3.6 GEOLOGY AND SOILS

3.6.1 Methodology

Geology and soils data were obtained from site specific Phase 1 Environmental Site Assessments and preliminary geotechnical reports. Soils and seismic information were obtained from the Natural Resource Conservation Service (NRCS) and U.S. Geologic Service (USGS), respectively.

The USGS develops estimates for mean return times of potential earthquake events of specific sizes and at a predetermined distance. Figure 3.6.1-1 depicts, by color, the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles for the eastern United States.

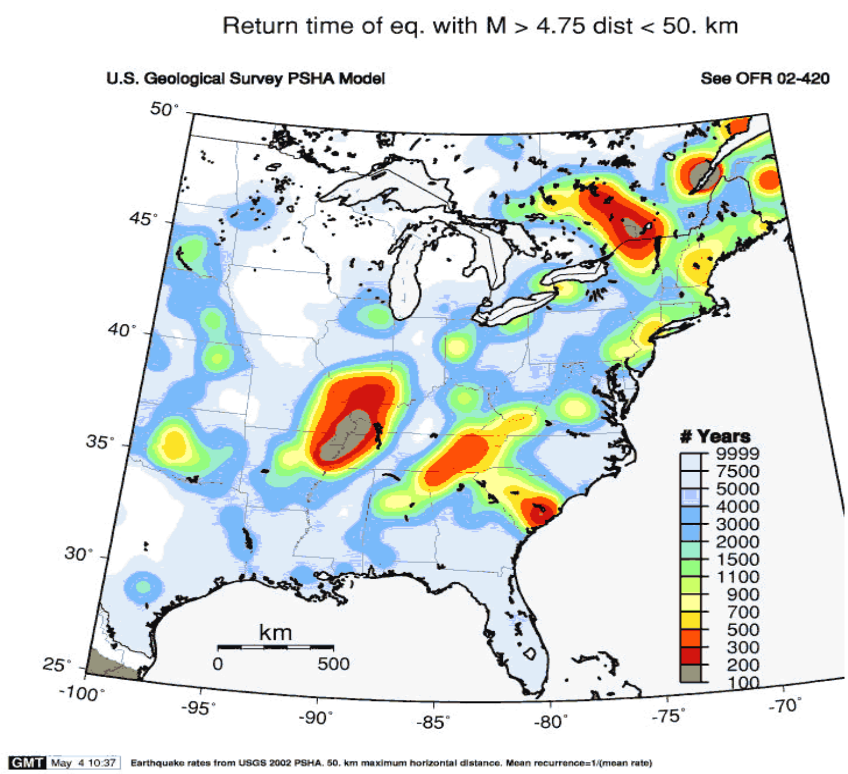


Figure 3.6.1-1 — Earthquake Return Frequency for the Eastern United States

The relative seismic hazard was evaluated based on historical seismicity and USGS seismic hazard map coverage. The USGS National Seismic Hazard Mapping Project maps depict predicted peak (ground) acceleration from earthquakes in units of percent "g" (force of acceleration relative to that of the Earth's gravity) for a given probability of exceedance. For this analysis, the maps used are based on a 2% probability of exceedance in 50 years (i.e., an annual chance of occurrence of about 1 in 2,500).

Site geologic stability was evaluated based on seismic soil classes defined in the 2006 International Building Code (IBC). The IBC would require using geotechnical seismic design criteria such as, but not limited to, seismic soil classes. The average subsurface properties in the top 100 feet of material (whether the strata include soil or rock) determine the seismic soil classification for a site. There are five seismic soil classes. Class A, which is a "hard rock" profile, is the "best" in terms of limiting ground motions on a structure. Class E soils are susceptible to liquefaction, where saturated "soft soil" ground can sometimes take on the characteristics of a fluid resulting in the loss of strength, sudden settlement, or lateral movement. All of the site alternatives have seismic soil classifications of D (soft to medium clays or sand), except the Umstead Research Farm Site in North Carolina.

Additionally, regulatory authorizations and planning requirements were resourced from individual state programs. These data were evaluated by site in an effort to assess potential effects of construction and operation from the proposed alternatives. Baseline geologic conditions were used to identify potential structural design considerations and potential effects as the design process proceeds. The potential area, volume, and footprint of soil disturbance were estimated in the *NBAF Conceptual Design and Feasibility Study* and NBAF *Site Characterization Study* (NDP 2007a; 2007b).

3.6.2 No Action Alternative

3.6.2.1 Affected Environment

The geology of Plum Island is dominated by sediments left during previous ice ages. The soil structure of the island is comprised of consolidated and unconsolidated sediments resting on a bed of crystalline Precambrian bedrock. The soils consist of glacial deposits dominated by sand and gravel that extend several hundred feet below land surface (bls). The sand and gravel is saturated with a freshwater lens rising from 100 feet bls to the surface (Crandell 1962; Terracon 2007a).

The upper sediment layers of the island are unconsolidated and of the Cretaceous and Quaternary age. The sediments consist of the Magothy Formation, Matawan Group, and the Raritan Formation. These sediment groups are comprised of fine clayey sands, medium to coarse sand, and gravel (Crandell 1962; Entech 2002). A preliminary geotechnical report described Plum Island as slightly hilly with a surface topography falling toward the south-southwest. Five test borings indicated groundwater levels ranging from 13.8 feet bls to 18.5 feet bls. The island's soils are generally described as topsoil and fill consisting of brown sand and silt from 0 to 3.5 feet bls, subsoil consisting of medium to fine sand from 2 feet bls to 5 feet bls, and glacial outwash consisting of coarse to fine sand from 5 feet bls to 25 feet bls (Terracon 2007a).

3.6.2.2 Construction Consequences

Construction of the NBAF would not occur under this alternative. However, infrastructure improvements at PIADC previously identified would proceed. In the Categorical Exclusion documentation prepared for these improvements, DHS indicated that numerous boulders would be encountered during excavation activities (NDP 20078). Construction site soils would be displaced, augmented, or replaced with proper foundation bearing soil types. Erosion control and storm water management efforts would be employed through the entire construction period. Additional oversight and caution during any subsurface excavations would be required based on previous and ongoing waste disposal assessment efforts (see also Section 3.12.2.1). If below-grade structures were proposed to meet space requirements, excavation dewatering would be required. Potential for soil settlement from construction dewatering would require design assessments to confirm adequate structural specifications. Any new or expanded foundations would be designed with an appropriate factor of safety, incorporating the bearing capacity and consolidation potential of the soil. The facility upgrades would be possible without significant effects to the site soils beyond the immediate footprint of the enhancements. Refer to Chapter 2 and Section 3.1.1 for additional storm water and constructability information.

3.6.2.3 Operation Consequences

A current facility expansion would likely increase PIADC's impervious area. The additional storm water discharge would be managed, reducing downstream erosion potential and allowing for subsurface filtration and groundwater recharge. Expansion of PIADC would not have anticipated adverse effects on the geology or soil structure of the area beyond the immediate footprint.

3.6.3 South Milledge Avenue Site

3.6.3.1 Affected Environment

Sixty percent of the Oconee River Basin is located in the Georgia Piedmont Region. The area is underlain by Precambrian and older Paleozoic crystalline rocks including biotite, granite, and amphibolites gneisses. The South Milledge Avenue Site is located in the Piedmont Region of Georgia. Moderate to high grade metamorphic rock and igneous rock make up the regions subsurface geology. These type soil structures can produce karst topography; however, such potential subsurface voids result from faults and fissures more so than dissolution or suffusion. The region is known for inactive fault zones that determine surface stream patterns and groundwater resources. The two primary tectonic terranes in the Piedmont Region are the Inner Piedmont and the Carolina, each separated by the Towaliga Fault Zone. The Inner Piedmont rocks, north of the fault zone, consist mainly of granitic and biotitic gneisses, whereas the Carolina rocks are predominantly metasedimentary. Deeply weathered Saprolite bedrock underlays much of the southeastern Piedmont Region. The geology of Georgia lends itself to earthquakes of various magnitudes and intensities. Table 3.6.3.1-1 is a brief historical summary of earthquakes in or felt in Georgia (USGS 2008).

Table 3.6.3.1-1 — Georgia Historical Earthquake Data

Date	Location	Intensity
1811-1812	New Madrid, Missouri	VI
August 31, 1886	Charleston, South Carolina	VIII
June 17,1872	Milledgeville	V
November 1, 1875	Atlanta	VI
October 18, 1902	Dalton	VI
January 23, 1903	Tybee Island	VI
June 20, 1912	Savannah	V
March 5, 1916	Atlanta	V
March 12, 1964	Haddock	V

Magnitude, as registered on seismographs, is the energy released from an earthquake, as well as intensity is the strength of shaking, determined from effects on people and structures. The following table describes the relationship between magnitude and intensity (USGS 2008).

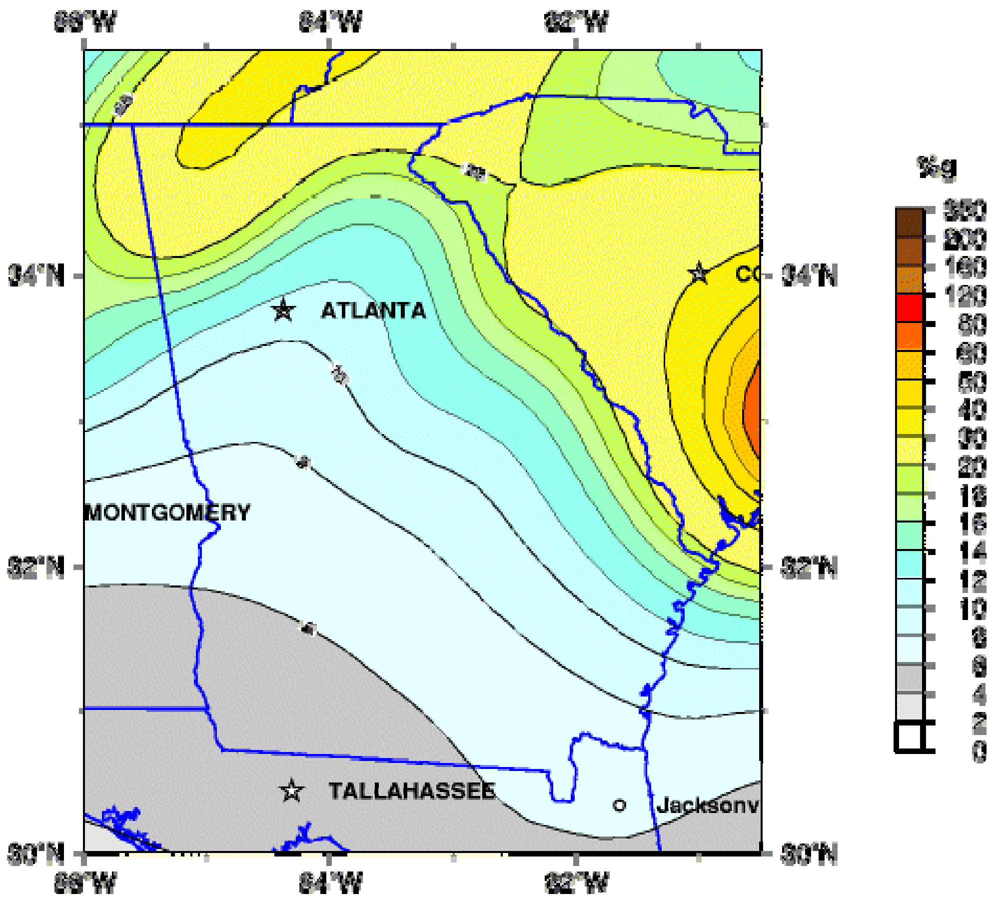
Table 3.6.3.1-2 — Magnitude vs. Intensity

Magnitude	Intensity	Intensity Description Examples
1.0 - 3.0	I	Not felt except by a very few under especially favorable conditions
3.0 - 3.9	II - III	Noticeably felt indoors, walls may creak
4.0 - 4.9	IV - V	Felt by nearly everyone, windows may break
5.0 - 5.9	VI - VII	Felt by all, heavy furniture moved
6.0 - 6.9	VII - IX	Damage considerable
7.0 and higher	VIII or higher	Most masonry and frame structures destroyed

The March 5, 1916, earthquake centered near Atlanta is considered one of the most significant in Georgia. With an intensity of V, the area of influence reached Cherokee County, North Carolina. The most recent Georgia earthquake, with a registered magnitude of 1.8, occurred on January 16, 2008, approximately 75 miles northwest of Atlanta or approximately 100 miles northwest of Athens. The USGS develops seismic hazard maps that are used in developing area building codes. Figure 3.6.3.1- 1 depicts peak acceleration for Georgia, and the South Milledge Avenue Site is approximately 60 miles east of Atlanta. As the ground shakes during an earthquake, the ground also experiences acceleration. The USGS defines peak acceleration as “the largest acceleration recorded by a particular station during an earthquake.” Refer to Sections 3.1.1 and 3.14 for additional constructability information.

The USGS develops estimates for mean return times of potential earthquake events of specific sizes and at a predetermined distance. The USGS estimated return time for 4.75, 5.0, and 6.5 magnitude earthquakes at a fixed distance of 31 miles exceeds 1,500 years for the Athens, Georgia, area. Refer to Section 3.6.1 for additional seismic information.

Soils at the South Milledge Avenue Site are in the Pacolet-Madison-Davidson Soil Association (Nutter and Associates 2007a). Of the several on-site soil classifications, Pacolet sandy clay loam dominates the site soil structure. The soils are well-drained with a 2% to 25% slope range. The surface texture is loam, a standard term defined according to percentages of sand, silt, and clay. In this case, "loam" is soil of 7% to 27% clay, 28% to 50% silt, and less than 52% sand. If particles coarser than sand exceed 15%, then an appropriate modifier such as “gravelly” is added. The NRCS Soils Map (Figure 3.6.3.1- 2) and Table 3.6.3.1- 3 describe the soil types and locations at the South Milledge Avenue Site.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.3.1-1 — Seismic Hazard Map for Georgia

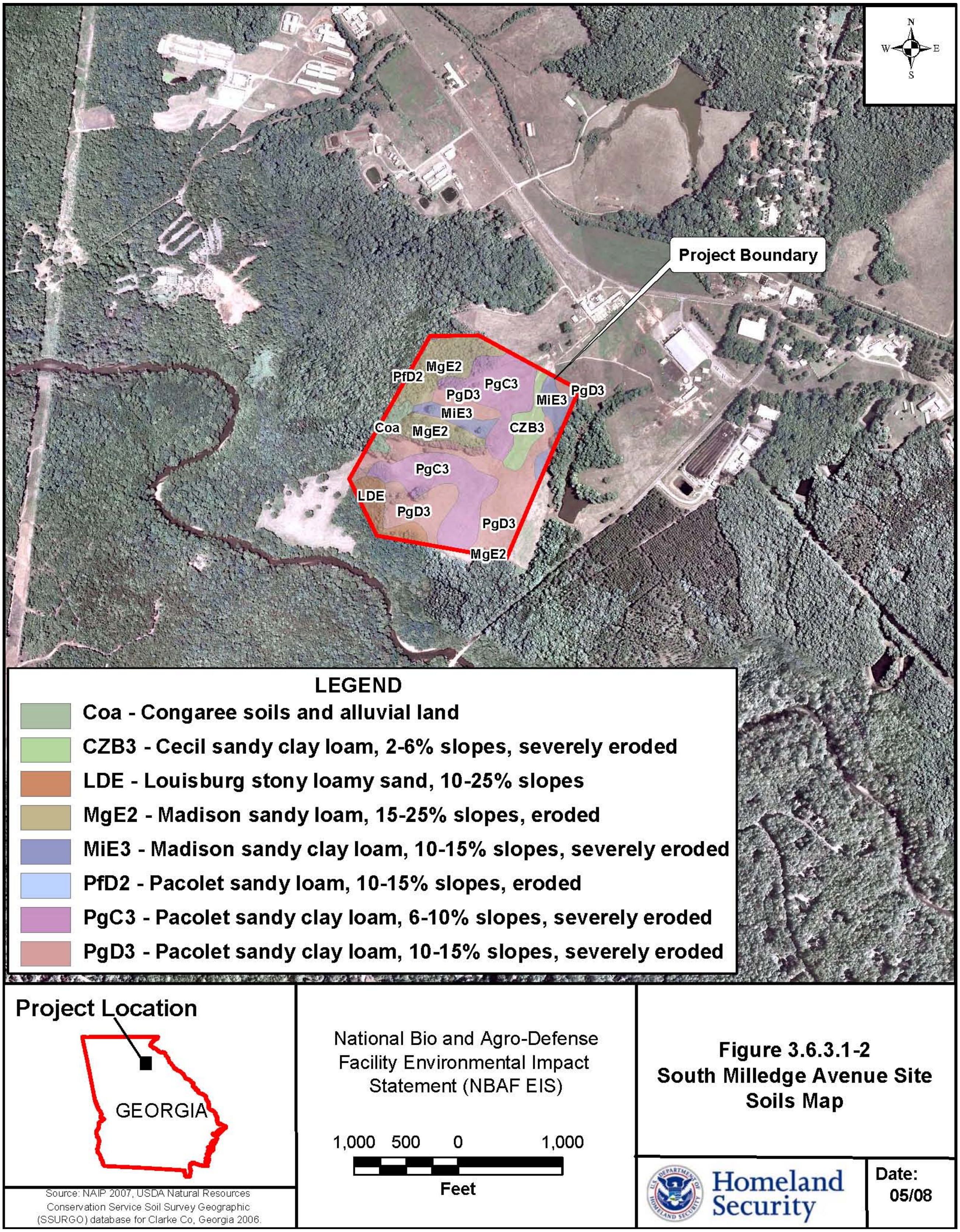


Figure 3.6.3.1-2 — South Milledge Avenue Site Soils Map

Table 3.6.3.1-3 — South Milledge Avenue Site Soil Descriptions

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	pH Range	Depth to Water Table (inches)
Coa	Congaree soils	0 - 80	Well drained	0 - 2	4.5 - 7.3	About 30 to 48
CZB3	Cecil sandy clay loam	0 - 75	Well drained	2 - 6	4.5 - 6.5	Greater than 80
LDE	Louisburg stony loamy sand	0 - 60	Well drained	10 - 25	4.5 - 6.0	Greater than 80
MgE2	Madison sandy loam	0 - 66	Well drained	15 - 25	4.5 - 6.5	Greater than 80
MiE3	Madison sandy clay loam	0 - 66	Well drained	10 - 25	4.5 - 6.5	Greater than 80
PgC3	Pacolet sandy clay loam	0 - 70	Well drained	6 - 10	4.5 - 6.5	Greater than 80
PgD3	Pacolet sandy clay loam	0 - 70	Well drained	10 - 15	4.5 - 6.5	Greater than 80

