HEADQUARTERS
633D AIR BASE WING
JOINT BASE LANGLEY-EUSTIS, VA

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

Plan Period
2019 – 2024

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INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

JBLE-LANGLEY VIRGINIA

PLAN YEARS
2019-2024

This updated Integrated Natural Resources Management Plan (INRMP) for Joint Base Langley Eustis (JBLE)-Langley, dated January 2019, has been prepared in accordance with the Sikes Act Improvement Amendment, Department of Defense Instruction 4715.3 "Environmental Conservation," and Air Force Instruction (AFI) 32-7064 "Integrated Natural Resources Management". The INRMP adheres to other standards and procedures of the Department of Defense (DoD) and the Air Force (AF) and has been prepared in cooperation with the United States Fish and Wildlife Service (USFWS) and the Virginia Department of Game and Inland Fisheries (VDGIF). The signatures below indicate the mutual agreement of the parties concerning the conservation, protection and management of the fish and wildlife resources presented in the INRMP.

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1.0 EXECUTIVE SUMMARY

This JBLE-Langley INRMP is a component plan to the JBLE-Langley Installation Development Plan. Its purpose is to guide the 633d Air Base Wing (633 ABW) as it implements landscape-level management of its natural resource assets while coordinating with the appropriate stakeholders. It is a management tool that ensures military operations and natural resource conservation strategies are integrated and consistent with good stewardship and legal requirements. The INRMP defines the natural resource management goals and supporting objectives that are consistent with the 633 ABW mission, while providing for no net loss in the capability of AF land to support the mission. In addition to the management of the JBLE-Langley Main Base (referred to as "Main Base"), this plan also includes the management of the Big Bethel Reservoir (BBR) property and the Langley Family Housing Annex (Family Housing). These lands collectively are referred to as JBLE-Langley.

The benefits of implementing this INRMP include: responsible management of AF resource assets, allowance for multipurpose use of AF natural resource assets, and the provision for public access where appropriate for those uses, without any net loss in the capability of the 633 ABW to accomplish its military mission. This INRMP also supports the 633 ABW efforts to develop and implement an Installation Development Plan, manage its airfield, plan and implement Bird/Wildlife Aircraft Strike Hazard (BASH) reduction initiatives, manage invasive species, conserve important or unique natural areas, and accomplish force protection initiatives.

The overarching goal of the 633 ABW Natural Resources Management Program is to provide a sustainable natural resource base that can support the AF mission at JBLE-Langley. That goal is accomplished by planning, programming, budgeting and executing projects that promote the following objectives:

- Identify and characterize the installation's natural resources
- Protect and maintain the installation's resources and manage BBR for natural resources and recreation opportunities
- Develop and enhance the installation's resources
- Create opportunities for beneficial use and enjoyment of installation resources by the public and installation personnel
- Support the BASH prevention program
- Ensure 633d Civil Engineer Squadron/Installation Management Environmental (CES/CEIE) Natural Resources personnel are adequately trained in the principles and practices of natural resources management on AF installations

This 2019 INRMP update incorporates the Annual Summary Reviews and updated information with no significant changes in the natural resource management philosophy for the 633 ABW. The Army completed the Fort Monroe and BBR INRMP Environmental Assessment (EA) in 1999. The JBLE-Langley INRMP was completed in 2006 with supporting National Environmental Policy Act (NEPA) documentation. There was no significant change in natural resources management planned when the Army transferred BBR to JBLE-Langley.
No additional NEPA analysis is necessary at this time because:

1. This updated INRMP updates the existing JBLE-Langley INRMP with only limited updated information and no significant changes in Base mission; and
2. Implementation of this updated INRMP is not expected to result in biophysical consequences materially different from those anticipated in the existing INRMP and analyzed in existing NEPA documents.

In September 2018, two federally-listed bat species were preliminarily detected utilizing habitat around Big Bethel Reservoir via acoustic analysis. These species, the Northern long-eared bat (*Myostis septentrionalis*) and the Indiana bat (*Myostis sodialis*) are federally threatened and federally endangered respectively. Both the U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries were notified of this preliminary discovery. Both agencies agreed to delay the requirement for an INRMP revision and associated NEPA analysis until more information could be collected regarding habitat utilization and species presence during various times of the year (summer breeding vs. winter roosting). This information is vital to the development of an effective wildlife management plan for these species. The timeline for development of a wildlife management plan proposed by JBLE-Langley and accepted by these agencies is 2020. NEPA analysis and revision of the INRMP will follow and should be completed by 2021.

The goal of integrating natural resource sustainability and military preparedness remains unchanged. Implementation of this updated INRMP will provide beneficial impacts to the human and natural environments that support the AF mission at JBLE-Langley.

2.0 GENERAL INFORMATION

2.1 Purpose and Scope. The JBLE-Langley INRMP is a component plan of the JBLE-Langley Installation Development Plan (JBLE-Langley, 2017) and provides the 633 ABW an opportunity to implement landscape-level management of its natural resource assets. The INRMP also provides documentation of the coordination between 633 ABW and appropriate stakeholders in the development and implementation of its natural resource management program. As a component of the Installation Development Plan, the INRMP functions as both a planning and a management tool, ensuring that military operations and natural resources conservation are integrated and consistent with good stewardship and legal requirements. Finally, the INRMP serves as a natural resources planning, budgeting and coordinating tool which aids in programming future natural resource project requirements and needs.

The JBLE-Langley INRMP covers those lands under 633 ABW authority, control or ownership at JBLE-Langley. The areas covered include the Main Base, Family Housing and BBR. Areas identified as the Main Base include all land inside the main installation. Big Bethel Reservoir is a geographically separated unit comprised of the Bethel Family Campground (FAMCAMP), the Bethel Recreation Area, Big Bethel Reservoir and the portions of its watershed owned by the AF. The airfield, which is under the control of the 1st Fighter Wing (1 FW), contains wetlands and shoreline with significant habitat and wildlife utilization. Management of this habitat is covered through the 1 FW BASH Plan in coordination with the Natural Resources Program. The resource assets addressed in this INRMP include plants, animals, land, water and air.

The JBLE-Langley INRMP is based on the principles of ecosystem management. It is intended to be a living document that provides guidance for daily natural resource asset management and the foundation for sustained military operations. The INRMP:

- Integrates conservation measures with military operations
- Reflects and documents the cooperation between the AF, USFWS, NOAA Fisheries and VDGIF relative to the proper management of fish and wildlife resources
- Documents the requirements of the natural resources program budget
- Serves as a principal information source for NEPA documents
- Aids JBLE-Langley Community Planner in the preparation of installation Area Development Plan (ADP)
- Guides the use and conservation of natural resource assets on lands and waters under AF control
- Identifies actions and projects required to achieve the plan's goal and objectives

2.2 Management Philosophy. This INRMP supports the AF military mission, was developed in an interdisciplinary and cooperative manner, and implements the AF principles for ecosystem management. As a key component of the Installation Development Plan, the INRMP provides the background and rationale for the policies and programming decisions related to land use, resource conservation, facilities and infrastructure development, and operations and maintenance, to ensure that they meet current requirements while providing for future growth.

The INRMP supports the mission by identifying the natural resources present on the installation, developing management goals for these resources and integrating these management objectives into the military requirements for mission operations/support. This INRMP outlines the steps needed to fulfill regulatory compliance requirements related to natural resources management and fosters environmental stewardship.

The INRMP was developed using an interdisciplinary approach and is based on existing information of the physical and biotic environments, mission activities and environmental management practices at JBLE-Langley. Information was obtained from a variety of documents, interviews with installation personnel, on-site observations and communications with both internal and external stakeholders. Goals and objectives require monitoring on a continuous basis. Management strategies for accomplishing goals are updated whenever there are changes in mission, environment, regulation or species present. The JBLE-Langley INRMP is a living document intended to change as needed through consultation and data sharing with federal agencies, state agencies, civilian groups and the discovery of new conditions on the installation resulting from daily mission activities. It is also a component plan to the JBLE-Langley Installation Development Plan; therefore, the INRMP's goals and objectives should be considered and evaluated early in the planning process for projects and mission changes on the installation.

The guiding principle behind the development of this INRMP is ecosystem management. The comprehensive goal of ecosystem management is to maintain, and improve the sustainability and biological diversity of native ecosystems while supporting the AF mission, legal requirements and the needs of the military community. This guiding principle is endorsed by Wing leadership through the JBLE-Langley Environmental Policy Statement (see Appendix A).

The JBLE-Langley INRMP advocates ecosystem management by setting objectives for attaining a desired land condition. It was prepared with the AF Principle of Ecosystem Management in mind. The objectives of AF Ecosystem Management are:

- Maintain or restore native ecosystem types across their natural range where practical and consistent with the AF mission.
- Maintain or restore ecological processes such as riparian buffer zones where practical and consistent with the AF mission.
- Maintain and preserve hydrological processes in streams, floodplains and wetlands when feasible.
- Use regional approaches to implement ecosystem management on AF property through collaboration with other DoD components as well as other federal, state, local agencies and adjoining property owners (as appropriate).
- Support outdoor recreation provided that such use does not inflict long-term ecosystem damage or negatively impact the AF mission.
- Maintain or reestablish viable populations of native species when practical and consistent with the military mission.
- Identify the presence of exotic and invasive species and implement programs and cooperative strategies to control and/or eradicate those species from AF installations.
- Reducing construction of impervious surfaces.

- Manage exotic and invasive species to improve the quality of training areas and non-training areas. This includes planting/replanting with native vegetation species.
- Convert sterile, non-productive areas into natural areas to reduce maintenance costs (such as maintaining open areas as early successional or young forest as opposed to mowing).
- Include natural resources sustainability consideration in all construction projects and training events.

2.3 Authority. The Sikes Act of 1960, (Public Law [P.L.] 86-779) provides for cooperation between the DoD and the Department of Interior (DoI) for the protection of natural resources on military lands. Congress passed the Sikes Act Improvement Amendment (SAIA) in November of 1997, which required the preparation and implementation of an INRMP to support the sustainable use by the public of natural resources to the extent that the use is not inconsistent with the needs of fish and wildlife resources. Title 16, United States Code (USC) § 670 et seq., of the Sikes Act guides that INRMPs will provide for no net loss in the capability of military installation lands to support the military mission of the installation (see Appendix A).

In addition to legislative requirements, this INRMP satisfies DoD Instruction 4715.03, *INRMP Implementation Manual*, which directs DoD installations to establish procedures for an integrated program for multiple-use management of natural resources. Additionally, AFI 32-7064, *Integrated Natural Resources Management*, implements the Sikes Act and applicable DoD directives by establishing the INRMP as the primary planning document for natural resources at AF installations. AFI 32-7064 establishes the installation or wing commander as the signatory authority for approval of the INRMP. The commander's signature on the INRMP commits the AF to the goals and objectives of the Plan. Once signed by the cooperating agencies (USFWS, NOAA Fisheries and VDGIF), the INRMP takes on the status of an interagency cooperative planning document.

JBLE-Langley meets the criteria for a Category 1 installation as specified in Section 3.2.1 of AFI 32-7064, dated 22 November 2016, therefore, an INRMP is required. The SAIA requires that the JBLE-Langley INRMP be prepared in cooperation with the USFWS, NOAA Fisheries and the VDGIF. Cooperation with these agencies is intended to "reflect the mutual agreement of the parties concerning conservation, protection and management of fish and wildlife resources."

Due to the installation's location within the Chesapeake Bay watershed, the JBLE-Langley INRMP is guided by Executive Order 13508, *Chesapeake Bay Protection and Restoration,* dated 12 May 2009 (74 Federal Register [FR] 23099). Executive Order (EO) 13508 additionally outlines the importance of collaboration among the many stakeholders in the Chesapeake Bay region. Specific strategic goals and outcomes developed as a result of the EO can be found in Section 7.13.

This INRMP is developed under, and proposes actions in accordance with applicable DoD and AF policies, directives and instructions. AFI 32-7064 provides the necessary direction and instructions for preparing an INRMP. Issues are addressed in this plan using guidance provided under legislation, EOs, Directives and Instructions. A summary of key legislation related to design and implementation of the INRMP is included in Appendix A and summarizes key legislation and guidance used to create and implement this INRMP.

2.4 Integration with Other Plans. This INRMP integrates closely with several other key installation plans. Coordination between the INRMP and the Installation Development Plan occurs through annual reviews and correspondence to ensure that updated information from the recently completed 2017 Installation Development Plan is incorporated into and guides this INRMP. Natural resource conservation is supported in the Installation Development Plan (JBLE-Langley, 2017; see Section 13.0) through Goal 4 and its objectives:

Goal 4: Exercise good stewardship of valuable lands and facilities.
- *Objective 4.1*: Comply with federal, state and local environmental laws, regulations and policies.
- *Objective 4.2*: Maintain and execute the JBLE INRMP and Integrated Cultural Resources Management Plan (ICRMP).
- *Objective 4.3*: Identify stewardship opportunities as they specifically relate to the Chesapeake Bay and its watershed.
- *Objective 4.4*: Prevent pollution and continue cleanup of previously contaminated sites.
- *Objective 4.5*: Consider BASH implications in all future development and redevelopment plans.

This INRMP and the Air Installation Compatible Use Zone (AICUZ) for JBLE-Langley are mutually supportive. The AICUZ program promotes compatible land uses in the areas around military airfields. The purpose of the AICUZ program is to minimize the effects of flying operations on land uses adjacent to installations, to prevent incompatible development, and to maintain operational capability through land use planning and control. Through a partnership with the City of Hampton and utilizing resources from Virginia Action Contingency Trust Fund, incompatible land use is prevented through land purchase by the City of Hampton. Purchased land is placed in an easement provided to JBLE-Langley. This program is compatible with the INRMP and helps to increase natural resource assets such as wetlands and forested tracts adjacent to JBLE-Langley while preventing encroachment into AICUZ areas. From 2016-2018, 108.46 acres of land were purchased and protected from development within the AICUZ. In 2019, 70 acres are currently slated for purchase (T. Willer, personal communication, 2018).

An overarching goal of this INRMP is to support the BASH prevention program. Specific BASH mitigation projects have been identified and implemented into the management goals and objectives section of this INRMP.

The INRMP and Integrated Pest Management Plan (IPMP) are mutually supportive. The INRMP plans for ongoing management of invasive species. All actions involving treatment of invasive species or removal of vertebrate pests are coordinated with the Pest Management Coordinator as required in the IPMP. INRMP revisions and concurrence with the final plan must be coordinated through the installation chain of command.

Other related management plans, such as the Invasive Species Inventory and Management Plan (ISIMP) are included as appendices of this plan. Recommendations from supporting plans are incorporated into the INRMP work plan when appropriate.

3.0 INSTALLATION OVERVIEW

3.1 Location and Area. JBLE-Langley is located in southeastern Virginia on the Virginia Peninsula, which is bordered by the James River, the York River and the Chesapeake Bay. JBLE-Langley consists of two geographically separate facilities, the Main Base and BBR / Langley Family Housing Annex (Figure 3-1).

The Main Base is a 2,883-acre installation located within the City of Hampton. Tributaries of the Back River form the northern, eastern and southern boundaries of the Main Base. The western boundary of the installation is generally defined by Armistead Avenue. On the northwest side, the Main Base borders the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC).

The 500+/- acre BBR property is located approximately 2 miles west northwest of the Main Base. BBR straddles the historical flow of Brick Kiln Creek, with York County to the north of the creek and the cities of Newport News and Hampton to the south. The Langley Family Housing Annex consists of 284 acres and is located in York County adjacent to the northeastern most portion of BBR.

JBLE-Langley supports a population of 28,385, including 10,002 military, 15,530 dependents and 2,853 civilians. In addition, many JBLE facilities and services are available to about 56,000 retired military personnel who live in the area. JBLE-Langley has a significant, positive impact on the region, accounting for more than $2.4 billion in local expenditures per year. Much of this is spent for housing, food and other consumer products and includes the purchases of materials, equipment and supplies from local and regional firms (JBLE-Langley, 2017).

3.2 Installation History. Langley Air Force Base was established as an air base (Langley Field) for the research and development of aircraft in 1916. By 1917, Langley Field had become the center of aircraft experimentation and evaluation for the Army Air Service. In 1918, a balloon detachment was assigned to Langley Field and it was the home of early experimentation with Lighter-than-Air (LTA) flight. An airship station was constructed in 1919 and by 1920, Langley Field was the site for the Air Corps' experimental use of blimps for aerial reconnaissance, coastal patrol and aerial photography missions (JBLE-Langley, 2015).

In the 1930s, the General Headquarters Air Force was headquartered at Langley Field and it soon became the United States (US) Army's center of tactical aviation. In the World War II years, Langley Field was expanded by 770 acres with the acquisition of the Shellbank Plantation. During that time, Langley became the headquarters for the 1st Bomber Command (JBLE-Langley, 2015).

In 1947, the Department of the Air Force was created, and Langley Field became the headquarters for its Tactical Air Command (TAC) and was renamed Langley Air Force Base. Research and development activities continued under the auspices of the National Advisory Committee for Aeronautics (NACA), which in 1958 was renamed NASA. NASA LaRC was responsible for much of the research and training associated with the early US space program

and still occupies land adjacent to the northwest portion of the installation (JBLE-Langley, 2015).

Langley Air Force Base became the home to the 1st Tactical Fighter Wing in 1975 and received the new F-15 Eagle aircraft. In 1991, the 1st Tactical Fighter Wing became the 1 FW and continued to maintain operational fighter aircraft participating in numerous deployments, exercises and combat missions throughout the world. The following year, Langley Air Force Base became headquarters to Air Combat Command (ACC), the primary force provider of combat airpower to America's warfighting commands. In 2005, Langley Air Force Base and the 1 FW were selected to be the first beddown location for the F-22 Raptor aircraft and reached full operational capability in December 2007 (JBLE-Langley, 2015).

The Big Bethel Reservoir property was acquired in the summer of 2006 from Fort Monroe, a neighboring Army installation. This action was a result of the 2005 Base Realignment and Closure (BRAC) Commission recommendation to close Fort Monroe. BBR provided safe drinking water to Langley Air Force Base and Fort Monroe from the early 20th century until the drinking water plant was closed in 2003 (JBLE-Langley, 2015).

In accordance with the 2005 BRAC Commission, the 633 ABW was reactivated in October 2010 and became the link in the joint basing initiative between Langley Air Force Base in Hampton and US Army Fort Eustis in Newport News. The 633 ABW is an AF-lead mission support wing headquartered at JBLE-Langley serving both AF and Army units known as JBLE (JBLE-Langley, 2015).

3.3 Current Military Mission. The 633 ABW mission at JBLE-Langley is to organize, train, maintain and equip air combat forces for rapid global deployment to conduct air superiority operations. Headquartered at JBLE-Langley, the 633 ABW consist of four groups that provide installation support to ACC, 1 FW, 480th Intelligence, Surveillance and Reconnaissance Wing, 363rd Intelligence, Surveillance and Reconnaissance Wing, 192d Wing Virginia Air National Guard (ANG) and several other tenant units. JBLE-Langley is also an aerial port of embarkation for the rapid deployment of fighter aircraft, supporting forces and units from neighboring military installations to meet worldwide mission requirements.

3.4 Surrounding Communities. The Main Base is located in the City of Hampton, Virginia, which has an estimated 2017 population 134,669. From 2010 to 2017, the City of Hampton experienced population decline of -2.0% (US Census Bureau, 2018). Hampton and neighboring communities in this region are collectively referred to as “Hampton Roads.” This term refers to the area where the James, Nansemond and Elizabeth Rivers empty into the Chesapeake Bay. Hampton Roads is in the Norfolk-Virginia Beach-Newport News Metropolitan Statistical Area, which has a population of more than 1.7 million that experienced a small increase of 0.39% per year between 2010 and 2017.

There is a large military presence and number of military installations in this region, including Oceana Naval Air Station and the Norfolk Naval Base Complex. The large number of federal installations in the area provides a relatively stable employment base. The services and manufacturing sectors are also major contributors to the area's economy (JBLE-Langley, 2017).

JBLE Langley maintains a strong relationship with the surrounding community. There has been regular coordination on land use compatibility issues, and local municipalities have actively participated in and adopted AICUZ and Joint Land Use Study (JLUS) programs. The City of Hampton has adopted land use overlay districts to regulate development in areas affected by noise and/or safety considerations. JBLE also has mutual aid agreements related to emergency response and public safety in place with York County, the Cities of Hampton, Newport News, Poquoson, and neighboring military installations.

3.5 Local and Regional Natural Areas. Although the Hampton Roads area is largely developed, several natural areas exist around JBLE-Langley. In 2010, a Hampton Roads Conservation Corridor (HRCC) was identified during the HRCC Study (HRCCS, 2010). The study identified critical natural resources in the Hampton Roads region to aid conservation efforts used in planning and also opportunities for developing a linked corridor system.

Natural areas around JBLE-Langley include Plum Tree Island National Wildlife Refuge (NWR), Grandview Natural Preserve, Blue Bird Gap Farm, Sandy Bottom Nature Park, Grafton Ponds Natural Area Preserve, several city parks and undeveloped shoreline along the Chesapeake Bay (JBLE-Langley, 2017). These natural areas maintain the character and water quality of the nearby Chesapeake Bay, the largest estuary in the continental United States.

Habitat similar to the bottomland hardwood forest present at BBR can be found at Sandy Bottom Nature Park and Grafton Ponds Natural Area. High quality marsh habitat similar to the Back River marshes present on the Main Base is present on both Plum Tree Island NWR and Grandview Nature Preserve.

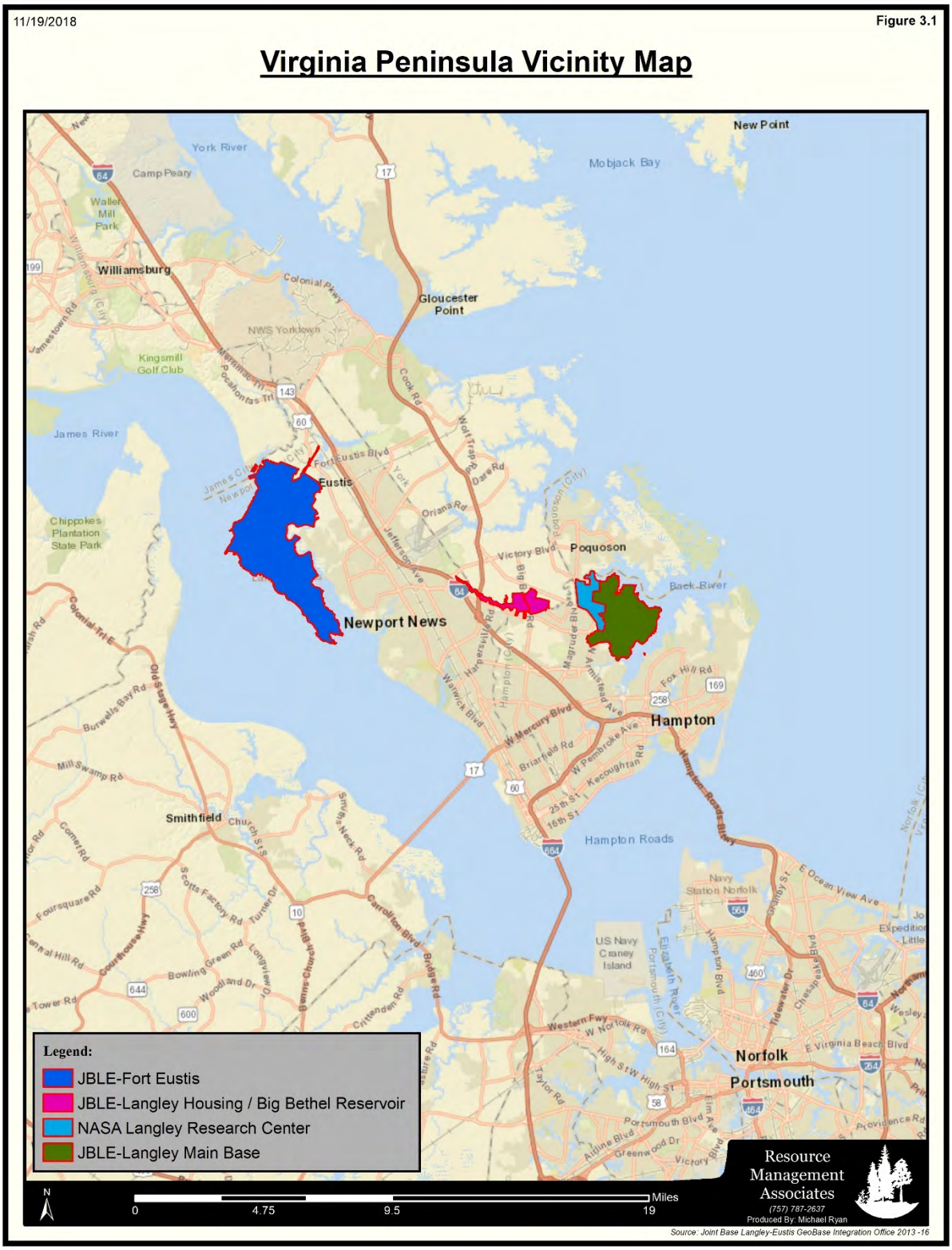


Figure 3-1: Virginia Peninsula Vicinity Map

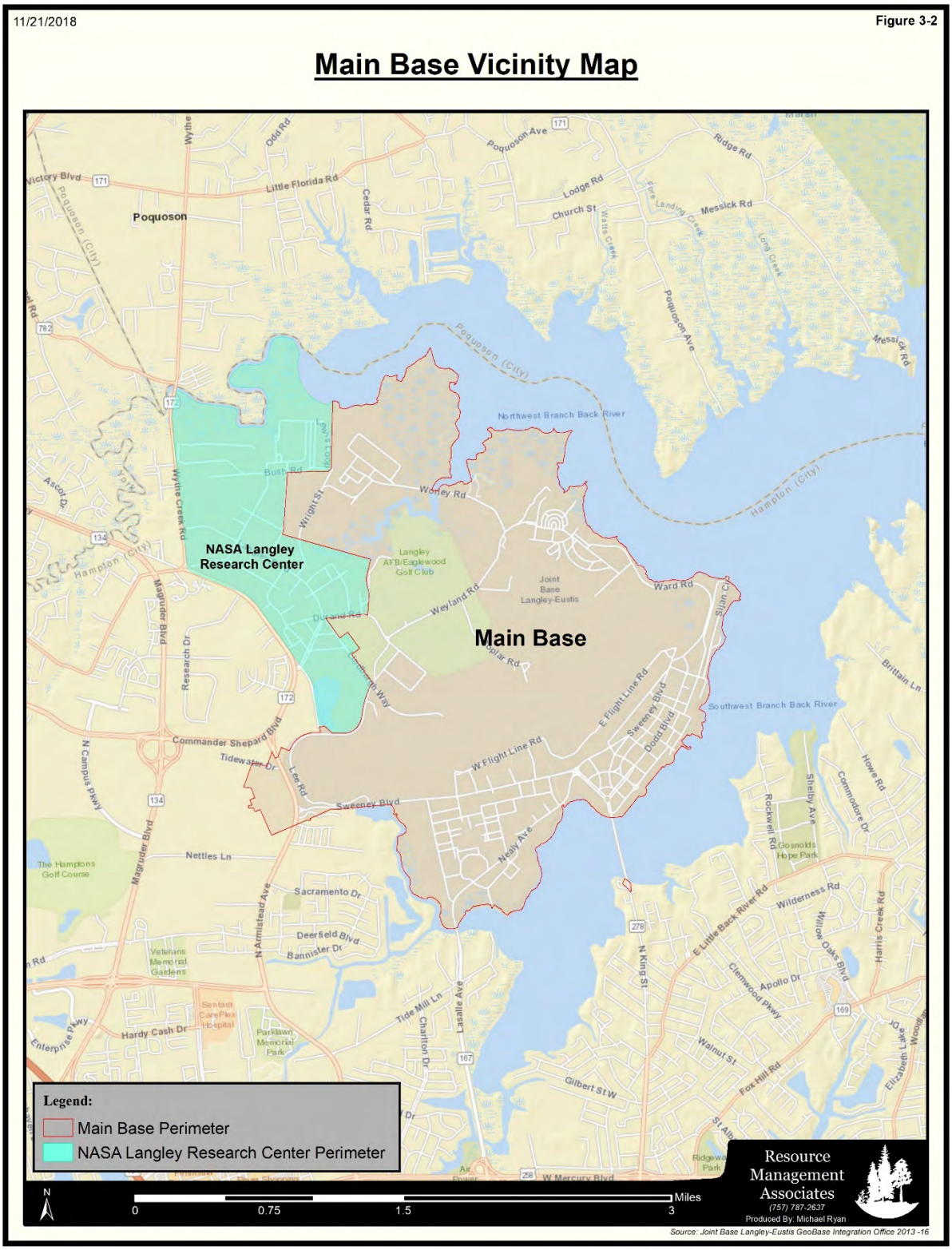


Figure 3-2: Main Base Vicinity Map

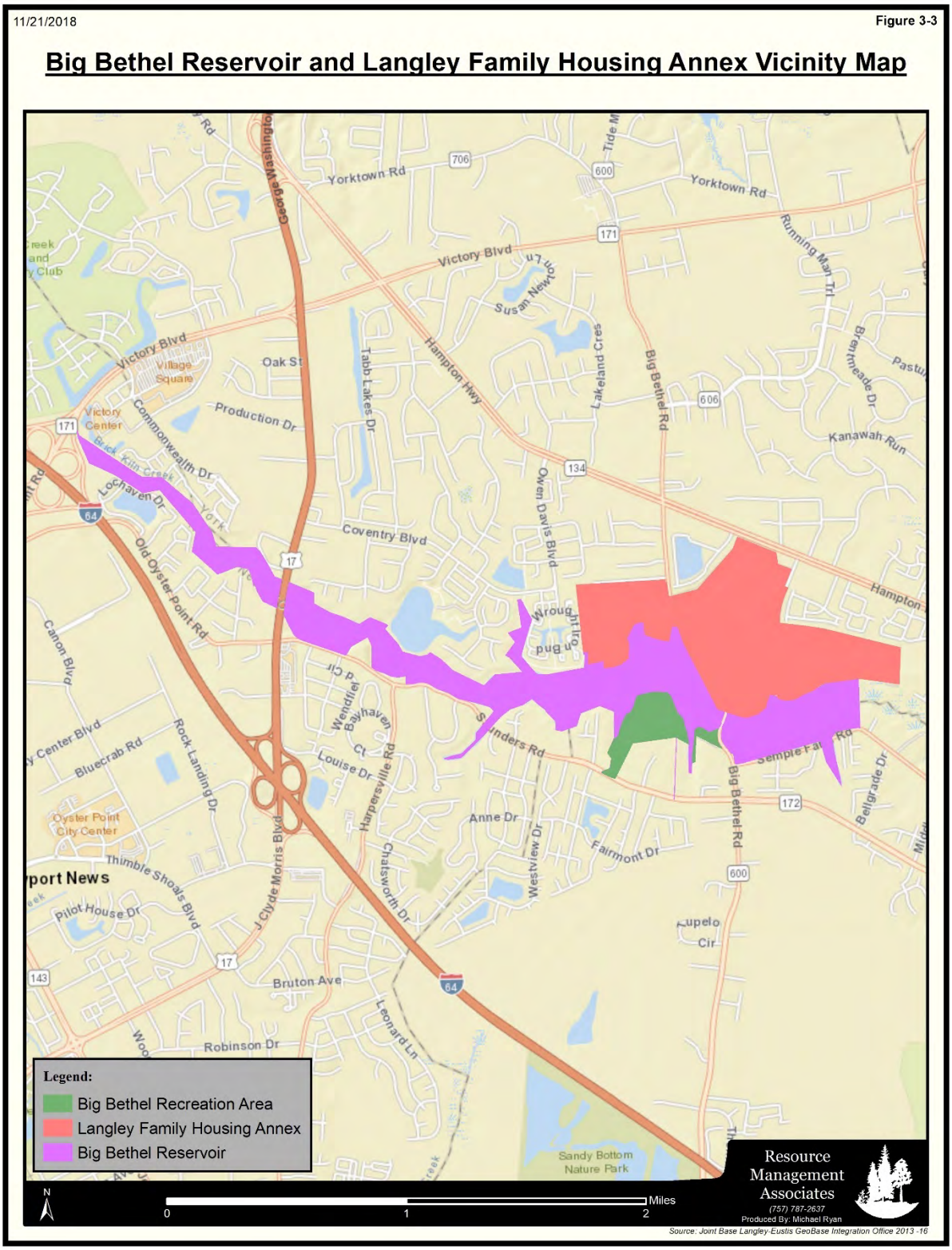


Figure 3-3: Big Bethel Reservoir and Langley Family Housing Annex Vicinity Map

4.0 PHYSICAL ENVIRONMENT

4.1 Climate. This summary of climate data is compiled from the Virginia State Climatology Office, JBLE-Langley meteorology office (1st Operations Support Squadron / Meteorology Flight [1 OSS/OSW]) and NOAA, through its National Climatic Data Center (NCDC).

The climate of the JBLE-Langley area is modified continental, with mild winters and warm, humid summers. In addition to latitude and location on the North American Continent, the Appalachian Mountains, Chesapeake Bay and Atlantic Ocean are the major factors controlling the climate. The mountains produce various steering, blocking and modifying effects on storms and air masses. The nearby large open bodies of water contribute greatly to moderation of the winters and to the humidity of the summers.

Mean annual temperatures at JBLE-Langley average near 59 degrees Fahrenheit (°F), which is similar to the average of other stations in this region. May through September is usually warm, each month having some days with the temperature greater than or equal to 90°F. Daytime highs during summer are usually in the middle 80s °F with nighttime lows around 70°F. Maximum temperatures up to 105°F and minimum temperatures in the 50s °F are the extremes during July and August. Heat waves are forecast to increase in frequency, intensity and duration in the Mid-Atlantic in the near future (Carter et al., 2014), which would affect the number of days per year exceeding 95°F at JBLE-Langley. Daytime highs during the cold season are usually near 50 °F with nighttime lows in the mid to low 30s °F. Maximum cold season temperatures are in the low 80s °F and minimum temperatures as low as -3°F. Table 4-1 provides monthly average temperatures and precipitation over the last 80 years of meteorological recording at Langley 1 OSS/OSW.

The growing season, defined as the period between the average date of the last freezing temperature in spring (25 March) and the average date of the first freezing temperature in fall (18 November), is 238 days. Freezing temperatures in spring have occurred as late as 21 April and as early as 21 October. This growing season is long enough to allow proper maturity of a large variety of crops.

The mean annual precipitation of 47.90 inches is well distributed throughout the year with a slight maximum in July through September and a minimum in November and April. Rainfall in summer is due mainly to showers and thundershowers. Nearly 40 days each year have thunderstorm activity, which is close to the average for the state. In winter, some precipitation usually occurs as snow. The average snowfall is 7.5 inches a year but is extremely variable, ranging from 0 to over 25 inches in a single-snowfall season. Recent research forecasts that the eastern United States may be subject to more frequent and/or intense winter snowstorms in the future (Francis & Vavrus, 2012).

South to southwest winds predominate, with a secondary maximum frequency from a northerly direction in most months, generally reflecting the progression of weather systems across the state. Relative humidity varies inversely with temperatures, being high in the morning and low in the afternoon. During the warm season, average values (%) are in the 80s early in the morning, dropping to around 60 in the afternoon. Daytime cloudiness is least (averaging about

55% coverage) during the fall season and greatest in winter (about 62% coverage). Partly-cloudy days are most frequent in summer with about 40% of the days in this category.

Tornadoes are rare, with only three significant events in the area reported in the past 54 years. In 1999, a series of seven tornadoes, four confirmed and three unconfirmed, passed through JBLE-Langley within 90 minutes. This series of storms caused over one million dollars in damage, including damage to three F-15s. Thunderstorms, accompanied by severe lightning, high winds and hail, are much more frequent and are generally responsible for the greatest amount of storm-related damage.

Earthquakes in Virginia are rare in the Coastal Plain. In 2011, Virginia had a magnitude 5.8 earthquake and the epicenter was in Louisa County. The tremors were felt at JBLE-Langley with no damage reported to JBLE-Langley.

In the last 10 years, JBLE-Langley has sustained damage from six separate storm events. Main Base closures for a total of 168 hours for all non-essential personnel have negatively impacted federal productivity and military readiness. Additional loss of airfield operation status for 210 hours due to standing water has further compromised military flight capability. Direct damage to infrastructure from flooding and subsequent standing water has impacted the AF mission capability; it has also resulted in $52 million in damage to infrastructure and equipment. This value does not include damage sustained from Hurricane Isabel which caused $146 million in damage from a single storm.

In September 2003, Hurricane Isabel came ashore, requiring the evacuation of 60 F-15 fighter jets and the mandatory evacuation of about 6,000 personnel living in Main Base housing. Much of the Main Base, including the Field Historic District and part of the flightline, was submerged by the rising storm surge which rose to 8.8 ft above sea level. In the wake of the storm, JBLE-Langley sustained $146 million worth of damage, including damage to 200+ historic resources and the loss of more than 700 trees. Several other nor'easter storms including remnants from more recent Hurricane Sandy (2012) produced damaging winds and storm surge in recent years. The frequency of major hurricanes (Categories 3 to 5) in the Western Atlantic has increased since the 1980s (Carter et al., 2014) and is forecast to increase more in the future (Bender et al., 2010), which may result in a continued or elevated risk of storm damages to JBLE-Langley.

Several studies forecast that sea level rise rates are much higher on the US East Coast than the global average, which may result in an increased risk of flooding of JBLE-Langley, both during storm events and in the long-term as water levels of the surrounding waters continue to rise. Detailed discussions of the regionally higher rates of sea level rise can be found in Saba et al., (2016), Krasting et al., (2016) and Sallenger et al., (2012).

