Fort Belvoir North Area (FBNA) Distribution Center Environmental Assessment

Fort Belvoir, Virginia
June 2022

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Fort Belvoir North Area (FBNA) Distribution Center
Fort Belvoir, Virginia

ENVIRONMENTAL ASSESSMENT

Reviewed by:
U.S. Army Garrison Fort Belvoir

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Pursuant to the National Environmental Policy Act (NEPA) of 1969 (Title 42, U.S. Code [USC], 4321-4370f), as amended; regulations of the Council on Environmental Quality (CEQ) (40 Code of Federal Regulations [CFR] 1500-1508); and 32 CFR 651, *Army Analysis of Environmental Actions*, Fort Belvoir has prepared an Environmental Assessment (EA) to evaluate potential environmental effects associated with construction and operation of a new distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia.

FBNA is located approximately 14 miles southwest of Washington, D.C., and about 13 miles southwest of the Pentagon, along Interstate 95 (I-95) in Fairfax County, Virginia (Figure 1-1). As a strategic sustaining base for America's Army in the National Capital Region, Fort Belvoir provides logistical, intelligence, and administrative support to a diverse group of more than 140 Army and Department of Defense (DoD) organizations. Fort Belvoir contributes to the nation's defense primarily by providing a secure operating environment for regional and worldwide DoD missions and functions. The garrison also provides housing, medical services, recreational facilities, and other support services for active duty military members and retirees in the National Capital Region (Fort Belvoir, 2014b).

The Army established Fort Belvoir during World War I as Camp A.A. Humphreys. In 1919, the Army Engineer School relocated to Camp Humphreys and remained on the installation until 1988. After World War II, Fort Belvoir's mission began to shift from training to research, development, test, and evaluation activities. In the 1950s, the installation's mission expanded to include hosting DoD organizations. With the departure of the Army Engineer School in 1988, Fort Belvoir's mission to support DoD organizations grew. In September 2005, the Defense Base Realignment and Closure (BRAC) Commission recommended numerous realignment and closure actions for military capabilities, which led to the establishment of the current configuration of facilities on FBNA.

Formerly known as the Army Engineer Proving Ground (EPG), FBNA is located in Springfield, Virginia, approximately 3 miles northwest of Fort Belvoir's main installation. FBNA currently hosts the National Geospatial Intelligence Agency (NGA) headquarters and associated support facilities, which were constructed in 2011.

1.2 PURPOSE AND NEED

The purpose of this Proposed Action is to construct and operate an approximately 525,000 square foot warehouse and administrative building with approximately 600 personnel, associated parking, and covered storage on FBNA. This facility would support the delivery and receipt of materials within and across the Washington Metropolitan Area and National Capital Region (NCR) to achieve distribution efficiencies. The action would also comply with Office of Management and Budget (OMB) guidance that encourages stewardship of taxpayer resources and improved joint site usage.

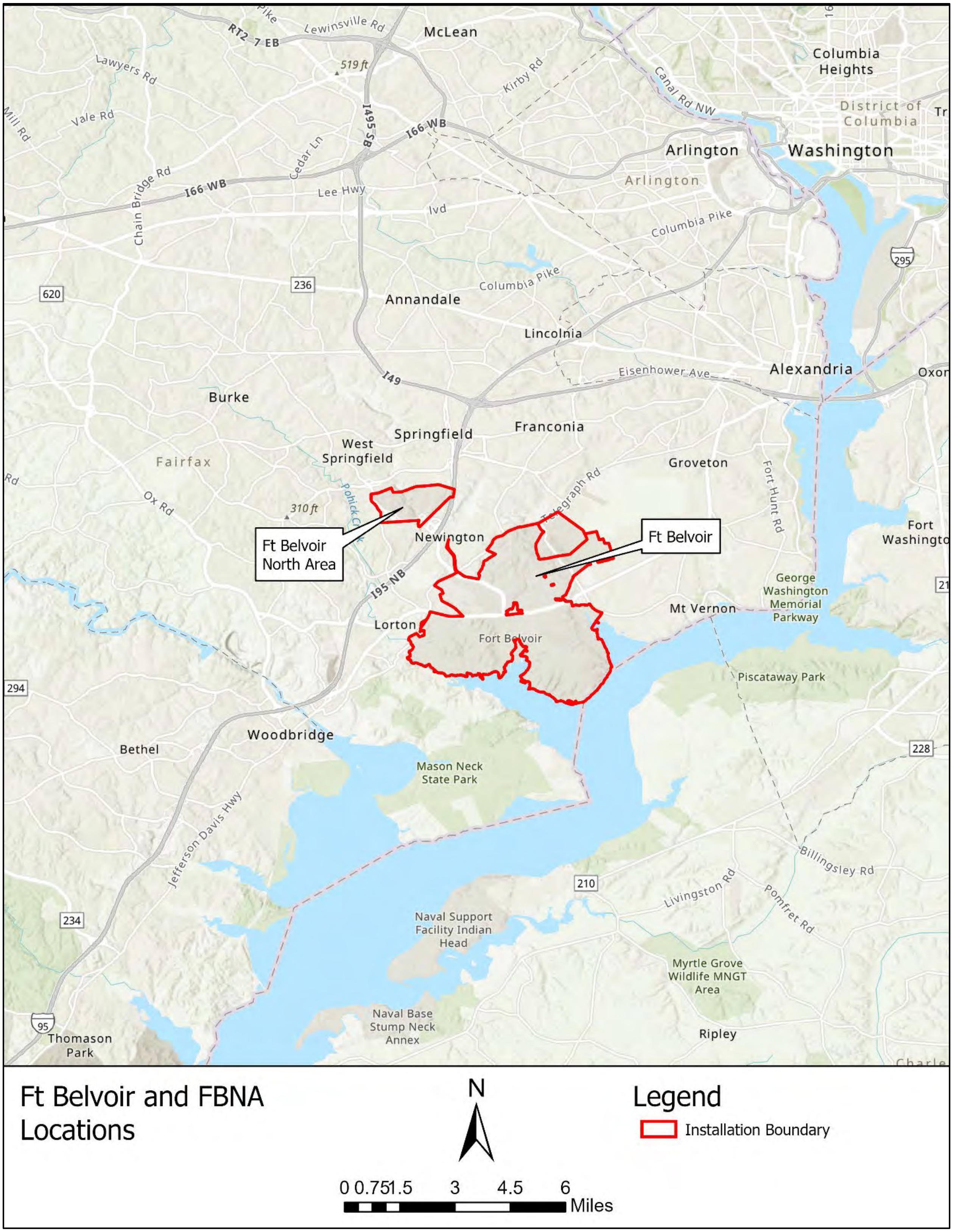

Figure 1-1: Location of Fort Belvoir and FBNA

The Proposed Action is needed to modernize logistical operations and address safety, security, and operational concerns specific to the distribution center and its administrative functions.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

Under the guidance provided in NEPA and in 32 CFR 651, either an EA or an Environmental Impact Statement (EIS) must be prepared for any major Federal action. Actions that are determined to be exempt by law, emergencies, or categorically excluded do not require the preparation of an EA or EIS. If an action may significantly affect the environment, an EIS would be prepared. An EA provides sufficient evidence and analysis for determining whether or not to prepare an EIS. An evaluation of the environmental consequences of the Proposed Action and the No Action Alternative includes direct, indirect, and cumulative effects, as well as qualitative and quantitative (where possible) assessment of the level of significance of these effects. The EA results in either a Finding of No Significant Impact (FNSI) or a Notice of Intent (NOI) to prepare an EIS.

The purpose of this EA is to inform decision makers and the public of the likely environmental consequences of the Proposed Action and No Action Alternative. This EA identifies, documents, and evaluates environmental effects of the construction and operation of a distribution center on FBNA in Springfield, Virginia. Environmental effects would include those related to construction and operation of the Proposed Action as well as impacts of increased personnel and traffic to FBNA. The Proposed Action and alternatives, including the No Action Alternative and other alternatives considered, are described in Section 2.0.

The existing conditions on FBNA are described in Section 3.0, *Affected Environment and Environmental Consequences*. These existing conditions, along with the No Action Alternative, serve as a baseline against which other alternatives will be measured to evaluate the effects of the construction and operation of the distribution center. The evaluation of cumulative impacts from the Proposed Action can be found in Section 4.0. The following resources are evaluated in this EA: land use; geology, topography and soils; water resources; biological resources; hazardous and toxic materials and waste (HTMW); utilities; noise; airspace; air quality; cultural and historic resources; traffic; and socioeconomics, environmental justice, and protection of children.

1.4 INTERAGENCY/INTERGOVERNMENTAL COORDINATION AND CONSULATIONS

1.4.1 Interagency Coordination and Consultation

Per the requirements of the Intergovernmental Cooperation Act of 1968 (42 United States Code [USC] 4231(a)) and Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, Federal, state, and local agencies with jurisdiction that could be affected by the Proposed Action will be notified during the development of a draft EA.

Early Input, or Scoping, is the early and open process used to solicit early comments on the Proposed Action so that comments can be considered and addressed in the draft EA.

An early input notice for this Proposed Action was advertised on 13 April 2022, and a virtual informational meeting was held on 19 April 2022 to provide additional information on the Proposed Action and ways for stakeholders and the public to submit early comments.

The early input notice was published in the Washington Post, the Connection Mount Vernon Gazette and Springfield, and the Washington Times. Comments were accepted via the project email FBNA@usace.army.mil and the project website, https://www.nab.usace.army.mil/FBNA/.

Appendix A contains the list of stakeholders and the public notified early for input.

1.4.2 Government to Government Consultations

EO 13175, *Consultation and Coordination with Indian Tribal Governments*, directs Federal agencies to coordinate and consult with Native American tribal governments whose interests might be directly and substantially affected by activities on Federally administered lands. Consistent with that EO and Department of Defense Instruction (DoDI) 4710.02, *Interactions with Federally Recognized Tribes*, Federally recognized tribes that are historically affiliated with the Fort Belvoir geographic region are invited to consult on all proposed undertakings that have a potential to affect properties of cultural, historical, or religious significance to the tribes. The tribal consultation process is distinct from NEPA consultation or the interagency coordination process, and it requires separate notification of all relevant tribes. The timelines for tribal consultation are also distinct from those of other consultations. The Native American tribal governments that were coordinated or consulted with regarding these actions are listed in Appendix A.

1.4.3 Other Agency Consultations

Per the requirements of Section 106 of the National Historic Preservation Act (NHPA) and implementing regulations (36 CFR 800); Section 7 of the Endangered Species Act (ESA) and implementing regulations; the Migratory Bird Treaty Act (MBTA); and Coastal Zone Management Act (CZMA); findings of effect and request for concurrence were transmitted to the Virginia Department of Historic Resources (VDHR) and the United States Fish and Wildlife Service (USFWS). Because the Proposed Action is located within Virginia's Coastal Zone, a consistency determination was drafted, and will be sent to the Virginia Coastal Zone Management Program for review (Appendix C).

Fort Belvoir also initiated consultation with the following agencies for the proposed project: Virginia Department of Wildlife Resources (VDWR), Virginia Department of Environmental Quality (VADEQ), Fairfax County Department of Planning and Development, and National Capital Planning Commission (NCPC).

Concurrence indicating a finding of no effect for the construction and operation of the distribution center was sent by the VDHR on 21 June 2022. On 22 February 2022, a report was generated through the Information for Planning and Consultation (IPaC) system, the USFWS online system for searching for species protected under the ESA, which notes that ten protected species have the potential to occur within the proposed project area.

Correspondence regarding the findings, concurrence, and resolution of any adverse impact is included in Appendix A.

1.5 PUBLIC AND AGENCY REVIEW OF THE DRAFT EA

A Notice of Availability (NOA) for the draft EA was advertised in the newspapers of record (listed below) announcing the availability of the draft EA for review. The NOA invited stakeholders and the public to review and comment on the draft EA. The scoping meeting presentation was updated and posted to the project website with a summary of analysis and results of the draft EA.

The NOA was published in the Washington Post, the Connection-Mount Vernon Gazette and Springfield, and the Washington Times. Electronic copies of the draft EA were made available for review on the project website, https://www.nab.usace.army.mil/FBNA, and on the Fort Belvoir Environmental webpage at https://home.army.mil/belvoir/index.php/about/Garrison/directorate-public-works/ environmental-division. The draft EA was also made available by request from Fort Belvoir, and hard copies were placed in the Fort Belvoir Library at 9800 Belvoir Rd, Fort Belvoir, VA 22060, and at the following Fairfax County Public Libraries:

- Kingstowne Library, 6500 Landsdowne Ctr, Alexandria, VA 22315
- Sherwood Regional Library, 2501 Sherwood Hall Lane, Alexandria, VA 22306
- Richard Byrd Library, 7250 Commerce St, Springfield, VA 22150

Comments received during the 30-day public review period will be addressed in the final EA, as appropriate. All coordination letters sent and responses received to date during the preparation of this EA are located in Appendix A.

1.6 ENVIRONMENTAL LAWS AND REGULATIONS

This draft EA has been prepared in accordance with the NEPA, as amended (Title 42 USC §4321 et seq.), NEPA-implementing regulations of the CEQ (40 CFR 1500–1508), and the Army's NEPA-implementing regulations at 32 CFR 651.

Army decisions that affect environmental resources and conditions occur within the framework of numerous laws, regulations, and EOs. Some of these authorities prescribe standards for compliance while others require specific planning and management actions to protect environmental values potentially affected by Army actions. Key provisions of appropriate statutes and EOs are described in more detail throughout the text of this EA and in Table 1-1.

Table 1-1: Compliance with Federal Environmental Statutes and Executive Orders

ACTS	Compliance
Archaeological Resources Protection Act (ARPA) of 1979	FULL
Army Regulation 200-1, Environmental Protection and Enhancement	FULL
Clean Air Act, as amended (42 United States Code [U.S.C.] ch. 85, subch. I §7401 et seq.)	FULL
Clean Water Act, as amended (33 U.S.C. ch. 23 §1151)	FULL
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. §9601 et seq.)	FULL
Endangered Species Act of 1973, as amended (16 U.S.C. ch. 35 §1531 et seq.)	FULL
Energy Independence and Security Act of 2007, Section 438	FULL
Farmland Protection Policy Act (7 U.S.C 4201)	FULL
Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e)	FULL
Migratory Bird Treaty Act (16 U.S.C §§703-712, et seq.)	FULL
National Environmental Policy Act of 1969 (42 U.S.C. §4321 et seq.)	FULL
National Historic Preservation Act of 1966, as amended (16 U.S.C. ch. 1A, subch.II §470 et seq.)	FULL
Noise Control Act of 1972, as amended (42 U.S.C. §§4901-4918, et seq.)	FULL
North American Wetlands Conservation Act (16 U.S.C. 4401-4412)	FULL
Resource Conservation and Recovery Act (42 U.S.C. ch. 82 §6901 et seq.)	FULL
Safe Drinking Water Act, as amended (42 U.S.C. §300f)	FULL
Sikes Act, as amended (16 U.S.C. 670a-670o)	FULL
Solid Waste Disposal Act of 1965, as amended (42 U.S.C 6901 et seq.)	FULL
Toxic Substances Control Act of 1976 (15 U.S.C. ch.53, subch. I §§2601-2629)	FULL
Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. §1101, et seq.)	FULL
Wild and Scenic Rivers Act (16 U.S.C. 1271, et seq.)	FULL
Executive Orders (EO)	Compliance
Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (EO 13990)	FULL
Floodplain Management (EO 11988)	FULL
Protection of Wetlands (EO 11990)	FULL
Environmental Justice in Minority Populations and Low-Income Populations (EO 12898)	FULL
Federal Compliance with Pollution Control Standards (EO 12088)	FULL
Protection of Children from Environmental Health Risks and Safety Risks (EO 13045)	FULL

Executive Orders (EO)	Compliance
Invasive Species (EO 13112)	FULL
Consultation and Coordination with Indian Tribal Governments (EO 13175)	FULL
Chesapeake Bay Protection and Restoration (EO 13508)	FULL

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2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Pursuant to the requirements of NEPA and the regulations for implementing NEPA promulgated by the CEQ (40 CFR 1500-1508) and 32 CFR 651, this section presents alternatives to the Proposed Action, including the No Action Alternative.

2.1 PROPOSED ACTION

The Proposed Action is to construct an approximately 525,000 square foot distribution center consolidated complex consisting of a high bay warehouse; two-story administrative building; truck maintenance/refueling building; covered/enclosed storage buildings; entry control facility, including gate house and vehicle inspection; emergency backup generator; and enhanced security measures along the fenceline, including a new fence, an approximately 30-foot clear zone around the fence, and a maintenance and patrol path. The distribution center expects minimal truck traffic compared to a typical industrial distribution center. The expected daily truck traffic flow is estimated to be about 640 cars and 12 trucks. The operational hours would typically be between 6am and 4pm.

2.1.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative is to construct a distribution center on FBNA in an existing professional/institutional area, keeping the same type of activity that already exists within the FBNA fence line. The proposed site location on FBNA is a forested area bordered to the west by the Fairfax County Parkway and to the east by Accotink Creek. A portion of the proposed site was previously used as former munitions training ranges. Figure 2-1 depicts the approximately 161-acre Proposed Action Site boundary.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, a distribution center would not be constructed or operated on FBNA.

Figure 2-1: Proposed Project Location on FBNA

2.3 OTHER ALTERNATIVES CONSIDERED BUT ELIMINATED

Analyses of alternative site locations were conducted for multiple government and commercial locations both inside and outside the NCR. The alternative sites discussed below were determined to not meet the purpose and need of the Proposed Action and were not further examined in this EA. A map showing the commercial and government sites that were considered within the NCR is shown in Figure 2-2.

2.3.1 Commercial Sites

A market survey report from April 2021 summarized the commercial sites for purchase that were analyzed for this Proposed Action. In total, 19 potential commercial sites were evaluated using the following screening criteria:

- Distance – should be ≤60-minute drive to Dulles International Airport and close to a military airport with sufficient runway length (11,000 feet);
- Zoning – should be zoned for commercial or industrial use;
- Infrastructure – should be available on site (or available to bring to site);
- Roadways – should be able to support traffic to/from the site;
- Floodplains – site should not be located within the floodplain; and
- Concerns regarding sale of the property – site may be undesirable or unavailable if it is ground lease only, has an unmotivated seller, or is under contract.

Of the 19 commercial sites evaluated, only two were considered "apparently suitable" – TerraBrite in Bristow, Virginia; and Prince William County Fairgrounds, Dumfries Assemblage, in Manassas, Virginia. These two sites were ultimately not carried forward in this EA because, in accordance with OMB Circular No. A-11, Appendix B guidance, joint site usage (a Federally owned site with similar Federal activities) was determined to be a better use of taxpayer resources, and mission partners are unknown for these sites.

2.3.2 Government Sites

In accordance with OMB guidance to use Federal sites, where feasible, at least 12 government sites on the east coast, both inside and outside the NCR, were considered for this project. Nine of these sites were screened from further consideration due to their distance from the NCR, distance from a railhead, and/or for not having at least 100 contiguous acres for project use. The remaining three government sites were FBNA; Quantico in Prince William County, Virginia; and Fort A.P. Hill in Caroline County, Virginia. Ultimately, Quantico and Fort A.P. Hill were screened from further consideration due to their distances to Dulles International Airport and their lack of mission partners.

Several other areas within FBNA were also considered; however, these sites were already slated for other uses in accordance with FBNA's draft Area Development Plan (ADP), and thus were not further analyzed in this EA.

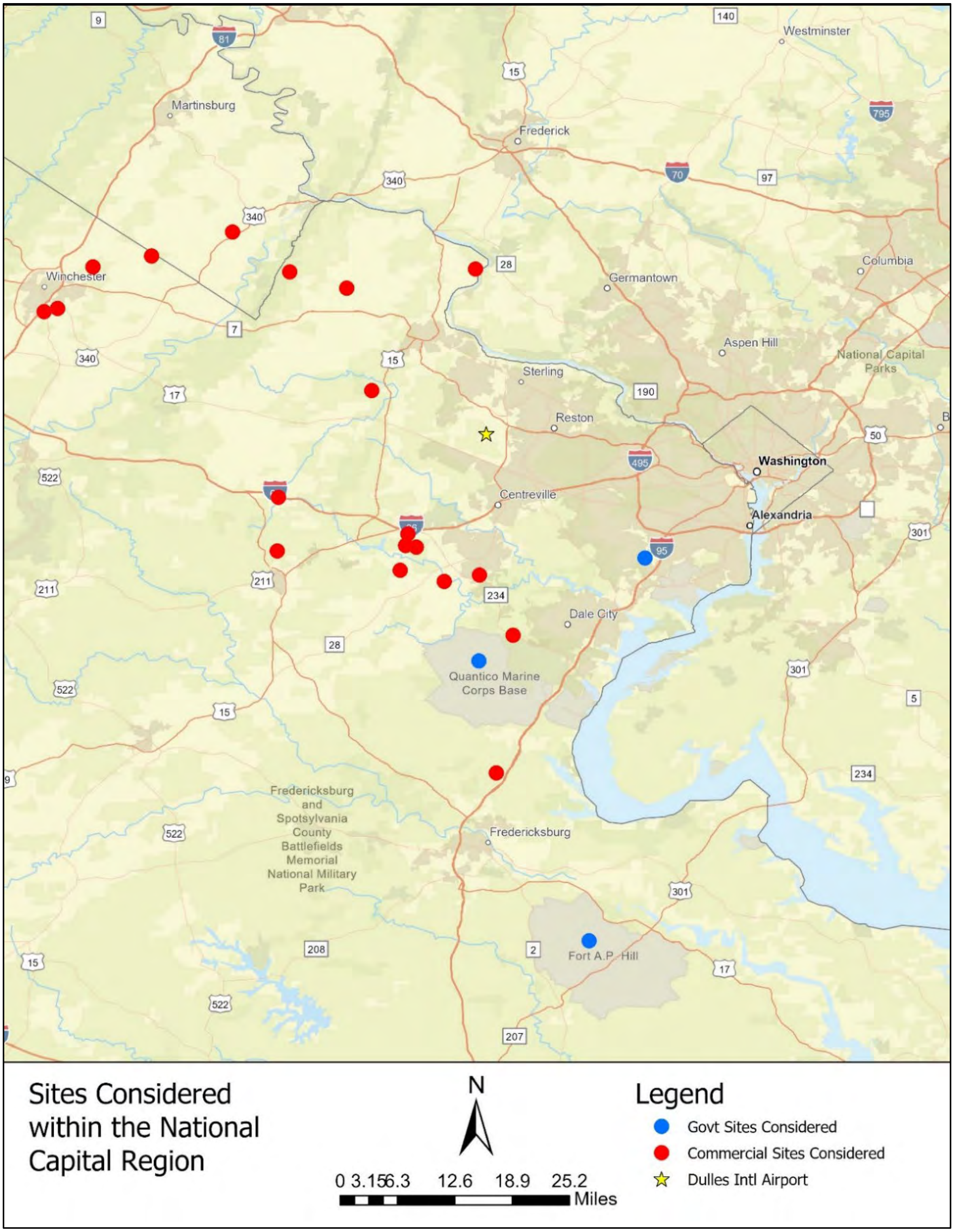

Figure 2-2: Project Sites Considered within the NCR

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 LAND USE

3.1.1 Affected Environment

FBNA, formerly known as the EPG, is an 804-acre noncontiguous property of Fort Belvoir that is located approximately 1.5 miles northwest of the Main Post. FBNA was acquired in the early 1940s for the testing of a wide range of military engineering equipment and supplies, including development of methods and equipment for the deployment, detection, and neutralization of landmines and explosives. FBNA was under the jurisdiction of the Army Research, Development, and Engineering Command and has undergone environmental investigation and remediation since the discontinuation of testing activities and the return of the property to Fort Belvoir in 1988 (U.S. Army, 2015). The Proposed Action Site, located west of Accotink Creek and north of Barta Road, was used for explosives and munitions training within former ranges 5, 5a, and 5b and explosive materials storage, located within the project boundary (USACE, 2021a).

Land use of the entire FBNA is classified as Professional/Institutional (U.S. Army, 2021). As part of the 2005 BRAC, NGA was relocated to the eastern side of FBNA and occupies approximately 62 acres between Accotink Creek and Interstate-95. Other facilities on FBNA include an emergency services center (fire station) located in the northeastern corner of the property north of Barta Road, a child development center for the NGA facility, and a remote inspection facility (RIF). The RIF is located on southwestern FBNA and includes parking areas, access control stations, and paved road surfaces.

The Proposed Action Site is situated on the west side of FBNA and is separated from the existing eastern facilities by Accotink Creek and from the RIF by Barta Road. Cissna Road traverses the southern area of the Proposed Action Site and an unpaved road connects Cissna Road north to the former ranges. Other than the former ranges and associated infrastructure, such as bunkers, the Site is relatively undeveloped with contiguous tracts of forested areas, tributaries, and associated wetlands. The Proposed Action is included in the final ADP for FBNA and is in accordance with the land use classification for the Site (U.S. Army, 2021).

3.1.2 Environmental Consequences

3.1.2.1 Threshold of Significance

Impacts on land use are analyzed based on the potential changes, caused by the Proposed Action, to land use designation.

3.1.2.2 Impacts of Proposed Action

The Proposed Action Site is situated within an area of FBNA designated as a Professional/Institutional land use zone. This land use generally includes non-tactical administrative functions, as well as some areas on post where research and development activities are concentrated (U.S. Army Garrison Fort Belvoir, 2015). Land use under the Proposed Action would be consistent with the current land use designation. Therefore, the Proposed Action would have no effect on land use, because no change to the site's current land use designation would be required for the Project.

3.1.2.3 Impacts of No Action Alternative

The No Action Alternative would have no effect on land use. The current land use would remain unchanged.

3.2 GEOLOGY, TOPOGRAPHY AND SOILS

3.2.1 Affected Environment

3.2.1.1 Geology

FBNA is located within the Piedmont geologic province, characterized by gently rolling topography with thick soils underlain by deeply weathered bedrock. In Virginia, the Piedmont province is bounded by the Blue Ridge Mountains to the west and the Fall Line, roughly demarcated by I-95, to the east. The underlying bedrock of the Piedmont is as much as 1,070 million years old and is comprised of rocks of sedimentary and metamorphic origins.

A finger of Piedmont Upland province bedrock extends from north to south along Accotink Creek, forming the bed and adjacent slopes of the creek that roughly bisects FBNA. Most of the more gently sloping areas to the east and west of the creek consist of unconsolidated sediment deposits typical of the Coastal Plain province found east of the Fall Line (U.S. Army, 2007).

3.2.1.2 Topography

The topography of FBNA is gently rolling, with steep slopes ranging from 20 to 30 percent grade forming a narrow valley along Accotink Creek (Figure 3-1). The Proposed Action Site is west of Accotink Creek, with elevations ranging from 150 to 300 feet above mean sea level (an approximate 4.1 percent slope), generally sloping down from northwest to southeast in the direction of Accotink Creek. Several ravines with streams that flow into Accotink Creek traverse the site.

3.2.1.3 Soils

There are 14 soil types within the Proposed Action Site (Figure 3-2, Table 3-1) that are comprised predominantly of Beltsville silt loam, 2 to 7 percent slopes, according to the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), soils map (USDA, 2022). The next most prevalent soil type is Sassafras-Marumsco complex, 15 to 25 percent slopes; followed by Glenelg silt loam, 2-7 percent slopes; and Nathalie gravelly loam, 7 to 15 percent

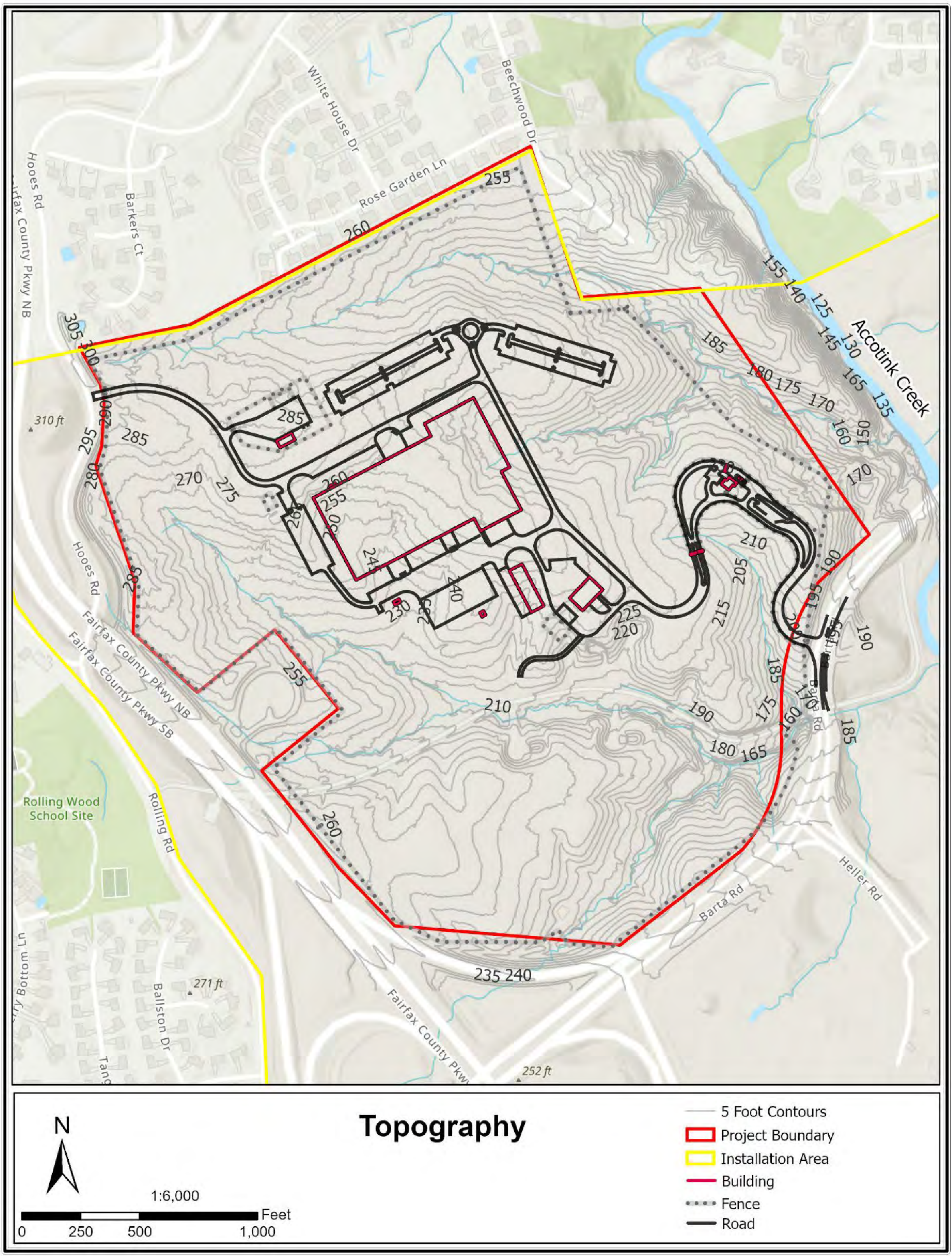

Figure 3-1: Topography

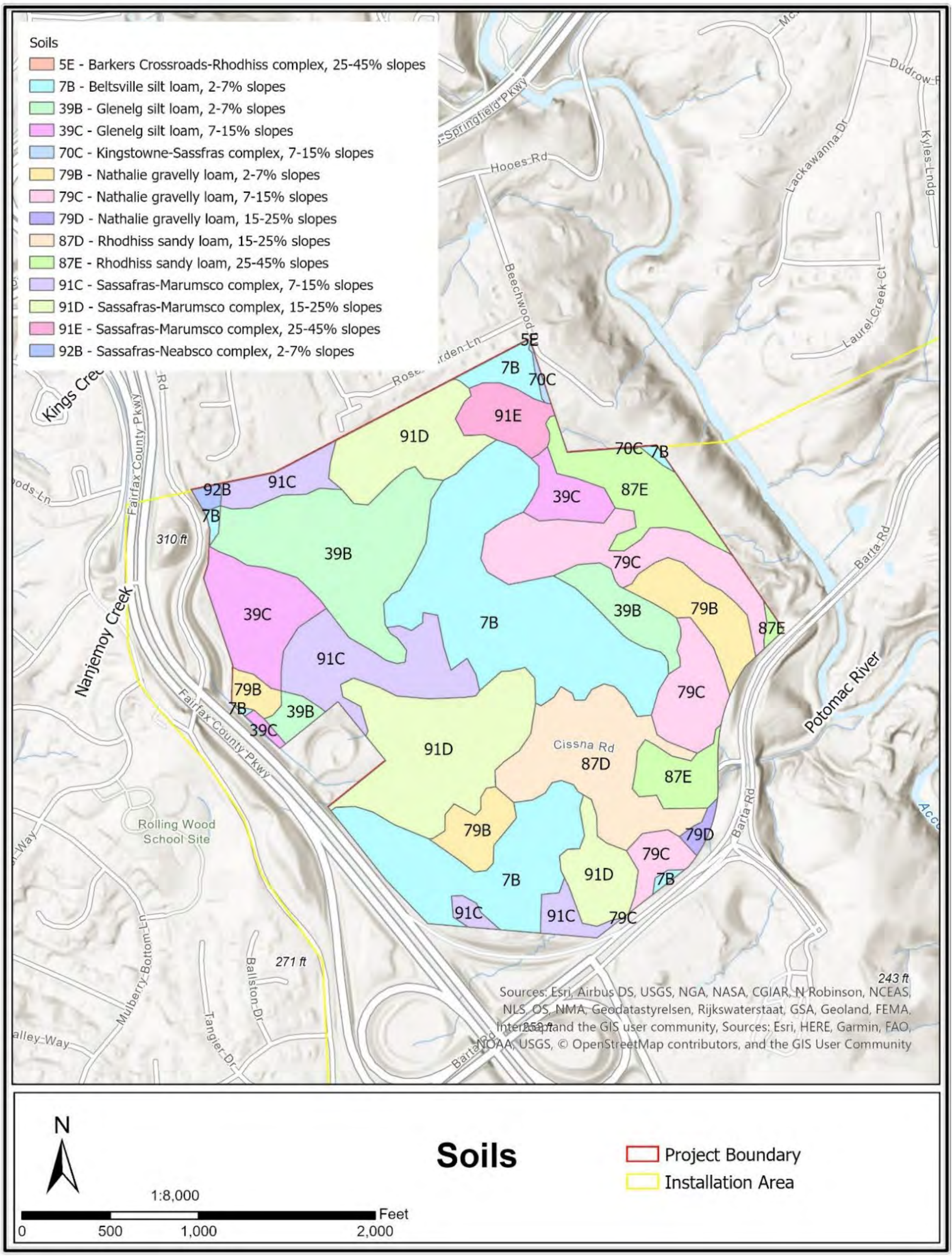

Figure 3-2: Soils

Table 3-1: Soil Types within the Proposed Action Site

Map Unit Symbol	Soil	Approximate acreage within Proposed Action Site	Drainage Class	Hydric
5E	Barkers Crossroads-Rhodhiss complex, 25 to 45% slopes	<0.1	Well Drained	No
7B	Beltsville silt loam, 2 to 7% slopes	38.8	Moderately well drained	No
39B	Glenelg silt loam, 2 to 7% slopes	20.6	Well Drained	No
39C	Glenelg silt loam, 7 to 15% slopes	9.8	Well Drained	No
70C	Kingstowne-Sassfras complex, 7 to 15% slopes	0.2	Well Drained	No
79B	Nathalie gravelly loam, 2 to 7% slopes	8.8	Well Drained	No
79C	Nathalie gravelly loam, 7 to 15% slopes	16.5	Well Drained	No
79D	Nathalie gravelly loam, 15 to 25% slopes	0.6	Well Drained	No
87D	Rhodhiss sandy loam, 15 to 25% slopes	12.1	Well Drained	No
87E	Rhodhiss sandy loam, 25 to 45% slopes	9.8	Well Drained	No
91C	Sassafras-Marumsco complex, 7 to 15% slopes	13.2	Well Drained	No
91D	Sassafras-Marumsco complex, 15 to 25% slopes	26.5	Well Drained	No
91E	Sassafras-Marumsco complex, 25 to 45 % slopes	3.5	Well Drained	No
92B	Sassafras-Neabsco complex, 2 to 7% slopes	0.4	Well Drained	No
Notes: Hydric criteria refer to the potential of a soil to support vegetation and/or hydric conditions indicative of wetlands. Source: NRCS, 2022				

slopes. All other soil types make up less than 10 percent of the Proposed Action Site. Soil types are moderately to well drained and are non-hydric.

3.2.2 Environmental Consequences

3.2.2.1 Threshold of Significance

Geology, topography, and soil impacts are evaluated separately in the following sections. The impacts on geology are analyzed based on potential changes, caused by the Proposed Action, to bedrock, unique sensitive landforms, or rock foundations. The impacts on topography are analyzed on potential changes to surface features, especially steep slopes. Impacts to soils are analyzed based on potential changes to soil type, erosion, and sedimentation due to the implementation of the Proposed Action.

3.2.2.2 Impacts of Proposed Action

Geology

The Proposed Action would have less-than-significant adverse impacts on underlying geology. While some excavation into the underlying bedrock would be required to establish the foundation for the two-story administrative building and single-story high bay warehouse, these actions would alter only a small area within the larger, regional landscape and would not alter the underlying geological characteristics.

Topography

The Proposed Action would have less-than-significant adverse effects on the topography of this site, and not result in the alteration or destruction of any unique or noteworthy topographic features within FBNA. Excavation and grading would be employed to prepare the site for construction, and the elevations would be permanently altered to support the buildings, the parking areas, and stormwater management system. The proposed buildings and parking areas would be located on the site's topographic highs and not within the steep slopes of the surface water drainages.

Soils

The Proposed Action would have short-term, less-than-significant adverse impacts on soils. Clearing of vegetation and grading and excavation of soils would cover approximately 30 acres within the project footprint. These actions expose soils and increase the potential for erosion. Because of the well-established connection between erosion of exposed soils and introduction of increased sedimentation into downstream waters, regulations have been enacted by federal, state and local governments to require project proponents to develop and implement plans to control site conditions and prevent erosion, and these regulations would be followed to minimize impacts. These regulations and the types of site control mechanisms are described in more detail in Section 3.3.1.6.

3.2.2.3 Impacts of No Action Alternative

Under the No Action Alternative, no impact on geology, topography or soils in the area would be expected, because no grading or other earthwork would occur.

3.3 WATER RESOURCES

3.3.1 Affected Environment

3.3.1.1 Surface Water

FBNA is located within the highly urbanized 52-square-mile Accotink Creek watershed, which ultimately discharges to Accotink Bay and the Potomac River. Accotink Creek roughly bisects

FBNA into eastern and western sections. Accotink Creek enters FBNA from the north at an elevation of approximately 120 feet above mean sea level and descends to an elevation of approximately 100 feet above mean sea level before exiting FBNA to the south. Steep slopes rise from both the eastern and western banks of Accotink Creek. The Accotink Creek Conservation Corridor was established in 2005 as a mitigation action associated with the 2005 BRAC Environmental Impact Statement Record of Decision and is a Special Natural Area that serves to protect the Accotink Creek riparian area on FBNA (U.S. Army, 2007). The Proposed Action Site is located within the northwestern half of FBNA, just west of Accotink Creek. Under preliminary design plans, a portion of the proposed roadway in the southeastern corner of the Proposed Action Site crosses into the Accotink Creek Conservation Corridor, where it connects to Barta Road (Figure 3-3).

The project area is predominantly forested with two unnamed tributaries that flow in a general west-to-east direction to their confluence with Accotink Creek off-site (Figure 3-4). The Fort Belvoir Integrated Natural Resources Management Plan (INRMP) (Fort Belvoir, 2017) has identified these areas as perennial streams with associated wetlands. The U.S. Army Corps of Engineers, (USACE) Baltimore District staff conducted a field survey on 9-10 October and 19-20 November 2021 to verify the location and size of the tributaries. The northern tributary (R1) consists of two branches beginning at wetlands on-site (Wetland 1) that flow into Accotink Creek. The southern tributary consists of six reaches (R2-7) beginning at Hooes Road to the northwest (R4), a Fairfax County Parkway stormwater pond to the west (R4), Fairfax County Parkway to the southwest and Barta Road to the south (R6), and Barta Road to the south (R7). These run west to east through the Proposed Action Site to R5, flowing under Barta Road and into Accotink Creek. A shorter reach, R8, begins north of R5 and connects east of the Proposed Action Site before Barta Road. The field study determined that the streams exhibited signs of recent erosion such as collapsed, unvegetated banks and steep incision, particularly as they progressed further downstream. Further information on these tributaries is found in Appendix B.

West of the Proposed Action Site is an approximate 2.1-acre fenced stormwater pond for Fairfax County Parkway. Reviews of historical aerial photography indicate that it was constructed between 2009 and 2010. The stormwater pond contains an outfall that connects to a pipe under the fence line and associated constructed berm, and then discharges to R4 of the southern unnamed tributary.

As discussed in Section 3.5, the former firing and training range resulted in the disposal of munitions and explosion debris within the project site and the contaminated area was designated as an area of potential concern (AOPC-21) (Arcadis, 2019). In March 2013, explosives and chlorinated solvent compounds were detected in surface water and sediment samples collected at AOPC-21 and included 1,3-dinotrobenzene, 2,4- dinitrotoluene (DNT), 2,6-DNT, 1-nitroso-3,5-dinitro-1,3,5-triazacyclohexane, 1,3,5-triazine (RDX), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), cis-1,2-dichloroethylene, and trichloroethylene (TCE). Long-term groundwater monitoring is ongoing at munitions site areas AOPC-21 and solid waste management units (SWMUs) M-32 and M-33 within the Proposed Action Site. Evaluation of potential risks associated with contaminated groundwater will be conducted based on the current monitoring results.

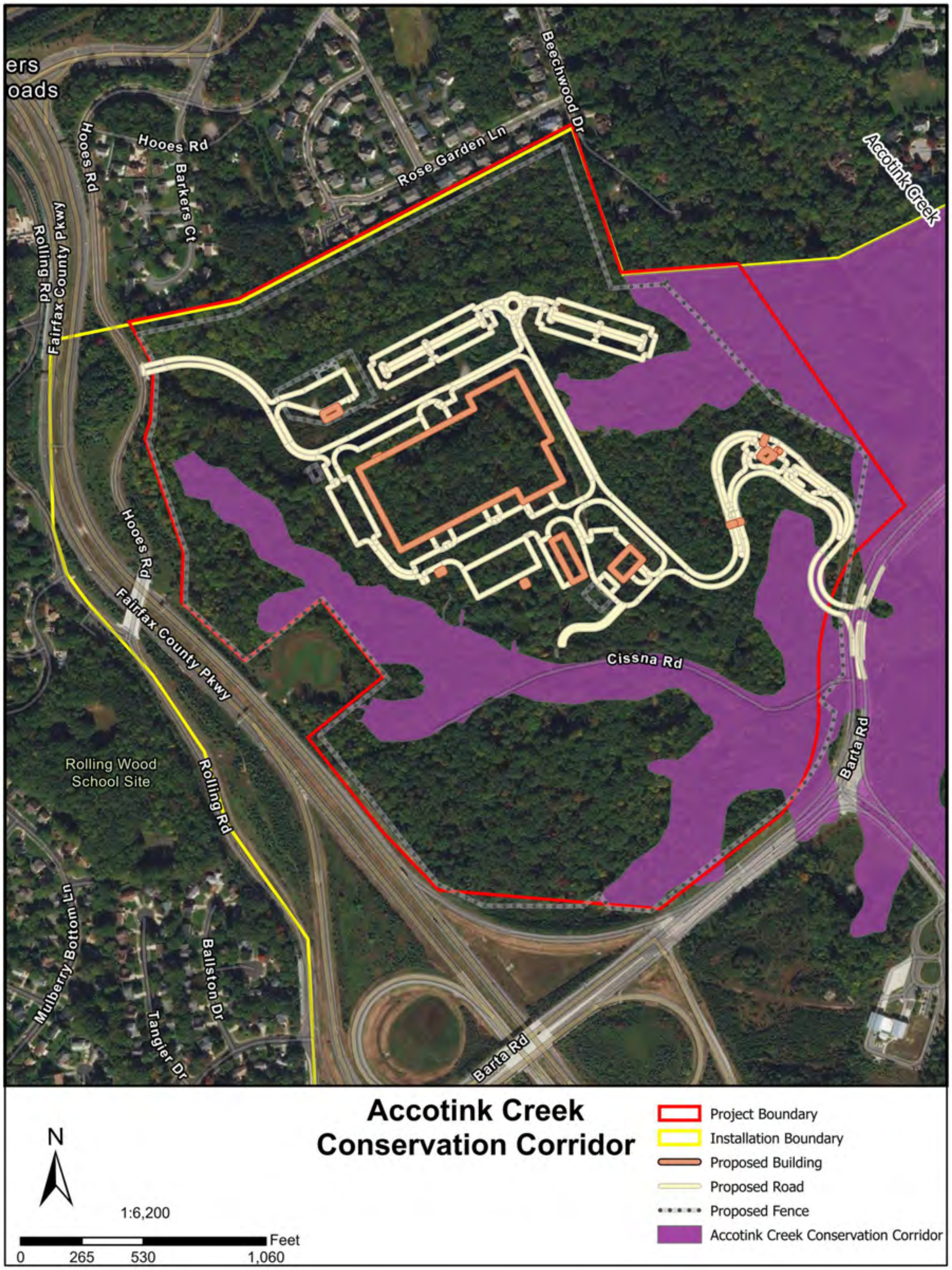

Figure 3-3: Accotink Creek Conservation Corridor

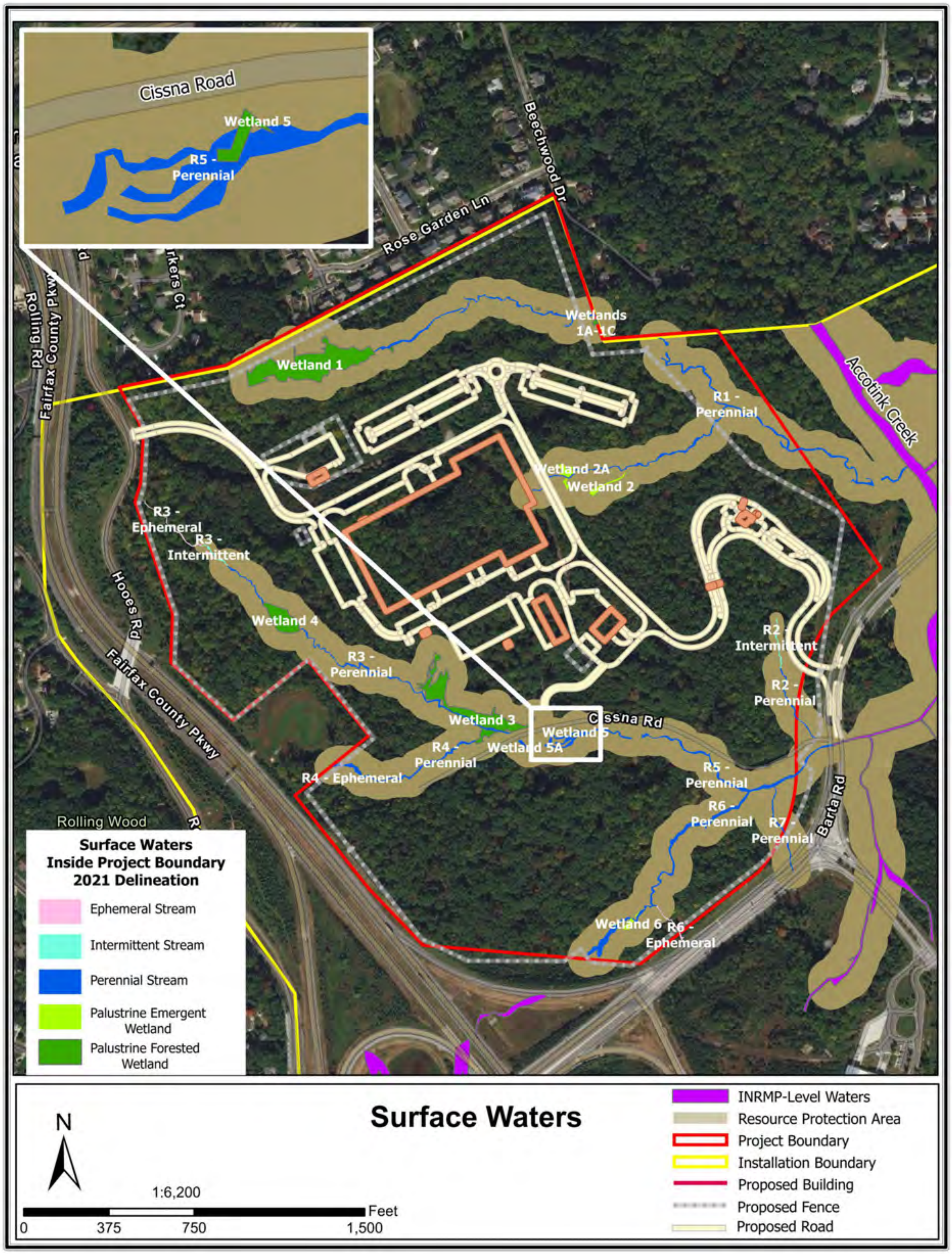

Figure 3-4: Surface Waters

The Accotink Creek watershed is 87 percent developed with commercial, industrial, transportation or residential land, with 28 percent of the non-tidal portion of the watershed covered by impervious surface (VADEQ, 2017). The quality of surface waters in such highly urbanized areas typically becomes degraded through increased amounts of sediments, chemicals, nutrients, and bacteria resulting from human activities. Pursuant to Section 303(d) of the federal Clean Water Act (CWA), which requires states to develop a list of impaired waterbodies, VADEQ has identified Accotink Creek as an impaired water based on biological monitoring of benthic macroinvertebrate communities. Section 303(d) of the CWA further requires states to take steps to halt or counteract degradation through development of Total Maximum Daily Load (TMDL) standards for specific pollutants. TMDLs target the load reduction needed to reduce the pollutants of concern and represent the total pollutant loading that a waterbody can receive without exceeding water quality standards. For Accotink Creek, TMDLs are under development for sediment and chlorides.

3.3.1.2 Resource Protection Areas

The two tributaries and associated wetlands in the Proposed Action Site are denoted as a Resource Protection Area (RPA) on Fort Belvoir's INRMP mapping. These features ultimately connect to Accotink Creek, which discharges to Accotink Bay, a tributary to the Potomac River and the Chesapeake Bay. Recognizing the Chesapeake Bay's critical role in the economy and health of the region and the importance of improving the health of the Bay, the State of Virginia's General Assembly adopted the Chesapeake Bay Preservation Act in 1988. The Act requires local governments within Tidewater Virginia to adopt implementing regulations that promote water quality protection measures. One of the key provisions of this Act requires the protection of vegetated riparian buffers, known as RPAs, no less than 100 feet wide located adjacent to and landward of all tidal shores, tidal wetlands, water bodies with perennial flow, and non-tidal wetlands connected by surface flow and contiguous to tidal wetlands along water bodies with perennial flow. In Fairfax County, where Fort Belvoir is located, the Chesapeake Bay Preservation Ordinance (CBPO) is the applicable local regulation. Fort Belvoir recognizes the RPA designation, but as a federal entity is not subject to the provisions of the Fairfax County ordinance. While Fort Belvoir does not use the RPA maps produced by Fairfax County, the Army does delineate RPAs on the installation, reflecting a spirit of compliance with the state and local requirements. Further, as part of the INRMP, Fort Belvoir designates a 35-foot RPA buffer for intermittent streams.

Establishing an RPA serves to limit adverse effects of development adjacent to streams and tidal wetlands by preserving vegetated buffers around sensitive aquatic resources. Vegetated buffers provide additional surface area for attenuation of surface water run-off velocity, thereby reducing erosion; filtration of excess nutrients and other pollutants carried by stormwater; and additional habitat corridors. Development in these areas should be avoided and/or minimized. When impacts occur, an additional review is conducted to determine the extent of impact, as well as mitigation for the RPA infringement. Mitigation for RPA impacts typically includes the replanting of trees and/or shrubs at a predetermined ratio or the enhancement of a degraded RPA elsewhere on Fort Belvoir. RPAs are typically addressed during the wetland permitting process or the CZMA federal consistency determination process.

It should be noted that EO 13508, *Chesapeake Bay Protection and Restoration*, must be addressed in terms of the Army's obligation to consider the protection and restoration of the Chesapeake watershed in terms of meeting the goals, outcomes and objectives set out in the Strategy for Protecting and Restoring the Chesapeake Bay Watershed. This document not only sets goals/outcomes/objectives of the federal government, but encourages coordination with state, local, and non-governmental partners to protect and restore the health of the Chesapeake Bay Watershed.

3.3.1.3 Floodplains

One-hundred-year floodplains on Fort Belvoir are protected under EO 11988, *Floodplain Management* (May 24, 1977), which directs federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The EO was issued in furtherance of NEPA, the National Flood Insurance Act of 1968, and the Flood Disaster Protection Act of 1973. Floodplains are defined in EO 11988 as the "lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." Additionally, EO 13690, *Establishing a Federal Flood Risk Management Standard and Process for Further Soliciting and Considering Stakeholder Input*, was reinstated in 2021. The EO established the Federal Flood Risk Management Standard, which is a flexible framework to increase the resilience against flooding and help preserve the natural values of floodplains.

As a federal agency subject to these EOs, Fort Belvoir is required to evaluate potential effects of any action occurring in a floodplain. The Proposed Action Site is located outside of the 100-year floodplain associated with Accotink Creek (Figure 3-5).

3.3.1.4 Wetlands

USACE defines wetlands as "those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328). Important wetland functions include water quality improvement, groundwater recharge and discharge, storm water attenuation and storage, sediment detention, fish and wildlife habitat, and erosion protection.

EO 11990, *Protection of Wetlands* (May 24, 1977), requires Federal agencies to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Under this EO, if wetlands are impacted by the Proposed Action, a Finding of No Practicable Alternative (FONPA) should be utilized to describe the proposed action, discuss its effect on the floodplain/wetland, and describe the alternatives considered. Construction in jurisdictional wetlands and waters of the United States is regulated by the USACE pursuant to Section 404 of the CWA as implemented in regulations contained in 33 CFR 320–330.

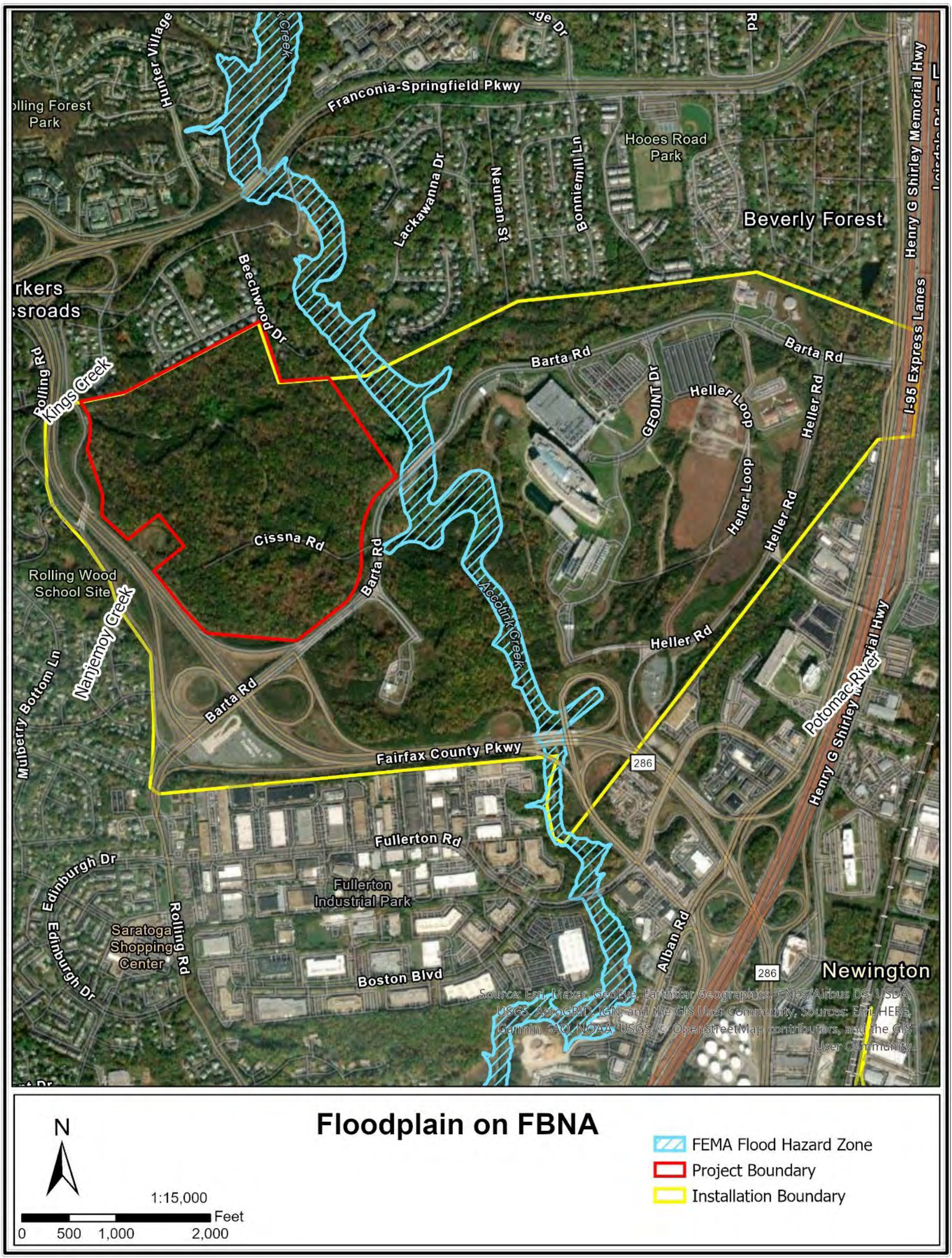

Figure 3-5: Floodplains

Impacts on state waters, including wetlands, are regulated by the Virginia Water Protection Permit Program (9 Virginia Administrative Code [VAC] 25-210-10 et seq.), which serves as Virginia's 401 Water Quality Certification Program for federal Section 404 Permits.

The predominant wetland type on Fort Belvoir is Palustrine Forested wetland, which tends to occur in association with the riparian areas of Accotink, Dogue, and Pohick Creeks. Wetlands generally occur along the perennial and intermittent streams that are drainages of these creeks (U.S. Army Garrison Fort Belvoir, 2015). The Fort Belvoir INRMP (Fort Belvoir, 2017) designated Palustrine Forested and small Palustrine Scrub-Shrub wetlands within the Proposed Action Site. Mapping of potential resources under the INRMP makes general assumptions based on a review of aerial photography; thus, a wetland delineation was conducted by USACE Baltimore District Staff on 9-10 October and 19-20 November 2021 pursuant to the 1987 *Corps of Engineers Wetland Delineation Manual* and the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region*. Six wetlands were delineated within the Proposed Action Site, amounting to approximately 2.33 acres. The wetlands are described below, and additional information is found in Appendix B

Wetland 1 is a riparian, forested wetland that forms the headwaters of the unnamed, perennial tributary that discharges to Accotink Creek off-site to the east of the Proposed Action Site. The wetland borders merge into the narrow banks of the stream, which becomes progressively more incised as it travels downstream. This wetland is classified as Palustrine Forested with broad-leaved deciduous vegetation and a temporary flood regime. Dominant vegetation includes blackgum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and bitternut hickory (*Carya cordiformis*) in the canopy, musclewood (*Carpinus caroliniana*) and sweetgum (*Liquidambar styraciflua*) in the understory, and cinnamon fern (*Osmundastrum* cinnamomeum) and Japanese stiltgrass (*Microstegium vimineum*) in the herbaceous layer.

Wetland 2 is a Palustrine Emergent wetland with persistent vegetation and a flood regime classified as seasonally flooded/saturated. The dominant vegetation observed included Japanese stiltgrass, false nettle (*Boehmeria cylindrica*), New York fern (*Thelypteris noveboracensis*), *Carex* spp. and common greenbrier (*Smilax rotundifolia*). The hydrology of this small wetland appears to originate from a hillside seep, which is a common wetland type found within Fort Belvoir. The groundwater daylights in the depression upslope from the relic roadbed, then flows downslope along its compacted surface. Although hydric soil characteristics are noted in the near-surface layers and hydrophytic vegetation predominates, there lacks a distinct and discrete discharge feature to the incised stream located to the north and downslope from this wetland.

Wetland 3 is classified as a Palustrine Forested wetland with broad-leaved deciduous vegetation and a temporary flood regime. Wetland 3 is a slope wetland that discharges into an unnamed tributary to Accotink Creek. The dominant canopy species observed was highbush blueberry (*Vaccinium corymbosum*). Dominant understory vegetation observed was sensitive fern (*Onoclea sensibilis*), deer tongue (*Dichanthelium clandestinum*) and common greenbrier.

Wetland 4 is classified as a Palustrine Forested wetland with broad-leaved deciduous vegetation and a temporary flood regime. Wetland 4 is a riparian wetland located further upstream of Wetland

3's discharge point into the same unnamed tributary. The dominant canopy species observed were sweet gum, red maple, white oak and tulip poplar (*Liriodendron tulipifera*). The dominant understory vegetation consists of American holly (*Ilex opaca*) and highbush blueberry, and the herbaceous layer was dominated by cinnamon fern, southern lady fern (*Athyrium asplenioides*), whorled wood aster (*Oclemena acuminata*) and common greenbrier.

Wetland 5 is classified as a Palustrine Forested wetland with broad-leaved deciduous vegetation and a temporary flood regime. Wetland 5 is a riparian wetland that drains into the unnamed tributary to Accotink Creek downstream (south) of the culvert crossing under Cissna Road. The canopy dominant species observed was tulip poplar with sweet gum and American holly in the sapling layer. The dominant understory species observed were Japanese stiltgrass, New York fern, soft rush (*Juncus effusus*), three-way sedge (*Dulichium arundinaceum*) and clearweed (*Pilea pumila*).

Wetland 6 is classified as a Palustrine Emergent wetland with persistent vegetation and a temporary flood regime (PEM1A). This small, depressional wetland is located adjacent to an unnamed tributary to Accotink Creek. The dominant vegetation observed was Japanese stiltgrass, mountain laurel (*Kalmia latifolia*) and highbush blueberry.

3.3.1.5 Groundwater

The groundwater on FBNA is located approximately 10 to 20 feet below the surface and follows the surface water drainage of the area (U.S. Army, 2007). In the Proposed Action Site, groundwater discharges to the surface water drainage of the unnamed tributaries and Accotink Creek.

Groundwater monitoring wells were installed and sampled as part of ongoing investigation and clearance activities at the former explosives and training ranges (Range 5, 5a, and 5b) located at the Proposed Action Site.

Initial groundwater sampling at AOPC-21 in Former Range 5 detected concentrations of TCE, RDX, and 2,4-/2,6-DNT (Arcadis, 2019) and identified them as groundwater constituents of concern (COCs). The removal of contaminated soil and Munitions and Explosives of Concern (MEC) materials has prevented the further leaching of contaminants into the groundwater, but elevated levels of RDX and 2,4-DNT/2,6-DNT remain. Groundwater sampling also detected COCs of RDX, 2,4-DNT/2,6-DNT at M-32 and M-33 at Former Range 5a (Arcadis, 2021). The contaminated sites are actively managed in conjunction with the lead regulatory agencies, VADEQ and USEPA, through groundwater use restrictions and groundwater sampling. Additional information about the investigations and clearance activities is found in Section 3.5.

3.3.1.6 Stormwater

The Proposed Action Site is located within the Accotink Creek watershed. There are no existing stormwater management structures within the Proposed Action Site (U.S. Army, 2021). Stormwater is directed by existing topography and drains downhill to the unnamed, perennial tributaries and eventually into Accotink Creek. Stormwater flow is primarily surface flow, with some shallow sub-surface movement. There is a 2.1-acre stormwater pond to the west of the Proposed Action Site that discharges stormwater to the tributary in the south side of the Site.

Stormwater runoff in urban areas is one of the leading sources of water pollution in the United States. Recognizing the importance of controlling stormwater generated from development, federal, state and local governments have adopted requirements. The following regulations apply:

Federal Requirements

- National Pollutant Discharge Elimination System (NPDES) - Section 402 of the Federal CWA, known as the NPDES program, requires permits for the discharge of pollutants from point sources and is administered by VADEQ through its Virginia Stormwater Management Program (VSMP). Fort Belvoir operates a municipal separate storm sewer system (MS4) for the entirety of the installation (including FBNA) pursuant to the NPDES regulations, and discharges stormwater runoff under VPDES Stormwater Permit No. VAR040093. Stormwater runoff generated by development on FBNA, including the Proposed Action, would be included under the installation-wide permit, provided the proponent comply with its terms and conditions and coordinate with the appropriate personnel on Fort Belvoir.

- Energy Independence and Security Act (EISA), Section 438 – federal projects 5,000 square feet in size or greater are required to maintain or restore pre-development hydrology. Guidance provided by the USEPA promotes retaining rainfall on-site through infiltration, evaporation/transpiration, and re-use to the same extent as occurred prior to development. Section 438 requires that practices known as low impact development (LID) or green infrastructure, including reducing impervious surfaces and using vegetative practices, porous pavements, cisterns and green roofs be incorporated into development plans https://www.epa.gov/sites/production/files/2015-09/documents/eisa-438-factsheet.pdf.

- LID is a stormwater management approach that emphasizes the retention of native vegetation and soils, reduces runoff, and seeks to approximate predevelopment hydrologic conditions. LID provides an effective alternative to more traditional stormwater management approaches that rely on engineered structures. When properly used, LID can be cost effective by reducing the reliance on hard structures. It can make more efficient use of land resources by reducing the need for large, centralized stormwater basins, decreasing the total amount of runoff generated, and providing water-quality improvements (HDR, 2020).

State (Virginia) Requirements (VADEQ)

- Stormwater Management Act (9VAC25-870)
    - General Permit for Discharges of Stormwater from Construction Activities
    - Virginia BMP Clearinghouse

    - Virginia Runoff Reduction Method
- Erosion and Sediment Control Law (9VAC25-840)
    - Erosion and Sediment Control Plan
    - Virginia Erosion and Sediment Control Handbook
- Chesapeake Bay Preservation Area Designation and Management (9VAC25-830-130)
    - Construction activities disturbing one or more acres, requires:
    - General Permit for the Discharge of Stormwater from Construction Activities
        - Stormwater Pollution Prevention Plan (SWPPP), developed by the project proponent, requires stormwater management measures as included in the approved site plan, and demonstration of how these measures would be maintained, identifying the responsible entity throughout duration of construction.

Installation Requirements

- The Fort Belvoir Directorate of Public Works (DPW) reviews all construction site plans involving 2,500 square feet or more of earth disturbance for compliance with the installation's MS4 conditions, state requirements for stormwater management and erosion/sediment control, and the Fairfax County Public Facilities Manual.

3.3.1.7 Coastal Zone

The CZMA of 1972 (16 USC §1451 et seq., as amended) provides assistance to the states, in cooperation with federal and local agencies, for developing land and water use programs in coastal zones. Section 307(c)(1) of the CZMA Reauthorization Amendment stipulates federal projects that affect land uses, water uses, or coastal resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of that state's federally approved coastal management plan. The Commonwealth of Virginia has developed and implemented a federally approved Coastal Resources Management Program (CRMP) describing current coastal legislation and enforceable policies. There are enforceable policies for:

- Fisheries management
- Subaqueous lands management
- Wetlands management
- Dune management
- Non-point source pollution control
- Point source pollution control
- Shoreline sanitation
- Air pollution control
- Coastal lands management

Virginia's Coastal Zone includes all of Fairfax County, including Fort Belvoir; therefore, federal actions at Fort Belvoir are subject to federal consistency requirements. The VADEQ serves as the lead agency for consistency reviews. The Proposed Action Site is characterized as previously disturbed, with a gravel parking lot, unpaved and paved roads, and areas of forest, wetlands, and grass/shrub groundcover. While there are streambanks adjacent to the Proposed Action Site, there is no coastline present, nor dunes.

3.3.2 Environmental Consequences

3.3.2.1 Threshold of Significance

The threshold of significance for water resource and surface water quality impacts would be exceeded if a proposed action would result in changes to regional groundwater patterns or depletion of groundwater, substantial alteration of local surface water, or substantial degradation of water quality. The threshold of significance for wetlands, RPAs, and floodplains would be exceeded if a proposed action would result in substantial degradation of wetlands without mitigation, and notable adverse impact on natural and beneficial floodplain values.

For coastal zone resources, the threshold of significance would be exceeded if a proposed action would not be consistent with the federal coastal zone policy, including consideration of the following:

- Substantial impacts of a proposed action on any land or water use or natural resource of the coastal zone;
- Substantial incremental impacts of a proposed action on any land or water use or natural resource of the coastal zone when added to past, present, and reasonably foreseeable future actions; and,
- Collective impacts of individual unrelated actions on any land or water use or natural resource of the coastal zone.

3.3.2.2 Impacts of Proposed Action

<u>Surface Waters and RPAs</u>

Implementation of the Proposed Action would result in less-than-significant adverse impacts on surface water. The Proposed Action includes the construction of roadways and parking features, which could involve minimal construction in, on, or over surface waters (i.e., wetlands or streams) and the Accotink Creek Conservation Corridor and could result in the disturbance, alteration, or filling of the adjacent RPAs in multiple areas within FBNA. The proposed roadway on the east side of the proposed warehouse and administrative building would potentially require a culvert crossing over stream R1. The crossing would be located where the southern branch of R1 emerges, upstream of Wetlands 2 and 2A and of the hillside seep. The culvert crossing would impact less than 0.002-acre of stream R1 and would not alter the stream course. The proposed roadway entering the project site from Barta Road would be constructed through a portion of the RPA for R2, but would not cross the stream itself; however, it would overlap with the Accotink Creek Conservation Corridor. A proposed parking feature south of the proposed warehouse and administrative building would be constructed slightly within the RPA for perennial stream R3.

The Proposed Action also includes the installation of a perimeter security fence, which could involve minimal construction in, on, or over surface waters and could result in the disturbance, alteration, or filling of the adjacent RPAs in multiple areas within FBNA. Short-term, less-than-significant adverse effects would result from the destabilization of the soils within the limits of disturbance as a result of vegetation clearing and excavation/grading to prepare the site. This stage of construction exposes soils and increases the potential for erosion and discharge of sediment-laden stormwater to downstream receiving waters; however, appropriate erosion and sediment control measures would be implemented, pursuant to the construction SWPPP and the VSMP Construction General Permit and would minimize any detrimental effects.

Construction of permanent stormwater management features would capture stormwater generated from the development and be designed to maintain pre-development levels of off-site discharge. It is expected that the overall effects of construction and operation of the buildings and parking features would be beneficial to downstream receiving waters by stabilization of soils through vegetation and retention and treatment of stormwater flows. Currently, there are no such downstream stormwater management features, resulting in channeling and erosion of soil, particularly associated with the more steeply sloped portions of the Proposed Action Site.

Through the site layout design process, all practicable steps would be made to avoid inclusion of the unnamed tributaries to Accotink Creek, and associated RPAs, within the limits of disturbance (LOD). Unavoidable crossings of the Accotink Creek Conservation Corridor would be mitigated through incorporation of one or any combination of the following: on-site tree planting mitigation or stream buffer enhancement vegetation planted elsewhere on FBNA along the Accotink Corridor; oversized box culverts for wildlife crossings with grates to allow for light to assist in wildlife crossing; streamside management zones; storm drains; bioretention and infiltration ponds; or green roofs, permeable pavements, and vegetated swales. Any work within the stream and RPA, as necessary to construct roadways, parking features, and security fencing would be appropriately permitted through USACE Regulatory and the Commonwealth of Virginia. Activities during construction would include appropriate best management practices (BMPs) to minimize sediment transport and erosion consistent with state and federal land and water quality criteria.

Wetlands

Implementation of the Proposed Action under the current conceptual plan, the project would avoid wetlands and have less-than-significant adverse impacts. However, there are approximately 2.33 acres of mapped wetlands within the project, and since the project plans are in the early stages of development, the project would continue to avoid these wetlands by relocating the perimeter fence alignment or have the fence traverse over the stream and associated wetland. Prior to construction, any unavoidable impacts would be permitted through USACE Regulatory and Commonwealth of Virginia's wetland permitting programs. Stormwater generated from within the project site during construction would be appropriately managed through erosion and sediment control measures required through the permitting process, preventing adverse effects of sedimentation on downstream receiving waters that include wetlands. Permanent stormwater management features would maintain pre- development levels of stormwater discharge.

Groundwater

Under the Proposed Action, no adverse effects are expected to occur to groundwater. Construction of the Proposed Action would result in an increase of impervious surface area, reducing the infiltration of stormwater into the shallow, near-surface aquifer. Due to residual groundwater contamination within the project footprint, stormwater management features for the Proposed Action would be required to control and redirect stormwater volume on site to minimize near field infiltration into subsurface groundwater.

Floodplains

Under the Proposed Action, no adverse effects are expected to occur on floodplains. The Proposed Action is not located within a floodplain.

Coastal Zone

Construction and operation of the Proposed Action would be consistent with Virginia's CRMP. Less-than-significant adverse impacts are anticipated under the current design plans; should any impacts on streams occur, they would be mitigated through contributions to habitat restoration at the installation's mitigation sites. Non-point source pollution would be managed through the use of temporary erosion and sediment control measures defined in an approved Erosion and Sediment Control plan or permanent stormwater management BMPs, as appropriate.

Fort Belvoir has determined that the Proposed Action would be consistent, to the maximum extent practicable, with the CRMP's enforceable policies, as described in Appendix C. State review and concurrence with the negative determination would be requested prior to initiating the Proposed Action.

Stormwater

Under the Proposed Action, less-than-significant adverse effects on stormwater would occur. The Proposed Action would add approximately 23.6 acres of impervious area within the Accotink Creek watershed, resulting in an increase in stormwater volume from impervious surfaces that could cause an increase in erosion and sedimentation if not appropriately controlled. The Proposed Action would meet all applicable stormwater management regulations, ensuring consistent and measurable steps to minimize detrimental impacts to water quality in downstream waters. As stated earlier, approximately 87 percent of land (45 square miles) within the watershed is developed, while approximately 28 percent (14 square miles) is covered by impervious surfaces. In the context of this 52-square mile watershed in central Fairfax County, which encompasses all of FBNA, this increase would be minimal and be reduced by stormwater management strategies. Petroleum pollutants from the exposed surfaces of the paved roadways and parking features would be treated through vegetated buffers and stormwater management structures.

Because the project is located within a Chesapeake Bay Preservation Area and would disturb more than 2,500 square feet, the construction contractor would be required to prepare an erosion and sediment control plan in compliance with the Virginia Erosion and Sediment Control Law (9 VAC 25-840) and in conformance with the Virginia Erosion and Sediment Control Handbook, Third Edition, 1992. The plan would be submitted to Fort Belvoir's Stormwater Permit Manager for review and approved by VADEQ's Northern Regional Office, and routine inspections would be conducted throughout construction to ensure compliance with these permits. The contractor would also obtain a Construction General Permit and prepare and implement a construction SWPPP to minimize sedimentation to downstream receiving water bodies.

This project and any construction activities associated with it has the potential to discharge pollutants in surface waters to a monitored/permitted Industrial Stormwater Outfall (ISW RO-031 and RO-032). This outfall is continually monitored for Total Suspended Solids (TSS), Total Petroleum Hydrocarbons (TPH), chloride, specific conductance, nitrogen and phosphorous, along with other constituents; therefore, any uncharacteristically high sediment content in the stormwater discharge detected at sampling could result in a violation of the VA0092771 permit. The construction contractor must contact Fort Belvoir DPW's Industrial Stormwater Section when construction begins and ends, so that precautions can be employed in the course of routine permit-required sampling events for this outfall. Construction as-builts of the new stormwater system would be required and must also be submitted to DPW's Environmental Division.

Construction BMPs would be implemented in accordance with federal, state, and local Fort Belvoir regulations, including Fort Belvoir's MS4 Program and VPDES Permit VA0400093, to protect downstream waters from sediment migration by ensuring adequate perimeter controls and buffers are used, including silt fencing, synthetic hay bales, and similar measures. While these measures would not entirely eliminate the potential for erosion and sedimentation, they would ensure that short-term adverse impacts remain negligible.

Use of appropriate erosion and sediment control measures and long-term LID measures would ensure that neither the construction nor the operation of the Proposed Action would contribute to further degradation of water quality or exceed TMDLs established for Accotink Creek as regulated under Section 303(d). Therefore, short-term and long-term impacts on surface water quality on and in the vicinity of FBNA would be negligible.

3.3.2.3 Impacts of No Action Alternative

Under the No Action Aternative, less-than-significant adverse effects would occur on surface water because existing conditions at the Proposed Action Site would remain. There would be no man-made alteration of the current pattern of surface water flows across and discharging from the area. The recent erosion observed within the Accotink Creek tributaries such as collapsed, unvegetated banks and steep incision would likely continue to experience further downcutting, contributing to sediment loads downstream. There would be no alteration or construction within the RPA.

The No Action alternative would not impact jurisdictional wetlands, groundwater, floodplains, coastal zone or stormwater on FBNA. Runoff would continue to discharge with no enhanced treatment for volume, velocity or sedimentation downstream to tributaries of Accotink Creek and associated floodplain wetlands that are located beyond the area.

3.4 BIOLOGICAL RESOURCES

Located on the western shore of the Potomac River, within the larger metropolitan area of Washington, D.C., Fort Belvoir sustains its military mission while maintaining relatively large areas of native vegetation in terms of size, diversity and regional position. Fort Belvoir has recognized the ecological importance of its natural habitats by designating three refuges, two biological corridors, wetlands and steep-sloped areas as environmentally constrained areas (Fort Belvoir, 2017). These large areas of native vegetation afford a contiguous band of wildlife habitat within and extending outside of the installation. Fort Belvoir's natural resources management strategy, outlined in its INRMP, prioritizes preserving the native diversity of communities and species within communities and implements an ecosystem-based natural resources management program based in part on DoD Instruction 4715.3, *Natural Resources Conservation Program* and Army Regulation 200-1, *Environmental Protection and Enhancement*, to guide development on Fort Belvoir.

The Accotink Bay Wildlife refuge, Jackson Miles Abbott Wetland Refuge, T-17 Refuge, Accotink Creek Conservation Corridor, and Forest and Wildlife Corridor are designated Special Natural Areas by Fort Belvoir. The Accotink Creek Conservation Corridor was designated as a Special Natural Area in 2005. This predominantly forested 191-acre area serves as a wildlife migratory corridor and supports potential habitat for federally listed small whorled pogonia (*Isotria medeoloides*) and several other species of management concern (Fort Belvoir, 2017).

Biological resources discussed in the following sections include vegetation, wildlife, threatened and endangered species, and Partners in Flight (PIF) habitat. Relevant regulations and policies are also discussed when applicable. The area of analysis for biological resources focuses on the Proposed Action Site, taking into account a broader geographic range when appropriate.

3.4.1 Vegetation

The Proposed Action Site consists of approximately 161 acres. The 2017 Fort Belvoir INRMP characterizes the site as predominantly forested and comprised of hardwood, mixed tulip poplar (*Liriodendron tulip*)/hardwood, mixed pine/hardwood, pine forests, and wetland seeps (Fort Belvoir, 2017). There are two upland areas that were previously cleared for the former MEC training area. Since these sites are no longer active, they have been allowed to revert to natural habitats and have become early successional communities dominated by a near monoculture of Virginia (*Pinus virginiana*) pine samplings. No tree planting mitigations have been done at the Proposed Action Site, and no tree planting mitigation sites will be impacted by the Proposed Action.

A forest stand delineation was performed by USACE Baltimore District Staff on 17 and 23-25 August 2021 to inventory the forest composition at the Proposed Action Site. Forest stands were distinguished primarily by differences in species composition and successional stage and ranked as Priority 1, 2, or 3 following the guidelines of the Maryland State Forest Conservation Technical Manual. Although this method is not a regulatory requirement in Virginia, it provides an efficient and comprehensive approach for cataloging and prioritizing forest resources. Priority 1 stands have wetlands, specimen trees of 30” diameter at breast height (dbh) or greater, intermittent or perennial streams, steep slopes, and/or other sensitive areas. Priority 2 may contain some elements listed for Priority 1 and/or have a designation of priority in a local land use plan, local forest conservation program, or other criteria adopted by a local forest conservation program. Priority 3 areas have evidence of increasing levels of human disturbance compared to Priority 1 and 2 areas.

Eight forest stands were identified within Proposed Action Site with seven designated Priority 1 (Stands 1-2 and 4-8), and one Priority 2 (Stand 3) (Figure 3-6). The stands support mature and specimen trees and most contain wetlands and/or perennial streams. Overall, invasive species coverage is relatively low with most occurrences in the ground cover layer. Tree canopy cover ranges from 70-100 percent coverage with dominant cover types of tulip poplar (*Liriodendron tulipifera*)/red maple (*Acer rubrum*) or oak (*Quercus* sp.)/hickory (*Carya* sp.).

Canopy and sub-canopy species include American beech (*Fagus grandiflora*), Northern red oak (*Quercus rubra*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), southern red oak (*Quercus falcata*), mockernut hickory (*Carya tomentosa*), black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), American holly (*Ilex opaca*), sweetgum (*Liquidambar styraciflua*), pawpaw (*Asimina triloba*), Virginia pine, and Loblolly pine (*Pinus taeda*). Understory species also include muscle wood (*Carpinus caroliniana*), Eastern red cedar (*Juniperus virginiana*), and mountain laurel (*Kalmia latifolia*). Herbaceous and woody species include cinnamon fern (*Osmundastrum cinnamomeum*), common greenbrier *(Smilax rotundifolia*), huckleberry (*Vaccinium membranaceum*), highbush blueberry (*Vaccinium corymbosum*), Indian cucumber-root (*Medeola virginiana*), Jack-in-the-pulpit (*Arisaema triphyllum*), partridgeberry (*Mitchella repens*), poison ivy (*Toxicodendron radicans*), saw-toothed viburnum (*Viburnum betulifolium*), tick trefoil (*Desmodium* spp.), and Virginia creeper (*Parthenocissus quinquefolia*). Invasive species include Asiatic bittersweet (*Celastrus orbiculatus*), Japanese honeysuckle (*Lonicera japonica*), Japanese stilt grass (*Microstegium vimineum*), multiflora rose *(Rosa multiflora*), and wisteria (*Wisteria sinensis*). Further information about the methods and results of the survey are found in Appendix D.

Fort Belvoir’s Tree Removal and Protection Policy requires the protection of existing trees and, where tree loss is unavoidable, mitigation for the removal of trees must be performed unless expressly exempted. In-kind mitigation measures include replacing any trees four inches or greater dbh that are removed with the planting of two new trees. Out-of-kind compensatory mitigation, such as environmentally beneficial restoration, enhancement, or preservation measures may be completed if in-kind mitigation is not a feasible option (Fort Belvoir, 2018). Pursuant to the Tree Removal and Protection Policy, a Tree Protection Plan must be prepared in accordance with Fort Belvoir DPW requirements and included as part of the 35 percent design submittal for construction projects.

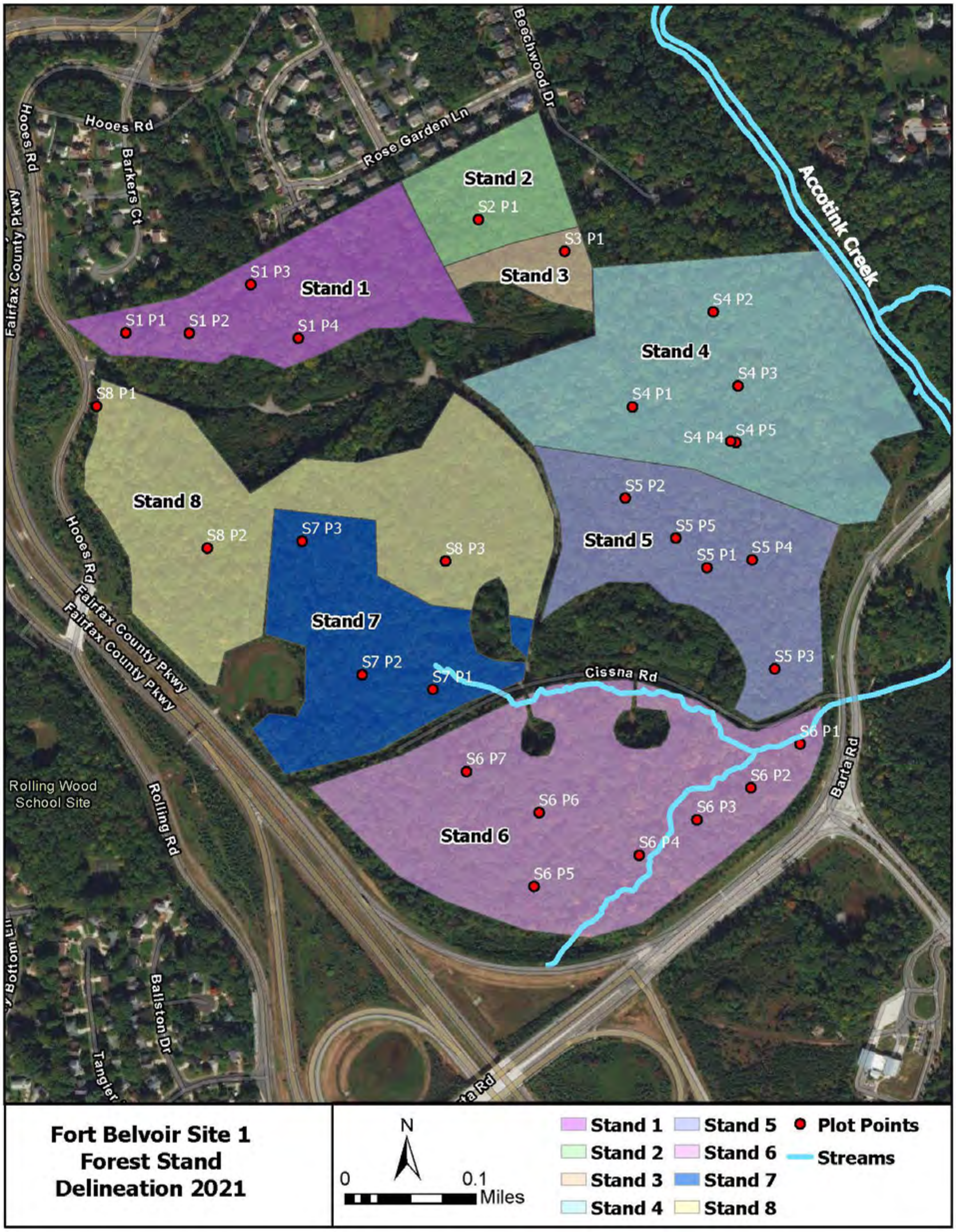

Figure 3-6: Forest Stands

3.4.2 Wildlife

There have been multiple surveys on the wildlife at Fort Belvoir (Fort Belvoir, 2017). A wildlife survey conducted on FBNA in 2006 found that mammals were predominantly white-tailed deer (*Odocoileus virginianus*), Virginia opossums (*Didelphis marsupialis*), and gray squirrels (*Sciurus carolinensis*) (U.S. Army, 2007). The Proposed Action Site primarily consists of upland and wetland forests. These types of habitats support a variety of species found on Fort Belvoir including the eastern chipmunk (*Tamias striatus*), southern flying squirrel (*Glaucomys Volans*), eastern cottontail (*Sylvilagus floridanus*), American beaver (*Castor canadensis*), and red fox (*Vulpes vulpes*) (Fort Belvoir, 2017). Reptiles found in these habitats include eastern mud turtle (*Kinosternon subrubrum subrubrum*), eastern rough green snake (*Opheodrys aestivus aestivus*), and northern ringneck snake (*Diadophis punctatus edwardsi*). Accotink Creek, along with its tributaries and associated floodplain wetlands, support amphibian species including spring peepers (*Pseudacris crucifer*), American toads (*Bufo americanus*), Fowler's toads (*Bufo woodhousii fowleri*), and bullfrogs (*Rana catesbeiana*).

3.4.3 Rare, Threatened and Endangered Species

Under the Endangered Species Act (ESA) of 1973, plant and animal species in danger of extinction throughout all or a significant part of their range are listed as endangered. Species that are likely to become endangered within the foreseeable future are listed as threatened. The USFWS is responsible for administering the ESA for terrestrial and freshwater organisms, as may be found within the Proposed Action Site and its vicinity. The ESA establishes the federal government's responsibility for protection and recovery of species considered to be in danger of extinction. The ESA requires federal agencies, in consultation with the USFWS to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. Critical habitat can include areas not occupied by the species at the time of the listing, but are essential to the conservation of the species.

3.4.3.1 Federally Listed Species

Section 7 of the ESA requires federal agencies to request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action for any project that is conducted, permitted, funded, or licensed by any federal agency. According to a screening of the Proposed Action Site using the USFWS' Information for Planning and Conservation (IpaC) online tool, the northern long-eared bat (*Myotis septentrionalis*) (NLEB), listed as a threatened species under the ESA, may occur in forested areas on or near the Proposed Action Site (USFWS, 2022). No critical habitat has been designated for this species. White-nose syndrome, a fungal disease known to affect bats, is the most severe and immediate threat to NLEB survival and is the basis for the listing of the species as threatened. During the active season (April 1 to October 31), bats roost singly or in colonies in cavities, underneath bark, crevices, or hollows of both live and dead trees and snags.

USFWS signed a Programmatic Biological Opinion (BO) 5 January 2016 on the Final 4(d) Rule that addresses effects to the NLEB by federal actions and provides a streamlined Section 7 consultation. USFWS has not yet designated critical habitat for NLEB. On May 24, 2022, a team of biologists from Fort Belvoir DPW Environmental Division conducted a field survey of the Proposed Action Site for the NLEB. Further information about the survey methods and results can be found in Appendix F.

The IpaC screening also lists small whorled pogonia (*Isotria medeoloides*) as potentially present within the Proposed Action Site. The small whorled pogonia is an orchid listed as federally threatened throughout its range and listed as state-endangered by the Commonwealth of Virginia. In Virginia, small whorled pogonia is most typically found in deciduous second or third growth successional hardwood forests with fairly sparse ground cover and highly acidic, nutrient-poor, sandy loam soils, although plants have been found in a wider range of habitats in recent years. To date, FBNA is the only location in Fairfax County, where the small whorled pogonia has been found (U.S. Army, 2007). The small whorled pogonia was observed in the summer of 2005 on steep, oak-dominated forested slopes on a first order tributary of Accotink Creek in the southwestern part of FBNA. Areas of FBNA that have been identified as potential suitable habitat for the small whorled pogonia are along the western and southern boundaries of FBNA.

A team of biologists from the USACE Baltimore District, Fort Belvoir DPW, and a certified surveyor from Coastal Resources, Inc. surveyed the area of FBNA identified as potentially suitable habitat for small whorled pogonia on July 20-21, 2021. The habitat was categorized as 1) unsuitable habitat with little or no potential to support small whorled pogonia due to the lack of forest, early succession stage, very dense understory and herbaceous cover, or presence of wetlands; 2) marginal habitat with mature habitat that have some potential to support small whorled pogonia but lacking other characteristics of suitable habitat; and 3) suitable habitat with a high potential to support small whorled pogonia, including mature forests on northerly or easterly facing slopes with flat to moderate topography; the presence of species associated with small whorled pogonia; acidic, sandy soils with low nutrients; an open understory and herbaceous layer; and canopy openings such as a small stream, road, or dead/fallen trees that allow sunlight to reach the forest floor (Figure 3-7).