Of the 7 soil types, 1 (Congaree soils) is partially hydric and is also of statewide farmland importance. The National Technical Committee for Hydric Soils (NTCHS) defines hydric soils as forming under conditions of saturation, flooding, or ponding long enough to develop anaerobic conditions in the upper strata. These soils, in natural conditions, are saturated or inundated during the growing season long enough to support growth and reproduction of hydrophytic vegetation. The NTCHS definition of "hydric" identifies soil properties based on their associated wetness and further recommends that more information, such as depth to and duration of, the water table is needed to determine if a specific soil type is specifically hydric or non-hydric. Table 3.6.3.1-4 describes the site's approximate soil classification percentages, and indicates whether the soil classification is hydric, or is considered of statewide farmland importance.

Table 3.6.3.1-4 — Hydric and Farmland Soils

Map Unit	Classification	Approx. Site %	Hydric Soil	Farmland Description
Coa	Congaree soils	2	Partially Hydric	Farmland of statewide importance
CZB3	Cecil sandy clay loam	5	Not Hydric	Not prime farmland
LDE	Louisburg stony loamy sand	6	Not Hydric	Not prime farmland
MgE2	Madison sandy loam	15	Not Hydric	Not prime farmland
MiE3	Madison sandy clay loam	8	Not Hydric	Not prime farmland
PgC3	Pacolet sandy clay loam	32	Not Hydric	Not prime farmland
PgD3	Pacolet sandy clay loam	32	Not Hydric	Not prime farmland

3.6.3.2 Construction Consequences

A detailed geotechnical report would be prepared once the preferred alternative is selected, and the findings and recommendations would be considered in the final design and specifications of the facility. The seismic soil class of the South Milledge Avenue Site is preliminarily considered Class D. Refer to Section 3.6.1, Table 3.6.1-1 for additional seismic information. Five preliminary geotechnical borings provided the following information: all borings were silty sand from 0 to 53 feet bls, most borings indicate partially weathered rock at varying depths of 1.5 feet bls to 71 feet bls, and dense rock was present in 1 boring at depths of 17 feet bls to 27 feet bls (Terracon 2007f). The subsurface geology of the site is formed from metamorphic and igneous rock limiting the likelihood of sinkhole development. Understanding the soil foundation and subsurface rock strata at the site are vital parameters and would influence the ultimate design and construction outlays. The proposed NBAF would be built to meet or exceed all applicable Georgia seismic building codes. The NBAF construction would not result in anticipated adverse effects on the geology of the region.

Site constructability has several variables ranging from the amount of excavation, depth to bedrock, depth to water table, and soil shrink/swell potentials. Structures built on sites with expansive clay soils should have an appreciable separation between these soils and the building foundation. With sufficient nonexpansive soil backfilling, a slab-on-grade foundation system would be considered. If the structure has more stringent movement tolerances, then a deep pile foundation system would be evaluated. Grade cut and fill needs would be anticipated to provide a fairly uniform surface for facility construction. An estimated volume of 292,000 cubic yards of on-site material would be displaced and managed during the construction phase. Additional information regarding seismic classification and construction considerations are included in Chapter 2, Sections 3.1.1 and 3.14.

The Congaree soil classification is the only soil described as of statewide farmland importance, and these soils make up less than 3% of the site soils. All federal projects are subject to the *Farmland Protection Policy Act* (FPPA) requirements if farmland would be irreversibly converted (directly or indirectly) to nonagricultural uses. The FPPA consultation would be required for all alternatives, and the NRCS local field office consultations have been initiated. The Farmland Conversion Impact Rating Form (AD-1006) and agency consultation would be finalized prior to construction. Good engineering and best management practices would be implemented through the entire construction phase, including implementation of approved erosion control and construction storm water pollution prevention plans. Implementation of these planning and regulatory authorizations would minimize or eliminate adverse effects on the soil classifications of the area beyond the immediate footprint of the site.

3.6.3.3 Operation Consequences

The preparation and implementation of a sediment and erosion control plans would minimize, if not prevent, any potential soil effects from the operation and maintenance of the facility. The proposed conceptual layout for the South Milledge Avenue Site avoids direct effects to on-site surface waters. The *NBAF Conceptual Design and Feasibility Study* acknowledged the need to address the facility design and structural components to ensure sufficient stiffness minimizing structural deflection and vibration. The *NBAF Conceptual Design and Feasibility Study* discussed design goals for sustainable hydrology, such as landscaping with functional storm water management uses, and the maintenance/retention of a healthy soil structure. The NBAF would have no anticipated adverse effects on soil at the South Milledge Avenue Site other than those within the immediate site's footprint.

3.6.4 Manhattan Campus Site

3.6.4.1 Affected Environment

Riley County has many different surface rock, soil, and bedrock types as compared to most Kansas counties. These soil/rock types and ages range from younger hill top and river bed soils, sands, and gravels to the older limestone bedrock in southeastern Riley County. Most of Riley County's bedrock is Permian age limestone and shale, containing flint, the rock naming the Flint Hills region (KGS 1995). Of the 105 Kansas counties, 26 counties have reported sinkholes. The Fort Riley Limestone outcropping south of Riley County is water soluble and accounts for a large distribution of karst topography in southeastern Kansas. Western Kansas also has sinkhole erosional features that are associated with other subsurface salt and carbonate deposits.

The Mid-continent Rift System stretches from Lake Superior to southern Kansas. The Rift System contains faults or fractures including the Humboldt Fault, a 300-million year-old subterranean fracture running through Kansas. In the Manhattan area, the Humboldt Fault is broken by a series of bisecting underground fissures, which is a plausible explanation for the recorded earthquakes in Riley and adjacent Pottawatomie Counties. Field investigations have confirmed that sedimentary deposits, with moderate susceptibility for liquefaction, are present in the vicinity of Wamego and Wabaunsee Kansas, less than 25 miles from the Manhattan Campus Site. The studies suggested that liquefaction features are present but may not be regionally pervasive

(Seismological Society of America 2004). The Kansas Geological Survey, with offices in Lawrence, Kansas, estimated that the Humboldt Fault is capable of producing a 6.5-magnitude earthquake every 2,000 to 5,000 years.

On April 24, 1867, a 5.1-magnitude earthquake centered near Manhattan resulted in structural damage, and a 2-foot high wave was reported moving south to north on the Kansas River near Manhattan. Between September and December 1929, a series of four earthquakes, with magnitudes between 3.2 and 4.2, occurred within the area surrounding Manhattan. The Kansas Geological Survey, with partial funding by the U.S. Army Corps of Engineers (USACE), has been studying and recording seismic epicenter and magnitude data since the 1960s. Based on these studies, very small earthquakes routinely occur in Kansas; most of these are micro-earthquakes, which are defined as earthquakes too small to feel. Table 3.6.4.1-1 provides a brief historical summary of earthquakes in or felt in Kansas (USGS 2008).

Table 3.6.4.1-1 — Kansas Historical Earthquake Data

Date	Location	Intensity[a]
April 24, 1867	Manhattan	VI
November 6, 1875	Valley Falls	V
October 31, 1895	Charleston, Missouri	ND[b]
October 27, 1904	Dodge City	V
January 7, 1906	Manhattan	VII
March 18, 1927	White Cloud	V
September 23, 1929 (2)	Manhattan	V
October 21, 1929	Manhattan	ND
December 7, 1929	Manhattan	ND
February 20, 1933	Decatur County	ND
April 9, 1952	Medicine Lodge	V
January 6, 1956	Coats	ND
April 13, 1961	Norton County	V
November 9, 1968	Eastern Kansas	VI

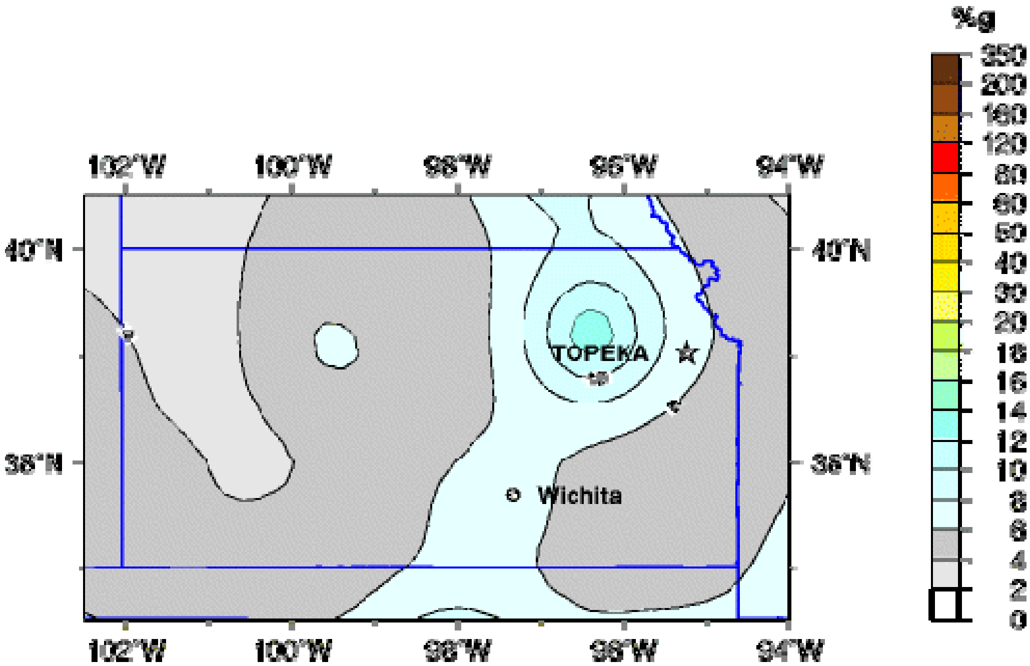
[a] Ref. Table 3.6.3.1-2 Magnitude vs. Intensity. [b] ND-No Data

The most recent earthquake, of a registered magnitude 2.7, occurred on January 1, 2008, approximately 15 miles west of Arkansas City, Kansas. Arkansas City is 149 miles southeast of Manhattan. Figure 3.6.4.1-1 shows the seismic hazard potential for Kansas; the Manhattan Campus Site is approximately 604 miles west of Topeka. The figure depicts the area of potential ground shaking hazard for the Manhattan Campus Site as 6% to 10% g. Refer to Section 3.6.1 for additional seismic information.

Figure 3.6.1-1 (Section 3.6.1) depicts the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles. The USGS estimated return time for 4.75-, 5.0-, and 6.5-magnitude earthquakes at a fixed distance of 31 miles exceeds 1,500 years for the Manhattan, Kansas, area.

Of the several on-site soil classifications, three dominate the Manhattan Campus Site: Tully silty clay loam, Clime-Sogn complex, and Smolan silt loam. These soils are well to moderately well drained with a 1% to 20% slope range. The site surface texture is a silt loam to a silty clay loam. Refer to Section 3.6.3.1 for additional soil information. The NRCS Soils Map (Figure 3.6.4.1- 2) and Table 3.6.4.1- 2 describe the on-site soil types and locations.

Table 3.6.4.2-3 describes approximate soil classification percentages at the site, general farmland description, and hydric determination. No on-site soil types are identified as prone to flooding or ponding, two are partially hydric, and five of six soil classifications are considered either prime or of statewide farmland importance. Refer to Sections 3.6.3.1 and 3.6.3.2 for additional hydric soil and FPPA information.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.4.1-1 — Seismic Hazard Map for Kansas

An estimated volume of 284,000 cubic yards of on-site material would be displaced and managed during the construction phase. A detailed geotechnical report would be prepared once the preferred alternative is selected.

Table 3.6.4.1-2 — Manhattan Campus Site Soils Description

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	pH Range	Depth to Water Table (inches)
3919 (Sm) & 3920 (Sn)	Smolan silt loam	0 - 60	Moderately well drained	1 to 7	5.6 - 7.8	More than 80
3923 (So)	Smolan silty clay loam	0 - 60	Moderately well drained	3 to 7	5.6 - 7.8	More than 80
4590 (Cs)	Clime-Sogn complex	0 - 34	Well drained	3 to 20	6.1 - 8.4	More than 80
4783 (Tu)	Tully silty clay loam	0 - 60	Well drained	3 to 7	5.6 - 8.4	More than 80
7681 (Wn)	Wymore silty clay loam	0 - 79	Moderately well drained	1 to 3	5.6 - 7.3	About 12 to 36
7690 (Bk)	Wymore-Kennebec complex	0 - 64	Moderately well drained	0 to 17	5.6 - 7.3	About 12 to 36

