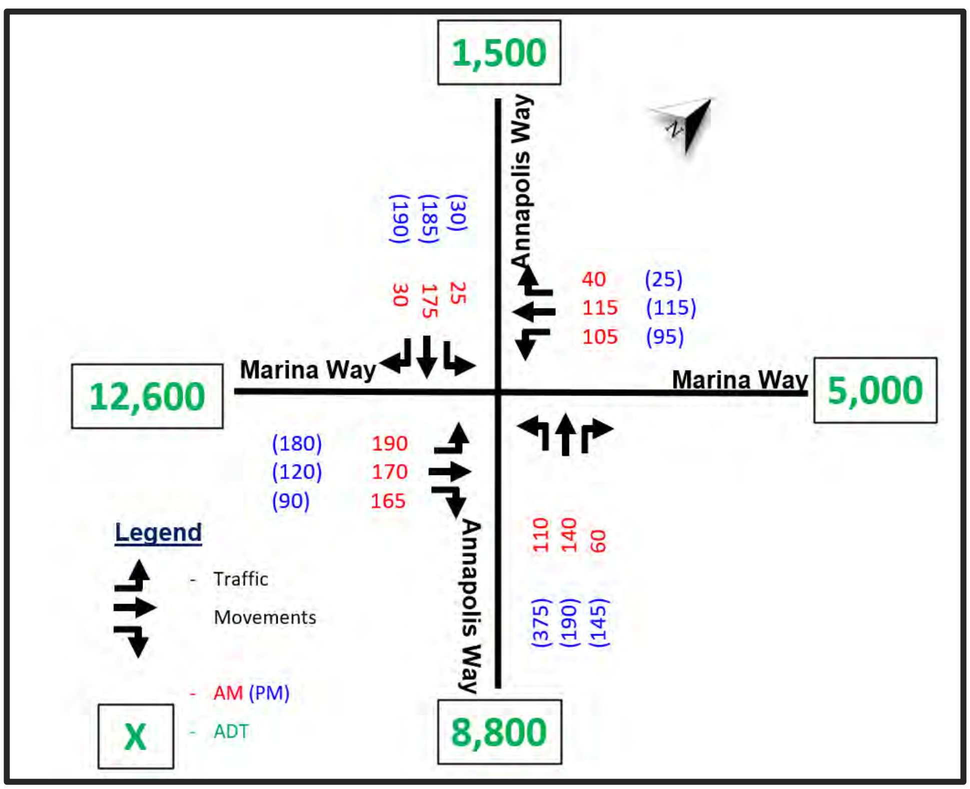


Figure 4: Design Year 2050 Peak Hour Volumes

SIGNAL WARRANT ANALYSIS (OPENING YEAR)

The signal warrants using the warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD, 2009 with Rev. 1 & 2), and the Virginia Supplement to the MUTCD. Warrant 7: Crash Experience was evaluated based on the FHWA Interim Approval #19. The study intersection includes a new roadway, therefore, there are no available hourly traffic counts that can be used for the warrant. Additionally, there are no schools, crashes, or grade crossings near the study intersection; the nearest signal is approximately 500 feet south. Due to these factors, only Warrants 1, and 8 were evaluated for this intersection. The explanation and result of the warrants are presented in the following sections.

Warrant 1: 8-hour Vehicular Volume

As mentioned above, the study intersection includes a new roadway, therefore, there are no feasible hourly traffic counts that can be used for 8-hour vehicular warrant. However, per the VDOT's 2011 Virginia Supplement to the MUTCD, ADT projections may be utilized to satisfy Warrant 1.

The need for a traffic control signal shall be considered using ADT projections if an engineering study finds that one of the following conditions exist for an average day:

A. The vehicles per day given in both of the 100 percent columns of Condition A in Table 4C-V1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per day given in both of the 100 percent columns of Condition B in Table 4C-V1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

The volume thresholds used for this study are highlighted in **Figure 5**, taken from the Virginia Supplement to the MUTCD Table 4C-V1.

Table 4C-V1. Traffic Signal Warrant Using Average Daily Traffic Estimate

(To be used only when traffic counts are not available, such as at a future intersection)

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per day on major street (total of both approaches)				Vehicles per day on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	8,000	6,400	5,600	4,480	2,400	1,920	1,680	1,344
2 or more	1	9,600	7,680	6,720	5,376	2,400	1,920	1,680	1,344
2 or more	2 or more	9,600	7,680	6,720	5,376	3,200	2,560	2,240	1,792
1	2 or more	8,000	6,400	5,600	4,480	3,200	2,560	2,240	1,792

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per day on major street (total of both approaches)				Vehicles per day on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	12,000	9,600	8,400	6,720	1,200	960	850	680
2 or more	1	14,400	11,520	10,080	8,064	1,200	960	850	680
2 or more	2 or more	14,400	11,520	10,080	8,064	1,600	1,280	1,120	896
1	2 or more	12,000	9,600	8,400	6,720	1,600	1,280	1,120	896

[a] Basic minimum hourly volume for urban areas
[b] Used for combination of Conditions A and B after adequate consideration of other remedial measures in urban areas
[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000
[d] May be used for combination of Conditions A and B after adequate consideration of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Figure 5: MUTCD Table 4C-1, Warrant 1

Annapolis Way has two lanes in both directions. Marina Way has one lane in the westbound direction and will have two lanes in the eastbound direction. For this study, Marina Way is considered the major road because of its projected higher opening year volumes ADT, and Annapolis Way is considered the minor road. Based on the projected opening year 2028 volumes, Marina Way will have an approach ADT of 4,500 vehicles per day (VPD), and Annapolis Way's higher volume approach will have an ADT of 1,900 VPD. Based on the approach ADTs, Marina Way and Annapolis Way do not meet the minimum VPD under the 100% threshold for Condition A and for Condition B. Therefore, **Warrant 1 is NOT SATISFIED** in the opening year.

Warrant 8: Roadway Network

This warrant is evaluated when a traffic control signal is considered for the intersection of two or more major routes and if the intersection meets one or both of the following criteria:

A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meets one or more of Warrants 1, 2, and 3 during an average weekday; or

B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).

Marina Way and Annapolis Way are classified as street/avenue roadways. However, upon completion of their respective extensions, they are proposed to be important local roadway links that will alleviate traffic from Route 1 and Route 123. Also, the study intersection is projected to have at least 1,000 entering vehicles per hour during the peak hour of a typical weekday during the opening year (2028). However, projected 2033 traffic volumes (5 years after the opening year), based on this study, do not meet Warrant 1. Therefore, **Warrant 8 is NOT SATISFIED**.

Summary

The result of the opening year 2028 signal warrant analysis, presented in **Table 1,** shows that neither of the two evaluated warrants are satisfied. According to the MUTCD, only one warrant needs to be satisfied for a signal to be considered for installation at an intersection. The analysis conducted concludes that a traffic signal is not warranted at the intersection of Marina Way and Annapolis Way in the opening year. However, for the projected 2050 design year ADT, Signal Warrant 1 (with the 80% threshold for Condition A) is anticipated to be satisfied. Marina Way is projected to have an ADT of 8,800 VPD for both approaches, and Annapolis is projected to have an ADT of 4,400 VPD for the higher approach, which are over the threshold in **Figure 5**. For this reason, an evaluation of traffic signalization is included in the **Operational Analysis** later in this report.

Table 1: Signal Warrant Analysis Results (Opening Year)

Warrant #	Description	Satisfied
1	8-hour Vehicular Volume	Not Satisfied
8	Roadway Network	Not Satisfied

ALTERNATIVE INTERSECTION ANALYSIS

Alternative intersection analysis was conducted using VDOT's Junction Screening Tool (VJuST) to select the best practical design for the intersection based on available funding, ROW constraints, lane capacity, and proximity to nearby intersections. This alternative screening was based on the projected year 2050 volumes. VJuST was used to evaluate multiple intersection designs based on traffic volumes, lane configurations, and number of lanes. This tool evaluates at-grade and grade-separated intersection designs. This intersection is not planned for any future interchange or overpass. Therefore, this study focused on at-grade intersection designs. **Table 2** shows the alternative intersections from VJuST that were considered along with the alternative intersection types that were *not* considered (including the most applicable justification).

Table 2: VJuST Possible Alternatives

VDOT Junction Screening Tool				
Possible Configurations				
Indicate with a "Y" or "N" if each intersection or interchange configuration should or should not be considered. Use the information links for guidance. Then, click the "Show/Hide Configurations button" to hide the worksheets for the configurations that will not be considered.				
#	**Intersections**	**Information**	**Consider?**	**Justification**
	Signalized Intersections			
1	Conventional	-	Y	
2	Bowtie	Link	N	Insufficient intersection spacing
3	Center Turn Overpass	Link	N	Not feasible for roadway facility type
4	Continuous Green-T	Link	N	Not feasible for roadway facility type
5	Echelon	Link	N	Not feasible for roadway facility type
6	Full Displaced Left Turn	Link	N	Not feasible for roadway facility type
7	Median U-Turn	Link	N	Unable to accommodate traffic patterns
8	Partial Displaced Left Turn	Link	N	Not feasible for roadway facility type
9	Partial Median U-Turn	Link	N	Unable to accommodate traffic patterns
10	Quadrant Roadway N-E	Link	N	Right-of-way restrictions identified
11	Quadrant Roadway N-W	Link	N	Right-of-way restrictions identified
12	Quadrant Roadway S-E	Link	N	Right-of-way restrictions identified
13	Quadrant Roadway S-W	Link	N	Right-of-way restrictions identified
14	Restricted Crossing U-Turn	Link	N	Unable to accommodate traffic patterns
15	Single Loop	Link	N	Right-of-way restrictions identified
16	Split Intersection	Link	N	Right-of-way restrictions identified
17	Thru-Cut	Link	N	Unable to accommodate traffic patterns
	Unsignalized Intersections			
18	50 Mini Roundabout	Link	Y	
19	75 Mini Roundabout	Link	Y	
20	Roundabout	Link	Y	
21	Two-Way Stop Control	-	Y	
#	**Interchanges**	**Information**	**Consider?**	**Justification**
22	Traditional Diamond	Link	N	Not feasible for roadway facility type
23	Contraflow Left	Link	N	Not feasible for roadway facility type
24	Displaced Left Turn	Link	N	Not feasible for roadway facility type
25	Diverging Diamond	Link	N	Not feasible for roadway facility type
26	Double Roundabout	Link	N	Not feasible for roadway facility type
27	Michigan Urban Diamond	Link	N	Not feasible for roadway facility type
28	Partial Cloverleaf	Link	N	Not feasible for roadway facility type
29	Single Point	Link	N	Not feasible for roadway facility type
30	Single Roundabout	Link	N	Not feasible for roadway facility type

As seen in the **Table 2**, five possible alternatives were considered for this study: a 50 feet mini roundabout, a 75 feet mini roundabout, a full roundabout, a two-way stop control, and a conventional traffic signal. It is noted that the conventional traffic signal option was still considered as part of the alternatives, even though it wasn't warranted in the opening year, to determine how it would operate in the ultimate (2050) design year. The other alternative designs were not considered because they either require acquisition of additional right-of-way (ROW), they are unable to accommodate the traffic volume, there are no existing roadway networks to detour traffic to, or the existing roadway characteristics do not meet the alternative's criteria. For example, the median U-turn, partial median U-turn, restricted crossing U-turn, and thru-cut alternatives all require median openings for a U-turn. Along Annapolis Way, the closest opening to the south of the study intersection is at the intersection of Route 1 and Annapolis Way. Route 1 and Annapolis Way intersection will need to be modified to accommodate the U-turn movements, especially for heavy vehicles. Additionally, the existing Marina Way is a two-lane undivided roadway with a width of approximately 26 feet. The type of roadway cannot accommodate U-turns. Modifications of intersection are constrained to the study intersection. The VJuST results are presented in **Figure 6** and **Figure 7** for the AM and PM peak hours, respectively.

Intersection Results

		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.51		48	$	
50 Mini Roundabout	-	0.78		8	$	
75 Mini Roundabout	-	0.74		8	$	
Roundabout	-	0.37		8	$$	
Two-Way Stop Control	-	0.96		48	$	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Figure 6: VJuST AM Peak Hour Intersection Result

Intersection Results

		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	Dir	Maximum V/C	Accommodation Compared to Conventional	Weighted Total Conflict Points	Planning Level Cost Category	
Conventional	-	0.72		48	$	
50 Mini Roundabout	-	1.09		8	$	
75 Mini Roundabout	-	1.03		8	$	
Roundabout	-	0.59		8	$$	
Two-Way Stop Control	-	N/A*		48	$	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Figure 7: VJuST PM Peak Hour Intersection Result

The results of the VJuST analysis show that the roundabout will operate the best with the lowest volume to capacity (v/c) ratio during both peaks, followed by the convention signal alternative. The mini roundabouts and two-way stop control alternatives will be over capacity in the design year during the PM peak hour. The AM and PM VJuST worksheets are in **Appendix C,** and **Appendix D**, respectively.

All-Way Stop Control (AWSC)

In addition to the alternative intersection analysis, all-way stop control (AWSC) was also considered for the intersection. The installation of an all-way stop was determined using the applicable criteria listed in Section 2B.07 of the Manual on Uniform Traffic Control Devices (MUTCD, 2009 with Rev. 1 & 2).

Criteria A

Criteria A states that an all-way stop is justified as an interim measure for an intersection where a traffic control signal is justified while arrangements are being made for traffic signal installation.

Analysis findings: A signal warrant analysis shows a signal is not warranted at this intersection in the opening year, so this criterion was **not evaluated** as part of this study.

Criteria B

Criteria B states that an all -way stop is justified by the occurrence of 5 or more crashes in a 12-month period that are potentially correctable by an all-way stop installation, including turning movement collisions and right-angle collisions.

Analysis findings: According to the VDOT Virginia Crash Map, no crash has occurred at the study intersection. Also, the intersection design will include a new roadway, and so this criterion was **not evaluated** as part of this study.

Criteria C

Criteria C is based on minimum hourly traffic volumes and delay and consists of two parts and must be satisfied by meeting the requirements of both C.1 and C.2 together. Furthermore, the volume requirements of C.1 and C.2 can be reduced if the major roadway approach speed exceeds 40 MPH. ***Criteria C.1*** states that the total vehicular volume of both major street approaches must average at least 300 vehicles per hour (VPH) for any 8 hours of an average day, which can be reduced to 210 VPH. ***Criterion C.2*** states that the total number of units (vehicles, bicycles, and pedestrians) on the minor street approaches must average at least 200 units per hour (UPH) for the same 8 hours used to satisfy C.1.

Analysis findings: The hourly volume for Marina Way and Annapolis Way were derived from the percentage difference between the peak hour volume and each hourly volume for each approach at the intersection of Gordon Boulevard and Horner Road. The percentage differences were then applied to the opening year forecasted peak hour volumes at Marina Way/Annapolis way. The forecasted AM peak hour was used to derive the hourly volume from 6 AM to 12 PM, except 7 AM, which was assumed to be the AM peak hour. The forecasted PM peak hour was used to derive the hourly volume from 12 PM to 6 PM, except 5 PM, which was assumed to be the PM peak hour. The diurnal data from the intersection of Gordon Boulevard and Horner Road was used since existing counts at the Marina Way and Annapolis Way intersection would not be representative of the daily traffic flow in the future. It was assumed that the daily flow through the intersection of Gordon Boulevard and Horner Road will be seen at the altered Marina Way and Annapolis Way intersection.

Analysis of volume data indicate that nine (9) (highlighted in green) of the 12 hourly volumes on the major street and minor street meet the volume requirements set for Criteria C is presented in **Table 3.** Therefore, the Volume Criterion for Criteria C is MET.

Table 3: Hourly Volume Analysis Criteria

Time	Major Street (Marina Way)		Minor Street (Annapolis Way)	
	Total Vehicles	*Criteria Requirement (100%)*	*Total Units*	*Criteria Requirement (100%)*
6:00 – 7:00 AM	579	300 Vehicles	256	200 Units
7:00 – 8:00 AM	510		380	
8:00 – 9:00 AM	262		300	
9:00 – 10:00 AM	182		276	
10:00 – 11:00 AM	155		266	
11:00 – 12:00 PM	135		299	
12:00 – 1:00 PM	425		394	
1:00 – 2:00 PM	435		407	
2:00 – 3:00 PM	417		527	
3:00 – 4:00 PM	412		703	
4:00 – 5:00 PM	403		745	
5:00 – 6:00 PM	430		785	

Criteria C.2 also requires an average delay of at least 30 seconds per vehicle (sec/veh) on the minor street approaches for the busiest hour.

Analysis findings: The intersection includes a new roadway, the proposed Marina Way extension, that will alter the existing west leg of the intersection, which will be a four-lane divided roadway with two lanes entering the intersection in the eastbound direction. This will require a new intersection control, and the existing intersection control, two-way stop control, will be void. Also, the VJuST analysis indicated the intersection with the proposed extension will operate over capacity under the existing control, in the design year. Therefore, Criteria C2 does not apply and is not evaluated.

Criteria D

Criteria D states that where no single criterion is met, an all-way stop may still be justified if all of Criteria B, C.1, and C.2 are satisfied to 80 percent of the minimum values.

Analysis findings: Since Criteria C1 is already satisfied, Criteria D does not apply and is not evaluated.

Other Criteria:

Other criteria listed in MUTCD were also considered as listed below:

A. *The need to control left turn conflicts*

Analysis findings: Due to the new roadway that will alter the intersection from existing condition, this criterion was not evaluated.

B. *The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes.*
Analysis findings: Due to the new roadway that will alter the intersection from existing condition, this criterion was not evaluated.

C. *Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop.*
Analysis findings: Due to the new roadway that will alter the intersection from existing condition, this criterion was not evaluated.

D. *An intersection of two residential neighborhood collector streets where all-way stop control would improve traffic operational characteristics of the intersection.*
Analysis findings: According to the 2019 North Woodbridge Small Area Plan, Marina Way and Annapolis Way are classified as avenue/street. The VJuST analysis indicated the intersection with the proposed extension will operate over capacity under the existing control (TWSC) in the design year. A Synchro operational analysis of the all-way stop control indicated that the intersection is expected to operate at acceptable LOS during the opening and design years. The operational results for the all-way stop control Synchro analysis are in the **All-Way Stop Control Section**.

The analysis provided in this study shows that an all-way stop control is justified since two of the Criteria (Criterion C & traffic operations improvement Criterion) listed in the MUTCD were satisfied.

OPERATIONAL ANALYSIS

The intersection was evaluated as a conventional signal, 50 feet mini roundabout, 75 feet mini roundabout, a full roundabout, and a two-way stop control. Further operational analysis was not conducted for the mini roundabouts and two-way stop control alternatives because they will not be able to accommodate the traffic volume in the design year based on the VJuST result. Operational analysis was conducted for the conventional signal and roundabout alternatives. In addition to the two alternatives, an all-way stop control (AWSC) was also analyzed for the intersection. An AWSC configuration is not included as an option in the VJuST tool; however, it was deemed a reasonable alternative, and also justified for analysis in this study given that traffic signal warrants are not initially satisfied (refer to previous section: **Signal Warrant Analysis (Opening Year)**).

The operational analysis of the conventional signal and AWSC alternatives was conducted using Synchro/SimTraffic, Version 11, implementing the built-in Highway Capacity Manual Methodology (HCM 6). The operational analysis of the roundabout was conducted using SIDRA Intersection 9.0. The measures of effectiveness (MOEs) reported are control delay (seconds per vehicle (s/veh)), level of service (LOS), and 95^{th} percentile queue length. The analysis was conducted for the AM and PM peak hours under the design year 2050 condition, with a peak hour factor of 0.92. According to the 2022 Prince William County Mobility Plan, a LOS E is acceptable for intersections, specifically in areas designated within Small Area Plans.

Conventional Signalized Intersection

The lane configuration for the signalized intersection alternative for the 2050 design year is presented in **Figure 8**. This lane configuration is based on the VJuST analysis, while considering ROW constraints.

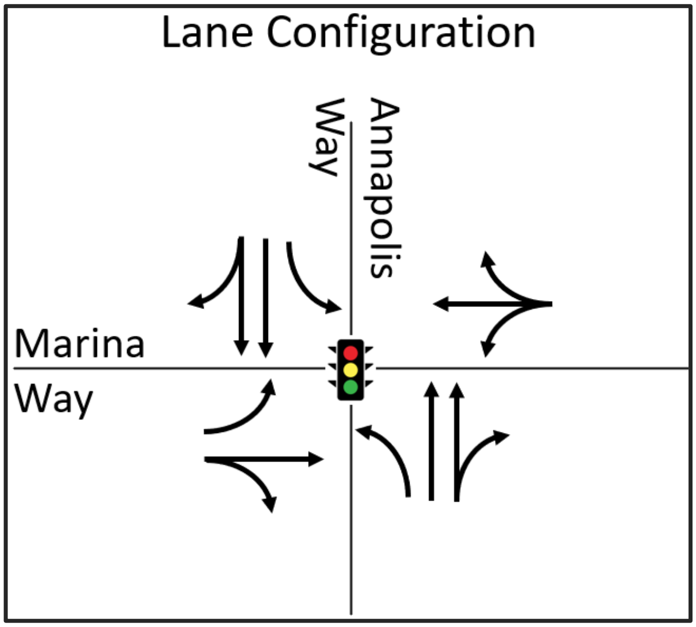


Figure 8: Proposed Signalized Lane Configuration

The result of the signalized intersection analysis for the 2050 design year is presented in **Table 4**. The Synchro and SimTraffic reports are presented in **Appendix E**.

Table 4: Proposed Signalized Operational Results (2050 Design Year)

ROADWAY	DIRECTION	LANE	STORAGE LENGTH (feet)	AM PEAK Delay (s/veh)	AM PEAK LOS	AM PEAK 95th Percentile Queue length (feet)	PM PEAK Delay (s/veh)	PM PEAK LOS	PM PEAK 95th Percentile Queue length (feet)
Marina Way	Eastbound	L	Continuous	15.6	B	132	17.1	B	137
		TR		15.9	B	180	15.7	B	119
	Approach Delay			**15.8**	**B**	-	**16.3**	**B**	-
	Westbound	LTR		24.0	C	196	24.9	C	178
	Approach Delay			**24.0**	**C**	-	**24.9**	**C**	-
Annapolis Way	Northbound	L	225	10.5	B	82	15.2	B	192
		TR		11.8	B	80	11.6	B	101
	Approach Delay			**11.3**	**B**	-	**13.5**	**B**	-
	Southbound	L	250	11.4	B	31	12.6	B	34
		TR		13.5	B	78	17.7	B	92
	Approach Delay			**13.2**	**B**	-	**16.9**	**B**	-
OVERALL DELAY				***15.9***	***B***	-	***16.4***	***B***	-

As shown in **Table 4**, the conventional signal is expected to operate at an acceptable overall LOS B during both peak hours. All the approaches and lane movements are expected to operate at an acceptable LOS C or better during both peaks. In addition, the queues are not expected to exceed the storage lengths for all the turn lanes for the approaches, based on the 95th percentile queue lengths presented in **Table 4**.

Roundabout

Singe-Lane Roundabout

A single-lane configuration with slip lanes was evaluated for the roundabout alternative. Annapolis Way is currently a four-lane roadway with two lanes each in the northbound and southbound approaches, which is in accordance with the 2019 North Woodbridge Small Area Plan. To maintain the existing four-lane roadway configuration along Annapolis Way and analyze for a single-lane roundabout, one of the two lanes in each approach was converted to a slip lane for the right-turn movement. The proposed eastbound approach two lane configuration along Marina Way was also assumed to be converted to a shared through and left-turn lane, and a slip lane for the right-turn movement (similar to the Annapolis Way approaches). The existing westbound approach single-lane configuration will be maintained. A screen-capture from SIDRA showing the lane configuration and intersection control for this alternative is presented in **Figure 9**.

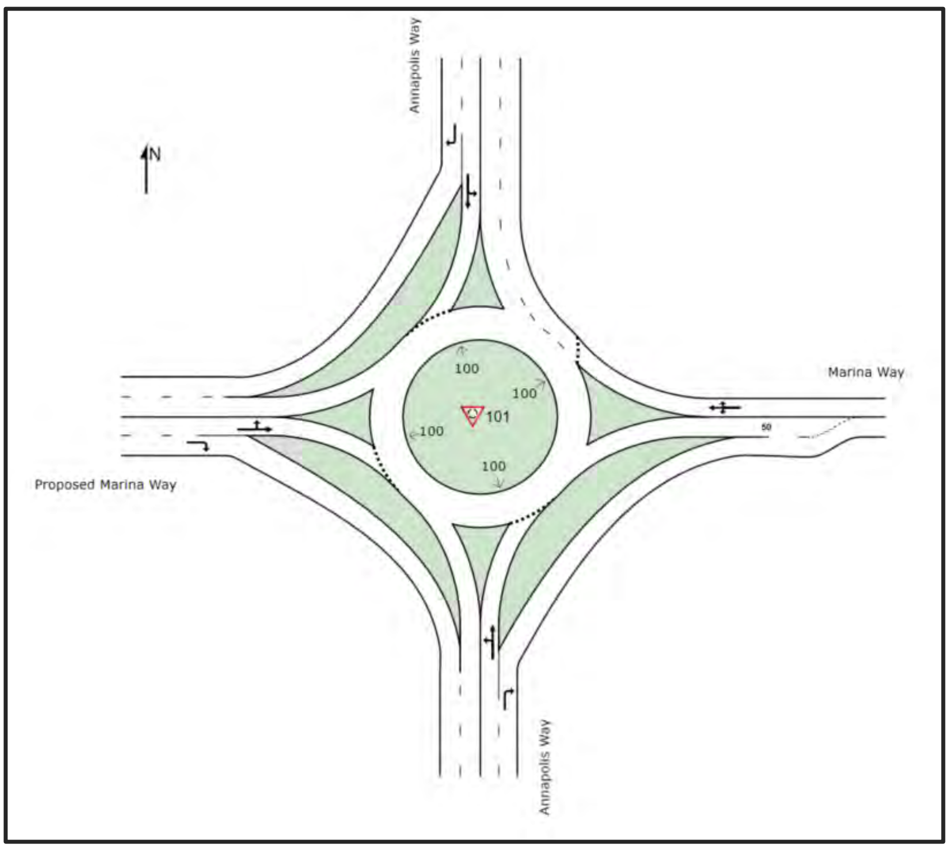


Figure 9: Proposed Single-Lane Roundabout Lane Configuration

The result of the roundabout analysis is presented in **Table 5.** The SIDRA result output is presented in **Appendix F**.

Table 5: Proposed Single-Lane Roundabout Operational Results

ROADWAY	DIRECTION	LANE	AM PEAK			PM PEAK		
			Delay (S/Veh)	LOS	95th Percentile Queue (feet)	Delay (S/Veh)	LOS	95th Percentile Queue (feet)
Marina Way	Eastbound	L	11.3	B	83.5	10.1	B	56.1
		T	14.3	B	83.5	13.1	B	56.1
		R	0	A	-	0	A	-
	Approach Delay		**8.8**	**A**	**-**	**8.7**	**A**	**-**
	Westbound	L	12.7	B	67.1	25.1	D	88.4
		T	12.7	B	67.1	25.1	D	88.4
		R	12.7	B	67.1	25.1	D	88.4
	Approach Delay		**12.7**	**B**	**-**	**25.1**	**D**	**-**
Annapolis Way	Northbound	L	9.8	A	43.9	24.9	C	349.8
		T	9.7	A	43.9	24.9	C	349.8
		R	0	A	-	0	A	-
	Approach Delay		**7.9**	**A**	**-**	**19.8**	**C**	**-**
	Southbound	L	11	B	30.5	16.8	C	56.4
		T	8	A	30.5	13.8	B	56.4
		R	0	A	-	0	A	-
	Approach Delay		**7.3**	**A**	**-**	**7.6**	**A**	**-**
OVERALL DELAY			***9.1***	***A***	***-***	***15.1***	***C***	***-***

The result of the analysis shows the roundabout is expected to perform at an acceptable overall LOS during both peaks. The movements and approaches are expected to operate at an acceptable LOS of D or better during both peak hours. In addition, the queues are not expected to spill to the downstream intersections, based on the 95th percentile queue lengths. It is noted that the northbound 95th percentile queue during the PM peak hour extends to approximately 50 feet from the downstream signalized intersection, without interfering or blocking.

Hybrid (2 x 1) Roundabout

VDOT requested that in addition to analyzing the single-lane configuration with slip lanes roundabout alternative, a hybrid configuration, with two lanes along Annapolis Road, and one lane along Marina Way, should be analyzed. This will ensure that all feasible alternatives have been evaluated under the roundabout alternative while still maintaining the existing four-lane roadway configuration along Annapolis Way, and also address the potential northbound queue that is expected to occur (and to extend within approximately 50’ of the upstream signalized intersection) under the single-lane roundabout alternative. A screen-capture from SIDRA showing the lane configuration and intersection control for this alternative is presented in **Figure 10**.

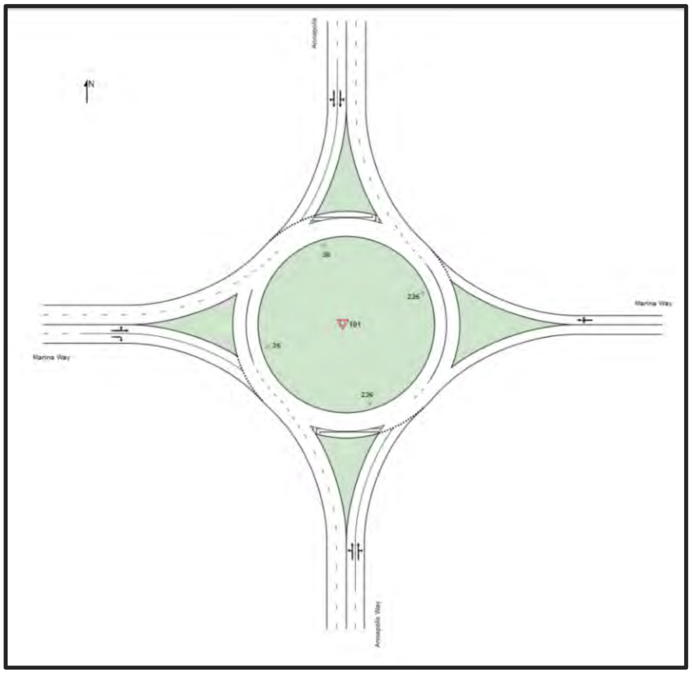


Figure 10: Proposed Hybrid Roundabout Lane Configuration

The result of the hybrid roundabout analysis is presented in **Table 6.** The SIDRA result output is presented in **Appendix F**.

Table 6: Proposed Hybrid Roundabout Operational Results

ROADWAY	DIRECTION	LANE	AM PEAK			PM PEAK		
			Delay (S/Veh)	LOS	95th Percentile Queue (feet)	Delay (S/Veh)	LOS	95th Percentile Queue (feet)
Marina Way	Eastbound	L	10.8	A	74.4	9.6	A	59.2
		T	10.8	B	74.4	9.6	A	59.2
		R	7.4	A	22.9	6.3	A	59.2
	Approach Delay		**9.8**	**A**	**-**	**8.9**	**A**	**-**
	Westbound	L	10.5	B	48.2	16.3	C	49.1
		T	10.5	B	48.2	16.3	C	49.1
		R	10.5	B	48.2	16.3	C	12.1
	Approach Delay		**10.5**	**B**	**-**	**16.3**	**C**	**-**
Annapolis Way	Northbound	L	7.6	A	22.6	12.5	B	100.7
		T	7.6	A	22.6	11.2	B	75.7
		R	7.6	A	22.6	11.2	B	75.7
	Approach Delay		**7.6**	**A**	**-**	**11.9**	**B**	**-**
	Southbound	L	6.4	A	15.5	12.6	B	47.9
		T	6.4	A	15.5	12.6	B	47.9
		R	6.4	A	15.5	12.6	B	47.9
	Approach Delay		**6.4**	**A**	**-**	**12.6**	**B**	**-**
OVERALL DELAY			***8.8***	***A***	***-***	***11.9***	***B***	***-***

The result of the analysis shows the roundabout is expected to perform at an acceptable overall LOS during both peaks. The movements and approaches are expected to operate an acceptable LOS of C or better during both peak hours. In addition, the 95th percentile queues are minimal (four vehicles or less) and are not expected to spill to near the downstream intersections.

All-Way Stop Control (AWSC)

An AWSC alternative was analyzed in the opening year 2028, and design year 2050 for the study intersection. Under this alternative, the existing lane configuration entering the intersection along Annapolis Way was modified from three lanes to two lanes to be within the HCM AWSC analysis standard. As seen in **Figure 11**, the northbound approach was converted to an exclusive left-turn lane and shared through and right lane, and the southbound approach was converted to a shared left and through lane and an exclusive right-turn lane. The proposed eastbound approach will be an exclusive left-turn lane and shared through and right lane.

The result of the AWSC analysis for the opening year is presented in **Table 7.** The opening year synchro output is presented in **Appendix G**.

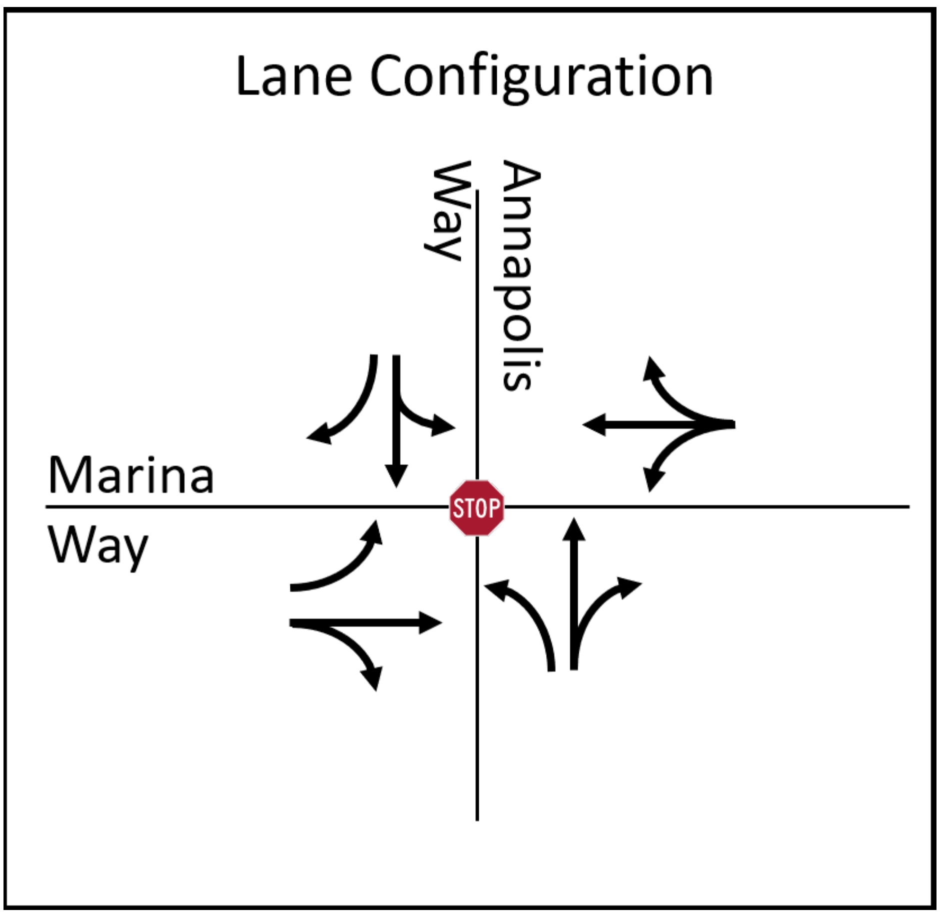


Figure 11: Proposed AWSC Lane Configuration

Table 7: Proposed AWSC Operational Results for the Opening Year 2028

ROADWAY	DIRECTION	LANE	AM PEAK			PM PEAK		
			Delay (S/Veh)	LOS	95th Percentile Queue (feet)	Delay (S/Veh)	LOS	95th Percentile Queue (feet)
Marina Way	Eastbound	L	12.0	B	28	14.1	B	33
		TR	12.7	B	50	13	B	33
	Approach Delay		**12.4**	**B**	-	**13.5**	**B**	-
	Westbound	LTR	13.2	B	40	15.4	C	45
	Approach Delay		**13.2**	**B**	-	**15.4**	**C**	-
Annapolis Way	Northbound	L	11.3	B	15	20.0	C	93
		TR	11.6	B	28	14.8	B	60
	Approach Delay		**11.5**	**B**	-	**17.6**	**C**	-
	Southbound	LT	12.4	B	30	13.6	B	35
		R	9.0	A	3	11.6	B	28
	Approach Delay		**12.0**	**B**	-	**12.7**	**B**	-
OVERALL DELAY			***12.3***	***B***	-	***15.3***	***C***	-

The opening year result shows the intersection is expected to perform at an acceptable overall LOS B and LOS C during the AM and PM peak hours, respectively. Additionally, all the lane movements and approaches are expected to operate at acceptable LOS.

The result of the AWSC analysis for the design year is presented in **Table 8**. The design year synchro output is presented in **Appendix H**.

Table 8: Proposed AWSC Operational Results for the Design Year 2050

ROADWAY	DIRECTION	LANE	AM PEAK			PM PEAK		
			Delay (S/Veh)	LOS	95th Percentile Queue (feet)	Delay (S/Veh)	LOS	95th Percentile Queue (feet)
Marina Way	Eastbound	L	17.2	C	58	21.8	C	70
		TR	25.7	D	143	21.3	C	78
	Approach Delay		**22.6**	**C**	-	**21.5**	**C**	-
	Westbound	LTR	22.9	C	103	28.1	D	110
	Approach Delay		**22.9**	**C**	-	**28.1**	**D**	-
Annapolis Way	Northbound	L	14.6	B	28	77	F	313
		TR	17.3	C	63	38	E	190
	Approach Delay		**16.3**	**C**	-	**58.6**	**F**	-
	Southbound	LT	18.9	C	68	23.3	C	88
		R	10.7	B	0	18.1	C	63
	Approach Delay		**17.8**	**C**	-	**20.9**	**C**	-
OVERALL DELAY			***20.4***	***C***	-	***37.5***	***E***	-

The result of the AWSC operational analysis shows the intersection is expected to perform at an acceptable overall LOS C and LOS E during the AM and PM peak hours, respectively. During the AM peak hour, the movements and approaches are expected to operate an acceptable LOS of D. During the PM peak hour, three of the four approaches operate with acceptable LOS D (or better); however, the northbound approach is expected to operate with failing LOS F and delay of 58.6 s/veh. The approach delay and LOS are driven by the northbound left-turn movement, which operates at LOS F and a delay of 77 s/veh.

RECOMMENDATIONS AND CONCLUSIONS

JMT evaluated the intersection of Marina Way and Annapolis Way as part of the Marina Way extension project to determine the most feasible and practical-based intersection design and traffic control given the available funding, right of way (ROW) constraints, lane capacity, and proximity to nearby intersections. Opening year 2028 and design year 2050 volumes were developed for this study. The opening year traffic volumes of 2028 were used for the signal warrant analysis and the design year 2050 volumes were used for the capacity analysis. The signal warrant analysis was conducted to determine whether a signal will be justified at the intersection during the opening year.

The signal warrant analysis showed that neither of the signal warrants evaluated herein (Warrant 1 and Warrant 8) are anticipated to be satisfied under opening year 2028 conditions. Other alternative intersection configurations were considered. VDOT's Junction Screening Tool (VJuST) was used to select the best practical design for the intersection based on available funding, ROW constraints, lane capacity, and proximity to nearby intersections. Using the year 2050 volumes, the VJuST analysis showed five alternative designs are practical and feasible at the study intersection: a 50 feet mini roundabout, 75 feet mini roundabout, a full roundabout, two-way stop control, and a conventional traffic signal. Based on projected 2050 design year volumes, a conventional traffic signal was still considered as part of the alternatives (even though it wasn't warranted in the opening year) to determine how it would operate in the design year. The other alternative designs were not considered because they either require acquisition of additional right-of-way (ROW), they are unable to accommodate the traffic volume, there are no existing roadway networks to detour traffic to, or the existing roadway characteristics do not meet the alternative's criteria. In the design year, the roundabout will operate with the lowest volume to capacity (v/c) ratio during both peaks, followed by the conventional signal alternative. The mini roundabouts and two-way stop control alternatives will be over capacity in the design year during the PM peak hour. Additionally, an all-way stop control (AWSC) warrant analysis was performed which indicated that an AWSC was justified at the intersection.

Operational analysis was conducted for the conventional signal, a single-lane roundabout, a hybrid (2 x 1) roundabout, and AWSC alternatives using the design year 2050 volumes. The lane configuration for all the alternatives conformed with the County's 2019 North Woodbridge Small Area Plan. The AWSC lane configuration was within the HCM AWSC analysis standard. The results showed the conventional signal and both roundabout alternatives are expected to operate at an acceptable LOS C or better. Additionally, all the movements and approaches are expected to operate at LOS D or better during the projected 2050 design year AM and PM peak hour.

The AWSC is expected to operate at an overall LOS C and LOS E during the AM and PM peak hours, respectively, in the design year. However, during the PM peak hour, the northbound approach is expected to operate with a failing LOS F and delay of 58.6 s/veh. Additionally, the northbound left-turn movement is expected to fail with a LOS F and delay of 77 s/veh. A sensitivity analysis was conducted to determine when the AWSC NB left-turn movement and approach will first experience a LOS F. A linear interpolation of the intersection PM peak volume was conducted between the year 2028 and year 2050, to determine the PM peak volume for the years in between. The sensitivity analysis showed that the northbound left-turn movement is anticipated to first experience a LOS F in the year 2045, and the approach in year 2049.

Based on the operational results presented above, a roundabout would be expected to provide the best overall intersection operations. However, given the following implications and physical constraints, a roundabout is not considered a feasible option:

ROW Impacts

The existing intersection is surrounded by a newly constructed apartment complex on the northwest corner, an existing facility parking lot on the SW corner, and a concrete facility on the northeast corner of the intersection. This presents major footprint constraints and acquisition challenges for the County. The concrete facility currently accesses the eastern leg of Marina Way to gain full access to Annapolis Way. Implementing a roundabout would potentially eliminate this access point, not to mention the fact that this section of Marina Way is currently privately owned. Access for the property owner on the northwest corner would be situated within the footprint of the roundabout and will have to be accommodated. This will require a new access point onto Annapolis Way for this property owner as well as parking remediation and potential impacts to their existing storm sewer system.

Proximity to Route 1 & Rivergate Apartments Intersection

To further expand on the physical constraints, given the surrounding land use, the design vehicle that would govern the design of a roundabout at this location would be a WB-67. This vehicle would significantly increase the footprint of this roundabout which would situate the roundabout at an offset from the original intersection. This would require major reconfiguration of the approaching roadways, which would not be feasible given the proximity of only 400’ to these existing intersections. In addition, the existing 4-lane roadway approaches will have to be reduced to single lane approaches. This would also cause implications for a future double-left from northbound Route 1 (turning onto Annapolis Way), which has already been constructed and is striped out for future use.

Access Management

There are multiple partial and full access entrances and exits within the proximity of this intersection. Installing a roundabout would trigger entrance spacing requirements to be met. This will result in multiple entrances being closed or relocated away from the roundabout. This will ultimately cause major liquidated damages to the County.

Adjacent Redevelopment

The owner of Parcel 003 (Ashna LLC), which is located in the southwest corner, is planning to redevelop their property in the near future and is currently in coordination with the County. Installing a roundabout will indefinitely encroach onto their property and may result in their parcel being undevelopable. This would require the County to perform a total acquisition and expend the ROW budget for litigation efforts with this owner.

Schedule

The County is on a stringent schedule to deliver this project and have Marina Way extension in operation before the redevelopment of the Gordon Plaza (Home Depot and Aldi) towards Route 123 is completed. Incorporating additional ROW impacts and potential remediation efforts for larger acquisitions at the Annapolis Way intersection would put the project delivery schedule in jeopardy.

In conclusion, an AWSC alternative is recommended for this intersection in the opening (and foreseeable future) years, because it is expected to operate at an acceptable level of service (and with acceptable 95th percentile queue lengths) during both peaks. In addition, a traffic signal is not warranted in the opening year, and a roundabout is not feasible for the intersection due to the constraints mentioned above.

It is recommended that the County consider further analysis and potential implementation of a traffic signal (or other types of traffic control improvements) by year 2045 (five years before the design year of 2050) because the northbound approach is expected to start failing under the AWSC configuration in year 2049. Traffic signal warrants under Warrant 1 with the 80% threshold for Condition A are expected to be satisfied by the year 2045. Marina Way is projected to have an ADT of 7,800 VPD for both approaches, and Annapolis Way is projected to have an ADT of 3,800 VPD for the higher approach, which are over the signal warrant thresholds in **Figure 5**.

Appendix A

Vehicular and Pedestrian Count Data

1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
Full Length (12 AM-12 AM (+1))
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345, Jacksonville Beach, FL, 32250, US

Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	Int
2023-06-08 12:00AM	0	0	2	0	2	0	2	0	0	0	2	0	2	0	0	0	2	0	0	0	0	0	0	0	6
12:15AM	0	0	0	0	0	0	3	0	0	0	3	0	0	0	1	0	1	0	0	1	0	0	1	0	5
12:30AM	0	0	0	0	0	0	2	0	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	0	4
12:45AM	0	0	0	0	0	0	3	0	0	0	3	0	0	1	4	0	5	0	0	0	0	0	0	0	8
Hourly Total	0	0	2	0	2	0	10	0	0	0	10	0	2	1	7	0	10	0	0	1	0	0	1	0	23
1:00AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	3	0	0	0	0	0	0	0	3
1:15AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	4
1:30AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
1:45AM	0	0	0	0	0	0	2	0	0	0	2	0	0	0	2	0	2	0	0	0	0	0	0	0	4
Hourly Total	0	0	0	0	0	0	2	0	0	0	2	0	0	1	9	0	10	0	0	0	0	0	0	0	12
2:00AM	0	0	0	0	0	0	1	0	0	0	1	0	1	0	2	0	3	0	0	0	0	0	0	0	4
2:15AM	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	1	0	0	1	0	4
2:30AM	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	2	0	0	0	0	0	0	0	3
2:45AM	0	1	0	0	1	0	1	0	0	0	1	0	1	1	1	0	3	0	0	0	0	0	0	0	5
Hourly Total	0	1	1	0	2	0	3	0	0	0	3	0	2	2	6	0	10	0	0	1	0	0	1	0	16
3:00AM	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	2
3:15AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
3:30AM	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	2
3:45AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
Hourly Total	0	0	0	0	0	0	2	0	0	0	2	0	0	2	1	0	3	0	0	1	0	0	1	0	6
4:00AM	1	0	0	0	1	0	7	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	8
4:15AM	0	0	0	0	0	0	10	0	0	0	10	0	0	0	1	0	1	0	0	0	0	0	0	0	11
4:30AM	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
4:45AM	0	0	0	0	0	0	3	0	0	0	3	0	0	0	3	0	3	0	0	3	0	0	3	0	9
Hourly Total	1	0	0	0	1	0	22	0	0	0	22	0	0	0	4	0	4	0	0	3	0	0	3	0	30
5:00AM	0	0	0	0	0	1	5	0	0	0	5	0	0	0	1	0	1	0	0	0	0	0	0	1	6
5:15AM	0	0	0	0	0	0	5	0	0	0	5	0	0	0	2	1	3	0	0	1	0	0	1	0	9
5:30AM	0	0	0	0	0	0	30	0	0	0	30	0	0	0	10	0	10	0	0	4	0	0	4	0	44
5:45AM	0	0	0	0	0	0	19	0	0	0	19	0	0	0	5	0	5	0	0	3	0	0	3	0	27
Hourly Total	0	0	0	0	0	1	59	0	0	0	59	0	0	0	18	1	19	0	0	8	0	0	8	1	86
6:00AM	0	0	1	0	1	0	12	1	0	0	13	0	0	3	1	0	4	0	0	6	0	0	6	0	24
6:15AM	0	0	0	0	0	0	21	0	0	0	21	0	0	1	8	1	10	0	0	5	0	1	6	0	37
6:30AM	0	0	0	0	0	0	23	0	0	0	23	0	0	3	4	0	7	0	0	6	0	0	6	1	36
6:45AM	0	0	0	0	0	0	14	0	0	0	14	0	0	3	5	0	8	0	1	11	0	0	12	0	34
Hourly Total	0	0	1	0	1	0	70	1	0	0	71	0	0	10	18	1	29	0	1	28	0	1	30	1	131
7:00AM	0	0	0	0	0	0	25	1	0	0	26	0	0	1	6	1	8	0	0	4	0	0	4	0	38
7:15AM	0	0	1	0	1	3	22	0	0	0	22	0	0	3	8	0	11	0	0	9	0	0	9	11	43
7:30AM	0	0	1	0	1	0	29	0	0	0	29	0	0	3	9	1	13	0	0	7	1	0	8	1	51
7:45AM	0	0	0	0	0	0	30	0	0	0	30	0	0	3	9	0	12	0	1	6	0	0	7	0	49
Hourly Total	0	0	2	0	2	3	106	1	0	0	107	0	0	10	32	2	44	0	1	26	1	0	28	12	181
8:00AM	0	0	1	0	1	0	27	0	0	0	27	0	1	3	17	0	21	0	0	8	0	0	8	0	57
8:15AM	0	0	0	0	0	0	16	0	0	0	16	0	1	4	7	0	12	0	0	9	0	0	9	0	37
8:30AM	0	0	0	0	0	1	15	0	1	0	16	0	1	3	11	0	15	0	0	10	0	0	10	0	41
8:45AM	0	0	0	0	0	0	17	0	0	0	17	0	1	3	12	0	16	0	2	7	0	0	9	0	42
Hourly Total	0	0	1	0	1	1	75	0	1	0	76	0	4	13	47	0	64	0	2	34	0	0	36	0	177
9:00AM	0	0	0	0	0	0	19	0	1	0	20	1	1	3	11	1	16	0	0	3	0	0	3	0	39
9:15AM	0	0	1	0	1	0	20	0	1	0	21	0	6	3	10	2	21	0	1	0	0	0	1	0	44
9:30AM	0	0	0	0	0	1	26	0	0	0	26	0	3	3	11	0	17	0	0	3	0	0	3	0	46
9:45AM	0	0	2	0	2	0	17	1	1	0	19	0	10	2	18	1	31	0	0	2	1	0	3	0	55
Hourly Total	0	0	3	0	3	1	82	1	3	0	86	1	20	11	50	4	85	0	1	8	1	0	10	0	184
10:00AM	1	0	0	0	1	0	15	0	0	0	15	0	12	3	14	0	29	0	0	3	0	0	3	0	48
10:15AM	0	0	1	0	1	0	13	0	0	0	13	0	1	4	17	0	22	0	0	1	0	0	1	0	37
10:30AM	0	0	1	0	1	0	11	0	1	0	12	0	3	1	11	0	15	0	0	8	0	0	8	0	36
10:45AM	1	0	1	0	2	1	23	0	1	0	24	0	1	0	17	0	18	0	0	4	1	0	5	0	49
Hourly Total	2	0	3	0	5	1	62	0	2	0	64	0	17	8	59	0	84	0	0	16	1	0	17	0	170
11:00AM	0	0	1	0	1	1	13	0	0	0	13	0	1	2	10	2	15	0	0	1	1	0	2	0	31
11:15AM	0	0	0	0	0	0	12	0	1	0	13	0	2	2	13	0	17	0	1	3	0	0	4	0	34
11:30AM	0	0	1	0	1	0	23	0	0	0	23	0	0	6	19	0	25	0	3	5	0	0	8	0	57
11:45AM	0	0	2	0	2	0	14	0	0	0	14	2	1	4	20	0	25	0	3	3	0	0	6	0	47
Hourly Total	0	0	4	0	4	1	62	0	1	0	63	2	4	14	62	2	82	0	7	12	1	0	20	0	169
12:00PM	0	0	2	0	2	1	13	0	2	0	15	0	3	4	14	0	21	0	0	8	0	0	8	1	46
12:15PM	0	0	2	0	2	2	18	0	0	0	18	0	0	3	7	1	11	0	1	3	0	0	4	1	35

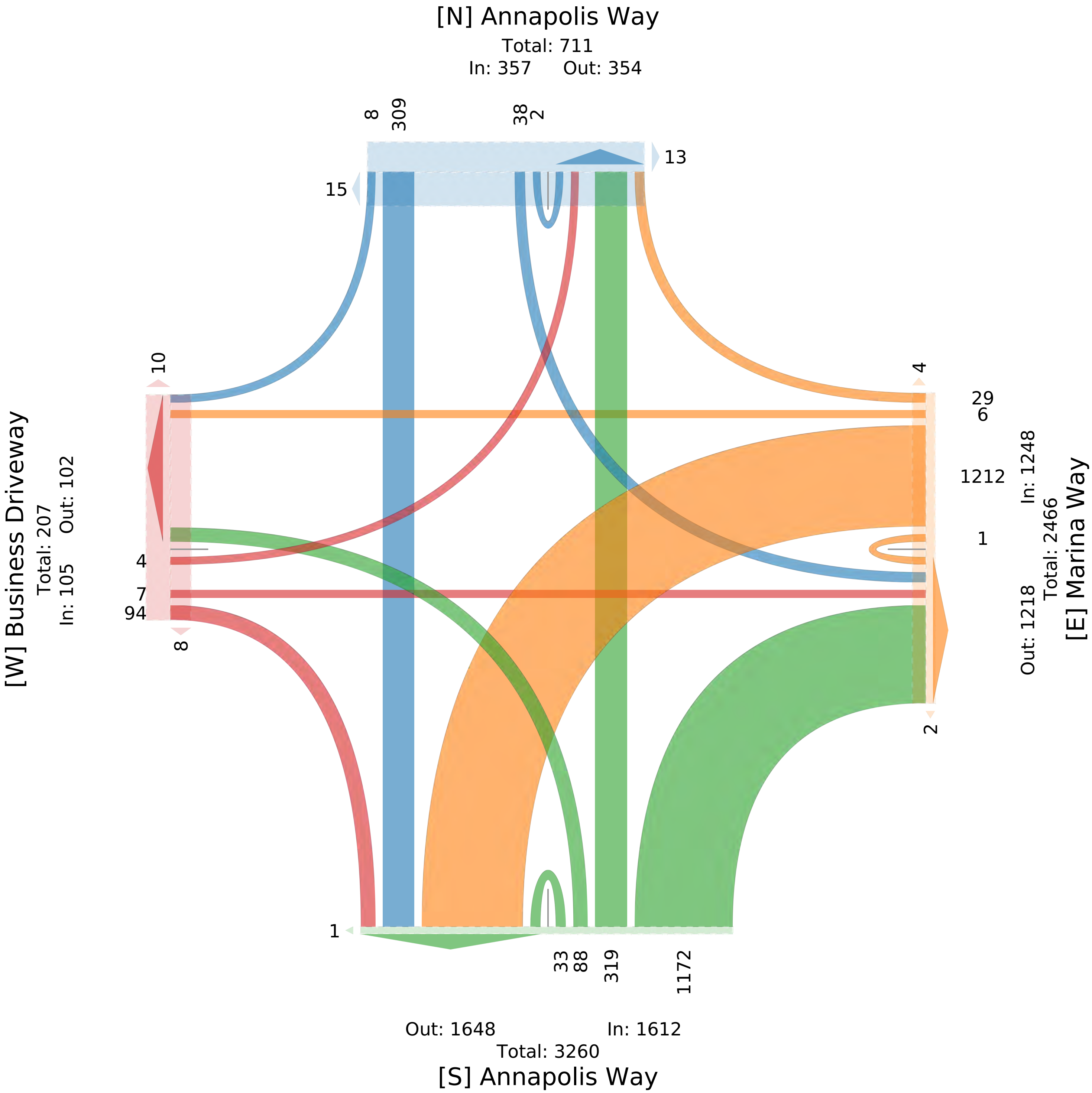
Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	L	T	R	U	App	Ped*	Int
12:30PM	0	0	0	0	**0**	0	12	0	0	0	**12**	0	0	3	18	1	**22**	0	1	5	0	0	**6**	0	**40**
12:45PM	0	1	2	0	**3**	0	9	0	1	0	**10**	0	0	5	17	0	**22**	0	1	1	1	0	**3**	0	**38**
Hourly Total	0	1	6	0	**7**	3	52	0	3	0	**55**	0	3	15	56	2	**76**	0	3	17	1	0	**21**	2	**159**
1:00PM	0	0	2	0	**2**	0	13	0	0	0	**13**	0	0	5	17	0	**22**	0	0	1	0	0	**1**	0	**38**
1:15PM	0	0	2	0	**2**	0	19	0	0	0	**19**	0	1	2	11	0	**14**	0	0	1	0	0	**1**	0	**36**
1:30PM	0	0	7	0	**7**	0	18	0	1	0	**19**	0	0	5	20	2	**27**	0	1	4	1	0	**6**	1	**59**
1:45PM	0	0	0	0	**0**	1	13	0	1	0	**14**	0	3	7	16	0	**26**	0	2	4	0	0	**6**	0	**46**
Hourly Total	0	0	11	0	**11**	1	63	0	2	0	**65**	0	4	19	64	2	**89**	0	3	10	1	0	**14**	1	**179**
2:00PM	0	0	0	0	**0**	0	14	0	0	0	**14**	0	1	5	11	1	**18**	0	0	5	0	0	**5**	0	**37**
2:15PM	0	0	1	0	**1**	0	13	0	1	0	**14**	0	2	5	16	1	**24**	0	1	4	0	0	**5**	0	**44**
2:30PM	0	0	4	0	**4**	0	22	0	0	0	**22**	0	4	4	19	0	**27**	0	1	9	0	0	**10**	0	**63**
2:45PM	0	0	0	0	**0**	0	18	1	0	0	**19**	0	1	5	12	0	**18**	0	0	7	0	0	**7**	0	**44**
Hourly Total	0	0	5	0	**5**	0	67	1	1	0	**69**	0	8	19	58	2	**87**	0	2	25	0	0	**27**	0	**188**
3:00PM	0	0	0	0	**0**	0	19	0	1	0	**20**	3	1	6	18	4	**29**	0	0	4	0	0	**4**	1	**53**
3:15PM	0	0	1	0	**1**	0	17	0	2	0	**19**	0	3	10	23	1	**37**	0	0	5	0	0	**5**	5	**62**
3:30PM	0	0	2	0	**2**	1	12	0	1	0	**13**	0	2	8	23	1	**34**	0	2	2	1	0	**5**	0	**54**
3:45PM	0	0	2	0	**2**	0	14	0	1	0	**15**	0	1	4	33	2	**40**	0	0	3	0	0	**3**	0	**60**
Hourly Total	0	0	5	0	**5**	1	62	0	5	0	**67**	3	7	28	97	8	**140**	0	2	14	1	0	**17**	6	**229**
4:00PM	0	0	1	0	**1**	0	10	0	0	0	**10**	0	0	6	21	1	**28**	1	1	2	0	0	**3**	0	**42**
4:15PM	0	0	1	0	**1**	0	21	0	1	0	**22**	0	0	6	29	0	**35**	0	2	4	0	0	**6**	0	**64**
4:30PM	0	0	0	0	**0**	1	18	0	0	0	**18**	0	0	2	28	1	**31**	0	0	0	0	0	**0**	0	**49**
4:45PM	0	0	1	0	**1**	0	8	0	0	0	**8**	0	1	13	21	2	**37**	0	1	6	0	0	**7**	0	**53**
Hourly Total	0	0	3	0	**3**	1	57	0	1	0	**58**	0	1	27	99	4	**131**	1	4	12	0	0	**16**	0	**208**
5:00PM	0	0	2	0	**2**	1	15	0	0	0	**15**	0	0	5	30	0	**35**	0	0	7	0	0	**7**	1	**59**
5:15PM	0	0	0	0	**0**	0	16	0	0	0	**16**	0	0	5	21	0	**26**	0	0	6	0	0	**6**	0	**48**
5:30PM	0	0	1	0	**1**	1	15	0	0	0	**15**	0	1	11	25	0	**37**	0	1	4	0	0	**5**	0	**58**
5:45PM	0	0	1	0	**1**	0	15	0	1	0	**16**	0	0	7	27	0	**34**	0	0	7	0	0	**7**	0	**58**
Hourly Total	0	0	4	0	**4**	2	61	0	1	0	**62**	0	1	28	103	0	**132**	0	1	24	0	0	**25**	1	**223**
6:00PM	0	0	4	0	**4**	0	16	0	1	0	**17**	0	1	6	21	1	**29**	0	0	3	0	0	**3**	0	**53**
6:15PM	0	0	2	0	**2**	0	18	0	0	0	**18**	0	1	6	31	1	**39**	0	1	2	0	0	**3**	0	**62**
6:30PM	1	0	2	0	**3**	0	18	0	0	0	**18**	0	3	7	30	0	**40**	0	0	3	0	0	**3**	0	**64**
6:45PM	0	0	1	0	**1**	0	16	0	0	0	**16**	0	4	8	25	0	**37**	0	2	5	0	1	**8**	0	**62**
Hourly Total	1	0	9	0	**10**	0	68	0	1	0	**69**	0	9	27	107	2	**145**	0	3	13	0	1	**17**	0	**241**
7:00PM	0	2	20	0	**22**	0	20	0	0	0	**20**	0	0	4	25	0	**29**	0	0	5	0	0	**5**	0	**76**
7:15PM	0	0	3	0	**3**	0	13	0	1	0	**14**	0	2	7	23	1	**33**	0	1	5	0	0	**6**	0	**56**
7:30PM	0	0	3	0	**3**	1	17	0	1	0	**18**	0	0	1	24	0	**25**	0	0	4	0	0	**4**	1	**50**
7:45PM	0	0	1	0	**1**	0	13	0	0	0	**13**	0	0	7	19	0	**26**	0	1	5	0	0	**6**	1	**46**
Hourly Total	0	2	27	0	**29**	1	63	0	2	0	**65**	0	2	19	91	1	**113**	0	2	19	0	0	**21**	2	**228**
8:00PM	0	0	2	0	**2**	0	16	1	1	0	**18**	0	1	6	23	0	**30**	0	1	4	0	0	**5**	0	**55**
8:15PM	0	1	2	0	**3**	0	10	1	0	0	**11**	0	2	14	15	0	**31**	0	2	3	0	0	**5**	0	**50**
8:30PM	0	0	1	0	**1**	0	19	0	1	0	**20**	0	0	3	20	1	**24**	0	1	2	0	0	**3**	0	**48**
8:45PM	0	1	0	0	**1**	0	13	0	1	0	**14**	0	0	3	18	0	**21**	0	0	5	0	0	**5**	0	**41**
Hourly Total	0	2	5	0	**7**	0	58	2	3	0	**63**	0	3	26	76	1	**106**	0	4	14	0	0	**18**	0	**194**
9:00PM	0	0	0	0	**0**	0	7	0	0	0	**7**	0	0	5	13	0	**18**	0	0	0	0	0	**0**	0	**25**
9:15PM	0	0	0	0	**0**	0	13	0	0	0	**13**	0	0	3	12	0	**15**	0	0	3	0	0	**3**	0	**31**
9:30PM	0	0	0	0	**0**	0	10	0	0	0	**10**	0	0	7	14	0	**21**	0	0	0	0	0	**0**	1	**31**
9:45PM	0	0	1	0	**1**	0	9	0	0	0	**9**	0	0	2	10	0	**12**	0	0	2	0	0	**2**	0	**24**
Hourly Total	0	0	1	0	**1**	0	39	0	0	0	**39**	0	0	17	49	0	**66**	0	0	5	0	0	**5**	1	**111**
10:00PM	0	1	0	0	**1**	1	14	0	2	1	**17**	0	0	6	16	0	**22**	0	1	4	0	0	**5**	1	**45**
10:15PM	0	0	0	0	**0**	0	12	0	0	0	**12**	0	0	2	11	0	**13**	0	1	4	0	0	**5**	0	**30**
10:30PM	0	0	1	0	**1**	0	8	0	0	0	**8**	0	1	4	5	0	**10**	0	0	1	1	0	**2**	0	**21**
10:45PM	0	0	0	0	**0**	0	5	0	0	0	**5**	0	0	3	6	0	**9**	0	0	2	0	0	**2**	0	**16**
Hourly Total	0	1	1	0	**2**	1	39	0	2	1	**42**	0	1	15	38	0	**54**	0	2	11	1	0	**14**	1	**112**
11:00PM	0	0	0	0	**0**	0	9	0	1	0	**10**	0	0	3	5	0	**8**	0	0	3	0	0	**3**	0	**21**
11:15PM	0	0	0	0	**0**	0	9	0	0	0	**9**	0	0	0	2	0	**2**	0	0	1	0	0	**1**	0	**12**
11:30PM	0	0	0	0	**0**	0	4	0	0	0	**4**	0	0	4	6	0	**10**	0	0	2	0	0	**2**	0	**16**
11:45PM	0	0	0	0	**0**	0	6	0	0	0	**6**	0	0	0	8	1	**9**	0	0	1	0	0	**1**	0	**16**
Hourly Total	0	0	0	0	**0**	0	28	0	1	0	**29**	0	0	7	21	1	**29**	0	0	7	0	0	**7**	0	**65**
Total	4	7	94	0	**105**	18	1212	6	29	1	**1248**	6	88	319	1172	33	**1612**	1	38	309	8	2	**357**	28	**3322**
% Approach	3.8%	6.7%	89.5%	0%	**-**	-	97.1%	0.5%	2.3%	0.1%	**-**	-	5.5%	19.8%	72.7%	2.0%	**-**	-	10.6%	86.6%	2.2%	0.6%	**-**	-	-
% Total	0.1%	0.2%	2.8%	0%	**3.2%**	-	36.5%	0.2%	0.9%	0%	**37.6%**	-	2.6%	9.6%	35.3%	1.0%	**48.5%**	-	1.1%	9.3%	0.2%	0.1%	**10.7%**	-	-
Lights and Motorcycles	4	7	85	0	**96**	-	1089	6	26	1	**1122**	-	81	306	1078	29	**1494**	-	36	297	6	2	**341**	-	3053
% Lights and Motorcycles	100%	100%	90.4%	0%	**91.4%**	-	89.9%	100%	89.7%	100%	**89.9%**	-	92.0%	95.9%	92.0%	87.9%	**92.7%**	-	94.7%	96.1%	75.0%	100%	**95.5%**	-	91.9%
Heavy	0	0	9	0	**9**	-	123	0	3	0	**126**	-	7	13	94	4	**118**	-	2	12	2	0	**16**	-	269
% Heavy	0%	0%	9.6%	0%	**8.6%**	-	10.1%	0%	10.3%	0%	**10.1%**	-	8.0%	4.1%	8.0%	12.1%	**7.3%**	-	5.3%	3.9%	25.0%	0%	**4.5%**	-	8.1%
Pedestrians	-	-	-	-	-	16	-	-	-	-	-	6	-	-	-	-	-	1	-	-	-	-	-	26	
% Pedestrians	-	-	-	-	-	88.9%	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	92.9%	-

Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	**Int**
Bicycles on Crosswalk	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	
% Bicycles on Crosswalk	-	-	-	-	-	11.1%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	7.1%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC
Thu Jun 8, 2023
Full Length (12 AM-12 AM (+1))
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US



1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

PEGGY MALONE & ASSOCIATES TRAFFIC DATA COLLECTION
Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US

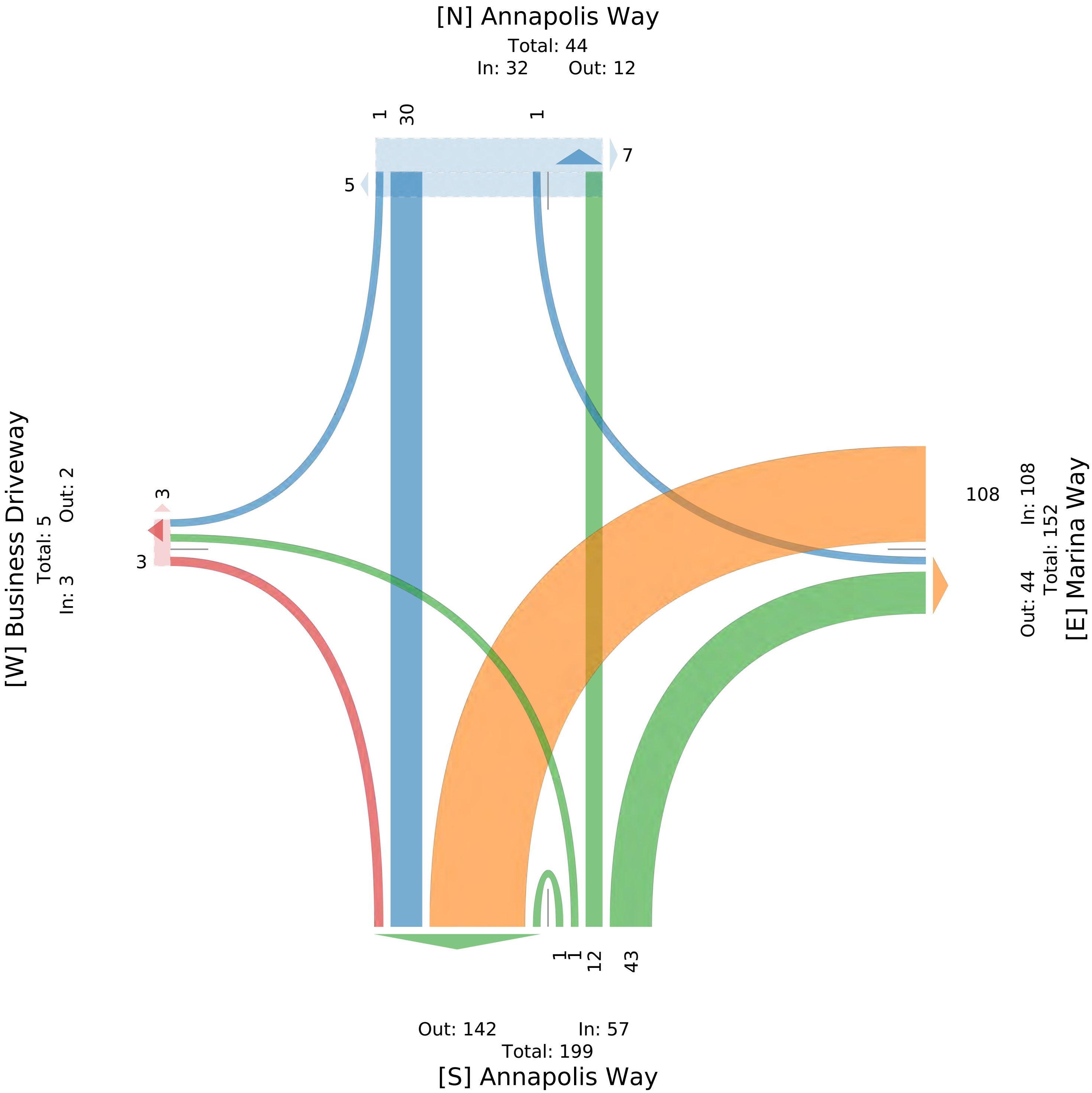
Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	**Int**
2023-06-08 7:15AM	0	0	1	0	**1**	3	22	0	0	0	**22**	0	0	3	8	0	**11**	0	0	9	0	0	**9**	11	**43**
7:30AM	0	0	1	0	**1**	0	29	0	0	0	**29**	0	0	3	9	1	**13**	0	0	7	1	0	**8**	1	**51**
7:45AM	0	0	0	0	**0**	0	30	0	0	0	**30**	0	0	3	9	0	**12**	0	1	6	0	0	**7**	0	**49**
8:00AM	0	0	1	0	**1**	0	27	0	0	0	**27**	0	1	3	17	0	**21**	0	0	8	0	0	**8**	0	**57**
Total	0	0	3	0	**3**	3	108	0	0	0	**108**	0	1	12	43	1	**57**	0	1	30	1	0	**32**	12	**200**
% Approach	0%	0%	100%	0%	-	-	100%	0%	0%	0%	-	-	1.8%	21.1%	75.4%	1.8%	-	-	3.1%	93.8%	3.1%	0%	-	-	-
% Total	0%	0%	1.5%	0%	**1.5%**	-	54.0%	0%	0%	0%	**54.0%**	-	0.5%	6.0%	21.5%	0.5%	**28.5%**	-	0.5%	15.0%	0.5%	0%	**16.0%**	-	-
PHF	-	-	0.750	-	**0.750**	-	0.900	-	-	-	**0.900**	-	0.250	1.000	0.632	0.250	**0.679**	-	0.250	0.833	0.250	-	**0.889**	-	0.877
Lights and Motorcycles	0	0	1	0	**1**	-	92	0	0	0	**92**	-	0	9	31	0	**40**	-	1	28	0	0	**29**	-	162
% Lights and Motorcycles	0%	0%	33.3%	0%	**33.3%**	-	85.2%	0%	0%	0%	**85.2%**	-	0%	75.0%	72.1%	0%	**70.2%**	-	100%	93.3%	0%	0%	**90.6%**	-	81.0%
Heavy	0	0	2	0	**2**	-	16	0	0	0	**16**	-	1	3	12	1	**17**	-	0	2	1	0	**3**	-	38
% Heavy	0%	0%	66.7%	0%	**66.7%**	-	14.8%	0%	0%	0%	**14.8%**	-	100%	25.0%	27.9%	100%	**29.8%**	-	0%	6.7%	100%	0%	**9.4%**	-	19.0%
Pedestrians	-	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	12	
% Pedestrians	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
AM Peak (7:15 AM - 8:15 AM)
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US



1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US

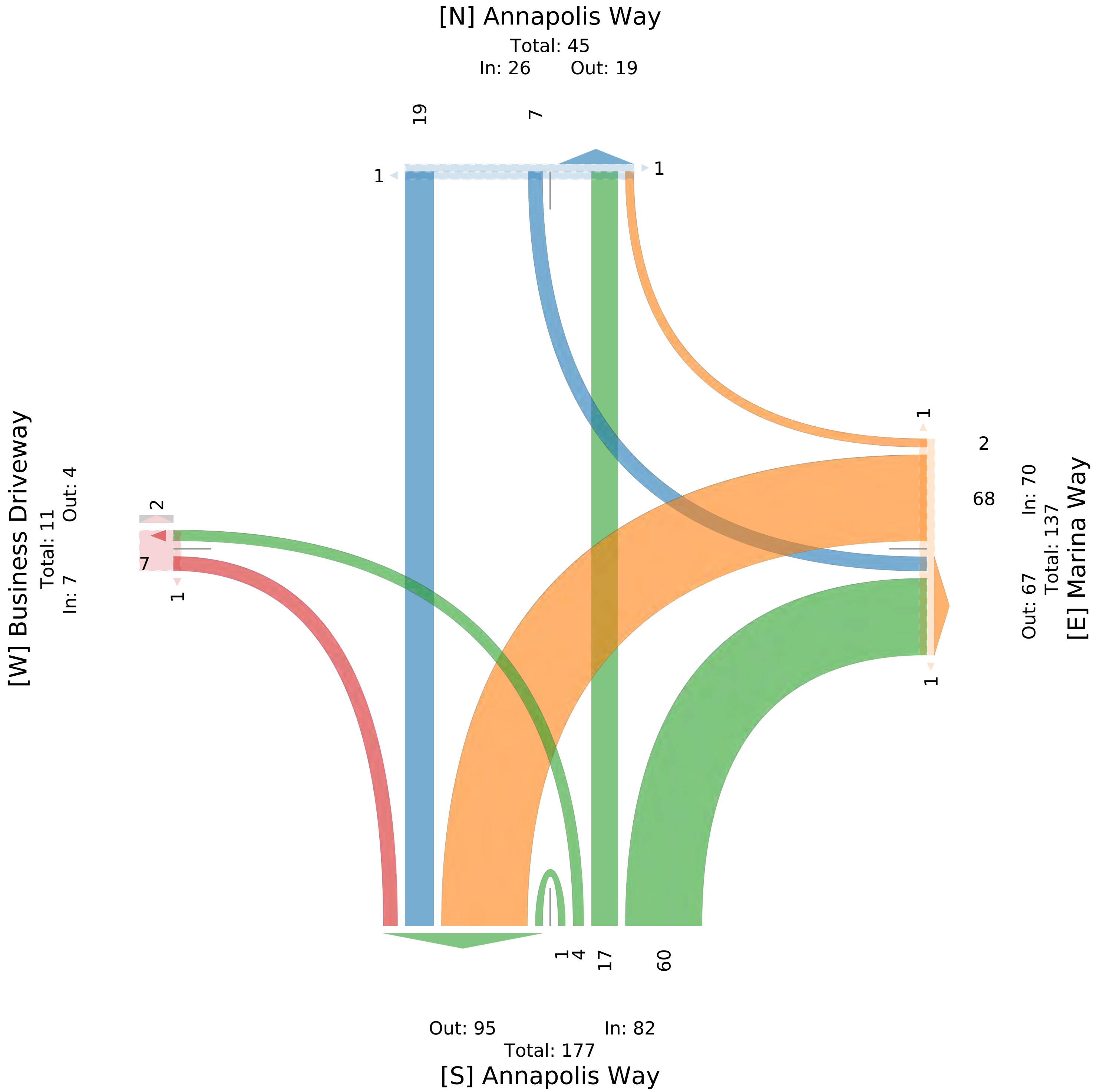
Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	**Int**
2023-06-08 11:30AM	0	0	1	0	**1**	0	23	0	0	0	**23**	0	0	6	19	0	**25**	0	3	5	0	0	**8**	0	**57**
11:45AM	0	0	2	0	**2**	0	14	0	0	0	**14**	2	1	4	20	0	**25**	0	3	3	0	0	**6**	0	**47**
12:00PM	0	0	2	0	**2**	1	13	0	2	0	**15**	0	3	4	14	0	**21**	0	0	8	0	0	**8**	1	**46**
12:15PM	0	0	2	0	**2**	2	18	0	0	0	**18**	0	0	3	7	1	**11**	0	1	3	0	0	**4**	1	**35**
Total	0	0	7	0	**7**	3	68	0	2	0	**70**	2	4	17	60	1	**82**	0	7	19	0	0	**26**	2	**185**
% Approach	0%	0%	100%	0%	-	-	97.1%	0%	2.9%	0%	-	-	4.9%	20.7%	73.2%	1.2%	-	-	26.9%	73.1%	0%	0%	-	-	-
% Total	0%	0%	3.8%	0%	**3.8%**	-	36.8%	0%	1.1%	0%	**37.8%**	-	2.2%	9.2%	32.4%	0.5%	**44.3%**	-	3.8%	10.3%	0%	0%	**14.1%**	-	-
PHF	-	-	0.875	-	**0.875**	-	0.739	-	0.250	-	**0.761**	-	0.333	0.708	0.750	0.250	**0.820**	-	0.583	0.594	-	-	**0.813**	-	0.811
Lights and Motorcycles	0	0	6	0	**6**	-	56	0	2	0	**58**	-	3	16	50	1	**70**	-	7	18	0	0	**25**	-	159
% Lights and Motorcycles	0%	0%	85.7%	0%	**85.7%**	-	82.4%	0%	100%	0%	**82.9%**	-	75.0%	94.1%	83.3%	100%	**85.4%**	-	100%	94.7%	0%	0%	**96.2%**	-	85.9%
Heavy	0	0	1	0	**1**	-	12	0	0	0	**12**	-	1	1	10	0	**12**	-	0	1	0	0	**1**	-	26
% Heavy	0%	0%	14.3%	0%	**14.3%**	-	17.6%	0%	0%	0%	**17.1%**	-	25.0%	5.9%	16.7%	0%	**14.6%**	-	0%	5.3%	0%	0%	**3.8%**	-	14.1%
Pedestrians	-	-	-	-	-	3	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	2	
% Pedestrians	-	-	-	-	-	100%	-	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US



1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC

Thu Jun 8, 2023
PM Peak (6:15 PM - 7:15 PM) - Overall Peak Hour
All Classes (Lights and Motorcycles, Heavy, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 1072154, Location: 38.666122, -77.24545

Provided by: Peggy Malone & Associates
14286 Beach Blvd, 19-345,
Jacksonville Beach, FL, 32250, US

Leg	Business Driveway						Marina Way						Annapolis Way						Annapolis Way						
Direction	Eastbound						Westbound						Northbound						Southbound						
Time	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	L	T	R	U	**App**	Ped*	**Int**
2023-06-08 6:15PM	0	0	2	0	**2**	0	18	0	0	0	**18**	0	1	6	31	1	**39**	0	1	2	0	0	**3**	0	**62**
6:30PM	1	0	2	0	**3**	0	18	0	0	0	**18**	0	3	7	30	0	**40**	0	0	3	0	0	**3**	0	**64**
6:45PM	0	0	1	0	**1**	0	16	0	0	0	**16**	0	4	8	25	0	**37**	0	2	5	0	1	**8**	0	**62**
7:00PM	0	2	20	0	**22**	0	20	0	0	0	**20**	0	0	4	25	0	**29**	0	0	5	0	0	**5**	0	**76**
Total	1	2	25	0	**28**	0	72	0	0	0	**72**	0	8	25	111	1	**145**	0	3	15	0	1	**19**	0	**264**
% Approach	3.6%	7.1%	89.3%	0%	-	-	100%	0%	0%	0%	-	-	5.5%	17.2%	76.6%	0.7%	-	-	15.8%	78.9%	0%	5.3%	-	-	-
% Total	0.4%	0.8%	9.5%	0%	**10.6%**	-	27.3%	0%	0%	0%	**27.3%**	-	3.0%	9.5%	42.0%	0.4%	**54.9%**	-	1.1%	5.7%	0%	0.4%	**7.2%**	-	-
PHF	0.250	0.250	0.313	-	**0.318**	-	0.900	-	-	-	**0.900**	-	0.500	0.781	0.895	0.250	**0.906**	-	0.375	0.750	-	0.250	**0.594**	-	0.868
Lights and Motorcycles	1	2	24	0	**27**	-	69	0	0	0	**69**	-	7	24	107	1	**139**	-	3	15	0	1	**19**	-	254
% Lights and Motorcycles	100%	100%	96.0%	0%	**96.4%**	-	95.8%	0%	0%	0%	**95.8%**	-	87.5%	96.0%	96.4%	100%	**95.9%**	-	100%	100%	0%	100%	**100%**	-	96.2%
Heavy	0	0	1	0	**1**	-	3	0	0	0	**3**	-	1	1	4	0	**6**	-	0	0	0	0	**0**	-	10
% Heavy	0%	0%	4.0%	0%	**3.6%**	-	4.2%	0%	0%	0%	**4.2%**	-	12.5%	4.0%	3.6%	0%	**4.1%**	-	0%	0%	0%	0%	**0%**	-	3.8%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

1-Annapolis Way & Mariana Way - Weekday (VA2... - TMC
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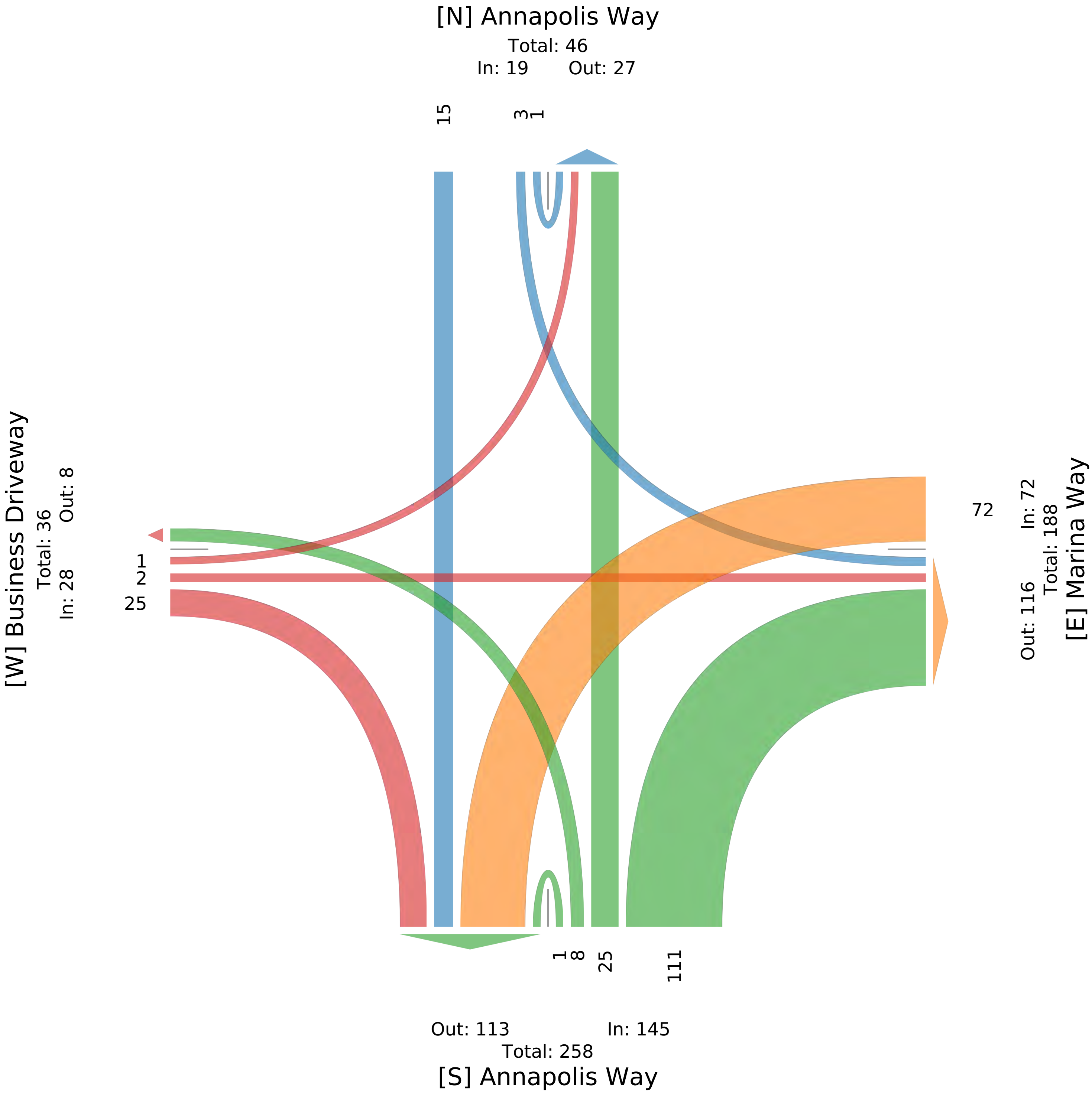


Appendix B

VDOT Approved Travel Forecast Memorandum

MEMORANDUM

TO: Jeffrey Daily, P.E
DATE: 10/27/2023
FROM: Olaoluwa Dairo, PE, PTOE, JMT
PROJECT NAME: Marina Way Extension (UPC 120778)
JMT PROJECT NO.: 19-01549-019
CONTRACT NO.: 5053661
RE: Traffic Forecast

JMT was contracted by the Prince William County Department of Transportation (PWCDOT) to design the extension of Marina Way to connect the existing Marina Way to Horner Road, passing through Annapolis Way, and Gordon Boulevard (Route 123). The Marina Way extension will be a four-lane divided roadway. The project is near the I-95 at the Route 123 interchange. The opening year for the project is 2028, and the design year is 2050. The project location is presented in **Figure 1**.