No small whorled pogonias were found during the habitat survey, although suitable (7.25 acres) and marginal (16.76 acres) habitat were identified along the stream corridors (Figure 3-7). An additional survey for the presence or absence of small whorled pogonia was conducted on June 21, 2022. Similar to the 2021 survey, no small whorled pogonias were located within the Proposed Action Site, but numerous colonies of common whorled pogonia (*Isotria verticillata*) were documented within the suitable small whorled pogonia habitat along the southern, unnamed tributary that flows southeast through the Proposed Action Site. Further information about the survey methods and results can be found in Appendix E.

The monarch butterfly (*Danaus plexippus*) is also listed in the IpaC screening as a candidate species and under consideration for official listing. Although there are generally no Section 7 requirements for candidate species, USFWS encourages agencies to take advantage of opportunities that may conserve the species. Primary threats to the monarch include loss and

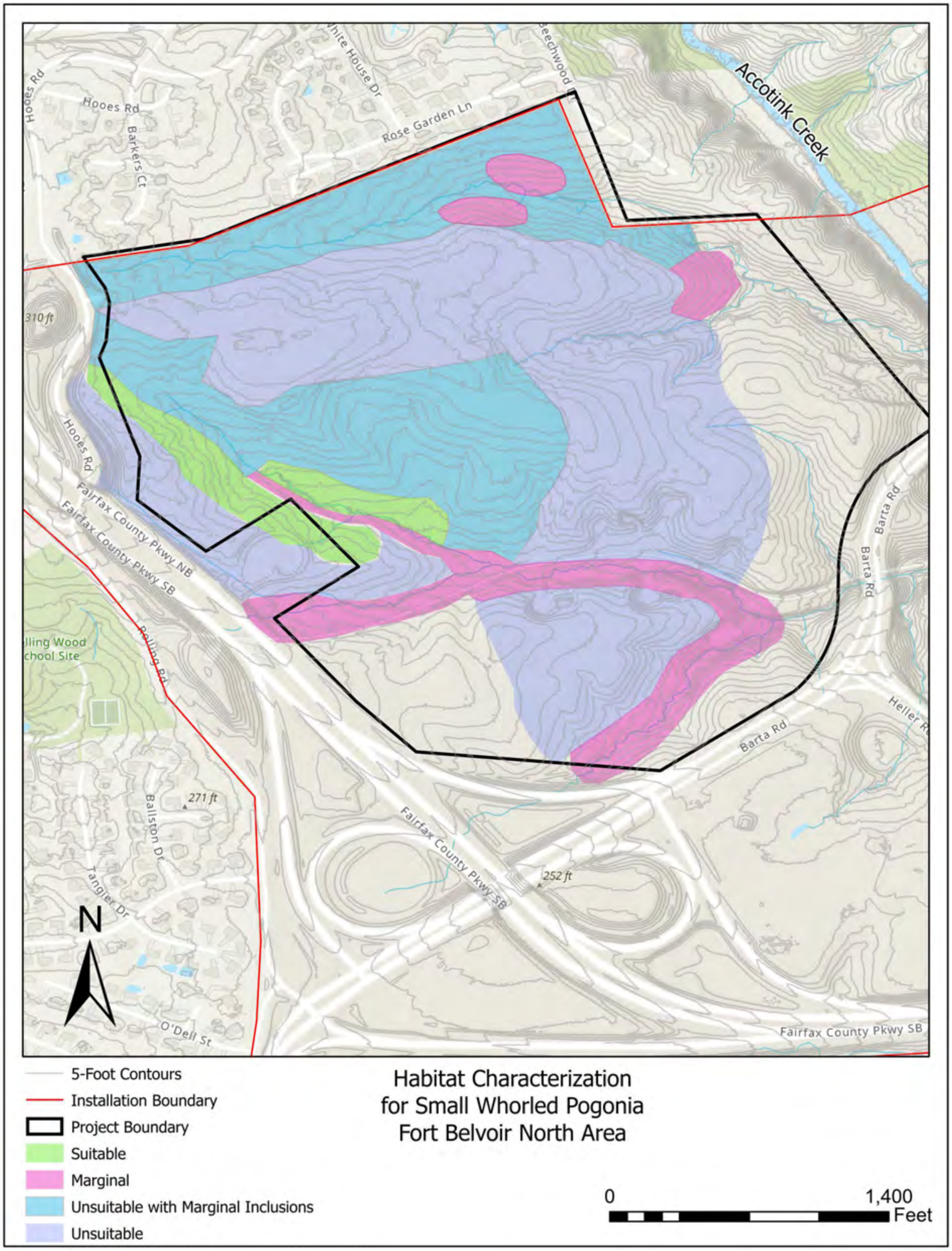

Figure 3-7: Small Whorled Pogonia Habitat

degradation of habitat, use of herbicides and pesticides, urban development, and climate change. Conservation efforts include protection of the obligate milkweed plants (primarily *Asclepias* spp.), which monarchs use for egg deposition and larvae feeding as well as other nectar resources for adults. Critical habitat has not been designated for this species.

3.4.3.2 Birds of Conservation Concern

The USFWS IpaC screening identified seven species of Birds of Conservation Concern within the Proposed Action Site that are protected under the MBTA. These include the black-billed cuckoo (*Coccyzus erythropthalmus*), prairie warbler (*Setophaga discolor*), prothonotary warbler (*Protonotaria citrea*), red-headed woodpecker (*Melanerpes erythrocephalus*), rusty blackbird (*Euphagus carolinus*), and wood thrush (*Hylocichla mustelina*). The bald eagle (*Haliaeetus leucocephalus*) is also identified as a Bird of Conservation Concern due to the special protections afforded under the Bald and Golden Eagle Protection Act of 1940, however, there are no documented bald eagle nesting areas on the Proposed Action Site.

3.4.3.3 State-Listed Species

The Commonwealth of Virginia has promulgated a state endangered species act that provides endangered and threatened listings for species vulnerable to extinctions at the state level. The Virginia statute (4 VAC 15-20-130) prohibits the taking, transportation, possession, sale, or offer for sale within the state of any species listed on the federal endangered species list or any other species designated by the state board. Virginia also provides protection for plant and insect species through Chapter 10 §3.2- 1000 of the Code of Virginia. It is the role of Virginia's Department of Conservation and Recreation, Division of Natural Heritage to maintain listings and rarity (i.e., conservation) rankings of rare plant and animal species and ecological communities. Unlike endangered and threatened listings, rare species listings and their rankings are not legal designations and do not provide any protective status, but, rather, are used to prioritize resources for conservation.

Fort Belvoir has five state-listed animal species that occur on the installation, including the state-listed threatened wood turtle (*Glyptemys insculpta*), the state-listed threatened peregrine falcon (*Falco peregrinus*), the state-listed endangered little brown bat (*Myotis lucifugus*), the state-listed endangered tri-colored bat (*Perimyotis subflavus*), and the state and federally listed threatened NLEB. Potential habitat for the wood turtle is primarily located along Accotink Creek and its tributaries. However, this species is also known to traverse connected deciduous woodlands within 300 feet of resident waterways. The peregrine falcon has been regularly recorded on Fort Belvoir, as it migrates through the regional area and takes advantage of foraging habitat along the Accotink Creek/Accotink Bay stream corridor. The little brown bat and the tri-colored bat have an active season similar to that of the NLEB. The conservation measures outlined by the Commonwealth of Virginia include time of year restrictions that fall within the bounds of restrictions already established for the NLEB. Therefore, the conservation measures required for protection of the NLEB would also be adequate for protection of the state-listed bat species.

3.4.4 Partners in Flight

The DoD PIF program uses a cooperative network of natural resources personnel from military installations across the United States to sustain and enhance the military mission through proactive, habitat-based conservation and management strategies that maintain healthy landscapes and training lands (https://partnersinflight.org/). The DoD PIF uses voluntary partnerships at local, state, regional, national and international levels to share information and develop ecosystem-based, proactive management programs and programmatic priorities that aim to "keep common birds common" and help recover species at risk. The USFWS, as well as state wildlife agencies such the Virginia Department of Wildlife Resources (VDWR), through the state nongame program, are also partners in this program.

As part of the PIF Program, DoD installations are encouraged to incorporate elements of the Partners in Flight Bird Conservation Strategy into their INRMPs. Such elements include habitat management practices such as prescribed burning and timber management programs. Designation of regional PIF priority bird species is the result of a cooperative/coordinated effort among various federal, state and private organizations. Fort Belvoir has designated approximately 4,200 acres of PIF habitat within its boundaries, most of it within the 1,480-acre Accotink Bay Wildlife Refuge along Accotink and Pohick Bays, and the 234-acre Jackson Miles Abbott Wetland Refuge along Dogue Creek, both areas of high-quality habitat located within Main Post. These large areas of habitat not only are valuable in and of themselves, but also provide for ecological connectivity through the installation to other regional habitats (USACE, 2015).

PIF Species of Concern (SOC) status and applicable conservation guidelines are part of a broader designation identified by the INRMP as Fort Belvoir Breeding Birds of Management Concern, and includes USFWS Birds of Conservation Concern, DoD PIF Mission Sensitive Species and Fort Belvoir Habitat Indicator Species in addition to the PIF SOC for Bird Conservation Region 30 (New England/Mid-Atlantic Coast). The prairie warbler, wood thrush and scarlet tanager (*Piranga olivacea*) are Fort Belvoir Breeding Birds of Management Concern species documented on FBNA (USACE, 2017). Documented occurrences of these species include Geographic Information Systems (GIS) mapping of a 500-foot buffer to provide protections for potential nesting and foraging areas (Figure 3-8). FBNA supports approximately 396 acres of designated habitat for PIF species (USACE, 2015). PIF management recommendations include maintaining upland forest habitat (to support wood thrushes) and creating and maintaining successional/shrub-scrub habitat (to support prairie warblers) (Fort Belvoir, 2017).

3.4.5 Environmental Consequences

3.4.5.1 Thresholds of Significance

The threshold of significance for biological resources would be exceeded if a proposed action would jeopardize the continued existence of any federally listed threatened or endangered species or result in destruction of critical habitat; decrease the available habitat for commonly found species to the extent that the species could no longer exist in the area; eliminate a sensitive habitat,

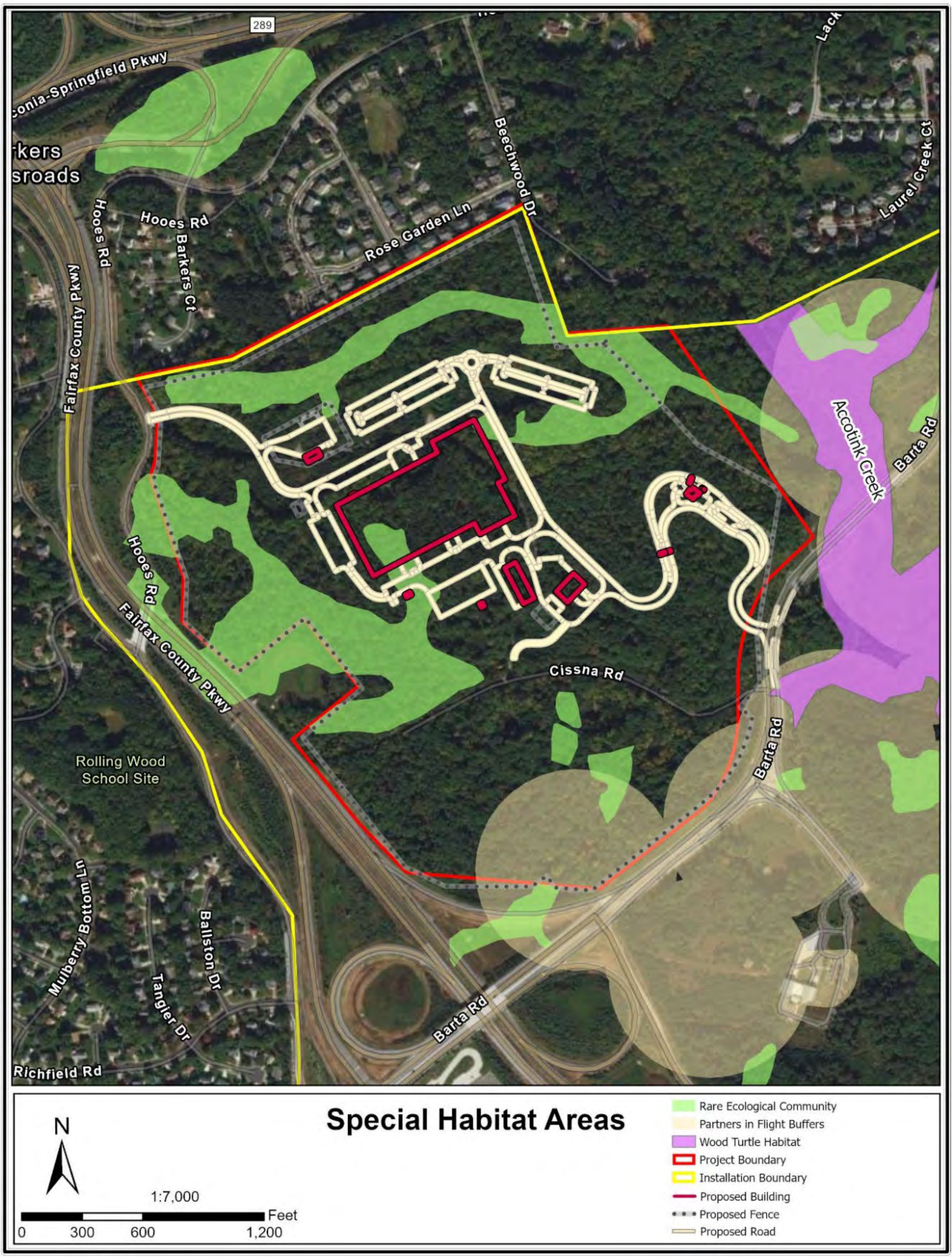

Figure 3-8: Special Habitat Areas

such as breeding areas, habitats of local significance, or rare or state-designated significant natural communities needed for the survival of a species; or substantially degrade or minimize habitat.

Potential impacts to plants, wildlife, and fish are evaluated in accordance with applicable regulations including, but not limited to, the ESA, the Fish and Wildlife Conservation Act of 1980, the MBTA, and EO 13112 on Invasive Species. The Sikes Act provides for cooperation by the Department of the Interior and DoD with state agencies in planning, development, and maintenance of fish and wildlife resources on military reservations throughout the U.S. The area of analysis for biological resources includes the Proposed Action Site.

3.4.5.2 Impacts of Proposed Action

<u>Vegetation</u>

Under the Proposed Action, short-term, less-than-significant adverse effects would occur on vegetation. Removal of approximately 30 acres of vegetation for construction of the facilities and infrastructure under the Proposed Action would result in short-term, minor, adverse effects on poplar/red maple and oak/hickory stand habitat on FBNA. This would be offset by a combination of replanting within other areas of Fort Belvoir in accordance with Fort Belvoir's Tree Removal and Protection Policy, requiring a 2:1 replacement ratio, since trees planted in urban forest situations only survive for an average of seven years and trees being replaced are generally far larger than trees planted as in-kind, in coordination with Fort Belvoir natural resources program staff. A tree survey was conducted by a USACE biologist on 17 and 23-25 August 2021 to characterize and quantify the forest resources within the Proposed Action Site to support determination of appropriate mitigation (see Appendix D). If it is not possible to plant the required number of replacement trees, project-related alternatives such as environmentally beneficial restoration, enhancement, or preservation measures may be done. DPW approval of out-of-kind, compensatory mitigation is required, and funding must be equivalent to that required to plant the remaining trees.

Following construction, the Proposed Action Site would be landscaped, per a DPW approved landscape plan, with grass, shrubs and tree species coordinated with the Fort Belvoir natural resources program staff to ensure that no invasive species would be introduced, and planting enhances wildlife habitat in a low-maintenance manner consistent with master planning objectives. While the character of the area would change from that of a mixture of poplar/red maple and oak/hickory stand habitat to a campus-like landscaped setting, some tree stands surrounding the facility would be retained to provide a cover and shade vegetative buffer along streams and wetlands. In addition, continued removal of invasive vegetative species and upkeep of desirable, native species throughout the life cycle of the facility would also result in an overall long-term beneficial effect.

<u>Wildlife</u>

Under the Proposed Action, short-term, less-than-significant adverse effects would occur on wildlife. During construction of the Proposed Action, equipment noise, ground disturbance, and vegetation removal would temporarily displace individuals of common wildlife species residing in the LOD. There may be limited mortality to individuals that are not able to relocate during construction. Population-level impacts would not reasonably occur due to the relatively small size of the construction area in relation to the overall size of FBNA. Additionally, most mobile species are able to safely avoid equipment. Therefore, construction activities associated with the Proposed Action are expected to result in short-term, negligible, direct, adverse effects on terrestrial wildlife resources located within the immediate area.

To minimize impacts on birds, construction activities should avoid cutting and removal of vegetation from 1 April to 15 July. If cutting and removal occurs during this time frame, a survey for birds and active bird nests is recommended. No migratory bird, active nest, egg, or hatchling should be disturbed, removed, damaged, or destroyed per the MBTA.

Following completion of construction, the Proposed Action Site would replace an undeveloped, infrequently used area with a distribution center that includes associated parking areas and security fencing. Wildlife accustomed to frequent human activity would use the new environment, while species requiring less disturbance and more secrecy would likely relocate. Planting of native vegetation near buildings and in open spaces within the campus would support habitat needs of species typically found within the vicinity of the Proposed Action Site and would serve as an extension of the stream corridor to the west of the developed area. The long-term adverse or beneficial effects of operation of the Proposed Action on wildlife are expected to be negligible.

Rare, Threatened, & Endangered Species

Under the Proposed Action, short-term, less-than-significant adverse effects would occur to rare, threatened, and endangered (RTE) species. The Proposed Action would occur in the former EPG that has had some prior disturbance as an area supporting testing facilities and used as an explosives and munitions training area with three former ranges (Ranges 5, 5a, and 5b).

The Proposed Action Site includes area mapped as potential habitat for the small whorled pogonia. Consistent with standard practice in Virginia, the acceptable survey window for the small whorled pogonia is between 1 June and 20 July. A survey was conducted within the Proposed Action Site on 21 June 2022. No small whorled pogonia were located within the Proposed Action Site. While the small whorled pogonia has not been located on FBNA since 2005, suitable habitat has been identified within the Proposed Action Site and should be avoided to preserve the habitat of this species (Appendix E).

Despite previous disturbance of the area, clearing of vegetation associated with construction under the Proposed Action could adversely impact protected species if pre-construction surveys are not conducted. No wood turtle habitat has been identified within the Proposed Action Site. Should wood turtle habitat be identified within the area, surveys for the presence of the wood turtle would be conducted prior to site clearing, and the results of these surveys coordinated with Fort Belvoir natural resources program staff and appropriate wildlife management agencies. Perimeter controls would be installed during the winter months to exclude the endangered wood turtle from areas of proposed construction activity, as necessary. To protect nesting bat species, no trees over three inches in diameter would be removed within the Proposed Action Site between 15 April and 15

September, in accordance with current USFWS guidelines and corresponding U.S. Army NLEB protection documents promulgated to protect the NLEB species (Appendix F).

Partners in Flight

Under the Proposed Action, short-term, less-than-significant adverse effects would occur on Breeding Birds of Management Concern. Fort Belvoir Environmental Division staff would be consulted to identify means to offset the loss of PIF habitat associated with the construction under the Proposed Action.

3.4.5.3 Impacts of No Action Alternative

Under the No Action Alternative, existing conditions would remain and no impacts on vegetation, wildlife, RTE species, or partners in flight would occur. Restoration plantings would not occur, and FBNA would continue to provide habitat for species that rely on tulip poplar/red maple and oak/hickory forest stand habitat. Maintenance of the area to prevent succession to invasive species cover would be dependent on Fort Belvoir DPW.

3.5 HAZARDOUS AND TOXIC MATERIALS AND WASTE (HTMW)

3.5.1 Affected Environment

Hazardous and toxic materials or substances are generally defined as materials or substances that pose a risk (i.e., through either physical or chemical reactions) to human health or the environment. Regulated hazardous substances are identified through a number of federal laws and regulations. The most comprehensive list is contained in 40 CFR 302, Designation, Reportable Quantities, and Notification, and provides quantities of these substances that, when released to the environment, require notification to a federal agency. Further, hazardous wastes, defined in 40 CFR 261.3, are considered hazardous substances. Generally, hazardous wastes are discarded materials (e.g., solids or liquids) not otherwise excluded by 40 CFR 261.4 that exhibit a hazardous characteristic (i.e., ignitable, corrosive, reactive, or toxic), or are specifically identified within 40 CFR 261. Petroleum products are specifically exempted from 40 CFR 302, but some are also generally considered hazardous substances due to their physical characteristics (i.e., especially fuel products), and their ability to impair natural resources.

Fort Belvoir conducts its hazardous waste management program in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United States Code (U.S.C.) 9605, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Pub. L. 99-499. Fort Belvoir has a Hazardous Waste Management/Waste Minimization Plan and a Master Spill Plan. Fort Belvoir also participates in the "Greening of Government" program (EO 13101, *"Greening" the Government through Waste Prevention*) that promotes the purchase of products to reduce solid and hazardous waste through implementation of a centralized system for tracking procurement, distribution, and management of toxic or hazardous materials. Fort Belvoir DPW Environmental Division also files annual hazardous material and toxic chemical reports in compliance with the Emergency Planning and Community Right-to-Know Act.

FBNA was used for the development and testing of military engineering equipment and supplies in addition to providing training areas and storage for equipment and materials testing, mine deployment and recovery, and demolition as part of EPG. The heaviest of activity was from the 1940s to the mid-1950s. Investigations and clean-up activities have been ongoing since 1989 and have included the removal of munitions debris and non-munitions related debris as well as testing and the removal of explosive compounds and associated residual contaminants (USACE, 2021a). Investigations identified six SWMUs and five AOPCs within three former range sites (Range 5, 5a, and 5b) and adjacent areas within the Proposed Action Site. No soil or groundwater contamination was found at a vehicle maintenance area (AOPC-1), a former bunker associated with Building 2095 (SWMU M-22), and septic drain field associated with Building 2089 (SWMU M-43). All debris, underground storage tanks, and buildings were removed, and the sites were issued NFAs in concurrence with USEPA (USEPA, 2017).

Range 5

Former Range 5 was approximately two acres and used for ordnance and munitions training (USACE, 2021a). The site was also reportedly used as a waste disposal area for ordnance, weapons, chemicals, and barbed wire. Investigative studies for MEC and associated residual explosive and inorganic contamination identified three AOPCs (AOPC-17, AOPC-18, AOPC-21). All MEC materials were removed at AOPC-17 and AOPC-18, and no explosives or soil contamination were found. The sites were closed, and an NFA issued in concurrence with USEPA (USEPA, 2017).

A Unilateral Administrative Order under RCRA, 42 U.S. Code Section 6934, required an additional investigation on FBNA to determine the significance of the threat posed by the presence of hazardous wastes, and included site AOPC-21 (Arcadis, 2019). Sources of contamination at the site were waste containers, MEC items, and a TCE storage drum. MEC materials, waste containers, and contaminated soil were removed between 2008 and 2010 and effectively eliminated the potential for continued leaching of chemical constituents from the site to groundwater. However, elevated levels of COCs RDX and 2,4-DNT/2,6-DNT remain. Fort Belvoir is conducting biannual groundwater sampling to monitor levels of COCs, and results indicate that concentrations are declining to below maximum threshold levels. The site is managed through land use controls (LUCs) including the restriction of groundwater usage.

Range 5a

Former Range 5a encompassed 1.1 acres and was used for explosives and steel cutting. Investigative studies identified three SWMUs (M-32, M-33, M-34) and one AOPC (AOPC-19). All MEC materials were removed at AOPC-19, and no explosives or soil contamination were found. Munitions debris pits and contaminated soils were removed at M-34. AOPC-19 and M-34 were closed, and an NFA issued in concurrence with USEPA.

The MEC investigation and clearance was completed at sites M-32 and M-33. Contaminated soil was also identified at M-32 and removed. Elevated levels of COCs RDX and 2,4-DNT/2,6-DNT were detected in the groundwater at M-32 and M-33. Biannual groundwater testing for COCs is conducted, and results submitted to VADEQ. The site is managed through LUCs including the restriction of groundwater usage for residential purposes.

Range 5b

Former Range 5b was approximately 4 acres and was used for landmine detonation and removal training. Investigative studies for MEC and as part of the Military Munitions Response Program (MMRP) identified one SWMU (SWMU M-35). A total of 353 pounds of MEC was removed resulting in an assessment of complete clearance by the USACE Baltimore District (USACE, 2021a).

3.5.1.1 Installation Restoration Program

The Fort Belvoir Installation Restoration Program (IRP) operates in coordination with the U.S. Army Environmental Command and USACE to restore former military training areas, waste sites, and petroleum areas through regulatory closure. The IRP is a comprehensive program designed to address contamination from past activities and restore Army lands to useable conditions. It is one of two programs established under the Defense Environmental Restoration Program (DERP) to identify, investigate, and clean up hazardous substances, pollutants, and contaminants that pose environmental health and safety risks at active military installations and formerly used defense sites. The IRP was established in 1975 and is achieving successful restoration of more than 11,000 identified active Army environmental cleanup sites.

The IRP response actions (i.e., site identification, investigation, removal actions, remedial actions, or a combination of removal and remedial actions) correct other environmental damage (such as the detection and disposal of unexploded ordnance) that poses an imminent and substantial endangerment to the public health or welfare or to the environment. IRP actions are conducted according to the provisions of CERCLA, EOs 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300).

3.5.1.2 Munitions

Congress established the MMRP in 2001, under the DERP, to address munitions-related concerns, including explosive safety, environmental, and health hazards from releases of unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) found at locations other than operational ranges on active and BRAC installations and Formerly Used Defense Sites (FUDS) properties. The MMRP provides a focused program to address the challenges presented at sites called munitions response sites. Munitions responses are response actions, including investigation, removal actions and remedial actions that address the explosives safety, human health or environmental risks presented by UXO, DMM, and MC (https://aec.army.mil/index.php?cID=365). Munitions response actions are conducted under the process outlined in the National Contingency Plan (NCP) (40 CFR 300) as authorized by the CERCLA.

Given its historical use and concentration of ranges and test areas, all of FBNA is considered a Munitions Response Area site encompassing all former munitions, testing and training activities within the FBNA boundary. The ranges on FBNA were used for mine warfare material testing, research, and development as part of EPG. In 2006, the ten closed ranges on FBNA were determined to be eligible for the DERP and were subsequently enrolled in the MMRP. Several former FBNA training ranges were successfully cleared of ordnance and explosives from 2003 through 2005 in preparation for the proposed land transfer for the Fairfax County Parkway right-of-way. Subsequent clearance occurred between 2006 and 2010 for the areas outside of the right-of-way in support of the 2005 BRAC-related construction. Fort Belvoir developed a Focused Feasibility Study (FFS) to evaluate remedial alternatives, as required by CERCLA (AECOM, 2021).

The 2021 FFS indicates Fort Belvoir will implement LUCs on FBNA. As part of the LUCs, all future ground disturbances and construction activities are required to conduct munitions clearance per the Fort Belvoir DPW Best Management Practice memorandum (U.S. Army Garrison Fort Belvoir Fort Belvoir, 2022). Once the full munitions clearance is complete for areas prior to development, then the level of munitions clearance and construction support will depend on the results of the full clearance and the recommendations of munitions experts on a case-by-case basis. VADEQ will be notified of any MEC/DMM discovered during these activities (AECOM, 2021).

3.5.2 Environmental Consequences

3.5.2.1 Thresholds of Significance

Effects on hazardous materials and wastes are assessed by evaluating the degree to which the Proposed Action could cause worker, resident, or visitor exposure to hazardous materials; whether the Proposed Action would lead to noncompliance with applicable federal or state regulations or increase the amounts generated or procured beyond current waste management procedures and capacities; and whether the Proposed Action would disturb a hazardous waste site, create a hazardous waste site, or contribute to a hazardous waste site resulting in adverse effects on human health or the environment.

Effects from UXO would occur if military munitions are inadvertently encountered, causing an unintended detonation or the release of munition chemicals to the environment.

3.5.2.2 Impacts of Proposed Action

<u>Hazardous Materials and Waste</u>

Under the Proposed Action, no significant impacts would occur on hazardous material and waste. The construction contractor would be required to prepare and adhere to a Spill Prevention, Control, and Countermeasures (SPCC) plan that identifies practices to minimize the potential for accidental spills of petroleum products or other hazardous substances and the procedures for containing and cleaning up any accidental spills that may occur.

Construction activities may require measures to prevent vapor intrusion below ground levels. Existing groundwater monitoring wells that would be impacted by construction activities would be capped and removed. Re-establishment of the monitoring well network would be coordinated with Fort Belvoir DPW.

Implementation of the Proposed Action would not result in a significant effect on hazardous materials and waste concerns within the Proposed Action Site. Soils excavated or otherwise disturbed during the project's construction phase would be tested in accordance with established Fort Belvoir policies and procedures. If concentrations of contaminants in soils are determined to exceed applicable regulatory thresholds for re-use on the site, any affected soils would be removed from the site and disposed of at a permitted facility off FBNA in accordance with Virginia Solid Waste Disposal Regulations as well as all other federal, state, and local laws and regulations.

<u>Munitions</u>

Under the Proposed Action, no significant impacts would occur from munitions. As previously described, LUCs require all future ground disturbances and construction activities to complete munitions clearance. Prior to construction of the Proposed Action, munitions clearance would be conducted and coordinated with Fort Belvoir DPW and the VADEQ. The Proposed Action would have a long-term, beneficial effect by alleviating safety concerns related to possible munitions remaining on the surface or buried near the surface through screening of the project area prior to construction. In addition, standard practice involves training of on-site personnel in the identification of potential munitions to prevent injury from unintentional detonations due to incorrect handling of discarded ordnance materials.

3.5.2.3 Impacts of No Action Alternative

The No Action Alternative would have no effect on hazardous and toxic materials and waste on FBNA. LUCs prohibit extraction of groundwater for potable use and development of the site into another use unless determined to be compatible with applicable LUC policies and the Fort Belvoir ADP. However, efforts to identify potentially buried munitions within the LOD would not occur until such future time, when the area could be developed.

3.6 UTILITIES

3.6.1 Affected Environment

3.6.1.1 Electricity

Electrical power is provided to FBNA by Dominion Energy using a 34.5-kilovolt (kV) distribution infrastructure, including a substation on the southern portion of FBNA and a network of overhead and buried cables. Dominion Energy entered into a 50-year Utilities Privatization services contract with Fort Belvoir in 2007, under which Dominion Energy is responsible for operation and maintenance of the electrical distribution infrastructure, as well as upgrades. As of 2016, more than 112 miles of overhead and underground electric line, three switching stations, and one substation were present on Fort Belvoir. Dominion Energy also owns and operates medium-sized emergency diesel generators to provide back-up power for critical-functions throughout the installation. There are no generating stations on FBNA that would be capable of powering the entire post.

3.6.1.2 Potable Water and Wastewater

Potable water on FBNA is purchased from Fairfax County Water. No treatment facilities or groundwater wells supply potable water on post. The majority of the water distribution system on FBNA is owned by American Water under a 50-year utilities privatization contract to provide domestic water and wastewater services.

The water distribution system was designed with the intent and capacity to support the full build-out of the FBNA campus. A 1.5-million-gallon water storage tank that serves FBNA is located north of Barta Road. There is a connection to Fairfax County Water that traverses the Proposed Action Site from Fairfax County Parkway to Barta Road.

Wastewater for the FBNA is collected by a 14-inch diameter line that runs to the Fairfax County Sewer stub-out at the south end of the campus.

3.6.1.3 Natural Gas

Washington Gas operates the natural gas distribution system serving FBNA, since a privatization contract was issued in 1998. There are no natural gas production storage facilities on the installation. As of 2016, the natural gas distribution system has a network of approximately 120 miles of pipes. The existing gas distribution on FBNA is a high-pressure gas system with an 8-inch pipe that enters from the south side of the installation and runs west along Heller Road, where it connects to the NGA facility's utility plants line. Fort Belvoir can receive approximately 160 million cubic feet per day of natural gas through two delivery points.

3.6.2 Environmental Consequences

3.6.2.1 Thresholds of Significance

Effects on utilities would be considered significant if an overload of the capacity of existing utilities were to occur to the extent that current levels of service are compromised, resulting in outages or shutdown of water or wastewater service.

3.6.2.2 Impacts of Proposed Action

<u>Electricity</u>
Under the Proposed Action, less-than-significant, long-term adverse effects would be expected from additional energy consumption. The electrical distribution system is new and in good condition with sufficient capacity for additional loading. Dominion Energy is responsible for

operation and maintenance of the electrical distribution center as well as upgrades. An emergency backup generator based on size load and including 48 hours of dedicated diesel-fuel supply would be required for the distribution center.

Wastewater

Less-than-significant, long-term adverse effects on wastewater are expected under the Proposed Action due to additional wastewater generation from construction and operation of the distribution center. The current usage of water is only 1/3 of the maximum usage available on the installation (HDR, 2020). The water distribution system on FBNA was designed to accommodate future development and is considered to be in good working condition. There is connection to Fairfax County Water that traverses the Proposed Action Site from the Fairfax County Parkway to Barta Road.

The wastewater system was designed in anticipation of a full build-out of the FBNA campus and, therefore, has the capacity to accommodate the wastewater generated by construction and operation of the Proposed Action. Low-flow toilets, sinks and showers would be installed wherever possible to minimize impacts on water. Potable water and fire suppression will be supplied by at least an 8-inch diameter service pipe and a redundant 6-inch diameter pipe. A fire hydrant loop around the facility would be provided.

Natural Gas

Under the Proposed Action, less-than-significant, long-term adverse impacts would occur on natural gas distribution. No system problems or capability issues would be expected. Construction and operation of the distribution center would increase the natural gas demands of the current system; however, it was built expansion in mind and is more than adequate to support increased natural gas demands.

3.6.2.3 Impact of No Action Alternative

Under the No Action Alternative, no impacts would be expected on any utilities. All operations on FBNA would remain the same, with no fluctuations in utility demands.

3.7 NOISE

3.7.1 Affected Environment

Noise is generally defined as unwanted sound. It can be any sound that is undesirable because it interferes with communications or other human activities, is intense enough to affect hearing, or is otherwise annoying. Noise may be intermittent or continuous, steady, or impulsive. Human response to noise varies, depending on the type of the noise, distance from the noise source, sensitivity, and time of day.

The decibel (dB) is a unit of measurement for noise levels and uses a logarithmic scale. To better match the sensitivity of the human ear, noise levels are typically A-weighted (dBA) to deemphasize low-frequency and very high-frequency sound. For low-frequency sounds such as artillery fire, noise levels are often C-weighted (dBC) to evaluate the presence of low-frequency sound.

This noise section uses two common environmental noise metrics. The equivalent-average sound level (LEQ) represents an average sound level in decibels of a given event or period of time (typically one hour). The day-night average sound level (DNL) represents a 24-hour LEQ with a 10-dBA penalty applied to nighttime hours when sleep interference is more likely (10pm to 7am).

3.7.1.1 Applicable Noise Regulations

The *Noise Control Act* of 1972 (42 United States Code [USC] §4901, et seq.) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. The applicable local noise control regulation is the Fairfax County noise ordinance (Chapter 108.1), which states "no person shall permit, operate, or cause any source of sound or sound generation to create a sound which exceeds the limits set forth in the following table titled 'Maximum Sound Levels' when measured at the property boundary of the sound source or at any point within any other property affected by the sound" (County of Fairfax, 2021). As shown in Table 3-2, the maximum sound levels from continuous sound sources (such as an air handling unit) in residential areas should not exceed 60 dBA during the day and 55 dBA at night. An impulsive sound (or impulse sound) is generally characterized by a sound event that lasts for no more than one second, such as sounds from weapons, pile drivers, or blasting.

Table 3-2: Fairfax County Noise Ordinance (County of Fairfax, 2021)

Use and Zoning District Classification	Time of Day	Maximum Sound Levels (dBA)	
		Continuous Sound	Impulse Sound
Residential Areas in Residential Districts	7am to 10pm	60	100
Residential Areas in Residential Districts	10pm to 7am	55	80

Section 108.1-4-1 of the Fairfax County noise ordinance contains some specific prohibitions relevant to the Proposed Action:

- Construction, repair, maintenance, remodeling, demolition, grading, or other improvement of real property is prohibited outdoors between the hours of 9pm and 7am from Sunday through Thursday and between the hours of 9pm and 9am on Fridays, Saturdays, and the day before a federal holiday.
- Loading or unloading trucks outdoors within 100 yards of a residential dwelling is prohibited between the hours of 9pm and 6am.

Section 108.1-5-1 of the Fairfax County noise ordinance contains some specific exceptions relevant to the Proposed Action:

- Emergency work is exempt from the provisions of Chapter 108.1.
- Motor vehicles on road right-of-way are exempt from the provisions of Chapter 108.1.

- Construction, repair, maintenance, remodeling, demolition, grading, or other improvement of real property is exempt from the provisions of Chapter 108.1, but such activity shall not generate noise levels exceeding 90 dBA in residential areas and shall not begin before 9am on Saturdays, Sundays, and federal holidays.
- Back-up generators are exempt from the provisions of Chapter 108.1 during power outages from storms and other emergencies. Routine testing and maintenance of back-up generators are exempt from the provisions of Chapter 108.1 between the hours of 7am and 9pm, and are prohibited from occurring at other hours. Additionally, the duration of routine testing and maintenance events shall not exceed two consecutive or non-consecutive hours in any one day.

Land use guidelines identified by the Federal Interagency Committee on Urban Noise are used to determine compatible levels of noise exposure for land use planning and control. Chapter 14 of AR 200-1 implements federal regulations associated with environmental noise from Army activities (U.S. Army, 2007). There are three Noise Zones (I, II, and III), which correlate to increasing noise levels (see Table 3-3). These zones are established based on the DNL over a period of 250 days for Active Army Installations and 104 days for Army Reserve and National Guard Installations. Additionally, there is the Land Use Planning Zone (LUPZ), which is the portion of Noise Zone I exposed to noise levels within 5 dB of Noise Zone II levels. One additional noise metric relevant to this discussion is the PK 15(met), which is the peak, unweighted noise level expected to be exceeded by 15 percent of all events that might occur.

Table 3-3: Noise Limits Definitions (U.S. Army, 2007)

Noise Zone	DNL Limit for Aviation Sources (dBA)	DNL Limit for Impulsive Sources (dBC)	PK 15(met) Limit for Small Arms (dB)
LUPZ (Land Use Planning Zone)	60-65	57-62	N/A
I	Less than 65	Less than 62	Less than 87
II	65-75	62-70	87-104
III	More than 75	More than 70	More than 104

* dBA = decibels, A-weighted ,dBC = decibels, C-weighted ,dBP = decibels, unweighted

The nearest potential noise-sensitive receptors (NSR) to the Proposed Action Site on FBNA are the North Belvoir Child Development Center (CDC) and the existing National Geospatial-Intelligence Agency (NGA) offices, located east of the Proposed Action Site and Accotink Creek (U.S. Army, 2021). A residential area is located north of the Proposed Action Site outside the FBNA boundary. The Proposed Action Site is relatively isolated from areas to the west by Fairfax County Parkway and areas to the south by Barta Road. The major thoroughfare of Interstate-95 (I-95) is located approximately 1.25 miles to the east of the Proposed Action Site. Currently, the major noise source in the project vicinity is generated from vehicular traffic on Fairfax County Parkway, Barta Road, and I-95. The Davison Army Airfield (DAAF) is located approximately 2.5 miles to the south of the Proposed Action Site and is an additional noise source from airplane and helicopter takeoffs and landings.

3.7.1.2 Existing Noise Levels

The Proposed Action Site is not located within the 65 dBA DNL areas for any nearby airports and airfields; therefore, aircraft-related noise is anticipated to be less than 65 dBA DNL. Noise measurements documented existing, outdoor noise levels from March 8 to 11, 2022, at two locations on the north end of the Proposed Action Site. Measurement Location (ML) 1 is in the northwest corner of the Proposed Action Site and is representative of residential NSRs north of the site that are closer to Fairfax County Parkway. ML2 is in the northeast corner of the Proposed Action Site and is representative of residential NSRs north of the site that are further from Fairfax County Parkway. The measurements were taken via Type 1 digital sound level meters and a Type 1 handheld calibrator. The microphones were protected using wind screens and were positioned away from reflecting surfaces. Table 3-4 summarizes the noise measurement results at ML1 and ML2.

Table 3-4: Noise Measurement Results

Measurement Location	Measured Overall Equivalent-Average Sound Level (LEQ) (dBA)	Measured Hourly LEQ at Daytime (dBA)	Measured Hourly LEQ at Night (dBA)	Measured Overall DNL (dBA)
ML1	54	45-65	39-59	58
ML2	49	44-55	39-56	55

* dBA = decibels, A-weighted; Daytime = 7 a.m. to 10 p.m.; Nighttime = 10 p.m. to 7 a.m.

ML1 was, on average, louder than ML2, which is to be expected for the location closer to Fairfax County Parkway. The measured noise levels during quieter periods were similar between the two locations. With reference to Table 3-3, the site would be classified as Noise Zone I because the measured DNL was below the transportation noise DNL threshold of 65 dBA at both locations.

3.7.2 Environmental Consequences

3.7.2.1 Threshold of Significance

Impacts on the noise environment from a proposed action or alternative would be considered significant if any of the following were to occur:

- Construction activities during prohibited hours or generating noise levels exceeding 90 dBA in residential areas.
- Back-up generators operating in a manner prohibited by Fairfax County.
- Typical operations generating noise levels exceeding the Fairfax County limits.
- Typical operations changing the Proposed Action Site from Noise Zone I to Noise Zone II or III.

3.7.2.2 Impacts of Proposed Action

The Proposed Action would introduce new noise sources during construction and operations, resulting in short- and long-term, less-than-significant, adverse impacts on the noise environment.

Construction

Construction under the Proposed Action would result in elevated noise levels due to operation of heavy equipment on site. The noise levels generated at any given time would vary depending on the phase of construction, the specific activities occurring, the types of equipment used, and the quantities used. Construction activity would generally only occur between the hours of 7:00am and 3:30pm, Monday through Friday, which would comply with the construction schedule requirements of the Fairfax County noise ordinance.

Table 3-5 summarizes calculated construction noise levels for representative activities that generate higher noise levels. The calculations assumed those representative equipment types would all operate at the same location for each activity.

Table 3-5: Calculated Construction Noise Levels

Activity (Equipment Types)	Hourly LEQ at 100 feet (dBA)	Hourly LEQ at 250 feet (dBA)	Hourly LEQ at 500 feet (dBA)
Peak Hour Traffic (auto, truck)	85	77	71
Mobilization (excavator, dozer, skid steer loader, truck)	84	76	70
Tree Removal / Grubbing (dozer, scraper, excavator, crane, truck)	85	77	71
Earthwork & Site Development (dozer, grader, excavator, truck)	85	77	71
Base Building Construction (crane, concrete saw, truck)	82	74	68

At 100 feet, the calculated hourly LEQs for the representative construction activities would be below 90 dBA. The primary site features associated with the Proposed Action are more than 100 feet from the FBNA property boundary. Based on the estimates of representative activities, construction noise is not anticipated to exceed 90 dBA in residential areas.

Therefore, construction noise is projected to have a short-term, less-than-significant, adverse impact.

Operations

Operation of the Proposed Action would introduce new or additional noise sources to the Proposed Action Site, including automobiles, trucks, electric forklifts, rooftop units, transformers, a diesel fire pump, and generators. The mobile and stationary noise sources associated with the Proposed Action were modeled using the industry-accepted 3-D environmental noise software Computer Aided Noise Abatement (CadnaA), with calculation methods from the International Organization for Standardization (ISO) 9613-2 "Acoustics – Attenuation of Sound during Propagation Outdoors" (ISO, 1996). The model was based on peak hour traffic volumes and representative stationary equipment noise emissions data. The model calculated hourly LEQs assuming all typical operations sources would operate simultaneously (generators excluded), with the electric forklifts excluded at nighttime hours. Table 3-6 summarizes the results of the typical operations noise model (Appendix I).

Table 3-6: Calculated Typical Operations Noise Levels

Location	Highest Modeled Hourly LEQ at Daytime (dBA)	Highest Modeled Hourly LEQ at Night (dBA)	Highest Modeled DNL (dBA)
North FBNA Boundary (residential parcels)	52	43	52
West FBNA Boundary (residential parcels)	55	38	53
South FBNA Boundary (industrial parcels)	47	28	45
FBNA NGA Remote Inspection Facility	50	34	49
FBNA NGA Headquarters	48	35	47

All modeled daytime hourly LEQs are below the Fairfax County daytime limit of 60 dBA, and all modeled nighttime hourly LEQs are below the nighttime limit of 55 dBA. The modeled daytime and nighttime hourly LEQs are within the range of existing hourly LEQ's measured at ML1 and ML2. The modeled DNLs are below the measured DNLs from ML1 and ML2; therefore, the site would be anticipated to remain classified as Noise Zone I during operations.

The generators were not included in the typical operations noise model as they would only operate during emergency conditions or for maintenance events. The maintenance events would only occur between the hours of 7:00 a.m. and 9:00 p.m. with a total duration in any one day not to exceed two hours, which would comply with the Fairfax County exemption for generator noise.

Therefore, operational noise is projected to have a long-term, less-than-significant, adverse impact.

3.7.2.3 Impacts of No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur. The Proposed Action Site would remain in its existing condition. The existing noise environment would not change; therefore, the No Action Alternative would have no impact on the noise environment.

3.8 AIRSPACE

3.8.1 Affected Environment

The Davison Army Airfield (DAAF), which is approximately 2.5 miles south of the Proposed Action Site, occupies approximately 400 developed acres of land west of Fairfax County Parkway. The mission of the DAAF is to transport passengers and freight for the Army and DoD to, from, and within the NCR.

The Federal Aviation Administration (FAA) secures specific airspace and zones at and around airports through Federal Aviation Regulation (FAR) Part 77 (14 CFR 77), *Safe, Efficient Use, and Preservation of the Navigable Airspace*, and FAA Advisory Circular 50/5300-13A, *Airport Design*. The areas defined in these regulations protect specific airspace and ground areas at and near airports. FAR Part 77 defines five types and dimensions of navigable airspace (imaginary surfaces) existing on and around a public airport, which must be kept free of obstructions and development that would conflict with air traffic so that aircraft may have a clear path for landing. These imaginary surfaces, shown in Figure 3-9 for DAAF, are the:

1) Primary Surface – airspace at ground-level elevation that is aligned on the runway centerline and extending 200 feet beyond the end of the runway,
2) Approach Surface – airspace aligned on the runway extended centerline that slopes up and outward from the end of the primary surface. The approach surface, considered the most critical among imaginary surfaces, must be clear of all objects to ensure safe landing.
3) Transitional Surface – airspace that extends out and slopes 7:1 upward from the sides of an airport and the primary surfaces of its runways and the approach surfaces at the runway ends,
4) Horizontal Surface – airspace that extends out from the transitional surface and upward to an elevation of 150 feet above the airfield, and
5) Conical Surface – airspace that extends out and slopes upward from the edge of the horizontal surface to an elevation of 350 feet above the airfield.

FAA Advisory Circular 50/5300-13A establishes airport design standards with specified clear, or obstacle-free zones, and safety areas along and just beyond the extents of an airport runway and taxiway to protect aircraft during takeoffs and landings (FAA, 2022). Building height restrictions are governed by guidelines and regulations relating to the identification and construction of obstructions within airspace (FAR Part 77). Building restrictions within the imaginary conical surface at the runway begin at 150 feet directly above the runway at the boundary with the inner horizontal surface and extend outward at a slope of 20:1 (horizontal: vertical) for a distance of 7,000 feet to an elevation of 500 feet above the airfield. Therefore, a building constitutes an obstruction to navigation if it extends 150- to 500-feet above ground level or runway elevation up to 3 miles from the runway (NOAA, 2022). The Proposed Action Site falls largely within the inner horizontal surface of DAAF, with a small portion within the transitional surface and outer horizontal surface (see Figure 3-9). The proposed buildings would constitute an obstruction to navigation if they were greater than 150 feet in height.

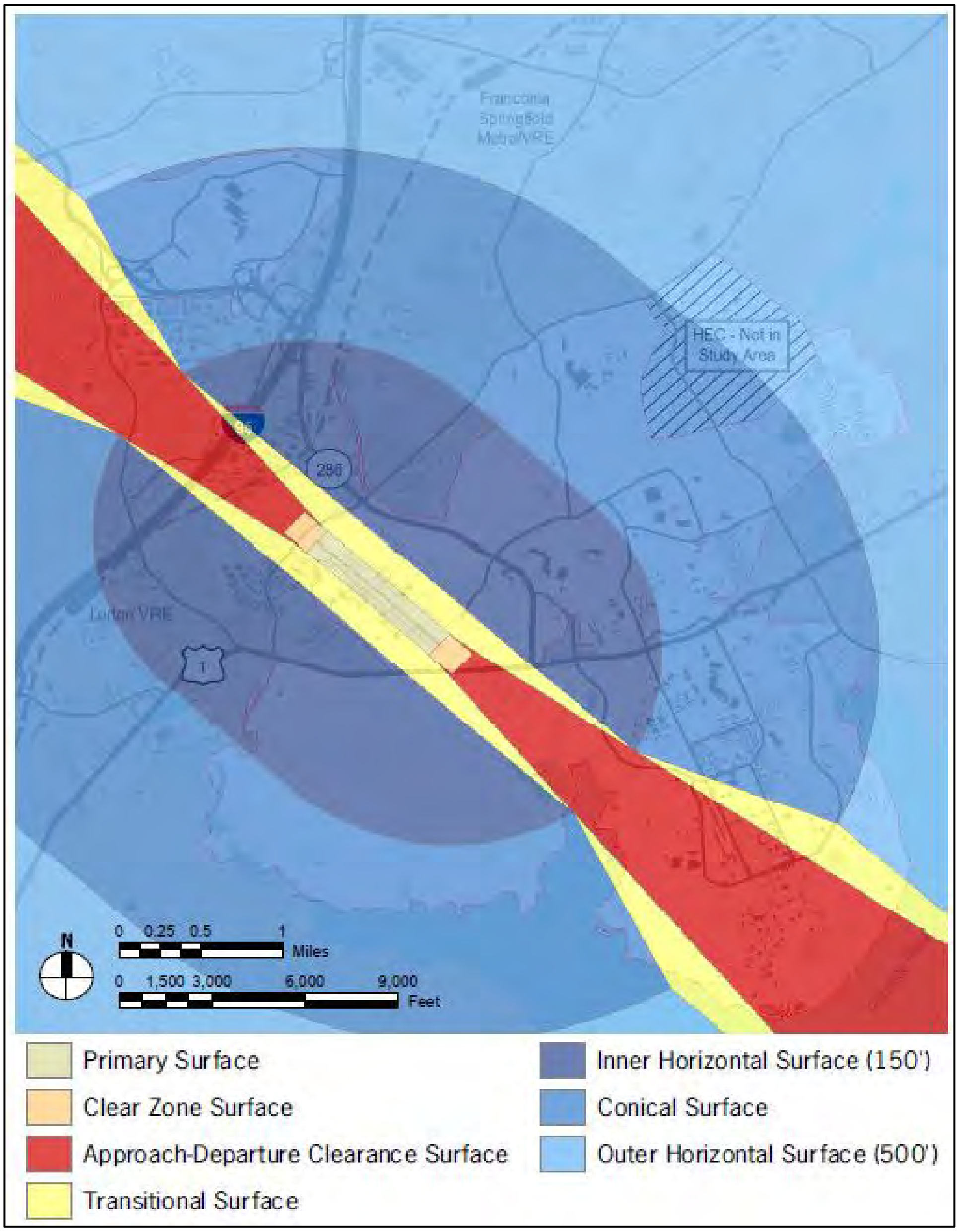

Figure 3-9: Imaginary Surfaces at DAAF
Source: U.S. Army Garrison Fort Belvoir, 2015

3.8.2 Environmental Consequences

3.8.2.1 Threshold of Significance

The Proposed Action and No Action Alternative were evaluated against the following significance criteria to determine if they would result in a significant impact on the airspace environment:

- Airspace would be obstructed by building heights.
- Aircraft operations would be substantially altered to accommodate new construction.

3.8.2.2 Impacts of Proposed Action

Under the Proposed Action, less-than-significant impacts to airspace would occur. The Proposed Action would construct a two-story administration building and a one-story high bay warehouse as the tallest structures. Because these buildings would be located approximately 2.5 miles north of the runway at DAAF and the associated imaginary conical surface and would not exceed 150 feet, the buildings would remain within the vertical limits of the applicable airspace restrictions and below the height of the adjacent NGA complex. No obstruction to airspace and no changes in aircraft operations would occur.

3.8.2.3 Impacts of No Action Alternative

Under the No Action Alternative, no changes would be expected to airspace. No buildings would be constructed, and all operations on FBNA would remain the same, with the same aircraft operations and airspace available.

3.9 AIR QUALITY

3.9.1 Affected Environment

Air quality is defined by the ambient air concentration of specific pollutants of concern at a given location. Air pollution occurs when harmful substances, including solid particles and gases, are introduced into the earth's atmosphere. It can cause harm to the natural environment, including humans, animals, and plants. The following sections describe existing air quality conditions in the vicinity of the Proposed Action Site on FBNA, applicable laws and regulations, and potential impacts on air quality that could result from the implementation of the Proposed Action.

3.9.1.1 NAAQS

The USEPA, under the requirements of the 1970 *Clean Air Act* (CAA) as amended in 1977 and 1990, established National Ambient Air Quality Standards (NAAQS) for the following six criteria pollutants (40 CFR 50):

- Carbon monoxide (CO)
- Lead
- Nitrogen dioxides
- Ozone (O_3)
- Sulfur dioxide
- Particulate matter (PM), divided into two size classes:
  - Measured less than or equal to 10 micrometers in diameter (PM_{10})
  - Measured less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$)

CO, sulfur oxides (SO_X), and some particulates are emitted directly into the atmosphere from emissions sources. Nitrogen dioxide, O_3, and some particulates are formed through atmospheric and chemical reactions that are influenced by weather, ultraviolet light, and other atmospheric processes. Volatile organic compounds (VOCs) and nitrogen oxides (NO_X) emissions are precursors of O_3 and are used to represent O_3 generation. Lead emissions from common air emissions sources that would be used under the Proposed Action have been negligible since leaded gasoline for on-road vehicles was phased out in the United States between 1973 and 1996. Therefore, lead is not included in the air quality analysis.

The NAAQS include primary and secondary standards. The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect the public welfare from the adverse effects associated with pollutants in the ambient air. Each state has the authority to adopt air quality standards stricter than those established under the federal NAAQS. The Commonwealth of Virginia accepts the federal standards (9 VAC Chapter 30). Table 3-7 shows the federal primary and secondary air quality standards accepted by the Commonwealth of Virginia.

Table 3-7: National Ambient Air Quality Standards

Criteria Pollutant	Primary/ Secondary	Averaging Time	Level	Form
CO	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
NO_X	Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
	Primary and secondary	Annual	53 ppb	Annual Mean
O_3	Primary and secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
$PM_{2.5}$	Primary	Annual	12 $\mu g/m^3$	Annual mean, averaged over 3 years
	Secondary	Annual	15 $\mu g/m^3$	Annual mean, averaged over 3 years
	Primary and secondary	24-hour	35 $\mu g/m^3$	98th percentile, averaged over 3 years
PM_{10}	Primary and secondary	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years
Lead	Primary and secondary	Rolling 3-month average	0.15 $\mu g/m^3$	Not to be exceeded
SO_X	Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Sources: 40 CFR 50, 9 VAC Chapter 30
Notes: ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter

Areas that are and have historically been in compliance with the NAAQS or have not been evaluated for NAAQS compliance are designated as attainment areas. Areas that violate a federal air quality standard are designated as nonattainment areas. Areas that have transitioned from nonattainment to attainment are designated as maintenance areas and are required to adhere to maintenance plans to ensure continued attainment.

FBNA is in Fairfax County, which is within the National Capital Interstate Air Quality Control Region (40 CFR 81.12). The USEPA has designated Fairfax County as marginal nonattainment for the 2015 8-hour O_3 NAAQS and as maintenance for the 2008 8-hour O_3 NAAQS. Fairfax County is designated as attainment or unclassified for all other criteria pollutants (USEPA, 2022a).

3.9.1.2 Clean Air Act Conformity

The CAA, as amended in 1990, requires state agencies to develop and adopt a State Implementation Plan to target the elimination or reduction of the severity and number of NAAQS violations in nonattainment areas. Federal agencies are required to ensure that their actions conform to the State Implementation Plan in a nonattainment area. Under Section 176(c) of CAA, a project is in "conformity" if it corresponds to a State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving their expeditious attainment.

Conformity further requires that such activities would not:

- cause or contribute to any new violations of any standards in any area;
- increase the frequency or severity of any existing violation of any standards in any area; or
- delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The USEPA published final rules on general conformity (40 CFR 51 and 93) in the Federal Register on November 30, 1993. The General Conformity Rules applies to federal actions in nonattainment or maintenance areas for any of the criteria pollutants. There are two main components to the overall process: a conformity applicability analysis to determine whether a conformity determination is required and, if it is, a conformity determination to demonstrate that the action conforms to the State Implementation Plan. A conformity applicability analysis is typically done by quantifying applicable direct and indirect emissions that are projected to result from implementation of a federal action. When the total emissions of nonattainment and maintenance pollutants (or their precursors) exceed specified thresholds, a general conformity determination is required. The emissions thresholds that trigger requirements for a general conformity determination are called *de minimis* levels. A federal action is exempt from a general conformity determination if the action's emissions for a particular criteria pollutant are below the pollutant's *de minimis* threshold.

Fairfax County is designated as nonattainment for the 2015 8-hour O_3 NAAQS and as maintenance for the 2008 8-hour O_3 NAAQS. Therefore, the General Conformity Rule is potentially applicable to emissions of VOCs and NO_X because they are precursors for O_3. As outlined in 40 CFR

93.153(b), the applicable *de minimis* level thresholds for these pollutants is 50 tons per year (tpy) for VOCs and 100 tpy for NO_X.

3.9.1.3 Hazardous Air Pollutants

In addition to criteria pollutant standards, USEPA also regulates hazardous air pollutant (HAP) emissions for each state. HAPs differ from criteria pollutants for they are known or suspected to cause cancer and other diseases or have adverse environmental impacts. The National Emission Standards for Hazardous Air Pollutants regulate 188 HAPs based on available control technologies. Sources of HAP emission on FBNA include stationary, mobile, and fugitive emissions sources. Stationary sources include boilers, incinerators, fuel storage tanks, fuel-dispensing facilities, vehicle maintenance shops, laboratories, degreasing units, and similar testing units. Mobile sources of emissions include private and government-owned vehicles.

3.9.1.4 Greenhouse Gas Emissions and Climate Change

Greenhouse gases (GHGs) are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon where gases trap heat within the surface-troposphere (lowest portion of Earth's atmosphere) system, causing heating at the Earth's surface. The primary long-lived GHGs directly emitted by human activities are carbon dioxide (CO_2), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The heating effect from these gases is considered the probable cause of the global warming observed over the last 50 years (USEPA, 2009). Global warming and climate change can affect many aspects of the environment. In the past, the USEPA has recognized potential risks to public health or welfare and signed an endangerment finding regarding GHGs under Section 202(a) of the CAA (74 Federal Register 66496, December 15, 2009), which found that the current and projected concentrations of the six key well-mixed GHGs in the atmosphere threaten the public health and welfare of current and future generations. To estimate global warming potential, all GHGs are expressed relative to a reference gas, CO_2, which is assigned a global warming potential equal to one (1). All six GHGs are multiplied by their global warming potential, and the results are added to calculate the total equivalent emissions of CO_2 (CO_2e). However, the dominant GHG emitted is CO_2, accounting for 80 percent of all GHG emissions as of 2019, the most recent year for which data are available (USEPA, 2022b). Current GHG emission sources on FBNA include combustion engines, boilers, chillers, and water heaters.

One of the key ways the DoD achieves reduction in GHG emissions in building construction and operation is through the Leadership in Energy and Environmental Design (LEED) certification program, an internationally recognized green building certification system providing third-party verification that a building or community was designed and built using measures to reduce energy and water use, GHG emissions and the amount of construction waste sent to landfills. The Energy Independence and Security Act of 2007 requires federal agencies to use a green building certification system for new construction and major renovations of buildings. Pursuant to DoD policy, the Proposed Action will be designed to achieve an LEED rating of Silver. The guiding principles for sustainability for the Proposed Action are the 2016 Guiding Principles for

Sustainable Federal Buildings and Determining Compliance with the Guiding Principles for Sustainable Federal Buildings, 2018 International Green Construction Code, UFC 3-600-01, Energy Star Energy Efficiency Labeling System (FEMP), and 40 CFR 247 Comprehensive Procurement Guideline for Products Containing Recovered Materials.

EO 13990, signed January 20, 2021, reinstated the final guidance issued on August 5, 2016 by the CEQ that required federal agencies to consider GHG emissions and the effects of climate change in NEPA reviews. DoD has committed to reduce GHG emissions from non-combat activities 42 percent by 2025 (DoD, 2016). Accordingly, estimated CO_2e emissions associated with the Proposed Action are provided in this EA for informative purposes.

Fort Belvoir is required to report to USEPA through the electronic GHG tool (e-GRRT) as the installation has exceeded 25,000 metric tons per year for CO_2e for the last five years. Current GHG emission sources at Fort Belvoir include combustion engines, boilers, chillers, and water heaters. The total CO_2e for Fort Belvoir is inclusive of Main Post and FBNA. FBNA sources however only account for 0.1 percent (natural gas) of the total 27,366.02 metric tons CO_2e for calendar year 2020 (DIA, 2021). The emission total is the amount reported annually under the requirements of 40 CFR 98 and does not include GHG emissions from mobile sources or emergency generators.

3.9.1.5 Emissions Reporting

Title V of the CAA requires states and local agencies to permit major stationary sources. As a major stationary source for emissions, Fort Belvoir (Main Post) operates under a Title V Permit (Registration Number 70550, issued on March 21, 2003). Fort Belvoir also operates under a minor New Source Review (mNSR) permit for Main Post (same Registration Number 70550).

The Title V and mNSR permits for Main Post do not apply to FBNA emission sources, as this area is non-contiguous from Main Post and considered a separate source. Stationary emission sources on FBNA include large boilers, generators, heaters, above ground storage tanks and emergency generators. FBNA emission sources are operated under a separate synthetic mNSR air permit (Registration Number 73630). Emissions limits for stationary sources, as directed by the mNSR permit, are included in Table 3-8. As a synthetic minor source, the FBNA annual update report does not include the requirement for an emission statement. The FBNA annual update report provides specific total throughput (million cubic feet burned and/or gallons burned) for the permitted equipment. However, as a requirement of the permit, Fort Belvoir Air Quality Program maintains a rolling 12-month total for the criteria pollutant emissions from FBNA sources, as found in Table 3-8. There are no existing emissions sources within the Proposed Action Site. Any new equipment with the potential to emit would be evaluated for permitting thresholds prior to purchase and installation. Should the final design require it, a new permit would be obtained to account for future stationary sources, as warranted.

Table 3-8: mNSR Emissions Limits and Emissions from Stationary Sources (tpy) for CY 2020

	SO_X	CO	PM_{10}	$PM_{2.5}$	NO_2	VOCs
mNSR Emissions Limits	3.1	35.5	4.3	None	75.0	7.0
2020 FBNA Emissions	0.15	1.65	0.25	0.25	6.31	0.35

Source: Fort Belvoir, Air Quality Program

3.9.1.6 Sensitive Receptors

CEQ NEPA regulations require evaluation of the degree to which the Proposed Action affects public health (40 CFR 1508.27). Children, elderly people, and people with illnesses are especially sensitive to the effects of air pollutants; therefore, hospitals, schools, convalescent facilities, religious facilities, and residential areas are considered sensitive receptors for air quality impacts, particularly when located within one mile from the emissions source. Within a one-mile radius of the Proposed Action Site is the North Belvoir CDC located on FBNA, as well as several schools, residential areas, and senior living facilities adjacent to FBNA.

3.9.2 Environmental Consequences

3.9.2.1 Threshold of Significance

The threshold of significance for air quality impacts would be exceeded if the Proposed Action were to result in any of the following:

- Exceedance of the applicable General Conformity Rule *de minimis* level thresholds;
- Increase of criteria pollutant emissions to levels above permitted source thresholds; or
- Meaningful contributions to the potential effects of global climate change.

Based on compliance with the NAAQS, the General Conformity Rule is potentially applicable to emissions of VOCs and NO_X in Fairfax County. The applicable *de minimis* thresholds for these pollutants is 50 tpy for VOCs and 100 tpy for NO_X (40 CFR 93.153[b]). While the General Conformity Rule is not applicable to emissions of CO, SO_X, $PM_{2.5}$, and PM_{10}, an insignificance indicator of 250 tpy, defined as the USEPA Prevention of Significant Deterioration threshold, can be used to provide an indication of the significance of potential impacts to air quality. The 250 tpy threshold indicator does not denote a significant impact; however, it does provide a threshold to identify actions that have insignificant impacts to air quality.

3.9.2.2 Impacts of Proposed Action

<u>Construction</u>

Short-term, minor, adverse impacts on air quality would result from the construction of the warehouse and administrative building. Emissions of criteria pollutants and GHGs would be directly produced from activities such as operation of heavy equipment; heavy duty diesel vehicles hauling construction materials and debris to and from the project site; workers commuting daily to and from the project site in their personal vehicles; and ground disturbance. All such emissions would be transitory in nature and would only occur when such activities are occurring. The estimated annual emissions for construction under the Proposed Action are summarized in Table 3-9.

Table 3-9: Estimated Annual Air Emissions from the Proposed Action

Year	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	CO_2e
2022 Construction of Distribution Center and Administrative Building	0.439	2.772	2.385	0.007	65.188	0.113	691.8
2023 Construction of Distribution Center and Administrative Building	0.900	6.138	5.390	0.017	65.231	0.226	1,735.2
2024 Construction of Distribution Center and Administrative Building Heating for Buildings Operation of Emergency Generators	6.875	3.265	2.890	0.016	0.191	0.189	2,507.3
2025 and later Heating for Buildings Operation of Emergency Generators	0.198	3.616	2.944	0.024	0.270	0.270	4,153.3
General Conformity *de minimis* Thresholds	50	100	250[1]	250[1]	250[1]	250[1]	N/A

Note: [1] The 250 tpy Prevention of Significant Deterioration threshold, as defined by USEPA, was used as an insignificance indicator for emissions of CO, SO_X, PM_{10}, and $PM_{2.5}$.
Key: N/A = not applicable

The air pollutant of greatest concern is particulate matter, such as fugitive dust, which is generated from ground-disturbing activities and combustion of fuels in construction equipment. The quantity of uncontrolled fugitive dust emissions from a construction site is proportional to the area of land being worked and the level of activity. Fugitive dust emissions would be greatest during initial site preparation activities and site grading and would vary from day to day depending on the work phase, level of activity, and prevailing weather conditions. In accordance with 9 VAC 5-40-90, construction contractors would be required to take reasonable precautions to prevent particulate matter from becoming airborne. BMPs and environmental control measures (e.g., wetting the ground surface) would be incorporated at construction areas to minimize fugitive dust emissions. In addition, work vehicles would be well-maintained and use diesel particulate filters to reduce emissions of criteria pollutants. These BMPs and environmental control measures could reduce uncontrolled particulate matter emissions from a construction site by approximately 50 percent.

Construction associated with the Proposed Action would produce a total of 2,857.7 tons (2,592 metric tons) of CO_2e. By comparison, 2,592 metric tons of CO_2e is approximately the GHG footprint of 558 passenger vehicles driven for 1 year or 504 homes' energy use of 1 year (USEPA, 2022c). In 2019, Virginia produced 103.2 million metric tons of CO_2 emissions (USEIA 2018). Assuming all CO_2e emissions from construction are from CO_2, emissions from construction under the Proposed Action would represent less than 0.003 percent of the total CO_2 emissions from the state. As such, air emissions produced during construction would not meaningfully contribute to the potential effects of global climate change and would not notably increase the total CO_2 emissions produced by the State.

Climate patterns and foreseeable climate trends in the northeast, such as increased average temperatures, increase in the frequency and intensity of flooding and drought events, and disruption of vegetative ecosystems, are unlikely to affect the U.S. Army's ability to implement the Proposed Action, and the Proposed Action would not appreciably contribute to the regional (i.e., northeastern United States) impacts from global climate change because of insignificant CO_2e emissions compared to the total emissions produced by the state. Therefore, climate change would not likely affect the ability for the Proposed Action to be implemented.

Operation

Long-term, negligible, adverse impacts on air quality would occur from operational air emissions associated with the Proposed Action. Operational air emissions would be produced from the natural gas-fired boilers for the proposed buildings and from the emergency generators near the warehouse and entry control facility. Total estimated annual air emissions from operation of the warehouse and administrative building are summarized in Table 3-9.

Emissions from the heating system and emergency generators at the proposed buildings would not increase the installation's potential to emit above permitted emissions limits, and the capacities of the systems is likely to be low enough that they would not need to be added to the mNSR permit as stationary sources. If determined that such equipment would require permitting, FBNA's mNSR permit could be modified to include the proposed boilers and emergency generators. However, these facilities may require permitting by the facility end user. In such case, the boilers and emergency generators would be permitted under a separate mNSR permit. In either event, the proposed emissions from these facilities, combined with the potential to emit for FBNA, would not exceed major source thresholds.

Operation of the warehouse and administrative building would produce 4,153.3 tons (3,767.8 metric tons) of CO_2e, which is equivalent to the GHG footprint of 812 passenger vehicles driven for 1 year or 475 homes' energy use for 1 year (USEPA, 2022c). Assuming all CO_2e operational emissions are from CO_2, operational emissions would represent less than 0.005 percent of the total CO_2 emissions from the state. As such, air emissions produced during operation of the warehouse and administrative building would not meaningfully contribute to the potential effects of climate change and would not noticeably increase the total CO_2 emissions produced by the state.

General Conformity

Emissions of VOCs and NO_X during the construction phase would be less than their respective *de minimis* level thresholds of 50 tpy for VOCs and 100 tpy for NO_X. Emissions of CO, SO_X, $PM_{2.5}$, and PM_{10} would be less than the insignificance threshold of 250 tpy. In addition, the annual emissions from operation of the warehouse and administrative building would not exceed the de minimis level thresholds or insignificance thresholds of any criteria pollutant (see Table 3-7). Therefore, a general conformity determination is not required and no significant impacts would occur. The U.S. Army has prepared a Record of Non-Applicability (RONA) for CAA conformity (see Appendix G).

3.9.2.3 Impacts of No Action Alternative

Under the No Action Alternative, air quality conditions would remain the same as described in Section 3.9.1 and no short- or long-term impacts on air quality would occur. Air emissions from construction and operation of a warehouse and administrative building on FBNA would not occur.

3.10 TRAFFIC

3.10.1 Affected Environment

This section describes the existing road network serving the Proposed Action on FBNA. A Traffic Impact Study (TIS) was conducted to evaluate existing conditions and the potential impacts of the Proposed Action to traffic patterns in the vicinity (see Appendix H). Four key intersections were identified in the traffic study area. Turning Movement Counts (TMCs) and roadway volume counts were conducted at the four locations shown in Figure 3-10. March 2022 traffic data was collected at four intersections along Barta Road to support the development of the TIS. This data was used to amend previously acquired counts collected in March 2021 for the DIA annex project.

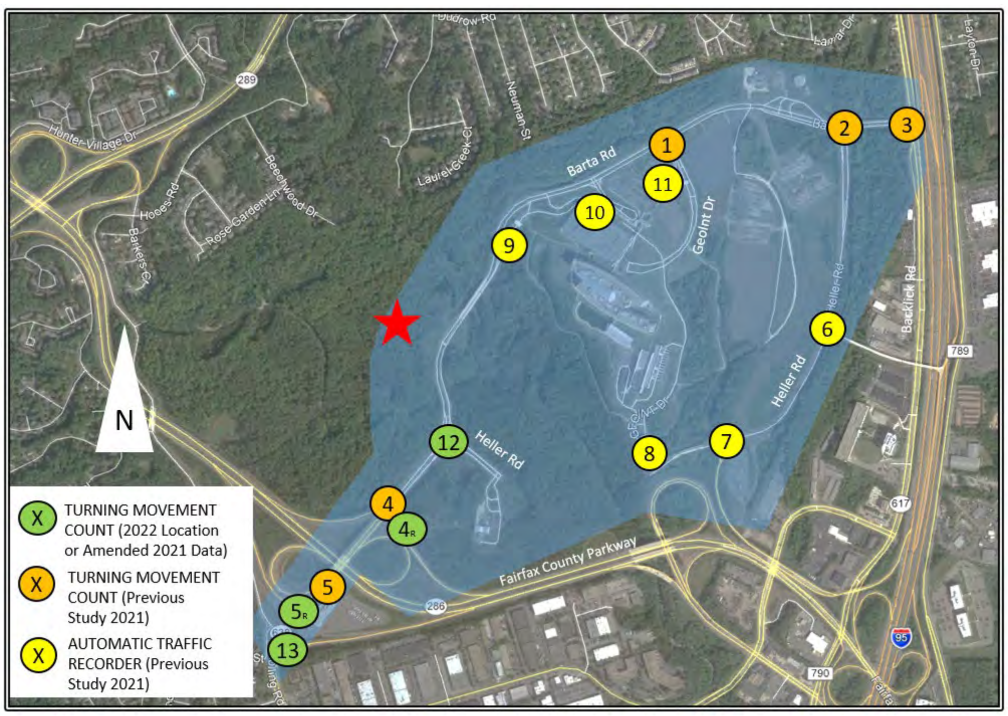

Figure 3-10: Count Locations for Existing Conditions

Level of Service Standards

Level of Service (LOS) is a qualitative measure describing operational traffic conditions, and the perception of these conditions by drivers or passengers. These conditions include factors such as speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Levels of service are given letter designations from A to F, with LOS A representing the best operating conditions (free flow, little delay) and LOS F, the worst (congestion, long delays). Generally, LOS A and B are considered high level of service, LOS C and D are considered moderate, and LOS E and F are considered low. In general, the standards are LOS D in urban areas and LOS C in rural areas.

The results of the operations analysis using Synchro are provided in Table 3-10.

Table 3-10: Existing Intersection Operational Analysis - FBNA

Intersection ID	Intersection	Signalized (Y/N)	am	pm	am	pm
			Delay (s/veh)		LOS	
B	Barta Road / Heller Road	Y	2.5	0.4	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.0	9.5	A	A
E	Barta Road / Main Guest Access	N	-	-	A	A
F	Barta Road / GEOINT Drive	Y	5.5	10.4	A	B
G	Barta Road / Heller Road	Y	9.8	0.4	A	A
H	Barta Road / Backlick Road	Y	7.9	18.9	A	B
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.3	9.3	A	A
Q	Barta Road / South Bound VA 286 Ramps	Y	6.2	8.4	A	A
R	Barta Road / North Bound VA 286 Ramps	Y	9.0	11.9	A	B

As shown in the table above, all intersections are operating at LOS B or better.

Transit

There are three bus transit routes that pass near Fort Belvoir and FBNA, including Route 171, Route 335, and REX (Richmond Highway Express). Routes 171 and 335 are operated by the Fairfax Connector, and the REX is operated by Washington Metropolitan Area Transit Authority.

Non-motorized Facilities

Sidewalks and pedestrian crossings are present near the Proposed Action Site, but few pedestrian movements were noticed during the traffic counts. Surrounding streets do not have marked bicycle lanes, and no bicycle movements were observed during the traffic counts.

3.10.2 Environmental Consequences

3.10.2.1 Thresholds of Significance

Roadway traffic resulting from operations of the Proposed Action could result in changes to the LOS provided by existing road systems. Key issues of concerns regarding potential traffic impacts of the Proposed Action include:

- Maintaining a LOS on affected roadways that meets an acceptable standard
- Minimizing the effect of 600 additional employees at the Access Control Points serving FBNA.

3.10.2.2 Impacts of Proposed Action

The distribution center construction is estimated to generate 600 additional staff positions. The analysis assumes that each additional staff member generates 0.9 additional AM and PM peak hour trip for 600 additional staff (distribution center) and one additional am and pm peak hour trip for each 650 additional staff (DIA Annex). In addition, 18 truck trips have been modeled for both the am and pm peak hours. The distribution between site access points was determined utilizing the March 2021 count data.

Peak Period Vehicular Traffic Impacts

Based on the traffic operational results, FBNA would be able to accommodate the existing site traffic and the anticipated additional traffic generated by the distribution center and the DIA Annex (Table 3-11); therefore, impacts would be less-than-significant.

Table 3-11: Build Condition (2023) Intersection Operational Analysis

Int. ID	Intersection	Signalized (Y/N)	***600 Added Personnel (DC) + 650 Added Personnel (DIA)***			
			am	pm	am	pm
			Delay (s/veh)		LOS	
A	New Entrance / Barta Road	Y	4.9	22.7	A	C
B	Barta Road / Heller Road	Y	4.6	0.9	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.1	7.7	A	A
E	Barta Road / Main Guest Access	N	8.7	11.4	A	B
F	Barta Road / GEOINT Drive	Y	5.8	66.3	A	E
G	Barta Road / Heller Road	Y	9.8	4.7	A	A
H	Barta Road / Backlick Road	Y	8.5	22.2	A	C

Int. ID	Intersection	Signalized (Y/N)	***600 Added Personnel (DC) + 650 Added Personnel (DIA)***			
			am	pm	am	pm
			Delay (s/veh)		LOS	
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.8	9.7	A	A
Q	Barta Road / South Bound VA 286 Ramps	Y	7.8	9.4	A	A
R	Barta Road / North Bound VA 286 Ramps	Y	27.7	11.3	C	B

Increased vehicle traffic may affect some intersections outside of the study area. The project traffic traveling through those intersections is expected to result in a small (less than 1 percent) increase in traffic at those intersections. The project trips associated with this project are not expected to affect the LOS of those intersections significantly.

<u>Pedestrian and Bicycle Operations</u>
Pedestrians are provided shared phasing with appropriate traffic phases. No impacts are expected along Barta Road. Additional connections to the new distribution facility may be appropriate with connection across Barta Road.

<u>Proposed Design Features Intended to Reduce Impacts</u>
From the analysis results, possible roadway and intersection improvements were identified to mitigate operational impacts that were degraded to LOS E. Potential mitigation is discussed below.

- pm – North B Geoint Drive to both EB & WB Barta Road
    - Mitigation – Signal optimization and additional turn lane for increased turn volumes.

Based on the modeling results, the existing roadway system build scenario operates at acceptable levels with the construction of the distribution center and added personnel. Low LOS at Geoint Drive in the pm would only be anticipated with the construction of the DIA Annex. LOS E is also expected only for exiting vehicles from existing Geoint Drive.

3.10.2.3 Impacts of No Action Alternative

Currently, the primary users of FBNA are government employees of NGA and their visitors. No growth in background traffic volumes in the study area would result from the No Action Alternative.

3.11 CULTURAL AND HISTORIC RESOURCES

3.11.1 Affected Environment

Several federal laws and regulations—including the NHPA of 1966, as amended, the Archaeological and Historic Preservation Act of 1974, the American Indian Religious Freedom Act (AIRFA) of 1978, the Archaeological Resource Protection Act of 1979 (ARPA), and the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990—have been established to manage cultural resources. Cultural resources include "historic properties" as defined by the NHPA, "cultural items" as defined by NAGPRA, "archaeological resources" as defined by the ARPA, "sacred sites" as defined by EO 13007 to which access is afforded under AIRFA, and collections and associated records as defined in 36 CFR 79.

Archaeological resources consist of locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains. Architectural resources include standing buildings, districts, bridges, dams, and other structures of historic significance. Traditional cultural properties include locations of historic occupations and events, historic and contemporary sacred and ceremonial areas, prominent topographical areas that have cultural significance, traditional hunting and gathering areas, and other resources that Native Americans or other groups consider essential for the persistence of their traditional culture.

The NHPA outlines federal policy to protect historic properties and promote historic preservation in cooperation with other nations, tribal governments, states, and local governments. Sections 106 and 110 of the NHPA require federal agencies to identify, evaluate, inventory, and protect historic properties (i.e. those listed or eligible for listing in the National Register of Historic Places [NRHP]) that are under their jurisdiction and control. Federal agencies must delineate the Area of Potential Effect (APE) within which impacts from a proposed action may occur, identify historic properties present within the APE, assess the potential effects of the undertaking on those historic properties and consider ways to avoid, minimize, or mitigate any adverse effects. The APE is the geographic area in which an undertaking may directly or indirectly cause changes in the use or character of a historic property. An undertaking is any federal action with the potential to affect historic properties. Federal agencies are further required to initiate consultation with the State Historic Preservation Officer (SHPO) for actions that may impact historic properties. VDHR serves as the SHPO in Virginia.

The APE for the Proposed Action is defined as the study area outlined in Figure 2-1 plus a 1-mile buffer surrounding the Proposed Action Site to account for any potential effects on the viewshed of historic districts in the vicinity.

3.11.1.1 Site History

The Army acquired FBNA (formerly EPG) in the early 1940s to support the Research, Development and Engineering Center for the testing of a wide range of engineering equipment and supplies, including methods and equipment for the deployment, detection, and neutralization of landmines. The Army used EPG for these purposes from the 1940s through the 1970s (U.S. Army, 2007), with the highest level of activity at EPG occurring during the 1940s to the mid-1950s. Commercial and residential encroachment in the vicinity of FBNA in the 1960s and 1970s contributed to the reduction of testing activities at this location.

The Proposed Action Site was used as a MEC training area known as Range 5 (Arcadis, 2019). The range has since been closed and allowed to regenerate to natural areas. At the site, there are abandoned ammunition storage magazines and other buildings associated with the former training activities.

3.11.1.2 Archaeological Resources in the APE

In compliance with Section 110 of the NHPA, an archaeological survey was completed for the entire FBNA in 1993, and no archaeological properties eligible for the NRHP were identified (MAAR Associates, 1993). To date, only one archaeological resource, an isolated prehistoric artifact, has been discovered on FBNA, but evaluated as not eligible for the NRHP (New South Associates, 2007).

3.11.1.3 Architectural Resources in the APE

A comprehensive architectural survey of all extant properties on FBNA was completed in 2006 and none were eligible for the NRHP, nor listed on any state or local resister (Fort Belvoir, 2014a). The findings of this report were reviewed and concurred by Virginia SHPO. Further, a review of the Fairfax County Inventory of Historic Sites, current Fairfax County Historic Overlay Districts, the Virginia Landmarks Register, and the NRHP indicated that no listed resources or historic overlay districts are in close proximity to the Proposed Action Site or FBNA (U.S. Army, 2007).

Based on the information provided above, Fort Belvoir has concluded that no historic properties exist within the APE or in close proximity.

3.11.2 Environmental Consequences

3.11.2.1 Thresholds of Significance

Significant impacts on cultural resources would occur if potential resources that have not been previously documented are not properly identified, consultation pursuant to Section 106 is not completed, or impacts on viewsheds within the APE buffer are not appropriately considered and addressed.

3.11.2.2 Impacts of Proposed Action

No effects on cultural resources are anticipated from the Proposed Action. The Proposed Action Site has been previously disturbed, as a result of its use for testing activities and munitions ranges, since its inception as a testing ground in the 1940s with subsequent ground disturbance from contamination testing and removal actions. No eligible archaeological or architectural resources exist within the APE for the Proposed Action on FBNA. In terms of potential effects to viewsheds of historic districts in the project vicinity, the project is consistent with the campus-style environment found across Fort Belvoir. The distribution center would be designed in accordance with applicable installation design guidelines, including the Fort Belvoir Master Plan. The site is surrounded by stands of second-growth pines and hardwood forest that provide a visual screen for off-site properties.

In accordance with Section 106 of the NHPA, consultation was initiated with the Virginia SHPO (VDHR) and Fort Belvoir received concurrence from the SHPO on the determination of “no historic properties affected." A record of this consultation is included in Appendix A.

Additionally, should cultural artifacts be inadvertently discovered during construction operations of the Proposed Action, the inadvertent discovery plan described in Fort Belvoir’s Integrated Cultural Resources Management Plan (ICRMP) would be implemented to ensure notifications are made to appropriate personnel and VDHR.

3.11.2.3 Impacts of No Action Alternative

No effects on cultural resources are anticipated from the No Action Alternative.

3.12 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, and PROTECTION OF CHILDREN

3.12.1 Affected Environment

3.12.1.1 Socioeconomics

Socioeconomic factors are defined by the interaction or combination of social and economic factors. The relevant factors related to the Proposed Action include population and housing, economic development, and quality of life/health and safety issues.

The Region of Influence (ROI) for socioeconomic characteristics encompasses Fairfax County, Virginia. This ROI includes the installation and the immediately surrounding communities that have direct and indirect socioeconomic relationships with the installation, because distribution center staff may potentially live in this county and military personnel may frequent commercial establishments outside the installation.

3.12.1.2 Environmental Justice

Environmental justice addresses the race, ethnicity, and poverty status of populations within the ROI. On February 11, 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* to focus the attention of federal agencies on the human health and environmental conditions in minority and low-income communities. EO 14008, *Tackling the Climate Crisis at Home and Abroad*, signed by President Biden on January 27, 2021, further strengthens EO 12898 by requiring that "Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."

Potential environmental justice considerations are determined by comparing demographic and economic characteristics (minority population composition and poverty rates) within the ROI to the same characteristics in the surrounding region. Environmental justice analyses are performed to identify potential disproportionate adverse effects from proposed actions and to identify alternatives that might mitigate these effects (USEPA, 2016).

The term minority refers to people who classified themselves as American Indian or Alaskan Native; Asian or Pacific Islander; African Americans or Black, not of Hispanic origin; or Hispanic.

Minority populations are defined as areas where racial minorities comprise 50 percent or more of the total population. Because CEQ guidance does not establish a threshold for low-income communities, for the purposes of this EA a low-income population is one with at least 25 percent or greater of its population living in poverty for the purposes of this EA.

<u>Demographics</u>

Fairfax County comprises an area of 391 square miles, and the estimated 2020 population was 1,150,309, according to the 01 April 2020, Population Census, a 6.0 percent increase from the population of 1,081,726 in 2010 (U.S. Census, 2021). In 2021, 35.3 percent of Fairfax County's population was composed of minorities. Fairfax County is not considered a minority community because the percentage of minorities living in the county is less than 50 percent of the total population. The median household income from 2015 to 2019 (in 2019 dollars) was $124,831. There were approximately 6 percent of persons living in poverty in Fairfax County. Fairfax County is not considered a low-income community because low-income people and families do not comprise 25 percent or more of the total population (U.S. Census, 2022). Some of the census tracts within Fairfax County and north of the Proposed Action Site do qualify as at least 25 percent minority. Census Tracts 4315 and 4316 are 38.9 percent and 70.3 percent minority, respectively (U.S. Census, 2020a). The surrounding census tracts are not considered low-income, because the percent population below poverty does not exceed 25 percent (U.S. Census, 2020b).

Fort Belvoir is approximately 8,000 acres in size and has an approximate working population of 40,000 people (NCPC, 2017). FBNA is roughly 804 acres in size and supports approximately 8,600 employees, most of whom are government civilians, military members, and contractors employed by the NGA Campus East, whose headquarters were completed as part of the 2005 BRAC actions in September 2011. NGA Campus East is the third largest federal facility in Washington, D.C. area, at approximately 2.77 million square feet (https://www.nga.mil/history/).

Housing

Approximately 7,500 residents live on Fort Belvoir (2,100 housing units, located on Main Post) (NCPC, 2017). A residential area is located north of and adjacent to the Proposed Action Site outside the FBNA boundary.

3.12.1.3 Protection of Children

On 21 April 1997, President Clinton issued EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, directing each federal agency to ensure that its policies, programs, activities, and standards address disproportionate environmental health or safety risks to children that may result from the agency's actions. EO 13045 recognizes that a growing body of scientific knowledge demonstrates that children may suffer disproportionately from environmental health and safety risks due to still developing neurological, immunological, physiological, and behavioral systems. Examples of risks to children include increased traffic volumes and industrial- or production-oriented activities that would generate substances or pollutants that children could come into contact with and ingest.

Two child development centers are located east of the Proposed Action Site on FBNA (U.S. Army, 2021). These facilities were completed in 2015 and provide childcare services primarily for the existing NGA facility. The Army has taken precautions for the safety of children by limiting access to certain areas, the use of fencing, and providing adult supervision (USACE, 2021b).

3.12.2 Environmental Consequences

3.12.2.1 Thresholds of Significance

Socioeconomics

A proposed action is evaluated against the following significance criteria to determine if they would result in a significant impact on the socioeconomic environment:

- Substantially change local population growth rates or employment opportunities.
- Create a demand for housing, schools, public facilities, or recreational opportunities that exceeds existing supply.

Environmental Justice

The concept of environmental justice is based on the premise that no segment of the population should bear a disproportionate share of adverse human health or environmental effects of a proposed federal action. Historically, low-income and minority communities have been disproportionately affected by negative environmental effects, receiving few of the benefits of economic growth and development while absorbing much of the societal cost.

A proposed action is evaluated against the following significance criteria to determine if they would result in a significant impact on environmental justice populations: it would cause socioeconomic impacts that disproportionately affect low-income or minority populations.

Protection of Children

Because children may suffer disproportionately from environmental health risks and safety risks, EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was issued in 1997 to prioritize the identification and assessment of environmental health risks and safety risks that may affect children and to ensure federal agencies' policies, programs, activities, and standards address environmental and safety risks to children.

A proposed action is evaluated against the following significance criteria to determine if they would result in a significant impact on the protection of children: it would increase risks to the safety of children.

3.12.2.2 Impacts of Proposed Action

Socioeconomics

Under the Proposed Action, long-term, less-than-significant, beneficial effects would be expected on socioeconomics. The construction and renovation expenditures would result in beneficial increases in the Return on Investment (ROI) business sales volume, income, and employment. Although the Proposed Action's expenditures would be quite substantial, Fort Belvoir is in an economically large and robust region where the magnitude of the expenditures relative to the regional demographic and economic forces would be considered minor. Because construction projects are, by nature, temporary, the economic stimulus from construction of the Proposed Action would diminish over time as the project reached completion.

Environmental Justice

Under the Proposed Action, no effects would be anticipated on environmental justice. The ROI for the Proposed Action is not considered to be a minority or low-income community (USACE, 2021b). In addition, the Proposed Action would not have the potential to substantially affect human health or the environment by excluding persons, denying persons benefits, or subjecting persons to discrimination because of their race, color, national origin, or income level.

Protection of Children

Under the Proposed Action, no effects would be anticipated to occur to children. The CDCs are to the east of the site and with proper precautions, would not allow children near the construction site. Post-construction, there would be no environmental risks for children near or in the Proposed Action Site.

3.12.2.3 Impacts of No Action Alternative

Under the No Action Alternative, no changes would be expected to occur to socioeconomics, environmental justice, or protection of children. Fairfax County would see no changes in employment or need for public services. No changes to minority or low-income communities would occur. No changes would occur on-site that have the potential to disproportionately affect children.

