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**Ecological Communities and
Wetland Resources Report**

Ecological Communities and Wetland Resources Report

**A Technical Report in Support of
the Environmental Impact Statement
for the Disposal and Reuse of
Naval Air Station Brunswick
Brunswick, Maine**

December 2008

Prepared for:

**U.S. Department of Navy
BRAC Project Management Office, Northeast
Philadelphia, Pennsylvania**

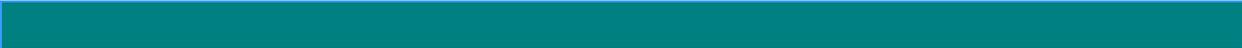
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List of Abbreviations and Acronyms

AMSL	above mean sea level
BASH	Bird Aircraft Strike Hazard
BRAC	Base Closure and Realignment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
GPS	Global Positioning System
INRMP	Integrated Natural Resources Management Plan
LRA	local redevelopment agency
MEDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MNAP	Maine Natural Areas Program
MNRPA	Maine Natural Resources Protection Act
NAS	Naval Air Station
NLCD	National Land Cover Data
NOAA	National Oceanic and Atmospheric Administration
NWI	National Wetland Inventory
ppt	parts per thousand
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

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Introduction

Originally commissioned in 1943, Naval Air Station (NAS) Brunswick has supported aircraft operations and other missions for more than 60 years. Located approximately 27 miles northeast of Portland and 31 miles south of Augusta, the installation occupies approximately 3,117 acres in the town of Brunswick, Cumberland County, Maine. In addition, several noncontiguous areas (outlying properties) are managed by NAS Brunswick, including sites in Brunswick, Topsham, and Phippsburg (Sagadahoc County) (see Figure 1-1).

In 2005, the Base Closure and Realignment (BRAC) Commission recommended closure of NAS Brunswick. By law, the base must be closed by September 15, 2011. Excess properties associated with NAS Brunswick that will be closed as part of the BRAC action include the Topsham Annex, McKeen Street Housing Annex, East Brunswick Radio Transmitter Site, and the Small Point and Sabino Hill Rake Stations. The Topsham Annex and Small Point Rake Station are not included in this report.

The Navy intends to dispose of NAS Brunswick and its excess properties based on the recommendations of the BRAC Commission. As part of the disposal process, a local redevelopment agency (LRA) has been established to develop and implement a reuse plan for the NAS Brunswick property. The Navy is currently in the process of preparing an Environmental Impact Statement (EIS) to evaluate the disposal and reuse of NAS Brunswick.

The following ecological communities and wetlands report has been developed to support the EIS. Field reconnaissance surveys were conducted at NAS Brunswick and the outlying properties in July 2008. Section 2 describes the methods used to evaluate the ecological communities, wetlands, and aquatic communities found at NAS Brunswick and provides a summary of the existing data for the ecological communities, including wetlands and aquatic communities. Section 3 describes the current conditions of the ecological communities identified on NAS Brunswick and its outlying properties based a reconnaissance field visit. In addition, this section includes a discussion of threatened and endangered species found or potentially occurring on the properties. Section 4 describes the wetlands and aquatic communities identified during the reconnaissance field visit.

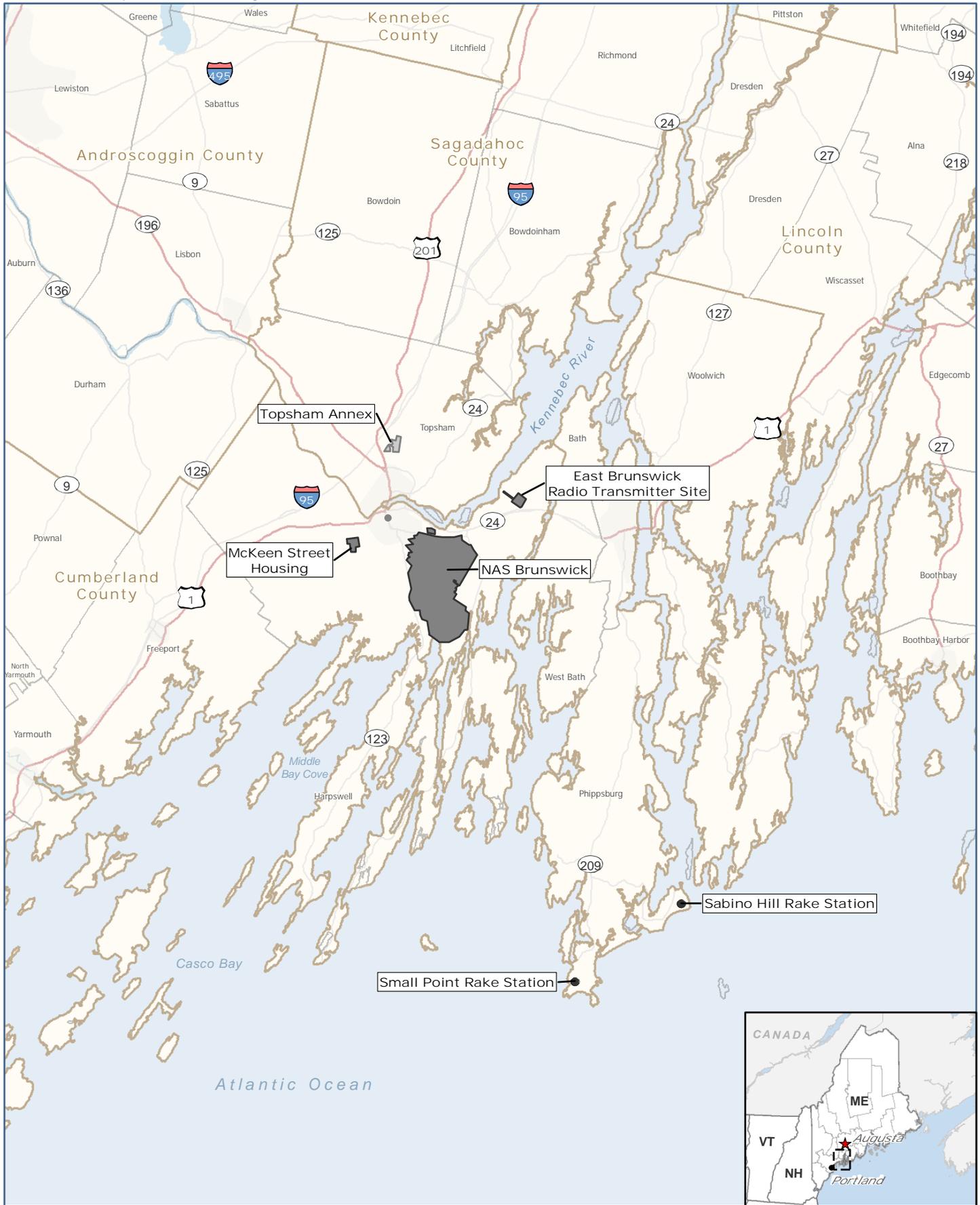


Figure 1-1
 Location Map
 NAS Brunswick, Maine

- NAS Brunswick
- Topsham Annex
- Municipal Boundary
- County Boundary



2

Methods

Field reconnaissance surveys of the natural communities at NAS Brunswick were conducted by Ecology and Environment, Inc. (E & E) in July 2008. The objectives of the field surveys included the following:

- Field-verify data presented in previous environmental studies of the base, including the locations of wetlands, previously delineated wetland boundaries, and previously identified significant vernal pools;
- Map the ecological communities present at NAS Brunswick, the McKeen Street Housing Annex, the East Brunswick Radio Transmitter Site, and the Sabino Hill Rake Station;
- Identify and map the locations of clothed sedge (*Carex vestita*), which is state-listed as endangered and known to occur at NAS Brunswick; and
- Identify any other threatened or endangered species, species of special concern, rare communities, and critical wildlife habitat.

The following section describes the methods used to conduct a desktop study and the field surveys.

2.1 Previous Studies

Prior to conducting the field surveys, existing NAS Brunswick studies, plans, and environmental documents were reviewed to obtain information on natural resources at NAS Brunswick, including wetlands.

Integrated Natural Resources Management Plan

An Integrated Natural Resources Management Plan (INRMP) must be prepared at each military installation to establish baseline conditions of the natural resources located on the installation and to facilitate a natural resources management program, as required by the Sikes Act Improvement Act (16 USC 670). An INRMP was completed for NAS Brunswick in 2001. The INRMP is reviewed annually and updated every 5 years as appropriate (Geo-Marine 2001). The most recent review and update of the INRMP for NAS Brunswick occurred in 2007.

The INRMP for NAS Brunswick includes a general inventory of the existing flora and fauna found on the property. For the purposes of the INRMP, limited surveys were conducted to determine the species inhabiting the installation. With a few exceptions, species documented as occurring at NAS Brunswick are typical of southern coastal Maine. No federally listed threatened or endangered species have been documented at the installation according to the INRMP; however, five species identified on the installation are considered threatened, endangered, or rare by the state of Maine. Two species (the grasshopper sparrow [*Ammodramus savannarum*] and the clothed sedge [*Carex vestita*]) are listed as endangered; one species (the upland sandpiper [*Bartramia longicauda*]) is listed as threatened; and two species (the vesper sparrow [*Pooecetes gramineus*] and horned lark [*Eremophila alpestris*]) are listed as rare but not afforded protection under Maine's endangered species regulations. All of these species are found within the grassland habitat adjacent to the airfield. These species are discussed further in Section 3.3.

The INRMP also describes the ecological communities of NAS Brunswick. The ecological communities were classified based on the *Natural Landscapes of Maine: A Classification of Ecosystems and Natural Communities* (Gawler and Cutko 1991)¹. The INRMP identifies seven terrestrial (uplands), six palustrine (wetlands), and four estuarine (tidal rivers and associated habitats) communities at NAS Brunswick.

The INRMP identifies the following ecological communities at NAS Brunswick and its outlying properties:

- Pine-Hemlock/Spruce Forest*
- Hemlock Slope
- Mixed Hardwood-Conifer Forest*
- Oak-Pine Woodland
- Tall Meadow*
- Pitch Pine-Heath Barren
- Sandplain Grassland*
- Red Maple Swamp*
- Beaver Flowage*
- Shrub Swamp*
- Cattail Marsh*
- Sedge Meadow*
- Graminoid Swale*

¹ After completion of the initial INRMP, a new edition of *Natural Landscapes of Maine* was published in 2004. In the new edition, many of the communities identified in the INRMP have been renamed, and additional communities have been described, some of which are found at NAS Brunswick and the outlying properties. The 2004 edition was used to classify the ecological communities presented in Sections 3 and 4 of this report.

- Cordgrass Saltmarsh*
- Salthay Saltmarsh*
- Subtidal Estuary*
- Brackish tidal Marsh

* Denotes a community that has been renamed or is no longer listed as an ecological community in the recent edition of *Natural Landscapes of Maine*.

The INRMP contains a map of representative locations containing each of these ecological communities; however, this map presents only points; it does not present the full extent or boundaries of the communities. The INRMP identifies the Pitch Pine Heath Barren and the Sandplain Grassland communities, both of which are considered rare and critically imperiled in the state of Maine. The remaining communities are common for the region, with Mixed Hardwood-Conifer Forests the most common community occurring on the installation.

Wetland Planning-Level Survey

Normandeau Associates (1998a) conducted a wetland inventory of NAS Brunswick in 1998 for planning purposes. The inventory was conducted through aerial photo-interpretation and review of existing soils and wetlands data. An on-site reconnaissance was conducted to confirm the approximate locations of wetland boundaries and to identify the community based on the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). This wetland community classification system is used widely throughout the United States for the purposes of inventory, evaluation, and management of wetlands. Under this system, wetlands are classified based on hydrology, soils, and plant communities.

The wetland inventory resulted in the mapping of approximately 443 acres of wetlands at NAS Brunswick (see Figure 2-1). Of the 443 acres, approximately 116 acres of estuarine wetland were mapped, most of which are located around Harpswell Cove and Buttermilk Cove. The remaining 327 acres of wetland were classified as palustrine or freshwater wetlands. Under the Cowardin (1979) classification, the palustrine wetlands occurring at NAS Brunswick are emergent (PEM), scrub-shrub (PSS) and forested (PFO). Freshwater ponds are also included and are classified as PUB.

Past Wetland Delineations

Formal wetland delineation surveys were conducted at NAS Brunswick in the recent past. Wetland boundaries were mapped in the field using the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) on portions of NAS Brunswick (see Figure 2-2). These field wetland surveys were conducted in support of planning and permitting for a variety of projects; however, formal wetland delineations have not been completed for the entire NAS Brunswick property or its outlying properties. Based on review of wetland delineation reports and associated mapping, approximately 80 acres of wetlands have been delineated at NAS Brunswick. Most of the delineations were conducted more than 5 years ago. In the state of Maine, only delineations that have been conducted with-

in 5 years are accepted by the Maine Department of Environmental Protection (MEDEP) and U.S. Army Corps of Engineers (USACE) for regulatory purposes.