The current Installation Development Plan states that the AF must be sensitive to potential threats from the natural environment because a base's mission can be severely impeded by climatic events. A recent study (Tompkins & DeConcini, 2014) determined that Hampton Roads is second only to New Orleans in its potential to experience impacts from flooding within the United States. Table 4-2 indicates significant climatic vulnerability according to the

Low Elevation Areas at JBLE-Langley at Risk during Storms and Tides

Sustainability Development Indicator metric (JBLE-Langley, 2017) with a high vulnerability to flooding and a medium vulnerability to storm surges and more than a one-foot rise in sea level.

Damage to infrastructure and loss of federal man-hours due to flooding and standing water conditions indicate that an investment in reducing flooding and improving flood resiliency would support military readiness. Outdated and poorly maintained stormwater systems have been shown to increase vulnerability to flooding in developed coastal areas (FitzRandolph, 2013). This has been clearly demonstrated in areas with a significant amount of impermeable surface and aging underground stormwater infrastructure. These conditions are present in the area of the Main Base referred to as the Heavier-Than-Air (HTA) district. Repair and rehabilitation of the installations stormwater management systems would help increase installation resiliency following storm events especially in the Heavier-Than-Air district of the base. Keeping roads passable and preventing infrastructure from flooding protects mission capability and prevents damage to mission essential assets such as the Headquarters Air Combat Command building.

A recent survey of stormwater outfalls conducted for compliance with JBLE-Langley's Municipal Separate Storm Sewer System (MS4) permit, showed that 86% of the stormwater outfalls require maintenance to move stormwater off the installation as intended. Furthermore, JBLE-Langley's stormwater Best Management Practices (BMPs) were inspected and over 50% were found to need immediate corrective action to function as designed. Large sinkholes that track along known stormwater pipe locations, standing water in roads over stormwater inlets, visibly broken culvert pipes under roads and outfalls that do not discharge water during heavy rain events are present (AECOM, 2018a, 2018b).

In order to protect the military mission from impacts of flooding, prevent damage to federal property and address MS4 program regulatory requirements, a study has been programmed to identify where the JBLE-Langley stormwater system is not functional and identify priorities and actions required for repair.

JBLE-Langley Areas Regularly Flooded by Storms and Tides

4.2 Landforms. JBLE-Langley is located in the Outer Coastal Plain of Southeastern Virginia near the terminus of the Virginia Peninsula. The area is characterized by a series of plains, which were created under subaqueous conditions, and scarps, which represent former shorelines of the ancestral Chesapeake Bay or James River during the Pleistocene Epoch (Johnson, 1976).

JBLE-Langley is located in the Atlantic Coastal Plain Physiographic Province. The elevation of the 100-year floodplain is 8.3 ft above MSL and all of the Main Base lies within the 100-year floodplain zone. The general topography of the Virginia Peninsula is characterized by a succession of plains separated by a series of scarps.

The Hampton Flat, on which JBLE-Langley is situated, is the principal physiographic feature in the lower part of York County and the cities of Newport News and Hampton. The surface of the Hampton Flat has a gentle slope of one foot per mile seaward and is bounded by the Big Bethel and Harpersville Scarps on the west, the York River on the north, Plum Tree Island to the east and by the James River and Chesapeake Bay to the south. With the exception of the Newmarket, Brick Kiln and other smaller creeks, the flat is nearly featureless. Drainage on the flat is typically poor and wetlands are abundant except along the banks of the Hampton and Back Rivers where prior dredging and filling activities have destroyed them (Johnson, 1976).

4.3 Geology and Soils

4.3.1 Geology. JBLE-Langley is situated in the Atlantic Coastal Plain Province. The Atlantic Coastal Plain Province consists of an eastward thickening wedge of unconsolidated, interbedded sand, silt and clay, ranging in age from Early Cretaceous to Holocene. JBLE-Langley is also situated above the Chesapeake Bay Impact Crater (CBIC) (Powars & Bruce, 1999). The CBIC, thought to have been created approximately 35 million years ago when a meteorite struck the inner continental shelf, produced a complex impact crater approximately 1.3 miles deep and

partly filled with debris and tsunami deposits (Powars & Bruce, 1999). The CBIC is now covered by Atlantic Coastal Plain sediments and the lower Chesapeake Bay. The geology at JBLE-Langley consists of a minor thickness of topsoil and construction fill that overlies the Water Table Aquifer (URS, 2003). Sediments at JBLE-Langley are mostly unconsolidated fluvial, marine and estuarine deposits. Fill has been added to level construction sites throughout the installation, which was compacted in areas where buildings were constructed or beneath concrete areas.

The surficial geology of both JBLE-Langley consists of three stratigraphic units: Yorktown Formation, Tabb Formation and Recent Deposits (Johnson, 1976). The age, depositional environment and texture of the three units (from youngest to oldest) are briefly summarized below (Johnson, 1976):

- Recent Deposits: Alluvium (silt, sand and clay), Marsh Sediment (peat, silt, sand and clay with organic matter), Sand (beach and dune sand, occurring as tidal flat mud)
- Tabb Formation (Pleistocene): Lynnhaven Member, sand and clay deposited in a near shore marine depositional environment
- Yorktown Formation (Pliocene): sand and silt deposited in a shallow marine depositional environment

The subsurface geology beneath this consists of three distinct lithologic units identified from a 2,083.8 feet (ft) core hole drilled on the nearby NASA property (Gohn et al., 2001; Powars et al., 2001). From oldest to youngest, the units are crystalline bedrock at 2,054.7 ft below ground surface (BGS); 1,280.4 ft of impact-generated crater-fill materials (2,054.7 ft to 774.3 ft BGS); and 774.3 ft of post-impact Coastal Plain deposits (774.3 ft BGS to top of the core hole).

4.3.2 Soils. Land moving and filling activities on the Main Base have altered soil profiles to the extent that site inspection of local soils does not concur with local soil surveys from adjacent counties (JBLE-Langley, 2017). Much of the Main Base is composed of lands that contain large amounts of fill material originating from the earth-moving, grading, movement of materials and filling activities associated with the early development of the installation. Because of this, a soil profile taken at any given location may not correspond to local soil surveys or to what is depicted on Hampton or other geographic information system (GIS) maps.

A comprehensive soil survey has not been conducted on JBLE-Langley. IT Corporation (2001) conducted a wetland survey of the Main Base and classified the presumed dominant soils of as the Altavista Series, Dragston Series, Tomotley Series and Urban land. It is presumed that most of the developed areas of JBLE-Langley correspond with areas in neighboring cities and counties mapped with units of Urban land. These areas are typically those that are covered more than 85 percent with asphalt, concrete, buildings or other impervious surfaces.

Soils at BBR were previously mapped by Hodges and Molten (1984). Soil surveys for the City of Hampton, Newport News and York County may also cover portions of the reservoir. Stable soils along the vegetated shoreline of BBR help ensure continued protection of the reservoir's water quality. The predominant soil types at BBR are Bojac sandy loam, Altavista fine sandy

loam and Craven fine sandy loam. Soil types are similar, consisting of sand and loam with minor differences in depth and how well they drain.

4.4 Hydrology

4.4.1 Watershed. The land occupied by JBLE-Langley lies entirely within the Lynnhaven-Poquoson watershed, hydrologic unit code (also known as the United States Geological Survey [USGS] Cataloguing Unit) 02080108 (US Environmental Protection Agency [USEPA], 2018).

The USEPA established the Chesapeake Bay Total Maximum Daily Load (TMDL) to address excess nitrogen, phosphorus and total suspended solids (TSS) (pollutants of concern or POCs) in the bay (USEPA, 2010). A TMDL is the maximum amount of a pollutant that a water body can assimilate and still support its designated use. The Chesapeake Bay watershed encompasses over 64,000 square miles including the entire District of Columbia and large sections of Delaware, Maryland, New York, Pennsylvania, West Virginia and Virginia.

In the Phase I and Phase II Chesapeake Bay Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL, the Commonwealth of Virginia committed to a phased approach to reducing nutrients and suspended solids discharging from MS4s. Section I.C of the JBLE–Langley MS4 Permit VAR040140, (effective 3 August 2017) requires JBLE-Langley to prepare a Chesapeake Bay TMDL Action Plan that demonstrates future plans to meet the required nutrient and suspended solids reductions. JBLE-Langley submits an Annual Report to the Virginia Department of Environmental Quality (VDEQ) documenting progress toward implementing requirements identified in the installation MS4 Program Plan and reducing pollution into the Chesapeake Bay Watershed.

The prepared Action Plan (AECOM, 2018b) presents the JBLE-Langley estimated load contribution, required load reductions and pollutant reduction credits. The plan also reports progress made toward meeting the 35% pollutant reduction requirement (cumulative 40% percent reduction) for the second permit cycle based upon the VDEQ Guidance Memo No. 15-2005. The recent completed draft of the 2018 JBLE-Langley Chesapeake Bay Phase II TMDL Action Plan states that if the stormwater BMPs are maintained as stated in the plan, JBLE-Langley currently meets its second permit cycle reduction requirement goals. JBLE-Langley will continue to investigate the applicability and feasibility of additional BMPs in order to meet milestone pollutant load reduction requirements of the Chesapeake Bay TMDL.

4.4.2 Surface Waters. The surface water surrounding the Main Base is brackish to saline and occurs in an estuarine setting. The Back River, New Market Creek, Brick Kiln Creek and Tabbs Creek provide drainage for the area. Two are listed on the 2014 Impaired Waters list; Brick Kiln Creek and Northwest Branch of Back River. These streams are considered impaired for recreation and shellfish consumption due to bacterial contamination.

The MS4 stormwater permit VAR040140 Section I.B requires development of TMDL action plans for the Back River that address bacteria impairment of this waterbody. The VDEQ assigned JBLE-Langley a reduction amount of 6.21% for bacteria, which include fecal coliform, enterococcus and E. coli. According to the 2017 VDEQ TMDL report, fecal bacteria originates

from multiple sources including natural and anthropogenic sources in the Back River watershed. The values presented in Table 4-3 indicate that wildlife is a significant pollutant source for JBLE-Langley. JBLE–Langley will conduct a local fecal bacteria source assessment with the goal of identifying potential pollutant "hot spots" across JBLE-Langley. This information will be used to better identify potential sources of bacteria on JBLE-Langley located within the TMDL watersheds.

Tidal Creek and Ditch at JBLE-Langley

In addition to the Chesapeake Bay TMDL Action Plan, which strives to limit pollution into surface waters, the Eaglewood Golf Course Nutrient Management Plan (approved 27 July 2017) provides guidelines for the use of fertilization to reduce excess nutrient runoff potential into nearby watersheds leading into the Chesapeake Bay. This plan is located in Section 13 for more information.

Salt and freshwater marshes along the Back River, New Market, Brick Kiln and Tabbs creeks are important to the Chesapeake Bay watershed due to their ability to filter nutrients and sediments from the water. To protect this important component of the watershed, the Chesapeake Bay Preservation Act requires riparian buffers of 100 feet from water features that drain into the bay at JBLE-Langley. In certain circumstances, this may be reduced to 50 ft if additional stormwater best management practices are incorporated into facility and site designs (JBLE-Langley, 2017).

Big Bethel Reservoir is formed by the damming of Brick Kiln Creek, a tributary of the Northwest Branch of Back River. Brick Kiln Creek is the boundary between York County and Newport News prior to entering the reservoir. The 2016 USEPA 305(b) water-quality assessment for BBR identified this body of water as "Fully Supporting" for the use categories of fish, shellfish and wildlife propagation; aquatic life harvesting; recreation; and as a public water supply.

Water-quality testing was conducted for BBR again in 2008. Twelve sites were tested for temperature, pH, turbidity and dissolved oxygen throughout the 266-acre Reservoir. The dissolved oxygen levels within the Reservoir had only minor fluctuations, but all levels were still within a healthy range for aquatic life, showing an improvement from the conditions of the 2006 report.

In spite of BBR fairly protected physical borders, the facility is still subject to impacts from the surrounding community. Erosion and sedimentation control permits, and sometimes mining permits, are required for any developers that are working on projects potentially impacting the water quality of the reservoir. These permits, and review of plans, are controlled by the individual municipalities surrounding the reservoir. A Federal Facility Site Assessment was conducted in 1998 and resulted in several recommendations, including specific planning level surveys aimed at watershed protection and drinking water quality improvements (Chesapeake Bay Program [CBP], 1998). Several Army reports recommended increased involvement and environmental awareness in the area based primarily on water quality concerns (CBP, 1998; Galvez et al., 1998). More active involvement of installation staff in the surrounding communities' watershed planning processes was recommended. Since then, the City of Newport News secured permission for an easement from the Army to channelize approximately 2,200 feet of Brick Kiln Creek starting near Willow Green Drive and generally running east-southeast to US-17, known as J. Clyde Morris Boulevard. This area needs remedial stream-bank stabilization to repair erosion and under-cutting of the banks. Significant quantities of sediment continue to be deposited in the creek bed and wetlands south of US-17. Sedimentation into the reservoir is clearly present and can be seen both on the ground and in aerial imagery.

Big Bethel Water Treatment Plant formerly provided drinking water to Fort Monroe and JBLE-Langley until it was closed in 2003. Water levels in the reservoir are no longer manipulated to facilitate potable water production. The pool elevation in the lower impoundment is no longer monitored daily nor adjusted to accommodate the local flooding concerns of York County and the cities of Hampton and Newport News. The water control valves which drop water levels are no longer functional as reported in the Big Bethel Dam Reports (US Army Corps of Engineers [USACE], 2016 a, 2016b). There is also a probability of sediment contamination from a historical nearby cannery source (JBLE-Langley, 2016).

The upper impoundment is manipulated to provide storage capacity for excess stormwater run-off from the adjacent properties within the watershed. Current practices do not reflect an ecosystem approach to natural resource management of the reservoir and the government-owned portions of the watershed. Passage is restricted for fish, reptiles and amphibians that need both structure and cover for protection from predators, foraging and breeding habitat. The lake has not been stocked for recreational fishing in over 10 years due to the lack of funding. The lower dam poses a significant barrier to fish passage for gizzard shad (*Dorosoma cepedianum*), who attempt to spawn within Brick Kiln Creek annually. Current conditions result in high observed mortality of this species both below the dam and within the adjacent drainage ditches (VDGIF Fish and Wildlife Information Service [VAFWIS], 2018; National Marine Fisheries Service [NMFS], 2017). The lower dam is also listed as a major impediment to fish passage by the North Atlantic Aquatic Connectivity Collaborative. Relevant regulatory agency consultations and correspondences are found in Appendix B.

Lower Big Bethel Dam

4.4.3 Groundwater. From a regional perspective, groundwater occurs in nine aquifers separated by eight confining units within the unconsolidated sediments of the Virginia portion of the Atlantic Coastal Plain (Meng & Harsh, 1988). The Coastal Plain in Virginia extends inland from the coast about 110 miles to the fall line and passes roughly through Fairfax County, Fredericksburg, Richmond, Petersburg and Emporia. The Coastal Plain region is composed mostly of unconsolidated deposits, primarily alternating layers of sand, gravel, shell rock, silt and clay. More groundwater is stored in these very permeable materials than in any other province in the state. However, the pollution potential in the uppermost unconfined aquifer here is high because of the permeability coupled with the high population density and agricultural activities in the area.

The Coastal Plain has two separate groundwater systems, one shallow and one deep. In many places, a shallow unconfined aquifer system lies above relatively impermeable clay beds and is the source of water for hundreds of domestic and small capacity wells. The principal source of major groundwater withdrawals is a deeper system of confined aquifers. The recharge area to these aquifers occur miles away where the formations outcrop, but infiltration from the water table and shallower confined aquifer also recharge the deeper confined aquifers and could carry pollutants into these deeper reaches.

Except for areas where saltwater, iron and hydrogen sulfide occur, the natural water quality in the Coastal Plain aquifers is good. In aquifers near a salt water interface, salt water may migrate west as aquifers are pumped. As a result, water from the deep aquifers on much of the lower Virginia Peninsula and the Norfolk-Virginia Beach area frequently contain high chloride concentrations, rendering the water too salty for domestic use without treatment (VDEQ website accessed 23 July 2018).

However, because of extraordinary circumstances of the Chesapeake Bay Impact Crater during the depositional history of the Lower Virginia peninsula, the occurrence of groundwater beneath JBLE-Langley does not conform to the regional model (URS, 2003). The outer rim of the crater appears to act as a boundary and a mixing zone separating groundwater of high salinity inside the outer rim from fresher, lower salinity water outside the outer rim. Virginia Coastal Plain sediments, the southern part of the Chesapeake Bay and a small part of the Atlantic Ocean now cover the crater (Powars & Bruce, 1999). The result of the impact was the local removal of five water-bearing units beneath the area now occupied by JBLE-Langley and their replacement by impact-generated crater fill sediments. Beneath JBLE-Langley, the hydrogeologic units include, in descending order: the Water Table Aquifer, the Yorktown Confining Unit, the Yorktown-Eastover Aquifer, the Eastover-Calvert Confining Unit, and the Chickahominy-Piney Point Aquifer (Powars & Bruce, 1999). Deeper aquifers, which may be present elsewhere in the Virginia Coastal Plain, were destroyed by the CBIC. See Powars et al. (2001) and Brockman and Focazio (1996) for a detailed characterization of the hydrostratigraphy beneath JBLE-Langley.

Due to the loss of aquifers associated with the CBIC, the groundwater beneath JBLE-Langley is not a practical source of irrigation or potable water. An investigation based on available regional and JBLE-Langley-specific well data (URS, 2003) predicted that the water table aquifer could yield up to 35 gallons per minute (GPM). This prediction was confirmed in 2004 when an exploratory production water well drilled at the JBLE-Langley golf course sustained a yield of 30 GPM. However, the water evacuated during the pump test proved too brackish to be used untreated for either irrigation or potable purposes.

4.4.4 Flood Plains. Almost all of the Main Base is within the 100-year floodplain and subject to severe flooding, particularly during major storms or hurricanes. Flooding events on the Main Base have led to relocating aircraft and implementing contingency plans to minimize property damage. Flooding can sometimes be severe on JBLE-Langley, particularly during major thunderstorms and hurricanes. Areas below nine feet mean sea level (MSL), along the Main Base's perimeter and closest to the water bodies surrounding the installation, are more prone to flooding (JBLE-Langley, 2013). See Figure 4-3 for generalized flood plain map for the Main Base. Similarly, all of BBR east of the impoundment is within the 100-year floodplain (USACE, 2000) (see Figure 4-4).

4.4.5 Drainage Patterns. JBLE-Langley is serviced by a stormwater drainage system that discharges to the Back River and its tributaries: Brown Creek, Tides Mill Creek, Brick Kiln Creek and Tabb Creek. The stormwater drainage system consists predominantly of reinforced concrete pipe and drainage ditches. Surface water may also drain to these water bodies via overland flow. Due to the flat relief of the area, a substantial increase in impervious surface area and the lack of consistent stormwater system maintenance, standing water tends to accumulate during rain events. BBR receives stormwater runoff from Brick Kiln Creek, adjacent residential communities and abutting road drainage systems.

JBLE-Langley Drainage into Surrounding Creeks and Rivers

4.4.6 Stormwater Retention. The discharge of stormwater associated with both industrial and non-industrial activities is regulated under by VDEQ under its Virginia Pollutant Discharge Elimination System (VPDES) program. JBLE-Langley has 24 permitted stormwater outfalls under the General Industrial Stormwater Permit VAR052285 which are visually inspected quarterly. Fourteen out of the 24 outfalls are currently monitored for chemicals on a semi-annual basis. The JBLE-Langley MS4 permit (VAR040140) covers 83 non-industrial outfalls associated with this permit which are visually inspected annually.

The General Industrial Stormwater Permit VAR052285 permit also contains a requirement to develop and implement a Stormwater Pollution Prevention Plan (SWPPP) which involves the assessment of stormwater outfalls, outdoor material storage and usage areas, an erosion and sediment control inspection and existing materials management practices. The plan is reviewed annually and updated as necessary when there are major changes at JBLE-Langley (JBLE-Langley, 2014a, 2017).

Aging stormwater infrastructure, tidal waterfront location and lack of elevation allow flooding to occur during wind- and tide-driven surges from events such as nor'easters or hurricanes. Because of the frequency of these events on the East Coast, JBLE-Langley constantly struggles with flood control and ponding associated with intense storms. The topography on the Main Base prevents the effective use of traditional stormwater drainage improvements. The stormwater system is aging and in need of upgrades especially where terracotta pipes were used in the early to mid-20th century (JBLE-Langley, 2017). As stated in Section 4.1, in order to

protect the military mission from impacts of flooding, protect property and address regulatory requirements, a study has been programmed to identify where the JBLE-Langley stormwater system is not functional. Following this study, repair of the stormwater system on JBLE-Langley will begin.

Because of the inadequate groundwater supply in the area and the cost of using potable water, golf course landscaping on the Main Base has been designed to minimize surface water runoff, promote surface storage and reuse rainfall for irrigation. These storage areas are a minimal part of the total installation landscape but do provide a water hazard to challenge golf course patrons. Over 80 percent of BBR is relatively undeveloped and allows for natural attenuation of stormwater.

Figure 4-1: Main Base Wetlands

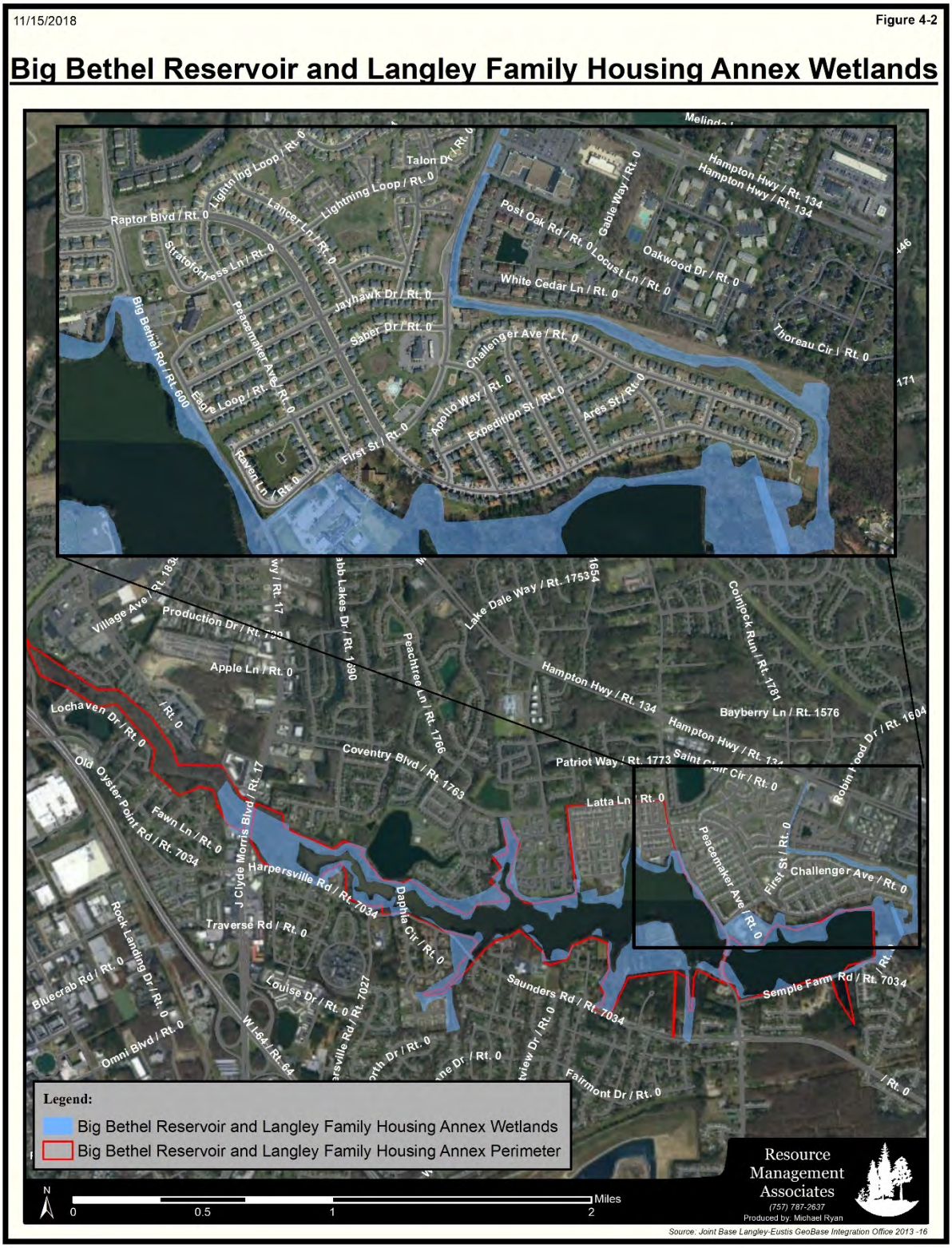


Figure 4-2: Big Bethel Reservoir and Langley Family Housing Annex Wetlands

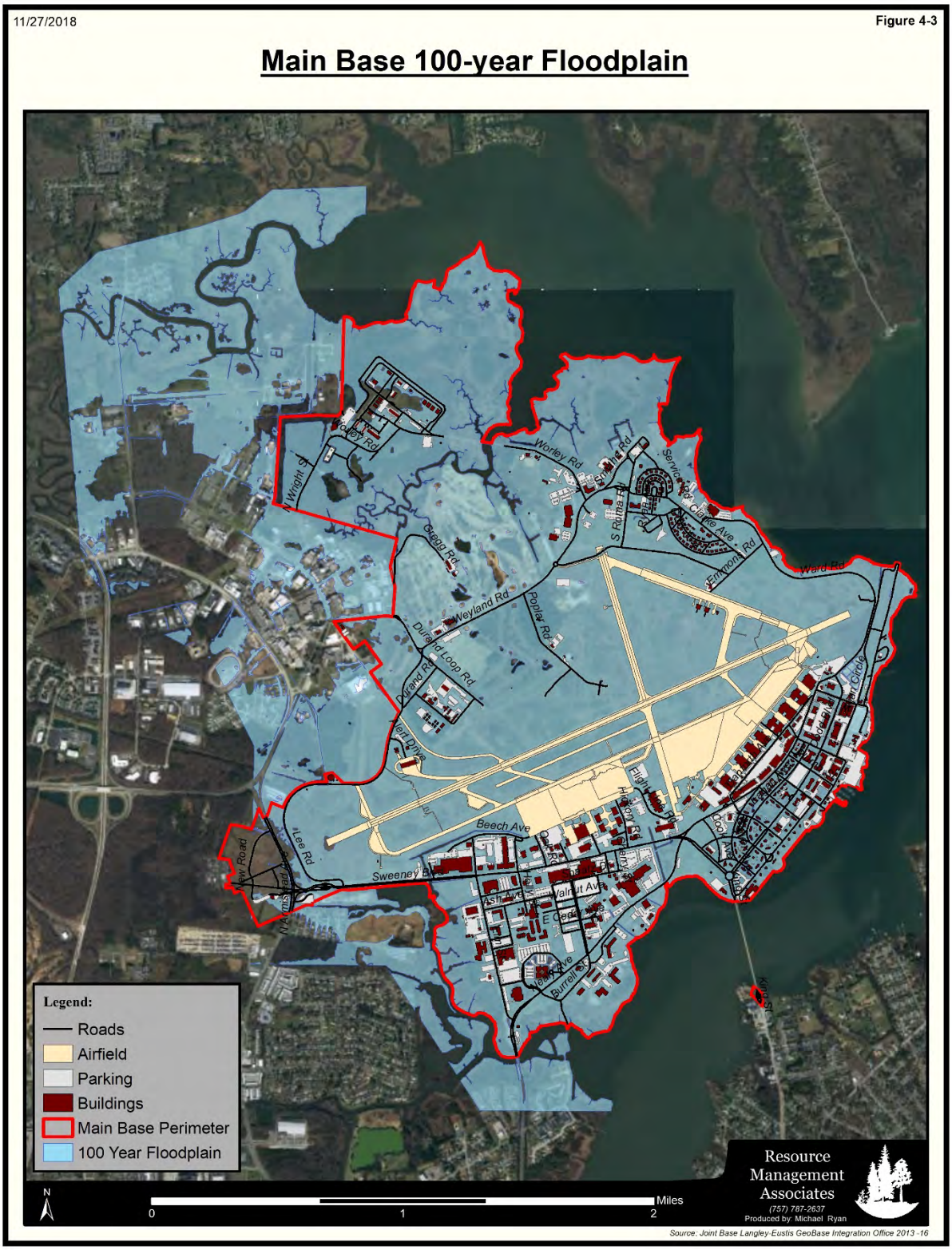


Figure 4-3: Main Base 100-Year Floodplain

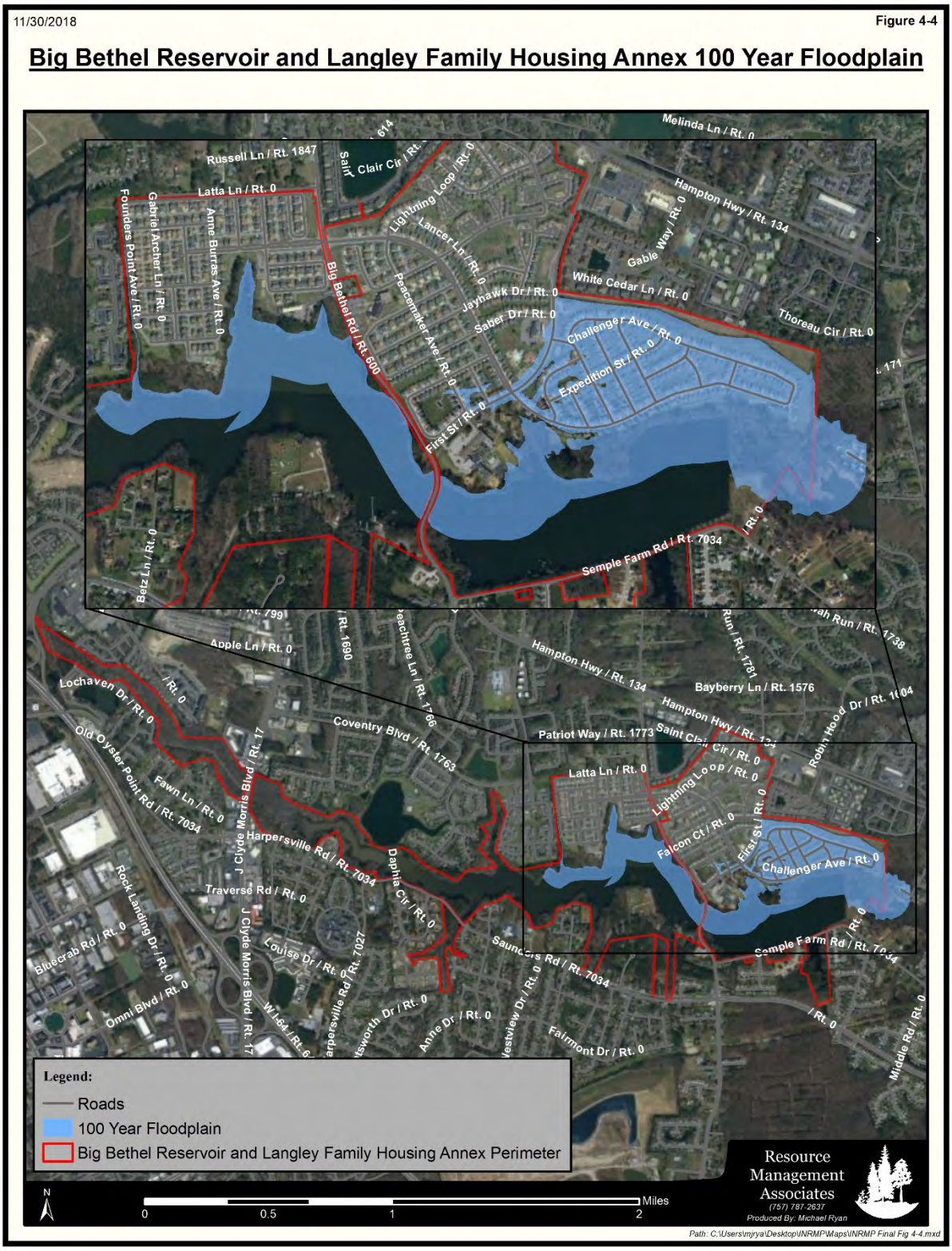


Figure 4-4: BBR and Langley Family Housing Annex 100-Year Floodplain

Table 4-1: Temperature and Precipitation for JBLE-Langley- 1936 – 2017

Source: JBLE-Langley Weather Station (1 OSS/OSW) averaged over the period (1936-2017)

	Temperature (F)			Precipitation (inches)		
Month	**Mean**	**Max. (F)**	**Min. (F)**	**Mean**	**Max**	**Min**
January	40	48	32	3.2	8.4	2.6
February	43	52	34	3.1	10.6	4.5
March	49	59	42	3.7	10.9	3.5
April	59	70	51	3.0	8.4	3.1
May	67	76	60	3.6	13.0	4.4
June	76	85	69	3.7	10.3	5.6
July	79	88	73	4.8	12.5	6.6
August	77	85	71	4.8	13.2	7.9
September	72	80	67	4.4	19.4	9.4
October	63	71	55	3.4	12.5	6.5
November	52	60	44	3.0	12.2	7.2
December	47	54	38	3.1	8.1	2.7

Table 4-2: Climatic Vulnerability

Source: 2017 Installation Development Plan (JBLE-Langley, 2017).

Climate Vulnerability Subcategory	Sustainable Development Indicator	Unit of Measure	Current Value
Climate Vulnerability	Federal Declared Floods	Vulnerability Rating (Flood/Square Mile (SM))	0.033731
Climate Vulnerability	Flood Risks	Vulnerability Rating (based on # of Persons in 500- year Floodplain)	H
Climate Vulnerability	Seismicity	Vulnerability Rating (% of Seismic Activity)	12%
Climate Vulnerability	Tornadoes	Vulnerability Rating (# of Tornadoes/SM in the County)	0.05504
Climate Vulnerability	Sea Level Rise	<1 Meter OR> = M	>1 M
Climate Vulnerability	Temperature Rise Impact	Impact Index (L, M, H)	L
Climate Vulnerability	Precipitation Pattern Changes	Change Index (L, M, H)	L
Climate Vulnerability	Storm Surge/Intensity	Intensity Index (L, M, H)	M
Climate Vulnerability	Drought Intensity	Drought Index	None

Table 4-3: Fecal Bacteria Source Allocations (%) in the Back River Watershed

Source: VDEQ 2017, Source Category Source Percent

Source Category	Source	Percent
Wildlife	Deer	**4.3**
	Ducks/Birds	**43.2**
	Muskrats	**0.6**
	Nutria	**1.3**
	Raccoons	**0.3**
Human	Human	**6.1**
	Human - Septic	**0.0**
	Marina (slips)	**0.4**
	Livestock	**9.0**
Pets	Dog	**34.6**

5.0 ECOSYSTEMS AND THE BIOTIC ENVIRONMENT

5.1 Ecosystem Classification. According to the National Hierarchical Framework of Ecological Units required for use in INRMPs (US Air Force [USAF], 2004) JBLE-Langley is located in the Humid Temperate Domain, Subtropical Division, Outer Coastal Plain Mixed Forest Province. Ecological land classification provides information for both the development of resources and the conservation of the environment. It also helps land use managers estimate ecosystem productivity, determine probable responses to land management practices and to address environmental issues over large areas.

Within the Middle Atlantic Coastal Plain, topography is generally flat, with elevations ranging up to 80 ft (Bailey, 1994). Soil types are generally poorly drained. Land cover constitutes a combination of forest, wetlands and agriculture. Wetlands are very common throughout the region and consist of several types including marshes, bottomland forests and pocosins. Additionally, this region includes surface waters and disturbed land. Climate consists of moderate to mild winters with hot, humid summers. Average annual precipitation is 40-60 inches. Land uses are primarily farming and forestry; however, urban development is locally significant in and around JBLE-Langley.

5.2 Vegetation

5.2.1 Historic Vegetative Cover. At the time the first colonists arrived, the area currently occupied by JBLE-Langley probably contained a mixture of loblolly pine (*Pinus taeda*), swamp chestnut oak (*Quercus michauxii*), willow oak (*Quercus phellos*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), white oak (*Quercus alba*), with an understory of greenbrier (*Smilax* spp.) and other water-tolerant species (Kuranda et al., 2004). After the first European colonists arrived, the land was cleared for farming. At the time the federal government acquired the property in 1916, pine appears to have been the dominant forest species in the uncultivated areas (Kuranda et al., 2004). Only remnant patches of the original native upland forest remain on Main Base and occur in the vicinity of Tabbs Creek and the MSA. Most of the natural vegetation in and around the Main Base and BBR has been lost or modified since urbanization and installation establishment (JBLE-Langley, 2014b; Hobson, 1996).

5.2.2 Current Vegetative Cover. Most of the natural habitat on the Main Base was filled and leveled when the base was constructed. The tidal wetlands along its shore are the only remaining significant natural areas on the installation. BBR remains a more natural area, except for partial development, but is surrounded by an urban environment. Most of the Main Base consists of managed lawns and landscaped areas with ornamental trees and shrubs and industrialized areas containing buildings, structures and pavement. The Langley Family Housing Annex is also a highly developed residential area with turf lawns and ornamental shrubbery. Bethel FAMCAMP still contains some native forest and shrub species and the remainder of BBR maintains a perimeter of native forest and shrub species. Native vegetation at BBR consists primarily of mature bottomland hardwood forests with understory components.