3.13 CUMULATIVE EFFECTS

This EA has been developed in accordance the 2020 CEQ NEPA regulations (40 CFR 1500) as amended on May 20, 2022, which require assessment of cumulative impacts (U.S. Army, 2022). A cumulative effect is defined as the following (40 CFR § 1508.1(g)(3)): An effect on the environment that results from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

3.13.1 Projects Considered for Potential Impacts

The assessment of cumulative effects involves identifying and defining the scope of other actions and their interrelationship with a proposed action or alternatives. The scope must consider other projects that coincide with the location and timeline of a proposed action and other actions. Therefore, this cumulative effects analysis focuses on past, present, and reasonably foreseeable actions taking place within and immediately adjacent to FBNA.

Past actions are those actions, and their associated impacts, that occurred within the geographical extent of cumulative effects that have shaped the current environmental conditions of the Project area and, therefore, are now part of the existing environment, in addition to present actions and included in the affected environments for each resource area. Reasonably foreseeable actions that could have a causal relationship to the Proposed Action and Alternatives and contribute to additional impacts on the human environment are discussed in this section. Because the Proposed Action would be largely confined to FBNA, aside from commuter and operational traffic, only those actions occurring on FBNA or immediately adjacent to FBNA are included in this analysis. Brief descriptions of these actions, as available, follow.

Fort Belvoir Defense Intelligence Agency (DIA) Headquarters (HQ) Annex. The Proposed Action involves the construction of the HQ annex building within FBNA, in the vicinity of the NGA complex. The HQ annex would consist of an approximately 77,000 net square foot/116,080 gross square foot administrative building and an associated parking structure. The proposed HQ annex would consolidate administrative facilities for approximately 650 personnel from DIA HQ to address safety, security, and operational concerns specific to the administrative functions of the agency (DIA 2021).

FBNA Real Property Master Plan (RPMP) And Area Development Plan (ADP) Projects. The Fort Belvoir RPMP and FBNA ADP describe various transportation, infrastructure, and land use projects to be implemented over time that would accomplish the following goals: Mission and Land Use Compatibility, Dense Mid-Rise Buildings, Short/Secured Delivery Routes, Emergency Response Quickness Maintained, Improved Power Redundancy, Mission Appropriate Parking Ratio, Architecture Adaptable to Emerging Technology (Utilidors, Conduit), Increased Transit and Rideshare, Continued Compliance with Existing Permits and Policies, and Mitigated Potential Encroachment (U.S. Army 2021; Fort Belvoir 2014b).

Fairfax County and Franconia-Springfield Parkways Alternatives Analysis and Long-Term Planning Study. The Planning Study includes a proposal to widen the Fairfax County Parkway from 4 to 6 general purpose lanes between the Barta Road interchange and John J. Kingman Road. This widening effort would also include construction of continuous, connected, multi-use trails on both sides of the Parkway. In addition, Fairfax County has proposed interchange modifications at Fairfax County Parkway and I-95 (FCDOT 2016).

3.13.2 Cumulative Effects on Resource Areas

The Proposed Action, when combined with present and reasonably foreseeable future projects, would not result in cumulatively significant effects on any resource area. Four resource areas that would likely incur cumulative impacts are discussed below; the other resource areas identified earlier in Section 3 would not incur greater than negligible cumulative impacts.

Water Resources. The master plan for Fort Belvoir envisions FBNA as a future center for an intelligence community integrated campus, with mid- and long-term additions of more buildings and associated infrastructure, including roads, parking and stormwater management facilities. This additional build-out, including the Proposed Action and DIA HQ annex, would add more impervious surfaces to FBNA. Construction of an extension of Heller Road, to form a loop (with Barta Road) around the eastern portion of FBNA could potentially impact Accotink Creek and associated wetlands. Project proponents would be expected to obtain coverage under applicable permits issued by USACE and VADEQ in accordance with the CWA and would adhere to avoidance, minimization and compensatory mitigation to ensure that impacts to regulated waters would remain minor, and the resulting cumulative impacts would not be significant.

Noise. If the Proposed Action were to occur at the same time as other construction efforts under the reasonably foreseeable actions, cumulative short-term, minor impacts on the noise environment would be expected as a result of combined construction equipment and construction-related noise. In combination with other reasonably foreseeable actions, such as the DIA HQ annex, long-term, minor but intermittent noise would be anticipated from commuter traffic and vehicle and generator use as part of daily operations. No project has been identified that, when combined with the Proposed Action, would result in significant impacts.

Air Quality. If the Proposed Action were to occur at the same time as other construction efforts under the reasonably foreseeable actions, cumulative short-term, minor impacts on air quality would be expected from construction vehicle emissions. Implementation of BMPs and environmental control measures, such as wetting the ground surface and regular maintenance of work vehicles, would be incorporated at construction areas and during operations to minimize potential impacts. Cumulative, long-term, negligible to minor, adverse impacts on air quality would be expected as a result of daily operation of the distribution warehouse and DIA HQ annex, and Fairfax County traffic due to vehicle, equipment, and generator use. Estimated air emissions generated by the Proposed Action would be *de minimis* and activities of this limited size and nature would not result in significant impacts on air quality.

Traffic. Long-term, negligible to minor, adverse impacts on traffic would be expected as a result of daily commutes and operations on FBNA under the Proposed Action. When combined with the DIA HQ annex, and potential operational expansions under the ADP and RPMP, cumulative long-term, minor, adverse impacts on traffic would be expected. Increased traffic on FBNA would be alleviated by traffic flow improvements due to Fairfax County Parkway widening and improvements. Cumulative impacts would not be significant.

4 CONCLUSIONS

This draft EA has been prepared to analyze the potential environmental, cultural, and socioeconomic effects associated with the proposed construction and operation of a distribution center on FBNA. The purpose of this project is to build and operate a 525,000-square foot distribution center warehouse and administrative building with associated parking and covered storage for approximately 600 personnel. The need for this Proposed Action is to modernize logistical operations and will address safety, security, and operational concerns specific to the distribution center and its administrative functions.

The analysis within this draft EA concluded that there would be no significant adverse impacts on land use, geology, topography, groundwater, floodplains, utilities, airspace, cultural and historic resources, socioeconomics, environmental justice and protection of children; short-term minor adverse impacts on soil, surface water, RPAs, coastal zones, wetlands, stormwater, vegetation, wildlife resources, noise, air quality and traffic; long-term minor beneficial impacts on vegetation, hazardous materials and waste, munitions, and socioeconomics; as well as short-term minor beneficial impacts on socioeconomics.

Table 4-1 summarizes the potential consequences the Proposed Action and No Action Alternative would have on the environmental resources.

Based on the evaluation of the environmental consequences in this draft EA, the Proposed Action would have no significant impacts on the environment, and the preparation of an EIS is not warranted. The preparation of an FNSI is appropriate.

Table 4-1: Summary of Potential Environmental Consequences on Environmental Resources

Resource	Proposed Action	No Action Alternative	Permits and Best Management and Mitigation Measures
Geology, topography, and soils	Short-term, less-than-significant adverse impacts on soils. Clearing, grubbing and grading would temporarily increase erosion and the potential for sediments to be transported off-site; however, the finished building would be beneficial in reducing accelerated rates of runoff from adversely affecting downstream receiving waters as a result of properly designed stormwater management	No effects	-Obtain ground disturbance permits from Fort Belvoir DPW -Follow ESC Plan (to be included in the project civil design plan following review by Fort Belvoir DPW and approval by VDEQ) -Follow SWPPP -Obtain Construction General Permit from VDEQ

Resource	Proposed Action	No Action Alternative	Permits and Best Management and Mitigation Measures
Water resources (Surface water, RPAs, wetlands, floodplains, groundwater, stormwater, Coastal Zone)	Less-than-significant adverse impacts on surface water, RPAs, wetlands, coastal zone and stormwater. No effects on groundwater and floodplains. This stage of construction exposes soils and increases the potential for erosion and discharge of sediment-laden stormwater to downstream receiving waters; however, appropriate erosion and sediment control measures would be implemented, pursuant to the construction SWPPP and the VSMP Construction General Permit, and would minimize any detrimental effects. Construction of permanent stormwater management features will handle stormwater generated from the development and be designed to maintain pre-development levels of off-site discharge.	Less-than-significant adverse impacts on surface water. No effects on RPAs, wetlands, groundwater, floodplains, coastal zone.	-Obtain CGP -Follow ESC and SWPPP, as referenced above -Design and construction would be performed in accordance with Virginia CZMA policies. -Obtain permit for impacts to wetlands/streams pursuant to Section 401/404 of the CWA prior to disturbance to these resources - All temporarily disturbed areas would be graded and revegetated upon completion of construction -Employ erosion and sediment control measures during construction, to include silt fencing and sediment traps. -Provide spill kits on site in the event of an accidental release of petroleum products from construction equipment. -Provide appropriate secondary containment for on-site generators.
Biological resources (Vegetation, wildlife, RTE species, PIF)	Less-than-significant, short-term, adverse effects on vegetation, wildlife, and RTE species. The Proposed Action would remove existing vegetation, disturbing habitat areas and causing fauna that use the area to relocate. The vegetation/tree removal would be offset with replantings, and the construction area stabilized and revegetated with native plants.	No effects	-Replanting to offset removal of existing trees within the site would be performed in accordance with Fort Belvoir's Tree Removal and Protection Policy. -Consultation regarding listed species would be conducted pursuant to Section 7 of the ESA. -Survey for the small whorled pogonia was conducted on 21 June 2022 and a bat survey for the NLEB was conducted in May 2022. Both species were absent from the Proposed Action Site. - Perimeter controls would be installed during the winter months to exclude the endangered wood turtle from proposed areas of construction activity, as necessary. - To minimize impacts to birds,

Resource	Proposed Action	No Action Alternative	Permits and Best Management and Mitigation Measures
			construction activities would avoid cutting and removal of vegetation from April 1 to July 15. - To protect nesting bat species, no trees over 3 inches in diameter would be removed within the project area between April 15 and September 15.
Hazardous Waste Materials and Munitions	Less-than-significant beneficial effects on hazardous waste and munitions. A munitions survey would ensure the Proposed Action area is cleared from munitions., alleviating safety concerns related to possible munitions remaining on the surface or buried near the surface.	No effects	-Munitions clearance would be conducted pursuant to the 2021 Fort Belvoir Best Management Practice memorandum. -Land use controls, likely to result in the requirement for a vapor intrusion barrier for the administrative building, would continue to be in effect for this site. -Ongoing remedial actions would continue through the re-establishment of an effective groundwater monitoring well system and capping of wells where necessary. -Soils excavated or otherwise disturbed during the project's construction phase would be tested in accordance with established Fort Belvoir policies and procedures. -The construction contractor would be required to prepare and adhere to a SPCC plan.
Utilities (Electric, Wastewater, and Natural Gas)	Less-than-significant, long-term adverse effects on electric, wastewater, and natural gas. The operation of the building would increase demand, but the existing utility systems have been constructed in consideration of long-term buildout of FBNA.	No effects	Any required ground disturbance associated with the extension of existing utilities for connection to the Proposed Action would adhere to the required sediment and erosion control permits.
Noise	Less-than-significant, long-term adverse effect and Less-than-significant, short-term adverse effects during the construction period would occur as a result of the various types of heavy equipment needed. BMPs (listed in	No effects	-The Fairfax County noise ordinance limits construction noise above 60 dBA for residential areas during weekdays. -Noise levels must not exceed National Institute for Occupational Safety and Health or Occupational Safety and Health Administration guidance for workers. -To minimize the potential adverse impact from these noises, construction

Resource	Proposed Action	No Action Alternative	Permits and Best Management and Mitigation Measures
	this section) would be employed to minimize the adverse effects from construction noise. Operation of the completed facility would be expected to result in a negligible increase in ambient noise from climate control (heating/cooling) infrastructure supporting the building and additional commuting vehicles.		vehicles would be equipped with noise dampening equipment including mufflers which would be operated according to the manufacturers' instructions. -Construction vehicles and equipment would be turned off when not in use for more than five minutes. -Construction would take place during daylight hours on weekdays, unless there is a specific action that would require working outside of this normal timeframe, such as mobilizing oversized materials or equipment to the site.
Airspace	Less-than-significant, adverse effects	No effects	No permits/BMPs required.
Air Quality	Less-than-significant, short- and long-term adverse effects. During construction engine emissions and potential fugitive dust emissions would have adverse effects; however, these impacts would be minimized through BMPs. Long-term operation of the facility would result in de minimis emissions.	No effects	-Comply with VDEQ's Fort Belvoir - North Area synthetic mNSR air permit -BMPs include: covering truck beds while in transit to reduce fugitive emissions; spraying water on any unpaved roads or stockpiles to limit fugitive emissions; using ultra-low sulfur diesel as a fuel source where appropriate to minimize oxides of sulfur emissions; using clean diesel in construction equipment and vehicles though the implementation of add-on control technologies and using electric-powered equipment in lieu of diesel-powered equipment when feasible; and, implementing control measures for heavy construction equipment and vehicles (e.g. minimizing operating and idling time). -LEED-Silver design to reduce energy and water usage over the life of the building.
Traffic	Less-than-significant, short-term adverse effects on the regional roadway network and project vicinity from construction worker commutes and delivery/pickup of construction materials/debris. Less-than-significant, long-term	No effects	-Possible roadway and intersection improvements to mitigate operational impacts.

Resource	Proposed Action	No Action Alternative	Permits and Best Management and Mitigation Measures
	effects of increased personnel commuting to/from FBNA.		
Cultural and Historic Resources	No effects. No sites eligible for listing on the NRHP are located within the study area.	No effects	-Consultation in accordance with Section 106 of the NHPA required. -Inadvertent discovery of cultural resources would be managed according to procedures documented in Fort Belvoir’s ICRMP.
Socioeconomics, Environmental Justice, and Protection of Children	Less-than-significant, short- and long-term beneficial effects on socioeconomics due to the potential employment of local construction workers and purchasing of materials from local vendors.	No effects	-The Proposed Action would be initiated only after this environmental review has been completed and the appropriate permits are acquired. It is anticipated that the permitting process would result in assurance of safety and protection of the public, including children. -Proper precautions including the placement of fencing, signage, and other types of barriers would be used to prevent potential harm to all civilians, including children.

5 ACRONYMS

ADP	Area Development Plan
AIRFA	American Indian Religious Freedom Act
AOPC	Area of Potential Concern
APE	Area of Potential Effect
ARPA	Archaeological Resource Protection Act
BMP	best management practices
BO	Biological Opinion
BRAC	Base Realignment and Closure
CAA	Clean Air Act
CBPO	Chesapeake Bay Preservation Ordinance
CDC	Child Development Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	equivalent emissions of CO_2
COC	Constituent of Concern
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DA	Department of Army
dB	decibel
dBA	A-weighted decibel
dBC	C-weighted decibel
DAAF	Davidson Army Air Field
DDD	dichlorodiphenyldichloroethane
DERP	Defense Environmental Restoration Program
DMM	discarded military munitions
DNL	day-night average sound level
DNT	dinitrotoluene
DoD	Department of Defense
DoDI	Department of Defense Instruction
DOPAA	Description of Proposed Action and Alternatives
DPW	Directorate of Public Works
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
EPG	Engineering Proving Ground
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation

FBNA	Fort Belvoir North Area
FNSI	Finding of No Significant Impact
FUDS	Formerly Used Defense Sites
GHG	greenhouse gases
HAP	hazardous air pollutant
HFC	hydrofluorocarbon
HHRA	Human Health Risk Assessment
HTMW	Hazardous and Toxic Materials and Waste
I-95	Interstate-95
ICRMP	Integrated Cultural Resources Management Plan
INRMP	Integrated and Natural Resources Management Plan
IPaC	Information for Planning and Conservation
IRP	Installation Restoration Program
kV	kilovolt
LEED	Leadership in Energy and Environmental Design
LEQ	equivalent-average sound level
LID	low impact development
LOD	limits of disturbance
LUC	land use control
LUCIP	Land Use Control Implementation Plan
LUPZ	Land Use Planning Zone
MBTA	Migratory Bird Treaty Act
MC	munitions constituents
MEC	Munitions and Explosives of Concern
ML	measurement location
mNSR	Minor New Source Review
MMRP	Military Munitions Response Program
MS4	Municipal Separate Storm Sewer System
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NCPC	National Capital Planning Commission
NCR	National Capital Region
NFA	No Further Action
NHPA	National Historic Preservation Act
NGA	National Geospatial Intelligence Agency
NHPA	National Historic Preservation Act
NLEB	Northern Long-eared Bat
NO_x	Nitrogen Dioxides
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSR	noise-sensitive receptors
O_3	ozone

PFC	perfluorocarbon
PIF	Partners in Flight
PM_{10}	particulate matter measured less than or equal to 10 microns in diameter
$PM_{2.5}$	particulate matter measured less than or equal to 2.5 microns in diameter
RCRA	Resource and Recovery Act
RDX	1,3,5-triazine
ROI	Region of Influence
RONA	Record of Non-Applicability
RPA	Resource Protection Area
RTE	rare, threatened, and endangered
SHPO	State Historic Preservation Office
SO_X	sulfur oxides
SOC	Species of Concern
SPCC	Spill Prevention, Control, and Countermeasures
SWMU	Solid Waste Management Unit
SWPP	Stormwater Pollution Prevention Plan
TCE	Trichloroethylene
TIS	Traffic Impact Study
TMC	Turning Movement Counts
TMDL	Total Maximum Daily Load
tpy	tons per year
UAG	U.S. Army Garrison
USC	United States Code
USACE	U.S. Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
VADEQ	Virginia Department of Environmental Quality
VDHR	Virginia Department of Historic Resources
VDWR	Virginia Department of Wildlife Resources
VOC	volatile organic compound

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APPENDIX A – AGENCY COORDINATION

Request for Early Input

Environmental Assessment
Proposed Action and Alternatives for the Distribution Center at
Fort Belvoir, Virginia

All Interested Parties: The U.S. Army Garrison, Fort Belvoir, Virginia is preparing an Environmental Assessment (EA) for the construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia, pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality (CEQ) regulations that implement NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and 32 CFR Part 651, *Environmental Analysis of Army Actions*. An EA is used as a planning document to assess environmental impacts, evaluate their significance, develop alternatives and mitigation measures, and allow for agency and public participation (32 CFR 651.20).

The EA is being prepared to evaluate the environmental impacts associated with the **Proposed Action** to build and operate a distribution center at FBNA. The project will modernize logistical operations and address safety, security, and operational concerns specific to the warehouse and its administrative functions. The project is needed to support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring a site within the National Capital Region to achieve distribution efficiencies.

The **Proposed Action** involves the construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage at FBNA for approximately 600 personnel. The hours of operation will typically be between 6am and 4pm. The proposed site location is in a forested area surrounded by industrial land use, keeping the same type of activity that already exists within the FBNA fence line.

The EA will also consider a **No Action Alternative**, which would involve no construction and no distribution center. Although the **No Action Alternative** would not meet the purpose and need for the action, CEQ requires the analysis of the **No Action Alternative**, as it also provides a benchmark for enabling decision-makers to compare the magnitude of environmental effects of the **Proposed Action**.

In accordance with 40 CFR 1500-1508, the Army invites you to provide early input on the **Proposed Action** to be considered in our analysis of each alternative in the forthcoming EA. This notice is being distributed to organizations that may have an interest in the project. Information on the **Proposed Action** can be found on the project website at https://www.nab.usace.army.mil/FBNA/. Comments on the **Proposed Action** can be submitted through the project website or via email to FBNA@usace.army.mil.

Additionally, once the draft EA is completed, agencies and the public will have an opportunity to review and provide comments during a 30-day public review period, which will be announced in a notice published in local newspapers, the project website shown above, and the Fort Belvoir website at https://home.army.mil/belvoir/index.php/about/Garrison/directorate-public-works/environmental-division. Printed copies of the draft EA will be available in the local libraries: Fort Belvoir Library, Lorton Library, Kingstowne Library, Sherwood Regional Library, and Richard Byrd Library.

We appreciate your attention to this matter. Early input will be accepted for a period of 15 days, beginning on the date of this notice. Should you require any additional information or have any questions, please contact the Fort Belvoir Directorate of Public Works-Environmental Division (DPW-ED) via phone at (703) 806-3193 or (703) 806-0020, during normal working business hours, Monday through Friday, 8:00 a.m. to 4:00 p.m.

December 22, 2021

Marc Holma
State Historic Preservation Officer
Office of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Re: Proposed Distribution Center on Fort Belvoir North Area (FBNA), Fort Belvoir, Virginia

Dear Mr. Holma:

U.S. Army Garrison Fort Belvoir would like to initiate formal Section 106 consultation with your office in accordance with Section 36 CFR § 800.3 of the Advisory Council on Historic Preservation's regulations implementing Section 106.

A project proponent is proposing the construction of a distribution center on FBNA, Fort Belvoir, Fairfax County, Virginia. The purpose of the project is to construct an approximately 525,000 square foot distribution center consolidated complex consisting of a high bay warehouse, a two-story administrative building, a truck maintenance/ refueling building, covered/enclosed storage buildings and an entry control facility (gate house and vehicle inspection). This facility will support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring close proximity within the National Capital Region to achieve distribution efficiencies. The action would also provide for compliance with Office of Management and Budget (OMB) guidance to identify "good stewardship of taxpayer resources" and increase joint site usage. The distribution center expects minimal truck traffic compared to a typical industrial distribution center.

The Area of Potential Effect (APE) for an undertaking generally includes the boundaries for ground disturbance for the project and the view shed. At this early stage in the analysis, the geographic boundaries of the APE for this undertaking are conservatively estimated to be the project boundary depicted in Figure 1-2, an approximately 160-acre site on the western portion of FBNA. The Army anticipates the APE would include areas where the construction and operation of the building may directly or indirectly cause changes in the character or use of historic properties.

Much of the area within the undertaking's limits of disturbance has been disturbed by previous construction. A comprehensive archaeological survey was completed for the FBNA (formerly known as the Engineering Proving Grounds) area in 1993, and no archaeological properties were present. Only one archaeological resource, an isolated prehistoric artifact, has been discovered on FBNA but evaluated as not eligible for the NRHP. A comprehensive architectural survey of all extant properties on FBNA was completed in 2006 and none were eligible for the National Register, nor listed on any state or local resister. Historic architectural resource surveys conducted in support of the Fort Belvoir 2016 ICRMP have determined there were no architectural resources eligible for listing in the National Register on FBNA.

No known cultural or historic sites would be impacted by this undertaking. Should archaeological artifacts or features be encountered during construction, all construction activities in the immediate vicinity of the discovery would stop and VDHR would be contacted immediately to determine appropriate treatment.

Pursuant to Section 106 of the National Historic Preservation Act, 36 Code of Federal Regulations § 800, we request your participation and comments on the proposed undertaking.

Please provide written comments within 30 days from the date of this letter to Fort Belvoir contact information. If you need further information, please contact Catherine Roberts, Cultural Resource Program Manager, at 703-806-XXXX.

Belvoir Env office chief signature block

Enclosures:
Figure 1-1: Location Map of Fort Belvoir
Figure 1-2: Project Area for Proposed Action on FBNA

Figure 1-1 Fort Belvoir, Virginia

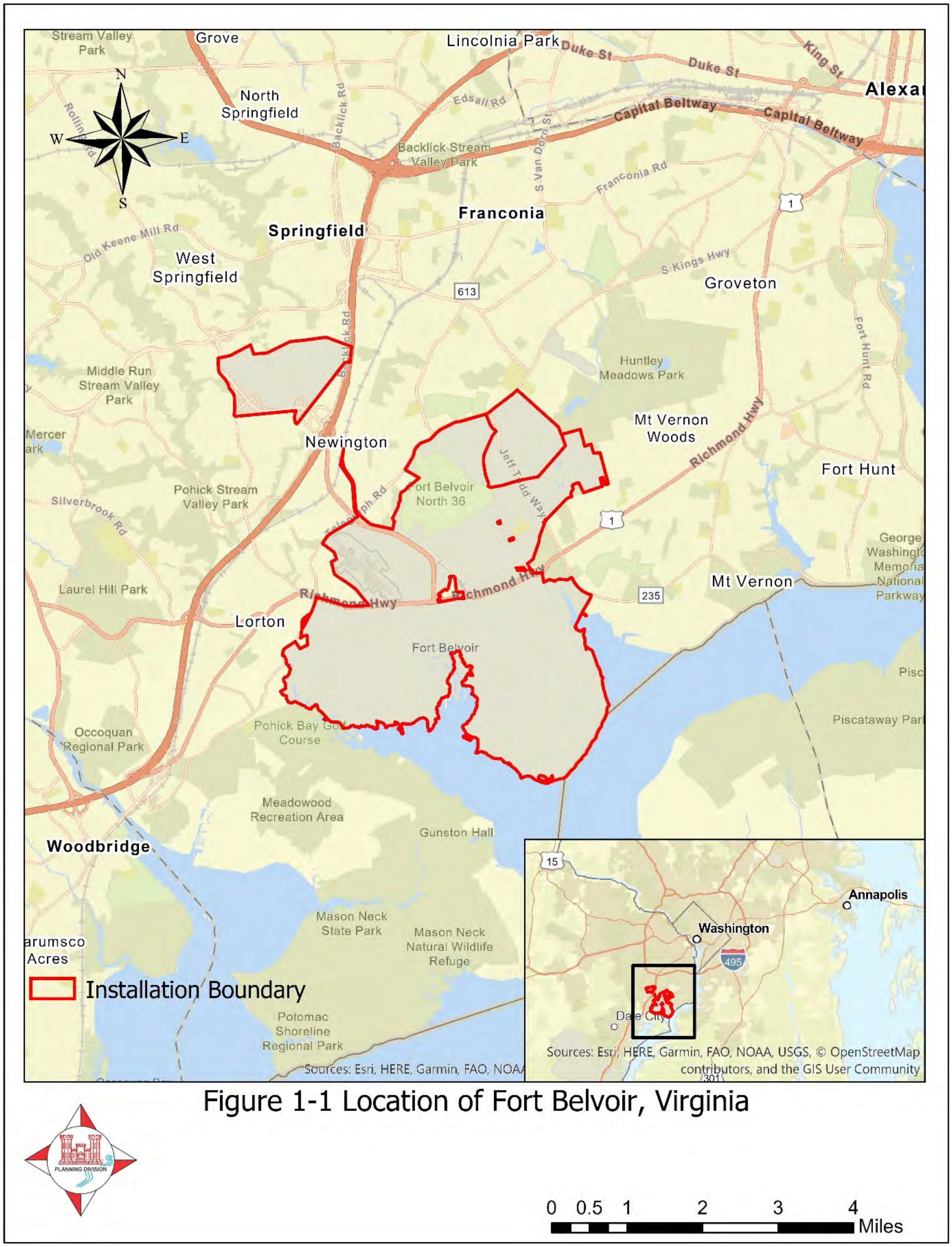


Figure 1-1 Location of Fort Belvoir, Virginia

Figure 1-2 Project Area for Proposed Action on FBNA

COMMONWEALTH of VIRGINIA

Department of Historic Resources

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

2801 Kensington Avenue, Richmond, Virginia 23221

MEMORANDUM

Julie V. Langan
Director
Tel: (804) 482-6446
Fax: (804) 367-2391
www.dhr.virginia.gov

DATE: 21 June 2022 **DHR File #** 2022-4056

TO: Ms Catherine Roberts
ARMY

FROM: Marc E. Holma, Architectural Historian (804) 482-6090
Review and Compliance Division

PROJECT: Fort Belvoir North Area Distribution Center Draft Environmental Assessment
Fort Belvoir, Fairfax County

____ This project will have an effect on historic resources. Based on the information provided, the effect will not be adverse.

____ This project will have an adverse effect on historic properties. Further consultation with DHR is needed under Section 106 of the NHPA.

____ Additional information is needed before we will be able to determine the effect of the project on historic resources. **Please see below.**

_X_ No further identification efforts are warranted. No historic properties will be affected by the project. Should unidentified historic properties be discovered during implementation of the project, please notify DHR.

____ We have previously reviewed this project. Attached is a copy of our correspondence.

____ Other (Please see comments below)

COMMENTS:

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Principal Chief Richard Sneed
Eastern Band of Cherokee Indians
P.O. Box 1927
Cherokee, NC 28719

Dear Chief Sneed:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

The Army will be preparing the EA under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508), and the Army's regulations implementing NEPA (32 CFR Part 651). This project is in the early stages of planning. As soon as more detailed project information has been developed, formal tribal consultation will be initiated. Current information about the Proposed Action can be found on our website at the following: https://www.nab.usace.army.mil/ERCA/.

The purpose of this EA is to inform decision-makers, tribes, stakeholders, and the public of the potential environmental consequences and any associated mitigations, as applicable. Affected Native American tribes and interested persons, organizations, and agencies will have multiple opportunities to provide input on the proposed project. The following resources are evaluated in this EA: land use; airspace; noise; air quality; water resources; biological resources; cultural resources; geology, topography, and soils; hazardous and toxic materials and waste (HTMW); traffic and transportation; infrastructure and utilities; socioeconomics, environmental justice, and protection of children; and human health and safety.

Please note that scoping for the EA is expected to be conducted virtually due to the ongoing coronavirus (COVID-19) pandemic. Informational materials will be posted on the project website at https://www.nab.usace.army.mil/ERCA/.

At this early stage in the analysis, the geographic boundaries of the Area of Potential Effects (APE) for this undertaking are conservatively estimated to be the project boundary depicted in Figure 1. The Army anticipates the APE would include areas where the construction and operation of the building may directly or indirectly cause changes in the character or use of historic properties.

As we are beginning the analysis of the above-referenced resource areas, I would like to invite your input on the anticipated APE for this undertaking. As discussed previously, more information about specific project plans will be provided for review as they are developed to better assist in evaluating the impacts the proposed project may create. I understand that information that you provide on tribal religious or cultural items will be offered voluntarily in the spirit of assisting with our decision making for the project. Based on the available information regarding the proposed action, we welcome any information you would like to share that might be relevant to potential impacts and should be evaluated in the EA.

Any information pertaining to whether this action has the potential to affect tribal trust, subsistence, and/or cultural resources or if tribal rights and/or any protected resources may be affected by this proposed action would be greatly appreciated. Any general comments you may have on the proposed action and proposed alternatives, including discussing possible actions that would benefit your tribe, would also be welcome. I would be happy to answer any questions you may have about the project at this stage. Feel free to connect with me about the project via the contact information listed below. All information provided will be treated with the utmost confidentiality and in accordance with your wishes of how and whether this information can be used. I am also interested in locating any official tribal histories or historical reference materials that are more accurate and/or preferred by your tribe.

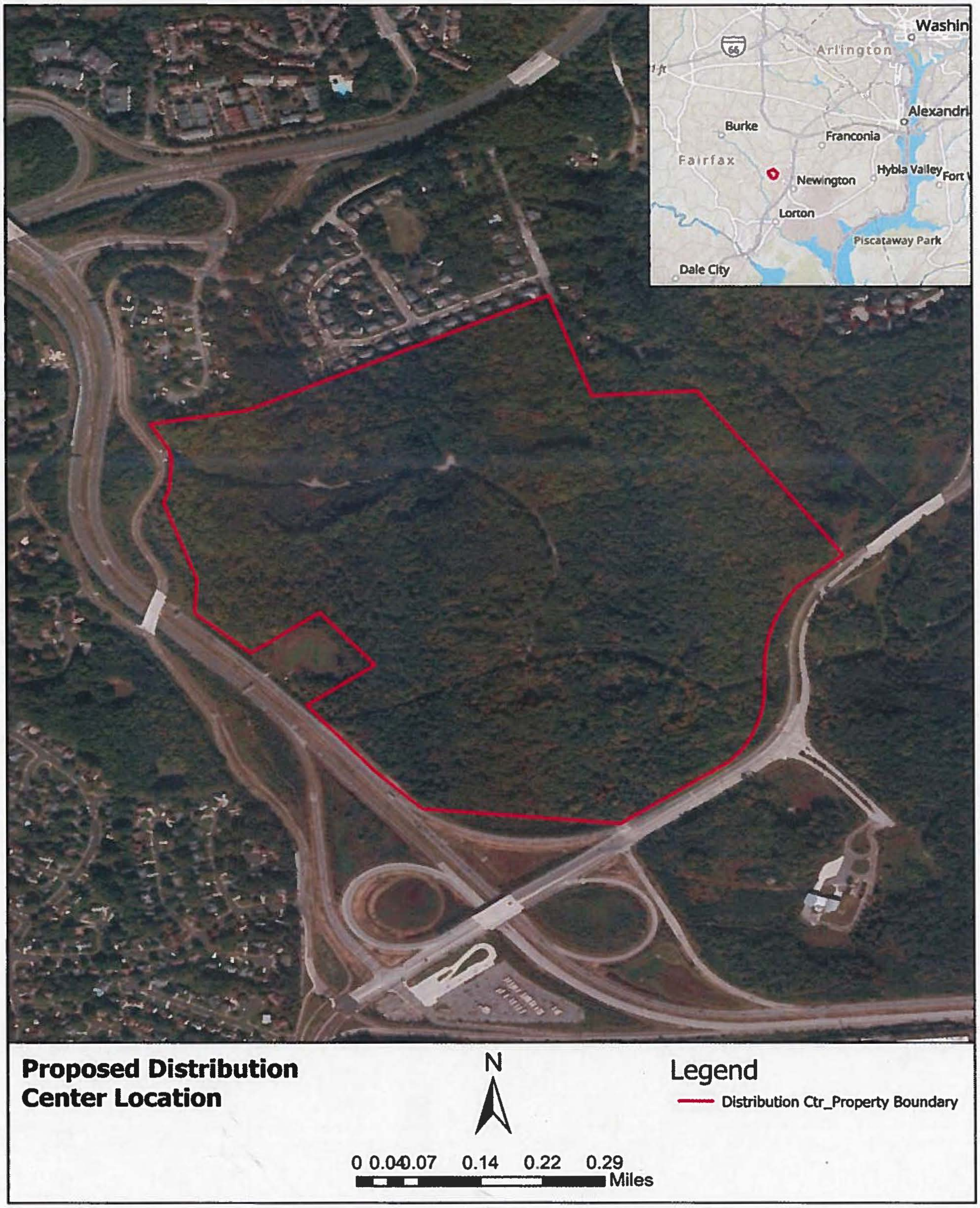
Determinations on the Army's process to identify historic properties within the APE and evaluation and effects determinations made in accordance with Section 106 of the NHPA will be made in consultation with all affected Native American tribes, as well as the State Historic Preservation Offices, and the interested public.

If you have questions or concerns, or require further information, please feel free to contact the Director of Public Works, Bradford Britain at bradford.d.britain.civ@army.mil or at (703) 806-3017.

Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

Figure 1: Project Location Map



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief Kenneth Branham
Monacan Indian Nation
111 Highview Drive
Madison Heights, VA 24572

Dear Chief Branham:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

The Army will be preparing the EA under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508), and the Army's regulations implementing NEPA (32 CFR Part 651). This project is in the early stages of planning. As soon as more detailed project information has been developed, formal tribal consultation will be initiated. Current information about the Proposed Action can be found on our website at the following: https://www.nab.usace.army.mil/ERCA/.

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Please note that scoping for the EA is expected to be conducted virtually due to the ongoing coronavirus (COVID-19) pandemic. Informational materials will be posted on the project website at https://www.nab.usace.army.mil/ERCA/.

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As we are beginning the analysis of the above-referenced resource areas, I would like to invite your input on the anticipated APE for this undertaking. As discussed previously, more information about specific project plans will be provided for review as they are developed to better assist in evaluating the impacts the proposed project may create. I understand that information that you provide on tribal religious or cultural items will be offered voluntarily in the spirit of assisting with our decision making for the project. Based on the available information regarding the proposed action, we welcome any information you would like to share that might be relevant to potential impacts and should be evaluated in the EA.

Any information pertaining to whether this action has the potential to affect tribal trust, subsistence, and/or cultural resources or if tribal rights and/or any protected resources may be affected by this proposed action would be greatly appreciated. Any general comments you may have on the proposed action and proposed alternatives, including discussing possible actions that would benefit your tribe, would also be welcome. I would be happy to answer any questions you may have about the project at this stage. Feel free to connect with me about the project via the contact information listed below. All information provided will be treated with the utmost confidentiality and in accordance with your wishes of how and whether this information can be used. I am also interested in locating any official tribal histories or historical reference materials that are more accurate and/or preferred by your tribe.

Determinations on the Army's process to identify historic properties within the APE and evaluation and effects determinations made in accordance with Section 106 of the NHPA will be made in consultation with all affected Native American tribes, as well as the State Historic Preservation Offices, and the interested public.

If you have questions or concerns, or require further information, please feel free to contact the Director of Public Works, Bradford Britain at bradford.d.britain.civ@army.mil or at (703) 806-3017.

Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

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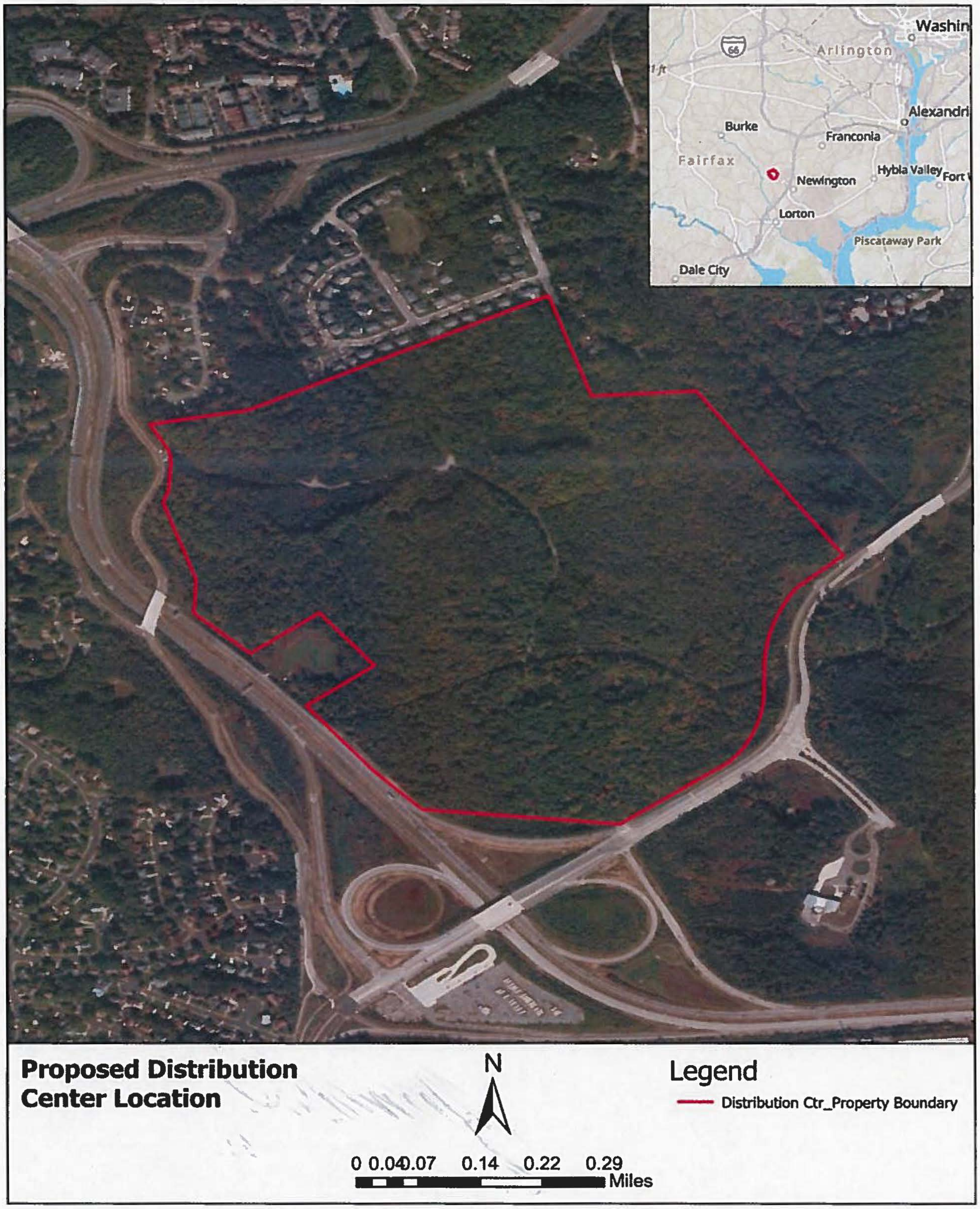

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief Earl L. Bass
Nansemond Indian Nation
1001 Pembroke Lane
Suffolk, VA 23434

Dear Chief Bass:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

The Army will be preparing the EA under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508), and the Army's regulations implementing NEPA (32 CFR Part 651). This project is in the early stages of planning. As soon as more detailed project information has been developed, formal tribal consultation will be initiated. Current information about the Proposed Action can be found on our website at the following: https://www.nab.usace.army.mil/ERCA/.

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Please note that scoping for the EA is expected to be conducted virtually due to the ongoing coronavirus (COVID-19) pandemic. Informational materials will be posted on the project website at https://www.nab.usace.army.mil/ERCA/.

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As we are beginning the analysis of the above-referenced resource areas, I would like to invite your input on the anticipated APE for this undertaking. As discussed previously, more information about specific project plans will be provided for review as they are developed to better assist in evaluating the impacts the proposed project may create. I understand that information that you provide on tribal religious or cultural items will be offered voluntarily in the spirit of assisting with our decision making for the project. Based on the available information regarding the proposed action, we welcome any information you would like to share that might be relevant to potential impacts and should be evaluated in the EA.

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Determinations on the Army's process to identify historic properties within the APE and evaluation and effects determinations made in accordance with Section 106 of the NHPA will be made in consultation with all affected Native American tribes, as well as the State Historic Preservation Offices, and the interested public.

If you have questions or concerns, or require further information, please feel free to contact the Director of Public Works, Bradford Britain at bradford.d.britain.civ@army.mil or at (703) 806-3017.

Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

DGC

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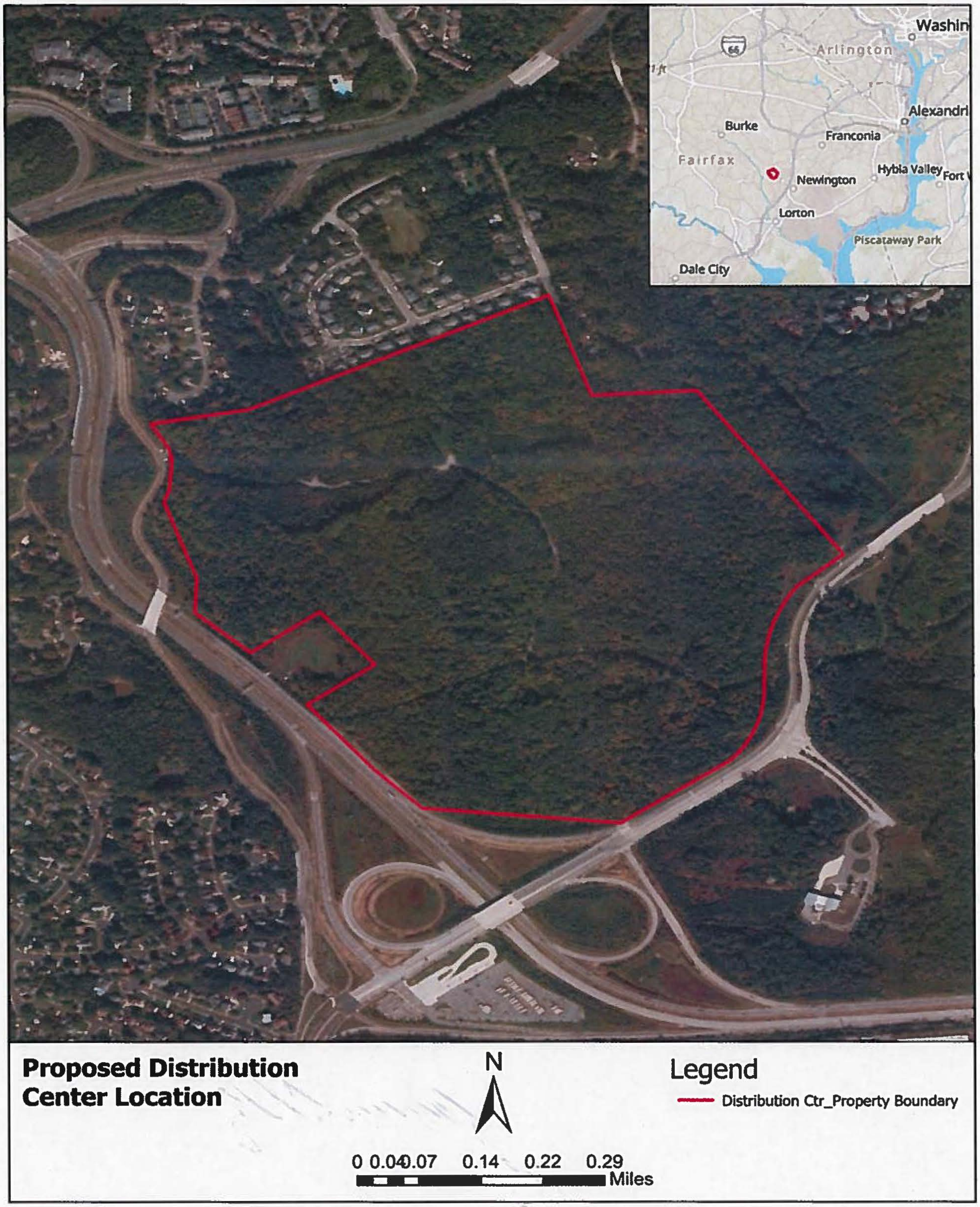

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief Robert Gray
Pamunkey Indian Tribe
1054 Pocahontas Trail
King William, VA 23086

Dear Chief Gray:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

The Army will be preparing the EA under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508), and the Army's regulations implementing NEPA (32 CFR Part 651). This project is in the early stages of planning. As soon as more detailed project information has been developed, formal tribal consultation will be initiated. Current information about the Proposed Action can be found on our website at the following: https://www.nab.usace.army.mil/ERCA/.

The purpose of this EA is to inform decision-makers, tribes, stakeholders, and the public of the potential environmental consequences and any associated mitigations, as applicable. Affected Native American tribes and interested persons, organizations, and agencies will have multiple opportunities to provide input on the proposed project. The following resources are evaluated in this EA: land use; airspace; noise; air quality; water resources; biological resources; cultural resources; geology, topography, and soils; hazardous and toxic materials and waste (HTMW); traffic and transportation; infrastructure and utilities; socioeconomics, environmental justice, and protection of children; and human health and safety.

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As we are beginning the analysis of the above-referenced resource areas, I would like to invite your input on the anticipated APE for this undertaking. As discussed previously, more information about specific project plans will be provided for review as they are developed to better assist in evaluating the impacts the proposed project may create. I understand that information that you provide on tribal religious or cultural items will be offered voluntarily in the spirit of assisting with our decision making for the project. Based on the available information regarding the proposed action, we welcome any information you would like to share that might be relevant to potential impacts and should be evaluated in the EA.

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Determinations on the Army's process to identify historic properties within the APE and evaluation and effects determinations made in accordance with Section 106 of the NHPA will be made in consultation with all affected Native American tribes, as well as the State Historic Preservation Offices, and the interested public.

If you have questions or concerns, or require further information, please feel free to contact the Director of Public Works, Bradford Britain at bradford.d.britain.civ@army.mil or at (703) 806-3017.

Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

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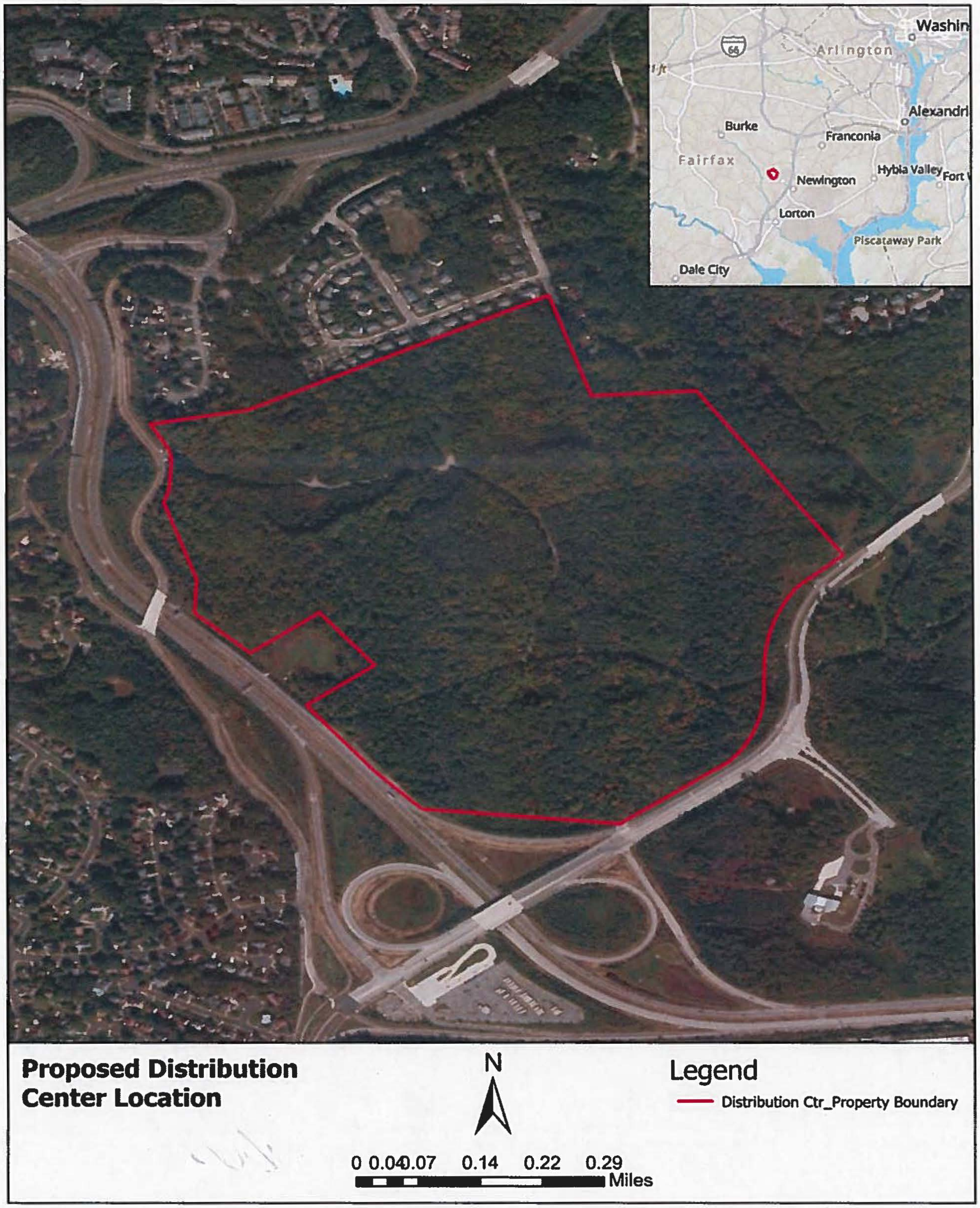

DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief W. Frank Adams
Upper Mattaponi Tribe
13476 King William Road
King William, VA 23086

Dear Chief Adams:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

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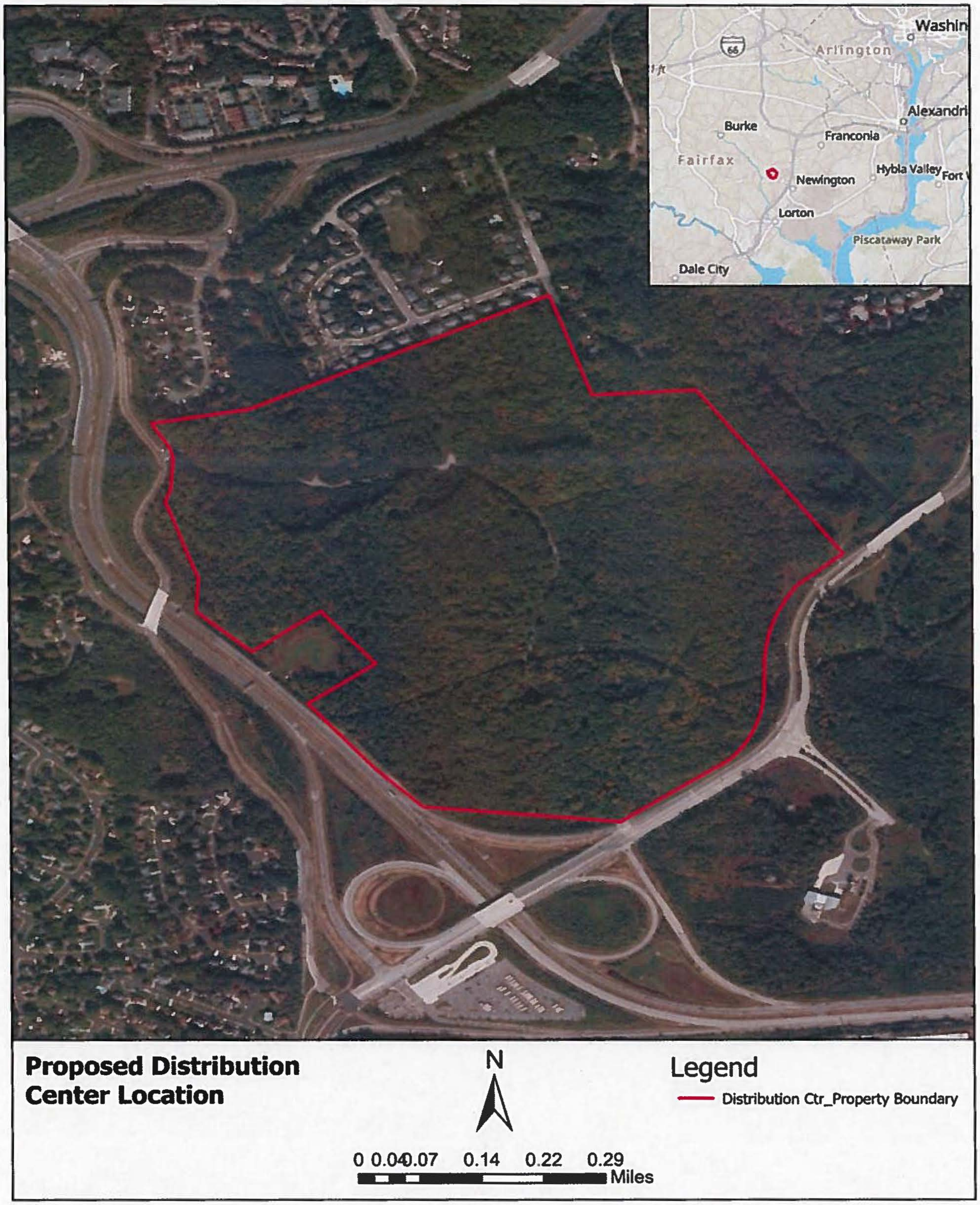
Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

Figure 1: Project Location Map



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief Robert Gray
Pamunkey Indian Tribe
1054 Pocahontas Trail
King William, VA 23086

Dear Chief Gray:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

The Army will be preparing the EA under the National Environmental Policy Act of 1969 (NEPA) (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500–1508), and the Army's regulations implementing NEPA (32 CFR Part 651). This project is in the early stages of planning. As soon as more detailed project information has been developed, formal tribal consultation will be initiated. Current information about the Proposed Action can be found on our website at the following: https://www.nab.usace.army.mil/ERCA/.

The purpose of this EA is to inform decision-makers, tribes, stakeholders, and the public of the potential environmental consequences and any associated mitigations, as applicable. Affected Native American tribes and interested persons, organizations, and agencies will have multiple opportunities to provide input on the proposed project. The following resources are evaluated in this EA: land use; airspace; noise; air quality; water resources; biological resources; cultural resources; geology, topography, and soils; hazardous and toxic materials and waste (HTMW); traffic and transportation; infrastructure and utilities; socioeconomics, environmental justice, and protection of children; and human health and safety.

Please note that scoping for the EA is expected to be conducted virtually due to the ongoing coronavirus (COVID-19) pandemic. Informational materials will be posted on the project website at https://www.nab.usace.army.mil/ERCA/.

At this early stage in the analysis, the geographic boundaries of the Area of Potential Effects (APE) for this undertaking are conservatively estimated to be the project boundary depicted in Figure 1. The Army anticipates the APE would include areas where the construction and operation of the building may directly or indirectly cause changes in the character or use of historic properties.

As we are beginning the analysis of the above-referenced resource areas, I would like to invite your input on the anticipated APE for this undertaking. As discussed previously, more information about specific project plans will be provided for review as they are developed to better assist in evaluating the impacts the proposed project may create. I understand that information that you provide on tribal religious or cultural items will be offered voluntarily in the spirit of assisting with our decision making for the project. Based on the available information regarding the proposed action, we welcome any information you would like to share that might be relevant to potential impacts and should be evaluated in the EA.

Any information pertaining to whether this action has the potential to affect tribal trust, subsistence, and/or cultural resources or if tribal rights and/or any protected resources may be affected by this proposed action would be greatly appreciated. Any general comments you may have on the proposed action and proposed alternatives, including discussing possible actions that would benefit your tribe, would also be welcome. I would be happy to answer any questions you may have about the project at this stage. Feel free to connect with me about the project via the contact information listed below. All information provided will be treated with the utmost confidentiality and in accordance with your wishes of how and whether this information can be used. I am also interested in locating any official tribal histories or historical reference materials that are more accurate and/or preferred by your tribe.

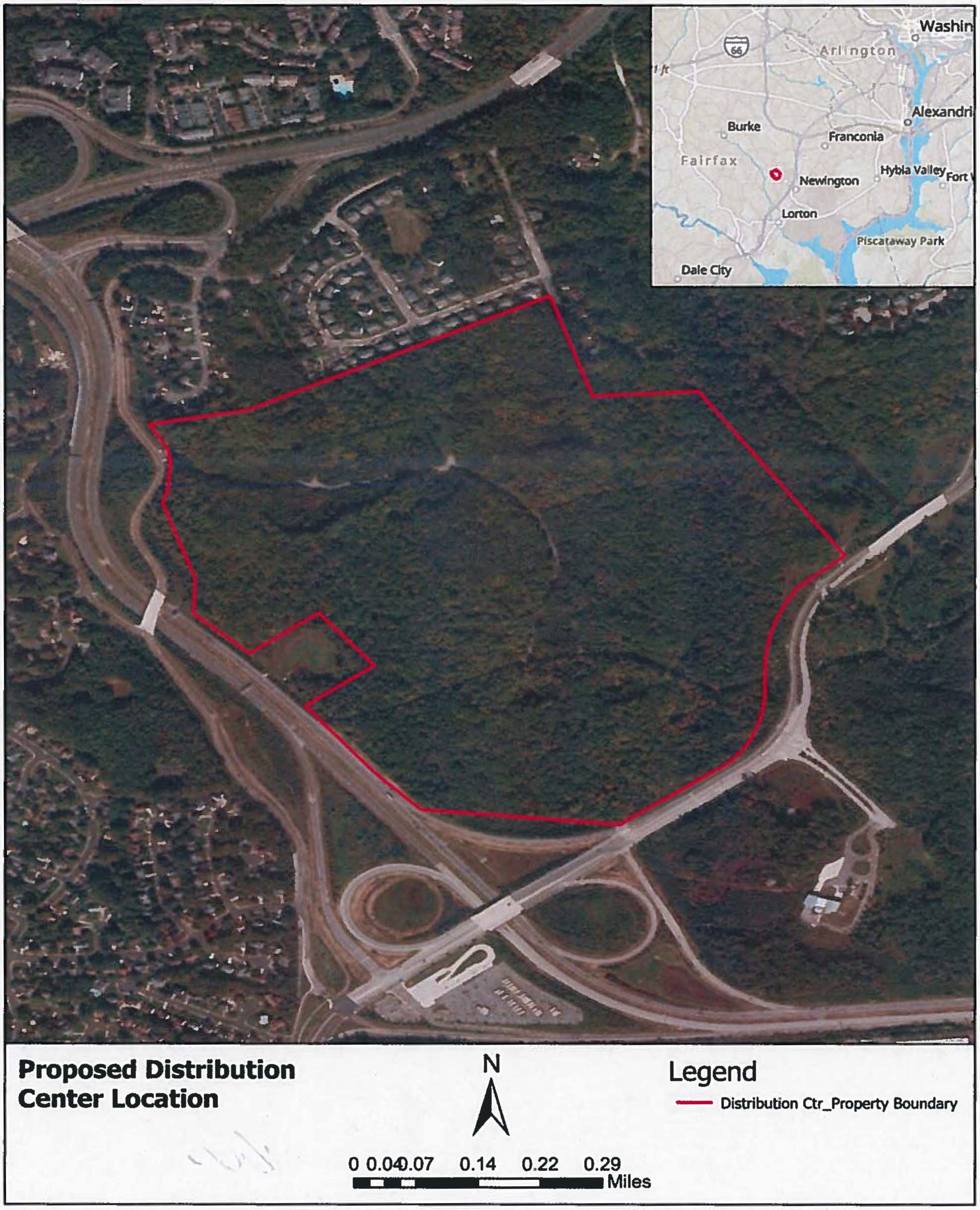
Determinations on the Army's process to identify historic properties within the APE and evaluation and effects determinations made in accordance with Section 106 of the NHPA will be made in consultation with all affected Native American tribes, as well as the State Historic Preservation Offices, and the interested public.

If you have questions or concerns, or require further information, please feel free to contact the Director of Public Works, Bradford Britain at bradford.d.britain.civ@army.mil or at (703) 806-3017.

Sincerely,

Joshua P. SeGraves
Colonel, U.S. Army
Commanding

Figure 1: Project Location Map



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT BELVOIR
9820 FLAGLER ROAD, SUITE 213
FORT BELVOIR, VIRGINIA 22060-5928

Directorate of Public Works

Chief W. Frank Adams
Upper Mattaponi Tribe
13476 King William Road
King William, VA 23086

Dear Chief Adams:

The Army recognizes its responsibilities to maintain Government-to-Government relationship with all tribes affected by activities on Army Installations and our federal trust responsibility for those lands. In the interest of early and frequent communication under Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, pursuant to 36 Code of Federal Regulations (CFR) Part 800.3(f)(2) and as part of the Department of Defense's policy for Government-to-Government consultation with Native American tribes, I am writing to inform you that the Army is beginning the scoping process to prepare an Environmental Assessment (EA) for the proposed construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage on Fort Belvoir's North Area (FBNA), Fort Belvoir, Virginia.

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Joshua P. SeGraves
Colonel, U.S. Army
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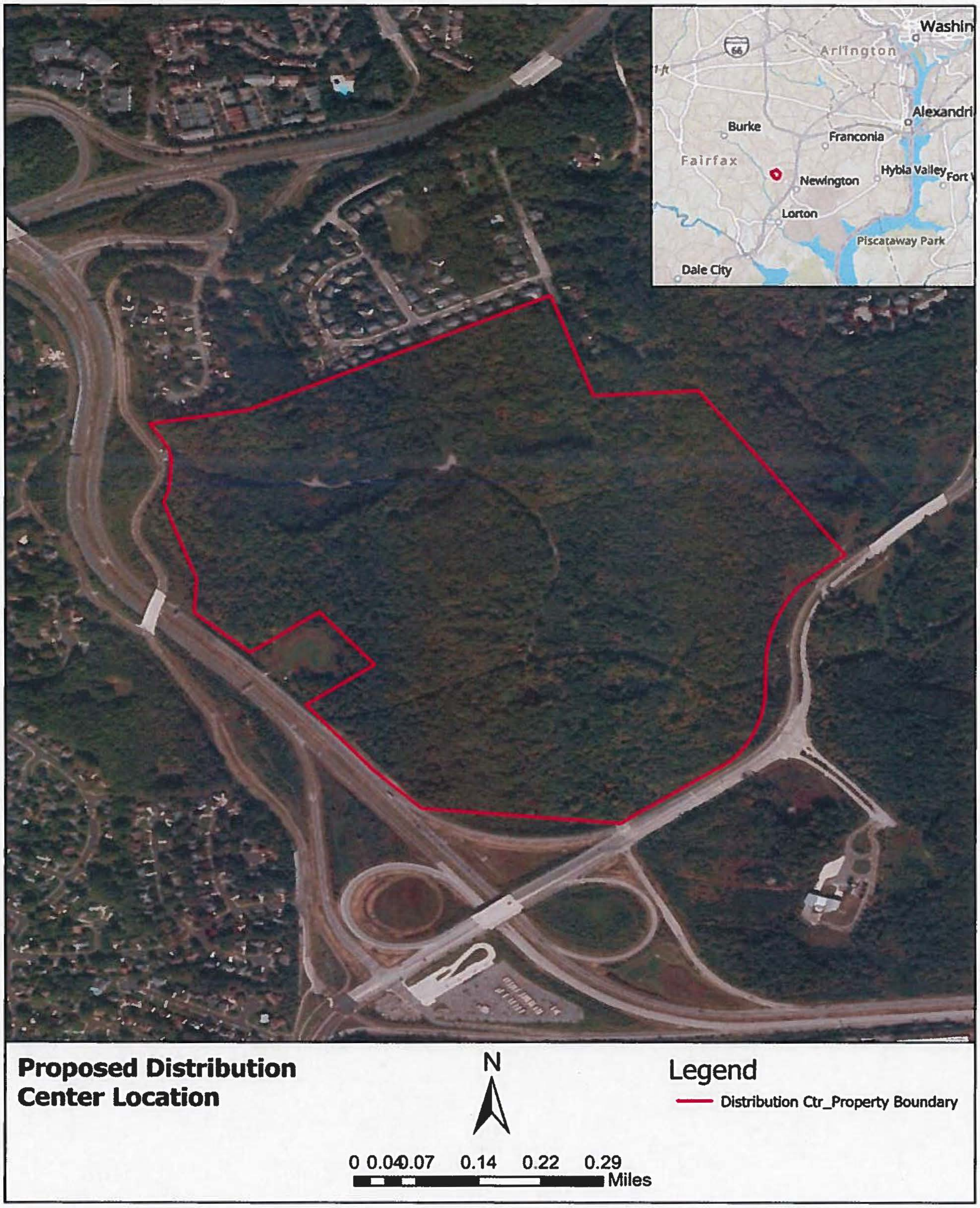


December 22, 2021

Ms. Genevieve LaRouche
Field Supervisor
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401

Dear Ms. LaRouche,

The purpose of this letter is to initiate consultation with your office under Section 7 of the Endangered Species Act for a proposed undertaking by a project proponent to construct a distribution center on Fort Belvoir's North Area, Fort Belvoir, Fairfax County, Virginia (Enclosure 1).

The purpose of the project is to construct an approximately 525,000 square foot distribution center consolidated complex consisting of a high bay warehouse, a two-story administrative building, a truck maintenance/ refueling building, covered/enclosed storage buildings and an entry control facility (gate house and vehicle inspection) (Figure 1). The project will also require new electrical, water, gas, sanitary sewer lines; information systems distribution; lighting; parking; curb and gutter; sidewalks; storm drainage; landscaping; and other site improvements.

This facility will support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring close proximity within the National Capital Region to achieve distribution efficiencies. The action would also provide for compliance with Office of Management and Budget (OMB) guidance to identify "good stewardship of taxpayer resources" and increase joint site usage. The distribution center expects minimal truck traffic compared to a typical industrial distribution center.

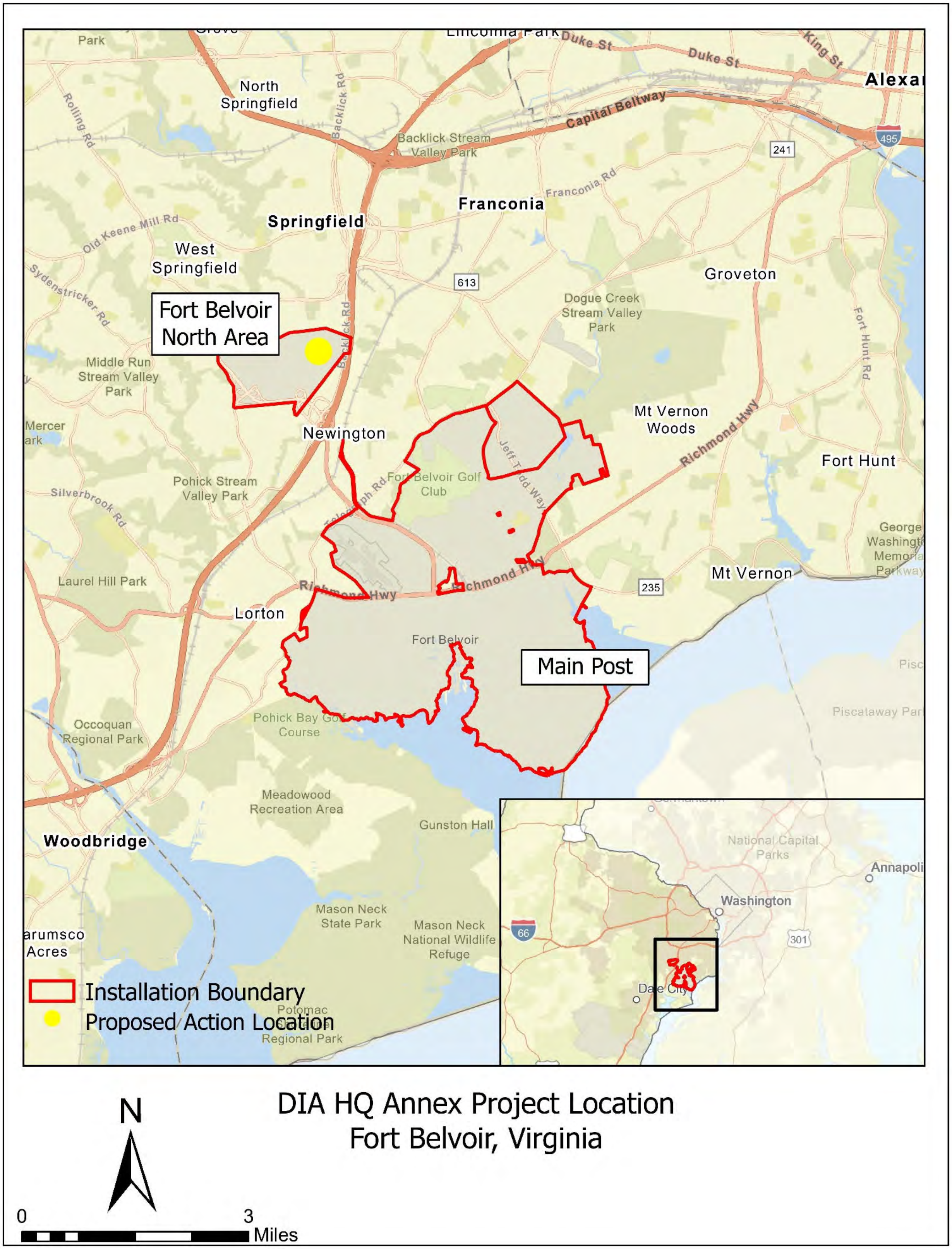
Fort Belvoir obtained an Official Species List and Self-Certification Letter from the U.S. Fish & Wildlife Service's Information for Planning and Consultation (IPaC) website for the proposed project (Enclosures 3 and 4). We request any additional information your office may have on the presence of federally protected animal and plant species listed by the Fish and Wildlife Coordination Act and Section 7 of the Endangered Species Act for the project areas shown on the enclosed site location map.

Please provide written comments within 30 days from the date of this letter to Wilamena Harback, Chief, Environmental Division, Directorate of Public Works, Building 1442, 9430 Jackson Loop, Fort Belvoir, Virginia 22060, or by email to wilamena.g.harback.civ@mail.mil. If you need further information, please contact Janesse Colon-Ruiz at 703-806-4008.

Fort Belvoir Env Office Chief Signature block

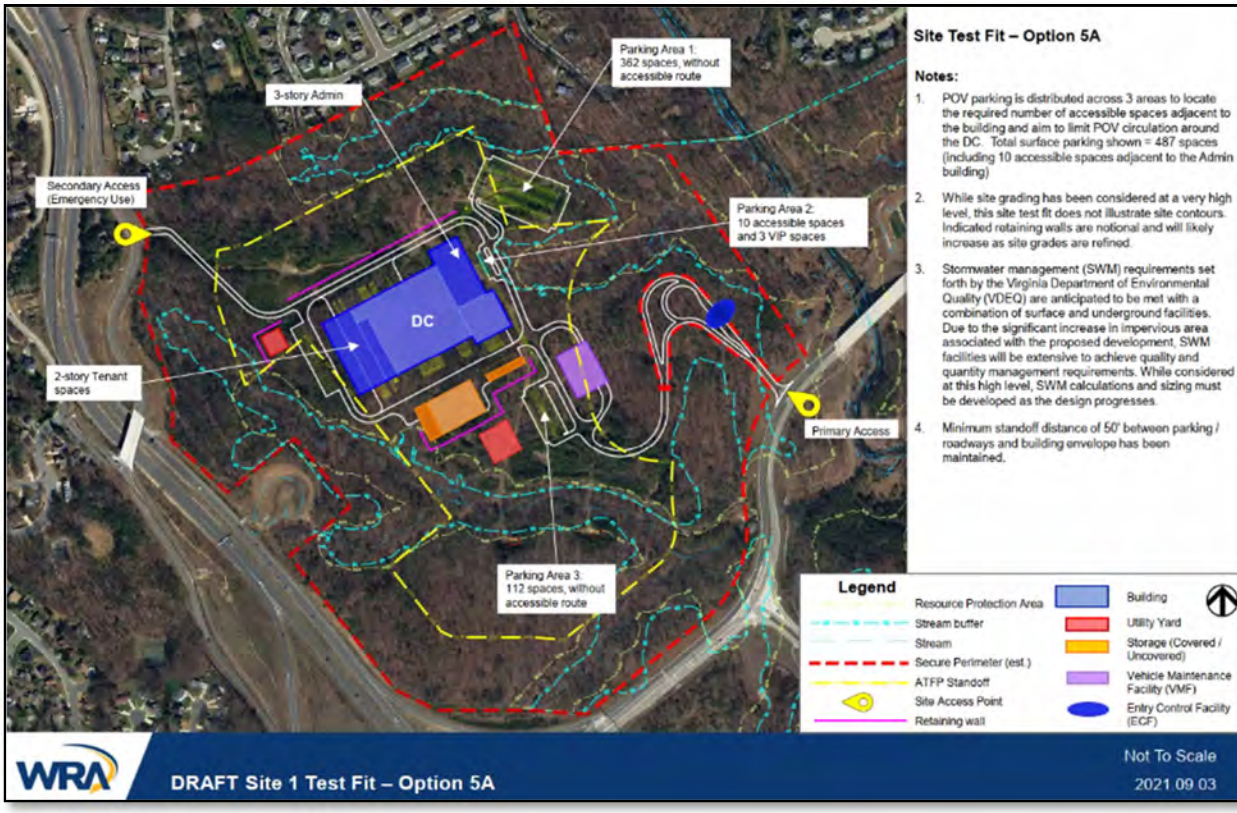
Enclosure 1: Site Location Map
Enclosure 2: FBNA Conceptual Site Layout
Enclosure 3: U.S. Fish & Wildlife Service’s (IPaC) Official Species List
Enclosure 4: Verification Letter for Northern Long-Eared Bat

Enclosure 1:



Fort Belvoir North Area
Main Post
North Springfield
Springfield
West Springfield
Franconia
Groveton
Newington
Lorton
Mt Vernon Woods
Mt Vernon
Fort Hunt
Fort Belvoir
Woodbridge
Capital Beltway
Richmond Hwy
Backlick Rd
Franconia Rd
Duke St
King St
Dogue Creek Stream Valley Park
Middle Run Stream Valley Park
Pohick Stream Valley Park
Laurel Hill Park
Occoquan Regional Park
Meadowood Recreation Area
Mason Neck State Park
Mason Neck National Wildlife Refuge
Gunston Hall
Fort Belvoir Golf Club
Pohick Bay Golf Course
Washington
Annapolis
Dale City
National Capital Parks
Installation Boundary
Proposed Action Location
N
0
3
Miles
DIA HQ Annex Project Location
Fort Belvoir, Virginia

Enclosure 2:



Site Test Fit – Option 5A
Notes:
1. POV parking is distributed across 3 areas to locate the required number of accessible spaces adjacent to the building and aim to limit POV circulation around the DC. Total surface parking shown = 487 spaces (including 10 accessible spaces adjacent to the Admin building)
2. While site grading has been considered at a very high level, this site test fit does not illustrate site contours. Indicated retaining walls are notional and will likely increase as site grades are refined.
3. Stormwater management (SWM) requirements set forth by the Virginia Department of Environmental Quality (VDEQ) are anticipated to be met with a combination of surface and underground facilities. Due to the significant increase in impervious area associated with the proposed development, SWM facilities will be extensive to achieve quality and quantity management requirements. While considered at this high level, SWM calculations and sizing must be developed as the design progresses.
4. Minimum standoff distance of 50' between parking / roadways and building envelope has been maintained.
Parking Area 1: 362 spaces, without accessible route
3-story Admin
Secondary Access (Emergency Use)
Parking Area 2: 10 accessible spaces and 3 VIP spaces
DC
2-story Tenant spaces
Primary Access
Parking Area 3: 112 spaces, without accessible route
Legend
Resource Protection Area
Stream buffer
Stream
Secure Perimeter (est.)
ATFP Standoff
Site Access Point
Retaining wall
Building
Utility Yard
Storage (Covered / Uncovered)
Vehicle Maintenance Facility (VMF)
Entry Control Facility (ECF)
WRA
DRAFT Site 1 Test Fit – Option 5A
Not To Scale
2021.09.03

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 Fax: (804) 693-9032
http://www.fws.gov/northeast/virginiafield/

In Reply Refer To: February 22, 2022
Project Code: 2022-0011272
Project Name: FNBA Distribution Center

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.*). Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

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 ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system 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:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.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 https://www.fws.gov/birds/policies-and-regulations.php.

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/birds/bird-enthusiasts/threats-to-birds.php.

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/birds/policies-and-regulations/executive-orders/e0-13186.php.

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 Project 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
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

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: 2022-0011272
Event Code: None
Project Name: FNBA Distribution Center
Project Type: Military Development
Project Description: Construction and Operation of a new distribution facility at Fort Belvoir North Area
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.7531398,-77.20868067034789,14z

Counties: Fairfax 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.

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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	Threatened

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

Flowering Plants

NAME	STATUS
Small Whorled Pogonia *Isotria medeoloides* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1890	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12

(0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

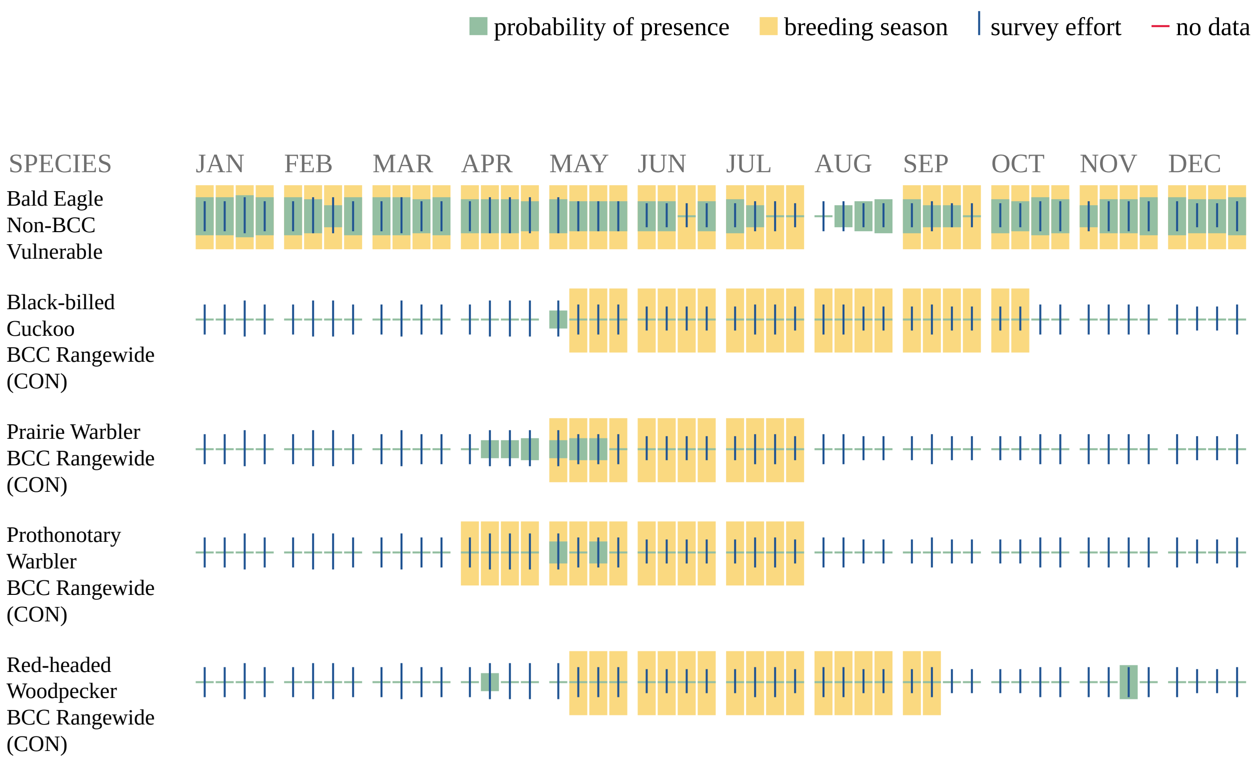
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

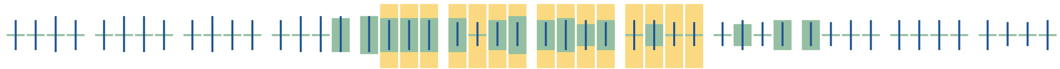
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Rusty Blackbird
BCC - BCR

Wood Thrush
BCC Rangewide
(CON)



Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical

Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

IPaC User Contact Information

Name:	Christina Olson
Address:	2 Hopkins Plaza
City:	Baltimore
State:	MD
Zip:	21201
Email	christina.a.olson@usace.army.mil
Phone:	5412702878

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 Fax: (804) 693-9032
http://www.fws.gov/northeast/virginiafield/

In Reply Refer To: March 04, 2022
Project code: 2022-0011272
Project Name: FNBA Distribution Center

Subject: Verification letter for the 'FNBA Distribution Center' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Christina Olson:

The U.S. Fish and Wildlife Service (Service) received on March 04, 2022 your effects determination for the 'FNBA Distribution Center' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service's January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from "take"[1] prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.

This IPaC-assisted determination allows you to rely on the PBO for compliance with ESA Section 7(a)(2) only for the northern long-eared bat. It **does not** apply to the following ESA-protected species that also may occur in the Action area:

- Monarch Butterfly *Danaus plexippus* Candidate
- Small Whorled Pogonia *Isotria medeoloides* Threatened

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

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[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

Action Description
You provided to IPaC the following name and description for the subject Action.

1. Name

FNBA Distribution Center

2. Description

The following description was provided for the project 'FNBA Distribution Center':

> Construction and Operation of a new distribution facility at Fort Belvoir North Area

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.75327195,-77.2086156714428,14z

Determination Key Result

This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service's PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR §17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

Determination Key Description: Northern Long-eared Bat 4(d) Rule

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service's PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).

Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service's January 5, 2016, *Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions* to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?

   Yes

2. Have you determined that the proposed action will have "no effect" on the northern long-eared bat? (If you are unsure select "No")

   No

3. Will your activity purposefully **Take** northern long-eared bats?

   No

4. [Semantic] Is the project action area located wholly outside the White-nose Syndrome Zone?

   Automatically answered
   No

5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

   Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases and other sources of information on the locations of northern long-eared bat roost trees and hibernacula is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.

   Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?

   No

7. Will the action involve Tree Removal?

   Yes

8. Will the action only remove hazardous trees for the protection of human life or property?

   No

9. Will the action remove trees within 0.25 miles of a known northern long-eared bat hibernaculum at any time of year?

   No

10. Will the action remove a known occupied northern long-eared bat maternity roost tree or any trees within 150 feet of a known occupied maternity roost tree from June 1 through July 31?

    No

Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type ‘0’ in questions 1-3.

1. Estimated total acres of forest conversion:

160

2. If known, estimated acres of forest conversion from April 1 to October 31

0

3. If known, estimated acres of forest conversion from June 1 to July 31

0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type ‘0’ in questions 4-6.

4. Estimated total acres of timber harvest

0

5. If known, estimated acres of timber harvest from April 1 to October 31

0

6. If known, estimated acres of timber harvest from June 1 to July 31

0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type ‘0’ in questions 7-9.

7. Estimated total acres of prescribed fire

0

8. If known, estimated acres of prescribed fire from April 1 to October 31

0

9. If known, estimated acres of prescribed fire from June 1 to July 31

0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type ‘0’ in question 10.

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?

0

IPaC User Contact Information

Agency: Army Corps of Engineers
Name: Christina Olson
Address: 2 Hopkins Plaza
City: Baltimore
State: MD
Zip: 21201
Email christina.a.olson@usace.army.mil
Phone: 5412702878

Lead Agency Contact Information

Lead Agency: Army
Name: John John Pilcicki
Email: john.l.pilcicki.civ@army.mil
Phone: 7038053968

From:	Atkinson, Kelly
To:	FBNA
Subject:	[URL Verdict: Neutral][Non-DoD Source] FW: FBNA Distribution Center Request for Early Input Notice
Date:	Tuesday, April 19, 2022 3:28:40 PM
Attachments:	image001.png NCPC Fort Belvoir North Post Area Development - December 2021_.pdf NCPC Fort Belvoir North Post Area Development-signed.pdf

Good afternoon,

Please find below Fairfax County's early input comments on the Draft EA. Fairfax County requests the opportunity to comment on the Draft EA once published.

- Fairfax County previously commented on the FBNA Area Development Plan Master Plan at the request of NCPC (please see attached letters). In the most recent submission reviewed (December 2021), the FBNA Area Development Plan depicted development in three growth boundary areas. The proposed Distribution Center and associated parking/infrastructure should be located in one of the three growth boundaries and take into consideration the natural features of the site and minimize any increase in impervious area and removal of large areas of mature vegetation. Mitigation measures including tree replacement; maximizing building heights/minimizing building footprints; phased parking structures instead of surface parking; Transportation Management Plan; water quantity and quality measures above minimum requirements (to include Low Impact Development techniques versus SWM ponds); and stormwater/stream restoration should be considered.
- The development proposal should promote walkability and cluster buildings where possible. To encourage pedestrian movement throughout the site, sidewalks, lighting, shade, signage and wayfinding, green space and an overall aesthetically pleasing environment should be considered, which will also mitigate environmental and transportation impacts. A pedestrian circulation plan should be included.
- Does the proposed Distribution Center need to be located on the west side of the creek? It was the County's understanding the Army would prioritize development east of the creek first.
- Impacts to Resource Protection Areas, floodplains, wetlands, and rare, threatened, and endangered species should be avoided or minimized to the greatest extent feasible.
- Will the building obtain LEED certification and if so, at what level? Fairfax County projects are encouraged to obtain LEED Gold along with the installation of solar arrays and electric vehicle charging stations and provide an on site renewable energy component. The Fairfax County Board of Supervisors also has policies on energy performance targets; Greenhouse Gas emissions; and Net Zero Energy for our own buildings that perhaps the Army could consider.
- Any access at Rolling Road should be restricted to emergency only and any existing pedestrian networks in the area maintained.
- Any undisturbed and unsurveyed areas that are planned for development should undergo a Phase I archaeological survey. If potentially significant sites are found, it is recommended the Army undergo Phase II archaeological testing to determine Fairfax County significance and/or eligibility for inclusion onto the National Register of Historic Places. If sites are found to be significant or eligible, avoidance or Phase III data recovery is recommended.

Fairfax County has provided these comments to provide early input on the proposed action to be considered in the forthcoming EA. These comments are subject to change based on the County's formal review of the forthcoming EA and represent staff analysis and do not necessarily reflect the opinion of the Fairfax County Board of Supervisors.

Thank you,
Kelly Atkinson

Kelly M. Atkinson, AICP (she/her/hers)
Branch Chief, Environment and Development Review Branch
Fairfax County Department of Planning and Development
12055 Government Center Parkway, 7th Floor
Fairfax, VA 22035
(703) 324-1380 (Main)
(571) 595-4238 (Mobile)

Note: My working hours may not be the same as your working hours. Please do not feel obligated to reply outside of your current work schedule.

From: FBNA <FBNA@usace.army.mil>
Sent: Wednesday, April 13, 2022 5:13 PM
Subject: FBNA Distribution Center Request for Early Input Notice

All Interested Parties:

The U.S. Army Garrison, Fort Belvoir, Virginia is preparing an Environmental Assessment (EA) for the construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia, pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality (CEQ) regulations that implement NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and 32 CFR Part 651, *Environmental Analysis of Army Actions*. An EA is used as a planning document to assess environmental impacts, evaluate their significance, develop alternatives and mitigation measures, and allow for agency and public participation (32 CFR 651.20).

The EA is being prepared to evaluate the environmental impacts associated with the Proposed Action to build and operate a distribution center at FBNA. The project will modernize logistical operations and address safety, security, and operational concerns specific to the warehouse and its administrative functions. The project is needed to support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring a site within the National Capital

Region to achieve distribution efficiencies.

In accordance with 40 CFR 1500-1508, the Army invites you to provide early input on the Proposed Action to be considered in our analysis of each alternative in the forthcoming EA. This notice is being distributed to organizations and the public that may have an interest in the project. Information on the Proposed Action can be found on the project website at https://www.nab.usace.army.mil/FBNA/. Comments on the Proposed Action can be submitted through the project website or via email to FBNA@usace.army.mil. Once the draft EA is completed, organizations and the public will have an opportunity to review the document and provide comments during a 30-day public review period.

We appreciate your attention to this matter. Early input will be accepted for a period of 15 days, beginning on the date of this notice. Should you require any additional information or have any questions, please contact the Fort Belvoir Directorate of Public Works-Environmental Division (DPW-ED) via phone at (703) 806-3193 or (703) 806-0020, during normal working business hours, Monday through Friday, 8:00 a.m. to 4:00 p.m.

July 30, 2021

Stephanie Free
National Capital Planning Commission
401 9th Street NW, Suite 500
Washington, DC 20004

RE: NCPC Project Referral - MP020A - Fort Belvoir North Post Area Development Plan

Dear Stephanie Free:

Thank you for the opportunity to comment on the draft environmental assessment (EA) for Fort Belvoir North Post Area Development Plan, located at the northwest quadrant of Interstate 95 and Fairfax County Parkway. The plan proposes to establish the development framework for functions of the Fort Belvoir North Area (FBNA), a non-contiguous 804-acre parcel, located north of the main installation of Fort Belvoir and separated to the west by Interstate 95, in Springfield, Virginia. Fairfax County understands that three alternatives for the site were reviewed and range in intensity from minimal improvements of only planned projects to maximum capacity based on the remainder of land available; the maximum capacity alternative is the preferred alternative according to the FBNA stakeholders. The Department of Planning and Development (DPD), in collaboration with the Fairfax County Department of Transportation (FCDOT) and Fairfax County Park Authority (FCPA) has reviewed the above-mentioned draft environmental assessment and provides the comments below.