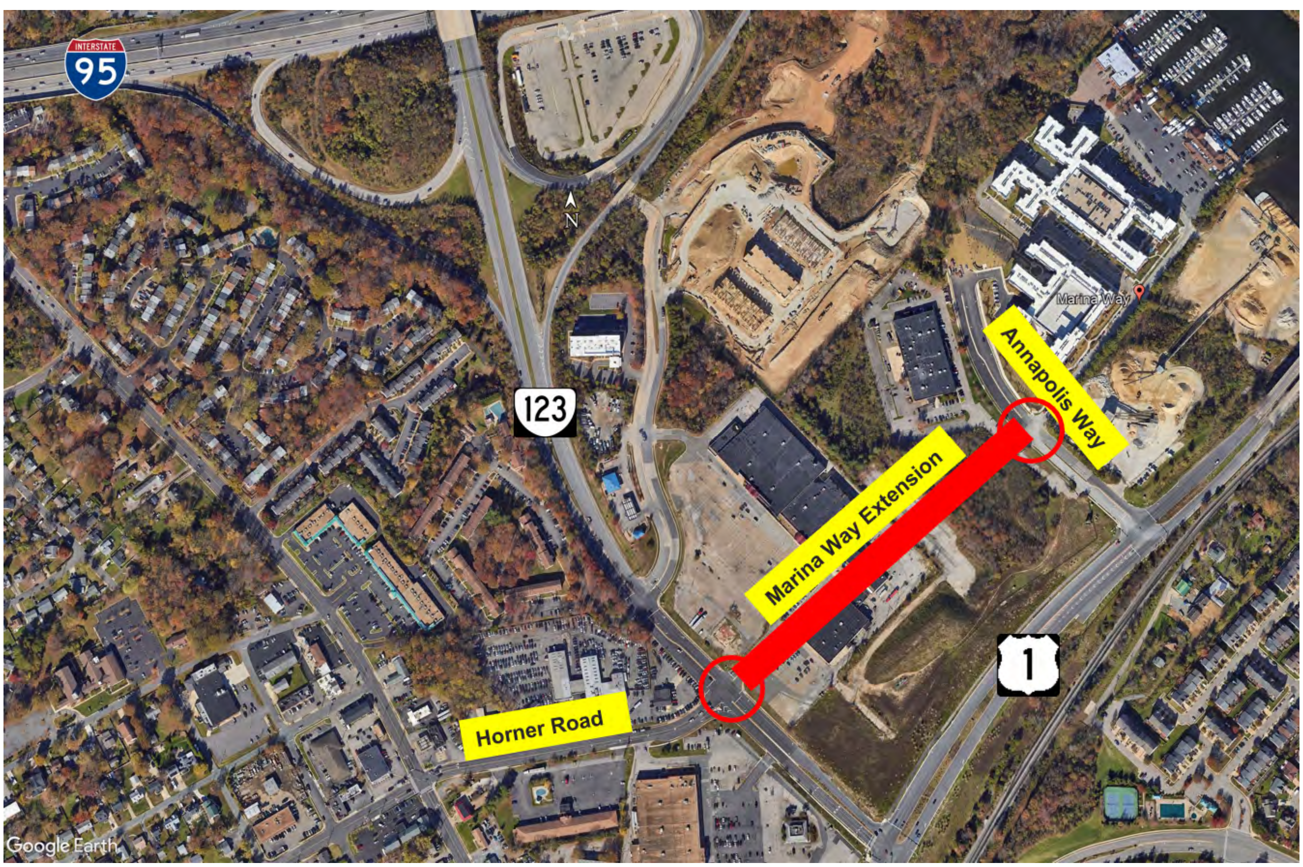


Figure 1: Marina Way Extension Project Location

For this project, two intersections will be analyzed. The intersections are located at both ends of the extension, circled in **Figure 1**. The intersections are Route 123 at Horner Road (the west terminus) and Annapolis Way at Marina Way (the east terminus). The eastern leg of Route 123 at Horner Road intersection currently leads to the Gordon Plaza Shopping Mall. The eastern leg marks the western terminus of the project limits. The western leg of the Annapolis Way at Marina Way intersection is an access to the Royalhouse Chapel International, Breakthrough Center. The western leg marks the eastern terminus of the extension. A 24-hour turning movement count was conducted at the intersection of Route 123 and Horner Road on Thursday, June 8, 2023. This memorandum describes the approach JMT used to develop the AM and PM peak hour volumes at the two study intersections.

During the scope development of this project, PWCDOT indicated a VDOT STARS study was conducted for the I-95 at Route 123 interchange. The study used the Prince William County Travel Demand Model (PWCTDM) to develop the traffic forecast for the project. The calibrated STARS study PWCTDM was provided to JMT by PWCDOT, which was used to develop the traffic forecast for this study. In addition to this, the approved land use data for PWC from the Metropolitan Washington Council of Governments (MWCOG) Round 10 cooperative land use forecast was provided by the County to be used for the model runs. The Round 10 land use data includes socio-economic/land use inputs for year 2050. In coordination with PWCDOT planning and programming division, it is assumed the PWC Round 10 cooperative land use forecasts include all the population and employment land use assumed in the North Woodbridge Small Area Plan that was approved in 2019. This includes the new developments coming into the North Woodbridge Area.

The PWCTDM included a roadway network with a base year of 2015 and future year of 2045. The base year 2015 roadway network was updated to reflect the existing 2023 roadway. The VDOT Travel Demand Modeling Policies and Procedures document was referenced to define the acceptable levels of deviation from ADTs. The Percent Root Mean Square Error (%RMSE), *Table 10.5 of the travel demand modeling policies and procedures document*, was used to compare major links surrounding the study area. The model was run and validated using existing volume data. **Table 1** presents the model validation results for the major roadways surrounding the study area. The result shows the model meets the validation criteria.

Table 1: Model Validation Check

Location	Exiting Data (VPD)	Model Output (VPD)	%RMSE Guideline	%RMSE
US 1 over Occoquan River[1]	39,000	35,988	25	7.72
Horner Road South of VA 123[2]	11,115	11,722	35	5.46
Occoquan Road[1]	13,000	11,947	35	8.10
VA 123 (Gordon Boulevard) Between US 1 and Horner[1]	19,000	18,657	30	1.81
VA 294 Between I-95 and US 1[1]	29,333	23,469	27	19.99
I-95 at Between VA 294 and Fairfax County Line[1]	230,000	209,500	19	8.91

1-ADT from VDOT 2019 Database
2-Existing 2023 turning movement count (24 hours)

As seen in **Table 1**, the numbers highlighted in green show that the daily volumes produced by the model are within the acceptable thresholds set in the VDOT Travel Demand Modeling Policies and Procedures document, when compared to the existing ADTs.

It is assumed the 2045 model encompasses the PWC transportation plan. Additional verification was done to confirm if the potential roadway projects are included in the model, such as the widening of Route 123 to six lanes from US 1 to Annapolis Way. JMT included the Annapolis Way connector which will connect Annapolis Way from US 1 to Route 123. In coordination with the County, no additional roadway or transit projects have been approved for 2050. Therefore, the model was not updated from 2045 to 2050 with any roadway or transit projects except for the Annapolis Way connector. JMT ran two future models; the no-build and build model for the design year 2050. In the no-build model, the Marina Way extension was not coded in the model. For the build model, the Marina Way extension was coded in the model. Both networks can be seen in **Figure 2**.

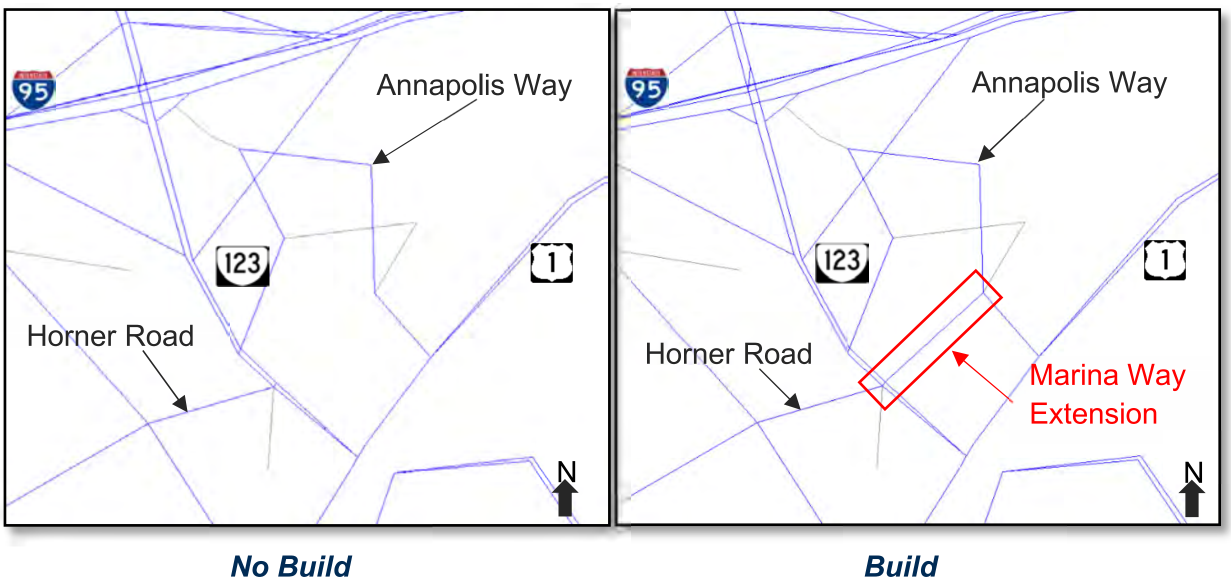


Figure 2: Marina Way Extension 2050 Networks

The two future models were then compared to determine the traffic volume that will divert from surrounding roadways such as US 1, and Route 123 onto Marina Way.

JMT also conducted a select link analysis along the centroid connector to the TAZ encompassing the North Woodbridge Area where the Marina Way extension is proposed. The select link was performed on the no-build condition to determine the distribution into and out of the centroid. The number of trips distributed was determined by performing the NCHRP Difference Method along the centroid. The calculation can be found in **Table 2**.

Table 2: North Woodbridge Area Centroid Growth

	Trips In	Trips Out	Total
Existing (Count)	3,613	3,777	7,390
Base Year Model	665	643	1,308
2028 Build	2,453	2,416	4,869
2050 Build	4,390	4,337	8,727
2050 Difference Method ADT (Rounded)	**7,400**	**7,500**	**14,900**
2028 Difference Method ADT	**5,400**	**5,600**	**11,000**

The AM and PM peak hour trips were then determined using the existing peak hour as a percentage of the existing daily volume. The AM and PM peak hour trips were then distributed through the network using the results of the select link analysis. To develop the forecasts for the movements that are not destined to or originating from the centroid, such as the through movements along Route 123, the growth from the base year model to the future year model was applied. The turning movement distribution from the existing condition was applied to the future condition for the movements not originating or destined to the select link centroid. JMT also compared the No Build and Build conditions to divert traffic to Marina Way. The spreadsheet used to determine the 2050 turning movements is attached to this memorandum.

To develop the 2028 opening year volumes, JMT linearly interpolated between the 2025 land use and the 2030 land use provided by the County, to determine the 2028 land use. The 2028 model network was updated to reflect the conditions expected during the opening year and was sourced from the VDOT STARS study 2030 model. The updated 2028 build model was run using the interpolated 2028 land use. The 2028 build model output was compared to the 2050 build model output. The result shows that there was a 30% reduction in trips in the centroid representing the North Woodbridge area. The reduction can be found in **Table 2**. This reduction was then applied to the developed 2050 peak hour volumes to arrive at the 2028 volumes. The resulting 2028 AM and PM peak hour volumes are displayed in **Figure 3**, and the 2050 volumes are displayed in **Figure 4**.

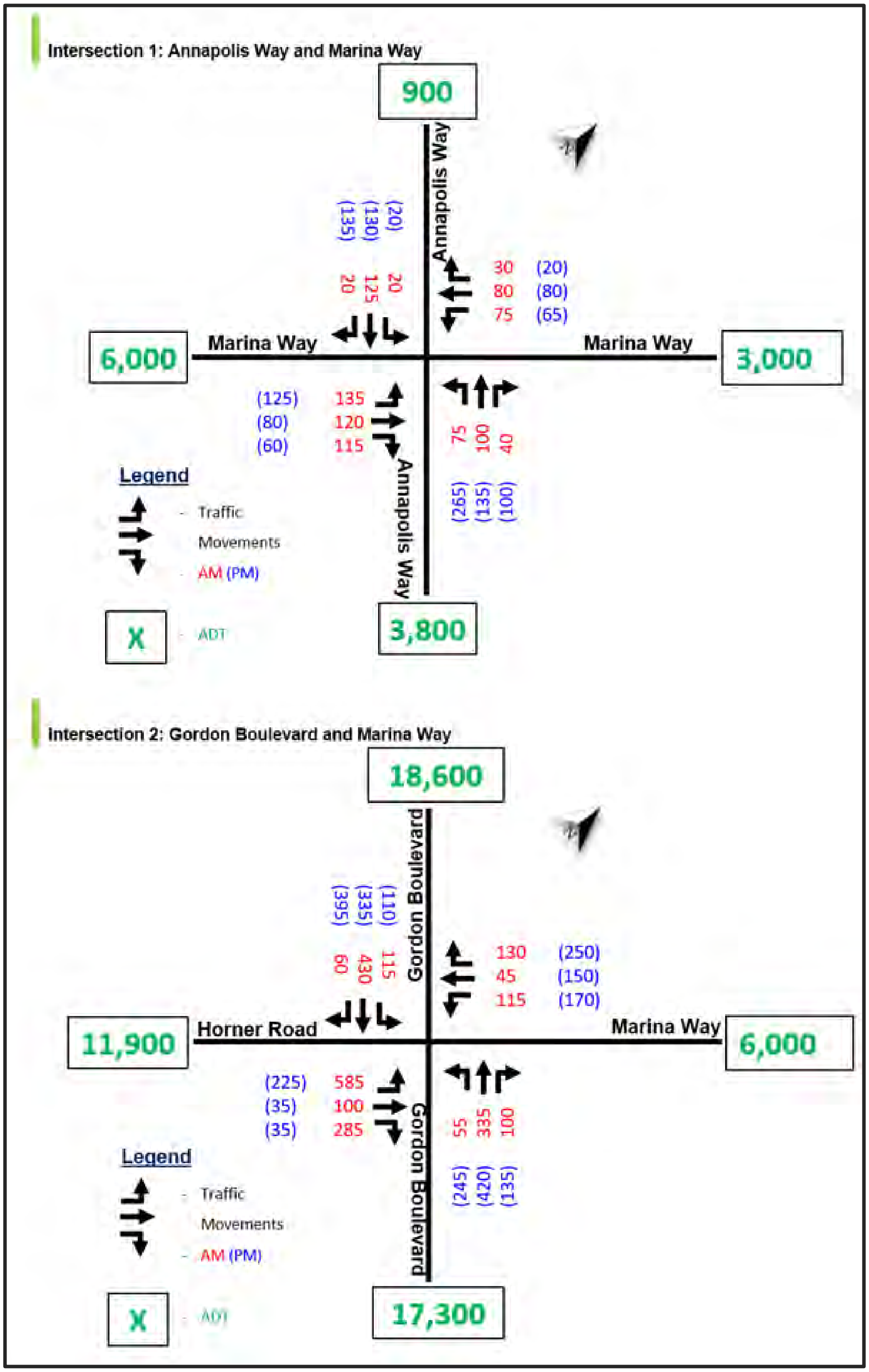


Figure 3: 2028 AM and PM Peak Hour Volumes

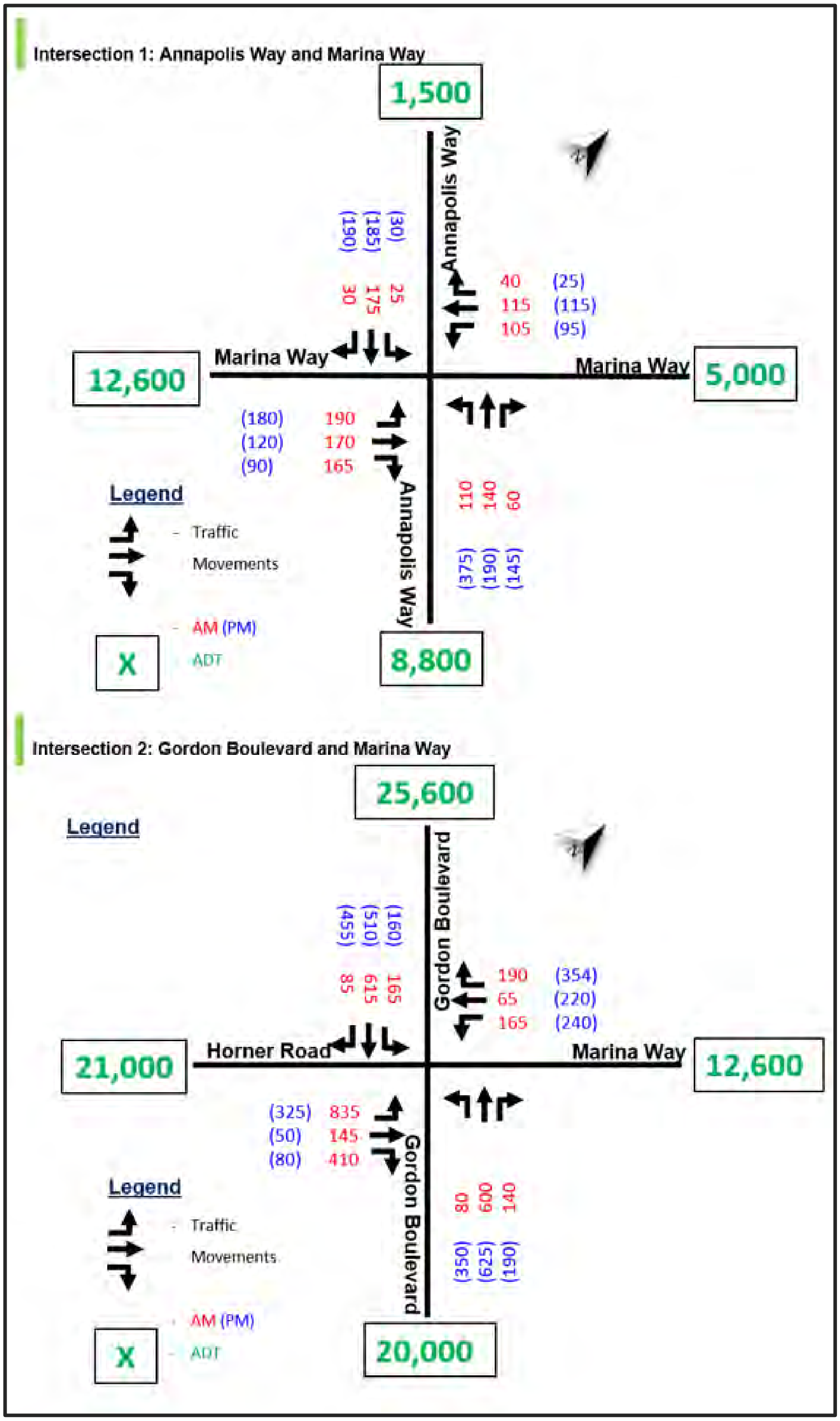
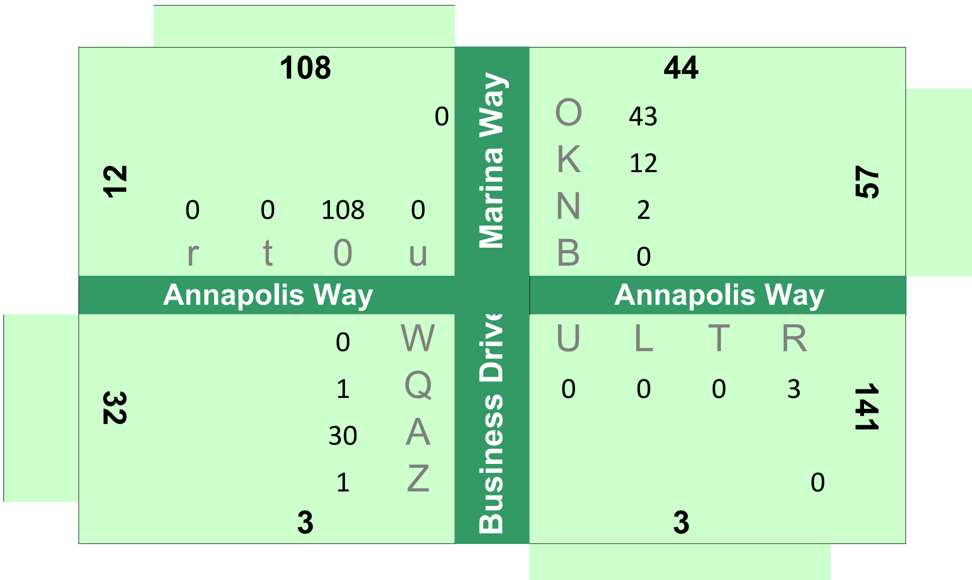
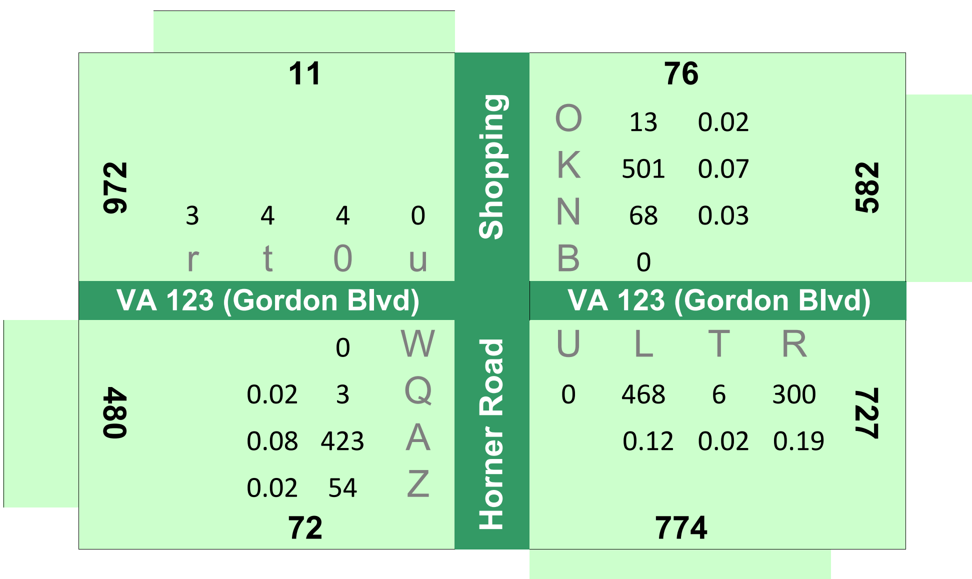


Figure 4: 2050 AM and PM Peak Hour Volumes

ATTACHMENT
Excerpt from Computation Spreadsheet

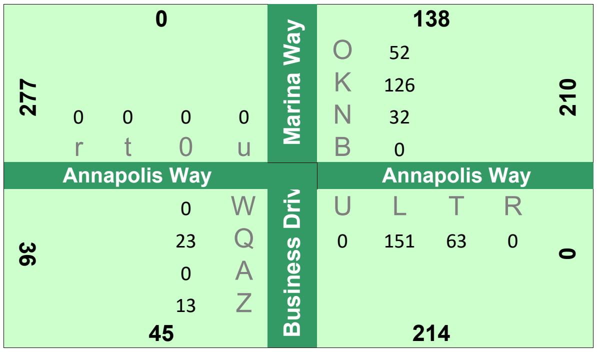
Existing Volume AM





2050 No-Build AM IN

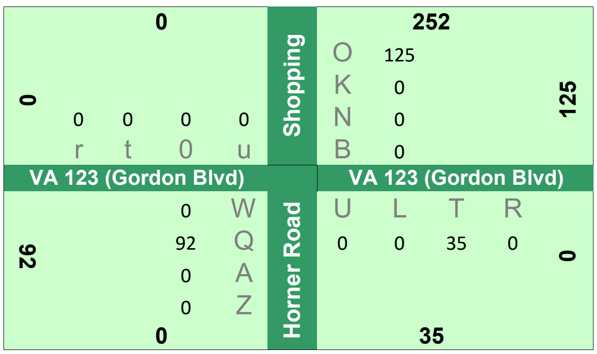
7400 in
AM Pk Hour =7.5% of ADT
555 trips in



Origin	Select Link Percentage
US 1 SB	15%
US 1 NB	45%
VA 123 EB	33%
Horner NB	7%

Destination*	Percentage
Annapolis Way WB	60%
Existing Marina Way	25%
Marina Way	15%

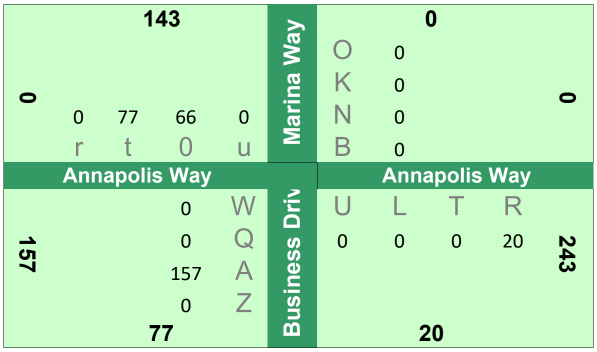
*Based on North Woodbridge Plan

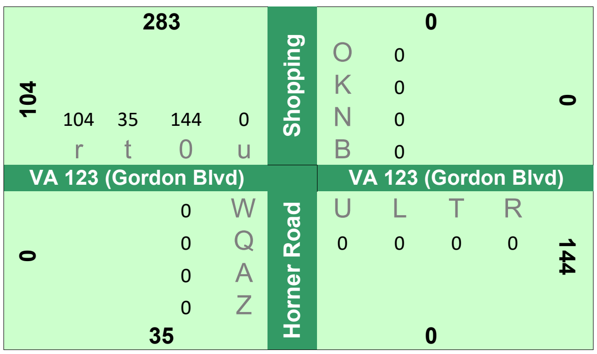


Some trips (93) use Annapolis

2050 No-Build AM OUT

7500 out
AM Pk Hour =7.5% of ADT
570 trips out



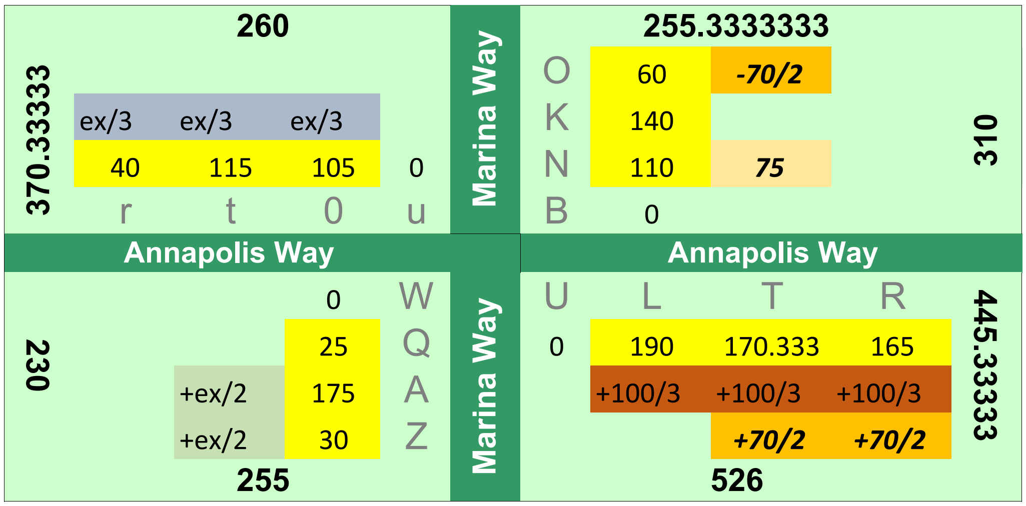


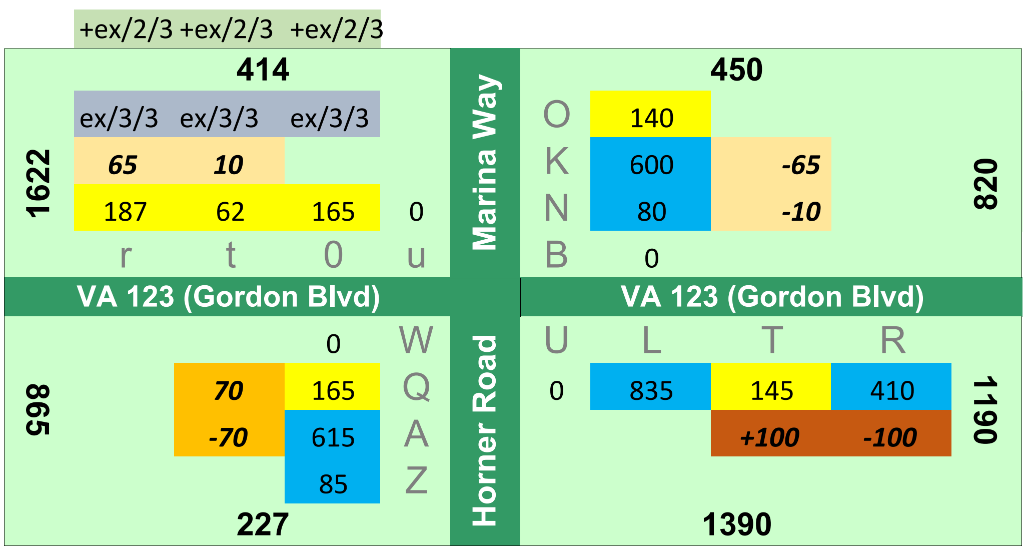
Destination	Select Link Percentage
US 1 SB	44%
US 1 NB	24%
VA 123 WB	26%
Horner SB	6%

Origin*	Percentage
Annapolis Way WB	60%
Existing Marina Way	25%
Marina Way	15%

*Based on North Woodbridge Plan

2050 Build AM

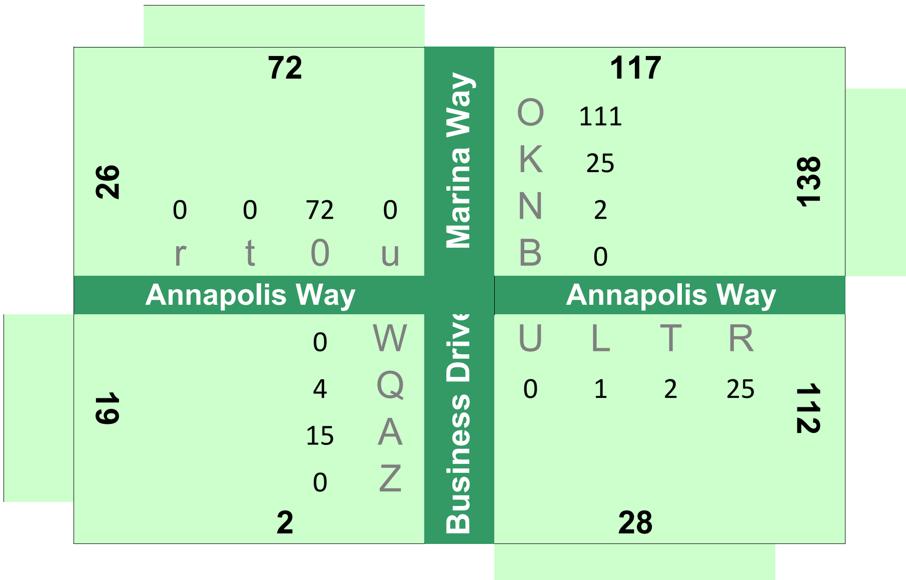


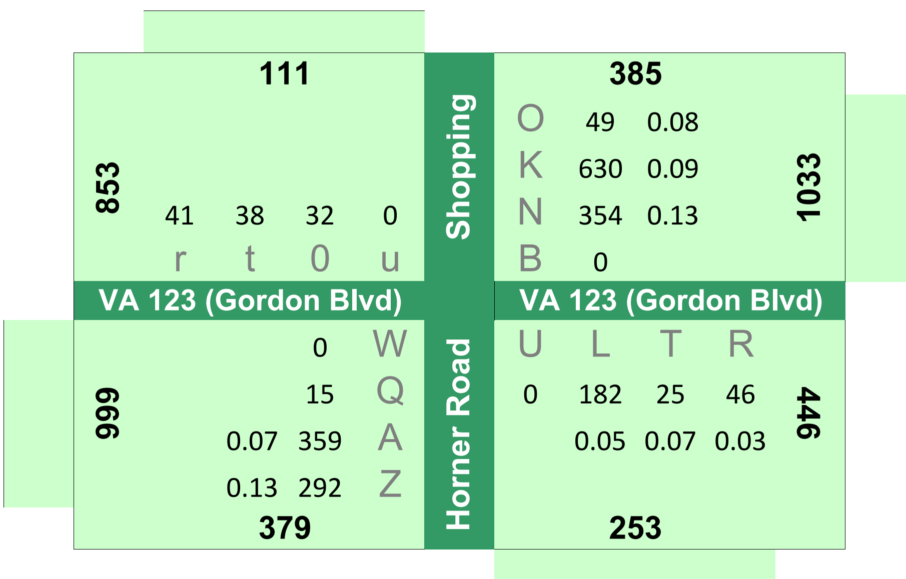


KEY

(yellow)	SLA in + SLA out + Existing
(blue)	2050 build/NoBuild x existing turning distribtion

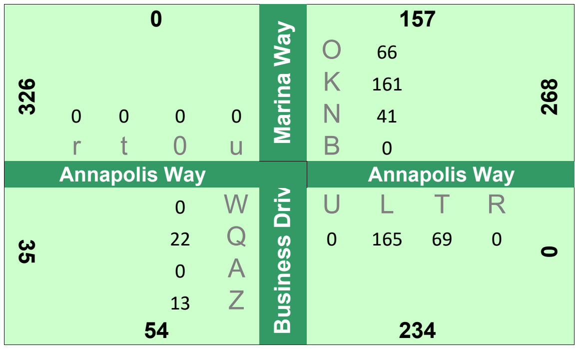
Existing Volume PM





2050 No Build PM IN

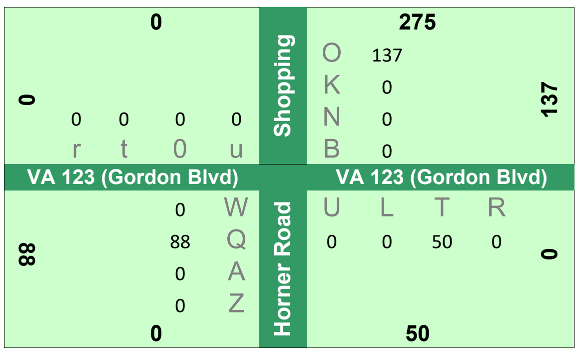
7400 in
PM Pk Hour =8.5% of ADT
630 trips in



Origin	Select Link Percentage
US 1 SB	21%
US 1 NB	44%
VA 123 EB	28%
Horner NB	7%

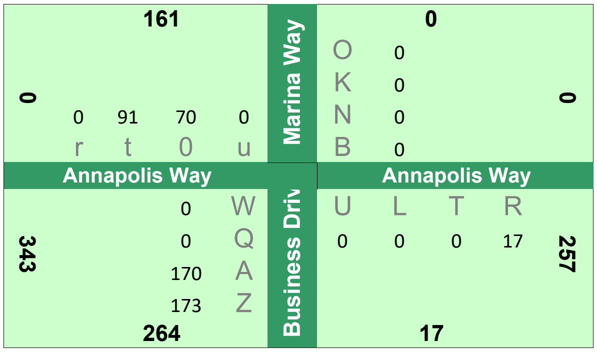
Destination*	Percentage
Annapolis Way WB	60%
Existing Marina Way	25%
Marina Way	15%

*Based on North Woodbridge Plan



2050 No Build PM OUT

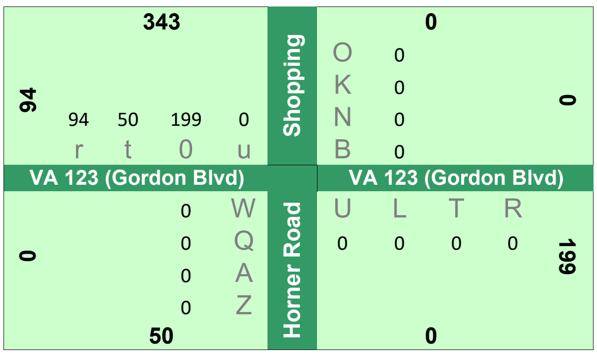
7500 out
PM Pk Hour =8.5% of ADT
640 trips out



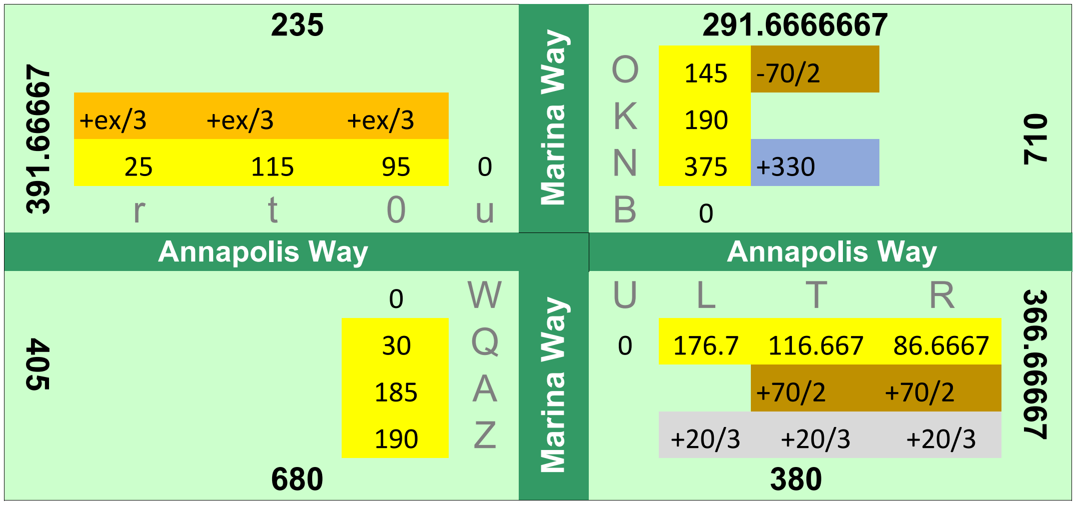
Destination	Select Link Percentage
US 1 SB	54%
US 1 NB	17%
VA 123 WB	21%
Horner SB	8%

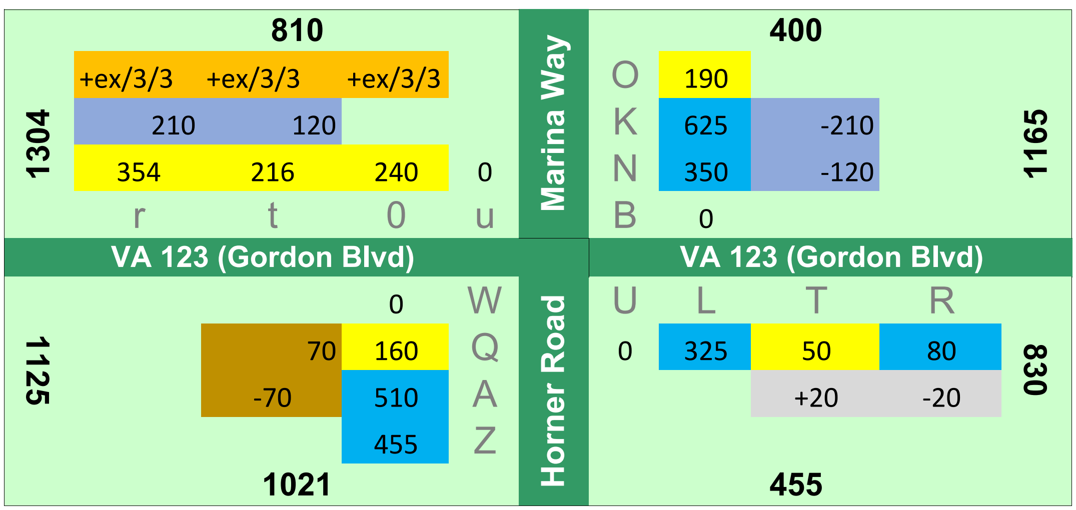
Origin*	Percentage
Annapolis Way WB	60%
Existing Marina Way	25%
Marina Way	15%

*Based on North Woodbridge Plan



2050 Build PM



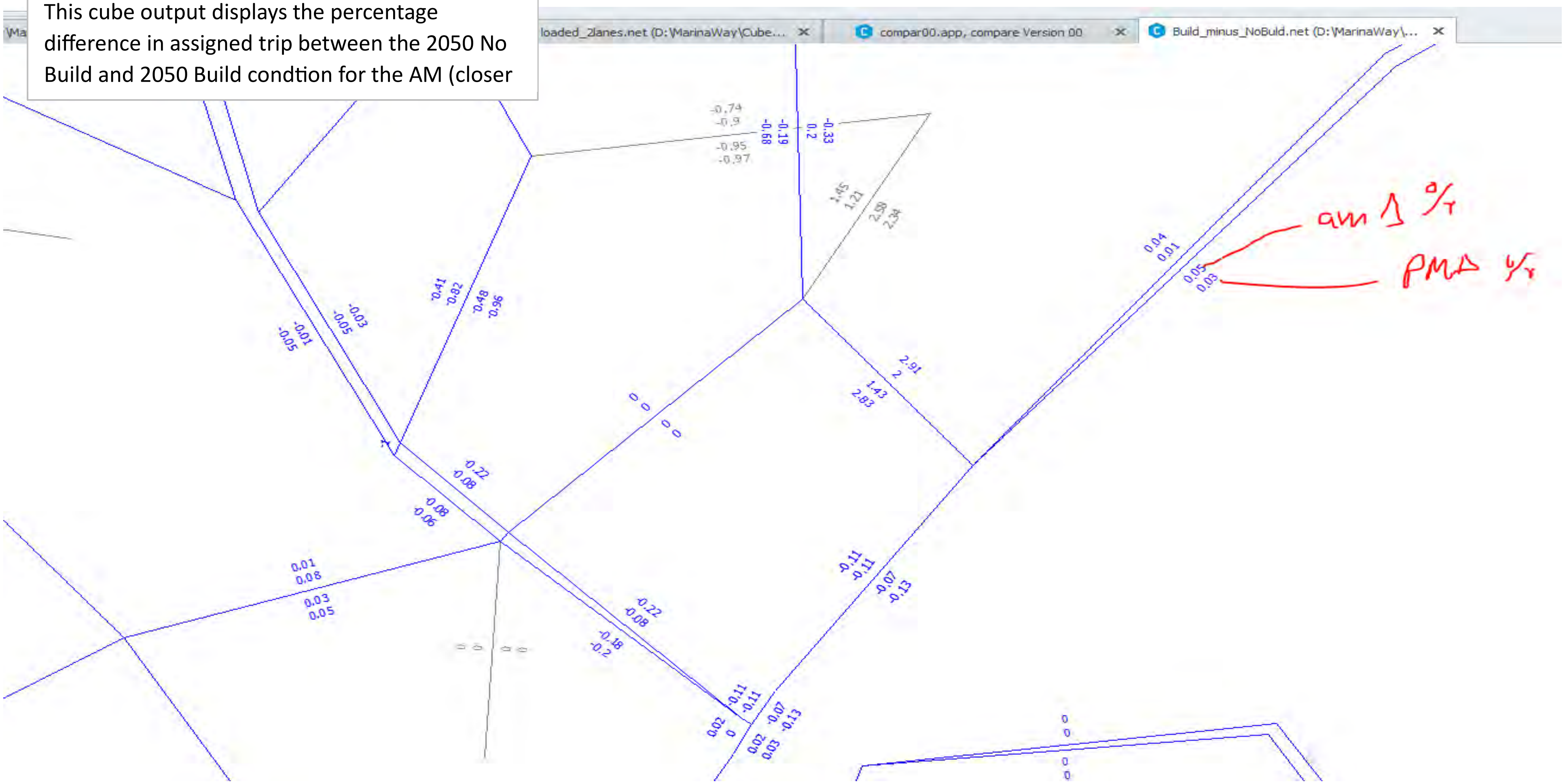


KEY

SLA in + SLA out + Existing

2050 build x existing turning distribtion

This cube output displays the percentage difference in assigned trip between the 2050 No Build and 2050 Build condtion for the AM (closer



Appendix C

AM VJuST Worksheets

VDOT Junction Screening Tool

Input Worksheet

Project Title:	*Marina Way Extension*
E-W Facility:	*Marina Way*
N-S Facility:	*Annapolis Way*
Date:	*November 4, 2023*

Traffic Volume Demand

Direction	Volume (veh/hr)				Truck Percent (%)
	U-Turn / Left		Through	Right	
Eastbound	190		170	165	2.00%
Westbound	105		115	40	2.00%
Northbound	110		140	60	2.00%
Southbound	25		175	30	2.00%
Adjustment Factor	0.80	0.95		0.85	
Suggested	**U - 0.8**	**L - 0.95**		**0.85**	
Truck to PCE Factor			**Suggested = 2.00**		2.00
Critical Lane Volume			1600		

Equivalent Passenger Car Volume

	Volume (pc/hr)			
	U-Turn / Left	Through	Right	Approach
Eastbound	194	173	168	535
Westbound	107	117	41	265
Northbound	112	143	61	316
Southbound	26	179	31	236

Notes:

Left-turn Adjustment Factor	*Conversion of left-turning vehicles to equivalent through vehicles*
Right-turn Adjustment Factor	*Conversion of right-turning vehicles to equivalent through vehicles*
U-turn Adjustment Factor	*Conversion of U-turning vehicles to equivalent through vehicles*
Truck to PCE Factor	*1 truck = X Passenger Car Equivalents*
Critical Lane Volume Sum Limit	*Saturation value for critical lane volume sum at an intersection*

VDOT Junction Screening Tool

Possible Configurations

Indicate with a "Y" or "N" if each intersection or interchange configuration should or should not be considered. Use the information links for guidance. Then, click the "Show/Hide Configurations button" to hide the worksheets for the configurations that will not be considered.

#	Intersections	Information	Consider?	Justification
	Signalized Intersections			
1	Conventional	-	Y	
2	Bowtie	Link	N	Insufficient intersection spacing
3	Center Turn Overpass	Link	N	Not feasible for roadway facility type
4	Continuous Green-T	Link	N	Not feasible for roadway facility type
5	Echelon	Link	N	Not feasible for roadway facility type
6	Full Displaced Left Turn	Link	N	Not feasible for roadway facility type
7	Median U-Turn	Link	N	Unable to accommodate traffic patterns
8	Partial Displaced Left Turn	Link	N	Not feasible for roadway facility type
9	Partial Median U-Turn	Link	N	Unable to accommodate traffic patterns
10	Quadrant Roadway N-E	Link	N	Right-of-way restrictions identified
11	Quadrant Roadway N-W	Link	N	Right-of-way restrictions identified
12	Quadrant Roadway S-E	Link	N	Right-of-way restrictions identified
13	Quadrant Roadway S-W	Link	N	Right-of-way restrictions identified
14	Restricted Crossing U-Turn	Link	N	Unable to accommodate traffic patterns
15	Single Loop	Link	N	Right-of-way restrictions identified
16	Split Intersection	Link	N	Right-of-way restrictions identified
17	Thru-Cut	Link	N	Unable to accommodate traffic patterns
	Unsignalized Intersections			
18	50 Mini Roundabout	Link	Y	
19	75 Mini Roundabout	Link	Y	
20	Roundabout	Link	Y	
21	Two-Way Stop Control	-	Y	
#	**Interchanges**	**Information**	**Consider?**	**Justification**
22	Traditional Diamond	Link	N	Not feasible for roadway facility type
23	Contraflow Left	Link	N	Not feasible for roadway facility type
24	Displaced Left Turn	Link	N	Not feasible for roadway facility type
25	Diverging Diamond	Link	N	Not feasible for roadway facility type
26	Double Roundabout	Link	N	Not feasible for roadway facility type
27	Michigan Urban Diamond	Link	N	Not feasible for roadway facility type
28	Partial Cloverleaf	Link	N	Not feasible for roadway facility type
29	Single Point	Link	N	Not feasible for roadway facility type
30	Single Roundabout	Link	N	Not feasible for roadway facility type

VDOT Junction Screening Tool

Directional Questions and Base Lane Configurations

Before entering a base number of through lanes for each direction, answer all applicable directional question for each intersection or interchange configuration selected for consideration. Navigate to the lane configuration worksheet for example diagrams, if provided.

Intersections	Question	Direction
Bowtie	N/A	N/A
Continuous Green-T	N/A	N/A
Echelon	N/A	N/A
Median U-Turn	N/A	N/A
Partial Displaced Left Turn	N/A	N/A
Partial Median U-Turn	N/A	N/A
Restricted Crossing U-Turn	N/A	N/A
Single Loop	N/A	N/A
Split Intersection	N/A	N/A
Thru-Cut	N/A	N/A
Interchanges	**Question**	**Direction**
All	N/A	N/A

Base Number of Through Lanes

Enter a base number of through lanes for each direction. The number of through lanes entered will populate on each non-roundabout lane configuration worksheet. This tool also allows the user to enter the number of through lanes on the lane configuration worksheets directly. This base number may be overwritten on individual lane configuration worksheets. Turn lanes, shared lanes, and channelized lanes must still be entered in each lane configuration worksheet.

Eastbound	1
Westbound	1
Northbound	2
Southbound	2

VDOT Junction Screening Tool

Results Worksheet

VJuST
VDOT Junction Screening Tool

General Information	
Project Title:	Marina Way Extension
EW Facility:	Marina Way
NS Facility:	Annapolis Way
Date:	November 4, 2023

Volumes (veh/hr)	U-Turn / Left	Through		Right
Eastbound	190	170	190	165
Westbound	105	115	190	40
Northbound	110	140	190	60
Southbound	25	175	190	30

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

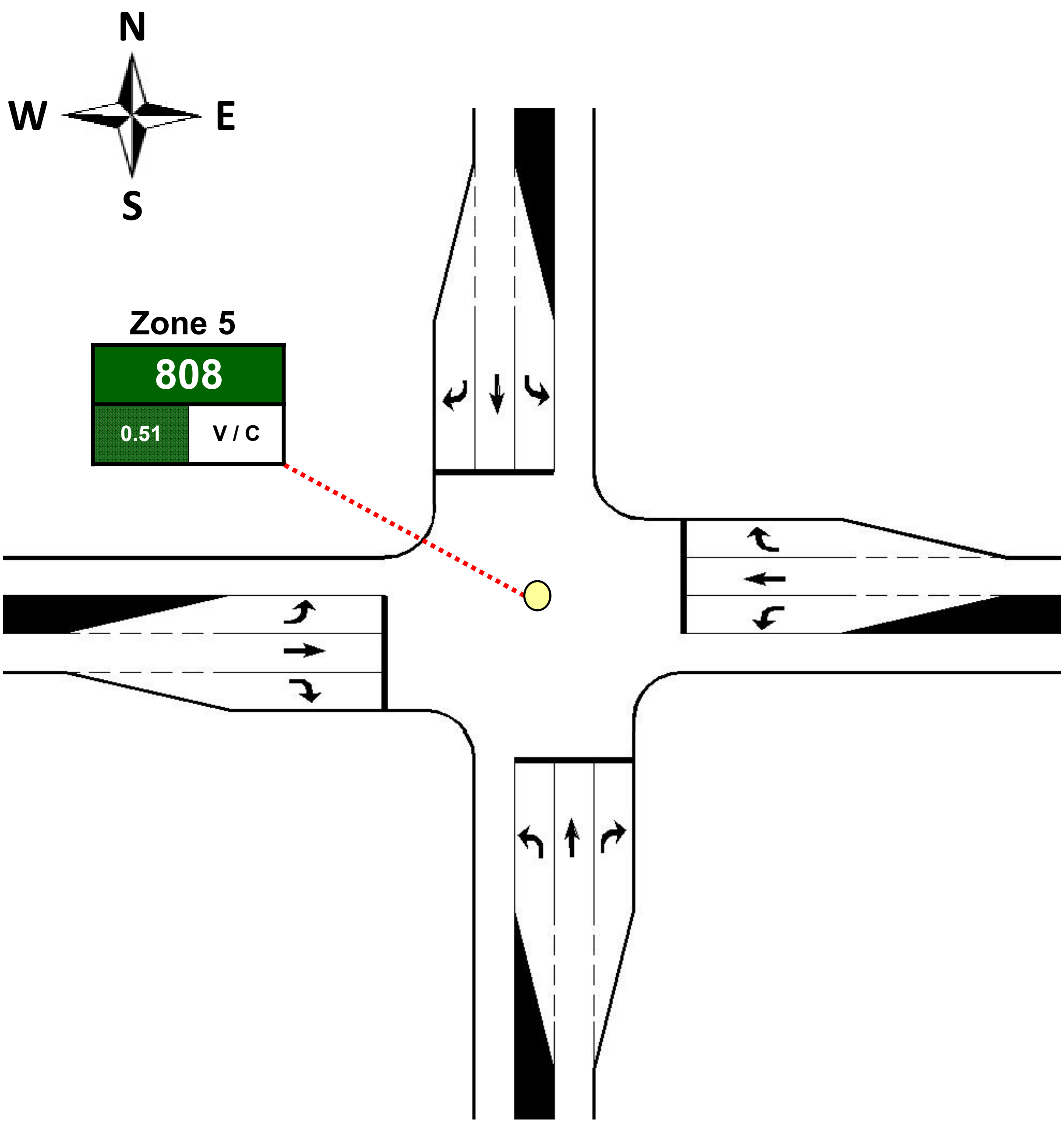
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	**Dir**	**Maximum V/C**	**Accommodation Compared to Conventional**	**Weighted Total Conflict Points**	**Planning Level Cost Category**	
Conventional	-	0.51		48	$	
50 Mini Roundabout	-	0.78		8	$	
75 Mini Roundabout	-	0.74		8	$	
Roundabout	-	0.37		8	$$	
Two-Way Stop Control	-	0.96		48	$	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Conventional

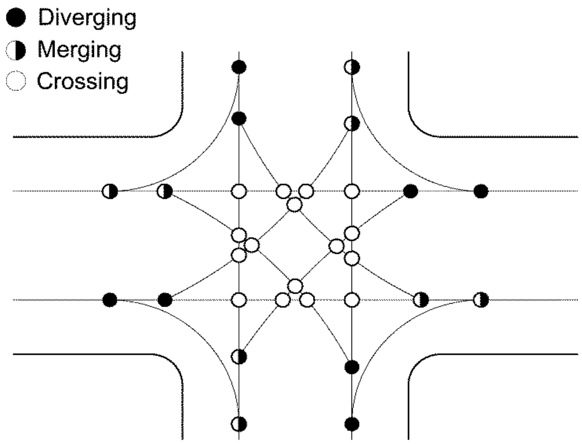
DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	***Critical Lane Volume Sum***			
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:		0.51	
Date:	*November 4, 2023*				



Note: This diagram does not reflect the actual lane configuration of the intersection

Safety - Conflict Point Diagram



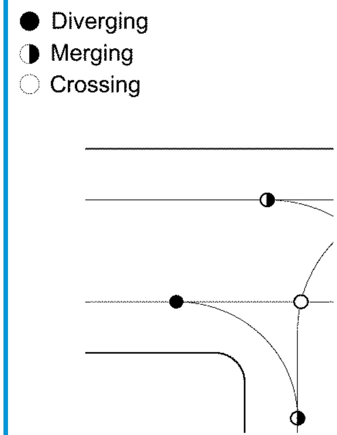
Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

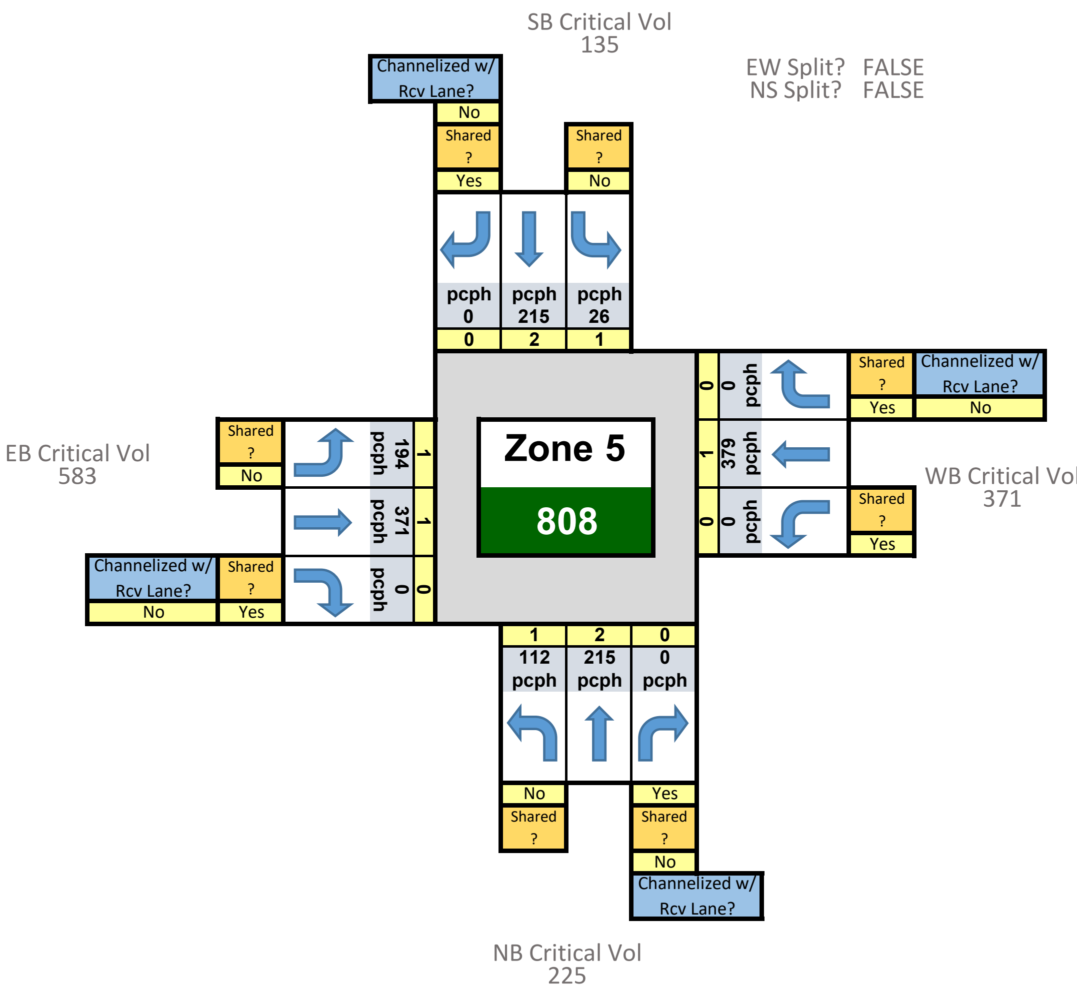
Safety - Cor



Conventional

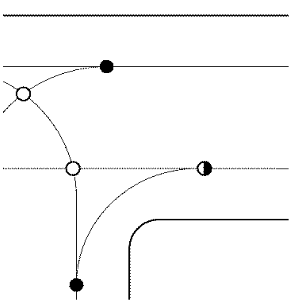
DATA INPUT AND CONFIGURATION

Enter the lane configurations in the yellow cells.



Back to Results

ıflict Point Diagram (Three Legs)



Conflict Type	Count
Crossing	3
Merging	3
Diverging	3
Total	**9**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

12

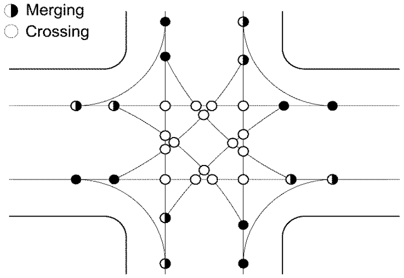
Planning Level Cost

$ $ $ $ $ **1**

- Are new lanes and/or pavement needed? **No**
- Cost category 1 if no new pavement needed, else cost cateogry 2.
- Assumes existing two-way stop contol or all-way stop control

Safety - Conflict Point Diagram

- Diverging
- Merging
- Crossing



Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

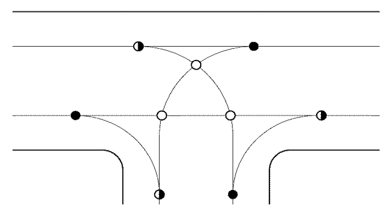
Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

Safety - Conflict Point Diagram (Three Legs)

- Diverging
- Merging
- Crossing



Conflict Type	Count
Crossing	3
Merging	3
Diverging	3
Total	**9**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

12

Planning Level Cost

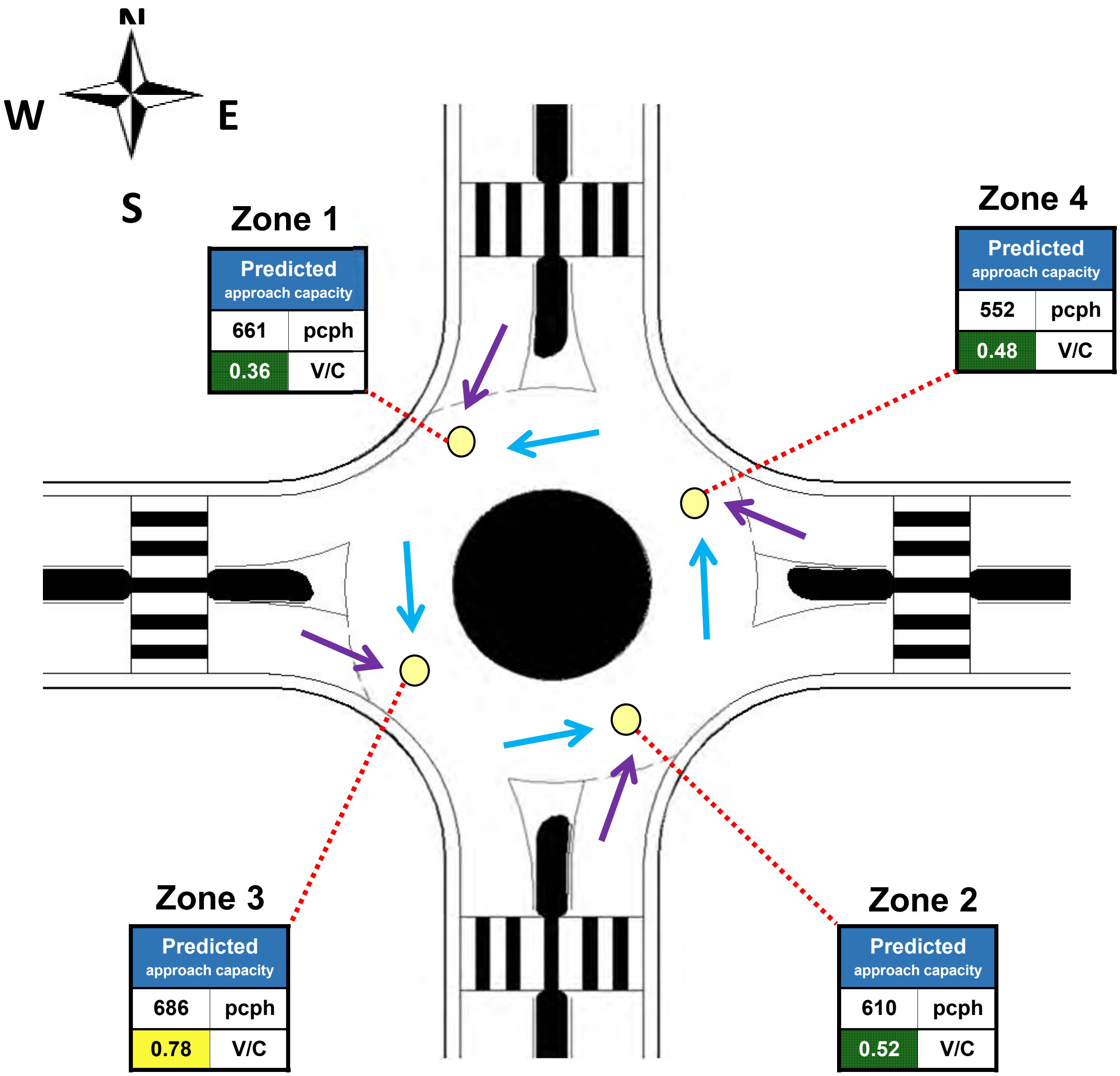
$ $ $ $ $ **1**

- Are new lanes and/or pavement needed? **No**
- Cost category 1 if no new pavement needed, else cost cateogry 2.
- Assumes existing two-way stop contol or all-way stop control

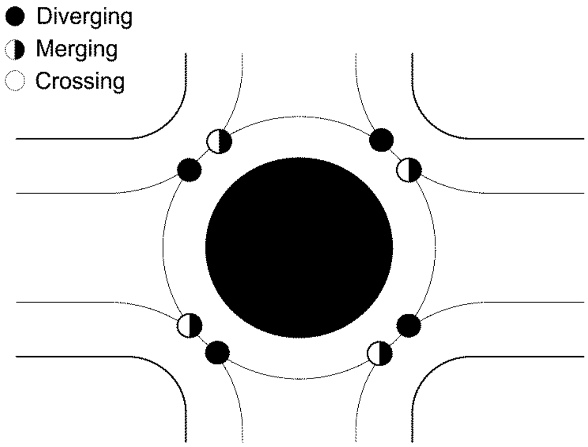
50' ICD Mini-Roundabout

DESIGN AND RESULTS

		Critical Lane Volume Sum			
Project Name:	*Marina Way Extension*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
EW Facility:	*Marina Way*	VOLUME / CAPACITY RATIO:	0.78		
NS Facility:	*Annapolis Way*				
Date:	*November 4, 2023*				



Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

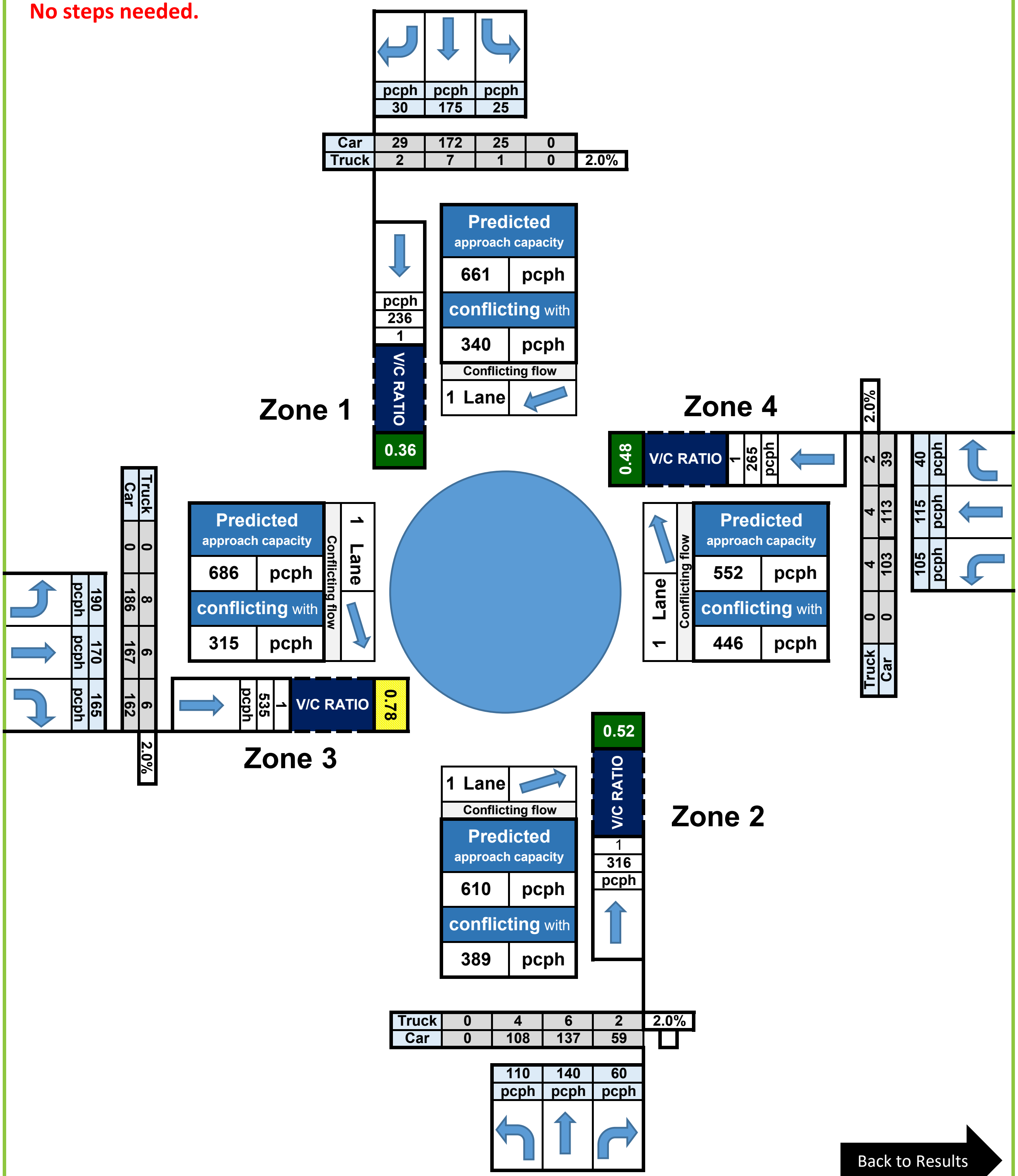
Assu

● This worksheet does not u calculations are based on the *Roundabout Capacity in the Journal of Transportation En*

50' ICD Mini-Roundabout

DATA INPUT AND CONFIGURATION

No steps needed.



Back to Results

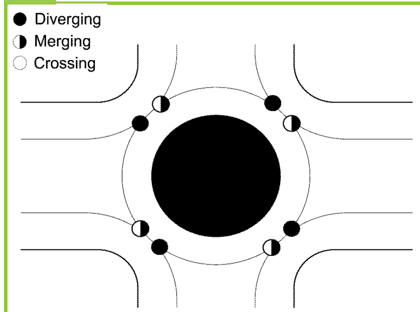
mptions

se the CLV methodology. The
e article *Determination of Mini-*
United States , published in the
gineering .

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes conversion from two-way stop control or all-way stop control.

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

● This worksheet does not use the CLV methodology. The calculations are based on the article *Determination of Mini-Roundabout Capacity in the United States* , published in the *Journal of Transportation Engineering* .

Planning Level Cost $ $ $ $ $ 1

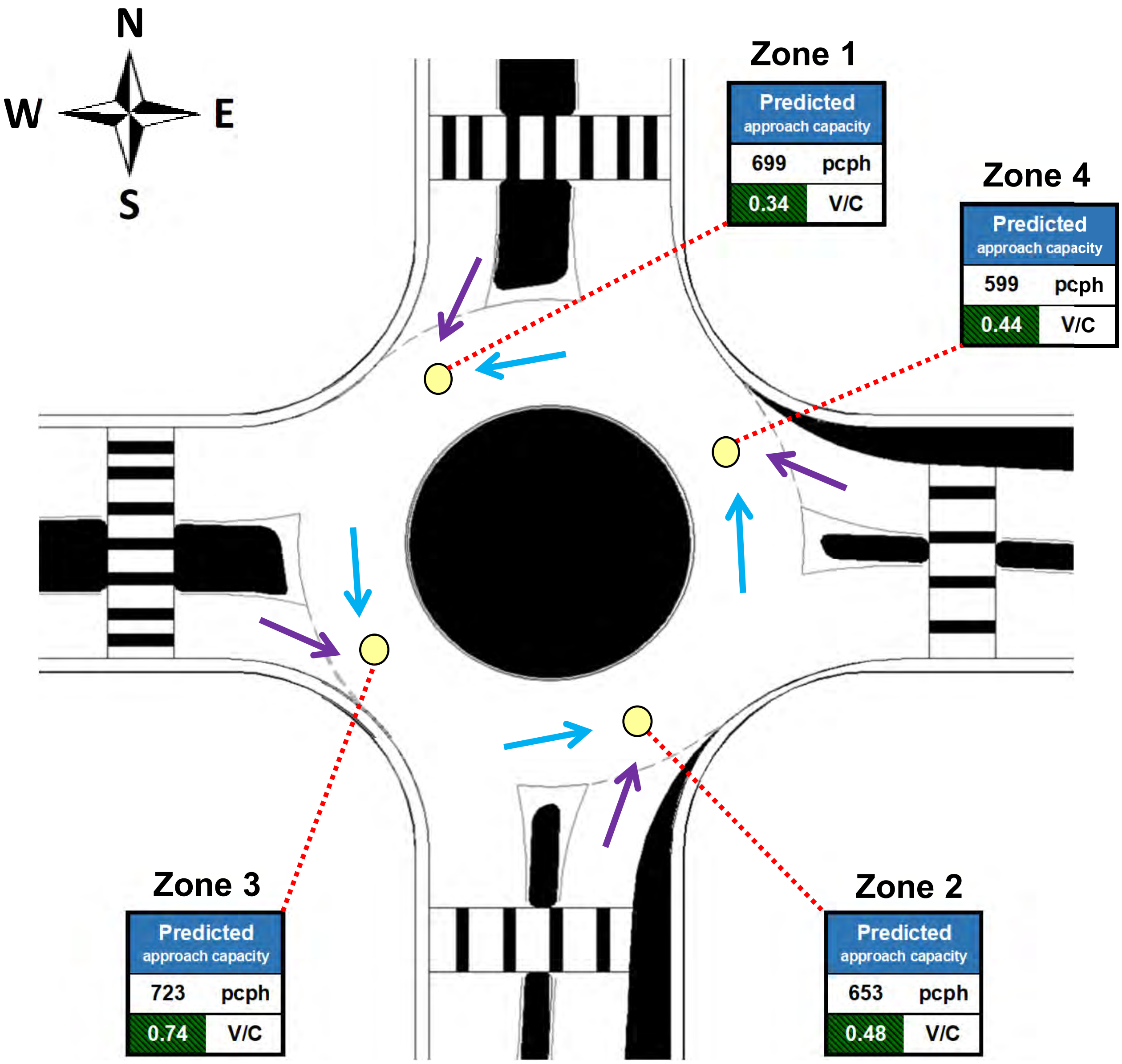
● Cost Category 1

● Assumes conversion from two-way stop control or all-way stop control.

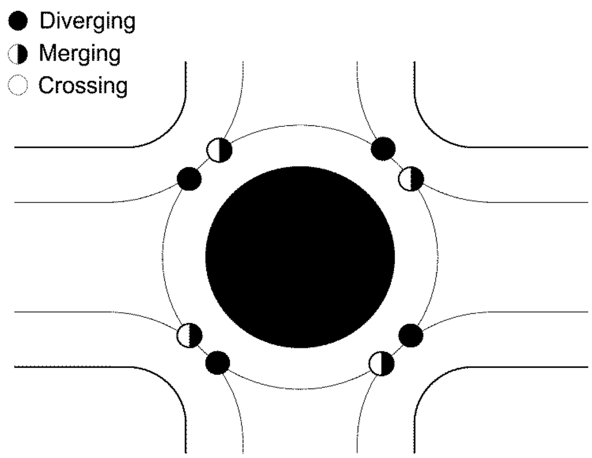
75' ICD Mini-Roundabout

DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	***Critical Lane Volume Sum***			
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:	0.74		
Date:	*November 4, 2023*				



Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

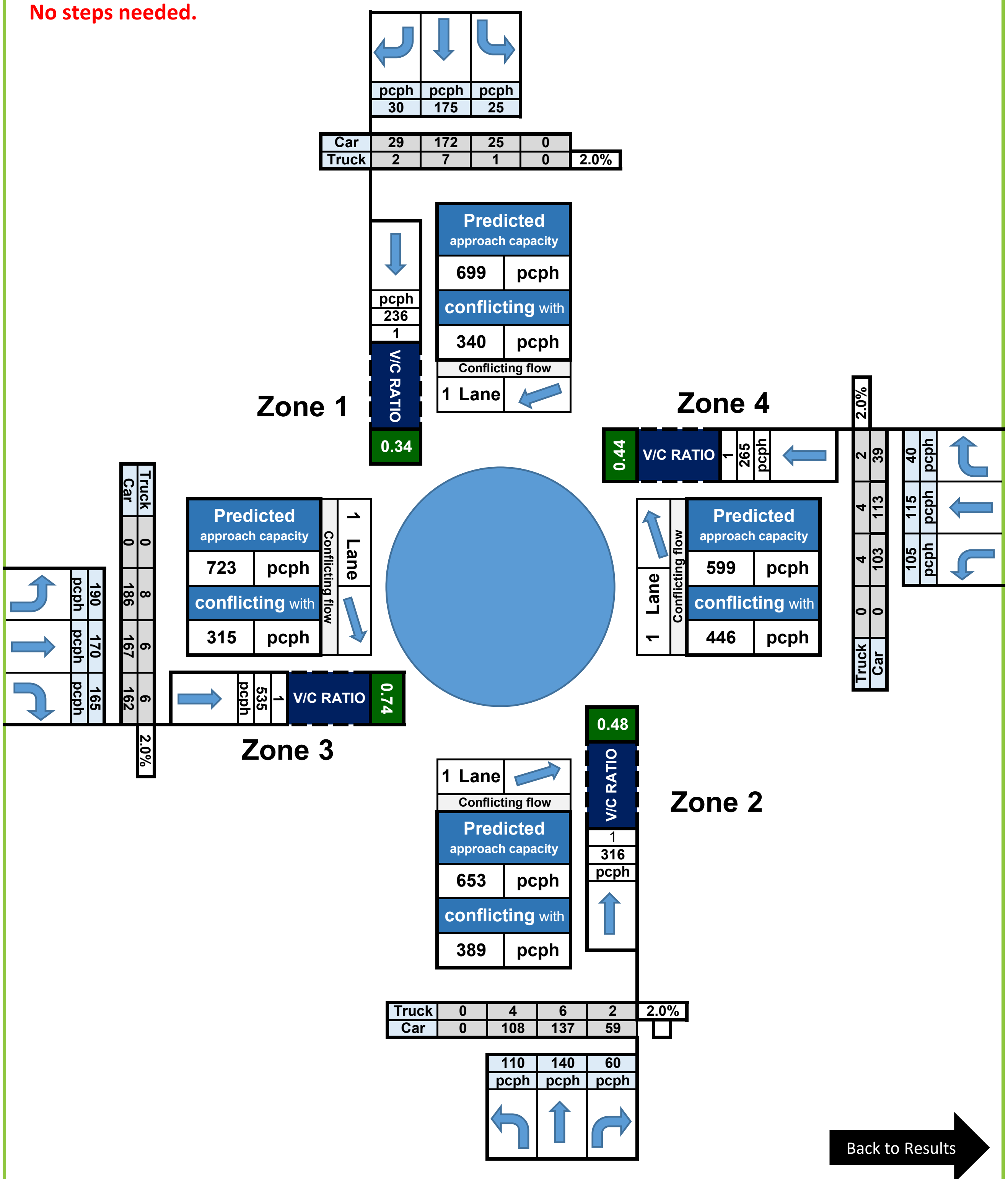
Assu

● This worksheet does not u
calculations are based on the
Roundabout Capacity in the
Journal of Transportation En

75' ICD Mini-Roundabout

DATA INPUT AND CONFIGURATION

No steps needed.



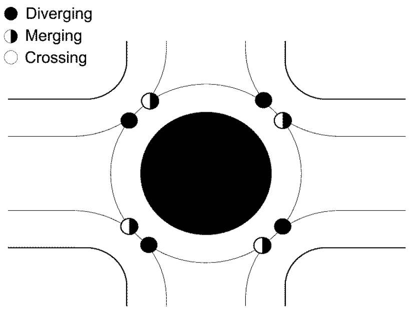
mptions

se the CLV methodology. The
e article *Determination of Mini-*
United States , published in the
gineering .

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes conversion from two-way stop control or all-way stop control.

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

● This worksheet does not use the CLV methodology. The calculations are based on the article *Determination of Mini-Roundabout Capacity in the United States* , published in the *Journal of Transportation Engineering* .

Planning Level Cost $ $ $ $ $ 1

● Cost Category 1

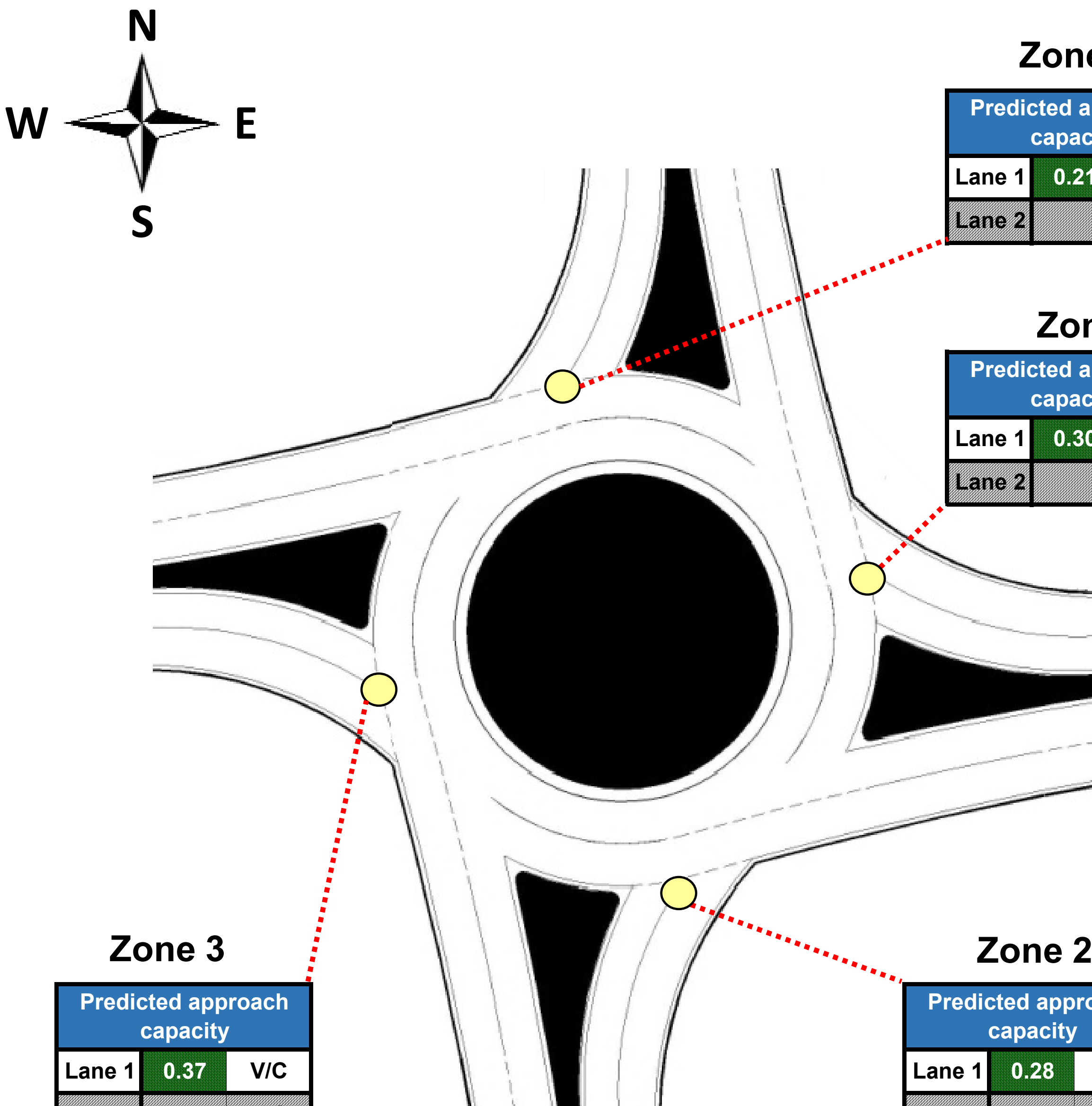
● Assumes conversion from two-way stop control or all-way stop control.