Approximately 230 acres of the Main Base is forested, mostly confined to the northwestern part of the base (see Figure 5-1). This area is dominated by second growth pine or sweet gum,

characteristic of old field succession and growth since federal acquisition. Although forests have not been commercially harvested, JBLE-Langley meets the requirement of commercial forest with more than 140 acres of forest of the required timber densities. AFI 32-7064, page 34, Section 9.1.6, states "Installations with commercial forest land capable of producing more than 20 cubic feet/acre/year in wood biomass must maintain a forest inventory and update them at least once every 10 years." No timber inventory has yet been conducted.

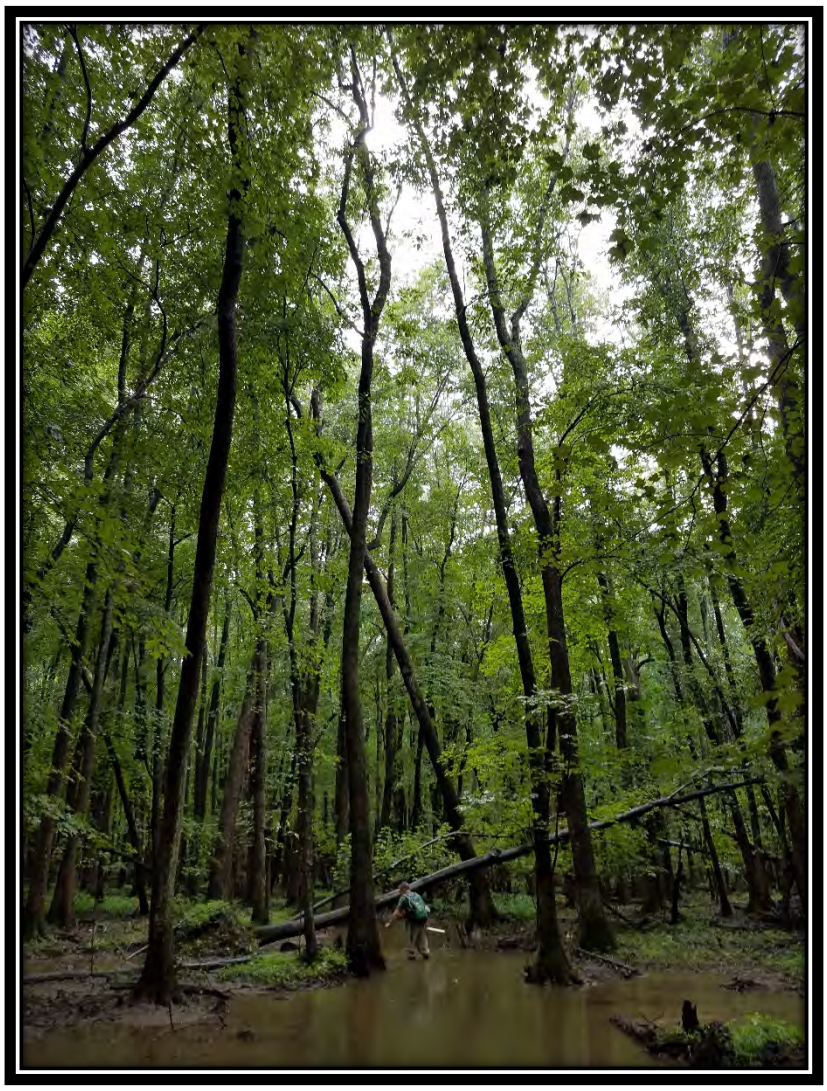
An 18.5-acre loblolly pine tract is located east of the Eaglewood Golf Course and is bisected by Poplar Road. These trees were topped because they penetrated the imaginary surface for the airfield. Additional trees will likely be cut to accommodate expansion and upgrade of the hazardous waste storage facility. In the northwest part of the Main Base, there are approximately 72 acres of mixed hardwoods and pine on either side of the Gray Road extension of Worley Road past the MSA.

In general, two types of upland forests (as classified by the Virginia Natural Heritage Program) are present on the Main Base: Maritime pine-hardwood forest and oak-pine forest (Hobson, 1996; Fleming and Patterson, 2017). Maritime pine-hardwood forest is a common community type in the Southeastern Coastal Plain. This community is typically found landward of the estuarine marsh ecotone and at lower elevations than other coastal plain upland community types.

Oak-pine forest on the Main Base is rare but occurs on the hummocks in the Tabbs Creek area. The canopy is dominated by black oak (*Quercus velutina),* southern red oak (*Quercus falcata) and* willow oak with loblolly pine, sweet gum and black gum (*Nyssa sylvatica*). This community type is widespread and common throughout the Coastal Plain of Virginia, generally occurring at slightly higher elevations than that of the maritime forest community.

Typical forested areas on the Main Base consist of a canopy of loblolly pine, southern red oak, white oak, willow oak, black cherry (*Prunus serotina),* sweet gum, red maple, tulip poplar (*Liriodendron tulipifera)* and hickory (*Carya* spp.*).*

The BBR forest canopy is composed mostly of bottomland swamp species such as black gum, red maple, ironwood (*Carpinus caroliniana*), tulip poplar, sycamore *(Platanus occidentalis)* and green ash (*Fraxinus pennsylvanica*). The sub-canopy species include winged sumac (*Rhus copallinum*), holly *(Ilex* spp.*),* sassafras *(Sassafras albidum),* mulberry *(Morus rubra and M. alba)* and sweetbay magnolia *(Magnolia virginiana).* The shrub layer or understory composition varies depending on the site but include: wax myrtle (*Myrica cerifera*), black bayberry (*Myrica heterophylla*), common elderberry (*Sambucus canadensis*), Hercules' club (*Aralia spinosa*), Japanese honeysuckle *(Lonicera japonica),* Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), muscadine and fox grape (*Vitis rotundifolia and V. labrusca*), bicolor lespedeza (*Lespedeza bicolor*) and high tide bush (*Baccharis halimifolia*). The vegetative layer consists of late throughwort (*Eupatorium serotinum*), dog fennel (*Eupatorium capillifolium*), mistflower (*Conoclinium coelestinum*), velvet panic grass (*Holcus lanatus*), deer-tongue panic grass (*Panicum clandestinum*), tall goldenrod (*Solidago canadensis*) and Terrell grass (*Elymus virginius*), among others (Hobson, 1996). Invasive species are also present in the understory of most forests on JBLE-Langley (see Section 5.2.3).



Large Trees Surrounding Big Bethel Reservoir

These forested areas are an important component of the installation's natural resources for a variety of reasons. First, these areas provide protective cover for wildlife species. Additionally, through their inherent biological processes, trees produce large quantities of oxygen, clean and cool the air and conserve heat at night. Most importantly, these areas help reduce soil erosion by reducing the amount of rainfall that reaches the ground, slowing runoff and stabilizing the soil and helping to reduce flooding impacts. Regeneration of this vegetation on JBLE-Langley has been significantly impacted by herbivory from deer. Appendix C contains a list of species observed on portions of JBLE-Langley, but a comprehensive survey has not been conducted. Because of the presence of forested habitat containing vernal pools at BBR, a preliminary biological site survey was conducted by Natural Resources staff in July-August 2018 (Garcia & Peterson, 2018). Additional surveys are recommended and scheduled.

5.2.3 Invasive Species. Many invasive animals and plants (see Appendix C), have become established and are competing with native vegetation at JBLE-Langley. The most common invasive plants include common reed (*Phragmites australis)*, Japanese honeysuckle (*Lonicera japonica*), privet (*Ligustrum* spp.) and Japanese stiltgrass (*Microstegium vimineum*). An Invasive Species Inventory and Management Plan for the Main Base was completed and published by Geo-Marine Incorporated in 2009 (Geo-Marine, 2009), however conditions have changed significantly since that time. In Fiscal Year 2014 (FY14), a habitat assessment of common reed at the Main Base was completed by Aerostar SES LLC, but funding for invasive species removal for species other than *Phragmites* has not been provided. In FY17, Three Rivers RC&D Inc. was funded to perform 150-acres of invasive species treatments on the Main Base. Using the FY14 Aerostar SES maps of *Phragmites* population locations on the Main Base, due to the potential for aggressive expansion of *Phragmites*, the contractor remapped the *Phragmites* populations suitable for aerial and ground-based applications as well as populations of privet located in upland forested areas. Figure 5-2 depicts the FY17 invasive species treatment areas.

Funding for invasive species removal for species other than *Phragmites* has not been provided but continues to be scheduled. In FY17, some other invasives around the Explosive Ordnance Disposal (EOD) Range and the Nature Trail were managed with additional funds from the Natural Resources Program. *Phragmites* was not treated for almost 10 years due to a lack of funding prior to the FY16 control project executed in FY17. As a result, the areas have spread significantly without the proper follow up treatment and will remain a problem until biomass is removed. Prescribed burning in these small areas may prove effective as part of the recommended follow up treatment to effectively control this aggressive invasive species. Section 7.11, Integrated Pest Management, provides more discussion on invasive species management and JBLE-Langley's efforts to control them.

5.2.4 Turf and Landscaped Areas. Developed areas on JBLE-Langley are primarily paved or turf. Vegetation is actively modified to prevent wildlife hazard attractants on the Main Base. Habitat management provides the most effective long-term remedial measure for reducing wildlife hazards on and near airfields. The goal of habitat management is to make the environment fairly uniform and unattractive to the species that are considered the greatest hazard to aviation (US Department of Agriculture [USDA], 2017). The current BASH Plan outlines vegetation management practices for each type of vegetated area, including forested/brushy areas, ornamental landscapes, grass and bare ground areas, golf course, wetlands, etc. A current Grounds Maintenance Services Contract Performance Work Statement outlines the standards to which grounds are maintained including solid waste collection and disposal.

Semi-improved ground fields on the Main Base and BBR recreation areas are mowed according to these standards as per AFI 91-202, *The USAF Mishap Prevention Program* (USDA, 2017). The long minimum grass height discourages flocks of birds from entering the airfield due to reduced visibility which disrupts inter-flock communications, flock integrity and prevents predator detection. Currently, the recommendations for habitat management presented in the BASH Plan (USDA, 2017) guide most man-made landscapes on JBLE-Langley. Due to a number of ground disturbing activities associated with airfield construction and improvement, the presence of clover on the Main Base has expanded since the last INRMP. This species is a particular wildlife attractant and therefore a BASH concern. An airfield turf management plan

should be developed to guide the control of this and other wildlife attracting species near the JBLE-Langley airfield.

The Raptor Course at Eaglewood Golf Course features 18 holes of warm season turf. This course includes a total of 119.16 acres of managed turfgrass; there are 2.44 acres of Bentgrass greens, 2.32 acres of Bermudagrass tees and 23.07 acres of Bermudagrass fairways, with the remaining acres in Hybrid Bermudagrass Rough.

The maintenance objective on the Eaglewood Golf Course is to provide an aesthetically pleasing golf course and grounds for the military and general public while maintaining a high level of conscience toward the environment and agronomics. The current nutrient management plan, dated June 2017, serves as a guideline for property management including the use of fertilization in an effort to reduce leaching and excess nutrient runoff potentials into nearby watersheds. Changes made to fertilization schedules and nutrient application rates must be done in accordance with (IAW) guidelines set forth within the *Virginia Nutrient Management Standards and Criteria*, dated July 2014. Several ecologically sensitive areas were identified and opportunities for habitat restoration are scheduled to reduce TMDL and intensive maintenance, increase water quality, resiliency and improve aesthetics (see Figure 5-3).

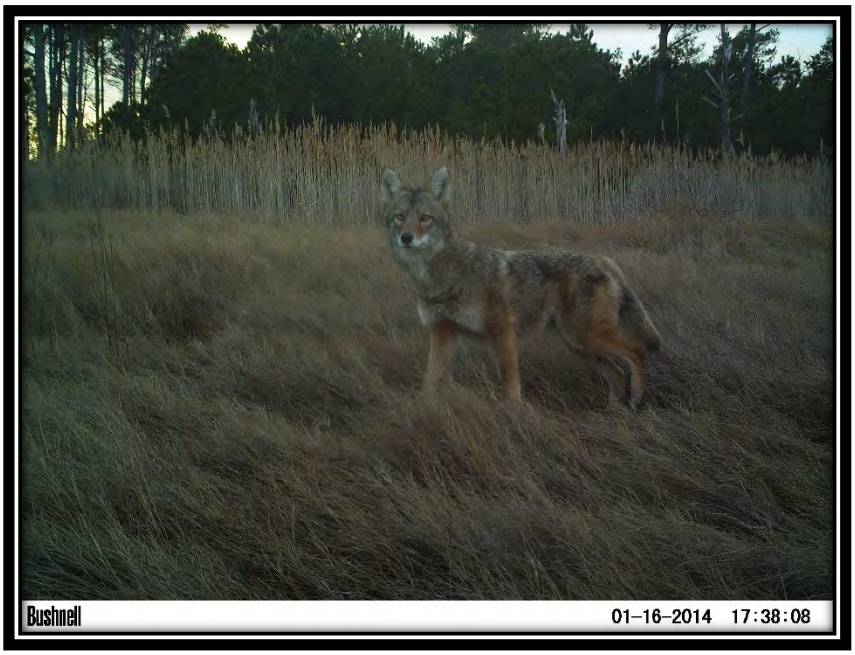
The pasture is another large open space on the Main Base and is located near Tabbs Creek, the large marsh and Nature Trail area. Pasture management is guided by the Pasture Runoff Assessment and Manure Management Plan (BEM, 2002) to reduce run off to the surrounding land and water.

A Tree Inventory and Urban Forest Management Plan was completed by Davey Research Group (2002, 2003). Most recently, the Hampton Roads Master Gardeners in partnership with Virginia Cooperative Extension (Hampton Roads Master Gardeners, 2017) produced an urban tree inventory for the Main Base that assessed tree health, species composition and dimensions. A plan for reforestation that is compatible with the Installation Development Plan with management recommendations would help guide future efforts and could reduce flooding.

5.3. Fish and Wildlife. Because of the proximity to the Chesapeake Bay and Atlantic Flyway, there is an abundance of fish and wildlife in the area. The VDGIF lists 541 species likely to occur in the area (see Appendix C). However, wildlife species residing on JBLE-Langley are likely either habitat generalists or very tolerant of human disturbance. The variety of fauna on JBLE-Langley includes game and fur-bearing species, small mammals, raptors, waterfowl, songbirds, amphibians, reptiles, fish and invertebrates.

5.3.1. Mammals. A comprehensive inventory of mammals has not been conducted on JBLE-Langley. Native mammals observed locally include white-tailed deer, raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), gray squirrels (*Sciurus carolinensis*), Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), meadow vole (*Microtus pennsylvanicus*), river otter (*Lontra canadensis*) and various other species of small rodents. Gray fox (*Urocyon cinereoargenteus*) have not been observed over the last two years and have possibly been extirpated by the increase and expansion of coyotes on the Main Base (Alicia Garcia, personal communication, July 2018). During a 1998 survey of BBR, 15 mammal

species were documented (Galvez et al., 1998; see Appendix C). Recommendations in that report included the control of raccoon populations (Galvez et al., 1998). The VDGIF (2018) also recently recommended raccoon control on the Main Base to prevent possible disease outbreaks within the species and reduce impacts to Virginia Species of Concern (SOC) from nest predation on egg laying species.



Coyote at JBLE-Langley Main Base

A bat survey was conducted during May-August of 2017, as part of a larger project to study 47 AF installations to determine the presence of bat species using acoustic monitoring. Five bat detectors recorded bat activity on the Main Base. The mean activity rate on the Main Base (160.4 bat passes/detector/night) ranked in the bottom third of the 47 installations sampled in the project (CIRE, 2018). Twelve species of bats were acoustically detected by machine, of which only seven were confirmed through additional analysis. A full list of bat and other mammal species known to occur on JBLE-Langley can be found in Appendix C. None of the seven confirmed species found on the Main Base is federally-listed though the tri-colored bat (*Perimyotis subflavus*), is listed as endangered in Virginia and is a federal candidate for listing under the Endangered Species Act. The little brown bat, which was also documented on the Main Base, is state listed as endangered.

Additional acoustic surveys were executed by JBLE-Langley by Natural Resources staff in July-August 2018 at BBR (Garcia & Peterson, 2018). Analysis of acoustic recordings was performed by Dr. Mark Ford, Associate Professor and Cooperative Research Unit at Virginia Polytechnic Institute. All seven species detected on the Main Base were detected at BBR except the silver-haired bat (*Lasionycteris noctivagans*) which was not found. Three species not detected on the Main Base were detected and manually confirmed by Dr. Ford. The species include Brazilian free-tailed bat (*Tadarida brasiliensis*), Indiana bat (*Myostis sodalis*) (Federal Endangered Species) and northern long-eared bat (*Myostis septentrionalis*) (Federal threatened). The

detection of these species was reported to VDGIF and USFWS in September 2018 as well as the Air Force Civil Engineer Center. Follow on studies to elucidate usage of BBR by federally-listed bat species is required in order to generate a management plan.

5.3.2 Birds. At least 150 species of breeding, migratory and overwintering birds have been documented on or around the Main Base and BBR. Airfield bird surveys have been conducted by USDA - Animal Plant Health Inspection Service - Wildlife Services (USDA/APHIS/WS) since 2000. Since 1986, volunteer bird enthusiasts, primarily from the Hampton Roads Bird Club, have participated in the annual National Audubon Christmas Bird Count, USGS Breeding Bird Survey and the Virginia Breeding Bird Atlas efforts. At least 153 species of birds have been observed on or near the Main Base during these surveys (Geo-Marine, 2011; Hampton Roads Bird Club, 2018). These volunteer, standardized surveys have been compiled by the Hampton Roads Bird Club or the Virginia Society of Ornithology from 1986-2018 (Hampton Roads Bird Club, 2018). Over these years, an average of 1,090 birds of 73 species were observed annually. The cumulative species list is found in Appendix C.

Nest counts have been conducted for osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus leucocephalus*), herons and egrets. A rookery of great blue herons *(Ardea herodias*) and great egrets (*Ardea alba*) on BBR has been monitored by Natural Resources staff, volunteers and the Center for Conservation Biology of the College of William and Mary in cooperation with a number of state and federal agencies for many years as part of the VDGIF Colonial Waterbird Program (Bryan Watts, personal communication, July 2018). The nest count conducted during the summer of 2010 of 10 great egret and 14 great blue heron nests (Geo-Marine, 2011) has increased to 32 great blue herons, 87 great egrets and three anhingas (*Anhinga anhinga*) in 2018 (Garcia & Sopko, 2018; Jim Peterson, personal communication, July 2018). BBR includes suitable habitat for these species with large, mature pine and deciduous trees surrounding the reservoir. This combination of factors provides foraging, nesting and overwintering habitat for many resident and migratory birds including bald eagles re-establishing populations in the area.

While the rookery has increased in size from 2010 to 2018, encroachment from humans is a concern. The presence of foot paths and plastic trash was observed in 2017 and 2018. It has been demonstrated that disturbance by humans into rookeries and hunting areas can reduce foraging success for members of the Ardeidae family (bitterns, herons and allies) (Phillimore, 2001). Improper disposal of household waste from this housing development is the probable source of the trash. Trash may pose a threat to adult and juvenile heron if birds become entangled in it or accidently ingest it.

Suitable habitat for foraging, roosting and/or nesting osprey and eagles occur along the 9.9 miles of shoreline bordering the Main Base. Osprey populations have decreased in recent years due to predation, translocation and loss of duck hunting stands for nesting (removed for dredging activities). They are still common in the area and can be seen along the Main Base's shorelines from March through September. Only one nest was located on the Main Base in 2018 and failed due to raccoon predation. More osprey nests are known to occur in the Back River. Osprey nests can pose a potential BASH risk to flight operation depending on their proximity to the airfield (USAF, 2013; USDA, 2017). A DoD Legacy Resource Management Program, developed with Illinois Department of Natural Resources (IDNR) and The Nature Conservancy

(TNC), provided for the translocation of JBLE-Langley's osprey to help recover the Illinois population. This project was completed in 2017 when recovery goals were met. This project also helped to reduce the risk to JBLE-Langley's osprey and aircraft (IDNR, 2012; USDA, 2017).

Osprey Nesting near JBLE-Langley Shoreline

The once endangered bald eagle (*Haliaeetus leucocephalus*) was downgraded to threatened in 1995, then delisted in 2007 based on recovery success. Bald eagles have been observed and nested at JBLE-Langley for many years. This species is protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act. The bald eagle population that breeds in Virginia has successfully recovered. Eagles have become a consistent presence on the airfield and the Main Base over the last few years. They are regularly observed hunting on the installation or eating carrion when available. Habitat suitable for bald eagle foraging, roosting and/or nesting occurs among the loblolly pines on the northern side of the Main Base. The current BASH Plan describes 204 separate non-lethal depredation actions to move bald eagle off of the JBLE-Langley airfield in 2017 (USDA, 2017).

The uniform age/size structure of loblolly pine stands may limit use of JBLE-Langley as nesting or roosting habitat for the bald eagle. The first nest was discovered in the forested north marsh area of the Main Base in 2007. This nest remains active and has successfully produced fledgling eagles each year (Alicia Garcia, personal communication, July 2018; Bryan Watts, personal communication, July 2018). One nest, established at BBR in 2005 was later abandoned, likely caused by residential encroachment (Bryan Watts, personal communication, 2007). More recent observation since 2016 indicate additional nests may have been established and nests within three miles of JBLE-Langley have been discovered in recent years. The Virginia Bald Eagle Nest Surveys have identified at least five additional nests outside of JBLE-Langley. An

additional nest was discovered during the 2013 breeding season (Thomas Olexa, personal communication, 2013) located less than a quarter mile from the LaSalle Gate entrance to the Main Base off of Tide Mill Lane along the shoreline of the Back River.

JBLE-Langley provides abundant habitat for both waterbirds and shorebirds. This poses a risk to flight operations because large flocks of these birds have been observed on the airfield annually during fall and winter, utilizing the large open space for roosting or standing (USDA, 2015). Large rafts of gulls are also routinely observed at BBR over which is a portion of the military flightpath. In December 2017, a Class A Collision (defined as a collision causing $2 million or more in damage) between an F-22 and a flock of approximately 150 dunlin (*Caladris alpina*) occurred. Based on observed environmental conditions during which shorebirds access JBLE-Langley, it is suspected that a correlation between weather conditions and shorebird behavior exists. Research is currently underway to investigate weather patterns during which large flocks of shorebirds utilize the installation. If a correlation is found, this information can be used to predict elevated Bird Watch Conditions (BWC) and inform installation policy related to flight operations. This may protect human health and safety, safeguard AF property and reduce impacts to wildlife from BASH incidents.

Several sites in the vicinity of JBLE-Langley support colonial nesting bird species. These colonies have been changing in number and size and continue to relocate throughout the Hampton Roads area. Craney Island and Grandview Beach both have supported least terns (*Sternula antillarum*) and other species. A 2018 nest attempt by an estimated 50 least tern adults was documented on a pebble roof of Building 330, which is located approximately 100 meters from the runway at the Main Base. This was considered to be a bird strike hazard. BASH program coordination and plan protocols were employed (USDA, 2017) and the birds were discouraged from nesting due to their proximity to the airfield. All actions to discourage nesting occurred prior to observation of eggs.

Waterbirds and Shorebirds on JBLE-Langley

In view of the planned Hampton Roads Tunnel project, continued urbanization and colony disturbance, colonies are expected to relocate in the Hampton Roads area. At least 12,000 nesting waterbirds including terns, gulls, skimmers, egrets and oystercatchers nested on the Tunnel Islands in 2018 (Ruth Boettcher, personal communication, July 2018). As habitat on the Tunnel Islands is altered to reduce bird use, more waterbirds will likely attempt to nest on JBLE-Langley. Close coordination with the BASH program will be required to minimize additional hazards and allow for potential compatible nest sites located away from the airfield on JBLE-Langley.

5.3.3 Fish. A summary of all fish and invertebrates likely to be found in the estuarine waters (Back River) surrounding the Main Base is included in Appendix C (USACE, 2000). The most recent survey was a 2007 VDGIF electrofishing survey of BBR resulted in documenting 11 fish species; largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), common carp (*Cyprinus carpio*), black crappie (*Promoxis nigromaculatus*), brown bullhead (*Ameriurus nebulosus*), chain pickerel (*Esox niger*), American eel (*Anguilla rostrata*), yellow perch (*Perca flavescens*), golden shiner (*Notemigonus crysoleucas*), redear sunfish (*Lepomis microlophus*) and brown bullhead (*Ameiurus nebulosus*). The VDGIF BBR fisheries report (VDGIF, 2007) indicates that eel have been either released as bait fish or stocked, or have circumnavigated the earthen dam, as the Bethel Dam is an impediment to fish passage and natural dispersal. The American eel is a long-lived, catadromous species considered to be an important prey item in the Chesapeake Bay for many commercial fish.

The VDGIF survey reported the largemouth bass population to be in good condition, representing a variety of sizes and year classes at the time of survey. The bluegill population was unbalanced with an abundance of small specimens. There was an abundant population of large carp. Due to the sampling method, only a few black crappie were collected, but one was a Virginia citation of 1.7 pounds. The survey also reported a productive population of brown bullhead, as well as American eel. The habitat for chain pickerel in the reservoir very limited and the population was observed as decreasing because of habitat limitation. The perch population was healthy as was the golden shiner. The red ear sunfish population was reported as low. No gizzard shad were collected but were most likely still present within the reservoir at the time of survey (Appendix C lists the species found in the survey).

Recent complaints of a lack of sizable largemouth bass in 2016 and 2017 from multiple fishermen who frequently fish the area indicate fish stocking may be necessary (Alicia Garcia, personal communication, 2018), although other fishermen report catching large fish in 2018. It is possible that past overstocking of largemouth bass has led to an overall reduction in species composition and size class diversity within the reservoir since the time of the last survey. If it is decided that further stocking of the reservoir is desired to support recreation, a revenue stream to support this purpose will need to be identified. Since AFI 32-7064 does not allow use of NR program funds for fish stocking, options include a reallocation of boat docking fees or addition of an installation fishing license to generate income if the BBR fishery is to be stocked or managed.

As stated in Section 4.4.2 on surface waters, the dams in place on Brick Kiln Creek which form BBR are significant impediments to fish passage. Fish mortality events related to the presence of

the dam have been documented in 2017 and 2018 (Alicia Garcia, personal communication, 2018). Species impacted appear to be solely Gizzard shad caught below the dam during spring spawning migration. Design work to naturalize a channelized tributary to Brick Kiln Creek is underway. Stream restoration work below the dam may help decrease fish mortality due to the dam but will likely not completely solve the problem. Removal of the lower dam would support fish passage but must be evaluated with consideration of the pollution potential from sediment behind the dam which is more fully discussed in Section 6.3.1.4. of this document.

Fish Mortality from Blocked Fish Passage at Lower Big Bethel Dam

5.3.4 Invertebrates. A rich diversity of wetland and aquatic invertebrates on or around the Main Base include the commercially important estuarine species such as crabs, oysters and clams. Blue crabs are harvested as both hard-shell and soft-shell crabs for the local seafood market, as well as exported from the Chesapeake Bay area. Fiddler crabs (*Uca* spp.), an important wildlife food source, are especially abundant in the Main Base's tidal marshes. The Chesapeake Bay and its tributaries also support Eastern oysters (*Crassostrea virginica*) and the hard clam (*Mercenaria mercenaria*), which have a patchy distribution in the Hampton Roads area. Within the Chesapeake Bay, hard clams are most abundant in lower bay areas with high salinity and coarse-grained sediments. Tributaries and creeks surrounding the Main Base support a high diversity of both nektonic and benthic organisms common in and around the lower Chesapeake Bay area.

The planktonic community supports both micro- and macro-organisms including diatoms, dinoflagellates, foraminifera, skeleton shrimp, jellyfish, stinging nettles and larval forms of fish, crustaceans and other organisms. These play an important role in the food chain and prey base for many commercial species of the Bay. Their abundance, health and safe consumption are dependent upon water quality in the area. The Virginia Department of Health (VDH), Division of Shellfish Sanitation monitors for Emergency and Seasonal Condemnation Zones and annual closures occur in portions of the Back River (VDH, 2018).

Thousands of terrestrial invertebrate species inhabit JBLE-Langley, ranging from common mosquitos and biting flies to land snails to many dragonflies and butterflies. Invertebrates serve as an important prey base for most animals on JBLE-Langley. Pollinators (including bees, flies, moths and many others) play a valuable role on JBLE-Langley as they pollinate gardens, flowers and trees. In 2017, the USFWS coordinated with the AFCEC to develop a *USAF Pollinator Conservation Strategy* (USFWS, 2017a) with reference guides. A few pollinator species have recently been listed or petitioned to list, including the rusty patched bumble bee (*Bombus affinis*) and monarch butterfly (*Danaus plexippus*).

Ticks have received attention on JBLE-Langley and nationally, as they carry multiple tick-borne diseases. Preliminary results from Old Dominion University (ODU) indicate that the Main Base supports six tick species which carry these diseases. Researchers from ODU analyzed data from 2009 - 2017 to determine presence and abundance of tick species and life stages present across Virginia. A study site for this larger project is located on JBLE-Langley (Gaff, 2018). Increasing mammal populations (especially deer, raccoon and muskrat) may provide hosts for these species. Mammal population control measures, summarized in the BASH Plan (USDA, 2017), may help keep these tick populations and the diseases they carry in check.

5.3.5 Reptiles and Amphibians. JBLE-Langley supports a diversity of reptiles and amphibians. A 2016-2017 survey documented 1,646 individuals of 25 species of herpetofauna on the Main Base from October 2016 through September 2017 (Terwilliger Consulting, Inc. [TCI], 2017). Amphibians comprised 11 species of 1,223 individuals. Reptiles comprised 14 species of 423 individuals documented. The 25 total species included eight species of frog, two species of toad, one species of salamander, five species of snakes, seven species of turtles and two species of lizards. No Federal or State Threatened or Endangered herptofauna were encountered. However, the diamondback terrapin (*Malaclemys terrapin*), a Tier II Species of Greatest Conservation Need (SGCN) in the Virginia State Wildlife Action Plan (SWAP), was documented in all life stages on the Main Base. Three species of VDGIF Tier III SGCN - the spotted turtle (*Clemmys guttata*), woodland (or eastern) box turtle (*Terrapene carolina carolina*) and eastern kingsnake (*Lampropeltis getula*) - were documented on Main Base. The common snapping turtle (*Chelydra serpentine*), a Tier IV SGCN, was also documented (see Appendix C).

Green Tree Frogs at JBLE-Langley

Previously conducted field reports (Galvez et al., 1998) have stated that BBR is an isolated body of water that lacks adequate acreage of suitable surrounding upland habitat to maintain a viable population of most reptiles and amphibians. A more recent preliminary biological site survey was conducted by Natural Resources staff in July-August 2018 at BBR (Garcia & Peterson, 2018). Common species observed at BBR include two adaptable species of freshwater turtles: the yellow-bellied slider (*Trachemys scripta scripta*) and the red-eared slider (*Trachemys scripta elegans*). Turtle nesting attempts observed for more than two weeks by Galvez et al. (1998) indicated significant predation, most likely by raccoons. This was also observed in 2018 (Alicia Garcia, personal communication, 2018). Common frog species observed at BBR include the American bullfrog (*Lithobates catesbeianus*), the green frog (*Rana clamitans*), southern leopard frog (*Lithobates sphenocephalus*), green tree frog *(Hyla cinerea*) and squirrel tree frog (*Hyla squirella*). Of particular note at BBR was the observed population density of the woodland box turtle which was both abundant and widely distributed on all portions of the property including the FAMCAMP. The area has both man-made ponds and small vernal pools that potentially could provide breeding areas for amphibians. Water quality studies are needed to confirm suitability of the pools for amphibians (Galvez et al., 1998) and survey work for amphibians, especially mole salamanders, should be conducted in the last winter to early spring when detection is most likely to occur. To date, amphibian surveys have only been conducted during the summer. Partnerships with community organizations concerned with herpetofauna conservation should be pursued to support further investigation of BBR species utilization.

5.3.6 Important Wildlife Diseases. Disease in wildlife is a natural occurrence but has been increasing across the county in recent years. Many factors contribute to increased risks and adverse outcomes in certain wildlife populations and in some cases directly affecting human health. The following wildlife diseases are considered important for this INRMP period.

5.3.6.1 Rabies. This viral disease has been documented in raccoons at NASA-Langley and remains a possibility for raccoons and other mammals on JBLE-Langley. Pest management personnel are typically the first responders regarding human-wildlife conflicts. These personnel coordinate directly with Preventive Medicine/Environmental Health staff immediately if any risk of exposure is identified.

5.3.6.2 Chytridiomycosis. Amphibians are at risk of chytrid fungi species, which have caused high mortality in Virginia and globally. The chytrid fungus *Batrachochytrium dendrobatidis* (Bd) adversely affects species of frogs and toads. According to JBLE Instruction 32-102 and recommended by this INRMP, the use of frogs, toads and tadpoles as fishing bait should be prohibited. Wildlife/fauna removal from or liberation onto JBLE-Langley is prohibited as these activities may introduce this disease into wild amphibian populations.

5.3.6.3 Snake Fungal Disease (SFD). SFD is an emerging disease characterized by skin lesions that has been observed among several snake species in Virginia and other Eastern United States. The USGS National Wildlife Health Center is monitoring SFD. In the event that a snake on JBLE-Langley is found with symptoms of this disease, the Natural Resource Manager will contact this organization to facilitate reporting and management.

5.3.6.4 Hemorrhagic Disease (HD). HD is the most important infectious disease of white-tailed deer in the southeastern US including Virginia. This disease is caused by the Epizootic Hemorrhagic Disease virus that is transmitted from biting flies in the genus *Culicoides*. HD outbreaks can occur annually, but with annual variations of severity, related to densities of *Culicoides,* individual deer immunity and virulence of the virus. HD outbreaks occur most often in late summer and early fall (August through October). Mortality rates from HD in southeast Virginia average less than 10% but can exceed 25% of the deer population. To date, this disease has not been detected on JBLE-Langley.

5.3.6.5 Chronic Wasting Disease (CWD). CWD is a fatal neurological disease of deer, elk and moose. CWD was first diagnosed in West Virginia in 2005, Virginia in 2009, Maryland in 2010 and Pennsylvania in 2012. CWD is caused by abnormal infectious proteins called prions. Prions can pass between deer through saliva, feces, urine and through water or soil contaminated with prions. The potential impacts of CWD to the Virginia white-tailed deer population are a serious concern, though the disease has not been shown to pose a health risk to humans or domestic animals. VDGIF is responsible for CWD surveillance and management in Virginia. The Department relies on assistance from hunters, taxidermists, processors and other agencies to implement surveillance. JBLE-Langley assists with surveillance as part of reporting for JBLE-Langley hunting program.

5.3.6.6 Canine Distemper. Canine distemper is a highly contagious and often fatal disease that affects both domestic canids and wild carnivores including raccoons. The disease is caused by a virus and is spread through contact with bodily fluids and feces. Immunization of domestic animals is the best preventative measure for pets. Symptoms are similar to those of rabies, but canine distemper is not transmissible to humans. Multiple observations by pest management of animals with signs of this disease were made in 2018. One raccoon trapped on the Main Base in 2018 was confirmed by JBLE veternarians to have canine distemper.

5.3.6.7 Leptospirosis. Leptospirosis is a zoonotic disease caused by a *Leptospira* bacterial infection. According to the Centers for Disease Control and Prevention, numerous animals can develop and spread leptospirosis, including rodents, raccoons, opossums, dogs, horses and livestock. Humans can be infected by leptospirosis by coming into contact with soil or water where the bacteria are present or with infected animals, including animal urine or body fluids. Military personnel, fishermen, farmers and people engaged in outdoor freshwater recreation activities are at risk. Pets may be vaccinated for leptospirosis and people infected with leptospirosis are typically treated with antibiotics.

5.3.6.8 Sarcoptic Mange. No cases of mange (as caused by the *Sarcoptes scabiei* mite) have been identified in any mammalian species at JBLE-Langley to date.

5.4 Threatened and Endangered Species and Species of Concern. Prior to 2016, no known state or federal threatened or endangered (T&E) species, other than the now delisted bald eagle, were documented on JBLE-Langley. However, the AF has always recognized the possibility of an incidental occurrence resulting from foraging or flyover, or due to the lack of adequate surveys to detect them. Species with the potential to occur on JBLE-Langley included rare, threatened and endangered mammals, birds, reptiles, amphibians, fish, invertebrates and plants listed or determined to be candidates for listing by the USFWS, NOAA, VDGIF or Virginia Department of Agriculture and Consumer Services (VDACS). Fish and wildlife species targeted for survey are mentioned in Section 5.3. Natural Resources staff request funding to conduct plant and animal surveys and inventories every five years.

Bat surveys described in Section 5.3.1 did not detect federally endangered bats on the Main Base. However, both the CIRE (2018) survey and the Natural Resources staff survey detected the tri-colored bat and the little brown bat. The tri-colored bat is listed as state endangered and is a federal candidate for listing under the Endangered Species Act (ESA). The little brown bat is listed by the state of Virginia as endangered. Additional acoustic surveys and netting are scheduled to determine status and habitat utilization by these species on JBLE-Langley.

A preliminary biological site survey at BBR was conducted by JBLE-Langley natural resources staff in July-August 2018 (Garcia & Peterson, 2018). This survey and its findings are discussed in Section 5.3. During the survey of BBR, two species of federally-listed bats were preliminarily detected via acoustic recording. This recent discovery is being further investigated by ongoing studies to confirm species presence and elucidate habitat utilization. Species listed under the ESA and preliminarily detected at BBR are the northern long-eared bat (NLEB) (listed as threatened effective 2 April 2015) and the Indiana Bat (listed as endangered effective 1967).