Vernal Pool Studies

Vernal pools are typically wetland habitats utilized by specific species of amphibians as breeding habitat and by some invertebrates as habitat. Vernal pool surveys have not been completed for the entire NAS Brunswick property or the outlying properties. In the spring of 2008, a survey of pools in the western portion of the installation was conducted on behalf of Bowdoin College (TRC 2008). The objective of the surveys was to determine which pools were functioning as breeding areas for vernal pool-dependent species. The surveys resulted in the identification of 27 vernal pools (see Figure 2-3). Of the 27 identified vernal pools, eight contained a large number of egg masses and qualified as “significant vernal pools” as defined by the MEDEP. This study has not been reviewed by the Maine Department of Inland Fisheries and Wildlife (MDIFW) (TRC 2008). Vernal pools may be present on portions of the installation not covered by these surveys. A more detailed discussion of vernal pools is provided in Section 4.2.

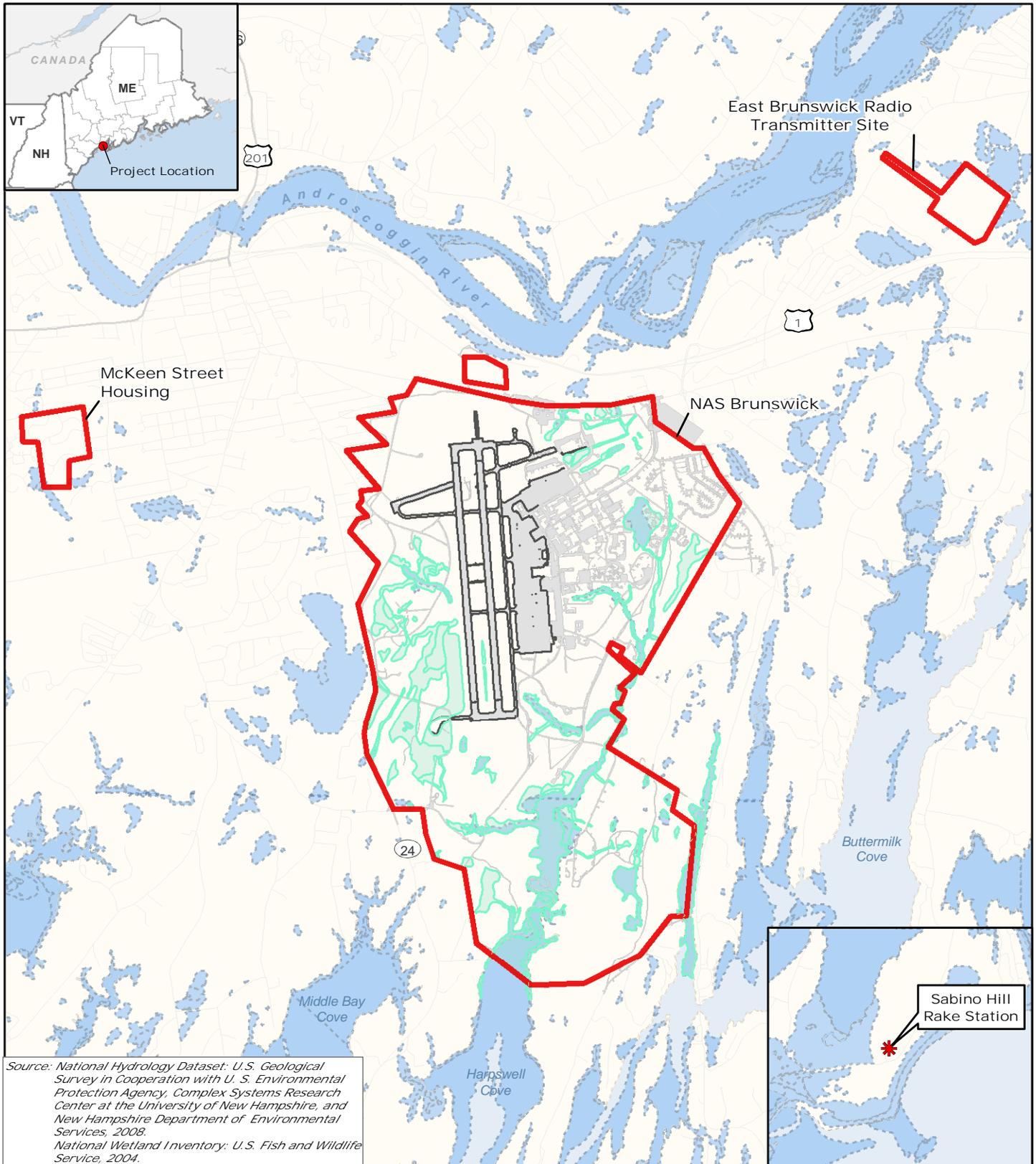
2.2 Desktop Study

The desktop study included not only the review of existing natural resource information for NAS Brunswick and its outlying properties, but also published natural resource data for the sites. The desktop analysis included a review of U.S. Geological Survey (USGS) topographic maps, USGS National Land Cover Data (NLCD), USGS National Hydrography Dataset, National Wetland Inventory (NWI) maps, and the most current aerial photographs available (MRA 2008).

To supplement the wetland maps and remote-sensing data, the results of a medium-intensity soil survey performed by Normandeau Associates (1998b) were reviewed to further assess the extent of potential wetlands on NAS Brunswick. The Cumberland County (USDA 1974) and Androscoggin and Sagadahoc County Soil Surveys (USDA 1970) were reviewed to determine the potential presence of wetlands at the outlying properties. USGS topographic maps (Brunswick and Orrs Island quadrangles) and the USGS National Hydrography Dataset were reviewed to identify surface water bodies at NAS Brunswick and its outlying properties.

2.2.1 Results of the Desktop Study

Current aerial photographs and the NLCD indicate that the majority of NAS Brunswick is forested, with a large percentage of open and developed land present in the central and northeastern portions of the property (see Figure 2-4). Open water and large wetland systems are evident throughout the southern, eastern, and western portions of the property. The aerial photos and NLCD indicate that the East Brunswick Transmitter Site is mainly open land and the McKeen Street Housing Annex is developed land. The Sabino Hill Rake Station is mainly forested and developed land.



Source: National Hydrology Dataset: U.S. Geological Survey in Cooperation with U. S. Environmental Protection Agency, Complex Systems Research Center at the University of New Hampshire, and New Hampshire Department of Environmental Services, 2008.
National Wetland Inventory: U.S. Fish and Wildlife Service, 2004.

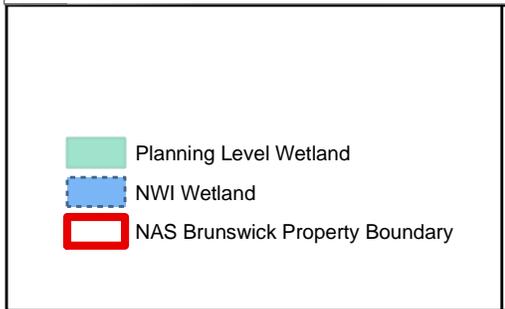
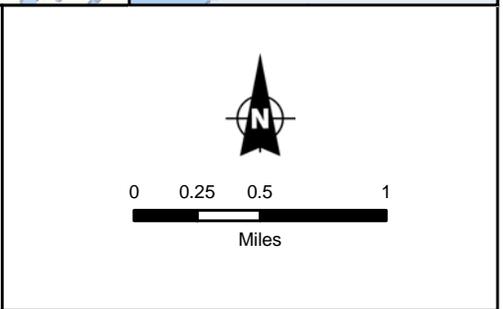
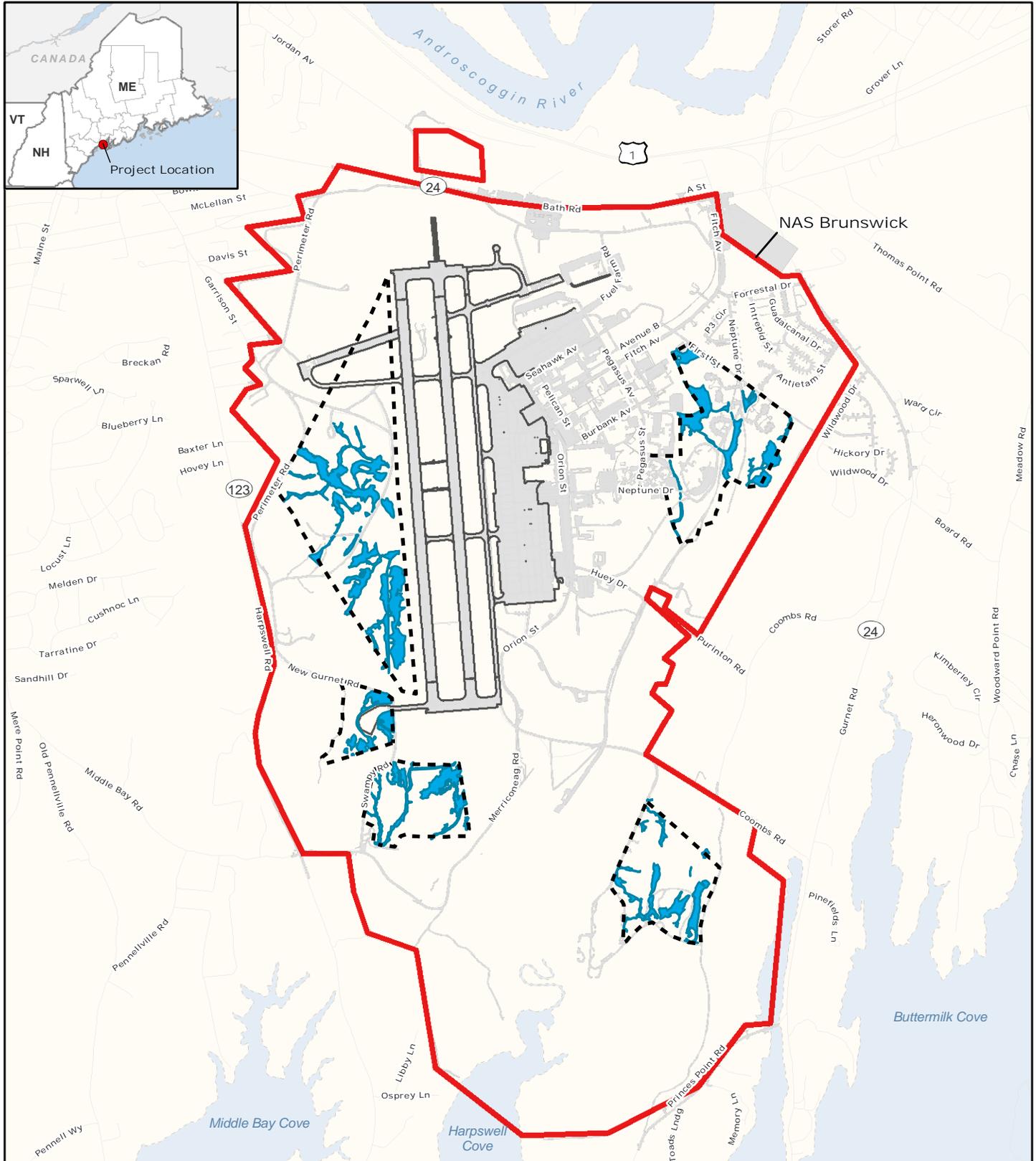


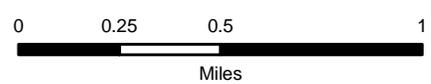
Figure 2-1
Planning Level and NWI
Wetlands of NAS Brunswick
Brunswick, Maine