Roundabout

DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	
EW Facility:	*Marina Way*	
NS Facility:	*Annapolis Way*	
Date:	*November 4, 2023*	

Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600
VOLUME / CAPACITY RATIO:	0.37		



Zone 1

Predicted approach capacity		
Lane 1	0.21	V/C
Lane 2		V/C

Zone 4

Predicted approach capacity		
Lane 1	0.30	V/C
Lane 2		V/C

Zone 3

Predicted approach capacity		
Lane 1	0.37	V/C
Lane 2		V/C

Zone 2

Predicted approach capacity		
Lane 1	0.28	V/C
Lane 2		V/C

Roundabout

DATA INPUT AND CONFIGURATION

Enter the lane configurations in the yellow cells.

pcph	pcph	pcph
31	179	26

41	117	107
pcph	pcph	pcph

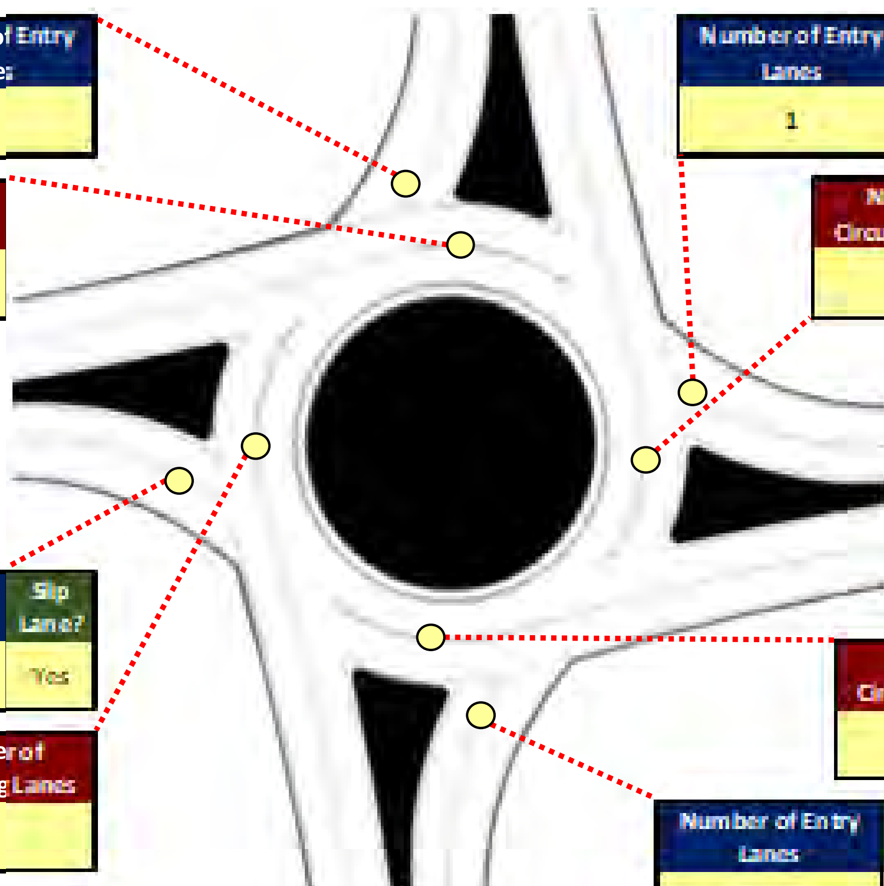
SB

Slip Lane?	Number of Entry Lanes
Yes	1

Number of Circulating Lanes
1

Number of Entry Lanes	Slip Lane?
1	No

Number of Circulating Lanes
1



EB

WB

Number of Entry Lanes	Slip Lane?
1	Yes

Number of Circulating Lanes
1

Number of Circulating Lanes
1

Number of Entry Lanes	Slip Lane?
1	Yes

NB

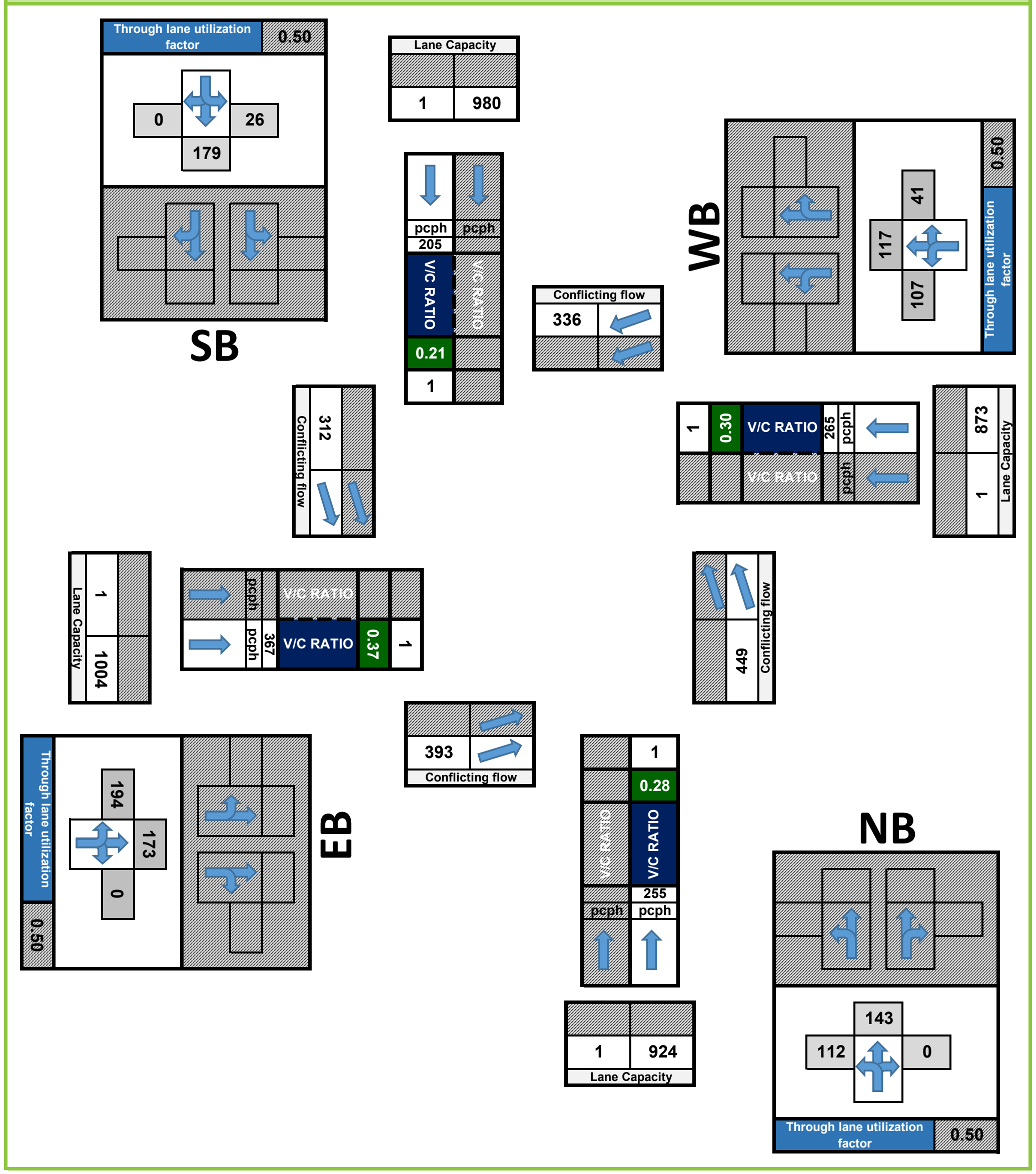
194	173	168
pcph	pcph	pcph

112	143	61
pcph	pcph	pcph

Back to Results

Roundabout

CAPACITY CALCULATIONS

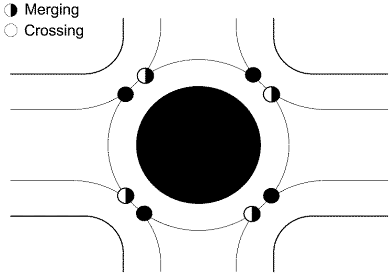


EQUATION: A x exp(-B x Q)

Number of Entry Lanes	Number of Circulating Lanes	Lane	A	B
1	1	-	1380	0.00102
1	2	-	1420	0.00085
2	1	Left	1420	0.00091
2	1	Right	1420	0.00091
2	2	Left	1350	0.00092
2	2	Right	1420	0.00085

Safety - Conflict Point Diagram

● Diverging
◑ Merging
○ Crossing



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

● The number of circulating lanes in one quadrant is assumed to be equal to the number of exiting lanes in the next quadrant.

● The roundabout is limited to a maximum of two entry lanes and two circulating lanes.

● All left-turning vehicles are assumed to stay in the innermost lane until exiting the roundabout.

● This worksheet does not use the CLV methodology. The calculations are based on the *HCM 6th Edition* .

Planning Level Cost $ $ $ $ $ 2

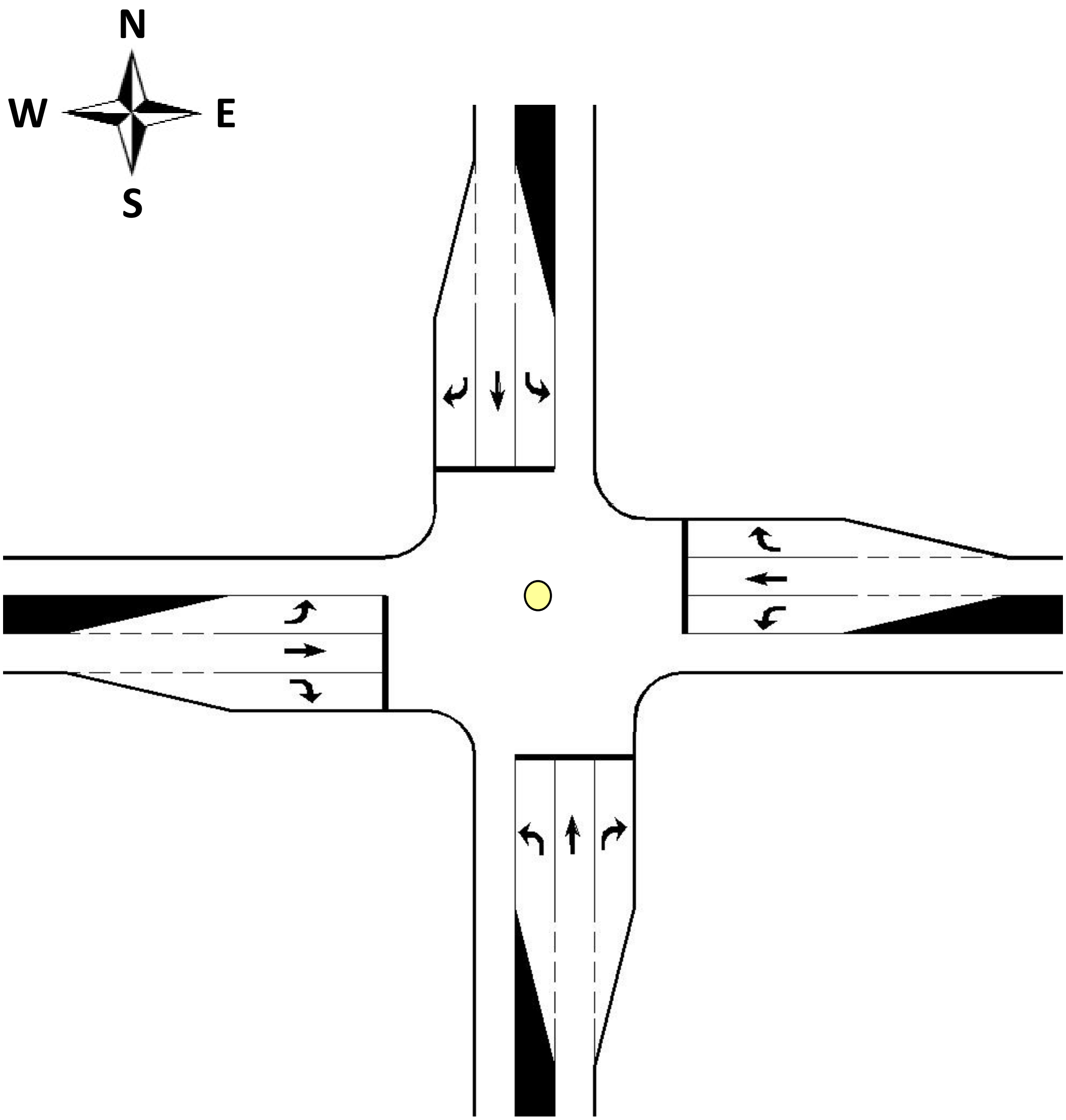
● Cost Category 2

● Assumes conversion from two-way stop control or all-way stop control.

Two-Way Stop Control (TWSC)

DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	***Critical Lane Volume Sum***			
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:		**0.96**	
Date:	*November 4, 2023*				



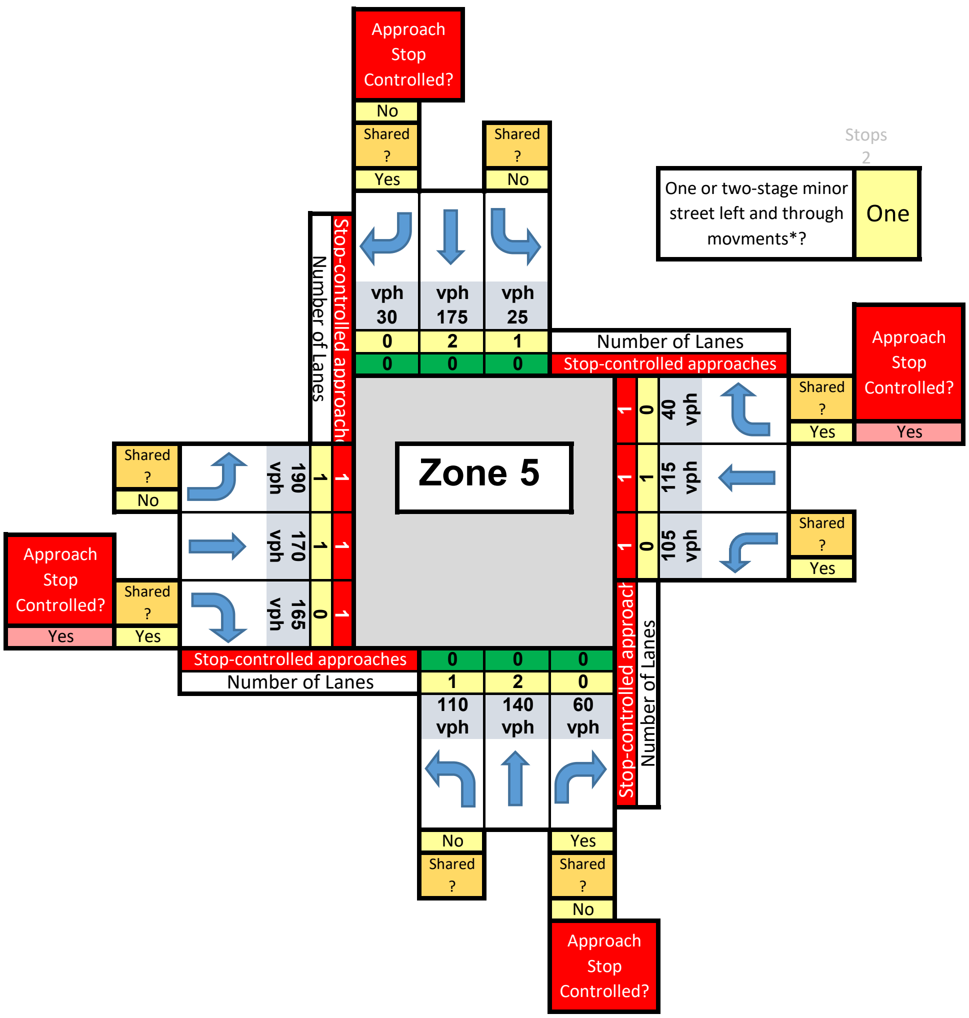
Note: This diagram does not reflect the actual lane configuration of the intersection

Two-Way Stop Control (TWSC)

DATA INPUT AND CONFIGURATION

Step 1: Identify which approaches are stop-controlled by selecting "Yes" from the drop-down box.

Step 2: Enter the lane configurations in the yellow cells.



Back to Results

Two-Way Stop Control (TWSC)

HCM 6 CALCULATIONS

Priority	MVMT	Rank
7	EBL	4
8	EBT	3
9	EBR	2
10	WBL	4
11	WBT	3
12	WBR	2
4	NBL	2
5	NBT	1
6	NBR	1
1	SBL	2
2	SBT	1
3	SBR	1

MAJOR	MINOR
NB	EB
SB	WB

Major street lanes	4
M1 Shared?	FALSE
M4 Shared?	FALSE

Priority	Rank	Flow Rates	Lanes	Shared?	Stop controlled?	Truck %
1	2	25	1	No		0.02
4	2	110	1	No		0.02
7	4	190	1	No	Yes	0.02
8	3	170	1		Yes	0.02
9	2	165	0	Yes	Yes	0.02
10	4	105	0	Yes	Yes	0.02
11	3	115	1		Yes	0.02
12	2	40	0	Yes	Yes	0.02
2	1	175	2			0.02
3	1	30	0	Yes	No	0.02
5	1	140	2			0.02
6	1	60	0	Yes	No	0.02

Conflicting Flows	
$v_{c,1}$	200.00
$v_{c,4}$	205.00
$v_{c,7}$	587.50
$v_{c,8}$	660.00
$v_{c,9}$	102.50
$v_{c,10}$	612.50
$v_{c,11}$	645.00
$v_{c,12}$	100.00

$v_{c,I,7}$	240.00
$v_{c,II,7}$	347.50
$v_{c,I,8}$	240.00
$v_{c,II,8}$	420.00
$v_{c,I,10}$	390.00
$v_{c,II,10}$	222.50
$v_{c,I,11}$	390.00
$v_{c,II,11}$	255.00

Critical Headways	
$t_{c,1}$	4.14
$t_{c,4}$	4.14
$t_{c,7}$	7.54
$t_{c,8}$	6.54
$t_{c,9}$	6.94
$t_{c,10}$	7.54
$t_{c,11}$	6.54
$t_{c,12}$	6.94

$t_{c,I,7}$	6.54
$t_{c,II,7}$	6.54
$t_{c,I,8}$	5.54
$t_{c,II,8}$	5.54
$t_{c,I,10}$	6.54
$t_{c,II,10}$	6.54
$t_{c,I,11}$	5.54
$t_{c,II,11}$	5.54

a	0.91

*Assumption:	One storage space in median (n_m = 1) for two-stage turns

Saturation Flow Rates	
Through	1800
Right	1500

Follow-Up Headways	
$t_{f,1}$	2.22
$t_{f,4}$	2.22
$t_{f,7}$	3.52
$t_{f,8}$	4.02
$t_{f,9}$	3.32
$t_{f,10}$	3.52
$t_{f,11}$	4.02
$t_{f,12}$	3.32

Potential Capacities	
$c_{p,1}$	1369.52
$c_{p,4}$	1363.72
$c_{p,7}$	392.78
$c_{p,8}$	381.60
$c_{p,9}$	932.64
$c_{p,10}$	376.88
$c_{p,11}$	389.26
$c_{p,12}$	936.08

Two-Stage Potential Capacities	
$c_{p,I,7}$	741.94
$c_{p,II,7}$	641.63
$c_{p,I,8}$	705.62
$c_{p,II,8}$	587.82
$c_{p,I,10}$	605.67
$c_{p,II,10}$	759.63
$c_{p,I,11}$	606.13
$c_{p,II,11}$	695.05

y_7	2.88
y_8	2.04
y_{10}	2.16
$y11$	0.93

Movement Capacities	
$c_{m,1}$	1369.52
$c_{m,4}$	1363.72
$c_{m,7}$	260.88
$c_{m,8}$	344.42
$c_{m,9}$	932.64
$c_{m,10}$	176.98
$c_{m,11}$	351.33
$c_{m,12}$	936.08

Two-Stage Movement Capacities	
$c_{m,I,7}$	728.40
$c_{m,II,7}$	448.14
$c_{m,I,8}$	692.74
$c_{m,II,8}$	540.41
$c_{m,I,10}$	556.82
$c_{m,II,10}$	463.19
$c_{m,I,11}$	557.24
$c_{m,II,11}$	682.37

$c_{T,7}$	348.08
$c_{T,8}$	419.07
$c_{T,10}$	271.42
$c_{T,11}$	418.00

Mvmt 1, excl left		$p_{0,1}$	0.98
Mvmt 4, excl left		$p_{0,4}$	0.92

Mvmt 1, shared left		$p^*_{0,1}$	0.98
Mvmt 4, shared left		$p^*_{0,4}$	0.91

Mvmt 7, 4-leg		p''_7	0.607
Mvmt 10, 4-leg		p''_{10}	0.457

$x_{1i,1+2}$	0.12
$x_{4i,1+2}$	0.12

One Stage	f_8	0.90
	f_{11}	0.90
	f_7	0.00
	f_{10}	0.00

Two Stage	$f_{I,8}$	0.98
	$f_{I,11}$	0.92
	$f_{I,7}$	0.98
	$f_{I.10}$	0.92

Shared Movement Capacities	
0	499.62
1	
1	
1	269.89
1	
1	

Single-Stage Movement Capacities	
$c_{m,7}$	260.88
$c_{m,8}$	344.42
$c_{m,10}$	176.98
$c_{m,11}$	351.33

$p_{0,8}$	0.51
$p_{0,11}$	0.67

p'_7	0.69
p'_{10}	0.57

$f_{II,8}$	0.92
$f_{II,11}$	0.98
$f_{II,7}$	0.70
$f_{II.10}$	0.61

Movement Capacities	
1	1369.52
2	3600.00
3	1500.00
4	1363.72
5	3600.00
6	1500.00
7	260.88
8-9	499.62
--	--
--	--
10-11-12	269.89
--	--

$p_{0,9}$	0.82
$p_{0,12}$	0.96

$f_{p,7}$	0.66
$f_{p,10}$	0.47

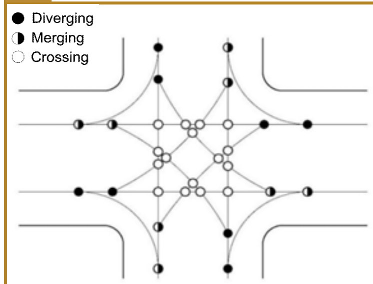
$p_{0,I,8}$	0.75
$p_{0,I,11}$	0.79

Movement V/C	
1	0.02
2	0.05
3	0.02
4	0.08
5	0.04
6	0.04
7	0.73
8-9	0.67
--	--
--	--
10-11-12	0.96
--	--

Intersection V/C
0.96

V/C Not Reported for Any Movements?
No

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

Assumptions

- This worksheet does not use the CLV methodology. The calculations are based on the *HCM, 6th Edition* . The calculations are based on vehicles per hour.

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes no intersection, but cost of new road is not included

Appendix D

PM VJuST Worksheets

VDOT Junction Screening Tool

Input Worksheet

Project Title:	*Marina Way Extension*
E-W Facility:	*Marina Way*
N-S Facility:	*Annapolis Way*
Date:	*November 4, 2023*

Traffic Volume Demand

Direction	Volume (veh/hr)				Truck Percent (%)
	U-Turn / Left		Through	Right	
Eastbound	180		120	90	2.00%
Westbound	95		115	25	2.00%
Northbound	375		190	145	2.00%
Southbound	30		185	190	2.00%
Adjustment Factor	0.80	0.95		0.85	
Suggested	**U - 0.8**	**L - 0.95**		**0.85**	
Truck to PCE Factor			**Suggested = 2.00**		2.00
Critical Lane Volume			1600		

Equivalent Passenger Car Volume

	Volume (pc/hr)			
	U-Turn / Left	Through	Right	Approach
Eastbound	184	122	92	398
Westbound	97	117	26	240
Northbound	383	194	148	725
Southbound	31	189	194	414

Notes:

Left-turn Adjustment Factor	*Conversion of left-turning vehicles to equivalent through vehicles*
Right-turn Adjustment Factor	*Conversion of right-turning vehicles to equivalent through vehicles*
U-turn Adjustment Factor	*Conversion of U-turning vehicles to equivalent through vehicles*
Truck to PCE Factor	*1 truck = X Passenger Car Equivalents*
Critical Lane Volume Sum Limit	*Saturation value for critical lane volume sum at an intersection*

VDOT Junction Screening Tool

Possible Configurations

Indicate with a "Y" or "N" if each intersection or interchange configuration should or should not be considered. Use the information links for guidance. Then, click the "Show/Hide Configurations button" to hide the worksheets for the configurations that will not be considered.

#	Intersections	Information	Consider?	Justification
	Signalized Intersections			
1	Conventional	-	Y	
2	Bowtie	Link	N	Insufficient intersection spacing
3	Center Turn Overpass	Link	N	Not feasible for roadway facility type
4	Continuous Green-T	Link	N	Not feasible for roadway facility type
5	Echelon	Link	N	Not feasible for roadway facility type
6	Full Displaced Left Turn	Link	N	Not feasible for roadway facility type
7	Median U-Turn	Link	N	Unable to accommodate traffic patterns
8	Partial Displaced Left Turn	Link	N	Not feasible for roadway facility type
9	Partial Median U-Turn	Link	N	Unable to accommodate traffic patterns
10	Quadrant Roadway N-E	Link	N	Right-of-way restrictions identified
11	Quadrant Roadway N-W	Link	N	Right-of-way restrictions identified
12	Quadrant Roadway S-E	Link	N	Right-of-way restrictions identified
13	Quadrant Roadway S-W	Link	N	Right-of-way restrictions identified
14	Restricted Crossing U-Turn	Link	N	Unable to accommodate traffic patterns
15	Single Loop	Link	N	Right-of-way restrictions identified
16	Split Intersection	Link	N	Right-of-way restrictions identified
17	Thru-Cut	Link	N	Unable to accommodate traffic patterns
	Unsignalized Intersections			
18	50 Mini Roundabout	Link	Y	
19	75 Mini Roundabout	Link	Y	
20	Roundabout	Link	Y	
21	Two-Way Stop Control	-	Y	
#	**Interchanges**	**Information**	**Consider?**	**Justification**
22	Traditional Diamond	Link	N	Not feasible for roadway facility type
23	Contraflow Left	Link	N	Not feasible for roadway facility type
24	Displaced Left Turn	Link	N	Not feasible for roadway facility type
25	Diverging Diamond	Link	N	Not feasible for roadway facility type
26	Double Roundabout	Link	N	Not feasible for roadway facility type
27	Michigan Urban Diamond	Link	N	Not feasible for roadway facility type
28	Partial Cloverleaf	Link	N	Not feasible for roadway facility type
29	Single Point	Link	N	Not feasible for roadway facility type
30	Single Roundabout	Link	N	Not feasible for roadway facility type

VDOT Junction Screening Tool

Directional Questions and Base Lane Configurations

Before entering a base number of through lanes for each direction, answer all applicable directional question for each intersection or interchange configuration selected for consideration. Navigate to the lane configuration worksheet for example diagrams, if provided.

Intersections	Question	Direction
Bowtie	N/A	N/A
Continuous Green-T	N/A	N/A
Echelon	N/A	N/A
Median U-Turn	N/A	N/A
Partial Displaced Left Turn	N/A	N/A
Partial Median U-Turn	N/A	N/A
Restricted Crossing U-Turn	N/A	N/A
Single Loop	N/A	N/A
Split Intersection	N/A	N/A
Thru-Cut	N/A	N/A
Interchanges	**Question**	**Direction**
All	N/A	N/A

Base Number of Through Lanes

Enter a base number of through lanes for each direction. The number of through lanes entered will populate on each non-roundabout lane configuration worksheet. This tool also allows the user to enter the number of through lanes on the lane configuration worksheets directly. This base number may be overwritten on individual lane configuration worksheets. Turn lanes, shared lanes, and channelized lanes must still be entered in each lane configuration worksheet.

Eastbound	1
Westbound	1
Northbound	2
Southbound	2

VDOT Junction Screening Tool

Results Worksheet

General Information	
Project Title:	Marina Way Extension
EW Facility:	Marina Way
NS Facility:	Annapolis Way
Date:	November 4, 2023

Volumes (veh/hr)	U-Turn / Left	Through		Right
Eastbound	180	120	180	90
Westbound	95	115	180	25
Northbound	375	190	180	145
Southbound	30	185	180	190

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

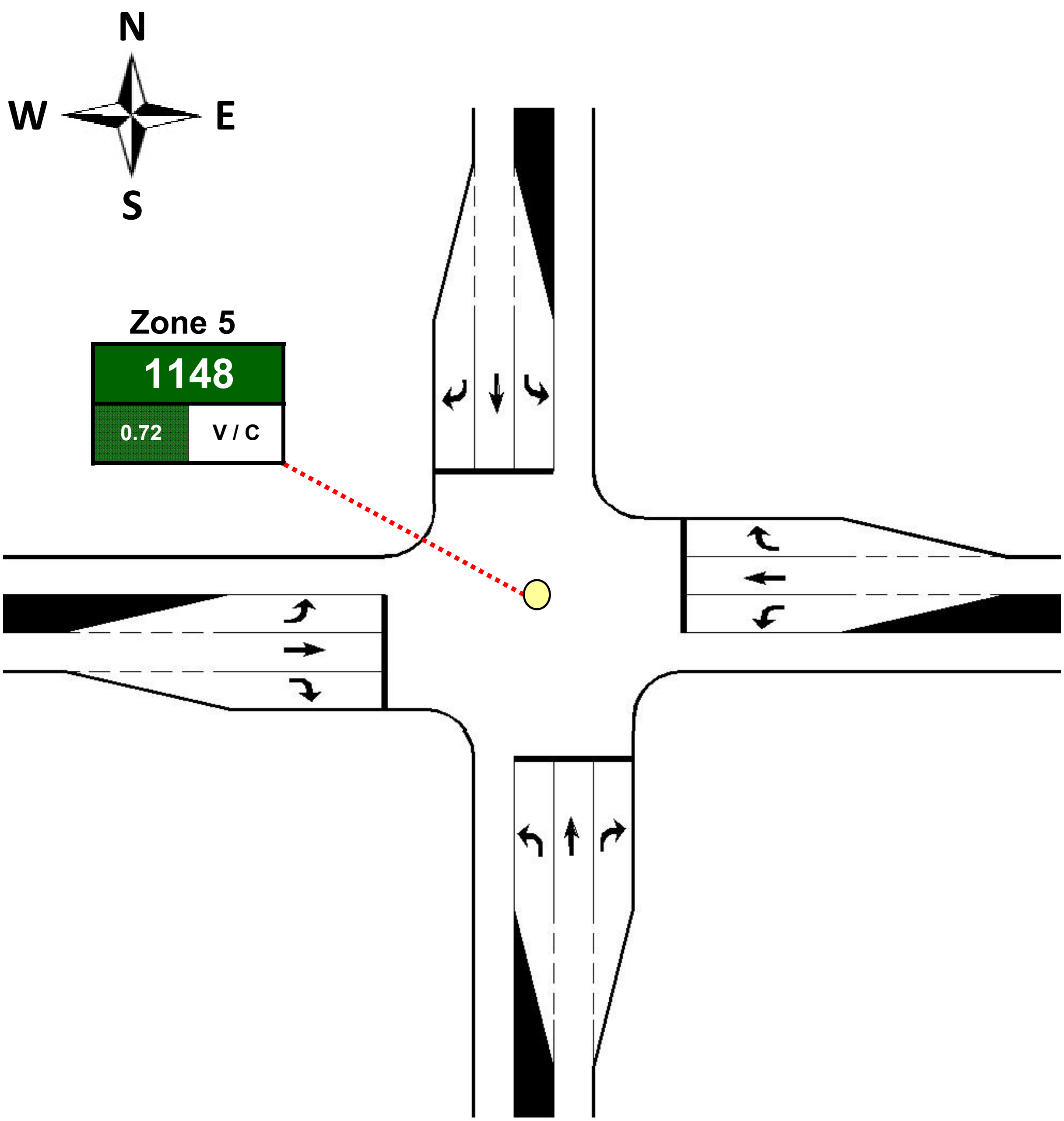
		Congestion	Pedestrian	Safety	Planning Level Costs	Notes
Type	**Dir**	**Maximum V/C**	**Accommodation Compared to Conventional**	**Weighted Total Conflict Points**	**Planning Level Cost Category**	
Conventional	-	0.72		48	$	
50 Mini Roundabout	-	1.09		8	$	
75 Mini Roundabout	-	1.03		8	$	
Roundabout	-	0.59		8	$$	
Two-Way Stop Control	-	N/A*		48	$	

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Conventional

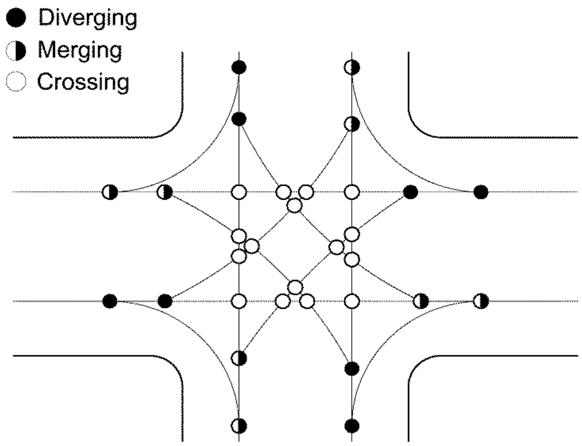
DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	*Critical Lane Volume Sum*			
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:		0.72	
Date:	*November 4, 2023*				



Note: This diagram does not reflect the actual lane configuration of the intersection

Safety - Conflict Point Diagram



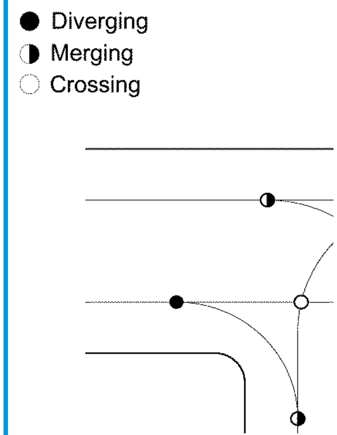
Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

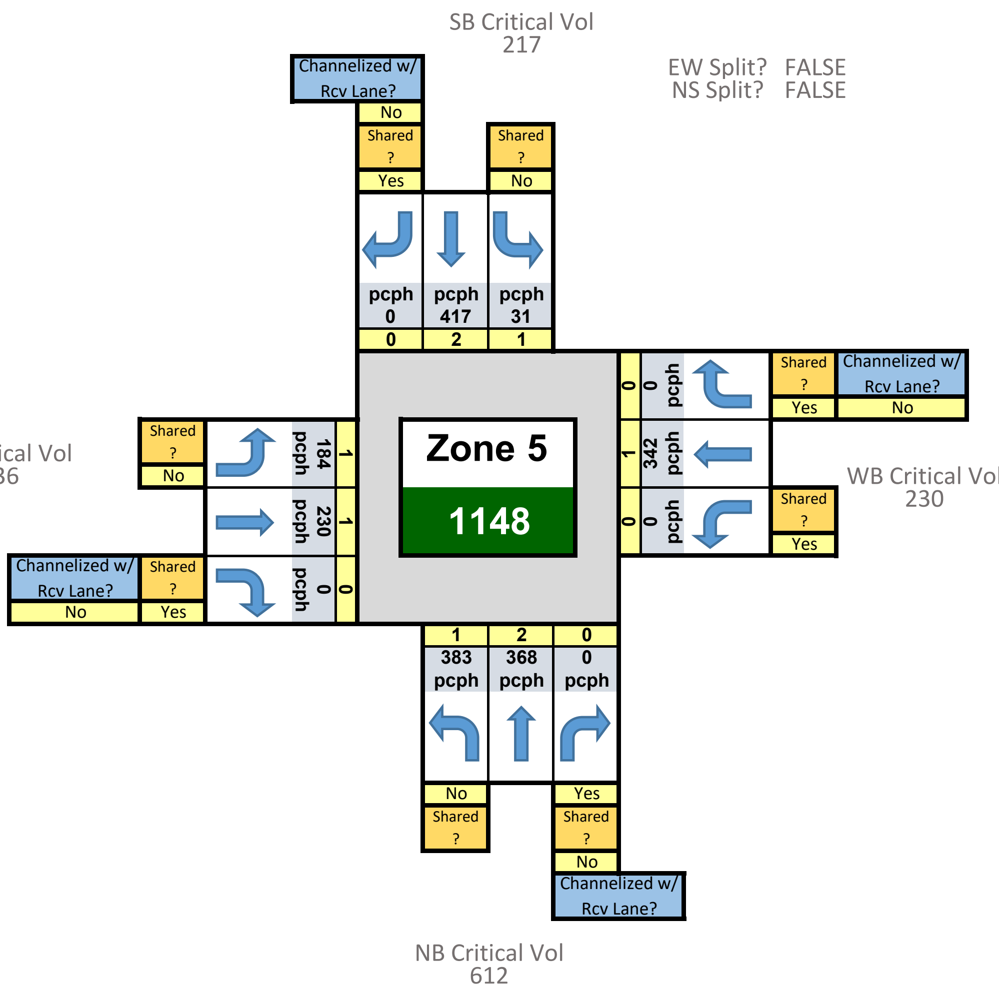
Safety - Cor



Conventional

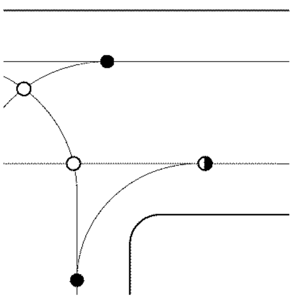
DATA INPUT AND CONFIGURATION

Enter the lane configurations in the yellow cells.



Back to Results

nflict Point Diagram (Three Legs)



Conflict Type	Count
Crossing	3
Merging	3
Diverging	3
Total	**9**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

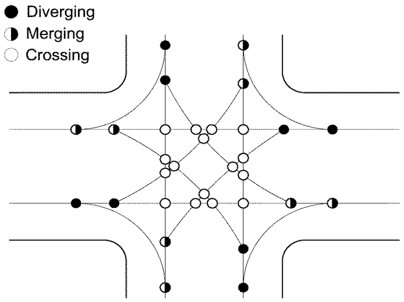
12

Planning Level Cost

$ $ $ $ $ **1**

- Are new lanes and/or pavement needed? **No**
- Cost category 1 if no new pavement needed, else cost cateogry 2.
- Assumes existing two-way stop contol or all-way stop control

Safety - Conflict Point Diagram



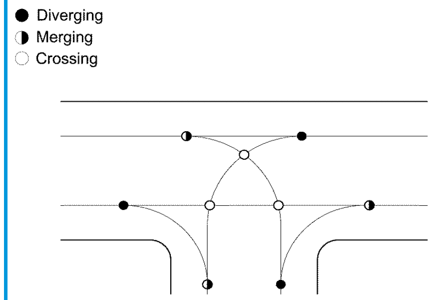
Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

Safety - Conflict Point Diagram (Three Legs)



Conflict Type	Count
Crossing	3
Merging	3
Diverging	3
Total	**9**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

12

Planning Level Cost

$ $ $ $ $ **1**

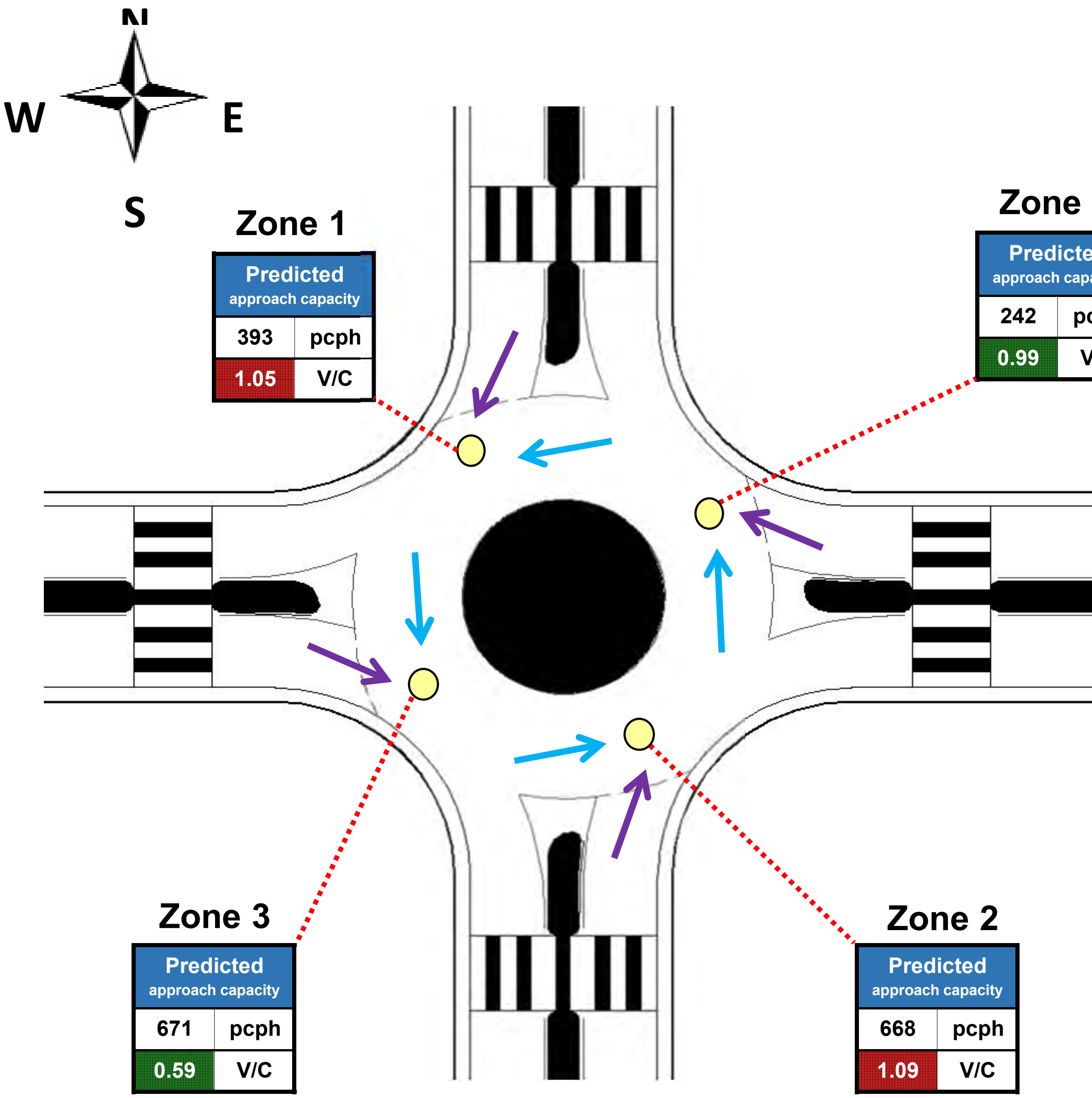
- Are new lanes and/or pavement needed? **No**
- Cost category 1 if no new pavement needed, else cost cateogry 2.
- Assumes existing two-way stop contol or all-way stop control

50' ICD Mini-Roundabout

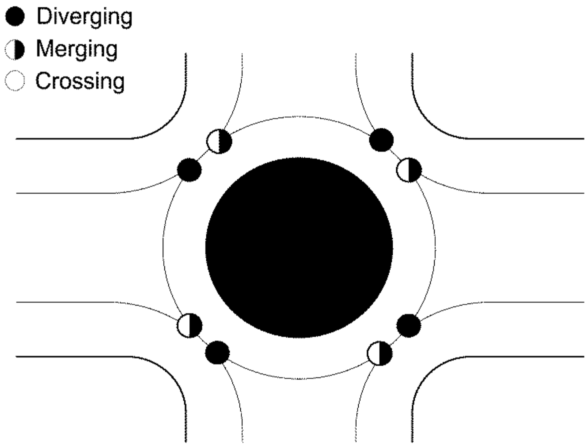
DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	
EW Facility:	*Marina Way*	
NS Facility:	*Annapolis Way*	
Date:	*November 4, 2023*	

Critical Lane Volume Sum			
< 1200	1200 - 1399	1400 - 1599	≥ 1600
VOLUME / CAPACITY RATIO:	1.09		



Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

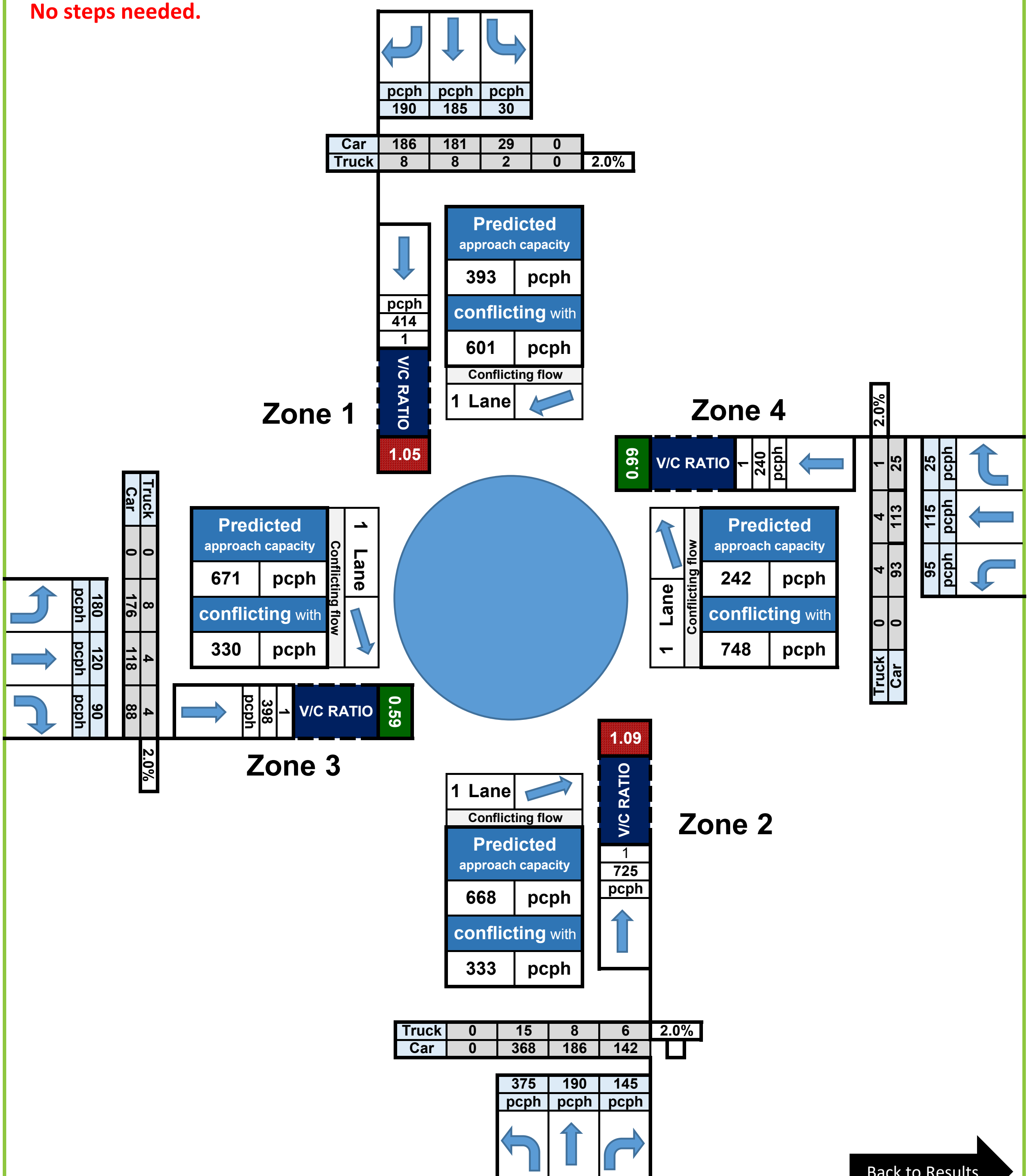
Assu

● This worksheet does not u
calculations are based on the
Roundabout Capacity in the
Journal of Transportation En

50' ICD Mini-Roundabout

DATA INPUT AND CONFIGURATION

No steps needed.



Back to Results

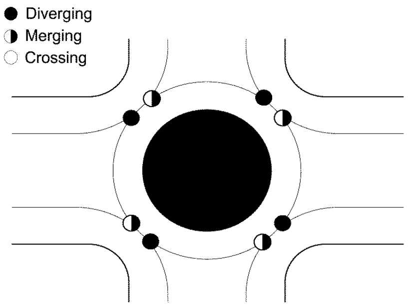
mptions

se the CLV methodology. The
e article *Determination of Mini-*
United States , published in the
gineering .

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes conversion from two-way stop control or all-way stop control.

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

● This worksheet does not use the CLV methodology. The calculations are based on the article *Determination of Mini-Roundabout Capacity in the United States* , published in the *Journal of Transportation Engineering* .

Planning Level Cost $ $ $ $ $ 1

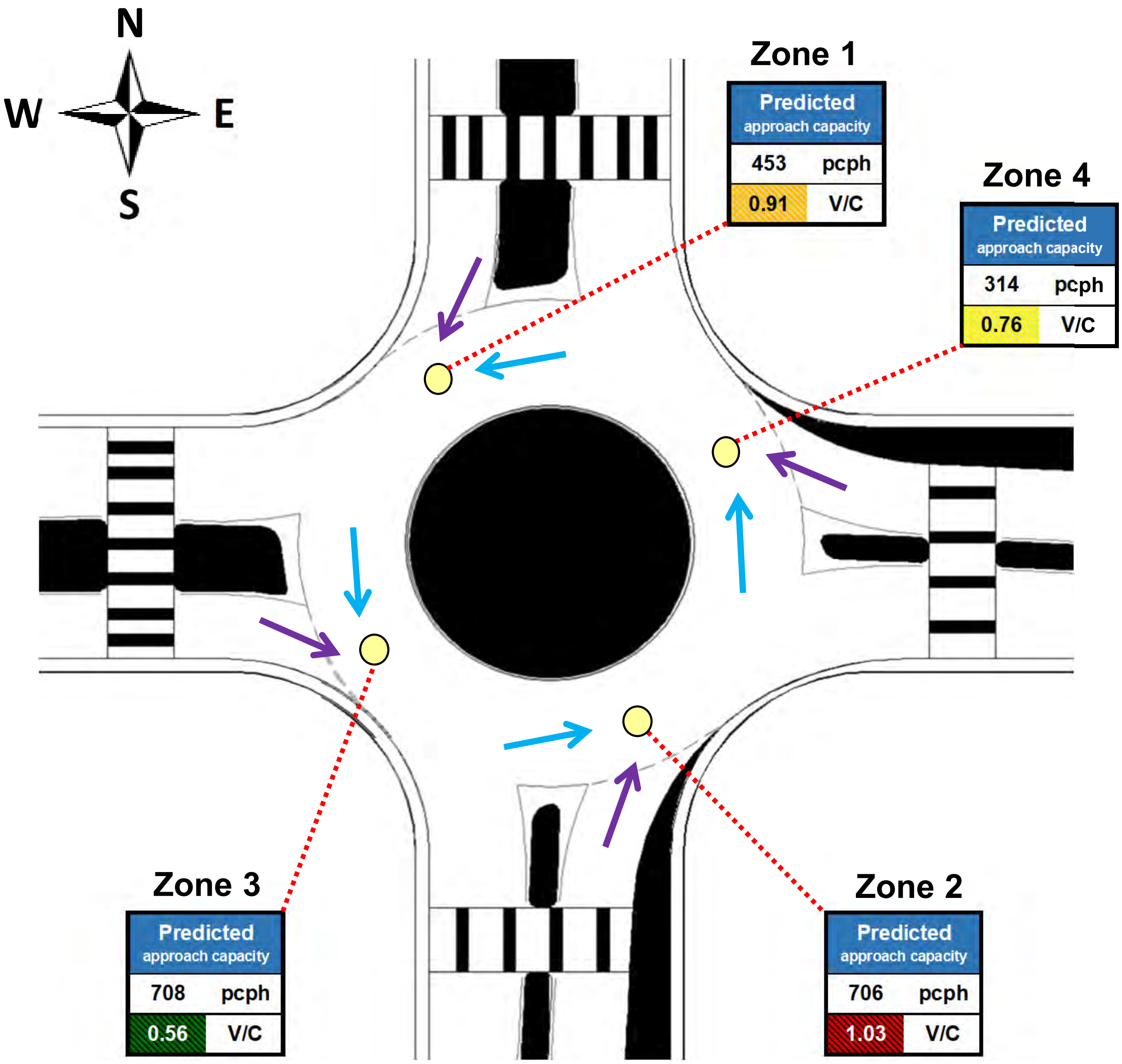
● Cost Category 1

● Assumes conversion from two-way stop control or all-way stop control.

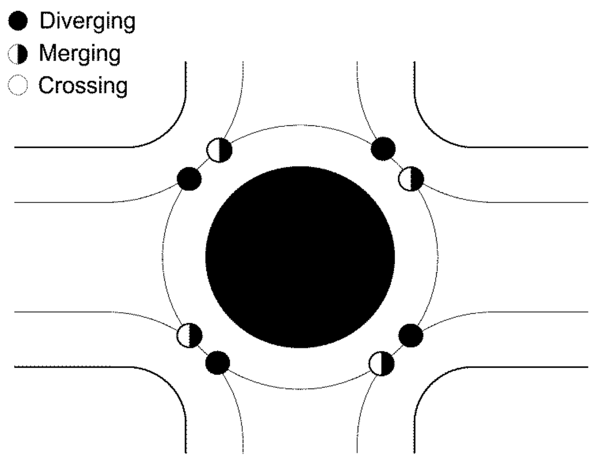
75' ICD Mini-Roundabout

DESIGN AND RESULTS

		Critical Lane Volume Sum				
Project Name:	*Marina Way Extension*					
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600	
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:	1.03			
Date:	*November 4, 2023*					



Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

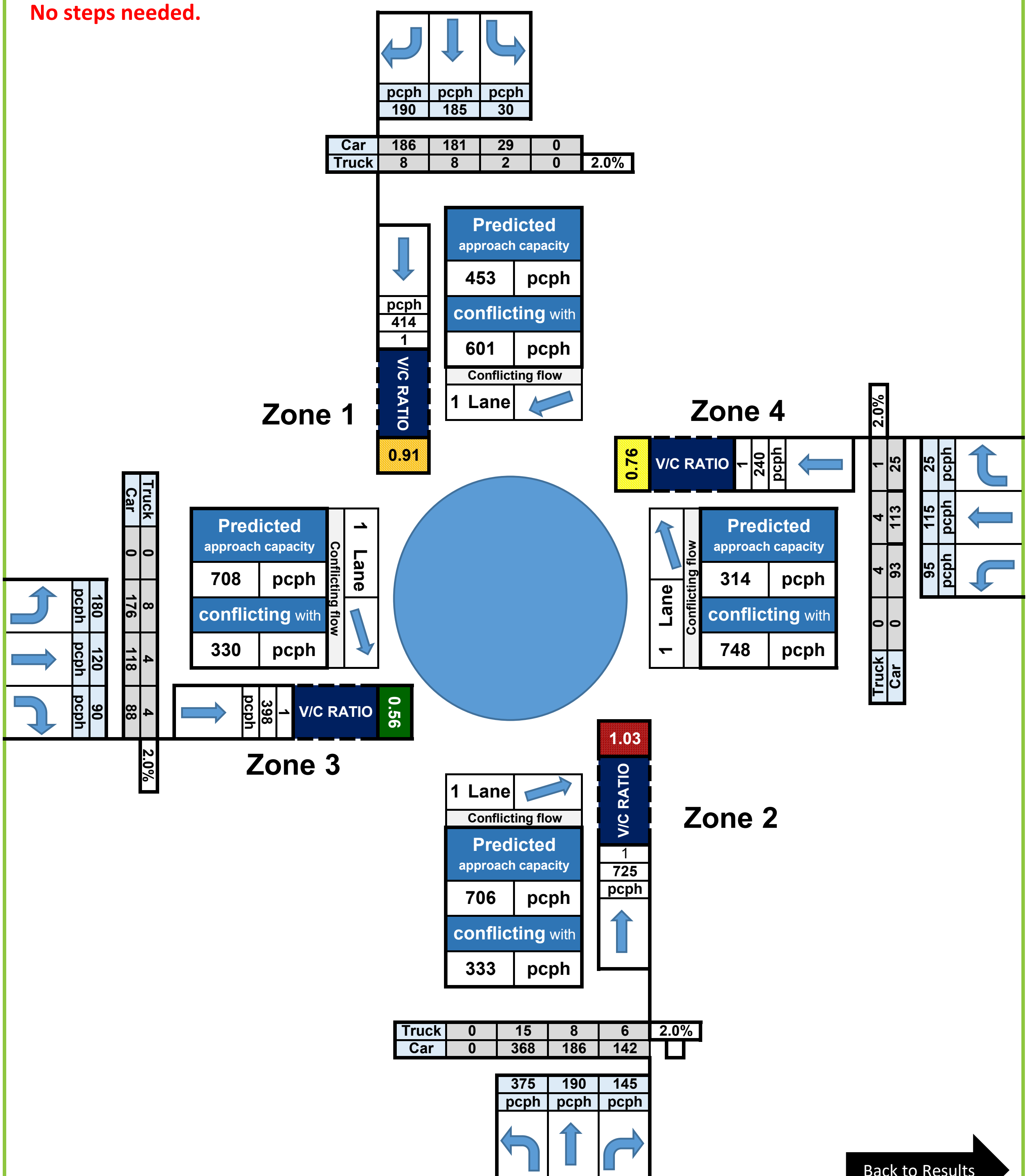
Assu

- This worksheet does not u calculations are based on the *Roundabout Capacity in the Journal of Transportation En*

75' ICD Mini-Roundabout

DATA INPUT AND CONFIGURATION

No steps needed.



Back to Results

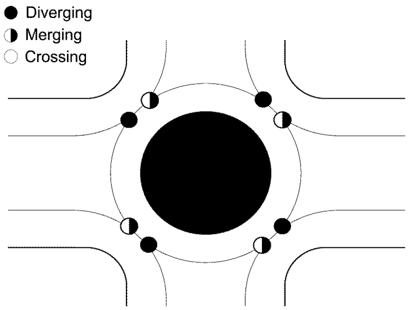
mptions

se the CLV methodology. The
e article *Determination of Mini-*
United States , published in the
gineering .

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes conversion from two-way stop control or all-way stop control.

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

● This worksheet does not use the CLV methodology. The calculations are based on the article *Determination of Mini-Roundabout Capacity in the United States* , published in the *Journal of Transportation Engineering* .

Planning Level Cost $ $ $ $ $ 1

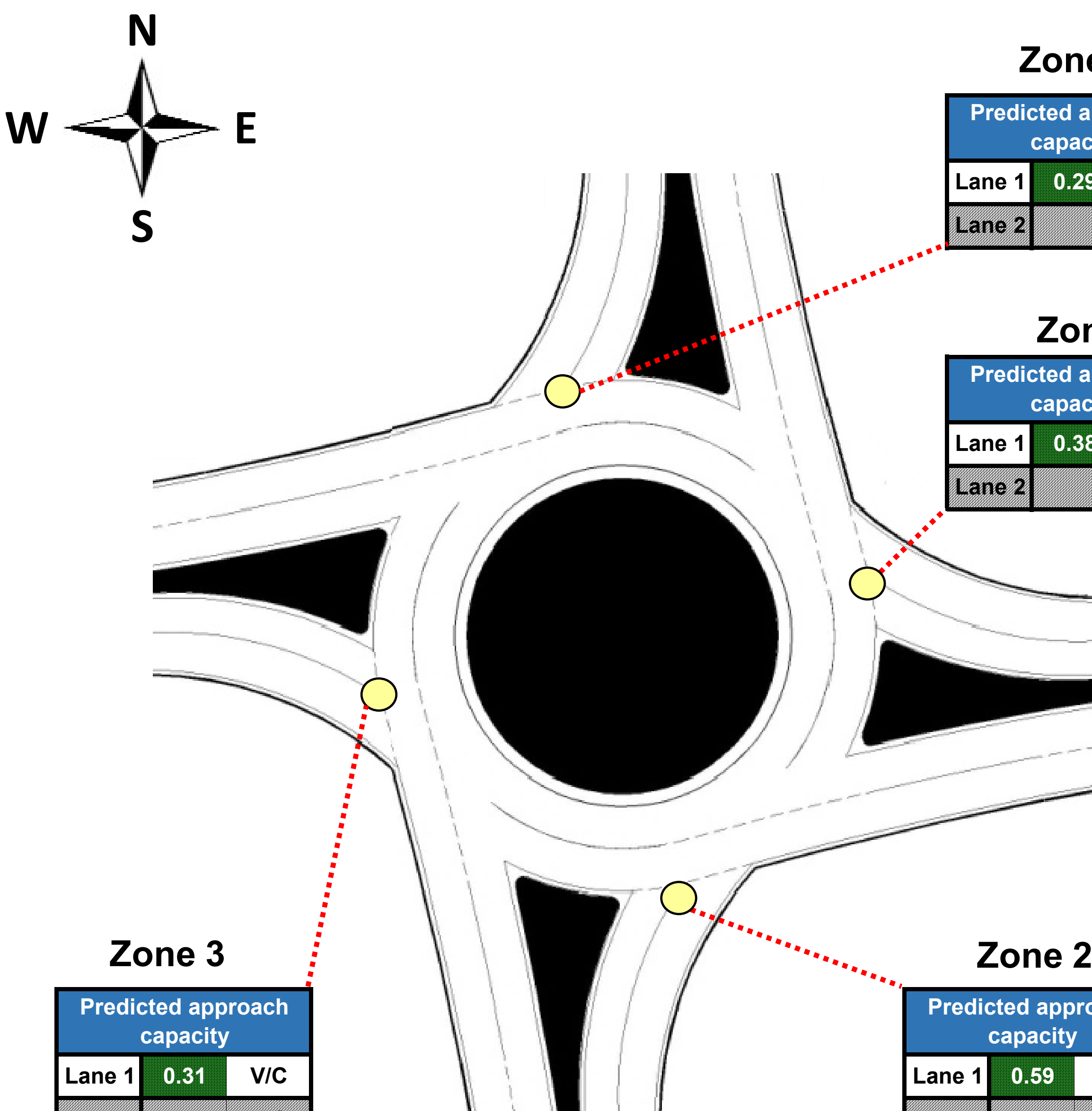
● Cost Category 1

● Assumes conversion from two-way stop control or all-way stop control.

Roundabout

DESIGN AND RESULTS

		Critical Lane Volume Sum			
Project Name:	Marina Way Extension	< 1200	1200 - 1399	1400 - 1599	≥ 1600
EW Facility:	Marina Way	VOLUME / CAPACITY RATIO:	0.59		
NS Facility:	Annapolis Way				
Date:	November 4, 2023				



Zone 1

Predicted approach capacity		
Lane 1	0.29	V/C
Lane 2		V/C

Zone 4

Predicted approach capacity		
Lane 1	0.38	V/C
Lane 2		V/C

Zone 3

Predicted approach capacity		
Lane 1	0.31	V/C
Lane 2		V/C

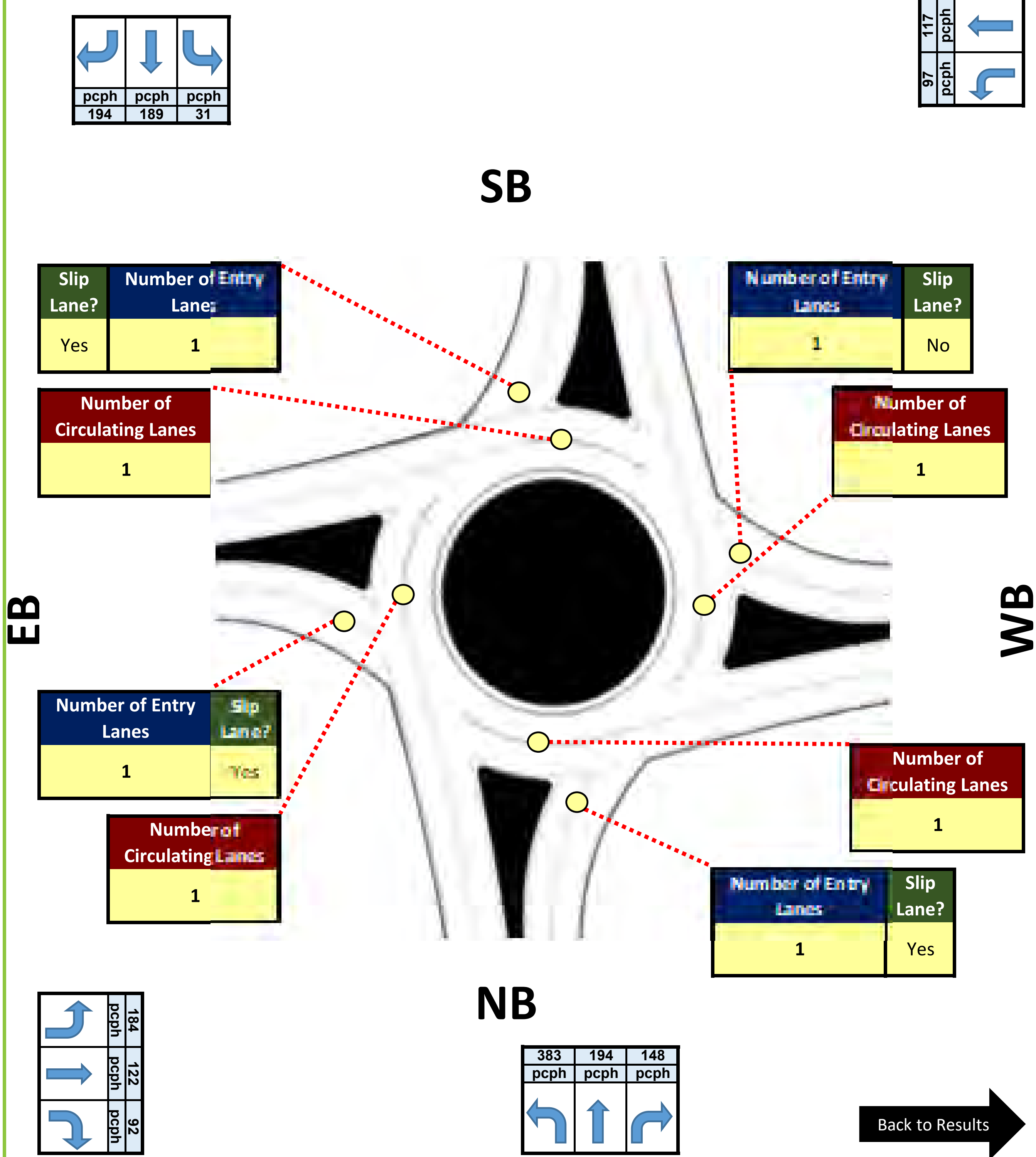
Zone 2

Predicted approach capacity		
Lane 1	0.59	V/C
Lane 2		V/C

Roundabout

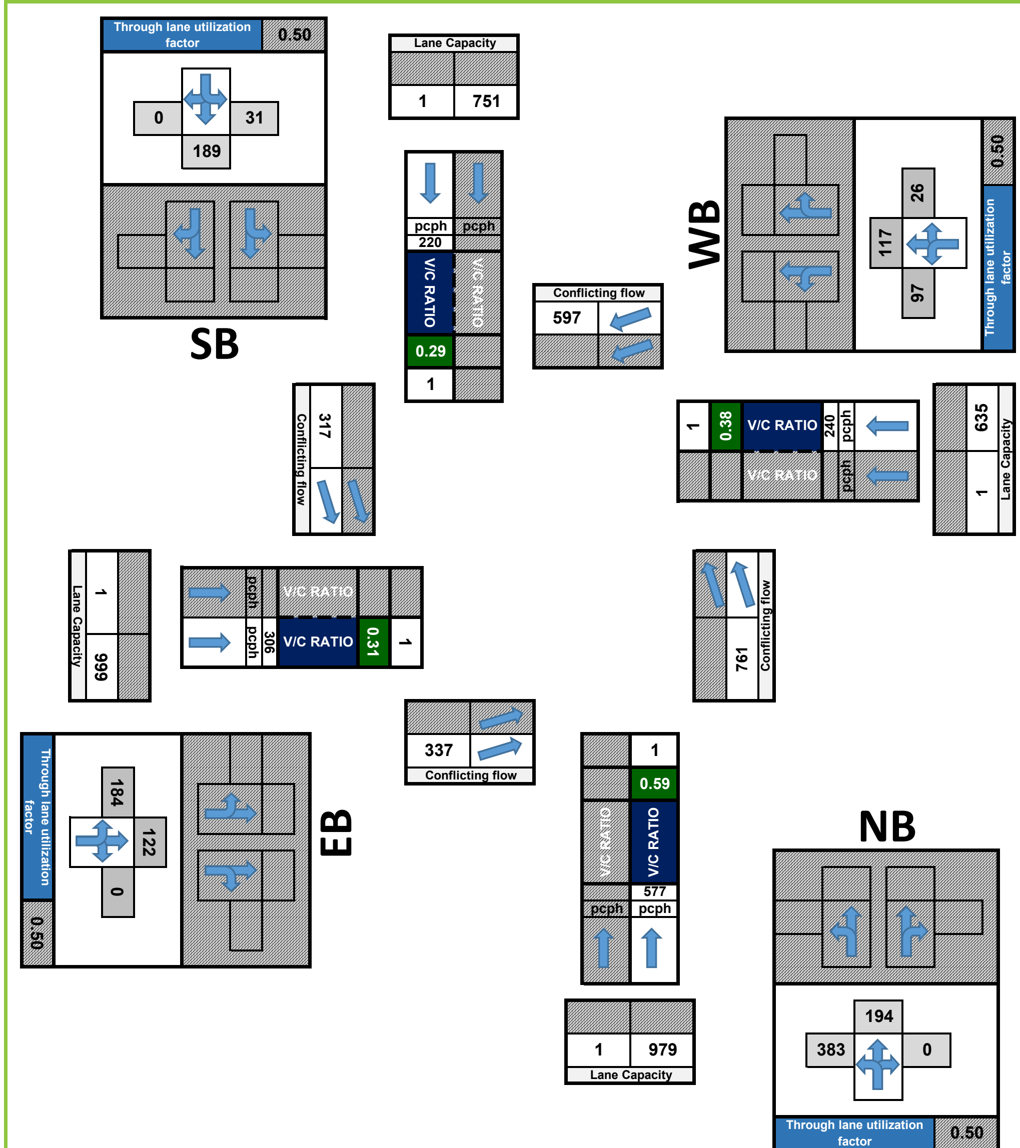
DATA INPUT AND CONFIGURATION

Enter the lane configurations in the yellow cells.



Roundabout

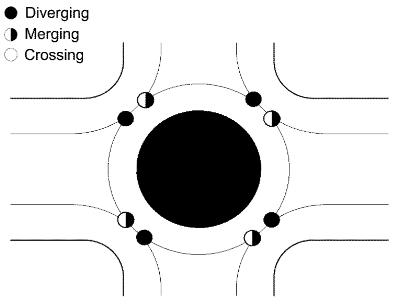
CAPACITY CALCULATIONS



EQUATION: A x exp(-B x Q)

Number of Entry Lanes	Number of Circulating Lanes	Lane	A	B
1	1	-	1380	0.00102
1	2	-	1420	0.00085
2	1	Left	1420	0.00091
2	1	Right	1420	0.00091
2	2	Left	1350	0.00092
2	2	Right	1420	0.00085

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	0
Merging	4
Diverging	4
Total	**8**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

8

Assumptions

- The number of circulating lanes in one quadrant is assumed to be equal to the number of exiting lanes in the next quadrant.
- The roundabout is limited to a maximum of two entry lanes and two circulating lanes.
- All left-turning vehicles are assumed to stay in the innermost lane until exiting the roundabout.
- This worksheet does not use the CLV methodology. The calculations are based on the *HCM 6th Edition* .

Planning Level Cost $ $ $ $ $ 2

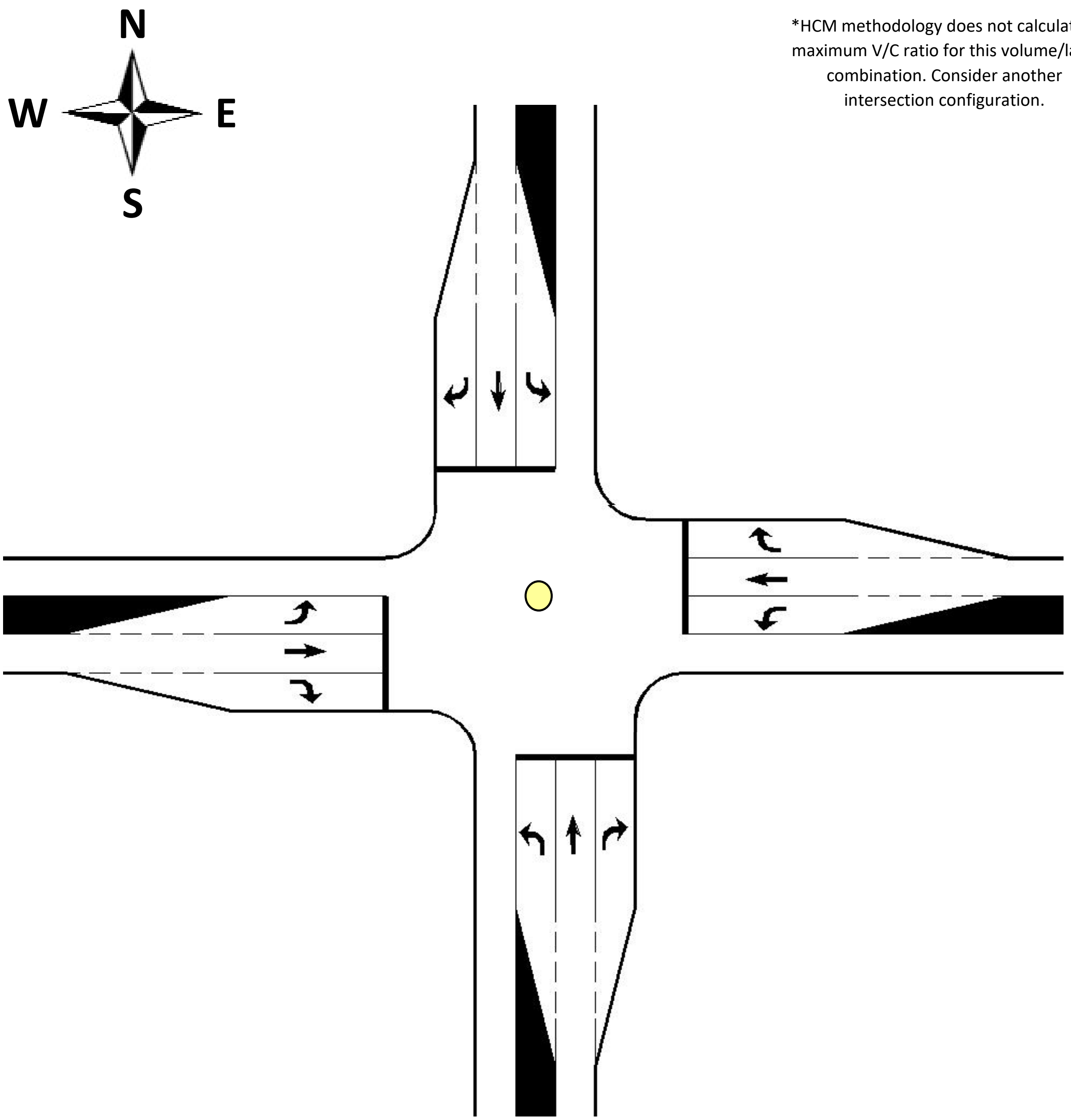
- Cost Category 2
- Assumes conversion from two-way stop control or all-way stop control.

Two-Way Stop Control (TWSC)

DESIGN AND RESULTS

Project Name:	*Marina Way Extension*	***Critical Lane Volume Sum***			
EW Facility:	*Marina Way*	< 1200	1200 - 1399	1400 - 1599	≥ 1600
NS Facility:	*Annapolis Way*	VOLUME / CAPACITY RATIO:		N/A*	
Date:	*November 4, 2023*				

*HCM methodology does not calculate a maximum V/C ratio for this volume/lane combination. Consider another intersection configuration.



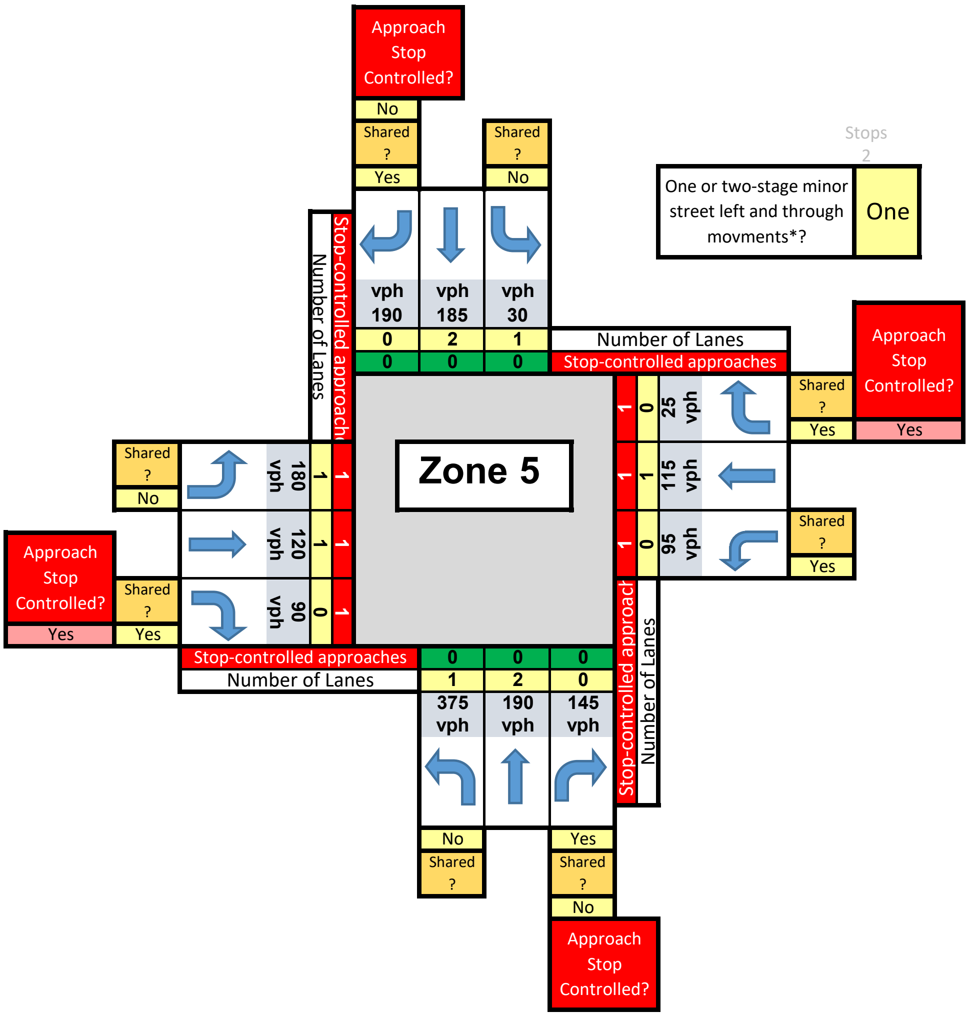
Note: This diagram does not reflect the actual lane configuration of the intersection

Two-Way Stop Control (TWSC)

DATA INPUT AND CONFIGURATION

Step 1: **Identify which approaches are stop-controlled by selecting "Yes" from the drop-down box.**

Step 2: **Enter the lane configurations in the yellow cells.**



Back to Results

Two-Way Stop Control (TWSC)

HCM 6 CALCULATIONS

Priority	MVMT	Rank
7	EBL	4
8	EBT	3
9	EBR	2
10	WBL	4
11	WBT	3
12	WBR	2
4	NBL	2
5	NBT	1
6	NBR	1
1	SBL	2
2	SBT	1
3	SBR	1

MAJOR	MINOR
NB	EB
SB	WB

Major street lanes	4
M1 Shared?	FALSE
M4 Shared?	FALSE

Priority	Rank	Flow Rates	Lanes	Shared?	Stop controlled?	Truck %
1	2	30	1	No		0.02
4	2	375	1	No		0.02
7	4	180	1	No	Yes	0.02
8	3	120	1		Yes	0.02
9	2	90	0	Yes	Yes	0.02
10	4	95	0	Yes	Yes	0.02
11	3	115	1		Yes	0.02
12	2	25	0	Yes	Yes	0.02
2	1	185	2			0.02
3	1	190	0	Yes	No	0.02
5	1	190	2			0.02
6	1	145	0	Yes	No	0.02

Conflicting Flows	
$v_{c,1}$	335.00
$v_{c,4}$	375.00
$v_{c,7}$	1242.50
$v_{c,8}$	1425.00
$v_{c,9}$	187.50
$v_{c,10}$	1225.00
$v_{c,11}$	1447.50
$v_{c,12}$	167.50

$v_{c,I,7}$	340.00
$v_{c,II,7}$	902.50
$v_{c,I,8}$	340.00
$v_{c,II,8}$	1085.00
$v_{c,I,10}$	1012.50
$v_{c,II,10}$	212.50
$v_{c,I,11}$	1012.50
$v_{c,II,11}$	435.00

Critical Headways	
$t_{c,1}$	4.14
$t_{c,4}$	4.14
$t_{c,7}$	7.54
$t_{c,8}$	6.54
$t_{c,9}$	6.94
$t_{c,10}$	7.54
$t_{c,11}$	6.54
$t_{c,12}$	6.94

$t_{c,I,7}$	6.54
$t_{c,II,7}$	6.54
$t_{c,I,8}$	5.54
$t_{c,II,8}$	5.54
$t_{c,I,10}$	6.54
$t_{c,II,10}$	6.54
$t_{c,I,11}$	5.54
$t_{c,II,11}$	5.54

α	0.91

***Assumption:**	One storage space in median (n_m = 1) for two-stage turns

Saturation Flow Rates	
Through	1800
Right	1500

Follow-Up Headways	
$t_{f,1}$	2.22
$t_{f,4}$	2.22
$t_{f,7}$	3.52
$t_{f,8}$	4.02
$t_{f,9}$	3.32
$t_{f,10}$	3.52
$t_{f,11}$	4.02
$t_{f,12}$	3.32

Potential Capacities	
$c_{p,1}$	1221.03
$c_{p,4}$	1180.07
$c_{p,7}$	130.92
$c_{p,8}$	134.41
$c_{p,9}$	822.61
$c_{p,10}$	134.87
$c_{p,11}$	130.24
$c_{p,12}$	847.31

Two-Stage Potential Capacities	
$c_{p,I,7}$	648.19
$c_{p,II,7}$	298.77
$c_{p,I,8}$	637.80
$c_{p,II,8}$	290.93
$c_{p,I,10}$	256.04
$c_{p,II,10}$	769.91
$c_{p,I,11}$	314.78
$c_{p,II,11}$	578.86

y_7	10.22
y_8	6.74
y_{10}	1.06
$y11$	1.24

Movement Capacities	
$c_{m,1}$	1221.03
$c_{m,4}$	1180.07
$c_{m,7}$	0.00
$c_{m,8}$	89.45
$c_{m,9}$	822.61
$c_{m,10}$	0.00
$c_{m,11}$	86.67
$c_{m,12}$	847.31

Two-Stage Movement Capacities	
$c_{m,I,7}$	632.26
$c_{m,II,7}$	91.88
$c_{m,I,8}$	622.13
$c_{m,II,8}$	198.48
$c_{m,I,10}$	174.68
$c_{m,II,10}$	539.82
$c_{m,I,11}$	214.75
$c_{m,II,11}$	564.63

$c_{T,7}$	51.45
$c_{T,8}$	144.46
$c_{T,10}$	77.41
$c_{T,11}$	131.21

Mvmt 1, excl left		$p_{0,1}$	0.98
Mvmt 4, excl left		$p_{0,4}$	0.68

Mvmt 1, shared left		$p^*_{0,1}$	0.97
Mvmt 4, shared left		$p^*_{0,4}$	0.60

Mvmt 7, 4-leg		p''_7	0.000
Mvmt 10, 4-leg		p''_{10}	0.000

$x_{1i,1+2}$	0.23
$x_{4i,1+2}$	0.20

One Stage	f_8	0.67
	f_{11}	0.67
	f_7	0.00
	f_{10}	0.00

Two Stage	$f_{I,8}$	0.98
	$f_{I,11}$	0.68
	$f_{I,7}$	0.98
	$f_{I.10}$	0.68

Shared Movement Capacities	
0	144.73
1	
1	
1	0.00
1	
1	

Single-Stage Movement Capacities	
$c_{m,7}$	0.00
$c_{m,8}$	89.45
$c_{m,10}$	0.00
$c_{m,11}$	86.67

$p_{0,8}$	0.00
$p_{0,11}$	0.00

p'_7	0.00
p'_{10}	0.00

$f_{II,8}$	0.68
$f_{II,11}$	0.98
$f_{II,7}$	0.31
$f_{II.10}$	0.70

Movement Capacities	
1	1221.03
2	3600.00
3	1500.00
4	1180.07
5	3600.00
6	1500.00
7	0.00
8-9	144.73
--	--
--	--
10-11-12	0.00
--	--

$p_{0,9}$	0.89
$p_{0,12}$	0.97

$f_{p,7}$	0.00
$f_{p,10}$	0.00

$p_{0,I,8}$	0.81
$p_{0,I,11}$	0.46

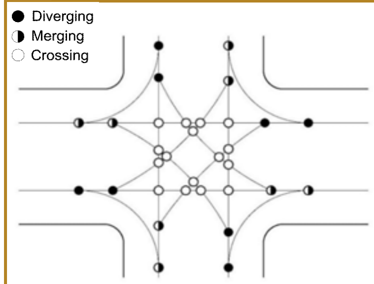
Movement V/C	
1	0.02
2	0.05
3	0.13
4	0.32
5	0.05
6	0.10
7	0.00
8-9	1.45
--	--
--	--
10-11-12	0.00
--	--

Intersection V/C
N/A*

V/C Not Reported for Any Movements?
Yes

*HCM methodology does not calculate a maximum V/C ratio for this volume/lane combination. Consider another intersection configuration.

Safety - Conflict Point Diagram



Conflict Type	Count
Crossing	16
Merging	8
Diverging	8
Total	**32**

Conflict Type	Weight
Crossing	2
Merging	1
Diverging	1

Weighted Total Conflict Points

48

Assumptions

- This worksheet does not use the CLV methodology. The calculations are based on the *HCM, 6th Edition* . The calculations are based on vehicles per hour.