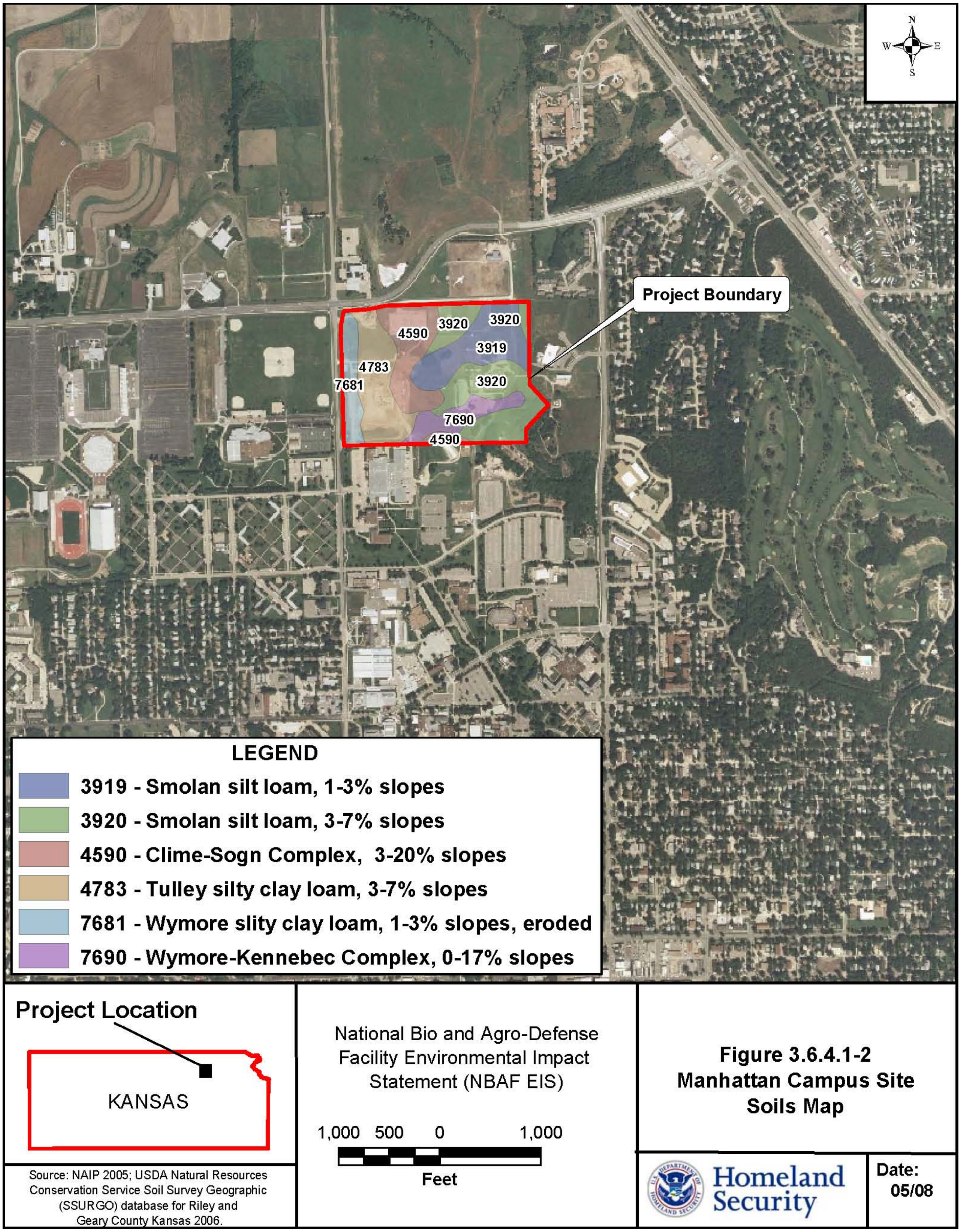


Figure 3.6.4.1-2 — Manhattan Campus Site Soils Map

Table 3.6.4.1-3 — Hydric and Farmland Soils

Classification	Approx. Site %	Hydric Soil	Farmland Description
Smolan silt loam	20	Not Hydric	All areas are prime farmland
Smolan silt loam & silty clay loam	5	Not Hydric	Farmland of statewide importance
Clime-Sogn complex	24	Partially Hydric	Farmland of statewide importance
Tully silty clay loam	28	Not Hydric	Farmland of statewide importance
Wymore silty clay loam	12	Not Hydric	All areas are prime farmland
Wymore-Kennebec complex	11	Partially Hydric	Not prime farmland

3.6.4.2 Construction Consequences

The Manhattan Campus Site is approximately 48.4 acres, and the minimum area required for the NBAF is 30 acres. Refer to Sections 3.6.3.1, 3.6.3.2, and 3.1.1 for additional facility and constructability information. There are no on-site wetlands, and only two of the six soil types are classified as partially hydric. Approximately 90% of the site soils are considered prime or of statewide farmland importance. NRCS coordination has been initiated. Refer to Sections 3.6.3.1 and 3.6.3.2 for additional hydric soil and FPPA information and Sections 3.6.3.2 and 3.1.1 for additional regulatory and constructability information. The Manhattan Campus Site seismic soil classification would be preliminarily considered Class D. Additional information regarding seismic classification and construction considerations are included in Chapter 2, Sections 3.1.1, 3.6.1, and 3.14 and Table 3.6.1-1.

The preliminary geotechnical data described the site soils as: 0 to 5 feet bls fat clay fill with rock fragments; native clays from 7 feet bls to 25 feet bls; and, in several borings, underlying limestone and shale from 5 feet bls to 26 feet bls (Terracon 2007c). Sections 3.6.3.1, 3.6.3.2, and 3.1.1 include additional constructability information. Preliminary geotechnical investigations did not identify any geologic features that would suggest sinkhole formation. The NBAF would be built to meet or exceed all applicable Kansas seismic building codes. Construction of the NBAF would not result in anticipated adverse effects on the geology of the region.

3.6.4.3 Operation Consequences

The NBAF would have no anticipated adverse effects on the Manhattan Campus Site soils, other than those within the immediate site footprint. Operation of the NBAF at the Manhattan Campus Site would not result in anticipated adverse effects on the geology of the region. Refer to Section 3.14 for additional operational information.

3.6.5 Flora Industrial Park Site

3.6.5.1 Affected Environment

The Flora Industrial Park Site is located within loessial soils overlying the Yazoo Formation. The Yazoo Formation, part of the Jackson Group, is a relatively homogeneous unit made up of calcareous and fossiliferous clays (MDEQ 2008). The Yazoo Formation was marine deposited during the Eocene and covers nearly three-fourths the width of central Mississippi. Mississippi is not known for karst features; however, there are three distinct Mississippi regions with limestone outcrops. The Fort Payne Formation is in the state’s northeast corner, the Ripley Formation that outcrops diagonally in the state’s center from north to southeast, and the Marianna Formation the trends east to west from the state’s southern central area. Ten Mississippi counties are within the three limestone regions but does not include Madison County. A shallow seaway crossed North America, from the Gulf of Mexico to the Arctic Ocean, and sediment from this seaway accumulated in a partial rift called the Reelfoot Rift. The Reelfoot Rift extends from Illinois southwest toward the Gulf of Mexico. The Reelfoot Rift is referred to as "inactive" but continues to influence the central United States. The New Madrid Seismic Zone lies within the central Mississippi Valley, and the New Madrid Fault

System lies within the confines of the Reelfoot Rift. Historically, this area has been the site of some of the largest earthquakes in North America.

Most earthquakes experienced in Mississippi have occurred from events outside the state boundaries. Table 3.6.5.1-1 briefly describes the earthquake history of Mississippi (USGS 2008).

Table 3.6.5.1-1 — Mississippi Historical Earthquake Data

Date	Location	Intensity[a]
1811 - 1812	New Madrid, Missouri	VI
December 16, 1931	Tallahatchie County	VI - VII
February 1, 1955	Gulfport	V
June 4, 1967	Greenville	III
June 29, 1967	Bolivar	III
March 29, 1972	Hillhouse	IV

[a] Ref. Table 3.6.3.1.- 2 Magnitude vs. Intensity.

The earthquake of December 17, 1931, was centered in Tallahatchie County approximately 100 miles north of the Flora Industrial Park Site, and is considered one of Mississippi's largest, with an intensity of VI. A more recent earthquake, with a registered magnitude of 1.7, occurred on January 20, 2008, near Grenada, Mississippi, approximately 95 miles north of the Flora Industrial Park Site.

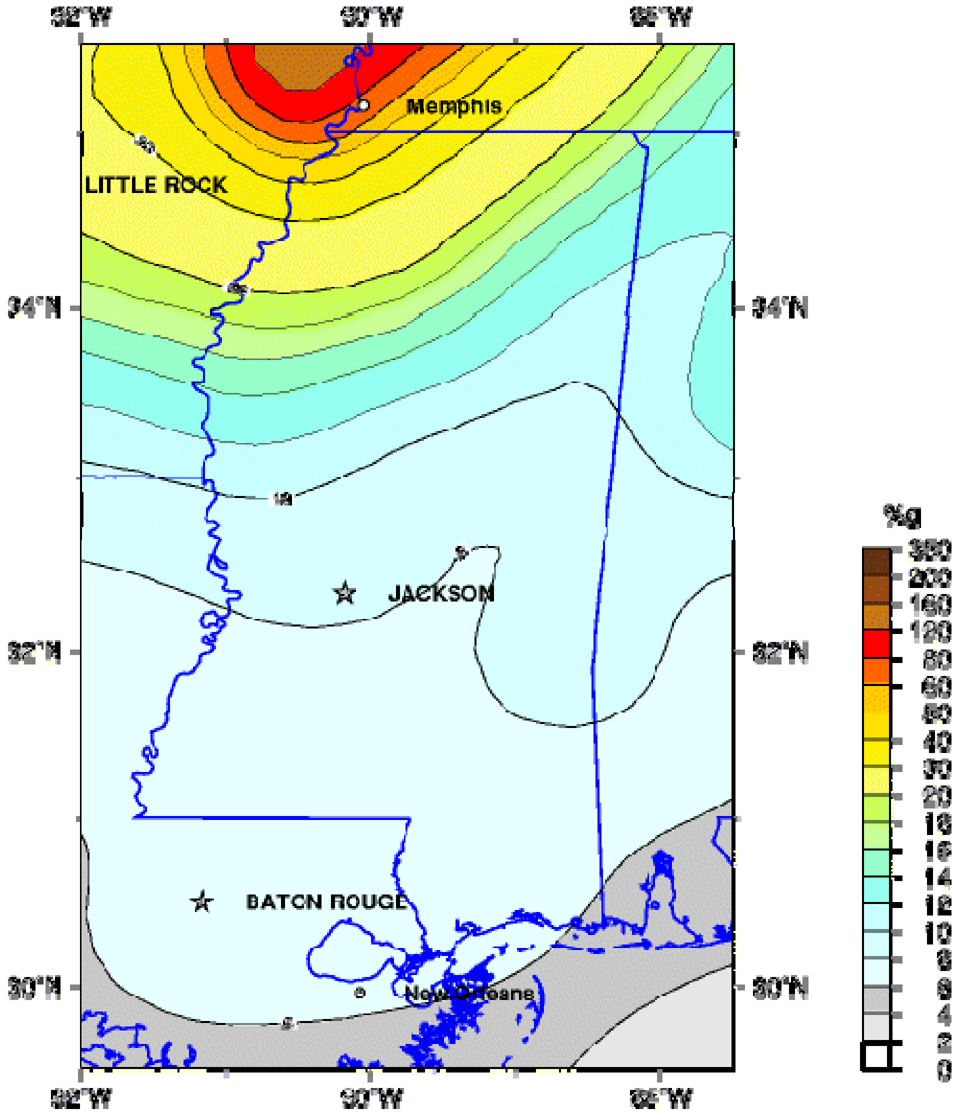
Figure 3.6.5.1-1 depicts seismic peak acceleration for Mississippi; the Flora Industrial Park Site is approximately 30 miles west of Jackson. The figure indicates that the Flora Industrial Park Site is within an area of potential ground-shaking hazard 8% to 10% g. Refer to Sections 3.6.1 and 3.6.3.1 for additional seismic information.

Figure 3.6.1-1 (Section 3.6.1) depicts the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles. The USGS estimated return time for 4.75-, 5.0-, and 6.5-magnitude earthquakes at a fixed distance of 31 miles exceeds 2,000 years for the Flora, Mississippi, area.

The soil profile for the Flora Industrial Park Site includes the Loring-Grenada-Calloway Soils Association. These soils are well to somewhat poorly drained, with a 1% to 8% slope range. The poorly drained silty soils have a subsurface soil layer that restricts water flow and root penetration primarily on uplands and stream terraces. The Flora Industrial Park Site Soils Map (Figure 3.6.5.1-2) illustrates soil type locations, and Table 3.6.5.1-2 describes the on-site soil types.

Table 3.6.5.1-2 — Flora Industrial Park Site Soils Descriptions

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	pH Range	Depth to Water Table (inches)
Ar	Ariel Silt Loam	0 - 65	Well drained	0 - 2	4.5 - 5.5	24 to 36
CbB	Calloway Silt Loam	0 - 68	Somewhat poorly drained	1 - 3	4.5 - 7.8	7 to 18
GrB2	Grenada Silt Loam	0 - 60	Moderately well drained	2 - 5	4.5 - 7.3	18 to 27
LoB2	Loring Silt Loam	0 - 72	Moderately well drained	2 - 5	4.5 - 6.5	24 to 32
LoC2	Loring Silt Loam	0 - 72	Moderately well drained	5 - 8	4.5 - 6.5	24 to 32
LoC3	Loring Silt Loam	0 - 72	Moderately well drained	5 - 8	4.5 - 6.5	24 to 32



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.5.1-1 — Seismic Hazard Map for Mississippi

Four soil types are partially hydric, and five of six are prime or of statewide farmland importance (Table 3.6.5.1-3) (NRCS 2007).

3.6.5.2 Construction Consequences

A detailed geotechnical report would be prepared once the preferred alternative is selected, and the findings and recommendations would be considered in the final design and specifications of the facility. Preliminary geotechnical investigations did not identify any geologic features that would suggest sinkhole formation. The NBAF would be built to meet or exceed all applicable Mississippi seismic building codes, and the seismic soil classification of the site would be preliminarily consider Class D. Refer to Chapter 2, Sections 3.1.1, 3.6.1, 3.6.3.1, 3.6.3.2, and 3.14 and Table 3.6.1-1 for additional seismic and constructability information. An estimated volume of 145,000 cubic yards of on-site material would be displaced and managed during the construction phase. Soils at the Flora Industrial Park Site are considered 90% prime or of statewide farmland importance. NRCS coordination has been initiated.

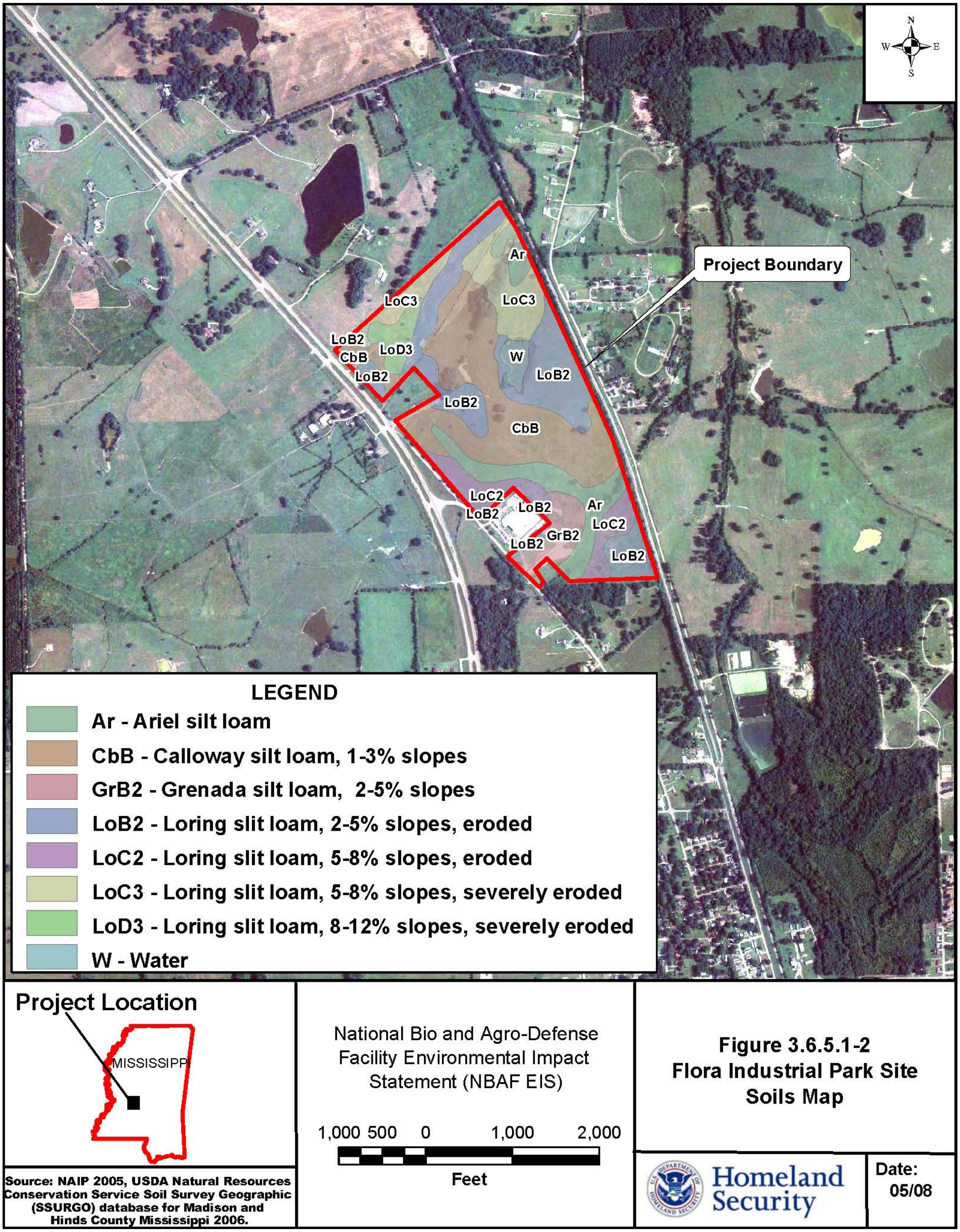


Figure 3.6.5.1-2 — Flora Industrial Park Site Soils Map

Table 3.6.5.1-3 — Hydric and Farmland Soils

Map Unit	Classification	Approx. Site %	Hydric Soil	Farmland Description
Ar	Ariel Silt Loam	15	Partially Hydric	Prime farmland if protected from flooding or not frequently flooded during the growing season
CbB	Calloway Silt Loam	35	Partially Hydric	All areas are prime farmland
GrB2	Grenada Silt Loam	5	Not Hydric	All areas are prime farmland
LoB2	Loring Silt Loam	25	Not Hydric	All areas are prime farmland
LoC2	Loring Silt Loam	10	Partially Hydric	Farmland of statewide importance
LoC3	Loring Silt Loam	10	Partially Hydric	Not prime farmland

3.6.5.3 Operation Consequences

The Calloway silt loam soil classification makes up a large portion of the soil classes at the site. The NBAF operations would have no anticipated adverse effects on the soil classifications of the area beyond the immediate site footprint. Refer to Section 3.14 for additional operational information.