In the interim, no projects involving tree removal occurred in FY14-FY18 and only one project involving minimal tree removal (one acre or less) is anticipated for FY19-24. This project will occur on the Main Base to accommodate an urgently needed expansion of the JBLE-Langley 90-Day Hazardous Waste facility. This project site is located at Building 1390 east of Poplar Road. It is more than 2.5 miles from where NLEB or Indiana bats were acoustically detected and represents a different forest/ecosystem type than is found around BBR. Furthermore, it is not within the range of any know hibernacula or roost trees. This site is also outside areas currently

identified as requiring time of land use restrictions by VDGIF for tri-colored or little brown bats. Consequently, no consultation work with USFWS or VDGIF for this project has occurred or is anticipated at this time. All correspondence requiring consultation with USFWS, NOAA or VDGIF can be found in Appendix B and demonstrates concurrence with no effect on T&E species for current projects underway.

One additional candidate species for federal listing has been confirmed on JBLE-Langley: the spotted turtle (*Clemmys guttata*) (TCI, 2017). The once common monarch butterfly (*Danaus plexippus)* (USFWS, 2018) was petitioned for listing under the ESA in 2014 and a listing decision is expected by USFWS in June 2019. This species has been observed in the adult life stage on the Main Base.

The rusty patched bumble bee (*Bombus affinis*) was listed as endangered effective 21 March 2017 (USFWS, 2017b). It is not listed in the Information, Planning and Consultation System (IPaC) for the area of the installation, but various sources include Virginia as part of its historical range. The presence of the rusty patched bumble bee on JBLE-Langley is not known, but a possible historical record was identified in Newport News (Virginia Department of Conservation and Recreation [VDCR], 2018). The *US Air Force Pollinator Conservation Reference Guide* (USFWS, 2017a) suggests the possibility it occurs in the area.

5.4.1 Aquatic Species Potentially Occurring in JBLE-Langley Waters. According to the NOAA Fisheries Section 7 website (NOAA, 2018) and consultation letters (Appendix B), there are five species of sea turtles (the loggerhead [*Caretta caretta*], green [*Chelonia mydas*], Kemp's ridley [*Lepidochelys kempii*], hawksbill [*Eretmochelys imbricata*] and leatherback [*Dermochelys coriacea*] sea turtles) and two species of fish, Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevicauda*), with no critical habitat areas listed under the ESA, that occur or have the potential to occur on JBLE-Langley or BBR. A recent Herpetological Survey conducted from 2016-2017 specifically targeted sea turtles but did not document any sea turtle nesting activity or use of JBLE-Langley, although these species have been documented in the nearby Chesapeake Bay waters and have the potential to occur in the area (TCI, 2017; Barco et al., 2016; Mallette et al., 2017; Swingle et al., 2015).

Federally-listed sturgeon have the potential to occur in waters adjacent to JBLE-Langley. The presence of both sturgeon species has been documented in the tributaries to the Chesapeake Bay (Balazik et al., 2012). Available information on the distribution of Atlantic sturgeon suggests that any Atlantic sturgeon in JBLE-Langley waters will be from the Chesapeake Bay Distinct Population Segment. It is anticipated that Atlantic sturgeon in the Back River action area are limited to occasional transient subadults or adults. The Back River is not designated as a unit of critical habitat in the Final Rule.

The Back River, a tributary to the Chesapeake Bay, is designated as essential fish habitat (EFH) for 14 federally managed species and is also designated a habitat area of particular concern for sandbar shark (*Carcharhinus plumbeus*) (ASMFC, 2008). Several species of marine mammals protected by the Marine Mammal Protection Act of 1972 also have the potential to occur in the waters surrounding JBLE-Langley and their distribution has been studied in cooperation with the US Navy, Virginia Coastal Zone Program and the Virginia Aquarium (Mallette et al., 2018).

Back River Habitat with Osprey Nest on Duck Blind

5.4.2 Listed Species Potentially Occurring on JBLE-Langley. Other federal and state-listed species with the potential to occur on JBLE-Langley's shorelines include the Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), red knot (*Calidris canutus*), Wilson's plover (*Charadrius wilsonia*) and the piping plover (*Charadrius melodus*). Several other listed waterbirds and shorebirds have the potential to occur on the small sandy patches of JBLE-Langley's shoreline. Other listed waterbirds, including the roseate (*Sterna dougallii*) and gull-billed terns (*Gelochelidon nilotica*) and black rails (*Laterallus jamaicensis*) may forage in waters or marshes nearby or could utilize the area as transients. The gull-billed tern and red knot have been observed during the bird surveys compiled by Hampton Roads Bird Club (2018). None of the other species have been documented on JBLE-Langley and were not observed during the 2016-2017 herpetological survey on sandy shoreline areas of suitable habitat surveyed. Little suitable, undisturbed habitat for these species' nesting or foraging is found at JBLE-Langley. However, the diamondback terrapin (a species of conservation concern, Conservation on International Trade in Endangered Species of Wild Fauna and Flora [CITES] Appendix II and VDGIF) has been documented as regularly occurring on the Main Base.

The Northeastern beach tiger beetle has the potential to occur along the Main Base's shoreline, although habitat is largely unsuitable and highly disturbed. This tiger beetle occurred historically in large numbers on Atlantic Coast beaches from Cape Cod to central New Jersey and along Chesapeake Bay beaches in Maryland and Virginia. The species occurs at over 50 sites within the Chesapeake Bay region, including nearby Grandview Nature Reserve (Jim Peterson, personal communication, 2018). This species is most vulnerable to disturbance in the larval stage, which lasts two years. Disturbance can occur from pedestrian traffic, off-road vehicles and other factors such as beach changes due to coastal development and beach stabilization. Although dispersal abilities of adults are good, population recruitment seems to be hampered by a lack of both

undisturbed beaches and of nearby populations as a colonizing source (USFWS, 1994).

The red knot, piping and Wilson's plovers are found primarily on the barrier islands in Virginia but have also nested at nearby Grandview Beach and Craney Island (VDGIF, 1995). Small, isolated, disturbed patches of foraging and nesting habitat are limited on JBLE-Langley and absent at BBR during any season. No documented use of the area was apparent during the sea turtle surveys in 2016-2017 (Karen Terwilliger, personal communication, 2018). There is the potential for piping plover to migrate through the area and use it as a stopover site, but this is unlikely due to the small, unsuitable and disturbed habitat on JBLE-Langley's shoreline.

Three additional species listed as state endangered are the Harper's fimbristylis (*Fimbristylis perpusilla*), canebrake rattlesnake (*Crotalus horridus*) and the Eastern tiger salamander (*Ambystoma tigrinum*). The Harper's fimbristylis is a small herb, producing clustered flowers in August to September and a pale brown banana-shaped fruit in September to October. Coastal seasonal ponds provide habitat for this plant. With heavy manipulation of Main Base vegetation, and grounds maintenance, it is unlikely that this species occurs. Management recommendations for the Harper's fimbristylis include maintaining water quality and avoiding activities that may change the water table (Patrick et al., 1995).

The canebrake rattlesnake is a large snake that inhabits hardwood and mixed hardwood-pine forests, herbaceous fields and the ridges and glades of swampy areas (Kleopfer et al., 2017). It overwinters in the base of hollow trees or in stumps. A canebrake rattlesnake survey was conducted in 2009, finding no evidence of the species at BBR. None were observed in the recent 2016-2017 survey of the Main Base (TCI, 2017). The Eastern tiger salamanders spend most of their lives below ground. The adults are terrestrial and inhabit woodlands or marshy grasslands. The larvae and aquatic juveniles hide in vegetation or bottom debris in ponds where they are hatched (Mitchell, 1994). BBR has potential habitat for this species, although the water quality and disturbed conditions with human use may have discouraged them from the area. More intensive surveys would be needed to document their presence or absence.

Potential state-threatened amphibians include the barking tree frog (*Hyla gratiosa*) and the Mabee's salamander (*Ambystoma mabeei*). Both of these amphibians breed in fish-free freshwater ponds. Ephemeral wetlands are most satisfactory as they are least likely to contain fish or good populations of predacious insects. Breeding does not occur in years when wetlands either fail to form or dry early due to drought or abnormal patterns of precipitation. None have been documented at JBLE-Langley, although they all have been found off-base near the northern end of BBR. The reservoir is not acceptable habitat for these animals, but adjoining wetlands and small feeder streams potentially offer habitat. Field surveys conducted in 2009 and again in 2016-2017 failed to document any Mabee's salamanders on the Main Base. Additional surveys are recommended for BBR.

Birds that are listed as state endangered or threatened include: the peregrine falcon (downlisted from the federal endangered species list [*Falco peregrinus*]), roseate and gull-billed terns, piping and Wilson's plover, upland sandpiper (*Bartramia longicauda*), Henslow's sparrow (*Ammodramus henslowii*), black rail, red knot and loggerhead shrike (*Lanius ludovicianus*), including the migrant subspecies. JBLE-Langley may be used by these bird species for foraging

or roosting as transients, but none are known to nest on the Main Base.

Undisturbed habitat is important to protecting populations of rare, endangered and threatened species. This INRMP will be updated with specific management recommendations if any of these sensitive species are found in future surveys. Additionally, JBLE-Langley will continue to use the NEPA process to analyze potential effects on sensitive species from proposed actions.

The VDGIF Wildlife Action Plan (VDGIF, 2018) lists wildlife SGCN, and VAFWIS lists 542 Species Known or Likely to occur within three miles of JBLE-Langley. The Virginia Wildlife Action Plan includes a specific section for the Hampton Roads Planning Region, ranks species imperilment and conservation need (see Appendix C) and provides recommendations for actions to conserve them.

5.5 Wetlands and Floodplains

5.5.1 Wetlands. JBLE-Langley has nearly 652 acres of federally designated wetlands, including 462 acres of non-freshwater estuarine wetlands. The Installation Development Plan identifies wetlands as a major planning constraint. Extensive marshes bordering the installation comprise significant wetland areas that remain in a relatively natural (unimproved) state. Salt and freshwater marshes of the northwest and southwest branches of the Back River, New Market Creek, Brick Kiln Creek, Tabbs Creek and Tides Mill Creek surround the Main Base on three sides. Tidal flow from the Chesapeake Bay is substantial along these margins; however, most inland freshwater wetlands have been filled, drained to ditches or converted into golf course features. Most wetlands at JBLE-Langley are located at the northern boundary of the Main Base along the Northwest Branch of the Back River and are tidal, estuarine wetlands (see Figure 4-3). Freshwater wetlands on Main Base include palustrine forested, emergent and scrub-shrub wetlands. Forest and scrub-shrub wetlands occur in low-lying upland areas with nutrient-poor sandy soils and are dominated by bottomland hardwood trees and shrubs. The largest wetland areas are located along Tabb Creek, Tide Mill Creek and their tributaries. Ten wetland types were delineated by IT Corporation in April 2001; their characteristics are discussed below and installation wetland management strategies are discussed in Section 7.6 of this INRMP. BBR includes 75 acres of wetlands (Figure 4-2), of which 67 acres are palustrine forested wetlands (see Figure 5-1).

Isolated palustrine emergent wetlands occur throughout the flightline area and have been altered for airfield safety. A permit has been granted to remove 46.09 acres of wetlands out of the Active Operations Area (AOA) to reduce current surface irregularities which can result in damage to landing aircraft. Ponding areas within the Runway 08 and 26 Clear Zones can attract birds which has the potential to increase the Bird Aircraft Strike Hazard (JBLE-Langley, 2016; USDA, 2017). Additional wetlands are altered for Main Base improvement and development purposes as outlined in the Installation Development Plan (JBLE-Langley, 2017) and EA (JBLE-Langley, 2016). All wetland mitigation actions are conducted IAW federal policies and Chesapeake Bay Agreements.

The most recent wetlands delineation for JBLE-Langley was conducted by USACE in February 2013 and has since expired. A two-year extension was requested but denied, as the USACE

indicated that their observations show that Main Base wetlands are expanding. The USACE further recommended that an updated wetlands delineation be conducted (letter from USACE

Airfield Wetlands Attract a Variety of Birds

dated 28 February 2018). A follow-up request to fund such an updated delineation was denied by AF Civil Engineer Center (AFCEC; letter dated 26 January 2018), resulting in the need to revise the JBLE-Langley INRMP to correct the project requirement for the jurisdictional wetlands delineation survey update in FY18. According to AFI 32-7064, para 4.1.1, "Installations are not required to update existing wetlands inventory maps unless there exists a change in hydrology or in the wetland delineation methodology." (See Wetland Delineation Denial and consult letters in Appendix B.)

> Jurisdictional wetlands are those wetlands subject to regulatory protection under Section 404 of the Clean Water Act (CWA). Wetlands at JBLE-Langley, classified as jurisdictional by the USACE, encompass approximately 652 acres, of which 462 acres are non-freshwater estuarine wetlands. Most of the wetlands are associated with Tabbs Creek, Tide Mill Creek and their tributaries. Established forested wetlands were identified in the northwest section of the Main Base, and isolated palustrine emergent wetlands were identified throughout the flightline area. Previously, IT Corporation identified these 10 distinct wetland communities within the confines of the Main Base (IT Corp, 2001): Big Cordgrass Community (E2EM, Black Needlerush Community (E2EM), Brackish Water Mixed Community (E2SS), Cattail Community (PEM1), Phragmites Community (E2EM), Isolated Freshwater Emergent Communities (PEM1), Saltbush Community (E2EM/SS), Saltmarsh Cordgrass Community (E2EM), Saltmeadow Community (E2EM/E2SS) and Forested Community.

5.5.2 Floodplains. As stated in Section 4.4.4, almost all of JBLE-Langley is within the 100-year floodplain and subject to severe flooding, particularly during major storms or hurricanes.

5.6 Other Natural Resource Information. Recent (post-2000) natural resource inventories, studies and surveys conducted at JBLE-Langley are summarized in Table 5-2. Past inventories (pre-2000), studies and surveys are summarized in Table 5-3. The most recent survey conducted at BBR is the Center for Conservation Biology's (College of William and Mary) annual surveys for bald eagles and monitoring of a heron rookery at BBR (Bryan Watts, personal communication, 2018; VDGIF, 2018). A preliminary biological site survey was conducted by Natural Resources staff in July-August 2018 at BBR (Garcia & Peterson, 2018), and additional surveys are scheduled.

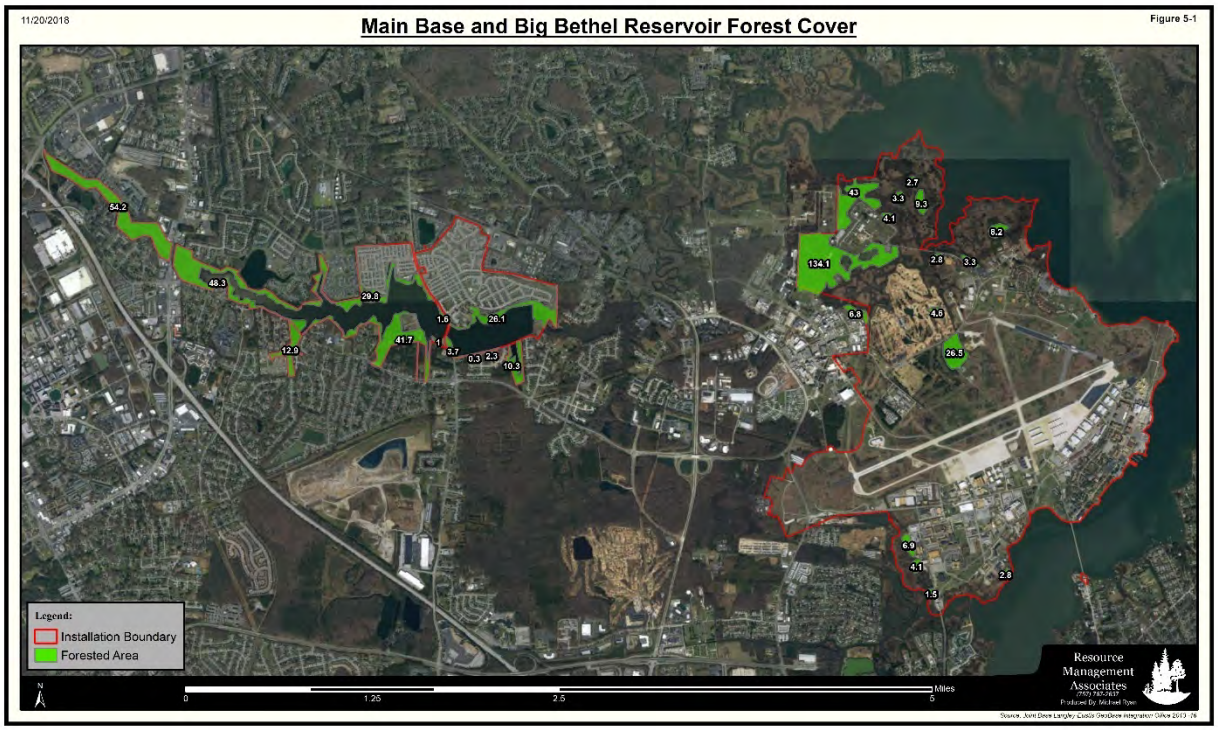


Figure 5-1: Main Base and Big Bethel Reservoir Forest Cover

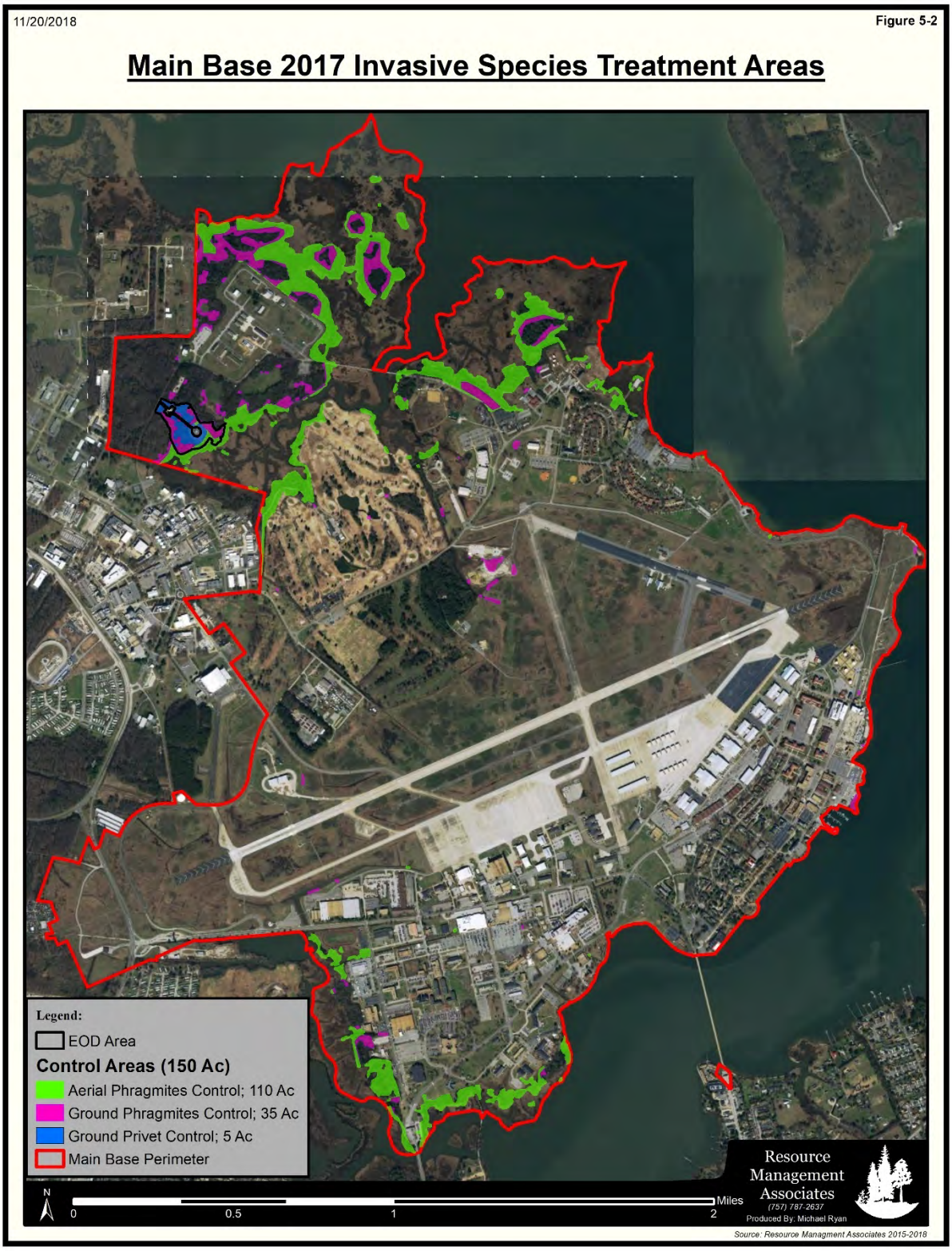


Figure 5-2: Main Base 2017 Invasive Species Treatment Areas

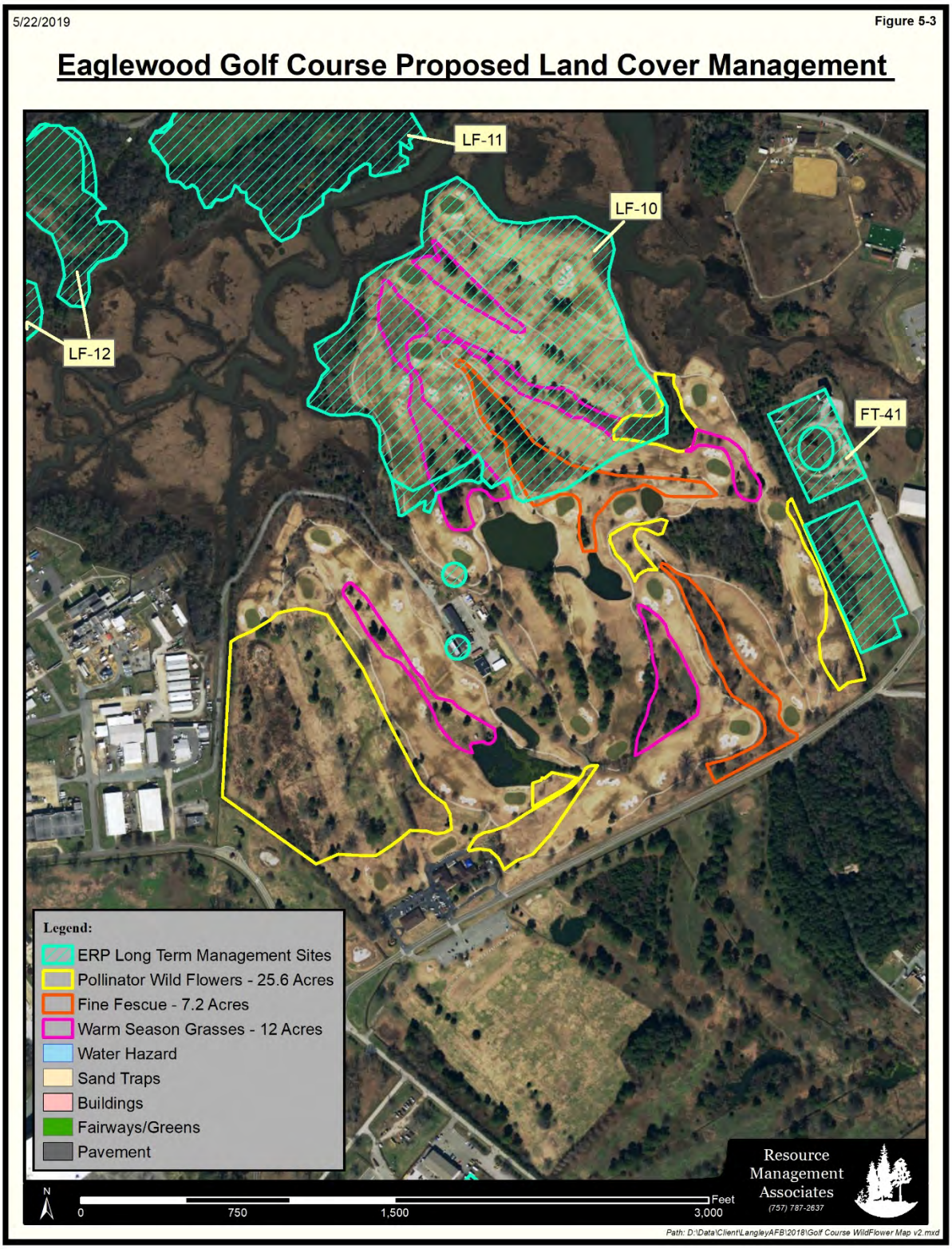


Figure 5-3: Eaglewood Golf Course Proposed Land Cover Management

Table 5-1: T&E Species with Potential to Occur on JBLE-Langley

Source: VDGIF, Fish and Wildlife Information System Online

Status*	Tier**	Common Name	Scientific Name	Observation Status (Most current survey)
FESE	Ia	Turtle, Kemp's ridley sea	*Lepidochelys kempii*	None observed (2017)
FESE	Ib	Sturgeon, Atlantic	*Acipenser oxyrinchus*	None observed (2017)
FESE	Ic	Turtle, leatherback sea	*Dermochelys coriacea*	None observed (2017)
FESE		Turtle, hawksbill sea	*Eretmochelys imbricate*	None observed (2017)
FESE		Tern, roseate	*Sterna dougallii*	None observed (2017)
FTST	Ia	Turtle, loggerhead sea	*Caretta*	None observed
FTST	Ia	Knot, red	*Calidris canutus rufa*	Observed (1986)
FTST	Ia	Bat, northern long-eared	*Myotis septentrionalis*	Preliminary observation needing confirmation
FTST	Ib	Turtle, green sea	*Chelonia mydas*	None observed (2017)
FTST	IIa	Plover, piping	*Charadrius melodus*	None observed (2017)
FTST	IIa	Beetle, northeastern beach tiger	*Cicindela dorsalis*	None observed (2017)
FTSE	IVb	Manatee, West Indian	*Trichechus manatus*	None observed (2017)
SE	Ia	Plover, Wilson's	*Charadrius wilsonia*	None observed (2017)
SE	Ia	Rail, black	*Laterallus jamaicensis*	None observed (2017)
SE	Ia	Bat, little brown	*Myotis lucifugus*	Preliminary observation (2018) needs confirmation
SE	Ia	Bat, tri-colored	*Perimyotis subflavus*	Preliminary observation (2018) needs confirmation
SE	IIa	Salamander, eastern tiger	*Ambystoma tigrinum*	None observed (2017)
SE	IIa	Rattlesnake, canebrake	*Crotalus horridus*	None observed (2017)
ST	Ia	Falcon, peregrine	*Falco peregrinus*	None observed (2017)
ST	Ia	Shrike, loggerhead	*Lanius ludovicianus*	None observed
ST	Ia	Sparrow, Henslow's	*Ammodramus henslowii*	None observed
ST	Ia	Tern, gull-billed	*Sterna nilotica*	Observed (2014)
ST	IIa	Salamander, Mabee's	*Ambystoma mabeei*	None observed (2017)
ST	IIa	Treefrog, barking	*Hyla gratiosa*	None observed (2017)
ST		Shrike, migrant loggerhead	*Lanius ludovicianus migrans*	None observed (2017)
CC	IIa	Terrapin, northern diamond-backed	*Malaclemys terrapin*	Observed all year (2017)
CC	IIIa	Turtle, spotted	*Clemmys guttata*	Observed in Main Base wetland (2017)
FESE ***	1a	Bat, Indiana	*Myotis sodalist*	Preliminary observation (2017) needs confirmation

***** FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; CC=Collection Concern

****** I=VA Wildlife Action Plan – Tier I - Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need

*** Not reported on VDGIF- but preliminarily observed.

Table 5-2: Recent Natural Resource Studies Accomplished

Year	Preparing Agency / Author	Title
2018	U.S. Air Force Safety Center	JBLE-Langley BASH Site Assessment Visit
2014-2018	VDGIF and Center for Conservation Biology	Annual Bald Eagle Surveys on Langley and BBR
2014-2018	USGS Virginia Cooperative Fish and Wildlife Research Unit Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Natural Resources (NR) Staff	Preliminary Threatened and Endangered Bat Inventory for Big Bethel Reservoir and Langley Air Force Base (AFB)
2016-2019	CIRE Montana, AF Bat Surveys	USAF Installations Across the United States – Bat Acoustic Surveys
2016-2017	TCI and Resource Management Associates (RMA), Locustville VA	Herpetofaunal survey of Langley AFB
2017-ongoing	College of William and Mary, Sam Mason	Estimating the Regional Population Structure of a Salt Marsh Obligate Butterfly *Panoquina panoquin* under Contemporary and Projected Climatic Conditions
2014-ongoing	ODU, Holly D. Gaff	Hampton Roads Ticks and Tick-Borne Diseases Monitoring
2015-2017	Hampton Master Naturalist Program	Urban Tree Inventory
ongoing	Hampton Roads Bird Club	Christmas Bird Counts, Breeding Bird Surveys, VA Breeding Bird Atlas
2014-2017	IDNR, TNC	Osprey Translocation Project 2014-2017
2016-ongoing	NR Staff	Shorebird Monitoring
2018	NR Staff	T&E understory vascular plant cursory survey of Big Bethel Reservoir
2018	CGI	Analysis of Shorebird Use of JBLE-Langley
2018	1 FW/USDAAFSEC	BASH SAV
2018-ongoing	Natural Resources Staff	Stream Restoration BBR (Brick Kiln Creek)
2018-2019	USGS Virginia Cooperative Fish and Wildlife Research Unit Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, NR Staff	Continued Threatened and Endangered Bat Inventory for JBLE-Langley
2013	USACE	Updated Wetland Delineation for Langley AFB and Bethel Housing
2012	USDA/APHIS/WS	1 FW BASH Prevention Report for JBLE-Langley, Dec 12
2011	USDA/APHIS/WS National Wildlife Research Center	DoD Legacy Resource Management Program: Assessing BASH Risk Potential of Migrating and Breeding Osprey in the Mid-Atlantic Chesapeake Bay Region (Final Report)

Year	Preparing Agency / Author	Title
2010	City of Hampton Matrix Design Group	Hampton-Langley JLUS
2009	Geo-Marine, Inc.	ISIMP for JBLE-Langley
2007	VDGIF	Fisheries sampling, Big Bethel Reservoir, Spring 2007
2005	USDA/APHIS/WS	Wildlife Hazard Assessment Monitoring and Bird/Wildlife Aircraft Strike Hazard Progress Report for the 1st Fighter Wing JBLE-Langley, Virginia
2004	Science Applications International Corporation	Fort Monroe (and BBR) Urban Forest Management Plan
2004	USDA/APHIS/WS	Wildlife Hazard Assessment Monitoring and BASH Progress Report for the 1 FW JBLE-Langley, Virginia (Jun 99 – May 03)
2004	Anne Arundel Community College Environmental Center	Bethel Reservoir, Coontail, Filamentous Algae and Eurasian Watermilfoil Control Summary (Draft Report)
2004	Geo-Marine Inc.	Archaeological Survey of 406 Acres, JBLE-Langley, Hampton, Virginia
2003	CH2MHILL	Natural Resources Liability Asset and Management Strategy for Air Combat Command-JBLE-Langley, Virginia
2003	Davey Research Group	Air Combat Command, Campus Urban Forest Plan for JBLE-Langley, Virginia
2002	Davey Research Group	Tree Inventory Review and Management Plan for JBLE-Langley, Virginia
2002	BEM Systems, Inc.	Pasture Runoff Assessment and Manure Management Plan
2001	IT Corporation	Wetland Report for JBLE-Langley, Virginia
2001	USFWS	Fisheries and Aquatic Resources Management (FARM) Plan for Bethel Reservoir, JBLE-Langley, Hampton, Virginia
2019-2024	Proposed in this INRMP	See SECTION 8
	Natural Resources Program Staff Alicia Garcia	Shoreline Restoration (Shellbank area)
	Natural Resources Program Staff Alicia Garcia	Invasive wildlife survey (Nutria)
	Natural Resources Program Staff Alicia Garcia	Forest Management- Understory
	Natural Resources Program Staff Alicia Garcia	Species habitat management- diamondback terrapin nesting habitat
	Natural Resources Program Staff Alicia Garcia	Pollinator Habitat Creation- convert golf course invasives
	Natural Resources Program Staff Alicia Garcia	Wetland delineation update needed on Main Base and BBR
	Natural Resources Program Staff Alicia Garcia	Invasive species Management Plan implementation
	Natural Resources Program Staff Alicia Garcia	Others indicated not yet accomplished

Table 5-3: Past Natural Resource Studies Accomplished

Year	Preparing Agency/Author	Title
2000	USDA Natural Resources Conservation Services Chesapeake Bay Program	Chesapeake Bay Program Federal Facility Assessment for Langley AFB, Virginia
2000	USDA/APHIS/WS	Wildlife Hazard Assessment for Langley AFB, Virginia (Jun 99-May 00)
1999	CH2M Hill	Water Quality Assessment of the Back River
1998	USFWS	Biological Diversity Survey of the Flora and Fauna of Fort Monroe and Bethel Reservoir-(did not assess understory of BBR)
1996	VDCR Division of Natural Heritage	A Natural Heritage Inventory of Langley AFB (Final Report)
1995	Old Dominion University, The Applied Marine Research Laboratory	Baseline Biological Survey of Terrestrial and Aquatic Habitats at NASA Langley Research Center, with Special Emphasis on Endangered and Threatened Fauna and Flora (Final Report)
1995	Geo-Marine Inc.	Survey for Bald Eagles and Peregrine Falcons at Langley AFB, Virginia, Air Combat Command
1994	USFWS	Wetland Mapping Report for - Langley AFB
1993	USFWS	The Distribution and Biological Effects of Selected Environmental Contaminants in the Back River, Virginia
1984	USFWS	Endangered and Threatened Species on USAF Installations
1981	USAF-USFWS	Responses of Raptorial Birds to Low-Level Military Jets and Sonic Booms
1981	Dealtris Associates	Pre and Post Dredging Surveys of Selected Oyster Grounds in the Southwest Branch of the Back River, Virginia
1973	Smithsonian Institution, Office of Environmental Sciences, Ecology Program	An Ecological Survey of Langley AFB
1969	No author given	Soil Report and Forestry Interpretation for LangleyAFB (report fragment)

6.0 MISSION IMPACTS ON NATURAL RESOURCES

6.1 Natural Resources Constraints to Missions and Mission Planning. Natural, environmental and cultural resources on JBLE provide positive aesthetic, social, cultural and recreational attributes that contribute to the overall quality of life on the installation. They can also play a key role in fulfilling mission. Natural resources support training activities at JBLE and also help protect JBLE-Langley from flooding and major loss of assets during storm events. Despite these benefits, natural planning constraints can also limit facility development and restrict where certain mission activities can occur. In some cases, these areas are integrated into the fabric of base development and will not prevent future development. In other cases, these constraints represent unbuildable conditions or require advanced engineering to overcome their impacts.

The 2017 Installation Development Plan cites wetlands and floodplains as the major constraints at JBLE (JBLE-Langley, 2017). Other major and minor constraints to development include:

- Explosive Safety Zones
- Airfield Clearances and AICUZ
- Antiterrorism
- Wetlands and Floodplains
- Bird/Wildlife Aircraft Strike Hazards
- Environmental Restoration Program
- Threatened and Endangered Species
- Historic/Archaeological Structures and Sites

The primary natural resource planning constraints at JBLE-Langley are wetlands and floodplains, bird/wildlife aircraft strike hazards, Environmental Restoration Program (ERP) sites and threatened and endangered species (JBLE-Langley, 2017). The Installation Development Plan characterizes natural resources (wetlands and T&E species) current value in acreage and dollars/funding (Table 6-1).

Well-planned future development at JBLE-Langley will help mitigate the conflicts between growth and resultant infrastructure development and the natural resource assets present on the installation. A prime example of this conflict will be the pressure to construct facilities increasingly closer to, or in, wetlands, riparian buffer zones or other sensitive natural areas as the available developable real estate at JBLE-Langley decreases with each new mission acquisition. With proper planning, site design and coordination, these types of conflicts can be resolved. Good wetland management strategies would recognize the off-base mitigation banking and the in-lieu fee fund as powerful tools to mitigate wetland impacts. Additional consequences of building on JBLE-Langley include impacts to floodplain management, riparian buffer degradation and impacts to stormwater management systems.

Integration of the INRMP with JBLE-Langley Installation Development Plan will help ensure that project proponents and stakeholders understand the issues and consequences presented by the continued urbanization of JBLE-Langley. Constraints on development, such as wetlands and

Ditches and Tidal Creeks with Narrow Buffers near Picnic Areas

bird strike hazards, can be mitigated early only if proponents and stakeholders recognize and acknowledge the need for effective planning, site design and coordination. Table 6-2 provides a list of short-term (1-5 year) projects associated with natural resources at JBLE-Langley.

Any new activities or infrastructure development plans are evaluated to determine if any limitations or restrictions apply. The 2016 EA assessed the impacts of projects (construction, demolition, renovation and maintenance activities) recommended by the 2013 General Plan and intended to support JBLE current and future missions (JBLE-Langley, 2017). A Finding of No Significant Impact (FONSI) was issued. The EA noted that whenever possible, new construction would avoid wetlands and areas where T&E species have the potential to occur.

Other than the bald eagle (now delisted), there have been no documented federally threatened or endangered species residing on JBLE-Langley. Bald eagles were removed from the List of Endangered and Threatened Wildlife in 2007 as populations recovered in the lower 48 states. However, this species is afforded protective measures under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. These protective measures preclude the taking of adult eagles, immatures, eggs, nests or bird parts without a permit. Bald eagle nest locations generally do not impact the JBLE-Langley mission due to their locations away from the airfield. However, in recent years, bald eagles have presented an increasing presence on the Main Base airfield resulting in 297 separate hazing incidents in 2017 to discourage eagles from loafing or hunting on the airfield during periods of flight operations (Jay Carr, personal communication, 2018) Research grant proposals have been submitted to support better understanding of movements, behavior and peak habitat utilization by young eagles on the Main Base airfield. As eagle populations continue to rise and nests are successful on and around the installation, management challenges, particularly with young birds, will continue to increase.