Planning Level Cost $ $ $ $ $ 1

- Cost Category 1
- Assumes no intersection, but cost of new road is not included

Appendix E

Signalized Intersection Synchro/SimTraffic Outputs

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	190	170	165	105	115	40	110	140	60	25	175	30
Future Volume (veh/h)	190	170	165	105	115	40	110	140	60	25	175	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	207	185	179	114	125	43	120	152	65	27	190	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	494	324	313	196	172	51	607	996	408	587	1109	189
Arrive On Green	0.07	0.37	0.37	0.24	0.24	0.24	0.06	0.41	0.41	0.02	0.37	0.37
Sat Flow, veh/h	1781	873	845	470	724	215	1781	2459	1007	1781	3036	518
Grp Volume(v), veh/h	207	0	364	282	0	0	120	108	109	27	110	113
Grp Sat Flow(s),veh/h/ln	1781	0	1718	1409	0	0	1781	1777	1689	1781	1777	1777
Q Serve(g_s), s	4.0	0.0	10.1	9.2	0.0	0.0	2.4	2.3	2.5	0.6	2.5	2.6
Cycle Q Clear(g_c), s	4.0	0.0	10.1	11.3	0.0	0.0	2.4	2.3	2.5	0.6	2.5	2.6
Prop In Lane	1.00		0.49	0.40		0.15	1.00		0.60	1.00		0.29
Lane Grp Cap(c), veh/h	494	0	637	419	0	0	607	720	684	587	649	649
V/C Ratio(X)	0.42	0.00	0.57	0.67	0.00	0.00	0.20	0.15	0.16	0.05	0.17	0.17
Avail Cap(c_a), veh/h	494	0	773	527	0	0	612	720	684	663	649	649
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.0	0.0	15.1	21.6	0.0	0.0	10.3	11.3	11.3	11.4	12.9	12.9
Incr Delay (d2), s/veh	0.6	0.0	0.8	2.4	0.0	0.0	0.2	0.4	0.5	0.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	3.8	3.8	0.0	0.0	0.9	0.9	0.9	0.2	1.0	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	15.6	0.0	15.9	24.0	0.0	0.0	10.5	11.7	11.8	11.4	13.4	13.5
LnGrp LOS	B	A	B	C	A	A	B	B	B	B	B	B
Approach Vol, veh/h		571			282			337			250	
Approach Delay, s/veh		15.8			24.0			11.3			13.2	
Approach LOS		B			C			B			B	
Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	5.4	28.3		26.2	7.8	25.9	8.0	18.2				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	17.0		27.0	4.0	17.0	4.0	19.0				
Max Q Clear Time (g_c+I1), s	2.6	4.5		12.1	4.4	4.6	6.0	13.3				
Green Ext Time (p_c), s	0.0	1.0		2.1	0.0	1.0	0.0	0.9				
Intersection Summary												
HCM 6th Ctrl Delay			15.9									
HCM 6th LOS			B									

Intersection: 4: Annapolis Way & Marina Way Ext/Marina Way

Movement	EB	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	164	211	224	105	93	88	41	100	56
Average Queue (ft)	78	107	119	40	39	30	10	38	10
95th Queue (ft)	132	180	196	82	80	66	31	78	32
Link Distance (ft)	763	763	547		489	489		544	544
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)				225			250		
Storage Blk Time (%)									
Queuing Penalty (veh)									

Network Summary

Network wide Queuing Penalty: 0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	120	90	95	115	25	375	190	145	30	185	190
Future Volume (veh/h)	180	120	90	95	115	25	375	190	145	30	185	190
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	196	130	98	103	125	27	408	207	158	33	201	207
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	472	332	251	188	171	33	583	856	622	507	588	524
Arrive On Green	0.07	0.34	0.34	0.20	0.20	0.20	0.13	0.44	0.44	0.03	0.33	0.33
Sat Flow, veh/h	1781	990	746	515	845	161	1781	1964	1426	1781	1777	1585
Grp Volume(v), veh/h	196	0	228	255	0	0	408	186	179	33	201	207
Grp Sat Flow(s),veh/h/ln	1781	0	1736	1521	0	0	1781	1777	1614	1781	1777	1585
Q Serve(g_s), s	4.0	0.0	6.0	7.9	0.0	0.0	8.0	4.0	4.2	0.7	5.1	6.0
Cycle Q Clear(g_c), s	4.0	0.0	6.0	9.5	0.0	0.0	8.0	4.0	4.2	0.7	5.1	6.0
Prop In Lane	1.00		0.43	0.40		0.11	1.00		0.88	1.00		1.00
Lane Grp Cap(c), veh/h	472	0	583	392	0	0	583	775	704	507	588	524
V/C Ratio(X)	0.42	0.00	0.39	0.65	0.00	0.00	0.70	0.24	0.25	0.07	0.34	0.39
Avail Cap(c_a), veh/h	472	0	694	487	0	0	583	775	704	575	588	524
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.5	0.0	15.2	22.7	0.0	0.0	11.5	10.7	10.7	12.6	15.1	15.4
Incr Delay (d2), s/veh	0.6	0.0	0.4	2.1	0.0	0.0	3.7	0.7	0.9	0.1	1.6	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.0	2.3	3.5	0.0	0.0	3.6	1.6	1.5	0.3	2.2	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.1	0.0	15.7	24.9	0.0	0.0	15.2	11.4	11.6	12.6	16.7	17.7
LnGrp LOS	B	A	B	C	A	A	B	B	B	B	B	B
Approach Vol, veh/h		424			255			773			441	
Approach Delay, s/veh		16.3			24.9			13.5			16.9	
Approach LOS		B			C			B			B	

Timer - Assigned Phs	1	2		4	5	6	7	8				
Phs Duration (G+Y+Rc), s	5.7	30.2		24.1	12.0	23.9	8.0	16.1				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0	4.0	4.0				
Max Green Setting (Gmax), s	4.0	20.0		24.0	8.0	16.0	4.0	16.0				
Max Q Clear Time (g_c+I1), s	2.7	6.2		8.0	10.0	8.0	6.0	11.5				
Green Ext Time (p_c), s	0.0	1.9		1.2	0.0	1.6	0.0	0.6				

Intersection Summary			
HCM 6th Ctrl Delay			16.4
HCM 6th LOS			B

Intersection: 4: Annapolis Way & Marina Way Ext/Marina Way

Movement	EB	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	168	143	214	209	139	132	43	109	118
Average Queue (ft)	81	70	107	114	38	55	13	49	39
95th Queue (ft)	137	119	178	192	97	101	34	92	86
Link Distance (ft)	763	763	547		489	489		544	544
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)				225			250		
Storage Blk Time (%)				0	0				
Queuing Penalty (veh)				0	0				

Network Summary

Network wide Queuing Penalty: 0

Appendix F

Roundabout SIDRA Output

MOVEMENT SUMMARY

Site: 101 [AM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Proposed Design 1
Roundabout
Sensitivity Analysis (Critical Gap & Follow-up Headway): Results for Parameter Scale = 120.0 %

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Annapolis Way															
3	L2	All MCs	120	2.0	120	2.0	0.377	9.8	LOS A	1.7	43.9	0.58	0.49	0.62	17.6
8	T1	All MCs	152	2.0	152	2.0	0.377	9.8	LOS A	1.7	43.9	0.58	0.49	0.62	17.9
18	R2	All MCs	65	2.0	65	2.0	0.041	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			337	2.0	337	2.0	0.377	7.9	LOS A	1.7	43.9	0.47	0.40	0.50	18.7
East: Marina Way															
1	L2	All MCs	114	2.0	114	2.0	0.454	12.7	LOS B	2.6	67.1	0.67	0.69	0.89	16.7
6	T1	All MCs	125	2.0	125	2.0	0.454	12.7	LOS B	2.6	67.1	0.67	0.69	0.89	17.2
16	R2	All MCs	43	2.0	43	2.0	0.454	12.7	LOS B	2.6	67.1	0.67	0.69	0.89	17.2
Approach			283	2.0	283	2.0	0.454	12.7	LOS B	2.6	67.1	0.67	0.69	0.89	17.0
North: Annapolis Way															
7	L2	All MCs	27	2.0	27	2.0	0.287	11.0	LOS B	1.2	30.5	0.52	0.40	0.52	19.4
4	T1	All MCs	190	2.0	190	2.0	0.287	8.0	LOS A	1.2	30.5	0.52	0.40	0.52	19.4
14	R2	All MCs	33	2.0	33	2.0	0.020	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			250	2.0	250	2.0	0.287	7.3	LOS A	1.2	30.5	0.45	0.34	0.45	19.9
West: Proposed Marina Way															
5	L2	All MCs	207	2.0	207	2.0	0.497	11.3	LOS B	3.3	83.5	0.60	0.55	0.78	17.2
2	T1	All MCs	185	2.0	185	2.0	0.497	14.3	LOS B	3.3	83.5	0.60	0.55	0.78	17.6
12	R2	All MCs	179	2.0	179	2.0	0.109	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			571	2.0	571	2.0	0.497	8.8	LOS A	3.3	83.5	0.41	0.38	0.53	18.8
All Vehicles			1440	2.0	1440	2.0	0.497	9.1	LOS A	3.3	83.5	0.48	0.44	0.58	18.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [PM (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Proposed Design 1
Roundabout
Sensitivity Analysis (Critical Gap & Follow-up Headway): Results for Parameter Scale = 120.0 %

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Annapolis Way															
3	L2	All MCs	408	2.0	408	2.0	0.810	24.9	LOS C	13.8	349.8	0.92	1.29	1.94	12.9
8	T1	All MCs	207	2.0	207	2.0	0.810	24.9	LOS C	13.8	349.8	0.92	1.29	1.94	13.2
18	R2	All MCs	158	2.0	158	2.0	0.100	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			772	2.0	772	2.0	0.810	19.8	LOS C	13.8	349.8	0.73	1.03	1.54	14.3
East: Marina Way															
1	L2	All MCs	103	2.0	103	2.0	0.602	25.1	LOS D	3.5	88.4	0.82	1.02	1.29	13.3
6	T1	All MCs	125	2.0	125	2.0	0.602	25.1	LOS D	3.5	88.4	0.82	1.02	1.29	13.7
16	R2	All MCs	5	2.0	5	2.0	0.602	25.1	LOS D	3.5	88.4	0.82	1.02	1.29	13.8
Approach			234	2.0	234	2.0	0.602	25.1	LOS D	3.5	88.4	0.82	1.02	1.29	13.5
North: Annapolis															
7	L2	All MCs	33	2.0	33	2.0	0.434	16.8	LOS C	2.2	56.4	0.70	0.76	0.93	17.1
4	T1	All MCs	201	2.0	201	2.0	0.434	13.8	LOS B	2.2	56.4	0.70	0.76	0.93	16.9
14	R2	All MCs	207	2.0	207	2.0	0.126	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			440	2.0	440	2.0	0.434	7.6	LOS A	2.2	56.4	0.37	0.40	0.49	19.6
West: Marina Way															
5	L2	All MCs	196	2.0	196	2.0	0.423	10.1	LOS B	2.2	56.1	0.58	0.46	0.63	17.5
2	T1	All MCs	130	2.0	130	2.0	0.423	13.1	LOS B	2.2	56.1	0.58	0.46	0.63	17.9
12	R2	All MCs	98	2.0	98	2.0	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	24.3
Approach			424	2.0	424	2.0	0.423	8.7	LOS A	2.2	56.1	0.44	0.36	0.48	18.7
All Vehicles			1870	2.0	1870	2.0	0.810	15.1	LOS C	13.8	349.8	0.59	0.73	1.02	16.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [AM -2 (Site Folder: Dual Lane)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Proposed Design 1
Roundabout
Sensitivity Analysis (Critical Gap & Follow-up Headway): Results for Parameter Scale = 120.0 %

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Annapolis Way															
3	L2	All MCs	120	2.0	120	2.0	0.233	7.6	LOS A	0.9	22.6	0.51	0.41	0.51	16.3
8	T1	All MCs	152	2.0	152	2.0	0.233	7.6	LOS A	0.9	22.6	0.51	0.41	0.51	20.1
18	R2	All MCs	65	2.0	65	2.0	0.233	7.6	LOS A	0.9	22.6	0.51	0.41	0.51	20.4
Approach			337	2.0	337	2.0	0.233	7.6	LOS A	0.9	22.6	0.51	0.41	0.51	18.5
East: Marina Way															
1	L2	All MCs	114	2.0	114	2.0	0.401	10.5	LOS B	1.9	48.2	0.58	0.56	0.71	20.2
6	T1	All MCs	125	2.0	125	2.0	0.401	10.5	LOS B	1.9	48.2	0.58	0.56	0.71	19.2
16	R2	All MCs	43	2.0	43	2.0	0.401	10.5	LOS B	1.9	48.2	0.58	0.56	0.71	19.2
Approach			283	2.0	283	2.0	0.401	10.5	LOS B	1.9	48.2	0.58	0.56	0.71	19.6
North: Annapolis Way															
7	L2	All MCs	27	2.0	27	2.0	0.164	6.4	LOS A	0.6	15.5	0.46	0.35	0.46	17.9
4	T1	All MCs	190	2.0	190	2.0	0.164	6.4	LOS A	0.6	15.5	0.46	0.35	0.46	20.9
14	R2	All MCs	33	2.0	33	2.0	0.164	6.4	LOS A	0.6	15.5	0.46	0.35	0.46	21.1
Approach			250	2.0	250	2.0	0.164	6.4	LOS A	0.6	15.5	0.46	0.35	0.46	20.5
West: Proposed Marina Way															
5	L2	All MCs	207	2.0	207	2.0	0.483	10.8	LOS B	2.9	74.4	0.56	0.51	0.71	15.5
2	T1	All MCs	185	2.0	185	2.0	0.483	10.8	LOS B	2.9	74.4	0.56	0.51	0.71	19.0
12	R2	All MCs	179	2.0	179	2.0	0.238	7.4	LOS A	0.9	22.9	0.46	0.35	0.46	19.9
Approach			571	2.0	571	2.0	0.483	9.8	LOS A	2.9	74.4	0.53	0.46	0.63	17.7
All Vehicles			1440	2.0	1440	2.0	0.483	8.8	LOS A	2.9	74.4	0.52	0.45	0.59	18.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [PM - 2 (Site Folder: Dual Lane)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: Proposed Design 1
Roundabout
Sensitivity Analysis (Critical Gap & Follow-up Headway): Results for Parameter Scale = 120.0 %

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] ft	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed mph
South: Annapolis Way															
3	L2	All MCs	408	2.0	408	2.0	0.535	12.5	LOS B	4.0	100.7	0.65	0.65	0.91	19.2
8	T1	All MCs	207	2.0	207	2.0	0.478	11.2	LOS B	3.0	75.7	0.61	0.56	0.78	18.6
18	R2	All MCs	158	2.0	158	2.0	0.478	11.2	LOS B	3.0	75.7	0.61	0.56	0.78	18.7
Approach			772	2.0	772	2.0	0.535	11.9	LOS B	4.0	100.7	0.63	0.61	0.85	18.9
East: Marina Way															
1	L2	All MCs	103	2.0	103	2.0	0.480	16.3	LOS C	2.3	59.2	0.71	0.86	1.05	18.0
6	T1	All MCs	125	2.0	125	2.0	0.480	16.3	LOS C	2.3	59.2	0.71	0.86	1.05	17.2
16	R2	All MCs	5	2.0	5	2.0	0.480	16.3	LOS C	2.3	59.2	0.71	0.86	1.05	17.3
Approach			234	2.0	234	2.0	0.480	16.3	LOS C	2.3	59.2	0.71	0.86	1.05	17.5
North: Annapolis															
7	L2	All MCs	33	2.0	33	2.0	0.396	12.6	LOS B	1.9	47.9	0.67	0.71	0.85	16.1
4	T1	All MCs	201	2.0	201	2.0	0.396	12.6	LOS B	1.9	47.9	0.67	0.71	0.85	18.2
14	R2	All MCs	207	2.0	207	2.0	0.396	12.6	LOS B	1.9	47.9	0.67	0.71	0.85	17.8
Approach			440	2.0	440	2.0	0.396	12.6	LOS B	1.9	47.9	0.67	0.71	0.85	17.8
West: Marina Way															
5	L2	All MCs	196	2.0	196	2.0	0.410	9.6	LOS A	1.9	49.1	0.54	0.42	0.56	15.8
2	T1	All MCs	130	2.0	130	2.0	0.410	9.6	LOS A	1.9	49.1	0.54	0.42	0.56	19.5
12	R2	All MCs	98	2.0	98	2.0	0.133	6.3	LOS A	0.5	12.1	0.44	0.34	0.44	20.6
Approach			424	2.0	424	2.0	0.410	8.9	LOS A	1.9	49.1	0.51	0.40	0.53	17.7
All Vehicles			1870	2.0	1870	2.0	0.535	11.9	LOS B	4.0	100.7	0.62	0.62	0.80	18.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Stopline Delay: Geometric Delay is not included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: Siegloch M1 implied by US HCM 6 Roundabout Capacity Model.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Appendix G

All-Way Stop Control Intersection Synchro Output – Opening Year

Intersection	
Intersection Delay, s/veh	12.3
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	135	120	115	75	80	30	75	100	40	20	125	20
Future Vol, veh/h	135	120	115	75	80	30	75	100	40	20	125	20
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	147	130	125	82	87	33	82	109	43	22	136	22
Number of Lanes	1	1	0	0	1	0	1	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	12.4	13.2	11.5	12
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	41%	14%	0%
Vol Thru, %	0%	71%	0%	51%	43%	86%	0%
Vol Right, %	0%	29%	0%	49%	16%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	75	140	135	235	185	145	20
LT Vol	75	0	135	0	75	20	0
Through Vol	0	100	0	120	80	125	0
RT Vol	0	40	0	115	30	0	20
Lane Flow Rate	82	152	147	255	201	158	22
Geometry Grp	7	7	7	7	6	7	7
Degree of Util (X)	0.162	0.271	0.273	0.414	0.362	0.297	0.036
Departure Headway (Hd)	7.135	6.421	6.691	5.838	6.476	6.79	6.005
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	501	557	536	613	553	526	593
Service Time	4.905	4.191	4.452	3.597	4.544	4.565	3.779
HCM Lane V/C Ratio	0.164	0.273	0.274	0.416	0.363	0.3	0.037
HCM Control Delay	11.3	11.6	12	12.7	13.2	12.4	9
HCM Lane LOS	B	B	B	B	B	B	A
HCM 95th-tile Q	0.6	1.1	1.1	2	1.6	1.2	0.1

Intersection	
Intersection Delay, s/veh	15.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	125	80	60	65	80	20	265	135	100	20	130	135
Future Vol, veh/h	125	80	60	65	80	20	265	135	100	20	130	135
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	136	87	65	71	87	22	288	147	109	22	141	147
Number of Lanes	1	1	0	0	1	0	1	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	13.5	15.4	17.6	12.7
HCM LOS	B	C	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	39%	13%	0%
Vol Thru, %	0%	57%	0%	57%	48%	87%	0%
Vol Right, %	0%	43%	0%	43%	12%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	265	235	125	140	165	150	135
LT Vol	265	0	125	0	65	20	0
Through Vol	0	135	0	80	80	130	0
RT Vol	0	100	0	60	20	0	135
Lane Flow Rate	288	255	136	152	179	163	147
Geometry Grp	7	7	7	7	6	7	7
Degree of Util (X)	0.587	0.463	0.301	0.302	0.381	0.331	0.266
Departure Headway (Hd)	7.336	6.52	7.966	7.147	7.652	7.309	6.522
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	493	552	451	504	470	492	550
Service Time	5.075	4.259	5.708	4.888	5.698	5.053	4.265
HCM Lane V/C Ratio	0.584	0.462	0.302	0.302	0.381	0.331	0.267
HCM Control Delay	20	14.8	14.1	13	15.4	13.6	11.6
HCM Lane LOS	C	B	B	B	C	B	B
HCM 95th-tile Q	3.7	2.4	1.3	1.3	1.8	1.4	1.1

Appendix H

All-Way Stop Control Intersection Synchro Output – Design Year

Intersection	
Intersection Delay, s/veh	20.4
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	190	170	165	105	115	40	110	140	60	25	175	30
Future Vol, veh/h	190	170	165	105	115	40	110	140	60	25	175	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	207	185	179	114	125	43	120	152	65	27	190	33
Number of Lanes	1	1	0	0	1	0	1	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	22.6	22.9	16.3	17.8
HCM LOS	C	C	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	40%	12%	0%
Vol Thru, %	0%	70%	0%	51%	44%	88%	0%
Vol Right, %	0%	30%	0%	49%	15%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	110	200	190	335	260	200	30
LT Vol	110	0	190	0	105	25	0
Through Vol	0	140	0	170	115	175	0
RT Vol	0	60	0	165	40	0	30
Lane Flow Rate	120	217	207	364	283	217	33
Geometry Grp	7	7	7	7	6	7	7
Degree of Util (X)	0.282	0.469	0.455	0.714	0.617	0.496	0.067
Departure Headway (Hd)	8.494	7.759	7.923	7.056	7.863	8.216	7.425
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	422	463	452	510	458	437	480
Service Time	6.274	5.539	5.698	4.831	5.945	5.999	5.208
HCM Lane V/C Ratio	0.284	0.469	0.458	0.714	0.618	0.497	0.069
HCM Control Delay	14.6	17.3	17.2	25.7	22.9	18.9	10.7
HCM Lane LOS	B	C	C	D	C	C	B
HCM 95th-tile Q	1.1	2.5	2.3	5.7	4.1	2.7	0.2

Intersection	
Intersection Delay, s/veh	37.4
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	180	120	90	95	115	25	375	190	145	30	185	190
Future Vol, veh/h	180	120	90	95	115	25	375	190	145	30	185	190
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	196	130	98	103	125	27	408	207	158	33	201	207
Number of Lanes	1	1	0	0	1	0	1	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	2
HCM Control Delay	21.5	28.1	58.6	20.9
HCM LOS	C	D	F	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	40%	14%	0%
Vol Thru, %	0%	57%	0%	57%	49%	86%	0%
Vol Right, %	0%	43%	0%	43%	11%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	375	335	180	210	235	215	190
LT Vol	375	0	180	0	95	30	0
Through Vol	0	190	0	120	115	185	0
RT Vol	0	145	0	90	25	0	190
Lane Flow Rate	408	364	196	228	255	234	207
Geometry Grp	7	7	7	7	6	7	7
Degree of Util (X)	1.007	0.816	0.509	0.543	0.649	0.576	0.47
Departure Headway (Hd)	8.898	8.064	9.557	8.725	9.346	9.054	8.188
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	408	448	380	415	388	402	440
Service Time	6.656	5.822	7.257	6.425	7.346	6.754	5.95
HCM Lane V/C Ratio	1	0.813	0.516	0.549	0.657	0.582	0.47
HCM Control Delay	77	38	21.8	21.3	28.1	23.3	18.1
HCM Lane LOS	F	E	C	C	D	C	C
HCM 95th-tile Q	12.5	7.6	2.8	3.1	4.4	3.5	2.5

Appendix C – Preliminary Noise Analysis Technical Report

Preliminary Noise Analysis Technical Report

Marina Way Extension

Prince William County Project No. 23C17011; UPC 120778

HMMH Report No. 311090.001

December 2023

Prepared for:

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1 Introduction

1.1 Background and Purpose

The Federal Highway Administration (FHWA) regulations for mitigation of highway traffic noise in the planning and design of federally aided highway projects are contained in Title 23 of the United States Code of Federal Regulations Part 772 (23 CFR 772). These regulations state that a “Type I” traffic noise impact analysis is required when there is the addition of through-traffic lanes or ramps in an interchange. The methods and procedures used in this preliminary noise impact evaluation are consistent with the latest noise assessment policies issued by FHWA and the Virginia Department of Transportation (VDOT).

This Preliminary Noise Analysis Technical Memorandum Report describes the details of a noise impact assessment and preliminary noise abatement evaluation performed for the Marina Way Extension Project in Prince William County, Virginia. The noise analysis was conducted in accordance with FHWA and VDOT noise assessment regulations and guidelines, both of which were revised and updated significantly in 2011. The FHWA regulations are set forth in 23 CFR Part 772. VDOT’s revised policy was updated most recently on February 15, 2022.

The study area analyzes all noise-sensitive land use within 500 feet of the proposed edge of pavement of the roadway improvements associated with the Marina Way Extension Project as seen in **Figure 1**.

This report presents a summary of the roadway improvements under study, description of noise terminology, the applicable standards and criteria, an evaluation of the existing noise conditions, a description of the computations of existing and future noise levels, a prediction of future noise impact, an evaluation of potential noise abatement measures, construction noise considerations, and information for local government officials. **Appendix A** presents predicted noise levels, **Appendix B** tabulates the traffic data used in the noise modeling, **Appendix C** presents details from the noise measurement program, and **Appendix D** provides the list of preparers.

1.2 Project Description

The Marina Way Extension Project includes a four-lane divided roadway extension of Marina Way from Annapolis Way to Gordon Boulevard (Route 123). The extension would function as a main street for the proposed North Woodbridge Town Center currently under development and would connect the existing Marina Way to Horner Road.

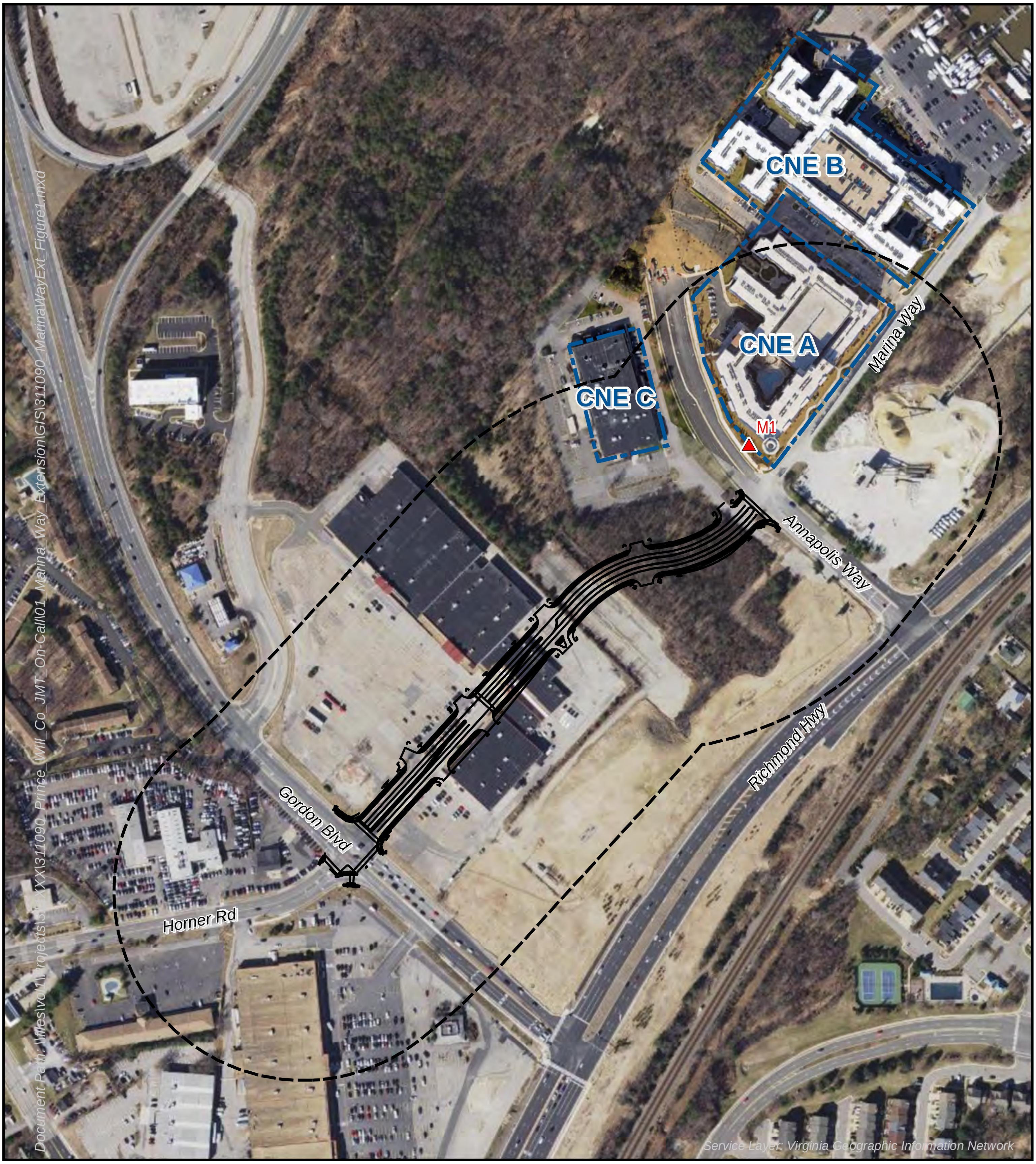
1.3 Study Area Description and Land Use

Noise sensitive land uses in the project study area include multi-family residences as well as one place of worship (Royalhouse Chapel International). Following VDOT and FHWA policies and procedures, the receptors used in the model to represent exterior activity areas at noise-sensitive land uses were grouped into Common Noise Environments (CNEs). Receptors in a CNE are exposed to similar noise sources and levels and are generally located between secondary noise sources, such as cross-streets. The modeled receptors for the Project were grouped into the CNEs listed below. **Figure 1** is an overview graphic of the study area that shows the locations of the CNEs and the noise measurement site. The following paragraphs describe the land use located within each CNE.

CNE A is located in the north corner of the Marina Way and Annapolis Way intersection. It is comprised entirely of residences and associated areas of exterior use within the Viridium Apartments Woodbridge community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a rooftop common area and outdoor pool area are also part of the complex.

CNE B is located north of Annapolis Way and west of Marina Way. It is comprised entirely of residences and associated areas of exterior use within the Rivergate Apartments community. The apartment community consists of a five-story building with exterior ground level outdoor use and balconies. Additionally, a common outdoor area with a pool is also part of the complex.

CNE C is located west of the Marina Way and Annapolis Way intersection. This CNE includes the Royalhouse Chapel International place of worship.



CNE Boundary
500' Noise Study Area
M-# Measurement Site

Figure 1
Locations of Common Noise Environments and Noise Monitoring Site
Marina Way Extension
Woodbridge, Prince William County, VA

0 200 400 800 Feet

2 Noise Abatement Criteria

2.1 Regulations and Guidelines

The potential noise impact of the Marina Way Extension Project was assessed in accordance with FHWA and VDOT noise assessment regulations and guidelines. The FHWA regulations are set forth in 23 CFR Part 772. On July 13, 2010, FHWA published revised noise regulations which became effective on July 13, 2011. FHWA has also published a guidance document to support the new regulations. VDOT prepared revisions to its noise policy in accordance with FHWA's requirements and revised policy. VDOT's revised policy has received approval from FHWA and was last updated on February 15, 2022.

2.2 Noise Abatement Criteria

To assess the degree of impact of highway traffic and noise on human activity, the FHWA established Noise Abatement Criteria (NAC) for different categories of land use activity (see **Table 1**).

Table 1. FHWA Noise Abatement Criteria (NAC)

Activity Category	Leq(h)[1]	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B[2]	67 (Exterior)	Residential
C[2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E[2]	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing
G	-	Undeveloped lands that are not permitted (without building permits)

Notes:
1. Hourly equivalent A-weighted sound level (dBA)
2. Includes undeveloped lands permitted for this activity category

Source: 23 CFR Part 772.

The NAC are given in terms of the hourly, A-weighted, equivalent sound level in decibels (dBA). The A-weighted sound level is commonly used when measuring environmental noise to provide a single number descriptor that correlates with human subjective response to noise because the sensitivity of human hearing varies with frequency. The A-weighted sound level is widely accepted by acousticians as a proper unit for describing environmental noise. Most environmental noise (and the A-weighted sound level) fluctuates from moment to moment, and it is common practice to characterize the fluctuating level by a single number called the equivalent sound level (Leq). The L_{eq} is the value or level of a steady, non-fluctuating sound that represents the same sound energy as the actual time-varying sound evaluated over the same time period. For traffic noise assessment, Leq is typically evaluated over a one-hour period and may be denoted as Leq(h).

In this study, residential areas (Activity Category B) and institutional interior spaces (Activity Category D) were evaluated for noise impact. For Category B, noise impact would occur when predicted exterior noise levels, due to the project, approach or exceed 67 dBA in terms of Leq(h) during the loudest hour of the day. For Category D, noise impact would occur where predicted interior sound levels due to the project approach or exceed 52 dBA Leq(h). VDOT defines the word "approach" in "approach or exceed" as within 1 decibel. For example, the threshold for noise impact for Activity Category B and C is where exterior noise levels are within 1 decibel of 67 dBA Leq(h), or 66 dBA. Noise impact also would occur wherever project noise causes a substantial increase over existing noise levels. VDOT defines a substantial increase as an increase of 10 decibels or more above existing noise levels.

When the predicted design-year Build case noise levels approach or exceed the NAC during the loudest hour of the day or cause a substantial increase in existing noise, consideration of traffic noise reduction measures is necessary. If it is found that such mitigation measures will cause adverse social, economic or environmental effects that outweigh the benefits received, they may be dismissed from consideration. For this study, noise levels throughout the study area were determined for Existing (2023) conditions and the design-year (2050) Build alternative.

All noise-sensitive land uses potentially affected by the project are near roads for which traffic data was developed as part of the environmental study. Therefore, all noise levels were computed from the appropriate loudest-hour traffic data. The prediction methods and predicted noise levels appear in **Section 3**.

This section of the report describes the methodology and establishes existing noise levels and the investigation of undeveloped lands and permitted developments.

2.3 Monitoring of Existing Noise Levels

Noise monitoring was conducted at one short-term site on November 28, 2023. The noise measurement was located adjacent to residential properties with the highest noise exposures nearest the proposed project. Traffic classification counts on the roadways nearest the measurement site were conducted simultaneously during the measurement as well as before and after the measurement. The short-term measurement characterized existing noise levels in the study area but was not necessarily conducted during the loudest hour of the day. It included contributions from sources other than traffic, such as train passbys and intermittent noise from the adjacent concrete plant. The short-term noise monitoring location is shown in **Figure 2** in **Section 4** and numbered with the prefix "M." It is also shown on the monitoring site log field data sheet in **Appendix C.**

Short-term noise monitoring is not a process to determine design-year noise impacts or barrier locations. Short-term noise monitoring provides a level of consistency between what is present in real-world situations and how that is represented in the computer noise model. Short-term monitoring does not need to occur within every CNE to validate the computer noise model.

Noise monitoring was conducted using a Brüel & Kjær Model 2245 sound level meter with current calibration traceable to the U.S. National Institute of Standards and Technology (NIST) and conforming to American National Standards Institute (ANSI) Standard S1.4 and International Electrotechnical Commission (IEC) Standard 61672 for Type 1 (precision) spectrum analyzers. Additional field calibrations were carried out at the beginning and end of each measurement using a NIST-certified Brüel & Kjær Model 4231 acoustic calibrator. The instruments were programmed to log noise levels continuously during each measurement period and recorded broadband A-weighted Leq sound levels in 1-second intervals. The short-term data collection procedure involved a measurement over a period of 30 minutes. Continuous logging of events was conducted during the monitoring, so that intervals with events not representative of the ambient noise environment or not traffic-related could be excluded later. For the 30-minute period, a “Total Leq” (includes non-contaminated sound level contributions from every 1-second interval) and a “Traffic-only Leq” (excludes those intervals that contained noise events unrelated to roadway noise) were determined. By comparing the two totals, the significance of non-traffic events (such as aircraft operations) to the overall noise level can be determined for the measurement period.

Table 2 presents the results of the noise monitoring program. The measured “Total” Leq sound level at site M1 was 59 dBA. **Table 2** shows the site number, address/location, date, start time, measurement duration and monitored noise level at the monitoring site. Note that the “Total” Leq value at site M1 was higher than the “Traffic-Only” Leq value indicating that there were non-traffic related noises occurring during the measurement duration that needed to be excluded during the post processing task.

Table 2. Monitored Noise Levels

Site No.	Address/ Location	Date	Time Start (hh:mm)	Duration (minutes)	Measured Total L_{eq} (dBA)	Measured Traffic-only L_{eq} (dBA)
M1	North corner of Marina Way and Annapolis Way	11/28/2023	15:06	30	59.0	58.2

Source: HMMH, 2023.

The noise measurement field notes, traffic counts, site photographs and calibration output are provided in **Appendix C**. The sound level meter calibration certificate is also included in **Appendix C.**

2.4 Predicted Existing Noise Levels

For calculation of loudest-hour noise levels throughout the study area for the existing (2023) conditions, receiver locations representing noise-sensitive sites adjacent to the project, along with the appropriate traffic data were added as input in the FHWA-approved noise prediction model to provide predicted existing noise levels. These predicted estimates of existing noise levels are then used as the baseline against which probable future noise levels are compared and potential noise impacts assessed. Additional information on the computation methods and computed levels used in this study are provided in **Section 3.**

2.5 Undeveloped Lands and Permitted Developments

In accordance with the VDOT Traffic Noise Policy, an undeveloped lot is considered to be planned, designed, and programmed if a building permit has been issued by the local authorities prior to the Date of Public Knowledge for the relevant project. VDOT considers the “Date of Public Knowledge” as the date that the final National Environmental Policy Act (NEPA) approval is made. VDOT or Prince William

County has no obligation to provide noise mitigation for any undeveloped land that is permitted or constructed after this date.

As mentioned within, the extension of Marina Way will provide a main street for the future development of the North Woodbridge Town Center. The town center is planned to be comprised of mixed-use development and includes future residential use. The location of the town center would be located on the east and west side of the Marina Way extension and within 500 feet of the proposed roadway improvements, therefore requiring further investigation into the status of the development. It was determined that no building permits have been issued for the North Woodbridge Town Center. Therefore, this future development was not incorporated into the noise analysis. No other undeveloped lots were identified within 500 feet of the Marina Way Extension project.

3 Traffic Noise Prediction

This section discusses the noise prediction model, the model validation process, traffic data used as input to the noise prediction model, and then presents a summary of the predicted noise levels.

3.1 Noise Prediction Model

HMMH used the FHWA's Traffic Noise Model (TNM Version 2.5) to compute existing and future Build case loudest-hour noise levels for all receptors located within the Project Noise Study Area. TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs and show excellent agreement in most cases for sites with and without noise barriers.

The traffic data and engineering plans, along with topographic contours and other supplemental information, were used to create a three-dimensional model of the existing and future design roadway configurations and the surrounding terrain within the FHWA TNM. The noise modeling accounted for such factors as propagation over different types of ground (acoustically soft and hard ground), elevated roadway sections, significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, over 260 noise prediction receivers (also called "receptors" and "sites") were added to the modeling.

Information on noise-sensitive residential land use in the study area (Activity Category B) includes the number of dwelling units identified from existing mapping and publicly available parcel data from Prince William County, Virginia.

Traffic-noise levels were predicted for the 2023 Existing conditions and 2050 Build alternative. No-Build noise levels are not typically required for a categorical exclusion (CE) or environmental assessment (EA) unless the project is related to the interstate system or there is a 4(f) resource within the corridor. The Marina Way Extension project is not located along an interstate system and there is no 4(f) resources within the corridor. Therefore, no traffic-noise prediction was completed for the 2050 No-Build condition.

3.2 Noise Model Validation

According to FHWA and VDOT policies, the accuracy of the noise prediction model must be verified on a project-by-project basis. The noise model validation process compares existing noise levels monitored in the field with predicted noise levels from the FHWA TNM using the traffic conditions during the monitoring period as input to the model. The purpose of the noise model validation is to evaluate the success of the model in representing the important acoustical characteristics of the study area. This is determined by examining the overall trend of the differences between measured and predicted noise levels at each measurement site. Individual site-to-site differences may vary significantly, depending on factors that may affect either the measured noise level or the predicted noise level at a given site. Examples of factors that affect noise levels are provided below:

- Factors affecting measured noise levels include atmospheric conditions (upwind, neutral or downwind conditions), shielding by structures that are difficult to model, and/or the presence of "loud" vehicle pass-bys during the measurement.
- Factors affecting predicted noise levels include the level of detail in modeling terrain features and locating receptors, as well as the degree to which ground zones, tree zones, and sparse rows of buildings are incorporated into the model.
- FHWA and VDOT consider the noise model to be validated when measured noise levels are within +/- 3 dBA of predicted noise levels for existing conditions.

FHWA discourages the "calibration" of a noise model through the use of adjustment factors within the noise model to match measured and predicted levels. FHWA recognizes that many factors are present both in the measurement of noise and in the development of a model that can lead to variability. Differences between measured and predicted levels that are outside the accepted accuracy of the model are likely due to unusual circumstances during the measurements, or to insufficient detail or inaccurate assumptions in the model. Only after a thorough examination of the measurement conditions and the modeling assumptions has been completed, should the highway noise analyst consider the use of adjustment factors in the model. FHWA recognizes that in some cases, it may not be possible to identify a specific reason for not validating a specific measurement site. Any such cases are to be documented in the noise study report.

Table 3 presents a comparison of the measured noise level and the corresponding TNM-computed noise level. The comparison for site M1 shows a difference of less than 3 dBA, and so the model has been appropriately validated for this project.

Table 3. Computed vs. Measured Sound Levels at the Measurement Site

Site No.	Address/ Location	Land Use	Measured Traffic-only Leq (dBA)	Computed Leq (dBA)	Difference (dBA)
M1	North corner of Marina Way and Annapolis Way	Residential	58.2	55.3	-2.9

Source: HMMH, 2023.

3.3 Traffic Data for Noise Prediction

The traffic data used in the noise analysis must produce sound levels representative of the loudest hour of the day in the future design year, per FHWA and VDOT policy. Traffic data provided by the project team and found within the *Marina Way and Annapolis Way Alternative Intersection Report* was used for input into the traffic noise model. The report includes traffic volumes along Marina Way and Annapolis Way for 2023 Existing Conditions and the Design Year of 2050. During the noise model validation exercise, it was determined that traffic from Richmond Highway (Route 1) contributes to the overall noise environment. Therefore, traffic counts conducted during the noise measurement for Richmond Highway (Route 1) were used to represent this additional traffic noise at receptors.

Traffic data were supplied as peak hourly volumes for one AM hour (7:15 AM – 8:15 AM) and one PM hour (6:15 PM – 7:15 PM). Truck percentages for Marina Way and Annapolis Way were provided by project traffic engineers. Based on observations from the noise measurements, it was assumed that all truck traffic would be related to medium trucks. Truck percentages along Richmond Highway (Route 1) were estimated using traffic counts collected during the noise measurement program. For existing conditions, average speeds collected during the noise measurement program were used in the noise model. Per Section 6.4.3 of the VDOT Noise Policy, the operating speed must be used if it has been determined to be consistently higher than the posted speed limit, and vice versa. However, since the future operating speeds were not readily available for Marina Way, the proposed speed limit of 30 miles-per-hour was used. For speeds along Annapolis Way and Richmond Highway (Route 1), it was assumed that future speeds would remain the same as existing.

The TNM model for existing conditions and the future design year Build Alternative were run for the entire set of receptors for all peak hour volumes. The loudest hour was determined to be PM peak traffic hour (6:15 PM – 7:15 PM) for most of the receptors located within the project study area and was therefore chosen for the noise analysis. **Appendix B** provides the loudest-hour traffic data for the roadways used in the TNM for this project.

3.4 Predicted Noise Levels

The study area includes exterior residential (FHWA Activity Category B) and interior institutional and religious (Category D) land uses.

Table 4 summarizes the range of predicted noise levels by CNE. The table includes a description of each CNE and its land use, the FHWA Activity Category, and the loudest-hour traffic noise levels, which are presented in terms of the A-weighted equivalent sound level, or Leq, in dBA. Loudest-hour noise levels were computed for 2023 Existing conditions, as well as the design-year (2050) Build alternative. Exterior sound levels are shown for Activity Category B and predicted interior sound levels are shown for Category D (interior institutional) land use. The noise-sensitive place of worship identified in the study area (Royalhouse Chapel International) appear to have air conditioning and masonry construction. Therefore, per FHWA guidance, an outside-to-inside noise reduction value of 25 decibels is used to determine the interior sound levels from the exterior sound levels predicted by TNM. **Appendix A** provides a table that lists the computed sound levels at all the modeled receptors included in the noise assessment.

Upon completion of the noise measurement program and noise modeling, it was determined that other sources of noise, other than roadway noise, contribute to the overall background noise level in the study area. To prevent under-predicting existing and future noise levels, an ambient noise level was incorporated into the traffic-noise modeling results. Based on noise measurement data and proximity of receptors to project roadways, it was determined that a background noise level of 50 decibels was an appropriate value to represent the ambient noise environment.

Figure 2, presented in **Section 4**, provides a location map for the CNEs and noise sensitive receptors. Each receptor is shown in **Figure 2** with a color-coded dot that indicates the status of each receptor according to its 2050 Build noise level.

Table 4. Ranges of Predicted Exterior and Interior Noise Levels for the Worst Hour

CNE	Land Use – Description	Activity Categories	Range of Predicted Exterior & Interior Noise Levels for the Worst Hour (dBA)	
			2023 Existing	2050 Build
A	Residential – West of Marina Way, between Annapolis Way and Rivergate Place. Comprised entirely of residences within the Viridium Woodbridge Apartments community.	B	50 - 58	50 - 61
B	Residential – West of Marina Way, north of Rivergate Place. Comprised entirely of residences within the Rivergate Apartments community.	B	50 - 54	50 - 56
C	Institutional – West of Marina Way, south of Annapolis Way. Includes the Royalhouse Chapel International.	D	26 - 26	31 - 31

Source: HMMH, 2023.

4 Noise Impact Assessment

The potential noise impact of the Marina Way Extension Project was evaluated according to FHWA and VDOT noise assessment guidelines, described in detail in **Section 2**. In summary, noise impact would occur wherever project noise levels are expected to approach within one decibel or exceed 67 dBA Leq at noise-sensitive land uses in Activity Categories B (exterior residential) or approach within one decibel or exceed 52 dBA Leq at noise-sensitive land uses in Activity Category D (interior institutional) during the loudest hour of the day. Noise impact also would occur wherever project noise levels cause a substantial increase over existing noise levels—an increase of 10 dB or more is considered substantial by VDOT.

In the 2023 Existing condition, noise-sensitive receptors are not predicted to be exposed to traffic-noise levels that approach or exceed the applicable NAC impact threshold for all locations. Likewise, in the 2050 Build alternative, traffic-noise levels at noise-sensitive receptors are predicted to be below the applicable NAC threshold for all locations. Additionally, increases in traffic-noise levels are predicted to range between one and seven decibels. Therefore, no impacts due to substantial increases are predicted. Since no noise impact is predicted to occur as a result of the project, no further analysis is required and noise mitigation would not be warranted.

Figure 2 shows the locations of individual receptors analyzed in the 2050 Build alternative. Receptors representing residences within the apartment communities have a designation of A, B, C, D, or E at the end of the receptor name, which represents Floor 1, 2, 3, 4, and 5, respectively.

Figure 2
Location Map for Common Noise Environments and Receptors

Marina Way Extension

Prince William County Project No. 23C17011; UPC 120778

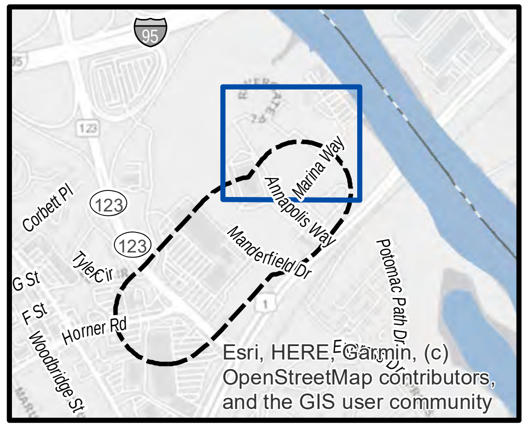
Receiver Site and Number

- Impacted
- Not Impacted

Top Floor Noise Prediction Result
Bottom Floor Noise Prediction Result

Note: Grouped Receiver Labels are in order of Leader Occurrence.

- M# Measurement Site
- 500 ft Noise Study Area
- CNE Boundary
- Property Parcel



0 55 110 220 Feet

5 Noise Abatement Measures

FHWA and VDOT policies require that noise abatement be considered for all receptors that are predicted to be impacted by traffic noise from the proposed project. FHWA has identified certain noise abatement measures that may be incorporated in projects to reduce traffic noise impact. In general, mitigation measures can include alternative measures (traffic management, the alteration of horizontal and vertical alignment, and low-noise pavement), in addition to the construction of noise barriers.

As discussed in **Section 4**, no impacts are predicted at any receptors within the noise study area. Therefore, no further analysis is required since noise abatement is not warranted.Construction Noise Consideration

Construction noise provisions are contained in Section 107.16(b)3 Noise of the 2020 VDOT Road and Bridge Specifications. The specifications have been reproduced below:

- The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall not exceed 80 decibels. Such noise level measurements shall be taken at a point on the perimeter of the construction limit that is closest to the adjoining property on which a noise-sensitive activity is occurring. A noise-sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purpose and not present an unreasonable public nuisance. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.
- The Department may monitor construction-related noise. If construction noise levels exceed 80 decibels during noise sensitive activities, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.
- The Department may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 10 P.M. and 6 A.M. If other hours are established by local ordinance, the local ordinance shall govern.
- Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.
- When feasible, the Contractor shall establish haul routes that direct vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.
- These requirements shall not be applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

6 Information for Local Government Officials

FHWA and VDOT policies require that VDOT provides certain information to local officials within whose jurisdiction the highway project is located, to minimize future traffic noise impacts of Type I projects on currently undeveloped lands. (Type I projects involve highway improvements with noise analysis.) This information must include information on noise-compatible land-use planning, noise impact zones in undeveloped land in the highway project corridor and federal participation in Type II projects (noise abatement only). This section of the report provides that information, as well as information about VDOT's noise abatement program.

6.1 Noise-Compatible Land-Use Planning

Section 9.0 of VDOT's noise policy outlines VDOT's approach to communication with local officials and provides information and resources on highway noise and noise-compatible land-use planning. VDOT's intention is to assist local officials in planning the uses of undeveloped land adjacent to highways to minimize the potential impacts of highway traffic noise.

Entering the Quiet Zone is a brochure that provides general information and examples to elected officials, planners, developers, and the general public about the problem of traffic noise and effective responses to it. A link to this brochure on FHWA's website is provided:

http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/land_use/qz00.cfm

A wide variety of administrative strategies may be used to minimize or eliminate potential highway noise impacts, thereby preventing the need or desire for costly noise abatement structures such as noise barriers in future years. There are five broad categories of such strategies:

- Zoning,

Other legal restrictions (subdivision control, building codes, health codes),
Municipal ownership or control of the land,
Financial incentives for compatible development, and
Educational and advisory services.
The Audible Landscape: A Manual for Highway and Land Use is a very well-written and comprehensive guide addressing these noise-compatible land use planning strategies, with significant detailed information. This document is available through FHWA's Website, at http://www.fhwa.dot.gov/environment/noise/noise_compatible_planning/federal_approach/audible_landscape/al00.cfm

6.2 **VDOT's Noise Abatement Program**

Information on VDOT's noise program is provided in "Highway Traffic Noise Guidance Manual (Version 9)," updated February 15, 2022. This document is available from VDOT's Noise Abatement Section, Virginia Department of Transportation, 1401 E. Broad St., Richmond, VA 23219.

7 References

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Appendix A Predicted Traffic Noise Levels

This appendix provides the predicted noise levels at all the receiver (receptor) locations shown in the study graphics for the 2023 Existing and design-year 2050 Build alternative. The receptor sites are organized by CNE. Also provided are the name and location of each receiver site, the number of dwelling units or recreational units assigned, a description of the land use, the applicable Noise Abatement Criteria, and the predicted loudest-hour Leq sound levels.

Table 5. Predicted Traffic Noise Levels

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-001A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	53	58	No Impact
A-001B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-001C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-001D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-001E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-002A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	53	59	No Impact
A-002B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-002C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	54	60	No Impact
A-002D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-002E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	55	60	No Impact
A-003A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	58	No Impact
A-003B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	60	No Impact
A-003C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	60	No Impact
A-003D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	60	No Impact
A-003E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	60	No Impact
A-004A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	57	No Impact
A-004B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	59	No Impact
A-004C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-004D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-004E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	59	No Impact
A-005	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	55	No Impact
A-006A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-006B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-006C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-006D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	53	No Impact
A-007A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-007B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	52	No Impact
A-007C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-007D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	54	No Impact
A-008A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-008E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-009	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-010A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-010E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-011A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-011E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-012A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-012E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-013A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-013E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-014A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)** 2023 Existing	2050 Build	2050 Impact Type
A-014C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-014E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-015A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-015D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-015E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-016A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-016D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
A-016E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
A-017A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-017B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-017C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	60	No Impact
A-017D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-017E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-018A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
A-018B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
A-018E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	52	No Impact
A-019A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-019B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-019C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-019D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-019E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-020A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-020B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
A-020C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
A-020D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
A-020E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
A-021A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	56	60	No Impact
A-021B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	60	No Impact
A-021C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	57	61	No Impact
A-021D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-021E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	58	61	No Impact
A-022A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-022D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-022E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
A-023A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-023E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
A-024A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-024E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-025A	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025B	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025C	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025D	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
A-025E	1000 Annapolis Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
A-026A	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026B	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026C	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026D	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-026E	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
A-027	1000 Annapolis Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-001A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-001B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-001C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-001D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
B-001E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	54	No Impact
B-002A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-002B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
B-002C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	52	No Impact
B-002D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	52	No Impact
B-002E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-003A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-003B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-003C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-003D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	52	No Impact
B-003E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	52	No Impact
B-004A	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-004B	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004C	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004D	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	51	No Impact
B-004E	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	51	52	No Impact
B-005A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-005B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-005C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)** 2023 Existing	2050 Build	2050 Impact Type
B-005D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-005E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-006A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-006D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-006E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-007A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-007D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-007E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-008A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-008D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-008E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-009A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-009E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-010E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-011A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-011C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-011E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-012A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-012E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-013A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-013E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-014A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-014E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	51	51	No Impact
B-015A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-015E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	51	No Impact
B-016A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-016B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	51	No Impact
B-016E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	51	51	No Impact
B-017A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)** 2023 Existing	2050 Build	2050 Impact Type
B-017B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-017E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	50	50	No Impact
B-018A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-018E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	50	50	No Impact
B-019A	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019B	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019C	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019D	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-019E	13175 Marina Way, Woodbridge, VA 22191	3	B	Res.	67	50	50	No Impact
B-020A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-020B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-020E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	53	No Impact
B-021B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-021E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-022C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-022D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-022E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-023A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-023B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	55	No Impact
B-023C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-023D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-023E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-024A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-024B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-024E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	56	No Impact
B-025A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	56	No Impact
B-025E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	54	56	No Impact
B-026A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-026B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	52	54	No Impact
B-026C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-026D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-026E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-027A	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027B	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027C	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	53	55	No Impact
B-027D	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-027E	13175 Marina Way, Woodbridge, VA 22191	2	B	Res.	67	54	55	No Impact
B-028	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
B-029A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-029B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-029C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact

CNE-Site No.	Address	Units	Cat.*	Land Use	NAC Imp. Crit.	Loudest-Hour L_{eq} (dBA)**		2050 Impact Type
						2023 Existing	2050 Build	
B-029D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	54	No Impact
B-029E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
B-030A	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	52	No Impact
B-030B	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030C	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030D	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	52	53	No Impact
B-030E	13175 Marina Way, Woodbridge, VA 22191	1	B	Res.	67	53	54	No Impact
C-001	991 Annapolis Way, Woodbridge, VA 22191	1	D	Int.	52	26	31	No Impact

* "Cat." = FHWA Activity Category.
HMMH, 2023.

Appendix B Traffic Data Used in Noise Analysis

This appendix provides the loudest-hour roadway traffic volumes and speeds used in the noise modeling for the 2023 Existing conditions, as well as the 2050 Build alternative.

Figure 3 shows the number of receptors for which the AM Peak Hour or the PM Peak Hour represents the worst noise hour for existing conditions by CNE. **Figure 4** shows the equivalent information for the Build Alternative.

Figure 3. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2023 Existing Conditions

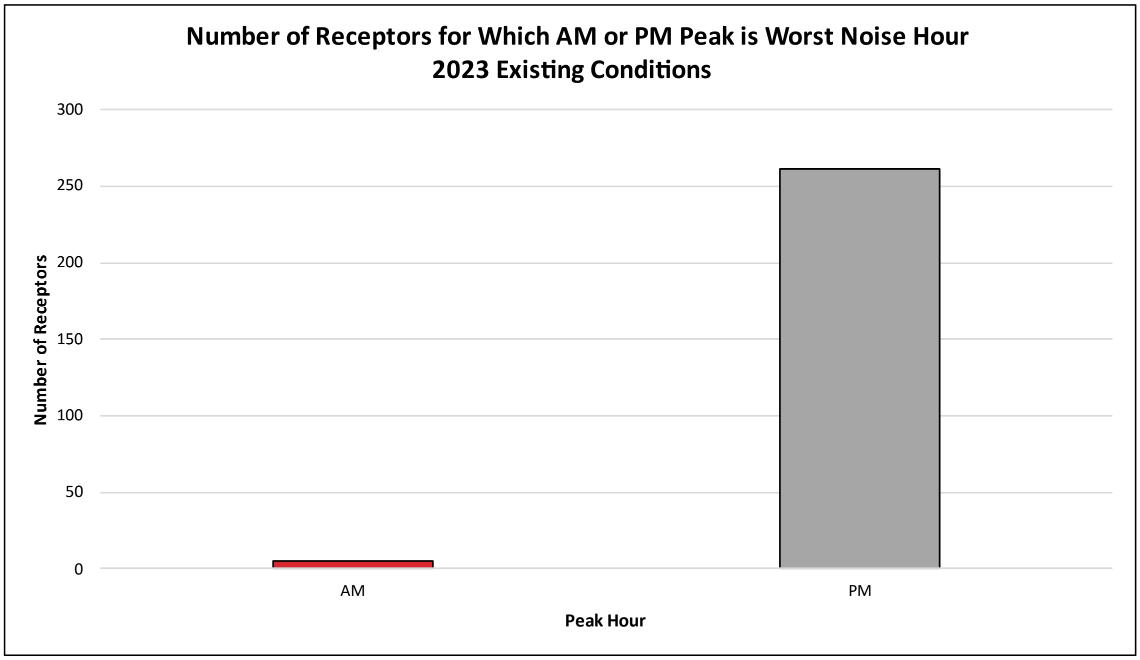
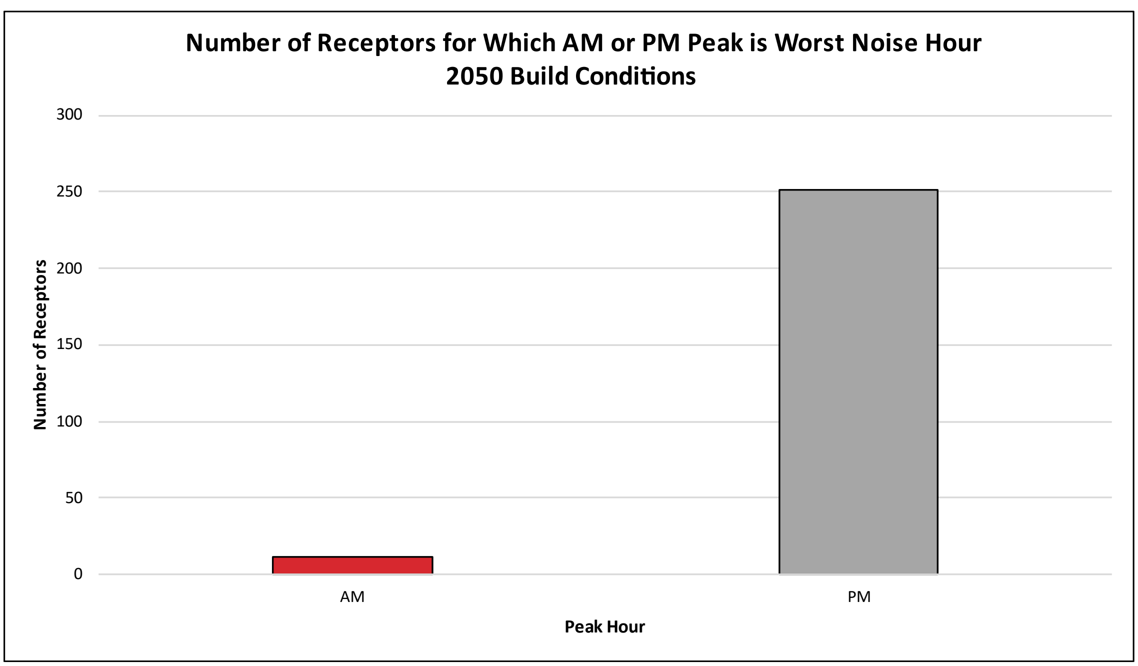


Figure 4. Number of Receptors for Which AM or PM Peak is Worst Noise Hour for 2050 Build Conditions



Marina Way Extension

Noise Measurement Traffic Data

Sample Counts

Sample #1

Time 14:00-14:15

Duration (min) 15

Sample #2

Time 15:46-16:02

Duration (min) 15

Route 1 NB (Sample #1)

Veh.Type	# of Veh.
A	190
MT	2
HT	10
Speed	35

Route 1 NB (Sample #2)

Veh.Type	# of Veh.
A	191
MT	4
HT	3
Speed	34

Route 1 SB (Sample #1)

Veh.Type	# of Veh.
A	295
MT	5
HT	14
Speed	36

Route 1 SB (Sample #2)

Veh.Type	# of Veh.
A	600
MT	5
HT	6
Speed	34

Time 15:06-15:36

Duration (min) 30

Marina Way NB/SB

Veh.Type	# of Veh.
A	54
MT	4
HT	0
Speed	15

Annapolis EB (West of Marina)

Veh.Type	# of Veh.
A	21
MT	4
HT	0
Speed	23

Annapolis EB (East of Marina)

Veh.Type	# of Veh.
A	40
MT	8
HT	0
Speed	23

Annapolis WB (West of Marina)

Veh.Type	# of Veh.
A	23
MT	2
HT	0
Speed	35

Annapolis WB (East of Marina)

Veh.Type	# of Veh.
A	44
MT	2
HT	0
Speed	35

TNM Input

Route 1 NB (Sample #2)

Veh.Type	# of Veh.	Speed
A	764	35
MT	16	35
HT	12	35

Route 1 SB (Sample #2)

Veh.Type	# of Veh.	Speed
A	2400	36
MT	20	36
HT	24	36

Marina Way NB/SB

Veh.Type	# of Veh.	Speed
A	108	15
MT	8	15
HT	0	0

Annapolis EB (West of Marina)

Veh.Type	# of Veh.	Speed
A	42	23
MT	8	23
HT	0	0

Annapolis EB (East of Marina)

Veh.Type	# of Veh.	Speed
A	80	23
MT	16	23
HT	0	0

Annapolis WB (West of Marina)

Veh.Type	# of Veh.	Speed
A	46	35
MT	4	35
HT	0	0

Annapolis WB (East of Marina)

Veh.Type	# of Veh.	Speed
A	88	35
MT	4	35
HT	0	0

Note:

1) Speeds use in validation exercsise are based on average speeds collected during field measurements.

Marina Way Extension
Existing 2023

Peak AM (7:15 AM - 8:15 AM)

Marina Way NB/SB
Total Vehicles 152

Veh.Type	# of Veh.	Speed	Truck %
A	149	25	
MT	3	25	2%
HT	0	25	

Annapolis EB (West of Marina)
Total Vehicles 32

Veh.Type	# of Veh.	Speed	Truck %
A	31	30	
MT	1	30	2%
HT	0	0	

Annapolis EB (East of Marina)
Total Vehicles 141

Veh.Type	# of Veh.	Speed	Truck %
A	138	30	
MT	3	30	2%
HT	0	0	

Annapolis WB (East of Marina)
Total Vehicles 57

Veh.Type	# of Veh.	Speed	Truck %
A	56	30	
MT	1	30	2%
HT	0	30	

Annapolis WB (West of Marina)
Total Vehicles 12

Veh.Type	# of Veh.	Speed	Truck %
A	12	30	
MT	0	0	2%
HT	0	0	

Route 1 NB
Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	764	35	
MT	16	35	2%
HT	12	35	2%

Route 1 SB
Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	2400	36	
MT	20	36	1%
HT	24	36	1%

Peak PM (6:15 PM - 7:15 PM)

Marina Way NB/SB
Total Vehicles 189

Veh.Type	# of Veh.	Speed	Truck %
A	185	25	
MT	4	25	2%
HT	0	25	

Annapolis EB (West of Marina)
Total Vehicles 19

Veh.Type	# of Veh.	Speed	Truck %
A	6	30	
MT	0	0	2%
HT	0	0	

Annapolis EB (East of Marina)
Total Vehicles 112

Veh.Type	# of Veh.	Speed	Truck %
A	55	30	
MT	1	30	2%
HT	0	0	

Annapolis WB (East of Marina)
Total Vehicles 145

Veh.Type	# of Veh.	Speed	Truck %
A	48	30	
MT	1	30	2%
HT	0	0	

Annapolis WB (West of Marina)
Total Vehicles 26

Veh.Type	# of Veh.	Speed	Truck %
A	13	30	
MT	0	30	2%
HT	0	0	

Route 1 NB
Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	764	35	
MT	16	35	2%
HT	12	35	2%

Route 1 SB
Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	2400	36	
MT	20	36	1%
HT	24	36	1%

Notes:

1) Per the draft "Marina Way and Annapolis Way Alternative Intersection Report" (November 2023), since Marina Way does not extend west beyond the Annapolis way intersection under existing conditions, the existing conditions operational analysis was not needed for this study as the proposed conditions alter the 991 Annapolos Way entrance to a four-lane divided throughoutway. Therefore, no traffic data beyond the existing Marina Way and Annapolis Way intersection is available.

2) Volumes for Route 1 reflect traffic counts conducted during the noise measurement program. Although this roadway is not included in the project's roadway network, traffic-noise from Route 1 contributes to the overall noise environment, as determined during the validation exercise.

Marina Way Extension

Build 2050

Peak AM (7:15 AM - 8:15 AM)

Marina Way NB/SB (North of intersection)

Total Vehicles 515

Veh.Type	# of Veh.	Speed	Truck %
A	505	30	
MT	10	30	2%
HT	0	0	

Marina Way NB (South of intersection)

Total Vehicles 525

Veh.Type	# of Veh.	Speed	Truck %
A	260	30	
MT	5	30	2%
HT	0	0	

Marina Way SB (South of intersection)

Total Vehicles 420

Veh.Type	# of Veh.	Speed	Truck %
A	208	30	
MT	4	30	2%
HT	0	0	

Annapolis EB (West of Marina)

Total Vehicles 230

Veh.Type	# of Veh.	Speed	Truck %
A	76	30	
MT	2	30	2%
HT	0	0	

Annapolis EB (East of Marina)

Total Vehicles 445

Veh.Type	# of Veh.	Speed	Truck %
A	147	30	
MT	3	30	2%
HT	0	0	

Annapolis WB (East of Marina)

Total Vehicles 310

Veh.Type	# of Veh.	Speed	Truck %
A	103	30	
MT	2	30	2%
HT	0	0	

Annapolis WB (West of Marina)

Total Vehicles 370

Veh.Type	# of Veh.	Speed	Truck %
A	183	30	
MT	4	30	2%
HT	0	0	

Route 1 NB

Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	382	35	
MT	8	35	2%
HT	6	35	2%

Route 1 SB

Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	600	36	
MT	5	36	1%
HT	6	36	1%

Peak PM (6:15 PM - 7:15 PM)

Marina Way NB/SB (North of intersection)

Total Vehicles 530

Veh.Type	# of Veh.	Speed	Truck %
A	519	30	
MT	11	30	2%
HT	0	0	

Marina Way NB (South of intersection)

Total Vehicles 390

Veh.Type	# of Veh.	Speed	Truck %
A	193	30	
MT	4	30	2%
HT	0	0	

Marina Way SB (South of intersection)

Total Vehicles 814

Veh.Type	# of Veh.	Speed	Truck %
A	403	30	
MT	8	30	2%
HT	0	0	

Annapolis EB (West of Marina)

Total Vehicles 405

Veh.Type	# of Veh.	Speed	Truck %
A	134	30	
MT	3	30	2%
HT	0	0	

Annapolis EB (East of Marina)

Total Vehicles 370

Veh.Type	# of Veh.	Speed	Truck %
A	123	30	
MT	2	30	2%
HT	0	0	

Annapolis WB (East of Marina)

Total Vehicles 710

Veh.Type	# of Veh.	Speed	Truck %
A	235	30	
MT	5	30	2%
HT	0	0	

Annapolis WB (West of Marina)

Total Vehicles 395

Veh.Type	# of Veh.	Speed	Truck %
A	196	30	
MT	4	30	2%
HT	0	0	

Route 1 NB

Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	382	35	
MT	8	35	2%
HT	6	35	2%

Route 1 SB

Total Vehicles

Veh.Type	# of Veh.	Speed	Truck %
A	600	36	
MT	5	36	1%
HT	6	36	1%

Notes:

1) Per the draft "Marina Way and Annapolis Way Alternative Intersection Report" (November 2023), since Marina Way does not extend west beyond the Annapolis way intersection under existing conditions, the existing conditions operational analysis was not needed for this study as the proposed conditions alter the 991 Annapolos Way entrance to a four-lane divided throughoutway. Therefore, traffic data along Gordon Boulevard was not utilized in the Build condition.

2) Volumes for Route 1 reflect traffic counts conducted during the noise measurement program. Although this roadway is not included in the project's roadway network, traffic-noise from Route 1 contributes to the overall noise environment, as determined during the validation exercise.

Appendix C Noise Measurement Details

This appendix includes data acquired during the noise measurement program including the site sketch, photographs, field noise and traffic count data sheets, and the calibration certificate.

Site M1. Facing East on Annapolis Way.

Site M1. Facing West on Annapolis Way.

HBK
HOTTINGER BRÜEL & KJÆR

The Hottinger Bruel & Kjaer Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770/209-6907
Fax: 770/447-4033
Web site address: http://www.hbkworld.com

A2LA ACCREDITED
Calibration Certificate Number 1568.01

CERTIFICATE OF CALIBRATION

Certificate No: CAS-616753-T0X2P4-801

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2245	Serial No: 2245-100484
Microphone:	Brüel & Kjær	4966	Serial No: 3236856
Supplied Calibrator:	Brüel & Kjær	4231	Serial No: 3025167
Software version:	1.1.2.386		

CLIENT:

Harris Miller Miller & Hanson Inc.
700 District Avenue Suite 800
Burlington, MA 01803

CALIBRATION CONDITIONS:

Preconditioning:	4 hours at 23 ± 3 °C
Environment conditions	See actual values in Environmental Condition sections

SPECIFICATIONS:

This document certifies that the instrument as listed under "Model/Serial Number" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor *k* = 2 providing a level of confidence of approximately 95%. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurement. The calibration of the listed instrumentation, was accomplished using a test system which conforms with the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and ISO 10012-1. For "as received" and/or "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation This Certificate and attached data pages shall not be reproduced, except in full, without the written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. This instrument has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

Hottinger Brüel & Kjær Model 3630 Sound Level Meter Calibration System Software 7763 Version 8.6 - DB: 8.60 Test Collection 2245-E, 4966 (BZ-7301).

RESULTS:

As Received Condition	As Received Data	Final Data
_X_ Received in good condition	_X_ Within acceptance criteria	_X_ Within acceptance criteria
___ Damaged - See attached report	___ Outside acceptance criteria	___ Limited test - See attached details
	___ Inoperative	
	___ Data not taken	

Date of Calibration: Jan. 09. 2023

Certificate issued: Jan. 10. 2023

John Avitabile

Grant Kennedy

Calibration Technician

John Avitabile
Quality Representative

HBK HOTTINGER BRÜEL & KJÆR
The Hottinger Brüel & Kjær Inc. Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770-209-6907
Fax: 770-447-4033
Web site address: http://www.hbkworld.com

A2LA ACCREDITED

Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION No.: CAS-616753-T0X2P4-402

CALIBRATION OF:

Microphone: Brüel & Kjær Type 4966 Serial No. 3236856

CUSTOMER:

Harris Miller Miller & Hanson, Inc
700 District Ave, Ste 800
Burlington, MA 01803

CALIBRATION CONDITIONS:

Environment conditions:	Air temperature:	23.1	°C
	Air pressure:	98.027	kPa
	Relative Humidity:	30	%RH
Applied polarization voltage:	0 Vdc		

SPECIFICATIONS:

This document certifies that the instrument as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Hottinger Brüel & Kjær Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants.

PROCEDURE:

The measurements have been performed with the assistance of the Hottinger Brüel & Kjær Inc. Microphone Calibration System B&K 9721 with application software WT9649 and WT9650 version 5.3.0.10 using calibration procedure: 4966 S251-FR01

RESULTS:

- [X] "As Received" Data: Within Acceptance Criteria
- [ ] "As Received" Data: Outside Acceptance Criteria
- [X] "Final" Data : Within Acceptance Criteria
- [ ] "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k=2$ providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from standards, calibration method, effect of environmental conditions and any short term contribution from the device under calibration.

Date of Calibration: January 11, 2023

Certificate issued: January 11, 2023

John Avitabile

Meshaun Hobbs
Calibration Technician

John Avitabile
Quality Representative

HBK HOTTINGER BRÜEL & KJÆR

The Hottinger Brüel & Kjær Inc. Calibration Laboratory
3079 Premiere Parkway Suite 120
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Telephone: 770-209-6907
Fax: 770-447-4033
Web site address: http://www.hbkworld.com

A2LA ACCREDITED
Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION

No.: CAS-616753-T0X2P4-401

CALIBRATION OF:

Calibrator:	Brüel & Kjær	Type 4231 IEC Class: 1	Serial No.: 3025167

CUSTOMER:

Harris Miller Miller & Hanson, Inc
700 District Ave, Ste 800
Burlington, MA 01803

CALIBRATION CONDITIONS:

Environment conditions:	Air temperature:	23.4	°C
	Air pressure:	97.81	kPa
	Relative Humidity:	31.8	%RH

SPECIFICATIONS:

This document certifies that the acoustic calibrator as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Hottinger Brüel & Kjær Inc. Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants. The acoustic calibrator has been calibrated in accordance with the requirements as specified in IEC60942.

PROCEDURE:

The measurements have been performed with the assistance of Hottinger Brüel & Kjær Inc. acoustic calibrator calibration application
Software version 2.3.4 Type 7794 using calibration procedure4231 Complete

RESULTS:

- [X] "As Received" Data: Within Acceptance Criteria
- [ ] "As Received" Data: Outside Acceptance Criteria
- [X] "Final" Data : Within Acceptance Criteria
- [ ] "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the calibrator under calibration.

Date of Calibration: January 11, 2023

Certificate issued: January 11, 2023

Meshaun Hobbs

Calibration Technician

John Atilik

Grant Kennedy
Quality Representative

Appendix D List of Preparers

This appendix lists the preparers of this report.

Preparers with HMMH are as follows:

- Tara Cruz - Project Manager and Lead Analyst
- Christopher Menge - Senior Technical Advisor and Principal-in-Charge
- Bob Finck - Document development support and QC
- Logan Katsoufis – Noise Measurements

Appendix D – Waters of the US and Wetland Delineation Report

Waters of the US and Wetlands Delineation Report

MARINA WAY EXTENTION PROJECT

Prince William County, Virginia

Project Identifier 23C17011
VDOT UPC 120778

Submitted to:
Prince William County Department of Transportation

February 2024

Executive Summary

Johnson, Mirmiran & Thompson (JMT) has conducted a delineation of jurisdictional waters of the U.S. (WOUS), including wetlands, within a 20.8 acre study area located in Prince William County, Virginia. (Figure 1) The project involves extending Marina Way from Annapolis Way to Horner Road at Gordon Boulevard with a four-lane divided roadway and associated pedestrian facilities. This report is intended to document the findings of the delineation investigation conducted by JMT in order to obtain a preliminary jurisdictional determination (PJD) from the U.S. Army Corps of Engineers (USACE).

There are approximately 0.14 acres of palustrine forested wetland within the study area.

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APPENDICES

APPENDIX A – PHOTOGRAPHIC DOCUMENTATION

APPENDIX B – FIGURES

APPENDIX C – SITE DATA SHEETS

Site Description

The proposed project is located within Prince William County between the Annapolis Way and Horner Road at Route 123 (Gordon Boulevard) and lies within the Coastal Plain physiographic province. The study area is approximately 20.8 acres. To gain access to the site from I-95 northbound, take exit 160A and continue on Route 123 (Gordon Boulevard) east, then turn north onto Horner Road.

The southern portion of the study area is completely paved. This area is used for customer parking that serves the stores located in the center of the study area (Figure 1). The northern portion of the study area is forest land consisting of mostly mixed, broad-leaf, deciduous forested communities that transition to old field/disturbed communities closer to Annapolis Way. Elevation ranges from approximately 70 to 100 feet above mean sea level (amsl) within an area that is predominantly developed (Figure 2). The study area watershed flows to Popes Head Creek which is part of the Middle Potomac – Anacostia – Occoquan River (Hydrologic Unit Code [HUC] 02070010). Elevations on the site range from approximately 71 to 91 feet above mean sea level (amsl). The latitude and longitude of the approximate center of the site are N 38.665503°, W -77.246582°. Mapping from the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) Panel 51153C0236E (Dated 8/3/215) is shown in Figure 3 and documents that the study area is not located within a FEMA 100-year floodplain (FEMA, 2015).

Field Investigation Methodology

A field investigation was conducted to delineate potentially jurisdictional Waters of the U.S. (WOUS), including wetlands within the study area. A wetland delineation was performed according to the Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Regional Supplement, Version 2.0, (USACE, 2010). The Corps of Engineers Wetland Delineation Manual states three criteria (wetland vegetation, wetland soils, and wetland hydrology) must be present for an area to qualify as a wetland, unless the area is significantly disturbed (atypical situation) or is considered a problem area (e.g., seasonally ponded soils). If the area is significantly disturbed or a problem area, then only two parameters must be evident to classify an area as a wetland. All delineated wetlands are classified into system, subsystem, class, and subclass according to the Classification of Wetlands and Deep Water Habitats of the United States (Cowardin et al., 1979).

In order to delineate wetland boundaries, samples were taken periodically using a dutch auger. Soil samples were collected at each wetland and upland sample point, and soil colors were recorded in the field using a Munsell soil color chart (Munsell Color, 2010). NRCS digital soils data and mapping were obtained from the NRCS website and were compared for consistency to the observed conditions encountered during the field investigations. These data were augmented by review of soils data for the property. Site photographs are included in Appendix A; a photo location key is included to orient photographic location within the site. All figures associated with desktop review and field delineation are located in Appendix B.

Samples of vegetation, soils, and hydrology were taken at representative locations that were possible wetlands and adjacent non-wetland areas to determine the potential wetland boundaries. Wetland Determination Data Forms describing representative plant communities, hydrology indicators, and soil characteristics are included in Appendix C. WOUS boundaries were flagged in the field and documented using a Trimble® global positioning system (GPS) capable of sub-meter accuracy.

Findings

PUBLISHED INFORMATION

Prior to conducting the fieldwork, a desktop review of published information was performed to identify known site conditions and to determine the presence of known jurisdictional wetlands and/or WOUS in the study area. The bullets below provide a list of the references utilized and their effective dates.

- Fort Belvoir, Virginia 7.5' x 7.5' Topographic Quadrangle (USGS, 2019) (**Figure 2**);
- FEMA FIRM Panel. Prince William County, Virginia. Map #51153C0236E (FEMA, 2010) (**Figure 3**)
- National Wetlands Inventory (NWI) (USFWS, 2017) (**Figure 4**);
- Web Soil Survey. Prince William County, Virginia (USDA/NRCS, 2021) (**Figure 5**); and

All figures are presented in Appendix B.

NWI mapping shows a palustrine freshwater emergent wetland (PEM) within the project study area **(Figure 4).** No other NWI-mapped wetlands or WOUS were identified in the desktop review.

Mapped soils information is presented in Table 1 below and no mapped hydric soils or soils with hydric inclusions (shown as Percent Hydric Presence) were identified within the project area. One soil map unit (54B) was not classified by hydric rating or % Hydric Presence, but is urban land and other disturbed soils that are highly variable and not typically expected to have hydric features. Mapped soils are shown in Figure 5.

TABLE 1. SOIL UNITS MAPPED WITHIN THE STUDY AREA

MAP UNIT SYMBOL	MAP UNIT NAME	MAP UNIT PROPERTIES	HYDRIC RATING	% HYDRIC PRESENCE
18D	Dumfries sandy loam, 15 to 25 percent slopes	Not prime farmland	Not hydric	0
42B	Neabsco-Quantico complex, 2 to 7 percent slopes	Not prime farmland	Not hydric	0
54B	Urban land-Udorthents complex, 0 to 7 percent slopes	Not prime farmland	Unclassified	Unclassified

Source: USDA-NRCS Soil Survey 2021

FIELD INVESTIGATIONS

Field investigations were conducted on June 13, 2023, by JMT environmental scientists Amy Musselman and Steven Swarr, to identify and delineate wetlands and WOUS within the study area. A pedestrian survey of the entire undeveloped limits within the property was conducted and potential jurisdictional areas identified during desktop review were investigated. Due to design constraints, the study area was expanded. A pedestrian survey of the additional area was performed on February 27, 2024. Two upland sample plots were taken to provide a representation of the study area and one wetland data point was collected, following the USACE regional supplement methods; one upland data point (DPU 1) was taken in the vicinity of the NWI-mapped wetland feature and documents absence of hydric soils, hydrology and wetland vegetation in this location. JMT delineated one forested wetland adjacent to the developed portions of the property. The location of the delineated system is shown on the Waters of the US Delineation Map in Figure 6. Photographic documentation is included in Appendix A. Wetland data sheets are in Appendix C.

Wetlands

Wetland A - Wetland A is an isolated palustrine forested (PFO) wetland located in the central portion of the project area along the SW edge of the undeveloped, vegetated area (Figure 6). The primary hydrology indicators throughout this wetland included standing water and water-stained leaves. The secondary hydrology indicators included a FAC-neutral test and drainage patterns. There was standing water (approximately 12 inches deep) where the wetland data point was taken. The dominant vegetation where the wetland data point was taken included willow oak (*Quercus phellos*) and common reed *(Phragmites australis)*. Vegetation throughout the wetland was consistent with the wetland data point. Soils were hydric with a matrix chroma of 10 YR 4/4 from 0-4 inches and 10 YR 3/2 from 4 plus inches. Soils were a silt loam. See Appendix C – Data Sheets for additional information.

TABLE 2. WETLANDS AND WATERS OF THE US IDENTIFIED WITHIN THE STUDY AREA

MAP ID	NAME	CLASSIFICATION	LENGTH (FT)	AREA (SQ FT)
Wet A	N/A	PFO	N/A	5,987

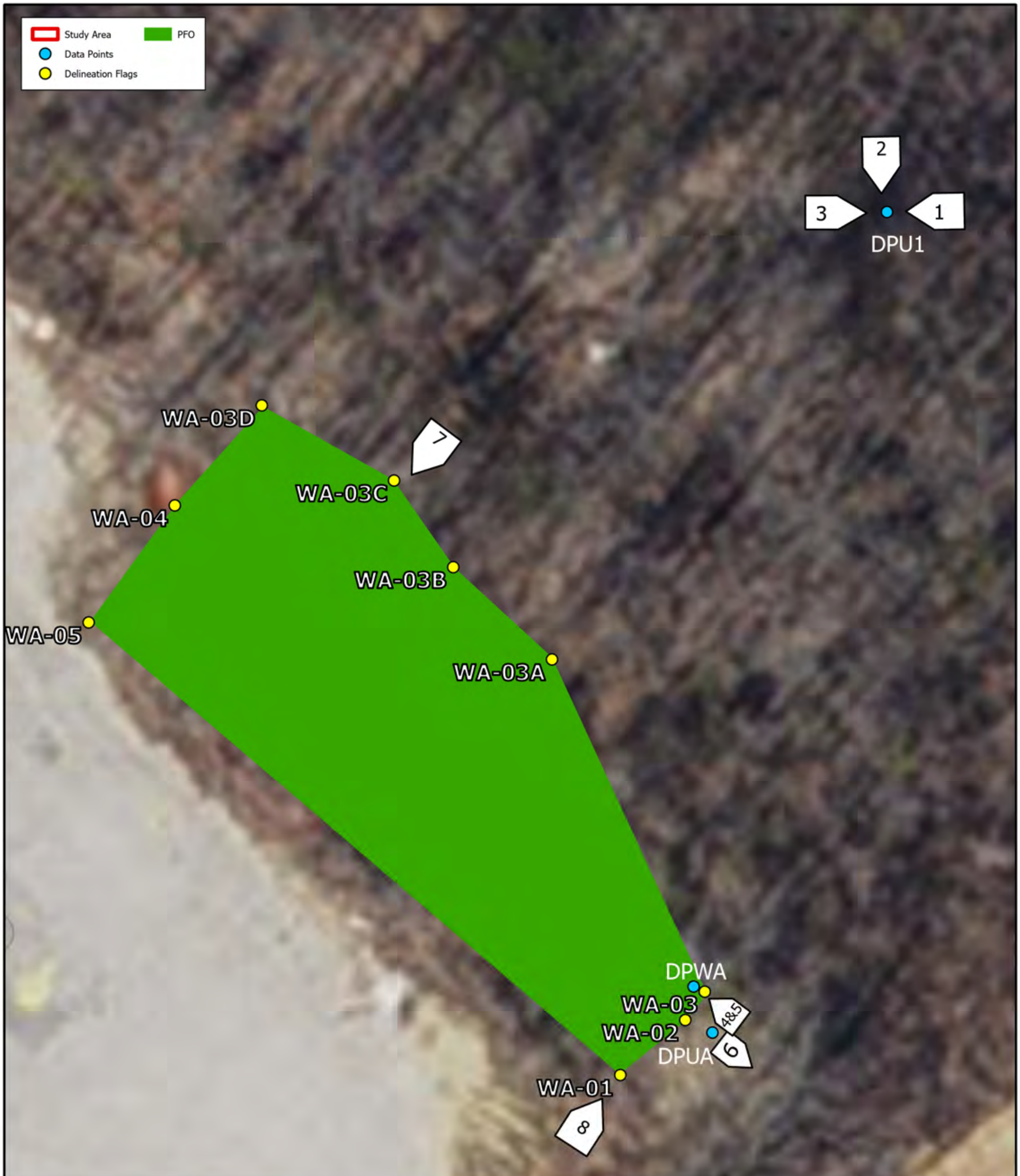
Regulatory Requirements and Limitations

The limits of WOUS described in this report are based on an examination of field conditions at the time of this investigation and may differ from future observations by others. This report does not constitute a jurisdictional determination; such determinations must be verified by the USACE or VA Department of Environmental Quality (VDEQ). Given the isolated nature of the wetland identified onsite, it is unlikely the USACE will exert jurisdiction over this feature. However, VDEQ currently conducts State Surface Water Determinations and may review this delineation upon request.

Resources not jurisdictional to USACE may still be regulated by VDEQ. Section 404 of the Clean Water Act authorizes the USACE to regulate the placement of fill in jurisdictional areas. Virginia Administrative Code (9VAC25-690-100) authorizes VDEQ to regulate activities in state waters, which includes wetlands, streams and waterbodies. Any proposed impacts to WOUS may require authorization from the appropriate federal, state, and/or local regulatory agencies.

Prince William County's Chesapeake Bay Preservation Ordinance is enacted to mandate the authority of the Chesapeake Bay Preservation Act (CBPA). The CBPA protects environmentally sensitive features which contribute to the water quality in the Chesapeake Bay. RPAs include both tidal and nontidal wetlands, as well as tidal shores, intermittent streams, water bodies with a perennial flow, and a 100-foot vegetated buffer area located adjacent to the aforementioned features. According to Section 118-5-2(a), public roads, such as this project, are exempt from the provisions of the Ordinance.

APPENDIX A
PHOTOGRAPHIC DOCUMENTATION



APPENDIX A
PHOTODOCUMENTATION LOCATION KEY
MARINA WAY EXTENSION (UPC 120778)

Prince William County, VA

Sources: Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)

Photo 1: View of DPU1 facing west.

Photo 2: View of DPU1 facing south.

Photo 3: View of DPU1 facing east.

Photo 4: View of DPWA facing northwest.

Photo 5: View of DPWA facing northwest.

Photo 6: View of DPUA facing east.

Photo 7: View of Wetland A (PFO) facing southwest.

Photo 8: View of Wetland A (PFO) facing northeast.