COORDINATION WITH OTHER COUNTY AGENCIES

Transportation Impacts

FCDOT staff did not have any specific comments regarding this proposal as the site has good highway access via Interstate 95 and the Fairfax County Parkway. Staff did want to make Fort Belvoir aware of an ongoing study of the Fairfax County/Franconia-Springfield Parkways. There are no recommendations yet; however, the following questions are being considered, which could impact access to Fort Belvoir North Area:

- The degree to which existing intersections should be considered for conversion to interchanges or under/overpasses;
- How transit should be integrated into the corridor;
- Whether tolling and or HOV lanes on the Parkways should be planned; and
- Bicycle/pedestrian mobility.

More information can be found at: Fairfax County & Franconia-Springfield Parkways Alternatives Analysis and Long Term Planning Study | Transportation.

Finally, FCDOT notes that Fairfax Connector Routes 340 and 341 began in 2017 and directly linked the FBNA to the Franconia Metrorail / VRE station. Both routes had low ridership pre-COVID and FCDOT is currently in the process of working with Fort Belvoir to rectify this situation. More information on the Fairfax Connector routes can be found at: Fairfax Connector Routes 340 and 341 (fairfaxcounty.gov).

Recreational and Heritage Resources

FCPA staff offered comments regarding the inclusion of a stream valley trail; request to perform a survey of rare, threatened, and endangered bat species; a request that a pedestrian circulation plan be included in the draft EA for evaluation; and requests to review all future documents related to the Accotink Stream Valley Park and Rolling Woods School site at the earliest opportunity.

Staff also recommends that any undisturbed and unsurveyed areas that are planned for development undergo a Phase I archaeological survey. If potentially significant sites are found, it is recommended they undergo Phase II archaeological testing to determine Fairfax County significance and/or eligibility for inclusion onto the National Register of Historic Places. FCPA comments are included in attachment to the letter. If sites are found to be significant or eligible, avoidance or Phase III data recovery is recommended.

ENVIRONMENTAL ASSESSMENT

The sections listed below include an overview of the applicable Comprehensive Plan policies and potential impacts within the project study area.

Water Resources Protection and Stormwater Management/Best Management Practices

The Environment Element of the Comprehensive Plan Policy Plan states that the protection and restoration of the ecological integrity of streams is expected in Fairfax County. In order to minimize the impacts that new development and redevelopment projects may have on county streams, the Comprehensive Plan encourages the protection of stream channels, buffer areas along stream channels, and restoration of degraded stream channels and riparian buffer areas. (Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Pages 7-9).

New development and redevelopment are also expected to result in high quality site design, pursue use of low impact development (LID) techniques and *"pursue commitments to reduce stormwater runoff volumes and peak flows, to increase groundwater recharge, and to increase preservation of undisturbed areas."* Some or all of the following practices should be considered in order to minimize the impacts that new development and redevelopment projects may have on the county's streams:

- *"Minimize the amount of impervious surface created …*
- *Site buildings to minimize impervious cover …*
- *Where feasible, convey drainage from impervious areas into pervious areas …*
- *Encourage cluster development …*
- *Encourage the preservation of wooded areas and steep slopes adjacent to stream valley EQC areas …*
- *Where appropriate, use protective easements in areas outside of private residential lots as a mechanism to protect wooded areas and steep slopes.*
- *Encourage the use of open ditch road sections …*
- *Encourage the use of innovative BMPs and infiltration techniques of stormwater management …*
- *Apply nonstructural best management practices and bioengineering practices …*
- *Encourage shared parking …*
- *Encourage the use of pervious parking surfaces in low-use parking areas …*
- *Maximize the use of infiltration landscaping within streetscapes consistent with county and state requirements."*

(Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Pages 7-9).

The proposed project will add a significant amount of impervious cover to the site under the maximum development potential alternative. With a greater amount of impervious surface, more runoff and pollutants reach the county streams. Higher levels of runoff from increased imperviousness accelerate stream channel erosion causing increased sedimentation. Deicing salt applied to roads and parking lots is the primary source of chloride in streams. The above listed practices would be applicable to the study and design of the development plan and should be incorporated to the greatest extent feasible.

County policies also state that stormwater design for all stormwater facilities should be closely coordinated with county staff to avoid degradation of impacted streams. The area development plan improvements should provide stormwater quality and quantity controls above the minimum requirements to minimize impacts to adjacent streams and, at a minimum, meet the water quantity detention requirements in Chapter 124 of the Fairfax County Code. County policies state that the county will maintain a best management practices (BMP) program for water quality and will ensure that new development and redevelopment complies with the county's best management practice (BMP) requirements. BMP requirements are to be updated as newer, more effective strategies become available.

Staff also recommends the avoidance of significant ecological resources to the maximum extent feasible; incorporation of linear stormwater controls into the facility designs to address stormwater requirements while minimizing the disturbance of ecological resources and open spaces; incorporation of ecological enhancements into any pond design to replace the ecological functionality of disturbed areas; integration of stream protection measures; demonstration that there will be no adverse impacts to downstream waterways, infrastructure, or property; assessment of the cumulative impact of multiple outfalls directed into a stream in the same general vicinity; incorporation of natural channel design, where applicable; incorporation of constructed wetlands as an alternative to the proposed pond designs; consideration of the retrofitting of existing wet ponds to meet stormwater requirements; adherence to current pollutant removal criteria for any dry ponds; restoration and monitoring of disturbed areas; and management of invasives to be considered in the project study.

Resource Protection Area (RPA), Floodplain and Environmental Quality Corridor (EQC)

Floodplain, RPA, and areas that qualify for designation as EQC exist on the site as shown in Attachment A, an environmental map of the Fort Belvoir North Area prepared by the Department of Planning and Development. Fairfax County recognizes that the Department of the Army is not subject to the provisions of the Chesapeake Bay Preservation Ordinance (CBPO) or County policies. However, Fairfax County continues to encourage the Army to meet the County's CBPO as described in Chapter 118 of the County Code, including conformance with the requirements for areas designated as RPAs and Resource Management Areas. Fairfax County also encourages the Army to minimize any impact to 100-year floodplains and/or wetlands, to the greatest extent feasible. Any mitigation/compensation of wetlands should occur as close to the area of impact as possible. Fairfax County encourages these areas to be protected consistent with county policy and regulations. EQCs as defined in Policy Plan Element of Fairfax County's Comprehensive Plan should also be considered for preservation. Land area that includes all 100-year floodplains, areas of 15% or greater slopes adjacent to the floodplain, and all wetlands qualify as designation of Environmental Quality Corridors and should be considered. This designation would protect and preserve habitat

quality, protect streams, reduce pollutants from entering the water, and provide a connected segment of open space to facilitate the movement of wildlife in the area as well as with the Accotink Creed EQC to the north of the property.
(Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Pages 15-18).

Soils

The Comprehensive Plan encourages new development to either avoids problem soil areas, or implement appropriate engineering measures to protect existing and new structures from unstable soils. (Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Page 13).

This property contains Marine Clay and problem class soils surrounding Accotink Creek and its tributaries. Staff recommends the Army cluster development away from problem class soils and complete a geotechnical study for the proposed development in the areas that exhibit problem class soils.

Forest Resources Policies and Impacts

The Comprehensive Plan anticipates that new development will include an urban forestry program and be designed in a manner that retains and restores meaningful amounts of tree cover, consistent with planned land use and good silvicultural practices. Good quality vegetation should be preserved and enhanced and lost vegetation restored through replanting. (Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Pages 17-18).

The project has the potential to disturb a large amount of mature tree cover. Tree planting should be incorporated extensively into the project design for all disturbed areas. In order to ensure the viability of the proposed plantings, staff recommends tree protection, to include adequate supervision during construction, to ensure that tree protection measures are implemented as planned. Additionally, staff recommends that all development plans avoid the following: significant changes to elevations (both “cut” and “fill” operations); changes to water flow; and excavation within the critical root zones of all trees to be protected. Additionally, staff recommends planting schemes featuring native and non-invasive trees, shrubs, perennial grasses and grass-like plants, and forbs for each planting area in the project design. For all new planting areas and for areas in which existing pavement is to be removed, staff recommends soil rebuilding in the project design, which would help ensure the viability of the proposed plantings.

Together, these measures would minimize impacts to ecological resources, increase the viability of the existing tree cover, increase the habitat value of the project, promote water infiltration, improve air quality and provide shade, consistent with the intent of the Comprehensive Plan.

Green Building

Fairfax County encourages commercial building development to incorporate green building measures into the design of all projects. Example green building measures can be derived from the U.S. Green Building Council's Leadership in Energy and Environmental Design for New Construction [LEED-NC®] or the U.S. Green Building Council's Leadership in Energy and Environmental Design for Core and Shell [LEED-CS®] or an equivalent program with independent third-party verification. Additional examples of measures that can be considered for the interior design are: Energy STAR fixtures, low flush toilets, high efficiency light, recycling of non-hazardous renovation materials, etc. Fairfax County also encourages the incorporation of electric vehicle charging into development proposals.
(Fairfax County Comprehensive Plan, 2019 Edition, Policy Plan, Environment, Amended through 12-3-2019, Pages 20-22).

Thank you again for the opportunity to comment on this proposal. If you have any questions about the comments, please contact Ellen Huber with the Department of Planning and Development at Ellen.Huber@fairfaxcounty.gov or 703-324-1364.

Sincerely,

Leanna H O'Donnell

Leanna H. O'Donnell, Director, Planning Division
Department of Planning and Development

LHO:EKH

Attachment A: Environmental Map of the Fort Belvoir North Area
Attachment B: Fairfax County Park Authority Memorandum

cc: Board of Supervisors
Bryan Hill, County Executive
Rachel Flynn, Deputy County Executive
Barbara Byron, Director, DPD
Kelly M. Atkinson, Chief, Environment and Development Review Branch, DPD

December 20, 2021

Stephanie Free
National Capital Planning Commission
401 9th Street NW, Suite 500
Washington, DC 20004

RE: NCPC Project Referral - MP020A - Fort Belvoir North Post Area Development Plan, Dated December 2021

Dear Stephanie Free:

Thank you for the opportunity to comment on the revised Fort Belvoir North Area Development Plan (FBNADP), dated December 2021. Fort Belvoir North Area (FBNA) is located at the northwest quadrant of Interstate 95 and the Fairfax County Parkway. The FBNADP proposes to establish the development framework for functions of the FBNA, a non-contiguous 804-acre parcel, located north of the main installation of Fort Belvoir.

In June 2021, Fairfax County provided you with comments on three development alternatives planned for the site which ranged in intensity from minimal improvements of only planned projects to maximum capacity based on the remainder of land available; the maximum capacity alternative was the preferred alternative according to the FBNA stakeholders. The maximum capacity alternative did not take into consideration the natural features of the site and would result in a significant increase in impervious area on site, as well as the removal of large areas of mature vegetation. Fairfax County identified several concerns and recommended mitigation measures that could be implemented in the final design to minimize the impact of the proposed development on environmentally sensitive areas (see Attachment 1). While some of those concerns have been better addressed with the most recent submission, Fairfax County continues to support our previous comments in Attachment 1, in addition to these additional comments on the current submission.

Growth Boundaries

In response to comments received on the June 2021 plan, Fort Belvoir conducted additional quantitative analyses with affected stakeholders to identify potential development areas within FBNA. This included an analysis of areas of the site that were prohibited for development due to cost or jurisdictional requirements; extent of mitigation required; soils; areas of existing development; and areas of existing vegetation, some of which would require additional mitigation if impacted. Additionally, consideration was made to ensure any future development would not conflict with the existing National Geospatial-Intelligence Agency (NGA) located on the eastern portion of the site. These constraints were then used to identify three growth boundaries that balance Fort Belvoir's expanded mission capacity while taking into consideration the need for a secure campus on the western portion of the site and preservation of natural features. The three growth boundaries are shown in Figure 1 and total 238 acres. As stated in the current plan, the intent of the growth boundaries is to establish a dense walkable campus in areas of prior disturbance to the extent possible, with a priority on the eastern portion of the site. As proposed, the area of development has been reduced by approximately 51 acres on the western portion of the site, including one area entirely that was located between the two western growth boundaries. The revised growth boundaries result in the preservation of approximately 90 additional acres of vegetation. While the plan still proposes 90 acres of tree removal, this has been reduced from 154 acres proposed with the June 2021 submission. Fairfax County appreciates the applicant's commitment to minimize the areas of development and minimize tree removal and disturbance by focusing development within three growth boundaries, which is consistent with County policies.

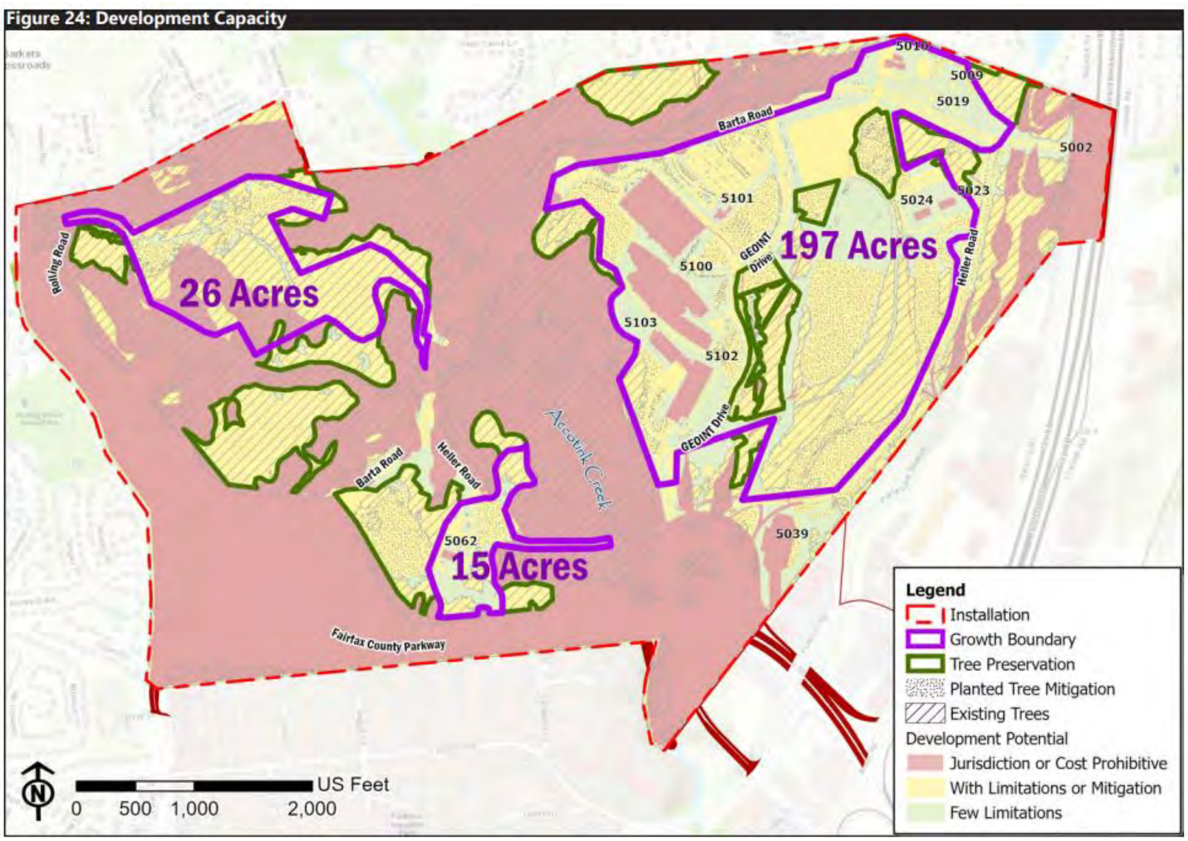
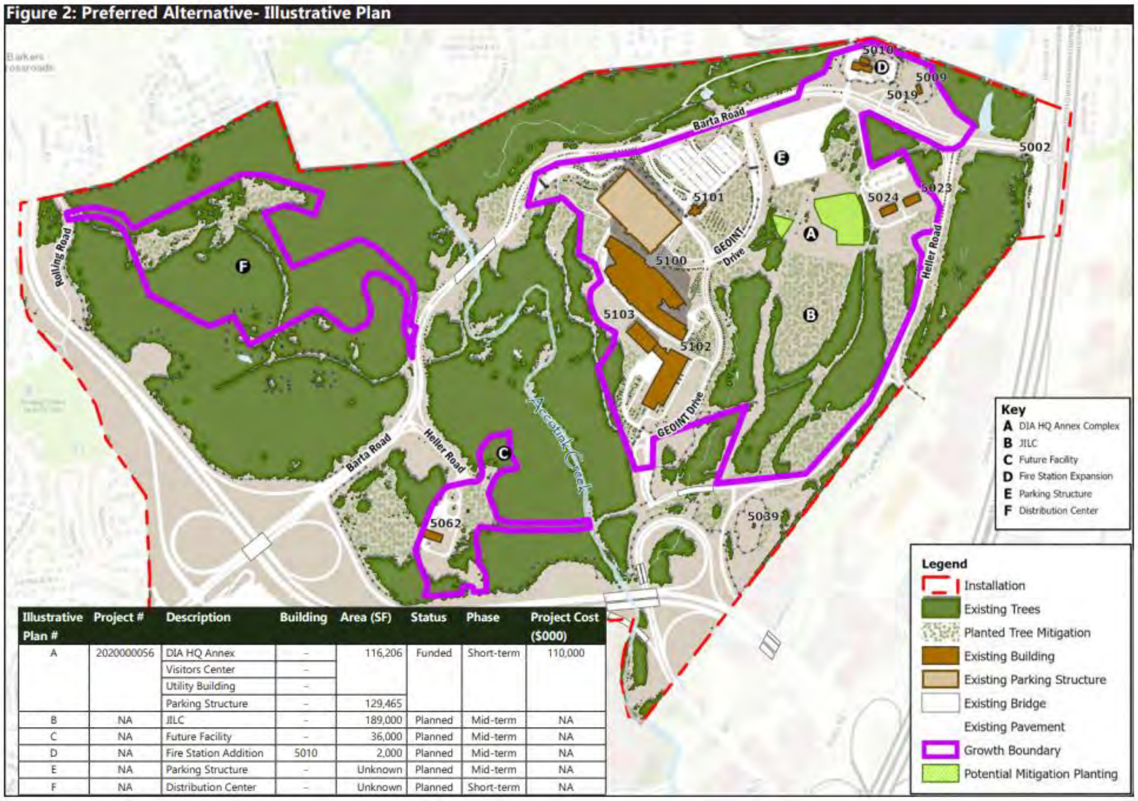


Figure 1: Development Capacity, Source: FBNADP December 2021, Page 53

Illustrative Plan

Figure 2 below depicts the proposed Illustrative Plan. The most significant change between the June and December plans is the removal of the proposed buildings on the western portion of the property. It is Fairfax County's understanding that any near-term development would first be concentrated on the eastern portion of the property, in the vicinity of the NGA, assuming there are no security concerns. Additionally, Fairfax County understands that currently, there are no end users for development on the western portion of the site; therefore, the depiction of buildings, parking areas and roads is premature and would be subject to further review by NCPC, as well as Fairfax County, at such time a user is identified. However, any development potential would be limited to the growth boundary. Building heights for future buildings have also been increased from one to three stories to three to eight stories to minimize building footprint. The current plan depicts a future Parking Structure (identified as "E" in Figure 2) to replace an existing overflow, surface parking lot. This will ensure adequate parking can be provided in a smaller footprint and result in less land disturbance. The current plan promotes density and multi-story buildings whenever feasible, which promotes walkability. To encourage pedestrian movement throughout the site, sidewalks, lighting, shade, signage and wayfinding, green space and an overall aesthetically pleasing environment are now proposed, which will also mitigate environmental and transportation impacts. Fairfax County finds this an improvement over the previous submission and consistent with County policies that seek to cluster development in pedestrian friendly developments.



Illustrative Plan #	Project #	Description	Building	Area (SF)	Status	Phase	Project Cost ($000)
A	2020000056	DIA HQ Annex	-	116,206	Funded	Short-term	110,000
		Visitors Center	-				
		Utility Building	-				
		Parking Structure	-	129,465			
B	NA	JILC	-	189,000	Planned	Mid-term	NA
C	NA	Future Facility	-	36,000	Planned	Mid-term	NA
D	NA	Fire Station Addition	5010	2,000	Planned	Mid-term	NA
E	NA	Parking Structure	-	Unknown	Planned	Mid-term	NA
F	NA	Distribution Center	-	Unknown	Planned	Short-term	NA

Figure 2: Development Capacity, Source: FBNADP December 2021, Page 10

<u>Forest Resources, Water Resources and Sustainability</u>

While Fort Belvoir has made efforts to focus growth in designated areas, preserve more vegetation, and minimize tree removal, the current plan continues to result in the potential for significant additions of impervious area and impacts to natural features. Therefore, the current plan now proposes compensation measures to include:

- 2:1 tree replanting on- or off-Post;
- Installation of additional solar/PV cells and/or wind power generation in the project, or elsewhere on-Post;
- Stream restoration along the tributaries affecting Fort Belvoir, both on- or off-Post; and
- Stormwater restoration and mitigation measures throughout Post.

Fairfax County supports these mitigation measures as they are consistent with the Environment Element of the Policy Plan that recommends the restoration of meaningful amounts of tree cover and the protection and restoration of the ecological integrity of streams. Fairfax County recommends any tree replanting be prioritized at a ratio of 2:1 and located on-Post to the greatest extent feasible to provide a more direct benefit adjacent to disturbed areas. If the full replanting cannot be accommodated on-Post, Fairfax County would support a 2:1 tree planting in areas within the County near the site. Alternatives could include contributions into a County Tree Preservation and Planting Fund to support the County's replanting efforts in the South County area of Fairfax County, or a joint partnership between the County and FBNA to identify areas in South County suitable for replanting by FBNA.

Fairfax County supports Fort Belvoir's efforts to complete steam restoration on site. The Environment Element of the Policy Plan states that the protection and restoration of the ecological integrity of streams is expected in Fairfax County. In order to minimize the impacts that new development and redevelopment projects may have on county streams, the Comprehensive Plan encourages the protection of stream channels, buffer areas along stream channels, and commitments to the restoration of degraded stream channels and riparian buffer areas. In addition, Fairfax County continues to recommend water quantity and quality measures be provided above any minimum requirements to minimize impact to adjacent streams. Finally, Fairfax County appreciates the removal of several stormwater management ponds and replacement with several low impact development (LID) measures for water quantity and quality. This is consistent with County policies that expects new development and redevelopment to result in high quality site design using LID techniques.

Fairfax County encourages commercial building development to incorporate green building measures into the design of all projects. Example green building measures can be derived from the U.S. Green Building Council's Leadership in Energy and Environmental Design for New Construction [LEED-NC®] or the U.S. Green Building Council's Leadership in Energy and Environmental Design for Core and Shell [LEED-CS®] or an equivalent program with independent third-party verification. Additionally, Fairfax County expects new County facilities to be designed and constructed to obtain LEED-Gold certification; incorporate solar and electric-vehicle readiness features; provide an on-site renewable energy generation component; obtain energy performance improvement; reduce greenhouse gas emissions; and ultimately achieve net zero energy (for projects designed in FY 2031 or later). Fairfax County understands that any new facilities constructed with this plan have been designed to achieve LEED-Silver; however, the NGA building has obtained LEED-Gold certification. The County recommends any new facilities on site also obtain LEED-Gold certification, which is consistent with the County's policy for new County facilities. Fairfax County also continues to recommend a minimum of 2-percent of any parking spaces on site be equipped with Level-2, universal electric vehicle charging facilities, fully wired and functional, consistent with County policies.

Finally, the current plan notes that any development on the western portion of the site include environmentally responsible development opportunities, to include solar arrays on roofs to enhance long-term benefits of renewable energy usage. This is consistent with the policy regarding renewable energy production for new County facilities.

Transportation

The circulation plan remains largely unchanged from the June 2021 submission, except for one change which was made to address a comment made by a Fairfax County resident. The previous proposal depicted a new road that would provide a connection from Rolling Road to Barta Road on the western portion of the property. This access could impact the existing, off-site pedestrian networks in the area. In response, this access at Rolling Road has been restricted to emergency only and any existing pedestrian networks in the area would be maintained. Fairfax County appreciates Fort Belvoir's response to this concern.

Fort Belvoir is required to maintain a Transportation Management Plan (TMP) to inform employees on transportation options for travelling to and from FBNA. Strategies include the use of structured parking at a ratio of 1:1.5; phased structured parking to ensure parking demands are constantly assessed; maximize structured parking over surface lots; secure and unsecured parking; single-occupancy vehicle reduction techniques; and annual review of the TMP. Fairfax County recommends similar measures for large redevelopment proposals in the County.

The June 2021 plan identified the use of parking maximums as an effective method of transportation demand management (TDM) for dense urban areas. The plan provided a range of parking ratios based on various sources applicable to similar sites. It was noted that while these ratios may be appropriate for other projects, they could not be achieved for FBNA. Reasons include not being adequately served by public transportation; unique security requirements; and a specialized workforce who sees adequate parking as a benefit. For these reasons, a 90% factor was used to determine parking requirements.

The December 2021 restates this concern; however, now offers additional suggestions to better meet the TDM requirements based on ten years of experience provided by the NGA and the TDM strategies implemented with that project, which include Ride-Sharing, Carpool, Vanpool, Guaranteed Ride Home, Ridematching Services, Ride-Sharing Marketing, Alternative Work Schedules, Telework (when applicable), Transit Subsidy, Bicycle/ Walking, and Mass Transit Education programs. Based on FBNA's experience with the NGA site, the current plan now proposes a 67% factor and the parking ratios are more aligned with the TMP.

Summary

Fairfax County appreciates the opportunity to comment on the revised Fort Belvoir North Area Development Plan dated December 2021. Overall, Fairfax County finds the proposed revisions an improvement over the June 2021 submission. The current plan more adequately balances the needs of the mission while protecting environmental resources. The identification of growth boundaries clearly defines where future development is expected, and the proposed mitigation will help address some of the proposed impacts. Fairfax County continues to recommend the applicant refine the proposed development as final plans progress and requests to review any revised plans developed for the site.

Thank you again for the opportunity to comment on this proposal. If you have any questions about the comments, please contact Kelly Atkinson with the Department of Planning and Development at Kelly.Atkinson@fairfaxcounty.gov or 703-324-1259.

Sincerely,

Leanna H O'Donnell

Leanna H. O'Donnell, Director, Planning Division
Department of Planning and Development

LHO:KMA

Attachment 1: NCPC Project Referral - MP020A - Fort Belvoir North Post Area Development Plan, Letter Dated July 30, 2021

cc: Board of Supervisors
Bryan Hill, County Executive
Rachel Flynn, Deputy County Executive
Barbara Byron, Director, DPD
Vance Zavela, Partnership Developer, Fort Belvoir

From:	Burke, Thomas W
To:	FBNA
Cc:	Atkinson, Kelly; Hermann, Jeffrey C.; Garcia, Michael W; Felschow, Michael; Kang, Hejun
Subject:	[URL Verdict: Neutral][Non-DoD Source] RE: FBNA Distribution Center Request for Early Input Notice
Date:	Thursday, April 28, 2022 4:14:37 PM
Attachments:	image001.png

Good morning,

Following up on Kelly Atkinson's comments from April 19, 2022, Fairfax County Department of Transportation just wanted to add a couple additional transportation-related notes, pertaining to the proposed development at Fort Belvoir North Area.

- Fairfax County has completed its **Fairfax County & Franconia-Springfield Parkways Alternatives Analysis & Long-Term Planning Study**. We are currently in the process of incorporating new long-term recommendations into the Comprehensive Plan. Public hearings for this Comprehensive Plan Amendment are anticipated for this Summer.
    - We are recommending that the Fairfax County Parkway be widened from 4 to 6 general purpose lanes, between the Barta Road interchange and John J Kingman Road.
    - We are recommending continuous, connected, multi-use trails on both sides of the Parkway.
    - We are recommending interchange modifications at Fairfax County Parkway and I-95.

Note that these are long-range, high-level, planning recommendations that will require additional outreach and analysis before concepts, alignments and cross sections are ultimately designed, engineered and constructed.

- Please note that Fairfax Connector is currently in the process of developing its Transit Strategic Plan (TSP). This is an ongoing effort, with draft recommendations. Final recommendations will need to be cost constrained and have yet to be confirmed.
    - Project website: https://www.fairfaxcounty.gov/connector/tsp.
    - Fairfax Connector Routes that serve the FBNA and nearby Saratoga Park & Ride, including Routes 340, 341, 393 and 394, are under consideration for potential changes.
        - Route 341 will remain the same; The team is currently working on several service options for Route 340, coordinating with agencies in the Fort Belvoir North Area.
    - Other routes nearby are also being assessed.
        - Route 371, which provides access to Franconia-Springfield VRE/Metrorail and Lorton VRE Stations, running on Rolling Road and Fullerton Road, will improve the rush-hour frequency to 15 mins. The improvements will be funded through the recently awarded Northern Virginia Transportation Commission (NVTC) grant.
    - New routes are also under consideration.
        - New Route 990 is under consideration that would connect the Herndon

Metrorail Station to FBNA via the Fairfax County Parkway, and on to the Franconia-Springfield VRE/Metrorail Station. It would potentially operate on weekdays, from 6:00am to 7:00pm with 20 minute frequency during the peak and 30 minute off-peak.

Final recommendations for the TSP will be submitted to the Board of Supervisors later this year or early next year for approval;
Implementation for any service change will depend on future funding and approval of the Board.

Please let us know if you have any additional questions.

-Tom

Thomas W. Burke, P.E., AICP
Senior Transportation Planner IV
Transportation Planning Section

Fairfax County Department of Transportation
4050 Legato Road, Suite 400
Fairfax, VA 22033
(703) 877-5600 (Main)   (703) 877-5681 (Direct)   (703) 877-5697 (Fax)

www.FairfaxCounty.gov/Transportation

From: Atkinson, Kelly
Sent: Tuesday, April 19, 2022 3:27 PM
To: FBNA@usace.army.mil
Subject: FW: FBNA Distribution Center Request for Early Input Notice

Good afternoon,

Please find below Fairfax County's early input comments on the Draft EA. Fairfax County requests the opportunity to comment on the Draft EA once published.

- Fairfax County previously commented on the FBNA Area Development Plan Master Plan at the request of NCPC (please see attached letters). In the most recent submission reviewed (December 2021), the FBNA Area Development Plan depicted development in three growth boundary areas. The proposed Distribution Center and associated parking/infrastructure should be located in one of the three growth boundaries and take into consideration the natural features of the site and minimize any increase in impervious area and removal of large areas of mature vegetation. Mitigation measures including tree replacement; maximizing building heights/minimizing building footprints; phased parking structures instead of surface parking; Transportation Management Plan; water quantity and quality measures above minimum requirements (to include Low Impact Development techniques versus SWM ponds); and stormwater/stream restoration should be considered.

- The development proposal should promote walkability and cluster buildings where possible. To encourage pedestrian movement throughout the site, sidewalks, lighting, shade, signage and wayfinding, green space and an overall aesthetically pleasing environment should be considered, which will also mitigate environmental and transportation impacts. A pedestrian circulation plan should be included.
- Does the proposed Distribution Center need to be located on the west side of the creek? It was the County's understanding the Army would prioritize development east of the creek first.
- Impacts to Resource Protection Areas, floodplains, wetlands, and rare, threatened, and endangered species should be avoided or minimized to the greatest extent feasible.
- Will the building obtain LEED certification and if so, at what level? Fairfax County projects are encouraged to obtain LEED Gold along with the installation of solar arrays and electric vehicle charging stations and provide an on site renewable energy component. The Fairfax County Board of Supervisors also has policies on energy performance targets; Greenhouse Gas emissions; and Net Zero Energy for our own buildings that perhaps the Army could consider.
- Any access at Rolling Road should be restricted to emergency only and any existing pedestrian networks in the area maintained.
- Any undisturbed and unsurveyed areas that are planned for development should undergo a Phase I archaeological survey. If potentially significant sites are found, it is recommended the Army undergo Phase II archaeological testing to determine Fairfax County significance and/or eligibility for inclusion onto the National Register of Historic Places. If sites are found to be significant or eligible, avoidance or Phase III data recovery is recommended.

Fairfax County has provided these comments to provide early input on the proposed action to be considered in the forthcoming EA. These comments are subject to change based on the County's formal review of the forthcoming EA and represent staff analysis and do not necessarily reflect the opinion of the Fairfax County Board of Supervisors.

Thank you,
Kelly Atkinson

Kelly M. Atkinson, AICP (she/her/hers)
Branch Chief, Environment and Development Review Branch
Fairfax County Department of Planning and Development
12055 Government Center Parkway, 7th Floor
Fairfax, VA 22035
(703) 324-1380 (Main)
(571) 595-4238 (Mobile)

Note: My working hours may not be the same as your working hours. Please do not feel obligated to reply outside of your current work schedule.

From: FBNA <FBNA@usace.army.mil>
Sent: Wednesday, April 13, 2022 5:13 PM
Subject: FBNA Distribution Center Request for Early Input Notice

All Interested Parties:

The U.S. Army Garrison, Fort Belvoir, Virginia is preparing an Environmental Assessment (EA) for the construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia, pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 United States Code Section 4321 *et seq.*), the Council on Environmental Quality (CEQ) regulations that implement NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and 32 CFR Part 651, *Environmental Analysis of Army Actions*. An EA is used as a planning document to assess environmental impacts, evaluate their significance, develop alternatives and mitigation measures, and allow for agency and public participation (32 CFR 651.20).

The EA is being prepared to evaluate the environmental impacts associated with the Proposed Action to build and operate a distribution center at FBNA. The project will modernize logistical operations and address safety, security, and operational concerns specific to the warehouse and its administrative functions. The project is needed to support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring a site within the National Capital Region to achieve distribution efficiencies.

In accordance with 40 CFR 1500-1508, the Army invites you to provide early input on the Proposed Action to be considered in our analysis of each alternative in the forthcoming EA. This notice is being distributed to organizations and the public that may have an interest in the project. Information on the Proposed Action can be found on the project website at https://www.nab.usace.army.mil/FBNA/. Comments on the Proposed Action can be submitted through the project website or via email to FBNA@usace.army.mil. Once the draft EA is completed, organizations and the public will have an opportunity to review the document and provide comments during a 30-day public review period.

We appreciate your attention to this matter. Early input will be accepted for a period of 15 days, beginning on the date of this notice. Should you require any additional information or have any questions, please contact the Fort Belvoir Directorate of Public Works-Environmental Division (DPW-ED) via phone at (703) 806-3193 or (703) 806-0020, during normal working business hours, Monday through Friday, 8:00 a.m. to 4:00 p.m.

National Capital Planning Commission 401 9th Street, NW North Lobby, Suite 500 Washington, DC 20004 Tel 202.482.7200 Fax 202.482.7272 www.ncpc.gov

IN REPLY REFER TO:
NCPC FILE No. MP020A

MAY 2, 2022

Ms. Heather Cisar
United States Army Corps of Engineers
Baltimore District, Maryland 21203

Re: Fort Belvoir North Area Distribution Center Scoping (Early Input) Comments

Dear Ms. Cisar:

Thank you for the opportunity to offer early input as part of the Fort Belvoir North Area (FBNA) distribution center's environmental review process under the National Environmental Policy Act (NEPA). As the federal government's planning agency for the National Capital Region, NCPC has advisory review authority over the project under the National Capital Planning Act (40 U.S.C. §§ 8722 (b)(1)). Our comments are based on policies from the Federal Elements of the NCPC Comprehensive Plan and in follow-up to our previous FBNA Area Development Plan review. For your reference, you may access a videotape of the meeting through NCPC's website at www.ncpc.gov/videos, as well as the Commission Action in the Appendix of this letter, which provides guidance that applies to the distribution center project.

Fort Belvoir North Area Final Area Development Plan

NCPC recently approved of the distribution center use for Area D with the following applicable guidance:

- The distribution center is required to be located on previously disturbed land to the greatest extent possible;
- Renewable energy is a priority for future FBNA projects including the distribution center; and
- The forested western campus (Area D) is for potential development by missions that are not compatible with other campus core area (Area A) development.

As the initial project within Area D, the new distribution center's layout and orientation are critical, not only to maximize its potential passive solar energy gain and to minimize its use of undisturbed land, but the new development will influence other future on-site projects as well. Thus, the EA should assess a design that aligns with these objectives and consider more than one project footprint to ensure an optimal future layout. In addition, the Army Corps of Engineers (USACE) should minimize future on-site parking as much as possible to help FBNA eventually attain its overall long-term 1:2 parking goal.

Future Environmental Assessment

We understand the EA assumes the future project would encompass an area of approximately 525,000 square feet (consisting of a warehouse and administrative building) to accommodate an additional six hundred personnel, with enhanced security measures, and space for 640 personal vehicles and twelve trucks daily. The new center would support delivery and receipt of materials for FBNA and other federal campuses throughout the National Capital Region. As part of the EA process, we recommend the USACE analyze the following impact topic areas:

- Travel and parking characteristics on-site and in the surrounding area;
- Vehicular and pedestrian circulation, and site security;
- Views/visual quality in and around the site;
- Energy and potable water use;
- Total impervious surface area changes;
- Stormwater runoff volumes;
- Stream health, function, and water quality;
- 100 and 500-year floodplain impacts;
- Vegetation, tree canopy area, and number of on-site trees;
- Habitat and functions of natural resources; and
- Effects on historic properties and resources.

Finally, the EA should include all existing and planned unbuilt projects in its evaluation of the project's cumulative impacts as requested in our March 2022 Commission Action.

Project Review Process

We recommend early consultation with NCPC staff to review the project's concept design (10-20%) to ensure the project would meet Commission expectations. The concept design should include proposed road, development configurations, stormwater management areas, parking, and proposed tree removal/mitigation information to include:

- A survey of existing trees that identifies forest cover acreage, species, composition, age, condition, location, and areas of natural regrowth;
- Prioritized on- and off-site tree replanting areas prior to implementing other alternative environmental compensation measures;
- Alternative environmental compensation measures early in the design process to maximize feasibility of their implementation;
- Quantitative data that demonstrates the proposed alternative environmental compensation measures would equate to at least one of the benefits provided by the net acreage of trees removed (e.g., carbon sequestration, stormwater capture, etc.); and
- Any alternative environmental compensation measures in addition to applicable federal, state, and local regulations already required.

The USACE should anticipate two separate project submissions (Preliminary and Final) to our Commission when plans are at an adequate level of detail. Please consult our agency website at www.ncpc.gov/review/guidelines for more information about our submission guidelines. Finally, we encourage the USACE to continue to coordinate the new distribution center project with Fairfax County during the NEPA process and later design stages.

We appreciate the opportunity to provide these staff comments and we look forward to reviewing the future draft EA and project submissions. If you have any questions, please contact Michael Weil at 240-575-0212, or michael.weil@ncpc.gov.

Sincerely,

Diane Sullivan

Diane Sullivan, Director
Urban Design and Plan Review Division

Attached: Fort Belvoir North Area – Final Area Development Plan Commission Action (March 3, 2022)

National Capital Planning Commission

Commission Action

March 3, 2022

PROJECT
Fort Belvoir North Area
Final Area Development Plan
Fort Belvoir
7500 GEO International Drive
Springfield, Virginia

SUBMITTED BY
United States Department of Defense
Department of the Army

REVIEW AUTHORITY
Approval of Master Plans for use by the Commission
per 40 U.S.C. § 8722(a) and (b)(1)

NCPC FILE NUMBER
MP020A

NCPC MAP FILE NUMBER
2205.10(05.00)45430

APPLICANT'S REQUEST
Approval of final master plan

ACTION TAKEN
Approved final master plan with comments

The Commission:

Notes the Fort Belvoir North Area (FBNA) master plan includes known future development, such as the Defense Intelligence Agency (DIA) Headquarters Annex, in addition to capacity planning with defined growth boundaries for possible future missions unknown at this time. Therefore;

Approves the following components of the Fort Belvoir North Area (FBNA) final master plan:

- The planning principles for determining the location of new missions;
- The defined growth boundaries for the Areas A and B;
- The location of the future DIA Headquarters, visitor's center, utility plant, and near-term DIA parking garage within the Area A growth boundary;
- The proposed mid-term fire station addition and Joint Intelligence Logistics Center (JILC) located in Area A and an undisclosed tenant facility located in Area B; and
- The proposed distribution center use within the growth boundary labeled Area D.

Defers review of the following until more is known about future development:

- The mid-term parking garage in Area A, and
- Additional development of Area D other than the distribution center.

Notes the following comments and future requirements regarding development; environmental impacts; renewable energy; and transportation.

Development Framework

Finds the Army responded to the Commission's comments on the draft master plan by reducing disturbance to undeveloped areas; defining tree preservation areas; increasing building heights;

eliminating new surface parking; and incorporating low impact development stormwater management techniques.

Notes the Army used a qualitative analysis to define future growth boundaries, which reduced the total developable land area from 289 acres in the draft master plan to 238 acres currently proposed.

Notes the final master plan proposes to prioritize development of the campus core and identifies the forested western campus as developable only for potential missions that are not compatible with missions in the campus core.

Requires the distribution center within Area D to be located on previously disturbed land to the greatest extent possible.

Requires the Army to seek early consultation with NCPC staff and include proposed road and development configurations for the respective growth boundaries with future site and building plan submissions.

Environmental Impacts

Finds that the development framework has improved and now preserves 90 more acres of trees compared to the draft submission. However, significant environmental impacts are still anticipated with full build-out of the plan.

Notes that in total, approximately 78 acres of potential tree removal is anticipated with full development of the growth area boundaries and there is limited space for additional planting on-site.

Notes that in the near-term, the Army has identified approximately four on-site acres of tree planting in addition to off-site stream restoration to mitigate impacts from the proposed DIA Headquarters and parking garage, which is generally consistent with the intent of NCPC's policies and will be further refined during project review.

Notes the Army has committed to the following alternative environmental compensation measures to mitigate tree loss as a result of future development at the FBNA:

- Evaluate locations off-site to replant trees at a 2:1 ratio;
- Consider solar and/or wind power generation installations on- and off-post;
- Implement stream restoration along tributaries affecting Fort Belvoir; and
- Integrate stormwater restoration and mitigation measures throughout the post.

Finds that additional detail is necessary in the project site and building plan submissions to determine if the alternative compensation measures proposed are comparable mitigation for the remaining amount of tree removal, and

Requires that for future project submissions the Army should:

- Complete a survey of existing trees that identifies forest cover acreage, species, composition, age, condition, location, and areas of natural regrowth;
- Prioritize on- and off-site tree replanting prior to implementing other alternative environmental compensation measures;
- Incorporate alternative environmental compensation measures early in the design process to maximize feasibility of their implementation;
- Provide quantitative data that demonstrates the proposed alternative environmental compensation measures will equate to at least one of the benefits provided by the net acreage of trees removed (e.g., carbon sequestration, stormwater capture, etc.); and
- Provide any alternative environmental compensation measures in addition to applicable federal, state, and local regulations already required.

Requests the National Environmental Policy Act (NEPA) process for each future project include existing and planned, unbuilt projects in the evaluation of cumulative impacts and includes NCPC in the NEPA scoping periods.

Renewable Energy

Notes the Department of Defense's (DoD) Climate Action Plan (CAP) creates a strategic framework to meet the directives of Executive Order (E.O.) 14008 and is also acting on requirements in several other E.O.s with a commitment to achieving carbon free electricity and net-zero installations.

Notes the final master plan indicates that solar panels may be installed on parking structure rooftops, existing surface parking lots, covered walkways, and new facilities evaluated through the Leadership in Energy and Environmental Design (LEED) design process.

Recommends the FBNA prioritize LEED's renewable energy credit points to achieve green building certification of its facilities.

Finds that additional effort is needed for individual projects to meet the larger goals of the DoD's CAP and goals related to carbon free electricity and net-zero installations at the FBNA.

Requests renewable energy is a priority for future FBNA projects including the DIA Headquarters and the future distribution center.

Transportation Near-term

Notes the proposed FBNA Transportation Management Plan (TMP) incorporates the NGA Transportation Demand Management (TDM) strategies, as previously requested by the Commission.

Notes the original NGA Headquarters TMP was approved with a parking ratio of 1:1.5 in 2015. The current parking ratio is approximately 1:1.7, due to an increase in employees and visitor events at the campus.

Notes NCPC revised the parking ratio for this area in 2017 to 1:2 as part of the *2017 National Capital Region Federal Parking Study.*

Notes the proposed DIA Headquarters garage will provide 1,547 spaces to serve NGA employees, DIA employees, and visitors. This garage will maintain the current parking ratio of 1:1.7 for the campus core.

Finds that compared to other installations of similar distance to Metro, NGA has done well in meeting NCPC's earlier parking ratio goal and has implemented many of the TDM strategies outlined in the existing NGA Headquarters TMP.

Finds there are a number of unique constraints that support a deviation from the 1:2 ratio at this time, including:

- Near-zero ability to telework among all employees because of the highest security requirements, and
- Overlapping shifts.

Finds the 1,380 parking spaces dedicated for an anticipated 2,650 visitor population is supported by 120 special events per month that occur at the conference center and NGA College.

Notes that if additional funding becomes available, the Army would like to increase the number of spaces in the DIA garage so that the near-term employee parking ratio for the campus core would decrease to a 1:1.5 ratio.

Notes the Commission is only approving the DIA garage sized for a 1:1.7 campus parking ratio at this time.

Finds more specific TMP data (see below) would be needed for the Commission to consider a decrease to the current campus parking ratio. If the Commission were to find a decrease to the near-term parking ratio justified, mid and long-term parking projects would need to bring the overall campus to a 1:2 parking ratio.

Transportation Mid and Long-term

Notes that the applicant intends to prepare a more robust TMP for the FBNA. Additional time is necessary to seek funding, coordinate with various missions, understand post-pandemic transportation, and realize the potential campus population associated with future development.

Notes the Army has stated they will work towards a 1:2 parking ratio goal over the long-term but the above constraints will prevent near and mid-term projects from reaching this goal.

Notes the mid-term garage will be sized in accordance with a future TMP to be reviewed by the Commission.

Requests the applicant return to the Commission in approximately two years, or when early planning begins for the next master plan project after the DIA Headquarters, with an update to the FBNA TMP. The update should identify:

- Specific mode split data;
- Existing parking utilization rates;
- Additional information about the need for, and amount of, overlapping shifts;
- TDM strategies and steps necessary to incrementally improve the campus parking ratio and an analysis of action items necessary to achieve a long-term parking ratio of 1:2;
- Outcome of efforts to reinstate the FBNA shuttle service between the Franconia-Springfield Metro Station and the campus; and
- Capabilities to bus visitors to/from the FBNA during special events, such as conferences.

Additional Coordination

Requests the Army continue coordination with Fairfax County as individual project implementation proceeds. Coordination should include, but not be limited to, the NEPA scoping process.

Julia Koster 03/04/2022

Julia A. Koster
Secretary to the National Capital Planning Commission

From:	Traver, Carrie
To:	FBNA
Cc:	Nevshehirlian, Stepan
Subject:	[URL Verdict: Neutral][Non-DoD Source] Environmental Assessment for the Construction and Operation of a Distribution Center at the Fort Belvoir North Area
Date:	Wednesday, May 4, 2022 6:31:02 PM

Thank you for providing the notice that the U.S. Army Garrison, Fort Belvoir is preparing an Environmental Assessment (EA) for the construction and operation of a distribution center at the Fort Belvoir North Area (FBNA). In response, the Environmental Protection Agency (EPA) has recommendations for your consideration in the development of the EA in compliance with the National Environmental Policy Act (NEPA) of 1969, the CEQ regulations implementing NEPA (40 CFR 1500-1508) and Section 309 of the Clean Air Act.

Purpose and Need, Alternatives

The Request for Early Input indicates that the project is needed to support the delivery and receipt of materials within and across the Washington Metropolitan Area and will "modernize logistical operations and address safety, security, and operational concerns." EPA recommends that the EA clearly identify the need for the project.

- The Purpose and Need section in the EA should describe the underlying problems or deficiencies and identify how the Proposed Action will resolve these issues.

- The purpose and need should inform the discussion of reasonable alternatives. We recommend discussing alternatives, including alternative sites at FBNA or other locations in the Washington Metropolitan Area that may have been evaluated, and other functional alternatives (e.g., multiple buildings, using existing facilities, etc.).

Aquatic Resources

EPA recommends that the Study evaluate any potential aquatic resource impacts, including direct fill and the potential for additional water quality degradation.

- To assess and avoid impacts, we recommend that the boundaries of any streams and wetlands present on or immediately surrounding the site be delineated.

- In accordance with the Clean Water Act Section 404, we recommend avoiding and minimizing impacts to Waters of the United States. If impacts to aquatic resources are proposed, we recommend including detailed data regarding resource type, size, condition, and functions and a plan to offset the functions of these resources in the watershed.

Water Quality and Stormwater

Existing water quality degradation has been documented in the Accotink Creek watershed. The creek is impaired, and Total Maximum Daily Loads (TMDLs) have been developed for pollutants such as sediment, chlorides, and E. coli. The Virginia Wetland Condition Assessment Tool (WetCAT) data viewer gives an indication of existing stressors from a GIS-based landscape assessment. WetCAT shows two mapped freshwater forested/shrub wetlands on the site. Based on 2016 landcover data, the wetland to the north of the site is rated as Severely Stressed for water quality and habitat and the larger one to the center/west was rated as Somewhat Severely Stressed for habitat and water quality. (See https://cmap2.vims.edu/WetCAT/WetCAT_Viewer/WetCAT_VA_2D.html)

The Proposed Action involves the construction and operation of an approximately 525,000 square foot warehouse and administrative building with associated parking and covered storage for approximately 600 personnel. According to the Accotink Creek Watershed Management Plan (approved in 2010), the watershed consists of 27% impervious surface. While impacts may occur under a range of impervious area, water quality impairment is generally evident as impervious cover rises above 10%. Above 25% impervious cover, significant degradation is generally expected. As the proposed construction is on a currently undeveloped site in a highly developed watershed with water quality impairments, we recommend minimizing the construction of new impervious area and reducing the impact as much as possible.

- If the Proposed Action is selected, careful planning according to principles of low impact development (LID) and use of green infrastructure will be critical in reducing potential impacts. LID uses and mimics natural processes that result in the infiltration, evapotranspiration, and use of stormwater in order to protect water quality and associated aquatic habitat. LID employs principles such as preserving natural landscape features, minimizing effective imperviousness, and treating stormwater as a resource. A number of resources for implementing green infrastructure practices and LID can be found at https://www.epa.gov/nps/urban-runoff-additional-resources.

- EPA recommends that the EA clearly indicate how the Proposed Action will avoid contributing to existing water quality impairments, including expected measures such as minimizing site grading and preserving and enhancing natural vegetation. EPA encourages the Army to maintain or enhance a riparian buffer for Accotink Creek for water quality, habitat, and climate resilience.

- Where possible, please consider exploring opportunities to minimize impervious areas from buildings, parking, and other appurtenances. We suggest evaluating structured parking and multiple floors for buildings where possible. Where it is not feasible to reduce the size of the roof area, options such as green roof installation or rainwater harvesting could help offset effects. Water collection and storage from roofs could be used for purposes such as landscape irrigation or flushing toilets to reduce water consumption from the facility. Green roof space can also be used as a building amenity and can make buildings more visually appealing.

- We recommend incorporating green infrastructure into parking, sidewalks, and roadways. We recommend considering permeable pavement for sidewalks and trails and vegetated stormwater best management practices (BMPs) to reduce volume and pollution from runoff. Vegetation-based BMPs such as tree pits or trenches, rain gardens, bioswales, planter boxes, and constructed wetlands have a number of co-benefits, including shade, aesthetic enhancement, and habitat.

EPA's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act can be found at: https://19january2017snapshot.epa.gov/sites/production/files/2015-09/documents/eisa-438.pdf

Greenhouse Gases, Energy Efficiency and Climate Change

EPA recommends that greenhouse gas (GHG) emissions associated with the Proposed Action be estimated and impacts evaluated. This includes emissions from site clearing and preparation, construction and conversion of the vegetated site, and emissions associated with operation and maintenance of the proposed facilities. We encourage minimizing GHG emissions where possible.

The Fourth National Climate Assessment (2018) indicates that many southeastern cities are particularly vulnerable to climate change. Resources, infrastructure, and human health are increasingly at risk from heat, flooding, and vector-borne disease linked to a changing climate. We recommend that the EA include a discussion of how the facility is planned to be resilient and contribute to resiliency efforts locally, given expected climate change impacts such as increased precipitation and extreme storm events.

As part of these efforts, we encourage incorporating energy efficiency into the building design and construction. For a large building, roof area is a key consideration. Roof treatments may impact energy efficiency; cool roof technologies may reduce air conditioning needs and green roofs may reduce energy use overall. Roof areas may also be suitable for installation of solar arrays to generate energy.

Please also consider recommendations such as those included in the LEED (Leadership in Energy and Environmental Design) Green Building Rating System for developing high-performance, sustainable buildings. http://www.usgbc.org/leed.

Wildlife and Vegetation

Impacts to the range of potential species should be evaluated from the Proposed Action. As this is a tract of undeveloped land in a generally residential and industrial area, it may provide a substantial habitat for local fauna.

We recommend discussing the vegetation to be cleared in detail. The acreage of each community type to be impacted should be assessed. For trees, species, community, and approximate age and size is useful to describe the impacts to vegetation and the habitat provided.

We suggest that the EA consider minimizing wildlife impacts in the design and maintenance of the facility. For example, migratory bird mortality may be caused by windows or reflective surfaces and lighting. (See https://www.audubon.org/magazine/november-december-2008/making-buildings-safe-birds) We suggest considering landscaping enhancements that may provide for habitat and management of invasive species.

Air Quality - General Conformity
In the discussion of air quality, EPA recommends that the EA specifically identify each National Ambient Air Quality Standard for which the site is or has been in nonattainment or maintenance.

A general conformity rule analysis should be conducted according to the guidance provided in Determining Conformity of General Federal Actions to State or Federal Implementation Plans. Under the general conformity rule, reasonably foreseeable emissions associated with all operational and construction activities, both direct and indirect, must be quantified and compared to the annual de minimis levels for those pollutants in nonattainment or maintenance for that area.

Noise
Based on aerial imagery of the area, it appears that residential development is located to the north. The study would benefit from a full evaluation of potential noise impacts to residences or other sensitive receptors from both construction and operation.

- We recommend identifying the distance to the nearest sensitive receptors and considering the equipment used, vegetation and/or topography, and planned BMPs to evaluate potential impacts. As the expected operation is 6AM to 4PM, we recommend including an assessment of potential noise during early morning hours.

- Other surrounding areas may be less-noise sensitive; for example, it appears that industrial land uses are located to the south and east. However, the EA would benefit from an assessment of the potential for construction noise effects on other facilities or businesses in the vicinity.

Environmental Justice
EPA recommends that an assessment be conducted to identify whether areas of potential environmental justice (EJ) concern are present and may be disproportionately impacted by project activities. The assessment should fully consider potential traffic and transportation impacts that may affect communities of EJ concern. Such an assessment should consider if communities that may be impacted by additional traffic to the facility are already burdened with air quality and health impacts from existing traffic proximity, potential safety impacts, and potential disruption or delays to transportation networks.

- EPA's screening tool, EJSCREEN (https://www.epa.gov/ejscreen) may be a good starting point to enable analyses of populations potentially experiencing adverse environmental impacts. In addition to demographic data for communities of color and low-income populations, the tool provides data regarding linguistic isolation, education, and age, and stressors such as traffic proximity. Please note that EPA recommends starting evaluation at the census block group level as it is the most refined data available from the US Census.

- Please consider referring to "Promising Practices for EJ Methodologies in NEPA Reviews": https://www.epa.gov/environmentaljustic/ej-iwg-promising-practices-ej-methodologies-nepa-reviews.

- We recommend that the identification of potential populations of EJ concern inform outreach to affected communities to assure that communication regarding the project reaches citizens in an appropriate way. For example, EPA encourages posting notices of public meetings, and other resources at frequently visited community locations. These locations may include, but may not be limited to, schools, churches, community centers, barbershops, salons, and medical facilities. For communities that may include a number of non-English speaking residents, materials published in other languages may be needed for full engagement. We recommend documenting efforts to inform and engage potentially impacted communities in the EA.

Socioeconomic and Community Impacts
We recommend that potential socioeconomic and community impacts of the facility and additional personnel and its effect on local housing, employment, schools, businesses, housing prices and availability, property values, etc. be assessed. This should include an evaluation of potential beneficial and negative community impacts during construction and operation of the facility.

Traffic and Transportation
Given the expected increase in vehicles to the site, EPA recommends that the EA thoroughly address traffic and transportation, including an evaluation of the impacts associated with construction and expected conditions for the completed project.

- We suggest as part of the traffic evaluation, the EA discuss existing public transit, ride sharing, and pedestrian and bike access to the facility.

- We recommend that opportunities to reduce use of single occupancy vehicles be evaluated to reduce congestion in the surrounding transportation network, emissions, and the need for parking. Such measures could include improved access via public transit, trail/sidewalk access, bicycle facilities, and incentives for public transit and ride sharing.
- EPA suggests developing a Transportation Management Plan for the facility.

Hazardous Wastes and Contamination
We recommend that the Study include an analysis of any hazardous sites or materials in the vicinity.

- Any known soil or groundwater contamination on the site should be described in the document; this should include the known extent of the pollution and any remediation actions that may have been taken or are planned in the project area. If contamination is present, please describe how earth-disturbing activities will be conducted to prevent the potential mobilization of contaminants.

- If contamination will be investigated, it would be helpful to indicate when studies are expected to be conducted.

Utilities
The Study would benefit from a discussion of whether existing infrastructure has sufficient capacity for project needs. Potential impacts from utility installation or upgrades should be assessed.

Please feel free to reach out to me if you have any questions on the topics listed above. I also request that you provide a copy or link to the EA by email when it is available for review.

Thank you,
Carrie

Carrie Traver
Life Scientist
Office of Communities, Tribes, & Environmental Assessment
U.S. Environmental Protection Agency, Region 3
1650 Arch Street – 3RA12
Philadelphia, PA 19103
215-814-2772
traver.carrie@epa.gov

Commonwealth of Virginia

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

1111 E. Main Street, Suite 1400, Richmond, Virginia 23219
P.O. Box 1105, Richmond, Virginia 23218
(800) 592-5482 FAX (804) 698-4178
www.deq.virginia.gov

Travis A. Voyles
Acting Secretary of Natural and Historic Resources

Michael S. Rolband, PE, PWD, PWS Emeritus
Director
(804) 698-4020

April 14, 2022

Fort Belvoir Directorate of Public Works-Environmental Division (DPW-ED)
FBNA@usace.army.mil

RE: Construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia

To Whom it May Concern:

This letter is in response to the scoping request for the above-referenced project.

As you may know, the Department of Environmental Quality, through its Office of Environmental Impact Review (DEQ-OEIR), is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. Similarly, DEQ-OEIR coordinates Virginia's review of federal consistency documents prepared pursuant to the Coastal Zone Management Act which applies to all federal activities which are reasonably likely to affect any land or water use or natural resources of Virginia's designated coastal resources management area must be consistent with the enforceable policies Virginia Coastal Zone Management (CZM) Program.

DOCUMENT SUBMISSIONS

In order to ensure an effective coordinated review of the environmental documents, notification should be sent directly to OEIR. We request that you submit one electronic to eir@deq.virginia.gov (25 MB maximum) or make the documents available for download at a website, file transfer protocol (ftp) site or the VITA LFT file share system (Requires an "invitation" for access. An invitation request should be sent to eir@deq.virginia.gov.). We request that the review of these documents be done concurrently, if possible.

The environmental documents should include U.S. Geological Survey topographic maps as part of their information. We strongly encourage you to issue shape files with the NEPA document. In addition, project details should be adequately described for the benefit of the reviewers.

ENVIRONMENTAL REVIEW UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT: PROJECT SCOPING AND AGENCY INVOLVEMENT

As you may know, NEPA (PL 91-190, 1969) and its implementing regulations (Title 40, *Code of Federal Regulations*, Parts 1500-1508) requires a draft and final Environmental Impact Statement (EIS) for federal activities or undertakings that are federally licensed or federally funded which will or may give rise to significant impacts upon the human environment. An EIS carries more stringent public participation requirements than an Environmental Assessment (EA) and provides more time and detail for comments and public decision-making. The possibility that an EIS may be required for the proposed project should not be overlooked in your planning for this project. Accordingly, we refer to "NEPA document" in the remainder of this letter.

While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the preparation of the NEPA document. Accordingly, we are providing notice of your scoping request to several state agencies and those localities and Planning District Commissions, including but not limited to:

Department of Environmental Quality:
- DEQ Regional Office*
- Air Division*
- Office of Wetlands and Stream Protection*
- Office of Local Government Programs*
- Division of Land Protection and Revitalization
- Office of Stormwater Management*

Department of Conservation and Recreation
Department of Health*
Department of Agriculture and Consumer Services
Department of Wildlife Resources*
Virginia Marine Resources Commission*
Department of Historic Resources
Department of Mines, Minerals, and Energy
Department of Forestry
Department of Transportation

Note: The agencies noted with a star (*) administer one or more of the enforceable policies of the Virginia CZM Program.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the federal Coastal Zone Management Act of 1972, as amended, and its implementing regulations in Title 15, *Code of Federal Regulations*, Part 930, federal activities, including permits, licenses, and federally funded projects, located in Virginia's Coastal Management Zone or those that can have reasonably foreseeable effects on Virginia's coastal uses or coastal resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia CZM Program.

Additional information on the Virginia's review for federal consistency documents can be found online at https://www.deq.virginia.gov/permits-regulations/environmental-impact-review/federal-consistency

DATA BASE ASSISTANCE

Below is a list of databases that may assist you in the preparation of a NEPA document:

- DEQ Online Database: Virginia Environmental Geographic Information Systems

  Information on Permitted Solid Waste Management Facilities, Impaired Waters, Petroleum Releases, Registered Petroleum Facilities, Permitted Discharge (Virginia Pollution Discharge Elimination System Permits) Facilities, Resource Conservation and Recovery Act (RCRA) Sites, Water Monitoring Stations, National Wetlands Inventory:
    - www.deq.virginia.gov/ConnectWithDEQ/VEGIS.aspx

- DEQ Virginia Coastal Geospatial and Educational Mapping System (GEMS)

  Virginia's coastal resource data and maps; coastal laws and policies; facts on coastal resource values; and direct links to collaborating agencies responsible for current data:
    - http://128.172.160.131/gems2/

- MARCO Mid-Atlantic Ocean Data Portal

  The Mid-Atlantic Ocean Data Portal is a publicly available online toolkit and resource center that consolidates available data and enables users to visualize and analyze ocean resources and human use information such as fishing grounds, recreational areas, shipping lanes, habitat areas, and energy sites, among others.

  http://portal.midatlanticocean.org/visualize/#x=-73.24&y=38.93&z=7&logo=true&controls=true&basemap=Ocean&tab=data&legends=false&layers=true

- DHR Data Sharing System.

  Survey records in the DHR inventory:

    - www.dhr.virginia.gov/archives/data_sharing_sys.htm

- DCR Natural Heritage Search

  Produces lists of resources that occur in specific counties, watersheds or physiographic regions:
    - www.dcr.virginia.gov/natural_heritage/dbsearchtool.shtml

- DWR Fish and Wildlife Information Service

  Information about Virginia's Wildlife resources:
    - http://vafwis.org/fwis/

- Total Maximum Daily Loads Approved Reports
    - https://www.deq.virginia.gov/programs/water/waterqualityinformationtmdls/tmdl/tmdldevelopment/approvedtmdlreports.aspx

- Virginia Outdoors Foundation: Identify VOF-protected land
    - http://vof.maps.arcgis.com/home/index.html

- Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Database: Superfund Information Systems

  Information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL:
    - www.epa.gov/superfund/sites/cursites/index.htm

- EPA RCRAInfo Search

  Information on hazardous waste facilities:
    - www.epa.gov/enviro/facts/rcrainfo/search.html

- EPA Envirofacts Database

  EPA Environmental Information, including EPA-Regulated Facilities and Toxics Release Inventory Reports:
    - www.epa.gov/enviro/index.html

- EPA NEPAssist Database

  Facilitates the environmental review process and project planning:
  http://nepaassisttool.epa.gov/nepaassist/entry.aspx

If you have questions about the environmental review process and/or the federal consistency review process, please feel free to contact me (telephone (804) 659-1915 or e-mail bettina.rayfield@deq.virginia.gov).

I hope this information is helpful to you.

Sincerely,

Bettina Rayfield, Program Manager
Environmental Impact Review and
Long-Range Priorities

From:	Fulcher, Valerie
To:	rr dgif-ESS Projects; Keith Tignor; rr DCR-PRR Environmental Review; odwreview (VDH); Carlos Martinez; Kotur Narasimhan; Lawrence Gavan; Bob Lazaro; Terrance Lasher; Roger Kirchen; rr EIR Coordination; Mark Miller; Atkinson, Kelly
Cc:	FBNA
Subject:	[Non-DoD Source] NEW SCOPING FT BELVOIR NORTH AREA
Date:	Tuesday, May 3, 2022 2:23:54 PM
Attachments:	FNBA Distribution Center Request for Early Input Notice (1).pdf Ft Belvoir Distribution Center Scoping Response.pdf

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Good afternoon—attached is a request for scoping comments on the following:

> **Construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia**

If you choose to make comments, please send them directly to the project sponsor (FBNA@usace.army.mil) and copy the DEQ Office of Environmental Impact Review: eir@deq.virginia.gov. We will coordinate a review when the environmental document is completed.

DEQ-OEIR's scoping response is also attached.

If you have any questions regarding this request, please email our office at eir@deq.virginia.gov.

Valerie

--

Valerie A. Fulcher, CAP, OM, Admin/Data Coordinator Senior

Department of Environmental Quality

Environmental Enhancement - Office of Environmental Impact Review

1111 East Main Street

Richmond, VA 23219

NEW PHONE NUMBER: 804-659-1550

Email: Valerie.Fulcher@deq.virginia.gov

https://www.deq.virginia.gov/permits-regulations/environmental-impact-review

OUR ENFORCEABLE POLICIES HAVE BEEN UPDATED FOR 2021: https://www.deq.virginia.gov/permits-regulations/environmental-impact-review/federal-consistency

For program updates and public notices please subscribe to Constant Contact: https://lp.constantcontact.com/su/MVcCump/EIR

From:	Warren, Arlene
To:	FBNA
Cc:	rr Environmental Impact Review
Subject:	[Non-DoD Source] Re: NEW SCOPING FT BELVOIR NORTH AREA
Date:	Thursday, May 5, 2022 1:58:15 PM

Project Name: Expedited - NEW SCOPING FT BELVOIR NORTH AREA
Project #: N/A
UPC #: N/A
Location: Springfield VA

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

There are no public groundwater wells within a 1-mile radius of the project site.

The following surface water intakes are located within a 5 mile radius of the project site:

PWS ID Number	System Name	Facility Name
6059501	FAIRFAX COUNTY WATER AUTHORITY	OCCOQUAN RESERVOIR INTAKE

The project is not within the watershed of any public surface water intakes.

Best Management Practices should be employed, including Erosion & Sedimentation Controls and Spill Prevention Controls & Countermeasures on the project site.

Materials should be managed while on site and during transport to prevent impacts to nearby surface water.

The Virginia Department of Health – Office of Drinking Water appreciates the opportunity to provide comments. If you have any questions, please let me know.

Best Regards,

Arlene F. Warren
GIS Program Support Technician
Virginia Department of Health, Office of Drinking Water
109 Governor Street, 6th Floor
Richmond, VA 23219
804-356-6658 (office/cell/text)

On Tue, May 3, 2022 at 2:16 PM Fulcher, Valerie <valerie.fulcher@deq.virginia.gov> wrote:

Good afternoon—attached is a request for scoping comments on the following:

> **Construction and operation of a distribution center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia**

If you choose to make comments, please send them directly to the project sponsor (FBNA@usace.army.mil) and copy the DEQ Office of Environmental Impact Review: eir@deq.virginia.gov. We will coordinate a review when the environmental document is completed.

DEQ-OEIR's scoping response is also attached.

If you have any questions regarding this request, please email our office at eir@deq.virginia.gov.

Valerie

--

Valerie A. Fulcher, CAP, OM, Admin/Data Coordinator Senior

Department of Environmental Quality

Environmental Enhancement - Office of Environmental Impact Review

1111 East Main Street

Richmond, VA 23219

NEW PHONE NUMBER: 804-659-1550

Email: Valerie.Fulcher@deq.virginia.gov

https://www.deq.virginia.gov/permits-regulations/environmental-impact-review

OUR ENFORCEABLE POLICIES HAVE BEEN UPDATED FOR 2021: https://www.deq.virginia.gov/permits-regulations/environmental-impact-review/federal-consistency

For program updates and public notices please subscribe to Constant Contact: https://lp.constantcontact.com/su/MVcCump/EIR

From:	Steward, Accotink Creek
To:	FBNA
Cc:	phillip@prknetwork.org; Renee Grebe; Susan Bonney; Ann Bennett
Subject:	[URL Verdict: Neutral][Non-DoD Source] Fort Belvoir North Area Distribution Center Early Input
Date:	Tuesday, May 3, 2022 10:12:03 PM
Attachments:	1651629000540.png 1651629079543.png

RE: Fort Belvoir North Area Distribution Center - Early Input of the Friends of Accotink Creek

These comments include the larger issues of the Fort Belvoir North Area Final Area Development Plan (ncpc.gov)

Who was invited to the April 19th public meeting or how was it announced? We were unaware.

We request site visits by concerned stakeholders be arranged.

Go for the Gold – LEED Gold. The National Geospatial Agency did it, so can all other buildings on Fort Belvoir North Area.

Neither our country nor the world can meet climate goals by cutting down more forests and hoping the climate will not notice. Forward-thinking and difficult choices must be made and we all must make them.
"*To keep the nation secure, we must tackle the existential threat of climate change. The unprecedented scale of*
wildfires, floods, droughts, typhoons, and other extreme weather events of recent months and years have damaged our
installations and bases, constrained force readiness and operations, and contributed to instability around the world." - Lloyd J. Austin III, Secretary of Defense, Department of Defense Climate Risk Analysis, Report Submitted to National Security Council, October 2021.

It is not facetious to suggest that we preserve the tree canopy and instead use the Fort Belvoir golf course for building or for reforestation.

2-to-1 tree replanting somewhere offsite? The likelihood of anyone offering their parking lot or playing field for this purpose seems vanishingly dim. Further, only mature trees will be counted (typically those above 8" diameter in the survey). Figuring in the expected survival rate of any replacement saplings will inevitably yield a lower tree population than what was sacrificed.

Digging up the earlier remediation tree plantings already? Really? Was there no planning involved in the selection of their locations? Will re-remediation plantings now be proposed that are truly protected?

Fort Belvoir North Area is not too far from Metro for improved Complete Street enhancements to provide climate reduction pedestrian and bicycle travel options to commuting personnel, such as:

- Possibly add bike lanes and shared use path along Backlick Road in addition to the existing sidewalk

- Possibly extend Backlick Road sidewalk south from Barta Road to connect with existing sidewalk
- Possibly a connection to the Fairfax County Parkway Trail via Constantine Avenue or Beverley Park Drive
- Possibly a pedestrian bridge across I-95 connecting to Loisdale Road bicycle facilities

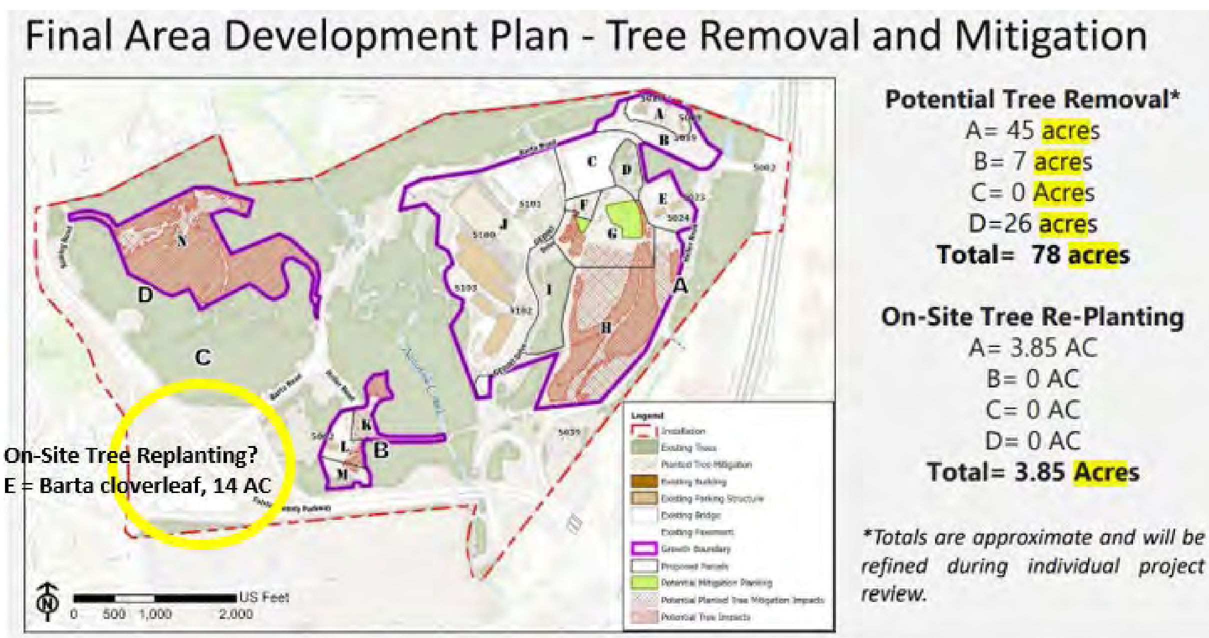
Possibilities for environmental remediation:

Stream remediation projects could focus on Field Lark Branch on the eastern boundary of Fort Belvoir North Area) and the small unnamed tributaries on Fort Belvoir North Area itself, in collaboration with Fairfax County Stormwater Planning Division

The [Accotink Gorge](#) Chinese wisteria removal project would benefit from the support of Fort Belvoir and its naturalist staff. The Accotink Gorge is immediately south of Fort Belvoir North Area and the Chinese wisteria infestation extends upstream along Accotink Creek onto the base.

Acquire land nearby for parks or conservation easements, possibly immediately to the north or south along Accotink Creek, perhaps even completing a protected park corridor from North Area to Main Base along the creek.

Replant the Fairfax County Parkway. The Barta Road cloverleaf alone would provide about 14 acres never replanted after the Parkway extension across Fort Belvoir North Area in 2010. This area is now partly colonized by exotic invasives, a sad successor to the mature forests that were lost.



Solarize everything that does not move.

Final Area Development Plan - Renewable Energy

- Project costs anticipate LEED ~~Silver~~ GOLD! ratings and Low Impact Development (LID) techniques.
- New facilities are intended to support on-site renewable energy production and will be considered on a case-by-case basis.
- Solar arrays considered for:
  - Parking structure rooftops
  - Surface lots
  - Covered walkways
  - New facility rooftops will be evaluated for potential during the LEED design process and against mission and security requirements


Parking Structure Photovoltaic Shade Structures


Pedestrian Photovoltaic Shade Structures

Sincerely,

Philip Latasa : : steward@accotink.org
Friends of Accotink Creek : : www.accotink.org : :
><((((º>`·.¸¸.·´¯`·.¸><((((º> *"Find just one other person who cares."* ><((((º>`·.¸¸.·´¯`·.¸><((((º>¸.·´¯`·.¸. ><((((º>
#SaveCinderBedWoods

Matthew S. Wells
Director

Frank N. Stovall
Deputy Director for Operations

Darryl Glover
Deputy Director for Dam Safety, Floodplain Management and Soil and Water Conservation

Laura Ellis
Interim Deputy Director for Administration and Finance

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

June 2, 2022

Heather Cisar
USACE-Planning Division
2 Hopkins Plaza
Baltimore, MD 21201

Re: Fort Belvoir North Area Distribution Center

Dear Ms. Cisar:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Fort Belvoir Proving Ground Conservation Site is located within the project site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Fort Belvoir Proving Ground Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at this site is:

Isotria medeoloides	Small whorled pogonia	G2?/S2/LT/LE

Small whorled pogonia is a perennial orchid that grows in a variety of woodland habitats in Virginia, but tends to favor mid-aged woodland habitats on gently north or northeast facing slopes often within small draws. It is quite natural for plants of this species to remain dormant in the soil for long periods of time. Direct destruction, as well as habitat loss and alteration, are principle reasons for the species' decline (Ware, 1991). The Virginia Field Office of the U.S. Fish and Wildlife Service (USFWS) recommends that field surveys for this species be conducted in areas of Virginia south of Caroline County from May 25 through July 15 and in areas of Virginia from Caroline County and north from June 1 through July 20 (K. Mayne, pers. com. 1999). Please note that this species is currently classified as threatened by the USFWS and as endangered by the Virginia Department of Agriculture and Consumer Services (VDACS).

Furthermore, according to a DCR biologist and predicted suitable habitat modeling, there is potential for additional populations of Small whorled pogonia to occur in the project area if suitable habitat exists on site.

To minimize adverse impacts to the documented occurrence of Small whorled pogonia, DCR recommends avoidance of the conservation site. Due to the potential for this site to support additional populations of Small whorled pogonia, DCR recommends an inventory for the resource in the study area. With the survey results we can more accurately evaluate potential impacts to natural heritage resources and offer specific protection recommendations for minimizing impacts to the documented resources.

DCR-Division of Natural Heritage biologists are qualified to conduct inventories for rare, threatened, and endangered species. Please contact Anne Chazal, Natural Heritage Chief Biologist, at anne.chazal@dcr.virginia.gov or 804-786-9014 to discuss availability and rates for field work. A list of other individuals who are qualified to conduct inventories may be obtained from the USFWS.

Due to the legal status of Small whorled pogonia, DCR also recommends coordination with USFWS to ensure compliance with protected species legislation.

In addition, the proposed project may impact Ecological Cores **(C5)** as identified in the Virginia Natural Landscape Assessment (https://www.dcr.virginia.gov/natural-heritage/vaconvisvnla). Mapped cores in the project area can be viewed via the Virginia Natural Heritage Data Explorer, available here: http://vanhde.org/content/map.

Ecological Cores are areas of at least 100 acres of continuous interior, natural cover that provides habitat for a wide range of species, from interior-dependent forest species to habitat generalists, as well as species that utilize marsh, dune, and beach habitats. Interior core areas begin 100 meters inside the nearest core edges and continue to the deepest parts of cores. Cores also provide natural and economic benefits of open space, recreation, water quality (including drinking water recharge and protection, and erosion prevention), and air quality (including carbon sequestration and oxygen production). Cores are ranked from C1 to C5 (C5 being the least significant) using nine prioritization criteria, including the habitats of natural heritage resources they contain.

Impacts to cores occur when their natural cover is partially or completely converted permanently to developed land uses. Habitat conversion to development results in changes that reduce ecosystem processes, biodiversity, population viability and habitat quality due to limited recolonization, increased predation, and increased introduction and establishment of invasive species.

Therefore, avoiding or minimizing core impacts is a key mitigation measure that will reduce deleterious effects and preserve the area and connectivity of habitats that are key components of biodiversity. DCR recommends efforts to minimize edge in remaining habitat fragments, retain natural corridors that allow movement between fragments and design the intervening landscape to support native wildlife (natural cover versus lawns).

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. Survey results should be coordinated with DCR-DNH and USFWS. Upon review of the results, if it is determined the species is present, and there is a likelihood of a negative impact on the species, DCR-DNH will recommend coordination with VDACS to ensure compliance with Virginia's Endangered Plant and Insect Species Act.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Wildlife Resources (VDWR) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Amy Martin at (804-367-2211) or amy.martin@dwr.virginia.gov.

Should you have any questions or concerns, please contact me at 804-225-2429. Thank you for the opportunity to comment on this project.

Sincerely,

Tyler Meader

Tyler Meader
Natural Heritage Locality Liaison

CC : Troy Andersen, USFWS

Literature Cited

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APPENDIX B – WETLAND DELINEATION REPORT

WETLAND DELINEATION REPORT
Distribution Center
Fort Belvoir North Area
Fort Belvoir, Virginia

Prepared for:

U.S. Army Corps of Engineers
Baltimore District, RSFO

Prepared by:

U.S. Army Corps of Engineers
Baltimore District, Planning Division
2 Hopkins Plaza
Baltimore, Maryland 21201

December 2021

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APPENDICES

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1 INTRODUCTION

1.1 STUDY PURPOSE

The U.S. Army Corps of Engineers (USACE), Baltimore District, Planning Division prepared this report at the request of the RSFO to identify and delineate waters of the U.S. (WUS) (i.e., wetlands and streams) found within the proposed site boundaries.

A project proponent proposes to design and construct a new distribution center on Fort Belvoir North Area (FBNA), Fort Belvoir, Fairfax County, Virginia. The facility will include a two-story warehouse building with associated parking, stormwater management facilities, and infrastructure. The building will provide warehouse storage, vehicle maintenance, and shipping and receiving areas. It will also contain offices, open office space, conference rooms, storage spaces and support spaces to serve approximately 90 occupants.

The study purpose was achieved through (1) collection and synthesis of existing wetlands and waters of the U.S. information; (2) a site visit to conduct routine wetland delineations as prescribed in the 1987 *Corps of Engineers Wetland Delineation Manual* and the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region*; and (3) preparation of a report of findings.

1.2 STUDY AREA

The proposed project area is approximately 180 acres, is currently forested, and situated in the northwestern half of FBNA, west of Accotink Creek. It is bounded by Accotink Creek to the east, Barta Road to the south, a residential neighborhood to the north, and Fairfax County Parkway to the west (Appendix A). In general, surface water appears to drain from the northwest to the southeast in the area as part of the Accotink Creek watershed.

FBNA is located near the transition between the Eastern Piedmont and the Coastal Plain Physiographic Provinces and therefore exhibits characteristics of both. Piedmont areas consist largely of Precambrian metamorphic and Cambrian igneous rock formations, whereas Coastal Plain areas consist of an eastward thickening wedge of unconsolidated sediments of gravel, sand, silt, and clay from the Cretaceous to Tertiary periods (Fort Belvoir 2014).

The topography of FBNA is gently rolling, except for steep slopes bordering Accotink Creek. Accotink Creek enters FBNA from the north at an elevation of approximately 120 feet above mean sea level and descends to an elevation of approximately 100 feet above mean sea level before exiting FBNA to the south. Steep slopes rise from both the eastern and western banks of Accotink Creek and its unnamed tributaries located to the west within the proposed project area. The grades on the slopes range between 20 and 30 percent at most locations (Fort Belvoir 2014). Elevation of the site ranges from 300 to 200 feet above mean sea level and slopes slightly from northwest to southeast.

2 METHODS

2.1 DATA COLLECTION AND ANALYSIS

Existing wetland information and GIS data was collected from various sources for preliminary analysis and identification of potential wetland areas within the study area. Sources of data include: U.S. Geological Survey (USGS) topographic quadrangles (USGS, 1977), U.S. Department of Agriculture (USDA) Web Soil Survey (USDA, 2021), the U.S. Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) maps (including aerial photography) (USFWS, 2015), and mapping found within the Draft Fort Belvoir Integrated Natural Resources Management Plan (INRMP), 2018-2023 (Belvoir, 2017).

2.2 WETLAND DELINEATION

The wetland delineation was performed pursuant to the 1987 *Corps of Engineers Wetland Delineation Manual* and the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region*, as Federal and state agencies require use of these documents for jurisdictional investigations. The delineation field work was conducted 9-10 October and 19-20 November 2021. All delineations were conducted by a team from USACE, Baltimore District, Planning Division. Data points were completed for each wetland. Wetland boundaries were marked with consecutively numbered pink survey flagging. Photographs of the wetlands are included in Appendix C.

2.3 GLOBAL POSITIONING SYSTEM (GPS) METHODOLOGY

The field survey was completed using a Carlson handheld Global Positioning System (GPS). The objective of the GPS survey was to collect location data for each wetland delineation flag and soil sample point. This survey horizontally references the North American Datum of 1983 (NAD83). This data was then transferred into ArcGIS Pro 2.6.1 for analysis and mapping.

3 RESULTS

3.1 GENERAL WETLAND FINDINGS

Wetlands are defined by the presence of three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology. Methods for determining if each of the three parameters are met are described in the 1987 *Corps of Engineers Wetland Delineation Manual* and the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region*.

Preliminary analysis of topographic maps, soils, and INRMP and NWI wetland mapping indicated the presence of wetlands and streams within the study area.

The USACE team placed numbered flags along the limits of six wetlands and one WUS within the study area. The flags were located using GPS survey methods. The wetland areas amount to over

78 acres of wetlands (Tables 3-2 and 3-3, Section 3.2). The maps of wetlands delineated within the study area are shown in Figures 1 and 2, Appendix A.

3.1.1 VEGETATION

For purposes of wetland identification, many plants are assigned an indicator status by the USFWS, which is useful for determining the probability of their occurrence in wetlands. Wetlands delineated within the study area were dominated by plants normally expected to occur within wetlands. No plant species observed on the site are listed as rare, threatened, or endangered at either a Federal or state level.

3.1.2 GENERAL SOIL CHARACTERISTICS

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

Drainage class refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized: excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained.

While the USDA web soil survey (USDA, 2021) identifies 29 soil series within the study area, soils within the wetlands are predominantly Sassafras-Marumsco complex, Nathalie gravelly loam or Rhodhiss sandy loam. Appendix D contains the full soil report. Table 3-1 lists a summary of the soils within the wetland perimeters, including name, the drainage class, and hydric status.

Table 3-1. Soils within the Wetlands

Soil Name	Map Symbol	Drainage Class	Hydric
Glenelg silt loam, 7 to 15 percent slopes	39B	Well drained	No
Nathalie gravelly loam, 7 to 15 percent slopes	79C	Well drained	No
Rhodhiss sandy loam, 15 to 25 percent slopes	87D	Well drained	No
Sassafras-Marumsco complex, 7 to 15 percent slopes	91C	Well drained	No
Sassafras-Marumsco, 15 to 25 percent slopes	91D	Well drained	Yes

3.1.3 HYDROLOGY

Evidence of wetland hydrology was observed in the areas identified as wetlands during the site investigation, and included water-stained leaves, oxidized rhizospheres along living roots, surface water, saturation, sparsely vegetated concave surface, and geomorphic position.

3.2 STREAMS

Several unnamed tributaries originate within the study area and flow in a generally west-to-east direction to their confluence with Accotink Creek off-site. Accotink Creek is the dominant hydrologic feature of FBNA, roughly bisecting the approximately 800-acre area (see Figure 1). The unnamed perennial stream originating out of Wetland 1 was flagged during the field investigations and found to be consistent with previous mapping associated with the INRMP. As such, and to expedite the field investigations, the remaining streams were not flagged but were walked to compare their general shape and extent to that found in the INRMP mapping. All streams exhibited signs of recent erosion such as collapsed, unvegetated banks and steep incision, particularly as they progressed further downstream towards the eastern half of the study area.

3.3 WETLANDS

Six wetlands were delineated within the proposed project areas, amounting to approximately 2.33 acres. Wetland data forms are located in Appendix B.

Plants found in and around the wetlands are classified by a regional wetland indicator status based on USDA's National Wetland Plant List. Indicator categories found in the wetlands on this site include:

FAC: Facultative Hydrophyte - Sometimes found in wetlands (34-66% frequency)
FACW: Facultative Wet Hydrophyte - Usually found in wetlands (66-99% frequency)
OBL: Obligate Hydrophyte - Almost always found in wetlands (99+% frequency)
NI: No Indicator – USDA has not assigned an indicator status for the species

Wetland 1 is a riparian, forested wetland that forms the headwaters of an unnamed, perennial tributary that discharges to Accotink Creek off-site to the east of the study area. The wetland borders merge into the narrow banks of the stream, which becomes progressively more incised as it travels downstream (see photos in Appendix C). This wetland is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporary flood regime (PFO1A). Dominant vegetation includes blackgum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and bitternut hickory (*Carya* cordiformis) in the canopy, musclewood (*Carpinus caroliniana*) and sweetgum (*Liquidambar styraciflua*) in the understory, and cinnamon fern (*Osmundastrum* cinnamomeum) and Japanese stiltgrass (*Microstegium vimineum*) in the herbaceous layer. The soil matrix was predominantly a sandy loam with a 7.5 YR 4/1 color and redoximorphic concentrations in the matrix of 7.5 YR 4/6 and 10 YR 5/8. This chroma meets a depleted matrix hydric soil indicator.

Wetland 2 is a palustrine emergent wetland with persistent vegetation and a flood regime classified as seasonally flooded/saturated (PEM1E). The dominant vegetation observed included Japanese stiltgrass, false nettle (*Boehmeria cylindrica*), New York fern (*Thelypteris noveboracensis*), *Carex* spp. and common greenbrier (*Similar rotundifolia*). The soil matrix was a silt loam 0-4 inches from the surface, with a matrix color of 10 YR 4/1 and 10 YR 6/8 redoximorphic features. Below the top 4 inches the soil became extremely compacted with a mixture of clay and gravel, except for the small depressional portion that sits above the relict unpaved road bed. The matrix color was 10 YR 6/1 with 10 YR 5/8 redoximorphic features. This soil matrix met the depleted matrix hydric soil indicator.

Note: The hydrology of this small wetland appears to originate from a hillside seep, which is a common wetland type found within Fort Belvoir. The groundwater daylights in the depression upslope from the relic road bed, then flows downslope along its compacted surface. The hydrology is such that hydric soil characteristics are noted in the near-surface layers and hydrophytic vegetation predominates; however, there lacks a distinct and discrete discharge feature to the incised stream located to the north and downslope from this wetland.

Wetland 3 is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporary flood regime (PFO1A). Wetland 3 is a slope wetland that discharges into an unnamed tributary to Accotink Creek. The dominant canopy species observed was highbush blueberry (*Vaccinium corymbosum*). Dominant understory vegetation observed was sensitive fern (*Onoclea sensibilis*), deer tongue (*Dichanthelium clandestinum*) and common greenbrier. The soil matrix was primarily a 10 YR 4/2 fine sandy loam with 7.5 YR 5/6 redoximorphic features. The matrix meets the hydric soil indicator for a depleted matrix.

Wetland 4 is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporary flood regime (PFO1A). Wetland 4 is a riparian wetland located further upstream of Wetland 3's discharge point into the same unnamed tributary. The dominant canopy species observed were sweet gum, red maple, white oak and tulip poplar (*Liriodendron tulipifera*). The dominant understory vegetation consists of American holly (*Ilex opaca*) and highbush blueberry, and the herbaceous layer was dominated by cinnamon fern, southern lady fern (*Athyrium asplenioides*), whorled wood aster (*Oclemena acuminata*) and common greenbrier. The soil matrix was predominantly a 10 YR 4/1 sandy clay loam with redoximorphic features of 7.5 YR 5/8 which meets the hydric soil criteria for a depleted matrix.

Wetland 5 is classified as a palustrine forested wetland with broad-leaved deciduous vegetation and a temporary flood regime (PFO1A). Wetland 5 is a riparian wetland that drains into the unnamed tributary to Accotink Creek downstream (south) of the culvert crossing under Cissna Road. The canopy dominant species observed was tulip poplar with sweet gum and American holly in the sapling layer. The dominant understory species observed were Japanese stiltgrass, New York fern, soft rush (*Juncus effusus*), three-way sedge (*Dulichium arundinaceum*) and clearweed (*Pilea pumila*). The soil matrix was primarily a sandy loam with a 10 YR 5/2 color with redoximorphic features of 7.5 YR 5/8. These colors meet the hydric soil depleted matrix indicator.