Two terrestrial and two aquatic federally-listed species occur in the vicinity and have the potential to occur on the Main Base (see Section 5.4 and Section 7.4. The recent acoustical

detection of two federally-listed bat species (Northern long-eared bat and the Indiana bat) in the vicinity is being further investigated to determine resource utilization by these species on JBLE-Langley.

6.2 Land Use. JBLE-Langley totals 3,981.20 acres, of which the Installation Development Plan cites 2,078.82 acres as constrained, 111.71 acres as undeveloped and 183 acres as developable land (JBLE-Langley, 2017). There are currently 13 land use categories at the installation. Developed lands include administrative, aircraft operations and maintenance, airfield clearance, airfield pavement, community (commercial), community (service), housing (accompanied), housing (unaccompanied), industrial and medical. Undeveloped lands include open space, outdoor recreation and water. Main Base land uses are grouped by function into geographic areas. The northwest portion of the installation is dedicated primarily to open space and outdoor recreation (golf course) and light industrial facilities (the North Base Industrial Area). Residential areas are found in the northeastern and southeastern portions of the Main Base. Community services are located in the southwestern part of the installation. The flightline, located in the center of the Main Base, is dedicated to aircraft operations and maintenance. JBLE-Langley utilizes integrated plans to guide land use on the installation, thus the importance of annual reviews. The generalized distribution of existing land use on the Main Base is depicted in Figure 6-1. Table 6-3 provides a summary of both current and future land uses, with acreage total for each land use.

The majority of land at BBR is unimproved, with 266 acres of submerged land, 75 acres of wetland, of which 67 are forested and approximately 49 acres of open space used for recreation (Figure 6-2) JBLE-Langley, 2014).

Five land use categories exist at the Langley Family Housing Annex. These include: Community (Commercial), Community (Service), Medical, Housing (Accompanied) and Outdoor Recreation (Figure 6-2). Community (Commercial) includes the Langley Family Housing gas station and a shoppette. The Bethel Chapel falls under the Community (Service) category. Medical facilities consist of satellite medical and dental clinics co-located with the Fire Department.

6.3 Current Major Impacts. This section briefly outlines mission activities that may impact ecosystem functions on JBLE-Langley and BBR, either directly or indirectly. Direct impacts include land use changes and loss of habitat including wetlands, air and water pollution, noise, and wildlife impacts including BASH. The 633 ABW BASH program for JBLE-Langley is coordinated through the 1st Fighter Wing Safety Office (1 FW/SE) and is described in Section 7.13. Indirect mission impacts include hazardous waste generation and ERP activities.

6.3.1 Permitted Air and Water Pollution Point Sources

6.3.1.1 Air Point Source Pollution. Air quality is important to military operations in nonattainment areas of USEPA ambient air quality. USEPA has set national air quality standards for six principal air pollutants (also referred to as criteria pollutants): nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO) and lead (Pb). Four of these pollutants (CO, Pb, NO_2 and SO_2) result primarily from direct emissions

from a variety of sources. PM results from direct emissions but is also commonly formed when emissions of nitrogen oxides (NO_x), sulfur oxides (SO_x), ammonia, organic compounds and other gases react in the atmosphere. Ozone is not directly emitted but is formed when NO_x and volatile organic compounds (VOCs) react in the presence of sunlight. The standards for the six criterion pollutants will have added restrictions on emissions from military operations (JBLE-Langley, 2017).

6.3.1.2 Major Source Threshold (MST) limit for all criteria pollutants. JBLE-Langley currently holds one Permit to Operate (PTO) issued by the VDEQ, dated 3 April 2013. Permitted equipment listed are: internal combustion engines, boilers, storage tanks/fuel handling, jet engine test cells, water evaporators, painting/coating operations, cold cleaners and woodworking. The limit of all permitted stationary sources combined is less than the Major Source Threshold (MST). The PTO requires records to be maintained for natural gas throughput, distillate oil, gasoline, Jet-A, solvents, diesel fuel and dismounted jet engine testing. Table 6-4 summarizes the 2017 Air Emissions by Pollutant Type at JBLE-Langley from the JBLE-Langley Air Emissions Inventory (Air Program Manager).

JBLE-Langley is located in the Hampton Roads Air Quality Region (HRAQR). On 30 April 2004, the HRAQR was re-designated marginal nonattainment for the 8-hour ozone standard using 2001-2003 air quality monitoring data for the HRAQR. The 1997 8-hour ozone standard was revoked on 6 April 2015. The Region is currently in attainment for all National Ambient Air Quality Standards. VDEQ anticipates no additional regulations of ozone precursors, NO_x and VOCs. The assessment of anticipated changes at JBLE-Langley indicates that base wide emissions should remain stable and below the MST for NO_x and VOCs and a significant change in these emissions is not expected. The 2005 acquisition of BBR had no impact on JBLE-Langley air pollution levels. There are no operations at BBR that adversely affect air quality.

6.3.1.3 Water Point Source Pollution. The discharge of stormwater associated with both industrial and non-industrial activities is regulated under the VPDES. Current industrial activities at JBLE-Langley include vehicle maintenance, airfield runoff, aircraft maintenance activities and bulk fuel storage. JBLE-Langley has 24 permitted stormwater outfalls under the General Industrial Stormwater Permit VAR052285. These outfalls and their maintenance and inspection requirements are described in Section 4.4.5. The permit also has a requirement to develop and implement a SWPPP which involves the assessment of stormwater outfalls, outdoor material storage and usage areas, an erosion and sediment control inspection and existing materials management practices. The plan is reviewed annually and updated as necessary when there are major changes at JBLE-Langley.

JBLE-Langley has a Municipal Separate Storm Sewer System Permit VAR040140 and outfalls are also described in Section 4.4.5. JBLE-Langley will continue to investigate the applicability and feasibility of additional BMPs and BMP types in order to meet the future milestone pollutant load reduction requirements of the Chesapeake Bay TMDL (AECOM, 2018a).

The MS4 stormwater program (permit VAR040140 Section I.B) requires development of TMDL action plans as described in Section 4.4.2. The action plan will address bacteria impairment of the Back River. The Virginia Department of Environmental Quality assigned JBLE-Langley a

reduction amount of 6.21% for bacterial which include fecal coliform, enterococcus and E. coli (AECOM, 2018b).

The discharge of municipal wastewater and discharge from oil/water separators at JBLE-Langley is covered under a permit issued by the regional sewer authority, the Hampton Roads Sanitation District (HRSD). The permit 0011 requires bimonthly sampling.

6.3.1.4 Big Bethel Reservoir. A potential pollution consideration is the condition of the Big Bethel Dam. A 2019 USACE report assessed Upper and Lower Big Bethel Dam and its appurtenant features and judged them to be in poor and unsatisfactory condition respectively and posing a high hazard to downstream municipalities (USACE, 2019). Deficiencies were identified during the inspection that required immediate remedial action. However, the dam is capable of fulfilling its current purpose. Completing these remedial actions recommended in the report will improve the condition of the dam and its capacity to operate safely for its current purpose:

Immediate Actions:

1. Remove flashboards at Upper Dam
2. Open Valve #1 at Lower Dam
3. Appoint a Dam Safety Officer to oversee dam safety activities
4. Appoint a Dam Operator to operate and inspect the dam

Short-term Actions:

1. Begin inspections of dam in accordance with Monitoring PlanFederal Guidelines: "The purpose of informal inspections is to have as far as practicable a continuous surveillance of the dam."

2. Coordinate and Rehearse Emergency Action PlanFederal Guidelines: "An emergency action plan should be developed for each dam that constitutes a hazard to life and property…The plan should be coordinated with local governmental and other authorities."

3. Improve access to the dams

Long-term decisions for consideration provided in the assessment include dam removal, repair or transfer. A feasibility study for dam removal or repair was funded for 2019. The purpose of this study is to assess the feasibility of both dam repair and removal options with the potential for the creation of a wetland bank.

The BBR pollution potential remains an issue and is receiving ongoing her study to determine the effects of a failed or removed dam. Consideration should also be given to the fact that the area previously contained a cannery and has a history of copper sulfate (to control aquatic weeds) use. One possible alternative land use for this area would be removal of the dam and creation of a wetland bank to facilitate mission objectives which require development of wetlands on JBLE- Langley. Some of the bottomland swamp habitat remaining is in good shape and serves as a

Lower Big Bethel Dam in Need of Repair

major pollution and flooding filter for the surrounding communities. Because of the combination of the age of the structure, the historical uses of the waterway and the current and increasing level of land development in the watershed, sediment buildup is a major concern (AECOM, 2018a). Dam failure could eject an impact plume into the downstream estuary, a biologically diverse and populated area, via a direct tributary to the Chesapeake Bay. Such an uncontrolled release of sediments would, at a minimum, increase turbidity and nutrient content, bury critical habitat, contribute to fatal light attenuation, and increase eutrophication that would devastate oyster reefs, sea grasses, submerged aquatic vegetation (SAV) and macro-invertebrate biomes downstream. The introduction of triploid carp as an algal remedy as well as the opportunity to restore fish passage should require additional fish and macroinvertebrate investigation.

While modification of the reservoir could result in disturbance of the downstream estuarine salt marsh and open water ecosystems, an uncontrolled release via dam breach would pose risk to various areas of interest (tourism, wildlife/birding, house prices, shellfish beds, commercial/recreational fishing, swimming, etc.), as well as environmental habitat and T&E species. Particular care needs to be taken in the evaluation and dam removal process due to the proximity of documented cultural materials and munitions potential. By evaluating the existing baseline ecosystem condition, the dam removal process (whether the goal is for final removal or replacement) can be more effectively assessed relative to community benefit and minimization of ecological impact. Effectively describing baseline conditions and anticipating potential impacts and feasibility of several alternatives will enhance decision support tools for JBLE-Langley and allow faster NEPA and CWA 401/404 compliance for the preferred alternative.

6.3.2 Environmental Restoration Program. The ERP includes the Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP). The ERP focuses on identifying, investigating and cleaning up hazardous substances and pollutants on military lands

to eliminate unacceptable risk to human health and the environment. The MMRP addresses unexploded ordnance, discarded military munitions and munitions constituents at sites other than on operational ranges.

Installation Restoration Program

There are currently 66 sites being tracked under the IRP which include 54 sites considered to be at Site Closure (SC) with 12 sites under long-term management (LTM). One site, OT-25, is scheduled for additional soil removal which will remove all contaminated soil posing an unacceptable risk and allow unrestricted use/unlimited exposure. OT-25 is scheduled to achieve SC in 2020. Twenty-five sites that are SC are former petroleum, oils and lubricants (POL) sites that may have some residual contamination in place. However, these sites are located within the flightline and housing areas and should not impact this INRMP. See Figure 6-3 for a map of the LTM sites.

Military Munitions Response Program

There are 16 MMRP sites at JBLE-Langley. Eleven sites required no further action of which five moved forward into a remedial investigation (RI). The RI is scheduled to be completed in 2020. See Figure 6-4 for a map of the five MMRP sites.

Site Restrictions or Land Use Controls Associated with Environmental Cleanup Sites

Site restrictions and land use controls (LUCs) have been placed on 12 ERP sites to reduce potential risks and restrict property use. No LUCs have been placed on any of the MMRP sites to date. Installation activities, tenants and project proponents shall coordinate with the AFCEC/CZOE Restoration Program Manager (RPM) and 633d Civil Engineer Squadron prior to any proposed projects taking place on or in a manner that may impact these sites. Coordination will include the preparation of a Construction Notice and/or the submission of a dig permit (AF Form 103).

Emerging Contaminants

In 1970, the AF began using aqueous film forming foam (AFFF), firefighting agents containing per- and polyfluorinated alkyl substances (PFAS), to extinguish petroleum fires. A total of six PFAS sites were selected for further inspection through the Site Inspection (SI) process at JBLE-Langley following completion of the Preliminary Assessment in 2015. The SI was finalized in July 2017 and recommended that the six sites move onto the RI phase. RI activities at these sites will be managed by AFCEC in future years. Figure 6-5 provides the location of the five Main Base PFAS sites and Figure 6-6 provides the location of the Langley Family Housing Annex site PFAS.

6.4 Potential Future Impacts. The JBLE-Langley Installation Development Plan outlines a buildout and redevelopment schedule for the Main Base over the next 10 to 15 years (JBLE-Langley, 2017) in nine Planning Districts. South of the flightline (Shellbank and HTA) areas, the majority of activity will consist of demolition and construction of new facilities to meet evolving 633 ABW and tenant unit mission requirements. This area is already heavily developed, thus construction should not adversely impact natural resource assets provided appropriate planning and site design are accomplished. The flightline area will need extensive repair of the main runway, taxiways and expansion of the west and north aprons. North of the

flightline (Flightline North and North Base areas) is where the majority of new construction and development will occur. NEPA documents for the ADPs or for singularly large individual projects are either underway or identified and programmed. Future impacts to natural resources are expected to be similar to current impacts discussed in Section 6.1. A generalized view of Main Base future land use, grounds categories and acreages are provided in Figure 6-7 and summarized in Table 6-3.

6.5 Natural Resources Needed to Support the Military Mission. JBLE-Langley requires open space, free of BASH threats, in order to conduct air operations. Stable shorelines to protect infrastructure and support flood resiliency are also required. Stormwater systems that adequately convey water off of the installation following storms and unusual tide events are necessary to allow personnel to access points on the installation and conduct their duties. Maintenance of compatible land use around the installation is also essential for ongoing military operations.

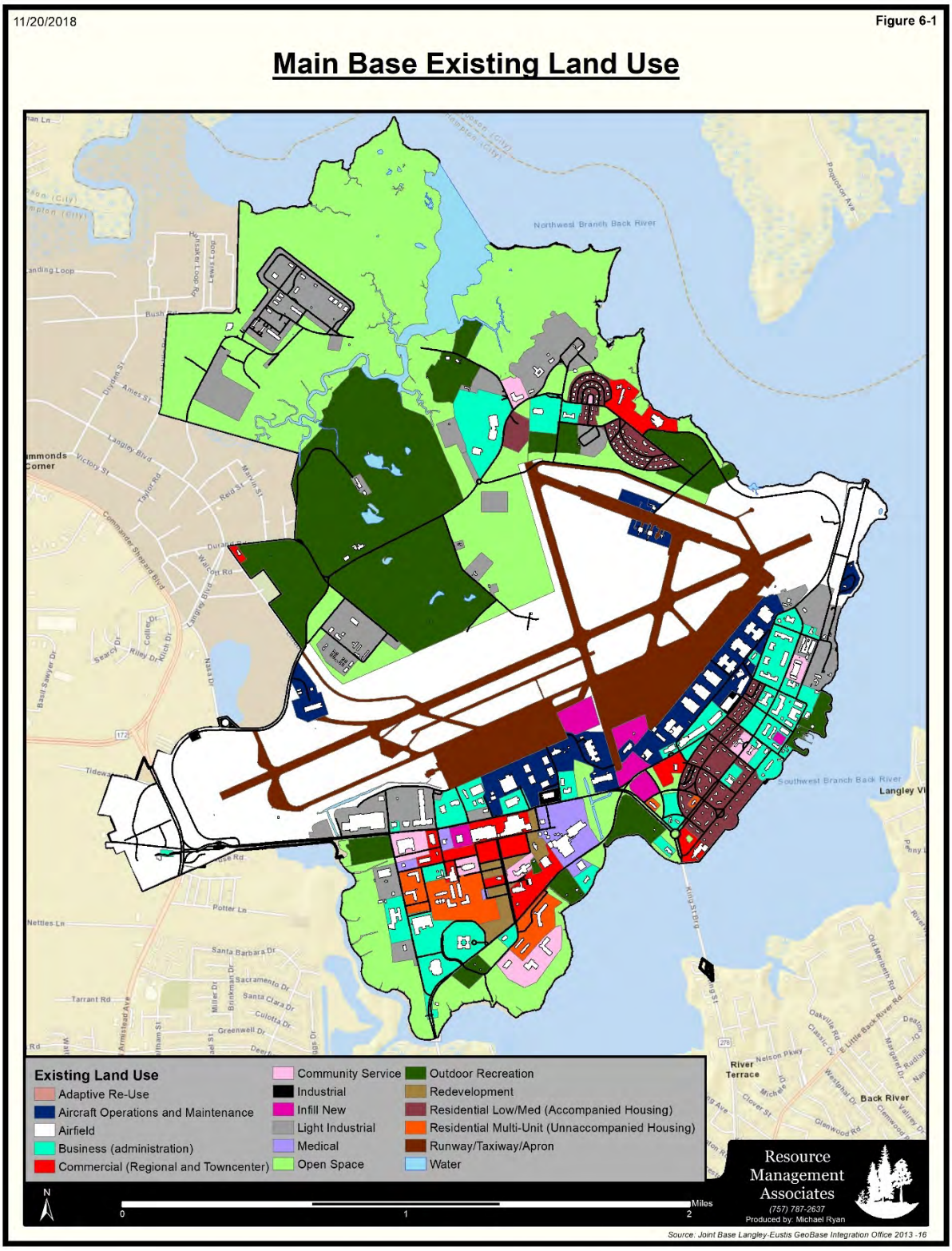


Figure 6-1: Main Base Existing Land Use

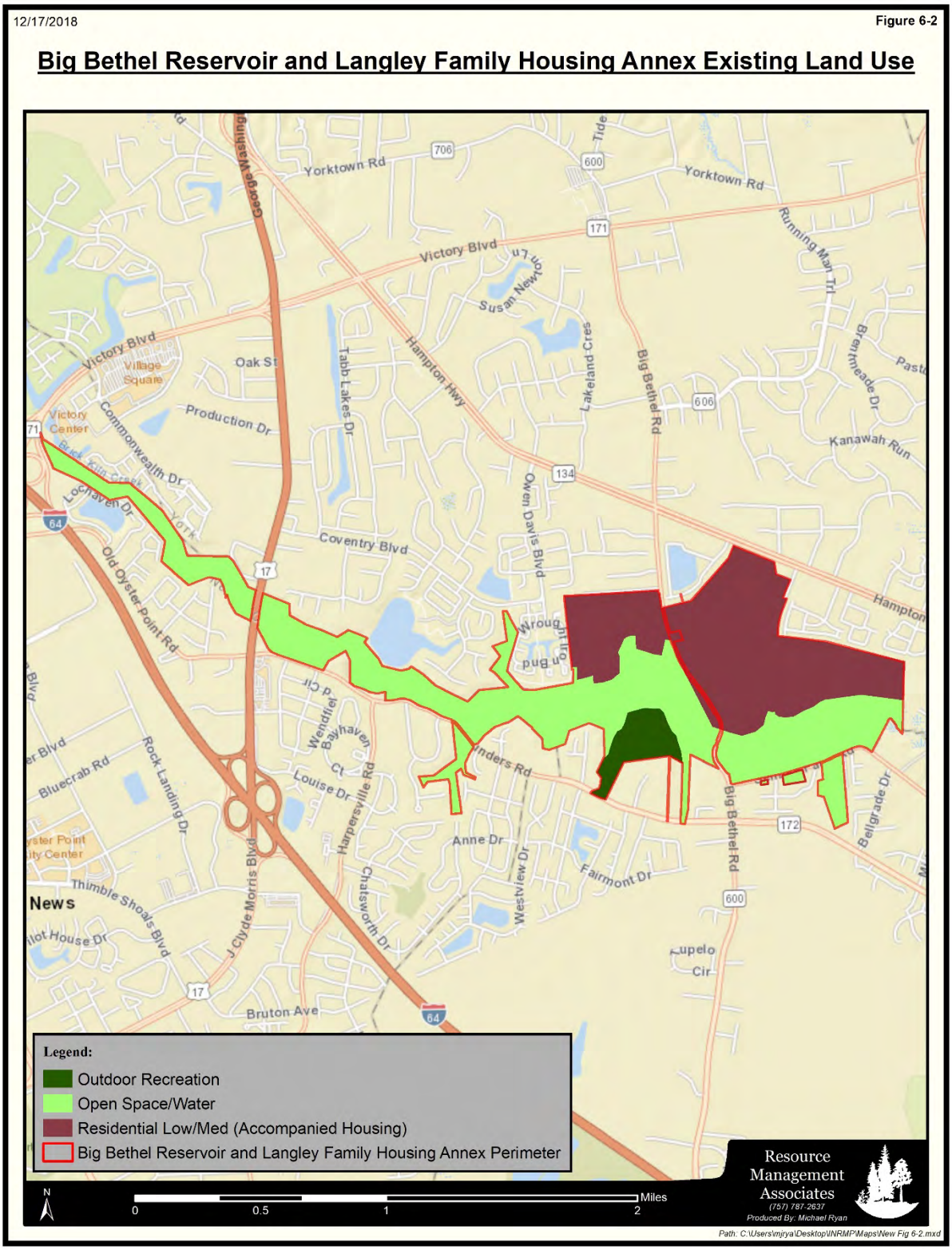


Figure 6-2: BBR and Langley Family Housing Annex Existing Land Use

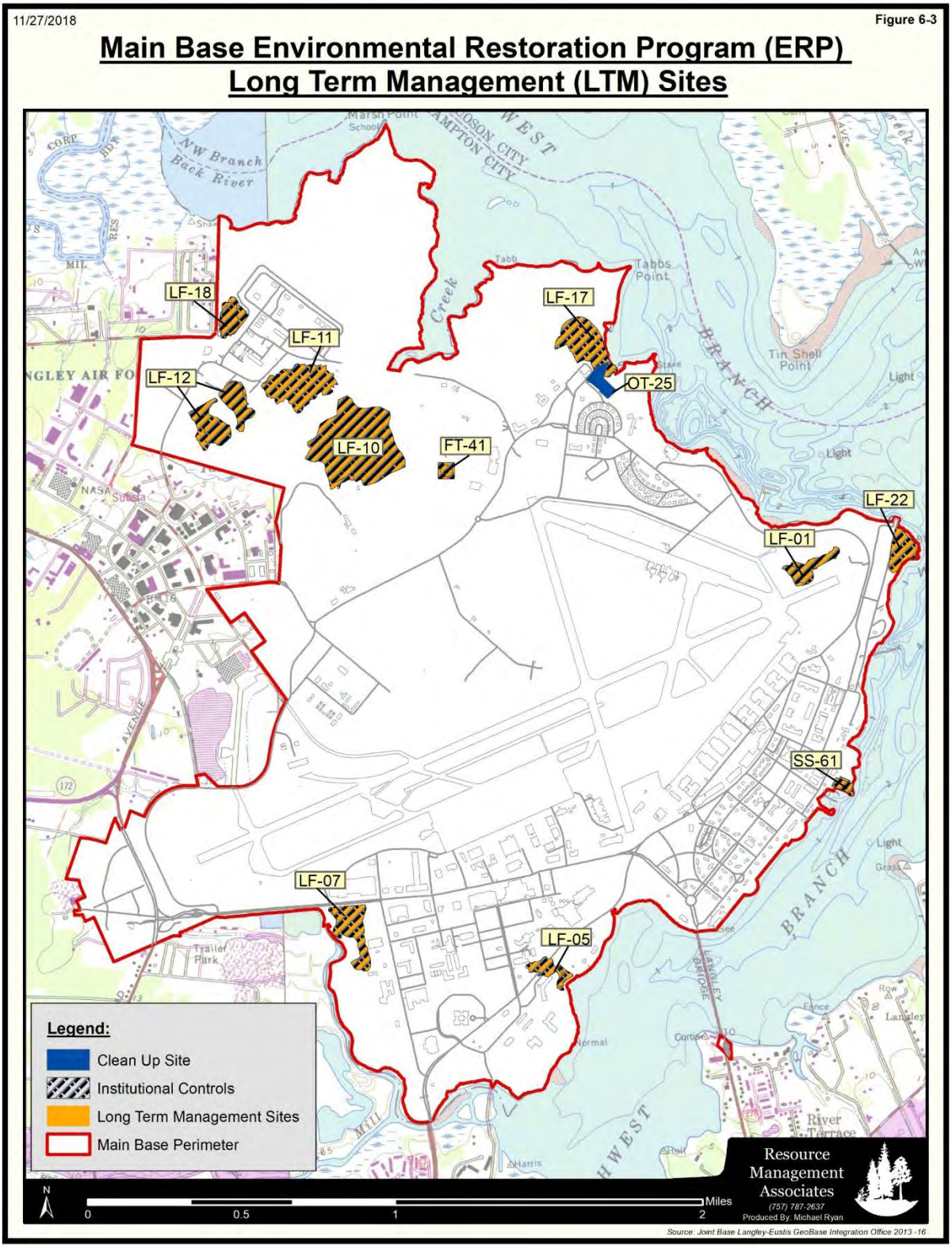


Figure 6-3: Main Base Environmental Restoration Program (ERP) Long-term Management (LTM) Sites

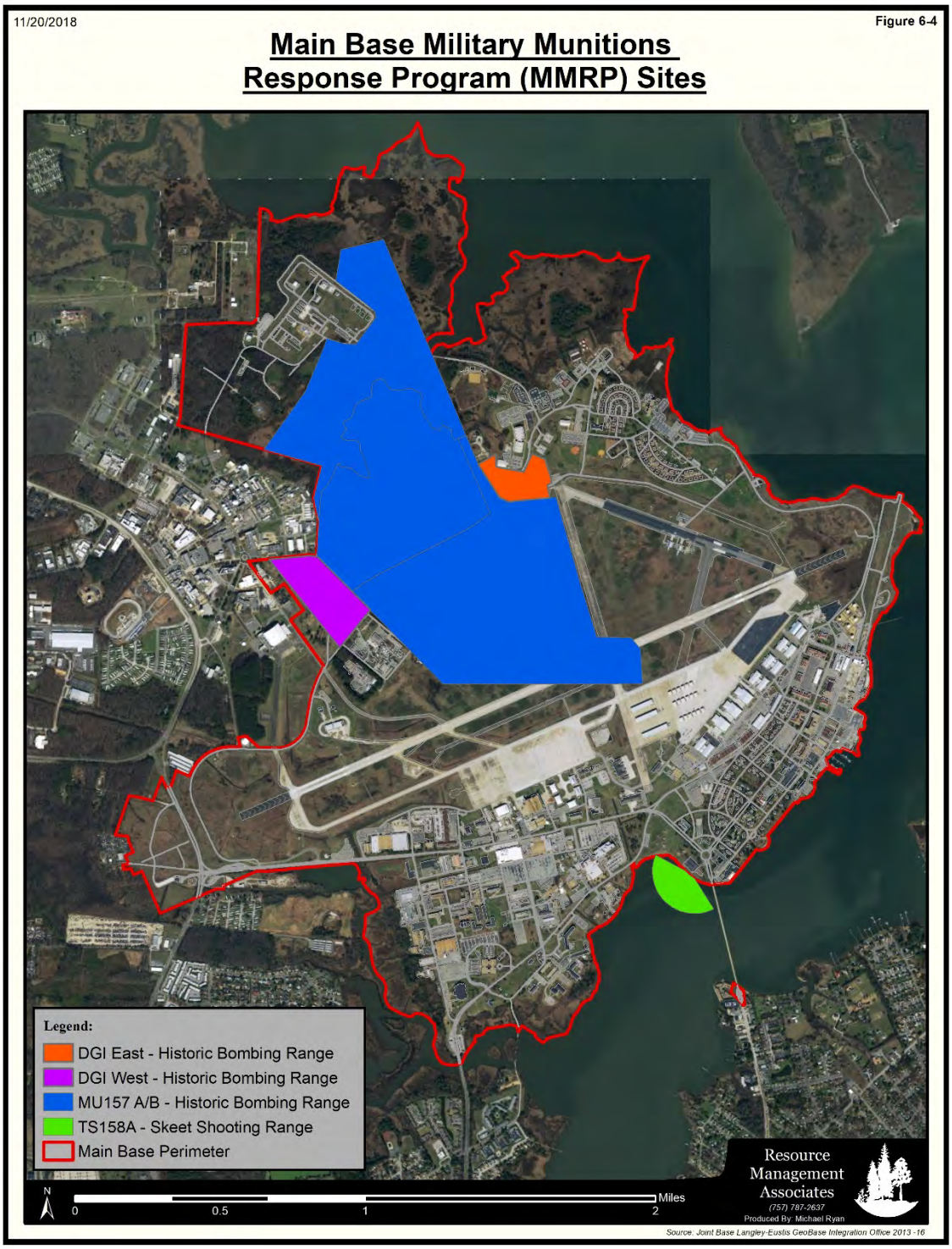


Figure 6-4: Main Base Military Munitions Response Program (MMRP) Sites

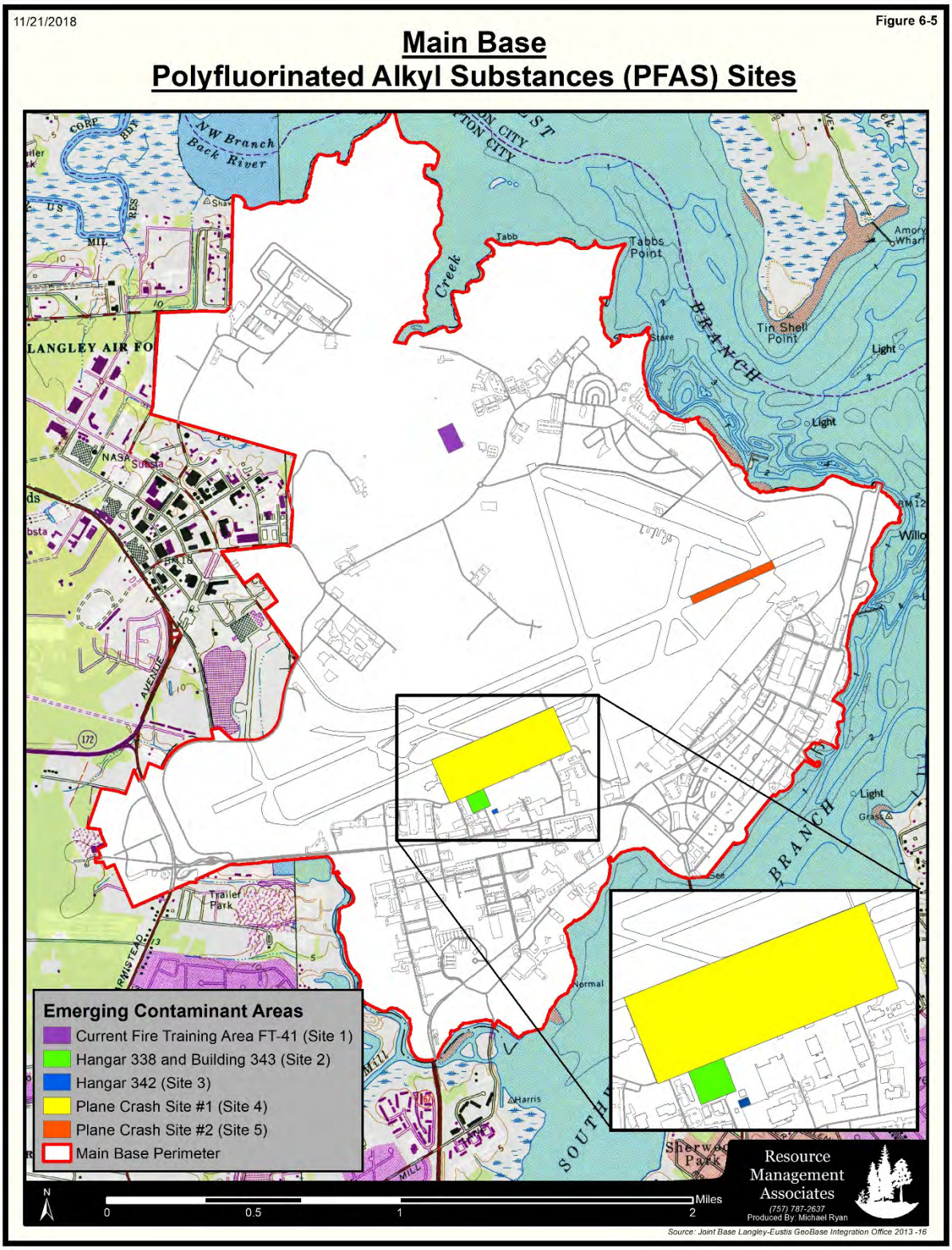


Figure 6-5: Main Base Polyflourinated Alkyl Substances (PFAS) Sites

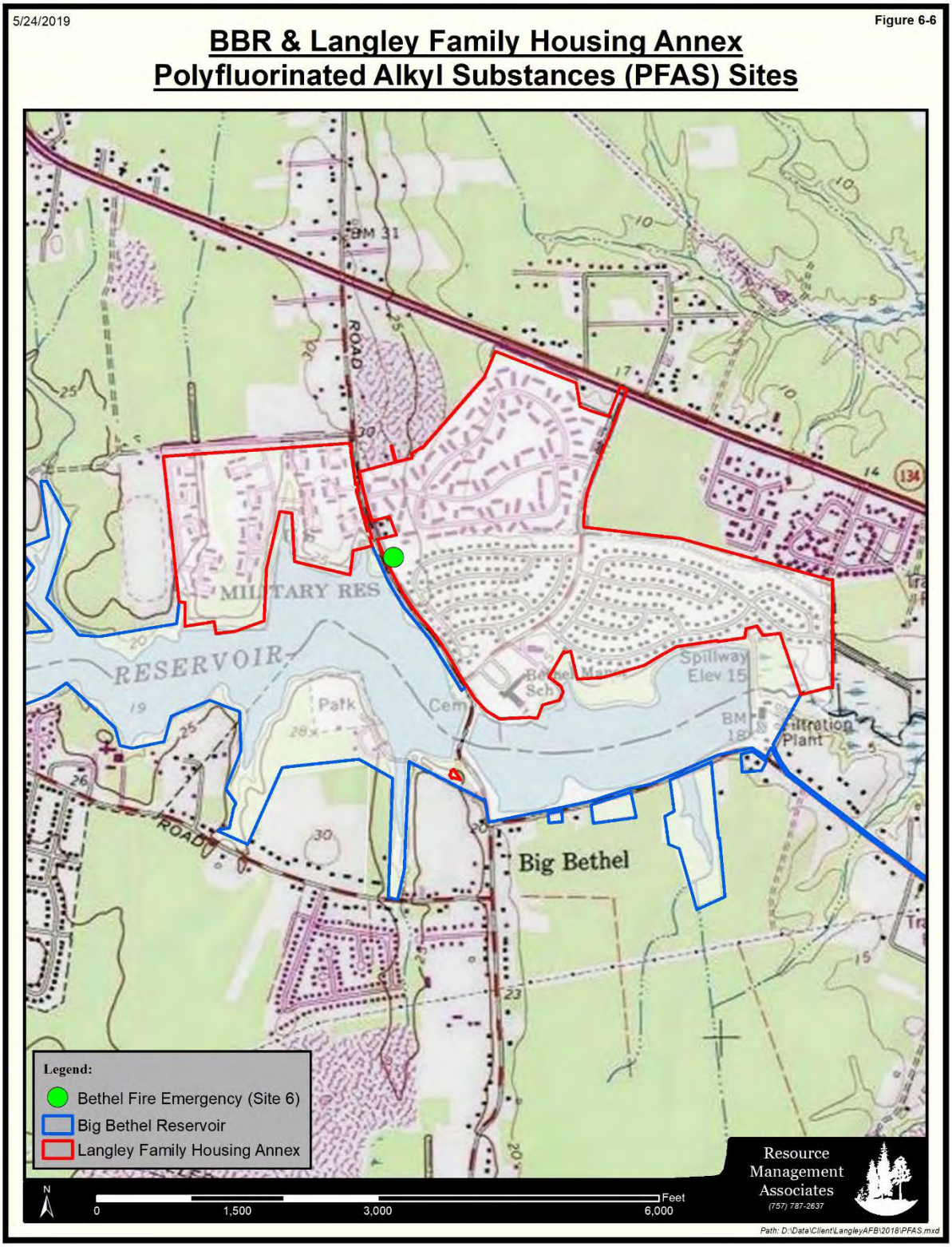


Figure 6-6: BBR and Langley Family Housing Annex Polyflourinated Alkyl Substances (PFAS) Sites