APPENDIX B
FIGURES

Sources: Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)

FIGURE 1
PROJECT LOCATION

MARINA WAY EXTENSION (UPC 120778)

0 210 420
Feet

Prince William County, VA

JMT®

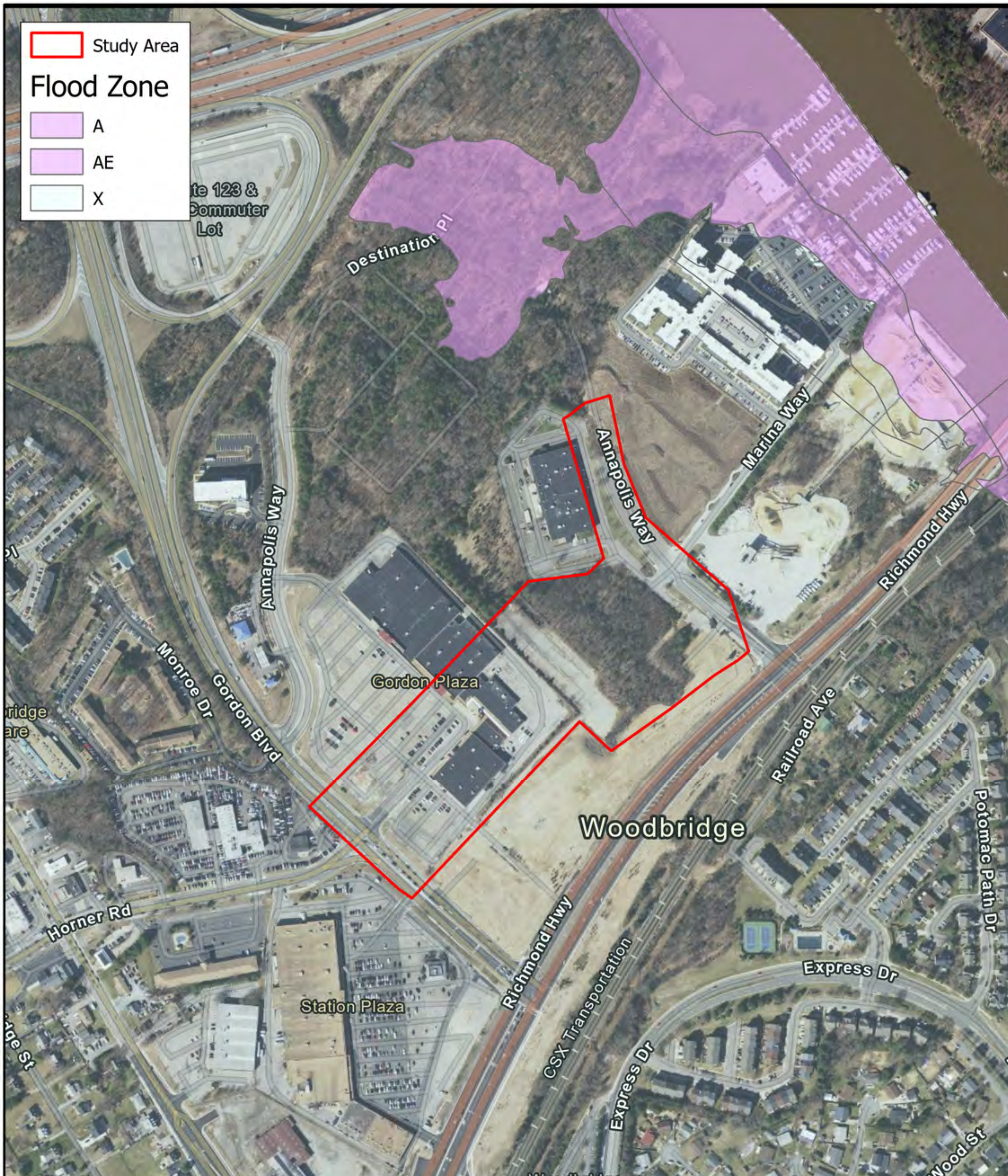
N

Sources: USGS, 2019

FIGURE 2
USGS TOPOGRAPHIC QUADRANGLE MAP
FORT BELVOIR, VA

MARINA WAY EXTENSION (UPC 120778)

0 240 480
Feet
Prince William County, VA



N

FIGURE 3
FEMA FLOOD HAZARD MAP #51153C0236E
MARINA WAY EXTENSION (UPC 120778)

0 210 420
Feet

Prince William County, VA

Sources: Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)

Sources: FWS HQ ES National Wetlands Inventory - Wetlands: U.S. Fish and Wildlife Service, National Standards and Support Team, wetlands_team@fws.gov
World Imagery: Maxar
Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)

FIGURE 4
NATIONAL WETLANDS INVENTORY MAP
MARINA WAY EXTENSION (UPC 120778)

Prince William County, VA

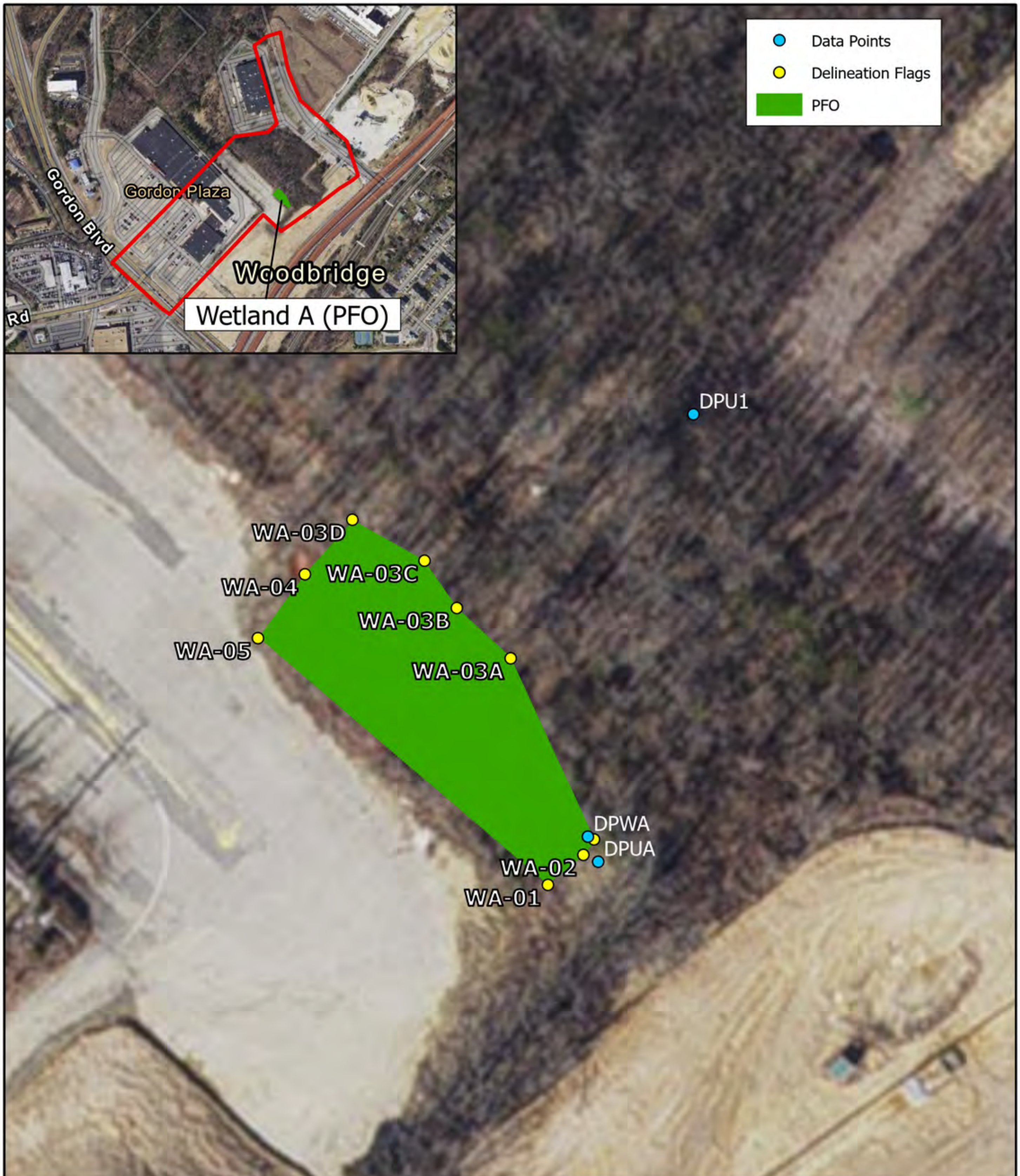
N

FIGURE 5
NRCS SOIL MAP
MARINA WAY EXTENSION (UPC 120778)

0 130 260
Feet

Prince William County, VA

Sources: World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)



N

Sources: Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
World Imagery: Maxar
Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
Aerial Photography Most Recent (VGIN): Virginia Geographic Information Network (VGIN)

FIGURE 6
DELINEATED RESOURCE MAP
MARINA WAY EXTENSION (UPC 120778)

0 20 40
Feet

Prince William County, VA

APPENDIX C
SITE DATA SHEETS

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Marina Way Extension City/County: ______ Sampling Date: 2023-06-07

Applicant/Owner: ______ State: ______ Sampling Point: DPU1

Investigator(s): AM/SS Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 38.66515376 Long: -77.24588516 Datum: WGS 84

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ✔ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ✔

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No ✔	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No** ✔
Hydric Soil Present?	Yes ___ No ✔		
Wetland Hydrology Present?	Yes ___ No ✔		

Remarks:

Area was in a drought leading up to delineation which is atypical for the area. According to NOAA, the area received 0.47 inches of precipitation in the 2 weeks prior to the site visit. Vegetation was disturbed from previous development and was not typical of that area (catalpa, bradford pear, etc.). Historic (Google Earth) photos show land disturbance and old field conditions within the last 20 years, particularly on the NE end of the site.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Vis ble on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___ No ✔	Depth (inches): ______	
Water Table Present?	Yes ___ No ✔	Depth (inches): ______	
Saturation Present? (includes capillary fringe)	Yes ___ No ✔	Depth (inches): ______	**Wetland Hydrology Present? Yes** ___ **No** ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DPU1

Tree Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	30	✔	FAC
2. Pyrus calleryana	20	✔	
3. Quercus rubra	10		FACU
4.			
5.			
6.			
	60% = Total Cover		
50% of total cover: 30.0	20% of total cover: 12.0		

Sapling Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Pyrus calleryana	15	✔	
2.			
3.			
4.			
5.			
6.			
	15% = Total Cover		
50% of total cover: 7.5	20% of total cover: 3.0		

Shrub Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Morus alba	10	✔	FACU
2.			
3.			
4.			
5.			
6.			
	10% = Total Cover		
50% of total cover: 5.0	20% of total cover: 2.0		

Herb Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	20	✔	FAC
2. Leersia virginica	10	✔	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30% = Total Cover		
50% of total cover: 15.0	20% of total cover: 6.0		

Woody Vine Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	10	x 2 = 20
FAC species	50	x 3 = 150
FACU species	20	x 4 = 80
UPL species	0	x 5 = 0
Column Totals:	80 (A)	250 (B)

Prevalence Index = B/A = 3.1

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✔ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: DPU1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0 - 4	10YR 3/4	100					Clay Loam	
4 - 12	10YR 4/6	100					Clay Loam	
-								
-								
-								
-								
-								

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A16) **(MLRA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ______ No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Marina Way Extension City/County: ______ Sampling Date: 2023-06-07

Applicant/Owner: ______ State: ______ Sampling Point: DPUA

Investigator(s): AM/SS Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 38.66474583 Long: -77.24600603 Datum: WGS 84

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ✔ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ✔

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No ✔	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** ✔
Hydric Soil Present?	Yes ___	No ✔	
Wetland Hydrology Present?	Yes ___	No ✔	

Remarks:
Area was in a drought leading up to delineation which is atypical for the area. According to NOAA, the area received 0.47 inches of precipitation in the 2 weeks prior to the site visit. Vegetation was disturbed from previous development and was not typical of that area (catalpa, bradford pear, etc.). Historic (Google Earth) photos show land disturbance and old field conditions within the last 20 years, particularly on the NE end of the site.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Vis ble on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No ✔	Depth (inches): ______
Water Table Present?	Yes ___	No ✔	Depth (inches): ______
Saturation Present? (includes capillary fringe)	Yes ___	No ✔	Depth (inches): ______

Wetland Hydrology Present? Yes ___ No ✔

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DPUA

Tree Stratum (Plot size: 30 ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Catalpa speciosa	20	✔	FACU
2.			
3.			
4.			
5.			
6.			
	20% = Total Cover		

50% of total cover: 10.0 20% of total cover: 4.0

Sapling Stratum (Plot size: 30 ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: 20% of total cover:

Shrub Stratum (Plot size: 30 ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: 20% of total cover:

Herb Stratum (Plot size: 30 ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	15	✔	FAC
2. Baccharis halimifolia	10	✔	FAC
3. Panicum sp.	5		
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30% = Total Cover		

50% of total cover: 15.0 20% of total cover: 6.0

Woody Vine Stratum (Plot size: 30 ft r)

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	25	x 3 = 75
FACU species	20	x 4 = 80
UPL species	0	x 5 = 0
Column Totals:	45 (A)	155 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✔ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ___ No ✔

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: DPUA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	10YR 3/4	100					Clay Loam	
-								
-								
-								
-								
-								
-								

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ______ No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Marina Way Extension City/County: ______ Sampling Date: 2023-06-07

Applicant/Owner: ______ State: ______ Sampling Point: DPWA

Investigator(s): AM/SS Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR or MLRA): ______ Lat: 38.66474630 Long: -77.24600443 Datum: WGS 84

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ✔ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ✔

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✔	No ___	**Is the Sampled Area within a Wetland?** **Yes** ___ **No** ✔
Hydric Soil Present?	Yes ___	No ✔	
Wetland Hydrology Present?	Yes ✔	No ___	

Remarks:

Area was in a drought leading up to delineation which is atypical for the area. According to NOAA, the area received 0.47 inches of precipitation in the 2 weeks prior to the site visit.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✔ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Vis ble on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✔ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✔	No ___	Depth (inches): 0
Water Table Present?	Yes ___	No ✔	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No ✔	Depth (inches): ___

Wetland Hydrology Present? Yes ✔ **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Ponded water observed in portion of wetland near DPWA

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: DPWA

Tree Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus phellos	15	✔	FACW
2.			
3.			
4.			
5.			
6.			
	15% = Total Cover		
50% of total cover: 7.5	20% of total cover: 3.0		

Sapling Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1. Phragmites australis	85	✔	FACW
2.			
3.			
4.			
5.			
6.			
	85% = Total Cover		
50% of total cover: 42.5	20% of total cover: 17.0		

Herb Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Woody Vine Stratum (Plot size: 30 ft r)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	100	x 2 = 200
FAC species	0	x 3 = 0
FACU species	0	x 4 = 0
UPL species	0	x 5 = 0
Column Totals:	100 (A)	200 (B)

Prevalence Index = B/A = 2.0

Hydrophytic Vegetation Indicators:

✔ 1 - Rapid Test for Hydrophytic Vegetation

✔ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✔ No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: DPWA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0 - 4	10 YR 4/4	100					Clay loam	
4 +	10 YR 3/2	100					Clay loam	
-								
-								
-								
-								
-								

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A16) **(MLRA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ✔ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ✔ **No** ______

Remarks:

Appendix E – Biological Review

MEMORANDUM

TO: USFWS Virginia Field Office (Northeast Region)
DATE: 3/21/2024
FROM: JMT
PROJECT: Marina Way Extension (UPC 120778)
STATE UPC: 120778
RE: USFWS Consultation Package

Prince William County, in coordination with the Virginia Department of Transportation (VDOT), has initiated the preparation of an Environmental Assessment (EA) for the Marina Way Extension project (Project) in Woodbridge, Virginia. Project improvements consist of connecting Annapolis Way to Horner Road with a four-lane divided roadway and associated pedestrian facilities. The extension will function as a main street for the proposed North Woodbridge Town Center and will help mitigate the congestion on surrounding Route 1 and Route 123 by better distributing traffic demand to multiple intersections. The EA is being prepared in accordance with the National Environmental Policy Act. Construction is scheduled to begin in March 2026 and last until August 2027.

The proposed project site is depicted on the attached General Location Map (Figure 1) and Natural Color Aerial Imagery (Figure 2). The project's forest impacts are illustrated on Figure 3.

Figures

N

0 390 780
Feet

Sources: World Topographic Map: Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS
World Topographic Map: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
World Hillshade: Esri, NASA, NGA, USGS, FEMA
World Hillshade: Esri, CGIAR, USGS

FIGURE 1
PROJECT LOCATION
MARINA WAY EXTENSION (UPC 120778)

Prince William County, VA

N

FIGURE 2
AERIAL IMAGERY

MARINA WAY EXTENSION (UPC 120778)

0 390 780
Feet

Prince William County, VA

Sources: Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
World Imagery: Earthstar Geographics
Hybrid Reference Layer: Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS
World Imagery: Maxar

Category	Impacted Area (acres)
Total Forest	1.12
Forest 0-100 ft From Pavement	0.66
Forest 100-300 ft From Pavement	0.46

Forest Impacts

Distance from Pavement

0-100 ft

100-300 ft

Limit of Distrubance (LOD)

Total Forested Area Within LOD

Figure 3

0 100 200 400 Feet

N

Sources: World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri Community Maps Contributors, County of Prince William, Fairfax County, VA, VGIN, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Photolog


Photograph #1 - Entrance to property from the south (7/13/2023)


Photograph #2 - View of onsite buildings from west (7/13/2023)

Photograph #3 - View of rear (north) side of on-site buildings (7/13/2023)

Photograph # 4 - Asphalt parking area in central area of site,
immediately north of commercial buildings (7/13/2023)

Photograph # 5 - View of soil stockpiles on vacant property east of site (7/13/2023)

Photograph # 6 - View of entrance to property from the east (7/13/2023)

Photograph # 7 - Asphalt paved area located in central portion of property. (7/13/2023)

Photograph # 8 - Loading dock on east side of commercial buildings (7/13/2023)

Photograph # 9 - View of location of restaurant site adjacent
to southwest corner of property (7/13/2023)

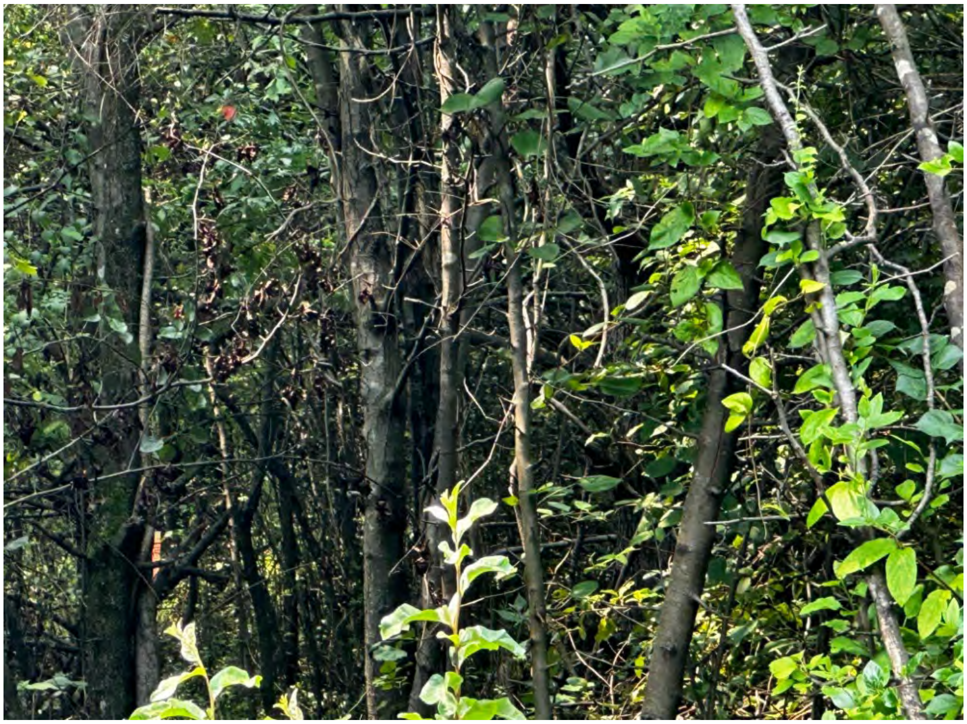
Photograph # 10 - Groundwater monitoring wells observed on
north side of onsite buildings (7/13/2023)

Photograph # 11 - Rear/north side of onsite buildings (7/13/2023)

Photograph # 12 - Utility connections for onsite buildings (typical) (7/13/2023)

Photograph # 13 - Pole mounted transformer on eastern property line (7/13/2023)

Photograph # 14 - Heavily wooded area on northern portion of property (7/13/2023)



Photograph #15 - Densely wooded/vegetated area on
northern portion of the property (7/13/2023)

Photograph # 16 - Residential development on north
adjacent property (7/13/2023)

Photograph #17 - Entrance to Vulcan Materials facility located immediately north/northeast of property (7/13/2023)

Photograph #18 – Office building located to the northwest, adjacent to property (7/13/2023)

Photograph # 19 – Looking east towards Annapolis Way from study area (3/1/2024)

Photograph # 20 – Looking southwest towards forested portion of study area from Annapolis Way (3/1/2024)

Photograph # 21 – Looking west along Annapolis Way (3/1/2024)

Photograph # 22 – Looking westward along Annapolis Way from Route 1 outside of study area (3/1/2024)

Photograph # 23 – Power poles and transformers adjacent to Vulcan materials plant; "Non PCB" labeling visible from ground. Also visible in Photo # 21. (3/1/2024)

Photograph # 24 – Active roadway construction occurring immediately northwest of study area at existing terminus of Annapolis Way (3/1/2024)

Photograph # 25 – Residential development (right) and office building (left) adjacent to study area along Annapolis Way (3/1/2024)

Photograph # 26 – Gordon Plaza Main Building exterior; west side (3/1/2024)

Photograph # 27 - Gordon Plaza Main Building exterior; east side and connection with Gordon Plaza South Building (3/1/2024)

Photograph # 28 – Gordon Plaza South Building Exterior (3/1/2024)

Photograph # 29 – Rear exterior of Gordon Plaza South Building (3/1/2024)

Photograph # 30 - Rear exterior of Gordon Plaza Main Building (3/1/2024)

Photograph # 31 – Representative portion of asphalt parking area in central area of site, immediately north of commercial buildings (3/1/2024)

Official Species List and Maps

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
Phone: (804) 693-6694

In Reply Refer To: March 04, 2024
Project Code: 2024-0040139
Project Name: Marina Way Extension

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through IPaC by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see Migratory Bird Permit | What We Do | U.S. Fish & Wildlife Service (fws.gov).

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
(804) 693-6694

PROJECT SUMMARY

Project Code: 2024-0040139
Project Name: Marina Way Extension
Project Type: Road/Hwy - New Construction
Project Description: The Prince William County (County) Department of Transportation, in coordination with the Virginia Department of Transportation (VDOT), is to construct the Marina Way Extension between Annapolis Way and Gordon Boulevard (Route 123) in Woodbridge, Virginia. The proposed four-lane, 0.26-mile roadway would be on new alignment. It would be a four-lane median-divided roadway with curb and gutter, a 4-foot buffer, and 5-foot-wide sidewalks on both sides of the road. Lane widths will be 11 feet wide with turn lanes present at the Route 123 intersection and main entrances into the Home Depot and Aldi grocery store. The proposed raised grass median will be 15 feet in width and will transition down to 4 feet at intersections where turn lanes are needed. The project does not involve additional capacity on existing Marina Way.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.6653552,-77.24609244722956,14z

Counties: Prince William County, Virginia

ENDANGERED SPECIES ACT SPECIES

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

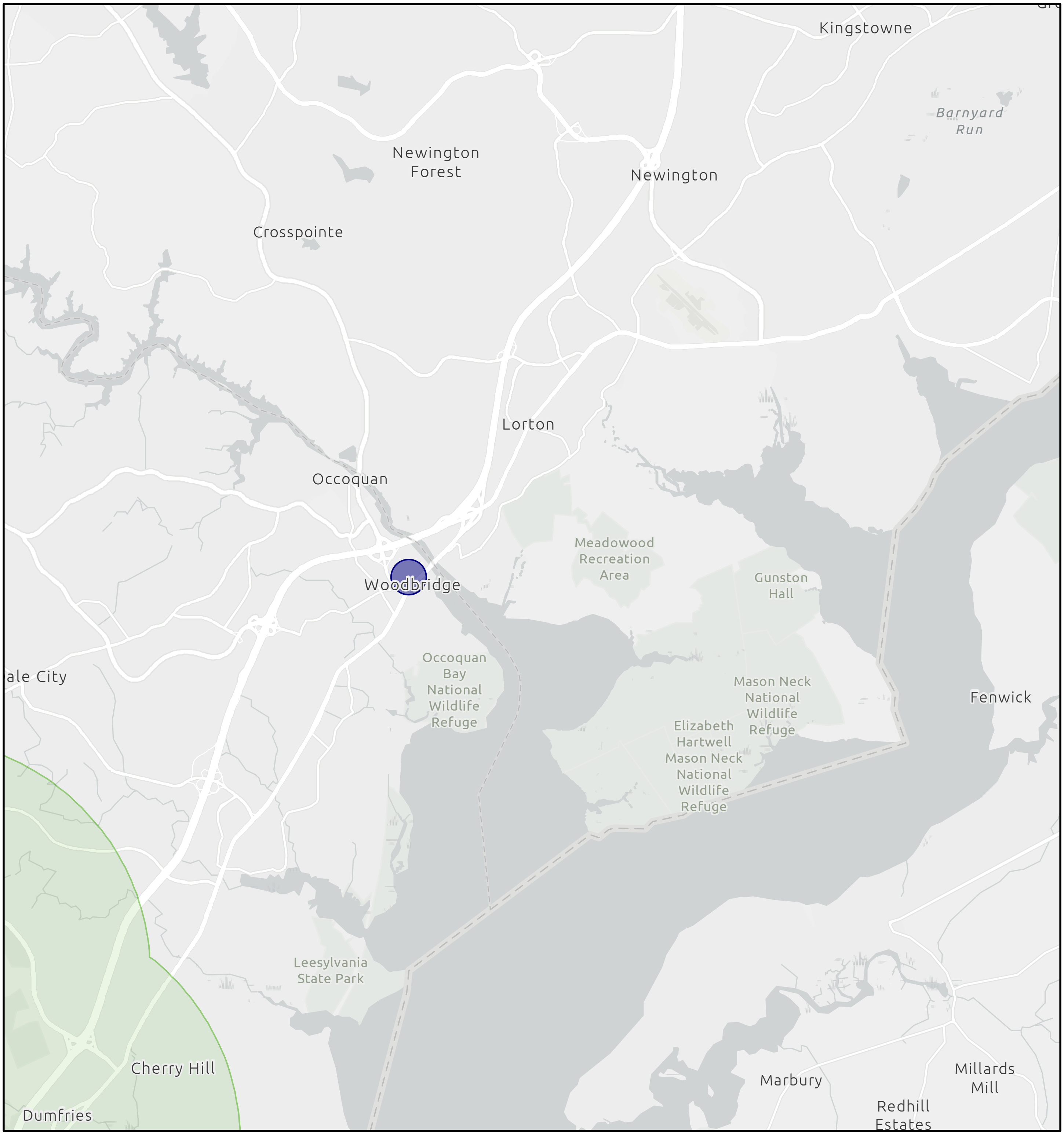
IPAC USER CONTACT INFORMATION

Agency:	County of Prince William
Name:	Steven Swarr
Address:	13454 Sunrise Valley Drive
Address Line 2:	Suite 500
City:	Herndon
State:	VA
Zip:	20147
Email	sswarr@jmt.com
Phone:	8046554822

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

NLEB Locations and Roost Trees



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NLEB Capture 3 Mile Buffer

1:144,448

0 1 2 4 mi

0 1.5 3 6 km

Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS

VA Dept. Game & Inland Fisheries
Fairfax County, VA, VGIN, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS | Virginia Geographic Information Network (VGIN), and the

Tricolored Bat Hibernaculum Map

3/12/2024, 3:33:52 PM

1:288,895

0 2 4 8 mi

0 3 6 12 km

County of Prince William, Fairfax County, VA, VITA, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Dept. Game and Inland Fisheries
County of Prince William, Fairfax County, VA, VITA, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS |

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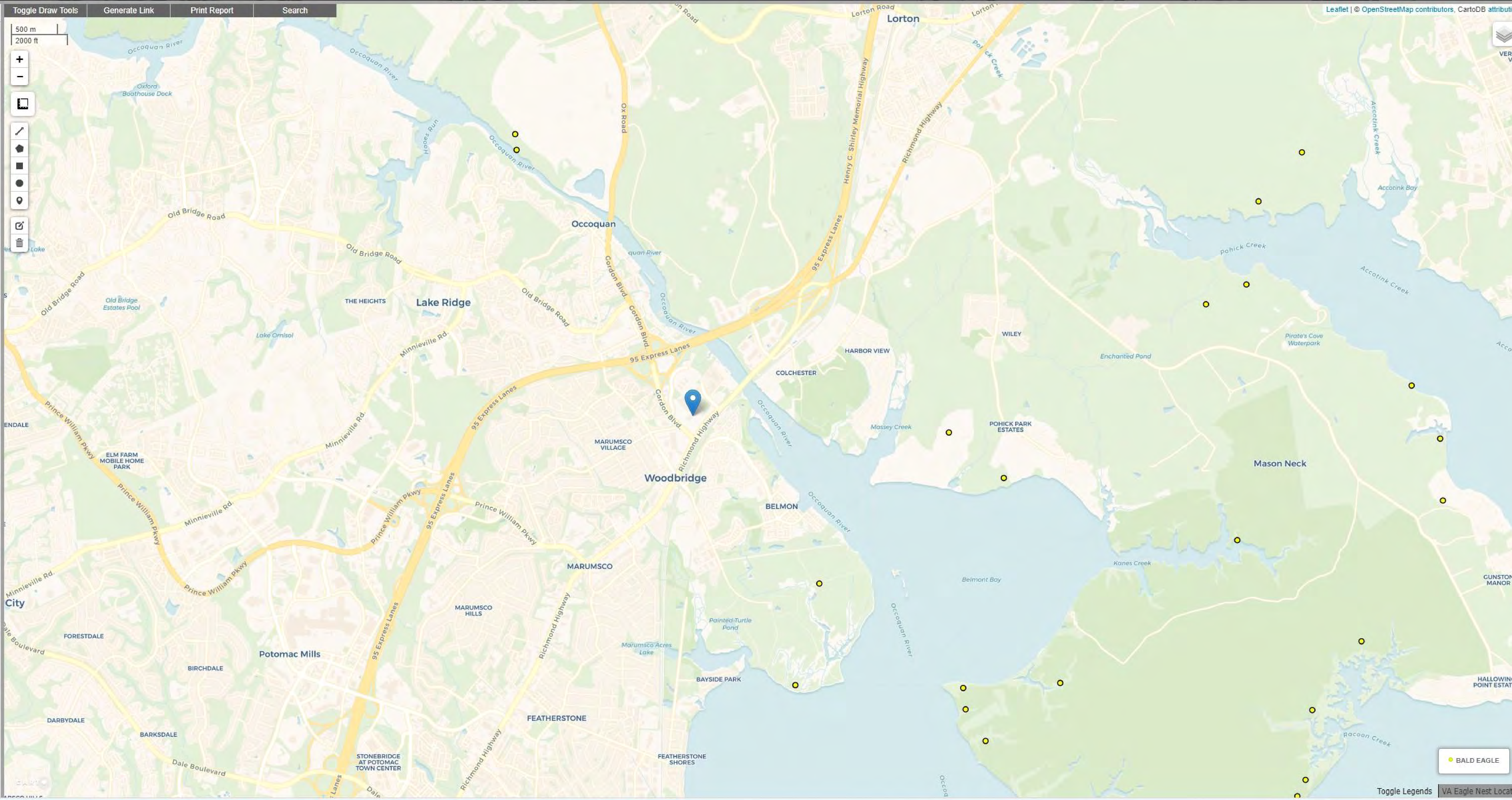

Endangered Species Act Determination Table

Endangered Species Act (ESA) Section 7 Determination Table

Project Name: Marina Way Extension Project (UPC 120778)

Date: March 21, 2024

Consultation Code: 2024-0040139

Species / Resource Name	Habitat/Species Presence in Action Area	Sources of Info	ESA Section 7 Determination	Project Elements that Support Determination
Insert name of species or resource as listed on Official Species List.	*Indicate if suitable habitat and species are present in the Action Area (see examples in Step 5).*	*Explain what info suitable habitat/species presence is based on.*	*Using reasoning and decision tables in Step 5, select determination for each species (e.g. no effect, not likely to adversely affect, or likely to adversely affect).*	*Explain which project elements may impact the habitat or individuals of each species and any Avoidance and Minimization Measures being implemented.*
Northern Long-eared Bat (*Myotis septentrionalis*)	There are forested areas with trees greater than 3" DBH in the project area. There are no bridge structures in the project area.	IPaC and field review.	May affect – likely to adversely affect.	VDGIF NLEB Winter Habitat & Roost Trees Map indicates that there are roost trees within 10 miles of the project area. There are forested areas or trees greater than 3" DBH and 1.12 acres of tree impacts anticipated. There will be no work on bridge structures. Programmatic Consultation Key was used for this determination. The County intends to observe the April 1st to November 14th time of year restriction (TOYR).
Tricolored Bat (*Perimyotis subflavus)*	There are forested areas within the project area.	IPaC and field review	May affect – Not likely to adversely affect.	There are forested areas within the project area. The project will result in 1.12 acres of forest impacts.
Monarch Butterfly *(Danaus plexippus)*	No habitat present	IPaC and field review	No Effect	Per the USFWS IPaC Endangered species review: "Since you answered yes to one or more of the previous questions, you may wish to skip using the CPB. The robust analysis process of the CPB is likely not necessary for projects which

Species / Resource Name	Habitat/Species Presence in Action Area	Sources of Info	ESA Section 7 Determination	Project Elements that Support Determination
				meet any of the above criteria." The County intends to observe the April 1st to November 14th TOYR.

Consistency Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
Phone: (804) 693-6694

In Reply Refer To: 03/21/2024 15:50:49 UTC
Project code: 2024-0040139
Project Name: Marina Way Extension

Subject: Consistency letter for the 'Marina Way Extension' project under the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (NLEB).

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated March 21, 2024 to verify that the **Marina Way Extension** (Proposed Action) may rely on the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action is within the scope and adheres to the criteria of the PBO, including the adoption of applicable avoidance and minimization measures. **At least one of the qualification interview questions indicated an activity or portion of your project is consistent with a likely to adversely affect therefore, the overall determination for your project is, may affect, and is likely to adversely affect the endangered Indiana bat (*Myotis sodalis*) and/or the endangered northern long-eared bat (*Myotis septentrionalis*)**. Consultation with the Service pursuant to section 7(a)(2) of the ESA (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) is required.

This "may affect - likely to adversely affect" determination becomes effective when the lead Federal action agency or designated non-federal representative requests the Service rely on the PBO to satisfy the agency's consultation requirements for this project. Please provide this consistency letter to the lead Federal action agency or its designated non-federal representative for review, and as the agency deems appropriate, transmit to this Service Office for verification that the project is consistent with the PBO.

This Service Office will respond by letter to the requesting Federal action agency or designated non-federal representative within 30 calendar days after receiving request for verification to:

- verify that the Proposed Action is consistent with the scope of actions covered under the PBO;
- verify that all applicable avoidance, minimization, and compensation measures are included in the action proposal;
- identify any action-specific monitoring and reporting requirements, consistent with the monitoring and reporting requirements of the PBO, and
- identify anticipated incidental take.

ESA Section 7 compliance for this Proposed Action is not complete until the Federal action agency or its designated non-federal representative receives a verification letter from the Service.

If the Proposed Action is modified, or new information reveals that it may affect the Indiana bat and/or Northern long-eared bat in a manner or to an extent not considered in the PBO, further review to conclude the requirements of ESA Section 7(a)(2) may be required.

For Proposed Actions that include bridge/culvert or structure removal, replacement, and/or maintenance activities: If your initial bridge/culvert or structure assessments failed to detect Indiana bats, but you later detect bats prior to, or during construction, please submit the Post Assessment Discovery of Bats at Bridge/Culvert or Structure Form (User Guide Appendix E) to this Service Office. In these instances, potential incidental take of Indiana bats may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species and/or designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please advise the lead Federal action agency accordingly.

The following species may occur in your project area and **are not** covered by this determination:

- Monarch Butterfly *Danaus plexippus* Candidate
- Tricolored Bat *Perimyotis subflavus* Proposed Endangered

PROJECT DESCRIPTION

The following project name and description was collected in IPaC as part of the endangered species review process.

NAME

Marina Way Extension

DESCRIPTION

The Prince William County (County) Department of Transportation, in coordination with the Virginia Department of Transportation (VDOT), is to construct the Marina Way Extension between Annapolis Way and Gordon Boulevard (Route 123) in Woodbridge, Virginia. The proposed four-lane, 0.26-mile roadway would be on new alignment. It would be a four-lane median-divided roadway with curb and gutter, a 4-foot buffer, and 5-foot-wide sidewalks on both sides of the road. Lane widths will be 11 feet wide with turn lanes present at the Route 123 intersection and main entrances into the Home Depot and Aldi grocery store. The proposed raised grass median will be 15 feet in width and will transition down to 4 feet at intersections where turn lanes are needed. The project does not involve additional capacity on existing Marina Way.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.6653552,-77.24609244722956,14z

DETERMINATION KEY RESULT

Based on your answers provided, this project is likely to adversely affect the endangered Indiana bat and/or the endangered northern long-eared bat. Therefore, consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required. However, also based on your answers provided, this project may rely on the conclusion and Incidental Take Statement provided in the amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

QUALIFICATION INTERVIEW

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No
2. Is the project within the range of the northern long-eared bat[1]?

   [1] See northern long-eared bat species profile

   Automatically answered
   Yes
3. Which Federal Agency is the lead for the action?

   A) Federal Highway Administration (FHWA)
4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales)

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   No
5. Does the project include *any* activities that are **greater than** 300 feet from existing road/ rail surfaces[1]?

   [1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

   No
6. Does the project include *any* activities **within** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]?

   [1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

   No

7. Is the project located **within** a karst area?

   No

8. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   [2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the User's Guide for the Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat.

   Yes

9. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat?

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   Yes

10. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail?

    No

11. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] **within** the suitable habitat located within your project action area?

    [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

    [2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    [3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

    [4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

    No

12. Does the project include activities **within documented NLEB habitat**[1][2]?

    [1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

    [2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

    No

13. Will the removal or trimming of habitat or trees occur **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors?

    Yes

14. What time of year will the removal or trimming of habitat or trees **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors occur?

    B) During the inactive season

15. Will *any* tree trimming or removal occur **within** 100 feet of existing road/rail surfaces?

    Yes

16. Will *any* tree trimming or removal occur **between** 100-300 feet of existing road/rail surfaces?

    Yes

17. Are *all* trees that are being removed clearly demarcated?

    Yes

18. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing **permanent** lighting?

    Yes

19. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation?

    No

20. Does the project include slash pile burning?

    No

21. Does the project include *any* bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)?

    No

22. Does the project include the removal, replacement, and/or maintenance of *any* structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.)

    No

23. Will the project involve the use of **temporary** lighting *during* the active season?

    Yes

24. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **temporary** lighting will be used?

    Yes

25. Will the project install *any* new or replace any existing **permanent** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities?

    Yes

26. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **permanent** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be installed or replaced?

    Yes

27. Does the project include percussives or other activities (**not including tree removal/ trimming or bridge/structure work**) that will increase noise levels above existing traffic/ background levels?

    No

28. Are *all* project activities that are **not associated with** habitat removal, tree removal/ trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives, limited to actions that DO NOT cause any additional stressors to the bat species?

    Examples: lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.

    Yes

29. Will the project raise the road profile **above the tree canopy**?

    No

30. Are the project activities that are not associated with habitat removal, tree removal/ trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives consistent with a No Effect determination in this key?

    Automatically answered
    Yes, other project activities are limited to actions that DO NOT cause any additional stressors to the bat species as described in the BA/BO

31. Is the habitat removal portion of this project consistent with a Not Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because the tree removal/trimming that occurs outside of the NLEB's active season occurs greater than 0.5 miles from the nearest hibernaculum, is less than 100 feet from the existing road/rail surface, includes clear demarcation of the trees that are to be removed, and does not alter documented roosts and/or surrounding summer habitat within 0.25 miles of a documented roost.

32. Is the habitat removal portion of this project consistent with a Likely to Adversely Affect determination in this key?

    Automatically answered
    Yes, because the tree removal that occurs outside the NLEB's active season is 100-300 feet from the existing road/rail surface, and is not in documented roosting/foraging habitat or travel corridors.

33. **General AMM 1**
    Will the project ensure *all* operators, employees, and contractors working in areas of known or presumed bat habitat are aware of *all* FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable Avoidance and Minimization Measures?

    Yes

34. **Tree Removal AMM 1**
    Can *all* phases/aspects of the project (e.g., temporary work areas, alignments) be modified, to the extent practicable, to avoid tree removal[1] in excess of what is required to implement the project safely?

    Note: Tree Removal AMM 1 is a minimization measure, the full implementation of which may not always be practicable. Projects may still be NLAA as long as Tree Removal AMMs 2, 3, and 4 are implemented and LAA as long as Tree Removal AMMs 3, 5, 6, and 7 are implemented.

    [1] The word “trees” as used in the AMMs refers to trees that are suitable habitat for each species within their range. See the USFWS’ current summer survey guidance for our latest definitions of suitable habitat.

    Yes

35. **Tree Removal AMM 3**
    Can tree removal be limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits)?

    Yes

36. **Lighting AMM 2**
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1] to rate the amount of light emitted in unwanted directions?

[1] Refer to The BUG System—A New Way To Control Stray Light

Yes

37. **Lighting AMM 2**
Will the **permanent** lighting used during removal of suitable habitat and/or the removal/ trimming of trees within suitable habitat be designed to be as close to 0 for all three BUG ratings as possible, with a priority of "uplight" of 0 and "backlight" as low as practicable?

Yes

38. **Lighting AMM 1**
Will *all* **temporary** lighting be directed away from suitable habitat during the active season?

Yes

39. **Lighting AMM 2**
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1] to rate the amount of light emitted in unwanted directions?

[1] Refer to The BUG System—A New Way To Control Stray Light

Yes

40. **Lighting AMM 2**
Will the **permanent** lighting (other than any lighting already indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) be designed to be as close to 0 for all three BUG ratings as possible, with a priority of "uplight" of 0 and "backlight" as low as practicable?

Yes

41. For Indiana bat, if applicable, compensatory mitigation measures are required to offset adverse effects on the species (see Section 2.10 of the BA). Please select the mechanism in which compensatory mitigation will be implemented:

6. Not Applicable

PROJECT QUESTIONNAIRE

1. Have you made a No Effect determination for *all* other species indicated on the FWS IPaC generated species list?

No

2. Have you made a May Affect determination for *any* other species on the FWS IPaC generated species list?

Yes

3. How many acres[1] of trees are proposed for removal between 0-100 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   0.66

4. How many acres[1] of trees are proposed for removal between 100-300 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   0.46

5. **Please verify:**
   All tree removal will occur greater than 0.5 mile from any hibernaculum.

   Yes, I verify that all tree removal will occur greater than 0.5 miles from any hibernaculum.

6. Is the project location 0-100 feet from the edge of existing road/rail surface?

   Yes

7. Is the project location 100-300 feet from the edge of existing road/rail surface?

   Yes

8. **Please verify:**
   No documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted between June 1 and July 31.

   Yes, I verify that no documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted during this period.

9. You have indicated that the following Avoidance and Minimization Measures (AMMs) will be implemented as part of the proposed project:
   - *Tree Removal AMM 1*
   - *Lighting AMM 1*
   - *Lighting AMM 2*
   - *Tree Removal AMM 3*
   - *General AMM 1*

AVOIDANCE AND MINIMIZATION MEASURES (AMMS)

This determination key result includes the committment to implement the following Avoidance and Minimization Measures (AMMs):

TREE REMOVAL AMM 1

Modify all phases/aspects of the project (e.g., temporary work areas, alignments) to avoid tree removal.

LIGHTING AMM 1

Direct temporary lighting away from suitable habitat during the active season.

LIGHTING AMM 2

When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

TREE REMOVAL AMM 3

Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).

GENERAL AMM 1

Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

DETERMINATION KEY DESCRIPTION: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

This key was last updated in IPaC on October 30, 2023. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which may require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the endangered **northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's amended February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion (dated March 23, 2023) for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

IPAC USER CONTACT INFORMATION

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LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

Appendix F – Phase IB Cultural Resources Survey

September 12, 2023

UPDATED: February 16, 2024

Phase IB Archaeological Survey

Marina Way Extension Project, Prince William County, Virginia

Project # 0639-076-348

UPC 120778

Submitted to: Prince William County Department of Transportation

By Kaitlin LaGrasta, RPA, Archaeologist, and Dan King, RPA, Archaeologist

and Lauren Gryctko, RPA, Senior Archaeologist and Principal Investigator

Lauren Gryctko

Signature of Principal Investigator

Abstract

This report documents the results of the Phase IB archaeological survey for the proposed Marina Way Extension Project (the project) in Prince William County, Virginia. The purpose of the project is to lessen the burden on key surrounding facilities such as Route 1 and Route 123 by connecting Marina Way to Horner Road with a four-lane divided roadway complete with pedestrian facilities. Marina Way, a two-lane undivided roadway, serves as the only access point to Occoquan Harbor. The road extension will function as a main street for the proposed North Woodbridge Town Center currently under development, which will better distribute traffic demand to multiple intersections. The proposed improvements will promote safety, improve land use development accesses, and enhance the visual aesthetics throughout the corridor. This federal-funded (SmartScale) Locally Administrated Project (LAP) is in the north Woodbridge area between I-95 and Route 1, just south of the Occoquan River. This original report was submitted to DHR in September 2023, however, since submittal, the project area has slightly changed to include and additional portion of Annapolis Way. The report has been updated throughout to reflect the appropriate acreage and project area boundaries. Because the project update only includes Annapolis Way, which is an existing road, no additional fieldwork was conducted.

The proposed project study area measures 20.9 acres and is located between Route 123 on the west, and Route 1 on the East; the 20.9 acres are considered the Area of Potential Effects (APE). This survey was conducted for Prince William County to identify the potential for significant archaeological resources within the proposed APE. All work was conducted in consultation with the Virginia Department of Historic Resources (DHR) and in accordance with DHR's (2017) Guidelines for Conducting Historic Resources Survey in Virginia. The project complies with requirements of Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its corresponding implementing regulations in 36 CFR 800. The purpose of the survey and assessment was to identify and evaluate archaeological sites for the National Register of Historic Places (NRHP). The criteria established for significance or potential significance is established in 36 CFR 60.4. JMT conducted the field survey and submits this report to DHR for concurrence on behalf of Prince William County.

JMT conducted a Phase IA reconnaissance survey in June 2023, which determined that the majority of the APE consists of paved roads, paved parking lots, grassy medians with buried and aboveground utilities, and part of the extant Gordon Plaza shopping center building (King et al. 2023). JMT determined that the wooded area located in the central portion of the APE has moderate potential for archaeological resources and recommended systematic survey per DHR Guidelines (2017), with shovel test pits (STPs) excavated at intervals of 50ft (15m). The testable area totals approximately 3.45 acres. Additionally, the historic and cultural background research as well as the potential for above ground resources impacted within the viewshed of the indirect effects APE were completed during the Phase IA survey. JMT did not recommend any additional work for historic architecture resources. No additional historic above ground resources were identified during the Phase I survey of the property and as such, JMT recommends no further work for the above ground resources.

This report provides the results of the archaeological survey within the APE. Fieldwork was conducted from August 14 – 18, 2023. Archaeological testing methods within the APE included visual inspection, pedestrian survey, and the systematic use of shovel test pits (STPs) placed at intervals of approximately 15 meters (50 feet) within the

recommended 3.45-acre testable area. Overall, the soils encountered varied in level of disturbance. No archaeological sites were identified and no further testing is recommended.

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1.0 Introduction

The Marina Way Road Extension Project (the project) in Prince William County, Virginia involves connecting Marina Way to Horner Road with a four-lane divided roadway complete with pedestrian facilities. The purpose is to lessen the burden on key surrounding facilities such as Route 1 and Route 123. This extension will function as a main street for the proposed North Woodbridge Town Center currently under development.

This report documents the results of the archaeological survey for the proposed project. This survey and assessment were conducted for Prince William County to identify the potential for significant cultural resources, archaeological sites, and standing structures in the proposed area of potential effects (APE). The project study area measures 20.9 acres and is located between Route 123 on the west, and Route 1 on the East (Figure 1 and Figure 2). The 20.9-acre project area is considered the APE.

JMT conducted a Phase IA reconnaissance survey in June 2023, which determined that the majority of the 20.9-acre APE consists of paved roads, paved parking lots, grassy medians with buried and aboveground utilities, and part of the extant Gordon Plaza shopping center building (King et al. 2023). JMT determined that the wooded area located in the central portion of the APE has moderate potential for archaeological resources and recommended systematic survey. The testable portion within the wooded area totals approximately 3.45 acres (Figure 3). Additionally, the historic and cultural background research as well as the potential for above ground resources impacted within the viewshed of the indirect effects APE were completed during the Phase IA survey. No additional aboveground resources were identified during the Phase I and therefore, JMT does not recommend any additional work for historic architecture resources.

Phase IB archaeological survey fieldwork was conducted from August 14 – 18, 2023. Fieldwork was completed by Daniel King, Registered Professional Archaeologist (RPA) and Archaeologist of JMT and Madison Ramsey, Field Technician of JMT. Lauren Gryctko, RPA and Senior Archaeologist of JMT with 13 years of experience, serves as Principal Investigator. Archaeological testing methods within the APE included visual inspection, pedestrian survey, and the systematic use of shovel test pits (STPs) placed at intervals of approximately 15 meters (50 feet) within the recommended 3.45-acre testable area, per Virginia Department of Historic Resources (DHR) guidelines (2017).

This original report was submitted to DHR in September 2023, however, since submittal, the project area has slightly changed to include and additional portion of Annapolis Way. The report has been updated throughout to reflect the appropriate acreage and project area boundaries. Because the project update only includes Annapolis Way, which is an existing road, no additional fieldwork was conducted.

This report is divided into six chapters: Chapter One: Introduction; Chapter Two: Environmental Setting; Chapter Three: Cultural Context; Chapter Four: Methods; Chapter Five: Results; and Chapter Six: Summary and Recommendations.

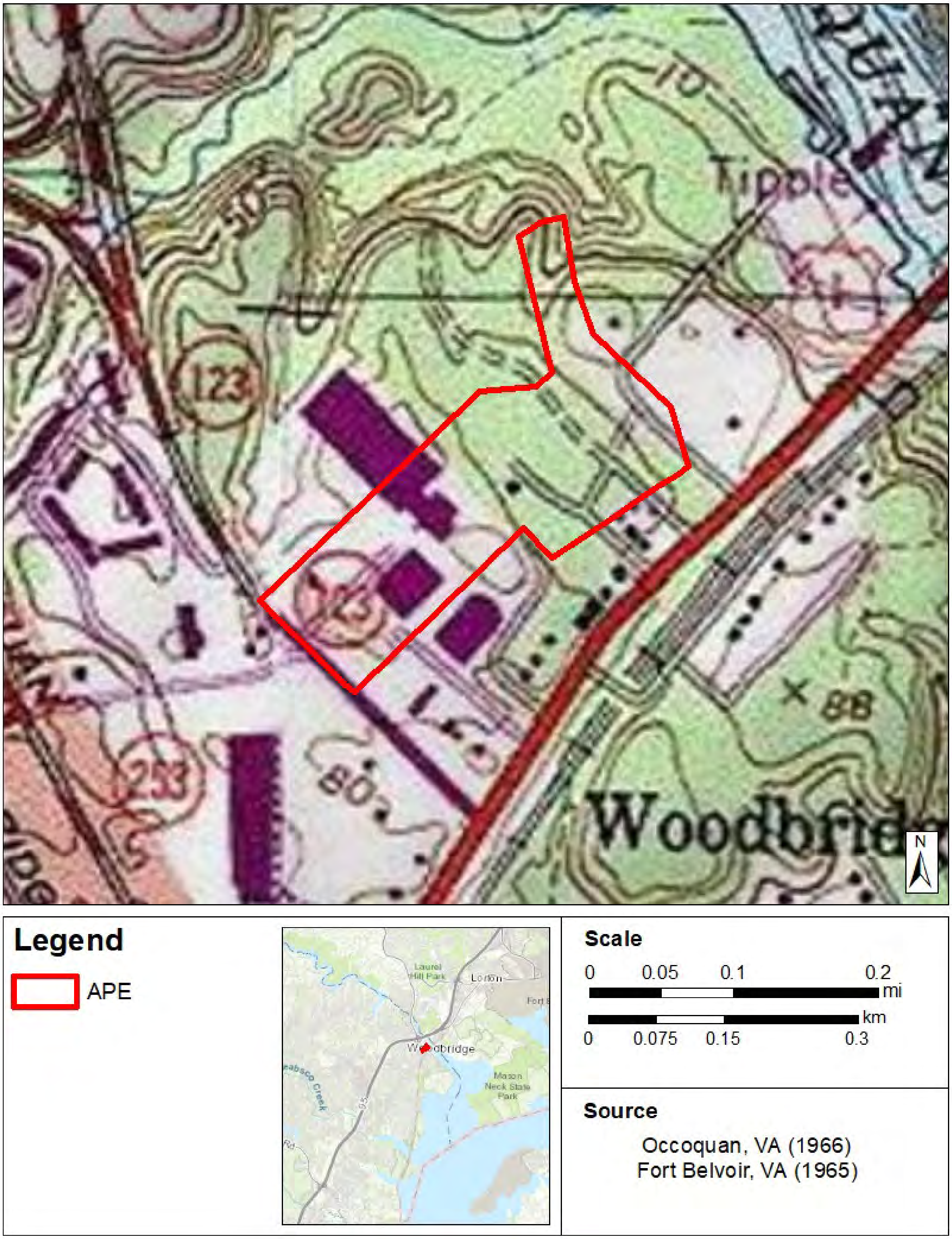

Figure 1. APE on 7.5-minute USGS topographic map of Occoquan, Virginia (1966) and Fort Belvoir, VA (1965).

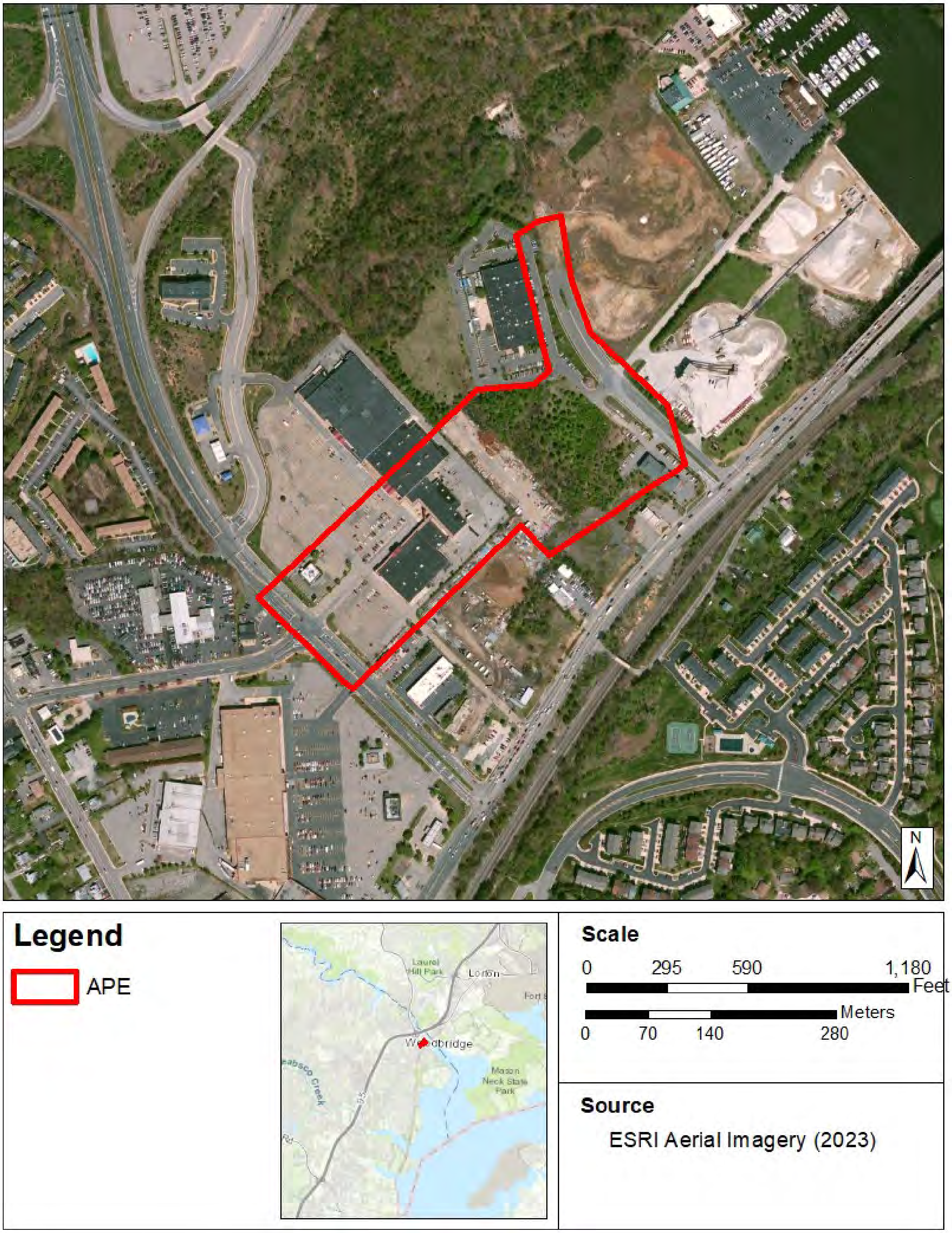

Figure 2. APE on ESRI Aerial Imagery (2023).

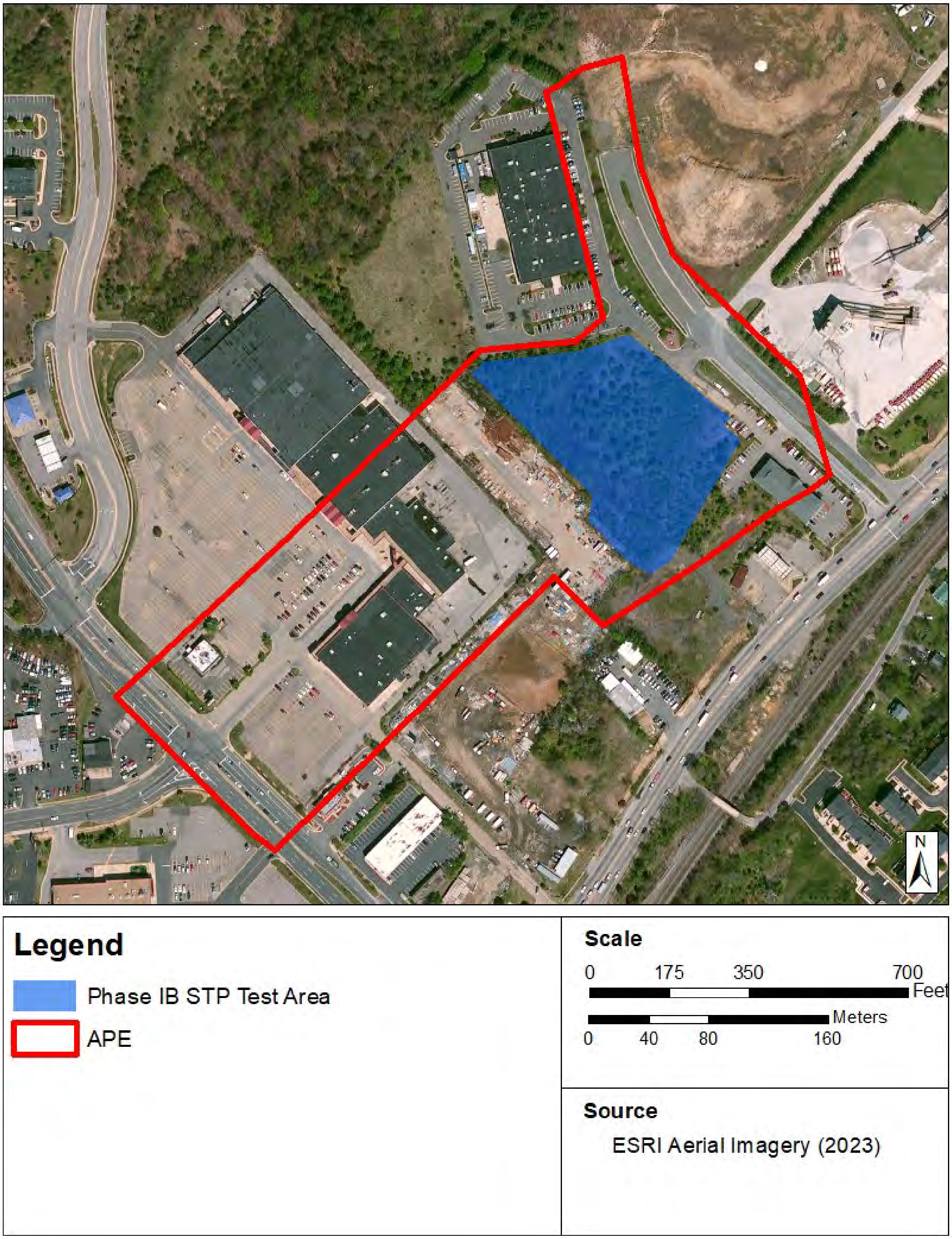

Figure 3. APE on ESRI Aerial Imagery (2023) showing the Phase IB STP testable area.

2.0 Environmental Setting

The APE lies on the eastern most edge of Prince William County, Virginia, approximately a quarter of a mile west of the Occoquan River. Prince William County was historically rural but has experienced growth and urban development due to its proximity to Washington D.C.

2.1 Physical Setting

The proposed project study area measures 20.9 acres and is located between Route 123 on the west, and Route 1 on the east. The APE associated with this undertaking includes two large strip malls and their associated drainage basin and woodlands, as well as entrances, roadways, and parking currently used to access both malls.

2.2 Physiography and Geology

Prince William County exhibits diverse physiography and geology. The county lies within the Piedmont physiographic province, characterized by rolling hills and occasional valleys (Roberts and Bailey 2000). It is underlain by complex geology, primarily consisting of metamorphic rocks such as gneiss, schist, and quartzite. These rocks formed during the Precambrian and experienced subsequent tectonic activity, including folding and faulting (Dietrich 2014). The presence of the Bull Run and Occoquan faults indicates the region's history of seismic activity. Additionally, the county features significant deposits of gravel, sand, and clay, which have been extensively quarried for construction materials (Binning 2021). The geologic diversity and historical geological processes contribute to the unique landscape and resources of the county.

Elevations in the county range from near sea level along the Occoquan River to 1230 ft (375 m) above mean sea level (amsl) at Chestnut Peak. Prince William County is bounded on the north by Fairfax and Loudoun Counties; on the east by the Occoquan River; on the south by Stafford County; and on the west by Fauquier County.

2.3 Hydrology

No streams cross the project APE, however several small drainages within the APE drain into Occoquan River, which is approximately 1,195 ft (365 m) east of the APE. The Occoquan River drains south into Belmont Bay before draining into the Potomac River at Woodbridge, Virginia. The Potomac River empties into Chesapeake Bay which empties into the Atlantic Ocean.

2.4 Flora and Fauna

Virginia is native to 12 varieties of oak (*Quercus var.)*, five species of pine (*Pinus var.*), two of walnut (*Juglans var.*), locust (*Robinia var.*), gum (*Liquidambar var.*), and poplar (*Liriodendron var.*). Pines predominate the Coastal Plain physiographic region, with numerous hardwoods on slopes and ridges further inland. (Advameg, Inc. 2023).

Indigenous mammalian species include the white-tailed deer (*Odocoileus virginianus*), black bear (*Ursa niger*), bobcat (*Lynx rufus*), groundhog (*Marmota monax*), raccoon (*Procyon lotor*), opossum (*Didelphis marsupialis*), red and gray foxes (*Urocyon var.*), and spotted and striped skunks (*Mephitis var.*).

Additionally, there are several species of moles (*Talpa var.*), shrews (*Sorex var.*), bats (*Pteropus var.*), squirrels (*Sciurus var.*), deer mice (*Peromyscus var.*), rats (*Rattus var.*), and rabbits (*Sylvilagus var.).* Dominant game birds include the ruffed grouse (*Bonasa umbellus*), wild turkey (*Meleagris gallopavo*), bobwhite quail (*Colinus virginianus*), mourning dove (*Zenaida macroura*), woodcock (*Scolopax minor*), and Wilson's snipe (*Gallinago delicata)*. Freshwater fish include bass (*Micropterus salmoides*), bream (*Abramis brama*), bluegill (*Lepomis macrochirus*), sunfish (*Lepomis var.*), perch (*Perca var.*), carp (*Cyprinus var.*), catfish (*Ictalurus var.*), and crappie (*Pomoxis var.*). Native reptiles consist of the northern copperhead (*Agkistrodon contortrix*), timber rattlesnake (*Crotalus horridus*), and black snake (*Elaphe var*) (Advameg, Inc. 2023).

2.5 Soils

There are three soil types present in the APE (Table 1; Figure 4). The most prevalent type is Urban land-Udorthents complex, 0 to 7 percent slopes (54B). Urban land-Udorthents complex is made up of leveled soils that have been cut away or graded and infilled. It has a typical profile of A - 0 to 5 inches: dark grayish brown (10YR 4/2) loam over E – 5 to 10 inches: dark grayish brown (10YR 4/2) loam over Bt1 – 10 to 24 inches: yellowish brown (10YR 5/6) clay over C – 24 to 42 inches: olive (5Y 5/4) sandy clay loam (Soil Survey Staff 2023). The second most prevalent soil type is Neabsco-Quantico complex, 2 to 7 percent slopes (42B). Neabsco-Quantico complex is a moderately well drained to well-drained soil occurring on hillslopes. Its parent material is marine deposits and it has a typical profile of H1 - 0 to 8 inches: loam over H2 - 8 to 17 inches: clay loam over H3 - 17 to 36 inches: loam over H4 - 36 to 52 inches: clay loam over H5 - 52 to 72 inches: very gravelly sandy loam (Soil Survey Staff 2023). The third soil type is Dumfries sandy loam, 15 to 25 percent slopes (18D). Dumfries sandy loam soils are well-drained occurring on hillslopes. Its parent material is marine deposits and it has a typical profile of H1 – 0 to 10 inches: sandy loam over H2 – 10 to 29 inches: sandy clay loam over H3 – 29 to 35 inches: sandy loam over H4 – 35 to 72 inches: sandy loam (Soil Survey Staff 2023).

Table 1. Soil types within APE.

Map Unit	Map Unit Name	Area (Acres)	Percent of APE
54B	Urban land-Udorthents complex, 0 to 7 percent slopes	13.3	63.8 %
42B	Neabsco-Quantico complex, 2 to 7 percent slopes	6.5	31.2 %
18D	Dumfries sandy loam, 15 to 25 percent slopes	1.1	4.9 %
	Total	20.9	100.0 %

2.6 Climate

Prince William County experiences a humid subtropical climate, characterized by four distinct seasons. Summers in Prince William County are generally hot and humid, with average temperatures ranging from the mid-70s to the mid-90s Fahrenheit (mid-20s to mid-30s Celsius). The region receives a moderate amount of rainfall during this season. Autumn brings milder temperatures, with temperatures ranging from the 50s to the 70s Fahrenheit (10s to 20s Celsius). Winters in Prince William County are cool, with average temperatures ranging from the 30s to the 50s Fahrenheit (0 to 10 degrees Celsius), and occasional snowfall. Spring brings mild temperatures in the 50s to 70s Fahrenheit (10s to 20s Celsius) and blooming flora. It is important to note that weather patterns can vary from year to year, but overall, Prince William County experiences the range of all four seasons (Sperling's 2021).

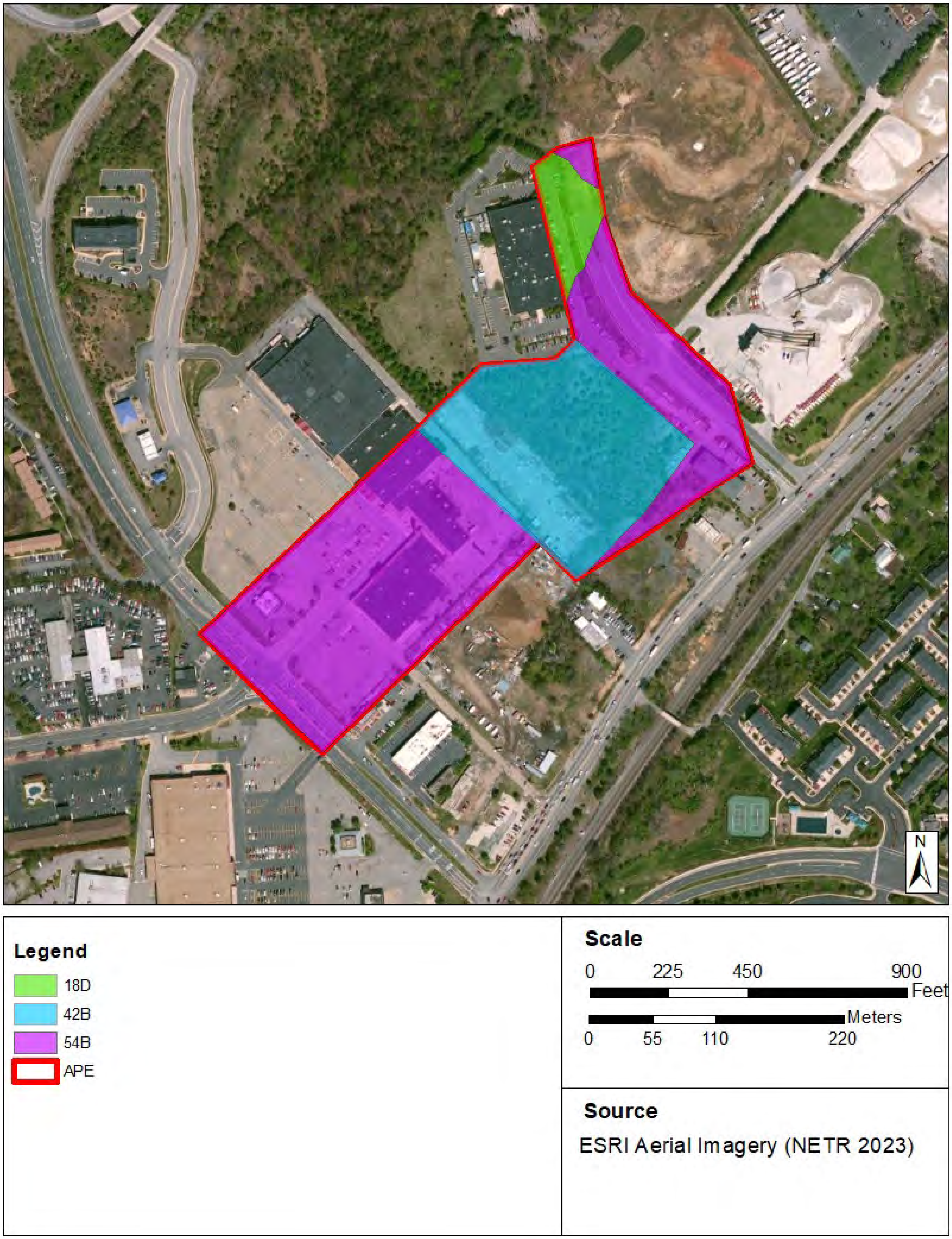

Figure 4. Soils within the APE.

3.0 Cultural Context

This section summarizes the precontact and historic cultural development of the Prince William County region of Virginia. This background is intended to serve as a context for assessing the significance of archaeological resources encountered in the project area.

3.1 Precontact Context

Precontact context in Virginia is typically divided into three main periods: Paleoindian (13,000 – 10,000 B.P.), Archaic (10,000 – 3200 B.P.), and Woodland (3200 – 350 B.P.). However, in recent years, there is evidence that a human presence was in the region pre-dating the Paleoindian.

PRE-CLOVIS (UNKNOWN – 13,000 B.P.)

Traditional hypotheses regarding human entrance into the New World have centered on Bering Land Bridge access and the corresponding ice-free corridor (Anderson et al. 1990:3). Though, in recent years, there has been widespread agreement in the professional community that early models of "Clovis first" are in need of revision due to growing evidence for earlier occupations (Cactus Hill in Virginia and Topper in South Carolina; McAvoy and McAvoy 1997).

Buried strata at the Cactus Hill Site in Sussex County, Virginia have returned radiocarbon dates of 15,000 years ago from strata situated below levels containing fluted points (McAvoy and McAvoy 1997). Prismatic blade-like flakes of quartzite chipped from specially prepared cobbles and lightly worked along one side to produce a sharp edge, make up the majority of stone cutting and scraping tools (Klein 2016; McAvoy and McAvoy 1997).

Sandstone grinding and abrading tools, also found in a significant quantity in the deepest artifact bearing strata, could indicate the production of wood and bone tools or ornaments. Because these tools do not possess unique characteristics that immediately identify them as dating to the Paleoindian period, archaeologists must consider the possibility of Pre-Clovis sites. At present, only a handful of potential such sites have been identified in North America (Klein 2016).

PALEOINDIAN PERIOD (13,000 – 10,000 B.P.)

The widely accepted Native American occupation of the eastern portion of North America begins approximately 13,000 B.P. The Paleoindian settlement-subsistence pattern revolved around hunting and gathering in small nomadic bands. These bands focused on hunting caribou, elk, deer, and possibly mega-fauna (Goodyear 1979; Meltzer 1988; Smith 1986a). Evidence for this period consists primarily of fluted projectile points. These points are rare and are often identified as isolated occurrences. While the discoveries are rare, the eastern half of the United States has some of the highest concentrations of Paleoindian points (Klein 2016). Only 271 sites with Paleoindian components have been identified in Virginia so far, according to VCRIS (DHR 2023a). While the fluted Clovis and Folsom points are the best known of the point types, others include the Hardaway-Dalton and Hardaway Side-Notched (Barber and Barfield 1989). Stone tools of this period are primarily made from high quality cryptocrystalline lithic material, and base camps have been identified near the source quarries for these materials (Moore et al. 2003:11). The Paleo toolkit included scrapers, gravers, unifacial tools, wedges, hammerstones, abraders, and other tools used for chopping and smashing (Gardner 1989; Klein 2016).

ARCHAIC PERIOD (10,000 – 3200 B.P.)

The Archaic period is dated from circa 10,000 – 3200 B.P. and is commonly divided into Early (10,000 – 8800 B.P.), Middle (8800 – 5500 B.P.), and Late (5500 – 3200 B.P.) subperiods based on specific projectile point types. The Archaic was a significant period of climate change with the onset of Holocene climatic conditions, a period that was warmer and wetter than the late Pleistocene. Environments shifted from boreal forests to northern hardwoods (Moore et al. 2003:12). Additionally, there was a significant rise in sea levels as continental glaciers began to melt. Precontact populations' response to these changes included increased population, expansion into new environmental zones, and regional variations in point styles.

EARLY ARCHAIC (10,000 – 8800 B.P.)

There does not appear to be a dramatic change in the toolkits of the Early Archaic from the Paleoindian predecessors. Their settlement and subsistence patterns appear to be very similar (Anderson et al. 1996; Cable 1996). The transition into the Archaic is marked by an increase in site size, artifact quantity, and the increase in the number of sites (Egloff and McAvoy 1990). Diagnostic artifacts of the Early Archaic include Kirk Corner-Notched and Palmer Corner-Notched points (Coe 1964; Egloff and McAvoy 1990). Additionally, some bifurcated stem points, St. Albans and LeCroy, appear to be associated with the increased use of hafted endscrapers (Coe 1964). The Early Archaic also marks the first appearance of groundstone tools such as axes, celts, adzes, and grinding stones. At the close of the Early Archaic, there was an increased reliance on a wider range of lithic resources.

MIDDLE ARCHAIC (8800 – 5500 B.P.)

There is a high degree of cultural continuity between the Early and Middle Archaic periods, but sites dating to the Middle Archaic are more numerous, pointing to a likely population increase; sites also appear to be occupied for longer periods of time (Klein 2016). This period is accompanied by a relatively warm and dry period that may have resulted in population movements (Delcourt and Delcourt 1987; Stoltman and Baerreis 1983). The primary cultural attributes of the Middle Archaic are "small-group band organization, impermanent settlement systems, infrequent aggregation phases, and low levels of regional or areal integration and interaction" (Mouer 1991:10). During the Middle Archaic, though base camps continued to be located along the floodplains of large drainages, smaller sites begin to appear in locations such as upland swamps and interior ridgetops (Gardner 1987). New tool types emerged for wood-working, seed-grinding, and nutcracking, such as axes and adzes, mauls, grinding slabs, and nutting stones (Katz 2011:16). Diagnostic artifacts of this period include Stanley Stemmed, Morrow Mountain Stemmed, Guilford Lanceolate, and Halifax Side-Notched projectile points.

LATE ARCHAIC (5500 – 3200 B.P.)

The Late Archaic is widely seen as the culmination of trends that began in the preceding periods of the Archaic (Dent 1995a). Dent (1995:178) suggests that the Late Archaic is "a time that contains both the ends of one way of life and the beginnings of a significant redirection". The artifact assemblage of this period is dominated by bifacial tools; though expedient flake scrapers, drills, perforators, and utilized flakes are also characteristic of the period. Groundstone tools, including adzes, celts, gourges, and axes are seen during this period, with the grooved axe making its first appearance (Dent 1995). Diagnostic artifacts of the early Late Archaic include the Bare Island/Lackawaxen, Lamoka, and Holmes projectile points, all of which are of the narrow blade tradition (Dent 1995; Mouer 1991).

The period of time from approximately 4500 to 3200 B.P. is considered the Transitional Period by some (Mouer 1991), but others argue that due to the lack of pottery, it is more accurately classified as an extension of the Late Archaic (Dent 1995). Associated with the appearance of these point types was a major change in settlement pattern, with sites focusing on the floodplains of higher-order streams (Mouer 1991b). Transitional Period sites tend to be larger than those of the Archaic periods, likely associated with an increase in population; however, there is still no evidence for year-round occupation. Dent (1995) argues that the larger sites may be misinterpreted as reflecting longer- term occupation and may simply point to the sites being revisited for short periods on multiple occasions. Material culture associated with the Transitional includes steatite vessels, as well as the groundstone tools from earlier in the Late Archaic. Broad-blade points associated with the terminal Late Archaic or Transitional Period include Savannah River, Susquehanna, and Perkiomen, and Dry Brook, and Orient Fishtail points (Dent 1995; Mouer 1991).

WOODLAND PERIOD (3200 – 350 B.P.)

The Woodland Period is also divided into three subperiods, Early (3200 – 2300 B.P.), Middle (2300 – 1100 B.P.), and Late (1100 – 350 B.P.). Highlights of this period are generally considered to be the appearance of pottery production on a large scale, increased semi-sedentary settlements, and horticulture (Ward and Davis 1999:76). Although subsistence strategies were a continuation of the earlier hunter-gatherer systems, they were augmented with increased reliance on the cultivation of native and domesticated plants (Smith 1986b). Overall, the Woodland is a period of increased sedentism with adaptive strategies concentrated on limited agriculture, mixed hunting, and intensive collecting. As agriculture grew in importance, so too did village life and social complexity; however, hunting and gathering continued to be a supplemental dietary strategy.

EARLY WOODLAND (3200 – 2300 B.P.)

The trend of population growth continues into the Early Woodland as settlements were established in estuarine contexts (Moore et al. 2003:14). The Early Woodland steatite-tempered Marcey Creek pottery is seen as the earliest ceramic ware produced in Virginia, most commonly found on sites located north of the James River (Egloff and Potter 1982:95–97). Marcey Creek ceramics are characterized by shallow, slab-built forms (Dent 1995b; McLearen 1991). Clay-tempered Croaker Landing ware, dating to 3150 – 2750 BP, was first identified in York County along the York River (Egloff and Potter 1982:97). Other contemporaneous wares include Selden Island and Bushnell Wares. Selden Island, another steatite-tempered, and other temper types appear during the Early Woodland (McLearen 1991). Around 1100 B.P. a shift from slab to coil construction and conoidal vessels occurs. This technology shift is accompanied by the introduction of surface treatments such as cord marking and net impression (Dent 1995; McLearen 1991). Projectile points of the Early Woodland include the Rossville Stemmed and possibly Piscataway Stemmed (Dent 1995).

MIDDLE WOODLAND (2300 – 1100 B.P.)

The Middle Woodland is characterized by the rise of interactions, marking the spread of religious and ritual behaviors, which appear in local traditions; while localized stylistic developments that appear independently alongside interregional styles, increased sedentism and evidence of ranked societies or incipient societies appear (McLearen 1992). Coastal populations intensified fishing and shellfish gathering, with larger, longer-term settlements occurring along freshwater-saltwater transition zones (Moore et al. 2003:14). Smaller, seasonal resource procurement sites were commonly settled along tributary waterways in the interior (Moore et al. 2003:14). Though there is a degree of commonality among Middle Woodland populations, one of the striking characteristics of the period is the rise of regional trends, specifically in pottery.

The use of shell-tempering in the Coastal Plain differs from the predominance of quartz-tempering in the Piedmont, and north-south differences corresponding to river drainages that drain into the Chesapeake Bay or Albemarle Sound appear. The regional diversity of surface treatments increases after 1500 B.P. and analysis of the regional pottery indicates that the Potomac, the Rappahannock, and Upper Dan were slightly different cultural subareas (Hantman and Klein 1992; Klein 2016).

There are two phases of the Middle Woodland based on ceramic chronology. The earlier is characterized by Popes Creek (north of the James River), Stoney Creek (south of the James River), and related ceramics (2600 – 1700 BP) and the later Mockley ceramic (1700 – 1000 BP) (Egloff and Potter 1982:99; Stewart 1992). Stoney Creek is a thick-walled, medium sand-tempered, and fabric, cord, or knotted net-impressed ware (Egloff and Potter 1982:99). Mockley is a shell-tempered, cord, net impressed, or smoothed ware, sometimes incised or punctate decorations on the exterior and interiors of rims (Custer 1989; Dent 1995c; Egloff and Potter 1982; Steponaitis 1980; Wright 1973) Projectile points of include the Fox Creek-Selby Bay points, often associated with Mockley pottery. Other points of the period include Jack's Reef corner-notched, Rossville, and Calvert points. The latter appear during the Early Woodland but may have carried over to the Middle Woodland based on their association with sites containing Popes Creek pottery.

LATE WOODLAND (1100 – 350 B.P.)

An increased intensification of agriculture, associated population growth, larger sedentary villages situated along floodplains, and increased sociocultural complexity characterize the Late Woodland (Gallivan 2003). In the early portion of the Late Woodland, settlements are comprised of small clusters of houses, though by 600 BP, larger villages are evident (Klein 2016). The presence of fortified, nucleated settlements, such as those at Piscataway Creek in the Lower Potomac region and Patawomeke in Stafford County, suggest an increase in interregional and intra-group hostilities during this time (Katz 2011:19). Other socio-political characteristics of this time include unequal access to resource surpluses and non-local goods, differences in burial practices based on rank, and hierarchical settlement patterns (Banguilan et al. 2010:18).

Ceramic types of the period include the shell-tempered Townsend ware (1000 BP – 1590 CE) and the quartz-tempered Potomac Creek ware (650 BP – 1600s CE) (Egloff and Potter 1982). There are five subtypes of Townsend ware as currently identified, including Rappahannock Fabric Impressed, Rappahannock Incised, Townsend Incised, Townsend Corded Horizontal, and Townsend Herringbone (DHR 2023b; Egloff and Potter 1982:107–109). Two sub-types of Potomac Creek wares are recognized, including Potomac Creek Cord-Impressed and Potomac Creek Plain (Egloff and Potter 1982:112). The smaller Madison, Levanna/Yadkin, Caraway, and Potomac triangular points are associated with the terminal Woodland period. The predominance of these small projectile points in Late Woodland contexts suggest reliance on bows and arrows for hunting (Banguilan et al. 2010:18).

3.2 Historic Context

HISTORY OF NORTHERN VIRGINIA AND PRINCE WILLIAM COUNTY (AD 1600 – PRESENT)

The Historic Context for the area is largely adapted from Crowl (2005) and other sources and summarizes the development of the region from the Contact through the present. At the Contact period the Siouan-speaking Manahoac Indians inhabited much of northern Virginia from the Potomac to the North Anna River. They were mentioned in accounts by early traders, travelers, and specifically by John Smith, who met a Manahoac group in 1608 (Egloff and Woodward 2006). The subsistence and settlement patterns of this period were largely continued from the Late Woodland period.

The Manahoac were driven from the area by 1667, as raiding Iroquois, disease, and colonial expansion pushed the group south to join the Monacans (Egloff and Woodward 2006). An additional group in the area was the Alqonquian-speaking Potowomekes, part of the Powhatan chiefdom, which lived along the Potomac River. During the seventeenth century, the lives of Native Americans and European Colonizers became increasingly co-mingled, sometimes peacefully, but often hostile. By 1650, disease and warfare had largely forced the remaining native population to move or lose their culture (Crowl 2005).

English colonizer Captain John Smith explored the region in 1608, but it was not until 1731 that the county was officially established and named after Prince William Augustus, the son of King George II. During the colonial era, Prince William County was predominantly rural and agricultural, with tobacco being the primary crop. It was an important center for trade and transportation, situated along the Potomac River and major roads connecting Virginia to the north.

As tensions rose between the American colonies and Great Britain, Prince William County played a role in the American Revolutionary War, as its strategic location near transportation routes made it a site of various skirmishes and battles. Notably, the Battle of Bull Run (First Manassas) took place in Prince William County in 1861, marking one of the early major engagements of the Civil War.

The Civil War had a profound impact on Prince William County. As part of Virginia, the county joined the Confederacy, and the region saw military activity and troop movements. The Battle of Bull Run, fought near Manassas in the county, resulted in a Confederate victory and was a significant turning point in the early stages of the war.

The clashes had a profound impact on the region, as it was located strategically between Washington, D.C., and Richmond, the capital of the Confederacy. The war brought destruction and hardship to the county and left the county in economic peril.

In the post-war years, Prince William County transitioned from an agricultural economy to a more diversified one. The county saw the growth of industries such as mining, manufacturing, and tourism. The construction of railroads and the development of transportation infrastructure further stimulated economic growth and brought prosperity to the region. The town of Manassas became important as a railroad terminal because it was a shipping hub for the Shenandoah Valley in the west and to the urban cores of Alexandria, Virginia and Washington, D.C. in the east (Klein and Davis III 2011).

As the United States grew closer to participation in World War I, the Marine Corps took on a greater role within the armed forces. In 1917, Marine officers leased a plot of 5,300 acres at Quantico (Klein and Davis III 2011). Later that year, the leasing company sold the property to the United States government due to financial hardship (Evans 1989). The Marine Corps Reservation at Quantico continued to grow throughout World War II, prompting economic and residential growth in Prince William County.

During the economic depression of the 1930s, land depleted by tobacco farming in the eighteenth and nineteenth centuries was bought for redevelopment through federal programs (Evans 1989). The Civilian Conservation Corps (CCC) built five cabin camps and several small lakes in Prince William County, including the Chopawamsic Recreation Demonstration Area (NPS 2005). During World War II these cabin camps were used to house and train allied spies for the Office of Strategic Services, which later became the CIA (Evans 1989). The park was returned to the National Park Service after WWII and became Prince William Forest Park (Evans 1989; NPS 2005).

The years after World War II saw the expansion of the federal government, including lobbying groups and research and development enterprises connecting Northern Virginia economically and physically to Washington, D.C. (Evans 1989). The 1956 Highway Act led to the construction of Interstate 95, which allowed urban and suburban development to prosper in Prince William County in the 1950s and beyond (Evans 1989).

Prince William County remains a dynamic and diverse community today. It has an economy which is driven by sectors such as technology, healthcare, and government contracting. The county is also known for its educational institutions, including Northern Virginia Community College and George Mason University's Science and Technology Campus. It also offers numerous recreational opportunities, with parks, trails, and cultural attractions meant to showcase the area's natural beauty and history.

HISTORY OF THE PROJECT AREA

According to a historic map review, the APE has been affected by development since at least the 1890s, at which time a topographic map shows two structures partially within the APE and a third structure just southwest of the APE (Figure 5). At this time, Route 1 and Route 123 were already in existence. Similarly, a railroad is shown running southwest-northeast along the southeastern edge of the projected location of the APE. By 1944, the area started to grow with a structure within the APE, several driveways running through the project area, and heavy development to the southeast of the project area (Figure 6). A 1951 topographic map shows additional development within the APE, both in the northeast and the southwest (Figure 7). At a greater distance, additional structures and roads are shown in the 1951 map within the vicinity of the project area. A 1962 aerial image shows recent demolition in the northeastern portion of the APE, and scattered development within and to the southeast of the project area (Figure 8). Northwest of the project area appears to have remained rural, wooded and agricultural land, however, by 1966, development appears to have expended to the northwest, with a large structure appearing within the APE on the 1966 topographic map (Figure 9). This is echoed in 1979 historic aerial imagery, which also shows clearing northwest of the project area, and suggests that construction and growth was within the vicinity of the project area during the 1970s (Figure 10). The project location and its vicinity experienced further development through the 1990s (Figure 11).