3.6.6 Plum Island Site

3.6.6.1 Affected Environment

The surface geology of Plum Island is described in Section 3.6.2.1.

The geology of New York lends itself to occasional earthquakes. Table 3.6.6.1-1 briefly describes the earthquake history of New York (USGS 2008).

Table 3.6.6.1-1 — New York Historical Earthquake Data

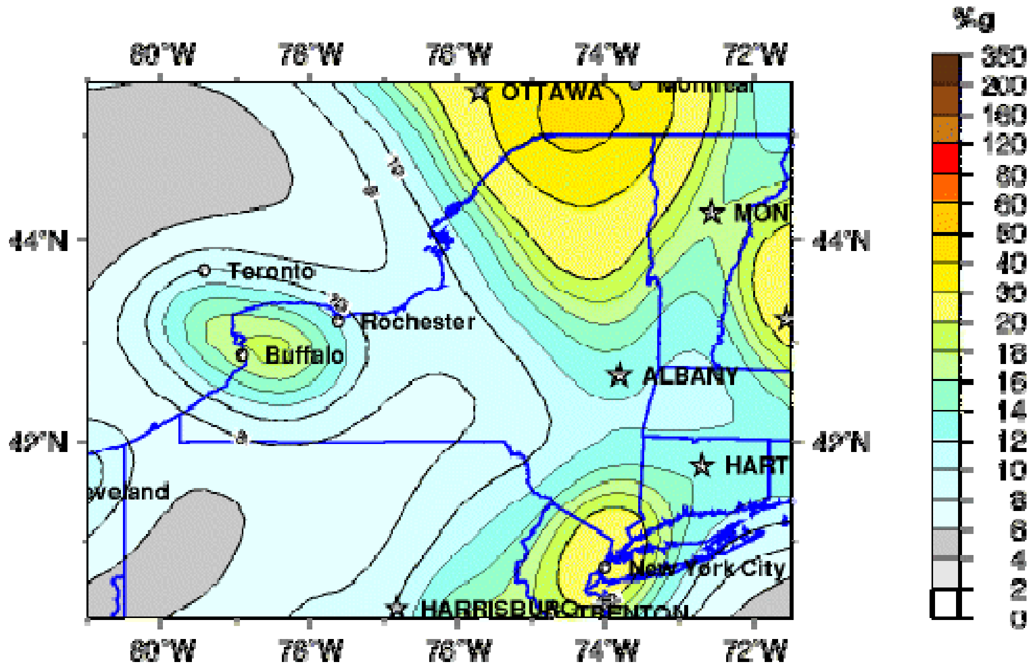
Date	Location	Intensity[a]
December 18, 1737	New York City	VII
October 23, 1857	Buffalo	VI
November 14, 1877	Lake Champlain	VII
August 10, 1884	Amityville	VII
August 12, 1929	Attica	VIII
April 20, 1931	Lake George	VII
September 4, 1944	Massena	VIII
January 1, 1966	Attica	VI

[a]Ref. Table 3.6.3.1- 2 Magnitude vs. Intensity.

The most recent earthquake in New York, with a registered magnitude of 1.9, occurred on March 15, 2008, approximately 10 miles south-southwest of Middletown or 100 miles west-northwest of Plum Island. Figure 3.6.6.1-1 shows seismic peak acceleration for New York; Plum Island is approximately 100 miles east-northeast of New York City. The figure depicts Plum Island within an area of potential ground-shaking hazard 8% to 10% g. Refer to Section 3.6.1 for additional seismic information.

Figure 3.6.1-1 (Section 3.6.1) depicts the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles. The USGS estimated return time for 4.75-, 5.0-, and 6.5-magnitude earthquakes at a fixed distance of 31 miles exceeds 1,500 years for the Plum Island, New York, area.

Of the several on-site soils classifications, Haven loam (HaB) and Carver/Plymouth sands (CpE) dominate. The soil drainage classes range from moderately well drained to excessively drained, and the slopes range from 2% to 35%. The NRCS Soils Map (Figure 3.6.6.1- 2) and Table 3.6.6.1- 2 describe the onsite soil types and locations found on the Plum Island site.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.6.1-1 — Seismic Hazard Map for New York

Table 3.6.6.1-2 — Plum Island Site Soils Descriptions

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	Depth to Water Table (inches)
BgB	Bridgehampton silt loam	0 - 80	Well drained	2 - 6	More than 80
CpE	Carver and Plymouth sands	0 - 60 0 - 60	Excessively drained Excessively drained	15 - 35	More than 80 More than 80
CuB	Cut and fill land, gently sloping	-	Moderately well drained	3 - 8	-
Gp	Gravel pits	-	-	-	-
HaB	Haven loam	0 - 60	Well drained	2 - 6	More than 80
PlC	Plymouth loamy sand	0 - 60	Excessively drained	8 - 15	More than 80

Figure 3.6.6.1-2 — Plum Island Site Soils Map

Table 3.6.6.1-3 describes the approximate soil classification percentages, general farmland description, and hydric determination for the site. No soil types are identified as prone to flooding or ponding, but two soil series are considered prime farmland.

Table 3.6.6.1-3 — Hydric and Farmland Soils

Classification	Approx. Site %	Hydric Soil	Farmland Description
Bridgehampton silt loam	4	Not Hydric	All areas are prime farmland
Carver and Plymouth sands	11	Not Hydric	Not prime farmland
Cut and fill land, gently sloping	23	Not Hydric	Not prime farmland
Gravel pits	15	Unknown Hydric	Not prime farmland
Haven loam	39	Not Hydric	All areas are prime farmland
Plymouth loamy sand	8	Not Hydric	Not prime farmland

The Plum Island Site has been mapped as Harbor Hill Ground-Moraine and Harbor Hill End-Moraine deposits of the Quaternary geologic age on the site's west and east sides, respectively (Terracon 2007a). The boundary between the ground-moraine and the end-moraine divides the site north to south at its approximate midpoint. The ground-moraine is described as glacial till, a poorly sorted mixture of clay, sand, and pebble-to boulder-sized gravel deposited by glacial ice. The end-moraine is described as glacial till overlying stratified sand and gravel. These Moraine soils are primarily light to dark brown, medium- to coarse-grain, silty sand, and gravel with some isolated gray to light brown mottled clay seams and extend approximately 60 feet bls. Abundant boulder, cobble, and gravel zones are located on the northern portion of the island (Entech 2002). Historically, there was a sand and gravel pit on the south side of the site (Terracon 2007a).

3.6.6.2 Construction Consequences

A detailed geotechnical report would be prepared once the preferred alternative is selected and the findings and recommendations would be considered in the final design and specifications of the facility. Construction of the NBAF would have no anticipated adverse effect on the geology and soils of the Plum Island Site, beyond the immediate footprint. Preliminary geotechnical investigations did not identify any geologic features that would suggest sinkhole formation.The seismic soil classification would be preliminarily considered Class D (Terracon 2007a). Refer to Section 3.6.1 and Table 3.6.1- 1 for additional seismic information. An estimated volume of 264,000 cubic yards of on-site material would be displaced and managed during site construction. Approximately 45% of the soils at the site are considered prime or of statewide farmland importance, and NRCS coordination has been initiated. Additional fill needs would be likely on the south side of the site at the location of a former sand and gravel pit. The soil displacement would not have an adverse effect on the regional topography. Additionally, laboratory wastes have been excavated and removed from this general area. Initial soil and groundwater assessments have been completed; however, the data have not been finalized. Supplemental construction planning efforts would be employed during soil manipulation and excavation. Refer to Chapter 2, Sections 3.1.1, 3.6.3.1, 3.6.3.2, 3.12.6, and 3.13.6 for additional soil, waste, and constructability information.

3.6.6.3 Operation Consequences

The Haven loam and Carver/Plymouth sand soil classifications make up a large portion of soil classes at the site. The conceptual layout of the Plum Island Site avoids direct impacts to island surface waters. Operation of the NBAF would have no anticipated adverse effects on the soil classifications beyond the immediate site footprint. Refer to Section 3.14 for additional operational information.

3.6.7 Umstead Research Farm Site

3.6.7.1 Affected Environment

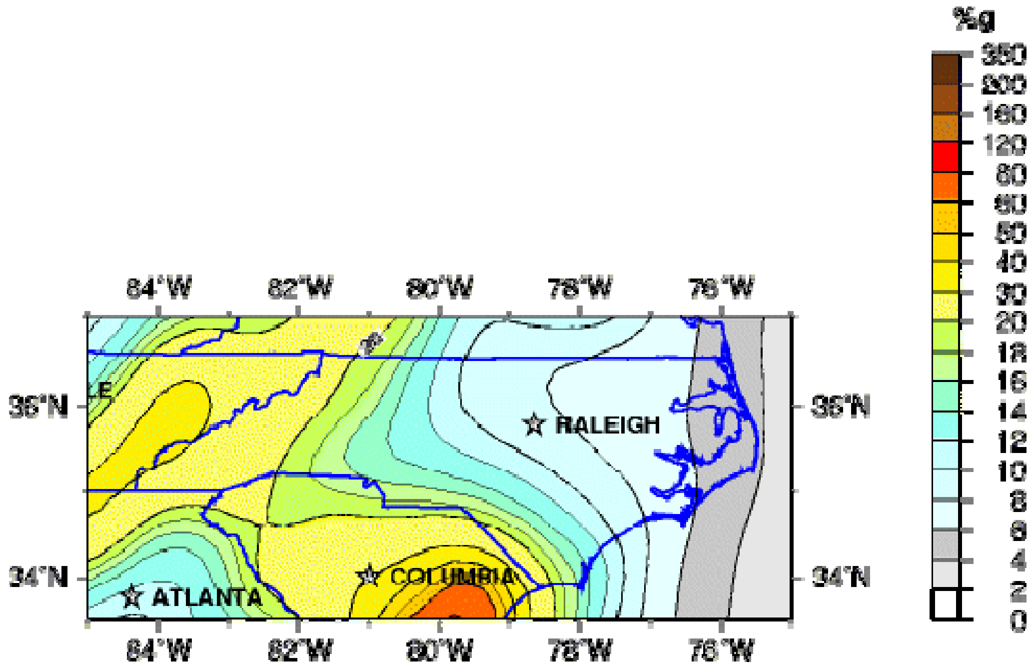
During the Triassic age, mudstones and claystones were laid down in the Durham Triassic Basin now known as North Carolina Piedmont Region. The ancient Jonesboro Fault, east of Raleigh, forms the basin's eastern boundary; these mud and clay "redbeds" became the mainstay of the North Carolina brick industry. The Carolina Slate Belt, formed from heated and deformed sedimentary rocks, bisects the Piedmont running almost from Virginia to South Carolina. The Castle Hayne limestone Formation is found primarily in the North Carolina southeastern coastal plain counties of Brunswick, New Hanover, Pender, Onslow, Jones, Lenoir, Craven, and Beaufort. The Umstead Research Farm Site is located in North Carolina's Piedmont Region and does not retain the soil structure normally seen in dissolution or suffusion limestone sinkholes. The geology of North Carolina lends itself to earthquakes of various magnitudes and intensities. Table 3.6.7.1-1 provides a brief historical summary of earthquakes that occurred in or were felt in North Carolina (USGS 2008).

Table 3.6.7.1-1 — North Carolina Historical Earthquake Data

Date	Location	Intensity[a]
March 8, 1735	Bath	V
February 21, 1774	Virginia south	ND[b]
1811 - 1812	New Madrid, Missouri	VI
February 10 and April 17, 1874	McDowell County	V, >75 events
December 13, 1879	Charlotte	V
January 18, 1884	Wilmington	V
August 6, 1885	Blowing Rock	IV - V
August 31, 1886	Charleston, South Carolina	X
May 31, 1897	Giles County, Virginia	ND
January 1, 1913	Union County, South Carolina	ND
October 29, 1915	Marshall	V
February 21, 1916	Asheville	VI, largest within state borders
August 26, 1916	Winston-Salem	V
July 8, 1926	Mitchell County	VI
November 2, 1928	Asheville	VI
January 1, 1935	Gary	ND
May 13, 1957	Micaville	VI
July 2, 1957	Asheville	VI
March 5, 1958	Wilmington	V
December 13, 1969	Glenville	V
September 9, 1970	Boone	V

[b] Ref. Table 3.6.3.1.-2 Magnitude vs. Intensity [b] ND = no data

The February 21, 1916, earthquake, centered in the Asheville area, is considered one of the largest to occur in North Carolina. With an intensity of VI, the area of influence was approximately 200,000 square miles. The most recent earthquake, with a registered magnitude of 3.1, occurred in North Carolina on December 7, 2007, approximately 25 miles north-northwest of Spartanburg, South Carolina, or approximately 200 miles southwest of the Umstead Research Farm Site. Figure 3.6.7.1-1 shows seismic peak acceleration for North Carolina; the Umstead Research Farm Site is approximately 30 miles north of Raleigh. The figure depicts the site within an area of potential ground-shaking hazard 8% to 10% g.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.7.1-1 — Seismic Hazard Map for North Carolina

Figure 3.6.1-1 (Section 3.6.1) depicts the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles. The USGS estimated return time for 4.75-, 5.0-, and 6.5-magnitude earthquakes at a fixed distance of 31 miles exceeds 4,000 years for the Umstead Research Farm Site area.

The soils on the Umstead Research Farm Site are in the White Store Creedmoor Association (USACE 2005). Of the several on-site soils classifications, three dominate: Lignum Silt Loam, Georgeville, and Herndon. The soils are well to somewhat well drained with a 2% to 25% slope range. The NRCS Soils Map (Figure 3.6.7.1-2) and Table 3.6.7.1-2 describe the on-site soil types and locations.

Lignum silt loam is the only partially hydric soil, and six of the seven soils are considered prime or of statewide farmland importance. Table 3.6.7.1-3 describes the approximate soil classification percentages, general farmland description, and hydric determination. No on-site soil types are prone to flooding or ponding.

An estimated volume of 244,000 cubic yards of on-site material would be displaced and managed during the construction phase. A detailed geotechnical report would be prepared once the preferred alternative is selected. The findings and recommendations would be considered in the final design and specifications of the facility.