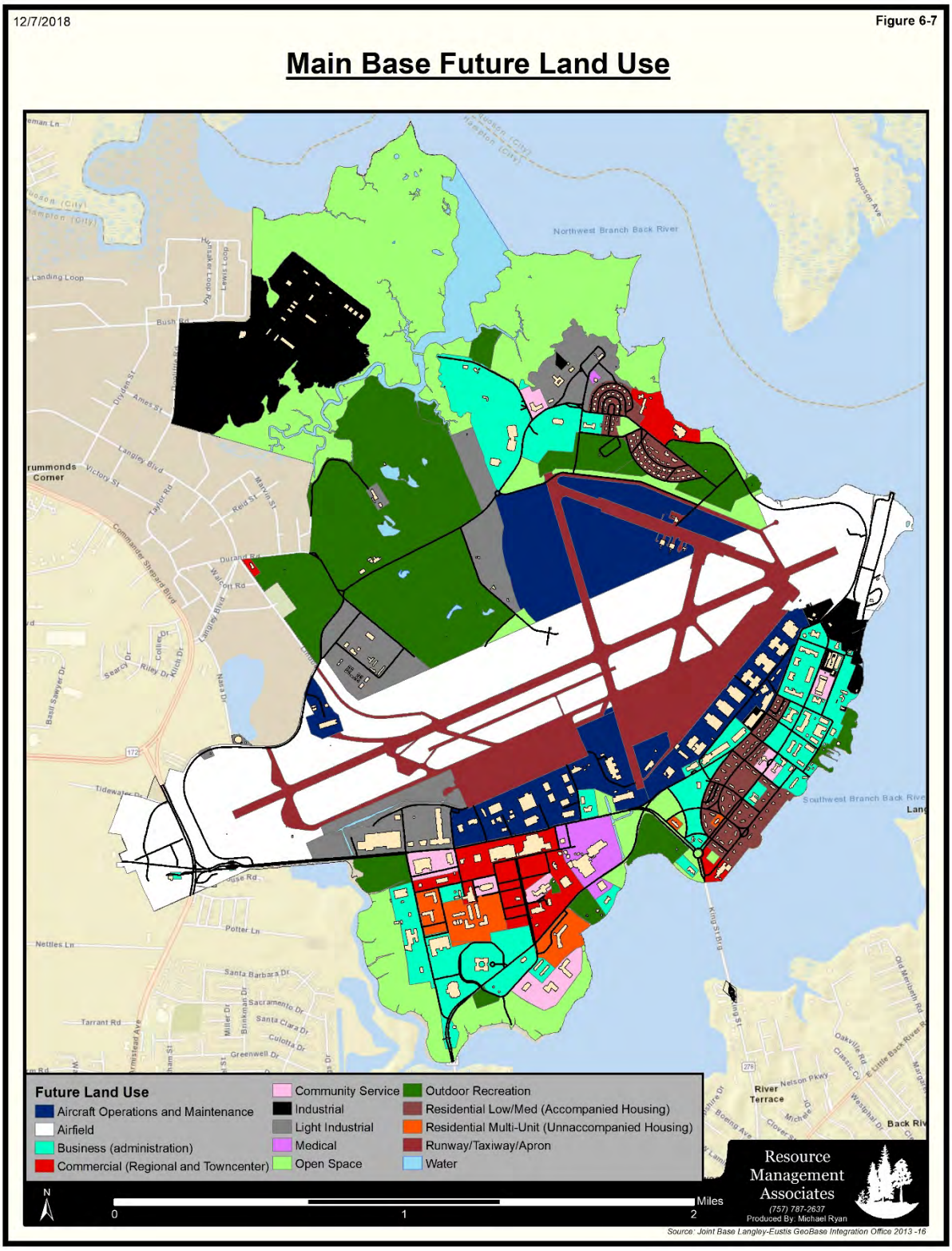


Figure 6-7: Main Base Future Land Use

Table 6-1: Natural Resource Current Value on Main Base

Source: JBLE- Langley, 2017

Natural/Cultural Subcategory	Sustainable Development Indicator (SDI)	Unit of Measure	Current Value
Natural	T and E Species	# Acres of Designated Critical Habitat Areas	0
Natural	T and E Species	Total $ as % of AF Total T and E Species Expenditures	$0
Natural	Wetlands	# Acres	585
Natural	Wetlands	% Acres (Wetlands to Total Installation Area)	19.53%
Natural	Forest	$/Acre Value of Timber to Offset Removal Costs	$6,000
Natural	Agricultural Outleases	$/Year	N/A

Table 6-2: Future Short-term (1-5 year) Projects List for Main Base

Source: JBLE- 2019 Langley Master Project List (633 CES Civil Engineering Flight)

Project #	2019 Langley Master Project List Description	Planning District
MUHJ 07-3013	Fuel Systems Maintenance Dock	Flightline East
MUHJ 13-3000	363 ISRW HQ	North Base
MUHJ 14-4077	Repair Runway/Txwy Circuit, Lights and PAPI System, F. 2380	Flightline East & Flightline West
MUHJ 14-4114	Repair HVAC, Fire Suppression and Utilities, Alert Hangar F 1362	Flightline North
MUHJ 03-4247	Repair East Apron	Flightline East
MUHJ 08-4027 P2	Repair Asphalt on Taxiway Foxtrot, F. 6005	Flightline North
MUHJ 09-4149	Maintain Runway 08 and 26 Clear Zone Drainage, F. 7025	Flightline North
MUHJ 14-4097	Repair Worley Rd on Tabb Creek, Bridge, F. 1045	North Base
MUHJ 08-3000	Fuel Pier & Ground Vehicle Refueling Facility	Flightline East
MUHJ 14-4152	Repair Sewer Force mains Ph 1	Multiple
MUHJ 15-4132	Repair West & South Overhead Feeder and Place Underground, F. 2100	Shellbank
MUHJ 12-4033	Repair Backflow Prevention Devices	Multiple
MUHJ 12-4035	Repair by Replacement 20 " Water Main, F. 2025	Multiple
MUHJ 15-3000	Flightline Security Fence	Multiple
MUHJ18-0036	Study, Traffic in Bethel manor Housing Area, F. 2620	Bethel Recreation
MUHJ 19-0333	Study, Identify facilities Vulnerable to Climate Impacts	Multiple
MUHJ 19-4007	Repair AFFF Tank/Air Compressor/Refrig Air Dryer, Corr Control, 1 FW, F. 342	Flightline East
MUHJ 18-0333	NEPA Support FY20/21 Storm Sewer Projects	Multiple
MUHJ 18-0032	Study, Update JBLE-Langley Wetland Delineation, F. 90000	Multiple
MUHJ 18-4023	Repair Missing Head Wall and Clear Storm Drains, F. 2250	Heavier-Than-Air
MUHJ 18-7001	Construct Gate Btwn W Apron. Flightline Rd, F. 6015	Flightline East
MUHJ 15-7005	Construct Addition to Hazardous Storage Facility. F. 1390	Flightline North
MUHJ 18-7002	Construct Airfield Security Fence and Gates, F. 1905	Multiple
MUHJ 18-9002	Demo Airfield Obstruction, Shop Facility F. 735	Heavier-Than-Air
MUHJ 18-9000	Demo Airfield Obstruction, LOX Facility, F. 732	Heavier-Than-Air
MUHJ 07-4071	Repair North Ramp, F. 17035	Flightline North
MUHJ 16-4067	Study/Repair Bethel Dam, F. 5005	Bethel Recreation
MUHJ 18-5013	Repair Runway Taxiway Shoulders	Flightline East
MUHJ 17-9000	Demo Afld Obstruction, Above Ground Bldg Foundation, F. 720	Heavier-Than-Air

Table 6-3: Existing and Future Land Use Acreage Comparison Summary for Main Base

Source: JBLE Installation Development Plan (JBLE-Langley, 2017). Includes only Main Base.

Land Use Category	Existing (Acres)	Future (Acres)	Difference (Acres)
Administrative	184.41	274.44	-90.03
Airfield Ops/Vehicle Maintenance	123.08	180.90	-57.82
Airfield Pavement	252.24	284.88	-32.64
Airfield	670.07	670.18	-0.11
Community Commercial	85.23	96.27	-11.04
Community Service	59.37	62.25	-2.88
Housing	383.99	370.47	50.98
Industrial	239.01	234.52	4.49
Medical/Dental	31.93	25.38	6.55
Open Space	949.23	923.00	26.23
Outdoor Recreation	425.25	269.85	155.40
Water Body	232.76	232.76	0.00

Table 6-4: Summary of 2018 Air Emissions by Pollutant Type at JBLE-Langley

Source: 2018 JBLE-Langley Air Emissions Inventory (Air Program Manager)

Pollutant	Allowable Emission Rate (tons/year)	Actual Emission Rate (tons/year)
PM (particulate matter)	16.0	1.80
SO_x (sulfur oxides)	23.4	0.95
NO_x (nitrogen oxides)	98.0	22.50
CO (carbon monoxides)	69.4	13.33
VOCs (volatile organic compounds)	32.9	8.66
Single Highest HAP (Hazardous Air Pollutants)	5.0	0.70
Total HAPs	16.0	2.84

7.0 NATURAL RESOURCES PROGRAM MANAGEMENT

7.1 Natural Resources Program Management

7.1.1 General. Successful implementation of this INRMP requires a cooperative effort among the parties directly involved. The level of success can be enhanced by developing partnerships with stakeholders that have a vested interest in natural resources management at JBLE-Langley. A brief description of the responsible and interested parties is provided in the following sections. Host and assigned unit commanders are responsible for ensuring their organization's compliance with the INRMP. Natural Resource Management INRMP implementation and compliance responsibilities at JBLE-Langley are summarized below and in Table 7-1:

- The 633d Air Base Wing Commander (633 ABW/CC) signs the INRMP, certifies the annual review of the INRMP as valid and current (or delegates the certification of the annual INRMP review to the appropriate designee) and controls access to and use of installation natural resources. 633 ABW/CC also ensures that natural resource laws are complied with and that funding and staffing are sufficient to promote the objectives and projects in the INRMP.

- The Environment, Safety and Occupational Health Council (ESOHC), chaired by the 633d Air Base Wing Vice Commander (633 ABW/CV), reviews the INRMP (through appropriate cross-functional team reviews) and provides input during the annual update and revision process. The ESOHC ensures that 633 ABW organizations comply with the provisions of the plan. On JBLE-Langley, this task has been delegated to JBLE-Langley 633 Civil Engineer Squadron Base Civil Engineer (BCE).

- The BCE is responsible for the preparation, maintenance and day-to-day implementation of the INRMP and is the focal point for all plan actions and issues. The BCE also establishes mechanisms to review and analyze the impacts using the AF Environmental Impact Analysis Process (EIAP) for all proposed actions of the INRMP and makes recommendations based on the analysis to the ESOHC for approval or disapproval.

- Natural Resources personnel (633 CES/CEIE) have primary day-to-day responsibility for natural resources management. 633d Civil Engineer Squadron (633 CES) identify opportunities for development of cooperative natural resource conservation agreements, memoranda of agreement (MOA) or memoranda of understanding (MOU) with relevant federal and state agencies or non-governmental organizations (NGOs) to AFCEC.

7.1.2 Cooperative INRMP Preparation and Implementation. Natural resource concerns for the 633 ABW at JBLE-Langley, identified in this section, are defined as essential points for consideration in achieving the goal and implementing the objectives and management strategies outlined in Section 8. Resource management issues generally relate to the need of ensuring flight safety, sustaining biodiversity, accommodating recreational needs of installation personnel, improving drainage and water quality and maintaining the visual quality of highly landscaped areas.

Specific responsibilities concerning natural resources management within the 633 ABW are outlined in Table 7-1. Responsibility for implementing the INRMP lies with the AF but can involve other federal or state agencies. The USFWS reviews and comments on the INRMP and is a signatory agency for the INRMP. The USFWS and NOAA Fisheries can also provide assistance in the identification of endangered or threatened species and their habitat. NOAA also provides consultation on Essential Fish Habitat. The VDGIF is a signatory to the INRMP and can provide assistance in the identification of endangered or threatened species and their habitat. The Natural Resources Conservation Service (NRCS) has special expertise regarding soil conservation and nutrient management.

The USACE plays a large role in the management of the installation's wetlands. They can delineate wetlands, confirm wetland delineations performed by others on behalf of JBLE-Langley and provide technical support to address JBLE-Langley participation in off-base wetland mitigation banking with conservation partners such as the Virginia Aquatic Resources Trust Fund (VARTF). By participating in an in-lieu fee program, JBLE-Langley has been able to offset the loss of marginal wetlands involved in installation development by contributing to local wetland mitigation banks and the VARTF, thus helping protect other high-value wetlands in the state.

Cooperative natural resource conservation partnerships have involved the Virginia Institute of Marine Science, the Virginia Marine Resources Commission (VMRC), the Chesapeake Bay Foundation, local Boy Scout troops, the Hampton Roads Bird Club, the Hampton Roads Master Naturalists, Old Dominion University, The College of William and Mary, The Center for Conservation Biology and other on-base organizations. Future plans involve the possibility of partnerships with the Navy, Army, National Park Service, USFWS, VDGIF, Natural Heritage Program of VDCR and Virginia Polytechnic Institute and State University.

While the Civil Engineer Installation Management Flight within the 633 ABW is ultimately responsible for natural resources management, the partnerships mentioned above play a vital role in contributing additional funds and manpower to supplement the 633 ABW.

7.1.3 Support from Other Defense Organizations.

- United States Air Force Civil Engineer Center. AFCEC assists JBLE-Langley by providing AF natural resources program budget guidance and programming natural resources projects into the Air Force Civil Engineer System (ACES) based on input from JBLE-Langley natural resources staff. In addition, AFCEC reviews budget requests and disburses funding to implement many of the projects and programs described in this INRMP. Installation Support Section provides review of revised INRMPs.

- USACE, Norfolk District. The USACE, Norfolk District, is responsible for overseeing permitting activities that affect waters of the U.S., including wetlands, per Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. The USACE has jurisdiction over wetlands on JBLE-Langley

7.1.4 Support/Participation by Other Federal Agencies

- USFWS. The USFWS provides signatory concurrence concerning the conservation, protection and management of the fish and wildlife resources presented in this INRMP. USFWS is the consulting federal agency for issues regarding fish and wildlife management, as well as the regulatory authority for the Endangered Species Act of 1973, as amended (16 USC 1531 et seq.) and the Migratory Bird Treaty Act (16 USC 703-711).

- US Department of Agriculture. The USDA provides assistance implementing the 1 FW BASH program and in nuisance wildlife control pending coordination through CEIE and availability of funding.

- US Environmental Protection Agency. The USEPA CBP, coordinates the efforts of federal agencies within the Chesapeake Bay watershed. The CBP was established in 1990 under a Cooperative Agreement between the DoD and the USEPA to restore and protect the Chesapeake Bay.

7.1.5 Assistance/Participation by State Agencies

- VDGIF. The VDGIF provides signatory agreement concerning the conservation, protection and management of the fish and wildlife resources presented in this INRMP. The VDGIF is the primary wildlife and freshwater fish management agency in the Commonwealth with full law enforcement and regulatory jurisdiction over those resources. VDGIF is a consulting agency under the USFWS Fish and Wildlife Coordination Act (16 USC 661 et seq.), and the agency provides environmental analysis of projects or permit applications coordinated through the VDEQ and VMRC.

- VMRC. The VMRC reviews and authorizes permit requests for projects involving tidal wetlands and waterways in conjunction with the City of Hampton Wetlands Board.

- Virginia Division of Natural Heritage (VDNH). VDNH is responsible by statutory authority under the Virginia Natural Area Preserves Act (Sections 10.1-209 through 217, Code of Virginia) for inventory, database maintenance, protection and management of Virginia's natural heritage resources. These resources are defined as the habitats of rare, threatened or endangered plant and animal species, rare or state significant communities, and other natural features.

- VDEQ. The VDEQ is the lead agency for coordinating Virginia's environmental policy and focuses on natural resources planning that includes but is not limited to air, water and waste issues. The VDEQ administers and enforces state laws (including isolated wetlands and joint permit applications) to protect Virginia's streams, rivers, bays and groundwater. The VDEQ also issues permits to new and modified sources of air pollution and inspects emission sources to ensure compliance with state regulations. In addition, VDEQ administers programs created by the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and the Virginia Water Management Act.

- Virginia Department of Agriculture and Consumer Services. VDACS has authority over endangered plants and insects in Virginia. Virginia Endangered Plant and Insect Species Program personnel cooperate with the USFWS, VDGIF and the VDCR Division of Natural Heritage and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their ranges.

7.2 Fish and Wildlife Management. An important function of the natural resources program is to maintain healthy and sustainable wildlife and fish populations of a diversity of native species and habitats to support them. This ranges from managing the most common species through controlled harvest programs to the protection of the rarest species on JBLE-Langley. Controlled harvest of fish and game species and habitat manipulation are the primary methods used to manage wildlife and fisheries on JBLE-Langley. As the character of JBLE-Langley and the surrounding area becomes more urbanized and developed, fish and wildlife management opportunities may decrease and constraints are likely to increase.

7.2.1 Hunting Program. White-tailed deer and wild turkey are the primary game species present on JBLE-Langley. Due to conflicts with mission safety, the deer hunting program was terminated in 2019 at the recommendation of the Air Force Safety Center. The deer herd will be controlled through more frequent population reduction activities managed by the USDA Wildlife Services contracted by 1FW to support the BASH program. This was not determined to be in conflict with sound natural resources management on JBLE-Langley because the deer herd on the main base exhibits significant inbreeding depression and poor body composition due to a lack of foraging options (Alicia Garcia, personal communication, 2018). Additionally, the deer population places excessive pressure on native plants and has severely impacted forest regeneration. Evidence that deer can spread invasive species such as stilt grass is also apparent (McShea, 2012).

JBLE-Langley's deer depredation program is coordinated with all applicable state agencies, primarily VDGIF. Accordingly, the population must be maintained at appropriate carrying capacities to (1) support a viable recreational hunting program for the installation community, (2) reduce risks of vehicular collisions, (3) reduce risks of tick-borne diseases, and (4) avoid habitat degradation from overbrowse of vegetation.

Wild turkey populations on JBLE-Langley have been monitored annually for more than a decade. Over the last few years, observations suggest turkey populations have decreased. The turkey hunting program was suspended in 2018 until populations can recover to a sustainable level to support hunting. The probable cause of the population decline is coyote and raccoon depredation in the restricted habitat available on JBLE-Langley. Continued monitoring of turkey, raccoon and coyote populations through field surveys and observations will be important in determining the size and health of the population to inform future decisions to reactivate the hunting program.

White-tailed Deer on Main Base

7.2.2 Nuisance Wildlife Control. The need to trap nuisance wildlife is assessed on a case-by-case basis and animals are removed by pest management personnel under permit and in consultation with the Natural Resources Manager. Several mammal species populations have increased enough to cause concern and impacts to wildlife and potentially humans on JBLE-Langley. The coyote population has expanded and is causing significant depredation on turtle, turkey and other bird nests on JBLE-Langley. It may also be reducing the fox population. Raccoon populations continue to increase and cause depredation, water pollution and potential health risk to humans as they have been documented with rabies on nearby NASA LaRC. Muskrats continue to cause serious impacts on stormwater infrastructure and water quality in wetlands on the Main Base. As stated in Section 4, the MS4 stormwater permit requires development of TMDL action plans for the Back River to address bacteria impairment. The values presented in Table 4-3 indicate that wildlife is a significant pollutant source for JBLE-Langley. JBLE-Langley will conduct a local fecal bacteria source assessment with the goal of identifying potential pollutant "hot spots" across JBLE-Langley. This information will be used to better identify potential sources of bacteria on JBLE-Langley and located within the TMDL watersheds (AECOM, 2018b).

The potential for disease increases with increasing mammal populations. These diseases can affect the health of other wildlife species and some pose a risk to human health and safety as well. Rabies, Lyme disease and other tick-borne diseases have been documented on JBLE-Langley.

Observed increases in nuisance wildlife populations (raccoon and muskrat) require technical assistance from USDA/APHIS/WS and Pest Management. The VDGIF assessed the serious depredation level on both birds and ground nesting species and recommended reducing population levels of raccoon and coyote to resolve the depredation problem on JBLE-Langley

(see Appendix B). Monitoring and management of nuisance wildlife needs to continue to minimize impacts on the vegetation, other wildlife, erosion and flooding resilience, water quality and human health and safety.

7.2.3 Fishing Program. Both fresh and saltwater fishing opportunities are provided by the combination of fishing programs on the Main Base and BBR. Permits are not required for saltwater fishing from the seawalls, shoreline and piers at the Main Base. Fishing on the Main Base consists of occasional use/opportunistic events by installation personnel along tidal guts and shorelines (see Figure 7-1). Fishing areas are limited due to the mission (no fishing in clear zones), presence of an MMRP site that extends into the water, and bacteriological contamination. Annual closures of sections of the Back River limit fishing and other recreational activities in those areas.

Freshwater fishing at BBR is overseen by the Outdoor Recreation Office. No installation permit is required and the fee collection area for boats at BBR is generally unstaffed. Approximately 18,000 fish were stocked in the upper impoundment in October 2008. Reports from fishermen vary from complaints of small fish size to others reporting large catch. One possible result of stocking many large bass could be a reduction in the smaller prey fish resulting in fishery collapse. The floating fishing pier was replaced with a permanent wood pier in 2009 and Natural Resources placed several dozen artificial fish-attracting structures around the pier to provide habitat and cover. Fishing policies and procedures for JBLE-Langley continue to be developed.

7.2.4 Nonharvested Fish and Wildlife. Management of nonharvested fish and wildlife is an important part of ecosystem management that contributes to biodiversity and healthy lands and waters. Wildlife diversity habitat enhancement will be coordinated and integrated with BASH, forest, grounds and other land management programs to promote resilient habitats that provide JBLE-Langley protection from flooding, erosion and storms as well as healthy and diverse fish and wildlife. Forest management to provide healthy, sustainable forests include a diversity of age structures and should retain snags and active den trees to increase habitat complexity and biodiversity. Although commercial forest management has not been used on JBLE-Langley, there is the potential for use in certain years to accomplish specific objectives. Forest management tools used to promote diversity include timber stand improvement, prescribed burning and customized harvest cuts. The Natural Resources Program will schedule and establish surveys to inventory priority species and taxa, including those listed in Virginia's Wildlife Action Plan. Nonharvested fish and wildlife offer many "Watchable Wildlife" opportunities for installation residents and visitors. Multiple community and state volunteer groups now contribute to JBLE-Langley's information on both plants and animals, especially fish and wildlife sightings.

Patches of forest and undeveloped land around BBR can augment T&E species habitat and/or can act as corridors for movement, especially for rare reptiles and amphibians. Recent evidence suggests a coastal migratory corridor for bats from Virginia's Eastern Shore down to the Dismal Swamp. Maintenance of large trees and dead, hollow trees provides breeding habitat to a variety of birds and bats. The value of the forested habitat surrounding BBR can contribute to the survival of many wildlife guilds including, bats, amphibians, reptiles and herbaceous plants. Abundant mature hardwood trees with complicated bark provide bat habitat. Further bat studies

plan netting and should be programmed to sample year-round species distribution

Opportunities: Restoring degraded areas to natural conditions, where compatible with BASH and JBLE-Langley mission, benefits biodiversity and contributes to land sustainability. There are several locations on the installation where the land and water resources have been degraded by various activities. Restoring the vegetation on these sites reduces erosion, enhances resiliency to flooding, storms and erosion, and improves aesthetics on the installation.

7.2.5 Contributing to Chesapeake Bay Fish and Wildlife Initiatives. Additional considerations include strategy outcomes developed in response to the Chesapeake Bay EO 13508 for oysters, blue crabs and the black duck. Small oyster restoration projects are in place at the marina with the CBP and are currently working to expand to areas near the Memorial Park to support the water program. Specific outcomes for each species include:

- the restoration of native oyster habitat and populations in 20 tributaries out of 35 to 40 candidate tributaries by 2025;
- maintaining a sustainable blue crab interim population target of 200 million adults (1+ years old) in 2011 and developing a new population rebuilding target for 2012-2025; and
- restoring a three-year average wintering population in the Chesapeake Bay watershed of 100,000 birds by 2025.

JBLE-Langley and BBR can support these outcomes with coordinated BASH, INRMP and water resource protection goals. The Chesapeake Bay Aquatic Connectivity effort plans to restore historical migratory fish routes by opening 1,000 additional stream miles by 2025, with restoration success indicated by the presence of river herring, American shad and American eel.

Opportunity: A study to determine the feasibility of removing lower Big Bethel Dam should be considered. Removing the lower dam would remove the first major impediment to fish passage on Brick Kiln Creek and create wetlands which could be used to offset impacts to wetlands on the Main Base due to development from mission actions.

Opportunity: Provide additional passive recreation opportunities to view wildlife while maintaining the existing trails and scenic views. Increase formal educational opportunities by programming activities and events. Increase informal outdoor education opportunities by providing additional interpretive displays and materials. Develop and/or participate in youth-based recreational opportunities and education. Expand cooperative partnerships with state, federal and local agencies as well as public, private and academic organizations to inventory, monitor, manage and research fish and wildlife populations.

Opportunity: Expand hunting opportunities for other game animals (e.g., waterfowl) and work with BASH, Pest Management and VDGIF for trapping furbearer animals (e.g., muskrat, raccoons and canids) to reduce an overabundant population of raccoon and muskrat to improve water quality and protect stormwater systems should be explored.

Constraint: As mentioned throughout this document, BASH objectives must be considered before implementing any actions that may increase interactions between aircraft and wildlife. Close coordination with the BASH program is necessary for all proposed projects that may

impact wildlife activity at JBLE-Langley. The turkey hunt program is currently suspended based on reduced turkey sightings and presumed population size, primarily due to increasing coyote populations, grass cutting, late spring weather and competition with deer for food.

Opportunity: Recent complaints about decrease in size of largemouth bass in 2016 and 2017 have been heard from multiple fishermen. Fish stocking may be necessary to address this. AFI 32-7064 does not allow use of NR program funds for this use, therefore options include a reallocation of boat docking fees or the addition of an installation fishing license to generate income if the BBR fishery is to be stocked or managed.

Opportunity: Implement fishing and boating fees to facilitate management activities and site improvements via the conservation reimbursement program under the Sikes Act with assistance from 633d Force Support Squadron (633 FSS). Fees are collected into the 57R5095 accounting classification and then released back to the installation into 57X5095, once approved. These fees must be used only on the installation where they were collected and used only for the protection, conservation and management of fish and wildlife, to include habitat improvement and related activities (AFI 32-7064).

Opportunity: To enhance recreational fishing opportunities, complete a comprehensive fisheries study at BBR to better understand the fish population dynamics. According to AFI 32-7064, this cannot be done using NR funds. Continue population and species sampling, placement of artificial habitat structures and fish stocking.

Opportunity: To increase historic migratory fish routes in the Chesapeake Bay watershed, investigation of dam removal or a fish ladder at BBR could be pursued. Dissolved oxygen levels in both impoundments must be studied to see if anadromous fish can survive in warm shallow water during summer. Water management strategies would have to be instituted to integrate managing pool elevations for fish survival and provide capacity from stormwater runoff.

Opportunity: Vegetation management at the golf course and some landfills, golf course and other areas could be compatible with the *USAF Pollinator Conservation Strategy*. These sites should be prioritized and cooperatively monitored and managed with collaborating program staff.

Opportunity: An opportunity exists to study shorebird occurrence, timing and weather correlations to improve prediction, detection and avoidance to support BASH program and JBLE-Langley mission.

7.3 Outdoor Recreation and Public Access to Natural Resources. 633d Force Support Squadron/Services (633 FSS/FSC) Outdoor Recreation Office manages outdoor recreation opportunities at JBLE-Langley to provide a continuing program for the conservation, utilization and protection of outdoor recreational resources. Outdoor recreational activities support the AF goal to improve the quality of life for military personnel and their dependents. Outdoor recreation areas are shown on Figure 7-2.

In addition to hunting and fishing, recreational opportunities at JBLE-Langley include walking,

biking, fishing, golfing, skating, jogging, picnicking, horseback riding, boating and gardening. Wildlife viewing opportunities exist at the JBLE-Langley Nature Walk located at the border of a 450-acre saltwater estuary at Tabb Creek. The JBLE-Langley Marina offers an area for boat launching and docking. Additional services include trailer boat launching and the permanent and transient mooring of recreational power and sailboats up to 40 ft. There is an outdoor running track at the fitness center and a 7-mile airfield perimeter jogging path.

Bethel FAMCAMP provides additional facilities and 49 acres for recreational use. Installation improvements over the years have included upgrading piers, adding picnic shelters, recreational trails and improvements to camping facilities. Recreational opportunities include camping, fishing, paintball games, picnicking, wildlife viewing and use of non-motorized watercraft, sports fields and playgrounds.

Twice a year, birding volunteers and local bird club members conduct standard Breeding and Wintering counts (Hampton Roads Bird Club, 2018) that have been conducted since 1986. The installation promotes a bird counting effort. Dubbed the Christmas Bird Count and the Spring Bird Count, the activities promote bird watching and appreciation and provide the installation's dedicated cadre the opportunity to hone their skills. Both the Main Base and BBR provide exceptional bird watching opportunities.

JBLE-Langley Installation Development Plan includes an Outdoor Recreational Areas Study. The study provides a brief condition assessment, analysis of use patterns and needs and recommendations for reconfiguration and new facilities for outdoor recreation areas.

Constraint: Eagle Park has insufficient parking for recreation, the Dental Clinic and hospital overflow. Restrooms in this area are in poor condition and outdoor lighting is insufficient. Frequency of flooding in this area make major improvements difficult. Due to the limited NR program funds, improvement or development of this area might offer an opportunity to collaborate with Outdoor Recreation.

Opportunity: The LTA area contains most of JBLE-Langley's sports fields. A project to reconfigure and regrade ball fields is recommended in JBLE-Langley Installation Development Plan as well as a development goal to link sports fields, parks, housing and the jogging trail with multi-use paths that take advantage of existing space and shoreline assets. Many of these are being created on JBLE-Langley and offer the opportunity to highlight natural resources with opportunity to link with nature trails.

Constraint: Increasing pressure for development to support expanding installation mission requirements may result in loss of currently existing sports fields.

Opportunities for expansion and development of outdoor recreation trails exists on JBLE-Langley both to connect infrastructure, such as sports fields and jogging paths, and to create hiking trails in close proximity to Langley Family Housing around BBR.

Opportunity: The forested perimeter of BBR provides an opportunity for a hiking/nature trail in an urbanizing environment. Fort Monroe had proposed the trail when BBR was under Army

management. The perimeter of Shellbank offers additional trail opportunities. These trails could be connected IAW suggestions laid out in the Installation Development Plan.

Opportunity: Develop and promote opportunities to increase outdoor recreation at the Main Base and BBR by partnering with non-profit organizations or clubs, such as Virginia Paddles, Hampton Roads Bird Club and Virginia Fishing Federation.

Opportunity: Create nature walk/tours with informational pamphlets and Apps of JBLE-Langley to include the Urban Tree Inventory, the Nature Trail and other installation highlights.

7.4 Conservation Law Enforcement. Legislative Jurisdiction and Law Enforcement Authority on JBLE-Langley falls into three categories: proprietary, concurrent or exclusive. For areas with proprietary jurisdiction the federal government does not possess any of the state's authority to make or enforce laws. There are two Main Base areas with proprietary jurisdiction, the MSA and the NASA gate. Portions of land associated with BBR are also proprietary. Land west of both Atkins Lane in Newport News and west of Commerce Circle in York County, is proprietary. This division is associated with the Chickahominy River Supplementary Pipeline which supports the City of Newport News drinking water supply. A portion of the BBR FAMCAMP is also proprietary.

One area of JBLE-Langley has concurrent jurisdiction and another is in the process of changing to concurrent jurisdiction. Under concurrent jurisdiction both the federal and local government may enforce the law. Langley Family Housing already has concurrent jurisdiction. All remaining JBLE-Langley property is under exclusive jurisdiction of the federal government. On this property, the federal government has sole law enforcement authority. On all areas of JBLE-Langley with proprietary jurisdiction, providing force protection for DoD personnel and assets at JBLE-Langley is the mission of the 633d Security Forces Squadron (633 SFS). 633 SFS operates under the general guidelines prescribed in AF Policy Directive (AFPD) 31-2 *Law Enforcement* and the implementing and interfacing policies referenced within it.

JBLE-Langley's natural resources, although restricted, require enforcement of applicable state and federal laws for protection. The installation does not retain full-time park rangers or conservation law enforcement officers. The 633 SFS personnel do not primarily function as conservation law enforcement officers. However, should a situation arise where law enforcement was needed, 633 SFS would assist in coordination with Base Civil Engineer Squadron Commander (633 CES/CC) and, if required, the Mission Support Group Commander (633 MSG/CC).

In accordance with AFI 32-7064 para. 6.4.2, the commander may designate fish and wildlife law enforcement authority to military or civilian personnel if the person has either been certified in conservation law enforcement through training at either the Federal Law Enforcement Training Center or by commission as a fish and wildlife conservation officer in the state where the installation is located. Law enforcement personnel who do not possess any wildlife enforcement certification can be used to supplement fish and wildlife law enforcement under the supervision of certified personnel. The VDGIF and/or USFWS, as Sikes Act partners, have authority to exercise law enforcement jurisdiction to protect natural resources. Any suspected natural

resources violations observed by the Natural Resources Manager are reported to 633 SFS or VDGIF Conservation Officer for enforcement.

Opportunity: Research the feasibility of enrolling a 633 SFS representative into the Federal Law Enforcement Training Center Land Management Police Training Program and/or enter into a Law Enforcement agreement with the VDGIF Law Enforcement Division.

7.5 Management of Threatened and Endangered Species and Habitats. The ESA of 1973 requires federal agencies to ensure that any action it authorizes, funds or carries out is not likely to jeopardize the continued existence of any federally-listed species. Furthermore it prohibits the destruction or adverse modification of federally-designated critical habitat. The ESA requires federal agencies to confer with the USFWS or the NOAA, as appropriate, on any action that is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat.

No federal listed T&E species are known to occur on the Main Base and no critical habitat has been designated on JBLE-Langley. Recent acoustical detection indicates that the Northern long-eared bat and Indiana bat may be present around BBR during summer months. Further studies are planned to confirm these findings and determine how habitat is being utilized. Preliminary data on bat acoustic monitoring around BBR has been shared with VDGIF and the USFWS (Appendix B). Once site usage by these species is both confirmed and clarified, a management plan and subsequent revision or update of the JBLE-Langley INRMP will occur in consultation with USFWS and VDGIF. This plan of action was put forth and approved by both USFWS and VDGIF in September 2018 (Appendix B).

If additional T&E species are identified on JBLE-Langley, the 633 CES Natural Resources Manager (NRM) will consult with the appropriate agencies (USFWS, NOAA, VDGIF and VMRC) to develop appropriate actions including surveys and Endangered Species Management Plans. The INRMP would then be revised to reflect any change in status and protection level.

The bald eagle and peregrine falcon, both removed from the federal endangered species list, can be observed on JBLE-Langley. Bald eagle nesting has occurred both at BBR and the Main Base. It is believed that residential encroachment may have deterred eagles breeding on BBR. An eagle nest was documented on the north end of the forested area on the Main Base in 2007 and has been active each year since. JBLE-Langley may be frequented by peregrine falcons at any time of year, although suitable nesting sites are generally lacking. Both of these species remain protected by the MBTA and the bald eagle is further protected under provisions of the Bald and Golden Eagle Protection Act.

The USFWS has finalized two regulations that authorize the issuance of permits for incidental take of bald and golden eagles on a limited basis and the removal of bald eagle and golden eagle nests. Effective 10 November 2009, incidental take will be authorized only if it can be determined that the take (1) is compatible with the preservation of the bald eagle and the golden eagle and (2) cannot practicably be avoided. Nest removal will only be authorized where (1) necessary to alleviate a safety hazard to people or eagles, (2) necessary to ensure public health and safety, (3) the nest prevents the use of a human-engineered structure, or (4) the activity, or

mitigation for the activity, will provide a net benefit to eagles (Eagle Permits; Take Necessary to Protect Interests in Particular Localities; Final Rules, 2009).

Several federal Candidate, At Risk and state-listed species occur at JBLE-Langley and should continue to be protected (see Section 5). The Natural Resources Program will continue to consider these species in all program activities and will continue to integrate habitat management and species protection into Program activities. The Natural Resource Program will maintain a proactive and prudent approach by consulting with regulatory agencies when there is a possibility that rare species may be affected. It is AF policy to try and keep common species common, and proactive management reduces later future constraints.

7.6 Water Resource Protection. Water resources are protected on JBLE-Langley through application of buffer zones where required and implementation of regional management goals and objectives as required by the Clean Water Act, Chesapeake Bay Preservation Act and Coastal Zone Management Act. Several federal and state laws and regulations reinforce the ecological and human health importance of maintaining healthy water bodies at JBLE-Langley. Federal Compliance with Pollution Control Standards (EO 12088) and the CWA require federal facilities to comply with all substantive and procedural requirements applicable to point and non-point sources of pollution. In accordance with these requirements, JBLE-Langley must obtain all appropriate federal, state, interstate and local certifications and permits required by point and non-point pollution control, groundwater protection, dredge and fill operations and stormwater management programs for any action that may impact water quality. USACE permits are required under Section 10 of the Rivers and Harbors Act of 1899 prior to commencing any work, or building any structures, in a navigable water of the United States.

JBLE-Langley is located within the Chesapeake Bay watershed. As required by EO 13508, Chesapeake Bay Protection and Restoration, dated 12 May 2009 (74 FR 23099), JBLE-Langley is a member of the DoD CBP. The Chesapeake Bay Program Office (CBPO) represents the federal government in the implementation of strategies to meet the restoration goals of the CBP. To the maximum extent practicable, the goals of the CBP are considered in the planning and design process for projects at JBLE-Langley.

JBLE-Langley is required by the federal Coastal Zone Management Act to follow the Chesapeake Bay Preservation Act (Virginia Code §10.1-2100) to the maximum extent practicable. JBLE-Langley established 100-foot upland buffers at tidal creeks, streams and wetlands, in conjunction with the 100-foot buffers established by the City of Hampton. The objective is to maintain these with native vegetation to the greatest extent practical.

Shoreline Restoration Project at JBLE-Langley

633 CES/Environmental maintains a SWPPP (Tab 10), which addresses pollution-control measures and management strategies for its industrial (i.e., aircraft) related stormwater discharges. This plan is a requirement under its VPDES stormwater discharge permit and requires the assessment of stormwater outfalls (with current monitoring requirements), outdoor material storage and usage areas, existing materials management practices and an annual erosion and sediment control survey.

With the promulgation of the small MS4 regulations by the USEPA in 2003, 633 CES/Environmental prepared a plan addressing stormwater discharges from its municipal-equivalent activities on Main Base. In this context, municipal-equivalent activities include those accomplished by the 633 CES (Pavements and Equipment Management), 633 LRS (Fuel and Transportation Management) and the 633 FSS (Golf Course Management). The golf course and pasture area each have current, approved management plans and service contract terms that guide their fertilizer use and pollution prevention. These plans will be updated as needed with support from Natural Resources staff.