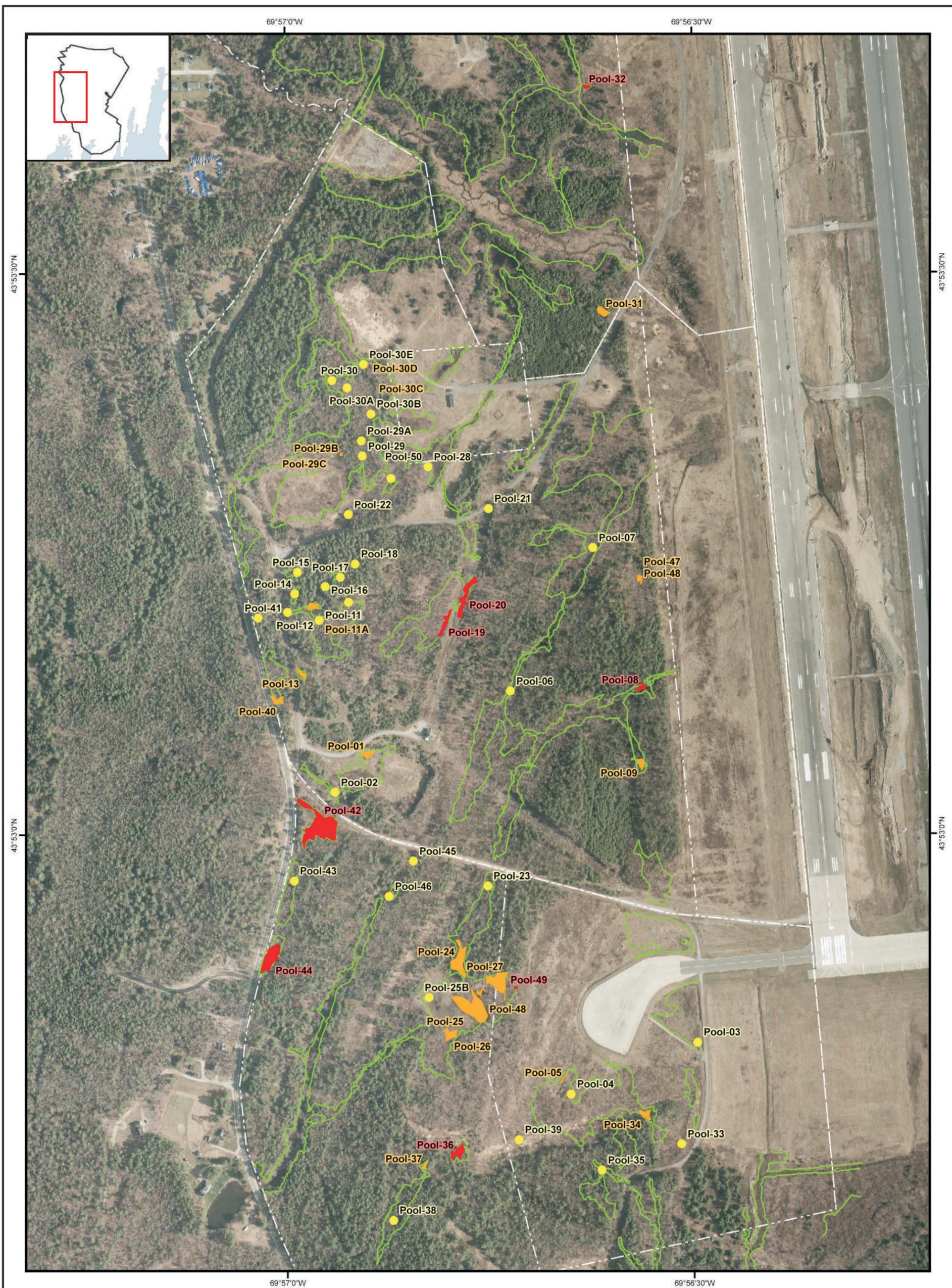




- Survey Boundary
- Field-Delineated Wetland
- NAS Brunswick Property Boundary

**Figure 2-2
 Wetland Delineations
 at NAS Brunswick
 Brunswick, Maine**



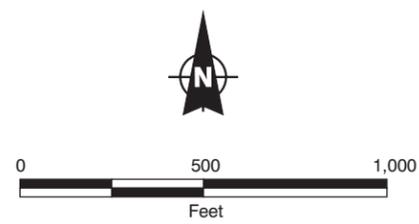


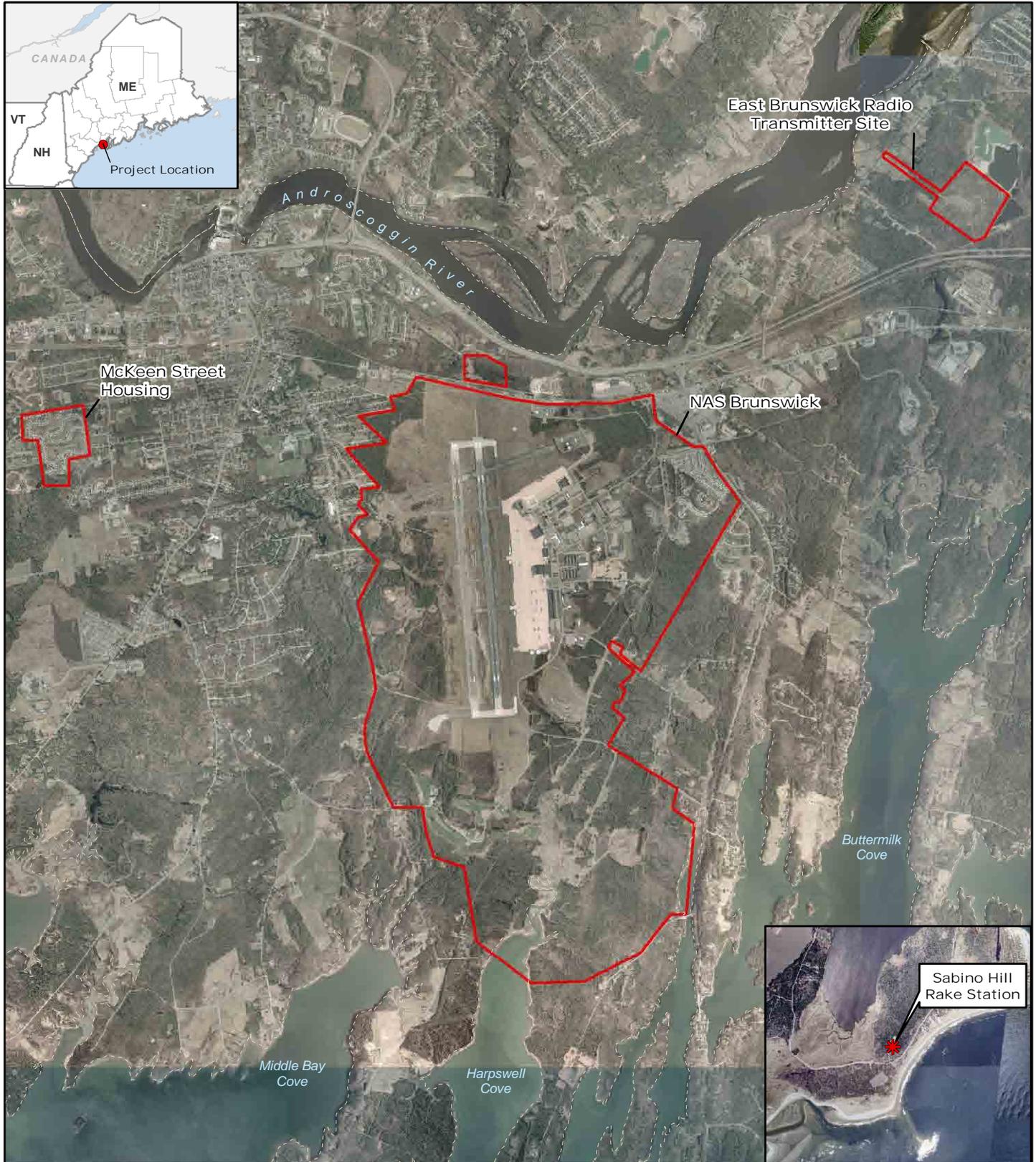
LEGEND

- Pools Surveyed
- Vernal Pools
- Significant Vernal Pools
- Wetland Boundaries
- NAS Brunswick Project Boundary

Figure 2-3
Pooled Areas Mapped by TRC
at NAS Brunswick,
Brunswick, Maine

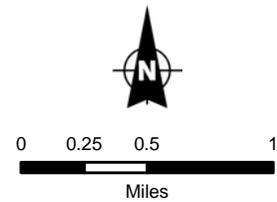
Source: TRC, 2008





 NAS Brunswick Property Boundary

Figure 2-4
Aerial Photograph of
NAS Brunswick
Brunswick, Maine



Source: Maine Library of Geographic Information (MLGI),
U.S. Geological Survey (USGS), Maine Office of
Geographic Information Systems (MEGIS), 2006.

The presence of wetlands and streams at NAS Brunswick is evident based on review of USGS topographic maps and NWI maps. According to the NWI maps, 221.91 acres of wetlands are present at NAS Brunswick (see Figure 2-1). No wetlands or streams were identified on the topographic or NWI maps for the outlying properties; however, two NWI-mapped wetlands are located within the southwestern boundary of the McKeen Street Housing Annex.

The medium-intensity soil survey conducted on NAS Brunswick identified poorly drained soils and soils with the potential for hydric inclusions throughout NAS Brunswick (see Figure 2-5) and the outlying properties (see Figure 2-6). A comparison of the wetland maps with the Cumberland, Androscoggin, and Sagadahoc County soils maps indicates a general correlation between the locations of poorly drained soils or soils with the potential for hydric inclusions and the mapped wetlands and streams.

The USGS topographic map, Brunswick Quadrangle, identified three named waterways at NAS Brunswick: Mere Brook, Harpswell Cove, and Buttermilk Cove. No streams were identified at the McKeen Street Housing Annex or East Brunswick Radio Transmitter Site. The USGS National Hydrography Dataset indicates there are many small streams and bays within the boundaries of NAS Brunswick proper and no waterways at the outlying properties (see Figure 2-7). The Orrs Island Quadrangle did not show any waterways at the Sabino Hill Rake Station.

2.3 Field Verification of Existing Information and Data Collection

Based on the results of the desktop analysis and review of existing studies, specific areas at NAS Brunswick and its outlying properties were identified and targeted for further assessment in the field. On July 21-24, 2008, field reconnaissance surveys of NAS Brunswick and its outlying properties were conducted. The methodology and results of the reconnaissance surveys are discussed below.

Wetlands

The field surveys consisted of walking each of the properties to confirm the approximate locations and extents of mapped wetlands and potential wetland areas identified based on aerial photo-interpretation and hydric soils information. Previously identified wetlands and vernal pools were located using a Global Positioning System (GPS) unit with sub-meter accuracy. The locations of wetlands and many of the previously mapped boundaries were verified in the field based on a visual assessment of dominant vegetation types, topography, and evidence of hydrologic conditions such as inundation, water-stained leaves, buttressed roots, and drainage patterns. The type of wetland community was also documented in the field.

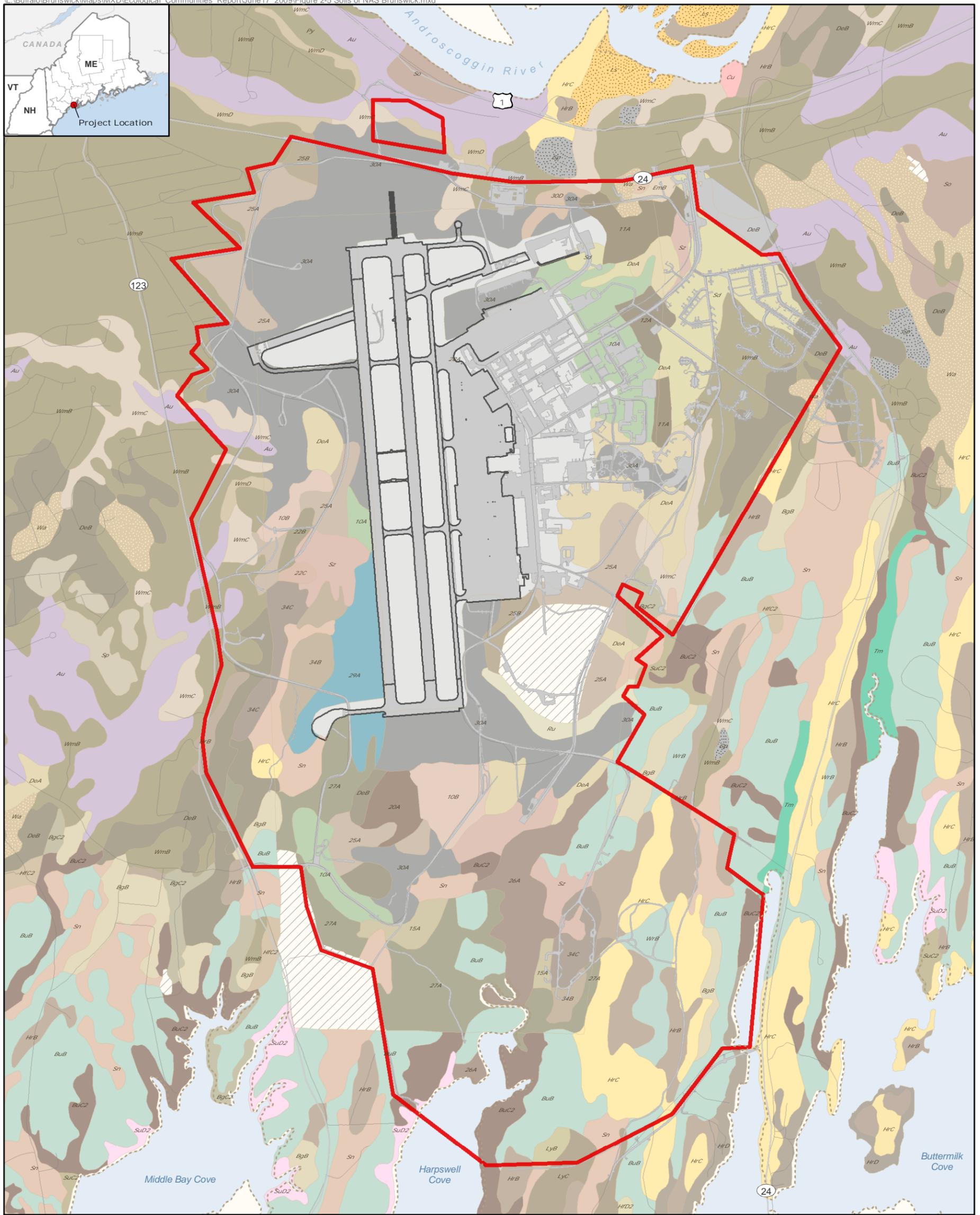
Previously delineated wetland boundaries were located and checked for accuracy by walking the boundary and observing indicators of wetlands (i.e., hydrology, soils, and vegetation). As previously mentioned, the USACE and MEDEP accept delineated wetland boundaries for a maximum of 5 years. This is because

changes in land use, land cover, and certain nearby disturbances can affect the hydrology of an area and cause a wetland to expand or recede. Some points were taken with the GPS unit to determine whether the previously mapped wetland boundaries were accurate. The results of these field surveys are presented in Section 4 and depicted on Figure 2-8.