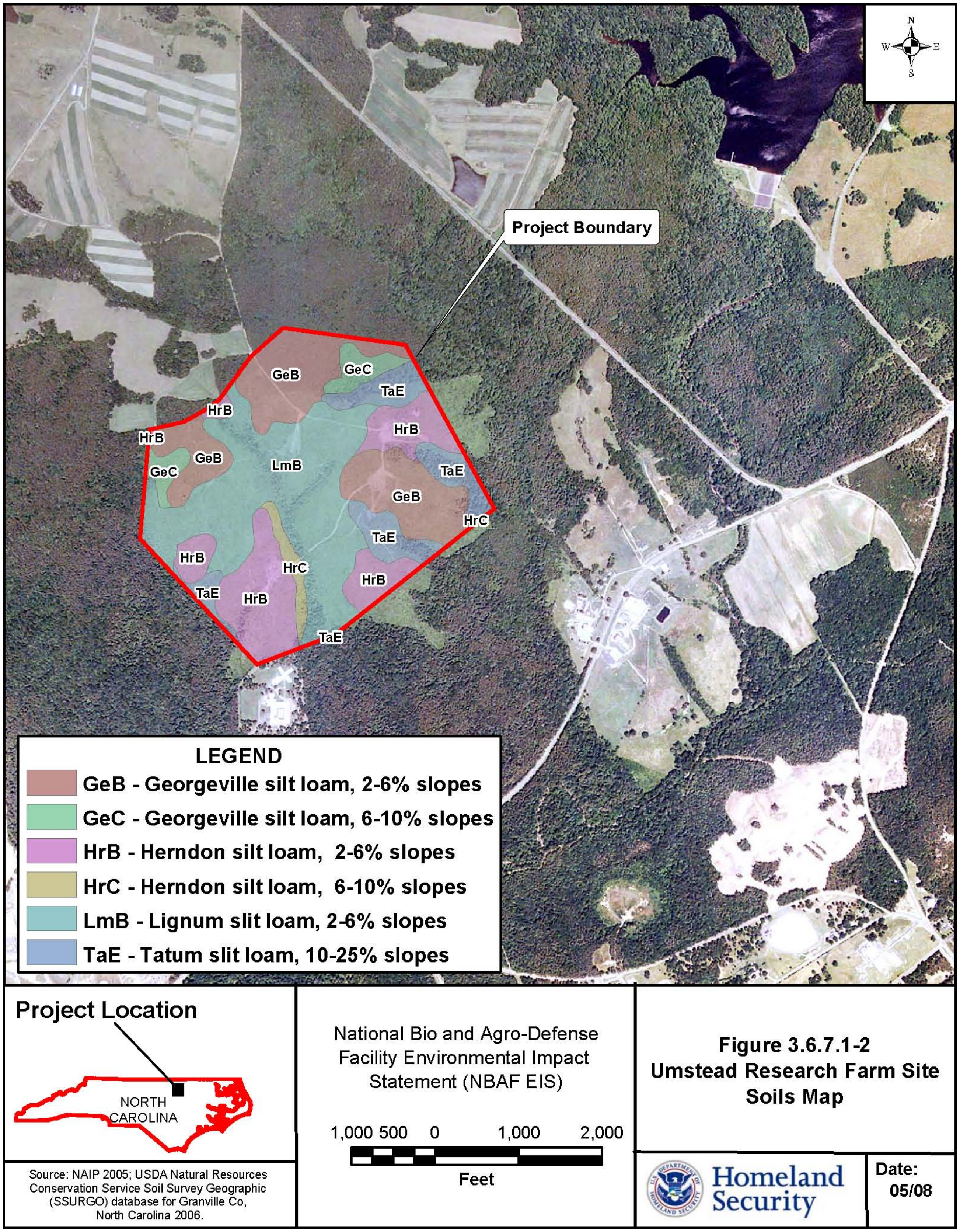


Figure 3.6.7.1-2 — Umstead Research Farm Site Soils Map

Table 3.6.7.1-2 — Umstead Research Farm Site Soils Descriptions

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	pH Range	Depth to Water Table (inches)
GeB	Georgeville silt loam	0 - 80	Well drained	2 - 6	4.5 - 7.3	Greater than 80
GeC	Georgeville silt loam	0 - 80	Well drained	6 - 10	4.5 - 7.3	Greater than 80
HrB	Herndon silt loam	0 - 80	Well drained	2 - 6	3.5 - 6.5	Greater than 80
HrC	Herndon silt loam	0 - 80	Well drained	6 - 10	3.5 - 6.5	Greater than 80
LmB	Lignum silt loam	0 - 80	Moderately well drained	2 - 6	2.0 - 7.2	About 12 to 20
TaE	Tatum loam	0 - 80	Well drained	10 - 25	4.5 - 5.5	Greater than 80
NaB	Nason gravelly loam	0 - 80	Well drained	2 - 6	4.5 - 5.5	Greater than 80

Table 3.6.7.1-3 — Hydric and Farmland Soils

Map Unit	Classification	Approx. Site %	Hydric Soil	Farmland Description
GeB	Georgeville silt loam	20	Not Hydric	All areas are prime farmland
GeC	Georgeville silt loam	2	Not Hydric	Farmland of statewide importance
HrB	Herndon silt loam	20	Not Hydric	All areas are prime farmland
HrC	Herndon silt loam	2	Not Hydric	Farmland of statewide importance
LmB	Lignum silt loam	50	Partially Hydric	Farmland of statewide importance
TaE	Tatum loam	6	Not Hydric	Not prime farmland
NaB	Nason gravelly loam	<1	Not Hydric	All areas are prime farmland

3.6.7.2 Construction Consequences

The Umstead Research Farm Site is approximately 249 acres, and the minimum area required for the NBAF is 30 acres. The seismic soil classification of the site would be preliminarily considered Class C. Refer to Section 3.6.1 and Table 3.6.1-1 for additional seismic information. Chapter 2 and Sections 3.1.1 and 3.14 include additional geologic and constructability information. During a preliminary subsurface investigation, soft near surface-soils were encountered, which if used in construction, would require engineered conditioning (GeoTechnologies 2008). Partially weathered rock was also encountered and would be a potential issue during excavations for utility placement. There would be no anticipated adverse effects to soil classifications of the area, beyond the immediate site footprint. Preliminary geotechnical investigations did not identify any geologic features that would suggest sinkhole formation. Approximately 95% of the site soil classifications are prime or of statewide importance. NRCS consultation has been initiated. Refer to Sections 3.6.3.1 and 3.6.3.2 for additional soil information.

3.6.7.3 Operation Consequences

Lignum Silt loam soil classification comprises the majority of the soil types at the Umstead Research Farm Site. The conceptual layout for the Umstead Research Farm Site avoids direct effects to on-site surface waters. The preliminary geotechnical data described the site surface soils at 0 to 30 feet bls as very stiff and dense, with rock encountered at approximately 30 feet bls in two of the five borings (Terracon 2007). The NBAF would have no anticipated adverse effects on the soils of the Umstead Research Farm Site other than those within the immediate site footprint. Refer to Section 3.14 for additional operational information.

3.6.8 Texas Research Park Site

3.6.8.1 Affected Environment

The proposed Texas Research Park Site lies within the regional geologic province known as the Balcones Fault Zone. The Balcones Fault Zone trends northeast-southwest and forms the boundary between the Edwards Plateau to the north and the Gulf Coast Plain to the south. The San Antonio region is underlain primarily by Cretaceous limestone, marl, and shale, with three major exposed geologic units: Anacacho limestone, Pecan Gap Marl, and Austin Chalk. The primary feature of the Texas Research Park Site is a shallow clay known as Pecan Gap Marl underlain with subsurface units comprised of Eagle Ford shale, Buda limestone, Del Rio shale, and Edwards limestone (Terracon 2007d; Raba-Kistner 1987). The topography of the Texas Research Park Site is characterized as gently sloping from the north to the south with elevations ranging from approximately 940 feet to 1,010 feet above sea level. The Balcones Fault Zone running south from Dallas to San Antonio contains Cretaceous limestone beds from the Edwards Group, Glen Rosa Formation and others. These limestone formations range between 300-700 feet thick, and the Edwards Formation outcrops at the surface north and west of San Antonio. Major caves formed by groundwater are found in Bexar and Medina Counties. The Texas Speleological Survey has documented approximately 500 caves and 231 sinks in Bexar County, and approximately 50 caves and 4 sinks in Medina County each associated with limestone karst topography.

The geology of Texas lends itself to earthquakes of various magnitudes and intensities. Table 3.6.8.1-1 is a brief historical summary of earthquakes that occurred in or were felt in Texas (USGS 2008).

Table 3.6.8.1-1 — Texas Historical Earthquakes

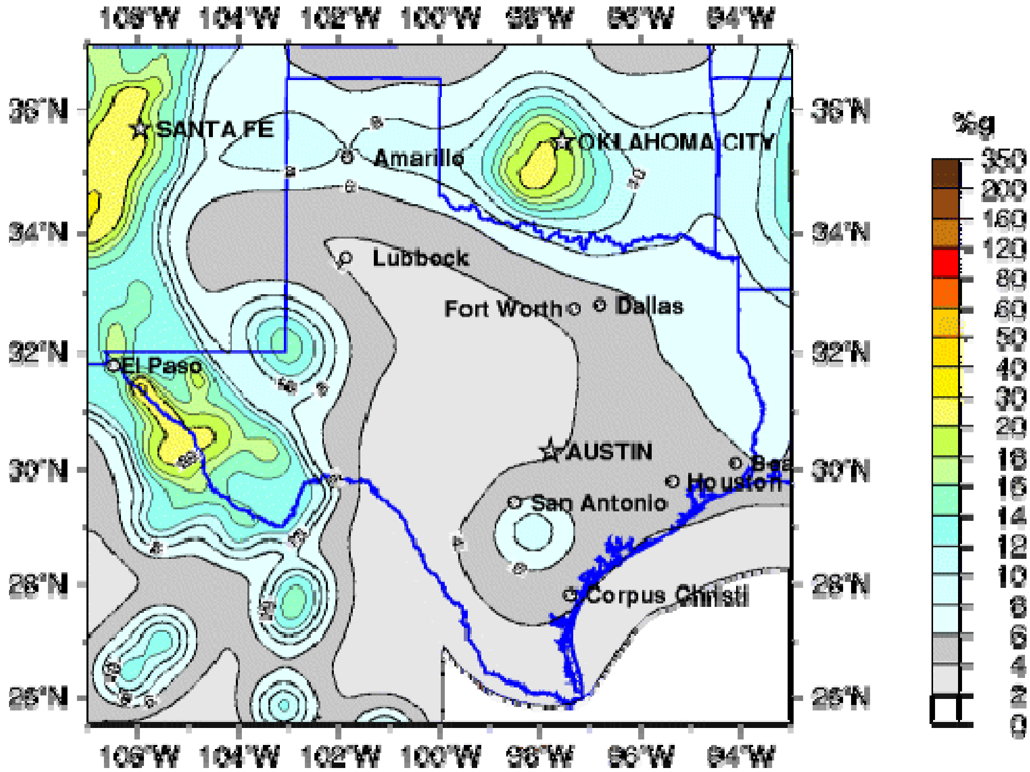
Date	Location	Intensity [a]
January 8, 1891	Rusk	VII
March 28, 1917	Panhandle	VI
July 30, 1925	Panhandle	V
August 16, 1931	Valentine	VIII
April 9, 1932	Mexia - Wortham	V-VI
June 20, 1951	Amarillo, Hereford	VI
April 28, 1964	Hemphill	V
July 20, 1966	Borger	V
May 12, 1969	El Paso	VI

[a] Ref. Table 3.6.3.1.-2 Magnitude vs. Intensity.

The most recent Texas earthquake, with a registered magnitude of 3.1, occurred on January 29, 2008, approximately 15 miles north-northeast of Snyder, Texas, or approximately 270 miles northwest of the Texas Research Park Site. The following USGS peak acceleration graphic includes San Antonio, Texas. Figure 3.6.8.1-1 depicts the seismic hazard map for Texas, including the Texas Research Park Site, which is within an area of potential ground-shaking hazard 4% to 6% g.

Figure 3.6.1-1 (Section 3.6.1) depicts the estimated time of return in years for a magnitude 4.75 earthquake at a fixed distance of 31 miles. The USGS estimated return time for 4.75-, 5.0-, and 6.5-magnitude earthquakes at a fixed distance of 31 miles exceeds 4,000 years for the San Antonio, Texas, area.

Three on-site soil series dominate at the Texas Research Park Site: Whitewright clay loam (BpC), Doss association (DSC), and Eckrant cobbly clay (TaB). All site soils are all well drained with slopes ranging up to 12%. Refer to Section 3.6.3.1 for additional soil information. The NRCS Soils Map (Figure 3.6.8.1-2) and Table 3.6.8.1-2 describe the on-site soil types and locations.



Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
Site: NEHRP B-C boundary
National Seismic Hazard Mapping Project

Figure 3.6.8.1-1 — Seismic Hazard Map for Texas

Table 3.6.8.1-3 describes the approximate soil classification percentages, general farmland description, and hydric determination for the site. No on-site soil types are prone to flooding or ponding, and only one soil series is considered prime farmland.

Table 3.6.8.1-2 — Texas Research Park Site Soils Descriptions

Map Unit	Classification	Depth Range (inches)	Drainage Class	Slope Range (%)	pH Range	Depth to Water Table (inches)
AuC	Austin silty clay	0 - 60	Well drained	1 to 5	7.9 - 8.4	More than 72
BpC	Whitewright clay loam	0 - 20	Well drained	1 to 5	7.9 - 8.4	More than 72
BrD	Brackett gravelly clay loam	0 - 30	Well drained	5 to 12	7.4 - 8.4	More than 72
DSC	Doss association	0 - 36	Well drained	Gently undulating	7.9 - 8.4	More than 72
RkD	Real and Kerrville soils	0 - 20 0 - 60	Well drained	1 to 8	7.9 - 8.4 7.4 - 8.4	More than 72
TaB	Eckrant cobbly clay	0 - 25	Well drained	1 to 5	6.6 - 8.4	More than 72

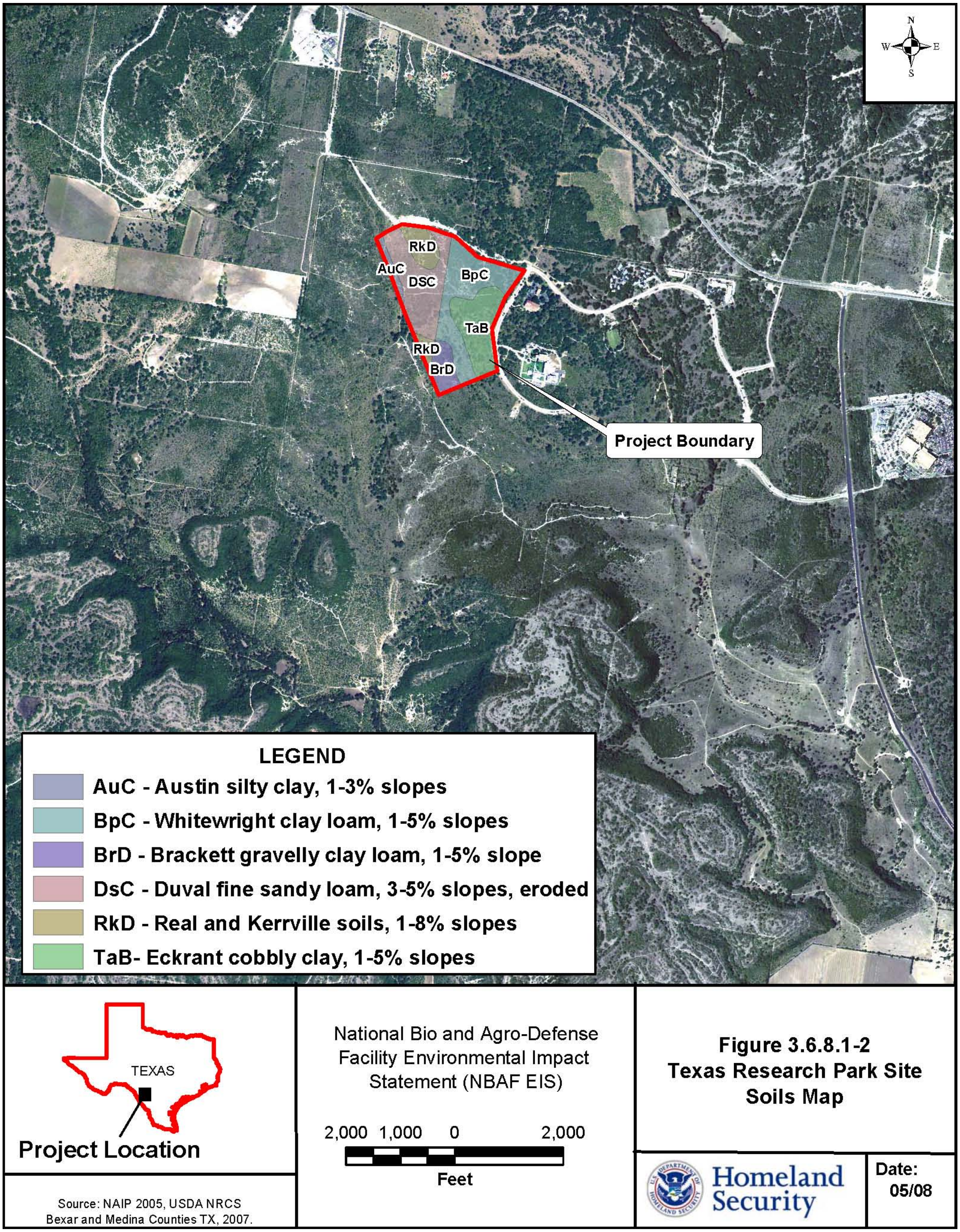


Figure 3.6.8.1-2 — Texas Research Park Site Soils Map

Table 3.6.8.1-3 — Hydric and Farmland Soils

Classification	Approx. Site %	Hydric Soil	Farmland Description
Austin silty clay	1	Not hydric	All areas are prime farmland
Whitewright clay loam	34	Not hydric	Not prime farmland
Brackett gravelly clay loam	9	Not hydric	Not prime farmland
Doss association	26	Not hydric	Not prime farmland
Real and Kerrville soils	11	Not hydric	Not prime farmland
Eckrant cobbly clay	19	Not hydric	Not prime farmland

Whitewright clay loam and Doss association soils are the primary soils at the site. Austin silty clay is the only site soil type considered prime farmland. The site soil types are susceptible to water erosion; however, terracing, contour tillage, and proper groundcover would help control erosion, conserve moisture, and maintain a healthy soil structure. These soils are best suited for natural vegetation, and maintaining a native grass cover would help control runoff and erosion.