Two related water-quality issues persist at BBR. Maintaining water quality in the upper reservoir is essential for recreation activities and protection of fish and wildlife resources. The lower reservoir provides habitat, although it is no longer producing potable water. USFWS surveys in 1998 and 2006 describing the flora and fauna at BBR noted the eutrophic appearance of the reservoir. This continues to impact recreational activities and the fisheries. Coontail and filamentous algae thrive in these waters causing even lower levels of dissolved oxygen due to their rapid life cycle and decomposition rates. In an effort to control these algae populations, grass carp were introduced in the upper reservoir in 2003 as a pilot program. Other management included winter drawdown as well as the prohibition of the use of gas-powered engines which can increase the population of the coontail algae and further degrade fishing opportunities. More recent testing and data shows that dissolved oxygen levels in the reservoir were within a healthy

range for aquatic life. VDGIF fish surveys and 2008 data showed improvements over the 2006 data. More current data are not available.

Dam maintenance continues to be a management issue from both a liability and ecological standpoint. The USACE (2019) identified emergency and high priority actions needed (see Section 6.2.1) in terms of repairs and vegetation removal.

The riparian Resource Protection Area buffer around the reservoir has been degraded on the federal portions adjacent to private land. Human disturbance from trespass has removed vegetation along portions of the federal property where no barrier between federal land and private property exists. Dumping of trash in areas where the fence is down, and trespass by homeless people, is also occurring on federal property and negatively impacting water quality.

Vegetation Encroachment on Lower Big Bethel Dam

Opportunity: Continue to build partnerships, collaboration and support for a watershed assessment for BBR in partnership with local communities and regulatory agencies.

7.7 Wetland Protection. JBLE-Langley strives to achieve a goal of no net loss of values and functions of existing wetlands and will also take a progressive approach toward protecting existing wetlands and rehabilitating degraded wetlands. Military construction and other projects with the potential to disturb wetlands are reviewed individually with regard to wetland impacts and individual permits are sought as needed. According to EO 11990, *Protection of Wetlands,* federal agencies may impact wetlands only after finding no practicable alternative (FONPA). In situations where avoidance is not possible, means to minimize the impacts will be considered. When avoidance and minimization are not possible, mitigation in the form of compensatory mitigation, which is outlined in any wetland permit application filed, must be met. When wetland permitting is required, JBLE-Langley may need to pursue wetland mitigation banking or the In-Lieu of Fee Fund (Virginia Aquatic Resources Trust Fund) for mitigation of wetland

impacts because land availability is limited.

The USACE published the last jurisdictional wetland delineation survey for the Main Base and Bethel Housing Annex in February 2013. This is now expired and a request for a 2-year extension from the USACE was denied. The USACE states that evidence of wetland expansion on JBLE-Langley is present and recommends an updated delineation. A new delineation is programmed as part of this INRMP (see Section 10, Project 2.1) as the previous requests to extend the expired delineation or conduct a new delineation were denied.

Several projects have begun since 2014 with the potential to impact wetlands. These projects include shoreline restoration projects and the Airfield Clear Zone Drainage Project which will remove wildlife attracting wetlands that serve as a wildlife sink for the airfield. The project will be constructed in three independent phases. Phase I will result in permanent impacts to a total of 0.92 acres of tidal emergent wetlands, 16.83 acres of non-tidal emergent wetlands. Phase II will result in permanent impacts to a total of 1.36 acres of tidal emergent wetlands, 4.74 acres of non-tidal emergent wetlands. Phase III will result in permanent impacts to a total of 8.29 acres of non-tidal emergent wetlands.

Several projects are currently underway that will enhance and restore wetlands on JBLE-Langley. A Shoreline Restoration Project (NAO-2017-00722/VMRC 17-0623), to protect a Historic Hampton University Building off of Nealy Avenue, is permitted and underway. Another shoreline restoration project to restore 1350 linear ft of shoreline north of the JBLE-Langley marina is currently being designed and will commence once permitted. Design work to convert 3400 ft of channelized ditch using stream restoration techniques is underway to improve water quality and create wetlands along Brick Kiln Creek. The first portion of this restoration work, which will need to be completed in phases, is funded for award in 2019.

Other development projects described in Table 6-2 that are planned to occur over the next five years are located in already disturbed areas on improved surfaces. Any impacts to wetlands will follow approved AF protocols and project consultations and permits.

Opportunity: Management of existing wetland areas provides wildlife habitat and supports stormwater management, pollution prevention and visual aesthetics.

Constraint: Management of wetlands and riparian zones to benefit wildlife must be balanced by BASH concerns. Locations for enhancement activities must be chosen with deference given to BASH concerns while acknowledging Executive Orders and federal rules pertaining to wetlands, stormwater management and the Chesapeake Bay.

Opportunity: Forested areas have the potential to be used for realistic training. However, much of the forested areas at JBLE-Langley contain wetlands, which are protected by Section 404 of the CWA. Consider “banking” any wetlands restored adjacent to the BBR water treatment plant. Use those wetland credits to offset any impacts caused by construction and operation of new military training areas.

Airfield Clear Zone Wetlands

Opportunity: Explore feasibility of dam removal and restoration of aquatic connectivity for several commercial fish species. The site is listed by VDGIF and the North American Aquatic Connectivity Collaborative as a major impediment to fish passage. A study would be required to determine the impacts and options of such an action.

7.8 Grounds Maintenance. The 1994 Presidential Memorandum on *Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds* (60 FR 40837) provides the primary guidance on landscaping requirements for federal properties. EO 13148, *Greening the Government through Leadership in Environmental Management*, requires federal agencies to incorporate beneficial landscaping into landscaping programs, policies and practices.

The term beneficial landscaping describes practices that integrate native vegetation and wildlife habitat into the landscape and minimize the adverse effects that landscaping has on the natural environment. Specific directives of the presidential memorandum are that, to the extent practicable, federal landscaping projects should:

- Use regionally native plants;
- Use construction practices that minimize adverse effects on the natural habitat;
- Reduce fertilizer and pesticide use;
- Use water-efficient practices; and
- Create outdoor demonstration nursery to promote awareness of the environmental and economic benefits of beneficial landscaping.

The purpose of this guidance is to ensure that plants suited for the local site conditions are selected and the introduction of potentially invasive species is avoided. Using native plants ensures compliance with EO 13112 (*Invasive Species*). Plants properly selected for the site conditions will require less intensive management, potentially reducing pesticide, fertilizer and water usage. Landscape design and installation are conducted IAW the American National Standards Institute (ANSI) for Nursery Stock (ANSI Z60.1) as well as Tree Care Operations (ANSI Z133.1).

Grounds maintenance on JBLE-Langley is primarily provided through service contracts. AF personnel administering these contracts should ensure that firms desiring to provide grounds maintenance services are qualified to do the work and familiar with the regulations and AF policies relevant to turf care and herbicide/pesticide usage. Grounds crews should understand overarching maintenance and natural infrastructure (NI) Superfund Amendments and Reauthorization Act (SARA) goals. This will allow the contractor the opportunity to tailor a specific assigned task to produce the expected results in line with JBLE-Langley IPMP. Many times, ground maintenance crews will operate in areas infested with invasive species and inadvertently transfer seeds and/or root stocks to un-infested areas. This process can further expand invasive plant species and compromise on-going efforts to control their populations.

Grounds Maintenance of Wetlands near Picnic Area

Grounds maintenance covers several aspects including: maintaining improved grounds (~335 acres), maintaining semi-improved/unimproved grounds (~760 acres), maintaining trees, shrubs, hedges, and leaf/tree debris removal. Specific details regarding maintenance tasks are closely coordinated with other organizations having natural resources management responsibilities. For example, grass on semi-improved grounds is kept IAW BASH standards to prevent bird habitation. Grounds maintenance also includes 49 acres at FAMCAMP and Langley Family Housing (except property occupied by Bethel Elementary at BBR). The sports fields, picnic areas, playgrounds, dams and water treatment plant areas around BBR have been maintained as improved grounds.

Opportunity: Updating of the grounds maintenance contract terms to include more specific contract conditions. Increase performance inspections and enforcement of penalties for poor performance in order to reduce soil compaction, tree damage and removal. Encourage the use of buffer creation and maintenance BMPs with native species planting.

Opportunity: Explore opportunities for creation of native habitat including pollinator habitat on the golf course, ERP sites and other mowed areas away from the airfield.

7.9 Forest Management. Commercial forestry does not occur on JBLE-Langley. The potential for limited commercial forestry exists but has not been pursued for aesthetic and water quality reasons. BBR contains mature forest with stand densities ranging from 90 ft^2/acre to 220 ft^2/acre (see Figure 5-1). Though the timber at BBR is not accessible for logging without impacting the plant community and water quality (USACE, 2000), a Forest Inventory and Management Plan is required for this property and should be programmed into future work plans. Timber around BBR is important for the large colonial bird rookery present as well as for bald eagles, bats and other wildlife. No forest management is planned for BBR at this time. Serious encroachment and trespass in the area are impacting the area, as trees are being cut and otherwise damaged. If forest health cannot be managed other options could also be pursued for BBR, including determining the feasibility of an option for transfer of the property ownership.

The potential for limited commercial forestry exists on JBLE-Langley and should be considered to more effectively manage forest health (Garcia & Peterson, 2018). While commercial forestry is not currently practiced, these operations receive many state and federal regulatory exemptions. For example, commercial forestry operations may be used to concurrently remove trees penetrating the artificial surface of the aerodrome, for forest health purposes or for small woodlot/selective harvest sales. If tree height around the airfield threatens operations or improvements to forest stands is desired in order to support natural resources, commercial forestry could be explored to support these requirements.

Urban forestry refers to the management of trees and forests in an urban ecosystem and includes the cultivation of trees as individuals or non-commercial forest stands. Management activities are conducted IAW the DoD *Urban Forestry Manual* (DoD, 1996). Inventory and maintenance are conducted to determine program requirements and to minimize landscape maintenance whenever possible. General observations on species diversity (number of species present), regeneration (relative presence of young trees), age distribution (regeneration, immature, mature) and tree condition (excellent, good, fair, poor, dead, hazard) are recorded during landscape inventories. The most current inventory was completed in 2017 by the Hampton Roads Master Gardeners in cooperation with the Virginia Cooperative Extension Service. Over 4,000 trees were inventoried over the last three years through the volunteer effort and local community partnership. A self-guided tour is being developed after the popular 2017 Urban Tree Tour in a partnership with the surrounding Hampton community.

As the Main Base continues to develop more of an urban character, the existing Urban Forest Management Plan should be updated, and its recommendations implemented. The recent tree inventory was conducted (at no cost) to determine health composition and location of trees on JBLE-Langley (Hampton Roads Master Gardeners, 2017) but did not provide management recommendations. Trees identified as hazards or in need of inspection were identified as top priorities for removal or maintenance in FY17. Additionally, while contract addendums specifically require protection of established trees and replacement of trees killed due to mechanical injury, a lack of manpower to support inspection or enforcement hinders the effectiveness of contracts to protect the urban forest.

While hazard trees are removed annually, no replanting generally occurs. A funded program to replant trees where no development is planned would encourage stormwater infiltration and

thereby reduce flooding. Additional information provided as part of the recent inventory should also be incorporated into a management plan with recommendations for urban forestry and tree planting which align with the Installation Development Plan.

Opportunity: Update and implement an Urban Forest Management Plan for both the Main Base and Langley Family Housing areas of JBLE-Langley. The plan would quantify the value of the urban treescape, identify hazard trees and show the monetary value lost when the trees are damaged by installation activities. Create a self-guided tour with information on these trees to provide additional outdoor recreation experience. Updating the Urban Tree Management Plan would allow urban tree preservation to be integrated into JBLE-Langley planning process. Early integrated planning is crucial to preserving and enhancing the urban treescape at JBLE-Langley.

Opportunity: A forest inventory and management plan is needed for BBR to address ongoing land encroachment challenges, meet AFI requirements and manage natural resources present on the property. Plan updates should occur on a 10-year cycle.

Urban Tree Management on JBLE-Langley

Opportunity: Increase manpower in service contracts section of 633 CES so that contracted grounds maintenance work can be inspected for contract compliance and enforcement of penalties can be pursued. This will help reduce soil compaction, tree death from root damage mechanical injury and encourage native species planting.

Opportunity: Develop a self-guided tour for urban trees for the Main Base.

7.10 Wildland Fire Management. Traditional wildland fire management is not practiced on JBLE-Langley. Open fires are expressly prohibited on JBLE-Langley and all property under its jurisdiction without written approval of JBLE-Langley Fire Chief or 633 MSG/CC. Open fires include, but are not limited to campfires, bonfires and leaf burning (USAF, 2003).

The exception to this policy occurs in years when Air Power Over Hampton Roads air shows are held. In preparation for the airshow, JBLE-Langley has utilized a small-scale prescribed burns on the airfield in preparation for the fireworks show. These burns have been accomplished in the past with assistance from the Virginia Department of Forestry. Small burns are accomplished to reduce the risk of a grass fire resulting from the pyrotechnic displays which are part of the air show.

Currently, the installation does not conduct prescribed burns as a habitat or vegetation management practice. In the future, prescribed burning could be used as a tool to control JBLE-Langley's primary invasive species, *Phragmites australis* (further described in Section 7.11). This prescribed burning could reduce the fuel load present at JBLE-Langley from *Phragmites* and control the spread of this invasive weed. Large fuel loads present a fire danger to JBLE-Langley and the surrounding community while the spread of *Phragmites* displaces other valuable wetlands plants. Close coordination with JBLE-Langley Fire Chief, USFWS, Virginia Department of Forestry, VDGIF and the VDCR is required to create a safe and effective prescribed burn plan.

A Draft Tier 1 Wildland Fire Management Plan was recently completed for JBLE (Chloeta, 2018) and should be implemented when approved (see Section 13). Trial prescribed fire opportunities exist on JBLE-Langley to use small fires to control invasive weeds, reduce fuel load and reduce fire hazards and manage for forest health and wildlife.

Opportunity: Conduct a wildland fire risk assessment and develop a wildland fire management/prescribed burn plan (if necessary) aimed at reducing fuel loads and the presence of *Phragmites australis* and other non-native/invasive vegetation.

Opportunity: Begin a trial program to support airfield fuel reduction for air shows. This program could include the possibility to burn created pollinator habitat on the golf course for annual maintenance as well as on pine hummocks around Main Base where choked with storm blow down, *Phragmites* and duff.

7.11 Agricultural Outleasing. No activities of this type occur on JBLE-Langley.

7.12 Integrated Pest Management. Integrated Pest Management (IPM) is a key component to natural resources management. These programs are closely coordinated and integrated on JBLE-Langley. Currently, the Natural Resources Manager and the Installation Pest Management Coordinator (IPMC) are both within the CES which supports program integration. Entomology is part of the Infrastructure Element of the Civil Engineer Operations Flight (633 CES/CEOIE) and its personnel are in charge of controlling certain species (insects, undesirable plant species, rodents, birds and mammals) in turf, ornamental landscapes and other areas on JBLE-Langley. The IPMP (JBLE-Langley, 2016 and Section 13) for JBLE-Langley describes the installation's

pest management requirements, outlines the resources necessary for surveillance and control and describes the administrative, safety and environmental requirements of the program. The IPMP applies to all activities and individuals working, residing or otherwise doing business on this installation. Nonchemical control efforts will be used to the maximum extent possible before pesticides are used. Only pesticides approved for use in the State of Virginia and having a current valid USEPA registration number and approved for use on Main Base are used at JBLE-Langley. Pest management personnel coordinate with 633 CES/Environmental and 633d Aerospace Medicine Squadron (633 AMDS, Bio-Environmental) before spraying in sensitive areas such as wetlands. The most current list of JBLE - DoD approved chemicals is found in Section 13.

Due to the significant amounts of saltwater marsh mosquito habitat surrounding JBLE-Langley, mosquito control constitutes a significant aspect of IPM for the installation. A representative from JBLE-Langley sits on the Lower Peninsula Mosquito Control Advisory board, which meets monthly to develop concerted efforts to address Peninsula saltwater marsh mosquito problems. Several control measures have been utilized in the past, some of which are used on a continuing basis. These measures include: natural drainage of breeding sites, removal of tire piles and other man-made breeding sites, larvicide application using Altosid and BTI, construction of natural habitats to promote bats and purple martin, and adulticide application using Dibrom® aerially and Anvil® in a ground fogger.

Some vertebrate species may be nuisances or hazards and can also affect biodiversity. Pest management activities will be coordinated with Civil Engineer (CE) Environmental biologists and the BASH program to ensure the success of those actions. The current IPMP addresses the relationship of pest management activities to other natural resources management activities on the Main Base and is cross-referenced with the INRMP. The relevant pest management policy regulations are provided in DoD Instruction (DoDI) FARM 4150.07 (*Pest Management Program*) and AFI 32-1053 (*Integrated Pest Management*).

Pest management includes nuisance wildlife. The coyote population throughout the Virginia Peninsula continues to become more abundant and has established a presence on JBLE-Langley. First observed on JBLE-Langley in 2006 (Thomas Olexa, personal communication, 2013), more than 40 coyotes have been observed on both JBLE-Langley and NASA LaRC (USDA 2015; Alicia Garcia, personal communication, 2018). Coyotes are legally considered a pest/nuisance species in Virginia. Because coyotes are territorial, they are a threat to free-roaming pets and also present a BASH risk when occupying airfield habitats. However, coyotes serve as a natural predator to rodents, small mammals, deer and even waterfowl and may be replacing and restricting the fox populations on JBLE-Langley. Specific problem coyotes on JBLE-Langley are controlled by USDA/APHIS/WS on or near the airfield.

7.12.1. Invasive Species Management. An invasive species is defined as a species that is (1) nonnative (or alien) to the ecosystem under consideration and (2) whose introduction harms or is likely to harm economic, environmental or human health (EO 13112, *Invasive Species*, February 1999). Due to the threats posed by invasive species and the challenges inherent to minimizing their spread, the President issued EO 13112, *Invasive Species*, on 3 February 1999. EO 13112 established the National Invasive Species Council, co-chaired by the Secretaries of Agriculture,

Commerce and Interior. EO 13112 directs federal agencies to "prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological and human health impacts that invasive species cause." Primary management objectives recommended in EO 13112 are to eradicate small infestations and contain expansive infestations. An updated management plan has been scheduled for 2022. Early eradication of small infestations will save significant time and money and will be more successful than attempts to eradicate larger infestations

Due to its developed nature, many invasive species, both plant and animal, now occur on JBLE-Langley. Historically, the primary invasive species of concern have been *Phragmites* and European starlings (*Sturnus vulgaris*), although the BASH Plan lists other current invasives. *Phragmites* control began as a joint agency project in October 2002, with the application of an isopropylamine salt of glyphosate. Aerial application was accomplished via helicopter in the tidal wetland areas of JBLE-Langley in 2002 (150 acres), 2005 (157 acres), 2007 (104 acres) and 2008 (114 acres). Aerial application treatments were suspended in 2009 until adequate funding could be obligated towards the program. Manual application treatments were continued in developed and natural areas (where possible) by 633 CES/Environmental and at ERP sites via contract. In FY17, Three Rivers RC&D Inc. was funded to perform 150 acres of invasive species treatments on JBLE-Langley. In FY14, Aerostar SES maps of *Phragmites* population locations on JBLE-Langley were used as a baseline. However, due to the potential for aggressive expansion of *Phragmites*, the contractor remapped the *Phragmites* populations suitable for aerial and ground-based applications as well as populations of privet located in upland forested areas. Figure 5-2 shows the FY17 invasive species treatment areas. Prior to that, *Phragmites* had not been treated for almost 10 years and will now require additional treatment to compensate for the lack of regular control. In FY18, the USACE – Savannah District funded invasive species treatment projects on JBLE-Langley for the treatment of approximately 8 acres of privet, 65 acres of *Phragmites* and 1.3 acres supporting Bermuda grass, privet and *Phragmites*.

The European starling is a cavity nesting bird that was imported to the United States in 1890. Starlings are considered invasive because they compete with native species such as woodpeckers, bluebirds (*Sialia sialis*) and purple martins (*Progne subis*). Starlings are considered a pest to agriculture and a wildlife hazard to aircraft. In 2006, USDA/APHIS/WS initiated an annual trapping program on the airfield to control the local starling population and reduce BASH. Starlings are considered a BASH risk at JBLE-Langley because of their local abundance and potential to impact an aircraft while in flight and cause damage to parked aircraft from nesting and droppings (USDA, 2017). BASH Wildlife Reports indicate that starlings have been involved in 13 strikes to aircraft since 1985 causing damage to aircraft.

According to the 2009 ISIMP for JBLE-Langley (JBLE-Langley, 2009), three other dominant invasive plant species are present on JBLE-Langley. Based on total occupied acreage, these include Japanese honeysuckle (*Lonicera japonica)* (108.44 acres), followed by Japanese stilt grass (*Microstegium vimineum)* (41.13 acres) and privet (*Ligustrum* spp., 23.16 acres). Due to the widespread occurrence of Japanese honeysuckle throughout the U.S., this species should be considered endemic with low chance for effective control. The management areas identified in the ISIMP with the most coverage of invasive plant species included the northwest airfield

(51.96 acres) and northeast airfield (45.13), with Japanese honeysuckle comprising the vast majority of that area (see Figure 5-2). Other management areas with significant invasive species presence were identified and named: MASH (31.04 acres and located West of Southwest Worley), Southwest Worley (17.58 acres), West Approach (8.9 acres), Langley Family Housing Central (8.71 acres) and Poplar Road Pines (7.59 acres).

Opportunity: Update the current ISIMP to include *Phragmites* and other more recent invasives on JBLE-Langley. The ISIMP for JBLE-Langley was completed in February 2009 and addressed plant pests at BBR and on the Main Base. However, the plan did not address *Phragmites* because of the aerial spray control program was ongoing at the time the plan was published.

Opportunity: Conduct aquatic weed and algae control at BBR, as needed. Manage the overpopulation of "sterile" carp which have greatly diminished the amount of both native and invasive vegetation.

7.13 Bird/Wildlife Aircraft Strike Hazard. The most current BASH Plan was completed in 2017 (USDA, 2017). JBLE-Langley's geographic location makes it a highly attractive area for wildlife. JBLE-Langley is surrounded by hundreds of acres of wetlands, forest and salt marsh. Waterways near JBLE-Langley further increase BASH potential, including the Chesapeake Bay, which is located along the Atlantic Flyway where several million birds migrate annually. Migratory and resident birds pose a significant bird/aircraft strike hazard at JBLE-Langley. The purpose of the BASH Plan is to provide a program designed to minimize aircraft exposure to potentially hazardous bird strikes in the JBLE-Langley local flying area. The plan also addresses mammals as potential aircraft strike hazards. The plan outlines the general and continuing tasks and responsibilities for each Wing organization, explains the bird hazard warning system and establishes procedures for its operation and gives specific information on hazard reduction measures for varying conditions and species.

Bird species that are commonly struck by aircraft at JBLE-Langley include the starling, American kestrel (*Falco sparverius*), eastern meadowlark (*Sturnella magna*), barn swallow (*Hirundo rustica*), mourning dove (*Zenaida macroura*) and killdeer (*Charadrius vociferus*) (USDA, 2017). The most hazardous bird groups at JBLE-Langley include raptors, waterfowl, gulls, shorebirds, columbids and starling-blackbirds (USDA 2015, 2017). Table 7-2 provides a summary of wildlife management events from 2000-2017 at JBLE-Langley. Several mammalian species also pose threats to flight operations. JBLE-Langley has a significant deer population on and immediately surrounding the airfield. The USDA/APHIS/WS, the National Wildlife Research Center and the Federal Aviation Administration (FAA) recommend a zero tolerance of deer on airfields because of their potential to cause catastrophic damage. Fox and coyotes are attracted to the airfields by rodents, rabbits and other food sources. Drainage culverts and soft sandy soils offer opportunities for den creation on the airfield. Rabbits and hares not only pose hazards to aircraft but also are an attractant to raptors and foxes. Small rodents, specifically for JBLE-Langley, meadow voles (*Microtus pennsylvanicus*), are of concern because they too attract raptors, herons, egrets, coyotes and fox (USDA 2015, 2017). Potential BASH hazard and management areas are depicted in Figure 7-2.

The acquisition of BBR added 499+ acres of land managed by JBLE-Langley. BBR provides habitat for a variety of birds. It harbors a great blue heron and great egret rookery along with providing habitat for a variety of waterfowl. The BASH risk related to these populations is considered minimal given the distance from JBLE-Langley (approximately three miles northwest of the facility).

Another wildlife attractant is the Bethel Landfill, located approximately four miles west of the Main Base. The landfill directly increases the risk of serious bird strikes attracting thousands of gulls and other species, creating local bird movement to and from JBLE-Langley (USDA, 2017).

Opportunity: Install and/or repair the bird exclusionary systems on the airfield and other areas where needed. These systems non-lethally discourage raptors, larks and starlings from perching on airfield structures and waterfowl from frequenting the freshwater ponds near the flightline. These have been implemented to date and should continue to be implemented.

Opportunity: Provide assistance in developing and implementing a control plan for populations of rodents on the airfield. The objective would be to treat the airfield with zinc phosphide and monitor its effectiveness by conducting small mammal and bird surveys before and after

Osprey Relocation Project Helps Recover Illinois Population

treatment applications. These airfield treatments have been accomplished and should continue. The application of zinc phosphide on the airfield will decrease rodent numbers, thus decreasing a food source for raptors and other predatory animals. Predator usage of the airfield should decrease as food abundance decreases, reducing wildlife/aircraft collisions and the need to take migratory birds posing a threat to flight safety.

Constraint: Zinc phosphide is a restricted use pesticide registered with and regulated by the USEPA and the state of Virginia.

Opportunity: Participate in raptor relocation/hacking efforts with sponsoring federal or state agencies. Relocation of raptors from airfield environments were conducted from 2014-2017 in cooperation with the state of Illinois and is being investigated for additional sites throughout North America. Although results vary between regions, there is some indication that trapping and relocating raptors during migration can reduce local populations and minimize bird strikes.

7.14 Coastal Zone Management. The 633 ABW manages its coastal areas, to the maximum extent practicable, in compliance with the policies of the Coastal Zone Management Act (CZMA). Consistency with the CZMA is documented in the NEPA documents prepared for each 633 ABW activity that may impact the coastal zone. Although federal lands are excluded from state coastal management areas, activities on federal lands that are likely to affect any land or water use or the natural resources designated coastal resources management areas must be consistent with the enforceable policies of the Virginia Coastal Resources Management Program (CRMP). Consistency reviews are triggered for all federal actions inside the coastal zone and for actions outside the coastal zone that have the potential to affect Virginia's coastal uses and resources. All federal development projects inside the coastal zone are automatically subject to consistency review and require a consistency determination IAW 15 Code of Federal Regulations (CFR) 930. JBLE-Langley is within the designated coastal resources management area (VDEQ, 2002). Project proponents are required to coordinate with CE Environmental regarding the preparation of Federal Consistency Determinations (FCD) IAW Virginia specifications and JBLE Instruction 32-101, *Environmental Management*. FCD are submitted to the VDEQ, which coordinates the document with other state and local agencies.

The Virginia CRMP establishes policies and objectives to guide the use and development of coastal management areas to ensure their protection and preservation. Included are policies on fisheries management, subaqueous lands management, wetlands, primary dunes, point and non-point source water pollution, point and non-point source air pollution, shoreline sanitation and coastal lands management.

Shoreline restoration projects have been developed which assist in the restoration or enhancement of the Main Base's shores. Oyster restoration sites near the marina help stabilize the shoreline and reduce impacts of flooding. Opportunities for additional living shoreline are being explored to provide for a healthy, natural shoreline with improved resilience to sea level rise, storms and erosion, as well as providing aesthetics and water quality.

Opportunity: The erosion rate along JBLE-Langley shoreline has ranged from six inches per year to as much as one foot per year. The 633 ABW should continue efforts to protect its shoreline through habitat restoration, shoreline stabilization or hardscape as appropriate. The use of living shorelines with native vegetation is recommended whenever possible.

Constraint: Areas for habitat restoration should be chosen with deference given to BASH concerns to minimize impacts to the Base mission.

Living Shorelines Protect JBLE-Langley and Its Resources

7.15 Cultural Resources Protection. The JBLE-Langley ICRMP (JBLE-Langley, 2015) defines the processes for managing cultural resources at JBLE-Langley. The ICRMP is designed to provide specific procedures for project coordination, planning and compliance with federal and state historic preservation and cultural resource management laws and regulations (including Sections 106 and 110 of the National Historic Preservation Act [NHPA] of 1996, as amended). The broad objective of the JBLE-Langley ICRMP is to provide guidance to the 633 ABW on managing and maintaining its cultural resources, through coordination, planning and compliance activities (Kuranda et al, 2004). An ICRMP study underway will look at the cumulative effect of development on the Langley Field Historic District.

The ICRMP provides base-specific recommendations for installation managers, engineers, architects and planners. Recommendations will identify appropriate treatment options for cultural and historic properties. At JBLE-Langley, the Cultural Resources Manager manages the processes and procedures involved with historic properties. JBLE-Langley includes a unique collection of historic resources derived from its original mission as an aeronautical station and proving ground for the NACA and the Signal Corps' Aviation Station. The resources include buildings and structures as well as known and potential archeological sites that portray the development of JBLE-Langley (Kuranda et al., 2004). The majority of the archeological sites and historic landmarks and buildings are located in the southeast portion of JBLE-Langley. The eastern portion of JBLE-Langley, the Langley Historic District, is eligible for listing on the National Register of Historic Places. BBR will need to be fully incorporated into the JBLE-Langley ICRMP. This property includes unique historical values as the location of a nationally recognized historic site, which was the scene of the Civil War's first land battle on 10 June 1861.

Native American historic occupation and land use in Virginia suggest that there is some potential for Native American resources to exist on property controlled by JBLE-Langley. At the time of

the ICRMP, there were four federally-recognized tribes associated with JBLE-Langley. On 3 January 2018, federal recognition was extended to several more Virginia Tribes through the Thomasina E. Jordan Indian Tribes of Virginia Federal Recognition Act of 2017. This included the Nansemond Tribe for which, for the purpose of the delivery of federal services to tribal members, the service area of the tribe shall be considered to be the area comprised of the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Suffolk and Virginia Beach, Virginia (HR 984 2018, see Appendix A). Consultation with federally-recognized Native American tribes should reveal the level of interest and particular concerns that are held. If any resources of potential interest to federally-recognized Native American tribes are identified, AF policy (*Consultation with American Indian Tribal Governments and Alaska Native Organizations*) requires that the Commander or his/her designated representative meet with designated representatives of the affected tribe.

7.16 Public Outreach. Public outreach for the natural resources program is led by 633 CES/Environmental with support from 633 ABW/PA (Public Affairs), 633 FSS and 1 FW/SE. 1 FW/SE is involved in public outreach through BASH awareness programs. To increase awareness of all the natural resource programs at JBLE-Langley, a brochure was developed for distribution through installation Housing and Outdoor Recreation outlets. Information is now also available on the JBLE-Langley environmental web page.

JBLE-Langley sponsors Earth Day, America Recycles Day, Clean the Bay Day, World Water Day and Arbor Day celebrations each year. Typically, a tree is planted at the Child Development Center with the Wing Commander and children from the center in attendance. During America Recycles Day, personnel from the pollution prevention and solid waste programs carry out a recycling drive for items such as eWaste or plastic bags. Also, once per year, the 633 CES/Environmental sponsors installation participation in the regional Clean the Bay Day program. This participation includes a weekend shore patrol to pick up trash and refuse from the JBLE-Langley shoreline. BBR provides an additional natural area for outdoor recreation and environmental education.

Opportunity: JBLE-Langley could utilize their own website or partner websites to make citizens and property owners abutting JBLE-Langley and BBR aware of the sensitive nature of that land and ways they can reduce impact to those ecosystems.

Opportunity: JBLE-Langley could build on and/or seek new partnerships within local non-profits, youth programs and other relevant organizations that already work to promote environmental stewardship.

Opportunity: The ongoing public outreach process regarding land acquisition, conservation easements and BASH programs as described in the 2010 Hampton-Langley JLUS provides a strategic outreach plan.

7.17 Geographic Information System. GIS is defined as a collection of computer software, hardware and geographic data for capturing, managing, analyzing and displaying all forms of geographically referenced information. A GIS database of natural resources data layers is maintained and updated by 633 CES. The GeoBase Integration Office (GIO) is the primary

party responsible for data layer management. The GIO is located in the 633d Civil Engineer Squadron Engineering Flight (633 CES/CEN). Air Combat Command's GeoBase program provides a strategy for guiding AF organizations to make long-term, shared use of geospatial information or digital maps to accomplish JBLE-Langley mission. It integrates information with existing knowledge to develop a comprehensive, coherent geospatial information resource that details installations worldwide.

GIS plays an important role in supporting planning and decision-making processes necessary to support the mission. Data and analysis derived from GIS play a vital role in the preparation of crucial planning documents such as INRMPs, ICRMPs, BASH Plans and Installation Development Plans. Additionally, GIS data contributes to fact-based decision-making through the EIAP. In order for GIS data to be useful, data sets must be up to date. Any new natural resources information collected as part of on-going or future projects will be provided to the GIO and the NRM for archiving.

Constraints: Visibility and accessibility to GIS files create some constraints on managing the installation's natural resources. Because natural resources data reside with the GIO, this can limit access to information and data needed for effective and efficient natural resource planning. Providing copies of data to both the GIO and the NRM can provide an additional safeguard for data protection and facilitate analysis of GIS data.

7.18 Prohibited Practices/Activities. Biological organisms and their ecosystems require effective monitoring and management to avoid damage or disruption of military missions, damage to natural functions, damage to infrastructure and increased risks to human health. To prevent these impacts, the following practices and actions are strictly prohibited at JBLE-Langley, including BBR (see Appendix A for laws and regulations that address these):

- Walking in or riding horses in wetland vegetation. Damage to or removal of the vegetation associated with this shoreline increases this risk.
- Off-road vehicle driving in wetlands, shorelines, beaches, forested areas and streams anywhere on JBLE-Langley. Patrol around the small arms range impact area is not included in this prohibition nor are actions associated with wildland fire management.
- Allowing domestic pets such as dogs and cats to run loose. Dogs and cats must be on a leash, confined to homes or respective yards, retained in an appropriate animal kennel/carrier, or within allowed areas.
- Intentionally or voluntarily releasing any sort of wild animal onto the installation. It is illegal to relocate native wildlife from a given location to JBLE-Langley. It is illegal to release or liberate non-native or exotic animals to include pets onto the installation. This includes animals used for fishing bait including bait fish, worms, crayfish, etc.
- Intentionally or voluntarily releasing or liberating insects, other arthropods or other invertebrate animals onto the installation. Examples include (but are not limited to) releasing butterflies for weddings or other events and predatory insects into gardens.
- Intentionally or voluntarily releasing captive-raised frogs, toads.
- Intentionally or voluntarily releasing or abandoning domestic dogs or cats onto the installation.

- Intentionally or voluntarily removing any wildlife, other fauna (including but not limited to insects [such as butterflies, other pollinators, caterpillars or any insect species], crayfish, etc.) or animal parts (such as but not limited to skulls, feathers, turtle carapaces/plastrons, carcasses, tails, claws, talons, fur, etc.) from the installation except as authorized by CE Environmental.
- Cut down or remove trees without prior authorization by CE Environmental.
- Cut or remove forestry products or trees such as standing timber (dead or live), timber lying on the ground, logs, limbs or sticks, or collected as firewood.
- Remove or otherwise collect herbaceous plants from the installation without prior authorization from CE Environmental.
- Create or operate a domestic cat colony on the installation (sometimes referred to as a "Trap-Neuter-Return colony").
- Utilize crayfish, frogs (adults or tadpoles) or salamanders as fishing bait on the installation or while fishing from the shoreline.
- Harvest or remove any frog or toad species on the installation (such as frog gigging or collection for retention as pets or for sale).
- Capture, trap, collect or remove any native wild animal from the installation. Animals are defined as any vertebrate or invertebrate species.
- Kill, injure, capture or harass any wildlife or other fauna except as permitted by installation recreational hunting, fishing and trapping policies.
- Collect or trap minnows or other bait from JBLE-Langley waters.
- Discharge or discard refuse, soil, sediments or any debris including vegetation debris into wetlands or streams.
- Cut or remove tree limbs or other native vegetation to camouflage duck blinds, other structures, etc.
- Remove, damage, tamper with or otherwise disrupt official government (or government contracted) animal traps or nets.

Collectively, these prohibitions are intended to prevent the following types of issues:

- Violation of federal or state law.
- Alter the normal biology and ecology of the system.
- Creation of pest issues that may affect other organisms and habitats including individual tree and forest health.
- Introduction of parasites or disease pathogens that could affect the natural populations or human health.
- Causing severe erosion or wetland fill that requires corrective action at a cost to the government.
- Compromising safety and other health concerns.