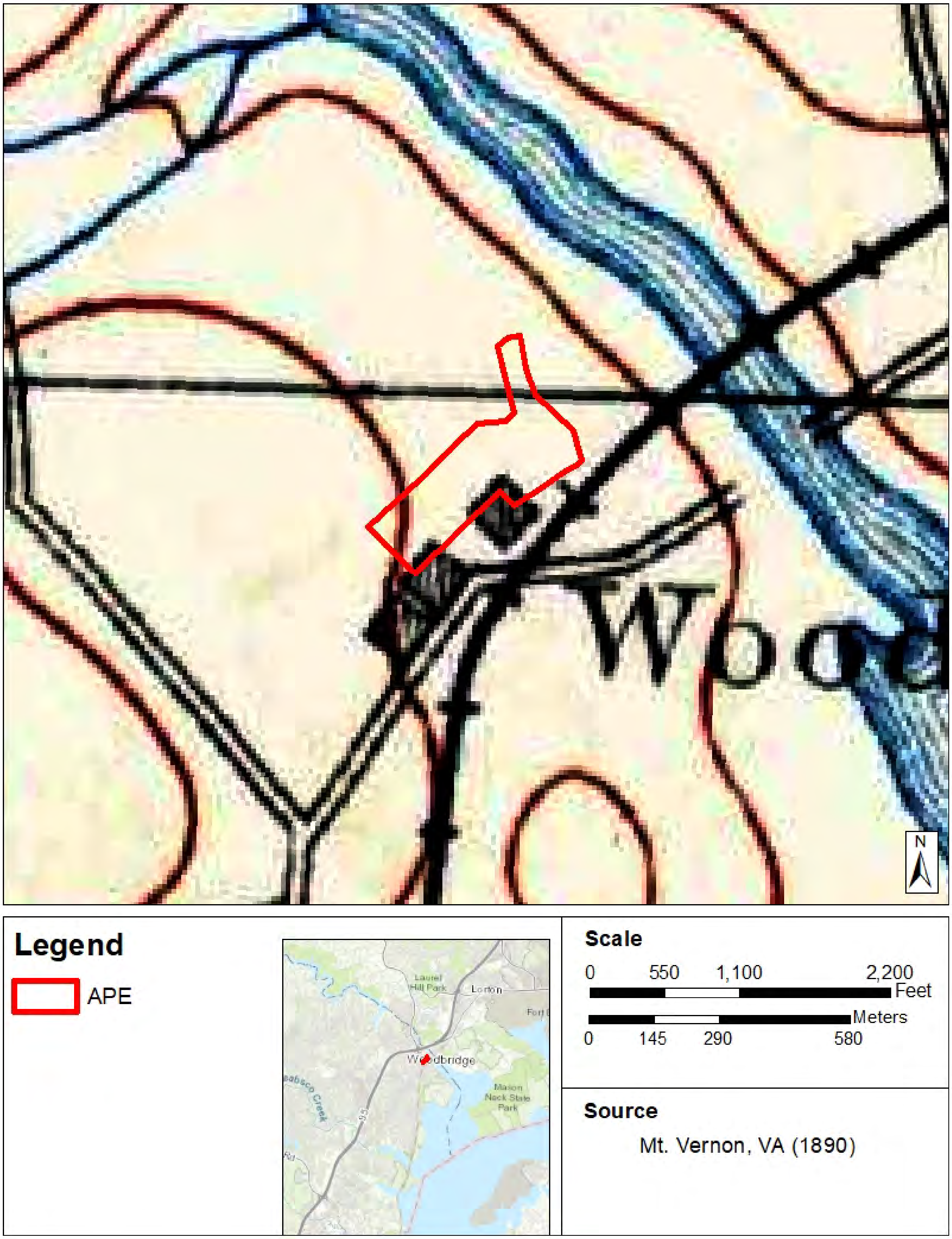

Figure 5. 1890 USGS Topographic map of the APE (USGS 1890).

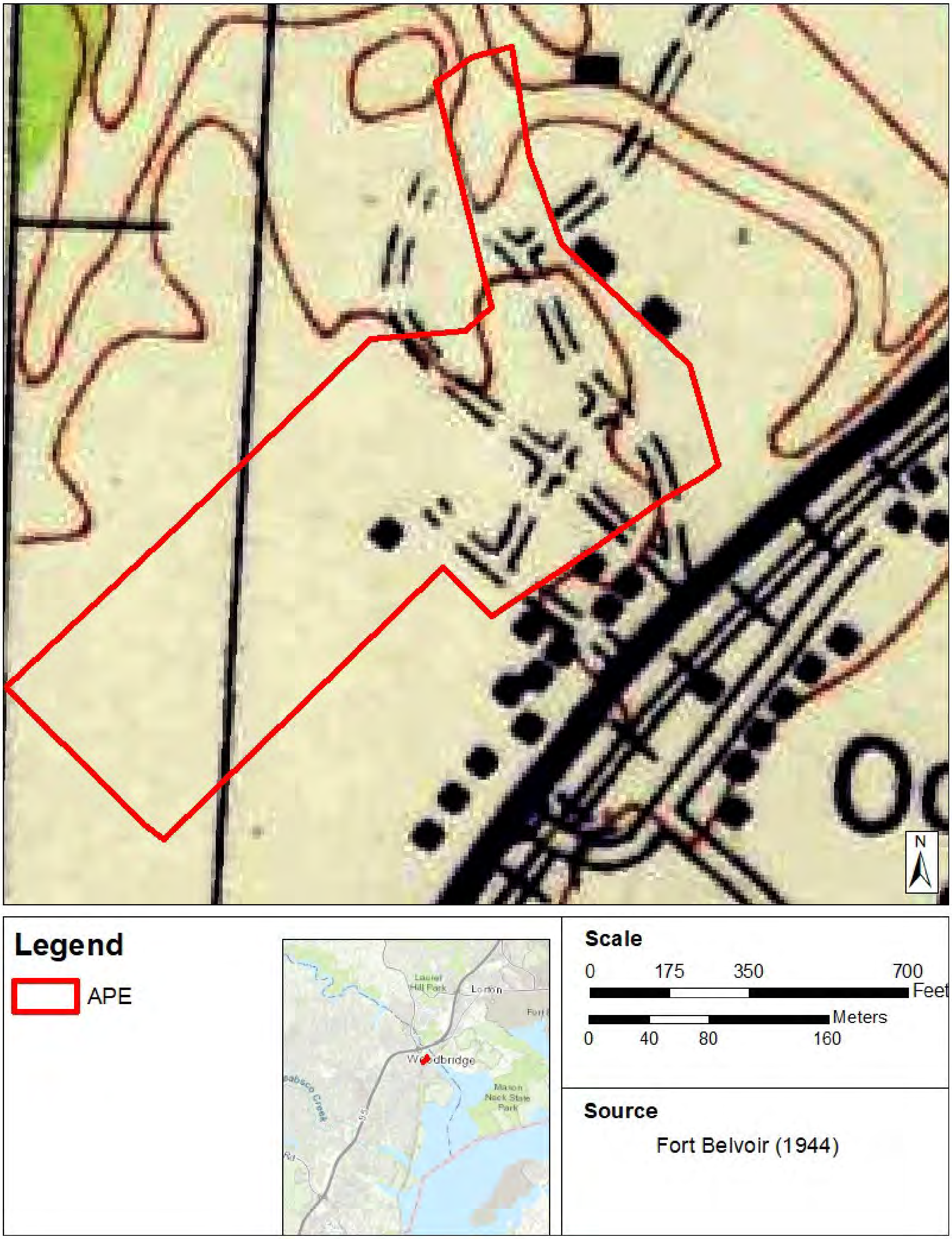

Figure 6. 1944 USGS Topographic map of the APE (USGS 1944).

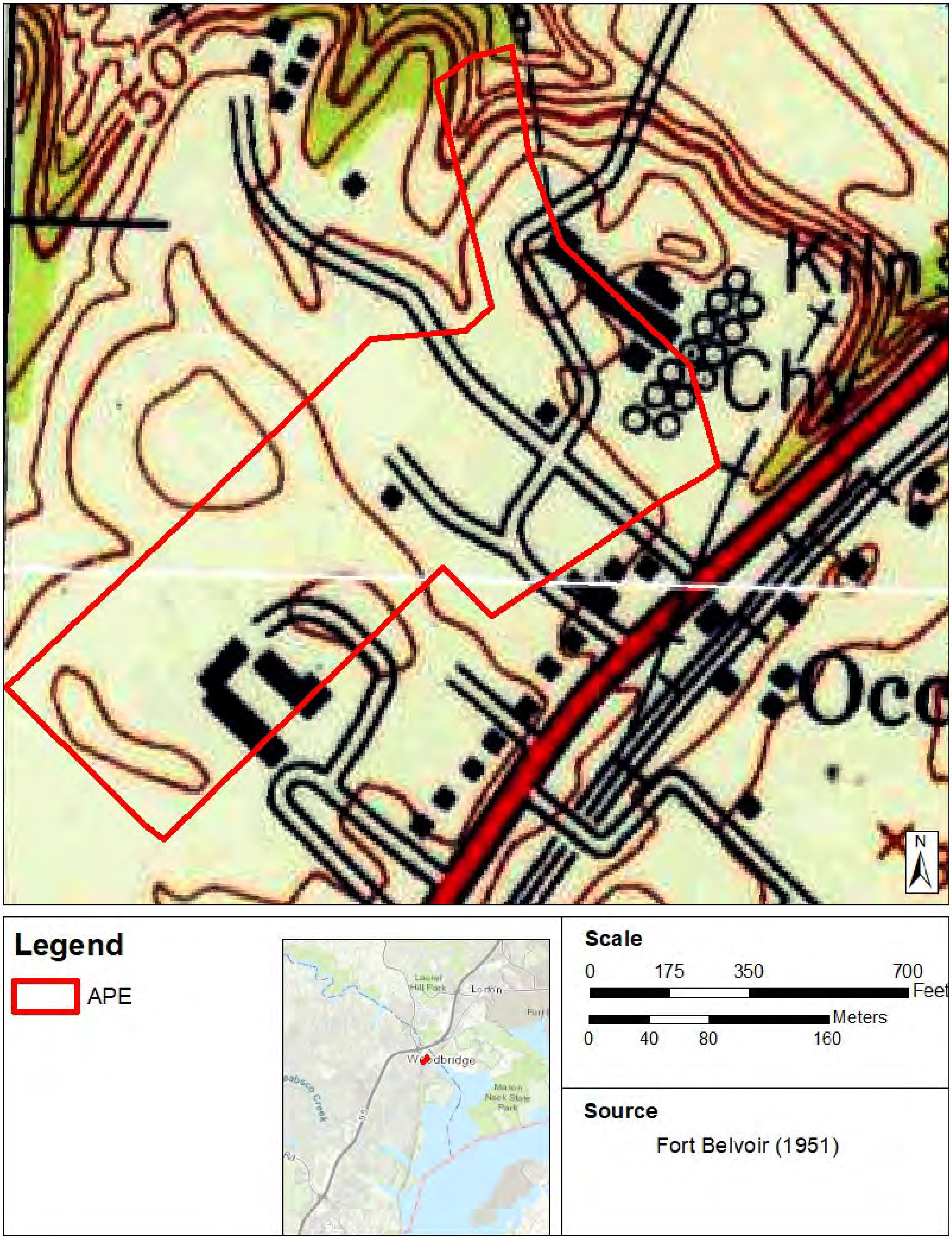

Figure 7. 1951 USGS Topographic map of the APE (USGS 1951).

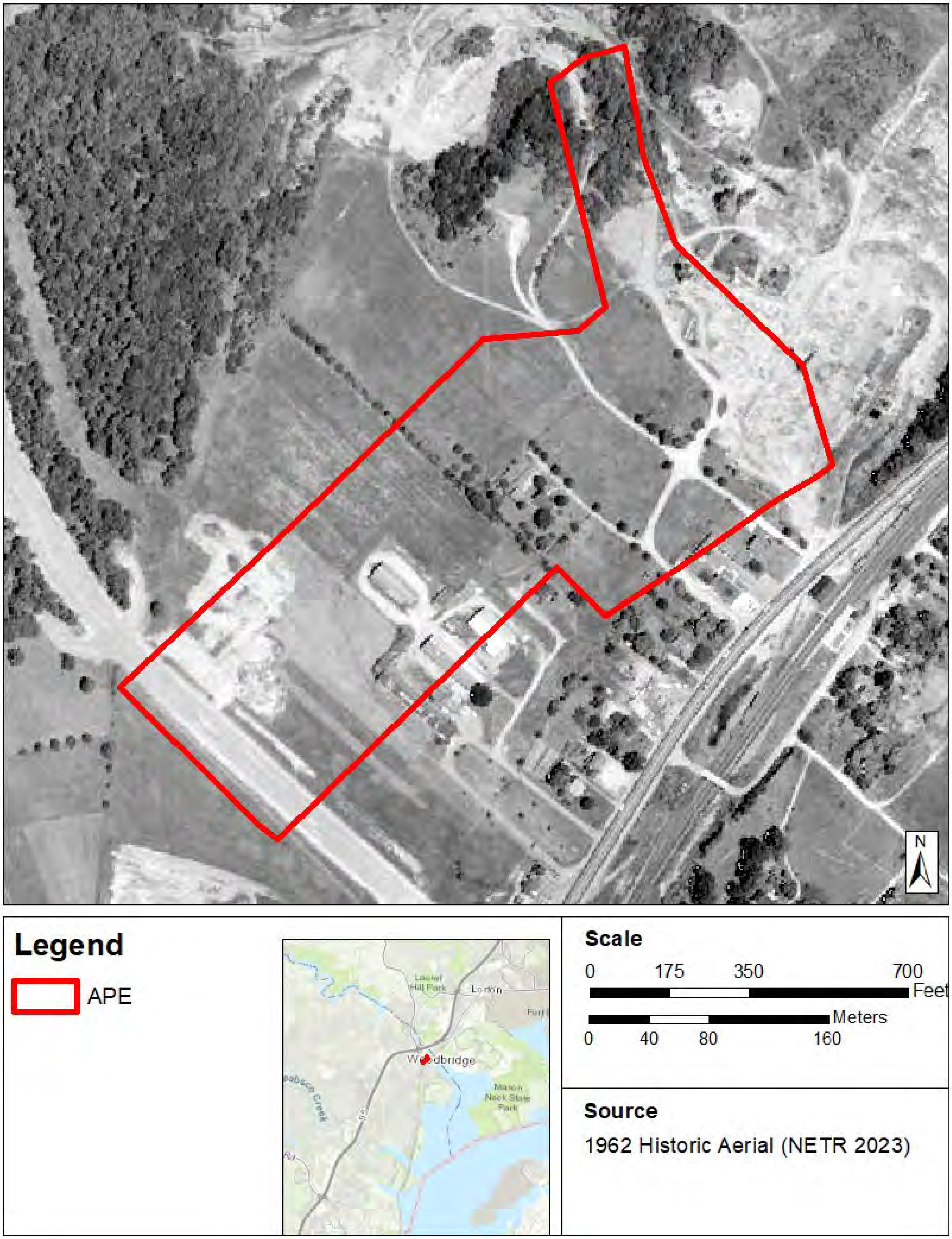

Figure 8. 1962 Historic aerial map of the APE (NETR Online 2023).

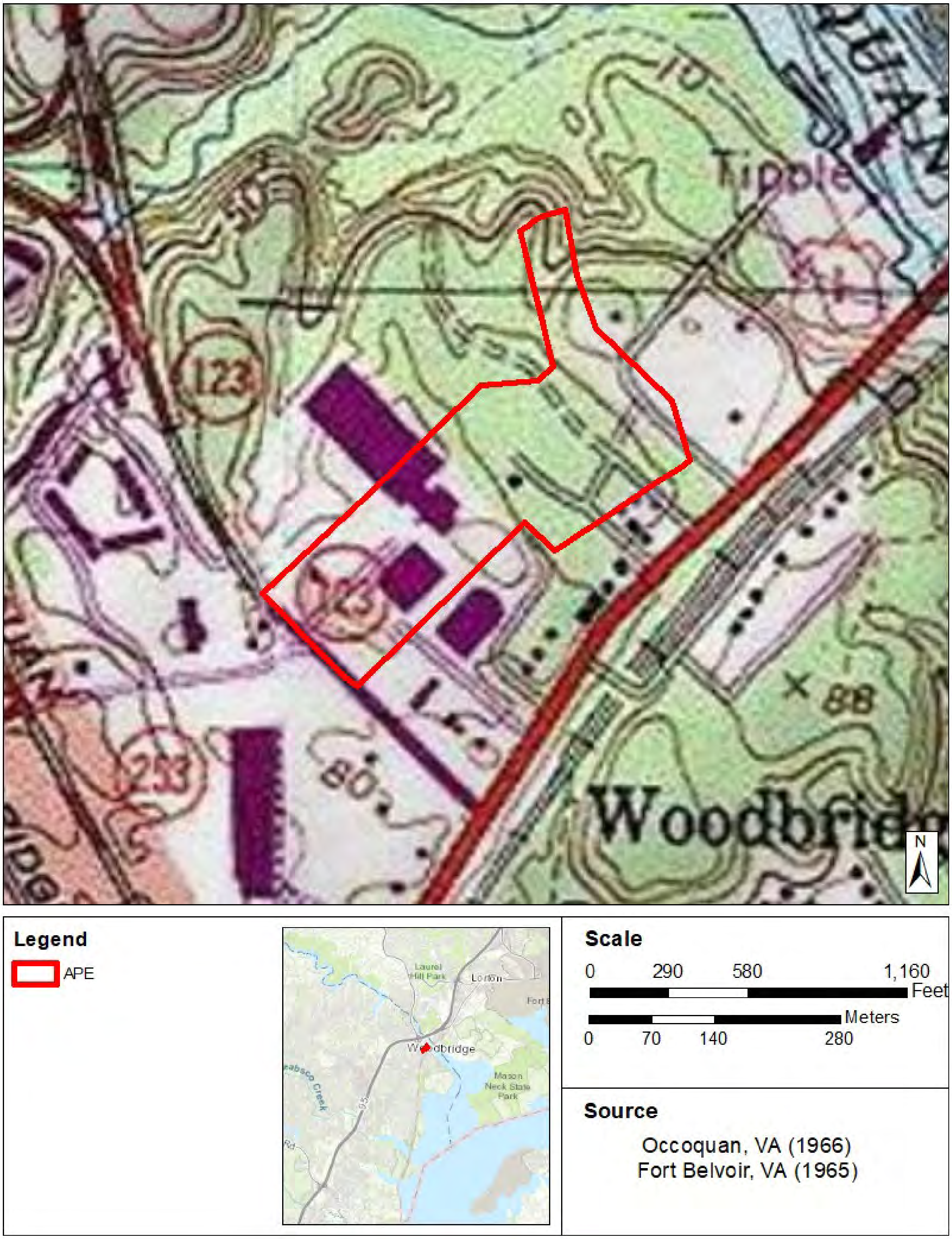

Figure 9. 1966 USGS topographic map of the APE (USGS 1965, 1966).

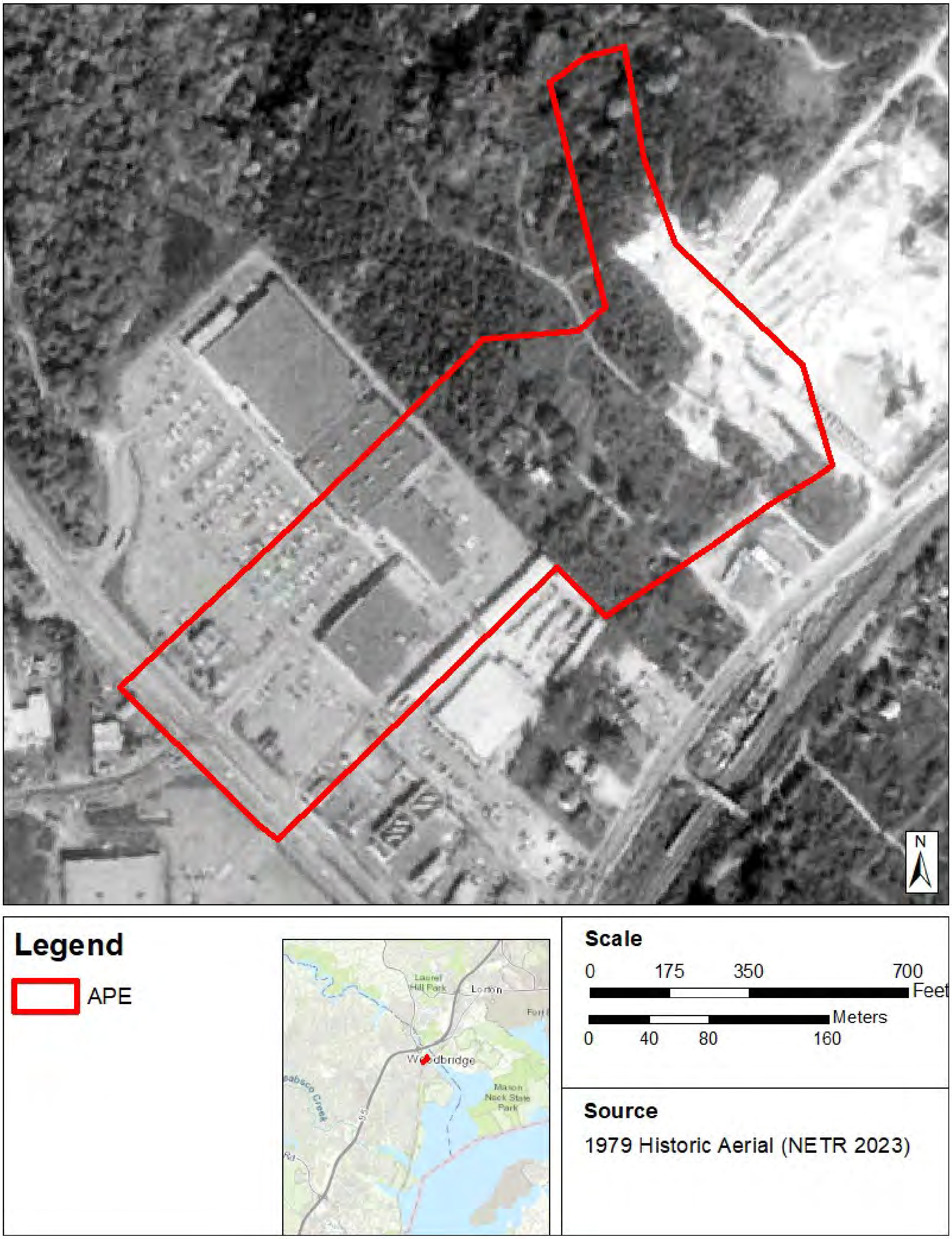

Figure 10. 1979 historic aerial map of the APE (NETR Online 2023).

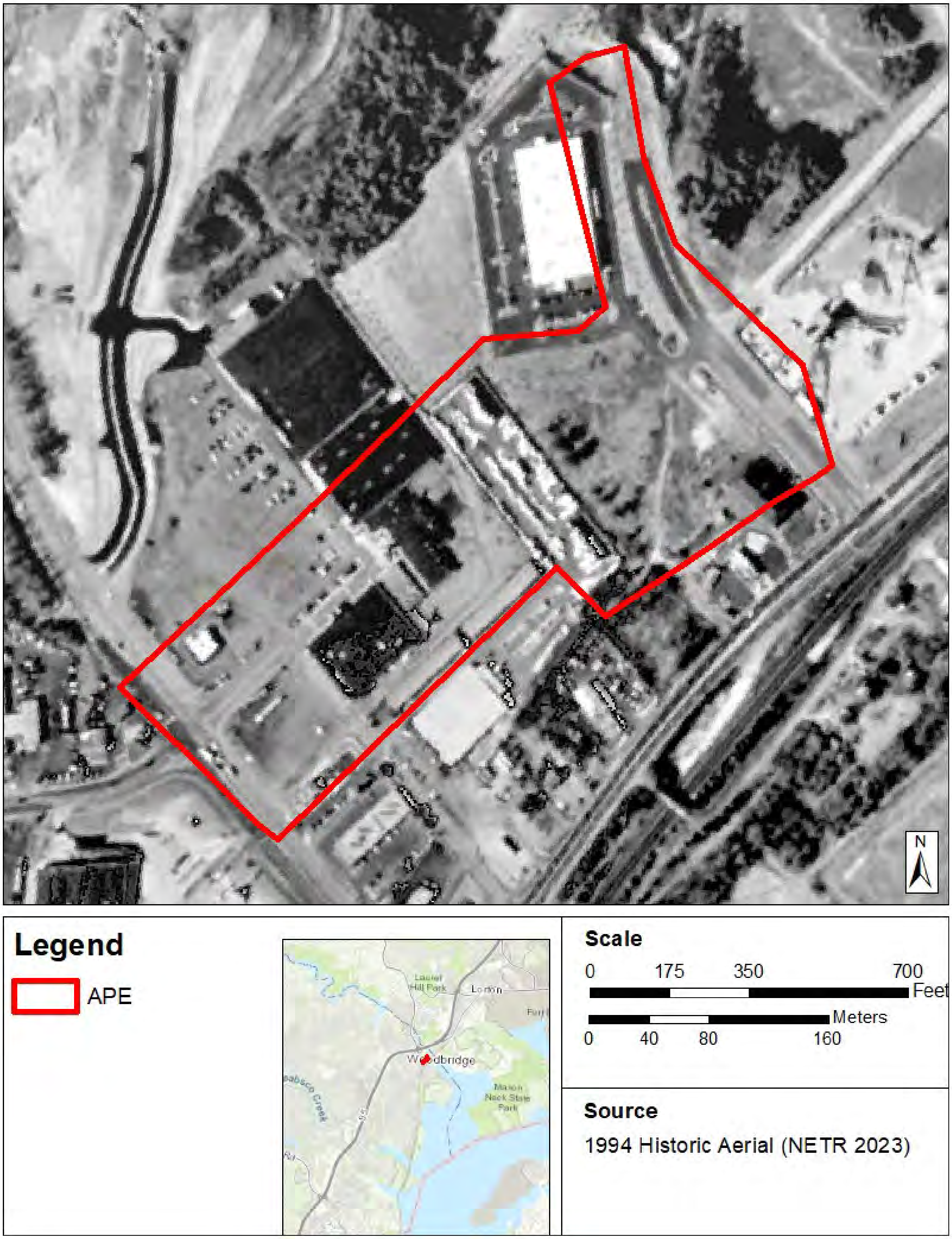

Figure 11. 1994 Historic aerial map of the APE (NETR Online 2023).

4.0 Methods

4.1 Archaeology Background Research

Background research was performed to identify previously recorded resources in the defined APE and to assess the archaeological potential of the project location. Background research was conducted in accordance with DHR Guidelines (2017). A records search was conducted via the Virginia Cultural Resource Information System (VCRIS), a cultural resource records database managed by DHR. Site files were reviewed along with GIS data, historic maps and atlases, soil surveys, aerial photography to identify any previously recorded archaeological sites within the project area or within 0.5-mile of the APE.

4.2 Archaeology Field Methods

SURVEY GOALS

The goal of the proposed survey was to identify archaeological sites in the APE. All forms of archaeological survey rely on sampling; it is time and cost-prohibitive to conduct an archaeological survey by excavating all possible site bearing soils within a project area. The standard for Section 106 compliance is that a reasonable and good faith effort be made to identify historic properties, including archaeological sites. A recommendation of potential eligibility for listing on the NRHP, as well as a determination of effects on these sites are also a goal of the initial archaeological survey.

PEDESTRIAN SURVEY

A pedestrian survey was conducted to determine the current conditions of the APE, including disturbed portions of the project area and any cultural features with surface visibility. Photographic documentation of the APE and surrounding area was also conducted.

SYTEMATIC SHOVEL TESTING

STPs were excavated at systematic intervals throughout all three segments of the APE. Per DHR Guidelines (2017), STPs were excavated at intervals of 15 m (50 ft). Areas that exhibited excessive prior disturbance, slope greater than 20 percent, or standing water were visually inspected, but not shovel tested. All shovel tests had an approximately 0.4-m (01.31-ft) diameter and were excavated 10 centimeters (cm) (4 inches [in]) into subsoil unless noted otherwise. All excavated soils were screened through 0.64-cm (1/4-inch) mesh. Had radial STPs been needed they would have been excavated at intervals of 7.5 m (25 ft) around regular interval positive STPs in a cruciform pattern and placed adjacent to negative STPs and the edge of the project's APE. No radial shovel tests were needed, due to the lack of artifacts. Each natural stratum was given a stratum designation (e.g., Stratum I) to delineate stratigraphic relationships. Representative STPs were photographed, and profile drawings were made of stratigraphy. Had artifacts been identified they would have been recovered and bagged by stratum when possible, however, no artifacts were recovered. Soil conditions and notations on disturbances were recorded within field notes. Following the recording of stratigraphic data, soil was backfilled, and the ground surface was returned, as closely as possible, to its original condition.

4.3 Lab Methods

Had artifacts been found, they would have been processed, catalogued, and prepared for curation in JMT's laboratory in Fort Washington, Pennsylvania in accordance with standard procedures outlined in DHR's (2011) State Collections Management Standards.

4.4 Curation

The project records are temporarily being curated by JMT.

4.5 Evaluation Criteria

The NRHP significance criteria in 36 CFR 60.4 defines eligible cultural resources as buildings, structures, objects, sites, and districts that have integrity of location, design, setting, materials, workmanship, feeling, and association and that meet one or more of the following criteria. Criterion D is most often, but not exclusively, used with archaeological resources.

- Criterion A: Association with events that have significantly contributed to the broad patterns of history;
- Criterion B: Association with persons significant in the past;
- Criterion C: Possession of the distinctive characteristics of a type, period, or method of construction; exemplification of the work of a master architect, engineer, or artist; embodiment of high artistic values; or evidence of a significant and discernible entity whose components may lack distinction on their own; and
- Criterion D: Ability to yield information significant to prehistory or history.

4.6 Expected Results

According to a historic map review, a twentieth century structure was identified in the 3.45-acre testable area of the APE. This area appears to have had some disturbance in the past from logging and development, though the Phase IA reconnaissance survey identified some intact soils. As such, there is a high potential that JMT will identify historic period archaeological resources within the APE. Additionally, given the project location near the Occoquan River, there is a moderate potential for identification of precontact archaeological resources in the APE.

5.0 Results

The following section provides the results of the archaeology background research and the archaeological survey of the APE. Overall, the majority of the 20.9-acre APE consists of paved roads, paved parking lots, grassy medians with buried and aboveground utilities, and part of the extant Gordon Plaza shopping center building. However, the wooded area located in the central portion of the APE has moderate potential for archaeological resources and recommended systematic survey. The testable portion within the wooded area totals approximately 3.45 acres. This original report was submitted to DHR in September 2023, however, since submittal, the project area has slightly changed to include and additional portion of Annapolis Way. The report has been updated throughout to reflect the appropriate acreage and project area boundaries. Because the project update only includes Annapolis Way, which is an existing road, no additional fieldwork was conducted.

5.1 Archaeological Background Research and Reconnaissance Survey Results

BACKGROUND RESEARCH RESULTS

The background research revealed that there are 13 previously recorded archaeological resources located within 0.5-mile of the APE (Table 2, Figure 12). None of the sites overlap the APE. Site 44FX2542 is the only site within the 0.5-mile search radius considered eligible or potentially eligible for listing in the NRHP. One of the sites was determined not eligible for listing in the NRHP by DHR Staff and the remaining 11 were not evaluated. The project area is not adjacent to any Civil War study or core areas. Background research also showed 10 prior Phase I surveys located within 0.5-mile of the APE (Table 3 see Figure 12). One of these surveys (FX-133) partially overlaps with the northeastern portion of the project APE.

Table 2. Archaeological sites within 0.5-mile of the project area.

DHR ID	Site Types	Time Periods	Evaluation
44FX0120	Store	18th Century: 2nd half (1750 - 1799), 20th Century: 1st half (1900 - 1949)	--
44FX0245	Cemetery	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 19th Century: 2nd/3rd quarter (1825 - 1874)	DHR Staff: Not Eligible
44FX0686	--	Historic/Unknown	--
44FX0874	--	--	--
44FX1994	Camp, base	Early Archaic (8500 - 6501 B.C.), Middle Archaic (6500 - 3001 B.C.), Late Archaic (3000 - 1201 B.C.), Early Woodland (1200 B.C. - 299 A.D.), Late Woodland (1000 - 1606)	--
44FX2015	--	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)	--
44FX2049	Camp	null	--
44FX2455	Camp, Dwelling, single	Pre-Contact, Reconstruction and Growth (1866 - 1916), World War I to World War II (1917 - 1945), The New Dominion (1946 - 1991)	--
44FX2542	Village/Town	Paleo-Indian (15000 - 8501 B.C.E), Early Archaic Period (8500 - 6501 B.C.E), Middle Archaic Period (6500 - 3001 B.C.E), Late Archaic Period (3000 - 1201 B.C.E), Early Woodland (1200 B.C.E - 299 C.E), Middle Woodland (300 - 999 C.E), Late Woodland (1000 - 1606), Contact Period (1607 - 1750), Colony to Nation (1751 - 1789), Early National Period (1790 - 1829)	DHR Staff: Potentially Eligible
44FX3197	Lithic scatter, Other, Village/Town, Vineyard	Pre-Contact, Contact Period (1607 - 1750), Colony to Nation (1751 - 1789), Early National Period (1790 - 1829), Antebellum Period (1830 - 1860), Civil War (1861 - 1865)	--

DHR ID	Site Types	Time Periods	Evaluation
44PW0853	Camp, temporary, Lithic workshop	Late Woodland (1000 - 1606)	--
44PW0854	Camp, temporary, Lithic workshop	Early Woodland (1200 B.C. - 299 A.D.)	--
44PW1843	Camp	Colony to Nation (1751 - 1789), Early National Period (1790 - 1829)	--

Table 3. Prior Phase I archaeological surveys within 0.5-mile of the APE.

Report Number	Title	Author	Year
FX-072	Phase I Archaeological Investigation of the Fairfax Yacht Club Occoquan Marina, Fairfax County, Virginia	Charles H. LeeDecker, Amy Friedlander, Teresa E. Ossion	1983
FX-133	Preliminary Cultural Resource Reconnaissance Report, Route 1-Occoquan River Bridge, Fairfax County, Virginia	Michael F. Johnson	1980
FX-158	Phase I Cultural Resource Reconnaissance Survey for the Interstate-95 HOV Lane Project, Fairfax and Prince William Counties, Virginia	Daniel Koski-Karell	1987
FX-344	Cultural Resource Evaluation on the Grounds of the Former Medium Security Facility, District of Columbia Detention Center, Lorton, Virginia	John T. Eddins, Eric F. Griffitts	1998
PW-014	An Archaeological Investigation of the Richard L. Krauss Riverfront Property for Determination of a Permit Action at the mouth of Occoquan River, Prince William County, Virginia	Stephen S. Israel	1981
PW-142	Cultural Resources Identification Survey (Phase I) Improvements to US 1 from Stafford County Line to Route 123, Prince William County, Virginia, Project A	Bill Hall, Loretta Lautzenheiser, John P. Cooke, Mary Ann Holm, N. Carolyn McCollum	2001
PW-143	Cultural Resources Identification Survey (Phase I) Improvements to U.S. Route 1 from Route 123 to Route 611 (Telegraph Road) Prince William and Fairfax Counties, Virginia, Project B	Loretta Lautzenheiser, John P. Cooke, Mary Ann Holm, Bill Hall, et al	2001
PW-198	Phase I Archaeological Investigations at Belmont Center, Woodbridge, Prince William County, Virginia	Cynthia Pfanstiehl, Tery D. Harris, Edward Otter	1994
PW-249	Phase I Cultural Resources Survey of Approximately 13 Acres at the Proposed Rivergate Development, Prince William County, Virginia	Matthew Laird	2005
ST-153	Phase I Archeological Investigations of the I-95/395 HOV/Bus/HOT Lanes Project, Arlington, Fairfax, Prince William and Stafford Counties and the City of Alexandria, Virginia	Brian Buchanan, Christopher Shephard, David Carroll, Curt Breckenridge, Johnna Flahive, Christine Jirikowic, Tammy Bryant, William Barse	2007

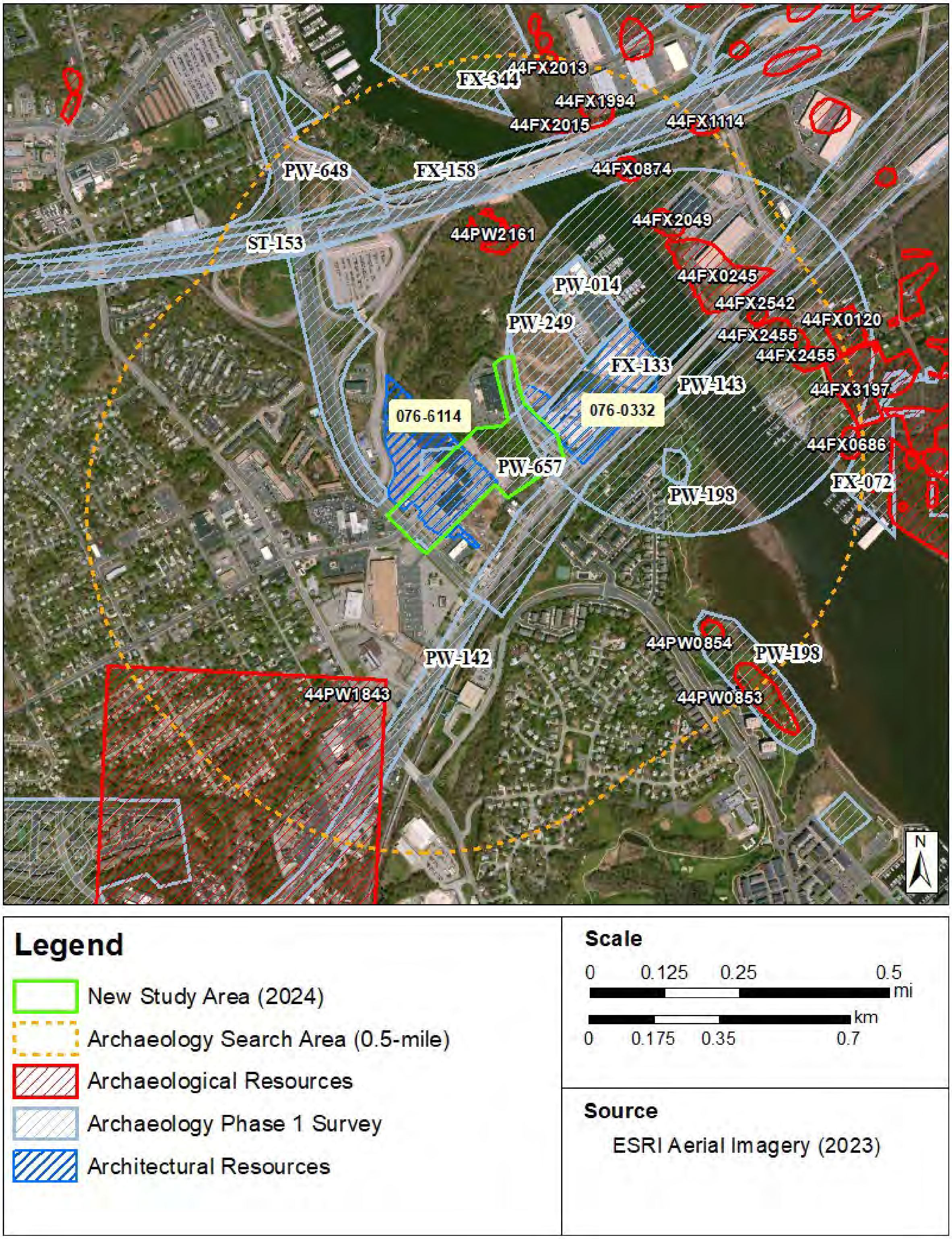

Figure 12. Cultural resources within the APE.

PHASE IA RECONNAISSANCE SURVEY RESULTS

A reconnaissance level survey was conducted to determine the current conditions of the APE and to assess the archaeology potential using pedestrian survey and limited soil testing to evaluate the soils within the project area (Figure 13). The reconnaissance survey determined that the majority of the 20.9-acre APE consists of paved roads, paved parking lots, grassy medians with buried and aboveground utilities, and part of the extant Gordon Plaza shopping center building (King et al. 2023). JMT determined that the wooded area located in the central portion of the APE has moderate potential for archaeological resources and recommended systematic survey. The testable portion within the wooded area totals approximately 3.45 acres.

The one architectural resource located within the APE, Gordon Plaza (076-6114), has been recommended not eligible for listing in the National Register of Historic Places. During the Phase IA architectural assessment, JMT determined the building was constructed ca. 1973 and has no discernable style and was modified with a new façade in the 1990s (King et al. 2023:27).

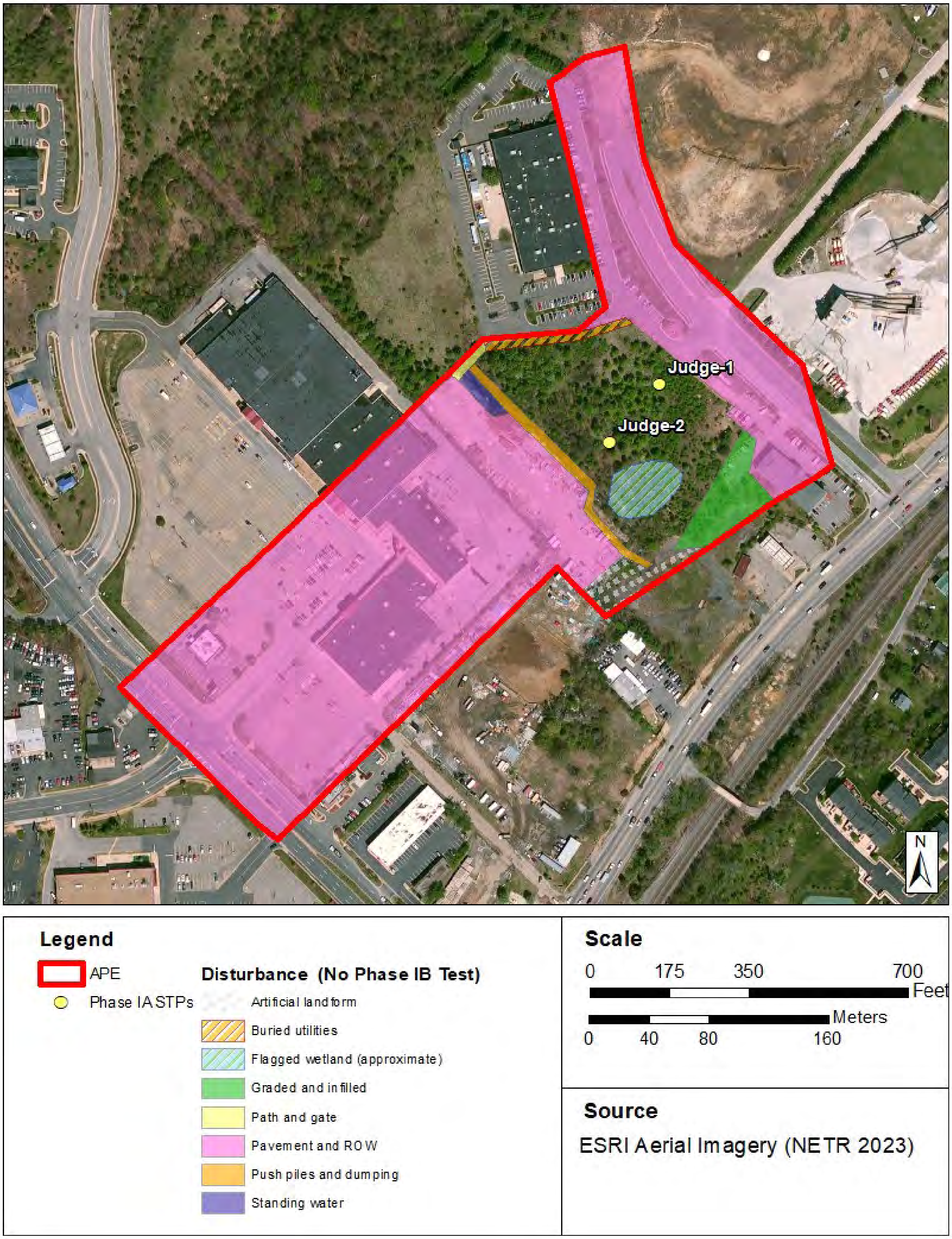

Figure 13. APE with locations of soil tests and visible disturbances.

5.2 Archaeology Survey Results

JMT archaeologists and archaeological field technicians conducted the Phase I survey fieldwork of the Marina Way APE between August 14-18, 2023. The wooded area located in the central portion of the APE was accessible from the northeast from parking lots west of the intersection of Annapolis Road and Marina Way. The vegetation in the northern half of the wooded area consisted of dense Bradford pear trees and young mixed hardwood seedlings with a moderately dense underbrush of poison ivy and bramble vines. The vegetation in the southern half of the wooded area consisted of open mixed hardwood forest with some saplings with an underbrush of poison ivy and bramble vines. A logging road remnant is also present within the wooded area.

Shovel tests were excavated at systematic intervals, and pedestrian survey was conducted throughout the entire APE as specified in Phase IA work plan. Per DHR Guidelines (2017) shovel tests were excavated at intervals of 50ft (15m) where feasible. Areas that exhibited excessive prior disturbance, slope greater than 20 percent, designated wetland, existing yards, obvious disturbance, or standing water were visually inspected, but not shovel tested. An ephemeral wetland was identified in the southeast corner of the wooded area. Other disturbances from wetlands, push piles, trash dumping, buried utilities, logging roads, and pavement were identified along the edges of the wooded area during the Phase IA survey and confirmed during the Phase IB survey. These areas were not shovel tested.

A total of 66 possible shovel test locations were investigated within the APE (Figure 14). Of the 66 potential STPs, 49 were excavated and all of those were found to be negative for historic or prehistoric artifacts. A total of 17 STPs were excluded and not excavated. The entirety of Line G, a total of 11 potential STPs, was not excavated due to standing water, modern push piles, and modern dump sites (Photographs 1-8). An additional four STPs (see Figure 14 – STPs C9, D9, E10, F11) were excluded due to the slope of the landscape (Photograph 9); a final two STPs (see Figure 14 – STPs E2 and E3) were not excavated due to the presence of standing water (Photographs 10 and 11). Four excavated shovel tests (STPs A1, B1, A8, E1) contained modern colorless and brown bottle glass which were determined to be less than 50 years of age and were not collected. These four STPs were located between disturbed and non-disturbed transition areas (Photograph 11) and contained modern refuse associated with the disturbances.

Soil profiles in this area varied depending on the level of disturbance and proximity to frequently inundated areas. A typical soil profile in an undisturbed area consists of three strata (Photograph 13): Stratum I, a 10YR 5/3 brown loam from 0-12 centimeters below ground surface (cmbgs); Stratum II, a 10YR 7/8 yellow sandy clay from 12-24 cmbgs; Stratum III, a 10YR 8/2 very pale brown sandy clay from 24-35 cmbgs (see Appendix B for a table containing all STP information).

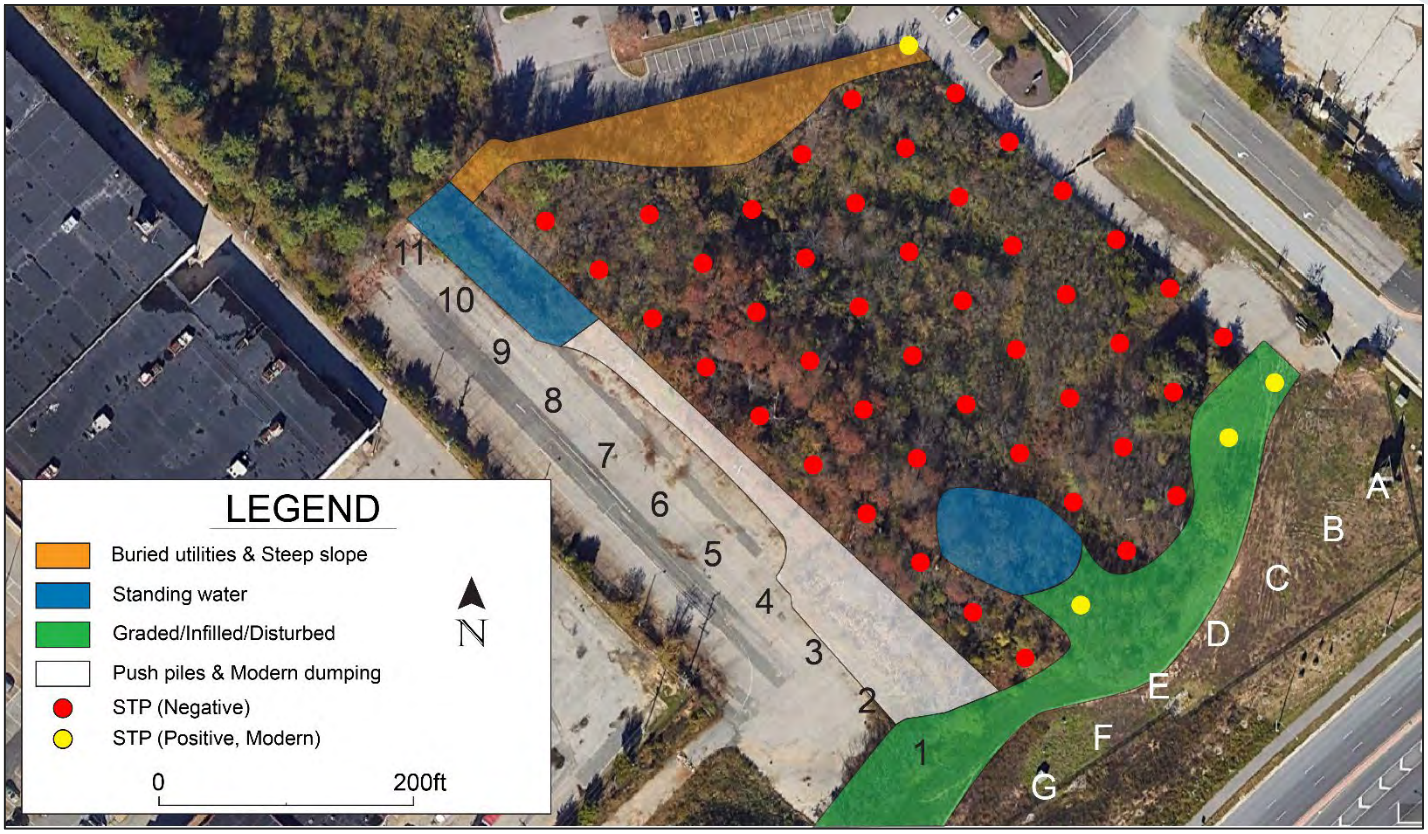

Figure 14. Map of all STP locations.

Photograph 1. Standing water along line "G" in the western corner of the APE.

Photograph 2. Standing water along the "G" line in the western corner of the APE.

Photograph 3. Standing water along the "G" line in the western corner of the APE.

Photograph 4. Standing water along the "G" line in the western corner of the APE.

Photograph 5. View of paved lot and push piles along the southwestern border of the APE, facing north.

Photograph 6. View of push piles along the southwestern border of the APE, facing east.

Photograph 7. Example of modern dump site along line "G."

Photograph 8. Example of dumping and standing water along line "G."

Photograph 9. View of the slope along the northeastern edge of the APE.

Photograph 10. Example of the wetland identified in the southern portion of the APE.

Photograph 11. View of the graded area comprising the southeastern edge of the APE.

Photograph 11. STP E2

Photograph 12. Example of a typical STP profile in an undisturbed section of the APE.

6.0 Summary and Recommendations

The Marina Way Road Extension Project (the project) in Prince William County, Virginia involves connecting Marina Way to Horner Road with a four-lane divided roadway complete with pedestrian facilities. The purpose is to lessen the burden on key surrounding facilities such as Route 1 and Route 123. This extension will function as a main street for the proposed North Woodbridge Town Center currently under development.

This report documented the results of the archaeological survey for the proposed project. The survey and assessment were conducted for Prince William County to identify the potential for significant cultural resources, archaeological sites, and standing structures in the proposed area of potential effects. The project study area measures 20.9 acres and is located between Route 123 on the west, and Route 1 on the East. The 20.9-acre project area is considered the APE.

JMT conducted a Phase IA reconnaissance survey in June 2023, which determined that the majority of the 120.9-acre APE consists of paved roads, paved parking lots, grassy medians with buried and aboveground utilities, and part of the extant Gordon Plaza shopping center building (King et al. 2023). JMT determined that the wooded area located in the central portion of the APE has moderate potential for archaeological resources and recommended systematic survey. The testable portion within the wooded area totals approximately 3.45 acres. Additionally, the historic and cultural background research as well as the potential for above ground resources impacted within the viewshed of the indirect effects APE were completed during the Phase IA survey. JMT does not recommend any additional work for historic architecture resources.

Phase IB archaeological survey fieldwork was conducted from August 14 – 18, 2023. Fieldwork was completed by Daniel King, RPA and Archaeologist of JMT and Madison Ramsey, Field Technician of JMT. Lauren Gryctko, RPA and Senior Archaeologist of JMT with 13 years of experience, served as Principal Investigator. Archaeological testing methods within the APE included visual inspection, pedestrian survey, and the systematic use of shovel test pits (STPs) placed at intervals of approximately 15 meters (50 feet) within the recommended 3.45-acre testable area, per Virginia Department of Historic Resources (DHR) guidelines (2017). This original report was submitted to DHR in September 2023, however, since submittal, the project area has slightly changed to include and additional portion of Annapolis Way. The report has been updated throughout to reflect the appropriate acreage and project area boundaries. Because the project update only includes Annapolis Way, which is an existing road, no additional fieldwork was conducted.

A total of 66 possible shovel test locations were investigated and 49 were excavated. Of those, all were found to be negative. A total of 17 STPs were excluded due to standing water, modern push piles, modern dump sites, the slope of the landscape. No artifacts were identified during archaeological testing for the project. No archaeological sites were identified, and no additional archaeological testing is recommended. It is our opinion that no additional archaeological investigation is warranted and that the project can proceed as currently designed.

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Appendix A. Resume of Principal Investigator

LAUREN GRYCTKO
SENIOR ARCHAEOLOGIST/PRINCIPAL INVESTIGATOR

EDUCATION
MA / Anthropology / The College of William & Mary, Williamsburg, VA (2015)
BS / Anthropology / James Madison University (2011)

YEARS OF EXPERIENCE
12

REGISTRATIONS/CERTIFICATIONS
RPA (5216) OSHA 30

Ms. Gryctko exceeds the qualifications for Archaeologist under the standards set forth by the Secretary of Interior. She has 12 years of professional archaeological experience, with a focus on eighteenth and nineteenth century domestic sites within the Mid-Atlantic. Ms. Gryctko is skilled in archaeological field and lab methods and has over 5 years of cultural resource management experience. She has extensive experience in managing and conducting archaeological projects within the Mid-Atlantic and Southeastern United States, ranging from Phase IAs to Phase IIIs and consisting of solar projects, large scale residential development, road maintenance, and transmission line rebuild projects. She is familiar with the Antiquities Act, the Archaeological Resources Protection Act (ARPA), the National Environmental Protection Act (NEPA), the National Historic Preservation Act (NHPA), Curation of Federally Owned and Administered Archaeological Collections (36 CFR 79), and Native American Graves Protection and Repatriation Act (NAGPRA), and eligibility criteria for the National Register of Historic Places (NRHP). She currently works as a senior archaeologist and principal investigator based in Richmond, Virginia.

PROJECT EXPERIENCE

Chesterfield County, Powhite Parkway Extension – Phase 1 Design. Senior Archaeologist. Reviewed archaeological finds, finalized eligibility recommendations for archaeological sites, and coordinated with VDHR. This project involves extending Powhite Parkway to Woolridge Road as a four-lane open median divided expressway. Submitted 2022.

The Phase II evaluation of Site 44LD1501, Loudoun County, VA. Project Manager/Principal Investigator. Responsible for implementing a Phase II archaeological strategy for and managing the Phase II archaeological survey of Site 44LD1501 in Loudoun County. The site consisted of an early to mid-nineteenth century site which consisted of intact portions of a stone foundation as well as a filled-in cellar. The project involved the establishment of a grid at a 3-meter (10-foot) interval across the site along with the excavation of 11 one-meter by one-meter units. The site was recommended to be eligible for inclusion in the NRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase II report. This archaeological survey was done in preparation for the construction of residential buildings within the project area. Submitted 2021.

Phase I Cultural Resources Survey of the ±21.4 Hectare (±53 Acre) Crosstrail C Boulevard Project Area, Loudoun County, VA. Project Manager. Responsible for managing the Phase I archaeological survey of the proposed extension of Crosstrail Boulevard in Loudoun County. The Crosstrail Boulevard (Segment C) from Sycolin Road to the Dulles Greenway project provides for the design and construction of a four-lane, median-divided road between Sycolin Road and the Dulles Greenway interchange. The length of this project is approximately 2,700 linear feet and includes a bridge over the south tributary to Sycolin Creek. This new segment of Crosstrail Boulevard will replace Shreve Mill Road as the means to get from the Dulles Greenway to Sycolin Road. One site was identified – 44LD1964. This site had an occupation range that ranged from 1830 to 1945. Due to the wide occupation range, and the small assemblage, this site was recommended as not eligible for inclusion in the NRHP. Submitted 2021.

Phase I Cultural Resource Survey of the ± 25.5 Hectare (±63.1 Acre) Jones Point Park Project Area, City of Alexandria, VA. Project Manager. Responsible for managing the Phase I survey within Jones Point Park, which focused on geotechnical boring locations in preparation for sewerage construction. conducted a Phase I Cultural Resources Survey within Jones Point Park in areas of proposed geotechnical investigations. Completed archaeological testing of 11 proposed geotechnical boring sites located within Jones Point Park in Alexandria, Virginia. Geotechnical boring was implemented by Daniel R. Hayes, of Hayes & Monaghan Geoarchaeologists LLC. The boring locations fell within one existing site – 44AX0078 – which is a scatter of artifacts associated with the demolition of the World War I Shipyard. These artifacts were out of context and mixed with modern debris, and as such the site was considered to not be eligible for inclusion in the NRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Worked closely with geo-archaeologist to discern the presence or absence of buried intact soils. Submitted 2020.

Phase I Cultural Resource Survey of the ±37.5 Hectare (±92.6 Acre) Sandy River Water Intake Project Area, Prince Edward County, VA. Project Manager/Principal Investigator. Responsible for implementing a Phase I strategy and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a water intake structure. Three sites were identified – Sites 44PE0115, 44PE0116, and 44PE0117. Sites 44PE0155 and 44PE0117 are historic artifact scatters and Site 44PE0114 is a pre-contact lithic scatter. Due to the small number of artifacts in each site, they were all determined to not be eligible for inclusion in the NRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. The project involves the construction of a water intake structure and associated infrastructure to withdraw water from the County-owned Sandy River Reservoir at a point near Reservoir Road. Submitted 2021.

Phase I Cultural Resources Survey of the Mount Storm-Valley and Forest Line 550 500 kV Transmission Line Rebuild, Dominion Energy, Rockingham County, VA. Project Manager/Principal Investigator. Responsible for implementing a Phase I strategy and for managing the Phase I survey of the entirety of the Area of Potential Effect in preparation for the replacement of powerline structures and the installation of new access roads. No sites were identified Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. The project involves the replacement of towers within an existing ROW which runs through the George Washington and Jefferson National Forests, the installation of new access roads, helicopter landing pads, puller pad locations, and other various improvements involved with maintaining the ROW and installing new towers. Project required coordination with Virginia SHPO, West Virginia SHPO, and the Forest Service. Submitted 2020.

Phase I Cultural Resource Survey of the ±660.12-Hectare (1,631.2-Acre) Moody Creek Solar Project Area, Apex Energy, Charlotte County, VA. Project Manager/Principal Investigator. Responsible for implementing a Phase I strategy and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a solar farm. A total of 10 sites were identified. All sites were determined to not be eligible for inclusion in the NRHP due to heavy logging disturbance. Three cemeteries were identified and were recommended to be avoided with a 100-ft buffer. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020

Phase IA and Phase I Cultural Resource Survey of the ±890-Hectare (±1,998-Acre) Riverstone Solar Project Area Buckingham County, VA. *Project Manager/Principal Investigator.* Responsible for conducting a Phase IA survey of the project area and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a solar farm. A total of six sites were identified and were determined to not be eligible for inclusion in the NRHP due to heavy disturbance. Three cemeteries were identified and recommended to be avoided with a 100-foot buffer or to be further delineated. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2022.

Phase I Cultural Resources Survey of the ±683-Hectare (±1,687-Acre) CC Solar Project Area, Caroline County, VA. *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project area in preparation for the installation of a solar farm. A total of 13 sites were identified. Eleven sites were recommended to not be eligible for inclusion in the NRHP due to disturbance. Three sites – 44CE1004, 44CE1005, and 44CE1014 were determined to be potentially eligible for inclusion in the NRHP. These sites included the remains of the Antebellum boy's school Concord Academy, an Early National to Antebellum period artifact scatter, and a Reconstruction and Growth period house site. A total of six cemeteries were identified and recommended to be avoided with a 100-foot buffer or to be further delineated. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2022.

Phase IA and Phase I Cultural Resource Survey of the ± 272 Hectare (±672 Acre) Birchwood Solar Project Area, King George County, VA. *Project Manager/Principal Investigator.* Responsible for conducting a Phase IA survey of the project area and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a solar farm. Five sites were identified – 44KG0249 through 44KG0253. 44KG0253 and 44KG0251 were determined to not be not eligible for inclusion in the NRHP due to disturbance. Sites 44KG0249 was recommended for further survey and Sites 44KG0250 and 44KG0252 were recommended to be potentially eligible for inclusion in the NRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2022.

Phase IA and Phase I Cultural Resource Survey of the ±553.36 Hectare (±1,367.4 Acre) Michaux Creek Solar Project Area, Orsted, Pittsylvania County, VA. *Project Manager/Principal Investigator.* Responsible for conducting a Phase IA survey of the project area and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a solar farm. Three sites – 44PY0555 through 44PY0557 were identified. Site 44PY0555 was a circa 1770s to the middle of the 1800s domestic site and was determined to be potentially eligible for inclusion in the NRHP due the presence of surface features, and the relatively undisturbed soil profiles within the site. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2021.

Phase I Cultural Resource Survey of the Line 53 and 72 500kV Transmission Line Rebuild, Dominion Energy, Chesterfield County, VA. *Project Manager/Principal Investigator.* Responsible for implementing a Phase I strategy and for managing the Phase I survey of the entirety of the Area of Potential Effect in preparation for the replacement of powerline structures and the installation of new access roads. Two sites were identified: Sites 44CG0681 and 44CF0692. Site 44CF0692 is a lithic scatter consisting of 100 prehistoric artifacts. Site 44CF0681 is the Battery Brooke earthwork. It was determined that Site 44CF0692 was potentially eligible for inclusion in the NRHP and that Battery Brooke was eligible for inclusion in theNRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Submitted 2021.

Phase I Cultural Resource Survey of the ±39.2-Hectare (±97-Acre) Appomattox EDA Park Project Area, Appomattox County, VA. *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project. No sites were identified during this survey. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2021.

Phase I Cultural Resource Survey of the ±49.8-Hectare (±123-Acre) Greymont Project Area, Hanover County, VA. *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project. Three sites – 44HN0454 through 44HN0456 – were identified. All three sites date from the Reconstruction and Growth period to the World War II period. Due to lack of diagnostic artifacts, these sites were determined to not be eligible for inclusion in the NRHP. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2021

Piney Creek Cemetery Delineation, Halifax County, VA. *Project Manager/Principal Investigator.* Responsible for implementing a delineation strategy two cemeteries and one potential cemetery within the Piney Creek Solar project area. Authored report. Submitted 2021.

Boundary Delineation Survey of a Cemetery in Bolen Park: PCEM-1111-0080, Loudoun County, VA. *Project Manager/Principal Investigator.* Responsible for implementing a delineation strategy of a cemetery within Bolen Park and authoring report. Submitted 2021.

Phase IA and Phase I Cultural Resource Survey of the Midway Solar Project Area, Sun Tribe Solar, Albemarle County, VA. *Project Manager/Principal Investigator.* Responsible for conducting a Phase IA survey of the project area and for managing the Phase I survey of the entirety of the project area in preparation for the installation of a small-scale solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Submitted 2021.

Phase I Cultural Resource Survey of the ±4.15-Hectare (±10.2-Acre) New Road Power Supply Project Area, Loudoun County, VA *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the ±639.2-Hectare (±1,579.5-Acre) Bookers Mill Solar Project Area, Richmond County, VA *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project area in preparation for the installation of solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the ±309-Hectare (±764-Acre) Bartonsville Solar Project Area, Frederick County, VA *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project area in preparation for the installation of solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the Millboro Springs Solar Project Area, Bath County, VA *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project area in preparation for the installation of solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the Moran Solar Project Area, Prince Edward County, VA *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project area in preparation for the installation of solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase IA and Phase I Cultural Resources Survey of the ±99.47-Hectare (±245.8-Acre) Watlington Solar Project Area, Halifax County, VA. *Project Manager.* Responsible for conducting a Phase IA survey of the project area and for managing the Phase I survey of the entirety of the project area in preparation for the installation of solar farm. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the ±90.0 Hectares (±222.6 Acres) Apple Grove Project Area, Louisa County, VA. *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Phase I Cultural Resource Survey of the ±2.02-Hectare (±5-Acre) 6403 Hillview Avenue Project Area, Fairfax, VA. *Project Manager/Principal Investigator.* Responsible for managing the Phase I survey of the entirety of the project. Coordinated archaeological excavations, conducted scheduling, and authored the Phase I report. Made recommendations for the National Register of Historic Places eligibility status of identified sites. Submitted 2020.

Crosby Cemetery Delineation, Chesterfield County, VA. *Project Manager/Principal Investigator.* Responsible for implementing a delineation strategy an approximately 0.15-acre cemetery consisting of nine visible, for monitoring the delineation, and authoring the report. Submitted 2020.

Rochambeau Cemetery Delineation, James City County, VA. *Project Manager.* Responsible for implementing a delineation strategy for a cemetery consisting of five visible markers and 21 burial shafts identified subsurface; monitored the delineation and authored the report. Submitted 2019.

Phase II Archaeological Evaluation of Sites 44GV0373, 44GV0386, 44GV0408, 44GV0409, 44GV0410, 44GV0407, and 44GV0415. Greensville County, VA. *Field Director.* Responsible for leading a team of up to five people during the Phase II excavation of a total of 7 sites within the ±1,643-acre Sadler Solar project area. These sites included Early to Late Archaic, Early to Late Woodland, and Colony to Nation through World War II sites. Coordinated excavations and contributed towards the recommendations for the National Register of Historic Places eligibility status of the sites. Submitted 2018.

Appendix B. Table of STP Profiles

STP	Strata	Depths (cm)	Soil Color	Soil Type	Cultural Resources
A1	I	0 – 16	10YR 4/2 with 2.5YR 5/8	Clay loam	Modern glass discarded
	II	16 – 26	5YR 5/8	Sandy clay loam	Negative
A2	I	0 – 8	10YR 4/2	Clay loam	Negative
	II	8 – 20	5YR 5/8	Sandy loam	Negative
A3	I	0 – 16	5YR 5/8	Sandy loam	Negative
A4	I	0 – 10	10YR 4/2	Clay loam	Negative
	II	10 – 20	5YR 5/8	Sandy loam	Negative
A5	I	0 – 10	10YR 4/2	Clay loam	Negative
	II	10 – 23	5YR 5/8	Sandy loam	Negative
A6	I	0 – 9	10YR 4/2	Clay loam	Negative
	II	9 – 19	5YR 5/8	Sandy loam	Negative
	III	19 – 30	10YR 8/2	Sandy clay	Negative
A7	I	0 – 5	10YR 4/2	Clay loam	Negative
	II	5 – 18	5YR 5/8	Sandy loam	Negative
	III	18 – 28	10YR 8/2	Sandy clay	Negative
A8	I	0 – 15	10YR 4/2	Clay loam	Modern glass discarded
	II	15 – 25	10YR 8/2	Sandy clay	Negative
B1	I	0 – 15	10YR 5/3	Loam	Modern glass discarded
	II	15 – 25	10YR 8/2	Clay	Negative
B2	I	0 – 7	10YR 5/3	Loam	Negative
	II	7 – 18	10YR 7/8	Sandy clay	Negative
	III	18 – 28	10YR 8/2	Sandy Clay	Negative
B3	I	0 – 10	10YR 5/3	Loam	Negative
	II	10 – 22	10YR 7/8	Sandy clay	Negative
	III	22 – 32	10YR 8/2	Sandy Clay	Negative
B4	I	0 – 14	10YR 5/3	Loam	Negative

STP	Strata	Depths (cm)	Soil Color	Soil Type	Cultural Resources
	II	14 – 24	10YR 7/8	Sandy clay	Negative
	III	24 – 34	10YR 8/2	Sandy Clay	Negative
B5	I	0 – 9	10YR 5/3	Loam	Negative
	II	9 – 19	10YR 7/8	Sandy clay	Negative
	III	19 – 29	10YR 8/2	Sandy Clay	Negative
B6	I	0 – 12	10YR 5/3	Loam	Negative
	II	12 – 24	10YR 7/8	Sandy clay	Negative
	III	24 – 34	10YR 8/2	Sandy Clay	Negative
B7	I	0 – 11	10YR 5/3	Loam	Negative
	II	11 – 26	10YR 7/8	Sandy clay	Negative
	III	26 – 36	10YR 8/2	Sandy Clay	Negative
B8	I	0 – 11	10YR 5/3	Loam	Negative
	II	11 – 15	10YR 7/8	Sandy clay	Negative
	III	15 – 25	10YR 8/2	Sandy Clay	Negative
B9	I	0 – 9	10YR 5/3	Loam	Negative
	II	9 – 21	10YR 7/8	Sandy clay	Negative
	III	21 – 31	10YR 8/2	Sandy Clay	Negative
C1	I	0 – 7	10YR 4/2	Loam	Negative
	II	7 – 20	10YR 5/8	Sandy clay	Negative
	III	20 – 30	10YR 8/2	Sandy Clay	Negative
C2	I	0 – 10	10YR 4/2	Loam	Negative
	II	10 – 20	10YR 5/8	Sandy clay	Negative
C3	I	0 – 12	10YR 4/2	Loam	Negative
	II	12 – 23	10YR 5/8	Sandy clay	Negative
	III	23 – 34	2.5Y 5/4	Clay loam	Negative
C4	I	0 – 16	10YR 4/2	Loam	Negative
	II	16 – 30	Waterlogged	Clay loam	Negative
C5	I	0 – 5	10YR 4/2	Loam	Negative

STP	Strata	Depths (cm)	Soil Color	Soil Type	Cultural Resources
	II	5 – 15	10YR 5/8	Sandy clay	Negative
C6	I	0 – 15	10YR 4/2	Loam	Negative
	II	15 – 28	10YR 5/8	Sandy clay	Negative
C7	I	0 – 20	10YR 4/2	Loam	Negative
	II	20 – 30	10YR 5/8	Sandy clay	Negative
D1	I	0 – 8	10YR 5/3	Loam	Negative
	II	8 – 22	10YR 7/8	Sandy clay	Negative
	III	22 – 32	10YR 8/2	Sandy clay	Negative
D2	I	0 – 5	10YR 5/3	Loam	Negative
	II	5 – 15	10YR 7/8	Sandy clay	Negative
	III	15 – 21	5Y 6/4	Sand	Negative
	IV	21 – 31	10YR 8/2	Sandy clay	Negative
D3	I	0 – 11	10YR 5/3	Loam	Negative
	II	11 – 40	10YR 7/8	Sandy clay	Negative
	III	40 – 50	10YR 8/2	Sandy Clay	Negative
D4	I	0 – 9	10YR 5/3	Loam	Negative
	II	9 – 20	10YR 7/8	Sandy clay	Negative
	III	20 – 30	10YR 8/2	Sandy Clay	Negative
D5	I	0 – 12	10YR 5/3	Loam	Negative
	II	12 – 25	10YR 7/8	Sandy clay	Negative
	III	25 – 35	10YR 8/2	Sandy Clay	Negative
D6	I	0 – 12	10YR 5/3	Loam	Negative
	II	12 – 29	10YR 7/8	Sandy clay	Negative
	III	29 – 40	10YR 8/2	Sandy Clay	Negative
D7	I	0 – 7	10YR 5/3	Loam	Negative
	II	7 – 27	10YR 7/8	Sandy clay	Negative
	III	27 – 39	10YR 8/2	Sandy Clay	Negative
D8	I	0 – 11	10YR 5/3	Loam	Negative

STP	Strata	Depths (cm)	Soil Color	Soil Type	Cultural Resources
	II	11 – 19	10YR 7/8	Sandy clay	Negative
	III	19 – 30	10YR 8/2	Sandy Clay	Negative
E1	I	0 – 8	10YR 4/2	Silty loam	Modern glass discarded
	II	8 – 15	5YR 5/8	Silty clay loam	Negative
E2	I	0 – 10	10YR 4/2	Silty loam	Negative
	II	10 – 15	5YR 5/8	Silty clay loam	Negative
E3	I	0 – 23	Waterlogged	Clay loam	Negative
E4	I	0 – 10	10YR 4/2	Silty loam	Negative
	II	10 – 20	5YR 5/8	Silty clay loam	Negative
E5	I	0 – 17	10YR 4/2	Silty loam	Negative
	II	17 – 29	5YR 5/8	Silty clay loam	Negative
E6	I	0 – 8	10YR 4/2	Silty loam	Negative
	II	8 – 22	10YR 5/3	Silty clay loam	Negative
	III	22 – 32	10YR 8/2	Clay loam	Negative
E7	I	0 – 15	10YR 5/3	Silty clay loam	Negative
	II	15 – 25	10YR 8/2	Clay loam	Negative
E8	I	0 – 23	10YR 5/3	Silty clay loam	Negative
	II	23 – 34	10YR 8/2	Clay loam	Negative
E9	I	0 – 5	10YR 5/3	Silty clay loam	Negative
	II	5 – 20	10YR 8/2	Clay loam	Negative
F1	I	0 – 9	10YR 5/3	Loam	Negative
	II	8 – 28	10YR 7/8	Loamy clay	Negative
	III	28 +	Water table	--	--
F2	I	0 – 8	10YR 5/3	Loam	Negative
	II	8 – 23	10YR 7/8	Loamy clay	Negative
	III	23 +	Water table	--	--
F3	I	0 – 18	10YR 5/3	Loam	Negative
	II	18 – 41	10YR 5/6	Loam clay	Negative

STP	Strata	Depths (cm)	Soil Color	Soil Type	Cultural Resources
	III	41 – 51	10YR 7/4	Sandy clay	Negative
F4	I	0 – 9	10YR 5/3	Loam	Negative
	II	9 – 35	10YR 7/3	Sandy clay loam	Negative
	III	35 – 45	10YR 8/2	Clay	Negative
F5	I	0 – 14	10YR 5/3	Loam	Negative
	II	14 – 29	10YR 8/2	Clay	Negative
F6	I	0 – 9	10YR 5/3	Loamy clay	Negative
	II	9 – 25	10 YR 8/2	Clay	Negative
F7	I	0 – 10	10YR 5/3	Loamy clay	Negative
	II	10 – 25	10 YR 8/2	Clay	Negative
F8	I	0 – 18	10YR 5/3	Loamy clay	Negative
	II	18 – 28	10 YR 8/2	Clay	Negative
F9	I	0 – 13	10YR 5/3	Loamy clay	Negative
	II	13 – 25	10 YR 8/2	Clay	Negative
F10	I	0 – 15	10YR 5/3	Loamy clay	Negative
	II	15 – 26	10 YR 8/2	Clay	Negative

Appendix G – Phase I Environmental Site Assessment

Appendix G – Phase I Environmental Site Assessment

PHASE I ENVIRONMENTAL SITE ASSESSMENT

Marina Way Extension
WOODBRIDGE, VA

Project # 19-01549-019

Submitted to:

Prince William County
1 County Complex Ct.
Prince William, VA 22192

Prepared by:

JMT, Inc.
9201 Arboretum Pkwy Ste 310
Richmond, Virginia 23236

Submitted: March 13, 2024

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1.0 SUMMARY

Johnson, Mirmiran, and Thompson, Inc. (JMT) performed a Phase I Environmental Site Assessment (Phase I ESA) on the **Marina Way Extension** in Prince William County, Virginia (hereafter referred to as the site). The site is comprised of one approximately 20.9-acre study area located in eastern Prince William County, Virginia. A Phase 1 ESA was previously completed on the property in November 2023. This Revised Phase I ESA addresses additions to the site boundary made in early 2024, which extended the northern portion of the site to the west and east along Annapolis Way. The general site location is shown on Figure 1. The site configuration, previous site boundary, and revised site boundary are shown on Figure 2.

This assessment was performed in accordance with the American Society of Testing and Materials (ASTM) Standard Practice for the Phase I Environmental Site Assessment Process (ASTM Designation: E1527-21) and the United States Environmental Protection Agency Standard Practice for All Appropriate Inquiries (AAI) (40 CFR Part 312). In accordance with ASTM, AAI does not mean an exhaustive assessment of a property, nor does it wholly eliminate uncertainty regarding environmental conditions.

In preparing this report, JMT relied upon certain verbal information and representations provided by the Client and other individuals familiar with the site. Historic documentation and available Federal, State, and Local databases pertaining to environmental matters for the individual parcels, adjoining properties, and the surrounding area were reviewed. A field inspection was completed in order to assess the property for recognized environmental conditions resulting from past or present activity and work practices.

ASTM E1527-21 defines recognized environmental conditions (RECs) as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment.

A past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls is referred to as a controlled REC (CREC).

A past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by regulatory authority, without subjecting the property to any required controls is referred to as a historical REC (HREC).

This Phase I Environmental Site Assessment was completed in conformance with the scope and limitations of ASTM E1527-21. Any exceptions to, or deletions from, this practice are described in Section 15 of this report.

This assessment has identified one recognized environmental condition (REC), the former Gordon Plaza Dry Cleaner, located at 13276 Gordon Boulevard, associated with the site. No CRECs or HRECs were identified in association with the site.

De minimis conditions are environmental conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

The following *de minimis* conditions were identified in association with the site:

1. Minimal scattered solid waste, typical of urban environments, consisting of various cans, bottles, paper and other debris is present throughout the site. Refer to Section 6.14.
2. Minor superficial petroleum stains were observed at numerous locations on the asphalt-paved portion of the property.

Recommendations

Based on the findings presented in this report, JMT recommends the following:

1. Obtain and review all available information regarding the observed groundwater monitoring wells to ascertain if the former drycleaning operation at the site has negatively impacted groundwater underlying the property.
2. Cleanup and disposal of solid waste, if remaining at time of purchase, by a waste management firm.
3. If present at the time of purchase, Prince William County should consider conducting a lead-based paint and an asbestos containing materials inspection of the Gordon Plaza buildings as they were built prior to the CPSC's prohibition of lead in paint for residential use and prior to EPA's ban on asbestos containing materials.

This report may be distributed and relied upon by the Client. Use of the information and conclusions in this report by any other person or entity is not authorized without their or JMT's consent.

2.0 INTRODUCTION

Prince William County, hereinafter referred to as “the Client”, authorized JMT to perform a Phase I ESA on the **Marina Way Extension, Woodbridge, Virginia**.

The purpose of this report is to identify, to the extent feasible, recognized environmental conditions at the site resulting from past or present industrial activity and work practices. They can be categorized as one of the following:

- A *Recognized Environmental Condition* (REC) is defined as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment.
- A *Controlled REC* (CREC) resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls.
- A *Historical REC* (HREC) resulting from a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by regulatory authority, without subjecting the property to any required controls.

RECs are not intended to include *de minimis* conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

3.0 PROJECT SCOPE

Methodologies used in the completion of this report are customary practice for conducting a Phase I ESA of a property for the purpose of identifying RECs and for meeting the necessary requirements to qualify for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) liability protections. The following tasks were performed during the implementation of this Phase I ESA:

- A questionnaire was completed by Mekdes Tabor (hereinafter referred to as the site representative).
- JMT personnel visually inspected the site on July 17, 2023, to determine if any visually apparent conditions exist that would be cause for concern or warrant additional study. An additional site visit was conducted on March 1, 2024 to visually inspect the additional areas included in the revised site boundary and review the remainder of the property for obvious changes.
- Historic and current topographic maps, aerial photography, and city directories were examined to evaluate the nature of past development and use of the site and surrounding properties.
- Government database searches were conducted for the properties using various environmental regulatory lists.

The scope of work did not include and should not be relied upon for guidance related to the following items:

- The collection and/or analysis of samples of air, soil, groundwater, flora, fauna, building materials, waste materials, asbestos containing materials, lead paint, or any other substance.
- Geotechnical considerations and the possible presence on or near the site of environmentally sensitive areas, endangered species, and culturally or historically important sites.
- A wetland study or delineation.

3.1 SIGNIFICANT ASSUMPTIONS

While this report provides an evaluation of RECs, both past and present, as with any Phase I ESA it is limited by the accuracy of information available at the time of the assessment(s). Conclusions and recommendations presented in this report are based on the authorized scope of work and the reasonably ascertainable information reviewed.

3.2 LIMITATIONS AND EXCEPTIONS

This Phase I ESA has been prepared in accordance with accepted environmental methodologies referred to in ASTM E1527-21 and AAI and contains limitations inherent in these methodologies. In accordance with ASTM, all appropriate inquiries does not mean an exhaustive assessment of a property, nor does it wholly eliminate uncertainty regarding environmental conditions. No other warranties, expressed or implied, are made as to the professional services provided under the terms of JMT's contract.

The conclusions of this Phase I ESA are based on information provided by others familiar with the site, upon documents provided to JMT, a visual inspection of the site, and information contained in Federal, State, and Local government agency databases. The possibility exists that unexpected environmental conditions, compounds or materials could be encountered at the site, which would not be detected or uncovered during a standard Phase I ESA.

Evaluating compliance of existing or past owners with applicable Tribal, Federal, State, and Local governmental laws, and regulations is not completed during a routine Phase I ESA and was not included in this assessment.

Under the ASTM E1527-21 Standard and the AAI Rule, a Phase I ESA is considered current for 6 months (180 days) from the date each component of the report is completed. See Section 16.0 (References) for dates.

3.3 USER RELIANCE

This report may be distributed and relied upon by the Client. Use of the information and conclusions in this report by any other person or entity is not authorized without their or JMT's consent.

4.0 SITE INSPECTION

2023 Site Inspection

JMT employee Garland H. Moore III, CPG visited the site on July 17, 2023. Weather conditions on the day of the site visit consisted of an ambient temperature of approximately 82 degrees F under partly cloudy skies.

The field reconnaissance consisted of a visual inspection of the study area boundaries, the interior of the property, and visual inspection of the exterior of the structures. The exteriors of adjoining properties were also visually evaluated from the site boundaries and from public roadways for identification of potential adjoining property RECs. Photographic documentation of the inspection is provided in Appendix A.

JMT personnel initially accessed the site from Gordon Boulevard, located immediately southwest of the property. The southwestern portion of the site is currently occupied by a section of Gordon Plaza, housing an Aldi Grocery Store, the Salvation Army Family Store and Joe's Place Italian Restaurant as well as one or more vacant units. Tenants in the remainder of Gordon Plaza include a thrift store, an appliance store, several vacant units and a church. The area surrounding this section of the plaza consists of asphalt paved parking lots to the southwest with some scattered landscaped islands. The southeast, east and northeast exterior areas are asphalt paved and utilized for deliveries, utilities, trash collection, etc. A chain link fence separates the east/southeast boundary of the site from a vacant parcel currently containing several large piles of fill material. Of note during the site visit was the existence of a minimum of 16 groundwater monitoring wells surrounding the section of the existing Gordon Plaza building addressed in this report. Information regarding these wells was not provided for JMT review prior to the site visit. JMT has requested available information (laboratory data, reports, etc.) related to these wells but has not received a response as of the date of this report.

The central portion of the site is separated from Gordon Plaza by chain link fencing and consists of an asphalt paved vehicle/truck parking area that is only accessible from the neighboring parcel to the east. North/northeast of this paved area, the property is heavily wooded/vegetated and includes a small freshwater pond and wetlands. A Wetland Map prepared by JMT is provided in Appendix D.

Adjacent properties consisted of the Gordon Plaza to the northwest, west and southwest, Gordon Boulevard to the south with various commercial enterprises beyond, a vacant parcel with piles of fill material to the southeast and east, Annapolis Way to the northeast with an apartment complex (Riversgate) and Vulcan Materials beyond to the northeast and Royalhouse Chapel, International to the northwest.

Photographs of the site are presented in Appendix A.

2024 Site Inspection

JMT employees Carter Teague and Ashley Wilkins visited the site on March 1, 2024. Weather conditions on the day of the site visit consisted of an ambient temperature of approximately 50 degrees F under sunny skies.

The field reconnaissance consisted of a visual inspection of the additional study areas along Annapolis Way and a visual assessment of the previously inspected areas for obvious changes. At the time of the inspection, active roadway construction was occurring on Annapolis Way to the west of the site.

Photographic documentation of the inspection is provided in Appendix A.

5.0 SITE DESCRIPTION

The proposed project is located within Prince William County between Annapolis Way and Horner Road at Route 123 (Gordon Boulevard) and lies within the Atlantic Coastal Plain physiographic province. The study area comprises approximately 20.9 acres with primary access from Gordon Boulevard to the southwest or Annapolis Way to the northeast (Figure 1).

The southern portion of the study area is completely paved. This area is used for customer parking that serves the stores located in the center of the study area (Figure 2). The northern portion of the study area is forest land consisting of mostly mixed, broad-leaf, deciduous forested communities that transition to old field/disturbed communities closer to Annapolis Way. The portion of the study area along Annapolis Way is impervious roadway and sidewalks and maintained turf and ornamental landscaping. Elevation ranges from approximately 74 ft amsl at the southwest boundary to approximately 72 ft at the northern boundary with a modestly elevated (approximately 80 ft amsl) area in the central portion of the property.

The latitude and longitude of the approximate center of the site are N 38°39’50”, W 77°14’52”. Mapping from the Federal Emergency Management Agency’s (FEMA) Flood Insurance Rate Map (FIRM) Panel 51153C0236E (Dated 8/3/15) is shown in Appendix D and documents that the study area is not located within a FEMA 100-year floodplain (FEMA, 2015).

The majority of the site is zoned Business (B-1), Heavy Industrial (M-1), with a small area of Planned Mixed Residential (PMR) at the northeast end. The site is in the community of Woodbridge in Prince William County, Virginia (see Figure 3). The site is comprised of the following eleven (11) parcels, which also extend beyond the site limits:

- GPIN 9999-99-9999 (PWC ROW),
- GPIN 9999-99-9999 (PWC ROW),
- GPIN 8492-07-0230 (LEARY FAMILY LLC),

- GPIN 8492-07-1869 (GORDON PLAZA 0225 LLC),
- GPIN 8492-07-7174 (COMMONWEALTH OF VIRGINIA),
- GPIN 8492-17-2556 (COMMONWEALTH OF VIRGINIA),
- GPIN 8492-07-3506 (VDOT)
- GPIN 8492-07-7096 (ASHNA LLC),
- GPIN 8492-08-7530 (991 ANNAPOLIS WAY LLC),
- GPIN 8492-18-1453 (RP II PROPERTY OWNER LLC), and
- GPIN 8492-18-3603 (VIRGINIA CONCRETE CO INC)

The property has two buildings associated with Gordon Plaza, which are described below in Table 1 and are shown on Figure 3. The Gordon Plaza buildings are positioned in the upper southwestern half of the site. The majority of this portion of the site consists of asphalt parking lots and structures. The upper northeastern half of the site contains a forested area.

TABLE 1: SUBJECT PROPERTY STRUCTURES
Gordon Plaza Main Building, single story concrete and brick commercial strip mall with various retail tenants and some vacant units. Connects to adjacent building via breezeway.
Gordon Plaza South Building, single story concrete and brick commercial strip mall structure containing grocery, retail, and a restaurant. Connects to main building via breezeway.

6.0 SITE CHARACTERISTICS

The following subsections describe the physical aspects of the site.