Wetland 6 is classified as a palustrine emergent wetland with persistent vegetation and a temporary flood regime (PEM1A). This small, depressional wetland is located adjacent to an unnamed tributary to Accotink Creek. The dominant vegetation observed was Japanese stiltgrass, mountain laurel (*Kalmia latifolia*) and highbush blueberry. The soil matrix was predominantly a 10 YR 2/1 sandy loam with 10 YR 5/8 redoximorphic features. These soils met the depleted matrix hydric soil indicator.

Descriptions of each wetland are provided in Table 3.3. A Cowardin classification key can be found in Appendix E.

Table 3-2. Wetlands in the Study Area

Wetland	Cowardin Classification	Total Acreage	Connection to Navigable Waters
Wetland 1	PFO1A	1.56	Drains to perennial tributary to Accotink Creek
Wetland 2	PEM 1E	0.04	Isolated wetland (see Note above)
Wetland 3	PFO1A	0.45	Drains to perennial tributary to Accotink Creek
Wetland 4	PFO1A	0.24	Drains to same perennial tributary to Accotink Creek as Wetland 3
Wetland 5	PFO1A	0.01	Drains to perennial tributary to Accotink Creek
Wetland 6	PEM1A	0.03	Drains to perennial tributary to Accotink Creek.
		2.33 Acres	

4 CONCLUSIONS

Six wetlands were delineated by USACE, Baltimore District, Planning Division, within the study area on Fort Belvoir's North Area. The delineation was performed over several days between October-November 2021.

The jurisdiction of the wetlands included in this report have **not** been verified by USACE-Regulatory Branch or the Virginia Department of Environmental Quality (DEQ). Any future design or construction that may impact these wetlands or the wetland buffers will require coordination with the USACE and DEQ, specifically in regard to potential permitting actions within Section 404, Section 10, and all other potential permitting actions.

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5 ACRONYMS AND ABBREVIATIONS

BARC	Beltsville Agricultural Research Center
BEP	Bureau of Engraving and Printing
CPF	Currency Production Facility
EIS	Environmental Impact Statement
FAC	Facultative Hydrophyte
FACW	Facultative Wet Hydrophyte
FBNA	Fort Belvoir North Area
GPS	Global Positioning System
INRMP	Integrated Natural Resources Management Plan
NAD83	North American Datum of 1983
NI	No Indicator
NTCHS	National Technical Committee for Hydric Soils
NWI	National Wetland Inventory
OBL	Obligate Hydrophyte
RSFO	
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
WUS	Waters of the U.S.

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APPENDIX A
Figures

Figure 1 – FBNA Study Area Overview

Figure 2: Wetlands – Northern Portion of Study Area

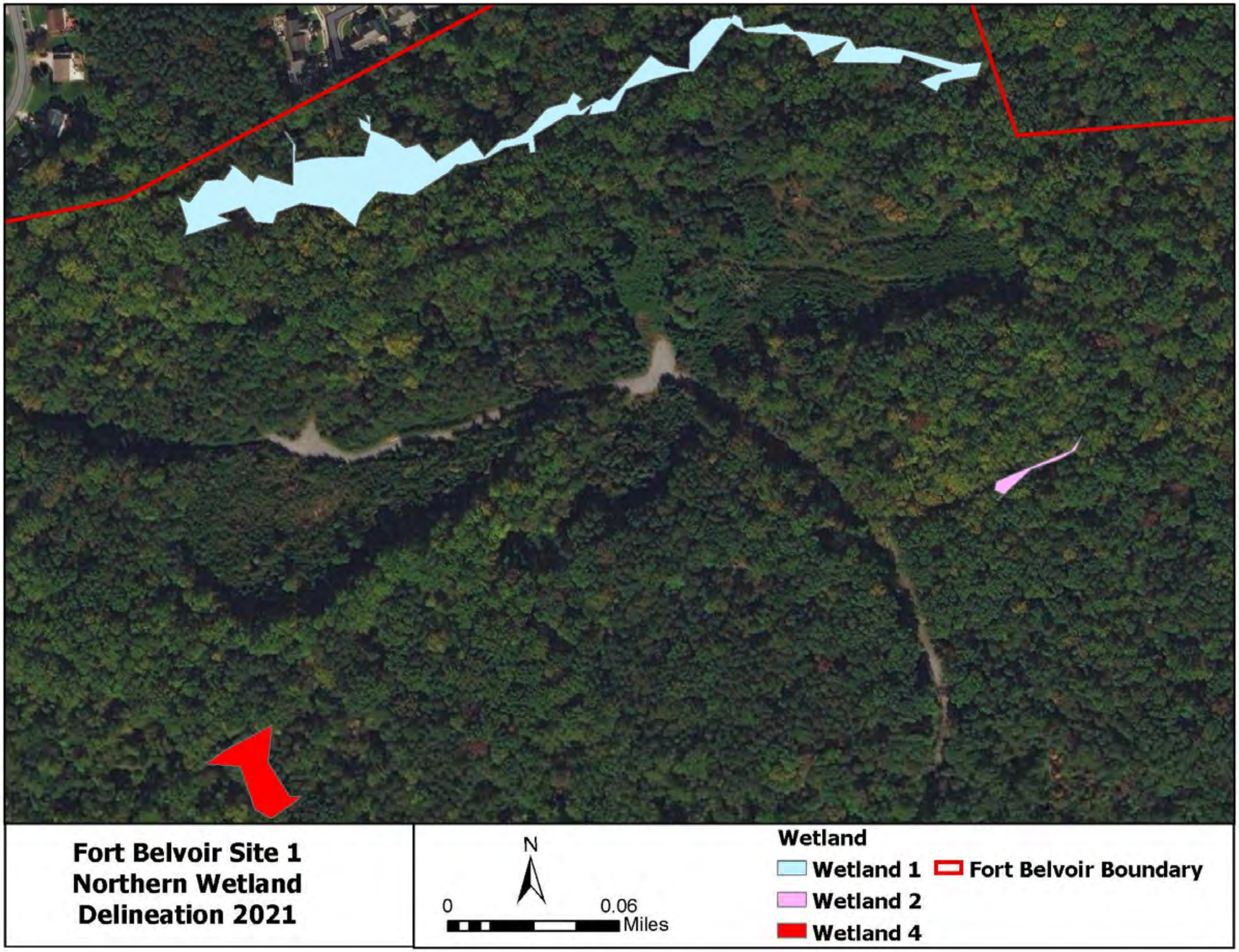
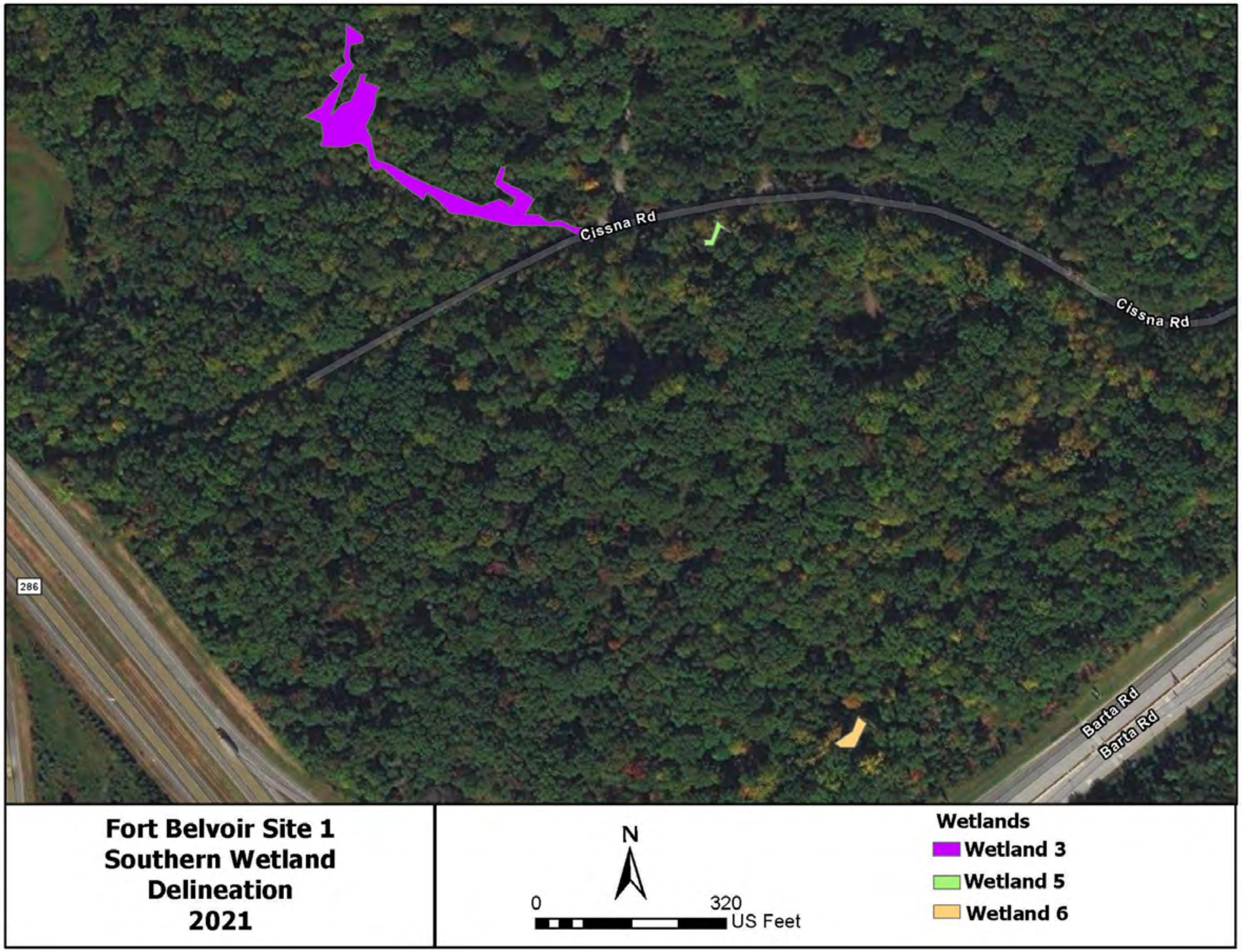


Figure 2: Wetlands – Southern Portion of Study Area



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APPENDIX B
Routine Wetland Data Forms

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APPENDIX C
Photographs

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APPENDIX D
Cowardin Classification Key

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APPENDIX E
Wetlands and Deepwater Habitats Classification

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APPENDIX C – COASTAL ZONE FEDERAL CONSISTENCY DETERMINATION

APPENDIX C
Determination of Consistency with Virginia's Coastal Resources Management Program

This document provides the Commonwealth of Virginia with the Fort Belvoir Consistency Determination under the Coastal Zone Management Act Section 307(c)(1) and 15 Code of Federal Regulations (CFR) Part 930, Subpart C, for the Fort Belvoir North Area Distribution Center, Fort Belvoir, Virginia. The information in this Consistency Determination is provided pursuant to 15 CFR § 930.39.

This document represents an analysis of project activities in light of established Virginia Coastal Resources Management Program (CRMP) Enforceable Policies and Programs. Furthermore, submission of this consistency determination reflects the commitment of the U.S. Department of the Army (Army) to comply with those Enforceable Policies and Programs. The Proposed Action would be implemented in a manner that is consistent with the Virginia CRMP. The Army has determined that the construction and operation of the FBNA Distribution Center would have a negligible impact on any land and water uses or natural resources of the Commonwealth of Virginia's coastal zone.

C1 Description of Proposed Action

The Proposed Action involves the construction of a distribution center within Fort Belvoir's North Area (FBNA) (see Figure 1). The proposed distribution center warehouse and administrative building would be approximately 525,000 square feet (SF) and would include associated parking, covered storage, and a perimeter security fence, all to support approximately 600 personnel. This facility would support the delivery and receipt of materials within and across the Washington Metropolitan Area, requiring close proximity within the National Capital Region to achieve distribution efficiencies. The action would also provide compliance with Office of Management and Budget guidance that encourages "good stewardship of taxpayer resources" and increasing joint site usage.

C2 Assessment of Probable Effects

The Army has prepared a draft Environmental Assessment (EA) to evaluate the potential environmental impacts from the FBNA distribution center in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S. Code 4321-4347), and 32 CFR Part 651, Environmental Analysis of Army Actions.

The Army intends to obtain all applicable permits required for implementation of the Proposed Action. A review of the permits and/or approvals required under the enforceable policies is being conducted. The Army has evaluated the construction of the FBNA distribution center for its foreseeable effects on the following enforceable policies:

Fisheries – The Proposed Action has no foreseeable impacts on fish or shellfish resources and would not affect the promotion of, or access to, commercial or recreational fisheries.

The proposed site is located approximately 4.5 miles northwest of the Potomac River and just west of Accotink Creek. The closest water features near the proposed site are unnamed tributaries to Accotink Creek and associated riparian wetlands. Compliance with the installation's Municipal Separate Storm Sewer System (MS4) Permit and the Virginia Erosion and Sediment Control regulations would minimize the risk of sediment being transported off the site to the Potomac River Fishery. Best management practices recommended by the Virginia Departments of Conservation and Recreation and Forestry would be employed when necessary.

Subaqueous Lands Management – The Virginia Marine Resources Commission, pursuant to Virginia Administrative Code (VAC) Section 28.2-1204, has jurisdiction over encroachments in, on, or over any State-owned rivers, streams and creeks. The project would have no foreseeable impacts on subaqueous resources.

Tidal and Non-tidal Wetlands Management – The Proposed Action would not affect any tidal wetlands. Potential impacts to non-tidal wetlands within the project area would be avoided, minimized and, if necessary, mitigated in accordance with applicable Virginia laws.

Dunes Management – The Proposed Action would not affect any coastal primary sand dunes.

Non-Point Source Water Pollution Control – Typically, a Proposed Action that is greater than 2,500 SF would require an erosion and sediment control (ESC) plan and a stormwater management plan to be developed. The ESC plan would include temporary erosion and sediment control measures. The ESC plan and stormwater management plan would be prepared utilizing the requirements for water quality and quantity found in the Virginia Technical Criteria Part IIB (9VAC25-870-62 through 9VAC25-870-92). The Proposed Action would disturb approximately 30 acres of soil; therefore, an ESC plan and stormwater management plan are required. A construction general permit in accordance with 9VAC25-830-130 would also be required. Short-term, minor, adverse impacts would occur from the Proposed Action on surface water with regard to water quality. Appropriate temporary erosion and sediment control measures and stormwater Best Management Practices (BMP) would be employed to minimize impacts to water quality from earth disturbance and potential erosion during construction.

Point Source Water Pollution Control – The Proposed Action would not result in point source water discharge.

Shoreline Sanitation – The Proposed Action is not located on or near a shoreline. The Proposed Action would therefore have no impact on shoreline sanitation.

Air Pollution Control – The proposed site is located within an ozone (O_3) non-attainment area, triggering the need to analyze emissions and determine the applicability of General Conformity Rule under the Clean Air Act. A construction emissions estimate indicates that construction and operation activity would not generate sufficient emissions to trigger a need for a full General Conformity Analysis.

The estimated emissions associated with the construction and operation of this project are very low. The temporary impacts to air quality would be short-term, minor impacts that would not be regionally or locally significant.

Coastal Lands Management – Resource Protection Areas (RPAs) are associated with Accotink Creek, its tributaries, and its associated tidal and non-tidal wetlands. Short-term, minor, adverse impacts to the RPAs associated with unnamed tributaries to Accotink Creek and the adjacent riparian, non-tidal wetlands are anticipated in the project area (see Figure 2). Avoidance and minimization of impacts to this area would be fully considered as the project design progresses. Any unavoidable impacts would be addressed through applicable permitting pursuant to Section 404 of the Clean Water Act and the Virginia Water Protection Permit Program (9 VAC 25-210-10 et seq.). Appropriate temporary erosion and sediment control measures and stormwater BMPs would be employed at the construction site to minimize downstream impacts to Accotink Creek from earth disturbance associated with construction activities.

C3 Summary of Findings

Based on the above analysis, which is elaborated on in the EA, Fort Belvoir personnel would: (1) ensure that the construction contractor uses and maintains appropriate temporary erosion and sediment controls; and (2) obtain the requisite permits and approvals. The Army finds that the proposed distribution center construction is fully consistent to the maximum extent practicable with the federally approved enforceable provisions of the Virginia CRMP, pursuant to the Coastal Zone Management Act of 1972, as amended and in accordance with 15 CFR 930.30.

Pursuant to 15 CFR Part 930.41, the Virginia CRMP has 60 days from receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension, in writing, under 15 CFR Part 930.41(b). Virginia's concurrence will be presumed if its response is not received by the Army on the 60th day from receipt of this determination. The state's response should be sent to U.S. Army Garrison Fort Belvoir, 9430 Jackson Loop, Suite 200, Fort Belvoir, VA 22060-5116.

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Joshua P. SeGraves
Colonel, US Army
Commanding

Figure 1: Proposed Project Location at FBNA

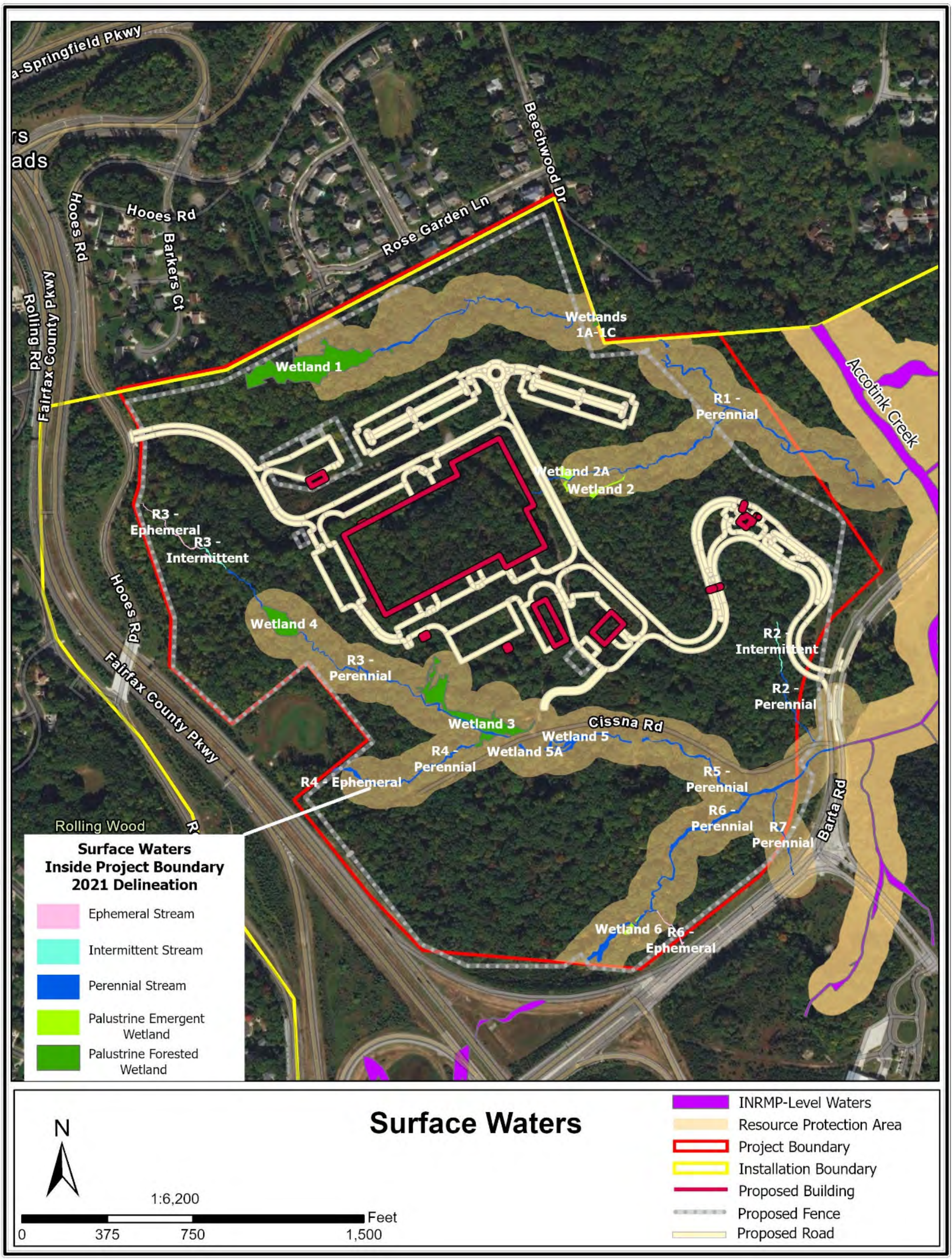

Figure 2: Surface Waters

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APPENDIX D – FOREST STAND DELINEATION STUDY

FOREST STAND DELINEATION REPORT
FOR
PROPOSED DISTRIBUTION CENTER
FORT BELVOIR NORTH AREA
FORT BELVOIR, VIRGINIA

DECEMBER 2021

PREPARED FOR:
U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT, RSFO

PREPARED BY:
U.S. ARMY CORPS OF ENGINEERS
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Maryland Department of Natural Resources Forest Conservation Qualified Professional
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FOREST STAND DELINEATION REPORT FOR
PROPOSED DISTRIBUTION CENTER
FORT BELVOIR NORTH AREA

I. Introduction

A project proponent proposes to design and construct a new distribution center on Fort Belvoir North Area (FBNA), Fort Belvoir, Fairfax County, Virginia. The facility will include a two-story warehouse building with associated parking, stormwater management facilities, and infrastructure. The building will provide warehouse storage, vehicle maintenance, and shipping and receiving areas. It will also contain offices, open office space, conference rooms, storage spaces and support spaces to serve approximately 90 occupants.

II. Site Description

The proposed project area is approximately 180 acres, is currently forested, and situated in the northwestern half of FBNA, west of Accotink Creek. It is bounded by Accotink Creek to the east, Barta Road to the south, a residential neighborhood to the north, and Fairfax County Parkway to the west (Appendix A).

FBNA is located near the transition between the Eastern Piedmont and the Coastal Plain Physiographic Provinces and therefore exhibits characteristics of both. Piedmont areas consist largely of Precambrian metamorphic and Cambrian igneous rock formations, whereas Coastal Plain areas consist of an eastward thickening wedge of unconsolidated sediments of gravel, sand, silt, and clay from the Cretaceous to Tertiary periods (Fort Belvoir 2014).

The topography of FBNA is gently rolling, except for steep slopes bordering Accotink Creek. Accotink Creek enters FBNA from the north at an elevation of approximately 120 feet above mean sea level and descends to an elevation of approximately 100 feet above mean sea level before exiting FBNA to the south. Steep slopes rise from both the eastern and western banks of Accotink Creek and its unnamed tributaries located to the west within the proposed project area. The grades on the slopes range between 20 and 30 percent at most locations (Fort Belvoir 2014).

Elevation of the site ranges from 300 to 200 feet above mean sea level and slopes slightly from northwest to southeast. Soils within western FBNA include Beltsville silt loam (7B), the Sassafras-Marumsco Complex (91D) and Nathalie gravelly loam (79C).

III. Methodology

Prior to field investigations, topographic maps, soil surveys and digital aerial photographs were reviewed to identify probable forest stand boundaries. A full Forest Stand Delineation was conducted on 17 and 23-25 August 2021. A 1/10-acre fixed plot sampling technique was used to assess forest stand conditions and forest structure. Forest stands were distinguished primarily by differences in species composition and successional stage. Sample plots were chosen so as to be evenly distributed throughout the stand. A stick flag was placed in the center of each plot and along the perimeter of the circular plot in each of the four cardinal directions. The plot center was marked in the field with red flagging and the stand and plot number labeled with a black marker. All additional forest stand and forest structure procedures for data collection follow guidelines of the Maryland State Forest Conservation Technical Manual (MDNR 1997). Although this method is not a regulatory requirement in Virginia, it provides an efficient and comprehensive approach for cataloging and prioritizing forest resources. Forest stands are ranked as Priority 1, 2, or 3 according to the guidelines in the Technical Manual. Priority 1 stands have wetlands, specimen trees of 30" diameter at breast height (dbh) or greater, intermittent or perennial streams, steep slopes, and/or other sensitive areas. Priority 2 may contain some elements listed for Priority 1 and/or have a designation of priority in a local land use plan, local forest conservation program, or other criteria adopted by a local forest conservation program. Priority 3 areas have evidence of increasing levels of human disturbance compared to Priority 1 and 2 areas. In some cases a stand can have a sensitive area within its boundaries, but be a low quality stand based upon quality of vegetation, presence of invasive species or other values. This is noted in the stand descriptions where applicable.

Stand priority rankings help inform decisions on what areas should receive more consideration for on-site preservation and influence how an overall development site is designed.

IV. Results

Eight forest stands were identified within the study area (Appendix A). Dominant cover types include tulip poplar/red maple and oak/hickory. Stand variations result from changes in topographic position, degree of slope, and amount and type of historical human disturbance. Forest stand conditions and forest structure were assessed at sample plots within the stand as detailed in the following stand descriptions (see also Appendix B). The Forest Stand Mapping in Appendix A depicts the approximate location of the sampling plots and boundary of forest cover type within the study area. A brief description of each forest stand follows, and representative photographs can be found in Appendix C:

Stand 1

Sample Plots:	**4**
Successional Stage:	**Mature**
Priority:	**1**
Cover Type:	**Tulip Poplar**

Stand 1 is dominated by tulip poplar (*Liriodendron tulipifera*) of size class 20-29.9" diameter at breast height (dbh), with approximately 80% canopy closure. The plots within this stand contain a specimen-sized (>30" dbh) tulip poplar and scarlet oak (*Quercus coccinea*). Trees in the sub-canopy included red maple (*Acer rubrum*), American beech (*Fagus grandiflora*), black gum (*Nyssa sylvatica*), Northern red oak (*Quercus rubrum*), mockernut hickory (*Carya tomentosa*), sassafras (*Sassafras albidum*), American holly (*Ilex opaca*) and sweetgum (*Liquidambar styraciflua*). The understory from 3' to 20' tall averages 80% coverage, and includes mountain laurel (*Kalmia latifolia*), black gum, American holly, American beech, sweetgum and muscadine grape vine (*Vitus rotundifolia*). Common herbaceous and woody species 0' to 3' tall consist of mountain laurel, partridgeberry (*Mitchella repens*), common greenbrier (*Smilax rotundifolia*), glaucous-leaved greenbrier (*Smilax glauca*), Virginia creeper (*Parthenocissus quinquefolia*), highbush blueberry (*Vaccinium corymbosum*), hay-scented fern (*Dennstaedtia punctilobula*), stout wood reed (*Cinna arundinacea*), Jack-in-the-pulpit (*Arisaema triphyllum*), false nettle (*Boehmeria cylindrica*), and poison ivy (*Toxicodendron radicans*) with approximately 100% coverage. Invasive species observed in the stand were multiflora rose (*Rosa multiflora*), Asiatic bittersweet (*Celastrus orbiculatus*), Japanese stilt grass (*Microstegium vimineum*) and Japanese honeysuckle (*Lonicera japonica*) with approximately 80% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of soft mast and seeds, with water sources available in adjacent areas. The stand is rated Priority 1 as there are wetlands within its boundary and it contains specimen trees. It is contiguous with other forest stands found within the western half of FBNA but separated from off-site forests by the Fairfax County Parkway and residential/commercial development.

Environmental Features

Stand 1 contains wetlands and specimen trees, with only one plot (out of 4) containing a high occurrence of invasive species. Adjacent land uses include neighborhoods, roads (including Fairfax County Parkway and Barta Road), and contiguous forest.

<u>Stand 2</u>

Sample Plots:	**1**
Successional Stage:	**Mature**
Priority:	**1**
Cover Type:	**Tulip Poplar**

Stand 2 is dominated by tulip poplar (*Liriodendron tulipifera*) of size class >30" dbh, with approximately 80% canopy closure. Plot 1 contains two specimen-sized (>30" dbh) tulip poplar. Trees in the sub-canopy included red maple (*Acer rubrum*) and American beech (*Fagus grandiflora*). The understory from 3' to 20' tall averages 20% coverage, and includes sweetgum (*Liquidambar styraciflua*) and pawpaw (*Asimina triloba*). Common herbaceous and woody species 0' to 3' tall consist of common greenbrier (*Smilax rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), highbush blueberry (*Vaccinium corymbosum*), huckleberry (*Vaccinium membranaceum*), wild yam (*Dioscorea villosa*), Jack-in-the-pulpit (*Arisaema triphyllum*), false nettle (*Boehmeria cylindrica*), cinnamon fern (*Osmundastrum cinnamomeum*) and fan clubmoss (*Diphasiastrum digitatum*) with approximately 100% coverage. Invasive species observed in the stand were Asiatic bittersweet (*Celastrus orbiculatus*), Japanese stilt grass (*Microstegium vimineum*) and Japanese honeysuckle (*Lonicera japonica*) with approximately 5% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in adjacent areas. The stand is rated Priority 1 as it contains specimen trees, a perennial stream and a low occurrence of invasive species. It is contiguous with forest stands found within the western half of FBNA and very similar to Stands 1 and 3.

Environmental Features

Stand 2 contains specimen trees, a perennial stream and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 3

Sample Plots: **1**
Successional Stage: **Mature**
Priority: **2**
Cover Type: **Tulip Poplar**

Stand 3 is co-dominated by tulip poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*) and scarlet oak (*Quercus coccinea*) of size class 20-29.9" dbh, with approximately 100% canopy closure. Trees in the sub-canopy included red maple (*Acer rubrum*), American beech, and black gum (*Nyssa sylvatica*). The understory from 3' to 20' tall averages 100% coverage and includes black gum and muscle wood (*Carpinus caroliniana*). Common herbaceous and woody species 0' to 3' tall consist of common greenbrier (*Smilax rotundifolia*), huckleberry (*Vaccinium membranaceum*), rattlesnake plantain (*Goodyera oblongifolia*), Indian cucumber root (*Medeola virginiana*), Solomon's seal (*Polygonatum* spp.), tick trefoil (*Desmodium* spp.), and fan clubmoss (*Diphasiastrum digitatum*) with approximately 100% coverage. No invasive species were observed in the stand. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in adjacent areas. The stand is rated Priority 2 as it contains a low occurrence of invasive species (none were observed). It is contiguous with forest stands found within the western half of FBNA and very similar to Stands 1 and 2.

Environmental Features
Stand 3 contains a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 4

Sample Plots: **4**
Successional Stage: **Mature**
Priority: **1**
Cover Type: **Tulip Poplar**

Stand 4 is co-dominated by tulip poplar, white oak, black oak and red maple of size class 12-19.9" dbh, with approximately 100% canopy closure. Trees in the sub-canopy included American beech, black gum, northern red oak, southern red oak (*Quercus falcata*), American holly, sassafras and mockernut hickory. The understory from 3' to 20' tall averages 80% coverage and includes beech, black gum and holly. Common herbaceous and woody species 0' to 3' tall consist of common greenbrier, huckleberry highbush blueberry, partridgeberry, black gum, red maple, mockernut hickory, white oak, holly, mountain laurel, beech, trefoil, Indian cucumber-root (*Medeola virginiana*), saw-toothed viburnum (*Viburnum betulifolium),* Christmas fern (*Polystichum acrostichoides*) and hog peanut (*Amphicarpaea bracteata*) with approximately 40% coverage. Invasive species observed in the stand were Asiatic bittersweet and wisteria (*Wisteria sinensis*) with approximately 5-10% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in adjacent areas. The stand is rated

Priority 1 as it contains perennial streams, a small seep wetland, areas with steep slopes, and a low occurrence of invasive species. It is contiguous with forest stands found within the western half of FBNA.

Environmental Features
Stand 4 contains perennial streams, a small seep wetland, areas with steep slopes, and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 5

Sample Plots: 5
Successional Stage: Mature
Priority: 1
Cover Type: Oak Hickory

Stand 5 is dominated by scarlet oak of size class 20-29.9" dbh, and co-dominated by tulip poplar, northern red oak, white oak, black oak (*Quercus velutina*), Virginia pine (*Pinus virginiana*), Loblolly pine (*Pinus taeda*) and red maple of size class 12-19.9" dbh, with approximately 100% canopy closure. Trees in the sub-canopy included American beech, Eastern red cedar (*Juniperus virginiana*), and mockernut hickory. The understory from 3' to 20' tall averages 80% coverage and includes beech, mountain laurel, black gum, red maple, mockernut hickory and holly. Common herbaceous and woody species 0' to 3' tall consist of glaucous-leaved greenbrier, common greenbrier, huckleberry, highbush blueberry, partridgeberry, black gum, red maple, sassafras, white oak, holly, mountain laurel, beech, trefoil, Indian cucumber-root, saw-toothed viburnum, Virginia creeper (*Parthenocissus quinquefolia*), partridgeberry and pawpaw with approximately 40% coverage. Invasive species observed in the stand were Japanese stilt grass with less than 1% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in adjacent areas. The stand is rated Priority 1 as it contains a stream and a low occurrence of invasive species. It is contiguous with forest stands found within the western half of FBNA, but differs in species composition from Stand 4, likely a result of geomorphic position on an adjacent ridgeline.

Environmental Features
Stand 5 contains a stream and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 6

Sample Plots: 7
Successional Stage: Mature
Priority: 1
Cover Type: Oak Hickory

Stand 6 is co-dominated by tulip poplar, white oak, scarlet oak, red maple and Virginia pine of size class 20-29.9” dbh, with approximately 80% canopy closure. Trees in the sub-canopy included American beech, black gum, northern red oak, southern red oak, black oak, chestnut oak and mockernut hickory. The understory from 3’ to 20’ tall averages 60% coverage and includes beech, mountain laurel, black gum, tulip poplar, holly, sassafras and red maple. Common herbaceous and woody species 0’ to 3’ tall consist of highbush blueberry, huckleberry, common pogonia, sassafras, mountain laurel, willow oak, white oak, deer tongue (*Dichanthelium clandestinum)*, muscle wood partridgeberry, glaucous-leaved greenbrier, and Virginia creeper with approximately 60% coverage. Invasive species observed in the stand were Japanese stilt grass with approximately 1-2% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in the form of two streams that join together within the stand, ultimately connecting into Accotink Creek. The stand is rated Priority 1 as it contains streams and a low occurrence of invasive species. It is contiguous with forest stands found within the western half of FBNA.

Environmental Features
Stand 6 contains streams and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 7

Sample Plots: **3**
Successional Stage: **Mature**
Priority: **1**
Cover Type: **Oak Hickory**

Stand 7 is dominated by one Virginia pine in size class 20-29.9” dbh, and co-dominated by Virginia pine, tulip poplar, and scarlet oak of size class 12-19.9” dbh, with approximately 70% canopy closure. Trees in the sub-canopy include black oak, northern red oak, scarlet oak, black gum, red maple and mockernut hickory. The understory from 3’ to 20’ tall averages 80% coverage and includes beech, mountain laurel, sassafras, and black gum. Common herbaceous and woody species 0’ to 3’ tall consist of highbush blueberry, huckleberry, common pogonia, sassafras, mountain laurel, willow oak (*Quercus phellos*), white oak, deer tongue, black gum, red maple, holly, muscle wood, hay-scented fern, common greenbrier, glaucous-leaved greenbrier, saw-tooth viburnum, (*Viburnum dentatum*) Virginia pine and Indian cucumber-root creeper with approximately 50% coverage. Invasive species observed in the stand were Japanese stilt grass with approximately 2% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in the form of an unnamed tributary stream that connects into Accotink Creek off-site. The stand is rated Priority 1 as it contains streams/wetlands and a low occurrence of invasive species. The slopes adjacent to the riparian zone of the unnamed tributary to Accotink Creek were identified as suitable habitat for the federally-endangered small-whorled pogonia (SWP) (*Isotria medeoloides*) during a July 21, 2021 site visit by a biologist certified for SWP surveys. While this designation is not synonymous with critical habitat, it should be considered in the ranking process and subsequent decisions for on-site preservation. The stand is contiguous with forest stands found within the western half of FBNA.

Environmental Features
Stand 7 contains a stream and riparian wetlands, suitable habitat for SWP and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

Stand 8

Sample Plots: **3**
Successional Stage: **Mature**
Priority: **1**
Cover Type: **Oak Hickory**

Stand 8 is dominated by tulip poplar in size classes >30" dbh and 20-29.9" dbh with approximately 70% canopy closure. Trees in the sub-canopy include American beech, black gum, northern red oak, southern red oak, mockernut hickory, Virginia pine, scarlet oak, willow oak and red maple. The understory from 3' to 20' tall averages 100% coverage and includes beech, mountain laurel, black gum, and red maple. Common herbaceous and woody species 0' to 3' tall consist of highbush blueberry, huckleberry, common greenbrier, cinnamon fern, Loblolly pine, Virginia pine, hay-scented fern, Christmas fern, Virginia creeper, sensitive fern, fan clubmoss, white oak, sweet gum, muscle wood partridgeberry, glaucous-leaved greenbrier, and Virginia creeper with approximately 70% coverage. Invasive species observed in the stand were Japanese stilt grass and Japanese honeysuckle with approximately 30% coverage. The wildlife value of the stand is moderate due to the presence of cover and forage, mostly in the form of hard mast and seeds, with water sources available in adjacent areas. The stand is rated Priority 1 as it contains specimen trees, a stream and wetlands, and a somewhat low occurrence of invasive species. The slopes adjacent to the unnamed stream support suitable habitat for the SWP, contiguous with the habitat found in Stand 7. The stand is contiguous with forest stands found within the western half of FBNA.

Environmental Features
Stand 8 contains specimen trees, a stream and wetlands, suitable SWP habitat and a low occurrence of invasive species. Adjacent land uses include neighborhoods, roads, and contiguous forest.

V. CONCLUSIONS

Eight forest stands were delineated and assessed on the site. The two dominant cover types included tulip poplar/red maple and oak-hickory. Areas of high previous disturbance associated with former ranges were dominated by a thick shrub-level coverage of Virginia pine (and not included in any stands). Unused bunker sites off Cissna Road are also characterized by a virtual monoculture of young Virginia pine. Remaining forested areas support mature trees and most contain wetlands, perennial streams and steep slopes. Invasive species coverage is high in some areas of the ground cover layers but overall remains relatively low.

Stands 1, 2 and 4-8 rated Priority 1 and Stand 3 was rated Priority 2 (summarized in table below). Priority 1 stands should be given particular consideration for on-site preservation where practicable. Stands 1 and 2 provide an additional service as a visual buffer between the proposed project site and the adjacent residential neighborhood to the north. Stand 4 provides a continuous forested habitat that connects directly into the Accotink Creek floodplain off-site. Stand 6 has streams running through it and also provides a good visual buffer between the project site and adjacent developed areas. Stands 7 and 8 support a stream, wetlands and suitable habitat for SWP, important when considering steps to eliminate or minimize potential adverse effects of the project in accordance with the Endangered Species Act (ESA).

Stand	Low Invasive Coverage	Specimen Trees	Wetlands/ Stream	Successional Stage	Ranking
1	Y	Y	Y	Mature	1
2	Y	Y	Y	Mature	1
3	Y	N	N	Mature	2
4	Y	N	Y	Mature	1
5	Y	N	Y	Mature	1
6	Y	N	Y	Mature	1
7	Y	N	Y	Mature	1
8	Y	Y	Y	Mature	1

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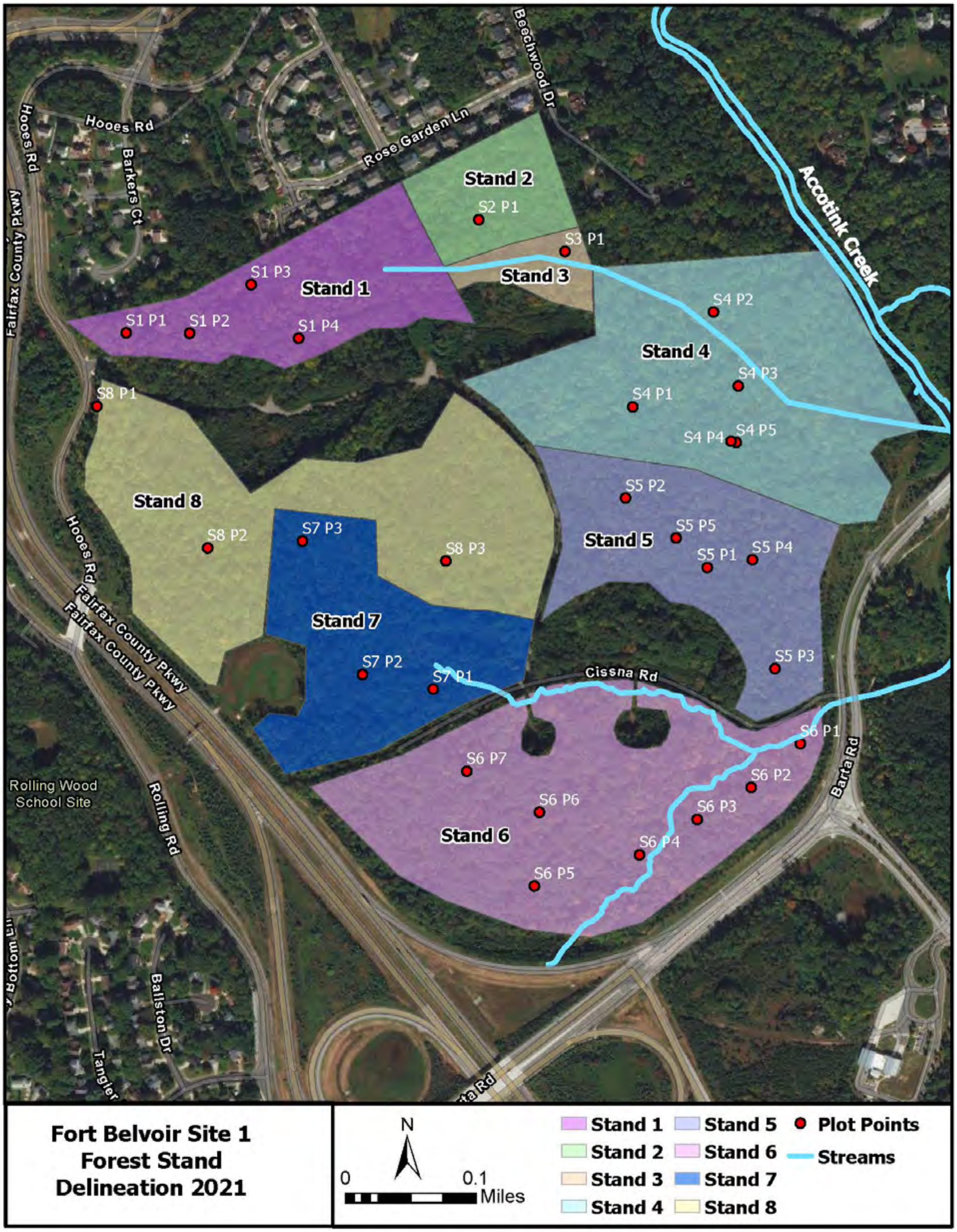
APPENDIX A

Forest Stand Mapping



Fort Belvoir Site 1 Forest Stand Delineation 2021

APPENDIX B

Field Sampling Data Sheets

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 1** **Plot #: 1**
Forest Cover Type: Tulip poplar	**Date:** 17 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 90	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			1			1		2		6							10
2 Red maple						1											1
3 American beech			2														2
4 Mockernut hickory			1			1											2
5 Black gum			3														3
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			7			3			2			6					18
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
American holly and beech

Canopy Closure:					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 5%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
mountain laurel, partridgeberry, bittersweet, highbush blueberry, Virginia creeper, blackberry, Christmas fern, hay-scented fern, common greenbrier, poison ivy (cont)

Understory Cover 3'-20':					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):
Asiatic bittersweet, Japanese honeysuckle, Japanese stilt grass

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	light
Downed woody debris:	light

Herbaceous & Woody Cover 0'-3':					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Downed Woody Debris:					
C	N	E	S	W	%
N	N	Y	Y	Y	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover, wetlands present in adjcent stands

Stand corridor/patch? Patch

FUNCTION: Where is stand in relation to sensitive areas on site? adjacent to forested wetlands

Comments**:**

Understory (continued): maple leaf viburnum, black gum, Virginia pine and sassafras

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) — **Prepared By: LJ/CLR**

Owner: U.S. Army, Fort Belvoir, Virginia — **Stand #: 1** — **Plot #: 2**

Forest Cover Type: Tulip poplar — **Date:** 17 August 2021

Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			2			1		1					1				5
2 Red maple						2											2
3 American beech			1														1
4 Mockernut hickory			1														1
5 Black gum			4														4
6 Sassafras			1														1
7 Black oak								1									1
8 American holly			1														1
9																	0
Total Number of Trees per Size Class			10			3			2			0			1		16
Number & Size of Standing Dead Trees		1															1

List of Woody Plant Species 3'-20':
mountian laurel and black gum

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 5-10%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
partridgeberry, Virginia creeper, highbush blueberry, Rhus spp., common greenbrier, NY fern, holly, glaucous-leaved greenbrier, black oak, beech, (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):
Japanese honeysuckle, Japanese stilt grass

Rare, etc. Species?	No
Specimen Trees?	Yes
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	light
Downed woody debris:	light

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	N	Y	Y	Y	80

Downed Woody Debris:

C	N	E	S	W	%
N	N	N	N	N	0

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover, wetlands present in adjcent stands

Stand corridor/patch? Patch

FUNCTION: Where is stand in relation to sensitive areas on site? adjacent to forested wetlands

Comments**:**

Tulip poplar specimen measured at 40" dbh

Understory (continued): maple leaf viburnum, poison ivy, white wood aster

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**

Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 1** | **Plot #: 3**

Forest Cover Type: Tulip poplar | **Date:** 17 August 2021

Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar								2		1							3
2 Red maple			1			1					1						3
3 Sweet gum			1														1
4 Mockernut hickory			2						1								3
5 Northern red oak						1											1
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			4			2			3			2					11
Number & Size of Standing Dead Trees								3			3						6

List of Woody Plant Species 3'-20':
beech, sweet gum, holly, ironwood, muscadine grape

Canopy Closure:

C	N	E	S	W	%
N	Y	Y	N	Y	60

Percent of Invasive Cover per Plot (all layers): 90%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
false nettle, stout wood reed, Jack-in-the-pulpit, common greenbrier, sensitive fern, Virginia creeper, Virginia chain fern, hog peanut, wild yam, cinnamon fern

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):
Japanese honeysuckle, Japanese stilt grass, Asisatic bittersweet, multiflora rose

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	N
Downed woody debris:	light

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Downed Woody Debris:

C	N	E	S	W	%
N	N	Y	Y	N	40

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover, wetlands present in adjcent stands

Stand corridor/patch? Patch

FUNCTION: Where is stand in relation to sensitive areas on site? forested wetland

Comments**:**

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**	
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 1**	**Plot #: 4**
Forest Cover Type: Tulip poplar	**Date:** 17 August 2021	
Plot Size: 1/10 Acre (37.5' radius)		

Basal Area in Square Feet per Acre: 160	**SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT**																
TREE SPECIES	**Number of Trees 2-5.9" dbh**			**Number of Trees 6-11.9" dbh**			**Number of Trees 12-19.9" dbh**			**Number of Trees 20-29.9" dbh**			**Number of Trees >30" dbh**			**Average Tree Height (ft)**	
Crown Position	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**		**Total**
1 Tulip poplar			2			2		8		1							13
2 Red maple			1			5											6
3 Scarlet oak													1				1
4 Black gum			1														1
5 Southern red oak						1											1
6 Sassafras			1														1
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			5			8			8			1			1		23
Number & Size of Standing Dead Trees		1															1

List of Woody Plant Species 3'-20':	**Canopy Closure:**						**Percent of Invasive Cover per Plot (all layers):**	**Plot Successional Stage:**
	C	**N**	**E**	**S**	**W**	**%**		
	Y	Y	Y	Y	Y	100	<5%	Mature

List of Understory Species 0'-3':	**Understory Cover 3'-20':**						**List of Major Invasive Species per Plot (All Layers):**
partridgeberry, sassafras, common greenbrier, highbush blueberry, red maple, holly, NY fern, sweet gum, mountain laurel, hog peanut, pawpaw	**C**	**N**	**E**	**S**	**W**	**%**	Japanese stilt grass
	N	N	Y	Y	Y	60	

Rare, etc. Species?	No	**Herbaceous & Woody Cover 0'-3':**						**HABITAT: What species present?**
Specimen Trees?	Yes	**C**	**N**	**E**	**S**	**W**	**%**	white-tailed deer, raccoon
Historic Sites?	No	Y	N	Y	Y	Y	80	**Habitat size, location, configuration:**
Disease?	No							stand surrounded by contiguous forest
Insects/Infestation?	No	**Downed Woody Debris:**						
Exotic Plants?	Yes	**C**	**N**	**E**	**S**	**W**	**%**	**Wildlife cover/food/water?**
Leaf litter?	moderate	N	N	N	N	Y	20	food and cover, wetlands present in adjcent stands
Downed woody debris:	light							**Stand corridor/patch?** continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site? forested wetland

Comments**:**

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 2** **Plot #: 1**
Forest Cover Type: Tulip poplar	**Date:** 17 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 100	**SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT**															
TREE SPECIES	**Number of Trees 2-5.9" dbh**			**Number of Trees 6-11.9" dbh**			**Number of Trees 12-19.9" dbh**			**Number of Trees 20-29.9" dbh**			**Number of Trees >30" dbh**			**Average Tree Height (ft)**	
Crown Position	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**		**Total**
1 Tulip poplar											1		2				3
2 Red maple						6			2		1						9
3 American beech						2											2
4																	0
5																	0
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class						8			2			2			2		14
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
sweet gum and pawpaw

Canopy Closure:

C	N	E	S	W	%
N	Y	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 5%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
cinnamon fern, huckleberry, fan clubmoss, pawpaw, common greenbrier, highbush blueberry, Jack-in-the-pulpit, Virginia creeper, white oak, wild yam, sweet gum,

Understory Cover 3'-20':

C	N	E	S	W	%
N	N	N	Y	N	20

List of Major Invasive Species per Plot (All Layers):
Japanese stilt grass, Japanese honeysuckle, Asiatic bittersweet

Rare, etc. Species?	No
Specimen Trees?	Yes
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	light

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	N	60

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	N	Y	Y	80

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover, wetlands present in adjcent stands

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site? forested wetland adjacent

Comments**:**

Dense understory (3-20' height) of sweet gum in portion of this stand. Although contiguous with Stand 1, the vegetative composition does noticeably shift from an oak assemblage to red maple/sweet gum.

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 3** **Plot #: 1**
Forest Cover Type: Tulip poplar	**Date:** 17 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 90

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			1			2			4		2						9
2 Red maple			2			1			1								4
3 American beech			1														1
4 White oak											1						1
5 Scarlet oak											1						1
6 Black gum			1														1
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			5			3			5			4			0		17
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
black gum and iron wood

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers):

Plot Successional Stage: Mature

List of Understory Species 0'-3':
huckleberry, rattlesnake plantain, common greenbrier, tick trifoil, false Solomon's seed, Indian cucumber, red maple, sweet gum, fan clubmoss

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	light

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Downed Woody Debris:

C	N	E	S	W	%
N	N	Y	Y	Y	60

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Similar to Stand 1 (may be considered a continuation of Stand 1, with Stand 2 an inclusion).

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 4** **Plot #: 1**
Forest Cover Type: Tulip poplar	**Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 80

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			3			1			6								10
2 Black gum			2			1											3
3 American beech			2			1											3
4 White oak			3														3
5																	0
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			10			3			6						0		19
Number & Size of Standing Dead Trees					1												1

List of Woody Plant Species 3'-20':
black gum

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
maple leaf viburnum, common greenbrier, beech, deer tongue, holly, blueberry, black gum, Virginia creeper, partridgeberry, sawtooth viburnum, hog peanut (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):
N/A

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	Y	80

Downed Woody Debris:

C	N	E	S	W	%
N	Y	N	N	N	20

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Undertstory (continued):
poison ivy, iron wood, Solomon's, white avens, Virginia pine, mockernut hickory, Christmas fern

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 4** | **Plot #: 2**
Forest Cover Type: Tulip poplar | **Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 50

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar						2			1		1						4
2 Red maple			5			1											6
3 American holly			1														1
4 White oak			1														1
5 Mockernut hickory			2														2
6 Northern red oak						1											1
7 Sassafras			1														1
8																	0
9																	0
Total Number of Trees per Size Class			10			4			1			1			0		16
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
beech

Canopy Closure: C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 10%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
sassafras, Christmas fern, common greenbrier, white oak, black gum, hay-scented fern, mountain laurel, glaucous-leaved greenbrier, hog peanut (cont.)

Understory Cover 3'-20': C	N	E	S	W	%
N	N	Y	Y	Y	60

List of Major Invasive Species per Plot (All Layers):
bittersweet and wisteria

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3': C	N	E	S	W	%
Y	Y	Y	N	Y	60

Downed Woody Debris: C	N	E	S	W	%
N	Y	N	Y	Y	60

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Undertstory (continued):
holly, blueberry, wild yam, partridgeberry, iron wood, trifoil, bittersweet, pawpaw, creeping strawberry

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**		
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 4**	**Plot #: 3**	
Forest Cover Type: Tulip poplar	**Date:** 23 August 2021		
Plot Size: 1/10 Acre (37.5' radius)			

Basal Area in Square Feet per Acre: 80	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			1			2		3									6
2 Red maple			4					2									6
3 Beech						1											1
4 White oak						1		1									2
5 Black gum			1														1
6 Southern red oak			1														1
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			7			4			6			0			0		17
Number & Size of Standing Dead Trees		2						1									3

List of Woody Plant Species 3'-20':	**Canopy Closure:**						**Percent of Invasive Cover per Plot (all layers): 5%**	**Plot Successional Stage:**
beech, holly	C	N	E	S	W	%		
	Y	Y	Y	Y	Y	100		Mid
List of Understory Species 0'-3':	**Understory Cover 3'-20':**						**List of Major Invasive Species per Plot (All Layers):**	
Blueberry, black gum, hog peanut, white oak, sassafras, bittersweet, northern red oak, Christmas fern, red maple, mockernut hickory, trifoil, Indian cucumber (cont.)	C	N	E	S	W	%		
	Y	Y	Y	Y	Y	100	bittersweet	
Rare, etc. Species? No	**Herbaceous & Woody Cover 0'-3':**						**HABITAT: What species present?**	
Specimen Trees? No	C	N	E	S	W	%	white-tailed deer, raccoon	
Historic Sites? No	Y	N	Y	N	Y	60	**Habitat size, location, configuration:**	
Disease? No							stand surrounded by contiguous forest	
Insects/Infestation? No	**Downed Woody Debris:**							
Exotic Plants? Yes	C	N	E	S	W	%	**Wildlife cover/food/water?**	
Leaf litter? moderate	Y	N	N	N	N	20	food and cover	
Downed woody debris: moderate							**Stand corridor/patch?** continuous forest	

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**
Some prior disturbance from road. More red maple than other plots in Stand 4, but still predominantly tulip stand.
Undertstory (continued):
mountain laurel, holly

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) — **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia — **Stand #: 4** — **Plot #: 4**
Forest Cover Type: Tulip poplar — **Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar						2			4								6
2 White oak						1			2								3
3 Beech			2														2
4 Black oak									1								1
5 Northern red oak						1											1
6 Red maple			3														3
7 American holly			1														1
8 Black gum			1														1
9																	0
Total Number of Trees per Size Class			7			4			7			0			0		18
Number & Size of Standing Dead Trees								1									1

List of Woody Plant Species 3'-20':
beech

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	N	80

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Blueberry, partridgeberry, common greenbrier, black gum, red maple, mockernut hickory, white oak, holly, beech, mountain laurel

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	light
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	N	Y	N	Y	60

Downed Woody Debris:

C	N	E	S	W	%
N	N	Y	Y	N	40

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

More mature, more species diversity, less understory

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**	
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 5**	**Plot #: 1**
Forest Cover Type: Oak/Hickory	**Date:** 23 August 2021	
Plot Size: 1/10 Acre (37.5' radius)		

Basal Area in Square Feet per Acre: 120	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 White oak						1		1									2
2 Scarlet oak								2		1							3
3 Red maple			1			3											4
4 Black gum			2														2
5 Northern red oak								2									2
6 Tulip poplar								1									1
7 Virginia pine								1									1
8 Black oak								1									1
9																	0
Total Number of Trees per Size Class			3			4			6			1					16
Number & Size of Standing Dead Trees					3												3

List of Woody Plant Species 3'-20':
beech and mountain laurel

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Blueberry, red maple, common greenbrier, glaucous-leaved greenbrier, holly, huckleberry, white oak, Virginia pine

Understory Cover 3'-20':

C	N	E	S	W	%
N	Y	Y	Y	Y	80

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
N	Y	Y	N	N	40

Downed Woody Debris:

C	N	E	S	W	%
Y	N	N	Y	Y	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Higher elevation

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 5** | **Plot #: 2**
Forest Cover Type: Oak/Hickory | **Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 90

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 White oak			1			3			1								5
2 Scarlet oak						2											2
3 Red maple			4			4											8
4 Loblolly pine									1								1
5 Tulip poplar			1						2								3
6 Mockernut hickory			3			2											5
7 Northern red oak			1			1											2
8 Virginia pine									2								2
9 American beech						1											1
Total Number of Trees per Size Class			10			13			6			0			0		29
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
mountain laurel

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Maple leaf viburnum, northern red oak, black gum, partridgeberry, sawtooth viburnum, huckleberry, pawpaw, common greenbrier

Understory Cover 3'-20':

C	N	E	S	W	%
Y	N	Y	Y	Y	80

List of Major Invasive Species per Plot (All Layers): N/A

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	N	Y	N	Y	60

Downed Woody Debris:

C	N	E	S	W	%
Y	N	N	Y	N	40

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Very little groundcover, abundance of small (<2' dbh understory trees).

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 5** | **Plot #: 3**
Forest Cover Type: Oak/Hickory | **Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 White oak			1			1											2
2 Scarlet oak								2									2
3 Red maple			5			2											7
4 Northern red oak								1									1
5 Tulip poplar						1											1
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			6			4			3			0			0		13
Number & Size of Standing Dead Trees								2									2

List of Woody Plant Species 3'-20':
holly

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 1%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Common greenbrier, black oak, white oak, maple leaf viburnum, red maple, sawtooth viburnum, Virginia pine, blueberry, sassafras, black gum, mountain laurel (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	N	N	60

List of Major Invasive Species per Plot (All Layers):
Japanese stilt grass

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	low
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	N	N	N	N	20

Downed Woody Debris:

C	N	E	S	W	%
Y	N	N	Y	N	40

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

East of bunkers, north of Barta Road, south of Cissna Road and stream, on higher ground.

Understory (continued):
Virginia creeper

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 5** | **Plot #: 4**
Forest Cover Type: Oak/Hickory | **Date:** 23 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 90	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT															
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 White oak			2			1											3
2 Scarlet oak									1								1
3 Red maple			4			1			1								6
4 Northern red oak									1								1
5 Tulip poplar									2								2
6 American beech			1														1
7 Virginia pine						1											1
8 Black gum			2														2
9																	0
Total Number of Trees per Size Class			9			3			5			0			0		17
Number & Size of Standing Dead Trees	1			1						1							3

List of Woody Plant Species 3'-20': holly, mockernut hickory, black gum, red maple

Canopy Closure:					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3': Highbush blueberry, holly, red maple, white oak, black gum, partridgeberry, mountain laurel, northern red oak, Indian cucumber, glaucous-leaved greenbrier

Understory Cover 3'-20':					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	high
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':					
C	N	E	S	W	%
Y	N	N	Y	Y	60

Downed Woody Debris:					
C	N	E	S	W	%
Y	Y	N	Y	N	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Plot located on the slope of a small creek; large amount of tree fall.

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**

Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 5** | **Plot #: 5**

Forest Cover Type: Oak/Hickory | **Date:** 23 August 2021

Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 90

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			3			1											4
2 Virginia pine								1									1
3 Southern red oak						1											1
4 Eastern red cedar			1														1
5 Mockernut hickory						1											1
6 Scarlet oak						1											1
7 Black gum			1														1
8 White oak						1		2									3
9 Black oak								1									1
Total Number of Trees per Size Class			5			5			4			0			0		14
Number & Size of Standing Dead Trees		3															3

List of Woody Plant Species 3'-20':
mockernut hickory

Canopy Closure:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, holly, red maple, white oak, black gum, glaucous-leaved greenbrier, huckleberry

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	high
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	N	N	Y	Y	60

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	N	Y	N	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Less ground cover, with more small trees.

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 6** | **Plot #: 1**
Forest Cover Type: Oak/Hickory | **Date:** 24 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 70	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			6			2											8
2 Tulip poplar								1									1
3 White oak			3			1		1									5
4 Chestnut oak								1									1
5 Mockernut hickory						1											1
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			9			4			3			0			0		16
Number & Size of Standing Dead Trees	1																1

List of Woody Plant Species 3'-20':
mountain laurel, red maple, beech

Canopy Closure:

C	N	E	S	W	%
Y	N	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 1%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, white oak, red maple, Virginia pine, black gum, holly, mockernut hickory, chestnut oak, partridgeberry, mountain laurel, huckleberry, ironwood

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	N	Y	Y	80

List of Major Invasive Species per Plot (All Layers):
Japanese stilt grass

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
N	Y	Y	Y	Y	80

Downed Woody Debris:

C	N	E	S	W	%
N	Y	N	N	N	20

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Specimen white oak within stand but outside of plot. Not many large trees but a thick, well-developed layer of mountain laurel. Located on slope between Barta Road and stream.

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 6** | **Plot #: 2**
Forest Cover Type: Oak/Hickory | **Date:** 24 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 80	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			7			2											9
2 Tulip poplar						2			2								4
3 White oak			1								1						2
4 Scarlet oak						2					2						4
5 Northern red oak						1											1
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			9			7			2			3			0		20
Number & Size of Standing Dead Trees																	0

List of Woody Plant Species 3'-20':
mountain laurel, red maple

Canopy Closure:

C	N	E	S	W	%
N	Y	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, red maple, sassafras, huckleberry, wintergreen, moutain laurel, iron wood, tulip poplar, Virginia pine, common greenbrier

Understory Cover 3'-20':

C	N	E	S	W	%
Y	N	N	Y	Y	60

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
N	Y	Y	N	Y	60

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**	
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 6**	**Plot #: 3**
Forest Cover Type: Oak/Hickory	**Date:** 24 August 2021	
Plot Size: 1/10 Acre (37.5' radius)		

Basal Area in Square Feet per Acre: 80	**SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT**																
TREE SPECIES	**Number of Trees 2-5.9" dbh**			**Number of Trees 6-11.9" dbh**			**Number of Trees 12-19.9" dbh**			**Number of Trees 20-29.9" dbh**			**Number of Trees >30" dbh**			**Average Tree Height (ft)**	
Crown Position	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**	**Dom**	**CoD**	**Other**		**Total**
1 Northern red oak						1											1
2 Tulip poplar			3						1		1						5
3 White oak											1		1				2
4 Black gum									1								1
5																	0
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			3			1			2			2			1		9
Number & Size of Standing Dead Trees					1												1

List of Woody Plant Species 3'-20':
mountain laurel, black gum, tulip poplar

Canopy Closure:					
C	**N**	**E**	**S**	**W**	**%**
Y	Y	Y	Y	Y	100

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage:
Mature

List of Understory Species 0'-3':
Highbush blueberry, red maple, sassafras, huckleberry, moutain laurel, iron wood, common greenbrier, black gum, Virginia creeper, common pogonia

Understory Cover 3'-20':					
C	**N**	**E**	**S**	**W**	**%**
N	N	Y	Y	N	40

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':					
C	**N**	**E**	**S**	**W**	**%**
Y	Y	Y	Y	N	80

Downed Woody Debris:					
C	**N**	**E**	**S**	**W**	**%**
N	N	N	Y	N	20

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 6** **Plot #: 4**
Forest Cover Type: Oak/Hickory	**Date:** 24 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 80

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			4			2											6
2 Scarlet oak								1									1
3 Black oak						1											1
4 Tulip poplar								2									2
5 American beech						1											1
6 Northern red oak								2									2
7 White oak								1					1				2
8 Black gum			1														1
9																	0
Total Number of Trees per Size Class			5			4			6			0			1		16
Number & Size of Standing Dead Trees		1									1						2

List of Woody Plant Species 3'-20':
mountain laurel, holly, beech

Canopy Closure:

C	N	E	S	W	%
N	Y	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, red maple, huckleberry, iron wood, common greenbrier, glaucous-leaved greenbrier, black gum, Virginia creeper, common pogonia (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
N	N	N	Y	Y	40

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	Yes
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	80
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	N	Y	Y	80

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	Y	Y	N	80

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Understory (Continued):
white oak, sassafras, holly, Virginia pine, partridgeberry, pawpaw

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) — **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia — **Stand #: 6** — **Plot #: 5**
Forest Cover Type: Oak/Hickory — **Date:** 24 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 70

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			4			3					1						8
2 White oak			4			3											7
3 Northern red oak						4											4
4 Virginia pine			1			2											3
5 Black gum			1														1
6 Tulip poplar								2									2
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			10			12			2			1			0		25
Number & Size of Standing Dead Trees		1															1

List of Woody Plant Species 3'-20':
black gum, red maple

Canopy Closure:

C	N	E	S	W	%
N	Y	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Red maple, northern red oak, willow oak, black gum, common greenbrier, hay-scented fern, sweet gum

Understory Cover 3'-20':

C	N	E	S	W	%
N	N	N	Y	Y	40

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	N	Y	Y	80

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	Y	Y	N	80

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Less sloped than areas further east (downstream); little understory but similar canopy composition to other plots.

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 6** | **Plot #: 6**
Forest Cover Type: Oak/Hickory | **Date:** 24 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 70

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Red maple			2			2											4
2 White oak			1			3											4
3 Northern red oak						1											1
4 Virginia pine									3		1						4
5 Black gum			5			1											6
6 American Beech			2														2
7 Scarlet oak						1			1								2
8																	0
9																	0
Total Number of Trees per Size Class			10			12			2			1			0		23
Number & Size of Standing Dead Trees		1															1

List of Woody Plant Species 3'-20':
mountain laurel, beech, holly

Canopy Closure:

C	N	E	S	W	%
N	Y	N	N	Y	40

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, huckleberry, common greenbrier, sassafras, partridgeberry, mountain laurel, beech, white oak, strawberry, black gum, willow oak (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	moderate
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	Y	80

Downed Woody Debris:

C	N	E	S	W	%
N	N	Y	Y	Y	60

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Understory (continued):
Virginia pine, sweet gum

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) — **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia — **Stand #: 7** — **Plot #: 1**
Forest Cover Type: Oak/Hickory — **Date:** 25 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 120	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT															
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			2			6			4								12
2 Virginia pine									1								1
3 White oak			1			3			3								7
4 Red maple			1						1								2
5 Black gum			1			1											2
6 Northern red oak									1								1
7 Mockernut hickory			1														1
8																	0
9																	0
Total Number of Trees per Size Class			6			10			10			0			0		26
Number & Size of Standing Dead Trees								1									1

List of Woody Plant Species 3'-20':
mountain laurel, beech, sassafras

Canopy Closure:

C	N	E	S	W	%
Y	N	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 2%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, huckleberry, common pogonia, sassafras, mountain laurel, willow oak, white oak, deer tongue, black gum, red maple, holly, iron wood (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
N	Y	Y	N	Y	60

List of Major Invasive Species per Plot (All Layers):
Japanese stilt grass

Rare, etc. Species? No
Specimen Trees? No
Historic Sites? No
Disease? No
Insects/Infestation? No
Exotic Plants? Yes
Leaf litter? moderate
Downed woody debris: moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	Y	N	80

Downed Woody Debris:

C	N	E	S	W	%
Y	N	N	Y	Y	60

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Lots of common pogonia and Indian cucumber root on the slope to stream.

Understory (continued):
Virginia pine, hay-scented fern, Indian cucumber root

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 7** | **Plot #: 2**
Forest Cover Type: Oak/Hickory | **Date:** 25 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Scarlet oak									1								1
2 Red maple			1			3			1								5
3 Virginia pine									3								3
4 Tulip poplar						2			1								3
5 Black gum			1														1
6 Black oak													1				1
7 White oak						1											1
8																	0
9																	0
Total Number of Trees per Size Class			2			6			6			0			1		15
Number & Size of Standing Dead Trees											1						1

List of Woody Plant Species 3'-20':
mountain laurel, beech, black gum

Canopy Closure:

C	N	E	S	W	%
Y	N	Y	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, huckleberry, common greenbrier, glaucous-leaved greenbrier, sassafras, partridgeberry, black gum, Indian cucumber, common pogonia (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
N	Y	Y	Y	Y	80

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	Yes
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	Y	80

Downed Woody Debris:

C	N	E	S	W	%
Y	Y	N	N	Y	60

HABITAT: What species present?
white-tailed deer, raccoon

Habitat size, location, configuration:
stand surrounded by contiguous forest

Wildlife cover/food/water?
food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Specimen black oak is a double trunk with one side dead.
Lots of blueberry in the understory.

Understory (continued): sawtooth viburnum

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 7** | **Plot #: 3**
Forest Cover Type: Oak/Hickory | **Date:** 25 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 60

SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT

TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Scarlet oak						1											1
2 Black gum			4														4
3 Virginia pine			1			2			2	1							6
4 Tulip poplar			1														1
5 Northern red oak						1											1
6 Black oak			1														1
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			7			4			2			1			0		14
Number & Size of Standing Dead Trees					1												1

List of Woody Plant Species 3'-20':
mountain laurel, beech, black gum

Canopy Closure:

C	N	E	S	W	%
N	Y	N	Y	Y	60

Percent of Invasive Cover per Plot (all layers): 0%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, huckleberry, common greenbrier, partridgeberry, black gum, white oak, black gum, holly, iron wood

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	moderate
Downed woody debris:	high

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	N	60

Downed Woody Debris:

C	N	E	S	W	%
Y	N	Y	N	Y	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Northern edge of stand before vegetation composotion change. Large amount of downed pines.

Understory (continued): sawtooth viburnum

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 8** | **Plot #: 1**
Forest Cover Type: (Tulip Poplar/Red Maple | **Date:** 25 August 2021
Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 130	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			1						7		1		2				11
2 American beech			1						1								2
3 Red maple			1			1			1								3
4 Black gum			2														2
5 Willow oak						1											1
6																	0
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			5			2			9			1			2		19
Number & Size of Standing Dead Trees		1						1									2

List of Woody Plant Species 3'-20':

Canopy Closure:

C	N	E	S	W	%
N	Y	N	Y	Y	60

Percent of Invasive Cover per Plot (all layers): 30%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, partidgeberry, common greenbrier, holly, fan clubmoss, pawpaw, white oak, Virginia pine, Loblolly pine, Virginia creeper, sensitive fern, black gum

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):
Japanese stilt grass; Japanese honeysuckle

Rare, etc. Species?	No
Specimen Trees?	Yes
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	Yes
Leaf litter?	low
Downed woody debris:	low

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	N	60

Downed Woody Debris:

C	N	E	S	W	%
Y	N	Y	N	Y	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Northern edge of stand before vegetation composotion change. Large amount of downed pines.

Understory (continued): sawtooth viburnum

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA) | **Prepared By: LJ/CLR**

Owner: U.S. Army, Fort Belvoir, Virginia | **Stand #: 8** | **Plot #: 2**

Forest Cover Type: (Tulip Poplar/Red Maple | **Date:** 25 August 2021

Plot Size: 1/10 Acre (37.5' radius)

Basal Area in Square Feet per Acre: 100	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Tulip poplar			1			4				3							8
2 Black gum			2			2											4
3 Red maple						1											1
4 American beech			1			2		1									4
5 Virginia pine						1		1									2
6 Mockernut hickory						1											1
7																	0
8																	0
9																	0
Total Number of Trees per Size Class			4			11			2			3			0		20
Number & Size of Standing Dead Trees								2									2

List of Woody Plant Species 3'-20':

Canopy Closure:

C	N	E	S	W	%
Y	Y	N	Y	N	60

Percent of Invasive Cover per Plot (all layers): 30%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, partidgeberry, common greenbrier, holly, fan clubmoss, white oak, hay-scented fern, black gum, Christmas fern, cinnamon fern, Rhus spp. (cont.)

Understory Cover 3'-20':

C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	low
Downed woody debris:	high

Herbaceous & Woody Cover 0'-3':

C	N	E	S	W	%
Y	Y	Y	N	Y	80

Downed Woody Debris:

C	N	E	S	W	%
Y	N	Y	Y	Y	80

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

Specimen tulip poplar within stand, outside of plot.

Understory (continued): Virginia chain fern

FOREST STAND DELINEATION
Field Sampling Data Sheet

Property: Fort Belvoir North Area (FBNA)	**Prepared By: LJ/CLR**
Owner: U.S. Army, Fort Belvoir, Virginia	**Stand #: 8** **Plot #: 3**
Forest Cover Type: Tulip Poplar/Red Maple	**Date:** 25 August 2021
Plot Size: 1/10 Acre (37.5' radius)	

Basal Area in Square Feet per Acre: 80	SIZE CLASS OF TREES >20' HEIGHT WITHIN SAMPLE PLOT																
TREE SPECIES	Number of Trees 2-5.9" dbh			Number of Trees 6-11.9" dbh			Number of Trees 12-19.9" dbh			Number of Trees 20-29.9" dbh			Number of Trees >30" dbh			Average Tree Height (ft)	
Crown Position	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other	Dom	CoD	Other		Total
1 Northern red oak									2								2
2 White oak						3			1								4
3 Tulip poplar									1		2						3
4 Scarlet oak									1								1
5 Black gum			3														3
6 Virginia pine									1								1
7 Southern red oak									1								1
8																	0
9																	0
Total Number of Trees per Size Class			3			3			7			2			0		15
Number & Size of Standing Dead Trees		2															2

List of Woody Plant Species 3'-20':
mountain laurel, black gum, red maple, beech

Canopy Closure:					
C	N	E	S	W	%
Y	Y	N	Y	Y	80

Percent of Invasive Cover per Plot (all layers): 30%

Plot Successional Stage: Mature

List of Understory Species 0'-3':
Highbush blueberry, holly, white oak, sweet gum, red maple, beech, iron wood, common greenbrier

Understory Cover 3'-20':					
C	N	E	S	W	%
Y	Y	Y	Y	Y	100

List of Major Invasive Species per Plot (All Layers):

Rare, etc. Species?	No
Specimen Trees?	No
Historic Sites?	No
Disease?	No
Insects/Infestation?	No
Exotic Plants?	No
Leaf litter?	moderate
Downed woody debris:	moderate

Herbaceous & Woody Cover 0'-3':					
C	N	E	S	W	%
Y	Y	N	N	N	40

Downed Woody Debris:					
C	N	E	S	W	%
N	Y	Y	N	Y	60

HABITAT: What species present? white-tailed deer, raccoon

Habitat size, location, configuration: stand surrounded by contiguous forest

Wildlife cover/food/water? food and cover

Stand corridor/patch? continuous forest

FUNCTION: Where is stand in relation to sensitive areas on site?

Comments**:**

This plot transitioning into more oak-dominated area.

APPENDIX C

Site Photographs

Stand 1, Plot 1

Stand 1, looking south with Virginia pine thicket (outside stand) in background.

Appendix C - Photos

Wetland within Stand 1

Stand 4

Appendix C - Photos

Stand 4

Stand 4, looking north toward Virginia pine thicket

Appendix C - Photos

Stand 5

Stand 5

Stand 6 – robust understory of mountain laurel in Plots 1 and 2

Appendix C - Photos

Stand 6

Stand 6, Plot 5 (western portion of stand with more open understory)

Appendix C - Photos

Stand 6

Stand 6

Stand 7

Appendix C - Photos

Stream within Stand 7

Stand 7, Plot 2 – large amount of downed woody debris

Stand 8 – Japanese stilt grass in understory


Stand 8

Stand 8 – Eastern edge

Appendix C - Photos

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APPENDIX E – SMALL WHORLED POGONIA STUDY

Small Whorled Pogonia Survey
for the
FBNA Distribution Center, Fort Belvoir, Virginia
21 June 2022

Coastal Resources, Inc. (CRI) conducted a survey for the federally threatened and state endangered small whorled pogonia (*Isotria medeoloides*) on the approximately 160-acre proposed development project at the Fort Belvoir North Area in Fairfax County, Virginia. The small whorled pogonia is a small terrestrial orchid that grows up to 25 cm, with a whitish-green, glaucous stem that bears a single whorl of 3-8 leaves. Due to the presence of the small whorled pogonia at Ft. Belvoir, the U.S. Fish and Wildlife Service (USFWS) requested that a survey be conducted within the Fort Belvoir North Area to addresses the Federal Endangered Species Act requirements for the proposed project.

The survey was conducted on June 21, 2022, by Sean Sipple, who is on the USFWS Virginia Field Office list of qualified surveyors for the small whorled pogonia. Other assistant surveyors included Megan Niehaus and Megan Bolcar with CRI, and John Pilcicki, Dan Cockerhan, and Christina Olson with the USACE. The survey was conducted in habitats identified as “Marginal” and “Suitable” during a preliminary small whorled pogonia survey conducted by CRI in 2021. During the 2022 survey, the team surveyed along parallel transects within “Marginal” and “Suitable” habitats. Transects were spaced between 15 and 25 feet apart, depending on suitability, to maximize detection. Any species observed that had a physical similarity to the small whorled pogonia such as Indian cucumber root (*Medeola virginiana*) or common whorled pogonia (*I. verticillata*) were carefully inspected, positively identified, and noted. The results of the survey documented numerous colonies of common whorled pogonia in the southern portion of the study area. However, no individuals of small whorled pogonia were identified during the survey. These results are consistent with the findings of the preliminary survey conducted by CRI in 2021.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, BALTIMORE DISTRICT
2 HOPKINS PLAZA
BALTIMORE, MARYLAND 21201-2930

CENAB-PL-I 4 August 2021

MEMORANDUM FOR: Robert Kobayashi, Senior Project Manager, Real Estate Field Office, U.S. Army Corps of Engineers, Baltimore District, (443) 615-0313, Robert.t.kobayashi@usace.army.mil

SUBJECT: Results of Field Survey for Small Whorled Pogonia on the Fort Belvoir North Area (FBNA), Fort Belvoir, Virginia

1. In support of National Environmental Policy Act (NEPA) documentation for a proposed building on FBNA, biologists from the USACE Planning Division, Fort Belvoir's Department of Public Works (DPW) Environmental Division, and Sean Sipple, a certified surveyor with Coastal Resources, Inc., conducted an overview survey of the approximately xx-acre portion of Fort Belvoir North Area west of Accotink Creek on July 20-21, 2021. The purpose of the field visit was to obtain as much updated information as possible on the current extent of potential suitable habitat, as well as locate the possible presence of small whorled pogonia (SWP) (*Isotria medeoloides*) itself.

2. A vital component of NEPA is compliance with Section 7 of the Endangered Species Act (ESA). The U.S. Fish and Wildlife Service (USFWS) is the agency responsible for administering the ESA for terrestrial species such as the SWP, a small orchid listed as threatened. The USFWS web-based Information for Planning and Consultation (IPaC) allows project proponents to screen for the potential presence of listed species. Through the IPaC and Fort Belvoir's Integrated Natural Resources Management Plan (INRMP), the western portion of FBNA has been identified as potential habitat for the SWP.

3. Consistent with standard practice in Virginia, the accepted survey window for SWP is between June 1 and July 20 of any given year. Given the time constraints of the proposed action, PL-ISB coordinated with the USFWS' Virginia Field Office regarding the acceptability of a limited survey to be conducted 20-21 July, as this was the soonest a certified surveyor could reasonably be mobilized to conduct fieldwork. It was agreed that the subsequent survey would not be represented to USFWS as an official, formal survey pursuant to the Virginia surveyor standards. Rather, the intent was to obtain as much information as possible to facilitate subsequent consultation as the project design and NEPA proceed, without the unacceptable delay of waiting for the 2022 survey window.

4. Prior to commencing the survey, the team of biologists conducted a site reconnaissance to identify areas that would be more suitable based on the habitat requirements of the SWP, thereby ruling out those areas that would be unsuitable and better focusing the investigation. Based on the reconnaissance, the team targeted slopes along existing stream corridors within the estimated project perimeter, as these areas support relatively mature forests dominated by mixed hardwood species. The team included 3 biologists the first day and 4 biologists the second day and

surveyed parallel transects along the stream corridors, spaced approximately 25 feet apart. Areas identified as suitable (see Enclosure 1) were surveyed closer to maximize detection. Any species observed that had a physical similarity to the small whorled pogonia (e.g., Indian cucumber root, *Medeola virginiana*, or common whorled pogonia, *Isotria verticillata*) were carefully inspected, positively identified, and noted. See Enclosure 2 for the CRI memorandum summarizing the field survey, including a list of vegetative species observed. See Enclosure 3 for photographs.

5. Based on habitat requirements from existing literature, habitat suitability was categorized as follows:

- **Unsuitable Habitat** - areas with little or no potential to support SWP due to the lack of forest, early succession stage, very dense understory and herbaceous cover, or presence of wetlands.
- **Marginal Habitat** – areas with some potential to support SWP. These areas were still mature forests but did not contain all of the other habitat requirements for suitable habitat.
- **Suitable Habitat** – areas with a high potential to support SWP, including mature forests on northerly or easterly facing slopes with flat to moderate topography; the presence of species associated with SWP; acidic, sandy soils with low nutrients; an open understory and herbaceous layer; and canopy openings such as a small stream, road, or dead/fallen trees that allow sunlight to reach the forest floor.

These areas are represented spatially in relation to the FBNA study area on Enclosure 1. In addition, another cover type was identified as Unsuitable with Marginal Inclusions. Due to the time constraints, extensive mapping to distinguish unsuitable from marginal within these areas was not feasible.

6. Although some suitable and marginal habitat was identified in the stream corridors, no small whorled pogonias were identified during the survey. Numerous colonies of common whorled pogonia were documented within the suitable small whorled pogonia habitat along the unnamed tributary that flows southeast across the southern portion of the study area.

7. Outside of the stream corridors, the study area consisted of regenerating or young forest dominated by Virginia pine (*Pinus virginiana*) and sweet gum (*Liquidambar styraciflua*) and young mixed hardwood forest with a relatively dense understory consisting of ericaceous shrubs. Most of these areas were considered unsuitable and were not surveyed or surveyed with less effort.

8. This memo does not complete the Section 7 consultation requirements of ESA. Rather, it is intended to provide information for the NEPA and for subsequent USFWS consultation.

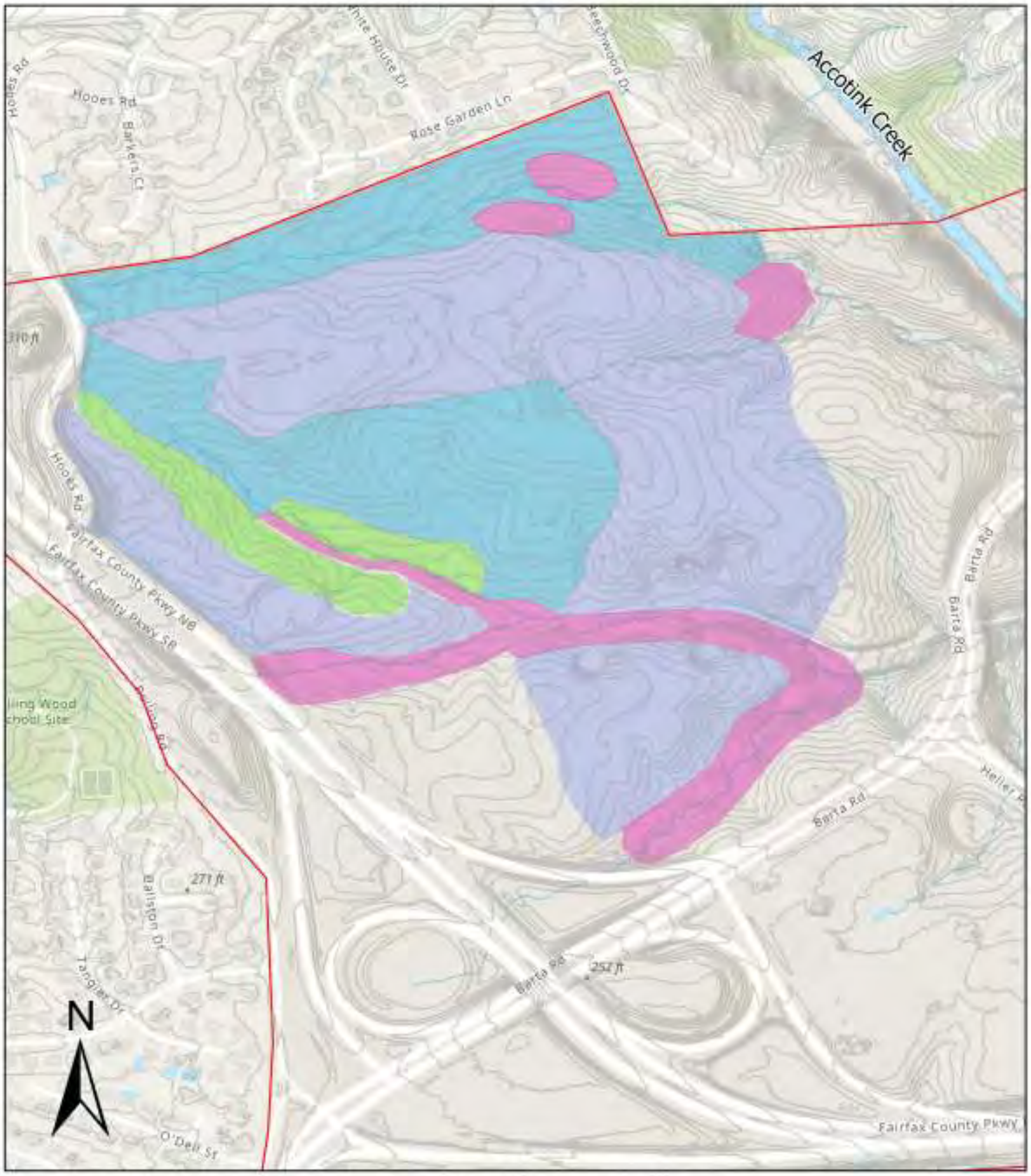
9. Please provide any questions or comments to Ms. Connie Ramsey at 410-962-7783.

MICHAEL J. SCHUSTER
Chief, Installation Support Branch
Planning Division

Encls:
1. Map of Survey Area
2. Memo from CRI dated July 22, 2021
3. Photographs

Enclosure 1:

Map of Survey Area



Contour_Belvoir_5ft
Installation
Marginal
Unsuitable with Marginal Inclusions
Suitable
Unsuitable

Habitat Characterization
for Small Whorled Pogonia
Fort Belvoir North Area

0 1,400 Feet

Enclosure 2:

Memo from CRI dated July 22, 2021

Enclosure 3:

Photographs

Common Whorled Pogonia Indian Cucumber Root

An example of suitable habitat near an unnamed stream within the study area.


An example of marginal habitat.


An example of marginal habitat.


An example of unsuitable habitat.


An example of unsuitable habitat along the installation perimeter.

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APPENDIX F – NORTHERN LONG-EARED BAT STUDY

2022 Bat Survey of Northern Fort Belvoir, Virginia

Prepared for:

John Pilcicki
Fort Belvoir

Prepared by:

Eric Britzke, Ph.D.
Research Wildlife Biologist
US Army Engineer Research and Development Center
Building 3270, Room 1218
3909 Halls Ferry Road
Vicksburg, MS 39180

June 16, 2022

Introduction

Bat conservation and management has become a major concern on state, federal, and private lands throughout the United States. Bats represent an important component of many ecosystems and contribute significantly to an area's biodiversity. Bats have a higher proportion that are considered rare, sensitive, threatened or endangered within some regulatory or assessment framework than for any other group of mammals in North America. Reasons for these listings range from loss of roosting and/or foraging habitat, pesticides, persecution, and disturbance of hibernacula (Racey and Entwistle 2003).

Recently, wind energy development (Johnson et al. 2003, Fiedler 2004, Arnett et al. 2008) and White-nose Syndrome (WNS) have emerged as additional threats (USGS 2008). WNS is an emerging disease that is responsible for the death of over 6 million hibernating bats. These declines has resulted in the listing of the once common northern long-eared bat (*Myotis septentrionalis*) as federally endangered in 2015. Mortality rates observed at wind energy production facilities have been variable, but at 1 facility in West Virginia, > 40 bats per turbine per year have been killed, including the Lasurine or "tree" species not believed to be impacted by WNS (Arnett et al. 2008). As bat populations continue to experience stress from these sources, understanding of bat distributions becomes more important.

Bats in the eastern United States use echolocation to orient to their surroundings and to locate prey. Ultrasonic detectors are now widely available and allows researchers to detect echolocation calls to assist in studies of bat ecology. Research has shown the presence of species-specific echolocation calls exists for many species (Krusic and Neefus 1996, Britzke et al. 2011). Ultrasonic detectors have many advantages over mist netting, including detection of more species at a site than mist nets (Murray et al. 1999, O'Farrell and Gannon 1999), sampling multiple sites without a researcher present, and sampling habitats that lack a constricted flyway necessary for traditional capture techniques. Use of ultrasonic detectors has the potential to increase detectability of some species, thereby improving the efficiency of bat surveys. This has prompted the US Fish and Wildlife Service to incorporate acoustic surveys into the survey guidance for federally listed bats species in the eastern United States.

Installations within the Department of Defense (DoD) are required to balance needs of the Mission as well as stewardship of natural resources. Recently, military installations have undertaken actions to inventory and manage bats on their lands. In order to assess potential regulatory impacts, installation managers must have an understanding of what bat species are present on proposed project areas.

Methods

Fort Belvoir covers approximately 8,650 acres in Fairfax County, VA. The proposed project area was sampled for presence of the northern long-eared bat using the USFWS 2021 Bat Survey guidance. Bat activity was recorded using Anabat Swift bat detector systems (Titley Scientific; www.titley-scientific.com). Prior to initial deployment, units were calibrated using an ultrasonic pest repeller following Larson and Hayes (2000). Sampling was only conducted on nights when temperatures were high enough to maintain bat activity, there was no precipitation, and wind speed was minimal.

Detectors were placed at 17 sites in the proposed project areas on Fort Belvoir in an attempt to conduct a complete bat survey of the property. Detectors were deployed on a tripod (Fig 1) and were set to record from sunset to sunrise. Some detectors were also housed in weatherproof boxes.

Figure 1. Example of Anabat Swift bat detector setup for recording at Fort Belvoir, Virginia during May 2022

Data analysis

Upon completion of 2-3 nights with suitable weather conditions (depending on the number of units deployed in each habitat block), equipment was picked up and the SD card was removed. Downloaded files were organized by site and analyzed using the Kaleidoscope v5.4.6 automated analysis program. The program filters files, extracts parameters, and classifies files based on statistical comparison to a known call library. The species set was picked to include all bat species that are possible on Fort Belvoir (Appendix A). An output file is created that summarizes the bat activity at the site as well as determines species presence using a maximum likelihood estimator (Britzke et al. 2002).

Results

A total of 17 sites were sampled for a total of 35 detector nights across the project area (Figure 2). Recording resulted in sampling of 4,692 files (mean = 130; range 3-458 files/night). A total of 2 bat species were determined to be present through manual vetting of recorded echolocation calls. Red bats were detected at all 17 sites, while big brown bats were detected at 11 sites. Due to the similarity of calls between big brown bats and silver-haired bats, these species were combined and called big brown because they are more common residents of the area during the summer maternity period.