Ecological Communities

An objective of the field surveys was to verify the existence of the ecological communities identified in the INRMP and determine whether any additional communities were present at NAS Brunswick and the outlying properties. As previously discussed, the INRMP did not include a map of the extent and location of the ecological communities found at NAS Brunswick and its outlying properties. The ecological community boundaries were estimated during the field survey, and the estimated boundaries were then overlain on aerial photographs. Section 3 presents the map of the ecological communities identified on NAS Brunswick and its outlying facilities.

In addition, searches for threatened, endangered, and rare plant species identified in the INRMP were conducted during the field surveys. Plant species identified in the field were mapped, and these are discussed in Section 3.



Legend

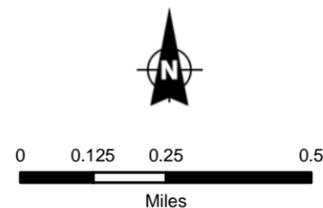
	No Value		25B Adams loamy fine sand		BgC2 Belgrade very fine sandy loam		HrC Hollis fine sandy loam		SuC2 Suffield silt loam
	10A Udorthents-Croghan complex		26A Gouldsboro silt loam		BuB Buxton silt loam		HrD Hollis fine sandy loam		SuD2 Suffield silt loam
	10B Udorthents-Croghan complex		27A Lamoine silt loam		BuC2 Buxton silt loam		*Ls Limerick-Saco silt loams		Sz Swanton fine sandy loam
	11A Haplaquents-Finch complex		28A Urban land-Udorthents-Haplaquents association		Cu Cut and fill land		LyB Lyman fine sandy loam		*Tm Tidal marsh
	12A Haplaquents-Naumburg complex		29A Haplaquents-Scantic complex		DeA Deerfield loamy sand		LyC Lyman fine sandy loam		*Wa Walpole fine sandy loam
	15A Haplaquents-Lamoline complex		30A Udorthents-Adams complex		DeB Deerfield loamy sand		Py Podunk fine sandy loam		WmB Windsor loamy sand
	*20A Naumburg loamy fine sand		30D Udorthents-Adams complex		EmB Elmwood fine sandy loam		*Ru Rumney fine sandy loam		WmC Windsor loamy sand
	22B Adams-Lyman complex		34B Tunbridge fine sandy loam		Gp Gravel pits		*Sd Saugatuck loamy sand		WmD Windsor loamy sand
	22C Adams-Lyman complex		34C Tunbridge fine sandy loam		HfC2 Hartland very fine sandy loam		*Sn Scantic silt loam		WrB Woodbridge fine sandy loam
	25A Adams loamy fine sand		Au Au Gres loamy sand		HfD2 Hartland very fine sandy loam		*So Scarborough sandy loam		
			BqB Belgrade very fine sandy loam		HrB Hollis fine sandy loam		*Sp Sebago mucky peat		

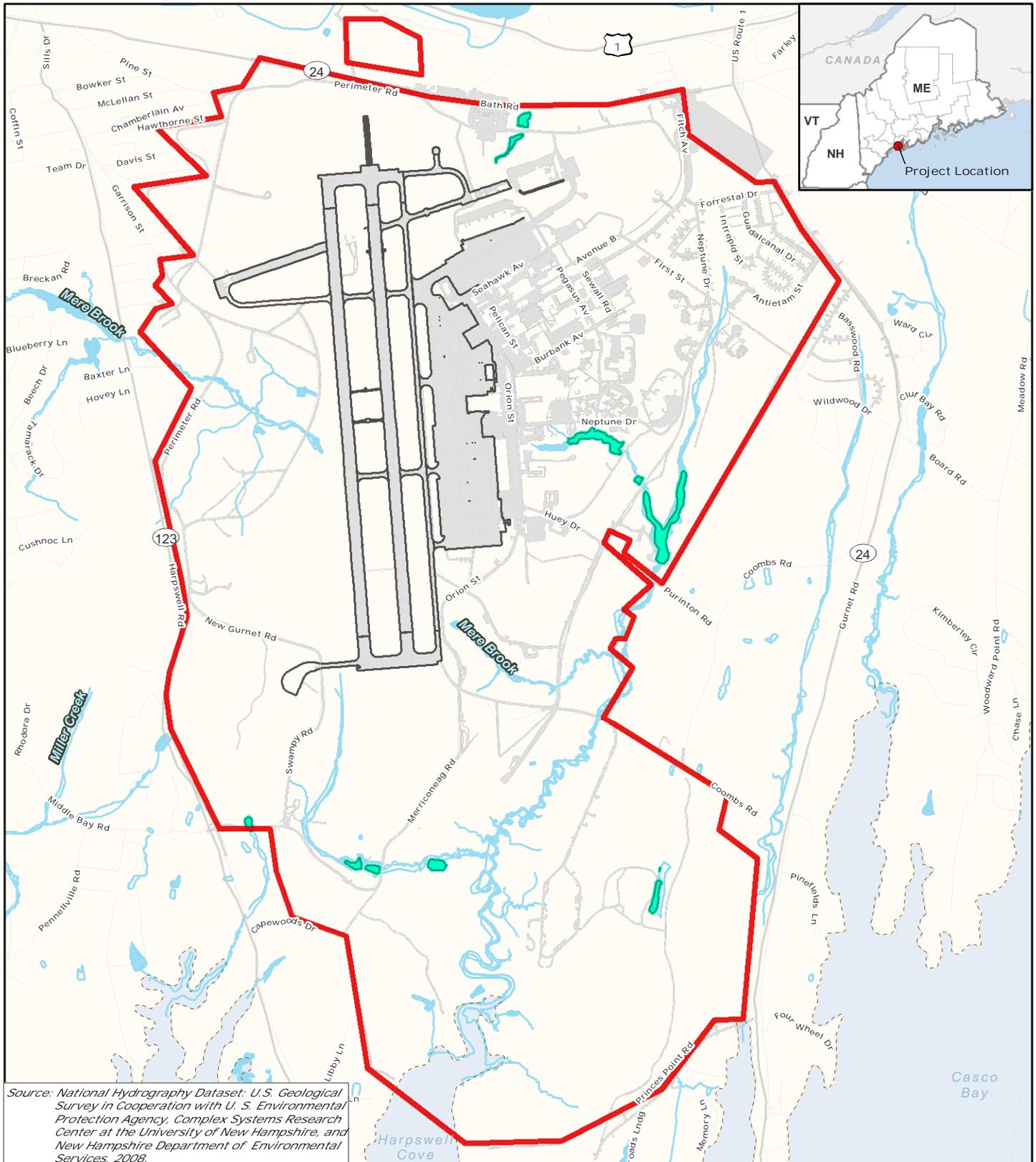
Note: * Indicates Hydric Soil Types

Source: Normandeau Associates, 1998.

NAS Brunswick Property Boundary

**Figure 2-5
 Soils of NAS Brunswick
 Brunswick, Maine**

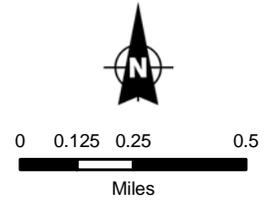


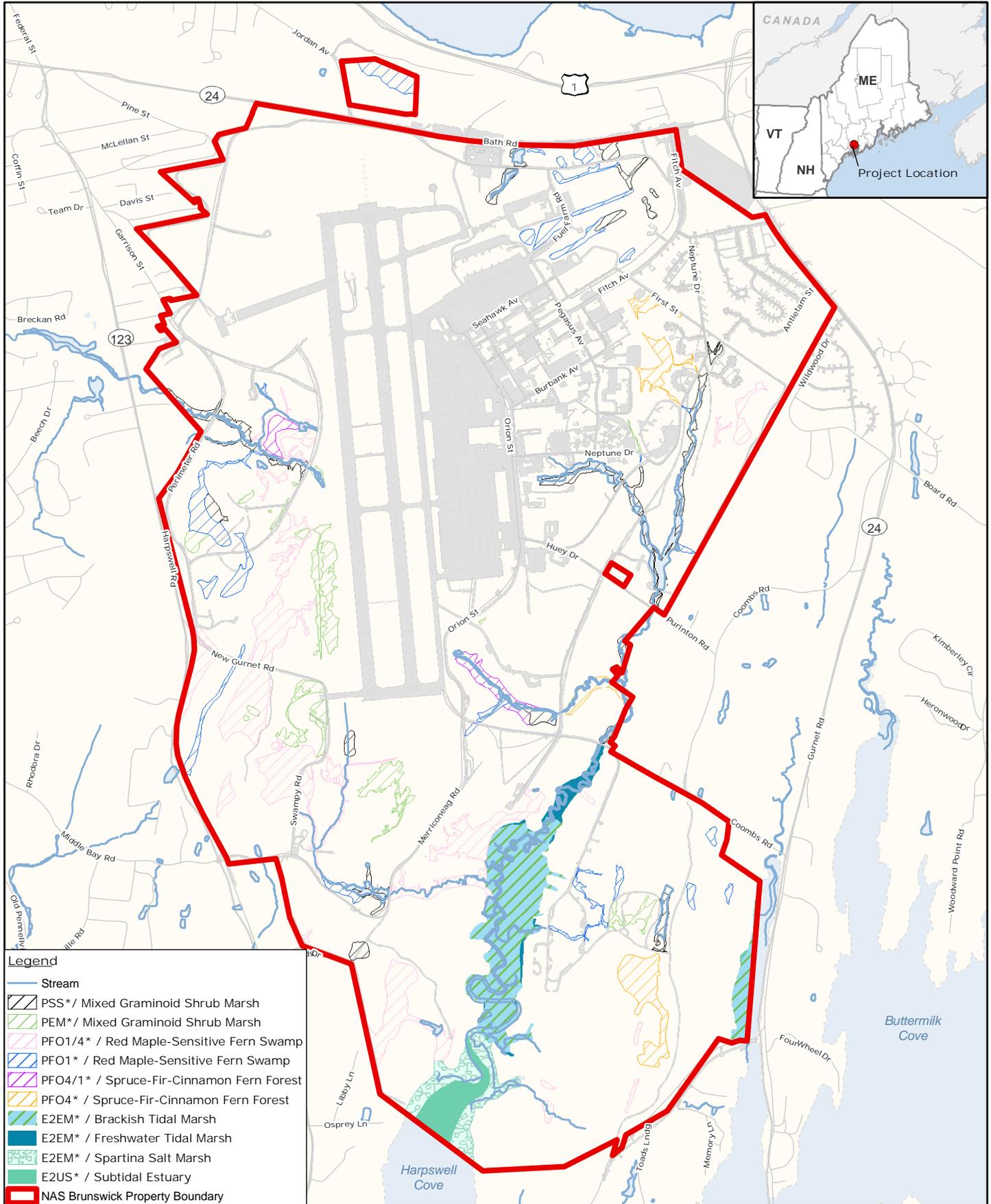


Source: National Hydrography Dataset: U.S. Geological Survey in Cooperation with U. S. Environmental Protection Agency, Complex Systems Research Center at the University of New Hampshire, and New Hampshire Department of Environmental Services, 2008.

-  Stream
-  Surface Waters
-  Pond
-  NAS Brunswick Property Boundary

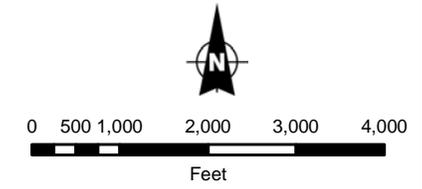
Figure 2-7
Surface Waters of NAS Brunswick
Brunswick, Maine





- Legend**
- Stream
 - PSS* / Mixed Graminoid Shrub Marsh
 - PEM* / Mixed Graminoid Shrub Marsh
 - PFO1/4* / Red Maple-Sensitive Fern Swamp
 - PFO1* / Red Maple-Sensitive Fern Swamp
 - PFO4/1* / Spruce-Fir-Cinnamon Fern Forest
 - PFO4* / Spruce-Fir-Cinnamon Fern Forest
 - E2EM* / Brackish Tidal Marsh
 - E2EM* / Freshwater Tidal Marsh
 - E2EM* / Spartina Salt Marsh
 - E2US* / Subtidal Estuary
 - NAS Brunswick Property Boundary

**Figure 2-8
 Results of Wetland
 Reconnaissance Survey 2008
 Brunswick, Maine**



3

Ecological Communities

Ecoregions were developed to classify large areas based on associations of plants, animals, and environmental factors such as climate, physiography, water, soils, air, and hydrology. Three Ecoregions occur within the state of Maine: Aroostook Hills and Lowlands; Maine and New Brunswick Foothills and Eastern Lowlands; and Central Maine Coastal and Interior (McNab and Avers 1994). NAS Brunswick and its outlying facilities are located in the Central Maine Coastal and Interior Ecoregion. The area comprises a glacially scoured and dissected peneplain that slopes toward the coast and exhibits glacial features such as kames, eskers, and terraces. The topography is generally flat to gently rolling, with elevations ranging from sea level to 1,000 feet above mean sea level (AMSL). The elevation of the airfield at NAS Brunswick is approximately 75 feet AMSL. Forests are the dominant vegetation type and consist of northern hardwood, northern hardwood-spruce, northern coastal spruce-fir, and spruce-fir-northern hardwood communities. Coastal pitch pine communities are known to occur in this ecoregion but are now uncommon. Open communities such as grasslands and tidal marshes also occur, but they do not comprise a significant percentage of the overall land cover of this ecoregion (McNab and Avers 1994).