3.6.8.2 Construction Consequences

A detailed geotechnical report would be prepared once the preferred alternative is selected. The findings and recommendations would be considered in the final design and specifications of the facility. Construction of the NBAF at the Texas Research Park Site would not have an anticipated adverse effect on the geology and soils of the area, beyond the immediate footprint. The area geology does not include any known transition or aquifer system recharge zones (Raba-Kistner 1987). The seismic soil classification at the site would be preliminarily considered Class D. Refer to Chapter 2, Sections 3.1.1, 3.6.1, and 3.14 and Table 3.6.1-1 for additional seismic and constructability information. Construction would require the excavation and removal of approximately 324,000 cubic yards of material. This soil displacement would not have an adverse effect on the regions topography. Preliminary geotechnical investigations did not identify any geologic features that would suggest sinkhole formation. The Austin silty clay represents less than 2% of the site soils and is the only class described as prime or of statewide farmland importance. NRCS consultation regarding Prime and Unique Farmlands has been initiated. Refer to Sections 3.6.3.1 and 3.6.3.2 for additional soil information.

3.6.8.3 Operation Consequences

Whitewright clay loam and Doss association soils comprise the majority of the soil types at the Texas Research Park Site. The conceptual layout of the NBAF avoids direct impacts to surface waters. The NBAF would have no anticipated adverse effects on the Texas Research Park Site soils other than those within the immediate site footprint. Refer to Section 3.14 for additional operational information.

3.7 WATER RESOURCES

3.7.1 Methodology

Direct and indirect effects on water resources were determined using existing data from local, state, and federal sources. Additional studies (e.g., Phase 1 Environmental Site Assessments, geotechnical studies, and soil borings) were conducted to supplement the existing data. In addition to evaluating direct effects on water resources at the proposed sites, the NBAF construction and operation potential to indirectly affect off-site resources was assessed, including surface water runoff, groundwater contamination, and hydrologic alteration.

Germane planning and response documents are referenced within the water resources sections. Storm water Pollution Prevention Plans (SWPPPs) are developed around Best Management Practices (BMPs) to minimize or prevent direct and indirect storm water runoff effects. Spill Prevention Countermeasure and Control plans (SPCCs), as required in the *Oil Pollution Prevention Act*, are developed to address direct and indirect effects from potential spill sources and associated appurtenances. The proposed NBAF would have an anticipated 50,000-gallon on-site fuel storage capability, exceeding the cumulative volume of the on-site fuel storage threshold, thereby triggering the SPCC plan requirement. The SPCC thresholds are aboveground petroleum storage in excess of 1,320 gallons or underground petroleum storage in excess of 42,000 gallons and, in the event of a release, the potential for navigable water impacts. The SPCC plan would fully address the elements described in the Oil Pollution Prevention regulations (40 CFR part 112). Although site-specific attributes for each action alternative would be explicitly addressed, the SPCC plan would generally include the following information (EPA 2008e):

- Facility Information
    - On-site responsible individual(s) and contacts
    - Emergency response contacts
    - Petroleum types and volumes
    - Storage features and locations
    - Containment infrastructure
    - Immediate spill response equipment
    - BMP preventatives
- Security Data
    - Fencing
    - Lighting
    - Access
- Inspection Records
- Training Records

The SPCC document would include reference tables delineating petroleum inventories, tank sizes, locations, and a mobile sources inventory including location and function. Site map(s) would include tank locations, volumes, petroleum types, emergency access routes, spill kit locations, mobile source locations, and source-specific drainage patterns/receiving waters. The SPCC plan would be certified by a professional engineer and executed by the executive manager of the facility.

Additionally, floodplain databases from the Federal Emergency Management Agency (FEMA) were consulted to determine potential flood zone locations, types, and potential effects (FEMA 2007a). FEMA flood zones include: Zone X, areas having moderate or minimal potential flooding hazard; Zone AE, low-lying wetland areas subject to 100-yr flood inundation; and Zone VE, immediate coastal areas considered special flood hazard areas subject to 100-yr flood inundation with additional velocity hazards (e.g., wave action).

Area surface waters were researched as to whether they meet state-designated uses and standards. If available, pollutant-specific total maximum daily loads (TMDLs) and target recovery goals were included.

3.7.2 No Action Alternative

3.7.2.1 Affected Environment

3.7.2.1.1 Surface Water

Long Island Sound surrounds Plum Island and is the receiving waters for treated storm water and wastewater effluents from PIADC. TMDLs for nitrogen were established for Long Island Sound in April 2001. The TMDL target end point is a 58.5% reduction in nitrogen loading, facilitating improved Long Island Sound dissolved oxygen levels (EPA 2008a). Plum Island contains no streams or rivers, and the surface water features on the island are freshwater wetlands. The island has approximately 54 acres of wetlands, with the majority located on the south end of the island. Currently, surface waters are not being used as a facility water source (B. Laing 2007; BMT Entech 2007a). The surface water runoff from the island is minimal, as most of the soils are described as well drained.

3.7.2.1.2 Storm Water

Storm water collection and management are both currently and historically limited. Under early permits with the State of New York, PIADC recorded as many as 20 individual outfalls discharging storm water from Plum Island into adjacent tidal waters. No outfalls to internal areas of the island were identified. In early 2007, the PIADC environmental staff conducted an extensive investigation of these various outfalls. It was determined that, over the course of many decades, most of these discharge points were no longer functional and were essentially being carried on the NYSDEC storm water management permit (NYR00B921) without reason. These outfalls were situated in the following four general locations: Plum Gut Harbor, the Building 100/101 laboratory compound, the former Fort Terry cantonment area, and the remote East End. These conveyances, if operational, are primarily used to remove precipitation from roadways and roofs of site structures.

In March 2007, PIADC contacted NYSDEC to request that its existing storm water permit (NYR00B921) be terminated and that the seven remaining operational storm water discharge outfalls be consolidated into a revised version of the PIADC State Pollution Discharge Elimination System (SPDES) permit (Permit No. NY0008117). NYSCEC granted this petition, and the active outfalls are now addressed under the combined SPDES discharge permit.

Seven additional storm water conveyance systems, located in the East End, were also addressed in the March 2007 correspondence between PIADC and the State of New York. These systems (Outfalls No. 016 – 022) were most likely installed during the occupation of the island by the U.S. Army. These historical conveyance systems are considered inoperable. Each basin or sump system is filled with soil and gravel from the deteriorating roadbed. The originally designed use of the conveyance system was to drain roadbeds. The outfalls of these historical systems have not been located, but presumably they empty into Long Island Sound and/or Gardiners Bay.

Storm water runoff requirements for a federal project involving development or redevelopment with a footprint exceeding 5,000 square feet does not apply to the existing PIADC facility under the No Action Alternative, as per Title IV, Subtitle C, and Section 438 of the *Energy Independence and Security Act* of 2007 (USEISA 2007).

3.7.2.1.3 Groundwater

Groundwater at Plum Island is found in an unconfined aquifer that extends approximately 100 ft bls. This groundwater resource occurs in a relic glacial deposit and has a maximum elevation of approximately 2.5 feet above sea level. The Plum Gut strait separates the Plum Island freshwater aquifer from that of Long Island. Plum Island averages 45 inches of precipitation per yr, and this precipitation is the primary recharge source for the Plum Island freshwater aquifer.

Fourteen federally owned shallow groundwater supply wells are the only source of potable water at PIADC. The groundwater is treated with lime and chlorine before entering the potable distribution system (Terracon 2007a). Water use at PIADC is approximately 70,000 gpd. A 2007 groundwater study estimated the safe groundwater usage yield at 150,000 gpd. Current freshwater storage capacity at PIADC is maintained by a 200,000-gallon elevated water tower (BMT Entech 2007a). The Suffolk County Department of Health Services classifies the potable system for the island as a “non-transient, non-community public water supplier.” This public water supply classification requires the facility to meet the monitoring and reporting requirements of the *Federal Safe Drinking Water Act*.

Plum Island is documented as having aboveground and underground storage tanks of various sizes with a cumulative storage capacity of approximately 650,000 gallons. Several regulatory spill databases document PIADC releases that vary from a broken pipe releasing 30,000 gallons of sewage to an undetermined volume of No. 2 diesel fuel leaking from a 1,000 gallon aboveground storage tank. Other past PIADC fuel oil releases have resulted in the installation of two remedial groundwater well recovery systems.

Five documented facility waste disposal sites may be impacting the Plum Island aquifer (BMT Entech 2007a). PIADC facilities are adjacent to the following contaminated sites:

- A groundwater-free product petroleum plume is located behind Buildings 101, 102, and 103 fuel storage installation.
- Petroleum-contaminated soils were found behind Building 38 (Motor Pool).
- Groundwater in the harbor area tank farm contains low levels of dissolved phase petroleum product.
- An area just east of the Shallow Well Field (Waste Management Area 26/27) has been identified with hydrocarbon contamination.

A former landfill (Waste Management Area 7/8) was identified in 2007 as a motor pool waste disposal site, which included other island operation and maintenance wastes. Soil and groundwater samples have indicated various organic and inorganic contaminants.

3.7.2.1.4 Floodplains

Plum Island is divided into three FEMA flood zone categories: Zone X, minimal 100-yr floodplain hazard; Zone AE, wetlands within a 100-yr floodplain; and Zone VE, coastal flood hazards potentially intensified by wave action. The FEMA Flood Insurance Rate Maps show that PIADC is in a Zone X, not within a 100-yr floodplain. However, buildings in Zone X could be flooded by severe, concentrated rainfall coupled with inadequate drainage. The flood-prone area nearest to PIDAC is in a coastal inundation zone along the beachfront and wetland area of the island. Refer to Section 3.7.6.1.4 for the Plum Island FEMA map.

3.7.2.2 Construction Consequences

3.7.2.2.1 Surface Water

PIADC enhancements and upgrades would be adjacent to the current facility and within previously disturbed areas. The new construction would be hundreds of feet from any freshwater wetlands. The upgrades would require a sediment and erosion control authorization and an addendum to the current storm water management authorization. The enhancement locations, the site soil structure, and the construction/operational BMPs would minimize, if not curtail, effects to the freshwater wetlands of Long Island Sound or Plum Island. Adverse surface water effects would not be anticipated. Refer to Section 3.3.2.2 for additional infrastructure enhancement information.

3.7.2.2.2 Storm Water

PIADC enhancement and upgrade construction would result in additional disturbed soils and an increase in impervious area. A NYSDEC erosion control authorization would be required, as well as a modification to the existing storm water authorization. The additional storm water would be managed through permit stipulations, required infrastructure, and BMPs. Adverse storm water effects on Long Island Sound, Plum Island freshwater wetlands, or the groundwater aquifer would not be anticipated.

3.7.2.2.3 Groundwater

Multiple Plum Island locations currently have documented groundwater contamination, and the enhancement and upgrade construction would not exacerbate the existing contaminated groundwater conditions. PIADC construction upgrades would require additional potable water but would not exceed the projected safe groundwater yield for the island. If contaminated groundwater was encountered during enhancement construction, supplemental construction efforts would be required to address potential safety, groundwater containment, and disposal. An adverse effect on the quantity or quality groundwater at Plum Island would not be anticipated.

3.7.2.2.4 Floodplains

The enhancement areas are previously disturbed locations near the current PIADC. The upgraded areas are within a FEMA Zone X, defined as outside the 100-yr floodplain. No adverse effect is anticipated on the Plum Island floodplains.

3.7.2.3 Operation Consequences

3.7.2.3.1 Surface Water

PIADC operational upgrades would result in additional storm water and wastewater, primarily from augmented laboratories. These additional flows would be managed through existing or upgraded PIADC infrastructure, while implementing current or improved facility BMPs. NYSDEC erosion control and storm water permits or permit modifications would be required. No adverse surface water effects are anticipated on freshwater wetlands at either Long Island Sound or Plum Island.

3.7.2.3.2 Storm Water

PIADC operational enhancements would result in additional storm water runoff. A NYSDEC permit or modified permit would be required, and current or improved infrastructure and BMPs would control and treat the increased storm water volumes before discharging into Long Island Sound. The facility infrastructure and BMPs would minimize potential groundwater recharge effects and potential effects on the freshwater wetlands on the island. No adverse storm water effects are anticipated.

3.7.2.3.3 Groundwater

PIADC operational upgrades would result in additional storm water volume and potential groundwater recharge. Potential groundwater recharge increases, resulting from upgraded facility storm water sources, would be addressed by existing or improved infrastructure and BMP implementation. PIADC operations would require additional potable water but would not exceed what is considered the safe yield of the groundwater aquifer. No adverse groundwater effects are anticipated.

3.7.2.3.4 Floodplains

The PIADC operational upgrades would be located within an area classified as a FEMA Zone X or outside the 100-yr floodplain. The enhancements would not be operated in a FEMA-defined AE Zone for wetlands or VE Zone for potential wave velocity effects. Effects on the 100-yr floodplain would not be anticipated.

3.7.3 South Milledge Avenue Site

3.7.3.1 Affected Environment

3.7.3.1.1 Surface Water

The North Oconee and the Middle Oconee Rivers are the two headwater tributaries that converge just south of Athens to form the Oconee River. The Oconee River Basin is located entirely within the state of Georgia and drains a total of 5,330 square miles. The South Milledge Avenue Site is located in the Oconee River Basin, Upper Oconee River Sub-basin, and the Middle Oconee River Watershed.

The South Milledge Avenue Site is primarily pastureland situated west of the South Milledge Avenue and Whitehall Road intersection. The site topography ranges in elevation from 580 to 680 feet above mean sea level. Several surface water features are located in the north-western and central-western sections of the proposed 67-acre site. The on-site first-order headwater streams feed an unnamed tributary that ultimately discharges into the Middle Oconee River located approximately 1,500 feet south of the site. The on-site stream segments have been identified as SA, SB, and SD (Table 3.7.3.1.1-1) (Nutter and Associates 2007a). Stream segment SA is a primary perennial stream forming a moderately sinuous channel, and stream segments SB and SD were documented as having flowing water. Figure 3.7.3.1.1-1 illustrates the local surface water features at the site.

Table 3.7.3.1.1-1 — South Milledge Avenue Site Surface Water Features

Jurisdictional Surface Waters	Linear Footage	Average Bankfull Width feet	Substrate Descriptions
Stream Segment A (SA)	575	4	Coarse sand, cobble and bedrock
Stream Segment B (SB)	80	4	Cobble
Stream Segment D (SD)	1,136	3	Coarse sand, gravel and cobble

There are several potable water sources near the South Milledge Avenue Site, including the Middle Oconee River, the North Oconee River, and the Jackson County Bear Creek Reservoir. The Athens-Clark County local government, with a combined withdrawal authorization from these three surface water sources of 28 mgd, provides the local potable water needs. Athens-Clark County has plans to increase the withdrawal authorization to 36 mgd by spring 2008 (ACC 2007b).

The GDNR has established six surface water use classifications: 1) Drinking Water Supplies; 2) Recreation; 3) Fishing, Propagation of Fish, Shellfish, Game, and Other Aquatic Life; 4) Wild River; 5) Scenic River; and 6) Coastal Fishing. The Middle Oconee River has been classified as a Drinking Water Supply. Drinking Water Supplies are defined by GDNR as, “Those waters approved as a source for public drinking water systems permitted or to be permitted by the Environmental Protection Division. Waters classified for drinking water supplies also support the fishing use and any other use requiring water of a lower quality."

If surface water quality standards are not being met, a water body and its use(s) can be considered partially supporting or impaired. States are required to develop a list of impaired waters, commonly known as the 303(d) lists [named from the federal *Clean Water Act* of 1972, Section 303(d)]. Once a water body is listed, states are required to establish a TMDL for the impaired water body. A TMDL is a pollutant-specific, calculated load that a water body can receive and still meet water quality standards and achieve designated uses (EPA 2007c). In 2006, parts of the Middle Oconee River and several of its tributaries were placed on the Georgia list of rivers and streams not fully supporting their designated uses, in this case primarily fishing. Fecal coliform contamination was the determining factor that resulted in the reduced use designation of the Middle Oconee; urban runoff is considered the suspected source. A coliform bacteria TMDL end point of 200 colony-forming units per 100 milliliters (cfu/100 ml) geometric mean from May to October has been established for the Oconee River (EPA 2008d).