6.1 TOPOGRAPHY, DRAINAGE PATTERNS, AND INFERRED GROUNDWATER FLOW

The USGS 7.5 and 15-minute quadrangle topographic maps were reviewed to assess the location of the subject site with respect to topography, surface water drainage and to infer groundwater flow. The site elevation is approximately 82 feet above mean sea level (amsl).

Topographic maps indicate that the site is relatively flat with a range in elevation of about 12 ft (Appendix B). The Physical Setting Addendum contained in the EDR Report indicates a general slope to the northeast for the property (Appendix C). This is generally consistent with field observations. Regional groundwater flow is anticipated to travel in a northeasterly direction toward the Occoquan River.

6.2 SURFACE WATER FEATURES, WETLANDS, AND FLOODPLAINS

The Occoquan River is located approximately 1,200 ft northeast of the site. One isolated forested freshwater wetland was identified on the site during a June 13, 2023 wetland delineation, including one freshwater forested/shrub wetland, one freshwater pond, and three riverine systems. Refer to the Wetland Map in Appendix D for specific water body locations.

According to the Flood Hazard Zone map in Appendix D, the site and adjoining properties are in an area of minimal flood hazard, referred to as Flood Zone Type X.

6.3 BEDROCK AND SURFICIAL GEOLOGY

JMT did not observe bedrock outcrops on or in the immediate vicinity of the site. According to the geologic information provided in the Physical Setting Addendum in Appendix C, the site is underlain by lower Cretaceous rock.

6.4 SOILS

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) SSURGO database contains information about soil as collected by the National Cooperative Soil Survey. NRCS reports that the SSURGO database information was gathered by walking over the land and observing the soil, as well as analyzing soil samples in laboratories. No soil samples were collected as part of this Phase I ESA.

Soil information provided by EDR is included in the Physical Setting Addendum of the EDR Radius Report in Appendix C. Information contained in the EDR report indicates that site soils consist of Urban land, Neabsco loam, and Dumfries sandy loam. Soils in the Neabsco group have a slow infiltration rate when thoroughly wet. Soils in the Dumfries group have a moderate infiltration rate when thoroughly wet.

6.5 SITE ACCESS AND PAVED SURFACES

Access to the property is from Gordon Boulevard to the south. Access from the northeast is from the existing intersection of Marina Way and Annapolis Way (see Figure 3).

6.6 FORMER BUILDING FOUNDATIONS AND STRUCTURES

No historical foundations or structures were observed onsite during the site visit. A building foundation immediately adjacent to the southwest corner of the study area was observed during the site visit. Information provided in the EDR City Directory Report indicates that various chain (fast food) restaurants occupied this portion of Gordon Plaza from prior to 1976 until between 2000 and 2005.

6.7 WATER SUPPLY WELLS AND GROUNDWATER MONITORING WELLS

The site is served by a connection to the public water main. No water supply wells were on the site during the site visit.

A minimum of 16 groundwater monitoring wells were observed surrounding the section of Gordon Plaza included in this study. The wells were not accessed, gauged, or sampled as part of this study. Additional information related to the wells has been requested from the landowner. At the time of this report, the landowner has stated that they are currently working with a separate environmental consultant to prepare a report on the wells and regarding “next steps” for the property. In the absence of that report, JMT recommends conducting groundwater investigations for potential contamination from the dry cleaner identified in the database results.

6.8 WASTEWATER AND SEPTIC SYSTEMS

The property is served by a public sewer system.

6.9 SITE UTILITIES AND HEATING/COOLING SYSTEMS

Observed site utilities include electric, water, sewer and natural gas as evidenced by utility hookups associated with the onsite buildings. Roof-mounted HVAC units were observed from the facility parking areas and on aerial photographs provided by EDR. An interior inspection of the buildings was not conducted as part of this investigation.

6.10 UNDERGROUND FEATURES

A minimum of 16 groundwater monitoring wells surrounding the existing structures were observed during the site visit. Information regarding these wells was requested from the client but has not been received as of the date of this report. At the time of this report, the landowner has stated that they are currently working with a separate environmental consultant to prepare a report on the wells and regarding “next steps” for the property. In the absence of that report, JMT recommends conducting groundwater investigations for potential contamination from the dry cleaner identified in the database results.

6.11 SUMPS, DRAINS, AND CATCH BASINS

No sumps, drains, or catch basins were observed at or reported for the site.

6.12 STAINED SOIL AND PAVEMENT

Widely scattered areas of surface staining were observed on the pavement of the Gordon Plaza parking lot. These stains appear to be petroleum-based in origin and consistent with typical commercial uses. These areas of staining constitute a *de minimis* condition (i.e., environmental conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies).

6.13 STRESSED VEGETATION

JMT observed no evidence of dead vegetation associated with the presence of petroleum or hazardous substances. All onsite vegetation appeared reasonably healthy for the time of year.

6.14 SOLID WASTE

Minor scattered accumulations of solid waste associated with the Gordon Plaza. The observed solid waste constitutes a *de minimis* condition (i.e. environmental conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies).

7.0 OIL, HAZARDOUS SUBSTANCE USE, TREATMENT, STORAGE, DISPOSAL, AND GENERATION

Determining the presence of aboveground storage tanks, underground storage tanks (USTs), and storage drums is considered essential in assessing potential contamination sources at the site. Visual inspection, property owner knowledge, and the review of tank registration records and Resource Conservation and Recovery Act (RCRA) generator records were used to determine the possible existence of historical and currently operating storage tanks at the property.

7.1 USTS, ASTS, AND DRUMS

Fire Insurance Maps (i.e., Sanborn Maps), which can indicate the location of tanks, were not available for the subject property or surrounding area (Appendix F). Therefore, JMT determined the presence of USTs, ASTs, and drums at the site by relying upon observations during the field inspection.

<u>USTs</u>

No evidence of USTs, such as vent or fill pipes, was observed during the field inspection or identified in standard historical sources (e.g., Federal and State databases).

<u>ASTs</u>

No ASTs were observed during the field inspection or identified in standard historical sources (e.g., Federal and State databases).

<u>Drums</u>

Four 55-gallon drums were observed at the rear entrance to Joe's Place restaurant. The observed drums appeared to be utilized for storage of spent grease and cooking oils from the restaurant kitchen and did not appear to be leaking at the time of the site visit.

7.2 OIL AND HAZARDOUS SUBSTANCES

Hazardous substances are defined pursuant to CERCLA 42 U.S.C.§9601(14) as: (A) any substance designated pursuant to section 1321(b)(2)(A) of Title 33; (B) any element, compound, mixture, solution, or substance designated pursuant to section 9602 of this title; (C) any hazardous waste having the characteristics identified under or listed pursuant to section 3001 of the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, (42 U.S.C. §6921) (but not including any waste the regulation of which under RCRA (42 U.S.C.§§6901 et seq.) has been suspended by Act of Congress); (D) any toxic pollutant listed under section 1317(a) of Title 33; (E) any hazardous air pollutant listed under section 112 of the Clean Air Act (42 U.S.C. §7412); and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator (of EPA) has taken action pursuant to section 2606 of Title 15. The term does not include generally petroleum, including crude oil or any fraction thereof and the term does not include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel (or mixtures of natural gas and such synthetic gas).

According to the EPA, "while most hazardous wastes that are ignitable, reactive, corrosive or toxic in America are regulated under Subtitle C of the Resource Conservation and Recovery Act (RCRA), Congress developed an exclusion for household waste. Under this exclusion, found in Title 40 of the Code of Federal Regulations Part 261.4, wastes generated by normal household activities (e.g., routine house and yard maintenance) are excluded from the definition of hazardous waste. Specifically, wastes covered by the household hazardous waste exclusion must satisfy two criteria:

1. The waste must be generated by individuals on the premise of a temporary or permanent residence, and
2. The waste stream must be composed primarily of materials found in wastes generated by consumers in their homes.

7.3 UNIDENTIFIED SUBSTANCE CONTAINERS

No unidentified substance containers were observed during the site inspection.

7.4 ODORS

No odors were observed or reported during the site inspection.

7.5 POLYCHLORINATED BIPHENYLS

One pole-mounted electrical transformer was observed on the eastern site boundary. No PCB labeling was observable from ground level.

7.6 ASBESTOS-CONTAINING BUILDING MATERIALS

According to ASTM E1527-21, "Asbestos is a naturally occurring mineral fiber that was once widely used in building materials and products for its thermal insulating properties and fire resistance. EPA defines asbestos-containing material (ACM) as material that contains more than 1% asbestos. Building products containing ACM are often referred to as asbestos containing building materials (ACBM). Under the Toxic Substance Control Act (TSCA), EPA banned the use of asbestos in many products in 1993. However, several categories of building products were not subject to the ban. Thus, existing and even new buildings may lawfully contain ACBM."

At least one structure subject to this Phase I ESA was constructed in 1973, prior to EPA's ban on asbestos in many products. A full assessment of ACBM is beyond the scope of this Phase I ESA.

7.7 LEAD-BASED PAINT (LBP)

Per ASTM E1527-21, "Lead is a soft, bluish metallic element that has been used in a wide variety of products. According to EPA, paint manufacturers frequently used lead as a primary ingredient in many oil-based interior and exterior house paints through the 1940s and gradually decreased its use in the 1950s and 1960s as latex paints became more widespread. The federal Department of Housing and Urban Development (HUD) estimated that 75% of the houses built in the United States before 1978 contain some lead-based paint. Lead from paint, chips, and dust can pose health hazards if not properly managed. The Consumer Product Safety Commission (CPSC) prohibited use of lead in paint for residential use in 1978 in concentrations greater than 0.06 percent lead by weight. It should be noted that the use of LBP in commercial and industrial buildings has not been prohibited."

At least one structure subject to this Phase I ESA was built in 1973, prior to the CPSC's prohibition of lead in paint for residential use. A full assessment of lead is beyond the scope of this Phase I ESA.

7.8 MOLD

No mold-like substances were observed by JMT during the site inspection; however, a full assessment of mold is beyond the scope of this Phase I ESA.

7.9 RADON

The USEPA has prepared a map to assist National, State, and Local agencies in identifying radon-prone areas. The map divides the country into three Radon Zones. Zone 1 being those areas with the greatest radon potential, the average predicted indoor radon concentration in residential dwellings exceeding the EPA Action limit of 4.0 pico/Curies per Liter (pCi/L). Zone 2 regions have a moderate potential of radon with a predicted average indoor screening level between 2.0 pCi/L and 4.0 pCi/L. Zone 3 regions have a low potential for radon with a predicted average indoor screening level less than 2.0 pCi/L. It is important to note that the EPA has found homes with elevated levels of radon in all three zones and recommends site-specific testing in order to determine radon levels at a specific location. However, the map does give a valuable indication of the propensity of radon gas accumulation in structures.

Review of the EPA Map of Radon Zones in the Physical Setting Addendum (Appendix C) places Prince William County, and therefore the subject property, in Zone 2 (2.0 pCi/L to 4.0 pCi/L). Sites tested for the subject property Zip code indicated 72 of 434 locations exceeded 4.0 pCi/L. The USEPA recommends that corrective measures be taken for indoor air concentrations of radon of 4.0 pCi/L or higher. A full assessment of radon is beyond the scope of this Phase I ESA.

8.0 SITE HISTORY

8.1 CURRENT OCCUPANTS AND USES

Both buildings at Gordon Plaza appear to be generally in use; however, some units are vacant. Current tenants of the structures included in this study (Gordon Plaza South Building) include Aldi, The Salvation Army Family Store, and Joe's Place Italian Restaurant. Tenants of the Gordon Plaza Main building include Regency Furniture, Renew Life Worship Center, Frugalista Outlet, and Better Appliance.

8.2 PAST DEVELOPED AREAS AND USES

Gordon Plaza has been used as commercial shopping centers since construction in 1973.

8.3 UNDEVELOPED PORTIONS

There is a forested portion of the site to the northeast of Gordon Plaza which is currently undeveloped.

8.4 FILL MATERIALS

According to ASTM E1527-21, fill is defined as "dirt, soil, sand, or other earth, that is obtained off-site, that is used to fill holes or depressions, create mounds, or otherwise artificially change the grade or elevation of real property. It does not include material that is used in limited quantities for normal landscaping activities."

JMT did not observe any obvious fill areas during the site inspection.

9.0 SURROUNDING AREA

JMT observed the visible exteriors of adjacent properties during its inspection while remaining within site boundaries. The frontage portions of nearby properties were also viewed from public roadways. The following sections provide information pertaining to adjacent property use.

9.1 CURRENT USE OF ADJOINING PROPERTIES

JMT observed the following property uses adjacent to the site:

TABLE 2: CURRENT USE OF ADJOINING PROPERTY USES	
DIRECTION	**USES**
N	Residential/Industrial
S	Commercial
E	Maintained Turf/Vacant
W	Commercial/Residential

9.2 HISTORICAL USE(S) OF ADJOINING PROPERTIES

Topographic maps show that land adjoining the site has been unforested since at least 1927, with the first structures appearing on site by 1890. According to aerial imagery (Appendix G), the surrounding area has gradually increased in density with commercial and industrial development of the surrounding area since at least 1954. By 1974, the shopping center currently present at the southwestern half of the site appears complete. Additional development appears in the northeast by 1988.

9.3 HIGH-RISK PROPERTIES WITHIN 1,000 FEET

Properties with a potentially elevated environmental risk include commercial or industrial lands that use onsite septic systems, that have railroad lines, those that were used as industrial parks, for heavy industrial use, or intensive agricultural use, and those with a history of documented environmental concerns. One high risk property located upgradient of the site was identified in the EDR Radius Report.

- The Horner Road Exxon station located immediately southwest/upgradient of the property at 13306 Gordon Boulevard, appears on the RCRA VSQG, VA Tanks, EDR Historic Auto and VA LUST databases. The facility, in operation since at least 1976, is not listed as currently under investigation for environmental issues.

No other high-risk properties were identified during this investigation.

9.4 AREA UTILITIES

Area properties reportedly use public water and sewer systems and are also serviced by telephone and electric providers.

10.0 REVIEW OF ENVIRONMENTAL DATABASE RECORDS

The purpose of the records review was to obtain and review information that would help identify RECs in connection with the site. Some records reviewed pertain not only to the subject property, but also to properties within a specified search distance in order to help assess the likelihood of conditions from migrating hazardous substances or petroleum products.

Regulatory agency lists were reviewed for documented environmental incidents or activities on the site and surrounding area. JMT reviewed Federal, State, and Local standard and supplemental databases for the site and area properties. This database research was completed using the standard ASTM search distances for Federal NPL/RCRA sites and State NPL equivalent.

10.1 SUMMARY OF ENVIRONMENTAL RECORDS FOR THE SITE

The site was identified in ten environmental database records relating to two facilities (Appendix C).

Six records referencing the Gordon Plaza Cleaners, located at 13267 Gordon Blvd (one record lists 13289 Gordon Blvd), consist of two EDR Historic Cleaners listings, one Drycleaners listing, one RCRA NonGen/NLR listing, one FINDS listing, and one ECHO listing. According to the EDR Historic Cleaners database, a drycleaning facility was present on the site from 1991 through 2000. The EDR City Directories Report for 1986 identified Golden Dry Cleaners at 13289 Gordon Boulevard, which was either immediately adjacent to the later named Gordon Plaza Cleaners or was the same location as Gordon Plaza Dry Cleaners prior to consolidation/readdressing of the units. The Drycleaners database lists the facility as permanently shut down. The RCRA NonGen/NLR database lists the facility as being a non-generator as of 2001. It was previously listed as a small quantity generator in 1985 for ignitable waste and various spent halogenated solvents, likely in reference to the Golden Dry Cleaners listing identified in the City Directory. No notices of violations were reported. No additional information directly referencing Golden Dry Cleaners was contained in the reviewed environmental records.

Four records referencing the General Dynamics Land Systems Woodbridge Technical facility, located at 991 Annapolis Way, consist of one RCRA NonGen, one Manifest listing, one FINDS listing, and one ECHO listing. According to the RCRA NonGen and Manifest listings, the facility is a non-generator as of 2014. It was previously listed as a small quantity generator in 1989 and a conditionally exempt small quantity generator in 2012 for ignitable waste, corrosive waste, cadmium, chromium, lead, mercury, benzene, methyl ethyl ketone, and various spent halogenated and nonhalogenated solvents associated with the manufacturing of military armored vehicle, tank, and tank components. No notices of violations were reported.

10.2 SUMMARY OF FEDERAL AND STATE DATABASE SEARCHES RESULTS FOR SURROUNDING PROPERTIES

According to the Environmental Database Report, 85 environmental records were identified within the ASTM-recommended search radii surrounding the site (Appendix C). Upgradient records within 1000 ft of the site are summarized below.

Eight records reference the Exxon #25666/Horner Road Exxon at 13306 Gordon Blvd. Dunivin & Sons, Inc. is also listed at the same address. The parcel is located approximately 0.016 miles from the site at a relatively higher elevation. The Exxon station appears on the RCRA-VSQG, LTANKS, UST FINDER, UST FINDER RELEASE and LUST databases. Dunivin & Sons, Inc. is listed on the EDR Historic Auto database. The RCRA-VSQG database record for "Exxon Co USA #25666" lists the Exxon station as a Conditionally Exempt Small Quantity Generator for undefined wastes and benzene in 1991 and as a Large Quantity Generator in 1996. No violations were reported. The RCRA-VSQG database record for "Horner Road Exxon" lists the Exxon station as a Conditionally Exempt Small Quantity Generator for undefined wastes, cadmium, chromium, benzene, and tetrachloroethylene in 1991. No violations were reported. The LTANKS, UST FINDER RELEASE, and LUST database records for the Exxon station state that one petroleum UST was involved in a product release to the environment in 1987 and in 1995. The releases were cleaned up and the records were closed in 1987 and 1997, respectively. The UST FINDER database states that a total of four tanks containing used oil and gasoline were removed in 1995. The EDR Historic Auto database for Dunivin & Sons, Inc. lists the parcel as a gasoline service station from 1982 to 2014.

Two records reference the Virginia Concrete – Woodbridge Plant located at 936 Annapolis Way. The parcel is located approximately 0.023 miles from the site at a relatively lower elevation. The facility is listed on the UST, UST FINDER, SPILLS, Financial Assurance, and Tier 2 databases. The UST and UST FINDER databases list one 12000-gallon Diesel On-Road UST as currently in use and installed in 1989, and three 4000-gallon diesel USTs as having been removed from the ground in 2001. The SPILLS database lists a suspected fugitive dust incident from 2017 at Vulcan Materials Company resulting from a complaint, however, the inspection found no issues and the case was reported closed. The SPILLS database also reports a small hydraulic oil spill (<2 gallons) resulting from a hose installation in 2022. The spill was contained and the database reports that no environmental impacts were expected; the case was reported closed. The Financial Assurance database lists the concrete plant as having a 12000-gallon UST in use. The Tier 2 database lists the various materials handled at the facility including diesel fuel, #2 fuel oil, gravel, crushed stone, Newcem, Portland cement, sand, and sulfuric acid.

Four records reference Woodbridge Public Auto Auction and JKJ Buick, which are located at 1108 Horner Road. The parcel is located approximately 0.078 miles from the site at a relatively higher elevation. Woodbridge Public

Auto Auction is listed on the LTANKS, RCRA-VSQG, FINDS, ECHO, and Manifest databases. JKJ Buick is listed on the UST and UST FINDER databases. The RCRA-VSQG database record lists the Woodbridge Public Auto Auction as a Conditionally Exempt Small Quantity Generator for ignitable waste, barium, cadmium, chromium, lead, benzene, chloroform, methyl ethyl ketone, tetrachloroethylene, trichlorethylene, 1,2-Benzenedicarboxylic acid, dibutyl ester (Or) dibutyl phthalate, methane, dichloro- (Or) methylene chloride, methanol (I) (Or) methyl alcohol (I) and various spent halogenated and nonhalogenated solvents in 2021. The facility received notices of violations in 2020. The LTANKS database record state that product release to the environment occurred in 2002. The releases were cleaned up and the record was closed in 2005. The UST and UST FINDER database states that three tanks containing used oil, diesel, and gasoline were removed in 1990.

Six records reference the Occoquan Shell/Shafer Property/Texaco/Bedsole Gene Stephen parcel, located at 13313 Occoquan Road. The parcel is located approximately 0.165 miles from the site at a relatively higher elevation. The facilities are listed on the UST, UST FINDER, UST FINDER RELEASE, Financial Assurance, LUST, LTANKS, SPILLS, RCRA-SQG, FINDS, and ECHO databases. The UST and UST FINDER databases list four active USTs and 4 inactive USTs at the facility. The four active USTs were installed in 1996 and are currently in use, and include a 12000-gallon gasoline UST, a 10000-gallon premium gasoline UST, a 6000-gallon diesel UST, and a 4000-gallon kerosene UST. The four inactive USTs include four 6000-gallon gasoline USTs of an unknown installation date and which were removed in 1996. The Financial Assurance database references the currently active USTs. The LUST, LTANKS, and UST FINDER RELEASE databases report that petroleum releases occurred in 1991 and 1997. The LUST database states that the case status is open, however, the LTANKS database reports the case as closed in 2014. The SPILLS database states that a caller reported observation of a staff member dumping product in storm drain in 2006. The case status is closed. The RCRA-SQG database states that the facility has been a small quantity generator since 1990 and handles undefined wastes and benzene. No violations were reported.

Three records reference the Woodbridge Jiffy Lube, located at 13319 Occoquan Road. The parcel is located approximately 0.17 miles from the site at a relatively higher elevation. The facility is listed on the RCRA-SQG, FINDS, ECHO, AST, UST FINDER RELEASE, LUST, and LTANKS databases. The RCRA-SQG database lists the facility as a small quantity generator for ignitable wastes and lead since 1990. No violations were reported. The AST database reports that there are two active ASTs at the facility which were installed in 1995 and are currently in use, including a 1000-gallon lube oil AST and a 1000-gallon used oil AST. The LUST, LTANKS, and UST FINDER RELEASE databases report that a petroleum release occurred in 1996. The case was reported closed in 1996.

One record references the Davis Vernelle Residence, located at 13321 Occoquan Road. The parcel is located approximately 0.173 miles from the site at a relatively higher elevation. The facility is listed on the LTANKS database, which states that a petroleum release occurred from a heating oil UST in 2004. The case was reported closed in 2005.

Additional records are listed in Appendix C (page 362) for unplottable facilities (i.e. not enough location information was provided by the agency to map the incidents). These records are associated with a 1997 petroleum release at the intersection of Route 1 & I-95 NB; a 1985 petroleum release at the Lorton Pump Station on Furnace Road; a SEMS listing for the NIKE Site N-64 Launch (non-NPL; ESI Ongoing), petroleum releases in 1990, 1991, 1992, 1995, and 1997 at the Woodbridge Research Facility on Dawson Beach Road; petroleum releases in 1994 and 1996 at the Exxon 20122 at 9098 Richmond Avenue; a 1991 petroleum release at Sunoco 013-7364 at 3125 Davis Ford Road; a 1994 petroleum release and associated voluntary remediation program at the Potomac Point Shopping Center; an active voluntary remediation program listing associated with a drycleaner at the Featherstone Square shopping Center, and a permanently closed drycleaner (Brite Cleaners) at the Woodbridge Center Plaza. All petroleum release records are listed as closed. No other environmental database records were reported within the ASTM search distances.

It is JMT's opinion that the records described above are unlikely to impact the site.

11.0 REVIEW OF HISTORIC DOCUMENTS

To meet the "prior use" requirements category of ASTM E1527-21, the following standard historical sources were searched and/or examined: aerial photographs, fire insurance maps, property tax records, topographic maps, city directories, and zoning/land use records. ASTM E1527-21 requires that, "All obvious uses of the property shall be identified from the present, back to the property's obvious first developed use, including agricultural uses, or back to 1940, whichever is earlier." This task requires reviewing only as many of the standard historical sources as are necessary and that are reasonably ascertainable and likely to be useful.

The objective of consulting historical sources is to develop a history of the previous uses of a property to help identify the likelihood of past uses having led to RECs in connection with the property. Historical use information describing the site was obtained from a variety of sources as discussed below. Information from these historical mapping resources is used throughout this report.

11.1 SUMMARY OF TOPOGRAPHIC MAPS

JMT reviewed historical USGS topographic maps for 2019, 2016, 2013, 1994, 1983, 1984, 1981, 1979, 1980, 1977, 1971, 1965, 1966, 1957, 1956, 1951, 1948, 1944, 1943, 1938, 1940, 1925, 1927, 1923, 1913, 1897, 1894, 1891, and 1890 to evaluate the potential liability on the target property and its surrounding area, resulting from past activities. Structures have been present adjacent to the site since 1890, with the first structures evident on the site itself by 1944. Kilns and a chimney are marked adjacent to the northeastern end of the site between 1948 and 1951, and a conveyor belt or tipple appear by 1957.

Topographic maps from all years show that the surrounding area has steadily increased in density over the past 133 years. No obvious environmental concerns for the site were identified using this resource. Refer to Appendix B for copies of the historical topographic maps.

11.2 SUMMARY OF FIRE INSURANCE MAPS

Fire Insurance Maps were not available for the subject property or surrounding area. Refer to Appendix F for search documentation.

11.3 SUMMARY OF HISTORICAL AERIALS

A comparative analysis using historic aerial photographs was conducted to help determine the past use of the site and surrounding area. Aerial photographs for the subject property and surrounding area for the years 1937, 1954, 1962, 1969, 1974, 1979, 1981, 1988, 1994, 2005, 2011, 2014, and 2018 were obtained from EDR.

Similar to the historic topographic maps, aerial photographs show a gradual increase in density and commercial and industrial development of the surrounding area since at least 1954, when kilns and other structures appear, likely associated with mining activity to the northwest. By 1974, the shopping center currently present at the southwestern half of the site appears complete. Additional development appears in the northeast by 1988. Copies of the historic aerial photographs are included in Appendix G.

11.4 SUMMARY OF CITY DIRECTORY ABSTRACT

City Directories are a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. City directories were searched for the target property and Gordon Boulevard, for the period of 1965 through 2020.

Search results indicate primarily commercial land use in the vicinity of the site. Refer to Appendix H for documentation. City Directory reports for 1991, 1995 and 200 identify Gordon Plaza Cleaners at 13267 Gordon Boulevard. The 1986 Directly identifies Golden Cleaners at 13289 Gordon Boulevard which appears to be located either adjacent to or in the same location as the later identified Gordon Plaza Cleaners.

11.5 ENVIRONMENTAL LIENS

The site representative was not aware of any environmental liens against the site that may be filed or recorded under Federal, Tribal, State, or Local law (Appendix E).

11.6 ACTIVITY AND USE LIMITATIONS

No Activity and Use Limitations (AULs) were found associated with the property.

11.7 LAND TITLE RECORDS

Chain of title information was not readily available via publicly accessible sources and therefore not included in the scope of this Phase 1 ESA.

11.8 DATA FAILURE AND DATA GAPS

The objective of consulting historical sources is to develop a history of the previous uses of the property and surrounding area to help identify the likelihood of past uses having led to RECs. Under the ASTM standard, all obvious uses of the property are to be identified from the present back to the first developed use, or back to 1940, whichever is earlier. A “Data Gap” is defined by ASTM as a lack of or inability to obtain information required by the standard despite good faith efforts by the environmental professional gathering the information. Often data gaps result from incompleteness in any of the activities required by this standard, including but not limited to parcels reconnaissance and interviews. “Data Failure” occurs when all the standard historical sources that are reasonably ascertainable and likely to be useful have been reviewed and yet the ASTM objectives have not been met.

Adequate historical information was available to establish site use back to 1937. JMT encountered one data gap, information regarding the observed onsite groundwater monitoring wells, during the completion of this assessment.

12.0 USER PROVIDED INFORMATION

12.1 REASON FOR PERFORMING PHASE I ESA

The Phase I ESA was prepared by JMT for the purpose of evaluating the site with respect to a potential property transaction.

12.2 SPECIALIZED KNOWLEDGE, COMMONLY KNOWN OR REASONABLY ASCERTAINABLE INFORMATION

Mekdes Tabor completed the ASTM required user questionnaire regarding past operations at the subject property. Information provided on the questionnaire has been incorporated into other portions of this report as appropriate. A copy of the completed signed questionnaire is provided in Appendix E.

The Client notes in the questionnaire that "Existing groundwater wells on the Gordon Plaza property have been located. We don't know the status of the wells at this time. The developer of this property is investigating these wells…PWC will find out regarding the existing wells and what actions need to be carried out once the developer completes the investigation."

Site information including physical setting data, fire insurance maps, topographic maps, historical aerials, city directories, and environmental database listings pertinent to the site were obtained from EDR and reviewed by JMT as described previously.

12.3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

This Phase 1 ESA was previously completed in November 2023. The site boundary was extended along Annapolis Way, and this Phase 1 ESA has been subsequently revised to incorporate additional database information and any observed changes during the site visit.

As of the preparation of this report, the site representative has reported that an environmental investigation(s) is underway with a separate environmental consultant regarding "next steps" for the property. They state that a report will not be available for several months.

12.4 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

This Phase I ESA is being conducted for a potential property transaction. No valuation reduction for environmental issues is expected. The site representative states that "due to the early stage of project design, the appraisals for the properties have not been finalized."

13.0 FINDINGS AND RECOMMENDATIONS

JMT has performed a Phase I ESA in conformance with the scope of ASTM Practice E1527-21 at the subject property. Any exceptions to, or deletions from, this practice are described in Section 15 of this report.

This assessment has revealed one REC, Gordon Plaza Cleaners, related to the site.

The following *de minimis* conditions were identified in association with the site:

- Solid waste associated with the Gordon Plaza is present throughout the site. Refer to Section 6.14.
- Minor superficial petroleum stains were observed.

Recommendations

Based on the findings presented in this report, JMT recommends the following:

1. Obtain and review all available information regarding the observed groundwater monitoring wells to ascertain if the former drycleaning operation at the site has negatively impacted groundwater underlying the property.
2. Cleanup and disposal of solid waste, if remaining at time of purchase, by a waste management firm.
3. If present at the time of purchase, Prince William County should consider conducting a lead-based paint and an asbestos containing materials inspection of the Gordon Plaza buildings as they were built prior to the CPSC's prohibition of lead in paint for residential use and prior to EPA's ban on asbestos containing materials.

14.0 DEVIATIONS

There were no deviations from the ASTM E1527-21 Standard during the completion of this Phase I ESA.

15.0 REFERENCES

The following documents, maps, or other publications may have been used in the preparation of this report.

Database Records

EDR Certified Sanborn Map Report, July 07, 2023

EDR Certified Sanborn Map Report, February 22, 2024.

EDR Historical Topographic Map Report, July 07, 2023.

EDR Historical Topographic Map Report, February 22, 2024.

EDR Radius Map Report with GeoCheck, July 07, 2023.

EDR Radius Map Report with GeoCheck, February 22, 2024.

EDR Aerial Photo Decade Package, July 10, 2023.

EDR Aerial Photo Decade Package, February 22, 2024.

EDR City Directory Image Report, July 12, 2023.

EDR City Directory Image Report, February 22, 2024.

Interviews

Mekdes Tabor, Site Questionnaire, November 3, 2023.

Additional Files

FEMA. National Flood Insurance Rate Map (FIRM) Map Number 51153C0236E. Effective Date August 3, 2015, August 25, 2023.

US FWS. National Wetlands Inventory Mapper, August 9, 2023.

United States

American Society for Testing and Materials Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM E1527-21).

16.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

We declare that to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312. We have the specific qualifications based on education, training, and experience to assess the nature, history, and setting of the Site. We have developed and performed the "All Appropriate Inquiries" in conformance with the standards and practices set forth in 40 CFR Part 312.

Prepared by:

Ashley Wilkins

Ashley Wilkins
Environmental Scientist

Carter Teague

Carter M. Teague, PWS
Senior Associate

Reviewed by:

Leo C Snead

Leo C. Snead, Jr.
Associate Vice President

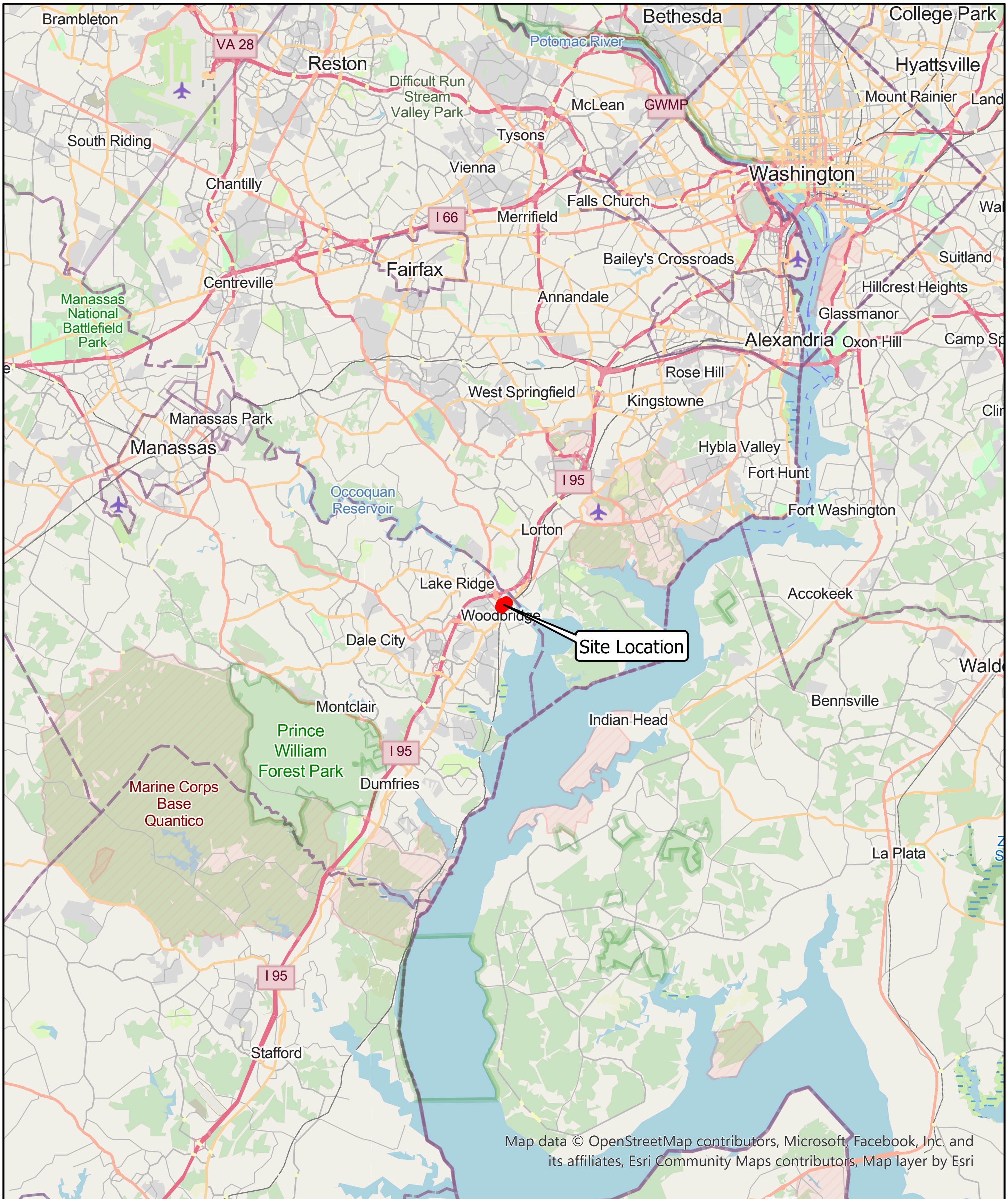
17.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

The qualifications of the environmental professional(s) and personnel conducting the inspection, interviews, and review of this report are provided in Appendix I.

TECHNICAL DUE DILIGENCE REPORT
PHASE I ENVIRONMENTAL SITE ASSESSMENT

Figures

Project #: 19-01549-019



40 Wight Ave., Hunt Valley, MD 21030
P: 410-329-3100 | F: 410-472-2200 | jmt.com

Marina Way Extension

Site Location

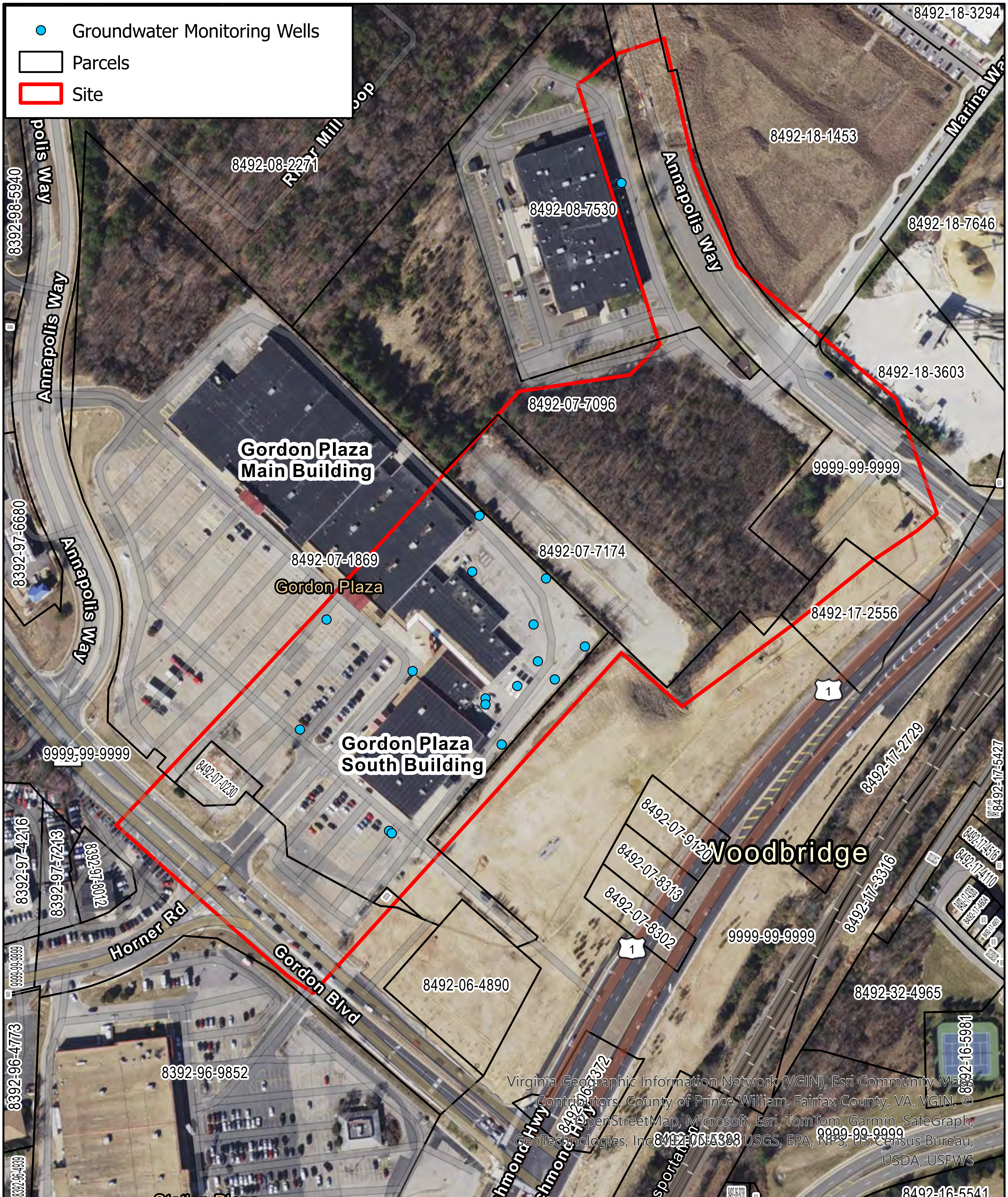
PROJ No.: 19-01549-019	Date: 09/01/2023	SCALE: 1" = 5 MI	FIGURE: 1

JMT
40 Wight Ave., Hunt Valley, MD 21030
P: 410-329-3100 | F: 410-472-2200 | jmt.com

Marina Way Extension

Aerial Photography

PROJ No.: 19-01549-019	Date: 03/13/2024	SCALE: 1" = 225 FT	FIGURE: 2



40 Wight Ave., Hunt Valley, MD 21030
P: 410-329-3100 | F: 410-472-2200 | jmt.com

Marina Way Extension

Site Features

PROJ No.: 19-01549-019	Date: 03/12/2024	SCALE: 1" = 250 FT	FIGURE: 3

TECHNICAL DUE DILIGENCE REPORT
PHASE I ENVIRONMENTAL SITE ASSESSMENT

Appendix A

Project #: 19-01549-019

Photograph #1 - Entrance to property from the south (7/13/2023)

Photograph #2 - View of onsite buildings from west (7/13/2023)

Photograph #3 - View of rear (north) side of on-site buildings (7/13/2023)

Photograph # 4 - Asphalt parking area in central area of site,
immediately north of commercial buildings (7/13/2023)

Photograph # 5 - View of soil stockpiles on vacant property east of site (7/13/2023)

Photograph # 6 - View of entrance to property from the east (7/13/2023)

Photograph # 7 - Asphalt paved area located in
central portion of property. (7/13/2023)

Photograph # 8 - Loading dock on east side of commercial buildings (7/13/2023)

Photograph # 9 - View of location of restaurant site adjacent
to southwest corner of property (7/13/2023)

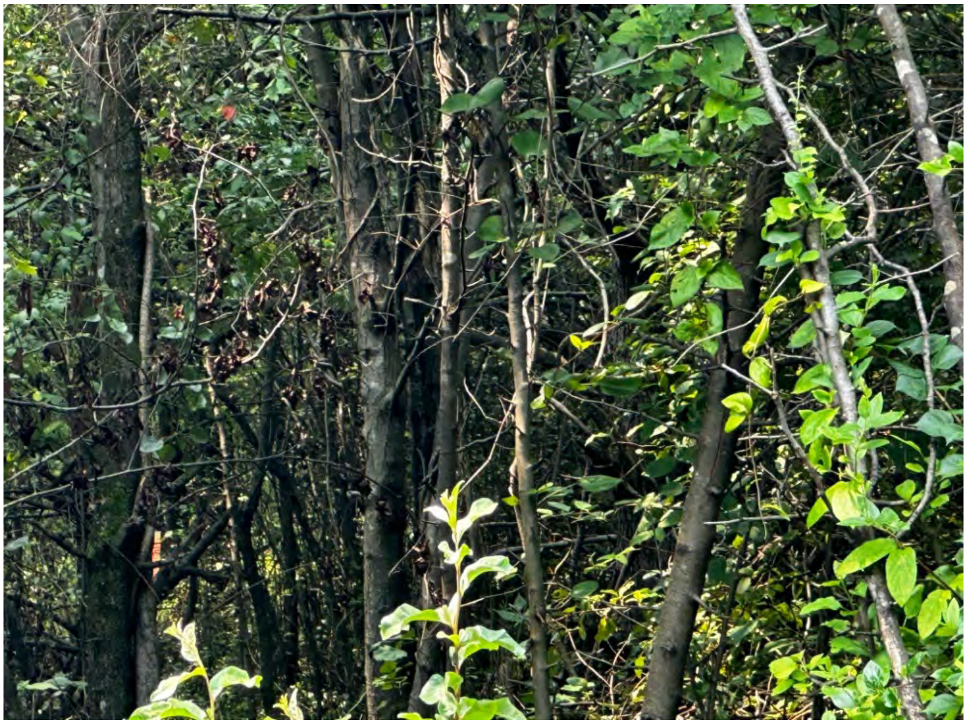
Photograph # 10 - Groundwater monitoring wells observed on
north side of onsite buildings (7/13/2023)

Photograph # 11 - Rear/north side of onsite buildings (7/13/2023)

Photograph # 12 - Utility connections for onsite buildings (typical) (7/13/2023)


Photograph # 13 - Pole mounted transformer on eastern property line (7/13/2023)


Photograph # 14 - Heavily wooded area on northern portion
of property (7/13/2023)



Photograph #15 - Densely wooded/vegetated area on northern portion of the property (7/13/2023)

Photograph # 16 - Residential development on north adjacent property (7/13/2023)

Photograph #17 - Entrance to Vulcan Materials facility located immediately north/northeast of property (7/13/2023)

Photograph #18 – Office building located to the northwest, adjacent to property (7/13/2023)

Photograph # 19 – Looking east towards Annapolis Way from study area (3/1/2024)

Photograph # 20 – Looking southwest towards forested portion of study area from Annapolis Way (3/1/2024)

Photograph # 21 – Looking west along Annapolis Way (3/1/2024)

Photograph # 22 – Looking westward along Annapolis Way from Route 1 outside of study area
(3/1/2024)

Photograph # 23 – Power poles and transformers adjacent to Vulcan materials plant; “Non PCB” labeling visible from ground. Also visible in Photo # 21. (3/1/2024)

Photograph # 24 – Active roadway construction occurring immediately northwest of study area at existing terminus of Annapolis Way (3/1/2024)

Photograph # 25 – Residential development (right) and office building (left) adjacent to study area along Annapolis Way (3/1/2024)

Photograph # 26 – Gordon Plaza Main Building exterior; west side (3/1/2024)

Photograph # 27 - Gordon Plaza Main Building exterior; east side and connection with Gordon Plaza South Building (3/1/2024)

Photograph # 28 – Gordon Plaza South Building Exterior (3/1/2024)

Photograph # 29 – Rear exterior of Gordon Plaza South Building (3/1/2024)

Photograph # 30 - Rear exterior of Gordon Plaza Main Building (3/1/2024)

Photograph # 31 – Representative portion of asphalt parking area in central area of site, immediately north of commercial buildings (3/1/2024)

TECHNICAL DUE DILIGENCE REPORT

PHASE I ENVIRONMENTAL SITE ASSESSMENT

Appendix B

Project #: 19-01549-019

Marina Way Extension

Gordon Plaza

Woodbridge, VA 22191

Inquiry Number: 7575545.4

February 22, 2024

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

02/22/24

Site Name:	**Client Name:**
Marina Way Extension	Johnson, Mirmiran & Thompson
Gordon Plaza	9201 Arboretum Pkwy Ste 310
Woodbridge, VA 22191	North Chesterfield, VA 23236
EDR Inquiry # 7575545.4	Contact: Ashley Wilkins

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by Johnson, Mirmiran & Thompson were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results: | ***Coordinates:***

P.O.#	NA	**Latitude:**	38.66492 38° 39' 54" North
Project:	Marina Way Extension	**Longitude:**	-77.24708 -77° 14' 49" West
		UTM Zone:	Zone 18 North
		UTM X Meters:	304495.89
		UTM Y Meters:	4281989.33
		Elevation:	81.74' above sea level

Maps Provided:

2022	1977	1943	1890
2019	1971	1938, 1940	
2016	1965, 1966	1925, 1927	
2013	1957	1923	
1994	1956	1913	
1983, 1984	1951	1897	
1981	1948	1894	
1979, 1980	1944	1891	

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2022 Source Sheets

Fort Belvoir
2022
7.5-minute, 24000

Occoquan
2022
7.5-minute, 24000

2019 Source Sheets

Fort Belvoir
2019
7.5-minute, 24000

Occoquan
2019
7.5-minute, 24000

2016 Source Sheets

Fort Belvoir
2016
7.5-minute, 24000

Occoquan
2016
7.5-minute, 24000

2013 Source Sheets

Fort Belvoir
2013
7.5-minute, 24000

Occoquan
2013
7.5-minute, 24000

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1994 Source Sheets

Occoquan
1994
7.5-minute, 24000
Aerial Photo Revised 1994

1983, 1984 Source Sheets

Fort Belvoir
1983
7.5-minute, 24000
Aerial Photo Revised 1981

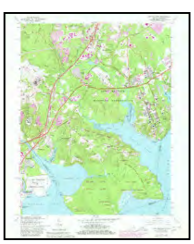
Occoquan
1984
7.5-minute, 24000
Aerial Photo Revised 1980

1981 Source Sheets

QUANTICO
1981
15-minute, 50000

1979, 1980 Source Sheets

Occoquan
1979
7.5-minute, 24000
Aerial Photo Revised 1977



Fort Belvoir
1980
7.5-minute, 24000
Aerial Photo Revised 1977

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1977 Source Sheets

Occoquan
1977
7.5-minute, 24000
Aerial Photo Revised 1977

Fort Belvoir
1977
7.5-minute, 24000
Aerial Photo Revised 1977

1971 Source Sheets

Fort Belvoir
1971
7.5-minute, 24000
Aerial Photo Revised 1971

Occoquan
1971
7.5-minute, 24000
Aerial Photo Revised 1971

1965, 1966 Source Sheets

Belvoir
1965
7.5-minute, 24000
Aerial Photo Revised 1950

Occoquan
1966
7.5-minute, 24000
Aerial Photo Revised 1950

1957 Source Sheets

INDIANHEAD
1957
15-minute, 50000

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

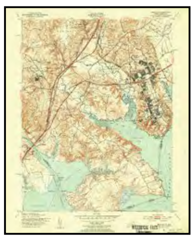
1956 Source Sheets

Occoquan
1956
7.5-minute, 24000
Aerial Photo Revised 1955

Belvoir
1956
7.5-minute, 24000
Aerial Photo Revised 1955

1951 Source Sheets

Occoquan
1951
7.5-minute, 24000
Aerial Photo Revised 1950



Belvoir
1951
7.5-minute, 24000
Aerial Photo Revised 1950

1948 Source Sheets

Occoquan
1948
7.5-minute, 24000
Aerial Photo Revised 1943

Belvoir
1948
7.5-minute, 24000

1944 Source Sheets

Occoquan
1944
7.5-minute, 31680
Aerial Photo Revised 1943

Belvoir
1944
7.5-minute, 31680
Aerial Photo Revised 1943

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1943 Source Sheets

Quantico
1943
15-minute, 62500
Aerial Photo Revised 1939

1938, 1940 Source Sheets

Indian Head
1938
15-minute, 62500

Quantico
1940
15-minute, 62500
Aerial Photo Revised 1939

1925, 1927 Source Sheets

Indian Head
1925
15-minute, 62500

Quantico
1927
15-minute, 62500

1923 Source Sheets

Indian Head
1923
15-minute, 48000

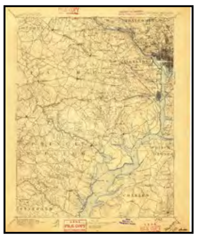
Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1913 Source Sheets

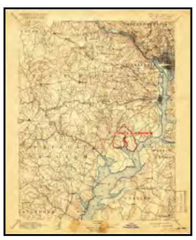
Indian Head
1913
15-minute, 62500

1897 Source Sheets



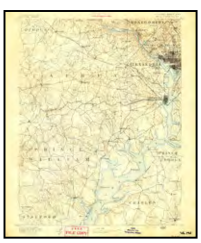
Mt. Vernon
1897
30-minute, 125000

1894 Source Sheets



Mt. Vernon
1894
30-minute, 125000

1891 Source Sheets



Mt. Vernon
1891
30-minute, 125000

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1890 Source Sheets

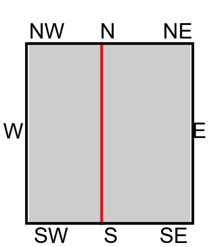
Mt. Vernon
1890
30-minute, 125000

Historical Topo Map

2022

This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



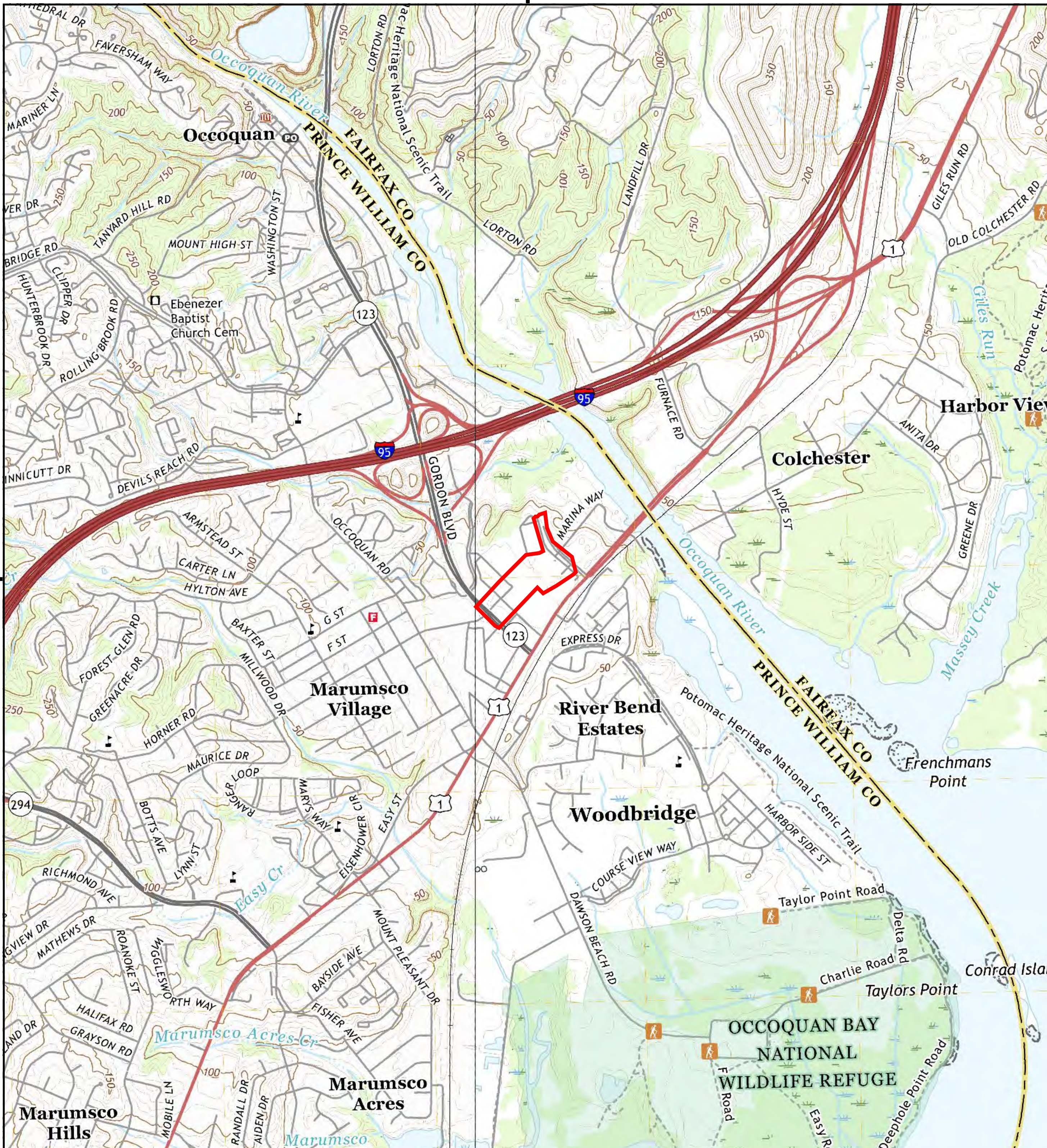
TP, Fort Belvoir, 2022, 7.5-minute
NW, Occoquan, 2022, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

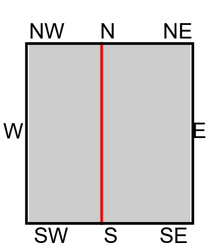
Historical Topo Map

2019



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



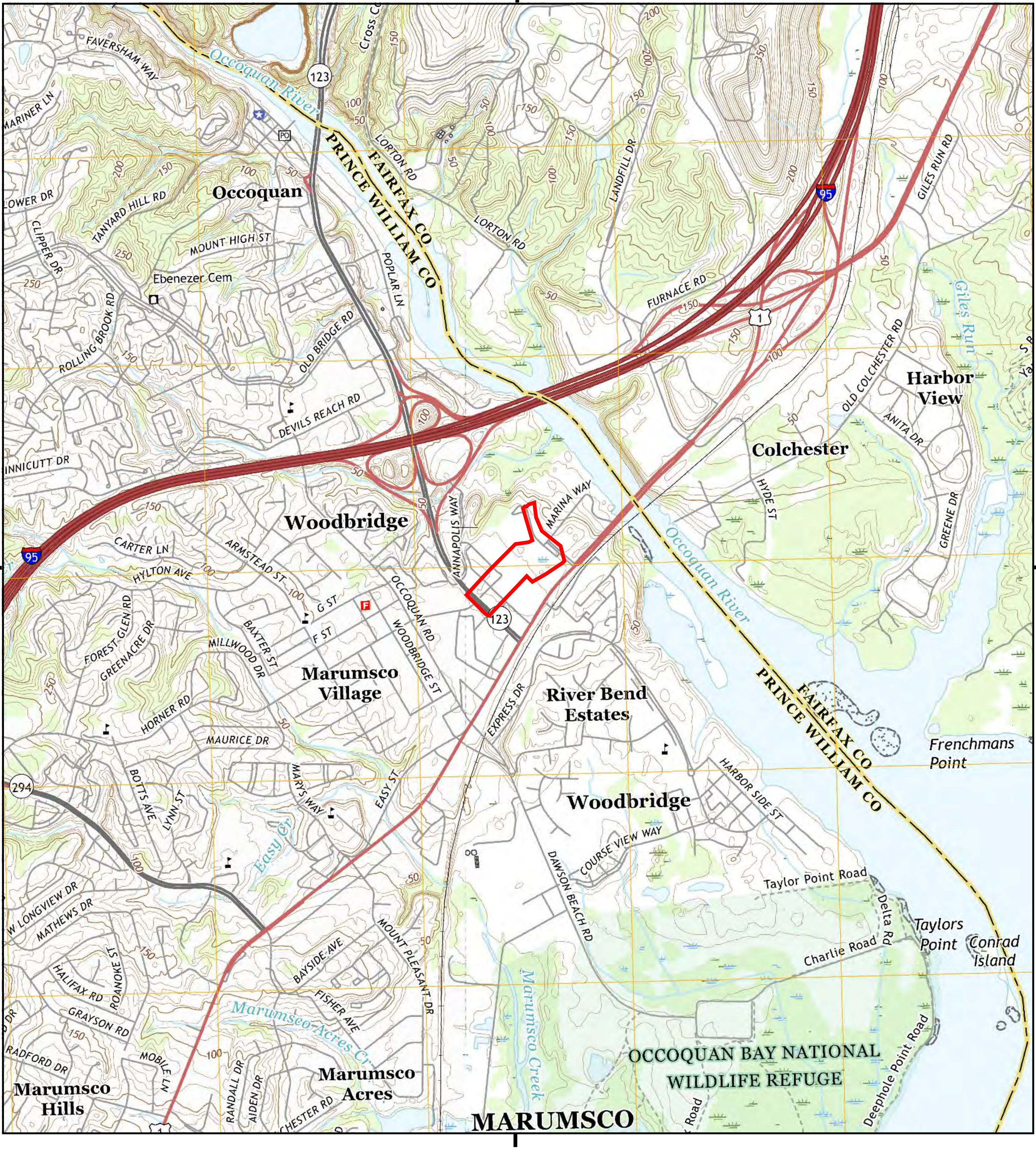
TP, Fort Belvoir, 2019, 7.5-minute
NW, Occoquan, 2019, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

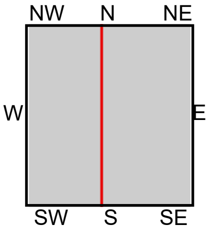
Historical Topo Map

2016



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



TP, Fort Belvoir, 2016, 7.5-minute
NW, Occoquan, 2016, 7.5-minute

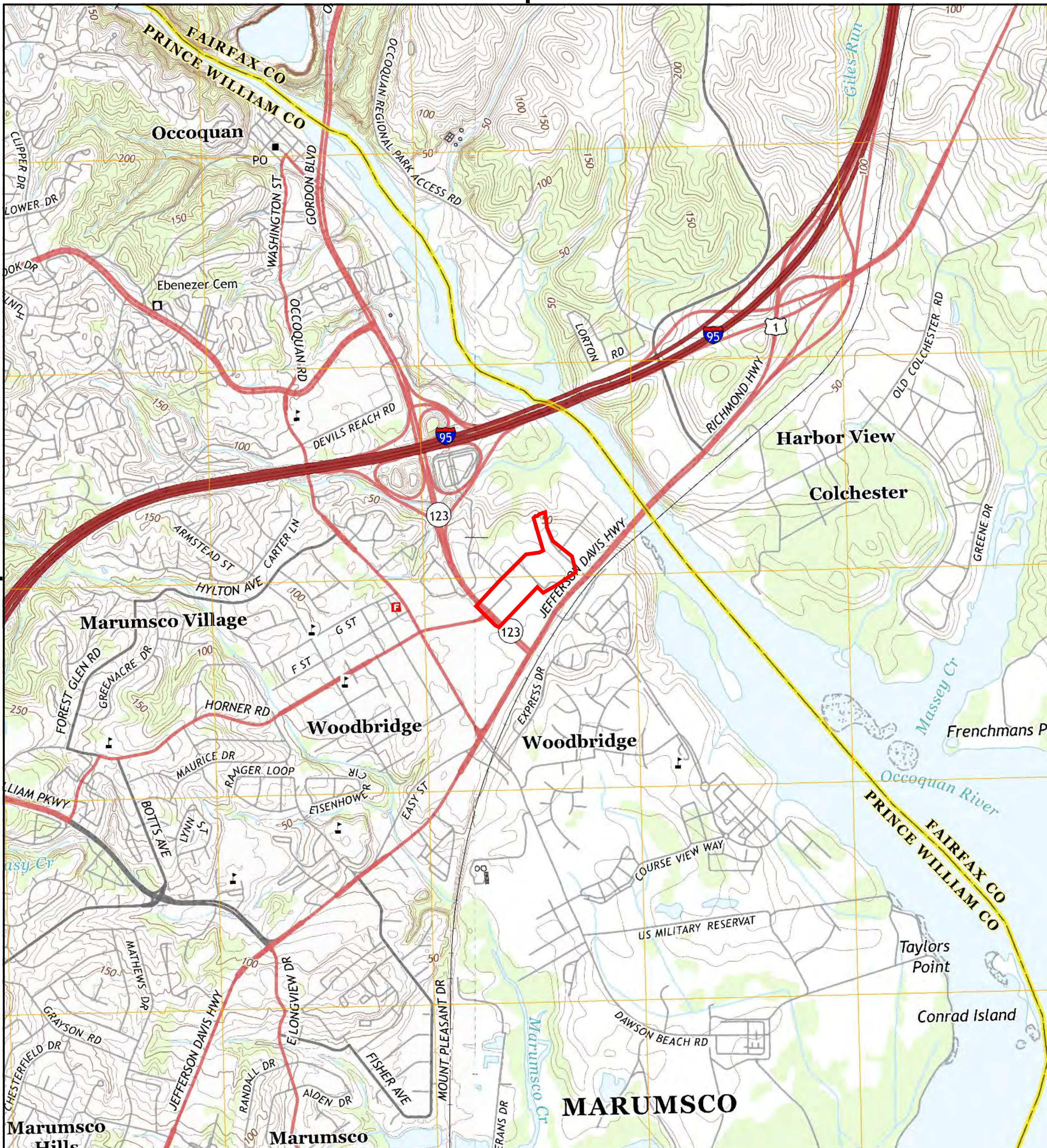
SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

EDR

Historical Topo Map

2013



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

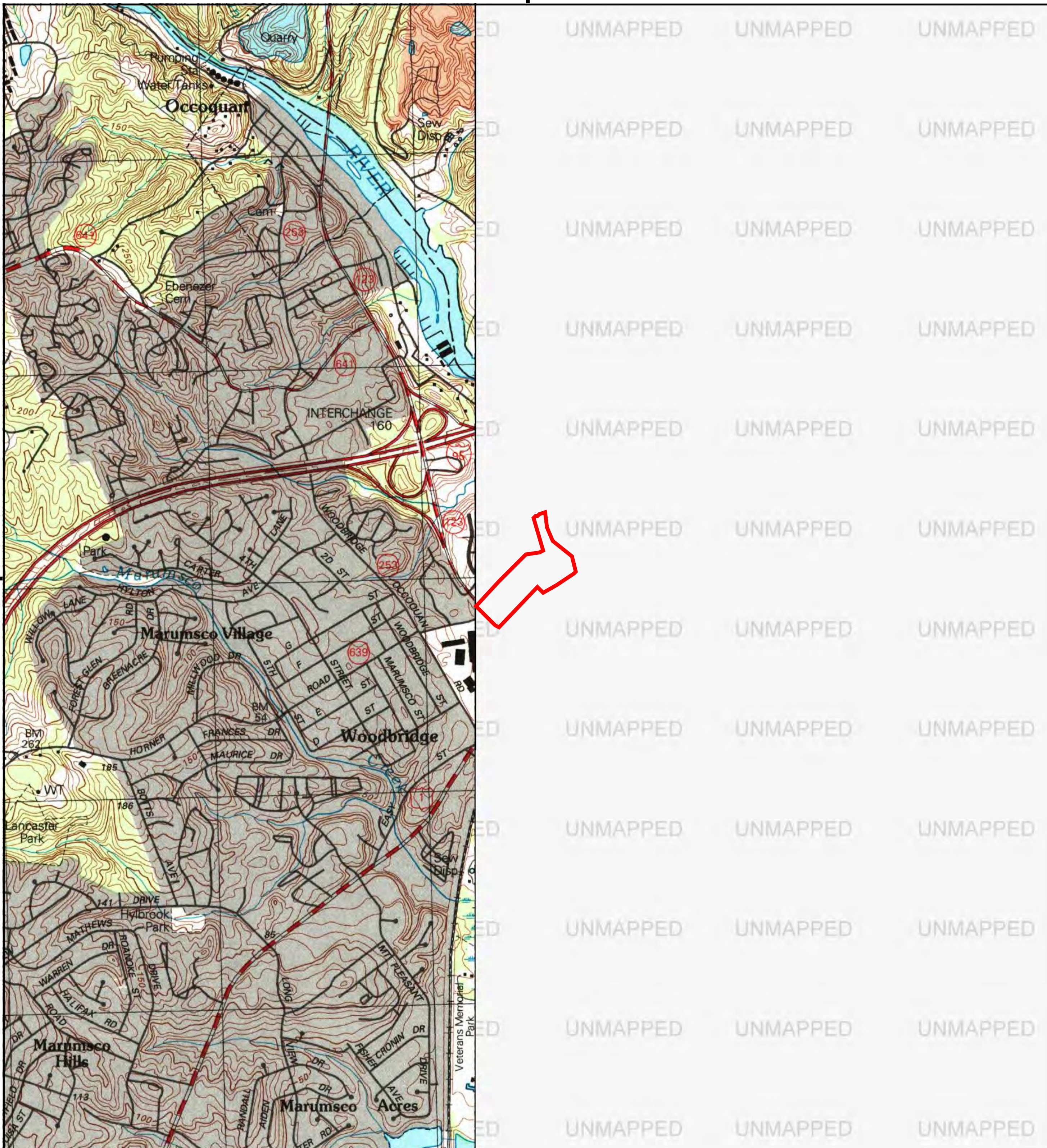
TP, Fort Belvoir, 2013, 7.5-minute
NW, Occoquan, 2013, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1994



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

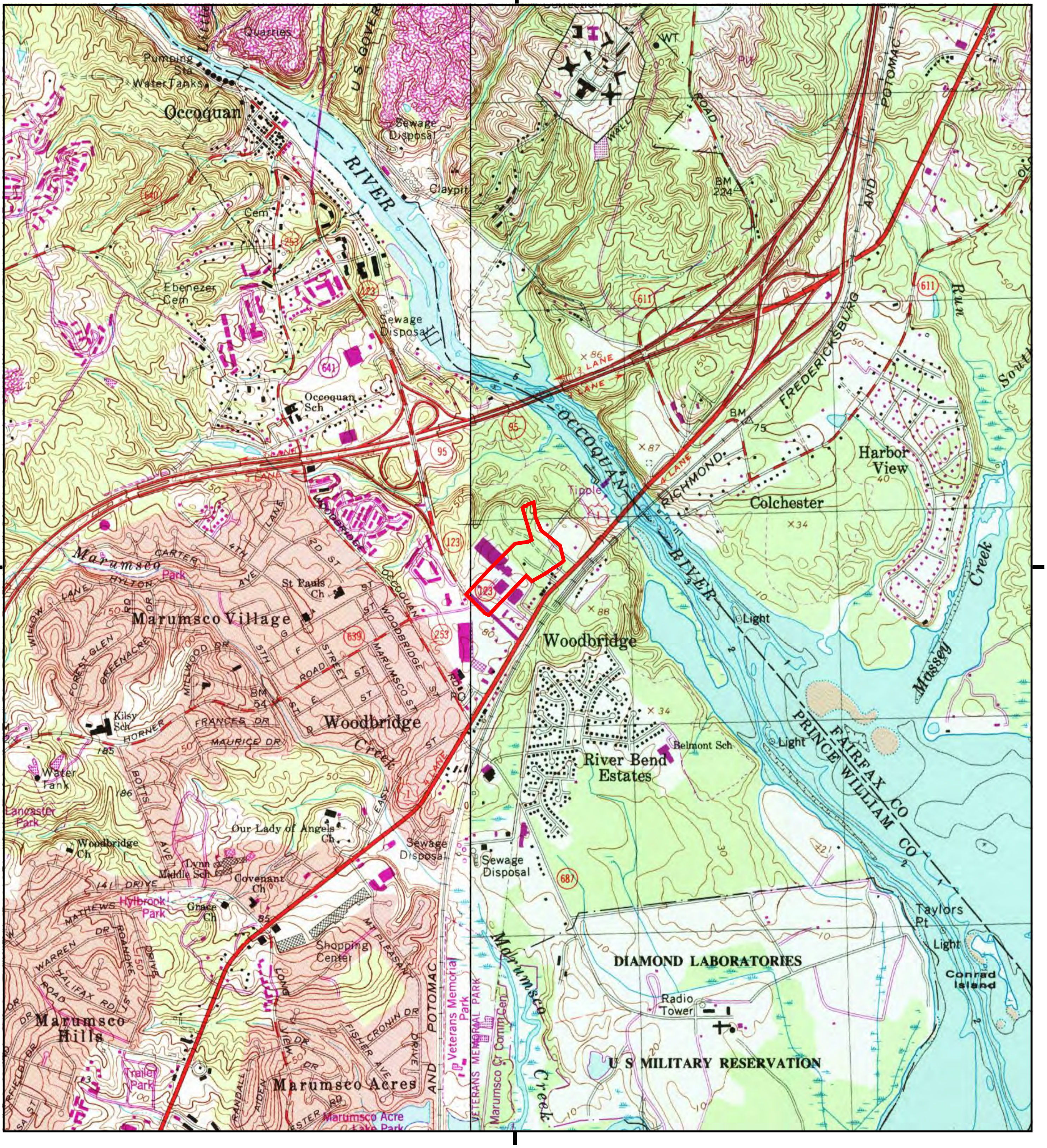
NW, Occoquan, 1994, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1983, 1984



This report includes information from the following map sheet(s).

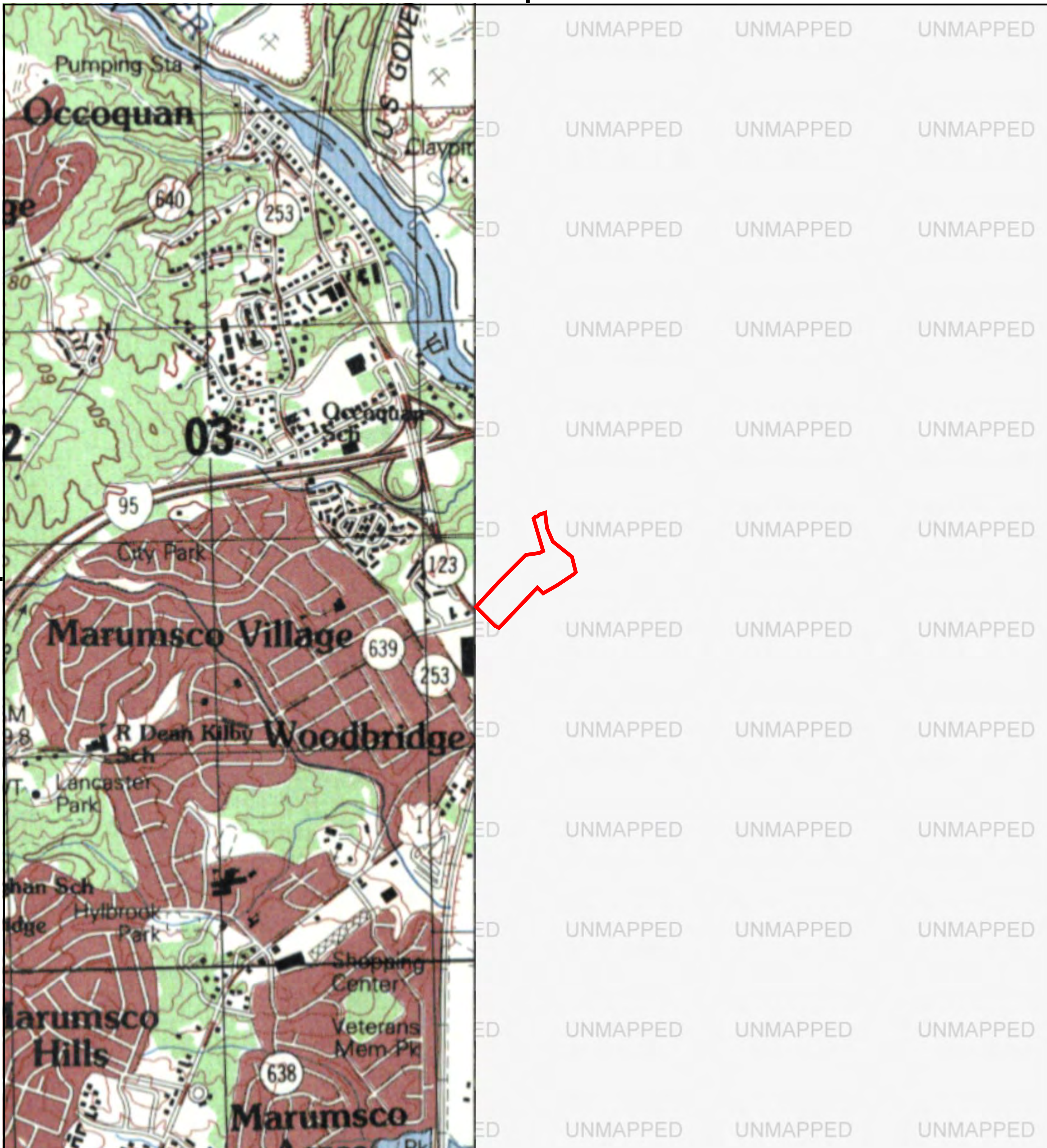
0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Fort Belvoir, 1983, 7.5-minute
NW, Occoquan, 1984, 7.5-minute

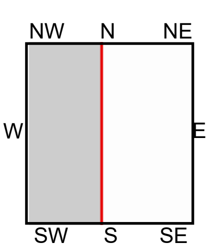
SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



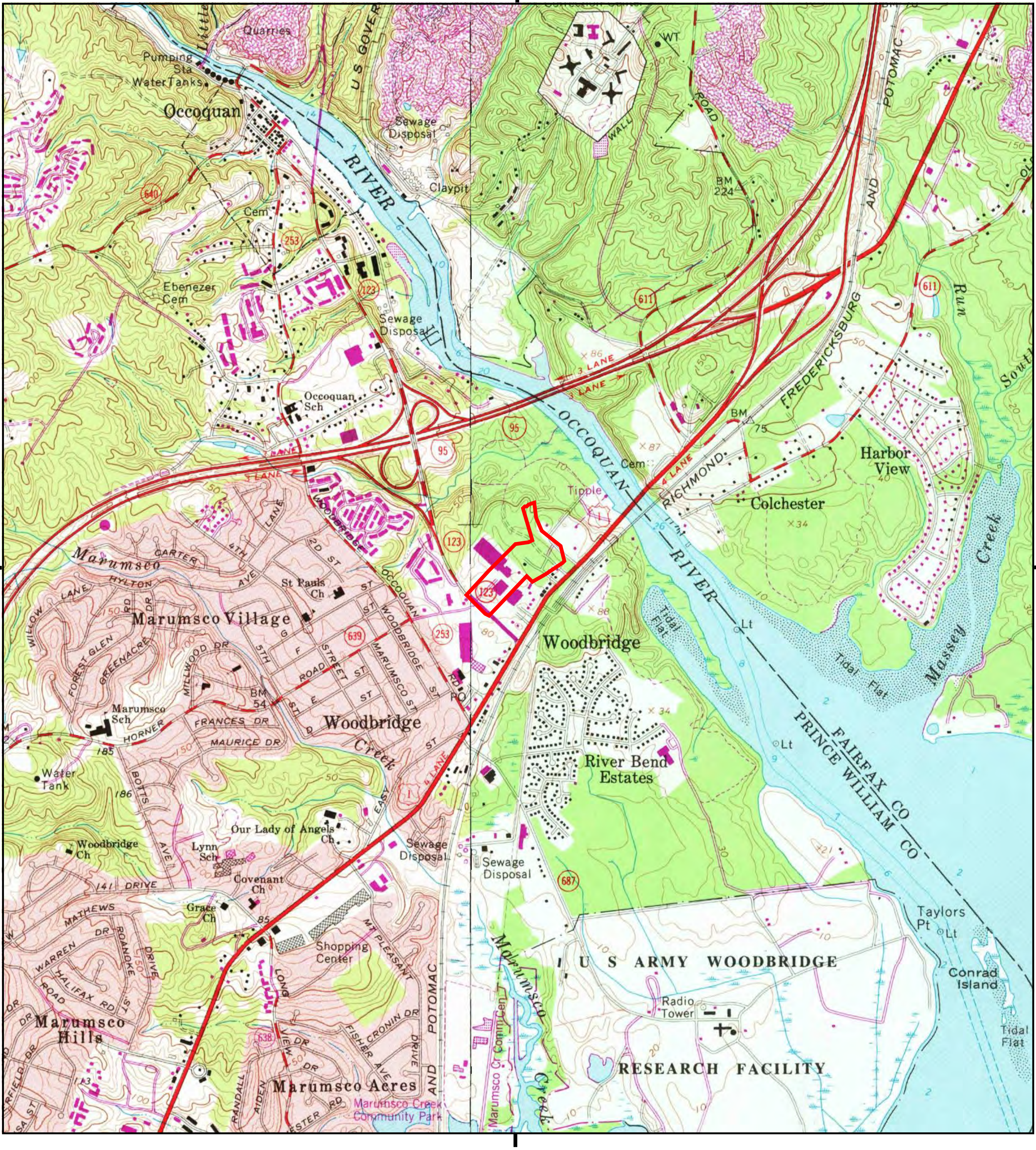
W, QUANTICO, 1981, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1979, 1980



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Fort Belvoir, 1980, 7.5-minute
NW, Occoquan, 1979, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1977

0 Miles 0.25 0.5 1 1.5

This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

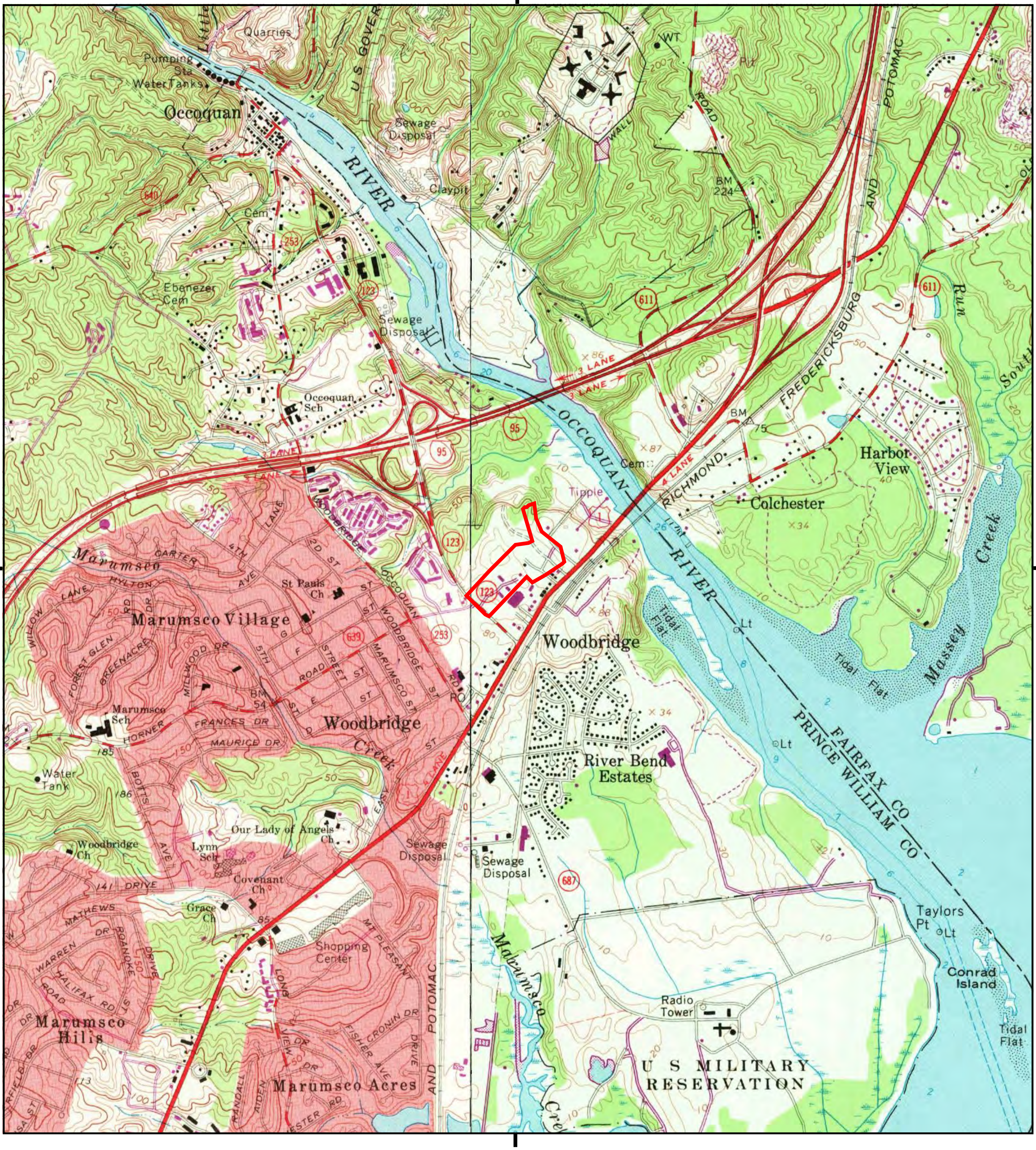
TP, Fort Belvoir, 1977, 7.5-minute
NW, Occoquan, 1977, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1971



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

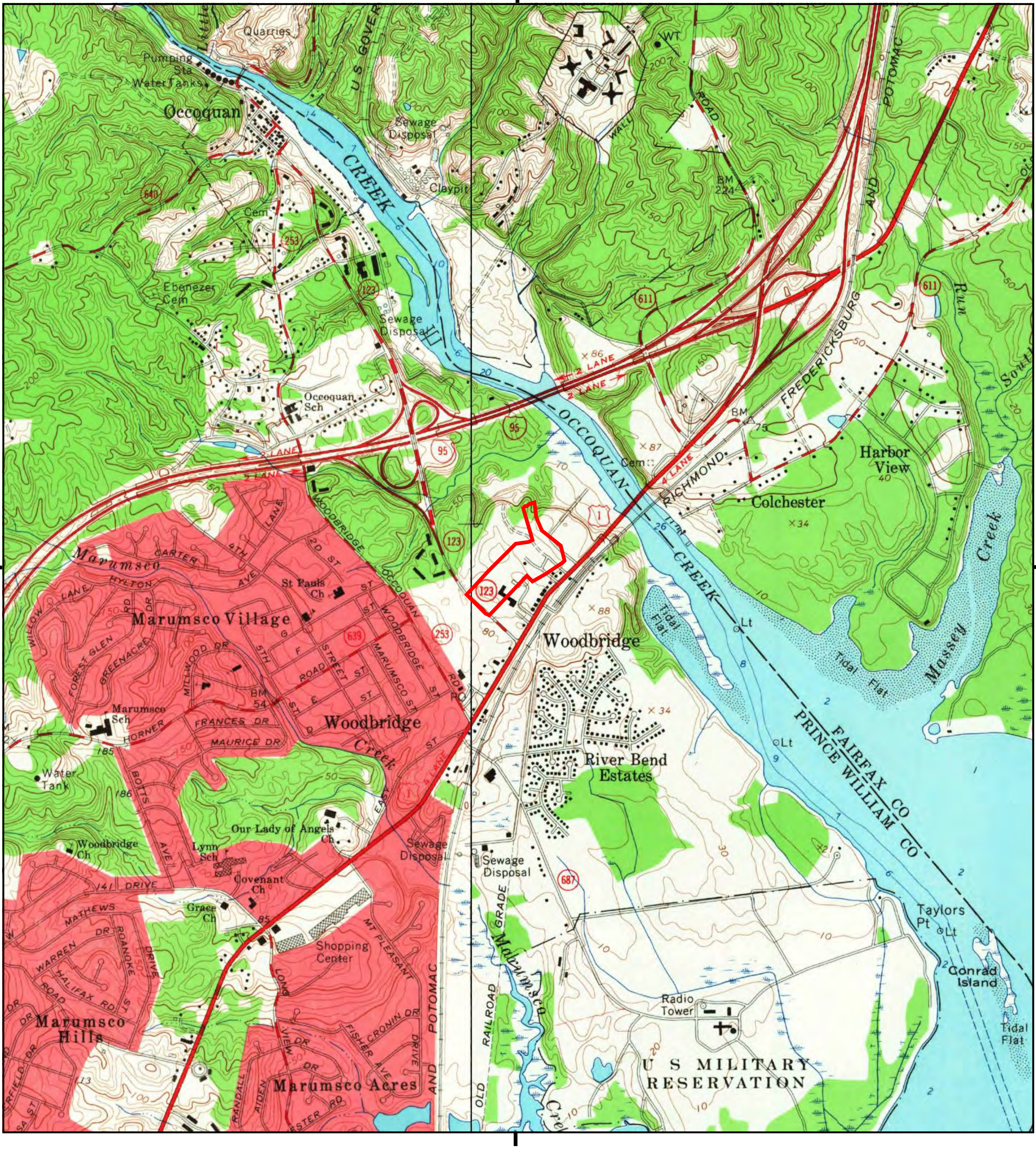
TP, Fort Belvoir, 1971, 7.5-minute
NW, Occoquan, 1971, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

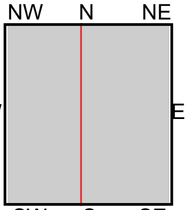
Historical Topo Map

1965, 1966



This report includes information from the following map sheet(s).