The Maine Natural Areas Program (MNAP) identifies 159 ecological communities in the state of Maine, 108 of which are described in *Natural Landscapes of Maine: A Classification of Ecosystems and Natural Communities* (Gawler and Cutko 2004). The 22 ecological communities found at NAS Brunswick and the East Brunswick Radio Transmitter Site were mapped based on the *Natural Landscapes of Maine* (see Figure 3-1). The McKeen Street Housing Annex is primarily residential, and the Sabino Hill Rake Station is a small lot (approximately 0.24 acre) primarily occupied by Navy facilities; therefore, ecological communities at these facilities were not mapped.

Three ecological communities not described by Gawler and Cutko (2004) were identified in the field: pine plantation, successional shrubland, and maintained land. These areas were identified based on community characteristics described in *Ecological Communities of New York State* (Edinger et al. 2002), which also served as the basis for many of the descriptions of community characteristics in the *Natural Landscapes of Maine*. The characteristics of these three communities are influenced, or have been influenced, by human activities that have altered the physical characteristics and the biological composition of the communities.

NAS Brunswick contains extensive paved areas (e.g., the airfield and parking lots), which are not considered to support an ecological community. However, for mapping and classification purposes, these areas are designated as “Maintained Land” on Figure 3-1.

The following ecological communities were identified in the field:

- Red oak-northern hardwoods-white pine forest
- Aspen-birch woodland/forest
- Maritime spruce-fir forest
- Oak-pine woodland
- Pitch pine-heath barren
- Hemlock slope forest,
- Red pine/white pine plantation
- Little bluestem-blueberry sandplain grassland
- Successional shrubland
- Maintained land
- Spruce-fir-cinnamon fern forested wetland
- Red maple-sensitive fern swamp
- Mixed graminoid shrub marsh
- Freshwater tidal marsh
- Brackish tidal marsh
- Spartina salt marsh
- Vernal pools
- Ephemeral and intermittent freshwater streams
- Perennial freshwater streams
- Freshwater ponds
- Tidal creeks
- Estuary

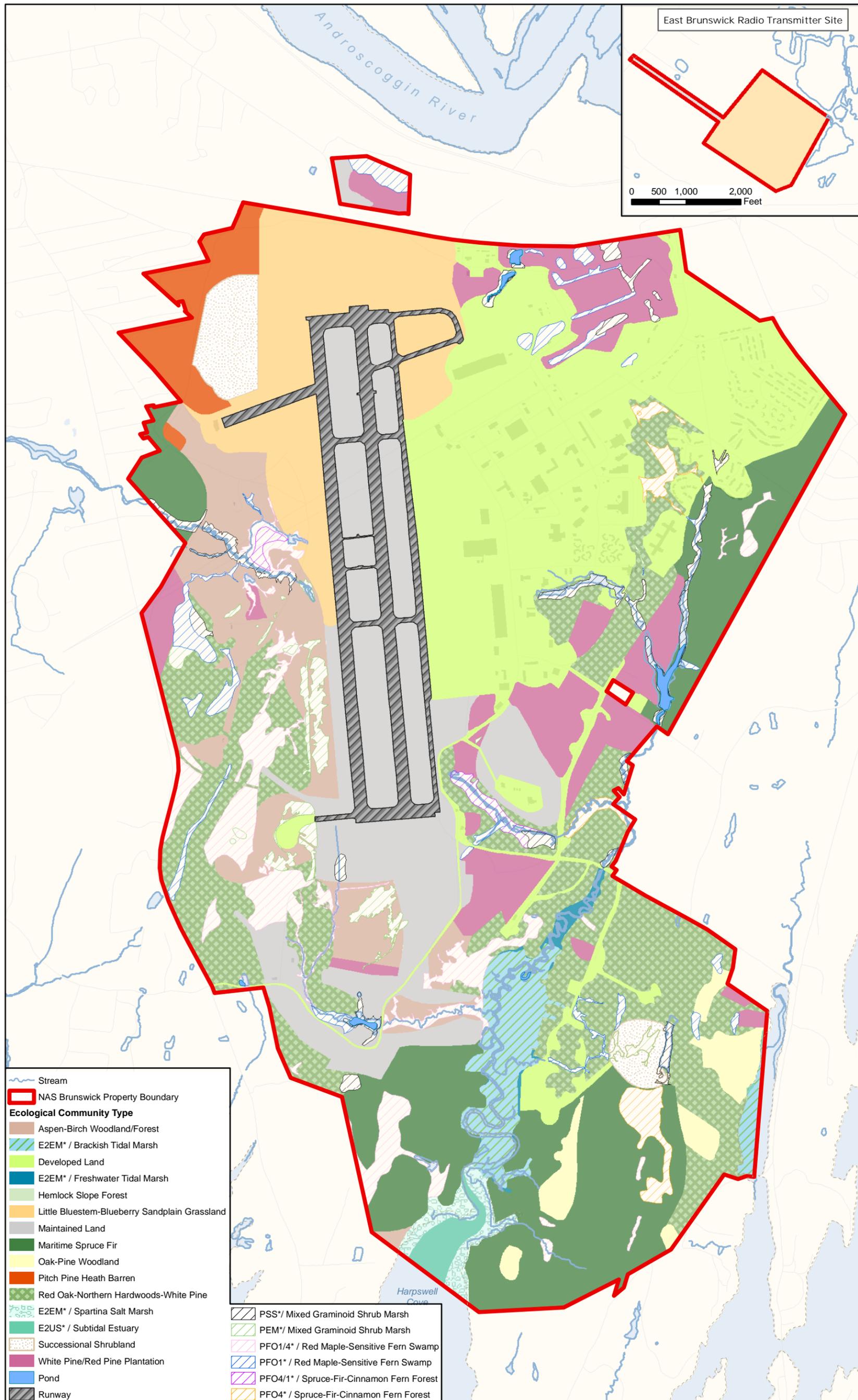
Forestland/woodland and open land ecological communities and their existing conditions are described in the following sections. Wetlands and aquatic communities are described in Section 4.

3.1 Forest Communities

The most prevalent cover type of NAS Brunswick’s main property is forested; approximately 1,336 acres (42%) of the property is forested. Five natural ecological forest communities were identified during field surveys, not including white pine (*Pinus strobus*) and red pine (*Pinus resinosa*) plantations.

3.1.1 Red Oak-Northern Hardwoods-White Pine Forest

Red oak-northern hardwoods-white pine forests are common throughout mid-coast Maine. This community contains a mix of common northern hardwood (deciduous) species and white pine and occasionally red spruce (*Picea rubens*).



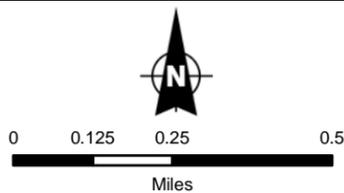
- Stream
- NAS Brunswick Property Boundary
- Ecological Community Type**
- Aspen-Birch Woodland/Forest
- E2EM* / Brackish Tidal Marsh
- Developed Land
- E2EM* / Freshwater Tidal Marsh
- Hemlock Slope Forest
- Little Bluestem-Blueberry Sandplain Grassland
- Maintained Land
- Maritime Spruce Fir
- Oak-Pine Woodland
- Pitch Pine Heath Barren
- Red Oak-Northern Hardwoods-White Pine
- E2EM* / Spartina Salt Marsh
- E2US* / Subtidal Estuary
- Successional Shrubland
- White Pine/Red Pine Plantation
- Pond
- Runway

- PSS* / Mixed Graminoid Shrub Marsh
- PEM* / Mixed Graminoid Shrub Marsh
- PFO1/4* / Red Maple-Sensitive Fern Swamp
- PFO1* / Red Maple-Sensitive Fern Swamp
- PFO4/1* / Spruce-Fir-Cinnamon Fern Forest
- PFO4* / Spruce-Fir-Cinnamon Fern Forest

Notes: Ecological Communities based on the Natural Landscapes of Maine (Gawler and Cutko 2004).

*Wetland Classification based on Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al 1979).

Figure 3-1
Ecological Communities
NAS Brunswick
Brunswick, Maine



Approximately 455 acres of this community are present on NAS Brunswick, comprising approximately 15% of the installation's area (see Figure 3-1). Large, contiguous tracts of this forest type are located east of Harpswell Road and west of the airfield and antenna fields. On the eastern portion of the installation, small tracts of this forest type are found adjacent to residential areas. Another large tract is located on the southeastern portion of the installation, northeast of the weapons compound.

At NAS Brunswick, this community has a dense canopy and moderately sparse vegetation in the understory (see Photo 3-1). The shrub layer was not distinct; when present, it was dominated by low-growing shrubs and saplings, which is typical of evenly aged forest stands. Dominant tree species include white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), red spruce, white spruce (*Alba glauca*), balsam fir (*Abies balsamea*), and red oak (*Quercus rubra*). Common understory species of these forests include winterberry (*Ilex verticillata*), low bush blueberry (*Vaccinium angustifolium*), and herbs such as cinnamon fern (*Osmunda cinnamomea*), interrupted fern (*Osmunda claytoniana*), bracken fern (*Pteridium aquilinum*), bunchberry (*Cornus canadensis*), and princess pine (*Lycopodium* spp.).



Photo 3-1 Typical view of red oak-northern hardwoods-white pine forest on NAS Brunswick. Photo taken in July 2008.

3.1.2 Aspen-Birch Woodland/Forest Complex

The Aspen-birch woodland/forest complex is an early successional forest type often found on sites that have experienced significant disturbance, such as from fire or logging. This community is most common on the western portion of NAS Brunswick, adjacent to the southwestern portion of the airfield and antenna fields. Approximately 180 acres of this community type are present at NAS Brunswick, comprising approximately 6% of the installation's area.

This community is dominated by immature trees ranging from 5 to 20 feet in height. At NAS Brunswick, this community contains species that are typical of a mixed conifer forest in the northeast, including white pine and balsam fir, as well as early successional tree species such as quacking aspen (*Populus tremuloides*), bigtooth aspen (*P. grandidentata*), grey birch, pin cherry (*Prunus pensylvanica*), and black cherry (*P. serotina*). The understory is composed of brambles (*Rubus* spp.), sweet fern (*Comptonia peregriana*), goldenrods (*Solidago* spp), and graminoids.

3.1.3 Maritime Spruce-Fir Forest

Approximately 387 acres of maritime spruce-fir forest are present at NAS Brunswick, comprising 12% of the installation's area. Two large, contiguous tracts of this community are located in the northeastern and southern portions of the installation. The tract in the southern portion of the property is exemplary of this forest type. These forests contain large, mature trees with a dense, high canopy and sparse understory (see Photo 3-2). Dominant tree species include white pine and balsam fir; some locations also may contain eastern hemlock or red pine. There is no shrub stratum. The understory consists of a scattering of herbaceous plants such as bunchberry (*Cornus canadensis*), wild sarsaparilla (*Aralia nudicaulis*), tea berry (*Gaultheria procumbens*), goldenthrum (*Coptis groenlandica*), and a variety of woodland ferns such as Christmas fern (*Polystichum acrostichoides*) and spinulose woodfern (*Dryopteris spinulosa*). At NAS Brunswick, the groundcover in this community type often consists of expansive mats of moss.



Photo 3-2 Typical view of maritime spruce-fir community on the southern portion of NAS Brunswick. Photo taken in July 2008.

3.1.4 Oak-Pine Woodland

Oak-pine woodland communities exist in relatively small areas on the southeastern portion of NAS Brunswick. Approximately 49 acres of this community type are present, comprising 2% of the installation's area. It occurs on high ridges

where bedrock is close to the soil surface and outcrops occur. The Sabino Hill Rake Station is surrounded by this ecological community type. The tree species composition is co-dominated by white pine and red oak. The canopy is not overly dense, and individual trees are rather small due to the relatively harsh conditions in which they exist (i.e., lower moisture, nutrient-poor soils, and exposure to wind). The shrub stratum is moderately distinct, low to the ground, and dominated by low bush blueberry (*Vaccinium angustifolium*), sweet fern, and bracken fern. The herbaceous layer is sparse and contains grasses and sedges.