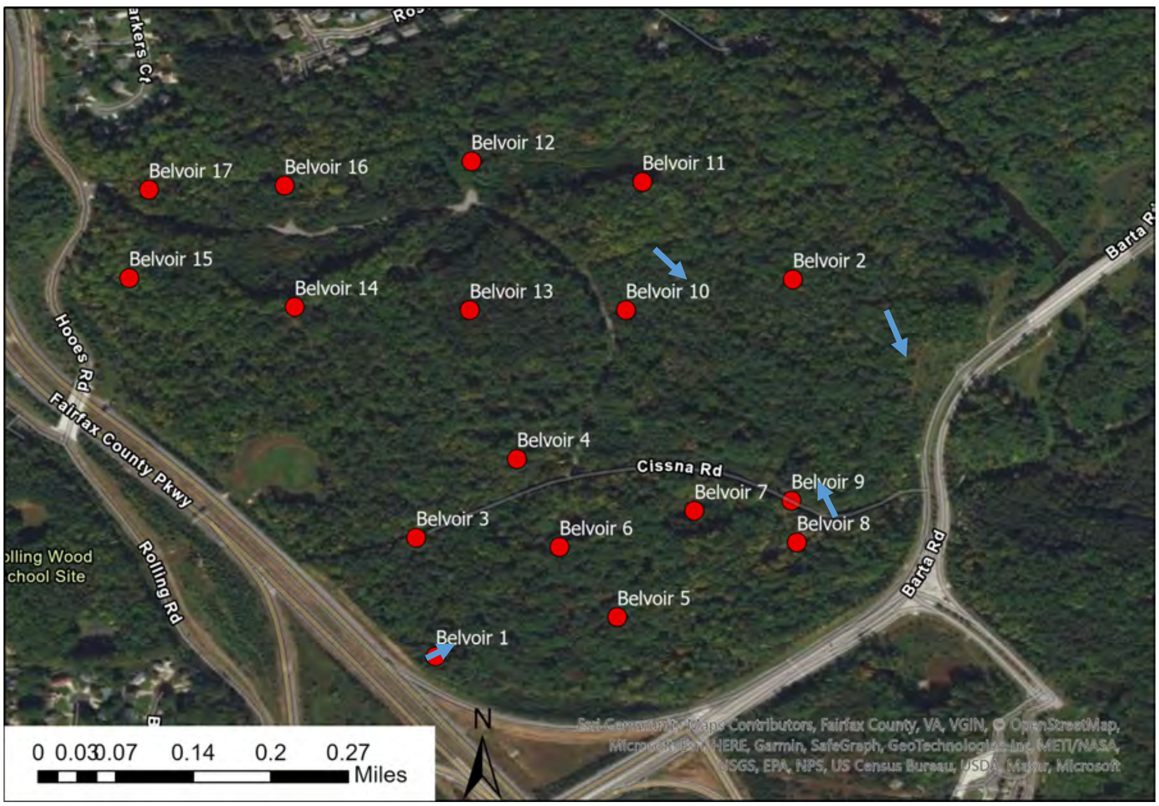

Figure 2. Location of the 17 sites sampled in May 2022 on Fort Belvoir.

Table 1. Results of the Anabat bat survey conducted at Fort Belvoir, Virginia in May 2022.

Location	Date	Total # of files	Bat species detected
Site1			
	5/24/2022	52	Eastern red
	5/25/2022	220	Big brown, Eastern red
Site2			
	5/24/2022	194	Eastern red
	5/25/2022	82	Big brown, Eastern red
Site3			
	5/24/2022	110	Big brown, Eastern red
	5/25/2022	108	Eastern red
Site4			
	5/24/2022	69	Eastern red
	5/25/2022	30	Eastern red
Site5			
	5/24/2022	11	Eastern red
	5/25/2022	118	Eastern red
Site6			
	5/24/2022	10	Big brown, Eastern red
	5/25/2022	107	Big brown, Eastern red
Site7			
	5/24/2022	Equip.	None
	5/25/2022	14	Eastern red
Site8			
	5/24/2022	84	Big brown, Eastern red
	5/25/2022	355	Big brown, Eastern red
Site9			
	5/24/2022	13	Eastern red
	5/25/2022	191	Big brown, Eastern red
Site10			
	5/24/2022	118	Eastern red
	5/25/2022	296	Eastern red
Site11			
	5/24/2022	3	None
	5/25/2022	38	Eastern red
	5/26/2022	270	Big brown, Eastern red
Site12			
	5/24/2022	31	Big brown, Eastern red
	5/25/2022	48	Big brown, Eastern red
	5/26/2022	49	Big brown, Eastern red
Site13			
	5/24/2022	8	Big brown, Eastern red
	5/25/2022	95	Big brown, Eastern red
	5/26/2022	458	Big brown, Eastern red

Site14			
	5/25/2022	59	Big brown, Eastern red
	5/26/2022	413	Eastern red
Site15			
	5/25/2022	150	Eastern red
	5/26/2022	276	Big brown, Eastern red
Site16			
	5/25/2022	128	Eastern red
	5/26/2022	89	Eastern red
Site17			
	5/25/2022	188	Eastern red
	5/26/2022	207	Eastern red

Discussion

Activity levels varied substantially throughout the sites sampled throughout the proposed project. Multiple sites included larger mature hardwood trees with numerous potential roost sites observed. However, likely due to the population declines from White Nose Syndrome, no listed bat species were detected in this survey. Detection of red bats and big browns bats was expected as these bat represent the vast majority of captures form mist nets and acoustic recording on Fort Belvoir in recent years (unpublished data).

Acknowledgements

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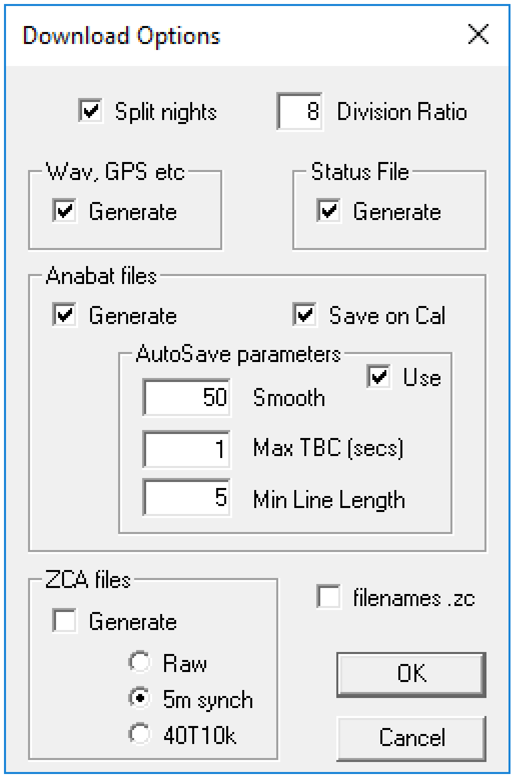
Appendix A. Settings used for Anabat Swift bat detectors at Fort Belvoir , May 2022.

Setting	**Value**
ZC Division Ratio	8
Maximum file length	15 seconds
Analog high pass filter	On
Sensitivity	15
Trigger frequency	10-250 kHz
Minimum event	1 second
Trigger window	1 second
Recording mode	Night

Appendix B – Settings used in downloading files from CFC Read program.



Appendix C. GPS location of the 17 sites sampled for bats at Fort Belvoir during the summer of 2022.

Site	**County**	**Lattitude**	**Longitude**	**Habitat**
Belvoir 1	Fairfax	38.74921	-77.21011	Canopy opening
Belvoir 2	Fairfax	38.75399	-77.20558	Canopy opening
Belvoir 3	Fairfax	38.75072	-77.21036	Road flyway
Belvoir 4	Fairfax	38.75172	-77.20908	Canopy opening
Belvoir 5	Fairfax	38.74971	-77.20781	Canopy opening
Belvoir 6	Fairfax	38.7506	-77.20854	Canopy opening
Belvoir 7	Fairfax	38.75106	-77.20683	Forest edge
Belvoir 8	Fairfax	38.75066	-77.20553	Canopy opening
Belvoir 9	Fairfax	38.75119	-77.2056	Road flyway
Belvoir 10	Fairfax	38.7536	-77.2077	Canopy opening
Belvoir 11	Fairfax	38.75523	-77.20749	Canopy opening
Belvoir 12	Fairfax	38.75549	-77.20966	Forest edge
Belvoir 13	Fairfax	38.7536	-77.20968	Canopy opening
Belvoir 14	Fairfax	38.75364	-77.2119	Canopy opening
Belvoir 15	Fairfax	38.75401	-77.214	Canopy opening
Belvoir 16	Fairfax	38.75518	-77.21203	Canopy opening
Belvoir 17	Fairfax	38.75513	-77.21375	Road flyway

Appendix D. Pictures of the habitat from each of the 4 sites sampled during this survey.

Site 1

Site 2

Site 3

Site 4

Site 5

Site 6

Site 7

Site 8

Site 9

Site 10


Site 11


Site 12


Site 13

Site 14

Site 15

Site 16

Site 17

Appendix E. Breakdown of the maximum likelihood results from the analysis of bat echolocation calls recorded in May 2022 at Fort Belvoir, Virginia.

KALEIDOSCOPE 5.4.6 Bats of North America 5.4.0 S/A: 0		EPTFUS	LASBOR	LASCIN	LASNOC	MYOLUC	MYOSEP	MYOSOD	NYCHUM	PERSUB
Site1										
	5/24/2022	6E-07	1	1	1	0.091014	1	1	1	1
	5/25/2022	0	0	1	1	0	0.99929	1	1	0.634743
Site10										
	5/24/2022	1	0.754845	1	1	5.5E-06	1	0.780393	0.144783	1
	5/25/2022	7E-07	0.235795	0.715696	1	0	1	1	1	0.914266
Site11										
	5/24/2022	0.127859	1	1	1	0.008283	1	1	1	1
	5/25/2022	1E-07	0.168335	1	1	0.400234	0.000333	0.560192	1	0.335571
	5/26/2022	0	1	1	1	1	0	1	1	1
Site12										
	5/24/2022	0	0.028334	1	1	1	1	1	0.973394	0.590364
	5/25/2022	0	4E-07	1	1	0.998613	1	1	1	0.994387
	5/26/2022	0	2.3E-06	1	1	1	1	1	1	1
Site13										
	5/24/2022	6E-07	1	1	1	1	1	1	1	1
	5/25/2022	0	0.040229	1	1	0.057243	1	0.000113	1	1
	5/26/2022	0	0.046332	1	1	1E-07	0.655685	0.146516	1	0.680691
Site14										

	5/25/2022	0	0.000775	1	1	0.07029	1	0.574625	0.654628	0.062454
	5/26/2022	0	0	1	1	0.132308	1	0.59335	1	1
Site15										
	5/25/2022	0	0	1	1	0.002262	1	1	1	1
	5/26/2022	0	0	1	1	6.24E-05	0.172263	1	1	1
Site16										
	5/25/2022	0	0.406446	1	1	0.000652	1	1	1	1
	5/26/2022	0	1	1	1	0.137273	1	1	0.30262	1
Site17										
	5/25/2022	0	5.01E-05	1	1	0.012257	0.793266	0	1	1
	5/26/2022	0	0	1	1	1E-07	0.725947	1	1	0.838486
Site2										
	5/24/2022	6E-07	0	1	1	1E-07	1	1	0.003864	1
	5/25/2022	0	0.179508	1	1	0.377803	1	1	1	0.053397
Site3										
	5/24/2022	0	1.41E-05	1	1	1	1	1	1.9E-06	1
	5/25/2022	0	0.000205	1	1	0.561362	1	1	0.885486	0.529955
Site4										
	5/24/2022	0	0.3387	1	1	0.081354	1	1	0.799292	1
	5/25/2022	1	1	0.047889	1	1	1	1	1	1
Site5										
	5/24/2022	1	1	1	1	1	1	1	1	1
	5/25/2022	0	0.142277	1	1	5.9E-06	0.084033	0.875778	1	0.535519
Site6										
	5/24/2022	0.593691	6.8E-06	1	0.097603	1	1	1	1	1
	5/25/2022	0	0.008217	0.818691	1	1	1	1	0.776166	1
Site7										
	5/25/2022	0.016348	1	1	1	1	1	1	1	1

Site8										
	5/24/2022	0	0	1	0.072406	1	1	1	0.994336	1
	5/25/2022	0	0	1	1	1	1	1	1	1
Site9										
	5/24/2022	1	0.092454	1	1	1	1	1	1	1
	5/25/2022	0	7E-07	1	1	0.077945	1	0.573154	1	0.066645

Appendix F. Weather Data for Bat Surveys in May 2022 at Fort Belvoir, Virginia.

Date	Start	End	Moon Illumination (%)	Moon Phase	Min Temperature (°F)	Max Temperature (°F)	Average Temperature (°F)	Average Humidity (%)	Precipitation (in.)	Wind Direction	Average Wind Speed (mph)
5/23	2021	0551	42	Waning crescent	63	75	68.13	58.46	1.5	N	10.83
5/24	2022	0550	32	Waning crescent	59	64	61.55	79.4	.29	NE	10.47
5/25	0549	2023	23	Waning crescent	58	71	64.57	62.07	.03	E	9.96
5/26	0549	2024	15	Waning crescent	61	72	66.91	74.96	0	SE	5.79

Appendix G – Resume for Dr. Eric Britzke

Education

Ph.D., Environmental Sciences with Concentration in Biology, Tennessee Technological University, 2003.
M.S., Biology, Missouri State University, 1998.
B.S., Biology, Missouri State University, 1994.

Work Experience

United States Army Engineer Research and Development Center, 11/08 – Present. Research Wildlife Biologist.
Independent Consultant, 6/05 – 11/08. Biologist.
East Arkansas Community College, 9/04 – 6/05. Environmental Science Specialist.
Clemson University, 9/03 – 8/04. Post Doctoral Fellow.
Tennessee Technological University, 1/01 – 5/01. Instructor.
Tennessee Technological University, 5/99 – 5/03. Graduate Research Assistant.
United States Forest Service, 10/98 – 11/98; 5/99- 8/99. Biological Aid.
Missouri State University, 8/95 – 5/98. Graduate Teaching Assistant
Missouri State University, 2/95–10/95; 1/97 – 12/97; 2/98–10/98.
Graduate Research Assistant.

Organizations, Panels, Committees, and Awards

Conservation Research Award, National Military Fish and Wildlife Association, 2014
Achievement Medal for Civilian Service, 2013
DoD representative, WNS National Plan Steering committee
WNS Coordination Team, WNS National Plan
Chair, WNS Disease Surveillance Working Group
National Military Fish and Wildlife Association, 2009- Present
Central Regional Director, 2011-2013
Chair, Bat Working Group, 2012-2014
Southeastern Bat Diversity Network, 1999 – Present.
Member of the Board of Directors 2003-2007
American Society of Mammalogists, 1995 - 2012
Wildlife Society, 2004 – 2012
Student Presentation Award Sigma XI, 1995, 1st place.
Golden Key National Honor Society
Wings Across the Americas Bat Conservation Award, 2008
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APPENDIX G – AIR QUALITY RECORD OF NON-APPLICABILITY

GENERAL CONFORMITY – RECORD OF NON-APPLICABILITY

Project/Action Name:	**Distribution Center and Administrative Building, Fort Belvoir North Area, Fairfax County, Virginia**
Project/Action Point of Contact:	**Carolyn Hein (484) 612-1060 Contractor, HDR**

Construction Begin Date (Anticipated): October 2022
Construction End Date (Anticipated): June 2024

The Proposed Action involves the construction of a distribution center within the Fort Belvoir North Area (FBNA). The proposed 525,000 square foot distribution center would consist of a high bay warehouse; a two-story administrative building; an entry control facility, including gate house and vehicle inspection; and enhanced security measures along the fence line including a new fence, an approximately 30-foot clear zone around the fence, and a maintenance and patrol path. The warehouse and administrative building would also include associated parking and covered storage for approximately 600 personnel. Estimated annual air emissions that would be produced from the Proposed Action are included in **Table 1**.

Table 1. Estimated Annual Air Emissions from Construction and Operation of a Distribution Center and Administrative Building[1]

Year	VOC	NO_x	CO[2]	SO_x[2]	PM_{10}[2]	$PM_{2.5}$[2]	CO_2e[2]
2022 Construction of Distribution Center and Administrative Building	0.439	2.772	2.385	0.007	65.188	0.113	691.8
2023 Construction of Distribution Center and Administrative Building	0.900	6.138	5.390	0.017	65.231	0.226	1,735.2
2024 Construction of Distribution Center and Administrative Building Heating for Buildings Operation of Emergency Generators	6.875	3.265	2.890	0.016	0.191	0.189	2,507.3
2025 and later Heating for Buildings Operation of Emergency Generators	0.198	3.616	2.944	0.024	0.270	0.270	4,153.3

Notes:
[1] All values are in tons per year (tpy).
[2] The Record of Non-Applicability does not apply to emissions of CO, SO_X, PM_{10}, $PM_{2.5}$, and CO_2e.
Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; CO2e = carbon dioxide equivalent.

The Fort Belvoir North Area is in Fairfax County, Virginia, which is within the National Capital Interstate Air Quality Control Region (District of Columbia, Maryland, and Virginia) (40 CFR §81.12). The county is designated by the U.S. Environmental Protection Agency as marginal nonattainment for the 2015 8-hour ozone standard and as maintenance for the 2008 8-hour ozone standard. Ozone forms when nitrogen oxides (NO_X) and volatile organic compounds (VOCs) react in the presence of sunlight. Fairfax County is designated unclassifiable/attainment for all other criteria pollutant standards including carbon monoxide (CO), sulfur dioxide (SO_2), suspended particulate matter (measured less than or equal to 10 microns in diameter [PM_{10}] and measured less than or equal to 2.5 microns in diameter [$PM_{2.5}$]), and lead. As such, the General Conformity Rule is potentially applicable to emissions of VOCs and NO_X and is not applicable to all other criteria pollutants. The General Conformity Rule applicability thresholds for VOCs and NO_X are 50 tons per year (tpy) and 100 tpy, respectively.

General Conformity under the Clean Air Act, Section 176 has been evaluated for the Proposed Action according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this action because the highest annual emissions from this action have been estimated to be under the applicability thresholds.

Supporting documentation and emissions estimates are attached.

____________________________________ _________________________

Wilamena Harback Date
Chief, Environmental Division

RECORD OF NON-APPLICABILITY (RONA)
SUPPORTING DOCUMENTATION
For Distribution Center and Administrative Building
Fort Belvoir North Area, Fairfax County, Virginia

The purpose of this documentation is to support General Conformity applicability determinations under the Clean Air Act, Section 176 for a new distribution center at the Fort Belvoir North Area (FBNA), Fairfax County, Virginia. This document provides an estimate of worst-case emissions from the proposed construction and operation of the new distribution center and administrative building. The emission estimates for which this documentation was developed were based on the following assumptions:

<u>Project Characteristics and Construction Assumptions</u>

- Construction and operation of a 525,000 square foot warehouse and administrative building with associated parking and covered storage at FBNA for approximately 600 personnel. Construction would include the high bay warehouse, two-story administrative building, truck maintenance/refueling building, covered/enclosed storage buildings, entry control facility, and enhanced security measures along the fenceline. The total square footage of all building was estimated to be 565,500 square feet. The height of the high bay warehouse and two-story administrative building was assumed to be 50 feet, which was conservatively estimated to be the height of all buildings.

- The proposed site for the new distribution center contains 160 acres. The total area of added impervious surfaces (buildings and pavements) was estimated to be 23.57 acres. For the purposes of this analysis, it was conservatively estimated that site grading would occur on approximately 50 acres (2,178,000 square feet).

- Site grading would include clearing of all vegetation, topsoil, and unsuitable material in order to prepare the site for construction. It was estimated that 11,400 cubic yards of material would be hauled off site. Remaining topsoil and other material would be reused in place and would not be hauled off site.

- Construction would include the high bay warehouse, two-story administrative building, truck maintenance/refueling building, covered/enclosed storage buildings, entry control facility, and enhanced security measures along the fenceline. The total square footage of all buildings was estimated to be 565,500 square feet. The height of the high bay warehouse and two-story administrative building was assumed to be 50 feet, which was conservatively estimated to be the height of all buildings.

- Trenching for underground utility duct banks was estimated to be 3,800 linear feet. Duct bank depth was estimated to be 3 feet.

- Architectural coatings would be applied to all buildings, for a total of approximately 565,500 square feet.

- Paving for the covered and uncovered storage areas, parking areas, and roads would occur on an area totaling approximately 135,000 square feet.

- The approximately 600 personnel that would be assigned to the distribution center would relocate from other areas of Fort Belvoir and would not be new to Fairfax County.

- Construction activities would occur throughout the project to varying degrees from October 2022 through June 2024. A project duration of 21 months was used.

<u>Contractor and Equipment Assumptions</u>

- Construction workers would be on-site for all weekdays during the 21-month construction period to complete this work. Approximately 50 percent would commute to the site each day in a light duty gasoline vehicle and 50 percent would commute in a light duty gasoline truck, with an average round trip commute of 20 miles.

- Durations of operation for heavy equipment would vary depending on the project phase. A breakdown of project phase and equipment use is included below.

    - Estimated equipment to be used includes graders, rollers, rubber tired dozers, scrapers, tractors, loaders, backhoes, excavators, cranes, forklifts, generators sets, welders, cement and mortar mixers, other paving equipment, other industrial equipment, and other construction equipment.

<u>Project Duration and Operation Assumptions</u>

- Construction period of 21 months (October 2022 through June 2024).

- Operational emissions would be produced from the Proposed Action, specifically from heating units and emergency generators. Heating for new buildings and operation of emergency generators would begin following the completion of construction, approximately July 2024.

    - New buildings would be heated via natural gas.

    - One 1-megawatt generator would be installed at the distribution center.

    - One 240-kilowatt generator would be installed at the entry control facility.

<u>Emissions</u>
The emission calculations to quantify these values are presented in the table below, and were performed using the Department of the Air Force's Air Conformity Applicability Model, version 5.0.17b. The model was developed using the methodology and information provided in the *Air Emissions Guide for Air Force Mobile Sources, June 2020, Air Emissions Guide to Air Force Transitory Sources, June 2020, and Air Emissions Factor Guide to Air Force Stationary Sources, June 2020.*

Estimated Annual Air Emissions from Construction and Operation of a Distribution Center and Administrative Building[1]

Year	VOC	NO_x	CO^2	$SO_x{}^2$	$PM_{10}{}^2$	$PM_{2.5}{}^2$	CO_2e^2
2022 Construction of Distribution Center and Administrative Building	0.439	2.772	2.385	0.007	65.188	0.113	691.8
2023 Construction of Distribution Center and Administrative Building	0.900	6.138	5.390	0.017	65.231	0.226	1,735.2
2024 Construction of Distribution Center and Administrative Building Heating for Buildings Operation of Emergency Generators	6.875	3.265	2.890	0.016	0.191	0.189	2,507.3
2025 and later Heating for Buildings Operation of Emergency Generators	0.198	3.616	2.944	0.024	0.270	0.270	4,153.3

Notes:
[1] All values are in tons per year.
[2] The Record of Non-Applicability does not apply to emissions of CO, SO_X, PM_{10}, $PM_{2.5}$, and CO_2e.
Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; CO2e = carbon dioxide equivalent.

General Conformity Applicability Thresholds for Actions Occurring in Fairfax County

VOC	50 tpy
NO_x	100 tpy

Construction Emissions for Distribution Center, Fort Belvoir North Area

Estimated Activity Emissions:

Pollutant	Total Emissions (tons)
VOC	8.115200
SO_X	0.027914
NO_X	10.366487
CO	9.193386
PM_{10}	130.475836
$PM_{2.5}$	0.392906
Pb	0.000000
NH_3	0.017819
CO_2e	2857.7

Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; Pb = lead; NH_3 = ammonia; CO_2e = carbon dioxide equivalent.

Site Grading Phase

- Phase Start Date
  Start Month: 10
  Start Year: 2022

- Phase Duration
  Number of Months: 6

- General Site Grading Information
  Area of Site to be Graded (ft^2): 2,178,000
  Amount of Material to be Hauled On-Site (yd^3): 0
  Amount of Material to be Hauled Off-Site (yd^3): 0
  Average Days worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Graders Composite	2	8
Other Construction Equipment Composite	2	8
Rollers Composite	1	8
Rubber Tired Dozers Composite	2	8
Scrapers Composite	4	8
Tractors/Loaders/Backhoes Composite	2	8

- Vehicle Exhaust
  Average Hauling Truck Capacity (yd^3): 20
  Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

Key: POV = privately-owned vehicle; LDGV = light duty gasoline vehicle (passenger cars); LDGT = light duty gasoline truck [0-8,500 pounds Gross Vehicle Weight Rating (GVWR)]; HDGV = heavy duty gasoline vehicle (>8,500pounds GVWR); LDDV = light duty diesel vehicle (passenger cars); LDDT = light duty diesel truck (0-8,500 pounds GVWR); HDDV = heavy duty diesel vehicle (>8,500 pounds GVWR); MC = motorcycle.

- Worker Trips
  Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Construction Exhaust Emission Factors

Equipment	Emissions Factors (pounds/hour)						GHG
	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
Graders Composite	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	132.92
Rollers Composite	0.0499	0.0007	0.3198	0.3798	0.0180	0.0180	67.149
Rubber Tires Dozers Composite	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	239.51
Scrapers Composite	0.1723	0.0026	1.1176	0.7579	0.0447	0.0447	262.87
Tractors/Loaders/Backhoes Composite	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	66.884
Other Construction Equipment Composite	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	122.61

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
LDGV	000.282	000.002	000.220	003.283	000.007	000.006	0.0	000.023	00323.276
LDGT	000.358	000.003	000.388	004.597	000.009	000.008	0.0	000.024	00417.298
HDGV	000.706	000.005	001.021	015.119	000.022	000.019	0.0	000.045	00770.239
LDDV	000.112	000.003	000.133	002.524	000.004	000.004	0.0	000.008	00313.527
LDDT	000.253	000.004	000.380	004.330	000.007	000.006	0.0	000.008	00445.483
HDDV	000.493	000.013	004.921	001.743	000.169	000.155	0.0	000.028	01496.485
MC	002.436	000.003	000.747	012.951	000.027	000.024	0.0	000.054	00397.607

- Site Grading Phase Formulas

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (tons)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (tons)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Construction Equipment to Number of Workers
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

Trenching/Excavating Phase

- Phase Start Date
  Start Month: 11
  Start Year: 2022

- Phase Duration
  Number of Months: 2

- General Trenching/Excavating Information
  Area of Site to be Trenched/Excavated (ft^2): 3,800
  Amount of Material to be Hauled On-Site (yd^3): 0
  Amount of Material to be Hauled Off-Site (yd^3): 11,400
  Average Days worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Excavators Composite	2	8

Other General Industrial Equipment Composite	1	8
Tractors/Loaders/Backhoes Composite	1	8

- Vehicle Exhaust
  Average Hauling Truck Capacity (yd^3): 20
  Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
  Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Construction Exhaust Emission Factors

Equipment	Emissions Factors (pounds/hour)						GHG
	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
Graders Composite	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	132.92
Rollers Composite	0.0499	0.0007	0.3198	0.3798	0.0180	0.0180	67.149
Rubber Tires Dozers Composite	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	239.51
Scrapers Composite	0.1723	0.0026	1.1176	0.7579	0.0447	0.0447	262.87
Tractors/Loaders/Backhoes Composite	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	66.884
Other Construction Equipment Composite	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	122.61

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
LDGV	000.282	000.002	000.220	003.283	000.007	000.006	0.0	000.023	00323.276
LDGT	000.358	000.003	000.388	004.597	000.009	000.008	0.0	000.024	00417.298
HDGV	000.706	000.005	001.021	015.119	000.022	000.019	0.0	000.045	00770.239
LDDV	000.112	000.003	000.133	002.524	000.004	000.004	0.0	000.008	00313.527
LDDT	000.253	000.004	000.380	004.330	000.007	000.006	0.0	000.008	00445.483
HDDV	000.493	000.013	004.921	001.743	000.169	000.155	0.0	000.028	01496.485
MC	002.436	000.003	000.747	012.951	000.027	000.024	0.0	000.054	00397.607

- Trenching / Excavating Phase Formulas

- Fugitive Dust Emissions per Phase

$PM10_{FD} = (20 * ACRE * WD) / 2000$

$PM10_{FD}$: Fugitive Dust PM 10 Emissions (tons)
20: Conversion Factor Acre Day to pounds (20 lb / 1 Acre Day)
ACRE: Total acres (acres)
WD: Number of Total Work Days (days)
2000: Conversion Factor pounds to tons

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (tons)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = (HA_{OnSite} + HA_{OffSite}) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
HA_{OnSite}: Amount of Material to be Hauled On-Site (yd^3)
$HA_{OffSite}$: Amount of Material to be Hauled Off-Site (yd^3)
HC: Average Hauling Truck Capacity (yd^3)
(1 / HC): Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Construction Equipment to Number of Workers
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

Building Construction Phase

- Phase Start Date
  Start Month: 1
  Start Year: 2023

- Phase Duration
  Number of Months: 16

- General Building Construction Information
  Building Category: Office or Industrial
  Area of Building (ft^2): 565,500
  Height of Building (ft): 50
  Average Days worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cranes Composite	1	7
Forklifts Composite	3	8
Generator Sets Composite	1	8
Tractors/Loaders/Backhoes Composite	3	7
Welders Composite	1	8

- Vehicle Exhaust
  Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Worker Trips
  Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Vendor Trips
  Average Vendor Round Trip Commute (mile): 40

- Vendor Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	0	0	0	0	0	100.00	0

- Construction Exhaust Emission Factors

	Emissions Factors (pounds/hour)						GHG
Equipment	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
Cranes Composite	0.0754	0.0013	0.5027	0.3786	0.0181	0.0181	128.79
Forklifts Composite	0.258	0.0006	0.1108	0.2145	0.0034	0.0034	54.454
Generator Sets Composite	0.320	0.0006	0.2612	0.2683	0.0103	0.0103	61.065
Tractors/Loaders/Backhoes Composite	0.0364	0.0007	0.2127	0.3593	0.0080	0.0080	66.879
Welders Composite	0.0242	0.0003	0.1487	0.1761	0.0067	0.0067	25.657

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e

LDGV	000.282	000.002	000.220	003.283	000.007	000.006	0.0	000.023	00323.276
LDGT	000.358	000.003	000.388	004.597	000.009	000.008	0.0	000.024	00417.298
HDGV	000.706	000.005	001.021	015.119	000.022	000.019	0.0	000.045	00770.239
LDDV	000.112	000.003	000.133	002.524	000.004	000.004	0.0	000.008	00313.527
LDDT	000.253	000.004	000.380	004.330	000.007	000.006	0.0	000.008	00445.483
HDDV	000.493	000.013	004.921	001.743	000.169	000.155	0.0	000.028	01496.485
MC	002.436	000.003	000.747	012.951	000.027	000.024	0.0	000.054	00397.607

- Building Construction Phase Formulas

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (tons)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = BA * BH * (0.42 / 1000) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.42 / 1000): Conversion Factor ft^3 to trips (0.42 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase

$VMT_{WT} = WD * WT * 1.25 * NE$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Construction Equipment to Number of Workers
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)

VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Vender Trips Emissions per Phase

VMT_{VT} = BA * BH * (0.38 / 1000) * HT

VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
BA: Area of Building (ft^2)
BH: Height of Building (ft)
(0.38 / 1000): Conversion Factor ft^3 to trips (0.38 trip / 1000 ft^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

V_{POL} = (VMT_{VT} * 0.002205 * EF_{POL} * VM) / 2000

V_{POL}: Vehicle Emissions (tons)
VMT_{VT}: Vender Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

Architectural Coatings Phase

- Phase Start Date
  Start Month: 4
  Start Year: 2024

- Phase Duration
  Number of Months: 1

- General Architectural Coatings Information
  Building Category: Non-Residential
  Total Square Footage (ft^2): 565,500
  Average Days worked per week: 5

- Worker Trips
  Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Worker Trips Emission Factors (grams/mile)

	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
LDGV	000.282	000.002	000.220	003.283	000.007	000.006	0.0	000.023	00323.276
LDGT	000.358	000.003	000.388	004.597	000.009	000.008	0.0	000.024	00417.298
HDGV	000.706	000.005	001.021	015.119	000.022	000.019	0.0	000.045	00770.239
LDDV	000.112	000.003	000.133	002.524	000.004	000.004	0.0	000.008	00313.527
LDDT	000.253	000.004	000.380	004.330	000.007	000.006	0.0	000.008	00445.483
HDDV	000.493	000.013	004.921	001.743	000.169	000.155	0.0	000.028	01496.485
MC	002.436	000.003	000.747	012.951	000.027	000.024	0.0	000.054	00397.607

- Architectural Coatings Phase Formulas

- Worker Trips Emissions per Phase

$VMT_{WT} = (1 * WT * PA) / 800$

VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
1: Conversion Factor man days to trips (1 trip / 1 man * day)
WT: Average Worker Round Trip Commute (mile)
PA: Paint Area (ft^2)
800: Conversion Factor square feet to man days (1 ft^2 / 1 man * day)

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (tons)
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase

$VOC_{AC} = (AB * 2.0 * 0.0116) / 2000.0$

VOC_{AC}: Architectural Coating VOC Emissions (tons)
BA: Area of Building (ft^2)
2.0: Conversion Factor total area to coated area (2.0 ft^2 coated area / total area)
0.0116: Emission Factor (lb/ft^2)
2000: Conversion Factor pounds to tons

Paving Phase

- Phase Start Date
  Start Month: 5
  Start Year: 2024

- Phase Duration
  Number of Months: 2

- General Paving Information
  Paving Area (ft^2): 135,000
  Average Days worked per week: 5

- Construction Exhaust

Equipment Name	Number Of Equipment	Hours Per Day
Cement and Mortar Mixers Composite	4	6
Pavers Composite	1	7
Paving Equipment Composite	2	6
Rollers Composite	1	7

- Vehicle Exhaust
  Average Hauling Truck Round Trip Commute (mile): 20

- Vehicle Exhaust Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC

POVs	0	0	0	0	0	100.00	0

- Worker Trips
  Average Worker Round Trip Commute (mile): 20

- Worker Trips Vehicle Mixture (percent)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	50.00	50.00	0	0	0	0	0

- Construction Exhaust Emission Factors

Equipment	Emissions Factors (pounds/hour)						GHG
	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
Graders Composite	0.0806	0.0014	0.4657	0.5731	0.0217	0.0217	132.92
Rollers Composite	0.0499	0.0007	0.3198	0.3798	0.0180	0.0180	67.149
Rubber Tired Dozers Composite	0.1919	0.0024	1.3611	0.7352	0.0536	0.0536	239.51
Scrapers Composite	0.1723	0.0026	1.1176	0.7579	0.0447	0.0447	262.87
Tractors/Loaders/Backhoes Composite	0.0383	0.0007	0.2301	0.3598	0.0095	0.0095	66.884
Other Construction Equipment Composite	0.0507	0.0012	0.2785	0.3488	0.0105	0.0105	122.61

- Vehicle Exhaust & Worker Trips Emission Factors (grams/mile)

	VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
LDGV	000.282	000.002	000.220	003.283	000.007	000.006	0.0	000.023	00323.276
LDGT	000.358	000.003	000.388	004.597	000.009	000.008	0.0	000.024	00417.298
HDGV	000.706	000.005	001.021	015.119	000.022	000.019	0.0	000.045	00770.239
LDDV	000.112	000.003	000.133	002.524	000.004	000.004	0.0	000.008	00313.527
LDDT	000.253	000.004	000.380	004.330	000.007	000.006	0.0	000.008	00445.483
HDDV	000.493	000.013	004.921	001.743	000.169	000.155	0.0	000.028	01496.485
MC	002.436	000.003	000.747	012.951	000.027	000.024	0.0	000.054	00397.607

- Paving Phase Formulas

- Construction Exhaust Emissions per Phase

$CEE_{POL} = (NE * WD * H * EF_{POL}) / 2000$

CEE_{POL}: Construction Exhaust Emissions (tons)
NE: Number of Equipment
WD: Number of Total Work Days (days)
H: Hours Worked per Day (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hour)
2000: Conversion Factor pounds to tons

- Vehicle Exhaust Emissions per Phase

$VMT_{VE} = PA * 0.25 * (1 / 27) * (1 / HC) * HT$

VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
PA: Paving Area (ft^2)
0.25: Thickness of Paving Area (ft)
(1 / 27): Conversion Factor cubic feet to cubic yards (1 yd^3 / 27 ft^3)
HC: Average Hauling Truck Capacity (yd^3)

$(1 / HC)$: Conversion Factor cubic yards to trips (1 trip / HC yd^3)
HT: Average Hauling Truck Round Trip Commute (mile/trip)

$V_{POL} = (VMT_{VE} * 0.002205 * EF_{POL} * VM) / 2000$
V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Vehicle Exhaust Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Vehicle Exhaust On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Worker Trips Emissions per Phase
$VMT_{WT} = WD * WT * 1.25 * NE$
VMT_{WT}: Worker Trips Vehicle Miles Travel (miles)
WD: Number of Total Work Days (days)
WT: Average Worker Round Trip Commute (mile)
1.25: Conversion Factor Construction Equipment to Number of Workers
NE: Number of Construction Equipment

$V_{POL} = (VMT_{WT} * 0.002205 * EF_{POL} * VM) / 2000$
V_{POL}: Vehicle Emissions (tons)
VMT_{VE}: Worker Trips Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Worker Trips On Road Vehicle Mixture (percent)
2000: Conversion Factor pounds to tons

- Off-Gassing Emissions per Phase
$VOC_P = (2.62 * PA) / 43560$
VOC_P: Paving VOC Emissions (tons)
2.62: Emission Factor (lb/acre)
PA: Paving Area (ft^2)
43560: Conversion Factor square feet to acre (43560 ft2 / acre$)^2$ / acre)

Heating Emissions for Distribution Center, Fort Belvoir North Area

Estimated Activity Emissions:

Pollutant	Total Emissions (tons)
VOC	0.189281
SO_X	0.020649
NO_X	3.441471
CO	2.890836
PM_{10}	0.261552
$PM_{2.5}$	0.261552
Pb	0.000000
NH_3	0.000000
CO_2e	4143.2

Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; Pb = lead; NH_3 = ammonia; CO_2e = carbon dioxide equivalent.

- Activity Start Date
  Start Month: 7
  Start Year: 2024

- Activity End Date
  Indefinite: Yes

- General Heating Information
  Heating Calculation Type: Heat Energy Requirement Method
  Area of floorspace to be heated (ft^2): 565,500
  Type of fuel: Natural Gas
  Type of boiler/furnace: Industrial (10 - 250 MMBtu/hr)
  Heat Value (MMBtu/ft^3): 0.00105
  Energy Intensity (MMBtu/ft^2): 0.1278
  Operating Time Per Year (hours): 900

- Heating Emission Factors (pound/1000000 standard cubic foot)

VOC	SO_X	NO_X	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
5.5	0.6	100	84	7.6	7.6	0.0	0.0	120390

- Heating Formulas
- Heating Fuel Consumption ft^3 per Year

FC_{HER}= HA * EI / HV / 1000000

FC_{HER}: Fuel Consumption for Heat Energy Requirement Method
HA: Area of floorspace to be heated (ft^2)
EI: Energy Intensity Requirement (MMBtu/ft^2)
HV: Heat Value (MMBTU/ft^3)
1000000: Conversion Factor

- Heating Emissions per Year

HE_{POL}= FC * EF_{POL} / 2000

HE_{POL}: Heating Emission Emissions (tons)
FC: Fuel Consumption
EF_{POL}: Emission Factor for Pollutant
2000: Conversion Factor pounds to tons

Distribution Center Generator Emissions for Distribution Center, Fort Belvoir North Area

Estimated Activity Emissions:

Pollutant	Total Emissions (tons)
VOC	0.004350
SO_X	0.000076
NO_X	0.157343
CO	0.041796
PM_{10}	0.004915
$PM_{2.5}$	0.004915
Pb	0.000000
NH_3	0.000000
CO_2e	8.1

Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; Pb = lead; NH_3 = ammonia; CO_2e = carbon dioxide equivalent.

- Activity Start Date
  Start Month: 7
  Start Year: 2024

- Activity End Date
  Indefinite: Yes

- General Emergency Generator Information
  Type of Fuel used in Emergency Generator: Diesel
  Number of Emergency Generators: 1
  Emergency Generator's Horsepower: 1350
  Average Operating Hours Per Year (hours): 9

- Emergency Generators Emission Factor (pounds/horsepower-hour)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809	0.0	0.0	1.33

- Emergency Generator Formula

- Emergency Generator Emissions per Year

AE_{POL}= (NGEN * HP * OT * EF_{POL}) / 2000

AE_{POL}: Activity Emissions (tons per year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)
2000: Conversion Factor pounds to tons

Entry Control Facility Generator Emissions for Distribution Center, Fort Belvoir North Area

Estimated Activity Emissions:

Pollutant	Total Emissions (tons)
VOC	0.004206
SO_X	0.003543
NO_X	0.017336
CO	0.011578
PM_{10}	0.003784
$PM_{2.5}$	0.003784
Pb	0.000000
NH_3	0.000000
CO_2e	2.0

Key: VOC = volatile organic compound; NO_X = nitrogen oxides; CO = carbon monoxide; SO_X = sulfur oxides; PM_{10} = particulate matter less than or equal to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 micrometers in diameter; Pb = lead; NH_3 = ammonia; CO_2e = carbon dioxide equivalent.

- Activity Start Date
  Start Month: 7
  Start Year: 2024

- Activity End Date
  Indefinite: Yes

- General Emergency Generator Information
  Type of Fuel used in Emergency Generator: Diesel
  Number of Emergency Generators: 1
  Emergency Generator's Horsepower: 335
  Average Operating Hours Per Year (hours): 9

- Emergency Generators Emission Factor (lb/hp-hr)

VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
0.000716	0.0000125	0.0259	0.00688	0.000809	0.000809	0.0	0.0	1.33

- Emergency Generator Formula

- Emergency Generator Emissions per Year

$$AE_{POL} = (NGEN * HP * OT * EF_{POL}) / 2000$$

AE_{POL}: Activity Emissions (tons per year)
NGEN: Number of Emergency Generators
HP: Emergency Generator's Horsepower (hp)
OT: Average Operating Hours Per Year (hours)
EF_{POL}: Emission Factor for Pollutant (lb/hp-hr)
2000: Conversion Factor pounds to tons

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APPENDIX H – TRAFFIC STUDY

HDR
A JOINT VENTURE
TEHAMA

US Army Corps
of Engineers
Baltimore District

Traffic Impact Study to Support National Environmental Policy Act Documentation for Distribution Center at Fort Belvoir North Area (FBNA)

Fort Belvoir, Virginia

Contract No. W912DR-20-D-0010
Task Order W912DR22F0048

May 2022

HDR
TEHAMA

Traffic Impact Study to Support National Environmental Policy Act Documentation for Distribution Center at Fort Belvoir North Area (FBNA)

Fort Belvoir, Virginia

Brad Loomis, PE, PTOE
Project Manager

Prepared for:
US Army Corps of Engineers
Baltimore District

Under contract with:
U.S. Army Corps of Engineers

Prepared by:
HDR-Tehama JV
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Our Reference:
Contract W912DR-20-D-0010
Task Order W912DR22F0048
Tehama Project F0140.02

Date:
4 May 2022

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TABLES

FIGURES

APPENDICES

EXECUTIVE SUMMARY

This Traffic Impact Study (TIS) presents the traffic operational analysis results in order to accommodate the proposed construction and operation of a new 525,000 square foot Distribution Center consolidated complex consisting of a high bay warehouse; two-story administrative building; truck maintenance/refueling building; covered/enclosed storage buildings; entry control facility, including gate house and vehicle inspection; enhanced security measures along the fenceline, including a new fence and an approximately 30-foot clear zone around the fence; a maintenance and patrol path; and parking areas for personnel. Approximately 600 additional personnel would be employed at the new site. This TIS focuses on roadways and intersections labeled A-R that provide access to the proposed Distribution Center location along Barta Road in the northwest area of the Fort Belvoir North Area (FBNA) complex (Figure ES-1).

A previous traffic study was completed in June 2021 to study alternate locations to construct an annex for the Defense Intelligence Agency (DIA) titled *Traffic Impact Study to Support National Environmental Policy Act Documentation for DIA HQ Annex* (HDR & Tehama, 2021). This annex construction project is hereinafter referred to as the “DIA Annex” or the “DIA Annex project.” The data, modeling, and results from this previous study for the DIA Annex project are used within this report. Counts for this previous study were performed in March 2021 during a time that experienced decreased traffic because of the Coronavirus disease 2019 (COVID-19) pandemic. It was assumed that at this time a portion of FBNA staff worked from a home office. The June 2021 report information for the DIA Annex project (i.e., [HDR & Tehama, 2021]) has been supplemented, verified, and/or adjusted to determine the aggregate operational impact for the additional traffic of the proposed Distribution Center with other immediate anticipated site development/improvements.

For this Distribution Center TIS, traffic data was collected in March 2022 at four (4) intersections along Barta Road using JAMAR boards. This data was used to amend the aforementioned previously acquired counts collected in March 2021 for the DIA Annex project. The intersections counted are shown in Figure 2-1.

Level of Service Standards

Level of service is a qualitative measure describing operational traffic conditions, and the perception of these conditions by drivers or passengers. These conditions include factors such as speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Levels of service are given letter designations from A to F, with Level of Service (LOS) A representing the best operating conditions (free flow, little delay) and LOS F, the worst (congestion, long delays). Generally, LOS A and B are considered high level of service, LOS C and D are considered moderate, and LOS E and F are considered low. In general, the standards are LOS D in urban areas and LOS C in rural areas.

The results of the operational analysis using Synchro are provided in Table ES-1.

Figure ES-1: **Analyzed Intersections for Distribution Center preferred location**

Table ES-1: Existing Intersection Operational Analysis – FBNA						
Intersection ID	Intersection	Signalized (Y/N)	AM	PM	AM	PM
			Delay (s/veh)		LOS	
B	Barta Road / Heller Road	Y	2.5	0.4	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.0	9.5	A	A
E	Barta Road / Main Guest Access	N	-	-	A	A
F	Barta Road / GEOINT Drive	Y	5.5	10.4	A	B
G	Barta Road / Heller Road	Y	9.8	0.4	A	A
H	Barta Road / Backlick Road	Y	7.9	18.9	A	B
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.3	9.3	A	A
Q	Barta Road / SB VA 286 Ramps	Y	6.2	8.4	A	A
R	Barta Road / NB VA 286 Ramps	Y	9.0	11.9	A	B

As shown in the table above, all intersections are operating at LOS B or better.

No changes in existing roadway geometrics were assumed for this study. A new signalized intersection/entrance was modeled at the location shown on Figure ES-1 (Note: This new, proposed signalized intersection/entrance is represented by a star symbol on Figure ES-1 and as Intersection ID letter "A" in the tables herein).

The Distribution Center construction is estimated to generate 600 additional staff positions. The analysis assumes that each additional staff member generates 0.9 additional AM and PM peak hour trip for 600 additional staff (Distribution Center) and one (1) additional AM and PM peak hour trip for each 650 additional staff (DIA Annex). In addition, eighteen (18) truck trips have been modeled for both the AM and PM peak hours. New trip origin and destination points were determined utilizing the March 2021 count data.

Table ES-2: Build Condition (2023) Intersection Operational Analysis						
Intersection ID	Intersection	Signalized (Y/N)	***600 Added Personnel (Distribution Center) + 650 Added Personnel (DIA Annex)***			
			AM	PM	AM	PM
			Delay (s/veh)		LOS	
A	New Entrance / Barta Road	Y	4.9	22.7	A	C
B	Barta Road / Heller Road	Y	4.6	0.9	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.1	7.7	A	A
E	Barta Road / Main Guest Access	N	8.7	11.4	A	B
F	Barta Road / GEOINT Drive	Y	5.8	66.3	A	E
G	Barta Road / Heller Road	Y	9.8	4.7	A	A
H	Barta Road / Backlick Road	Y	8.5	22.2	A	C
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.8	9.7	A	A
Q	Barta Road / SB VA 286 Ramps	Y	7.8	9.4	A	A
R	Barta Road / NB VA 286 Ramps	Y	27.7	11.3	C	B

Based on the traffic operational results found in Table ES-2, this study concludes that FBNA can accommodate the existing site traffic and the anticipated additional traffic generated by the Distribution Center and the DIA Annex.

Indirect Effects

Increased vehicle traffic may affect some intersections outside of the study area. The project traffic traveling through those intersections is expected to result in a small (less than 1 percent) increase in traffic at those intersections. The project trips associated with this project are not expected to affect the LOS of those intersections significantly based on the minor delay increase associated with the proposed additional trips at each outer intersection (H and P in tables ES-1 and ES-2).

Pedestrian and Bicycle Operations

Pedestrians are provided shared phasing with appropriate traffic phases. No impacts are expected along Barta Road. Additional connections to the new distribution facility may be appropriate with connection across Barta Road.

Proposed Design Features Intended to Reduce Impacts

From the analyses results, possible roadway and intersection improvements were identified to mitigate operational impacts that were degraded to LOS E. Potential mitigation is discussed below.

- PM - NB Geoint Drive to both EB & WB Barta Road
    - Mitigation – Signal optimization and additional turn lane for increased turn volumes.

Based on the modeling results, the existing roadway system build scenario operates at acceptable levels with the construction of the Distribution Center and added personnel. Low LOS at Geoint Drive in the PM will only be anticipated with the construction of the DIA Annex. LOS E is also expected only for exiting vehicles from existing Geoint Drive.

1 INTRODUCTION

1.1 Introduction

Tehama-HDR Joint Venture (JV) was retained by US Army Corps of Engineers (USACE) to evaluate the potential traffic impacts resulting from the proposed construction and operation of a new approximately 525,000 square foot Distribution Center consolidated complex consisting of a high bay warehouse; two-story administrative building; truck maintenance/refueling building; covered/enclosed storage buildings; entry control facility, including gate house and vehicle inspection; enhanced security measures along the fenceline, including a new fence, and an approximately 30-foot clear zone around the fence; a maintenance and patrol path; and parking areas for personnel. Approximately 600 additional personnel would be employed at the new site. This Traffic Impact Study (TIS) focused on roadways providing adequate site access to the proposed Distribution Center location along Barta Road in the northwest area of the Fort Belvoir North Area (FBNA) complex.

Various Measures of Effectiveness (MOEs), such as intersection delay and Level of Service (LOS) are presented in this study. The analysis results are determined using the definitions and methodology outlined in the Transportation Research Board (TRB)'s 6th edition of the Highway Capacity Manual (HCM) (TRB, 2016). The Synchro 11 software module is used to evaluate the signalized and unsignalized intersections.

1.2 Analyses Years

The traffic analyses were performed during morning (AM) and afternoon (PM) weekday peak hours for the following analysis years:

- Existing Year (2022)
  - 2022 turning movement counts (TMC) at 4 intersections at west end of Barta Road.
  - 2021 Adjusted volumes and TMCs based on total inbound base gate counts from January 2020 (pre Coronavirus disease 2019 or "COVID-19" pandemic) and January 2021. Volumes were increased by 40% to account for the 35-40% reduction in overall base traffic experienced.
- Build Condition (2023)
  - Additional 600 personnel reporting to new Distribution Center balanced with adjusted 2021 traffic.
  - Additional 650 personnel reporting to new DIA Annex with adjusted 2021 traffic. This development is planned for short-term implementation and has been included.

1.3 Study Area / Project

Formerly known as the Engineer Proving Ground, FBNA is located in Springfield, Virginia, approximately 3 miles northwest of Fort Belvoir's main installation (see Figure 1-1). FBNA currently hosts the National Geospatial-Intelligence Agency (NGA) headquarters and associated support facilities, which were constructed in 2011. The study area is located in the northwest corner of the FBNA.

Figure 1-1: Proposed Project Location at FBNA

2 DATA COLLECTION

2.1 Traffic Volume Collection

Traffic data for this study was gathered in March 2021 and March 2022. Additional 2018 traffic data was acquired from Fairfax County Department of Transportation (County of Fairfax, 2021).

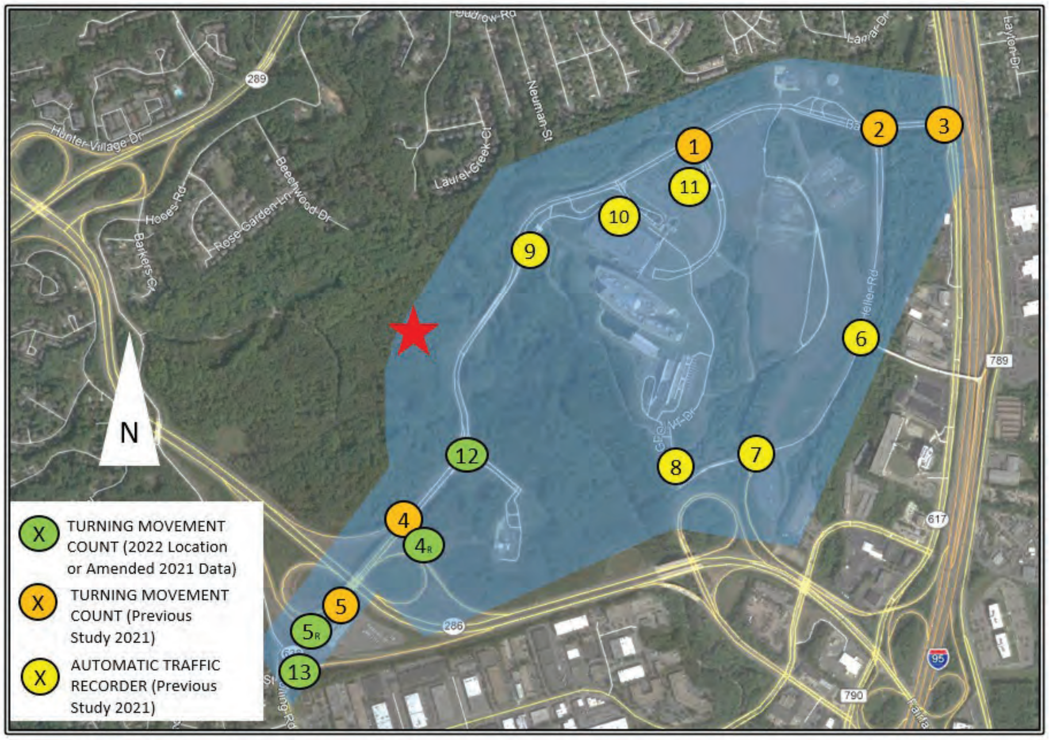


Figure 2-1: Count Locations for Existing Conditions

2.1.1 2021 Traffic Volume Collection

A previous traffic study was completed in June 2021 to study alternate locations to construct an annex for the Defense Intelligence Agency (DIA) titled *Traffic Impact Study to Support National Environmental Policy Act Documentation for DIA HQ Annex* (HDR & Tehama, 2021). This annex construction project is hereinafter referred to as the "DIA Annex" or the "DIA Annex project." The data, modeling, and results from this previous study for the DIA Annex project are used within this report. Counts for this previous study were performed in March 2021 during a time that experienced decreased traffic because of the Coronavirus disease 2019 (COVID-19) pandemic. It was assumed that at this time a portion of FBNA staff worked from a home office. The June 2021 report information for the DIA Annex project (i.e., [HDR & Tehama, 2021]) has been supplemented, verified, and/or adjusted to determine the aggregate operational impact for the additional traffic of the proposed Distribution Center with other immediate anticipated site development/improvements.

Traffic data was collected at eleven (11) locations to support the development of this TIS. Both turning movement counts (TMCs) at the major intersections (5 locations) and automated traffic recorders counts (ATRs) at select ramps/gates (6 locations) were collected. The turning movement counts were completed using JAMAR boards, which are industry-standard counting equipment versatile in acquiring data at signalized, unsignalized, and roundabout intersections. Pico tubes were used for the volume data at ATR identified locations. The tubes allowed the acquisition of 24-hour counts which helped identify peak hours.

TMCs and roadway volume counts were conducted at the locations shown in Figure 2-1. The locations for the roadways and intersection counts are listed below in Table 2-1. Figure 2-2 and Figure 2-3 present diagrams of the volumes counted at specific intersections within the study areas (refer to Appendix A for the original count data). The counts were collected during the AM and PM peak hours over a three-day period of a typical Tuesday, Wednesday, and Thursday. During project discussions, NGA noted that focus may be given to certain times based on employee work schedules. Based on this input, it was assumed the AM peak occurs between 6-9 AM and the PM peak occurs between 3-6 PM. The turning movement counts were collected in 15-minute periods and include classification of passenger vehicles, trucks (vehicles with 3 or more axles), and bicycles/pedestrians. This information was input into the existing conditions model.

Table 2-1: Traffic Volume Count Locations – March 2021

Count ID	Intersection	Count Date	Type
1	Barta Road with Geoint Drive	2021-03-23	TMC (JAMAR)
2	Barta Road with Heller Road	2021-03-23	TMC (JAMAR)
3	Barta Road with Backlick Road	2021-03-23	TMC (JAMAR)
4	Barta Road / Fairfax County Parkway (VA 286) NB Ramps	2021-03-24	TMC (JAMAR)
5	Barta Road / Fairfax County Parkway (VA 286) SB Ramps	2021-03-24	TMC (JAMAR)
6	Heller Road with I-95 NB/I-95 SB Express Lane	2021-03-23	ATR (Pico)
7	Heller Road with I-95 SB	2021-03-23	ATR (Pico)
8a	Heller Road with NGA South Gate (inbound)	2021-03-23	ATR (Pico)
8b	Heller Road with NGA South Gate (outbound)	2021-03-24	ATR (Pico)
9	Barta Road at NGA West Gate Entry	2021-03-24	ATR (Pico)
10	Barta Road at NGA West Gate Exit	2021-03-24	ATR (Pico)
11	GEOINT Drive Visitor Parking Lot Access Lane	2021-03-24	ATR (Pico)

24-Hour Counts were taken on either Tuesday, Wednesday, or Thursday at 6 primary locations (6 – 11) identified in Figure 2-1; The average daily traffic (ADT) measured in vehicles per day (vpd) is shown in Table 2-2.

Table 2-2 : 24-Hour Tube (ATR) Count ADT (2021)

Count ID	Roadway	Description	Direction	ADT (vpd)
6	HOV Entrance Lane	Traffic From Heller Road to I-95	EB	4697
7a	I-95 Exit Ramp	Exit Ramp to Heller Road (RT)	EB	2234
7b	I-95 Exit Ramp	Exit Ramp to Heller Road (LT)	WB	1792
8a	Heller Road	South Gate (Outbound)	SB	188
8b	Heller Road	South Gate (Inbound)	NB	2632
9	West Gate	West Gate Entrance Traffic	EB	5788
10	Exit Gate (Onto Barta Road)	Parking Garage Exit	NB	4180
11	GEOINT Drive	Visitor Parking Lot Access Lane	SB	1344

2.1.2 2022 Traffic Volume Collection

March 2022 traffic data was collected at four (4) intersections along Barta Road to support the development of the TIS using JAMAR boards. This data was used to amend previously acquired counts collected in March 2021 for the DIA Annex project. The intersections counted are shown in Figure 2-1.

TMCs were conducted at the locations shown in Figure 2-1. The locations for the intersection counts are listed below in Table 2-3. Figure 2-2 and Figure 2-3 present diagrams of the volumes counted and balanced at specific intersections within the study areas (refer to Appendix A for the original count data). The counts were collected during the AM and PM peak hours over a two-day period of a typical Tuesday and Wednesday. This information was input into the existing conditions model. Data was compared to previous data collected and adjusted for anticipated volumes.

Table 2-3: Traffic Volume Count Locations – March 2022			
Count ID	**Intersection**	**Count Date**	**Type**
4R	Barta Road / Fairfax County Parkway (VA 286) NB Ramps	2022-03-02	TMC (JAMAR)
5R	Barta Road / Fairfax County Parkway (VA 286) SB Ramps	2022-03-01	TMC (JAMAR)
12	Barta Road with Heller Road	2022-03-02	TMC (JAMAR)
13	Barta Road with Rolling Road	2022-03-01	TMC (JAMAR)

2.2 Existing Year (2022) Traffic Volumes

A review of the traffic count data indicates that the weekday morning and afternoon peak hours are not consistent among the study intersections. The respective peak hour for each intersection is shown in Table 2-4.

Table 2-4: Peak Hours for Existing Counts (2021)

Count ID	Location	Peak Hour	
		AM	PM
March 2021 Counts			
1	Barta Road with Geoint Drive	6:45–7:45	4:30–5:30
2	Barta Road with Heller Road	7:15-8:15	3:45-4:45
3	Barta Road with Backlick Road	7:00-8:00	4:00-5:00
4-5	Barta Road with Fairfax County Parkway (VA 286) NB Ramps (WB Barta Road)	6:45–7:45	3:45-4:45
6	Heller Road with I-95 NB/I-95 SB Express Lane	12:00-1:00	5:45-6:45
7	Heller Road with I-95 SB	7:45-8:45	3:00-4:00
8	Heller Road with NGA South Gate (inbound)	7:30-8:30	8:45-9:45
9	Barta Road at NGA West Gate Entry	9:30-10:30	-
10	Barta Road at NGA West Gate Exit	-	5:45-6:45
11	GEOINT Drive Visitor Parking Lot Access Lane	7:15-8:15	2:45-3:45
March 2022 Counts			
4R	Barta Road with Fairfax County Parkway (VA 286) NB Ramps	7:15-8:15	4:15-5:15
5R	Barta Road with Fairfax County Parkway (VA 286) SB Ramps	7:30-8:30	4:00-5:00
12	Barta Road with Heller Road	7:15-8:15	4:15-5:15
13	Barta Road with Rolling Road	7:45-8:45	4:30-5:30

Figures 2-2 through Figure 2-3 show the Existing morning (AM) and afternoon (PM) peak hour traffic volumes.

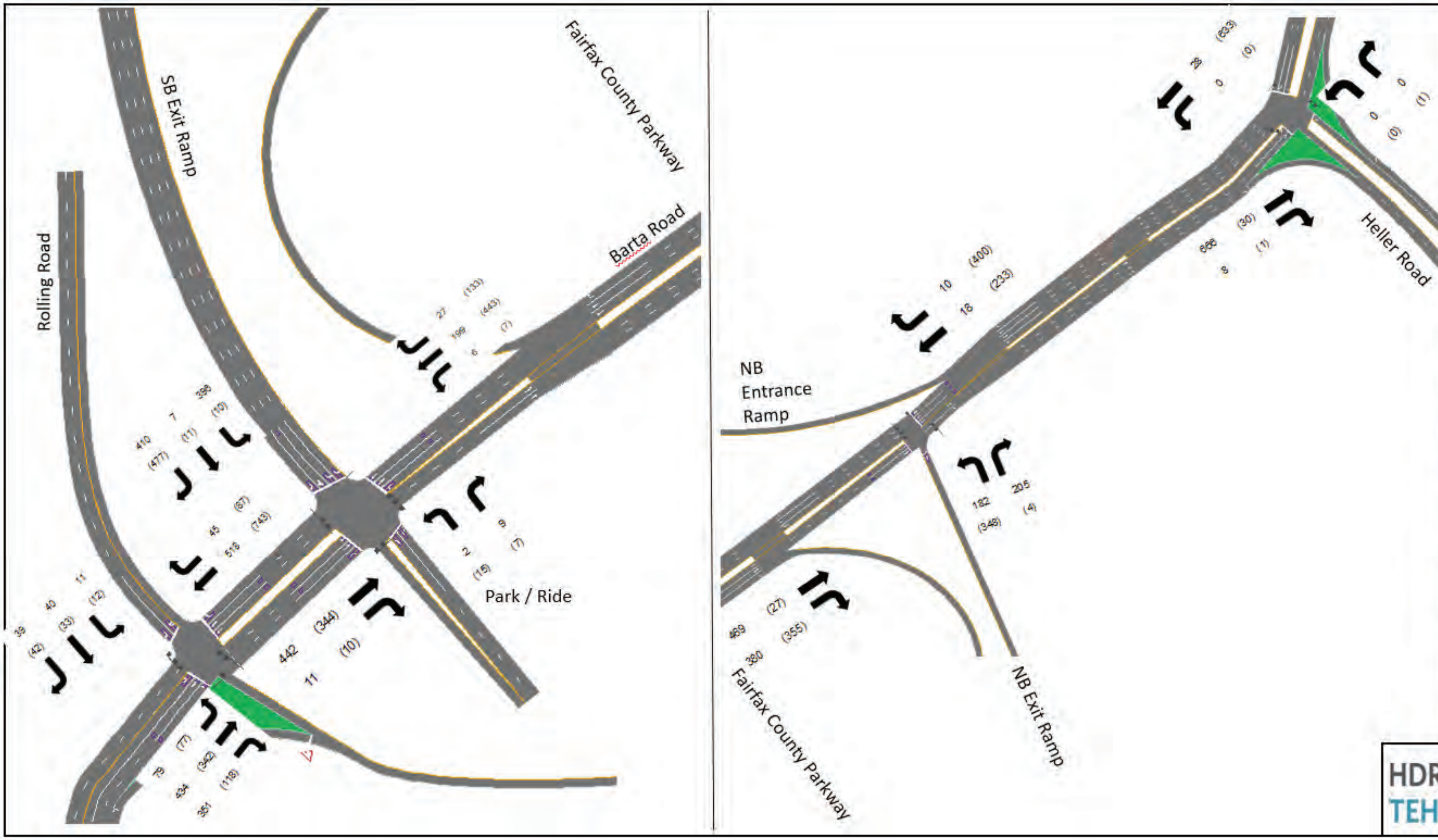


Figure 2-2: AM (PM) Peak Hour Turning Movement Volumes – Existing Conditions, Rolling Road to Heller (2022)

HDR
TEHAMA

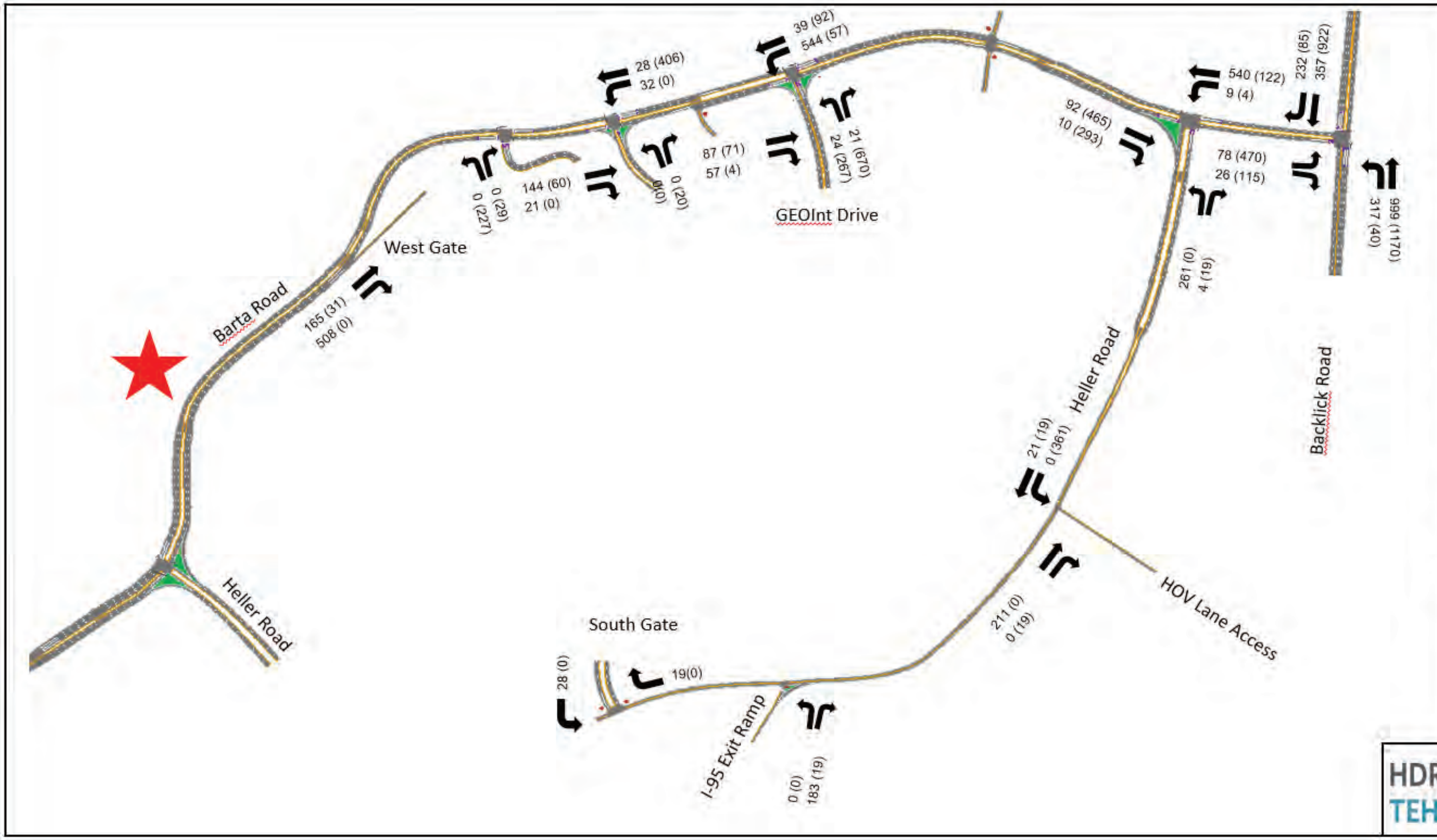


Figure 2-3: AM (PM) Peak Hour Turning Movement Volumes – Existing Conditions, Heller Road to Backlick Road (2022)

HDR TEHAMA

2.3 Traffic Signal Timing Data

Signal timing was not provided by the agencies. Timing was observed during traffic counts and noted. Total cycle length, protected / permissive movements, and phase lengths were collected and modelled within Synchro 11. Where timing and cycle length information was not recorded in the field, Synchro "optimized" conditions were used in the model. See Appendix A for field notes taken.

3 OPERATIONAL ANALYSES

3.1 Methodology

This study includes the operational analysis of the existing year 2022 conditions, future 2022 conditions with 600 new staff (proposed Distribution Center) and 650 new staff (proposed DIA Annex). The future year analyses were performed for only the 2023 Build condition. The operating condition of the study intersections were evaluated using the Synchro/SimTraffic micro-simulation software.

Different MOEs were evaluated while performing the operational condition. The intersection delay and LOS were evaluated and presented in this study for the existing, future year build traffic conditions.

The Synchro 11 traffic simulation software program was used to perform intersection and arterial operational analyses. This software provides industry standard analysis for signalized and roundabout intersections. The study area consists of both unsignalized and signalized intersections. The analysis methodologies are described in the following sections.

3.2 Description of Level of Service Grades (LOS)

Based on delay or density values, a "grade" or LOS ranging from LOS A, the best, to LOS F, the worst are assigned. The HCM (TRB, 2016) describes service as the following:

LOS A - free flow

Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes. The average spacing between vehicles is about 550 ft (167 m) or 27 car lengths. Motorists have a high level of physical and psychological comfort. The effects of incidents or point breakdowns are easily absorbed. LOS A generally occurs late at night in urban areas and frequently in rural areas.

LOS B - reasonably free flow

LOS A speeds are maintained, maneuverability within the traffic stream is slightly restricted. The lowest average vehicle spacing is about 330 ft (100 m) or 16 car lengths. Motorists still have a high level of physical and psychological comfort.

LOS C - stable flow, at or near free flow

Ability to maneuver through lanes is noticeably restricted and lane changes require more driver awareness. Minimum vehicle spacing is about 220 ft (67 m) or 11 car lengths. Most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained. Minor incidents may still have no effect but localized service will have noticeable effects and traffic delays will form behind the incident. This is the target LOS for some urban and most rural highways.

LOS D - approaching unstable flow

Speeds slightly decrease as traffic volume slightly increase. Freedom to maneuver within the traffic stream is much more limited and driver comfort levels decrease. Vehicles are spaced about 160 ft (50m) or 8 car lengths. Minor incidents are expected to create delays. Examples are a busy shopping corridor in the middle of a weekday, or a functional urban highway during commuting hours. It is a common goal for urban streets during peak hours, as attaining LOS C would require prohibitive cost and societal impact in bypass roads and lane additions.

LOS E - unstable flow, operating at capacity

Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to maneuver in the traffic stream and speeds rarely reach the posted limit. Vehicle spacing is about 6 car lengths, but speeds are still at or above 50 mi/h(80 km/h). Any disruption to traffic flow, such as merging ramp traffic or lane changes, will create a shock wave affecting traffic upstream. Any incident will create serious delays. Drivers' level of comfort become poor. This is a common standard in larger urban areas, where some roadway congestion is inevitable.

LOS F - forced or breakdown flow

Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity. A road in a constant traffic jam is at this LOS, because LOS is an average or typical service rather than a constant state. For example, a highway might be at LOS D for the AM peak hour, but have traffic consistent with LOS C some days, LOS E or F others, and come to a halt once every few weeks.

Figure 3-1 shows the roadway traffic condition corresponding to the LOS letter grades. The goal of this study is to ensure study intersections would operate at an acceptable LOS D or better in the future build year.

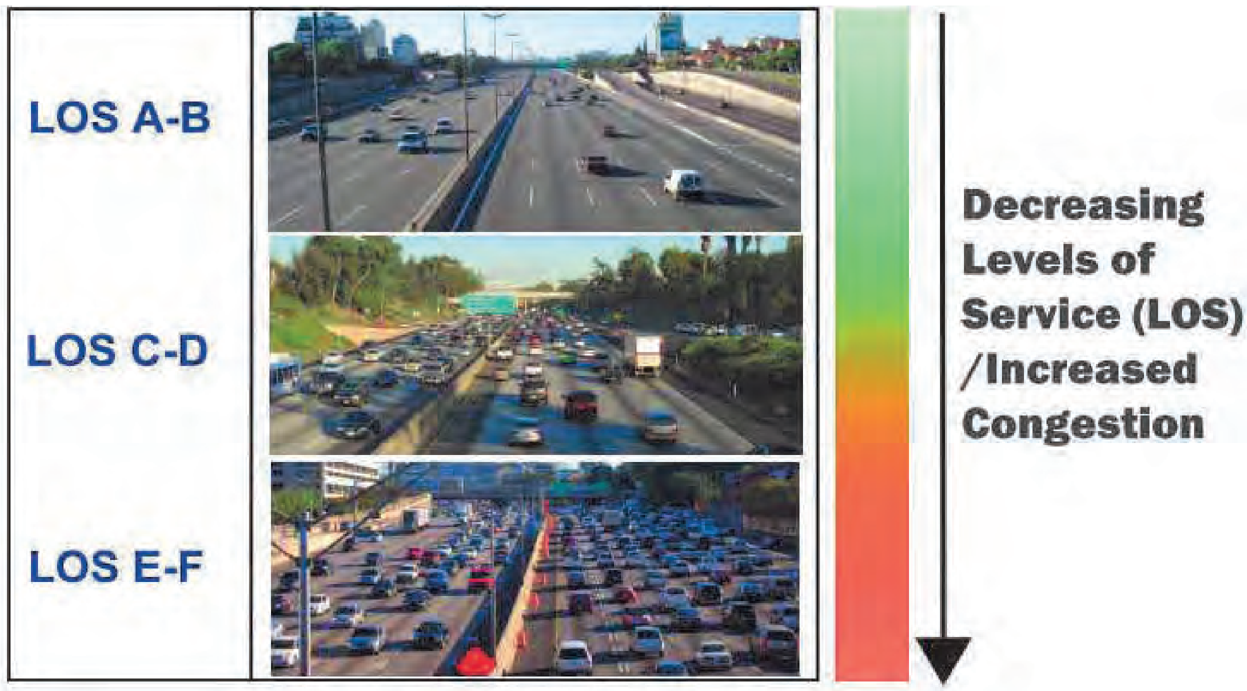


Figure 3-1: Level of Service (LOS) Conditions

3.3 Analysis Methodology for STOP Controlled Intersections

The capacity analysis procedures provide an 'approach delay' for the stop sign controlled approaches to the unsignalized intersections. The intersection LOS "grades" for two-way stop-controlled intersections are as follows in Table 3-1:

Table 3-1: STOP Controlled Intersection Level of Service (LOS) Criteria

Level of Service (LOS)	Average Control Delay (sec/veh)
A	< 10
B	10 to 15
C	15 to 25
D	25 to 35
E	35 to 50
F	> 50

Source: Highway Capacity Manual (TRB, 2016)

3.4 Analysis Methodology for SIGNAL Controlled Intersections

At a signalized intersection, the total delay is dependent upon a number of factors, including when a driver approaches the intersection, the driver's position in the queue and the traffic signal cycle length and green times. The control delay for a signalized intersection is determined for each lane group and aggregated for each approach and for the intersection as a whole.

Table 3-2 below presents the LOS criteria for signalized intersections (based on HCM), which is directly related to the overall intersection control delay value. The intersection LOS for signalized intersections are as follows:

Table 3-2: SIGNAL Controlled Intersection Level of Service (LOS) Criteria

Level of Service (LOS)	Average Control Delay (sec/veh)
A	< 10
B	10 to 20
C	20 to 35
D	35 to 55
E	55 to 80
F	> 80

Source: Highway Capacity Manual (TRB, 2016)

The operational analyses at each study area intersection, for each individual alternative, were evaluated based on these signalized intersection delay thresholds.

4 EXISTING CONDITIONS

4.1 Existing Geometric Configuration and Intersections

The study areas have been defined to include the development's area of influence shown below in Figure 4-1.

Figure 4-1: Analyzed Intersections for Distribution Center preferred location

Figure 4-2 presents the lane configurations for intersections within the study area under existing conditions for FBNA. Existing conditions in this report refer to the current conditions as of April 2022. Site visits were conducted in March 2021 and March 2022 to document the lane configurations in place at that time.

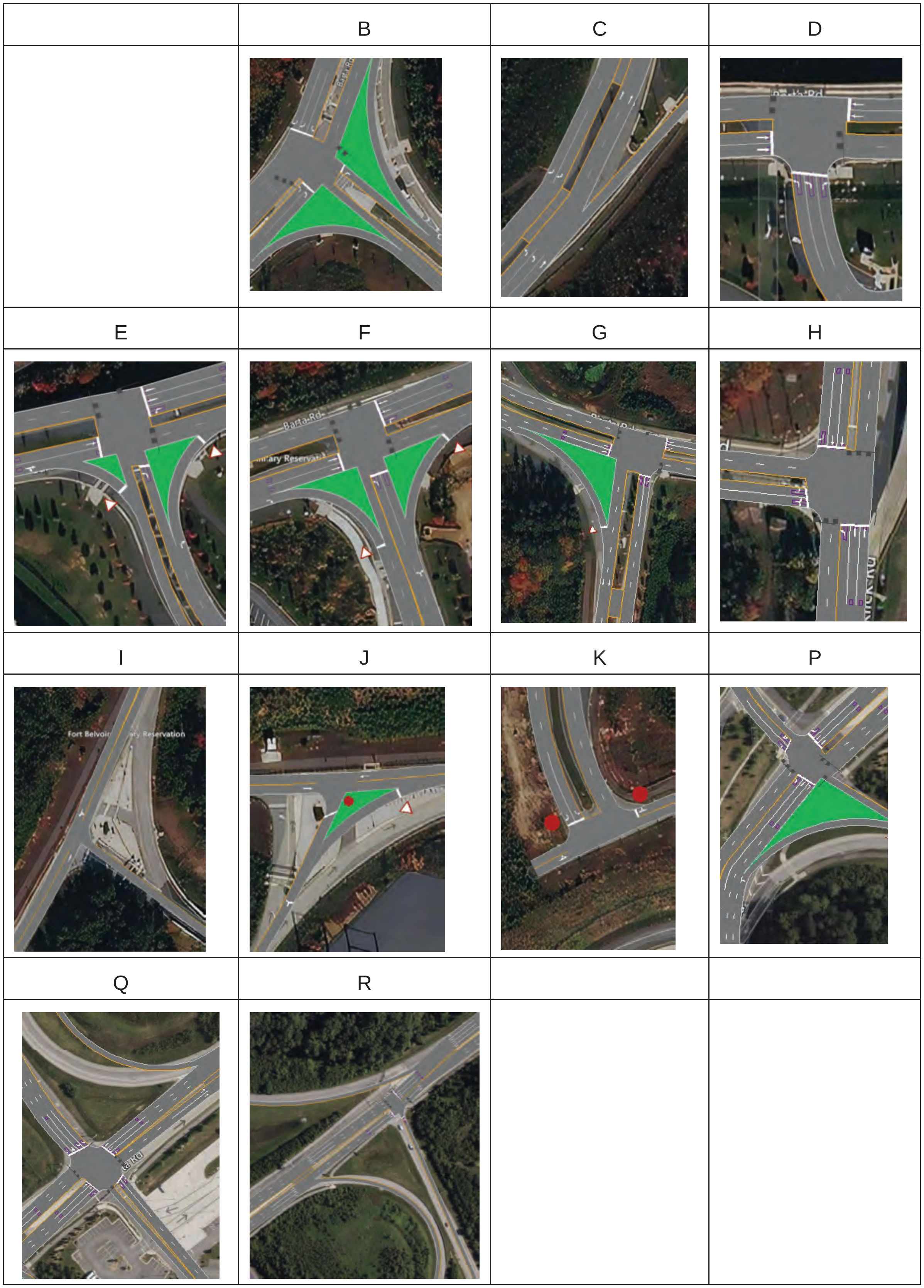


Figure 4-2: Existing Lane Configurations, Fort Belvoir North Area

4.2 Existing Operational Analysis

As previously discussed above, a traffic study was completed in June 2021 for the DIA Annex. Counts for this previous study were performed in March 2021, during a time that experienced decreased traffic as a result of the Covid-19 pandemic. During this time, it was assumed that a portion of FBNA staff worked remotely.

The existing peak hour traffic volume (AM peak and PM peak hours) (Figures 2-2 and 2-3) and the existing lane-use configuration (Figures 4-2) were used in performing the existing (2022) operational analysis. The existing (2022) peak hour volumes were adjusted using a combination of 2021 DIA Annex TIS assumptions, March 2022 counts, and site observations.

4.2.1 Existing (2022) Intersection Operational Analysis

The AM and PM peak hour intersection operational analyses results were evaluated using the Synchro 11 model. They are presented in Table 4-1. The existing year Synchro output files are included in Appendix B.

Due to the nature of the anticipated additional trips, the weekday AM and PM peak periods were the focus of this study. Total volume counts system-wide were calculated from the 2021 intersection (TMC) and ATR data. The following peak hours were identified and compared to Table 2-3.

FBNA

- AM peak period: 7:30am-8:30am;
- PM peak period: 4:15pm-5:15pm.

Table 4-1: Existing Intersection Operational Analysis – FBNA

Intersection ID	Intersection	Signalized (Y/N)	AM	PM	AM	PM
			Delay (s/veh)		LOS	
B	Barta Road / Heller Road	Y	2.5	0.4	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.0	9.5	A	A
E	Barta Road / Main Guest Access	N	-	-	A	A
F	Barta Road / GEOINT Drive	Y	5.5	10.4	A	B
G	Barta Road / Heller Road	Y	9.8	0.4	A	A
H	Barta Road / Backlick Road	Y	7.9	18.9	A	B
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.3	9.3	A	A
Q	Barta Road / SB VA 286 Ramps	Y	6.2	8.4	A	A
R	Barta Road / NB VA 286 Ramps	Y	9.0	11.9	A	B

Existing

- All intersections (AM and PM) operate at LOS B or better.

5 BUILD CONDITIONS

5.1 Proposed Site Development

A location within FBNA has been selected to accommodate the proposed construction and operation of a new 525,000 square foot Distribution Center consolidated complex consisting of a high bay warehouse and a two-story administrative building with associated parking and covered storage for approximately 600 personnel. No changes to existing roadways have been identified. New infrastructure improvements are assumed to be limited to the building, parking structure, intersection along Barta Road, access lanes, and associated site improvements. In addition to the Distribution Center, trips associated with a DIA Annex at FBNA have also been included in modeling.

5.2 Geometric Configuration

No changes in existing roadway geometrics were assumed for this study. A new signalized intersection was modeled at the location, Proposed Distribution Center Entrance, shown on Figure 4-1.

5.3 Trip generation

The Distribution Center construction is estimated to generate 600 additional staff positions. The analysis assumes that each additional staff member generates 0.9 additional AM and PM peak hour trip for both 600 additional staff (Distribution Center) and one (1) additional AM and PM peak hour trip for each 650 additional staff (DIA Annex). In addition, eighteen (18) truck trips have been modeled for both the AM and PM peak hours. The distribution between site access points was determined utilizing the March 2021 count data.

Table 5-1: Trip Generation

Build Development	Scenario Description	Trips	
		AM	PM
Distribution Center	600 Additional Staff	540	540
DIA Annex	650 Additional Staff	650	650

5.4 Distribution of Access Volumes

Estimated percentages of entering and exiting traffic to the DIA Annex were calculated using the March 2021 field counts. Trip distribution for the Distribution Center was estimated based on site access, entrance location, and estimated distribution of new DIA Annex traffic. Table 4-1 and Table 4-2 summarize the distribution of entering and exiting vehicle percentages for each location during peak hours. It was noted that the existing South Gate traffic occurred during off peak times in 2021. The West Gate off Barta Road, however, does not have direct access to the DIA Annex site location. Therefore, this study assumes that the South Gate would provide an alternative access point. The percentage shown below in Table 5-2 and Table 5-3 will be used to distribute expected new trips generated by the new facility for normal conditions.

Table 5-2: Modeled Gate Access Volumes (%) – Distribution Center

	Description	**AM**	**PM**
Belvoir Gate (Enter) / Meade Gate (Exit)			
New	New Gate via Backlick Road	30%	30%
New	New Gate via VA 286 and Barta Road(EB)	70%	70%

Table 5-3: Modeled Gate Access Volume (%) – DIA Annex

Access ID	**Description**	**AM**	**PM**
Existing	West Gate / Parking Garage Exit (Barta Road)	0%	0%
Existing	North Gate (GEOINT Drive)	70%	70%
Existing	South Gate (Heller Road)	30%	30%

Figure 5-1 through Figure 5-2 show the total intersection volumes used for the Build condition. No background growth was used for the two alternative sites.

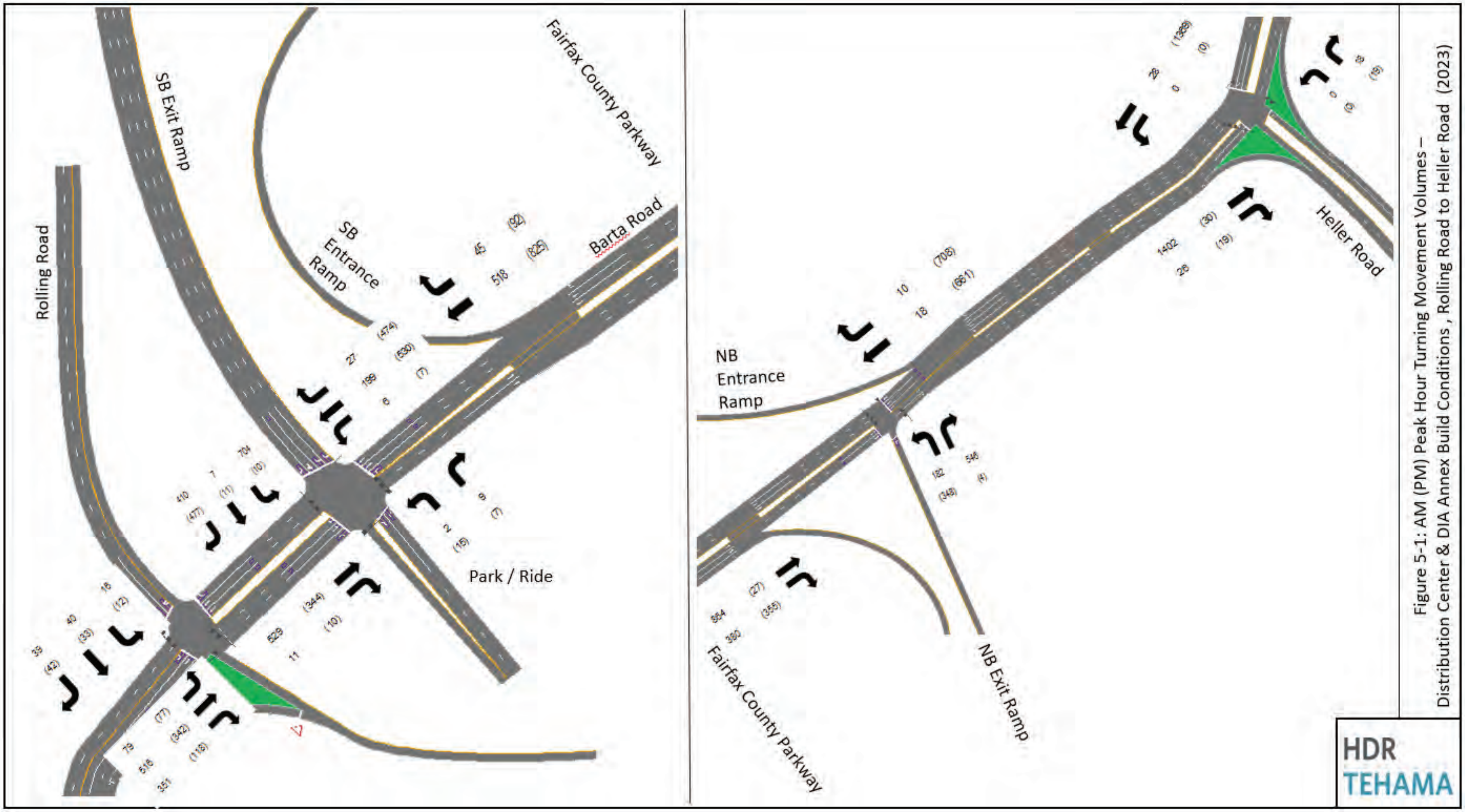


Figure 5-1: AM (PM) Peak Hour Turning Movement Volumes – Distribution Center & DIA Annex Build Conditions , Rolling Road to Heller Road (2023)

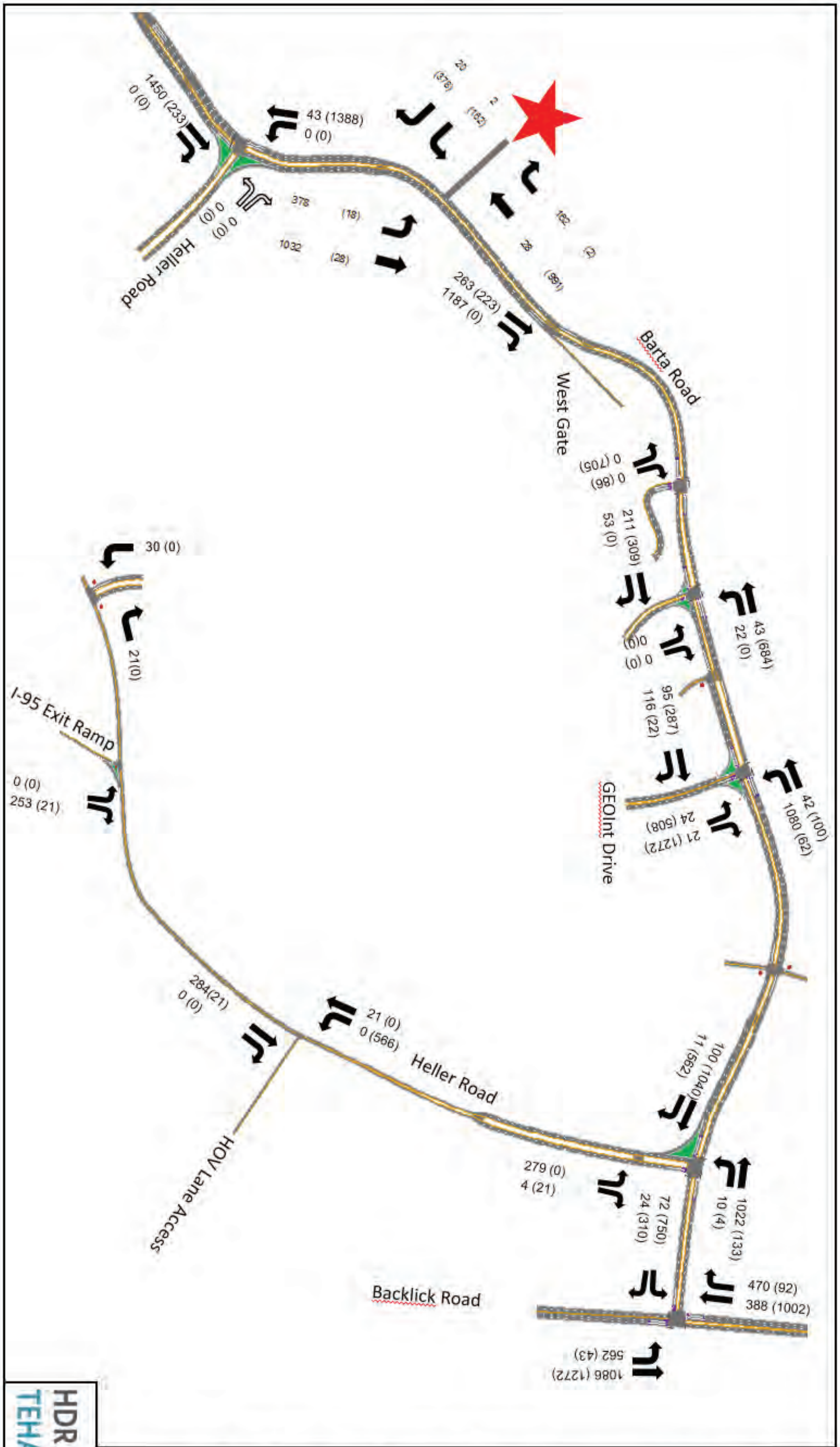


Figure 5-2: AM (PM) Peak Hour Turning Movement Volumes –
Distribution Center & DIA Annex Build Conditions, Heller Road to Backlick Road (2023)

5.5 General Traffic Operations

Synchro traffic analysis models were created for each of the AM and PM peak periods to analyze traffic operations under existing and full-build conditions. The performance results of these models area presented in this section. Full Synchro reports are provided in Appendix B.