0 Miles | 0.25 | 0.5 | 1 | 1.5



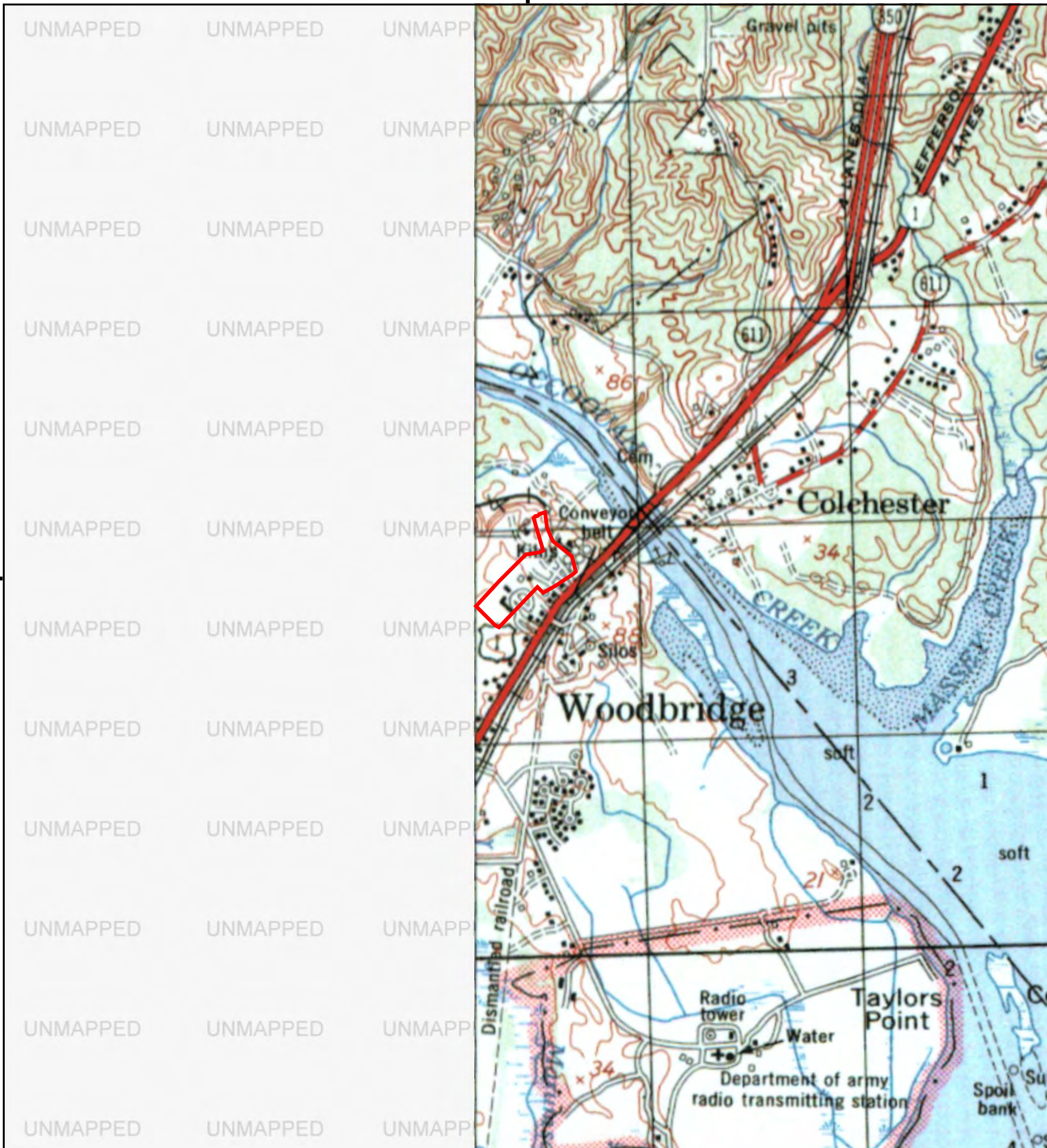
TP, Belvoir, 1965, 7.5-minute
NW, Occoquan, 1966, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1957



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

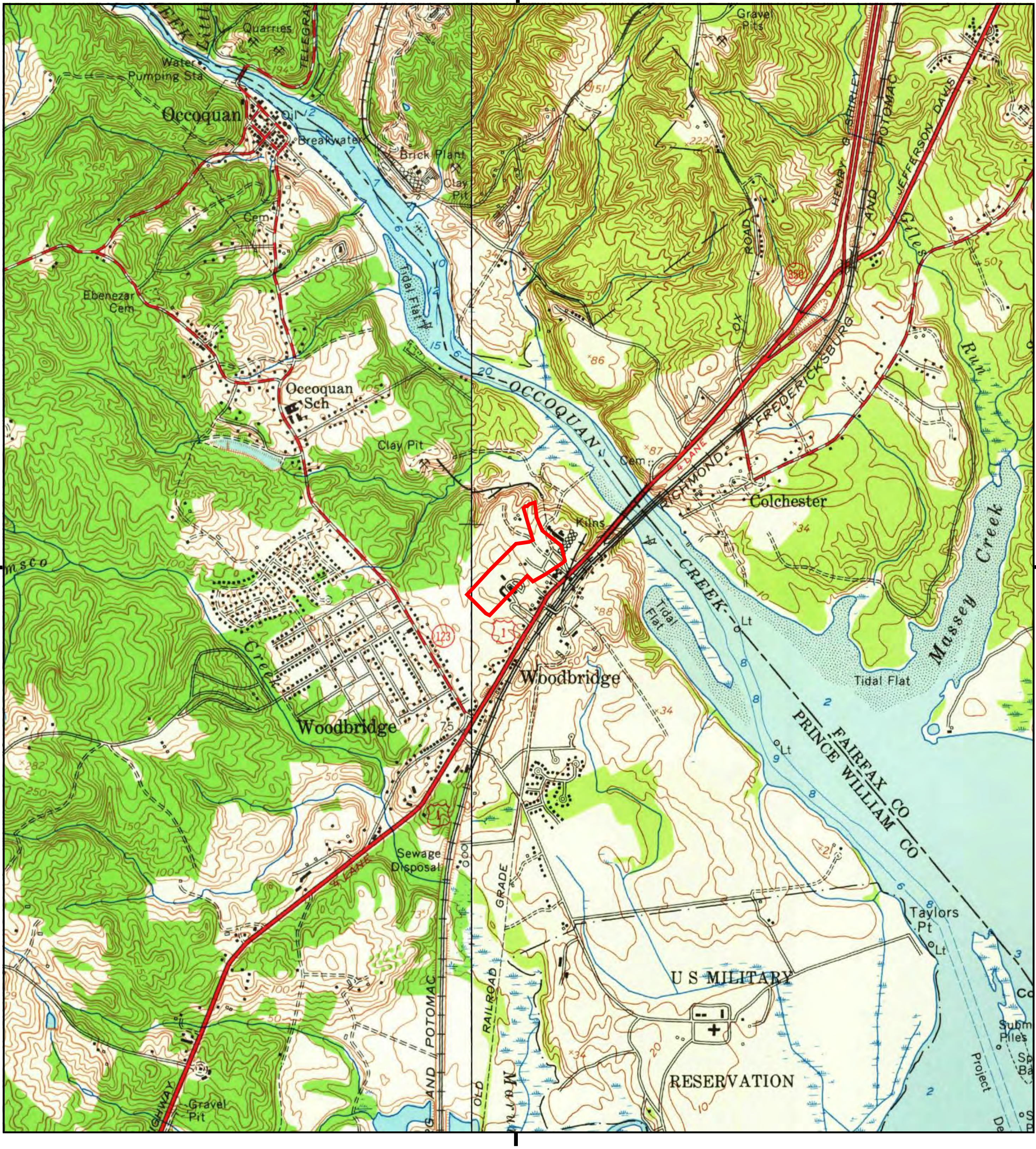
TP, INDIANHEAD, 1957, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

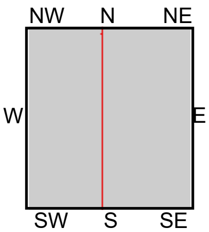
Historical Topo Map

1956



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



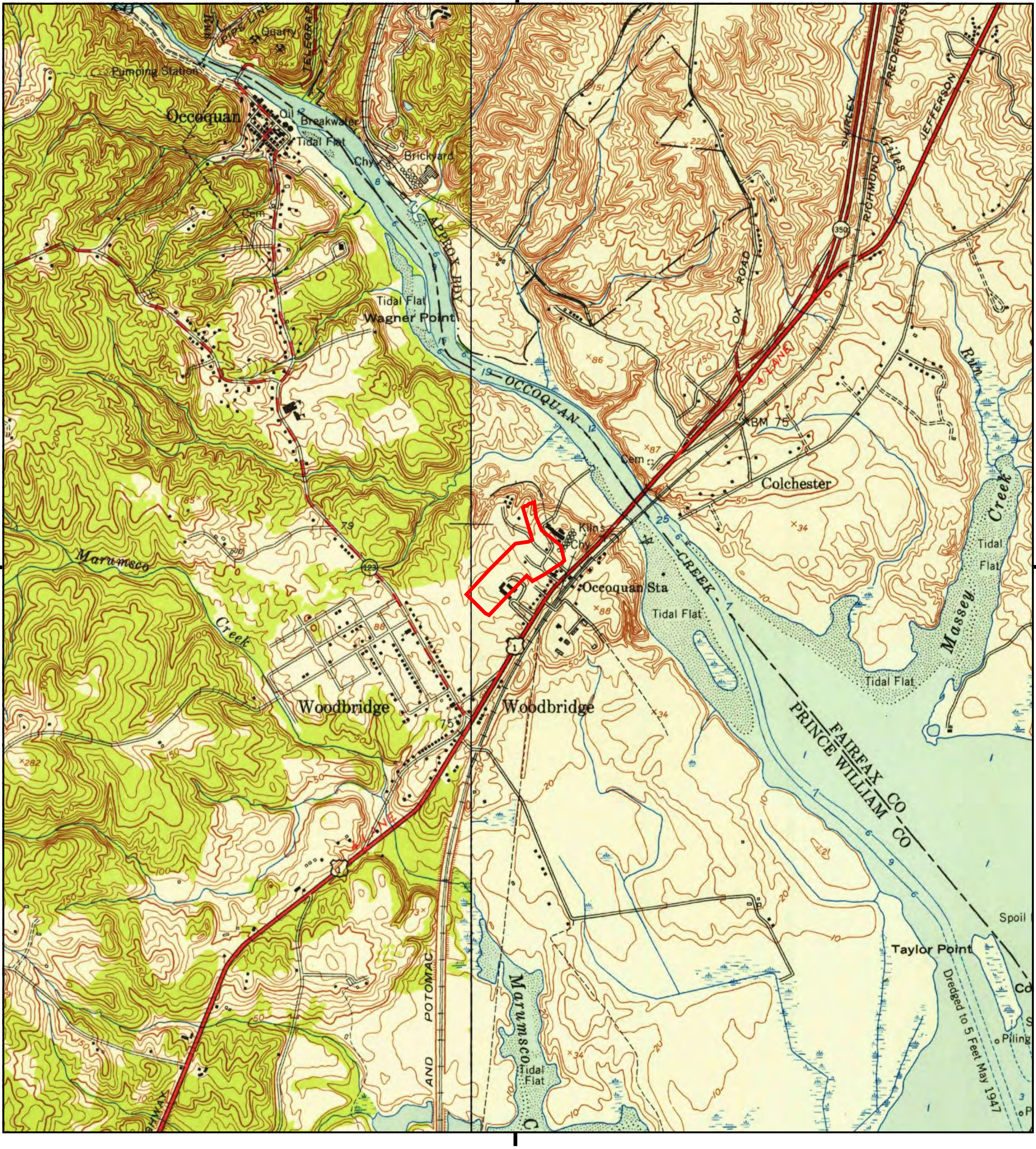
TP, Belvoir, 1956, 7.5-minute
NW, Occoquan, 1956, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1951



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

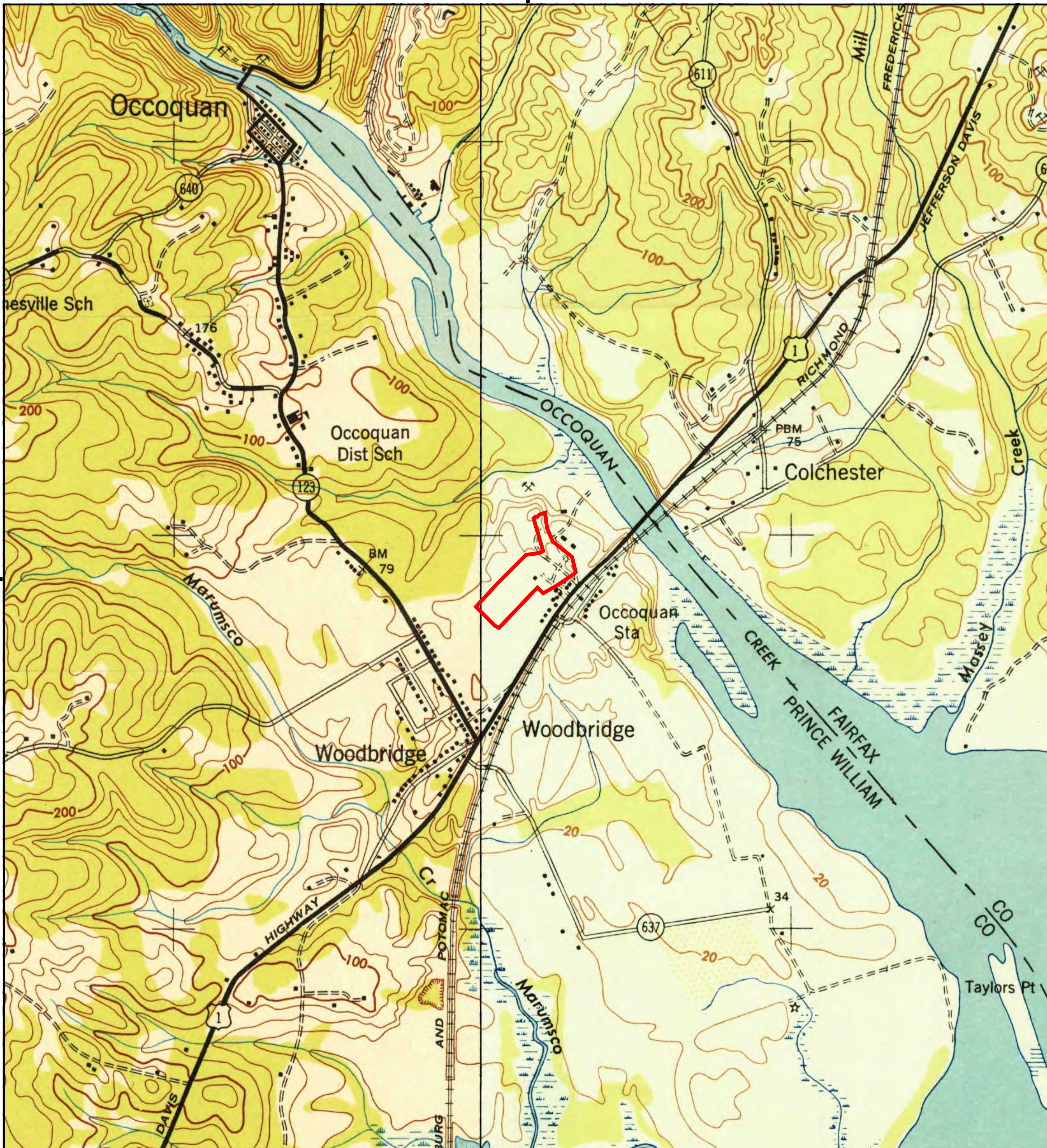
TP, Belvoir, 1951, 7.5-minute
NW, Occoquan, 1951, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1948



0 Miles 0.25 0.5 1 1.5

This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

TP, Belvoir, 1948, 7.5-minute
NW, Occoquan, 1948, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

Historical Topo Map

1944

This report includes information from the following map sheet(s).

0 Miles	0.25	0.5	1	1.5

NW N NE
W E
SW S SE

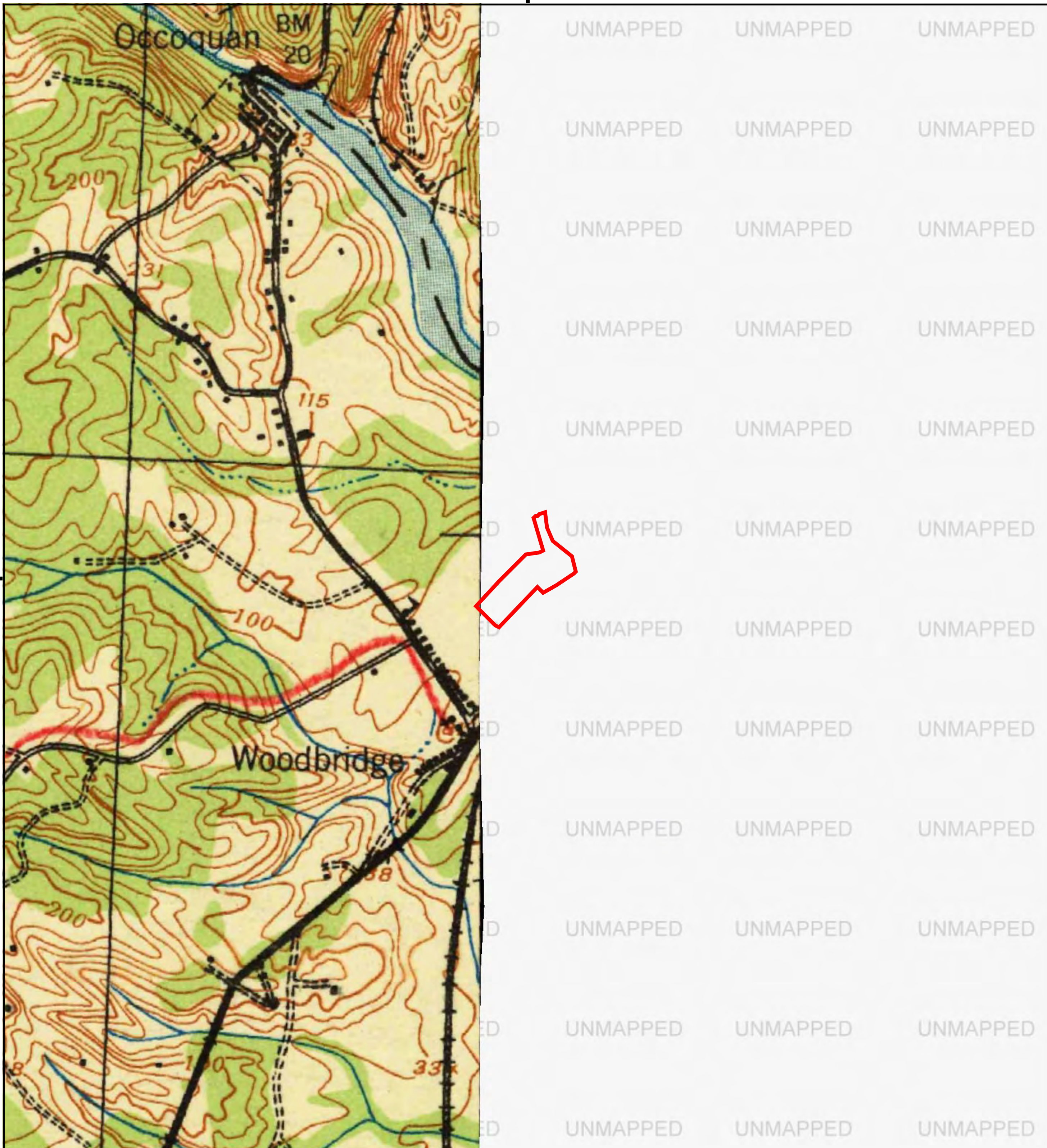
TP, Belvoir, 1944, 7.5-minute
NW, Occoquan, 1944, 7.5-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

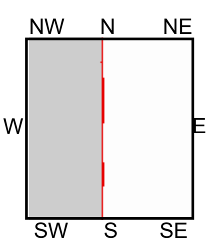
Historical Topo Map

1943



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5



W, Quantico, 1943, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

EDR

Historical Topo Map

1938, 1940

This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Indian Head, 1938, 15-minute
W, Quantico, 1940, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

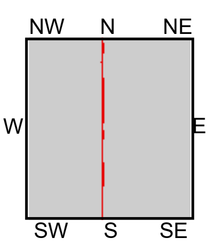
N

Historical Topo Map

1925, 1927

This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

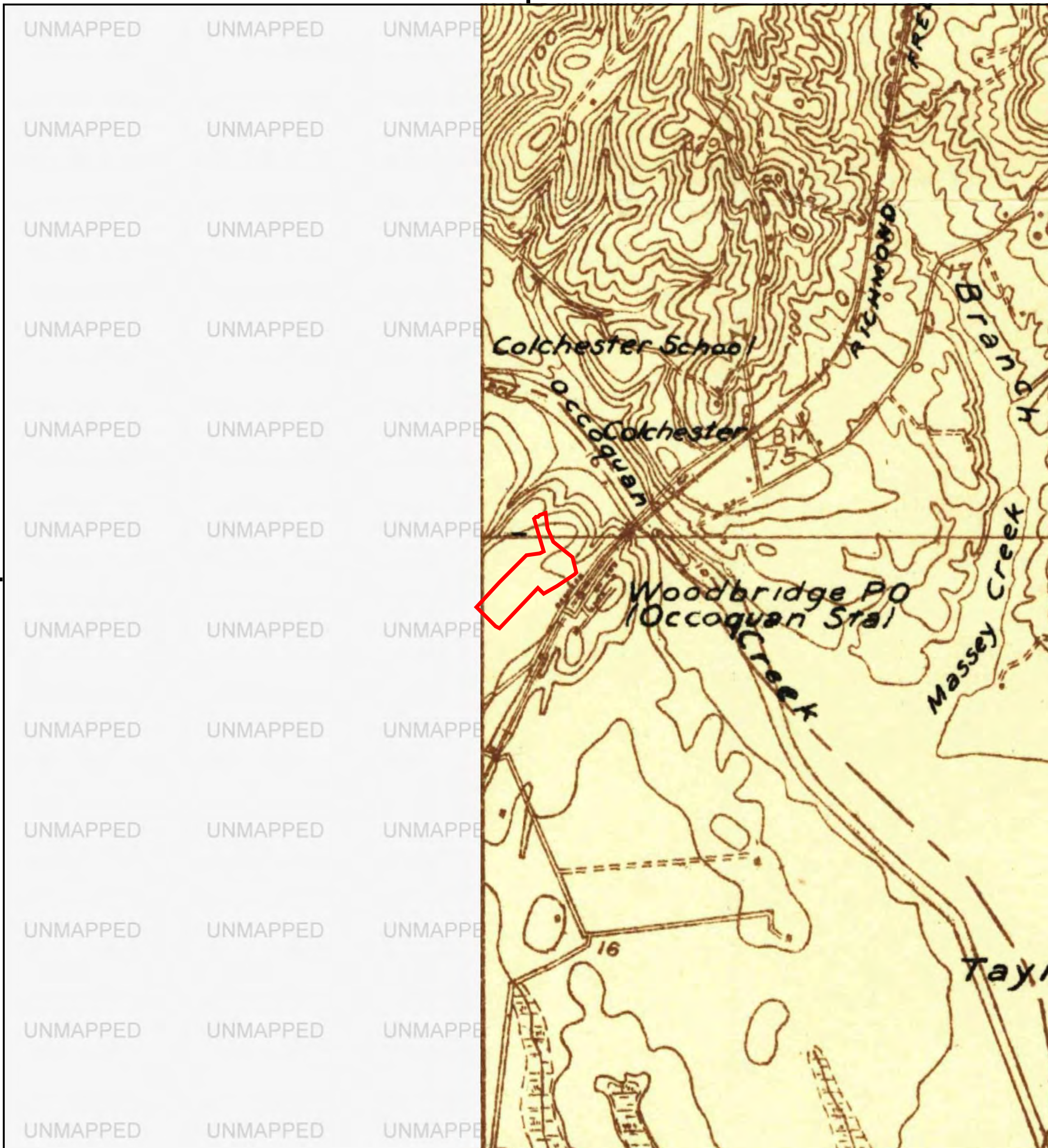


TP, Indian Head, 1925, 15-minute
W, Quantico, 1927, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

Historical Topo Map

1923



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE

W E

SW S SE

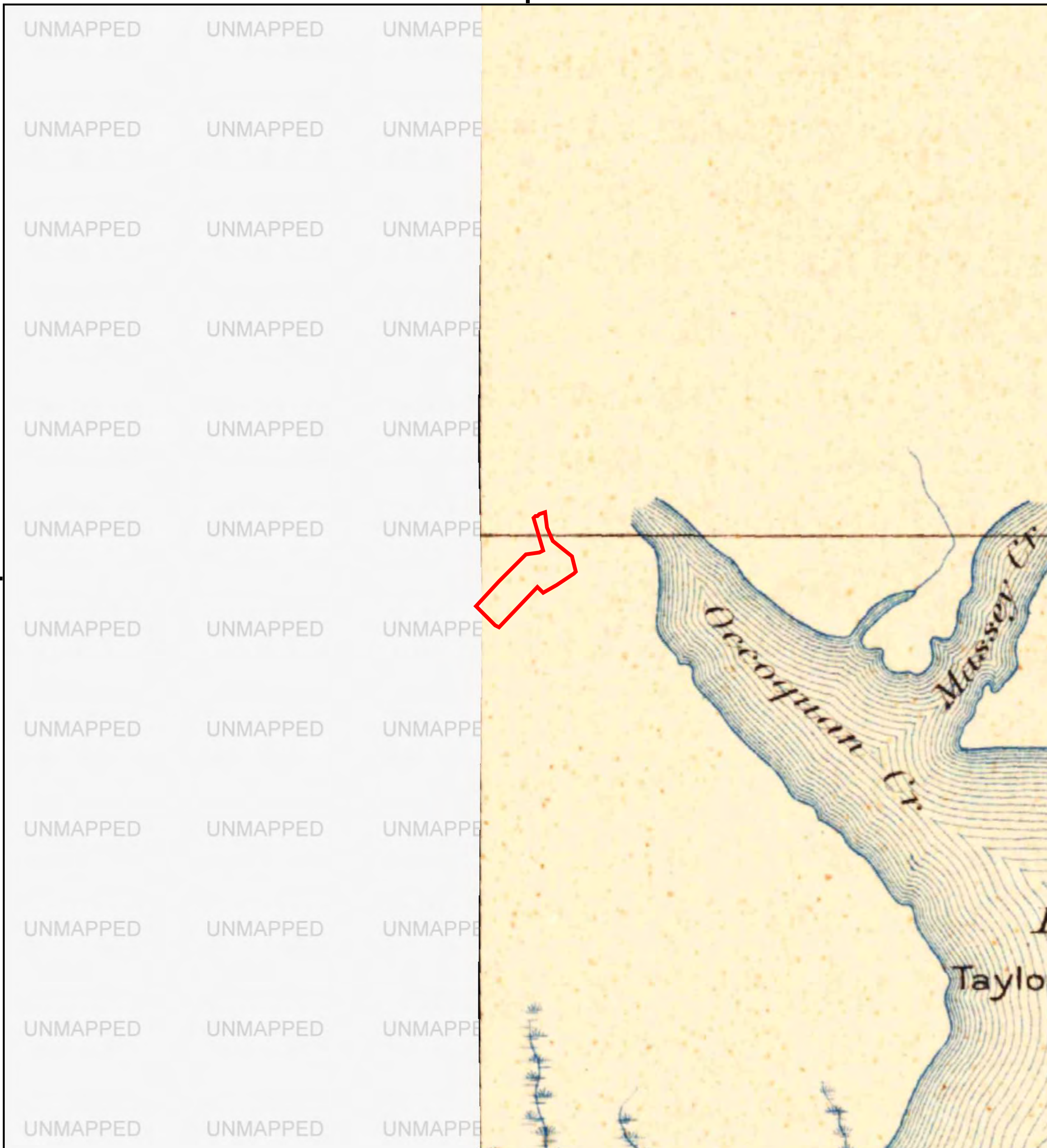
TP, Indian Head, 1923, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

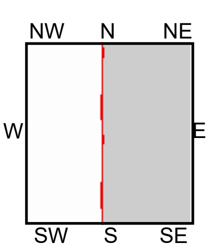
Historical Topo Map

1913



0 Miles 0.25 0.5 1 1.5

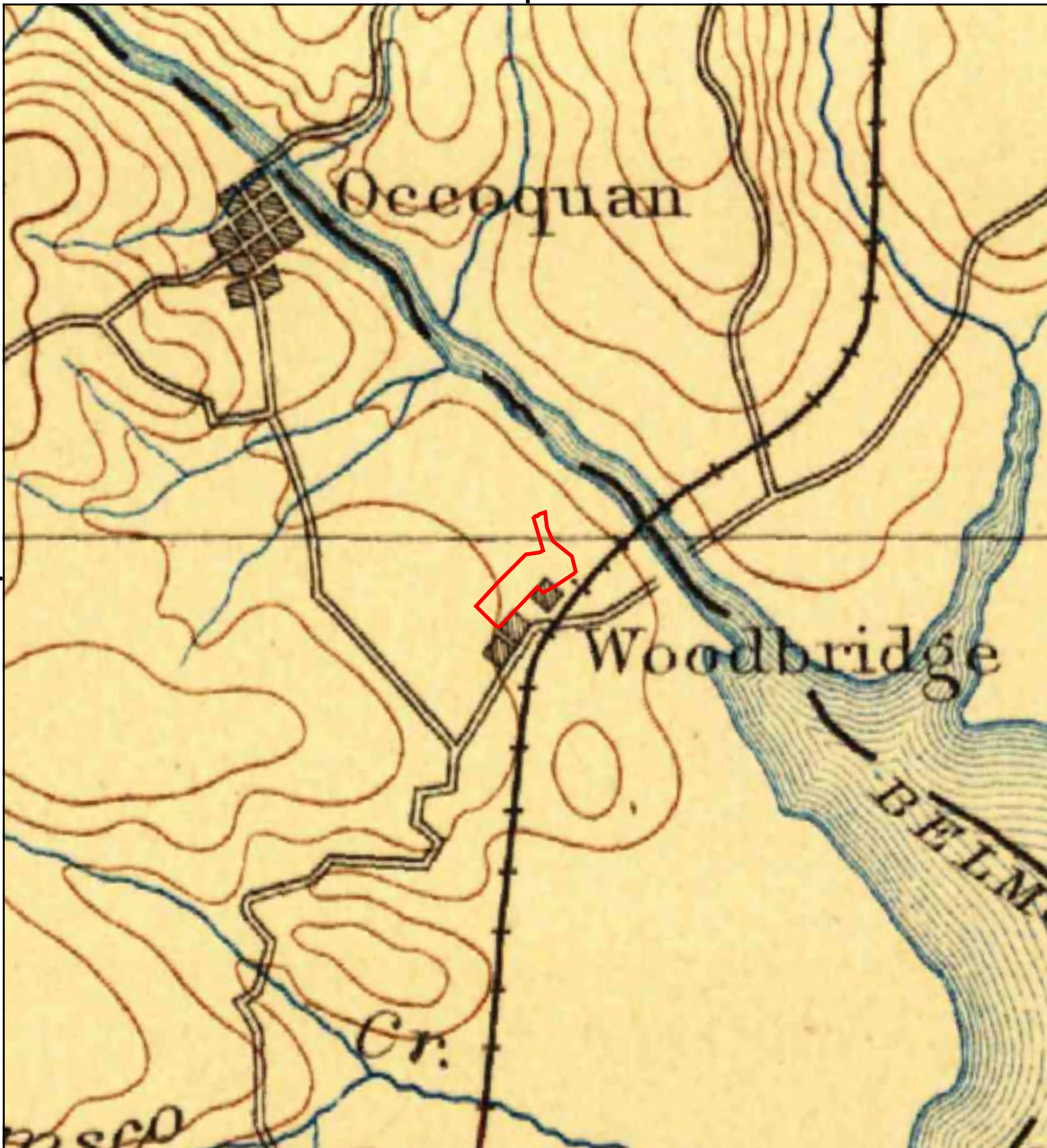
This report includes information from the following map sheet(s).



TP, Indian Head, 1913, 15-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

Historical Topo Map



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

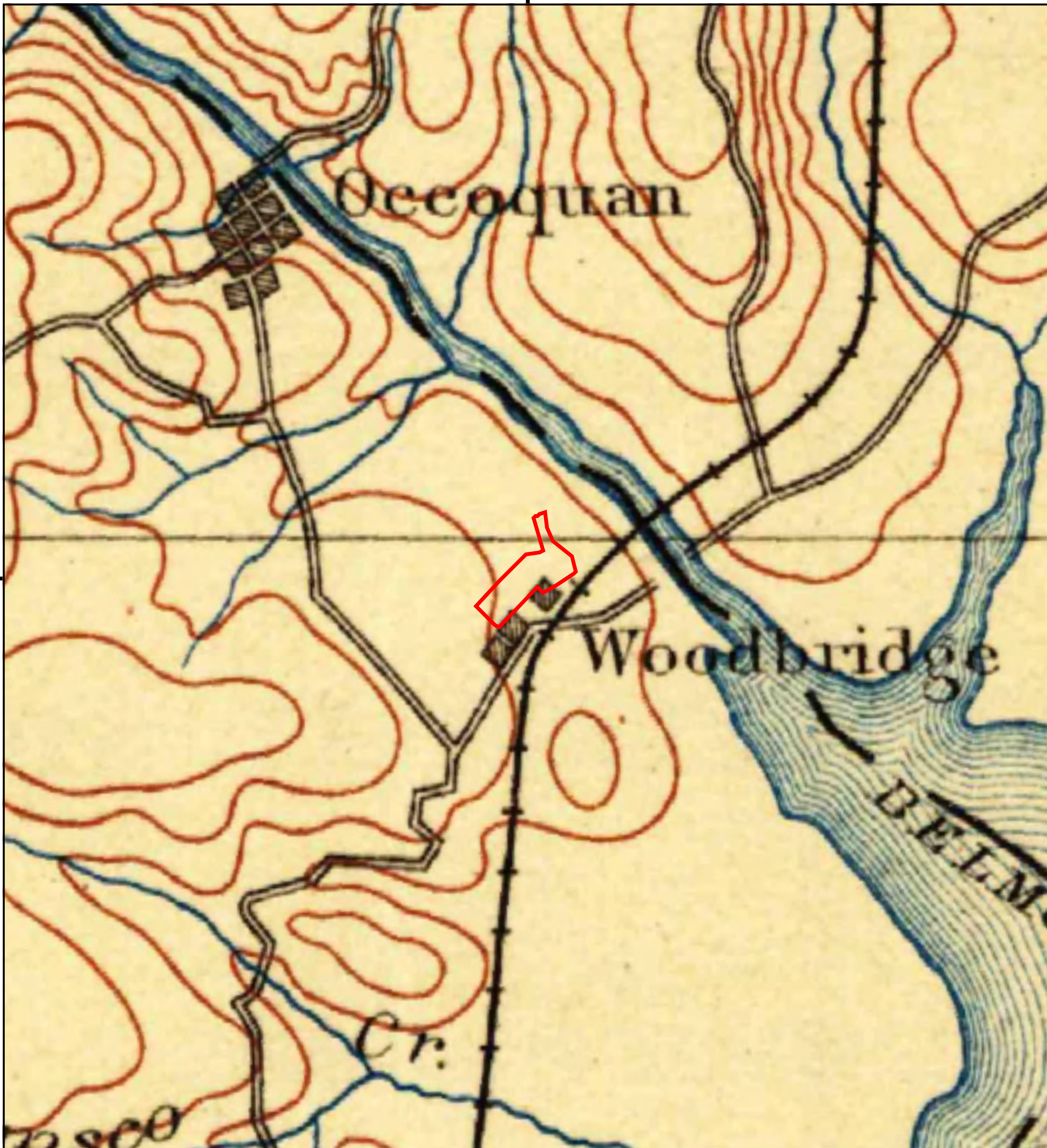
NW N NE
W E
SW S SE

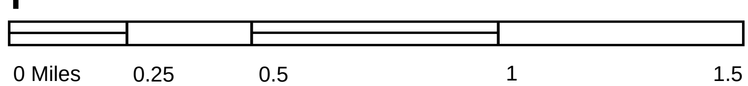
TP, Mt. Vernon, 1897, 30-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

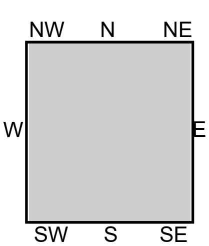
N

Historical Topo Map





This report includes information from the following map sheet(s).

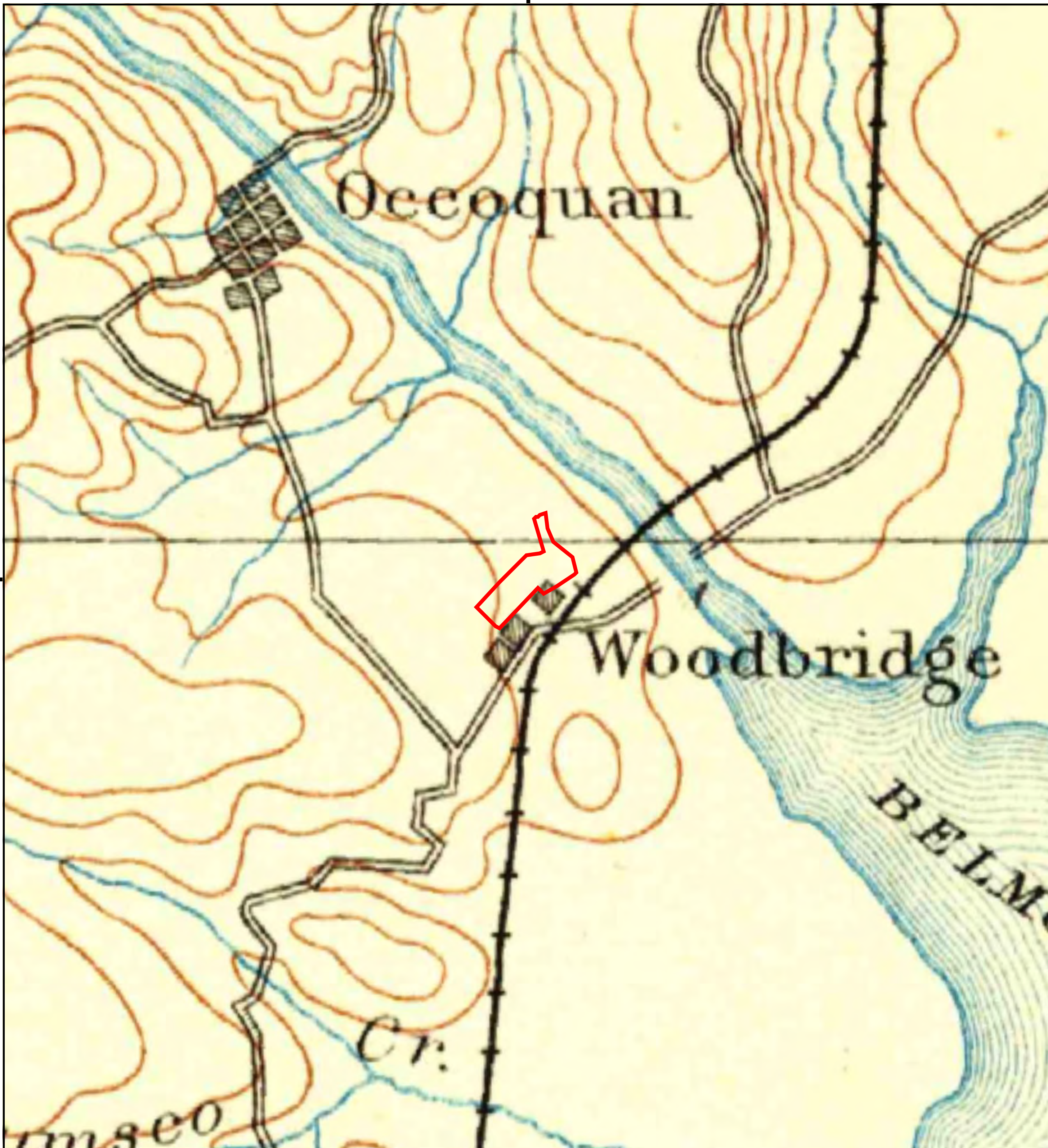


TP, Mt. Vernon, 1894, 30-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

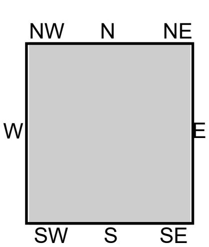
Historical Topo Map

1891



This report includes information from the following map sheet(s).

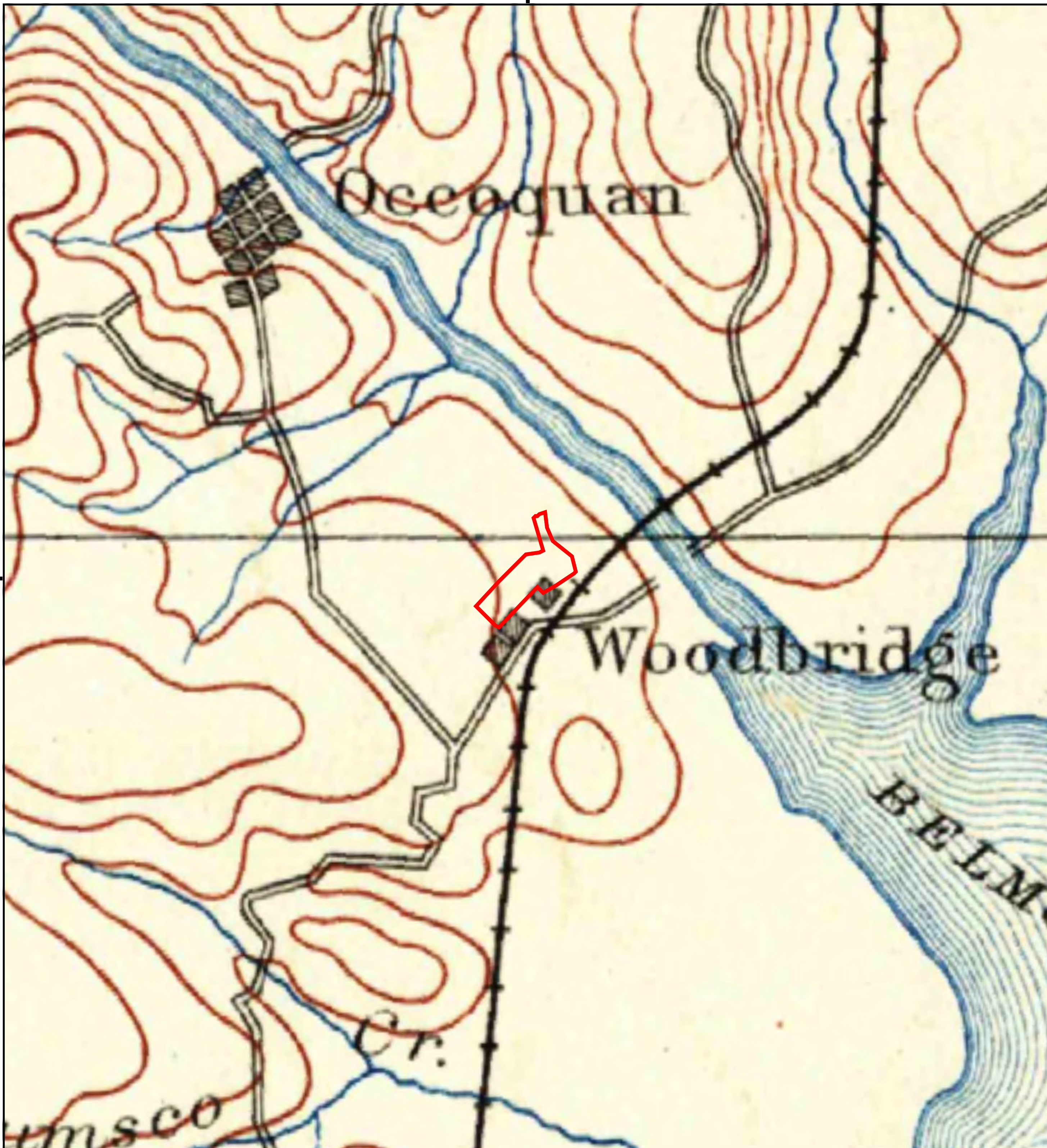
0 Miles 0.25 0.5 1 1.5



TP, Mt. Vernon, 1891, 30-minute

SITE NAME:	Marina Way Extension
ADDRESS:	Gordon Plaza Woodbridge, VA 22191
CLIENT:	Johnson, Mirmiran & Thompson

Historical Topo Map



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Mt. Vernon, 1890, 30-minute

SITE NAME: Marina Way Extension
ADDRESS: Gordon Plaza
Woodbridge, VA 22191
CLIENT: Johnson, Mirmiran & Thompson

N

TECHNICAL DUE DILIGENCE REPORT
PHASE I ENVIRONMENTAL SITE ASSESSMENT

Appendix C

Project #: 19-01549-019

Marina Way Extension
Gordon Plaza
Woodbridge, VA 22191

Inquiry Number: 7575545.2s
February 22, 2024

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Physical Setting Source Summary A-2
Physical Setting SSURGO Soil Map A-5
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Physical Setting Source Records Searched PSGR-1

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E1527 - 21), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E2247 - 16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E1528 - 22) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

GORDON PLAZA
WOODBRIDGE, VA 22191

COORDINATES

Latitude (North):	38.6649200 - 38˚ 39' 53.71''
Longitude (West):	77.2470800 - 77˚ 14' 49.48''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	304490.9
UTM Y (Meters):	4281782.0
Elevation:	82 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	50023284 FORT BELVOIR, VA
Version Date:	2022
Northwest Map:	50023287 OCCOQUAN, VA
Version Date:	2022

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20181025
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
GORDON PLAZA
WOODBRIDGE, VA 22191

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	GORDON PLAZA CLEANER	13267 GORDON BLVD	VA DRYCLEANERS	Higher	1 ft.
A2	GORDON PLAZA CLEANER	13267 GORDON BLVD	FINDS, ECHO	Higher	1 ft.
A3	GORDON PLAZA CLEANER	13267-A GORDON BLVD	RCRA NonGen / NLR	Higher	1 ft.
A4	GORDON PLAZA CLEANER	13289 GORDON BLVD	EDR Hist Cleaner	Higher	1 ft.
A5	GOLDEN PLAZA CLEANER	13267 GORDON BLVD	EDR Hist Cleaner	Higher	1 ft.
B6	GENERAL DYNAMICS LAN	991 ANNAPOLIS WAY	RCRA NonGen / NLR, NJ MANIFEST	Lower	1 ft.
B7	GENERAL DYNAMICS LAN	991 ANNAPOLIS WAY	FINDS, ECHO	Lower	1 ft.
A8	DUNIVIN & SONS INC	13306 GORDON BLVD	EDR Hist Auto	Higher	87, 0.016, WSW
A9	EXXON #2-5666 (XREF	13306 GORDON BOULEVA	VA LUST	Higher	87, 0.016, WSW
A10	EXXON 25666	13306 GORDON BLVD	UST FINDER RELEASE	Higher	87, 0.016, WSW
A11	EXXON #2-5666 (XREF	13306 GORDON BOULEVA	VA LUST	Higher	87, 0.016, WSW
A12	EXXON CO USA #25666	13306 GORDON BLVD-TA	RCRA-VSQG	Higher	87, 0.016, WSW
A13	EXXON S/S #2-5666	13306 GORDON BLVD	UST FINDER	Higher	87, 0.016, WSW
A14	HORNER RD EXXON	13306 GORDON BLVD	RCRA-VSQG	Higher	87, 0.016, WSW
A15	EXXON 25666	13306 GORDON BLVD	VA LTANKS	Higher	87, 0.016, WSW
C16	VIRGINIA CONCRETE -	936 ANNAPOLIS WAY	VA UST, VA SPILLS, VA Financial Assurance, VA TIER...	Lower	119, 0.023, East
C17	VIRGINIA CONCRETE -	936 ANNAPOLIS WAY	UST FINDER	Lower	119, 0.023, East
D18	STAR 230641303	13254 JEFFERSON DAVI	UST FINDER RELEASE	Lower	130, 0.025, East
D19	WOODBRIDGE TEXACO IN	13254 JEFFERSON DAVI	EDR Hist Auto	Lower	130, 0.025, East
D20	STAR ENTERPRISE	13254 JEFFERSON DAVI	RCRA NonGen / NLR, FINDS, ECHO	Lower	130, 0.025, East
D21	TEXACO (23-068-1303)	13254 JEFFERSON DAVI	UST FINDER	Lower	130, 0.025, East
D22	TEXACO (23-068-1303)	13254 JEFFERSON DAVI	VA UST	Lower	130, 0.025, East
D23	STAR FACILITY #23-06	13254 JEFFERSON DAVI	VA LUST, VA LTANKS, VA SPILLS	Lower	130, 0.025, East
D24	GATES MARINA INC	13260 JEFFERSON DAVI	EDR Hist Auto	Lower	197, 0.037, ESE
E25	K&W AUTO BODY INC	13302 JEFFERSON DAVI	RCRA NonGen / NLR, FINDS, ECHO	Lower	278, 0.053, SE
E26	BRIDGE AUTO SERVICE	13304 JEFF DAVIS HWY	EDR Hist Auto	Lower	302, 0.057, SE
E27	RAINBOW AUTOMOTIVE S	13304 JEFFERSON DAVI	EDR Hist Auto	Lower	302, 0.057, SE
F28	JKJ BUICK	1108 HORNER RD	VA UST	Higher	411, 0.078, WSW
F29	WOODBRIDGE PUBLIC AU	1108 HORNER RD	VA LTANKS	Higher	411, 0.078, WSW
F30	JKJ BUICK	1108 HORNER RD	UST FINDER	Higher	411, 0.078, WSW
F31	WOODBRIDGE PUBLIC AU	1108 HORNER RD	RCRA-VSQG, FINDS, ECHO, NJ MANIFEST	Higher	411, 0.078, WSW
G32	MARYLAND ROCK INDUST	13260 MARINA WAY	VA AST	Lower	412, 0.078, NE
H33	EXXON #23886	13324 JEFFERSON DAVI	UST FINDER, UST FINDER RELEASE	Lower	500, 0.095, South
H34	EXXON 23886	13324 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	500, 0.095, South
H35	ZARA PETROLEUM INC	13324 JEFFERSON DAVI	EDR Hist Auto	Lower	500, 0.095, South
H36	EXXON #23886	13324 JEFFERSON DAVI	VA UST	Lower	500, 0.095, South
I37	GORDON PLAZA SUNOCO	1260 ANNAPOLIS WAY	UST FINDER	Lower	512, 0.097, West
I38	SUNOCO STATION 0489	1260 ANNAPOLIS WAY	UST FINDER RELEASE	Lower	512, 0.097, West
I39	AFSHAR LIMITED TOOL	1260 ANNAPOLIS WAY	EDR Hist Auto	Lower	512, 0.097, West

MAPPED SITES SUMMARY

Target Property Address:
GORDON PLAZA
WOODBRIDGE, VA 22191

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
I40	SUNOCO STATION 0489	1260 ANNAPOLIS WAY	VA LTANKS, VA SPILLS	Lower	512, 0.097, West
I41	GORDON PLAZA SUNOCO	1260 ANNAPOLIS WAY	VA UST, VA Financial Assurance	Lower	512, 0.097, West
G42	L-04 OCCOQUAN CREEK	13221 MARINA WAY	VA UST, VA AST, VA SPILLS	Lower	529, 0.100, NE
G43	L-04 OCCOQUAN CREEK	13221 MARINA WAY	UST FINDER	Lower	529, 0.100, NE
G44	OCCOQUAN HARBOUR MAR	13204 MARINA WAY	UST FINDER	Lower	566, 0.107, NE
H45	SHIRLEY EXXON	13324 JEFF DAVIS HWY	EDR Hist Auto	Lower	575, 0.109, South
H46	STRINGERS INC	13324 RT 1 JEFF DAVI	EDR Hist Auto	Lower	575, 0.109, South
H47	EXXON CO USA #23886	13324 JEFF DAVIS HWY	RCRA-VSQG, FINDS, ECHO	Lower	575, 0.109, South
I48	HORNER ROAD EXXON IN	13006 GORDON BLVD	EDR Hist Auto	Lower	614, 0.116, West
G49	OCCOQUAN HARBOUR MAR	13180 MARINA WAY	VA UST, VA AST, VA SPILLS	Lower	618, 0.117, NE
J50	VDOT RIGHT OF WAY FO	13400 JEFFERSON DAVI	VA UST	Lower	761, 0.144, South
J51	SUNOCO SERVICE STATI	13400 JEFFERSON DAVI	RCRA NonGen / NLR	Lower	761, 0.144, South
J52	AMOCO 60015	13400 JEFFERSON DAVI	UST FINDER RELEASE	Lower	761, 0.144, South
J53	AMOCO #60015-TANKS	13400 JEFFERSON DAVI	RCRA NonGen / NLR, FINDS, ECHO	Lower	761, 0.144, South
J54	AMOCO 60015	13400 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	761, 0.144, South
J55	VDOT RIGHT OF WAY FO	13400 JEFFERSON DAVI	UST FINDER	Lower	761, 0.144, South
J56	AMOCO 1655	13404 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	783, 0.148, South
J57	AMOCO OIL CO S/S 165	13404 JEFFERSON DAVI	UST FINDER	Lower	783, 0.148, South
J58	AMOCO OIL CO S/S 165	13404 JEFFERSON DAVI	VA UST	Lower	783, 0.148, South
J59	AMOCO 1655	13404 JEFFERSON DAVI	UST FINDER RELEASE	Lower	783, 0.148, South
J60	PENSKE AUTO CENTER	13412 JEFFERSON DAVI	RCRA-VSQG, FINDS, ECHO	Lower	819, 0.155, South
K61	SHAFER PROPERTY - TE	13313 OCCOQUAN RD	UST FINDER RELEASE	Higher	870, 0.165, WSW
K62	HORNER ROAD SHELL	13313 OCCOQUAN RD	UST FINDER RELEASE	Higher	870, 0.165, WSW
K63	OCCOQUAN SHELL	13313 OCCOQUAN RD	UST FINDER	Higher	870, 0.165, WSW
K64	OCCOQUAN SHELL	13313 OCCOQUAN RD	VA UST, VA Financial Assurance	Higher	870, 0.165, WSW
K65	BEDSOLE GENE STEPHEN	13313 OCCAQUAN RD	RCRA-SQG, FINDS, ECHO	Higher	870, 0.165, WSW
K66	SHAFER PROPERTY/TEXA	13313 OCCOQUAN ROAD	VA LUST, VA LTANKS, VA SPILLS	Higher	870, 0.165, WSW
K67	JIFFY LUBE WOODBRIDG	13319 OCCOQUAN RD	VA AST	Higher	897, 0.170, WSW
K68	JIFFY LUBE	13319 OCCOQUAN RD	UST FINDER RELEASE	Higher	897, 0.170, WSW
K69	JIFFY LUBE	13319 OCCOQUAN RD	VA LUST, VA LTANKS	Higher	897, 0.170, WSW
K70	DIRK-WILSON INC T/A	13319 OCCOQUAN RD	RCRA-SQG, FINDS, ECHO	Higher	897, 0.170, WSW
J71	STATION PLAZA SHOPPI	13432 JEFFERSON DAVI	VA ENG CONTROLS, VA INST CONTROL, VA VCP	Lower	913, 0.173, South
72	DAVIS VERNELLE RESID	13321 OCCOQUAN RD	VA LTANKS	Higher	915, 0.173, SW
K73	KWALITY CLEANERS	13309 OCCOQUAN RD	RCRA NonGen / NLR, FINDS, ECHO	Lower	927, 0.176, WSW
J74	BRITE CLEANERS - WOO	13438 JEFFERSON DAVI	VA DRYCLEANERS	Lower	944, 0.179, South
J75	BRIDGE TAILORS & DRY	13438 JEFF-DAVIS HWY	RCRA NonGen / NLR	Lower	944, 0.179, South
J76	BRIDGEWOOD SHOPPING	13440 JEFFERSON DAVI	UST FINDER RELEASE	Lower	954, 0.181, SSW
J77	KMART - BRIDGEWOOD S	13440 JEFFERSON DAVI	VA UST	Lower	954, 0.181, SSW
J78	KMART - BRIDGEWOOD S	13440 JEFFERSON DAVI	UST FINDER	Lower	954, 0.181, SSW

MAPPED SITES SUMMARY

Target Property Address:
GORDON PLAZA
WOODBRIDGE, VA 22191

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
J79	BRIDGEWOOD SHOPPING	13440 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	954, 0.181, SSW
L80	BP FORMER	13303 OCCOQUAN RD	UST FINDER RELEASE	Lower	983, 0.186, WSW
L81	C&E AUTO SERVICE, IN	13303 OCCOQUAN RD	VA UST	Lower	983, 0.186, WSW
L82	C & E AUTOMOTIVE	13303 OCCOQUAN ROAD	VA LUST	Lower	983, 0.186, WSW
L83	BP STATION (FORMER)	13303 OCCOQUAN ROAD	VA LUST	Lower	983, 0.186, WSW
L84	BP FORMER	13303 OCCOQUAN RD	VA LTANKS	Lower	983, 0.186, WSW
L85	C&E AUTO SERVICE, IN	13303 OCCOQUAN RD	UST FINDER	Lower	983, 0.186, WSW
M86	STATION PLAZA SHOPPI	13450 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	1005, 0.190, SSW
N87	AAL QUIP CORP	13409 OCCOQUAN RD	VA UST	Higher	1014, 0.192, SW
N88	AAL QUIP CORP	13409 OCCOQUAN RD	UST FINDER	Higher	1014, 0.192, SW
M89	CHEVRON #135468	13452 JEFFERSON DAVI	VA LUST, VA LTANKS, VA SPILLS	Lower	1016, 0.192, SSW
M90	CHEVRON 135468	13452 JEFFERSON DAVI	UST FINDER RELEASE	Lower	1016, 0.192, SSW
M91	EXXON #2-4209	13452 JEFFERSON DAVI	VA LUST	Lower	1016, 0.192, SSW
M92	EXXON #24209	13452 JEFFERSON DAVI	UST FINDER, UST FINDER RELEASE	Lower	1016, 0.192, SSW
M93	EXXON CO USA #24209	13452 JEFFERSON DAVI	RCRA NonGen / NLR, FINDS, ECHO	Lower	1016, 0.192, SSW
M94	EXXON #24209	13452 JEFFERSON DAVI	VA UST, VA SPILLS	Lower	1016, 0.192, SSW
O95	COWLES FORD INC	13494 JEFFERSON DAVI	RCRA-VSQG, VA UST, FINDS, ECHO, NJ MANIFEST	Higher	1088, 0.206, SSW
O96	COWLES FORD INC	13494 JEFFERSON DAVI	UST FINDER	Higher	1088, 0.206, SSW
O97	COWLES FORD	13494 JEFFERSON DAVI	VA LUST, VA LTANKS	Higher	1088, 0.206, SSW
M98	WOODBRIDGE CLEANERS	13417 JEFFERSON DAVI	VA DRYCLEANERS	Lower	1157, 0.219, South
M99	WOODBRIDGE CLEANERS	13417 JEFFERSON DAVI	RCRA NonGen / NLR, FINDS, ECHO	Lower	1157, 0.219, South
L100	LEONARD SPLAINE CO.,	13300 OCCOQUAN RD	RCRA NonGen / NLR	Lower	1157, 0.219, West
L101	LEONARD SPLAINE COMP	13300 OCCOQUAN RD	VA LTANKS, VA UST, VA Financial Assurance	Lower	1157, 0.219, West
L102	LEONARD SPLAINE COMP	13300 OCCOQUAN RD	UST FINDER	Lower	1157, 0.219, West
L103	LAKE-WOOD AUTO SERVI	13302 OCCOQUAN RD	RCRA-VSQG, FINDS, ECHO	Lower	1234, 0.234, WSW
P104	WOODBRIDGE SQUARE SH	13249 OCCOQUAN DR	VA VCP	Lower	1290, 0.244, West
Q105	PRIME EQUIPMENT	1308 HORNER ROAD	VA LUST, VA LTANKS, VA SPILLS, VA TIER 2	Higher	1300, 0.246, WSW
Q106	RENTAL DEPOT	1308 HORNER RD	VA UST	Higher	1300, 0.246, WSW
Q107	RENTAL DEPOT	1308 HORNER RD	UST FINDER	Higher	1300, 0.246, WSW
Q108	PRIME EQUIPMENT	1308 HORNER RD	UST FINDER RELEASE	Higher	1300, 0.246, WSW
P109	SHELL STATION	13226 OCCOQUAN ROAD	VA LUST, VA LTANKS	Lower	1373, 0.260, West
P110	SHELL - OCCOQUAN ROA	13226 OCCOQUAN RD	UST FINDER RELEASE	Lower	1373, 0.260, West
111	FIRE STATION BOTTS O	1306 F ST	VA LUST, VA LTANKS	Higher	1476, 0.280, WSW
112	KILDAY TIMOTHY J SR	13511 FITZHUGH LN	VA LTANKS	Lower	1554, 0.294, SSE
R113	FORMER LAUNDRY SALON	13520 JEFFERSON DAVI	VA VCP	Lower	1788, 0.339, SSW
R114	THE LAUNDRY SALON	13520 JEFFERSON DAVI	VA VCP	Lower	1788, 0.339, SSW
R115	EXXON 23903	13601 JEFFERSON DAVI	UST FINDER RELEASE	Lower	1982, 0.375, SSW
R116	EXXON #2-3903 (XREF	13601 JEFFERSON DAVI	VA LUST, VA LTANKS, VA SPILLS	Lower	1982, 0.375, SSW
R117	EXXON #2-3903 (XREF	13601 JEFFERSON DAVI	VA LUST	Lower	1982, 0.375, SSW

MAPPED SITES SUMMARY

Target Property Address:
GORDON PLAZA
WOODBRIDGE, VA 22191

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
S118	CAPTAIN JOHN'S BEACH	10729 COLCHESTER ROA	VA LUST	Lower	2048, 0.388, ENE
S119	CAPTAIN JOHNS BEACH	10729 OLD COLCHESTER	UST FINDER RELEASE	Lower	2048, 0.388, ENE
S120	CAPTAIN JOHN S BEACH	10729 OLD COLCHESTER	VA LTANKS, VA UST, VA SPILLS, VA Financial...	Lower	2048, 0.388, ENE
T121	SHANDOR LARRY AND MA	918 REGENCY RD	VA LTANKS	Lower	2186, 0.414, South
U122	MJM AUTO	13608 JEFFERSON DAVI	VA LTANKS	Lower	2265, 0.429, SSW
123	WOOD WILLIAM S RESID	1110 SWAN POINT RD	VA LTANKS	Lower	2281, 0.432, NNW
124	DEUTSCHE NATIONAL BA	13211 ALDRIN ST	VA LTANKS	Higher	2315, 0.438, West
U125	CHECKERED FLAG AND A	13614 JEFFERSON DAVI	VA LTANKS	Lower	2409, 0.456, SSW
T126	PHELPS MITCHELL RESI	922 ALEXIS RD	VA LUST, VA LTANKS	Lower	2445, 0.463, South
127	WOODARD PROPERTY	1303 BRICE ST	VA LUST, VA LTANKS	Lower	2471, 0.468, SSW
U128	RF AND P FACILITY -	13609 JEFFERSON DAVI	VA LUST, VA LTANKS	Lower	2480, 0.470, SSW
129	GOMEZ CONCEPCION RES	903 REGENCY RD	VA LTANKS, VA SPILLS	Lower	2488, 0.471, SSE
V130	USA WOODBRIDGE RESEA	DAWSON BEACH ROAD	SEMS, ROD	Lower	4803, 0.910, South
V131	US WOODBRIDGE RESEAR	DAWSON BEACH RD	CORRACTS, RCRA NonGen / NLR, NY MANIFEST	Lower	4803, 0.910, South

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal NPL (Superfund) sites

NPL - National Priority List
Proposed NPL - Proposed National Priority List Sites
NPL LIENS - Federal Superfund Liens

Lists of Federal Delisted NPL sites

Delisted NPL - National Priority List Deletions

Lists of Federal sites subject to CERCLA removals and CERCLA orders

FEDERAL FACILITY - Federal Facility Site Information listing

Lists of Federal CERCLA sites with NFRAP

SEMS-ARCHIVE - Superfund Enterprise Management System Archive

Lists of Federal RCRA TSD facilities

RCRA-TSDF - RCRA - Treatment, Storage and Disposal

Lists of Federal RCRA generators

RCRA-LQG - RCRA - Large Quantity Generators

Federal institutional controls / engineering controls registries

LUCIS - Land Use Control Information System
US ENG CONTROLS - Engineering Controls Sites List
US INST CONTROLS - Institutional Controls Sites List

Federal ERNS list

ERNS - Emergency Response Notification System

Lists of state- and tribal hazardous waste facilities

VA SHWS - This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

EXECUTIVE SUMMARY

Lists of state and tribal landfills and solid waste disposal facilities

VA SWF/LF - - - Solid Waste Management Facilities

Lists of state and tribal leaking storage tanks

INDIAN LUST - - - Leaking Underground Storage Tanks on Indian Land

Lists of state and tribal registered storage tanks

FEMA UST - - - Underground Storage Tank Listing
INDIAN UST - - - Underground Storage Tanks on Indian Land

Lists of state and tribal voluntary cleanup sites

INDIAN VCP - - - Voluntary Cleanup Priority Listing

Lists of state and tribal brownfield sites

VA BROWNFIELDS - - - Brownfields Site Specific Assessments

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS - - - A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI - - - Report on the Status of Open Dumps on Indian Lands
ODI - - - Open Dump Inventory
DEBRIS REGION 9 - - - Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS - - - Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL - - - Delisted National Clandestine Laboratory Register
US CDL - - - National Clandestine Laboratory Register

Local Land Records

LIENS 2 - - - CERCLA Lien Information

Records of Emergency Release Reports

HMIRS - - - Hazardous Materials Information Reporting System
VA SPILLS 90 - - - SPILLS 90 data from FirstSearch

Other Ascertainable Records

FUDS - - - Formerly Used Defense Sites
DOD - - - Department of Defense Sites
SCRD DRYCLEANERS - - - State Coalition for Remediation of Drycleaners Listing

EXECUTIVE SUMMARY

US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
MINES MRDS	Mineral Resources Data System
ABANDONED MINES	Abandoned Mines
DOCKET HWC	Hazardous Waste Compliance Docket Listing
UXO	Unexploded Ordnance Sites
FUELS PROGRAM	EPA Fuels Program Registered Listing
PFAS NPL	Superfund Sites with PFAS Detections Information
PFAS FEDERAL SITES	Federal Sites PFAS Information
PFAS TRIS	List of PFAS Added to the TRI
PFAS TSCA	PFAS Manufacture and Imports Information
PFAS RCRA MANIFEST	PFAS Transfers Identified In the RCRA Database Listing
PFAS ATSDR	PFAS Contamination Site Location Listing
PFAS WQP	Ambient Environmental Sampling for PFAS
PFAS NPDES	Clean Water Act Discharge Monitoring Information
PFAS ECHO	Facilities in Industries that May Be Handling PFAS Listing
PFAS ECHO FIRE TRAINING	Facilities in Industries that May Be Handling PFAS Listing
PFAS PART 139 AIRPORT	All Certified Part 139 Airports PFAS Information Listing
AQUEOUS FOAM NRC	Aqueous Foam Related Incidents Listing
BIOSOLIDS	ICIS-NPDES Biosolids Facility Data
VA AIRS	Permitted Airs Facility List
VA NPDES	Comprehensive Environmental Data System
VA COAL ASH	Coal Ash Disposal Sites
VA ENF	Enforcement Actions Data
VA UIC	Underground Injection Control Wells

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants

EXECUTIVE SUMMARY

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

VA RGA LF - - - - - - Recovered Government Archive Solid Waste Facilities List
VA RGA LUST - - - - - Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Lists of Federal RCRA facilities undergoing Corrective Action

CORRACTS: CORRACTS is a list of handlers with RCRA Corrective Action Activity. This report shows which nationally-defined corrective action core events have occurred for every handler that has had corrective action activity.

A review of the CORRACTS list, as provided by EDR, and dated 12/04/2023 has revealed that there is 1 CORRACTS site within approximately 1 mile of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
US WOODBRIDGE RESEAR EPA ID:: VA0210000907	***DAWSON BEACH RD***	***S 1/2 - 1 (0.910 mi.)***	***V131***	***408***

Lists of Federal RCRA generators

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 12/04/2023 has revealed that there are 2 RCRA-SQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
BEDSOLE GENE STEPHEN	***13313 OCCAQUAN RD***	***WSW 1/8 - 1/4 (0.165 mi.)***	***K65***	***214***

EPA ID:: VAD988172581				
DIRK-WILSON INC T/A EPA ID:: VAD988174991	***13319 OCCOQUAN RD***	***WSW 1/8 - 1/4 (0.170 mi.)***	***K70***	***225***

RCRA-VSQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Very small quantity generators (VSQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-VSQG list, as provided by EDR, and dated 12/04/2023 has revealed that there are 7 RCRA-VSQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
EXXON CO USA #25666 EPA ID:: VAD988194502	13306 GORDON BLVD-TA	WSW 0 - 1/8 (0.016 mi.)	A12	29
HORNER RD EXXON EPA ID:: VAD988202776	13306 GORDON BLVD	WSW 0 - 1/8 (0.016 mi.)	A14	33
WOODBRIDGE PUBLIC AU EPA ID:: VAD044977395	***1108 HORNER RD***	***WSW 0 - 1/8 (0.078 mi.)***	***F31***	***94***
COWLES FORD INC EPA ID:: VAD024010795	***13494 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.206 mi.)***	***O95***	***283***

Lower Elevation	Address	Direction / Distance	Map ID	Page
EXXON CO USA #23886 EPA ID:: VAD988194536	***13324 JEFF DAVIS HWY***	***S 0 - 1/8 (0.109 mi.)***	***H47***	***155***
PENSKE AUTO CENTER EPA ID:: VAR000003426	***13412 JEFFERSON DAVI***	***S 1/8 - 1/4 (0.155 mi.)***	***J60***	***194***
LAKE-WOOD AUTO SERVI EPA ID:: VAD988204707	***13302 OCCOQUAN RD***	***WSW 1/8 - 1/4 (0.234 mi.)***	***L103***	***344***

Lists of state and tribal leaking storage tanks

VA LUST: The Leaking Underground Storage Tank Database.

A review of the VA LUST list, as provided by EDR, has revealed that there are 24 VA LUST sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
EXXON #2-5666 (XREF Database: LUST REG NO, Date of Government Version: 05/18/2004 Facility Status: Closed Pollution Complaint #: 96-3037 Closed Date: 8/7/1997 Facility ID: 3009925	13306 GORDON BOULEVA	WSW 0 - 1/8 (0.016 mi.)	A9	27
EXXON #2-5666 (XREF Database: LUST REG NO, Date of Government Version: 05/18/2004	13306 GORDON BOULEVA	WSW 0 - 1/8 (0.016 mi.)	A11	29

Facility Status: Closed
Pollution Complaint #: 88-9998
Closed Date: 9/11/1987
Facility ID: 3009925

	Address	Direction / Distance	Map ID	Page
SHAFER PROPERTY/TEXA	***13313 OCCOQUAN ROAD***	***WSW 1/8 - 1/4 (0.165 mi.)***	***K66***	***217***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Open
Pollution Complaint #: 92-0234
Facility ID: 3007889

JIFFY LUBE	***13319 OCCOQUAN RD***	***WSW 1/8 - 1/4 (0.170 mi.)***	***K69***	***224***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 96-3151
Closed Date: 10/1/1996
Facility ID: 3032044

COWLES FORD	***13494 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.206 mi.)***	***O97***	***309***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 94-2943
Closed Date: 8/23/1994
Facility ID: 3009685

PRIME EQUIPMENT	***1308 HORNER ROAD***	***WSW 1/8 - 1/4 (0.246 mi.)***	***Q105***	***351***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 97-3185
Closed Date: 8/11/1997
Facility ID: 3004261

FIRE STATION BOTTS O	***1306 F ST***	***WSW 1/4 - 1/2 (0.280 mi.)***	***111***	***363***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 96-3031
Closed Date: 10/13/1995
Facility ID: 3900886

Lower Elevation	Address	Direction / Distance	Map ID	Page
STAR FACILITY #23-06	***13254 JEFFERSON DAVI***	***E 0 - 1/8 (0.025 mi.)***	***D23***	***81***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Open
Pollution Complaint #: 96-3099
Facility ID: 3019171

EXXON 23886	***13324 JEFFERSON DAVI***	***S 0 - 1/8 (0.095 mi.)***	***H34***	***114***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 94-3516
Closed Date: 1/22/1997
Facility ID: 3009881

AMOCO 60015	***13400 JEFFERSON DAVI***	***S 1/8 - 1/4 (0.144 mi.)***	***J54***	***183***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Open
Pollution Complaint #: 92-1776
Facility ID: 3003716

AMOCO 1655	***13404 JEFFERSON DAVI***	***S 1/8 - 1/4 (0.148 mi.)***	***J56***	***186***

Database: LUST REG NO, Date of Government Version: 05/18/2004

EXECUTIVE SUMMARY

Facility Status: Open
Pollution Complaint #: 86-0179
Facility ID: 3003716

BRIDGEWOOD SHOPPING	***13440 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.181 mi.)***	***J79***	***243***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 94-0798
Closed Date: 1/7/1994
Facility ID: 3022871

C & E AUTOMOTIVE	13303 OCCOQUAN ROAD	WSW 1/8 - 1/4 (0.186 mi.)	L82	252

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 99-3205
Closed Date: 2/9/1999
Facility ID: 3007334

BP STATION (FORMER)	13303 OCCOQUAN ROAD	WSW 1/8 - 1/4 (0.186 mi.)	L83	252

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 92-0655
Pollution Complaint #: 92-0665
Closed Date: 3/23/1993
Closed Date: 12/3/1993
Facility ID: 3014292

STATION PLAZA SHOPPI	***13450 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.190 mi.)***	***M86***	***256***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 98-3641
Closed Date: 1/13/1998
Facility ID: 3900130

CHEVRON #135468	***13452 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.192 mi.)***	***M89***	***261***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 89-1223
Closed Date: 6/7/1995
Facility ID: 3015725

EXXON #2-4209	13452 JEFFERSON DAVI	SSW 1/8 - 1/4 (0.192 mi.)	M91	265

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 95-4078
Closed Date: 5/28/1997
Facility ID: 3015725

SHELL STATION	***13226 OCCOQUAN ROAD***	***W 1/4 - 1/2 (0.260 mi.)***	***P109***	***360***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Facility Status: Open
Pollution Complaint #: 91-0966
Pollution Complaint #: 90-1791
Closed Date: 9/28/1994
Facility ID: 3014296

EXXON #2-3903 (XREF	***13601 JEFFERSON DAVI***	***SSW 1/4 - 1/2 (0.375 mi.)***	***R116***	***373***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed

Pollution Complaint #: 90-0188
Closed Date: 12/15/1999
Facility ID: 3009783

EXXON #2-3903 (XREF	13601 JEFFERSON DAVI	SSW 1/4 - 1/2 (0.375 mi.)	R117	376

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 90-1828
Closed Date: 12/15/1999
Facility ID: 3009783

CAPTAIN JOHN’S BEACH	10729 COLCHESTER ROA	ENE 1/4 - 1/2 (0.388 mi.)	S118	376

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Open
Pollution Complaint #: 00-3364
Facility ID: 0

PHELPS MITCHELL RESI	***922 ALEXIS RD***	***S 1/4 - 1/2 (0.463 mi.)***	***T126***	***393***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 98-3757
Closed Date: 7/22/1998
Facility ID: 3900637

WOODARD PROPERTY	***1303 BRICE ST***	***SSW 1/4 - 1/2 (0.468 mi.)***	***127***	***394***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 99-3301
Closed Date: 1/8/2001
Facility ID: 3900116

RF AND P FACILITY -	***13609 JEFFERSON DAVI***	***SSW 1/4 - 1/2 (0.470 mi.)***	***U128***	***395***

Database: LUST REG NO, Date of Government Version: 05/18/2004
Facility Status: Closed
Pollution Complaint #: 91-1567
Closed Date: 10/17/1995
Facility ID: 3025197

VA LTANKS: The Leaking Tanks Database contains current Leaking petroleum tanks. The data comes from the Department of Environmental Quality.

A review of the VA LTANKS list, as provided by EDR, and dated 11/02/2023 has revealed that there are 31 VA LTANKS sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
EXXON 25666	13306 GORDON BLVD	WSW 0 - 1/8 (0.016 mi.)	A15	36

Facility Status: Closed
CEDS Facility Id: 200000078547
Pollution Complaint #: 19889998
Pollution Complaint #: 19963037

WOODBRIDGE PUBLIC AU	1108 HORNER RD	WSW 0 - 1/8 (0.078 mi.)	F29	92

Facility Status: Closed
CEDS Facility Id: 200000077252
Pollution Complaint #: 20033078

SHAFER PROPERTY/TEXA	***13313 OCCOQUAN ROAD***	***WSW 1/8 - 1/4 (0.165 mi.)***	***K66***	***217***

Facility Status: Closed CEDS Facility Id: 200000193849 Pollution Complaint #: 20053228 Pollution Complaint #: 19920234				
JIFFY LUBE Facility Status: Closed CEDS Facility Id: 200000077258 Pollution Complaint #: 19963151	***13319 OCCOQUAN RD***	***WSW 1/8 - 1/4 (0.170 mi.)***	***K69***	***224***
DAVIS VERNELLE RESID Facility Status: Closed CEDS Facility Id: 200000215339 Pollution Complaint #: 20043265	13321 OCCOQUAN RD	SW 1/8 - 1/4 (0.173 mi.)	72	231
COWLES FORD Facility Status: Closed CEDS Facility Id: 200000079177 Pollution Complaint #: 19942943	***13494 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.206 mi.)***	***O97***	***309***
PRIME EQUIPMENT Facility Status: Closed CEDS Facility Id: 200000193853 Pollution Complaint #: 19973185	***1308 HORNER ROAD***	***WSW 1/8 - 1/4 (0.246 mi.)***	***Q105***	***351***
FIRE STATION BOTTS O Facility Status: Closed CEDS Facility Id: 200000186088 Pollution Complaint #: 19963031	***1306 F ST***	***WSW 1/4 - 1/2 (0.280 mi.)***	***111***	***363***
DEUTSCHE NATIONAL BA Facility Status: Closed CEDS Facility Id: 200000851264 Pollution Complaint #: 20093191	13211 ALDRIN ST	W 1/4 - 1/2 (0.438 mi.)	124	391

Lower Elevation	Address	Direction / Distance	Map ID	Page
STAR FACILITY #23-06 Facility Status: Closed CEDS Facility Id: 200000193899 Pollution Complaint #: 19963099	***13254 JEFFERSON DAVI***	***E 0 - 1/8 (0.025 mi.)***	***D23***	***81***
EXXON 23886 Facility Status: Closed CEDS Facility Id: 200000078607 Pollution Complaint #: 19943516	***13324 JEFFERSON DAVI***	***S 0 - 1/8 (0.095 mi.)***	***H34***	***114***
SUNOCO STATION 0489 Facility Status: Closed CEDS Facility Id: 200000195860 Pollution Complaint #: 20063165	***1260 ANNAPOLIS WAY***	***W 0 - 1/8 (0.097 mi.)***	***I40***	***132***
AMOCO 60015 Facility Status: Closed CEDS Facility Id: 200000193847 Pollution Complaint #: 19921776	***13400 JEFFERSON DAVI***	***S 1/8 - 1/4 (0.144 mi.)***	***J54***	***183***
AMOCO 1655 Facility Status: Closed CEDS Facility Id: 200000093360 Pollution Complaint #: 19860179	***13404 JEFFERSON DAVI***	***S 1/8 - 1/4 (0.148 mi.)***	***J56***	***186***
BRIDGEWOOD SHOPPING	***13440 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.181 mi.)***	***J79***	***243***

Facility Status: Closed CEDS Facility Id: 200000073545 Pollution Complaint #: 19940798				
BP FORMER Facility Status: Closed CEDS Facility Id: 200000079823 Pollution Complaint #: 19920665 Pollution Complaint #: 19993205	13303 OCCOQUAN RD	WSW 1/8 - 1/4 (0.186 mi.)	L84	253
STATION PLAZA SHOPPI Facility Status: Closed CEDS Facility Id: 200000185332 Pollution Complaint #: 19983641	***13450 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.190 mi.)***	***M86***	***256***
CHEVRON #135468 Facility Status: Closed CEDS Facility Id: 200000193837 Pollution Complaint #: 19891223 Pollution Complaint #: 19954078	***13452 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.192 mi.)***	***M89***	***261***
LEONARD SPLAINE COMP Facility Status: Closed CEDS Facility Id: 200000076954 Pollution Complaint #: 20233052	***13300 OCCOQUAN RD***	***W 1/8 - 1/4 (0.219 mi.)***	***L101***	***319***
SHELL STATION Facility Status: Closed CEDS Facility Id: 200000074631 Pollution Complaint #: 19910966 Pollution Complaint #: 19901791	***13226 OCCOQUAN ROAD***	***W 1/4 - 1/2 (0.260 mi.)***	***P109***	***360***
KILDAY TIMOTHY J SR Facility Status: Closed CEDS Facility Id: 200000890080 Pollution Complaint #: 20203073	13511 FITZHUGH LN	SSE 1/4 - 1/2 (0.294 mi.)	112	364
EXXON #2-3903 (XREF Facility Status: Closed CEDS Facility Id: 200000087300 Pollution Complaint #: 19901828 Pollution Complaint #: 19900188	***13601 JEFFERSON DAVI***	***SSW 1/4 - 1/2 (0.375 mi.)***	***R116***	***373***
CAPTAIN JOHN S BEACH Facility Status: Closed CEDS Facility Id: 200000079753 Pollution Complaint #: 20003364	***10729 OLD COLCHESTER***	***ENE 1/4 - 1/2 (0.388 mi.)***	***S120***	***377***
SHANDOR LARRY AND MA Facility Status: Closed CEDS Facility Id: 200000847963 Pollution Complaint #: 20083136	918 REGENCY RD	S 1/4 - 1/2 (0.414 mi.)	T121	388
MJM AUTO Facility Status: Closed CEDS Facility Id: 200000860199 Pollution Complaint #: 20143037	13608 JEFFERSON DAVI	SSW 1/4 - 1/2 (0.429 mi.)	U122	389
WOOD WILLIAM S RESID Facility Status: Closed CEDS Facility Id: 200000853886 Pollution Complaint #: 20113020	1110 SWAN POINT RD	NNW 1/4 - 1/2 (0.432 mi.)	123	390
CHECKERED FLAG AND A	13614 JEFFERSON DAVI	SSW 1/4 - 1/2 (0.456 mi.)	U125	392

Facility Status: Closed CEDS Facility Id: 200000860200 Pollution Complaint #: 20143038				
PHELPS MITCHELL RESI Facility Status: Closed CEDS Facility Id: 200000185839 Pollution Complaint #: 19983757	***922 ALEXIS RD***	***S 1/4 - 1/2 (0.463 mi.)***	***T126***	***393***
WOODARD PROPERTY Facility Status: Closed CEDS Facility Id: 200000185318 Pollution Complaint #: 19993301	***1303 BRICE ST***	***SSW 1/4 - 1/2 (0.468 mi.)***	***127***	***394***
RF AND P FACILITY - Facility Status: Closed CEDS Facility Id: 200000080440 Pollution Complaint #: 19911567	***13609 JEFFERSON DAVI***	***SSW 1/4 - 1/2 (0.470 mi.)***	***U128***	***395***
GOMEZ CONCEPCION RES Facility Status: Closed CEDS Facility Id: 200000851859 Pollution Complaint #: 20103034	***903 REGENCY RD***	***SSE 1/4 - 1/2 (0.471 mi.)***	***129***	***396***

Lists of state and tribal registered storage tanks

VA UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Environmental Quality's Underground Storage Tank Data Notification Information.

A review of the VA UST list, as provided by EDR, and dated 10/02/2023 has revealed that there are 17 VA UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
JKJ BUICK CEDS Facility ID: 200000077252 Tank Status: REM FROM GRD Facility Id: 3000680	1108 HORNER RD	WSW 0 - 1/8 (0.078 mi.)	F28	88
OCCOQUAN SHELL CEDS Facility ID: 200000193849 Tank Status: CURR IN USE Tank Status: REM FROM GRD Facility Id: 3007889	***13313 OCCOQUAN RD***	***WSW 1/8 - 1/4 (0.165 mi.)***	***K64***	***201***
AAL QUIP CORP CEDS Facility ID: 200000073446 Tank Status: CLS IN GRD Facility Id: 3003628	13409 OCCOQUAN RD	SW 1/8 - 1/4 (0.192 mi.)	N87	257
COWLES FORD INC CEDS Facility ID: 200000079177 Tank Status: REM FROM GRD Facility Id: 3009685	***13494 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.206 mi.)***	***O95***	***283***
RENTAL DEPOT CEDS Facility ID: 200000193853	1308 HORNER RD	WSW 1/8 - 1/4 (0.246 mi.)	Q106	354

EXECUTIVE SUMMARY

Tank Status: REM FROM GRD
Facility Id: 3004261

Lower Elevation	Address	Direction / Distance	Map ID	Page
VIRGINIA CONCRETE - CEDS Facility ID: 200000088153 Tank Status: CURR IN USE Tank Status: REM FROM GRD Facility Id: 3019484	***936 ANNAPOLIS WAY***	***E 0 - 1/8 (0.023 mi.)***	***C16***	***37***
TEXACO (23-068-1303) CEDS Facility ID: 200000193899 Tank Status: PERM OUT OF USE Tank Status: REM FROM GRD Facility Id: 3019171	13254 JEFFERSON DAVI	E 0 - 1/8 (0.025 mi.)	D22	71
EXXON #23886 CEDS Facility ID: 200000078607 Tank Status: REM FROM GRD Facility Id: 3009881	13324 JEFFERSON DAVI	S 0 - 1/8 (0.095 mi.)	H36	116
GORDON PLAZA SUNOCO CEDS Facility ID: 200000195860 Tank Status: CURR IN USE Facility Id: 3005281	***1260 ANNAPOLIS WAY***	***W 0 - 1/8 (0.097 mi.)***	***I41***	***141***
L-04 OCCOQUAN CREEK CEDS Facility ID: 200000087035 Tank Status: REM FROM GRD Facility Id: 3018240	***13221 MARINA WAY***	***NE 0 - 1/8 (0.100 mi.)***	***G42***	***148***
OCCOQUAN HARBOUR MAR CEDS Facility ID: 200000075867 Tank Status: CLS IN GRD Facility Id: 3018046	***13180 MARINA WAY***	***NE 0 - 1/8 (0.117 mi.)***	***G49***	***159***
VDOT RIGHT OF WAY FO CEDS Facility ID: 200000193847 Tank Status: REM FROM GRD Facility Id: 3024070	13400 JEFFERSON DAVI	S 1/8 - 1/4 (0.144 mi.)	J50	170
AMOCO OIL CO S/S 165 CEDS Facility ID: 200000093360 Tank Status: REM FROM GRD Facility Id: 3003716	13404 JEFFERSON DAVI	S 1/8 - 1/4 (0.148 mi.)	J58	188
KMART - BRIDGEWOOD S CEDS Facility ID: 200000073545 Tank Status: REM FROM GRD Facility Id: 3022871	13440 JEFFERSON DAVI	SSW 1/8 - 1/4 (0.181 mi.)	J77	241
C&E AUTO SERVICE, IN CEDS Facility ID: 200000079823 Tank Status: REM FROM GRD Facility Id: 3007334	13303 OCCOQUAN RD	WSW 1/8 - 1/4 (0.186 mi.)	L81	245
EXXON #24209 CEDS Facility ID: 200000193837 Tank Status: REM FROM GRD Facility Id: 3015725	***13452 JEFFERSON DAVI***	***SSW 1/8 - 1/4 (0.192 mi.)***	***M94***	***271***
LEONARD SPLAINE COMP	***13300 OCCOQUAN RD***	***W 1/8 - 1/4 (0.219 mi.)***	***L101***	***319***