3.1.5 Pitch Pine-Heath Barren

Pitch pine heath barrens have been identified by MNAP as a critically imperiled ecosystem (five or fewer known occurrences) and are globally ranked as imperiled or rare (MNAP 2008). The existence of this community is dependent on fire to maintain the understory free of shrubs and other tree species, which may out-compete the pitch pine (*Pinus rigida*). In addition, pitch pine cones are serotinous, i.e., they will not open to release their seeds without extreme heat; without fire, this community succeeds into a different forest community type. Pitch pine heath barrens occupy approximately 49 acres, or 2%, of the installation. This community occurs in the northwestern corner of NAS Brunswick, adjacent to the little blue stem-blueberry sandplain grassland community. This community is dominated by pitch pine and has no shrub stratum (see Photo 3-3). The canopy of the heath barren at NAS Brunswick is tall and dense. There are a few white pines interspersed within the pitch pine heath barren; however, the white pines are on the edges of this community type, along the roadways. The understory consists of several shade-tolerant grasses and low bush blueberries but is not dense. There is a large amount of leaf litter from the needles of the trees on the forest floor. The pitch pine heath barren on this site is exemplary of this community.

3.1.6 Hemlock Slope Forest

Hemlock slope forest was observed only on the north clear zone parcel at NAS Brunswick (see Figure 3-1). Approximately 9 acres of this community type are present, comprising less than 1% of the installation's area. This community occurs on a moist, north-facing, steep slope (>10%) and is dominated by eastern hemlock (*Tsuga canadensis*). The canopy is high and dense, the understory is sparse, and there is no shrub stratum. The forest floor is covered with debris from the hemlock trees. The individual trees on this site are very mature and large in diameter (see Photo 3-4). This community is common throughout Maine, and this particular community is a good example of a hemlock slope forest.



Photo 3-3 Typical view of pitch pine-heath barren on NAS Brunswick.
Photo taken in July 2008.

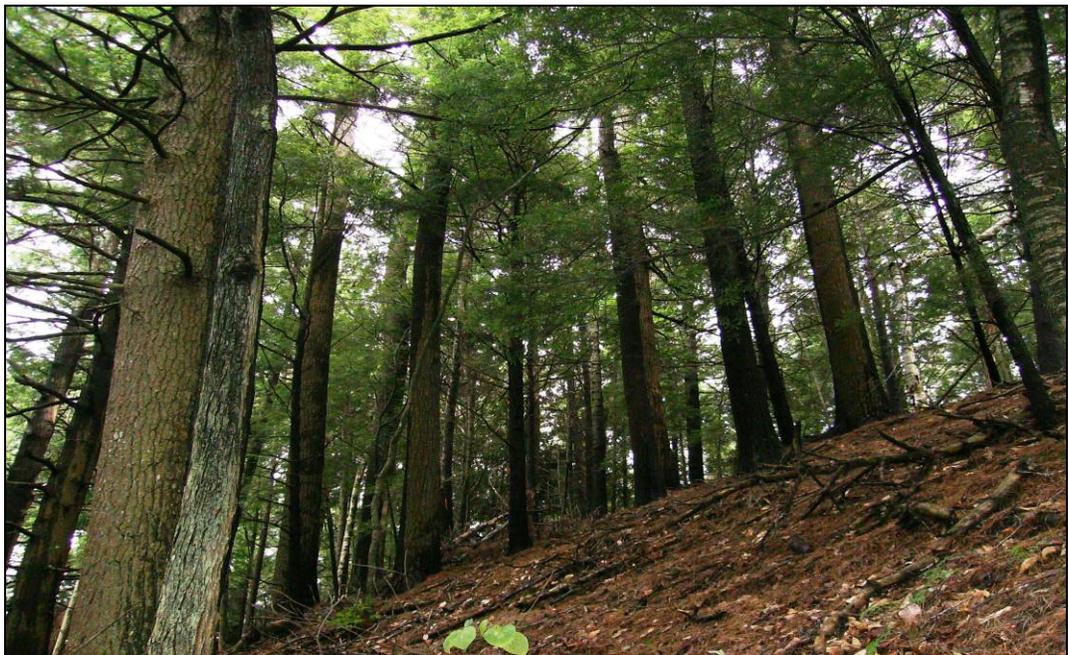


Photo 3-4 Hemlock slope forest located on NAS Brunswick property.
Photo taken in July 2008.

3.1.7 Pine Plantation

Pine plantations are common in Maine and were observed in multiple areas on and adjacent to NAS Brunswick, especially near disturbed and developed sites in the northeastern and western portions of the installation. The plantations on the installation consist of stands of red pine or white pine. Approximately 207 acres of this community type are present, comprising 7% of the installation's area.

These areas were planted in the 1960s in support of base beautification efforts (Prosser Hallock Planners and Engineers 2002).

This community is characterized by a single species planted in evenly spaced rows. The trees are mature, the canopy is dense, and there is little vegetation in the understory, which is completely covered with pine needles. Vegetative diversity within these areas is low; consequently, this is not a highly diverse ecological community, and wildlife utilization of these areas is relatively low.

3.2 Open Land Communities

3.2.1 Little Bluestem-Blueberry Sandplain Grassland

NAS Brunswick

The little bluestem-blueberry sandplain grassland (sandplain grassland) is located to the west and north of the runways, within the airfield clear zone (see Figure 3-1). Approximately 220 acres of this community type are present at NAS Brunswick, comprising 7% of the installation's area. This habitat may not have existed in this area prior to establishment of the airfield, but the soils, dry conditions, and maintenance practices have allowed this ecosystem to become established at this location (see Photo 3-5).



Photo 3-5 Typical view of little bluestem-blueberry sandplain grassland on NAS Brunswick. Photo taken in July 2008.

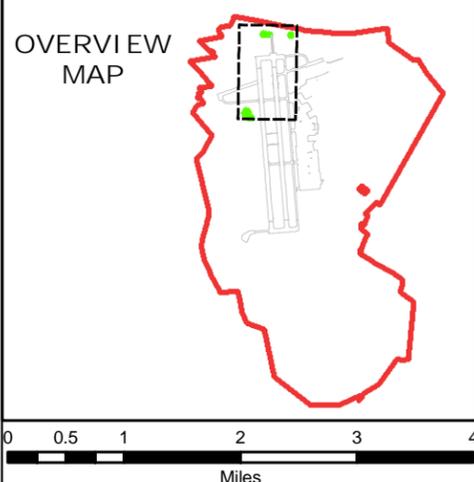
Sandplain grasslands are uncommon communities in Maine and are ranked as critically imperiled (S1) by the state of Maine. These communities are highly diverse in species composition and can contain many species of rare plants and animals. Species commonly found in this community type include little bluestem (*Schizachyrium scoparium*), poverty oat grass (*Danthonia spicata*), sheep fescue (*Festuca ovina*), low bush blueberry (*Vaccinium angustifolium*), wood lily (*Lilium philadelphicum*) (see Photo 3-6 below), three-toothed cinquefoil (*Sibbaldiopsis*

tridentate), goldenrods (*Solidago* spp.), and brambles (*Rubus* spp.). State-listed endangered and threatened birds, including the endangered grasshopper sparrow (*Ammodramus savannarum*) and threatened upland sandpiper (*Bartramia longicauda*), are known to have occurred in this community on NAS Brunswick.



Photo 3-6 Wood lily found in little bluestem-blueberry sandplain grassland at NAS Brunswick. Photo taken in July 2008.

In addition to these species, clothed sedge (*Carex vestita*), an endangered plant species in the state of Maine, is found in scattered populations in this community (see Photo 3-7). The clothed sedge was considered extirpated in Maine until its discovery at NAS Brunswick in 1999 (Geo-Marine 2001). During the recent field surveys, the locations of known populations of clothed sedge were checked and new locations were identified (see Figure 3-2). The recent field surveys revealed that the amount of clothed sedge in the northeastern portion of the sandplain grassland on NAS Brunswick is declining when compared to previous field surveys and mapping. The individual plants are small and appear stunted. However, the population in the southwestern portion, adjacent to the airfield, is expanding when compared to previous mapping, and the plants are large and vigorous (see Photo 3-8).



-  Clothed Sedge Populations
-  NAS Brunswick Property Boundary

Figure 3-2
Location of Clothed Sedge (*Carex vestita*)
NAS Brunswick, Maine

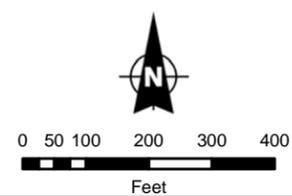




Photo 3-7 Close-up of clothed sedge. Photo taken in July 2008.



Photo 3-8 Healthy population of clothed sedge located to the west of the airfield. Photo taken in July 2008.

East Brunswick Radio Transmitter Site

The East Brunswick Radio Transmitter site also contains a little bluestem-blueberry sandplain grassland community. The site is approximately 66 acres in size and is the former location of a radar transmitting facility, which has been removed. The sandplain grassland community occupies approximately 64 acres, or 97%, of this site. The remaining 2 acres, or 3%, of the site contains the paved access road to the site.

The sandplain grassland community on this site differs from the NAS Brunswick community in appearance, community structure, and dominant species as this site has reverted almost exclusively to blueberries (*Vaccinium* spp.) (see Photo 3-9). A few immature pitch pines and red maples have also colonized the site (see Photo 3-10). Adjacent the property to the west is a small pitch pine heath barren, which potentially is the seed source for the pitch pines that have colonized this site. Goldenrods (*Solidago* spp.) and bracken fern are also a part of the species assemblage on this site. A small patch of Japanese knotweed is located in the northeastern corner of the site, near the property boundary. Currently, there is no control program to manage the Japanese knotweed at this site.



Photo 3-9 Close-up view of the blueberries at the East Brunswick Radio Transmitter Site. Photo taken in July 2008.

Dry land sedge (*Carex siccata*) is a species of special concern in the state of Maine and was observed at the East Brunswick Radio Transmitter Site. The ecology of this species is similar to that of the clothed sedge in that it requires dry, open sites. Dry land sedge was discovered at the East Brunswick Radio Transmitter Site in July 2007 (Walker 2008). Its potential presence was unknown during the site visit in July 2008; therefore, this species was not evaluated at this site during the field surveys.



Photo 3-10 Typical view of the little bluestem-blueberry sandplain grassland at the East Brunswick Radio Transmitter Site. Photo taken in July 2008.

3.2.2 Successional Shrubland

Successional shrubland, which typically becomes established after a disturbance, is defined as having an open canopy and dominated at least 50% by shrubs. This community is present in the western portion of NAS Brunswick, adjacent to the airfield, and occupies 53 acres, or approximately 2%, of the area of the installation. These areas are dominated by sweet fern, blueberries, brambles, wild raisin (*Viburnum cassinoides*), and grey birch saplings (*Betula populifolia*). If left undisturbed, this ecosystem would mature into a northern hardwood forest.

Maintained Land

For the purposes of this report, maintained land is defined as any area that is routinely manipulated so that it remains in a constant state. Large areas at NAS Brunswick are maintained on a routine basis, including the residential and industrial portions of the base, the golf course, and the airfield. Approximately 342 acres of maintained land are present at NAS Brunswick, comprising 11% of the installation's area. These areas are comprised of non-native, cool-season grasses and common forbs. The forbs includes dandelions (*Taraxacum* sp.), hawkweed (*Hieracium* sp.), and English plantain (*Plantago lanceolata*). With the exception of the airfield, these areas are frequently mowed to maintain the grass at heights below 6 inches. A long-grass maintenance program has been implemented on the airfield in support of the station's Bird Aircraft Strike Hazard (BASH) program. Except along the edges of the runways and taxiways, grasses on the airfield are maintained at heights of between 7 and 14 inches to deter large flocking birds from using this habitat. These taller grasses support nesting grassland birds.

4

Wetlands and Aquatic Communities

Wetlands and aquatic communities such as streams, ponds, and tidal bays may be diverse systems and perform a variety of ecosystem functions. These communities are scattered throughout NAS Brunswick and encompass approximately 389 acres, or 12%, of the property based on the results of this survey. Twelve wetland and aquatic communities have been identified at NAS Brunswick, and these are discussed below. For the purposes of this report, wetland systems have been divided into freshwater wetlands (i.e., those that receive freshwater) and coastal wetlands (i.e., those influenced by tides).

The Sabino Hill Rake Station and East Brunswick Radio Transmitter Site lack wetlands and aquatic habitats. Although formal wetland delineations have not been conducted at these sites, no wetlands or aquatic communities were observed during site visits conducted in July 2008. According to NWI wetland maps, an acre of forested wetland is present in the southwestern portion of the McKeen Street Housing Annex, near the property boundary; however, no wetland was found at the McKeen Street Housing Annex during the field surveys.

4.1 Freshwater Wetlands

Based on the results of the reconnaissance-level survey conducted in 2008 to verify the previous wetland inventory conducted in 1998 (Normandeu Associates 1998a) and the various wetland delineations, approximately 280 acres of freshwater wetlands and 9 acres of ponds and streams are present at NAS Brunswick. Figure 3-1 identifies the types and locations of freshwater wetlands identified during the reconnaissance-level survey. Each wetland was classified using the Cowardin et al. (1979) classification system during the planning-level wetlands survey in 1998 (Normandeu Associates 1998a). The cover type was also verified during the reconnaissance level survey. The Cowardin et al. (1979) system classifies wetland vegetation according to the community structure. The freshwater, or palustrine, wetlands were generally classified as emergent (PEM), shrub-scrub (PSS), and forested (PFO) wetlands. The forested wetlands (PFO) were composed of predominantly deciduous tree species (hardwoods) (PFO1), coniferous species (PFO4), or a mixture of both (PFO1/4 or PFO 4/1). The classification of the wetlands according to Cowardin et al. (1979) were then compared to the descriptions of the ecological communities for freshwater wetlands in *Natural Landscapes of Maine* (Gawler and Cutko 2004). Typically, the Cowardin et al. (1979)

classification is broader than Gawler and Cutko (2004) and is not detailed enough for determining species composition of a specific wetland community.