5.5.1 Intersections Analysis

Table 5-4 presents the general traffic operations summary for the Build scenario that includes the Distribution Center and planned DIA Annex.

Table 5-4: Build Condition (2023) Intersection Operational Analysis

Int. ID	Intersection	Signalized (Y/N)	*600 Added Personnel (Distribution Center) + 650 Added Personnel (DIA Annex)*			
			AM	PM	AM	PM
			Delay (s/veh)		LOS	
A	New Entrance / Barta Road	Y	4.9	22.7	A	C
B	Barta Road / Heller Road	Y	4.6	0.9	A	A
C	West Gate Entrance	N	-	-	A	A
D	Barta Road / Parking Garage Exit	Y	0.1	7.7	A	A
E	Barta Road / Main Guest Access	N	8.7	11.4	A	B
F	Barta Road / GEOINT Drive	Y	5.8	66.3	A	E
G	Barta Road / Heller Road	Y	9.8	4.7	A	A
H	Barta Road / Backlick Road	Y	8.5	22.2	A	C
I	Heller Road / HOV Entrance Ramp	N	-	-	A	A
J	I-95 Exit Ramp / Heller Road	N	-	-	A	A
K	South Gate Entrance	N	-	-	A	A
P	Barta Road / Rolling Road	Y	8.8	9.7	A	A
Q	Barta Road / SB VA 286 Ramps	Y	7.8	9.4	A	A
R	Barta Road / NB VA 286 Ramps	Y	27.7	11.3	C	B

Build Scenario

- All intersections (AM and PM) operate at LOS C or better with the exception of the intersections of:
    - Barta Road /Geoint Drive (LOS E during the PM peak hour) – Exiting traffic from Geoint Drive creates queues while waiting to turn on to Barta Road.

6 CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis completed in the above sections, the following conclusions can be made:

Traffic Operations

- Existing Conditions
  - The analysis indicates that all signalized intersections are operating at acceptable levels overall (LOS B or better) at both alternate locations.
  - For the unsignalized intersections, the analysis indicates that the majority of the intersections are operating well.
- Build Scenario
  - FBNA – Build Scenario 1 (600 additional personnel – Distribution Center; 650 Additional Personnel – DIA Annex; Total 1250)
    - Intersection F (Barta Road/Geoint Drive) – The increased left/right turning volumes exiting Geoint Drive (PM) decrease the level of service due to added delay. Intersection PM peak LOS drops from LOS B to LOS E. The following are critical movement:
      - AM - WB Barta Road to SB Geoint Drive
      - PM - NB Geoint Drive to both EB & WB Barta Road
    - Intersection H (Barta Road/Backlick Drive) – The additional AM left turns from the south leg of Backlick Road exceed the capacity of the single turn lane and signal timing plan. Intersection PM peak LOS drops from LOS B to LOS C.
      - PM - EB Barta Road to NB Backlick Road
      - PM - SB Backlick Road
- Mitigation
  - Some intersection movements above are shown to have a less than desirable LOS. In these cases, geometric improvements in the form of an additional turn lane and signal optimization may be appropriate.
- Pedestrian and Bicycle Operations
  - Pedestrians are provided shared phasing with appropriate traffic phases. No impacts are expected along Barta Road. Additional connections to the new distribution facility may be appropriate with connection across Barta Road.

Based on the modeling results, the existing roadway system build scenario operates at acceptable levels with the construction of the Distribution Center and added personnel. Low level of service at Geoint Drive in the PM would only be anticipated with the construction of the DIA Annex. LOS E is also expected only for exiting vehicles from Geoint Drive.

7 ACRONYMS AND ABBREVIATIONS

ADT	Average Daily Traffic
ATR	Automated Traffic Recorder
DIA	Defense Intelligence Agency
EBL	Eastbound Left
EBR	Eastbound Right
EBT	Eastbound Thru
Ex	Existing
Ft	Foot
HCM	Highway Capacity Manual
HQ	Headquarters
JV	Joint Venture
LOS	Level of Service
MOE	Measure of Effectiveness
NBL	Northbound Left
NBR	Northbound Right
NBT	Northbound Thru
NGA	National Geospatial-Intelligence Agency
PE	Professional Engineer
s	Seconds
SBL	Southbound Left
SBR	Southbound Right
SBT	Southbound Thru
TIS	Traffic Impact Study
TMC	Turning Movement Count
TRB	Transportation Research Board
USACE	United States Army Corps of Engineers
veh	Vehicle
v/c	volume to capacity
vpd	vehicles per day
WBL	Westbound Left
WBR	Westbound Right
WBT	Westbound Thru

8 REFERENCES

County of Fairfax, 2021	County of Fairfax, Virginia. 2021. *Fairfax County & Franconia-Springfield Parkways: Alternatives Analysis & Long-Term Planning Study*.
HDR & Tehama, 2021	Appendix D: Traffic Impact Study to Support National Environmental Policy Act Documentation for DIA HQ Annex, REVISED DRAFT. In *Defense Intelligence Agency (DIA) Headquarters (HQ) Annex Environmental Assessment*, Fort Belvoir, Virginia, October 2021. Prepared for U.S. Army Corps of Engineers, Baltimore District and U.S. Army Garrison Fort Belvoir. June 2021.
TRB, 2016	Transportation Research Board (TRB) Highway Capacity Manual (HCM), 6th Edition: A Guide for Multimodal Mobility Analysis. Washington, DC: The National Academies Press.

APPENDIX A

Traffic Data

AM Counts

Barta Road at Rolling Road

1-Mar-22													
	Rolling Road From North			Barta From East			Ramp From South			Barta From West			Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
6:00:00 AM	5	7	2	4	36	0	0	0	0	50	29	2	135
6:15:00 AM	2	8	3	4	29	0	0	0	0	70	26	0	143
6:30:00 AM	6	11	1	2	53	0	0	0	0	67	40	6	186
6:45:00 AM	10	8	2	1	67	0	0	0	0	70	55	4	217
7:00:00 AM	7	14	2	5	54	0	0	0	0	69	82	9	242
7:15:00 AM	16	15	2	2	83	0	0	0	0	88	106	16	328
7:30:00 AM	7	14	1	3	92	0	0	0	0	102	107	24	350
7:45:00 AM	11	15	3	14	102	0	0	0	0	95	110	26	376
8:00:00 AM	11	7	4	4	152	0	0	0	0	87	98	22	385
8:15:00 AM	6	11	1	17	141	0	0	0	0	76	119	19	390
8:30:00 AM	11	7	3	10	123	0	0	0	0	93	107	12	366
8:45:00 AM	16	11	7	7	160	0	0	0	0	86	70	13	370

Barta Road at SB Ramp / Comm Parking

1-Mar-22													
	SB Ramp / Comme Lot			Barta From East			Comm. Lot From South			Barta From West			Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
5:45:00 AM	19	10	62	0	10	2	2	0	4	6	21	0	141
6:00:00 AM	24	3	65	0	10	3	4	0	0	3	27	0	139
6:15:00 AM	32	1	93	0	20	1	5	0	4	3	43	0	202
6:30:00 AM	39	0	71	4	22	1	3	0	3	4	49	0	196
6:45:00 AM	42	4	97	3	19	0	2	0	2	5	66	0	240
7:00:00 AM	36	1	112	7	30	3	4	0	1	1	109	0	304
7:15:00 AM	79	1	92	3	26	1	3	0	0	4	97	0	306
7:30:00 AM	92	2	104	5	35	2	0	0	0	1	121	0	362
7:45:00 AM	115	2	93	16	44	2	3	0	2	1	104	0	382
8:00:00 AM	112	1	101	4	65	0	3	0	0	5	103	1	395
8:15:00 AM	91	2	98	2	55	2	3	0	0	4	114	0	371
8:30:00 AM	99	1	67	5	72	1	3	0	1	6	87	0	342

Barta Road at NB Ramp

1-Mar-22													
	NB Ramp From North			Barta From East			NB Ramp From South			Barta From West			Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
5:45:00 AM	0	0	0	3	7	0	53	0	15	15	64	0	157
6:00:00 AM	0	0	0	1	4	0	40	0	19	23	93	0	180
6:15:00 AM	0	0	0	0	3	0	55	0	20	40	94	0	212
6:30:00 AM	0	0	0	1	2	0	48	0	19	39	134	0	243
6:45:00 AM	0	0	0	1	4	0	38	0	30	53	121	0	247
7:00:00 AM	0	0	0	3	2	0	57	0	26	82	121	0	291
7:15:00 AM	0	0	0	2	7	0	67	0	35	87	107	0	305
7:30:00 AM	0	0	0	3	3	0	39	0	39	95	151	0	330
7:45:00 AM	0	0	0	1	1	0	48	0	48	107	96	0	301
8:00:00 AM	0	0	0	0	7	0	51	0	60	91	115	0	324
8:15:00 AM	0	0	0	3	7	0	40	1	53	92	108	0	304
8:30:00 AM	0	0	0	1	5	0	36	0	65	69	96	0	272

Barta Road at Heller Road

1-Mar-22													
	4 From North			B From East			4 From South			B From West			Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	
6:00:00 AM	0	0	0	0	0	0	0	0	0	3	0	0	3
6:15:00 AM	0	0	0	0	0	0	0	0	0	3	0	0	3
6:30:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1
6:45:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1
7:00:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1
7:15:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1
7:30:00 AM	0	0	0	0	0	0	0	0	1	1	0	0	2
7:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00:00 AM	0	0	0	0	0	0	0	0	1	2	0	0	3
8:15:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1
8:30:00 AM	0	0	0	0	0	0	0	0	1	1	0	0	2
8:45:00 AM	0	0	0	0	0	0	0	0	0	1	0	0	1

PM Counts

Barta Road at Rolling Road

2-Mar-22

	Rolling Road From North			Barta From East			SB Ramp From South			Barta From West				Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		
2:45:00 PM	10	9	4	11	144	0	0	0	0	84	80	12		354
3:00:00 PM	9	5	0	15	155	0	0	0	0	72	76	18		350
3:15:00 PM	11	9	3	19	135	0	0	0	0	56	87	16		336
3:30:00 PM	14	1	1	14	140	0	0	0	0	64	58	15		307
3:45:00 PM	9	5	2	16	156	0	0	0	0	60	55	24		327
4:00:00 PM	13	7	1	15	209	0	0	0	0	64	81	19		409
4:15:00 PM	13	11	2	32	176	1	0	0	0	69	91	25		420
4:30:00 PM	10	4	2	22	193	0	0	0	0	85	87	22		425
4:45:00 PM	9	11	2	12	145	0	0	0	0	70	69	15		333
5:00:00 PM	11	11	5	25	200	0	0	0	0	80	84	18		434
5:15:00 PM	12	7	3	28	205	0	0	0	0	63	102	22		442
5:30:00 PM	7	4	2	25	187	0	0	0	0	55	73	22		375

Barta Road at SB Ramp / Comm Parking

2-Mar-22

	SB Ramp From North			Barta From East			Comm. Lot From South			Barta From West				Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		
2:45:00 PM	100	1	2	33	73	2	1	0	0	1	82	0		295
3:00:00 PM	98	0	2	76	95	0	0	0	0	0	77	0		348
3:15:00 PM	102	1	4	25	82	0	2	0	2	1	100	0		319
3:30:00 PM	117	0	4	33	71	1	0	1	0	2	63	0		292
3:45:00 PM	93	2	4	36	92	4	1	0	5	3	60	0		300
4:00:00 PM	126	1	5	49	102	1	2	0	4	1	85	0		376
4:15:00 PM	117	5	4	40	105	3	0	0	4	2	93	0		373
4:30:00 PM	116	3	0	31	131	2	1	0	5	3	94	0		386
4:45:00 PM	118	2	1	13	105	1	4	0	2	3	72	0		321
5:00:00 PM	117	3	1	25	118	0	0	0	4	2	97	1		368
5:15:00 PM	121	2	2	23	119	1	1	0	5	2	102	0		378
5:30:00 PM	121	2	0	21	100	1	1	0	1	0	69	3		319

Barta Road at NB Ramp

2-Mar-22

	NB Ramp From North			Barta From East			NB Ramp From South			Barta From West				Total Veh.
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left		
2:45:00 PM	0	0	0	70	49	0	3	0	44	66	8	0		240
3:00:00 PM	0	0	0	106	97	0	2	0	56	73	8	0		342
3:15:00 PM	0	0	0	73	62	0	2	0	68	83	10	0		298
3:30:00 PM	0	0	0	90	65	0	2	0	53	56	5	0		271
3:45:00 PM	0	0	0	95	52	0	1	0	49	72	10	0		279
4:00:00 PM	0	0	0	104	68	0	2	0	50	69	3	0		296
4:15:00 PM	0	0	0	88	55	0	2	0	87	83	6	0		321
4:30:00 PM	0	0	0	82	52	0	0	0	82	81	8	0		305
4:45:00 PM	0	0	0	77	44	0	1	0	79	90	6	0		297
5:00:00 PM	0	0	0	78	38	0	1	0	100	101	7	0		325
5:15:00 PM	0	0	0	71	47	0	1	0	63	91	4	0		277
5:30:00 PM	0	0	0	65	43	0	0	0	82	97	10	0		297

Barta Road at Heller Road

2-Mar-22

	Heller From North			Barta From East			Heller From South			Barta From West				Total Veh.
Start Time	Right	Thru	Left	Right *	Thru *	Left	Right *	Thru	Left	Right	Thru	Left		
2:45:00 PM	0	0	0	70	49	0	3	0	0	0	0	0		4
3:00:00 PM	0	0	0	106	97	0	2	0	0	0	0	0		2
3:15:00 PM	0	0	0	73	62	0	2	0	0	0	0	0		2
3:30:00 PM	0	0	0	90	65	0	2	0	0	0	0	0		2
3:45:00 PM	0	0	0	95	52	0	1	0	0	0	0	0		1
4:00:00 PM	0	0	0	104	68	0	2	0	0	0	0	0		2
4:15:00 PM	0	0	0	88	55	0	2	0	0	0	0	0		2
4:30:00 PM	0	0	0	82	52	0	0	0	0	0	0	0		0
4:45:00 PM	0	0	0	77	44	0	1	0	0	0	0	0		1
5:00:00 PM	0	0	0	78	38	0	1	0	0	0	0	0		1
5:15:00 PM	0	0	0	71	47	0	1	0	0	0	0	0		1
5:30:00 PM	0	0	0	65	43	0	0	0	0	0	0	0		0

movements at Intersection NB Ramp

APPENDIX B

Synchro Files

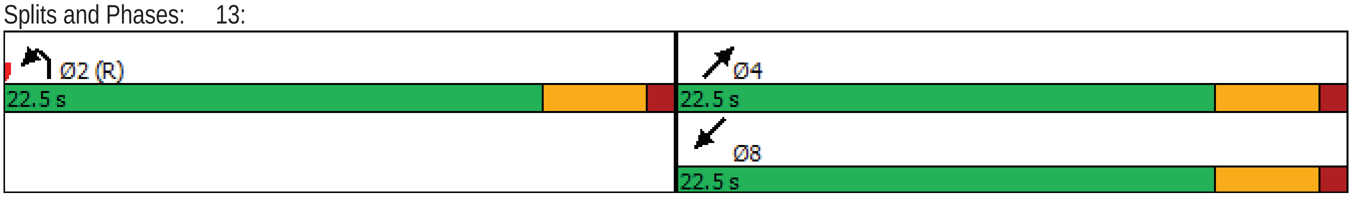
AM Existing LOS

Lane Group	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	214	205	469	0	0	18
Future Volume (vph)	214	205	469	0	0	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt	0.934					
Flt Protected	0.975					
Satd. Flow (prot)	1696	0	3539	0	0	5085
Flt Permitted	0.975					
Satd. Flow (perm)	1696	0	3539	0	0	5085
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	128					
Link Speed (mph)	30		30			30
Link Distance (ft)	765		397			221
Travel Time (s)	17.4		9.0			5.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	223	510	0	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	456	0	510	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		6			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60		60	60	
Turn Type	Prot		NA			NA
Protected Phases	2		4			8
Permitted Phases						
Minimum Split (s)	22.5		22.5			22.5
Total Split (s)	22.5		22.5			22.5
Total Split (%)	50.0%		50.0%			50.0%
Maximum Green (s)	18.0		18.0			18.0
Yellow Time (s)	3.5		3.5			3.5
All-Red Time (s)	1.0		1.0			1.0
Lost Time Adjust (s)	0.0		0.0			0.0
Total Lost Time (s)	4.5		4.5			4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0			7.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	5		5			5
Act Effct Green (s)	18.0		18.0			18.0
Actuated g/C Ratio	0.40		0.40			0.40
v/c Ratio	0.60		0.36			0.01
Control Delay	11.6		6.7			8.2
Queue Delay	0.0		0.0			0.0
Total Delay	11.6		6.7			8.2

Lane Group	NBL	NBR	NET	NER	SWL	SWT
LOS	B		A			A
Approach Delay	11.6		6.7			8.2
Approach LOS	B		A			A
Queue Length 50th (ft)	59		34			1
Queue Length 95th (ft)	131		51			4
Internal Link Dist (ft)	685		317			141
Turn Bay Length (ft)						
Base Capacity (vph)	755		1415			2034
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.60		0.36			0.01

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 9.0	Intersection LOS: A
Intersection Capacity Utilization 44.9%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13:



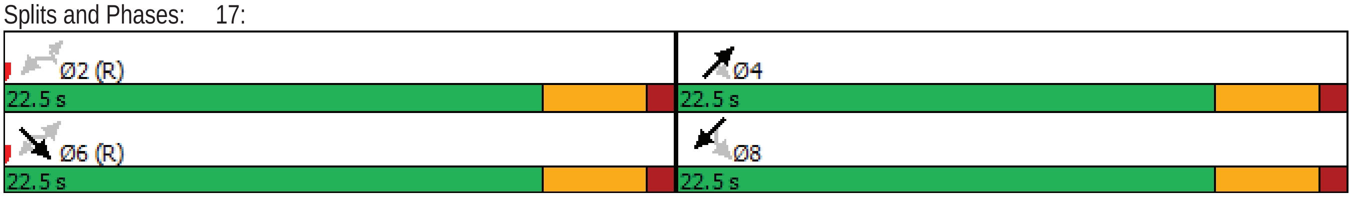
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	396	7	410	2	0	9	0	442	11	6	199	0
Future Volume (vph)	396	7	410	2	0	9	0	442	11	6	199	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.855	0.850			0.850			0.850			
Flt Protected	0.950			0.950						0.950		
Satd. Flow (prot)	3433	1513	1504	1770	0	1583	0	3539	1583	1770	3539	0
Flt Permitted	0.950			0.610						0.478		
Satd. Flow (perm)	3433	1513	1504	1136	0	1583	0	3539	1583	890	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		219	227			36			36			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		872			347			301			374	
Travel Time (s)		19.8			7.9			6.8			8.5	
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
Adj. Flow (vph)	430	8	446	2	0	10	0	480	12	7	216	0
Shared Lane Traffic (%)			49%									
Lane Group Flow (vph)	430	227	227	2	0	10	0	480	12	7	216	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60		60	60		60	60		60	60		60
Turn Type	Perm	NA	Perm	Perm		Perm		NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6	2		2			4	8		
Minimum Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%		50.0%		50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5		3.5		3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0		1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5		4.5	4.5	4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0		7.0		7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0		11.0		11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	5	5	5	5		5		5	5	5	5	
Act Effct Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40		0.40		0.40	0.40	0.40	0.40	
v/c Ratio	0.31	0.31	0.31	0.00		0.02		0.34	0.02	0.02	0.15	
Control Delay	10.1	3.2	3.0	8.0		1.0		4.6	0.2	9.8	8.9	
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Delay	10.1	3.2	3.0	8.0		1.0		4.6	0.2	9.8	8.9	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
LOS	B	A	A	A		A		A	A	A	A	
Approach Delay		6.5			2.2			4.5			9.0	
Approach LOS		A			A			A			A	
Queue Length 50th (ft)	37	1	0	0		0		13	0	1	12	
Queue Length 95th (ft)	61	32	30	3		2		20	m0	m2	m31	
Internal Link Dist (ft)		792			267			221			294	
Turn Bay Length (ft)												
Base Capacity (vph)	1373	736	737	454		654		1415	654	356	1415	
Starvation Cap Reductn	0	0	0	0		0		0	0	0	0	
Spillback Cap Reductn	0	0	0	0		0		0	0	0	0	
Storage Cap Reductn	0	0	0	0		0		0	0	0	0	
Reduced v/c Ratio	0.31	0.31	0.31	0.00		0.02		0.34	0.02	0.02	0.15	

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NWL and 6:SETL, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.34	
Intersection Signal Delay: 6.2	Intersection LOS: A
Intersection Capacity Utilization 38.9%	ICU Level of Service A
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 17:



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	0	0	60	0	0
Future Volume (vph)	144	0	0	60	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	3539	0	0	3539	0	1863
Flt Permitted						
Satd. Flow (perm)	3539	0	0	3539	0	1863
Link Speed (mph)	30			30	30	
Link Distance (ft)	404			491	211	
Travel Time (s)	9.2			11.2	4.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	157	0	0	65	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	157	0	0	65	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	12			24	0	
Link Offset(ft)	0			6	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 7.3%	ICU Level of Service A
Analysis Period (min) 15	

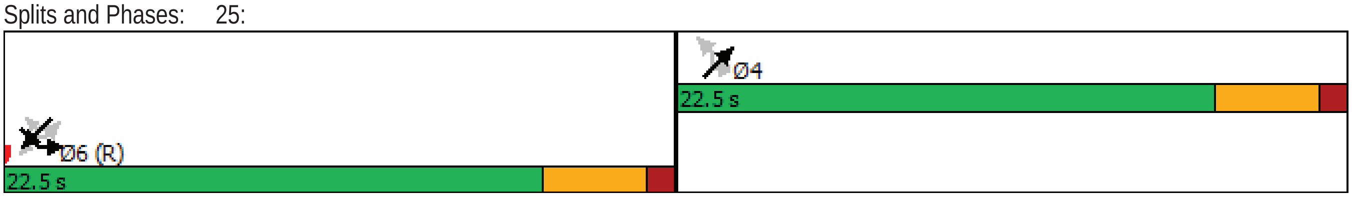
Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	11	40	39	79	434	351	0	518	45
Future Volume (vph)	0	0	11	40	39	79	434	351	0	518	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	0	250		0	0		0
Storage Lanes	0	0		1	1	1		1	0		1
Taper Length (ft)	100			100		100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt					0.850			0.850			0.850
Flt Protected				0.950		0.950					
Satd. Flow (prot)	0	0	0	1770	1583	1770	3539	1583	0	3539	1583
Flt Permitted				0.950		0.441					
Satd. Flow (perm)	0	0	0	1770	1583	821	3539	1583	0	3539	1583
Right Turn on Red					Yes			Yes			Yes
Satd. Flow (RTOR)					42			382			49
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	601			719			925			301	
Travel Time (s)	13.7			16.3			21.0			6.8	
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
Adj. Flow (vph)	0	0	12	43	42	86	472	382	0	563	49
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	0	0	55	42	86	472	382	0	563	49
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	0			12			12			12	
Link Offset(ft)	0			0			0			0	
Crosswalk Width(ft)	10			10			10			10	
Two way Left Turn Lane											
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60	60	60	60		60	60		60
Turn Type			D.Pm	Prot	Perm	Perm	NA	Perm		NA	Perm
Protected Phases				6!			4			6!	
Permitted Phases			6!		6	4		4			6
Minimum Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (%)			50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%
Maximum Green (s)			18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0
Yellow Time (s)			3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)			1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)				4.5	4.5	4.5	4.5	4.5		4.5	4.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)			11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)			5	5	5	5	5	5		5	5
Act Effct Green (s)				18.0	18.0	18.0	18.0	18.0		18.0	18.0
Actuated g/C Ratio				0.40	0.40	0.40	0.40	0.40		0.40	0.40
v/c Ratio				0.08	0.06	0.26	0.33	0.44		0.40	0.07

Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Control Delay				8.8	3.8	11.7	10.2	3.2		10.4	3.3
Queue Delay				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay				8.8	3.8	11.7	10.2	3.2		10.4	3.3
LOS				A	A	B	B	A		B	A
Approach Delay				6.6			7.5			9.8	
Approach LOS				A			A			A	
Queue Length 50th (ft)				8	0	14	42	0		58	0
Queue Length 95th (ft)				24	12	39	68	38		75	11
Internal Link Dist (ft)	521			639			845			221	
Turn Bay Length (ft)						250					
Base Capacity (vph)				708	658	328	1415	862		1415	662
Starvation Cap Reductn				0	0	0	0	0		0	0
Spillback Cap Reductn				0	0	0	0	0		0	0
Storage Cap Reductn				0	0	0	0	0		0	0
Reduced v/c Ratio				0.08	0.06	0.26	0.33	0.44		0.40	0.07

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2: and 6:SESW, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.44
Intersection Signal Delay: 8.3 Intersection LOS: A
Intersection Capacity Utilization 34.1% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 25:



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	673	28	0
Future Volume (vph)	0	0	0	673	28	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	250			150
Storage Lanes	1	1	1			1
Taper Length (ft)	100		25			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	1863	1863	3539	3539	1863
Flt Permitted						
Satd. Flow (perm)	1863	1863	1863	3539	3539	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	755			451	920	
Travel Time (s)	17.2			10.3	20.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	732	30	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	732	30	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	6	
Link Offset(ft)	0			-6	6	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (ft)	20	20	20	100	100	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	5	5	5	5	5	5
Act Effct Green (s)				39.6	39.6	
Actuated g/C Ratio				0.88	0.88	
v/c Ratio				0.24	0.01	
Control Delay				3.4	3.0	
Queue Delay				0.0	0.0	
Total Delay				3.4	3.0	
LOS				A	A	
Approach Delay				3.4	3.0	
Approach LOS				A	A	
Queue Length 50th (ft)				0	0	
Queue Length 95th (ft)				109	11	
Internal Link Dist (ft)	675			371	840	
Turn Bay Length (ft)						
Base Capacity (vph)				3114	3114	
Starvation Cap Reductn				0	0	
Spillback Cap Reductn				0	0	
Storage Cap Reductn				0	0	
Reduced v/c Ratio				0.24	0.01	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 45

Control Type: Actuated-Coordinated

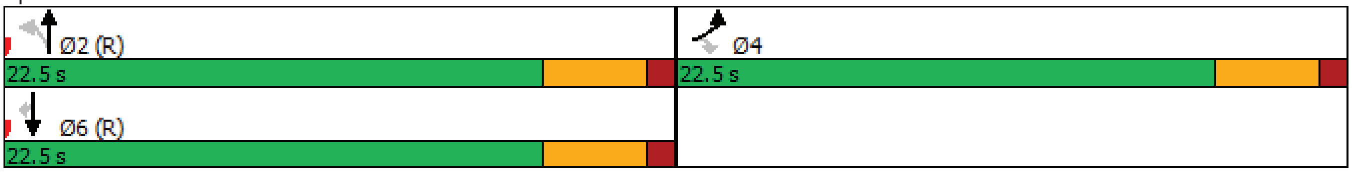
Maximum v/c Ratio: 0.24

Intersection Signal Delay: 3.4 Intersection LOS: A

Intersection Capacity Utilization 22.4% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 28:



Lane Group	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	28	165	508	0	0
Future Volume (vph)	0	28	165	508	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	1.00
Frt		0.850				
Flt Protected			0.950	0.998		
Satd. Flow (prot)	0	2787	1681	1766	0	0
Flt Permitted			0.950	0.998		
Satd. Flow (perm)	0	2787	1681	1766	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	227			920	549	
Travel Time (s)	5.2			20.9	12.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	30	179	552	0	0
Shared Lane Traffic (%)			10%			
Lane Group Flow (vph)	0	30	161	570	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			36	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 27.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	847	205	27
Future Volume (vph)	0	0	0	847	205	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	3539	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	3539	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	818			374	654	
Travel Time (s)	18.6			8.5	14.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	921	223	29
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	921	223	29
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Sign Control	Free			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 26.7% ICU Level of Service A

Analysis Period (min) 15

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations			↑↑	↱		↑↑↑
Traffic Volume (vph)	0	0	469	380	0	232
Future Volume (vph)	0	0	469	380	0	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt				0.850		
Flt Protected						
Satd. Flow (prot)	0	0	3539	1583	0	5085
Flt Permitted						
Satd. Flow (perm)	0	0	3539	1583	0	5085
Link Speed (mph)	30		30			30
Link Distance (ft)	815		654			397
Travel Time (s)	18.5		14.9			9.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	510	413	0	252
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	510	413	0	252
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60		60	60	
Sign Control	Free		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 44.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	674	18	10
Future Volume (vph)	0	0	0	674	18	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	5085	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	5085	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	1042			221	359	
Travel Time (s)	23.7			5.0	8.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	733	20	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	733	20	11
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	8			0	6	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 22.0%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lane Configurations						
Traffic Volume (vph)	0	28	0	7	666	8
Future Volume (vph)	0	28	0	7	666	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0	500	0	0
Storage Lanes	1	2	1	1	2	1
Taper Length (ft)	25		25		25	
Lane Util. Factor	1.00	0.88	1.00	1.00	0.97	1.00
Frt		0.850		0.850		0.850
Flt Protected					0.950	
Satd. Flow (prot)	1863	2787	1863	1583	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	1863	2787	1863	1583	3433	1583
Right Turn on Red		Yes		Yes		Yes
Satd. Flow (RTOR)		1920		492		9
Link Speed (mph)	30		30		30	
Link Distance (ft)	570		723		430	
Travel Time (s)	13.0		16.4		9.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	30	0	8	724	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	30	0	8	724	9
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	30		32		32	
Link Offset(ft)	30		0		0	
Crosswalk Width(ft)	10		10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	9	15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Thru	Thru	Thru	Thru	Thru
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	Prot	pt+ov	Prot	Perm	Prot	Perm
Protected Phases	5	5 6	4		6	
Permitted Phases				4		6
Detector Phase	5	5 6	4	4	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	15.5		15.5	15.5	19.0	19.0
Total Split (%)	31.0%		31.0%	31.0%	38.0%	38.0%
Maximum Green (s)	11.0		11.0	11.0	14.5	14.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag	Lead				Lag	Lag

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lead-Lag Optimize?	Yes				Yes	Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	C-Max	C-Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)		47.1		5.5	45.1	45.1
Actuated g/C Ratio		0.94		0.11	0.90	0.90
v/c Ratio		0.01		0.01	0.23	0.01
Control Delay		0.0		0.0	2.6	2.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		0.0		0.0	2.6	2.8
LOS		A		A	A	A
Approach Delay					2.6	
Approach LOS					A	
Queue Length 50th (ft)		0		0	0	0
Queue Length 95th (ft)		0		0	92	5
Internal Link Dist (ft)	490		643		350	
Turn Bay Length (ft)				500		
Base Capacity (vph)		2737		732	3096	1429
Starvation Cap Reductn		0		0	0	0
Spillback Cap Reductn		0		0	0	0
Storage Cap Reductn		0		0	0	0
Reduced v/c Ratio		0.01		0.01	0.23	0.01

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 6:NEL, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.23

Intersection Signal Delay: 2.4 Intersection LOS: A

Intersection Capacity Utilization 22.7% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 102:

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	165	0	0	28	0	0
Future Volume (vph)	165	0	0	28	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	3539	0	0	3539	3614	1863
Flt Permitted						
Satd. Flow (perm)	3539	0	0	3539	3614	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	923			533	500	
Travel Time (s)	21.0			12.1	11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	179	0	0	30	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	179	0	0	30	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2			2	1	1
Detector Template	Thru			Thru	Left	Right
Leading Detector (ft)	100			100	20	20
Trailing Detector (ft)	0			0	0	0
Detector 1 Position(ft)	0			0	0	0
Detector 1 Size(ft)	6			6	20	20
Detector 1 Type	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0			0.0	0.0	0.0
Detector 1 Queue (s)	0.0			0.0	0.0	0.0
Detector 1 Delay (s)	0.0			0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA			NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases						4
Detector Phase	6			2	4	4
Switch Phase						
Minimum Initial (s)	5.0			5.0	5.0	5.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	22.5			22.5	22.5	22.5
Total Split (s)	22.5			22.5	22.5	22.5
Total Split (%)	50.0%			50.0%	50.0%	50.0%
Maximum Green (s)	18.0			18.0	18.0	18.0
Yellow Time (s)	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0
Total Lost Time (s)	4.5			4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Recall Mode	C-Max			C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	45.0			45.0		
Actuated g/C Ratio	1.00			1.00		
v/c Ratio	0.05			0.01		
Control Delay	0.0			0.0		
Queue Delay	0.0			0.0		
Total Delay	0.0			0.0		
LOS	A			A		
Approach Delay						
Approach LOS						
Queue Length 50th (ft)	0			0		
Queue Length 95th (ft)	0			1		
Internal Link Dist (ft)	843			453	420	
Turn Bay Length (ft)						
Base Capacity (vph)	3539			3539		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.05			0.01		

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green

Natural Cycle: 45

Control Type: Actuated-Coordinated

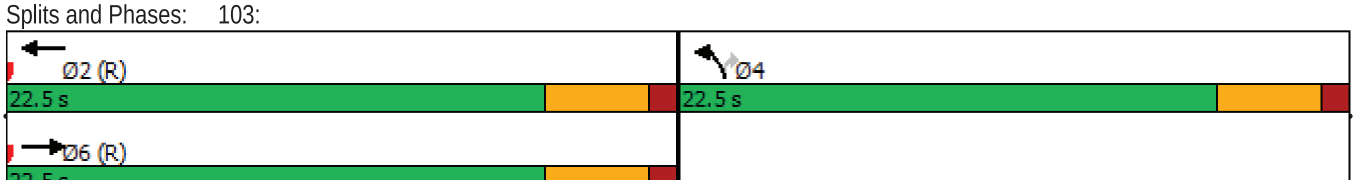
Maximum v/c Ratio: 0.05

Intersection Signal Delay: 0.0 Intersection LOS: A

Intersection Capacity Utilization 8.3% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 103:

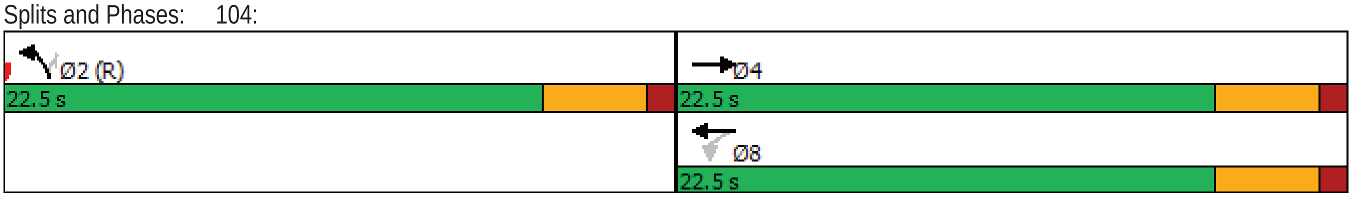


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	21	32	28	0	0
Future Volume (vph)	144	21	32	28	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.981					
Flt Protected			0.950			
Satd. Flow (prot)	3472	0	1770	3539	1863	1863
Flt Permitted			0.638			
Satd. Flow (perm)	3472	0	1188	3539	1863	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	23					
Link Speed (mph)	30			30	30	
Link Distance (ft)	533			404	428	
Travel Time (s)	12.1			9.2	9.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	157	23	35	30	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	180	0	35	30	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	20	
Link Offset(ft)	-12			8	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (%)	50.0%		50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0		18.0	18.0	18.0	18.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	18.0		18.0	18.0		
Actuated g/C Ratio	0.40		0.40	0.40		
v/c Ratio	0.13		0.07	0.02		
Control Delay	6.1		9.0	8.3		
Queue Delay	0.0		0.0	0.0		
Total Delay	6.1		9.0	8.3		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
LOS	A		A	A		
Approach Delay	6.1			8.7		
Approach LOS	A			A		
Queue Length 50th (ft)	12		5	2		
Queue Length 95th (ft)	14		18	7		
Internal Link Dist (ft)	453			324	348	
Turn Bay Length (ft)						
Base Capacity (vph)	1402		475	1415		
Starvation Cap Reductn	0		0	0		
Spillback Cap Reductn	0		0	0		
Storage Cap Reductn	0		0	0		
Reduced v/c Ratio	0.13		0.07	0.02		

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.13	
Intersection Signal Delay: 6.7	Intersection LOS: A
Intersection Capacity Utilization 16.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 104:



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	87	57	544	39	22	19
Future Volume (vph)	87	57	544	39	22	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95
Frt		0.850			0.930	
Flt Protected			0.950		0.974	
Satd. Flow (prot)	3539	1583	1770	3539	3273	0
Flt Permitted			0.581		0.974	
Satd. Flow (perm)	3539	1583	1082	3539	3273	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		62			21	
Link Speed (mph)	30			30	30	
Link Distance (ft)	491			971	1149	
Travel Time (s)	11.2			22.1	26.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	62	591	42	24	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	95	62	591	42	45	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (ft)	100	20	20	100	20	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	6	20	20	6	20	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	pm+pt	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases		6	2			
Detector Phase	6	6	5	2	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	20.0	20.0	9.5	22.5	15.0	
Total Split (s)	15.0	15.0	20.0	35.0	15.0	
Total Split (%)	30.0%	30.0%	40.0%	70.0%	30.0%	
Maximum Green (s)	10.5	10.5	15.5	30.5	10.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	None	C-Max	None	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	26.1	26.1	41.1	43.8	6.0	
Actuated g/C Ratio	0.52	0.52	0.82	0.88	0.12	
v/c Ratio	0.05	0.07	0.57	0.01	0.11	
Control Delay	11.3	5.8	4.2	1.3	13.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	11.3	5.8	4.2	1.3	13.9	
LOS	B	A	A	A	B	
Approach Delay	9.1			4.0	13.9	
Approach LOS	A			A	B	
Queue Length 50th (ft)	3	0	1	0	3	
Queue Length 95th (ft)	26	23	75	m3	14	
Internal Link Dist (ft)	411			891	1069	
Turn Bay Length (ft)						
Base Capacity (vph)	1848	856	1112	3099	703	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.07	0.53	0.01	0.06	

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.57

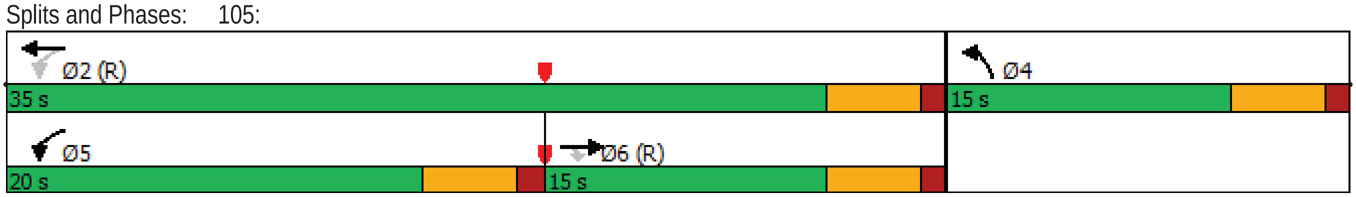
Intersection Signal Delay: 5.5 Intersection LOS: A

Intersection Capacity Utilization 48.5% ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 105:



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	99	7	150	582	15	0	0	4	0	0	0
Future Volume (vph)	0	99	7	150	582	15	0	0	4	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990			0.997			0.865				
Flt Protected					0.990							
Satd. Flow (prot)	0	3504	0	0	3493	0	0	1611	0	0	1863	0
Flt Permitted					0.990							
Satd. Flow (perm)	0	3504	0	0	3493	0	0	1611	0	0	1863	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		971			260			262			305	
Travel Time (s)		22.1			5.9			6.0			6.9	
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
Adj. Flow (vph)	0	108	8	163	633	16	0	0	4	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	116	0	0	812	0	0	4	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 34.2% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	92	10	9	540	207	4
Future Volume (vph)	92	10	9	540	207	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	12	12	12
Lane Util. Factor	0.95	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected				0.999	0.950	
Satd. Flow (prot)	3539	1689	0	3536	1770	1583
Flt Permitted				0.952	0.950	
Satd. Flow (perm)	3539	1689	0	3369	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		11				4
Link Speed (mph)	30			30	30	
Link Distance (ft)	777			738	307	
Travel Time (s)	17.7			16.8	7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	11	10	587	225	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	11	0	597	225	4
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	R NA	Left	Left	Left	Right
Median Width(ft)	16			16	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	0.92	1.00	1.00	1.00	1.00
Turning Speed (mph)		15	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	6		5	2	4	
Permitted Phases		6	2			4
Detector Phase	6	6	5	2	4	4
Switch Phase						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	9.5	22.5	22.5	22.5
Total Split (s)	20.0	20.0	8.5	28.5	21.5	21.5
Total Split (%)	40.0%	40.0%	17.0%	57.0%	43.0%	43.0%
Maximum Green (s)	15.5	15.5	4.0	24.0	17.0	17.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	None	C-Max	None	None
Walk Time (s)	7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0
Act Effct Green (s)	29.5	29.5		29.5	11.5	11.5
Actuated g/C Ratio	0.59	0.59		0.59	0.23	0.23
v/c Ratio	0.05	0.01		0.30	0.55	0.01
Control Delay	2.2	0.5		6.8	21.5	9.0
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	2.2	0.5		6.8	21.5	9.0
LOS	A	A		A	C	A
Approach Delay	2.0			6.8	21.3	
Approach LOS	A			A	C	
Queue Length 50th (ft)	7	1		37	58	0
Queue Length 95th (ft)	1	0		75	98	5
Internal Link Dist (ft)	697			658	227	
Turn Bay Length (ft)						
Base Capacity (vph)	2085	999		1984	601	540
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.05	0.01		0.30	0.37	0.01

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green

Natural Cycle: 55

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 9.8 Intersection LOS: A

Intersection Capacity Utilization 37.5% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 107:

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	72	24	317	999	357	232
Future Volume (vph)	72	24	317	999	357	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	1.00	0.95	0.95	1.00
Frt	0.962					0.850
Flt Protected	0.964		0.950			
Satd. Flow (prot)	3351	0	1770	3539	3539	1583
Flt Permitted	0.964		0.405			
Satd. Flow (perm)	3351	0	754	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	26					252
Link Speed (mph)	30			30	30	
Link Distance (ft)	738			727	965	
Travel Time (s)	16.8			16.5	21.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	26	345	1086	388	252
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	0	345	1086	388	252
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	36			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Minimum Split (s)	22.5		9.5	22.5	22.5	22.5
Total Split (s)	15.0		15.0	35.0	20.0	20.0
Total Split (%)	30.0%		30.0%	70.0%	40.0%	40.0%
Maximum Green (s)	10.5		10.5	30.5	15.5	15.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	10.5		30.5	30.5	15.5	15.5
Actuated g/C Ratio	0.21		0.61	0.61	0.31	0.31
v/c Ratio	0.14		0.51	0.50	0.35	0.38
Control Delay	8.3		7.7	6.5	14.5	4.2
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	8.3		7.7	6.5	14.5	4.2

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	A		A	A	B	A
Approach Delay	8.3			6.8	10.5	
Approach LOS	A			A	B	
Queue Length 50th (ft)	12		40	77	45	0
Queue Length 95th (ft)	26		74	113	74	39
Internal Link Dist (ft)	658			647	885	
Turn Bay Length (ft)						
Base Capacity (vph)	724		673	2158	1097	664
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.14		0.51	0.50	0.35	0.38

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green, Master Intersection
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 7.9 Intersection LOS: A
Intersection Capacity Utilization 42.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 108:

Lane Group	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations	↑			↑		
Traffic Volume (vph)	211	0	0	19	0	0
Future Volume (vph)	211	0	0	19	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	0	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1082			1015	590	
Travel Time (s)	24.6			23.1	13.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	229	0	0	21	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	229	0	0	21	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 14.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	Y	
Traffic Volume (vph)	28	0	0	19	0	183
Future Volume (vph)	28	0	0	19	0	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	1611	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	1611	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	839			634	538	
Travel Time (s)	19.1			14.4	12.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	0	0	21	0	199
Shared Lane Traffic (%)						
Lane Group Flow (vph)	30	0	0	21	199	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 21.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	19	28	0
Future Volume (vph)	0	0	0	19	28	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.865			
Flt Protected					0.950	
Satd. Flow (prot)	0	1863	1611	0	1770	1863
Flt Permitted					0.950	
Satd. Flow (perm)	0	1863	1611	0	1770	1863
Link Speed (mph)		30	30		30	
Link Distance (ft)		98	839		286	
Travel Time (s)		2.2	19.1		6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	21	30	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	21	0	30	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		36	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		10	10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Stop		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

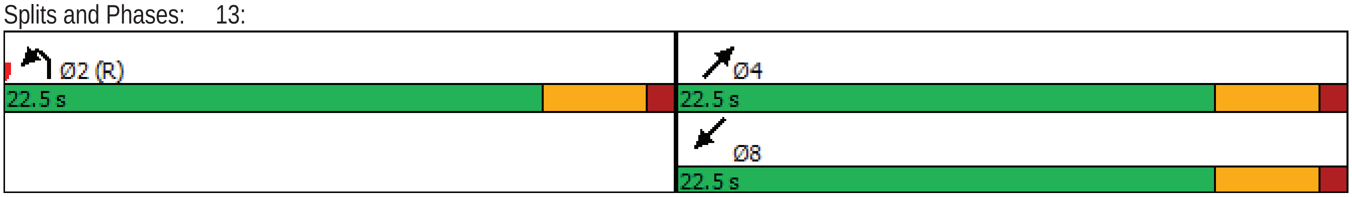
PM Existing LOS

Lane Group	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	348	4	27	0	0	233
Future Volume (vph)	348	4	27	0	0	233
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt	0.999					
Flt Protected	0.953					
Satd. Flow (prot)	1773	0	3539	0	0	5085
Flt Permitted	0.953					
Satd. Flow (perm)	1773	0	3539	0	0	5085
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	1					
Link Speed (mph)	35		35			35
Link Distance (ft)	765		397			221
Travel Time (s)	14.9		7.7			4.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	378	4	29	0	0	253
Shared Lane Traffic (%)						
Lane Group Flow (vph)	382	0	29	0	0	253
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		6			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Turn Type	Prot		NA			NA
Protected Phases	2		4			8
Permitted Phases						
Minimum Split (s)	22.5		22.5			22.5
Total Split (s)	22.5		22.5			22.5
Total Split (%)	50.0%		50.0%			50.0%
Maximum Green (s)	18.0		18.0			18.0
Yellow Time (s)	3.5		3.5			3.5
All-Red Time (s)	1.0		1.0			1.0
Lost Time Adjust (s)	0.0		0.0			0.0
Total Lost Time (s)	4.5		4.5			4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0			7.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	5		5			5
Act Effct Green (s)	18.0		18.0			18.0
Actuated g/C Ratio	0.40		0.40			0.40
v/c Ratio	0.54		0.02			0.12
Control Delay	13.8		13.9			8.8
Queue Delay	0.0		0.0			0.0
Total Delay	13.8		13.9			8.8

Lane Group	NBL	NBR	NET	NER	SWL	SWT
LOS	B		B			A
Approach Delay	13.8		13.9			8.8
Approach LOS	B		B			A
Queue Length 50th (ft)	71		4			14
Queue Length 95th (ft)	133		14			25
Internal Link Dist (ft)	685		317			141
Turn Bay Length (ft)						
Base Capacity (vph)	709		1415			2034
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.54		0.02			0.12

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 11.9	Intersection LOS: B
Intersection Capacity Utilization 31.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13:



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	10	11	477	15	0	7	0	344	10	7	443	0
Future Volume (vph)	10	11	477	15	0	7	0	344	10	7	443	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.857	0.850			0.850			0.850			
Flt Protected	0.950			0.950						0.950		
Satd. Flow (prot)	3433	1517	1504	1770	0	1583	0	3539	1583	1770	3539	0
Flt Permitted	0.950			0.572						0.530		
Satd. Flow (perm)	3433	1517	1504	1065	0	1583	0	3539	1583	987	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		226	226			36			36			
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		872			347			301			374	
Travel Time (s)		17.0			6.8			5.9			7.3	
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
Adj. Flow (vph)	11	12	518	16	0	8	0	374	11	8	482	0
Shared Lane Traffic (%)			49%									
Lane Group Flow (vph)	11	266	264	16	0	8	0	374	11	8	482	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA	Perm	Perm		Perm		NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6	2		2			4	8		
Minimum Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%		50.0%		50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5		3.5		3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0		1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5		4.5	4.5	4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0		7.0		7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0		11.0		11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	5	5	5	5		5		5	5	5	5	
Act Effct Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40		0.40		0.40	0.40	0.40	0.40	
v/c Ratio	0.01	0.36	0.36	0.04		0.01		0.26	0.02	0.02	0.34	
Control Delay	8.2	4.1	4.0	8.7		0.4		14.7	7.9	7.9	8.6	
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Delay	8.2	4.1	4.0	8.7		0.4		14.7	7.9	7.9	8.6	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
LOS	A	A	A	A		A		B	A	A	A	
Approach Delay		4.1			5.9			14.5			8.6	
Approach LOS		A			A			B			A	
Queue Length 50th (ft)	1	6	6	2		0		55	0	1	34	
Queue Length 95th (ft)	4	41	41	11		1		94	m8	m4	57	
Internal Link Dist (ft)		792			267			221			294	
Turn Bay Length (ft)												
Base Capacity (vph)	1373	742	737	426		654		1415	654	394	1415	
Starvation Cap Reductn	0	0	0	0		0		0	0	0	0	
Spillback Cap Reductn	0	0	0	0		0		0	0	0	0	
Storage Cap Reductn	0	0	0	0		0		0	0	0	0	
Reduced v/c Ratio	0.01	0.36	0.36	0.04		0.01		0.26	0.02	0.02	0.34	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NWL and 6:SETL, Start of Green

Natural Cycle: 45

Control Type: Pretimed

Maximum v/c Ratio: 0.36

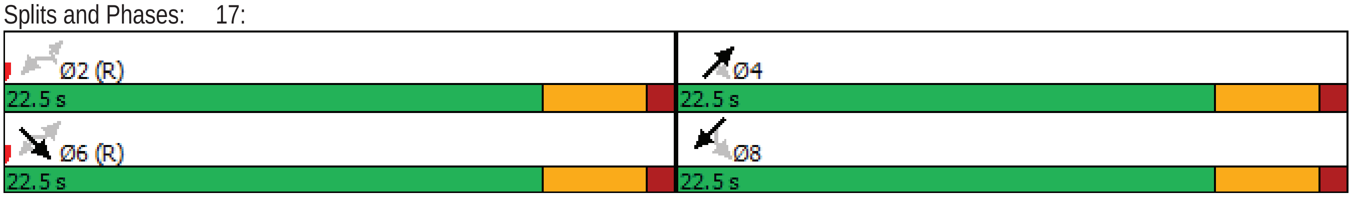
Intersection Signal Delay: 8.4 Intersection LOS: A

Intersection Capacity Utilization 46.1% ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 17:



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	40	20	0	359	47	35
Future Volume (vph)	40	20	0	359	47	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.949					0.865
Flt Protected					0.950	
Satd. Flow (prot)	3359	0	0	3539	0	1611
Flt Permitted					0.950	
Satd. Flow (perm)	3359	0	0	3539	0	1611
Link Speed (mph)	35			35	35	
Link Distance (ft)	404			491	211	
Travel Time (s)	7.9			9.6	4.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	22	0	390	51	38
Shared Lane Traffic (%)						
Lane Group Flow (vph)	65	0	0	390	51	38
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	12			24	0	
Link Offset(ft)	0			6	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization Err% ICU Level of Service H

Analysis Period (min) 15

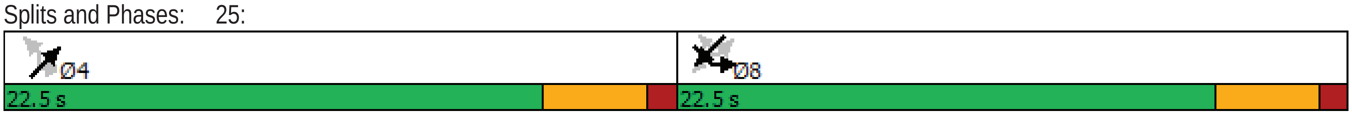
Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	12	33	42	77	342	118	0	743	87
Future Volume (vph)	0	0	12	33	42	77	342	118	0	743	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	0	250		0	0		0
Storage Lanes	0	0		1	1	1		1	0		1
Taper Length (ft)	100			100		100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt					0.850			0.850			0.850
Flt Protected				0.950		0.950					
Satd. Flow (prot)	0	0	0	1770	1583	1770	3539	1583	0	3539	1583
Flt Permitted				0.950		0.222					
Satd. Flow (perm)	0	0	0	1770	1583	414	3539	1583	0	3539	1583
Right Turn on Red					Yes			Yes			Yes
Satd. Flow (RTOR)					46			128			95
Link Speed (mph)	35			35			35			35	
Link Distance (ft)	601			719			925			301	
Travel Time (s)	11.7			14.0			18.0			5.9	
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
Adj. Flow (vph)	0	0	13	36	46	84	372	128	0	808	95
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	0	0	49	46	84	372	128	0	808	95
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	0			12			12			12	
Link Offset(ft)	0			0			0			0	
Crosswalk Width(ft)	10			10			10			10	
Two way Left Turn Lane											
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	15	9	15		9	15		9
Turn Type			D.Pm	Prot	Perm	Perm	NA	Perm		NA	Perm
Protected Phases				8!			4			8!	
Permitted Phases			8!		8	4		4			8
Minimum Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (%)			50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%
Maximum Green (s)			18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0
Yellow Time (s)			3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)			1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)				4.5	4.5	4.5	4.5	4.5		4.5	4.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)			11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)			5	5	5	5	5	5		5	5
Act Effct Green (s)				18.0	18.0	18.0	18.0	18.0		18.0	18.0
Actuated g/C Ratio				0.40	0.40	0.40	0.40	0.40		0.40	0.40
v/c Ratio				0.07	0.07	0.51	0.26	0.18		0.57	0.14

Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Control Delay				8.7	3.8	25.2	9.7	3.1		9.6	2.7
Queue Delay				0.0	0.0	0.0	0.0	0.0		0.1	0.0
Total Delay				8.7	3.8	25.2	9.7	3.1		9.6	2.7
LOS				A	A	C	A	A		A	A
Approach Delay				6.3			10.5			8.9	
Approach LOS				A			B			A	
Queue Length 50th (ft)				7	0	15	32	0		49	0
Queue Length 95th (ft)				22	13	#65	54	22		98	17
Internal Link Dist (ft)	521			639			845			221	
Turn Bay Length (ft)						250					
Base Capacity (vph)				708	660	165	1415	710		1415	690
Starvation Cap Reductn				0	0	0	0	0		54	0
Spillback Cap Reductn				0	0	0	0	0		0	0
Storage Cap Reductn				0	0	0	0	0		0	0
Reduced v/c Ratio				0.07	0.07	0.51	0.26	0.18		0.59	0.14

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.57
Intersection Signal Delay: 9.3 Intersection LOS: A
Intersection Capacity Utilization 40.2% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
! Phase conflict between lane groups.

Splits and Phases: 25:



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	31	633	0
Future Volume (vph)	0	0	0	31	633	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	250			150
Storage Lanes	1	1	1			1
Taper Length (ft)	100		25			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	1863	1863	3539	3539	1863
Flt Permitted						
Satd. Flow (perm)	1863	1863	1863	3539	3539	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						
Link Speed (mph)	35			35	35	
Link Distance (ft)	755			451	920	
Travel Time (s)	14.7			8.8	17.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	34	688	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	34	688	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	6	
Link Offset(ft)	0			-6	6	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (ft)	20	20	20	100	100	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	5	5	5	5	5	5
Act Effct Green (s)				39.6	39.6	
Actuated g/C Ratio				0.88	0.88	
v/c Ratio				0.01	0.22	
Control Delay				4.1	3.4	
Queue Delay				0.0	0.0	
Total Delay				4.1	3.4	
LOS				A	A	
Approach Delay				4.1	3.4	
Approach LOS				A	A	
Queue Length 50th (ft)				0	0	
Queue Length 95th (ft)				8	102	
Internal Link Dist (ft)	675			371	840	
Turn Bay Length (ft)						
Base Capacity (vph)				3114	3114	
Starvation Cap Reductn				0	0	
Spillback Cap Reductn				0	0	
Storage Cap Reductn				0	0	
Reduced v/c Ratio				0.01	0.22	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 45

Control Type: Actuated-Coordinated

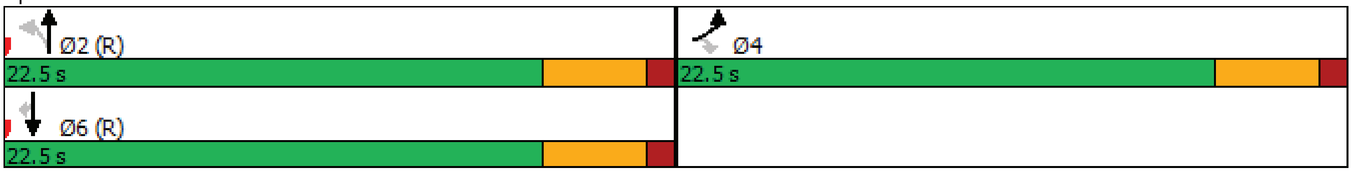
Maximum v/c Ratio: 0.22

Intersection Signal Delay: 3.4 Intersection LOS: A

Intersection Capacity Utilization 21.2% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 28:



Lane Group	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	633	31	0	0	0
Future Volume (vph)	0	633	31	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	1.00
Frt		0.850				
Flt Protected			0.950	0.950		
Satd. Flow (prot)	0	2787	1681	1681	0	0
Flt Permitted			0.950	0.950		
Satd. Flow (perm)	0	2787	1681	1681	0	0
Link Speed (mph)	35			35	35	
Link Distance (ft)	227			920	549	
Travel Time (s)	4.4			17.9	10.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	688	34	0	0	0
Shared Lane Traffic (%)			50%			
Lane Group Flow (vph)	0	688	17	17	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			36	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 25.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	361	450	133
Future Volume (vph)	0	0	0	361	450	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	3539	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	3539	1583
Link Speed (mph)	35			35	35	
Link Distance (ft)	818			374	654	
Travel Time (s)	15.9			7.3	12.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	392	489	145
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	392	489	145
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	0	0	27	355	0	581
Future Volume (vph)	0	0	27	355	0	581
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt				0.850		
Flt Protected						
Satd. Flow (prot)	0	0	3539	1583	0	5085
Flt Permitted						
Satd. Flow (perm)	0	0	3539	1583	0	5085
Link Speed (mph)	35		35			35
Link Distance (ft)	815		654			397
Travel Time (s)	15.9		12.7			7.7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	29	386	0	632
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	29	386	0	632
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 31.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	31	233	400
Future Volume (vph)	0	0	0	31	233	400
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	5085	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	5085	1583
Link Speed (mph)	35			35	35	
Link Distance (ft)	1042			221	359	
Travel Time (s)	20.3			4.3	7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	34	253	435
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	34	253	435
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	8			0	6	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 28.1%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lane Configurations						
Traffic Volume (vph)	0	633	0	1	30	1
Future Volume (vph)	0	633	0	1	30	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0	500	0	0
Storage Lanes	1	2	1	1	2	1
Taper Length (ft)	25		25		25	
Lane Util. Factor	1.00	0.88	1.00	1.00	0.97	1.00
Frt		0.850		0.850		0.850
Flt Protected					0.950	
Satd. Flow (prot)	1863	2787	1863	1583	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	1863	2787	1863	1583	3433	1583
Right Turn on Red		Yes		Yes		Yes
Satd. Flow (RTOR)		1920		1007		1
Link Speed (mph)	35		35		35	
Link Distance (ft)	570		723		430	
Travel Time (s)	11.1		14.1		8.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	688	0	1	33	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	688	0	1	33	1
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	30		32		32	
Link Offset(ft)	30		0		0	
Crosswalk Width(ft)	10		10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	9	15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Thru	Thru	Thru	Thru	Thru
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	Prot	pt+ov	Prot	Perm	Prot	Perm
Protected Phases	5	5 6	4		6	
Permitted Phases				4		6
Detector Phase	5	5 6	4	4	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	15.5		15.5	15.5	19.0	19.0
Total Split (%)	31.0%		31.0%	31.0%	38.0%	38.0%
Maximum Green (s)	11.0		11.0	11.0	14.5	14.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag	Lead				Lag	Lag

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lead-Lag Optimize?	Yes				Yes	Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	C-Max	C-Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)		47.1		5.5	33.3	33.3
Actuated g/C Ratio		0.94		0.11	0.67	0.67
v/c Ratio		0.25		0.00	0.01	0.00
Control Delay		0.2		0.0	4.4	4.0
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		0.2		0.0	4.4	4.0
LOS		A		A	A	A
Approach Delay	0.2				4.4	
Approach LOS	A				A	
Queue Length 50th (ft)		0		0	1	0
Queue Length 95th (ft)		0		0	7	2
Internal Link Dist (ft)	490		643		350	
Turn Bay Length (ft)				500		
Base Capacity (vph)		2737		1133	2286	1054
Starvation Cap Reductn		0		0	0	0
Spillback Cap Reductn		0		0	0	0
Storage Cap Reductn		0		0	0	0
Reduced v/c Ratio		0.25		0.00	0.01	0.00

Intersection Summary	
Area Type: Other	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 6:NEL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.25	
Intersection Signal Delay: 0.4	Intersection LOS: A
Intersection Capacity Utilization 25.9%	ICU Level of Service A
Analysis Period (min) 15	

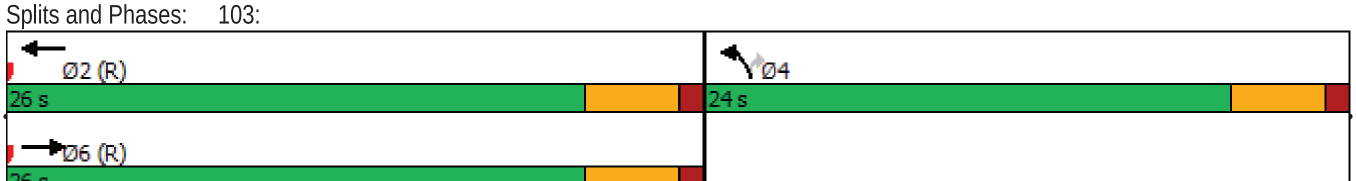
Splits and Phases: 102:

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↰↰	↱
Traffic Volume (vph)	31	0	0	406	227	29
Future Volume (vph)	31	0	0	406	227	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt						0.850
Flt Protected					0.950	
Satd. Flow (prot)	3539	0	0	3539	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	3539	0	0	3539	3433	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						32
Link Speed (mph)	35			35	35	
Link Distance (ft)	923			533	500	
Travel Time (s)	18.0			10.4	9.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	0	0	441	247	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	0	441	247	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2			2	1	1
Detector Template	Thru			Thru	Left	Right
Leading Detector (ft)	100			100	20	20
Trailing Detector (ft)	0			0	0	0
Detector 1 Position(ft)	0			0	0	0
Detector 1 Size(ft)	6			6	20	20
Detector 1 Type	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0			0.0	0.0	0.0
Detector 1 Queue (s)	0.0			0.0	0.0	0.0
Detector 1 Delay (s)	0.0			0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA			NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases						4
Detector Phase	6			2	4	4
Switch Phase						
Minimum Initial (s)	5.0			5.0	5.0	5.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	22.5			22.5	22.5	22.5
Total Split (s)	26.0			26.0	24.0	24.0
Total Split (%)	52.0%			52.0%	48.0%	48.0%
Maximum Green (s)	21.5			21.5	19.5	19.5
Yellow Time (s)	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0
Total Lost Time (s)	4.5			4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Recall Mode	C-Max			C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	32.1			32.1	8.9	8.9
Actuated g/C Ratio	0.64			0.64	0.18	0.18
v/c Ratio	0.01			0.19	0.40	0.10
Control Delay	3.8			4.2	19.8	7.9
Queue Delay	0.0			0.0	0.0	0.0
Total Delay	3.8			4.2	19.8	7.9
LOS	A			A	B	A
Approach Delay	3.8			4.2	18.4	
Approach LOS	A			A	B	
Queue Length 50th (ft)	1			22	33	0
Queue Length 95th (ft)	5			42	55	16
Internal Link Dist (ft)	843			453	420	
Turn Bay Length (ft)						
Base Capacity (vph)	2272			2272	1338	636
Starvation Cap Reductn	0			0	0	0
Spillback Cap Reductn	0			0	0	0
Storage Cap Reductn	0			0	0	0
Reduced v/c Ratio	0.01			0.19	0.18	0.05

Intersection Summary	
Area Type: Other	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.40	
Intersection Signal Delay: 9.5	Intersection LOS: A
Intersection Capacity Utilization 25.2%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 103:



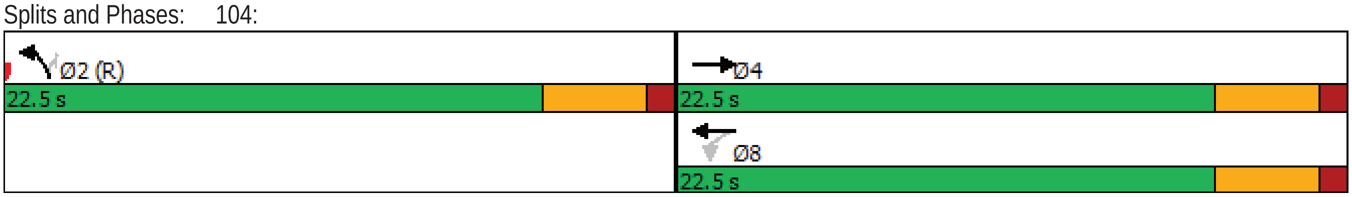
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	60	0	0	406	0	20
Future Volume (vph)	60	0	0	406	0	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	3539	0	1863	3539	1863	1583
Flt Permitted						
Satd. Flow (perm)	3539	0	1863	3539	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						887
Link Speed (mph)	35			35	35	
Link Distance (ft)	533			404	428	
Travel Time (s)	10.4			7.9	8.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	0	0	441	0	22
Shared Lane Traffic (%)						
Lane Group Flow (vph)	65	0	0	441	0	22
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	20	
Link Offset(ft)	-12			8	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (%)	50.0%		50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0		18.0	18.0	18.0	18.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	18.0			18.0		18.0
Actuated g/C Ratio	0.40			0.40		0.40
v/c Ratio	0.05			0.31		0.02
Control Delay	8.4			10.0		0.1
Queue Delay	0.0			0.0		0.0
Total Delay	8.4			10.0		0.1

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
LOS	A			B		A
Approach Delay	8.4			10.0	0.1	
Approach LOS	A			B	A	
Queue Length 50th (ft)	5			38		0
Queue Length 95th (ft)	13			64		0
Internal Link Dist (ft)	453			324	348	
Turn Bay Length (ft)						
Base Capacity (vph)	1415			1415		1165
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.05			0.31		0.02

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.31
Intersection Signal Delay: 9.4 Intersection LOS: A
Intersection Capacity Utilization 15.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 104:



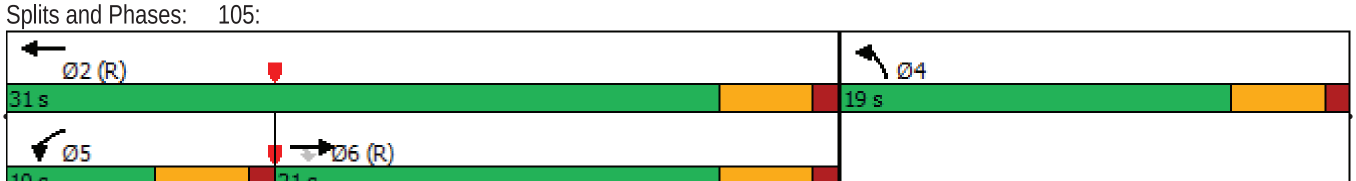
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	4	57	92	267	670
Future Volume (vph)	71	4	57	92	267	670
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95
Frt		0.850			0.893	
Flt Protected			0.950		0.986	
Satd. Flow (prot)	3539	1583	1770	3539	3182	0
Flt Permitted			0.950		0.986	
Satd. Flow (perm)	3539	1583	1770	3539	3182	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		4			728	
Link Speed (mph)	35			35	35	
Link Distance (ft)	491			971	1149	
Travel Time (s)	9.6			18.9	22.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	4	62	100	290	728
Shared Lane Traffic (%)						
Lane Group Flow (vph)	77	4	62	100	1018	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (ft)	100	20	20	100	20	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	6	20	20	6	20	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases		6				
Detector Phase	6	6	5	2	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	20.0	20.0	9.5	22.5	15.0	
Total Split (s)	21.0	21.0	10.0	31.0	19.0	
Total Split (%)	42.0%	42.0%	20.0%	62.0%	38.0%	
Maximum Green (s)	16.5	16.5	5.5	26.5	14.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	None	C-Max	None	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	23.4	23.4	6.0	29.7	11.3	
Actuated g/C Ratio	0.47	0.47	0.12	0.59	0.23	
v/c Ratio	0.05	0.01	0.30	0.05	0.79	
Control Delay	10.9	8.2	28.4	3.8	10.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	10.9	8.2	28.4	3.8	10.0	
LOS	B	A	C	A	A	
Approach Delay	10.8			13.2	10.0	
Approach LOS	B			B	A	
Queue Length 50th (ft)	7	0	16	4	35	
Queue Length 95th (ft)	18	5	48	11	79	
Internal Link Dist (ft)	411			891	1069	
Turn Bay Length (ft)						
Base Capacity (vph)	1654	742	210	2101	1439	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.01	0.30	0.05	0.71	

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 10.4 Intersection LOS: B
Intersection Capacity Utilization 46.2% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 105:



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑			↑			↑	
Traffic Volume (vph)	0	741	0	2	119	2	27	0	17	0	0	4
Future Volume (vph)	0	741	0	2	119	2	27	0	17	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.998			0.948			0.865	
Flt Protected					0.999			0.970				
Satd. Flow (prot)	0	3539	0	0	3529	0	0	1713	0	0	1611	0
Flt Permitted					0.999			0.970				
Satd. Flow (perm)	0	3539	0	0	3529	0	0	1713	0	0	1611	0
Link Speed (mph)		35			35			35			35	
Link Distance (ft)		971			260			262			305	
Travel Time (s)		18.9			5.1			5.1			5.9	
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
Adj. Flow (vph)	0	805	0	2	129	2	29	0	18	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	805	0	0	133	0	0	47	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 36.4% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	465	293	4	122	0	19
Future Volume (vph)	465	293	4	122	0	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	12	12	12
Lane Util. Factor	0.95	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected				0.999		
Satd. Flow (prot)	3539	1689	0	3536	1863	1583
Flt Permitted				0.947		
Satd. Flow (perm)	3539	1689	0	3352	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		318				253
Link Speed (mph)	35			35	35	
Link Distance (ft)	777			738	307	
Travel Time (s)	15.1			14.4	6.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	505	318	4	133	0	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	505	318	0	137	0	21
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	R NA	Left	Left	Left	Right
Median Width(ft)	16			16	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	0.92	1.00	1.00	1.00	1.00
Turning Speed (mph)		15	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases		6	2			4
Detector Phase	6	6	2	2	4	4
Switch Phase						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	27.0	27.0	27.0	27.0	23.0	23.0
Total Split (%)	54.0%	54.0%	54.0%	54.0%	46.0%	46.0%
Maximum Green (s)	22.5	22.5	22.5	22.5	18.5	18.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	47.1	47.1		47.1		5.5
Actuated g/C Ratio	0.94	0.94		0.94		0.11
v/c Ratio	0.15	0.20		0.04		0.05
Control Delay	0.5	0.2		0.7		0.3
Queue Delay	0.0	0.0		0.0		0.0
Total Delay	0.5	0.2		0.7		0.3
LOS	A	A		A		A
Approach Delay	0.4			0.7	0.3	
Approach LOS	A			A	A	
Queue Length 50th (ft)	0	0		0		0
Queue Length 95th (ft)	m14	m0		7		0
Internal Link Dist (ft)	697			658	227	
Turn Bay Length (ft)						
Base Capacity (vph)	3334	1609		3157		745
Starvation Cap Reductn	0	0		0		0
Spillback Cap Reductn	0	0		0		0
Storage Cap Reductn	0	0		0		0
Reduced v/c Ratio	0.15	0.20		0.04		0.03

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green

Natural Cycle: 45

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.20

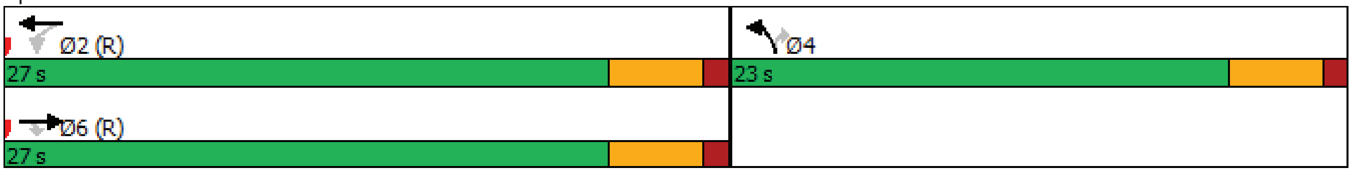
Intersection Signal Delay: 0.4 Intersection LOS: A

Intersection Capacity Utilization 29.8% ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 107:



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	470	115	40	1170	922	85
Future Volume (vph)	470	115	40	1170	922	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	1.00	0.95	0.95	1.00
Frt	0.971					0.850
Flt Protected	0.961		0.950			
Satd. Flow (prot)	3372	0	1770	3539	3539	1583
Flt Permitted	0.961		0.200			
Satd. Flow (perm)	3372	0	373	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	67					92
Link Speed (mph)	35			35	35	
Link Distance (ft)	738			727	965	
Travel Time (s)	14.4			14.2	18.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	511	125	43	1272	1002	92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	636	0	43	1272	1002	92
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	36			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Minimum Split (s)	22.5		9.5	22.5	22.5	22.5
Total Split (s)	21.5		8.5	28.5	20.0	20.0
Total Split (%)	43.0%		17.0%	57.0%	40.0%	40.0%
Maximum Green (s)	17.0		4.0	24.0	15.5	15.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	17.0		24.0	24.0	15.5	15.5
Actuated g/C Ratio	0.34		0.48	0.48	0.31	0.31
v/c Ratio	0.53		0.15	0.75	0.91	0.17
Control Delay	10.6		8.2	14.0	32.0	4.6
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	10.6		8.2	14.0	32.0	4.6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	B		A	B	C	A
Approach Delay	10.6			13.8	29.7	
Approach LOS	B			B	C	
Queue Length 50th (ft)	52		6	145	145	0
Queue Length 95th (ft)	68		18	212	#253	24
Internal Link Dist (ft)	658			647	885	
Turn Bay Length (ft)						
Base Capacity (vph)	1190		290	1698	1097	554
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.53		0.15	0.75	0.91	0.17

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green, Master Intersection
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 18.9 Intersection LOS: B
Intersection Capacity Utilization 57.8% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 108:

Lane Group	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	19	0	361	0	0	0
Future Volume (vph)	19	0	361	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected				0.950		
Satd. Flow (prot)	1863	0	0	1770	0	0
Flt Permitted				0.950		
Satd. Flow (perm)	1863	0	0	1770	0	0
Link Speed (mph)	35			35	35	
Link Distance (ft)	1082			1015	590	
Travel Time (s)	21.1			19.8	11.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	0	392	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	21	0	0	392	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 30.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	Y	
Traffic Volume (vph)	0	0	0	0	0	19
Future Volume (vph)	0	0	0	0	0	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	1611	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	1611	0
Link Speed (mph)	35			35	35	
Link Distance (ft)	839			634	538	
Travel Time (s)	16.3			12.4	10.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	21	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	0	1863	1863	0	1863	1863
Flt Permitted						
Satd. Flow (perm)	0	1863	1863	0	1863	1863
Link Speed (mph)		35	35		35	
Link Distance (ft)		98	839		286	
Travel Time (s)		1.9	16.3		5.6	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		36	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		10	10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Stop		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

AM Build LOS

Lane Group	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	214	205	469	0	0	18
Future Volume (vph)	214	523	855	0	0	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt	0.904					
Flt Protected	0.986					
Satd. Flow (prot)	1660	0	3539	0	0	5085
Flt Permitted	0.986					
Satd. Flow (perm)	1660	0	3539	0	0	5085
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	18					
Link Speed (mph)	30		30			30
Link Distance (ft)	765		397			221
Travel Time (s)	17.4		9.0			5.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	233	568	929	0	0	20
Shared Lane Traffic (%)						
Lane Group Flow (vph)	801	0	929	0	0	20
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		6			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60		60	60	
Turn Type	Prot		NA			NA
Protected Phases	2		4			8
Permitted Phases						
Minimum Split (s)	22.5		22.5			22.5
Total Split (s)	37.0		23.0			23.0
Total Split (%)	61.7%		38.3%			38.3%
Maximum Green (s)	32.5		18.5			18.5
Yellow Time (s)	3.5		3.5			3.5
All-Red Time (s)	1.0		1.0			1.0
Lost Time Adjust (s)	0.0		0.0			0.0
Total Lost Time (s)	4.5		4.5			4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0			7.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	5		5			5
Act Effct Green (s)	32.5		18.5			18.5
Actuated g/C Ratio	0.54		0.31			0.31
v/c Ratio	0.88		0.85			0.01
Control Delay	26.3		29.2			14.5
Queue Delay	0.0		0.0			0.0
Total Delay	26.3		29.2			14.5

Lane Group	NBL	NBR	NET	NER	SWL	SWT
LOS	C		C			B
Approach Delay	26.3		29.2			14.5
Approach LOS	C		C			B
Queue Length 50th (ft)	225		163			1
Queue Length 95th (ft)	#461		#262			6
Internal Link Dist (ft)	685		317			141
Turn Bay Length (ft)						
Base Capacity (vph)	907		1091			1567
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.88		0.85			0.01

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 60

Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green

Natural Cycle: 60

Control Type: Pretimed

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 27.7 Intersection LOS: C

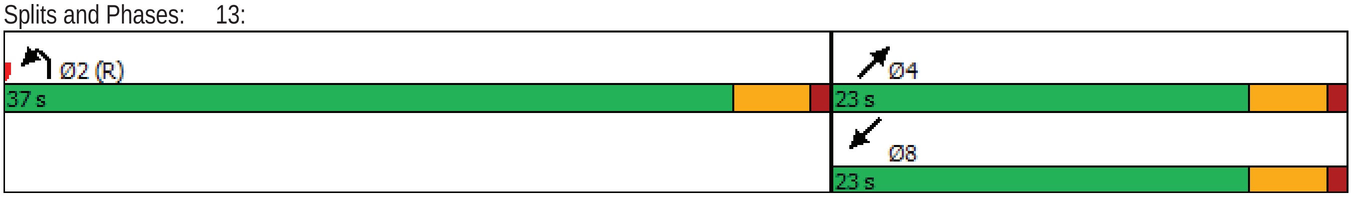
Intersection Capacity Utilization 44.9% ICU Level of Service A

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 13:



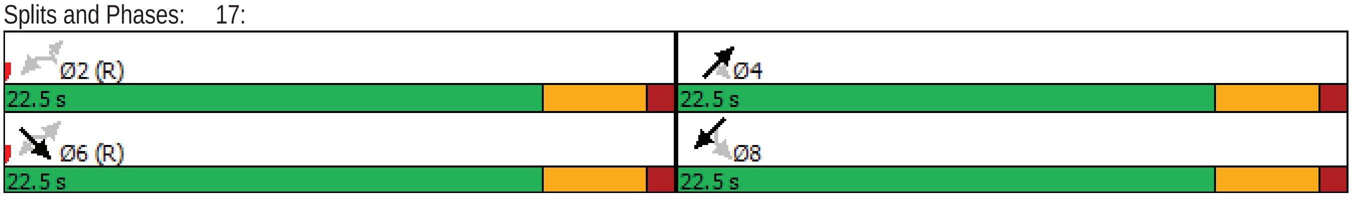
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	396	7	410	2	0	9	0	442	11	6	199	0
Future Volume (vph)	721	7	410	2	0	9	0	503	11	6	199	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.855	0.850			0.850			0.850			
Flt Protected	0.950			0.950						0.950		
Satd. Flow (prot)	3433	1513	1504	1770	0	1583	0	3539	1583	1770	3539	0
Flt Permitted	0.950			0.610						0.432		
Satd. Flow (perm)	3433	1513	1504	1136	0	1583	0	3539	1583	805	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		219	227			36			36			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		872			347			301			374	
Travel Time (s)		19.8			7.9			6.8			8.5	
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
Adj. Flow (vph)	784	8	446	2	0	10	0	547	12	7	216	0
Shared Lane Traffic (%)			49%									
Lane Group Flow (vph)	784	227	227	2	0	10	0	547	12	7	216	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60		60	60		60	60		60	60		60
Turn Type	Perm	NA	Perm	Perm		Perm		NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6	2		2			4	8		
Minimum Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%		50.0%		50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5		3.5		3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0		1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5		4.5	4.5	4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0		7.0		7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0		11.0		11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	5	5	5	5		5		5	5	5	5	
Act Effct Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40		0.40		0.40	0.40	0.40	0.40	
v/c Ratio	0.57	0.31	0.31	0.00		0.02		0.39	0.02	0.02	0.15	
Control Delay	12.5	3.2	3.0	8.0		1.0		4.8	0.2	8.5	9.0	
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Delay	12.5	3.2	3.0	8.0		1.0		4.8	0.2	8.5	9.0	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
LOS	B	A	A	A		A		A	A	A	A	
Approach Delay		9.1			2.2			4.7			9.0	
Approach LOS		A			A			A			A	
Queue Length 50th (ft)	76	1	0	0		0		16	0	1	17	
Queue Length 95th (ft)	118	32	30	3		2		23	m0	6	33	
Internal Link Dist (ft)		792			267			221			294	
Turn Bay Length (ft)												
Base Capacity (vph)	1373	736	737	454		654		1415	654	322	1415	
Starvation Cap Reductn	0	0	0	0		0		0	0	0	0	
Spillback Cap Reductn	0	0	0	0		0		0	0	0	0	
Storage Cap Reductn	0	0	0	0		0		0	0	0	0	
Reduced v/c Ratio	0.57	0.31	0.31	0.00		0.02		0.39	0.02	0.02	0.15	

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NWL and 6:SETL, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.57	
Intersection Signal Delay: 7.8	Intersection LOS: A
Intersection Capacity Utilization 38.9%	ICU Level of Service A
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 17:



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	0	0	60	0	0
Future Volume (vph)	470	0	0	222	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	3539	0	0	3539	0	1863
Flt Permitted						
Satd. Flow (perm)	3539	0	0	3539	0	1863
Link Speed (mph)	30			30	30	
Link Distance (ft)	404			491	211	
Travel Time (s)	9.2			11.2	4.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	511	0	0	241	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	511	0	0	241	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	12			24	0	
Link Offset(ft)	0			6	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 7.3%	ICU Level of Service A
Analysis Period (min) 15	

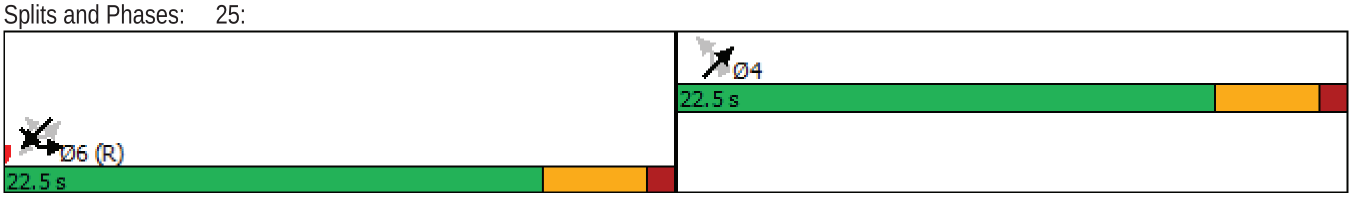
Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	11	40	39	79	434	351	0	518	45
Future Volume (vph)	0	0	16	40	39	79	490	351	0	518	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	0	250		0	0		0
Storage Lanes	0	0		1	1	1		1	0		1
Taper Length (ft)	100			100		100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt					0.850			0.850			0.850
Flt Protected				0.950		0.950					
Satd. Flow (prot)	0	0	0	1770	1583	1770	3539	1583	0	3539	1583
Flt Permitted				0.950		0.441					
Satd. Flow (perm)	0	0	0	1770	1583	821	3539	1583	0	3539	1583
Right Turn on Red					Yes			Yes			Yes
Satd. Flow (RTOR)					42			382			49
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	601			719			925			301	
Travel Time (s)	13.7			16.3			21.0			6.8	
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
Adj. Flow (vph)	0	0	17	43	42	86	533	382	0	563	49
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	0	0	60	42	86	533	382	0	563	49
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	0			12			12			12	
Link Offset(ft)	0			0			0			0	
Crosswalk Width(ft)	10			10			10			10	
Two way Left Turn Lane											
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60	60	60	60		60	60		60
Turn Type			D.Pm	Prot	Perm	Perm	NA	Perm		NA	Perm
Protected Phases				6!			4			6!	
Permitted Phases			6!		6	4		4			6
Minimum Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (%)			50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%
Maximum Green (s)			18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0
Yellow Time (s)			3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)			1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)				4.5	4.5	4.5	4.5	4.5		4.5	4.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)			11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)			5	5	5	5	5	5		5	5
Act Effct Green (s)				18.0	18.0	18.0	18.0	18.0		18.0	18.0
Actuated g/C Ratio				0.40	0.40	0.40	0.40	0.40		0.40	0.40
v/c Ratio				0.08	0.06	0.26	0.38	0.44		0.40	0.07

Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Control Delay				8.9	3.8	11.7	10.5	3.2		11.3	4.2
Queue Delay				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay				8.9	3.8	11.7	10.5	3.2		11.3	4.2
LOS				A	A	B	B	A		B	A
Approach Delay				6.8			7.8			10.8	
Approach LOS				A			A			B	
Queue Length 50th (ft)				9	0	14	48	0		63	3
Queue Length 95th (ft)				25	12	39	77	38		78	14
Internal Link Dist (ft)	521			639			845			221	
Turn Bay Length (ft)						250					
Base Capacity (vph)				708	658	328	1415	862		1415	662
Starvation Cap Reductn				0	0	0	0	0		0	0
Spillback Cap Reductn				0	0	0	0	0		0	0
Storage Cap Reductn				0	0	0	0	0		0	0
Reduced v/c Ratio				0.08	0.06	0.26	0.38	0.44		0.40	0.07

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2: and 6:SESW, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.44
Intersection Signal Delay: 8.8 Intersection LOS: A
Intersection Capacity Utilization 34.1% ICU Level of Service A
Analysis Period (min) 15
! Phase conflict between lane groups.