Figure 7-1: Main Base Outdoor Recreation Areas

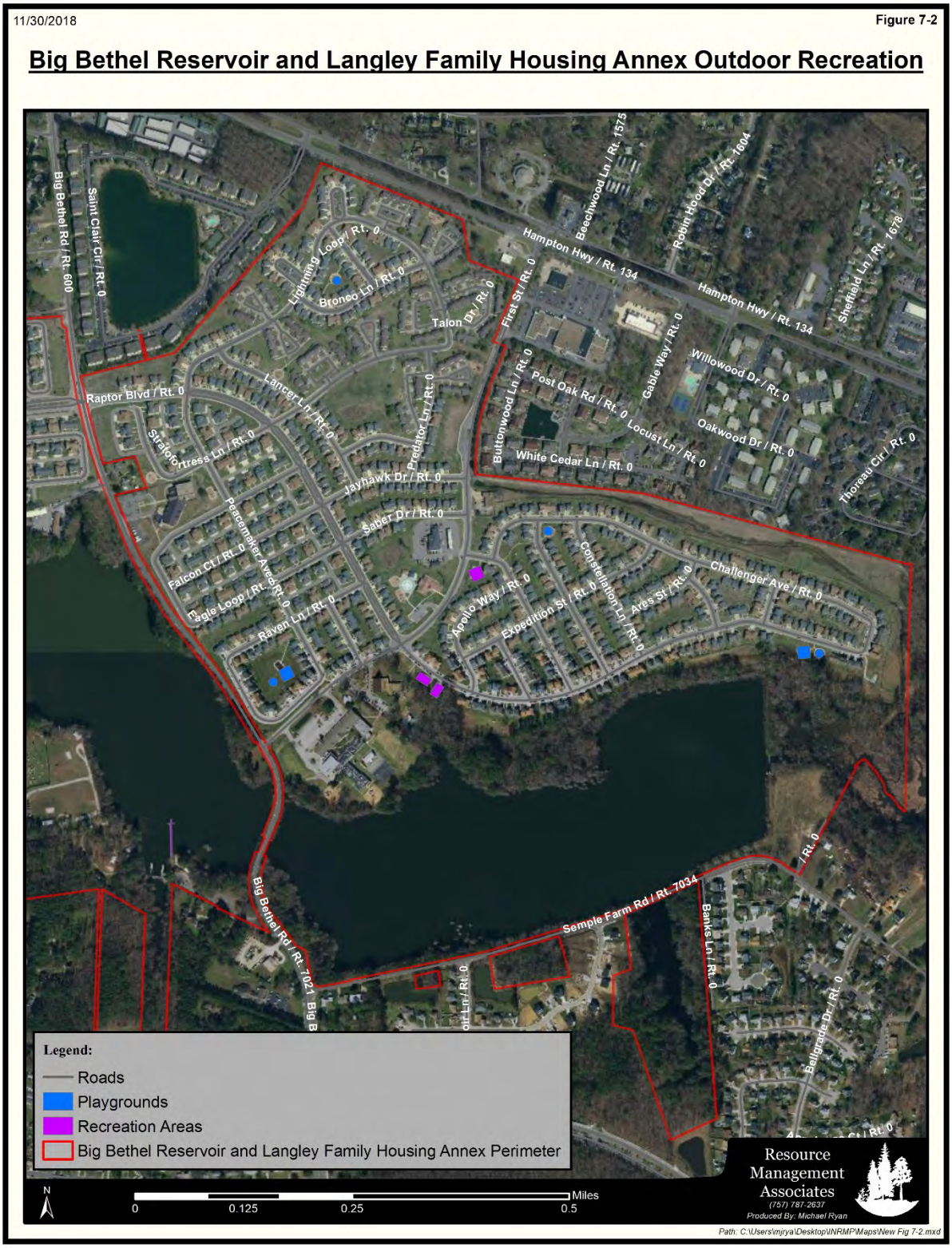


Figure 7-2: BBR Outdoor Recreation Areas

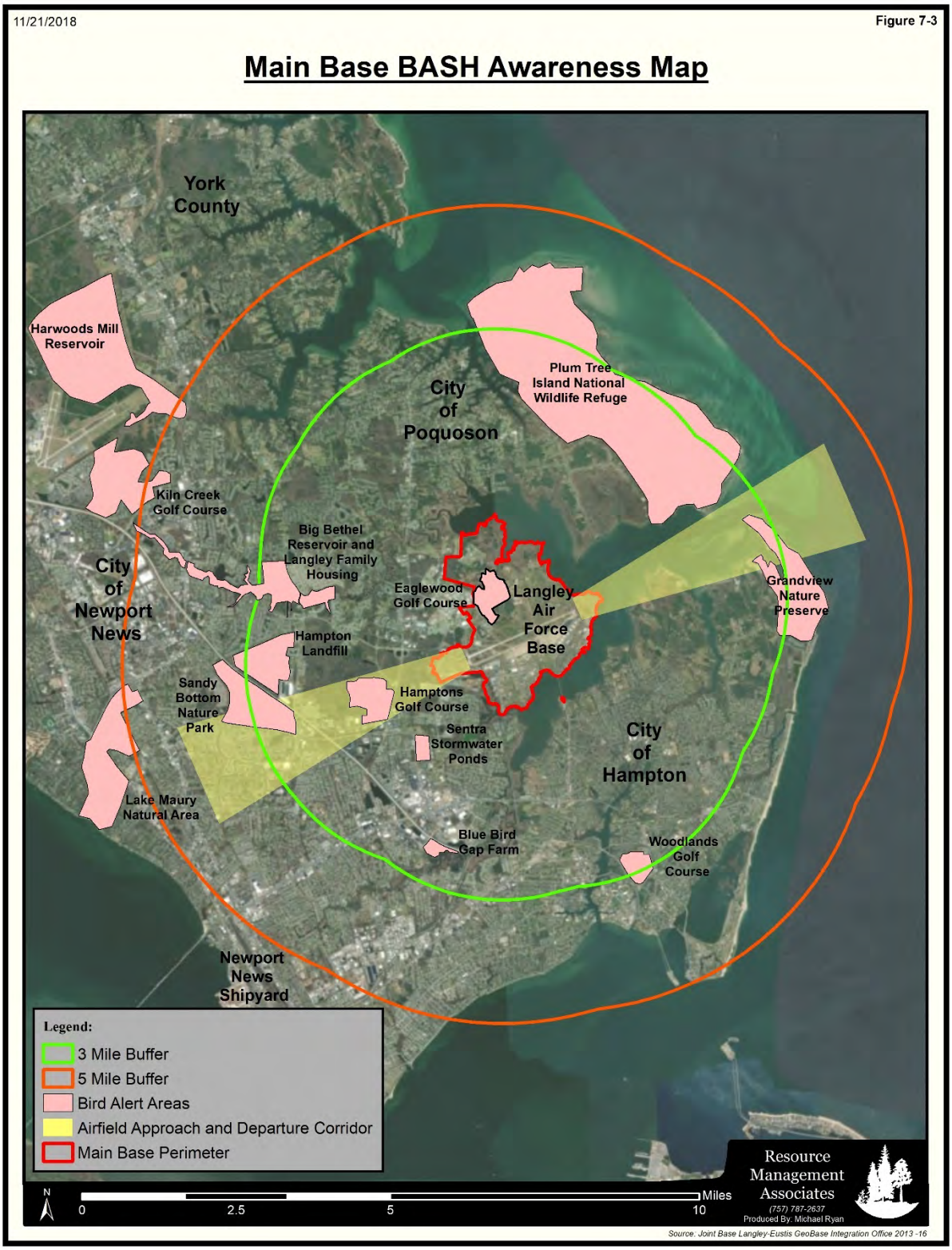


Figure 7-3: JBLE-Langley BASH Awareness Map

Table 7-1: 633 ABW Natural Resource Management Responsibilities

Wing and Staff Agencies		Title	Responsibility
633 ABW	633 ABW/CC	Wing Commander	Approves and signs the INRMP, certifies the Annual INRMP Review Summaries (unless delegated to the Commander of the Civil Engineer Squadron)
	633 ABW/CV	Vice Wing Commander	Chair, ESOHC
	633 ABW/JA	Judge Advocate	Regulatory Interpretation, Off-Base Disputes/Complaint Resolution, Legal Representation
	1 FW/SE	Wing Safety	BASH Monitoring and Minimization, Wildlife Services Interagency Agreement, BASH Working Group Coordinator
	633 ABW/PA	Public Affairs	Public Outreach, Assists the Natural Resources Program manager to place notices in Base newspaper- *The Peninsula Warrior*
Group	**Squadron/Flight**	**Title**	**Responsibility**
633d Medical Group (633 MDG)			
	633 AMDS	Bioenvironmental Engineering	Potable Water Supply Sampling, Monitoring and Reporting
1st Operations Group (1 OG)			
	1 OSS/OSAA	Airfield Management Flight	BASH Monitoring and Minimization, BASH Working Group Representative
633d Mission Support Group (633 MSG)			
	633 CES/CEN	Engineering	Stormwater/Erosion Control and Landscaping Specifications for New Construction
	633 CES/CEO	Operations Flight	Oil/Water Separator Maintenance, General Grounds Maintenance, Airfields Grounds Maintenance (mowing), Road Kill Removal, Pest Management (Entomology), Invasive Species Management
	633 CES/CEIE	Environmental Management	Natural Resources Management (Including BBR monitoring/management), Hazmat/Hazwaste Management, Air Quality Monitoring/Compliance, Environmental Impact Analysis Process, Stormwater/Wastewater/Aboveground/ Underground Storage Tank Management, Pollution Prevention, Cultural Resources Management, Hunting Program, BASH Working Group Representative
	633 FSS/FSC	Force Support	Golf Course Grounds Maintenance, Outdoor Recreation Program
	633 SFS	Security Forces	Force Protection for DoD Assets, Basic Conservation Law Enforcement

Table 7-2: Summary of Wildlife Events Conducted at JBLE-Langley from 2000- 2017.
Source: USDA, 2017

Fiscal Year	Management Events	Individuals Dispersed	Individuals Lethally removed	Total Managed	Percentage of events using non-lethal methods
2001	1,408	21,181	367	21,548	98%
2002	1,616	53,986	446	54,432	99%
2003	1,106	23,972	798	24,770	97%
2004	621	7,436	360	7,796	95%
2005	608	18,365	265	18,630	99%
2006	555	50,871	842	51,713	98%
2007	770	20,612	468	21,080	98%
2008	1,852	31,267	1,604	32,871	95%
2009	2,130	41,019	1,302	42,321	97%
2010	1,460	43,620	495	44,115	99%
2011	858	50,331	959	51,290	98%
2012	923	15,286	504	15,790	97%
2013	1,623	55,370	668	56,038	99%
2014	1,985	59,363	586	59,949	99%
2015	1,691	52,820	3,848	56,668	93%
2016	2,205	20,066	2,304	22,370	90%
2017	2,172	29,887	2,193	32,080	93%
Total	**23,583**	**595,452**	**18,009**	**613,461**	**-**

8.0 MANAGEMENT GOALS AND OBJECTIVES

This section describes the goal and objectives of the natural resources management program at JBLE-Langley. Since acquisition of BBR in 2006, JBLE-Langley has incorporated this property into these management goals to the maximum extent practicable. The proposed project titles follow AF naming conventions for conservation level 0 and level 1 projects. The goal of the natural resources management program at JBLE-Langley is:

GOAL: Provide a sustainable natural resource base to support the AF mission at JBLE-Langley.

The goal is accomplished through planning, programming, budgeting and executing projects that promote the following objectives:

- Support the 633 ABW BASH program
- Identify and characterize the installation's natural resources
- Protect and maintain the installation's resources
- Develop and enhance the installation's resources
- Create opportunities for beneficial use and enjoyment of installation resources by the public and installation personnel
- Ensure 633 CES/Environmental Natural Resources Personnel are adequately trained in the principles and practices of natural resources management on AF installations

Objective 1: Support the 633 ABW BASH Program

Project 1.1.a. (MANAGEMENT [MGT], HABITAT - BIRD EXCLUSIONARY DEVICES SYSTEMS, FY19-23)
Maintain and improve bird hazard exclusionary devices or systems to applicable airfield structures such as runway markers and approach lights. Evaluate newly constructed assets near the airfield such as the newly constructed fuel pier and add exclusionary devices as appropriate. The non-lethal deterrent reduces use by birds for perching adjacent to runway control areas.

Project 1.1.b. (MGT, HABITAT - BIRD EXCLUSIONARY DEVICES SYSTEMS, FY19)
Apply results of shorebird survey to enhance effectiveness BASH efforts during identified prime weather conditions.

Project 1.2. (MGT, HABITAT – AIRFIELD TURF REPAIR AND MAINTENANCE, FY22)
Prepare an airfield turf repair management plan (when airfield drainage project is complete) and implement recommendations. The project should include initial application of drill seeded high endophyte fescue species over bare areas, application of plant growth regulator herbicides (Plateau) to encourage a monoculture stand, suppression of seed establishment for woody dicot plants, and written recommendations for maintenance. Airfield turf currently consists of mix of disturbance tolerant species including clover, broad –leafed weeds and other wildlife attracting species as well as bare areas due to soil compaction and salination.

Project 1.3. (MGT, HABITAT – AIRFIELD GRASS HEIGHT, FY23)
Design and implement a study after completion of the airfield drainage project, and if still needed after turf repair, to apply the results of the USACE-funded research on increased grass height to reduce BASH risk on DoD airfields. This strategy has been proven effective on other DoD installations located within the Hampton Roads area. Determine if this strategy is effective on JBLE-Langley.

Objective 2: Identify and Characterize the Installation's Natural Resources

Project 2.1. (SURVEY, UPDATE - WETLAND CHARACTERIZATION, FY19)
Survey and characterize the types of wetlands present on the Main Base, Bethel Housing Annex and BBR. The 2013 survey was valid until 14 February 2018 and did not identify types (i.e., palustrine, tidal, freshwater) of wetlands present on the installation or assess their natural/ecological value. Characterization is a necessary to determine potential wetland mitigation costs and facilitate environmental project review.

Project 2.2. (MGT, HABITAT, FOREST, FY19)
Prepare a Forest Management Plan to inventory, characterize, manage and conserve JBLE-Langley's remaining forest tracts

Project 2.3. (SURVEY, UPDATE - T&E SPECIES, FY19)
Complete a comprehensive endangered and threatened species survey of birds, flora and invertebrates at JBLE-Langley. Include BBR in these survey efforts and perform a comprehensive survey for listed bats on the BBR property. Surveys of invertebrates and flora were programed but not accomplished and should be conducted during this planning cycle.

Project 2.4. (SURVEY, UPDATE - Waterbird Management Plan, FY21)
Develop a shorebird/waterbird management plan. Recent movements of sensitive shorebirds/waterbirds in the area make JBLE-Langley a prime location for new occurrences. Work with USDA and 1 FW/SE to determine where bird habitation is acceptable and allow for use in order to protect declining species with listing significance. Develop a plan to discourage use where incompatible with AF mission and BASH activities such as on aggregate building tops directly adjacent to the airfield.

Objective 3: Protect and Maintain the Installation's Natural Resources

Project 3.1. (MGT, INVASIVE SPECIES CONTROL – PHRAGMITES, PRIVET, JOHNSON GRASS, FY19-23)
Provide funds for development and implementation of an updated invasive species management plan that includes survey, monitoring, herbicide application, mowing, controlled burning and native vegetation plantings to control the invasive reed grass, privet, Johnson grass and autumn olive. The project should be programmed and implemented over consecutive years to fully remove biomass or work completed to date will not be effective. (Project costs will leveraged with grant funds if available.)

Project 3.2. (MONITOR WETLAND RECOVERY, FY21)
Design and implement post-habitat monitoring with baseline and post-clear zone drainage project to ensure all temporarily impacted wetlands recover according to design permitting requirements proposed for FY21.

Project 3.3. (MANAGEMENT PLAN, T&E BAT SPECIES, FY20)
Prepare a management plan in cooperation with USFWS and VDGIF for federally-listed bat species present on JBLE-Langley at BBR.

Project 3.4. (NUISANCE WILDLIFE MANAGEMENT, FY20-23)
Survey for nutria and assess overabundant/nuisance wildlife population levels (raccoon, coyote, and muskrat). Eradicate nutria if found and reduce native nuisance wildlife to a sustainable level. Work should focus on overabundant species which are negatively impacting species on the Virginia State Wildlife Action Plan IAW VDGIF recommendations. Develop updated information on nuisance wildlife as conditions and populations change annually.

Objective 4: Enhance and Develop the Installation's Natural Resources

Project 4.1. (STREAM RESTORATION, COASTAL ZONE MANAGEMENT, FY22-23)
Provide funds to restore channelized and degraded streams/ditches. Repairing streams to more natural conditions we will reduce erosion, meet TMDL goals and reduce the ability of the ditches particularly near the golf course to serve as flood pathways during storm events. Construct tidal wetlands, repair tidal stormwater systems, restore shoreline and plant native vegetation. These projects will protect JBLE-Langley from flooding and storm surges and provide for marsh migration in relation to local land subsidence and sea level rise. Scope of work would include, but not be limited to; stream channel restoration, flood plain stabilization or construction of living shoreline.

Project 4.2. (STREAM RESTORATION, COASTAL ZONE MANAGEMENT, FY19-21)
Repair stream function for portions of Brick Kiln Creek in order to meet TMDL reduction targets required by the Chesapeake Bay Protection Act and mandated by MS4 permits. Stream restoration will also reduce mosquito habitat, fish mortality, and may provide for recreational (fishing/walking) opportunities for installation housing residents. Stream restoration will also create wetlands which may offset wetland impacts required for mission.

Project 4.3. (UPDATE URBAN FOREST MANAGEMENT PLAN, FY22)
Update the Urban Forest Management Plan (last revised 2003). Incorporate and update inventory data from 2017 survey completed by Master Gardeners and develop recommendations for tree removal(s) and replacement(s) necessary for a sustainable urban forest. Develop tree revitalization plan (BASH and Installation Development Plan compatible), which includes a tree planting/replacement plan with recommended species and BMPs to be incorporated into tree/landscape maintenance contracts to improve tree health and survival and gain clean water credits which facilitate installation development.

Project 4.4. (WILDLAND FIRE PLAN SUPPLEMENT, FY20)
Prepare a wildland fire management plan supplement which specifically addresses JBLE-

Langley and outlines control and response actions for wildfire hazards. The supplement should also address prescribed burns to support airfield vegetative fuel reduction, control *Phragmites* and/or improve small area habitat at JBLE-Langley.

Project 4.5. (GOLF COURSE HABITAT RESTORATION, FY19-23)
Design and implement habitat restoration and improvement on identified areas of ecological sensitivity to reduce TMDL, improve water quality, resiliency and efficient landscape maintenance. Apply the *USAF Pollinator Conservation Strategy Guidelines* to create pollinator conservation habitat on selected areas of the Golf Course and other suitable landscape areas where BASH and ERP compatible.

Objective 5: Create opportunities for beneficial use and enjoyment of installation resources by installation personnel and the public.

Project 5.1. (UPDATE CONSERVATION, RECREATION AND ENFORCEMENT INSTRUCTION, FY19-23)
Update 633 ABW 32-7001 to include current policies, procedures and responsibilities for fishing, hunting and outdoor recreation use, enforcement of fish and wildlife conservation and policies relative to cultural resources on land under control of 633 MSG. Research and provide additional information to update the prohibited or restricted activities on JBLE-Langley. This includes incorporating the need for change in the turkey hunt program and bait fish/amphibian protection regulations to prevent spread of invasive species or wildlife disease. Annually assess and update the list of prohibited activities on the installation if needed in order to capture new wildlife disease and population status information.

Project 5.2. (PUBLIC AWARENESS & OUTREACH, FY19-23)
Enhance watchable wildlife programs on the Main Base and BBR. Enhance wildlife viewing areas, repair/replace aging signs on the nature trail, enhance usage of watchable wildlife locations with display signs and create partnerships with local non-profit organizations, such as the Hampton Roads Bird Club and Peninsula Naturalist Program. Provide updated information to installation personnel and visitors on allowable activities on the installation. Provide funds to print installation natural resources awareness pamphlet. (To be distributed to installation Housing residents with their move-in package, at Right-Start briefings, installation Earth Day events and similarly oriented installation activities). Develop and print a self-guided walkable tree tour guide based on the urban tree survey completed in 2017.

Project 5.3. (REPAIR NATURE TRAIL – LTA BOARDWALK AREA, FY19-23)
Repair sections of Nature Trail boardwalk and observation platforms where needed annually in response to weather destruction and plant overgrowth. Clear and remove excessive vegetative growth along the wooded trail and place mulch to keep the trail passable between maintenance events.

Objective 6: Ensure 633 CES/Environmental Natural Resources personnel are adequately trained in the principles and practices of natural resource management on AF installations.

Project 6.1. (ANNUAL TRAINING, FY19-23)

633 CES Environmental Natural Resources personnel will attend at least one DoD-sponsored natural resources training workshop, USFWS National Conservation Training Center course or a training offering by another Sikes Act partner each year. Examples include: the National Military Fish and Wildlife Association annual training workshop, the annual DoD Forestry Workshop and the DoD Conservation Workshop.

Project 6.2 (TRAINING, SPECIFIC, FY19-23)
633 CES Environmental Natural Resources personnel will attend additional job-related training as required in order to obtain mission essential skills required to manage specific natural resources present on JBLE-Langley. Examples include wetland delineation training, bird banding training, boat operator training, etc.

Project 6.3. (TRAINING, CONSERVATION LAW ENFORCEMENT, FY21)
Provide Federal Land Management Police Training (79 day course) for a Security Forces Partner or NRM from the Federal Law Enforcement Training Center in Glynco, Georgia. Fund only if JBLE-Langley chooses to keep the land around BBR under Federal Exclusive Legislative Jurisdiction and Law Enforcement Authority. Training will facilitate enforcement of installation NR policies and prevent trespassing and unauthorized use of land under JBLE-Langley control.

9.0 INRMP IMPLEMENTATION, UPDATE, AND REVISION PROCESS

9.1 INRMP Implementation

9.1.1. Implementation. The 633 ABW Commander has the overall responsibility for the implementation of this INRMP, however, all JBLE-Langley organizations, including tenant commands, must support the implementation of this INRMP's goals and objectives (AFI 32-7064). The 633 Environmental NRM shall conduct an annual review of the INRMP in coordination with the USFWS, NOAA Fisheries and the VDGIF.

9.1.2 Natural Resources Management Staffing. Minimal staffing for implementation of the JBLE-Langley Natural Resources Management Program requires at least one permanent natural resources staff member who is qualified in the GS-0400 Biological Sciences Job Series.

Currently JBLE-Langley does not have conservation law enforcement capability through 633 SFS or employment of a credentialed conservation law enforcement officer. Conservation law enforcement can be conducted by Sikes Act partners through interagency agreement and will be supported by 633 SFS as needed. This capability could be enhanced through professional training in conservation law enforcement of either Natural Resources or 633 SFS personnel.

9.1.3 Monitoring INRMP Implementation. At the end of the annual review process, the Chief, Environmental Element or the NRM submits a report to the Commander, 633 ABW (or Commander, Civil Engineer Squadron when so delegated) articulating the outcome of the review which includes insight on the following areas:

1. All "must fund" projects have been budgeted for and implementation are on schedule.
2. All required trained natural resources positions are filled or are in the process of being filled.
3. Projects and activities for the upcoming year have been identified and are included in the INRMP.
4. All required coordination with the USFWS, NOAA and VDGIF have occurred.
5. Any significant changes in the installation's mission requirements or its natural resources have been identified.
6. Any significant issues related to natural resources management or losses of natural resources that have been identified.
7. Accomplishment of natural resource-related projects.

9.2 Annual INRMP Review and Coordination Requirements. The NRM shall conduct an annual review of the INRMP in coordination with the USFWS, NOAA Fisheries and the VDGIF. Unfinished work from the past year's workplan will be evaluated for inclusion in the current, or future year's workplan.

9.3 INRMP Update and Revision Process. The annual review process will be performed 1-30 September by the Chief Environmental Element or the NRM. The INRMP manager will notify key installation staff and tenants requesting their annual review be completed by 25 September. Following this review, the INRMP manager will review comments and coordinate changes if needed. The objective is to complete this by 30 September. Following this, notifications to USFWS, NOAA and VDGIF will be performed to solicit their input.

Interim updates or revisions to the INRMP may be required at an interval of less than (less than five years) in cases such as:

A. Changes in military mission that affect natural resources have occurred or are anticipated.
B. New environmental compliance requirements are present.
C. Other changes affecting implementation of the INRMP.
D. Identification of federally-listed plant or animal species (identified as threatened or endangered IAW the ESA) on JBLE-Langley controlled land.

Two federally-listed bat species were preliminarily detected in September 2018, utilizing habitat around BBR via acoustic analysis. These species, the Northern long-eared bat and the Indiana bat (*Myostis sodialis*) are federally threatened and federally endangered respectively. Both the USFWS and the VDGIF were notified of this preliminary discovery. Both agencies agreed to delay the requirement for an INRMP revision and associated NEPA analysis until more information could be collected regarding habitat utilization and species presence during various times of the year (summer breeding vs. winter roosting). This information is vital to the development of an effective wildlife management plan for these species. The timeline for development of a wildlife management plan proposed by JBLE-Langley and accepted by these agencies is 2020. NEPA analysis and revision of the INRMP will follow and should be completed by 2021.

10.0 ANNUAL WORK PLANS

Programmed Year	Project	Priority Level	Funding Source
FY19	Project 2.1. SURVEY, UPDATE - WETLAND CHARACTERIZATION	high	CES Project # MUHJ180032
FY19	Project 2.2. MGT, HABITAT, FOREST	medium	EQ Project # MUHJ190878
FY19	Project 2.3. SURVEY, UPDATE - T&E SPECIES	medium	EQ Project # MUHJ190891
FY19	Project 1.1.b. MGT, HABITAT - BIRD EXCLUSIONARY DEVICES SYSTEMS	low	In-House
FY19-21	Project 4.2. STREAM RESTORATION, COASTAL ZONE MANAGEMENT	medium	FY19 EQ Project # MUHJ190850
FY19-23	Project 6.1. ANNUAL TRAINING	medium	EQ Training Funds
FY19-23	Project 6.2 TRAINING, SPECIFIC	low	EQ Training Funds
FY19-23	Project 3.1. MANAGEMENT, INVASIVE SPECIES CONTROL UPDATE INVASIVE SPECIES MANAGEMENT PLAN	medium	FY19-23 EQ Funds Project #s MUHJ190877, MUHJ200877, MUHJ210877, MUHJ220877, MUHJ230877
FY19-23	Project 4.5. GOLF COURSE HABITAT RESTORATION	low	In-House
FY19-23	Project 5.1. UPDATE CONSERVATION, RECREATION AND ENFORCEMENT INSTRUCTION	medium	In-House
FY19-23	Project 5.3. REPAIR NATURE TRAIL – LTA BOARDWALK AREA	low	In-House
FY19-23	Project 5.2. PUBLIC AWARENESS & OUTREACH	low	EQ Training Funds

Programmed Year	Project	Priority Level	Funding Source
FY19-23	1.1.a. MGT, HABITAT - BIRD EXCLUSIONARY DEVICES SYSTEMS	medium	In-House
FY20	Project 3.3. MANAGEMENT PLAN, T&E BAT SPECIES	high	EQ Funds
FY20	Project 4.4. PLAN UPDATE - WILDLAND FIRE PLAN SUPPLEMENT	low	In-House
FY20-23	Project 3.4. NUISANCE WILDLIFE MANAGEMENT	high	EQ Funds
FY21	Project 2.4. SURVEY, UPDATE - WATERBIRD MANAGEMENT PLAN	medium	In-House
FY21	Project 3.2. MONITOR WETLAND RECOVERY	high	In-House
FY21	Project 6.3. TRAINING, CONSERVATION LAW ENFORCEMENT	low	EQ Training Funds
FY22	Project 4.3. UPDATE URBAN FOREST MANAGEMENT PLAN	medium	EQ Funds
FY 22	Project 3.1. UPDATE INVASIVE SPECIES MANAGEMENT PLAN	medium	EQ Funds
FY22	Project 1.2. MGT, HABITAT – AIRFIELD TURF REPAIR AND MAINTENANCE	low	332 from 1 FW with funds committed
FY22-23	Project 4.1. STREAM RESTORATION, COASTAL ZONE MANAGEMENT	low	EQ Funds
FY23	Project 1.3. MGT, HABITAT – AIRFIELD GRASS HEIGHT	low	Grant Funds

11.0 ABBREVIATIONS AND ACRONYMS

° F	Degrees Fahrenheit
1 FW	1st Fighter Wing
1 FW/SE	1st Fighter Wing Safety Office
1 OG	1st Operations Group
1 OSS/OSAA	1st Operations Support Squadron/Airfield Management Flight
1 OSS/OSW	1st Operations Support Squadron/Meteorology Flight
633 ABW	633d Air Base Wing
633 ABW/CC	633d Air Base Wing Commander
633 ABW/CV	633d Air Base Wing Vice Commander
633 ABW/JA	633d Air Base Wing Judge Advocate
633 ABW/PA	633d Air Base Wing Public Affairs
633 AMDS	633d Aerospace Medicine Squadron
633 CES	633d Civil Engineer Squadron
633 CES/CC	633d Civil Engineer Squadron Commander
633 CES/CEIE	633d Civil Engineer Squadron/Installation Management Environmental
633 CES/CEO	633d Civil Engineer Squadron/Operations Flight
633 CES/CEOIE	633d Civil Engineer Squadron/Operations Flight Entomology
633 CES/CEN	633d Civil Engineer Squadron/Engineer Flight
633 FSS	633d Force Support Squadron
633 FSS/FSC	633d Force Support Squadron/Services
633 MDG	633d Medical Group
633 MSG	633d Mission Support Group
633 MSG/CC	633d Mission Support Group Commander
633 SFS	633d Security Forces Squadron
733 LRS	733d Logistics Readiness Squadron
ACC	Air Combat Command
ACES	Air Force Civil Engineer System
ADP	Area Development Plan
A/E	Architect / Engineer
AF	Air Force
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	Aqueous Film Forming Foam
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AFR	Air Force Regulation
AICUZ	Air Installation Compatible Use Zone
ANG	Air National Guard
ANSI	American National Standards Institute

AOA	Active Operations Area
ASMFC	Atlantic States Marine Fisheries Commission
BASH	Bird/Wildlife Aircraft Strike Hazard
BBR	Big Bethel Reservoir
BCE	Base Civil Engineer
Bd	Batradrochytrium dendrobatidis
BGS	Below Ground Surface
BMP	Best Management Practices
BRAC	Base Realignment and Closure
BWC	Bird Watch Conditions
CBIC	Chesapeake Bay Impact Crater
CBP	Chesapeake Bay Program
CBPO	Chesapeake Bay Program Office
CE	Civil Engineer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon monoxide
CRMP	Coastal Resources Management Program
CWA	Clean Water Act
CWD	Chronic Wasting Disease
CZMA	Coastal Zone Management Act
DoD	Department of Defense
DoDI	Department of Defense Instruction
DoI	Department of Interior
EA	Environmental Assessment
EAP	Emergency Action Plan
EFH	Essential Fish Habitat
EIAP	Environmental Impact Analysis Process
EO	Executive Order
EOD	Explosive Ordnance Disposal
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESOHC	Environment, Safety and Occupational Health Council
FAA	Federal Aviation Administration
FAMCAMP	Family Campground
FARM	Fisheries and Aquatic Resources Management
FCD	Federal Consistency Determination
FEMA	Federal Emergency Management Agency
FONPA	Finding of No Practicable Alternative
FONSI	Finding of No Significant Impact
FR	Federal Register

FT	Feet
FY	Fiscal Year
GIO	GeoBase Integration Office
GIS	Geographic Information System
GPM	Gallons per Minute
HAP	Hazardous Air Pollutants
HD	Hemorrhagic Disease
HQ TAC	Headquarters Tactical Air Command
HRAQR	Hampton Roads Air Quality Region
HRCC	Hampton Roads Conservation Corridor
HRCCS	Hampton Roads Conservation Corridor Study
HRSD	Hampton Roads Sanitation District
HTA	Heavier-than-Air
IAW	In Accordance With
ICRMP	Integrated Cultural Resources Management Plan
IDNR	Illinois Department of Natural Resources
INRMP	Integrated Natural Resources Management Plan
IPaC	Information, Planning and Consultation System
IPM	Integrated Pest Management
IPMC	Integrated Pest Management Coordinator
IPMP	Integrated Pest Management Plan
IRP	Installation Restoration Program
ISIMP	Invasive Species Inventory and Management Plan
JBLE	Joint Base Langley Eustis
JLUS	Joint Land Use Study
KM	Kilometers
LaRC	Langley Research Center
LID	Low Impact Development
LTA	Lighter-than-Air
LTM	Long-term Management
LUC	Land Use Control
MBTA	Migratory Bird Treaty Act
MGT	Management
MMRP	Military Munitions Response Program
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
MSA	Munitions Storage Area
MSL	Mean Sea Level
MST	Major Source Threshold
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration

NCDC	National Climatic Data Center
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NI	Natural Infrastructure
NLEB	Northern Long-Eared Bat
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NR	Natural Resources
NRCS	Natural Resources Conservation Service
NRM	Natural Resources Manager
NWR	National Wildlife Refuge
ODU	Old Dominion University
O_3	Ozone
Pb	Lead
PFAS	Polyfluorinated Alkyl Substances
PL	Public Law
PM	Particulate Matter
POC	Particulates of Concern
POL	Petroleum, Oil and Lubricants
PTO	Permit to Operate
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RMA	Resource Management Associates
RPM	Restoration Program Manager
SAIA	Sikes Act Improvement Amendment
SARA	Superfund Amendments and Reauthorization Act
SAV	Submerged Aquatic Vegetation
SC	Site Closure
SFD	Snake Fungal Disease
SGCN	Species of Greatest Conservation Need
SI	Site Inspection
SO_2	Sulfur Dioxide
SO_x	Sulfur oxides
SOC	Species of Concern
SOP	Standard Operating Procedure
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered Species

TAC	Tactical Air Command
TCI	Terwilliger Consulting, Inc.
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TSS	Total Suspended Solids
US	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USC	United States Code
USDA	United States Department of Agriculture
USDA/APHIS/WS	United States Department of Agriculture/Animal Plant Health Inspection Service/Wildlife Services
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VAFWIS	Virginia Fish and Wildlife Information Services
VARTF	Virginia Aquatic Resources Trust Fund
VDACS	Virginia Department of Agriculture and Consumer Services
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VDNH	Virginia Division of Natural Heritage
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VOCs	Volatile Organic Compounds
VPDES	Virginia Pollutant Discharge Elimination System
VSCO	Virginia State Climatology Office

12.0 APPENDICES

Appendix A. Regulatory Framework

Appendix A1. Regulatory framework (Sikes Act, AFI, etc.)

Appendix A2. Annual INRMP Reviews

Appendix B. NEPA Environmental Analysis, Consultations and Coordination with Regulatory Agencies

Appendix C. Flora and Fauna on or Potentially Occurring on JBLE-Langley

Appendix D. Cited Publications

Appendix E. Other Resources Cited

Appendix F. Persons Contacted

APPENDIX A. REGULATORY FRAMEWORK

Appendix A1. Regulatory framework (Sikes Act, AFI, etc.)
Appendix A2. Annual INRMP Reviews

APPENDIX B. NEPA ENVIRONMENTAL ANALYSIS, CONSULTATIONS AND COORDINATION WITH REGULATORY AGENCIES

APPENDIX C. FLORA AND FAUNA ON OR POTENTIALLY OCCURRING ON JBLE-LANGLEY

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APPENDIX F. PERSONS CONTACTED

Name	Position
Brenda Cook	Deputy Base Civil Engineer
Carmichael "Mike" Patton	Chief, Environmental Element, 633 CES/CEIE
Dave Jennings	Air/Toxics/Cultural Resources/NEPA
Ken Dunn	Hazardous Waste/EMS Coordinator
Dawn Christian	Water Program Manager
Alicia Garcia	Natural Resources Program Manager
Sherry Johnson	Pollution Prevention
Jay Carr	Wildlife Biologist
Joseph Gentry	Wildlife Biologist
Adam Priestly	Wildlife Biologist
James Watson	Integrated Pest Management Chief
Nicole Woodward	Environmental Scientist - Project Manager
Amy Ewing	Environmental Services Biologist – JBLE-Langley INRMP POC
Troy Anderson	USFWS Temp POC for INRMP update
Brian Hopper	Protected Resources Division
David O'Brien	Essential Fish Habitat Consults
John Wilson	AFCEC Installation Support
John Tice	Environmental Restoration Program Manager
Chris Boes	Environmental Restoration Program
Alicia Nelson	VMRC Endangered Species Staff
Adam Kenyan	Fisheries Temp POC
Sandi Swanton	Base Legal
Joann Whitson	AFCEC ISS Chief
SMSgt Eloris Jordan	Airfield Operations Chief
Aaron Woods	Airfield Operations
TSgt Aaron Woods	Airfield Operations
Todd Englemeyer	VDGIF
Ruth Boettcher	VDGIF
Rick Reynolds	VDGIF
Bryan Watts	Center for Conservation Biology
Michael Ryan	RCM
Jim Peterson	Program Aide from Texas A&M Natural Resources Institute
Kenyatta Spruill	USACE - Savannah District
Laura McKay	VDCR Coastal Resources Program
TSgt April Iloba	USAF Weather Craftsman

13.0 ASSOCIATED AND COMPONENT PLANS

Tab 1- IPMP (with approved list of pesticides) (2016)
Tab 2- BASH Plan (2017)
Tab 3-Wildland Fire Management Plan (2017)
Tab 4- Integrated Cultural Resources Management Plan (2015)
Tab 5- Installation Development Plan (2017)
Tab 6- Forest/Urban Tree Plan
Tab 7- Chesapeake Bay Act, Coastal Zone Management Act consistency/MOA, etc.
Tab 8- Hazardous Waste Management Plan and ERP Long-term Monitoring Plan 2018
Tab 9- Integrated Solid Waste Management Plan
Tab 10- Stormwater Pollution Prevention Plan
Tab 11- Stormwater Management Plan
Tab 12- Spill Prevention, Control and Countermeasures Plan (SPCC)
Tab 13- JBLE-Langley Installation Emergency Management Plan
Tab 14- Golf Course Management Plan/Contract/Grounds Maintenance Contract
Tab 15- Main Base ISIMP (2009)

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