4.1.1 Spruce-Fir-Cinnamon Fern Forest

Spruce-fir-cinnamon fern forests are forested wetlands dominated by black spruce (*Picea mariana*) or red spruce and balsam fir. These systems are defined as PFO4, and approximately 40 acres of this wetland type are found on the installation, comprising 1% of the installation's area. This community is present within the maritime spruce-fir forest in the southeastern portion of NAS Brunswick in a long, poorly drained valley between two ridges. This community has pronounced pit and mound topography. The herb layer is productive and dominated by cinnamon fern (*Osmunda cinnamomea*), but it also contains a variety of sedges, grasses, and other herbs such as three-seeded sedge (*Carex trisperma*), manna-grasses (*Glyceria* spp.), golden thread (*Coptis trifolia*), saxifrage (*Saxifraga pennsylvanica*), and skunk cabbage (*Symplocarpus foetidus*). There are a few scattered shrubs, mainly wild raisin and winterberry (*Ilex verticillata*). The forest floor is blanketed with sphagnum mosses. Although the ground is covered with sphagnum moss, the underlying soil is mineral. Photo 4-1 presents a typical view of this community on NAS Brunswick.



Photo 4-1 Typical view of a spruce-fir-cinnamon fern forest at NAS Brunswick. Photo taken in July 2008.

4.1.2 Red Maple-Sensitive Fern Swamp

Red maple-sensitive fern swamps are a common forested wetland community type in Maine. Red maple-sensitive fern swamps have been identified at NAS Brunswick in several areas, including along the edges of the retention ponds in the eastern portion of the installation; adjacent to Mere Brook in the northwest portion of the installation; in the weapons compound; and in the northern clear zone parcel, north of Bath Road. There are approximately 162 acres of this wetland type at NAS Brunswick, comprising 5% of the installation's area.

The structure of this community varies; the canopy ranges from open to closed, and the shrub layer ranges from prominent to nonexistent. For example, the red maple-sensitive fern swamp located in the northern clear zone (see Photo 4-2) has a closed canopy and a defined shrub layer, while the red maple-sensitive fern swamp in the weapons area (see Photo 4-3) has an open canopy and no shrub layer. Balsam fir, yellow birch (*Betula allegheniensis*), and green ash (*Fraxinus pennsylvanica*) are common associates in the overstory and are sometimes co-dominant with red maple. The shrub layer, if present, typically contained winter-berry, wild raisin, willows (*Salix* spp.), and sapling of red maple, balsam fir, or green ash. As evidenced in photos 4-2 and 4-3, the herb layer is highly productive. Sensitive fern (*Onoclea sensibilis*) is a dominant plant in the herb layer. Other herbs found in this community are a function of the hydrology and the degree of canopy closure. Commonly observed herbs in all the red maple-sensitive fern swamps on NAS Brunswick include tussock sedge (*Carex stricta*), reed canary grass (*Phalaris arundinacea*), iris (*Iris versicolor*), raspberry (*Rubus ideas*), and jewelweed (*Impatiens pratensis*).



Photo 4-2 A red maple-sensitive fern swamp located in the northern clear zone parcel. Photo taken in July 2008.



Photo 4-3 A red maple-sensitive fern swamp located in the weapons compound. Photo taken in July 2008.

Red maple-sensitive fern swamps with balsam fir as a co-dominant tree species are classified as PFO1/4 or PFO 4/1 in the Cowardin et al. (1979) classification system. Wetlands in which balsam fir is dominant over the deciduous tree species but still comprises approximately less than 75% are classified as PFO4/1. Wetlands in which the deciduous trees species comprise more than 50% of the coverage, with balsam fir comprising enough cover to be considered dominant, are classified as PFO1/4. Red maple-sensitive fern swamps in which balsam fir is not a dominant species are classified as PFO1.

4.1.3 Mixed Graminoid-Shrub Marsh

Mixed graminoid-shrub marsh, a common community in Maine, is present throughout NAS Brunswick. These areas may be transitional to other wetland types or to open water, or they may occur as a large wetland complex. The plant community structure ranges from containing only herbs and no shrubs to having a dominant shrub layer (Gawler and Cutco 2004). In the Cowardin et al. (1979) classification system, the wetlands with predominately herbaceous cover are classified as PEM wetlands, and those with predominately shrubs as cover are classified as PSS wetlands. At NAS Brunswick, these communities range from being dominated by herbs to dominated by shrubs.

There are approximately 78 acres of mixed graminoid-shrub marsh at NAS Brunswick, comprising approximately 2% of the installation's area. Mixed graminoid-shrub marshes dominated by herbs were observed at the southern end of the airfield; in a meadow adjacent to an antenna field on the west side of the airfield (see Photo 4-4); and in a wetland located in the south-central portion of the installation (see Photo 4-5). In these marshes, commonly observed species include rice cut grass (*Leersia oryzoides*), reed canary grass, soft rush (*Juncus effusus*), mangrass, sensitive fern, wool grass (*Scirpus cyperinus*), dark green bul-

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rush (*Scirpus atrovirens*), jewelweed, tear-thumb (*Polygonum sagittatum*), boneset (*Eupatorium perfoliatum*), and Joe-pye weed (*Eupatorium maculatum*). Mixed graminoid-shrub marshes dominated by shrubs were observed in the weapons compound (see Photos 4-6 and 4-7). Shrub species commonly observed in these wetland areas include pussy willow (*Salix discolor*), steeplebush (*Spirea tomentosa*), meadowsweet (*Spirea latifolia*), and red osier dogwood (*Cornus stolonifera*).



Photo 4-4 A mixed graminoid-shrub marsh community resulting from an old beaver pond located west of the airfield. Photo taken in July 2008.



Photo 4-5 A mixed graminoid-shrub marsh located in the south-central portion of NAS Brunswick. Photo taken in July 2008.



Photo 4-6 A mixed graminoid-shrub marsh located within the Weapons Compound. Photo taken in July 2008.



Photo 4-7 A mixed graminoid-shrub marsh located in the Weapons Compound. Photo taken July 2008.

4.2 Coastal Wetlands

Coastal wetlands are common in southern and mid-coast Maine. Three types of coastal wetland communities were identified at NAS Brunswick: freshwater tidal marsh, brackish tidal marsh, and spartina salt marsh. These communities are defined by specific salinity gradients; freshwater tidal marshes receive the most freshwater and spartina salt marshes receive the least freshwater. All these com-

munities are influenced by the tides and are dominated by herbaceous vegetation. The average tidal range in this area is approximately 9.5 feet, though monthly spring tides can exceed 11 feet (Geo-Marine 2001).

The Cowardin et al. (1979) classification system classifies estuarine systems based on the tidal zone (intertidal or subtidal), substrate, and vegetative cover type (if any). All of the estuarine wetlands that occur at NAS Brunswick are intertidal and contain emergent vegetation. These wetlands are classified as E2EM wetlands according to the Cowardin et al. (1979) system.

4.2.1 Freshwater Tidal Marsh

Freshwater tidal marshes are found in the upper reaches of tidal influence and are typically fed by a freshwater stream or river. The salinity is typically less than 0.5 parts per thousand (ppt) (Gawler and Cutco 2004). Freshwater tidal marshes are found in small areas where Mere Brook and other smaller tributaries empty into Harpswell Cove and Buttermilk Cove (see Photo 4-8). This wetland community type is dominated by herbaceous vegetation, including cattails (*Typha* spp.), rice cutgrass, northern water plantain (*Alisma trivale*), and pickerelweed (*Pontederia cordata*).



Photo 4-8 Freshwater tidal marsh in the northern portion of Harpswell Cove. Photo taken in July 2008.

Freshwater tidal marshes can be large and provide valuable waterfowl and wading bird habitat. Freshwater tidal marshes occupy approximately 9 acres at NAS Brunswick, comprising less than 1% of the installation's area. The freshwater tidal marshes found on NAS Brunswick are small and likely support transient individuals of waterfowl and wading birds, such as great blue heron (*Ardea Herodias*), black duck (*Anas rubripes*), mallard duck (*Anas platyrhynchos*), greater yellowleg (*Tringa melanoleuca*), lesser yellowleg (*Tringa flavipes*), spotted sandpiper (*Actitis macularia*), and solitary sandpiper (*Tringa solitaria*).

4.2.2 Brackish Tidal Marsh

Brackish tidal marshes are located along the coastal areas of NAS Brunswick. These marshes were identified in the upper portion of Harpswell Cove and Buttermilk Cove, downgradient of the freshwater tidal marsh communities, and were also identified along the edges of the estuaries (see Section 4.4 for more details on estuaries). Salinity levels within this community may range from 0.5 to 18 ppt (Gawler and Cutko 2004). The vegetation consists of a mix of saltmeadow cordgrass (*Spartina patens*), smooth cordgrass (*Spartina alterniflora*), and a variety of rushes and sedges such as soft stem bulrush (*Scirpus tabernaemontani*) and black grass (*Juncus gerardii*). Cordgrasses are dominant, with the other vegetation less abundant. Large expanses of this ecosystem were observed at NAS Brunswick (see Photos 4-9 and 4-10). Approximately 77 acres of brackish tidal marsh are present at NAS Brunswick, comprising 2% of the installation's area.



Photo 4-9 Brackish tidal marsh (foreground) bordered by freshwater tidal marsh (background) in Harpswell Cover. Photo taken in July 2008.



Photo 4-10 Brackish tidal marsh adjacent the weapons compound. Photo taken in July 2008.

Brackish tidal marshes provide valuable wildlife habitat and are important nesting habitat for a variety of birds, including Nelson’s sharp-tailed sparrow (*Ammodramus nelsoni*), the saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*), seaside sparrow (*Ammodramus maritimus*), glossy ibis (*Plegadis falcinellus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), and green heron (*Butorides virescens*). Sea otters (*Enhydra lutris*), raccoons (*Procyon lotor*), white-tailed deer (*Odocoileus virginianus*), and small rodents also utilize brackish tidal marshes for habitat.

4.2.3 Spartina Salt Marsh

Spartina salt marshes are dominated by smooth cordgrass and are often referred to as “high marshes.” The name “high marsh” comes from the higher elevation in which the salt marsh forms. They are typically found on elevated plateaus in which organic matter can build up to several meters thick. Spartina salt marshes are able to tolerate high levels of salinity. This coastal wetland community is found on the southern portion of NAS Brunswick, in Harpswell Cove. Approximately 23 acres of spartina salt marshes are present at NAS Brunswick, comprising less than 1% of the installation’s area. Smooth cordgrass is dominant in this community; however, seaside goldenrod (*Solidago sempervirens*) and sea-lavender (*Limonium carolinianum*) are also common. Peat, which is commonly associated with spartina salt marshes, was not observed as the substrate of this community during the field surveys. However, the vegetative community and landscape position are consistent with the characteristics of this community (see Photo 4-11). Spartina salt marshes are utilized by an assemblage of wildlife similar to that which utilizes brackish tidal marshes.



Photo 4-11 Spartina salt marsh in Harpswell Cove. Photo taken in July 2008.

4.3 Freshwater Aquatic Habitats

4.3.1 Vernal Pools

A vernal pool is a temporary to semi-permanent body of water occurring in a shallow depression that typically fills during the spring or fall and may dry up during the summer. Vernal pools are not necessarily wetlands and have no obvious direct surface connection to streams or ponds. Vernal pools do not support populations of fish. A vernal pool may provide the primary breeding habitat for wood frogs (*Rana sylvatica*), spotted salamanders (*Ambystoma maculatum*), blue-spotted salamanders (*Ambystoma laterale*), and fairy shrimp (*Eubranchipus vernalis*), and they may provide valuable habitat for other plants and wildlife, including several rare, threatened, and endangered species. A vernal pool is considered “significant” under the Maine Natural Resources Protection Act (MNRPA) if either a state-listed threatened or endangered species use it to complete a critical part of its life history or it supports a notable abundance of obligate vernal pool species (i.e., fairy shrimp, wood frog, spotted salamander, or blue-spotted salamander). The MEDEP defines and protects significant vernal pool habitats, as well as a 250-foot-radius upland area around the boundary of the vernal pool.