GDNR erosion control and storm water permitting requirements protect perennial stream corridors by establishing stream-side buffer zones. Athens-Clark County has also developed buffer standards required to protect surface and groundwater supply sources (Table 3.7.3.1.1-2). According to the Athens-Clark County classifications, streams at the South Milledge Avenue Site would be classified as, “All other protected streams” (ACC 2005).

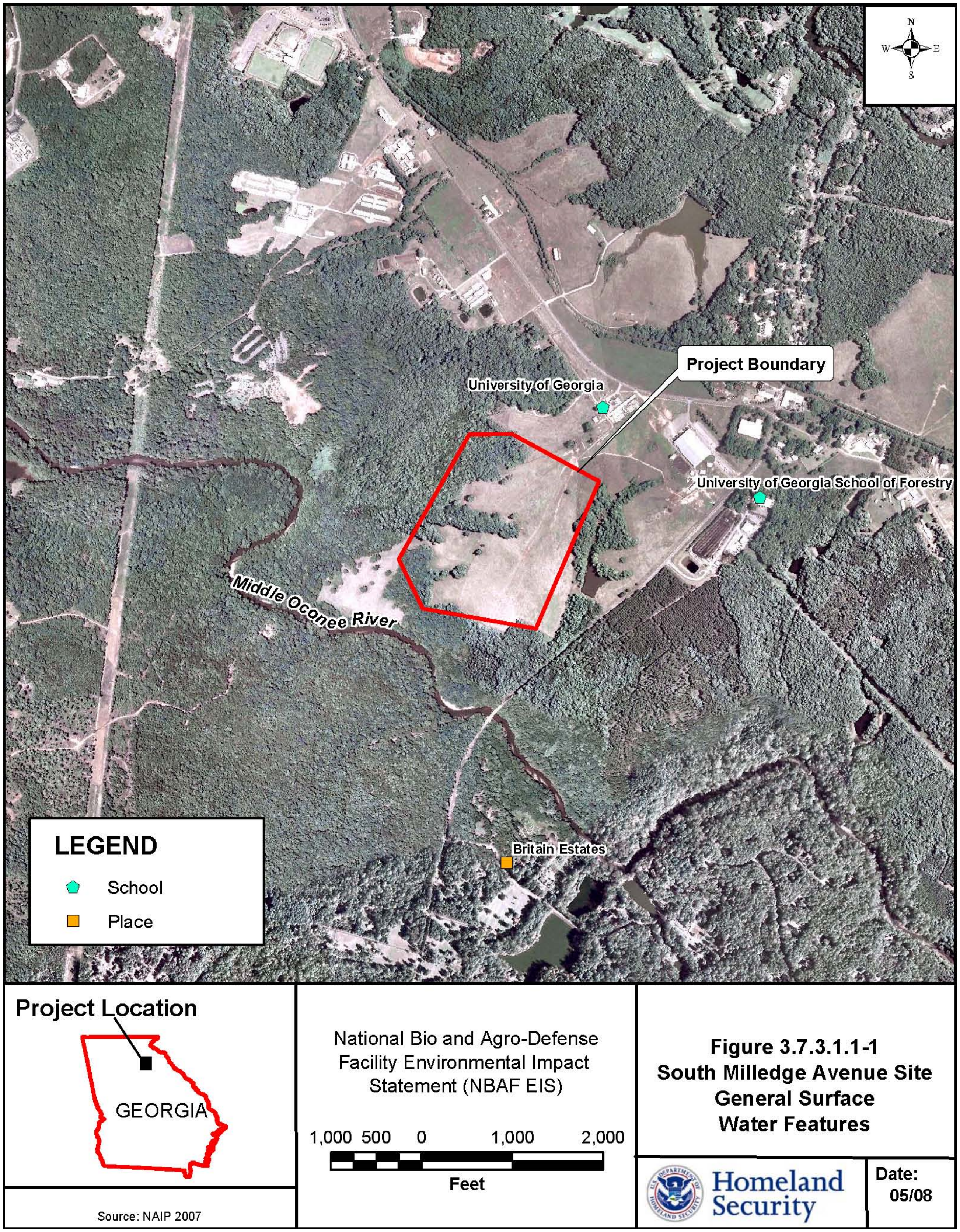


Figure 3.7.3.1.1-1 — South Milledge Avenue Site General Surface Water Features

Table 3.7.3.1.1-2 — Athens-Clarke County Buffer Standards

Hydrologic Feature	Riparian Buffer Width feet
Protected river	100
Upper North Oconee River and Sandy Creek	100
Protected streams in Industrial ("I") zones as defined in Title 9 of Athens-Clarke County Code	150
All other protected streams	75
Lake or pond	25
State waters	25

3.7.3.1.2 Stormwater

Surface water runoff from the South Milledge Avenue Site ultimately discharges through on-site, unnamed tributaries into the Middle Oconee River. The site is within 1,500 feet of the Middle Oconee River the nearest designated U.S. waters. The South Milledge Avenue Site has no existing storm water infrastructure other than natural on-site conveyances.

3.7.3.1.3 Groundwater

Georgia has an abundant supply of groundwater, and almost all groundwater in Georgia originates within the state boundaries. Groundwater aquifers provide water for almost half of the state population and about 90% of its rural residents. Groundwater quality in the state is good, but some areas do have elevated levels of iron and manganese, which cause stains and a bitter taste at high concentrations. Groundwater contamination from human activity has generally been localized and has not caused widespread aquifer contamination. There is no known public, community, or domestic groundwater supply wells on or near the NBAF South Milledge Avenue Site. Based on adjacent groundwater well and piezometer (temporary groundwater level monitoring well) data, the groundwater flow is generally toward the west-southwest.

There is no known groundwater contamination at the South Milledge Avenue Site (Geo-Hydro Engineers 2007). However, the former South Milledge Avenue Landfill, located approximately 1-mile northwest of the site, was listed in the Solid and Hazardous Waste Site regulatory database (Geo-Hydro Engineers 2007). The former landfill has a known release of lead, barium, mercury, zinc, dichloromethane, 1,2-dichloroethane, chloroform, and other chemical constituents. Only lead is documented in the groundwater at concentrations exceeding the regulatory reportable quantity. Soil and groundwater at the former landfill are currently under remediation.

3.7.3.1.4 Floodplains

Elevation at the 67-acre South Milledge Avenue Site ranges from 580 to 680 feet above mean sea level. The central areas of the site have moderate slopes of 6% to 15%. Slopes get as steep as 25% at the edge of the property and near natural water conveyance features. The South Milledge Avenue Site appears to drain east, west, and south (Nutter and Associates 2007a). Surface drainage on the south portion of the site is overland toward the Middle Oconee River; surface drainage on the east and west portions converge toward natural drainage ways that also release into the Middle Oconee River. These on-site surface drainage patterns result in unnamed, perennial streams carrying surface and storm water off-site, all ultimately discharging into the Middle Oconee River. FEMA has mapped the South Milledge Avenue Site in a Zone X, an area outside the 100-yr floodplain, and the Athens-Clark County Department of Transportation and Public Works notes that the site lies outside the 100-yr floodplain (FEMA 2007a).

3.7.3.2 Construction Consequences

3.7.3.2.1 Surface Water

The South Milledge Avenue Site is approximately 67 acres of primarily undeveloped pastures and woodlands. The NBAF South Milledge Avenue Site would encompass approximately 30 acres. The South Milledge Avenue Site would include supplemental structures, such as fuel storage tanks, the utilities building, and facility maintenance buildings.

Construction of the NBAF at the South Milledge Avenue Site would trigger the need for Erosion Control and Storm water Permits. The Erosion Control Permit would authorize land clearing and grading, while requiring sediment control devices and BMPs capable of retaining on-site sediment generated from land disturbing actions. Examples of on-site construction areas that would be evaluated for BMPs are any graded/disturbed areas, access and haul roads, material lay down areas, and construction debris piles. On-site construction management options, such as filter fabric fences, drop inlet protection, natural covered swales, and sedimentation ponds, would be evaluated. The NBAF South Milledge Avenue Site erosion control authorization would require an undisturbed 25-foot buffer along all state waters and additional buffering measures up to 75-feet from the stream banks. Following construction, the buffer zone may be thinned but the natural vegetative cover and stream canopy would be retained within the 25-foot buffer. A National Pollutant Discharge Elimination System (NPDES) SWPPP would also be required, and the South Milledge Avenue Site would have several areas where BMPs vary. Each area would be individually evaluated and included in a site-wide SWPPP. A SPCC plan would be prepared to describe potential spill sources, locations, volumes, flow directions, and response/mitigation tactics.

Based on a conceptual site drawing, the proposed facility would directly affect on-site surface water features. Direct and indirect surface water effects would be minimized through design parameters, and mitigation options for direct takes would be evaluated. Design measures could include pervious pavement in both parking lots and pedestrian walkways, capturing and using roof runoff for landscape watering, and grading parking lots to filter storm water through landscaped areas (NDP 2007a). By implementing approved erosion control/storm water pollution prevention and plans facilitating good engineering and construction BMPs, downstream facilities/resources such as the Middle Oconee River would not be adversely affected by the NBAF construction at the South Milledge Avenue Site.

3.7.3.2.2 Storm Water

Construction of the NBAF at the South Milledge Avenue Site would result in undeveloped area disturbances. During construction, a SWPPP would be prepared and notice given as required by the GDNR Environmental Protection Division. Under the SWPPP, BMPs would be implemented to manage and minimize potential construction storm water runoff from the NBAF. Sediment and erosion control devices (such as filter fabric and inlet protection barriers) would be installed prior to construction and would be maintained until construction is complete. A sediment basin would also likely be required during construction (NDP 2007a). Construction of the NBAF at the South Milledge Avenue Site would have no anticipated adverse effect on local surface waters from storm water runoff.

3.7.3.2.3 Groundwater

The proposed conceptual facility layout would include a basement area with a floor elevation approximately 10 feet bls and ceiling height of 25 feet to facilitate mechanical and building support equipment. The facility design would potentially require significant soil excavation and groundwater management. Proper construction management would minimize sediment erosion and pollutant transport to surface waters. Measures such as filter fabric fences, drop inlet protection, vegetated swales, and sediment basins would be evaluated. Any on-site surficial groundwater dewatering would be temporary, and the groundwater discharged from dewatered cofferdams, trenches, or other excavated areas would be directed through sedimentation basins, vegetated filters, geotextile material, or other best management options before surface water discharging. The velocity of discharged water would be managed to minimize or curtail downstream scouring. Any down gradient groundwater fed features such as wetlands or ponds would potentially be affected by the delayed or redirected groundwater flow during construction dewatering. Any on-site surficial groundwater dewatering would be temporary and would not affect the drinking water supplies of Athens. Preliminary design features would direct storm water through landscaped or natural covered swales allowing subsurface retention and filtration prior to surficial groundwater mixing. With GDNR project oversight, permit(s) stipulations, and best site management practices, potential downstream or groundwater impacts would be minimized.

3.7.3.2.4 Floodplains

The South Milledge Avenue Site is not located within the 100-yr floodplain; therefore, there would be no direct effects from construction activities on flood storage or floodways. The quality and volume of potential surface water leaving the site would be managed through approved storm water and erosion control permit stipulations, minimizing potential indirect off-site flooding effects. Construction of the NBAF at the South Milledge Avenue Site would have no adverse effects in the 100-yr floodplain.

3.7.3.3 Operation Consequences

3.7.3.3.1 Surface Water

The NBAF would be primarily a research laboratory and educational facility. Expected storm water constituents would be similar to those at most office complexes. Specific compound areas such as, but not limited to, the utilities building, fuel storage areas, and facility maintenance would have varying storm water constituents. Specific BMPs and permit recommendations would be evaluated and considered in those site-specific locations. Preliminary design efforts being considered to reduce surface water runoff are pervious pavement in both parking lots and pedestrian walkways, capturing and using roof runoff for landscape watering, and grading parking lots to filter storm water through landscaped areas.

Additionally, specific post-development storm water management criteria are required by Athens-Clark County. Storm water must be treated to remove 80% of the average annual post-development total suspended solids load, and stream channel buffers must be preserved or restored with natural vegetation. Also, all structural storm water controls must be selected and designed using applicable criteria found in the Georgia Storm water Management Manual. A 75-foot buffer, measured from each stream bank, would be required along the perennial stream corridors in accordance with Athens-Clark County buffer standards (Table 3.7.3.1.1-2). There are more restrictions in the 25-foot buffer nearest the stream. No land disturbance or clearing is allowed within 25 feet of the stream bank, retaining a natural bank cover and stream canopy and no parking lots or agricultural waste pits are allowed within 75 feet of the stream bank. Limited activities such as non-mechanical clearing of vegetation less than 6-inches in diameter can occur in the remaining buffer zone 25 to 75 feet from the stream bank (ACC 2005). Operation of the NBAF is anticipated to have no adverse effect on local surface waters.

<u>Cumulative Impacts</u>

According to the University of Georgia Office of the University Architects for Facilities Planning (Kevin Kirsche, UGA, January 25, 2008), the UGA has no immediate projects of significant consequence planned for areas surrounding the proposed South Milledge Avenue Site. Five significant development projects anticipated by the University over the next 5 years and submitted to the University System of Georgia Board of Regents are to be located on main campus and are not within reasonable distance of the South Milledge Avenue Site to contribute to cumulative impacts. In addition, there are no proposed regional development projects within a 2-mile radius of the site (Brad Griffin, Athens-Clark County Planning Director, January 24, 2008).

It is unknown at this time the potential impacts of future projects on water resources in Clarke County. However, it is anticipated that the rapid population growth of Clarke County would continue, and demand for water would increase accordingly.

The geographic ROI for the South Milledge Avenue Site is the Upper Oconee watershed, which comprises part of the Oconee River basin. The Middle Oconee River joins with the North Oconee River approximately 1.75 miles southeast of the site to form the Oconee River. The watershed has been historically affected by accelerated runoff from the adjacent pasture areas, resulting in channel alteration and sedimentation.

Currently, drought conditions exist in Clarke County, as well as throughout much of the southeastern United States. Conditions are severe enough that Clarke County issued a ban on outdoor water use throughout the county. As previously discussed, operation of the NBAF at the South Milledge Avenue Site would result in the use of approximately 118,000 gpd (43 mgy), which represents approximately 0.76% of the City of Athens use of 15.5 mgd. Water use by future projects in the ROI is not known. Although the final project design would incorporate measures for water conservation whenever possible, the NBAF would still contribute to water use in the area.

<u>Wild and Scenic Rivers</u>

The nearest Georgia River designated in the Wild and Scenic River inventory is the Chattooga River, located in the Chattahoochee National Forest 68 miles northwest of Athens. Because the Chattooga River is over 60 miles northwest of the South Milledge Avenue Site, the proposed NBAF site would not impact the Chattooga River or its Wild and Scenic River designation (WSR 2008).

3.7.3.3.2 Storm Water

The Middle Oconee River would receive surface water drainage from the NBAF South Milledge Avenue Site. The design of the proposed NBAF uses Low Impact Design (LID) approaches. The LID design goal is to minimize runoff volume and preserve existing flow patterns (NDP 2007a). Increases in impervious area, higher peak runoff rates, and shorter concentration times (i.e., higher peak runoff) from the proposed NBAF would be mitigated by managing runoff and detaining storm water prior to discharging. The presence of the NBAF would result in an increase of 270,000 square feet (6.2 acres) or 9.0% of impervious area and would result in 225,000 cubic feet (1,683,000 gallons) of total runoff based on a site-specific 100-yr, 24-hour, 10-inch storm event.

Operations of the NBAF would not likely exacerbate erosion or degrade surface water runoff. There would be some hydrologic impact due to rainwater interception by paved areas where none previously existed. The paved facility footprint is 270,000 square feet (6.2 acres) compared to the total 67-acre area size of the South Milledge Avenue Site itself.

Georgia has EPA-delegated authority for both NPDES wastewater and storm water permitting. As a baseline, a NPDES SWPPP would be required for the facility. Unlike construction storm water impacts, industrial storm water impacts can persist if problematic routine activities are not monitored, evaluated, and corrected. The NBAF would be designed to minimize the need for storm drain piping and inlets in and around the building, as well as in the parking lot (NDP 2007b). The parking lot could utilize a pervious paving system to reduce storm water runoff and minimize the need for storm drainage appurtenances. Storm water overflow from parking lots could drain into landscaped areas designed to filter runoff and facilitate infiltration.