Splits and Phases: 25:



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	673	28	0
Future Volume (vph)	0	0	378	999	28	162
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	250			150
Storage Lanes	1	1	1			1
Taper Length (ft)	100		25			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850
Flt Protected			0.950			
Satd. Flow (prot)	1863	1863	1770	3539	3539	1583
Flt Permitted			0.737			
Satd. Flow (perm)	1863	1863	1373	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						176
Link Speed (mph)	30			30	30	
Link Distance (ft)	755			451	920	
Travel Time (s)	17.2			10.3	20.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	411	1086	30	176
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	411	1086	30	176
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	6	
Link Offset(ft)	0			-6	6	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (ft)	20	20	20	100	100	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	5	5	5	5	5	5
Act Effct Green (s)			39.6	39.6	39.6	39.6
Actuated g/C Ratio			0.88	0.88	0.88	0.88
v/c Ratio			0.34	0.35	0.01	0.12
Control Delay			7.1	4.4	2.6	3.2
Queue Delay			0.0	0.0	0.0	0.0
Total Delay			7.1	4.4	2.6	3.2
LOS			A	A	A	A
Approach Delay				5.1	3.1	
Approach LOS				A	A	
Queue Length 50th (ft)			0	0	0	0
Queue Length 95th (ft)			#207	181	11	73
Internal Link Dist (ft)	675			371	840	
Turn Bay Length (ft)			250			150
Base Capacity (vph)			1208	3114	3114	1414
Starvation Cap Reductn			0	0	0	0
Spillback Cap Reductn			0	0	0	0
Storage Cap Reductn			0	0	0	0
Reduced v/c Ratio			0.34	0.35	0.01	0.12

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.35

Intersection Signal Delay: 4.9 Intersection LOS: A

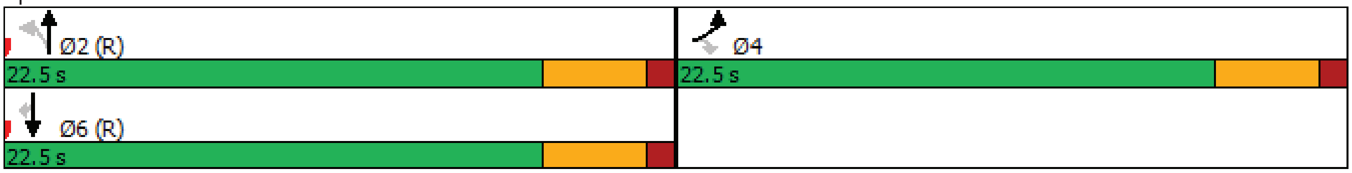
Intersection Capacity Utilization 22.4% ICU Level of Service A

Analysis Period (min) 15

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 28:



Lane Group	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	28	165	508	0	0
Future Volume (vph)	0	190	491	508	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	1.00
Frt		0.850				
Flt Protected			0.950	0.996		
Satd. Flow (prot)	0	2787	1681	1763	0	0
Flt Permitted			0.950	0.996		
Satd. Flow (perm)	0	2787	1681	1763	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	227			920	549	
Travel Time (s)	5.2			20.9	12.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	207	534	552	0	0
Shared Lane Traffic (%)			10%			
Lane Group Flow (vph)	0	207	481	605	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			36	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 27.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	847	205	27
Future Volume (vph)	0	0	0	1233	205	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	3539	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	3539	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	818			374	654	
Travel Time (s)	18.6			8.5	14.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1340	223	29
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1340	223	29
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60	60			60
Sign Control	Free			Free	Free	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 26.7%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	0	0	469	380	0	232
Future Volume (vph)	0	0	855	380	0	232
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt				0.850		
Flt Protected						
Satd. Flow (prot)	0	0	3539	1583	0	5085
Flt Permitted						
Satd. Flow (perm)	0	0	3539	1583	0	5085
Link Speed (mph)	30		30			30
Link Distance (ft)	815		654			397
Travel Time (s)	18.5		14.9			9.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	929	413	0	252
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	929	413	0	252
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	60	60		60	60	
Sign Control	Free		Free			Free

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 44.9%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	674	18	10
Future Volume (vph)	0	0	0	1378	18	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	5085	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	5085	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	1042			221	359	
Travel Time (s)	23.7			5.0	8.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1498	20	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	1498	20	11
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	8			0	6	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 22.0% ICU Level of Service A

Analysis Period (min) 15

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lane Configurations						
Traffic Volume (vph)	0	28	0	7	666	8
Future Volume (vph)	0	28	0	7	1370	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0	500	0	0
Storage Lanes	1	2	1	1	2	1
Taper Length (ft)	25		25		25	
Lane Util. Factor	1.00	0.88	1.00	1.00	0.97	1.00
Frt		0.850		0.850		0.850
Flt Protected					0.950	
Satd. Flow (prot)	1863	2787	1863	1583	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	1863	2787	1863	1583	3433	1583
Right Turn on Red		Yes		Yes		Yes
Satd. Flow (RTOR)		1920		471		9
Link Speed (mph)	30		30		30	
Link Distance (ft)	570		723		430	
Travel Time (s)	13.0		16.4		9.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	30	0	8	1489	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	30	0	8	1489	9
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	30		32		32	
Link Offset(ft)	30		0		0	
Crosswalk Width(ft)	10		10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	9	15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Thru	Thru	Thru	Thru	Thru
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	Prot	pt+ov	Prot	Perm	Prot	Perm
Protected Phases	5	5 6	4		6	
Permitted Phases				4		6
Detector Phase	5	5 6	4	4	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	15.5		15.5	15.5	19.0	19.0
Total Split (%)	31.0%		31.0%	31.0%	38.0%	38.0%
Maximum Green (s)	11.0		11.0	11.0	14.5	14.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag	Lead				Lag	Lag

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lead-Lag Optimize?	Yes				Yes	Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	C-Max	C-Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)		47.1		5.5	45.1	45.1
Actuated g/C Ratio		0.94		0.11	0.90	0.90
v/c Ratio		0.01		0.01	0.48	0.01
Control Delay		0.0		0.0	4.7	2.8
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		0.0		0.0	4.7	2.8
LOS		A		A	A	A
Approach Delay					4.7	
Approach LOS					A	
Queue Length 50th (ft)		0		0	0	0
Queue Length 95th (ft)		0		0	#281	5
Internal Link Dist (ft)	490		643		350	
Turn Bay Length (ft)				500		
Base Capacity (vph)		2737		715	3096	1429
Starvation Cap Reductn		0		0	0	0
Spillback Cap Reductn		0		0	0	0
Storage Cap Reductn		0		0	0	0
Reduced v/c Ratio		0.01		0.01	0.48	0.01

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 6:NEL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.48
Intersection Signal Delay: 4.6 Intersection LOS: A
Intersection Capacity Utilization 22.7% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 102:

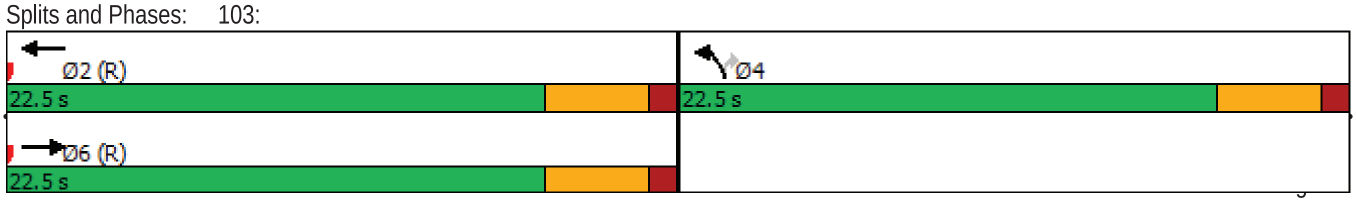
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	165	0	0	28	0	0
Future Volume (vph)	491	0	0	190	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	3539	0	0	3539	3614	1863
Flt Permitted						
Satd. Flow (perm)	3539	0	0	3539	3614	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	923			533	500	
Travel Time (s)	21.0			12.1	11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	534	0	0	207	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	534	0	0	207	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2			2	1	1
Detector Template	Thru			Thru	Left	Right
Leading Detector (ft)	100			100	20	20
Trailing Detector (ft)	0			0	0	0
Detector 1 Position(ft)	0			0	0	0
Detector 1 Size(ft)	6			6	20	20
Detector 1 Type	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0			0.0	0.0	0.0
Detector 1 Queue (s)	0.0			0.0	0.0	0.0
Detector 1 Delay (s)	0.0			0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA			NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases						4
Detector Phase	6			2	4	4
Switch Phase						
Minimum Initial (s)	5.0			5.0	5.0	5.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	22.5			22.5	22.5	22.5
Total Split (s)	22.5			22.5	22.5	22.5
Total Split (%)	50.0%			50.0%	50.0%	50.0%
Maximum Green (s)	18.0			18.0	18.0	18.0
Yellow Time (s)	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0
Total Lost Time (s)	4.5			4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Recall Mode	C-Max			C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	45.0			45.0		
Actuated g/C Ratio	1.00			1.00		
v/c Ratio	0.15			0.06		
Control Delay	0.1			0.0		
Queue Delay	0.0			0.0		
Total Delay	0.1			0.0		
LOS	A			A		
Approach Delay	0.1					
Approach LOS	A					
Queue Length 50th (ft)	0			0		
Queue Length 95th (ft)	0			0		
Internal Link Dist (ft)	843			453	420	
Turn Bay Length (ft)						
Base Capacity (vph)	3539			3539		
Starvation Cap Reductn	0			0		
Spillback Cap Reductn	0			0		
Storage Cap Reductn	0			0		
Reduced v/c Ratio	0.15			0.06		

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.15
Intersection Signal Delay: 0.1 Intersection LOS: A
Intersection Capacity Utilization 8.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 103:

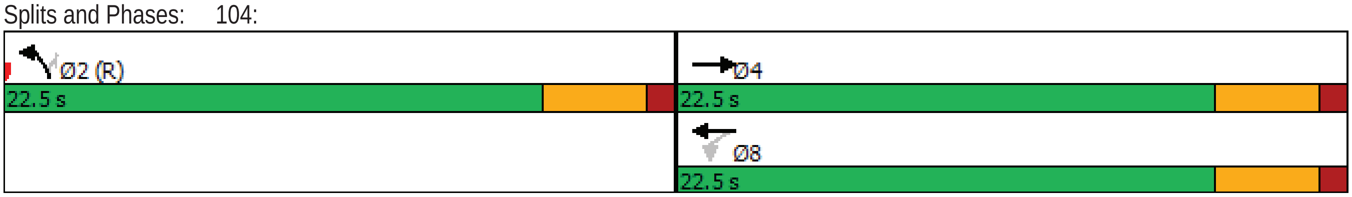


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	144	21	32	28	0	0
Future Volume (vph)	470	21	32	190	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.994					
Flt Protected			0.950			
Satd. Flow (prot)	3518	0	1770	3539	1863	1863
Flt Permitted			0.441			
Satd. Flow (perm)	3518	0	821	3539	1863	1863
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	12					
Link Speed (mph)	30			30	30	
Link Distance (ft)	533			404	428	
Travel Time (s)	12.1			9.2	9.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	511	23	35	207	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	534	0	35	207	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	20	
Link Offset(ft)	-12			8	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (%)	50.0%		50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0		18.0	18.0	18.0	18.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	18.0		18.0	18.0		
Actuated g/C Ratio	0.40		0.40	0.40		
v/c Ratio	0.38		0.11	0.15		
Control Delay	8.5		9.6	9.0		
Queue Delay	0.0		0.0	0.0		
Total Delay	8.5		9.6	9.0		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
LOS	A		A	A		
Approach Delay	8.5			9.1		
Approach LOS	A			A		
Queue Length 50th (ft)	47		5	16		
Queue Length 95th (ft)	37		19	32		
Internal Link Dist (ft)	453			324	348	
Turn Bay Length (ft)						
Base Capacity (vph)	1414		328	1415		
Starvation Cap Reductn	0		0	0		
Spillback Cap Reductn	0		0	0		
Storage Cap Reductn	0		0	0		
Reduced v/c Ratio	0.38		0.11	0.15		

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.38	
Intersection Signal Delay: 8.7	Intersection LOS: A
Intersection Capacity Utilization 16.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 104:



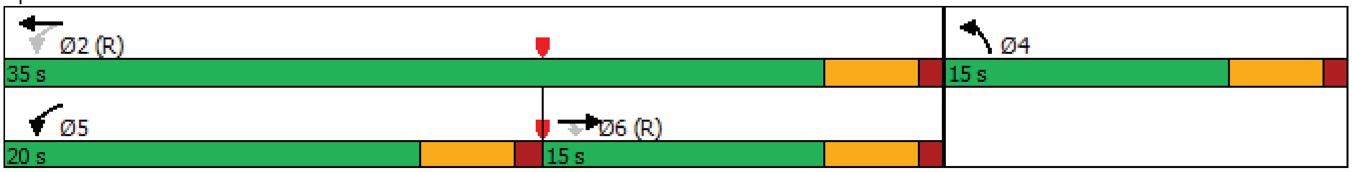
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	87	57	544	39	22	19
Future Volume (vph)	87	383	674	201	22	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95
Frt		0.850			0.930	
Flt Protected			0.950		0.974	
Satd. Flow (prot)	3539	1583	1770	3539	3273	0
Flt Permitted			0.568		0.974	
Satd. Flow (perm)	3539	1583	1058	3539	3273	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		416			21	
Link Speed (mph)	30			30	30	
Link Distance (ft)	491			971	1149	
Travel Time (s)	11.2			22.1	26.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	416	733	218	24	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	95	416	733	218	45	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (ft)	100	20	20	100	20	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	6	20	20	6	20	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	pm+pt	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases		6	2			
Detector Phase	6	6	5	2	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	20.0	20.0	9.5	22.5	15.0	
Total Split (s)	15.0	15.0	20.0	35.0	15.0	
Total Split (%)	30.0%	30.0%	40.0%	70.0%	30.0%	
Maximum Green (s)	10.5	10.5	15.5	30.5	10.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	None	C-Max	None	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	23.2	23.2	41.1	43.8	6.0	
Actuated g/C Ratio	0.46	0.46	0.82	0.88	0.12	
v/c Ratio	0.06	0.43	0.69	0.07	0.11	
Control Delay	12.6	4.2	6.8	0.8	13.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	12.6	4.2	6.8	0.8	13.9	
LOS	B	A	A	A	B	
Approach Delay	5.8			5.4	13.9	
Approach LOS	A			A	B	
Queue Length 50th (ft)	4	0	12	0	3	
Queue Length 95th (ft)	26	58	#124	7	14	
Internal Link Dist (ft)	411			891	1069	
Turn Bay Length (ft)						
Base Capacity (vph)	1643	958	1112	3099	703	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.06	0.43	0.66	0.07	0.06	

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 5.8 Intersection LOS: A
Intersection Capacity Utilization 48.5% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 105:



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	99	7	150	582	15	0	0	4	0	0	0
Future Volume (vph)	0	99	7	150	874	15	0	0	4	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990			0.998			0.865				
Flt Protected					0.993							
Satd. Flow (prot)	0	3504	0	0	3507	0	0	1611	0	0	1863	0
Flt Permitted					0.993							
Satd. Flow (perm)	0	3504	0	0	3507	0	0	1611	0	0	1863	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		971			260			262			305	
Travel Time (s)		22.1			5.9			6.0			6.9	
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
Adj. Flow (vph)	0	108	8	163	950	16	0	0	4	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	116	0	0	1129	0	0	4	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 34.2%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	92	10	9	540	207	4
Future Volume (vph)	92	10	107	832	207	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	12	12	12
Lane Util. Factor	0.95	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected				0.994	0.950	
Satd. Flow (prot)	3539	1689	0	3518	1770	1583
Flt Permitted				0.904	0.950	
Satd. Flow (perm)	3539	1689	0	3199	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		11				4
Link Speed (mph)	30			30	30	
Link Distance (ft)	777			738	307	
Travel Time (s)	17.7			16.8	7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	11	116	904	225	4
Shared Lane Traffic (%)						
Lane Group Flow (vph)	100	11	0	1020	225	4
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	R NA	Left	Left	Left	Right
Median Width(ft)	16			16	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	0.92	1.00	1.00	1.00	1.00
Turning Speed (mph)		15	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	pm+pt	NA	Prot	Perm
Protected Phases	6		5	2	4	
Permitted Phases		6	2			4
Detector Phase	6	6	5	2	4	4
Switch Phase						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	9.5	22.5	22.5	22.5
Total Split (s)	20.0	20.0	8.5	28.5	21.5	21.5
Total Split (%)	40.0%	40.0%	17.0%	57.0%	43.0%	43.0%
Maximum Green (s)	15.5	15.5	4.0	24.0	17.0	17.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	None	C-Max	None	None
Walk Time (s)	7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0
Act Effct Green (s)	29.5	29.5		29.5	11.5	11.5
Actuated g/C Ratio	0.59	0.59		0.59	0.23	0.23
v/c Ratio	0.05	0.01		0.54	0.55	0.01
Control Delay	1.8	0.4		8.1	21.5	9.0
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	1.8	0.4		8.1	21.5	9.0
LOS	A	A		A	C	A
Approach Delay	1.6			8.1	21.3	
Approach LOS	A			A	C	
Queue Length 50th (ft)	7	1		70	58	0
Queue Length 95th (ft)	1	0		137	98	5
Internal Link Dist (ft)	697			658	227	
Turn Bay Length (ft)						
Base Capacity (vph)	2085	999		1884	601	540
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.05	0.01		0.54	0.37	0.01

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green

Natural Cycle: 55

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 9.8 Intersection LOS: A

Intersection Capacity Utilization 37.5% ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 107:

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	72	24	317	999	357	232
Future Volume (vph)	72	24	431	999	357	508
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	1.00	0.95	0.95	1.00
Frt	0.962					0.850
Flt Protected	0.964		0.950			
Satd. Flow (prot)	3351	0	1770	3539	3539	1583
Flt Permitted	0.964		0.405			
Satd. Flow (perm)	3351	0	754	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	26					552
Link Speed (mph)	30			30	30	
Link Distance (ft)	738			727	965	
Travel Time (s)	16.8			16.5	21.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	26	468	1086	388	552
Shared Lane Traffic (%)						
Lane Group Flow (vph)	104	0	468	1086	388	552
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	36			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Minimum Split (s)	22.5		9.5	22.5	22.5	22.5
Total Split (s)	15.0		15.0	35.0	20.0	20.0
Total Split (%)	30.0%		30.0%	70.0%	40.0%	40.0%
Maximum Green (s)	10.5		10.5	30.5	15.5	15.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	10.5		30.5	30.5	15.5	15.5
Actuated g/C Ratio	0.21		0.61	0.61	0.31	0.31
v/c Ratio	0.14		0.70	0.50	0.35	0.63
Control Delay	7.5		12.1	6.5	14.5	5.5
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	7.5		12.1	6.5	14.5	5.5

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	A		B	A	B	A
Approach Delay	7.5			8.2	9.2	
Approach LOS	A			A	A	
Queue Length 50th (ft)	12		60	77	45	0
Queue Length 95th (ft)	26		#115	113	74	56
Internal Link Dist (ft)	658			647	885	
Turn Bay Length (ft)						
Base Capacity (vph)	724		673	2158	1097	871
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.14		0.70	0.50	0.35	0.63

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green, Master Intersection
Natural Cycle: 60
Control Type: Pretimed
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 8.5 Intersection LOS: A
Intersection Capacity Utilization 42.8% ICU Level of Service A
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 108:

Lane Group	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	211	0	0	19	0	0
Future Volume (vph)	211	0	0	117	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	0	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1082			1015	590	
Travel Time (s)	24.6			23.1	13.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	229	0	0	127	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	229	0	0	127	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 14.4%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	28	0	0	19	0	183
Future Volume (vph)	28	0	0	117	98	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.912	
Flt Protected					0.983	
Satd. Flow (prot)	1863	0	0	1863	1670	0
Flt Permitted					0.983	
Satd. Flow (perm)	1863	0	0	1863	1670	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	839			634	538	
Travel Time (s)	19.1			14.4	12.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	30	0	0	127	107	199
Shared Lane Traffic (%)						
Lane Group Flow (vph)	30	0	0	127	306	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 21.3%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	19	28	0
Future Volume (vph)	0	0	0	215	28	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.865			
Flt Protected					0.950	
Satd. Flow (prot)	0	1863	1611	0	1770	1863
Flt Permitted					0.950	
Satd. Flow (perm)	0	1863	1611	0	1770	1863
Link Speed (mph)		30	30		30	
Link Distance (ft)		98	839		286	
Travel Time (s)		2.2	19.1		6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	234	30	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	234	0	30	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		36	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		10	10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Stop		Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

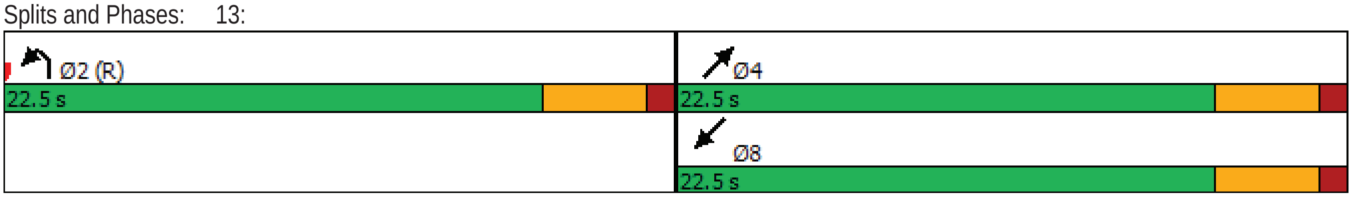
PM Build LOS

Lane Group	NBL	NBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	348	4	27	0	0	233
Future Volume (vph)	348	4	27	0	0	612
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt	0.999					
Flt Protected	0.953					
Satd. Flow (prot)	1773	0	3539	0	0	5085
Flt Permitted	0.953					
Satd. Flow (perm)	1773	0	3539	0	0	5085
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)	1					
Link Speed (mph)	30		30			30
Link Distance (ft)	765		397			221
Travel Time (s)	17.4		9.0			5.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	378	4	29	0	0	665
Shared Lane Traffic (%)						
Lane Group Flow (vph)	382	0	29	0	0	665
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		6			0
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Turn Type	Prot		NA			NA
Protected Phases	2		4			8
Permitted Phases						
Minimum Split (s)	22.5		22.5			22.5
Total Split (s)	22.5		22.5			22.5
Total Split (%)	50.0%		50.0%			50.0%
Maximum Green (s)	18.0		18.0			18.0
Yellow Time (s)	3.5		3.5			3.5
All-Red Time (s)	1.0		1.0			1.0
Lost Time Adjust (s)	0.0		0.0			0.0
Total Lost Time (s)	4.5		4.5			4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0			7.0
Flash Dont Walk (s)	11.0		11.0			11.0
Pedestrian Calls (#/hr)	5		5			5
Act Effct Green (s)	18.0		18.0			18.0
Actuated g/C Ratio	0.40		0.40			0.40
v/c Ratio	0.54		0.02			0.33
Control Delay	13.8		9.6			9.9
Queue Delay	0.0		0.0			0.0
Total Delay	13.8		9.6			9.9

Lane Group	NBL	NBR	NET	NER	SWL	SWT
LOS	B		A			A
Approach Delay	13.8		9.6			9.9
Approach LOS	B		A			A
Queue Length 50th (ft)	71		4			41
Queue Length 95th (ft)	133		14			61
Internal Link Dist (ft)	685		317			141
Turn Bay Length (ft)						
Base Capacity (vph)	709		1415			2034
Starvation Cap Reductn	0		0			0
Spillback Cap Reductn	0		0			0
Storage Cap Reductn	0		0			0
Reduced v/c Ratio	0.54		0.02			0.33

Intersection Summary	
Area Type: Other	
Cycle Length: 45	
Actuated Cycle Length: 45	
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green	
Natural Cycle: 45	
Control Type: Pretimed	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 11.3	Intersection LOS: B
Intersection Capacity Utilization 31.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 13:



Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	10	11	477	15	0	7	0	344	10	7	443	0
Future Volume (vph)	10	11	477	15	0	7	0	344	10	7	504	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		0.857	0.850			0.850			0.850			
Flt Protected	0.950			0.950						0.950		
Satd. Flow (prot)	3433	1517	1504	1770	0	1583	0	3539	1583	1770	3539	0
Flt Permitted	0.950			0.572						0.530		
Satd. Flow (perm)	3433	1517	1504	1065	0	1583	0	3539	1583	987	3539	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		181	181			36			36			
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		872			347			301			374	
Travel Time (s)		19.8			7.9			6.8			8.5	
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
Adj. Flow (vph)	11	12	518	16	0	8	0	374	11	8	548	0
Shared Lane Traffic (%)			49%									
Lane Group Flow (vph)	11	266	264	16	0	8	0	374	11	8	548	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	Perm	NA	Perm	Perm		Perm		NA	Perm	Perm	NA	
Protected Phases		6						4			8	
Permitted Phases	6		6	2		2			4	8		
Minimum Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5		22.5		22.5	22.5	22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%		50.0%		50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5		3.5		3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0		1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5		4.5	4.5	4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0		7.0		7.0	7.0	7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0		11.0		11.0	11.0	11.0	11.0	
Pedestrian Calls (#/hr)	5	5	5	5		5		5	5	5	5	
Act Effct Green (s)	18.0	18.0	18.0	18.0		18.0		18.0	18.0	18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40		0.40		0.40	0.40	0.40	0.40	
v/c Ratio	0.01	0.37	0.37	0.04		0.01		0.26	0.02	0.02	0.39	
Control Delay	8.2	5.3	5.3	8.7		0.4		13.8	7.5	8.9	10.5	
Queue Delay	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	
Total Delay	8.2	5.3	5.3	8.7		0.4		13.8	7.5	8.9	10.5	

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
LOS	A	A	A	A		A		B	A	A	B	
Approach Delay		5.3			5.9			13.6			10.5	
Approach LOS		A			A			B			B	
Queue Length 50th (ft)	1	13	13	2		0		54	0	1	55	
Queue Length 95th (ft)	4	51	50	11		1		92	m8	m4	100	
Internal Link Dist (ft)		792			267			221			294	
Turn Bay Length (ft)												
Base Capacity (vph)	1373	715	710	426		654		1415	654	394	1415	
Starvation Cap Reductn	0	0	0	0		0		0	0	0	0	
Spillback Cap Reductn	0	0	0	0		0		0	0	0	0	
Storage Cap Reductn	0	0	0	0		0		0	0	0	0	
Reduced v/c Ratio	0.01	0.37	0.37	0.04		0.01		0.26	0.02	0.02	0.39	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 45

Offset: 0 (0%), Referenced to phase 2:NWL and 6:SETL, Start of Green

Natural Cycle: 45

Control Type: Pretimed

Maximum v/c Ratio: 0.39

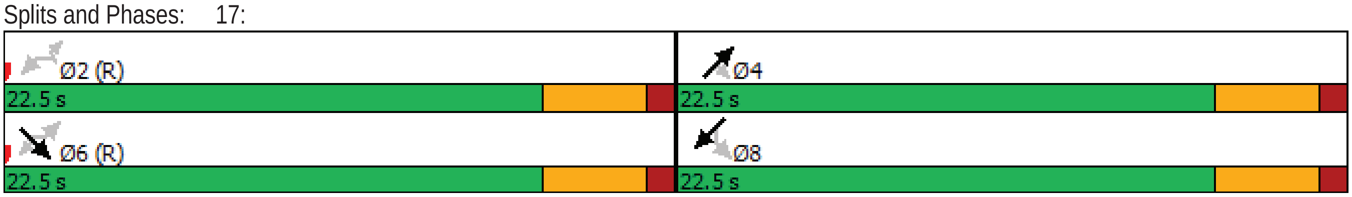
Intersection Signal Delay: 9.4 Intersection LOS: A

Intersection Capacity Utilization 46.1% ICU Level of Service A

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 17:



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	40	20	0	359	47	35
Future Volume (vph)	202	20	0	685	47	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt	0.986					0.865
Flt Protected					0.950	
Satd. Flow (prot)	3490	0	0	3539	0	1611
Flt Permitted					0.950	
Satd. Flow (perm)	3490	0	0	3539	0	1611
Link Speed (mph)	30			30	30	
Link Distance (ft)	404			491	211	
Travel Time (s)	9.2			11.2	4.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	220	22	0	745	51	38
Shared Lane Traffic (%)						
Lane Group Flow (vph)	242	0	0	745	51	38
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	12			24	0	
Link Offset(ft)	0			6	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization Err%	ICU Level of Service H
Analysis Period (min) 15	

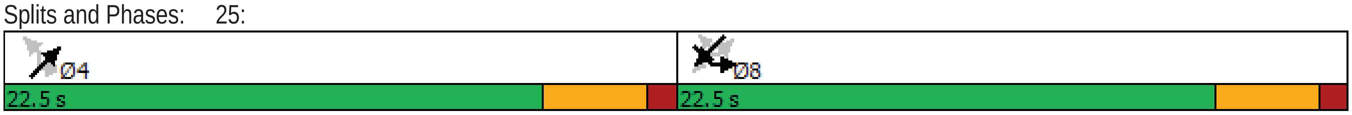
Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Traffic Volume (vph)	0	0	12	33	42	77	342	118	0	743	87
Future Volume (vph)	0	0	12	33	42	77	342	118	0	799	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		0	0	250		0	0		0
Storage Lanes	0	0		1	1	1		1	0		1
Taper Length (ft)	100			100		100			100		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt					0.850			0.850			0.850
Flt Protected				0.950		0.950					
Satd. Flow (prot)	0	0	0	1770	1583	1770	3539	1583	0	3539	1583
Flt Permitted				0.950		0.222					
Satd. Flow (perm)	0	0	0	1770	1583	414	3539	1583	0	3539	1583
Right Turn on Red					Yes			Yes			Yes
Satd. Flow (RTOR)					46			128			100
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	601			719			925			301	
Travel Time (s)	13.7			16.3			21.0			6.8	
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
Adj. Flow (vph)	0	0	13	36	46	84	372	128	0	868	100
Shared Lane Traffic (%)											
Lane Group Flow (vph)	0	0	0	49	46	84	372	128	0	868	100
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)	0			12			12			12	
Link Offset(ft)	0			0			0			0	
Crosswalk Width(ft)	10			10			10			10	
Two way Left Turn Lane											
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	15	9	15		9	15		9
Turn Type			D.Pm	Prot	Perm	Perm	NA	Perm		NA	Perm
Protected Phases				8!			4			8!	
Permitted Phases			8!		8	4		4			8
Minimum Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (s)			22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5
Total Split (%)			50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%
Maximum Green (s)			18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0
Yellow Time (s)			3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)			1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)				0.0	0.0	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)				4.5	4.5	4.5	4.5	4.5		4.5	4.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0
Flash Dont Walk (s)			11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)			5	5	5	5	5	5		5	5
Act Effct Green (s)				18.0	18.0	18.0	18.0	18.0		18.0	18.0
Actuated g/C Ratio				0.40	0.40	0.40	0.40	0.40		0.40	0.40
v/c Ratio				0.07	0.07	0.51	0.26	0.18		0.61	0.14

Lane Group	WBL	WBR	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Control Delay				8.7	3.8	25.2	9.7	3.1		10.3	2.2
Queue Delay				0.0	0.0	0.0	0.0	0.0		0.1	0.0
Total Delay				8.7	3.8	25.2	9.7	3.1		10.3	2.2
LOS				A	A	C	A	A		B	A
Approach Delay				6.3			10.5			9.5	
Approach LOS				A			B			A	
Queue Length 50th (ft)				7	0	15	32	0		66	1
Queue Length 95th (ft)				22	13	#65	54	22		96	14
Internal Link Dist (ft)	521			639			845			221	
Turn Bay Length (ft)						250					
Base Capacity (vph)				708	660	165	1415	710		1415	693
Starvation Cap Reductn				0	0	0	0	0		44	0
Spillback Cap Reductn				0	0	0	0	0		0	0
Storage Cap Reductn				0	0	0	0	0		0	0
Reduced v/c Ratio				0.07	0.07	0.51	0.26	0.18		0.63	0.14

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2: and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 9.7 Intersection LOS: A
Intersection Capacity Utilization 40.2% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
! Phase conflict between lane groups.

Splits and Phases: 25:

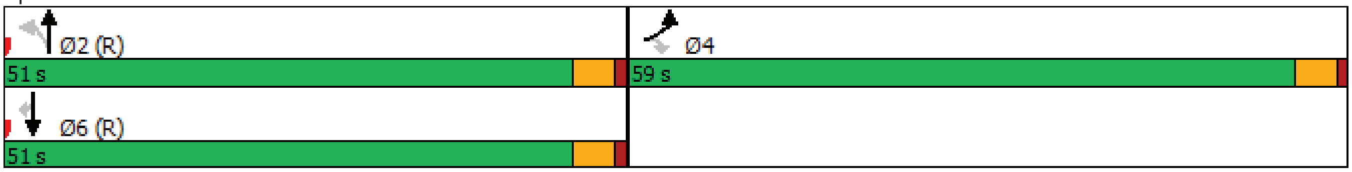


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	18	31	633	2
Future Volume (vph)	162	378	18	31	959	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	250			150
Storage Lanes	1	1	1			1
Taper Length (ft)	100		25			
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1770	1583	1770	3539	3539	1583
Flt Permitted	0.950		0.217			
Satd. Flow (perm)	1770	1583	404	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		39				1
Link Speed (mph)	30			30	30	
Link Distance (ft)	755			451	920	
Travel Time (s)	17.2			10.3	20.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	176	411	20	34	1042	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	176	411	20	34	1042	2
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			24	6	
Link Offset(ft)	0			-6	6	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (ft)	20	20	20	100	100	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	20	20	6	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)				94	94	
Detector 2 Size(ft)				6	6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	4			2	6	
Permitted Phases		4	2			6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	59.0	59.0	51.0	51.0	51.0	51.0
Total Split (%)	53.6%	53.6%	46.4%	46.4%	46.4%	46.4%
Maximum Green (s)	54.5	54.5	46.5	46.5	46.5	46.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	5	5	5	5	5	5
Act Effct Green (s)	33.6	33.6	67.4	67.4	67.4	67.4
Actuated g/C Ratio	0.31	0.31	0.61	0.61	0.61	0.61
v/c Ratio	0.33	0.81	0.08	0.02	0.48	0.00
Control Delay	29.3	43.3	13.1	11.1	14.0	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	43.3	13.1	11.1	14.0	10.5
LOS	C	D	B	B	B	B
Approach Delay	39.1			11.8	14.0	
Approach LOS	D			B	B	
Queue Length 50th (ft)	96	244	5	4	197	0
Queue Length 95th (ft)	130	309	22	14	325	4
Internal Link Dist (ft)	675			371	840	
Turn Bay Length (ft)			250			150
Base Capacity (vph)	876	803	247	2168	2168	970
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.51	0.08	0.02	0.48	0.00

Intersection Summary	
Area Type: Other	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green	
Natural Cycle: 50	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 22.7	Intersection LOS: C
Intersection Capacity Utilization 21.2%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 28:



Lane Group	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	633	31	0	0	0
Future Volume (vph)	0	959	193	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	1.00
Frt		0.850				
Flt Protected			0.950	0.950		
Satd. Flow (prot)	0	2787	1681	1681	0	0
Flt Permitted			0.950	0.950		
Satd. Flow (perm)	0	2787	1681	1681	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	227			920	549	
Travel Time (s)	5.2			20.9	12.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1042	210	0	0	0
Shared Lane Traffic (%)			50%			
Lane Group Flow (vph)	0	1042	105	105	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			36	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 25.5% ICU Level of Service A

Analysis Period (min) 15

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	361	450	133
Future Volume (vph)	0	0	0	361	511	451
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	3539	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	3539	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	818			374	654	
Travel Time (s)	18.6			8.5	14.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	392	555	490
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	392	555	490
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Stop			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 15.8% ICU Level of Service A

Analysis Period (min) 15

Lane Group	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Volume (vph)	0	0	27	355	0	581
Future Volume (vph)	0	0	27	355	0	960
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	0.91
Frt				0.850		
Flt Protected						
Satd. Flow (prot)	0	0	3539	1583	0	5085
Flt Permitted						
Satd. Flow (perm)	0	0	3539	1583	0	5085
Link Speed (mph)	30		30			30
Link Distance (ft)	815		654			397
Travel Time (s)	18.5		14.9			9.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	29	386	0	1043
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	29	386	0	1043
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	0		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	10		10			10
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 31.5%	ICU Level of Service A
Analysis Period (min) 15	

Lane Group	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (vph)	0	0	0	31	233	400
Future Volume (vph)	0	0	0	31	612	725
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	0.95	0.91	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	0	0	0	3539	5085	1583
Flt Permitted						
Satd. Flow (perm)	0	0	0	3539	5085	1583
Link Speed (mph)	30			30	30	
Link Distance (ft)	1042			221	359	
Travel Time (s)	23.7			5.0	8.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	34	665	788
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	34	665	788
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	8			0	6	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Sign Control	Free			Free	Free	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 28.1% ICU Level of Service A

Analysis Period (min) 15

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lane Configurations						
Traffic Volume (vph)	0	633	0	19	30	19
Future Volume (vph)	0	1337	0	19	30	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	0	500	0	0
Storage Lanes	1	2	1	1	2	1
Taper Length (ft)	25		25		25	
Lane Util. Factor	1.00	0.88	1.00	1.00	0.97	1.00
Frt		0.850		0.850		0.850
Flt Protected					0.950	
Satd. Flow (prot)	1863	2787	1863	1583	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	1863	2787	1863	1583	3433	1583
Right Turn on Red		Yes		Yes		Yes
Satd. Flow (RTOR)		1920		1007		21
Link Speed (mph)	30		30		30	
Link Distance (ft)	570		723		430	
Travel Time (s)	13.0		16.4		9.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1453	0	21	33	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	1453	0	21	33	21
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Right
Median Width(ft)	30		32		32	
Link Offset(ft)	30		0		0	
Crosswalk Width(ft)	10		10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15	9	15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Thru	Thru	Thru	Thru	Thru
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	Prot	pt+ov	Prot	Perm	Prot	Perm
Protected Phases	5	5 6	4		6	
Permitted Phases				4		6
Detector Phase	5	5 6	4	4	6	6
Switch Phase						
Minimum Initial (s)	5.0		5.0	5.0	5.0	5.0
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	15.5		15.5	15.5	19.0	19.0
Total Split (%)	31.0%		31.0%	31.0%	38.0%	38.0%
Maximum Green (s)	11.0		11.0	11.0	14.5	14.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag	Lead				Lag	Lag

Lane Group	SBL	SBR	NWL	NWR	NEL	NER
Lead-Lag Optimize?	Yes				Yes	Yes
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	None		None	None	C-Max	C-Max
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)		47.1		5.5	30.9	30.9
Actuated g/C Ratio		0.94		0.11	0.62	0.62
v/c Ratio		0.53		0.02	0.02	0.02
Control Delay		0.7		0.1	5.7	3.6
Queue Delay		0.0		0.0	0.0	0.0
Total Delay		0.7		0.1	5.7	3.6
LOS		A		A	A	A
Approach Delay	0.7		0.1		4.9	
Approach LOS	A		A		A	
Queue Length 50th (ft)		0		0	1	0
Queue Length 95th (ft)		0		0	8	9
Internal Link Dist (ft)	490		643		350	
Turn Bay Length (ft)				500		
Base Capacity (vph)		2709		1133	2121	986
Starvation Cap Reductn		0		0	0	0
Spillback Cap Reductn		0		0	0	0
Storage Cap Reductn		0		0	0	0
Reduced v/c Ratio		0.54		0.02	0.02	0.02

Intersection Summary	
Area Type: Other	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 6:NEL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.53	
Intersection Signal Delay: 0.9	Intersection LOS: A
Intersection Capacity Utilization 25.9%	ICU Level of Service A
Analysis Period (min) 15	

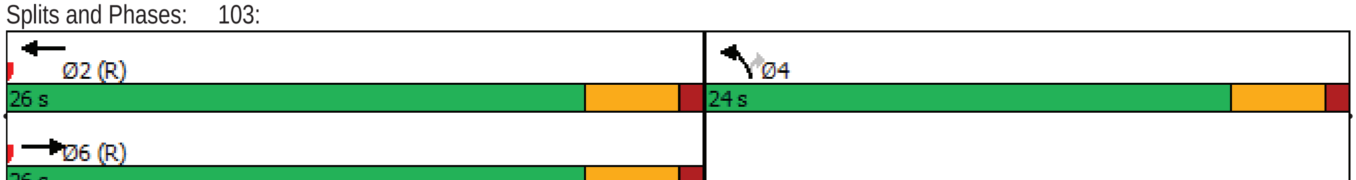
Splits and Phases: 102:

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	31	0	0	406	227	29
Future Volume (vph)	193	0	0	732	227	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	1.00
Frt						0.850
Flt Protected					0.950	
Satd. Flow (prot)	3539	0	0	3539	3433	1583
Flt Permitted					0.950	
Satd. Flow (perm)	3539	0	0	3539	3433	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						32
Link Speed (mph)	30			30	30	
Link Distance (ft)	923			533	500	
Travel Time (s)	21.0			12.1	11.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	210	0	0	796	247	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	210	0	0	796	247	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2			2	1	1
Detector Template	Thru			Thru	Left	Right
Leading Detector (ft)	100			100	20	20
Trailing Detector (ft)	0			0	0	0
Detector 1 Position(ft)	0			0	0	0
Detector 1 Size(ft)	6			6	20	20
Detector 1 Type	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0			0.0	0.0	0.0
Detector 1 Queue (s)	0.0			0.0	0.0	0.0
Detector 1 Delay (s)	0.0			0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA			NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases						4
Detector Phase	6			2	4	4
Switch Phase						
Minimum Initial (s)	5.0			5.0	5.0	5.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	22.5			22.5	22.5	22.5
Total Split (s)	26.0			26.0	24.0	24.0
Total Split (%)	52.0%			52.0%	48.0%	48.0%
Maximum Green (s)	21.5			21.5	19.5	19.5
Yellow Time (s)	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0	0.0
Total Lost Time (s)	4.5			4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Recall Mode	C-Max			C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	32.1			32.1	8.9	8.9
Actuated g/C Ratio	0.64			0.64	0.18	0.18
v/c Ratio	0.09			0.35	0.40	0.10
Control Delay	3.9			5.0	19.8	7.9
Queue Delay	0.0			0.0	0.0	0.0
Total Delay	3.9			5.0	19.8	7.9
LOS	A			A	B	A
Approach Delay	3.9			5.0	18.4	
Approach LOS	A			A	B	
Queue Length 50th (ft)	9			44	33	0
Queue Length 95th (ft)	21			80	55	16
Internal Link Dist (ft)	843			453	420	
Turn Bay Length (ft)						
Base Capacity (vph)	2272			2272	1338	636
Starvation Cap Reductn	0			0	0	0
Spillback Cap Reductn	0			0	0	0
Storage Cap Reductn	0			0	0	0
Reduced v/c Ratio	0.09			0.35	0.18	0.05

Intersection Summary	
Area Type: Other	
Cycle Length: 50	
Actuated Cycle Length: 50	
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green	
Natural Cycle: 45	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.40	
Intersection Signal Delay: 7.7	Intersection LOS: A
Intersection Capacity Utilization 25.2%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 103:



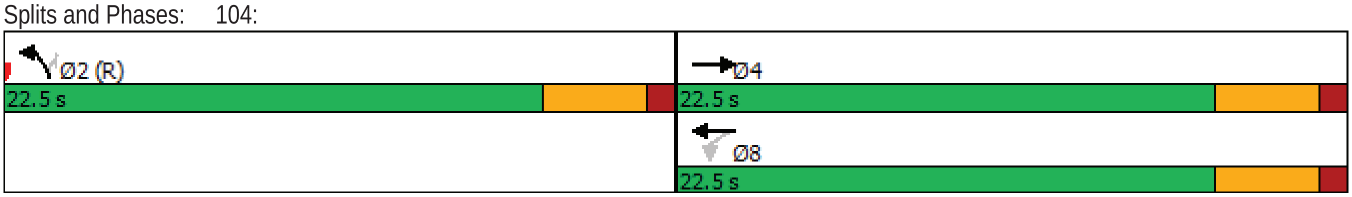
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	60	0	0	406	0	20
Future Volume (vph)	222	0	0	732	0	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	1.00	1.00
Frt						0.850
Flt Protected						
Satd. Flow (prot)	3539	0	1863	3539	1863	1583
Flt Permitted						
Satd. Flow (perm)	3539	0	1863	3539	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)						503
Link Speed (mph)	30			30	30	
Link Distance (ft)	533			404	428	
Travel Time (s)	12.1			9.2	9.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	241	0	0	796	0	22
Shared Lane Traffic (%)						
Lane Group Flow (vph)	241	0	0	796	0	22
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	20	
Link Offset(ft)	-12			8	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Turn Type	NA		Perm	NA	Prot	Perm
Protected Phases	4			8	2	
Permitted Phases			8			2
Minimum Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (s)	22.5		22.5	22.5	22.5	22.5
Total Split (%)	50.0%		50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	18.0		18.0	18.0	18.0	18.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	7.0		7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0
Act Effct Green (s)	18.0			18.0		18.0
Actuated g/C Ratio	0.40			0.40		0.40
v/c Ratio	0.17			0.56		0.02
Control Delay	9.1			12.4		0.1
Queue Delay	0.0			0.0		0.0
Total Delay	9.1			12.4		0.1

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
LOS	A			B		A
Approach Delay	9.1			12.4	0.1	
Approach LOS	A			B	A	
Queue Length 50th (ft)	20			78		0
Queue Length 95th (ft)	36			121		0
Internal Link Dist (ft)	453			324	348	
Turn Bay Length (ft)						
Base Capacity (vph)	1415			1415		935
Starvation Cap Reductn	0			0		0
Spillback Cap Reductn	0			0		0
Storage Cap Reductn	0			0		0
Reduced v/c Ratio	0.17			0.56		0.02

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.56
Intersection Signal Delay: 11.4 Intersection LOS: B
Intersection Capacity Utilization 15.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 104:



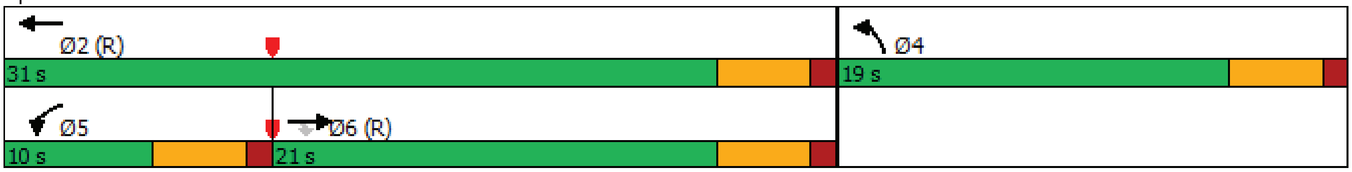
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	4	57	92	267	670
Future Volume (vph)	233	4	57	92	593	800
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95
Frt		0.850			0.914	
Flt Protected			0.950		0.979	
Satd. Flow (prot)	3539	1583	1770	3539	3234	0
Flt Permitted			0.950		0.979	
Satd. Flow (perm)	3539	1583	1770	3539	3234	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		4			577	
Link Speed (mph)	30			30	30	
Link Distance (ft)	491			971	1149	
Travel Time (s)	11.2			22.1	26.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	4	62	100	645	870
Shared Lane Traffic (%)						
Lane Group Flow (vph)	253	4	62	100	1515	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	24			24	24	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (ft)	100	20	20	100	20	
Trailing Detector (ft)	0	0	0	0	0	
Detector 1 Position(ft)	0	0	0	0	0	
Detector 1 Size(ft)	6	20	20	6	20	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Prot	NA	Prot	
Protected Phases	6		5	2	4	
Permitted Phases		6				
Detector Phase	6	6	5	2	4	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Split (s)	20.0	20.0	9.5	22.5	15.0	
Total Split (s)	21.0	21.0	10.0	31.0	19.0	
Total Split (%)	42.0%	42.0%	20.0%	62.0%	38.0%	
Maximum Green (s)	16.5	16.5	5.5	26.5	14.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	None	C-Max	None	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	20.5	20.5	5.5	26.5	14.5	
Actuated g/C Ratio	0.41	0.41	0.11	0.53	0.29	
v/c Ratio	0.17	0.01	0.32	0.05	1.12	
Control Delay	11.3	8.2	26.9	2.8	81.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	11.3	8.2	26.9	2.8	81.4	
LOS	B	A	C	A	F	
Approach Delay	11.3			12.1	81.4	
Approach LOS	B			B	F	
Queue Length 50th (ft)	27	0	18	5	~206	
Queue Length 95th (ft)	48	5	39	4	#322	
Internal Link Dist (ft)	411			891	1069	
Turn Bay Length (ft)						
Base Capacity (vph)	1450	651	194	1875	1347	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.17	0.01	0.32	0.05	1.12	

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.12
Intersection Signal Delay: 66.3 Intersection LOS: E
Intersection Capacity Utilization 46.2% ICU Level of Service A
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 105:



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	741	0	2	119	2	27	0	17	0	0	4
Future Volume (vph)	0	1033	0	2	119	2	27	0	17	0	0	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.998			0.948			0.865	
Flt Protected					0.999			0.970				
Satd. Flow (prot)	0	3539	0	0	3529	0	0	1713	0	0	1611	0
Flt Permitted					0.999			0.970				
Satd. Flow (perm)	0	3539	0	0	3529	0	0	1713	0	0	1611	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		971			260			262			305	
Travel Time (s)		22.1			5.9			6.0			6.9	
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
Adj. Flow (vph)	0	1123	0	2	129	2	29	0	18	0	0	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1123	0	0	133	0	0	47	0	0	4	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		16			16			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		10			10			10			10	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 36.4%	ICU Level of Service A
Analysis Period (min) 15	

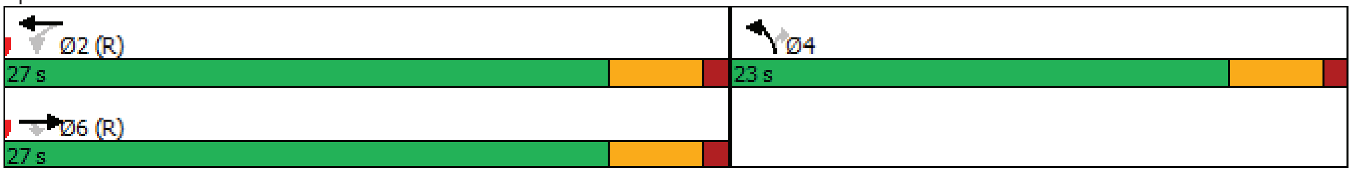
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	465	293	4	122	0	19
Future Volume (vph)	757	293	4	122	0	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	12	12	12
Lane Util. Factor	0.95	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected				0.999		
Satd. Flow (prot)	3539	1689	0	3536	1863	1583
Flt Permitted				0.941		
Satd. Flow (perm)	3539	1689	0	3330	1863	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		318				96
Link Speed (mph)	30			30	30	
Link Distance (ft)	777			738	307	
Travel Time (s)	17.7			16.8	7.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	823	318	4	133	0	127
Shared Lane Traffic (%)						
Lane Group Flow (vph)	823	318	0	137	0	127
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	R NA	Left	Left	Left	Right
Median Width(ft)	16			16	36	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	0.92	1.00	1.00	1.00	1.00
Turning Speed (mph)		15	15		15	9
Number of Detectors	2	1	1	2	1	1
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	100	20	20	100	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	6	20	20	6	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)	94			94		
Detector 2 Size(ft)	6			6		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	Perm
Protected Phases	6			2	4	
Permitted Phases		6	2			4
Detector Phase	6	6	2	2	4	4
Switch Phase						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	27.0	27.0	27.0	27.0	23.0	23.0
Total Split (%)	54.0%	54.0%	54.0%	54.0%	46.0%	46.0%
Maximum Green (s)	22.5	22.5	22.5	22.5	18.5	18.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	36.7	36.7		36.7		7.2
Actuated g/C Ratio	0.73	0.73		0.73		0.14
v/c Ratio	0.32	0.24		0.06		0.41
Control Delay	5.0	2.1		2.8		11.6
Queue Delay	0.0	0.0		0.0		0.0
Total Delay	5.0	2.1		2.8		11.6
LOS	A	A		A		B
Approach Delay	4.2			2.8	11.6	
Approach LOS	A			A	B	
Queue Length 50th (ft)	53	6		5		8
Queue Length 95th (ft)	m57	m7		11		42
Internal Link Dist (ft)	697			658	227	
Turn Bay Length (ft)						
Base Capacity (vph)	2600	1325		2446		646
Starvation Cap Reductn	0	0		0		0
Spillback Cap Reductn	0	0		0		0
Storage Cap Reductn	0	0		0		0
Reduced v/c Ratio	0.32	0.24		0.06		0.20

Intersection Summary

Area Type: Other
Cycle Length: 50
Actuated Cycle Length: 50
Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBT, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.41
Intersection Signal Delay: 4.7 Intersection LOS: A
Intersection Capacity Utilization 29.8% ICU Level of Service A
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 107:



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	470	115	40	1170	922	85
Future Volume (vph)	746	229	40	1170	922	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.95	1.00	0.95	0.95	1.00
Frt	0.965					0.850
Flt Protected	0.963		0.950			
Satd. Flow (prot)	3358	0	1770	3539	3539	1583
Flt Permitted	0.963		0.200			
Satd. Flow (perm)	3358	0	373	3539	3539	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	91					92
Link Speed (mph)	30			30	30	
Link Distance (ft)	738			727	965	
Travel Time (s)	16.8			16.5	21.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	811	249	43	1272	1002	92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1060	0	43	1272	1002	92
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	36			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9	15			9
Turn Type	Prot		pm+pt	NA	NA	Perm
Protected Phases	4		5	2	6	
Permitted Phases			2			6
Minimum Split (s)	22.5		9.5	22.5	22.5	22.5
Total Split (s)	21.5		8.5	28.5	20.0	20.0
Total Split (%)	43.0%		17.0%	57.0%	40.0%	40.0%
Maximum Green (s)	17.0		4.0	24.0	15.5	15.5
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5		4.5	4.5	4.5	4.5
Lead/Lag			Lead		Lag	Lag
Lead-Lag Optimize?			Yes		Yes	Yes
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	11.0	11.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	17.0		24.0	24.0	15.5	15.5
Actuated g/C Ratio	0.34		0.48	0.48	0.31	0.31
v/c Ratio	0.88		0.15	0.75	0.91	0.17
Control Delay	24.9		8.2	14.0	32.0	4.6
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	24.9		8.2	14.0	32.0	4.6

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
LOS	C		A	B	C	A
Approach Delay	24.9			13.8	29.7	
Approach LOS	C			B	C	
Queue Length 50th (ft)	141		6	145	145	0
Queue Length 95th (ft)	#234		18	212	#253	24
Internal Link Dist (ft)	658			647	885	
Turn Bay Length (ft)						
Base Capacity (vph)	1201		290	1698	1097	554
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.88		0.15	0.75	0.91	0.17

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green, Master Intersection

Natural Cycle: 60

Control Type: Pretimed

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 22.2 Intersection LOS: C

Intersection Capacity Utilization 57.8% ICU Level of Service B

Analysis Period (min) 15

\# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 108:

Lane Group	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Traffic Volume (vph)	19	0	361	0	0	0
Future Volume (vph)	117	98	361	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.938					
Flt Protected				0.950		
Satd. Flow (prot)	1747	0	0	1770	0	0
Flt Permitted				0.950		
Satd. Flow (perm)	1747	0	0	1770	0	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	1082			1015	590	
Travel Time (s)	24.6			23.1	13.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	127	107	392	0	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	234	0	0	392	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	0	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 30.0%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	19
Future Volume (vph)	196	0	0	0	0	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.865	
Flt Protected						
Satd. Flow (prot)	1863	0	0	1863	1611	0
Flt Permitted						
Satd. Flow (perm)	1863	0	0	1863	1611	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	839			634	538	
Travel Time (s)	19.1			14.4	12.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	213	0	0	0	0	21
Shared Lane Traffic (%)						
Lane Group Flow (vph)	213	0	0	0	21	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	0			0	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	10			10	10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
Control Type: Unsignalized
Intersection Capacity Utilization 13.3% ICU Level of Service A
Analysis Period (min) 15

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	196	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected					0.950	
Satd. Flow (prot)	0	1863	1863	0	1770	1863
Flt Permitted					0.950	
Satd. Flow (perm)	0	1863	1863	0	1770	1863
Link Speed (mph)		30	30		30	
Link Distance (ft)		98	839		286	
Travel Time (s)		2.2	19.1		6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	213	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	0	0	0	213	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		36	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		10	10		10	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Stop		Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 13.3% ICU Level of Service A

Analysis Period (min) 15

HDR Tehama JV
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Ste 754

Kansas City, MO 64102-1064

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APPENDIX I – NOISE STUDY

HDR
A JOINT VENTURE
TEHAMA

Draft

Noise Technical Report

Fort Belvoir North Area (FBNA) Distribution Center

Springfield, Virginia

Contract No. W912DR-20-D-0010
Task Order W912DR22F0048

May 9, 2022

US Army Corps
of Engineers
Baltimore District

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Contents

Tables

Figures

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1 Introduction

Fort Belvoir proposes to construct and operate a new Distribution Center at the Fort Belvoir North Area (FBNA) in Springfield, Virginia. FBNA currently hosts the National Geospatial-Intelligence Agency (NGA) headquarters and associated support facilities. The Proposed Action would construct a high bay warehouse, a two-story administrative building, a truck maintenance/refueling building, covered/enclosed storage buildings, an entry control facility, and enhanced site security measures.

HDR performed a noise analysis for the Proposed Action and the No Action Alternative. This report details the affected noise environment and the evaluation of environmental consequences related to noise.

1.1 Noise Concepts

Noise is generally defined as unwanted sound. Noise may be continuous, intermittent, or impulsive. An impulsive sound (or impulse sound) generally lasts for no more than one second, such as sound from firearms, pile drivers, or blasting. Human response to noise varies depending on the type of the noise, distance from the noise source, sensitivity, and time of day.

The decibel (dB) is a unit of measurement for noise levels and uses a logarithmic scale. To better match the sensitivity of the human ear, noise levels are typically A-weighted (dBA) to deemphasize low-frequency and very high-frequency sound. For low-frequency sounds such as artillery fire, noise levels are often C-weighted (dBC) to evaluate the presence of low-frequency sound. Table 1-1 contains average sound levels for some common noise sources.

Table 1-1. Common Sources of Noise

Sound Source	Average Sound Level (dB)
Soft whisper	30
Refrigerator hum	40
Normal conversation, air conditioner	60
Washing machine, dishwasher	70
City traffic (inside the car), gas-powered lawnmowers, and leaf blowers	80 – 85
Motorcycle	95

Source: Centers for Disease Control and Prevention (CDC), 2019

Because of the logarithmic scale, noise levels cannot be simply added or subtracted. If sound energy is doubled, the noise level only increases by 3 dB. However, a doubling of sound energy is not perceived by humans as a doubling of loudness. A 3-dB change is generally perceived as a just noticeable difference, a 5-dB change is generally perceived as a clearly noticeable difference, and a 10-dB change is generally perceived as twice as loud or half as loud.

Environmental noise levels are often expressed over a specified period. The equivalent-average sound level (LEQ) represents an average sound level in decibels of a given event or period of time (typically one hour). The day-night average sound level (DNL) represents a 24-hour LEQ with a 10-dBA penalty applied to nighttime hours. Daytime is defined as 7:00 a.m. to 10:00 p.m., and nighttime as 10:00 p.m. to 7:00 a.m.

2 Affected Environment

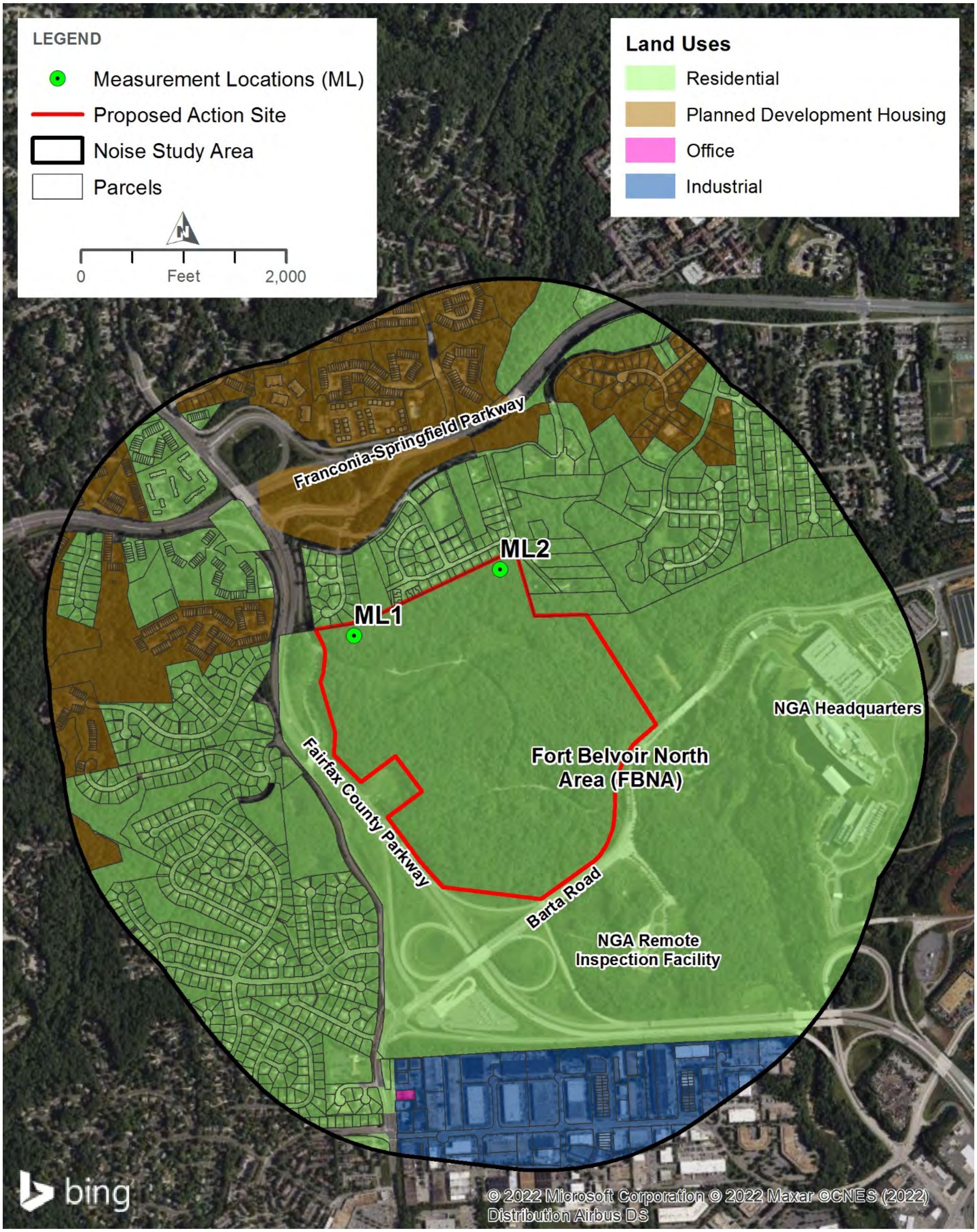
HDR evaluated the affected environment by defining a noise study area, reviewing applicable noise regulations, and documenting existing noise levels for the Proposed Action Site.

2.1 Noise Study Area

Figure 2-1, below, shows the Proposed Action Site, the noise study area, and the land uses within that area. The noise study area is defined as the area within one half mile of the Proposed Action Site. The nearest noise-sensitive receptors (NSR) to the Proposed Action Site include residences to the north and to the west, outside the FBNA property boundary. NSRs within the FBNA boundary include the existing NGA headquarters, located east of the Proposed Action Site, and the existing NGA remote inspection facility, located to the south.

The Proposed Action Site is separated from areas to the west by Fairfax County Parkway and areas to the south by Barta Road. The major thoroughfare of Interstate-95 (I-95) is located approximately 1.25 miles to the east of the Proposed Action Site. Currently, the major noise source in the project vicinity is vehicular traffic on Fairfax County Parkway, Barta Road, Franconia-Springfield Parkway, and I-95. Davison Army Airfield is located approximately 2.5 miles to the south of the Proposed Action Site.

Figure 2-1. Noise Study Area



Note: Figure uses computer-aided design (CAD) and geographic information system (GIS) data from the U.S. Army Corps of Engineers (USACE) and Fairfax County

2.2 Applicable Noise Regulations

Department of Defense (DoD) Instruction 4715.13 instructs facilities to minimize effects on the environment from military noise (DoD, 2020). The Noise Control Act of 1972 (42 United States Code [USC] §4901, et seq.) directs federal agencies to comply with applicable federal, state, interstate, and local noise control regulations. The applicable local noise control regulation is the Fairfax County noise ordinance (Chapter 108.1), which includes quantitative noise limits that apply at the property boundary of the sound source or at any point within any other property affected by the sound (County of Fairfax, 2021). Table 2-1 summarizes the Fairfax County maximum sound levels, which include limits for continuous sound sources (e.g., an air handling unit) and impulse sound sources (e.g., a firearm).

Table 2-1. Fairfax County Maximum Sound Levels

Use and Zoning District Classification	Time of Day	Maximum Continuous Sound Level (dBA)	Maximum Impulse Sound Level (dBA)
Residential Areas in Residential Districts	7 a.m. to 10 p.m.	60	100
Residential Areas in Residential Districts	10 p.m. to 7 a.m.	55	80
Non-Residential Areas in Residential Districts	All	60	100
Mixed Use Area	7 a.m. to 10 p.m.	65	100
Mixed Use Area	10 p.m. to 7 a.m.	60	80
Commercial Districts	All	65	100
Industrial Districts	7 a.m. to 10 p.m.	72	120
Industrial Districts	10 p.m. to 7 a.m.	65	100

Source: County of Fairfax, 2021 (Chapter 108.1)

Section 108.1-4-1 of the Fairfax County noise ordinance contains some specific prohibitions relevant to the Proposed Action:

- Construction, repair, maintenance, remodeling, demolition, grading, or other improvement of real property is prohibited outdoors between the hours of 9:00 p.m. and 7:00 a.m. from Sunday through Thursday and between the hours of 9:00 p.m. and 9:00 a.m. on Fridays, Saturdays, and the day before a federal holiday.
- Loading or unloading trucks outdoors within 100 yards of a residential dwelling is prohibited between the hours of 9:00 p.m. and 6:00 a.m.

Section 108.1-5-1 of the Fairfax County noise ordinance contains some specific exceptions relevant to the Proposed Action:

- Emergency work is exempt from the provisions of Chapter 108.1.
- Motor vehicles on road right-of-way are exempt from the provisions of Chapter 108.1.
- Construction, repair, maintenance, remodeling, demolition, grading, or other improvement of real property is exempt from the provisions of Chapter 108.1 except that such activity shall not generate noise levels exceeding 90 dBA in residential

areas and shall not begin before 9:00 a.m. on Saturdays, Sundays, and federal holidays.

- Back-up generators are exempt from the provisions of Chapter 108.1 during power outages from storms or other emergencies. Routine testing and maintenance of back-up generators are exempt from the provisions of Chapter 108.1 between the hours of 7:00 a.m. and 9:00 p.m., and are prohibited from occurring at other hours. Additionally, the duration of routine testing and maintenance events shall not exceed two consecutive or non-consecutive hours in any one day.

Section 14-4 of Army Regulation 200-1 defines noise zones for the determination of compatible land use (U.S. Army, 2007). The DNL is the primary metric for military zones, and is typically assessed and averaged over a period of 250 days for Active Army Installations and 104 days for Army Reserve and National Guard Installations. Single event noise metrics are used for small arms and large caliber weapons noise. The metric PK 15(met) is the peak noise level expected to be exceeded by 15 percent of all events that might occur, and does not include a frequency weighting. Table 2-2 defines the noise zones and their associated noise levels.

Table 2-2. Noise Limits for Noise Zones

Noise Zone	DNL Limit for Aviation Sources (dBA)	DNL Limit for Impulsive Sources (dBC)	PK 15(met) Limit for Small Arms (dB)
LUPZ (Land Use Planning Zone)	60 – 65	57 – 62	N/A
I	< 65	< 62	< 87
II	65 – 75	62 – 70	87 – 104
III	> 75	> 70	> 104

Source: U.S. Army, 2007

2.3 Existing Noise Levels

The nearest airfields are Davison Army Airfield, located approximately 2.5 miles to the south of the Proposed Action Site; Ronald Reagan Washington National Airport, located approximately 10.5 miles to the northeast; and Dulles International Airport, located approximately 16.5 miles to the northwest. The noise associated with airfields is generally reported to the public with maps showing the areas anticipated to experience aircraft overflight noise levels of 65 dBA DNL or more. The Proposed Action Site falls outside of these 65 dBA DNL areas for the nearest airfields; therefore, aircraft-related noise is anticipated to be less than 65 dBA DNL and existing noise levels are anticipated to be driven by other sources.

HDR measured outdoor noise levels from March 8 to 11, 2022, at two locations on the north end of the Proposed Action Site to document existing noise conditions. Measurement Location (ML) 1 is in the northwest corner of the Proposed Action Site and is representative of residential NSRs north of the site that are closer to Fairfax County Parkway (see Figure 2-1). ML2 is in the northeast corner of the Proposed Action Site and is representative of residential NSRs north of the site that are further from Fairfax County Parkway. HDR followed measurement guidelines from the American National

Standards Institute (ANSI) and the Acoustical Society of America (ASA) standard S1.13, "Measurement of Sound Pressure Levels in Air" (ANSI/ASA, 2010). HDR used Type 1 digital sound level meters and a Type 1 handheld calibrator to perform the measurements. The microphones were protected using wind screens and were positioned away from reflecting surfaces.

Table 2-3 summarizes the existing noise levels at ML1 and ML2.

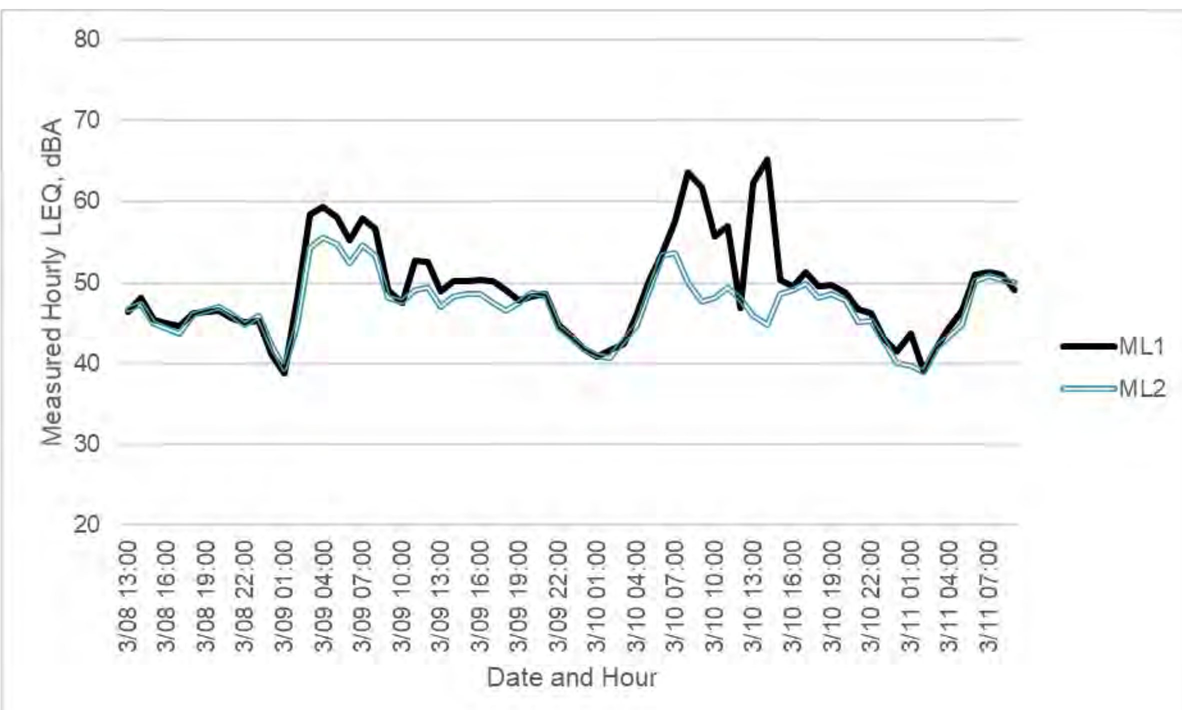
Table 2-3. Noise Measurement Results

Measurement Location	Measured Overall Equivalent-Average Sound Level (LEQ) (dBA)	Range of Measured Hourly LEQ at Daytime (dBA)	Range of Measured hourly LEQ at Night (dBA)	Measured Overall DNL (dBA)
ML1	54	45 - 65	39 - 59	58
ML2	49	44 - 55	39 - 56	55

ML1 was generally louder than ML2, which is to be expected for the location closer to Fairfax County Parkway. The measured noise levels during quieter periods were similar between the two locations. With reference to Table 2-2, the site would be classified as Noise Zone I because the measured DNL was below the aviation noise DNL threshold of 65 dBA at both locations.

Figure 2-2 illustrates the measured hourly LEQ at ML1 and ML2.

Figure 2-2. Measured Hourly Noise Levels



The measured hourly LEQ at ML1 and ML2 were similar for about half of the measurement duration, but there were two periods when noise levels were higher at ML1. Noise levels in residential areas often display a pattern of elevated noise levels during the day when there is more noise from transportation sources, and lower noise levels at night. This pattern was disrupted between the hours of 3:00 a.m. and 8:00 a.m. on March 9, when noise levels were elevated at both ML1 and ML2. On March 10, noise levels were again elevated at ML1 between the hours of 7:00 a.m. and 2:00 p.m., but the event appears to have been more localized to ML1. The sources of these elevated noise levels on March 9 and March 10 are unclear.

3 Environmental Consequences

HDR evaluated the potential for noise impacts resulting from the Proposed Action and the No Action Alternative.

3.1 Noise Analysis Approach

Impacts on the noise environment from the Proposed Action or No Action Alternative would be considered significant if any of the following were to occur:

- Construction activities during prohibited hours or generating noise levels exceeding the Fairfax County noise limit of 90 dBA in residential areas (see Section 2.2).
- Back-up generator testing in a manner prohibited by Fairfax County (see Section 2.2).
- Typical operations generating noise levels exceeding the Fairfax County limits (see Table 2-1).
- Typical operations exceeding Noise Zone I aviation noise limits of 65 dBA DNL at on-site or off-site NSRs (see Table 2-2).

3.1.1 Noise Analysis Approach for Proposed Action Construction

HDR estimated construction noise levels using source levels and usage factors from the Federal Highway Administration's (FHWA) Highway Construction Noise Handbook (FHWA, 2006). Exact equipment types, quantities, and locations are unknown at this time; therefore, calculated construction noise levels are representative of various activities at set distances. The calculations assumed all equipment associated with an activity would operate at the same location. HDR anticipates construction equipment would be spread throughout the site, so the calculation approach may result in higher noise levels than during peak construction periods. The FHWA Highway Construction Noise Handbook quantifies construction equipment noise emissions using the maximum sound level (LMAX). HDR used the LMAX and usage factors to calculate hourly LEQs for representative activities.

3.1.2 Noise Analysis Approach for Proposed Action Operations

HDR calculated operations noise levels using the 3-D environmental noise software Computer Aided Noise Abatement (CadnaA), with calculation methods from the International Organization for Standardization (ISO) 9613-2, "Acoustics – Attenuation of Sound during Propagation Outdoors" (ISO, 1996). The model accounts for mobile and stationary Proposed Action noise sources, terrain (including grading), and existing and proposed buildings. The noise model does not include noise from existing sources.

The Fairfax County noise ordinance exempts motor vehicles on right-of-way; therefore, modeled noise levels represent on-site mobile noise sources. The automobile and truck noise emissions were based on FHWA Traffic Noise Model (TNM) calculation methods in CadnaA. HDR used projected peak hour traffic volumes to estimate noise from automobile and truck movements around the site. Table 3-1 summarizes the projected inbound and outbound traffic volumes for the Proposed Action.

Table 3-1. Projected Traffic Volumes for Proposed Action

Period	Inbound Traffic Volume	Outbound Traffic Volume
Peak AM Hour	540 [a]	22 [b]
Peak PM Hour	20 [c]	540 [a]

Source: HDR-Tehama JV, 2022
[a] Assumed 18 of these vehicles would be heavy trucks.
[b] Assumed 4 of these vehicles would be heavy trucks.
[c] Assumed 2 of these vehicles would be heavy trucks.

HDR modeled on-site automobile and truck noise based on the following assumptions.

- Peak PM hour volumes were modeled throughout the daytime hours (7:00 a.m. to 10:00 p.m.).
- Peak AM hour volumes divided by nine were modeled throughout the nighttime hours (10:00 p.m. to 7:00 a.m.). Assumed peak AM hour commuters may arrive before 7:00 a.m., but other overnight vehicle movements would be minimal.
- Half of the heavy trucks would travel to and from the north side of the Distribution Center and half of the heavy trucks would travel to and from the south side of the Distribution Center.
- Automobile movements were distributed throughout the site largely based on the number of parking stalls at each parking area.
- Automobiles and trucks would move around the site at a speed of 15 miles per hour.

HDR modeled on-site stationary noise from electric forklifts, rooftop units, transformers, and a diesel fire pump. Electric forklifts are a mobile source, but HDR assumed they would operate within defined areas on the north and south sides of the Distribution Center. HDR assumed the location, quantity, and noise emissions for all stationary noise sources. Table 3-2 summarizes the modeled sound power levels.

Table 3-2. Modeled Stationary Source Sound Power Levels

Stationary Source	Lw at 63 Hz (dBL)	Lw at 125 Hz (dBL)	Lw at 250 Hz (dBL)	Lw at 500 Hz (dBL)	Lw at 1000 Hz (dBL)	Lw at 2000 Hz (dBL)	Lw at 4000 Hz (dBL)	Lw at 8000 Hz (dBL)
Electric Forklift (Qty 3) [a]	122	117	114	112	112	108	102	97
Rooftop Unit (Qty 3) [b]	97	96	97	96	94	90	86	81
Transformer (Qty 2) [c]	99	101	96	96	90	85	80	73
Diesel Fire Pump (Qty 1) [c]	103	101	100	99	98	97	96	92

[a] Octave band sound power levels derived from British Standard (BS) 5228-1:2009 (British Standards Institution [BSI], 2009)

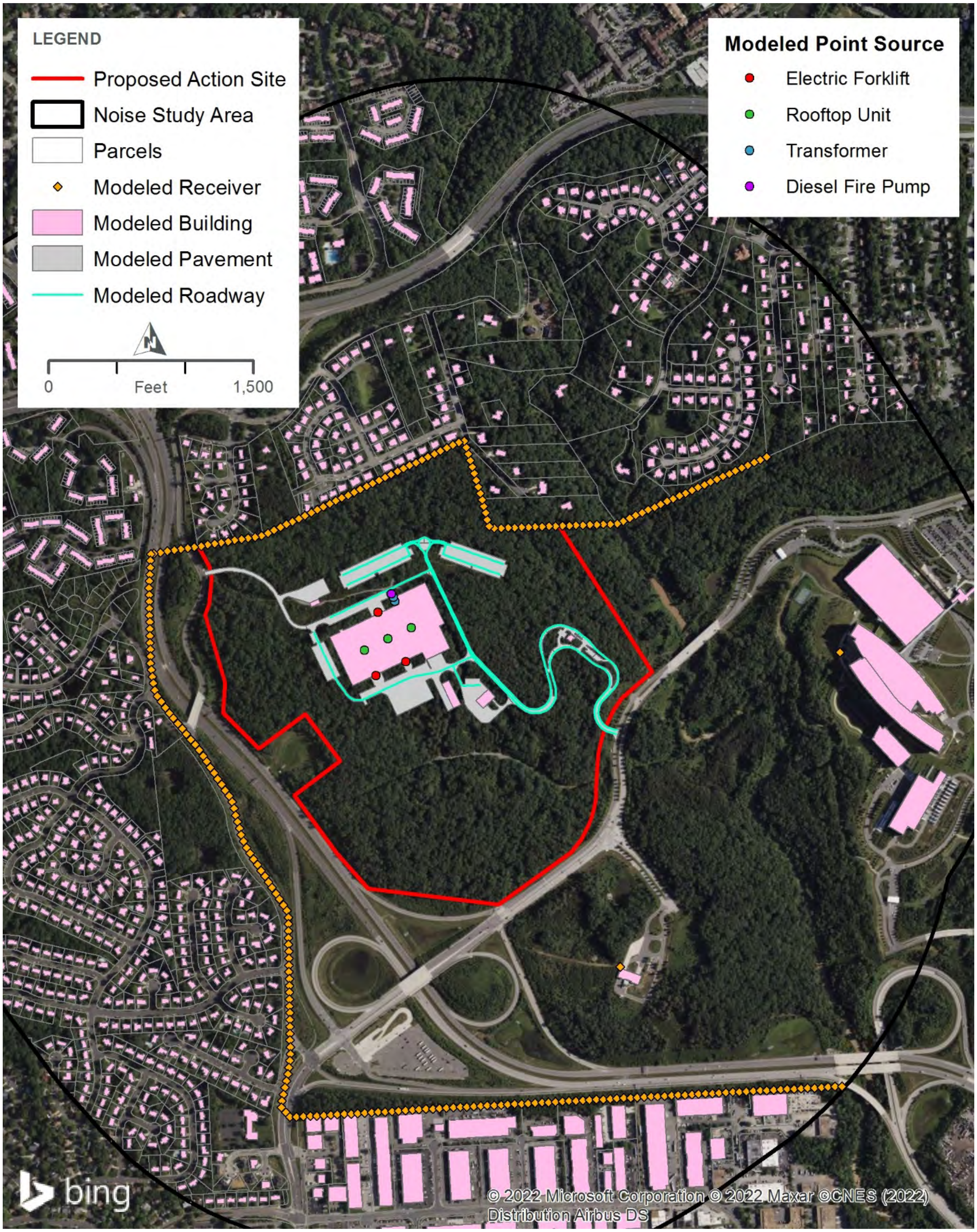
[b] Octave band sound power levels derived from typical submittals

[c] Octave band sound power levels derived from "Electric Power Plant Environmental Noise Guide" (Edison Electric Institute, 1984)

HDR assumed the electric forklifts would operate at all daytime hours, and the rooftop units, transformers, and diesel fire pump would operate at all hours of the day. HDR assumed the stated quantities of each source would operate simultaneously. The Proposed Action would also include two generators. The Fairfax County noise ordinance includes exemptions for back-up generators, so HDR excluded them from the noise model.

Figure 3-1 shows the noise model features.

Figure 3-1. Noise Model Features



Note: Figure uses CAD and GIS data from USACE and Fairfax County

Table 3-3 summarizes the modeled heights for the stationary noise sources and existing and proposed buildings.

Table 3-3. Modeled Heights

Stationary Source / Building	Modeled Height (feet)
Electric Forklift	3.3
Rooftop Unit (height relative to Distribution Center / Administrative Building roof)	9.9
Transformer	6.6
Diesel Fire Pump	3.3
Distribution Center / Administrative Building	48
Support Buildings	15
Gate House	10
Existing FBNA NGA Headquarters	91
Existing FBNA NGA Support Building & Parking Structure	39
Existing FBNA NGA Central Plant & Visitor Center & Remote Inspection Facility	15
Existing Off-site Buildings	15

Table 3-4 summarizes the noise model parameters.

Table 3-4. Model Parameters

Parameter	Model Approach
Terrain	Proposed Action grading was merged with publicly available terrain data. Model included 5-foot interval contour lines.
Buildings	Model included proposed buildings and existing off-site buildings based on publicly available GIS data.
Ground Factor	The ground was generally modeled as 45% absorptive to account for mostly soft ground. Proposed pavement was modeled as 0% absorptive.
Foliage	No foliage was modeled. While the Proposed Action Site is wooded, the foliage appears to be mostly deciduous. The model represents the condition when the trees have shed their leaves, because this condition would result in higher modeled noise levels than the condition when the trees have their leaves.
Meteorology	Downwind conditions were assumed in all directions – at each modeled receiver. Downwind conditions result in higher modeled noise levels.
Temperature and Relative Humidity	The modeled temperature of 10 degrees Celsius and relative humidity of 70% generally aligned with publicly available annual averages for the Washington, D.C. area.

HDR modeled operations noise levels at specific receiver points, which were placed every 50 feet along the FBNA property boundary. Additional receiver points were placed to represent the NGA headquarters and remote inspection facility.

3.2 Proposed Action Analysis

The Proposed Action would introduce short-term noise sources during construction and long-term noise sources during operations.

3.2.1 Analysis of Proposed Action Construction

Construction under the Proposed Action would result in elevated noise levels due to heavy equipment operation on-site for about 21 months. The noise levels generated at any given time would vary depending on the phase of construction, the specific activities occurring, and the equipment used. The highest construction noise levels would more likely occur during earlier phases of construction due to grading and earthwork activities. Construction activity would generally occur between the hours of 7:00 a.m. and 3:30 p.m., Monday through Friday, which would comply with the construction schedule requirements of the Fairfax County noise ordinance.

Table 3-5 summarizes calculated construction noise levels for representative activities and equipment that may operate on the Proposed Action Site.

Table 3-5. Calculated Construction Noise Levels

Equipment Type	Quantity	Usage Factor [a]	LMAX at 50 feet (dBA) [a]	Hourly LEQ at 50 feet (dBA)	Hourly LEQ at 100 feet (dBA)	Hourly LEQ at 250 feet (dBA)	Hourly LEQ at 500 feet (dBA)
Peak Hour Traffic (6:30 a.m. to 7:30 a.m.)							
Automobile	56	0.25 [b]	55	66	60	52	46
Truck	18	0.25 [b]	84	91	85	77	71
Total for Activity	-	-	-	91	85	77	71
Mobilization							
Excavator	1	0.40	85	81	75	67	61
Dozer	3	0.40	85	86	80	72	66
Skid Steer Loader	2	0.40	80	79	73	65	59
Truck	6	0.25 [b]	84	86	80	72	66
Total for Activity	-	-	-	90	84	76	70
Tree Removal / Grubbing							
Dozer	3	0.40	85	86	80	72	66
Scraper	2	0.40	85	84	78	70	64
Excavator	1	0.40	85	81	75	67	61
Crane	1	0.16	85	77	71	63	57
Truck	6	0.25 [b]	84	86	80	72	66
Total for Activity	-	-	-	91	85	77	71
Earthwork & Site Development							
Dozer	3	0.40	85	86	80	72	66
Grader	2	0.40	85	84	78	70	64
Excavator	1	0.40	85	81	75	67	61
Truck	6	0.25 [b]	84	86	80	72	66
Total for Activity	-	-	-	91	85	77	71
Base Building Construction							
Crane	1	0.16	85	77	71	63	57
Concrete Saw	2	0.20	90	86	80	72	66
Truck	3	0.25 [b]	84	83	77	69	63
Total for Activity	-	-	-	88	82	74	68

[a] LMAX and Usage Factor generally derived from FHWA Highway Construction Noise Handbook (FHWA, 2006)
[b] Assumed max vehicle idling time of 15 minutes per hour (one quarter of the hour)

While the Fairfax County noise ordinance includes an exemption for daytime construction activities, such activities cannot generate noise levels exceeding 90 dBA in residential areas. The calculated construction noise levels in Table 3-5 exceed 90 dBA within 50 feet of some activities. At 100 feet, all calculated construction activity noise levels would be below 90 dBA. The primary site features associated with the Proposed Action are more than 100 feet from the FBNA property boundary. HDR assumes some equipment may operate within 100 feet of the FBNA property boundary, but not a concentration of construction equipment. Therefore, based on the representative construction activities and equipment outlined in Table 3-5, construction noise levels are not anticipated to exceed 90 dBA in residential areas.

Construction of the Proposed Action would result in elevated noise levels throughout the construction phase. The construction schedule would comply with the Fairfax County noise ordinance. The representative calculations of Table 3-5 indicate the resulting noise levels in residential areas would be below 90 dBA. Therefore, construction noise is projected to have a ***less than significant adverse impact***.

3.2.2 Analysis of Proposed Action Operations

Operation of the Proposed Action would introduce new or additional noise sources to the noise study area, including automobiles, trucks, electric forklifts, rooftop units, transformers, a diesel fire pump, and generators. While HDR's modeling approach assumed more consistent traffic volumes, the automobile noise would be highest during the morning and afternoon/evening commuting hours. HDR assumes truck and electric forklift noise would be variable depending on the timing of material deliveries and retrievals. The Distribution Center / administration building is more than 100 yards from the FBNA property boundary, so HDR assumes loading and unloading of trucks would not occur within 100 yards of a residential dwelling per the Fairfax County noise ordinance.

Table 3-6 summarizes the noise model results for typical operations, which excludes the generators.

Table 3-6. Noise Model Results for Typical Operations

Modeled Receiver Group	Highest Modeled Hourly LEQ at Daytime (dBA)	Highest Modeled Hourly LEQ at Night (dBA)	Highest Modeled DNL (dBA)
North FBNA Boundary (residential parcels)	52	43	52
West FBNA Boundary (residential parcels)	55	38	53
South FBNA Boundary (industrial parcels)	47	28	45
FBNA NGA Remote Inspection Facility	50	34	49
FBNA NGA Headquarters	48	35	47

The FBNA boundary results represent the highest modeled noise levels across those receiver points. They are considered representative of the adjacent NSRs. The typical operations noise sources were assumed to operate continuously in calculating hourly

LEQs, so HDR compared the modeled results to the Fairfax County noise limits for continuous sources. All modeled daytime hourly LEQ are below the most stringent Fairfax County daytime limit of 60 dBA, and all modeled nighttime hourly LEQs are below the most stringent nighttime limit of 55 dBA. The modeled daytime and nighttime hourly LEQs are within the range of existing hourly LEQs measured at ML1 and ML2 (see Table 2-3). The modeled DNLs are below the measured DNLs from ML1 and ML2. Therefore, HDR anticipates the site would remain classified as Noise Zone I during operations (see Table 2-2).

HDR assumes the generators would only operate during emergency conditions or for maintenance events. HDR assumes the maintenance events would only occur between the hours of 7:00 a.m. and 9:00 p.m. with a total duration in any one day not to exceed two hours. Under these conditions, the generators would comply with the Fairfax County exemption for generator noise.

Based on the modeled typical operations noise levels and assumed generator maintenance schedule, the operational noise from the Proposed Action is projected to have a ***less than significant adverse impact***.

3.3 No Action Alternative Analysis

Under the No Action Alternative, the Proposed Action would not occur. The Proposed Action Site would remain in its existing condition. The existing noise environment would not change; therefore, the No Action Alternative would have ***no impact*** on the noise environment.

4 Mitigation Measures

While no significant adverse noise impacts are anticipated, HDR recommends best practice mitigation measures for construction and operation under the Proposed Action.

4.1 Mitigation Measures for Construction

Best practices for managing noise during construction include the following:

- Select quietest available construction methods and equipment.
- Include the original equipment manufacturer's muffler or a higher performing muffler on all equipment.
- Maintain and inspect all equipment to allow for quieter operation.
- Use augmented back-up alarms, such as chirps.
- Use neoprene padding on dump truck tailgates.
- Prohibit jake braking or engine compression braking at the Proposed Action Site.
- Utilize noise barriers and enclosures where feasible.

4.2 Mitigation Measures for Operations

Select the quietest available electric forklifts, rooftop units, transformers, diesel fire pump, and generators. Place the generators in enclosures with exhaust mufflers.

5 Acronyms and Abbreviations

ANSI	American National Standards Institute
ASA	Acoustical Society of America
BS	British Standard
BSI	British Standards Institution
CAD	computer-aided design
CadnaA	Computer Aided Noise Abatement
CDC	Centers for Disease Control and Prevention
dB	decibel
dBA	decibel, A-weighted
dBC	decibel, C-weighted
DNL	day-night average sound level
DoD	Department of Defense
FBNA	Fort Belvoir North Area
FHWA	Federal Highway Administration
GIS	geographic information system
I-95	Interstate-95
ISO	International Organization for Standardization
LEQ	equivalent-average sound level
LMAX	maximum sound level
LUPZ	Land Use Planning Zone
ML	measurement location
NGA	National Geospatial-Intelligence Agency
NSR	noise-sensitive receptor
PK 15(met)	peak noise level exceeded by 15 percent of events
TNM	Traffic Noise Model
USC	United States Code
USACE	U.S. Army Corps of Engineers

6 References

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2010 S1.13, Measurement of Sound Pressure Levels in Air.

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2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise. BS 5228-1:2009.

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2019 What Noises Cause Hearing Loss, last reviewed October 7, 2019. https://www.cdc.gov/nceh/hearing_loss/what_noises_cause_hearing_loss.html

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2020 DoD Instruction 4715.13, DoD Operational Noise Program. Prepared by the Office of the Under Secretary of Defense for Acquisition and Sustainment, January 28, 2020.

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