In the spring of 2008, TRC Companies, Inc. (TRC) conducted surveys for vernal pools and egg masses in the western portion of NAS Brunswick on behalf of Bowdoin College. Twenty-seven vernal pools were identified, of which eight qualify as significant vernal pools in accordance with MEDEP standards (TRC 2008). Vernal pools and significant vernal pools mapped by TRC are depicted on Figure 2-3. Most of the vernal pools that were identified by the TRC surveys, and all of the pools that were determined to be significant, were visited during the field surveys conducted in July 2008. The majority of the vernal pools identified during the Bowdoin surveys were wetland ecosystems and were likely functioning as vernal pools (i.e., standing water present for a sufficient duration during the

spring to support egg masses). A small number of the pools surveyed by TRC were small depressions (<100 square feet) in upland areas that may hold water in the spring but likely not for sufficient duration to function as a vernal pool. Significance could not be confirmed during the July 2008 field surveys because the surveys were conducted outside of the breeding season of the obligate vernal pool species (generally April-May). However, based on other characteristics, these areas appeared to be high-quality vernal pool habitat. None of the pools contained standing water, but they did have water-stained leaves, a wetted perimeter, and water marks on their upland edges, indicating water was pooled for a relatively long duration. Furthermore, all of the significant pools were located in forested areas. Photos 4-12 and 4-13 present examples of significant vernal pools found on NAS Brunswick. Vernal pools likely exist on other portions of the installation; however, additional field surveys would need to be conducted during the breeding season to confirm the presence of these pools.



Photo 4-12 Vernal Pool 42, a significant vernal pool.



Photo 4-13 Vernal Pool 50, a significant vernal pool.

4.3.2 Ephemeral and Intermittent Streams

Many unnamed ephemeral and intermittent streams are located throughout NAS Brunswick. These streams flow either north into the Androscoggin River, or south towards the Atlantic Ocean. It is unlikely that fish species are present within the ephemeral or intermittent streams on NAS Brunswick unless they are found near the confluence of a perennial stream.

4.3.3 Perennial Streams

Perennial streams occur throughout NAS Brunswick, primarily on the western and southeastern portions of the installation. Mere Brook and Merriconeag Stream are the only named tributaries at NAS Brunswick. Mere Brook originates to the west of NAS Brunswick, enters NAS Brunswick on the northwest, and flows in a southeasterly direction, eventually draining into Harpswell Cove. The stream is culverted for approximately 0.6 mile under the airfield. Merriconeag stream begins at the confluence of Mere Brook and the unnamed tributary of Picnic Pond. This stream is joined by a number of small, intermittent streams to form a wide, tidal stream that discharges into the head of Harpswell Cove.

Mere Brook has been subjected to extensive human alterations in the past. The extensive culverted portion of the stream likely restricts fish passage to the northern extent of the stream. Brook trout (*Salvelinus fontinalis*) have historically been present in Mere Brook; however, this species may no longer be present. A few species that have been identified in Mere Brook include golden shiner (*Notemigonus crysoleucas*), common shiner (*Notropis cornutus*), blacknose dace (*Rhinichthys atratulus*), northern redbelly dace (*Phoxinus eos*), and finescale dace (*Phoxinus neogaeus*) (Geo-Marine 2001).

4.3.4 Ponds

Storm water retention ponds are located throughout NAS Brunswick, primarily within the Androscoggin River and Mere Brook watersheds. The three retention ponds within the Androscoggin watershed were created to treat surface water runoff from the northern portion of the airfield and the Jet Fuel Storage Installation. These ponds drain into an unnamed tributary to the Androscoggin River. No fish species are known to be present in any of these ponds.

The three storm water retention ponds within the Mere Brook watershed were created to treat surface water runoff from the remaining portion of the airfield and most of the industrial area on the installation. These small ponds are located along an unnamed tributary of Mere Brook that drains into Picnic Pond, an approximately 3.5-acre pond located on the eastern side of the installation. Flow exiting Picnic Pond discharges to an unnamed tributary of Mere Brook and eventually into Harpswell Cove. Fish species that have been identified in Picnic Pond include golden shiner, emerald shiner (*Notropis atherinoides*), and American eel (*Anguilla rostrata*) (Mierzykowski and Carr 1999).

4.4 Brackish Water/Estuarine Areas

Brunswick is a coastal area that borders Casco Bay of the Atlantic Ocean. Harpswell Cove and Buttermilk Cove are subtidal estuaries within Casco Bay. Subtidal estuaries are characterized as open-water areas heavily influenced by the tide. They support submerged and floating plants but, due to the varying conditions, not emergent vegetation. These areas include tidal flats, which serve as important feeding areas for shorebirds and habitat for a variety of fish and crustaceans.

The locations of the estuaries were visually noted during the field surveys, but surveys for plant community composition were not conducted. Approximately 18 acres of subtidal estuaries are located at NAS Brunswick. Species of submerged plants commonly found in estuaries along the coast of Maine include rockweeds (*Fucus vesiculosus*, *F. spiralis*, *F. edentatus*, *Ascophyllum nodosum*), eelgrass (*Zostera marina*), wigeon grass (*Ruppia maritima*), and sago pondweed (*Potamogeton pectinatus*). The estuaries and coves provide habitat for American lobster (*Homarus americanus*), quahog (*Mercenaria mercenaria*), soft-shell clam (*Mya arenaria*), blue mussel (*Mytilus edulis*), and rock crab (*Cancer irroratus*). All of these species occur in parts of Harpswell Cove and Buttermilk Cove and are commercially and recreationally important. Many other invertebrate species that inhabit these environments are not commercially important, but they are of considerable importance to the ecosystem. These include oligochaete and polychaete worms, amphipods, mud snails, periwinkles (*Littorina littorea*), Baltic clams (*Macoma balthica*), razor clams, ribbed mussels (*Geukensia demissa*), sand shrimp (*Crangon septemspinosa*), grass shrimp (*Palaemonetes pugio*), and horseshoe crabs (*Limulus polyphemus*) (Geo-Marine 2001). It should be noted that these subtidal estuaries are highly productive and diverse and offer a variety of recreational opportunities.

The National Oceanic and Atmospheric Administration (NOAA) has designated portions of Casco Bay as Essential Fish Habitat (EFH), including areas south of

Brunswick and Harpswell. Areas in Casco Bay designated as EFH contain habitats for breeding, spawning, nursery, feeding, or cover for many commercially and recreationally important species. Harpswell Cove and Buttermilk Cove may contain EFH for the following species (NOAA n.d.): Atlantic salmon (*Salmo salar*), Atlantic cod (*Gadus morhua*), pollock (*Pollachius virens*), whiting (*Merluccius bilinearis*), red hake (*Urophycis chuss*), white hake (*Urophycis tenuis*), winter flounder (*Pleuronectes ferruginea*), windowpane flounder (*Scopthalmus aquosus*), American plaice (*Hippoglossoides platessoides*), ocean pout (*Macrozoarces americanus*), yellowtail flounder (*Pleuronectes ferruginea*), windowpane flounder (*Scopthalmus aquosus*), American plaice (*Hippoglossus hippoglossus*), Atlantic sea scallop (*Placopecten magellanicus*), Atlantic sea herring (*Clupea harengus*), bluefish (*Pomatomus saltatrix*), Atlantic mackerel (*Scomber scombrus*), and bluefin tuna (*Thunnus thynnus*).

4.5 Wetland and Aquatic Community Regulations

Wetlands perform important ecosystem functions, including flood retention, groundwater recharge and discharge, nutrient cycling, production export, provision of wildlife habitats, provision of recreational opportunities, entrapment of sediments, and filtration of toxicants (USACE 1999). Aquatic communities also provide important functions, including wildlife habitat, recreational opportunities, sources of drinking water, nutrient cycling, production export, movement of sediment, storage of floodwater, and groundwater recharge and discharge points. These communities are protected under the Federal Clean Water Act and the MNRPA.

Section 404 of the Clean Water Act authorizes the USACE to administer permits for dredging, filling, and discharging to waters of the U.S., including wetlands. For a wetland to be considered under USACE jurisdiction, there must be a clear hydrological connection to waters of the U.S. Many of the wetlands within NAS Brunswick have a clear hydrological connection; however, some do not and thus may not fall under the jurisdiction of the USACE. If any activity involves dredging, filling, or discharging to wetlands or waters, a jurisdictional determination of those wetlands will be necessary and a permit may be required from the USACE.

The MNRPA protects all wetlands and streams; however, not all wetlands are afforded the same level of protection. If a wetland qualifies as a “Wetland of Special Significance,” disturbance to it is strongly discouraged and a permit is required for disturbances within 75 feet of the wetland boundary. Wetlands of Special Significance are defined as follows: all coastal wetlands and great ponds²; freshwater wetlands with a critically imperiled or imperiled community; wetlands that contain significant wildlife habitat; wetlands located within 250 feet of a coastal wetland or a great pond; wetlands with at least 20,000 square feet of aquatic vegetation, emergent marsh vegetation, or open water; wetlands that are sub-

² A great pond is defined as any inland water body that, in a natural state, has a surface area in excess of 10 acres, or any inland water body that has been artificially formed or increased and which has a surface area in excess of 30 acres (<http://www.mainelegislature.org/legis/statutes/38/title38sec480-B.html>).

ject to flooding; all peatlands; and wetlands that are located within 25 feet of a river, stream, or brook (38 MRSA 480-B).

All of the coastal wetlands at NAS Brunswick (freshwater tidal marsh, brackish tidal marsh, and spartina salt marsh) are considered Wetlands of Special Significance. No freshwater wetland communities on NAS Brunswick are imperiled communities; however, many are associated with a stream, and the mixed graminoid-shrub communities within the weapons compound has at least 20,000 square feet of emergent vegetation and open water. Wetlands associated with a stream or of this size are considered Wetlands of Special Significance in accordance with the MNRPA.

As of September 1, 2007, significant vernal pool habitat is protected under the MNRPA. A vernal pool is considered a significant vernal pool if it (1) supports a sufficient number and type of pool-breeding amphibian egg masses, (2) has a population of fairy shrimp, or (3) is used by state-listed threatened or endangered species to complete a critical part of its life history (06-096 CMR Chapter 335). Significant vernal pool habitat includes the vernal pool itself and the area within a 250-foot radius of the spring or fall high-water mark of the pool, which is considered critical terrestrial habitat. The determination and documentation of whether a vernal pool is significant must be made by an individual qualified by sufficient experience and training in either wetland ecology or wildlife ecology. An activity in, on, over, or adjacent to a significant vernal pool must avoid unreasonable impacts on the significant vernal pool habitat. Approval for such activity must be obtained from the MEDEP through a Permit by Rule or individual MNRPA approval.

5

References

- Cowardin, L. et al. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*, U.S. Fish and Wildlife Service, Biological Services Program, Washington, D.C., FWS/OBS-79/31.
- Edinger, G.J., Evans, D.J., S. Gebauer, T.G. Howard, D.M. Hunt, A.M. Olivero. 2002. *Ecological Communities of New York State*. 2nd Edition. New York State Department of Environmental Conservation.
- Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-81-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.
- Geo-Marine, Inc. 2001. *Integrated Natural Resources Management Plan Naval Air Station Brunswick*. Atlantic Division Naval Facilities Engineering Command document.
- Gawler, S.C and A.R. Cutko. 1991. *Natural Landscapes of Maine: A Classification of Vegetated Natural Communities and Ecosystems*. Maine Natural Areas Program, Department of Economic and Community Development.
- _____. 2004. *Natural Landscapes of Maine: A Classification of Vegetated Natural Communities and Ecosystems*. 2nd Edition. Maine Natural Areas Program, Department of Environmental Protection.
- Maine Natural Areas Program (MNAP). 2008. List of Natural Community Types and Rank. http://www.mainenaturalareas.org/docs/natural_communities/links/Community_Rank_List.htm.
- Mierzykowski, S.E., and K.C. Carr. 1999. *Environmental Contaminants in Golden Shiners from Picnic Pond, U.S. Naval Air Station Brunswick, Maine*. U.S. Fish and Wildlife Service Maine Field Office Special Project Report: FY97-MEFO-2-EC.
- McNab, W. H. and P. E. Avers. 1994. *Ecological Subregions of the United States*. USDA Forest Service Document WO-WSA-5.

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- National Oceanic and Atmospheric Administration (NOAA). n.d. Gulf of Maine Summary of Essential Fish Habitat Designation. http://www.nero.noaa.gov/hcd/STATES4/Gulf_of_Marine_3_western_part/43406950.html.
- Normandeau Associates. 1998a. *Naval Air Station Brunswick Wetland Survey*. Report No. P-16674.0000. Normandeau Associates, Yarmouth Maine.
- Normandeau Associates. 1998b. *Naval Air Station Brunswick Soil Survey*. Report No. P-16674.001. Normandeau Associates, Yarmouth Maine.
- Prosser Hallock Planners and Engineers. 2002. *Naval Air Station Brunswick, Maine, Master Plan Update*, May 16, 2002. Prepared for Commander NAS Brunswick.
- Silver, Joe. 2009. Telephone communication between Joe Silver, NAS Brunswick Pest Controller, and Kari Moore, Ecology and Environment Environmental Scientist, March 20, 2009.
- TRC Environmental Corporation (TRC). 2008. *Naval Air Station Brunswick Vernal Pool Summary Report*.
- United States Department of Agriculture (USDA). 1970. *Soil Survey of Androscoggin and Sagadahoc Counties, Maine*.
- _____. 1974. *Soil Survey of Cumberland County, Maine*.
- United States Army Corps of Engineers (USACE). 1999. *The Highway Methodology Workbook. Wetland Functions and Values, a Descriptive Approach*. NAEPP-360-1-30a.
- Walker, Steve. 2008. Telephone communication between Steve Walker, Maine Department of Inland Fisheries and Wildlife, Beginning with Habitat Program Manager, and Averi Marciano, Ecology and Environment Biologist, December 18, 2008.