Flat roof structures with parapet edges could have emergency overflow drainage systems consisting of conventional downspouts or overflow scuppers. Primary and secondary (emergency) storm drainage systems would be sized based on a maximum rainfall rate corresponding to a 100-yr, 60-min rainfall. Some, of the storm water runoff from roofs could be collected in cisterns and used for landscaping or flushing toilets, unless local water rights or codes supersede (NDP 2007a).

A dedicated storm drainage system would convey rainwater from the roof of the building and paved areas to one or more discharge points. Belowground storm piping would be constructed of cast iron. Where soil conditions are determined unsuitable for cast iron, approved rigid corrosion resistant piping materials would be utilized. Aboveground storm water piping would be cast iron constructed, and horizontal runs would be insulated to prevent freezing, which would ensure proper function of the storm drainage system for the life of the facility. Some discharge points could be preceded by a detention facility to mitigate flow to the local drainage or receiving waters. The primary function of the storm water management system would be to clean and absorb a maximum amount of rainfall (NDP 2007a). Operation of the NBAF at the South Milledge Avenue Site is anticipated to have no adverse effect on local or downstream surface waters.

<u>Cumulative Impacts</u>

Although no immediate projects of significant consequence are planned by UGA for an area within a 2-mile radius of the South Milledge Avenue Site (see Section 3.7.3.3.1), it is anticipated that the rapid population growth of Clarke County would continue, and storm water runoff would increase accordingly.

The Middle Oconee River would be the ultimate receiving waters from the NBAF wastewater and storm water elimination system, and the river currently does not meet all GDNR designated uses, primarily fishing. The NBAF storm water contribution is not anticipated to be substantial; however, the effluent volume and constituents would contribute to the general trend of increased storm water runoff in the ROI.

3.7.3.3.3 Groundwater

No direct groundwater effects are anticipated from operation of the NBAF at the South Milledge Avenue Site. Athens-Clark County would provide the proposed NBAF with potable water; therefore, no on-site groundwater wells are anticipated. Specific areas such as the utilities building, fuel storage, and facility maintenance would have varying storm water components, as well as varying potential groundwater recharge constituents. To mitigate indirect groundwater effects, design features and BMPs would minimize or prevent horizontal or vertical transport of pollutants. Preliminary design efforts would be considered to direct storm water through landscaped or natural covered swales, allowing subsurface retention and filtration prior to discharge to the surficial groundwater table. A below-grade structural feature would represent a potential groundwater diversionary attribute. Any down gradient groundwater-fed features such as wetlands or ponds would be potentially affected by the delayed or redirected groundwater flow as a post-construction characteristic (DEQ 1992). As previously discussed, the proposed NBAF would trigger the need for a facility SPCC plan. This spill response plan would describe potential spill sources, locations, volumes, flow directions, and response/mitigation tactics. The NBAF is anticipated to have no direct or indirect adverse effects on groundwater resources in the area.

3.7.3.3.4 Floodplains

The South Milledge Avenue Site is not located in the 100-yr floodplain; therefore, there would be no direct effects on flood storage or floodways from operation of the NBAF. Operation of the NBAF at the South Milledge Avenue Site would have no anticipated indirect adverse effect on flood storage, floodways, or downstream facilities/resources.

3.7.4 Manhattan Campus Site

3.7.4.1 Affected Environment

3.7.4.1.1 Surface Water

The Manhattan Campus Site lies within the Kansas-Lower Republican Basin that includes all or parts of 24 counties. The Kansas-Lower Republican Basin has the largest population of 12 major river basins in Kansas, including the Kansas River and the Big Blue River, as well as the surface water feature of Tuttle

Creek Reservoir. The Tuttle Creek Reservoir is located 5 miles north of Manhattan and approximately 10 miles upstream from the confluence of the Big Blue River and the Kansas River. The Big Blue River flows south and is approximately 2 miles east of Manhattan. The Big Blue River ultimately discharges into the Kansas River—which is approximately 5 miles south of the site.

The Kansas-Lower Republican Basin is further divided into sub-basins or watersheds. The Upper Kansas watershed includes Riley County, Manhattan, and many streams and tributaries, including the Kansas River and Wildcat Creek. Wildcat Creek and the Kansas River are both located primarily south of Manhattan. These waters have diverse uses, the most common being aquatic life, food procurement, and contact recreation.

The KDHE establishes water quality standards for the state. These standards define the water quality needed to fully support designated uses of the streams, lakes, and wetlands in Kansas. Examples of designated uses are domestic water supply, primary contact recreation (swimming), and secondary contact recreation (e.g., wading and fishing). KDHE further defines receiving surface waters and their uses into three tiers:

Tier 1: Provides the baseline that protects existing uses.
Tier 2: Protects high-quality waters and limits degradation.
Tier 3: Provides special protection for Outstanding Resource Waters (KDHE 2004).

The Big Blue River and its associated tributaries near Manhattan are considered "General Purpose Waters" and are included in Tier 1 or Tier 2. KDHE oversees, monitors, and enforces the state water quality standards. If water quality standards are not being met, a water body and its use(s) can be considered partially supporting or impaired, requiring state TMDL development. State-listed impairments during the 2004 cycle for the Big Blue River included the herbicide Atrazine, impaired biota, beryllium, chloride, copper, and pH, but potential sources for these impairments were not reported. In August 2007, a TMDL was established for Atrazine; the domestic water supply quality criterion for Atrazine is 3 μg/l (or 3 parts per billion). No other TMDL criteria are immediately anticipated (EPA 2008a). There are no natural streams, creeks, or ponds on-site, and the soils are described as well to moderately well draining. Refer to Section 3.7.3.1.1 for additional TMDL information.

The Manhattan Campus Site is somewhat hilly with elevations ranging from 1,050 to 1,185 feet above mean sea level. The current topography of the site directs storm water flow in a west-southwest direction toward Denison Avenue and the KSU northern campus areas.

The western surface flow of the site would intercept Denison Avenue, an area referred to as the Stadium Watershed on the Manhattan storm water watershed map (KDHE 1994). Northwest of the Kimball and Denison Avenues intersection is a small tributary, Stadium Creek. Stadium Creek flows north, ultimately discharging into the Big Blue River northeast of the Northview City Park.

The south-southwest surface flow at the site is through the KSU northeast campus area, referred to by the city as the Downtown East Watershed. The southwest surface flow at the site directs the discharges through the city storm water infrastructure under North Manhattan Avenue to Campus Creek, ultimately discharging into the Kansas River.

<u>Wild and Scenic Rivers</u>

The Big Blue River and the Kansas River are not listed in the Wild and Scenic River inventory (WSR 2008).

3.7.4.1.2 Storm Water

There are existing storm sewers that collect and convey storm water from the area, including the Manhattan Campus Site, through a series of open and closed conveyances. The current topography of the site directs storm water flow in a west-southwest direction toward Denison Avenue and the KSU northern campus areas.

The Manhattan Campus Site lies outside the 100-yr floodplain. The site is approximately 2 miles west of the Big Blue River, the nearest designated U.S. waters (WSR 2008).

3.7.4.1.3 Groundwater

Kansas has appreciable quantities of groundwater found primarily in unconsolidated materials such as gravel, sand, and silt; however, some significant volumes are also found in consolidated bedrock. In total, major Kansas aquifers are estimated to hold approximately 590-million acre-feet of freshwater storage. Manhattan and the Manhattan Campus Site are located in the Upper Kansas watershed. The Alluvial Aquifer and portions of the Glacial Drift Aquifer are the primary groundwater resources in this watershed, and both are associated with the Kansas River and its tributaries (KDHE 2001). The Glacial Drift aquifer, located more northeast in the watershed, is often used for rural domestic water supply. However, the water of this aquifer is high in minerals, and nitrates are one of the primary pollutants of concern. The Alluvial Aquifer exists throughout the watershed and is the primary water source for many public water systems. The water quality of the Alluvial Aquifer is generally good, but nitrates, minerals, and pesticides are pollutants of concern. Both aquifers are used for potable water, irrigation, industry, and livestock watering. A gravel and sand layer, which retains significant water volumes, is approximately 20 feet beneath Manhattan followed by a layer of limestone bedrock. The groundwater flow in the Manhattan upper aquifer is east-northeast.

Water supply systems have population-triggered treatment requirements such as, but not limited to, chlorination, iron, and manganese removal; membrane filtration; and the addition of chemicals other than chlorine for improved water quality. The KDHE Bureau of Water monitors public water supply wells through an ambient groundwater monitoring program that ensures compliance with state and federal drinking water standards. Because the population of Manhattan exceeds 45,000, the water supply system is designated as Class IV (KDHE 2007c).

There are several groundwater wells of various uses located within a 3-mile radius of the site, but none are located immediately onsite. Groundwater elevations at the NBAF Manhattan Campus Site range from approximately 5 to 25 feet bls. The groundwater data suggests a higher water table on the eastern boundary of the site. Groundwater is potable water source for Manhattan, and it is pumped from a 16-well groundwater supply field. The well field is located near the confluence of the Big Blue River and the Kansas River, and the wells vary in size and pumping capacity. The Manhattan water treatment plant softens, fluoridates, disinfects (chlorinates), and filters the city water. The plant has a maximum daily output of 20 mgd. In 2005, drinking water for Manhattan met or surpassed all state and federal standards.

The KSU Old Chemical Waste Landfill, located approximately 1 mile due west of the NBAF Manhattan Campus Site, is currently being monitored for multiple chemicals of concern including heavy metals, trichloroethylene, benzene, and trichloromethane. Approximately 36 groundwater monitoring wells are at this location, and the general groundwater movement is in a northeastern direction from the proposed site, likely intercepting Stadium Creek.

3.7.4.1.4 Floodplains

Elevations at the Manhattan Campus Site range from 1,050 to 1,185 feet above mean sea level, with a primarily west-southwest surface drainage pattern. The western drainage pattern would intercept the Denison Avenue storm water infrastructure. The southwest surface flow at the site feeds Campus Creek, discharging under North Manhattan Avenue through city drainage infrastructure, and ultimately discharging into the Kansas River.

The 2003 Manhattan Urban Area Comprehensive Plan included several guiding principles regarding the consideration and preservation of the area's natural resources. "The Kansas and Blue Rivers are significant natural features that impact the region's historic and future land use patterns. As part of the planning process, policy decisions will need to be made about the extent to which the 100-yr floodplain as well as land with the 'special flood risk' areas associated with the 1993 flood is considered to be a constraint to development." The

FEMA map of the area indicates that the NBAF Manhattan Campus Site is in a Zone X, an area not within the 100-yr floodplain (FEMA 2003).

3.7.4.2 Construction Consequences

3.7.4.2.1 Surface Water

There are no natural surface water features onsite; therefore, there would be no direct surface water effects from construction. However, in an effort to eliminate or minimize indirect effects to off-site surface waters, construction storm water permits for the KDHE Stormwater Program would be required prior to land clearing. The construction general storm water permit would be triggered by the disturbance of more than 1 acre of land. Construction of the NBAF at the Manhattan Campus Site would require the development and implementation of a SWPPP plan. By implementing approved erosion control/storm water pollution prevention plans and facilitating good engineering and construction BMPs, downstream facilities/resources such as the Big Blue River and the Kansas River would not be adversely affected by construction of the NBAF.

3.7.4.2.2 Storm Water

The proposed construction of the NBAF would disturb previously undeveloped areas. During construction, a SWPPP would be prepared and notice given as required by KDHE (KDHE 2007b). Information regarding design and mitigation measures have been previously described and would be applicable to the Manhattan Campus Site.

3.7.4.2.3 Groundwater

The conceptual design would potentially require the handling and management of 284,000 cubic yards of cut or fill soils. Groundwater elevations vary from approximately 5 to 25 feet bls, requiring contact and proper management of the intercepted groundwater. Proper groundwater management during construction would minimize or curtail surface water pollutant transport and sediment erosion, as well as minimizing any potential effects to groundwater resources. Potential downstream or groundwater effects would be minimized through KDHE project oversight, permit(s) stipulations, and best site management practices.

3.7.4.2.4 Floodplains

The Manhattan Campus Site is not located within the 100-yr floodplain; therefore, the construction would have no direct effects on the 100-yr floodplain. Surface water leaving the site would eventually move through areas included in the 100-yr floodplain; however, the quality and volume of surface water leaving the site would be managed through approved storm water and erosion control permit stipulations, thereby eliminating or minimizing indirect off-site flooding effects.

Refer to Sections 3.7.3.2.1, 3.7.3.2.2, 3.7.3.2.3, 3.7.3.3.1, 3.7.3.3.2, and 3.7.3.3.3 for additional water resources information.

3.7.4.3 Operation Consequences

3.7.4.3.1 Surface Water

Operation of the NBAF at the Manhattan Campus Site would potentially trigger the need for an industrial storm water permit. The industrial storm water permit would regulate discharges, protect state waters, improve surface water quality through pollutant reduction, and meet the applicable federal statutes. Once KDHE authorizes the Notice-of-Intent, the NBAF would be assigned a state and federal permit number. The primary goal of an industrial storm water permit is to develop and implement a SWPPP for the operation of a facility such as NBAF. The SWPPP would specify BMPs that would be implemented and maintained to minimize or curtail potential storm water impacts during facility operations. Through the development and implementation of a SWPPP, the potential for adverse effects on city infrastructure to the west, Campus Creek to the southwest, or subsurface aquifers would be minimized. The anticipated 50,000-gallon on-site fuel storage capability would exceed the cumulative on-site storage threshold, thereby triggering the SPCC plan requirement. Refer to Section 3.7.1 for additional SPCC information.

Cumulative Impacts

According to KSU (Ron Trewyn, KSU, January 28, 2008), KSU has two major projects planned within a 2-mile radius of the Manhattan Campus Site. These projects, the Kansas State Equine Education Center and the Flint Hills Horse and Park Events Center, are related and would be located at the same site north of Kimball Avenue and east of Denison Avenue, encompassing 85 to100 acres and include both the educational and competitive event components. These projects would result in 150 to 180 full-time and part-time jobs. The increase in traffic is estimated to be 500 to 700 vehicles per week, primarily on weekends. The projects are in the preliminary planning stages, so any increase in public service demands and environmental impacts are not known.

There are additional projects planned on the KSU campus. One noteworthy project is the Jardine Complex Phase II, which includes 544 new bedrooms. Phase I added 608 bedrooms and over 2,000 daily trips, while Phase II is adding 347 apartments and another 2,000 daily trips. Another project is the Equestrian Center Phase I for the College of Agriculture, Department of Animal Sciences at Kansas State Athletic Department. There are 80 equestrian team members/coaches, a 40-seat classroom, and scheduled 400-person stadium events. This project would result in over 1,000 daily trips.

The ROI for water resources is the Upper Kansas watershed, which includes Riley County, the City of Manhattan, and many streams/tributaries including the Kansas River and Wildcat Creek. The Alluvial Aquifer exists throughout the watershed and is the primary water source for many public water systems.

As previously discussed in Section 3.3.4, operation of the NBAF would result in the use of approximately 118,000 gpd (43 mgy). This represents less than 6% of the City of Manhattan's projected capacity of over 20 mgd. The City of Manhattan is planning a major water treatment plant and well field improvements that would increase the capacity to 30 mgd. Projected water use of the future planned projects described above is unknown. However, in combination with the NBAF, they would cumulatively add to water use in the ROI.

Wild and Scenic Rivers

The NBAF would not have an adverse effect on any Kansas listed Wild and Scenic Rivers.

3.7.4.3.2 Storm Water

The design of the NBAF uses LID approaches. The LID design goal for the NBAF is to minimize runoff volume and preserve existing flow patterns (NDP 2007b). A dedicated storm drainage system would convey rainwater from the roof of buildings to 5 feet outside the building walls and then connect to the existing storm sewer. Existing storm sewer mains have sufficient capacity to accept flow from the NBAF and the proposed site would require multiple storm sewer service lines.

The NBAF would result in an increase of 270,000 square feet (6.2 acres) of impervious area and result in 180,000 cubic feet (1,347,000 gallons) of total runoff based on a site-specific 100-yr, 24-hr, 8-inch storm event. Operations at the NBAF would likely not exacerbate erosion or degrade the surface water runoff. After site selection, the design team would also evaluate the need for a storm water detention basin to reduce potential surface water runoff effects from the facility on local drainage ways. There would be some hydrologic impact due to rainwater interception by paved areas where none previously existed. The paved facility footprint is 270,000 square feet (6.2 acres), compared to the total 48.4-acre site area. Any associated hydrologic effect would be minimal. Kansas has EPA-delegated authority for both NPDES wastewater and storm water permitting.

3.7.4.3.3 Groundwater

There would be no direct groundwater effects from operation of the NBAF at the Manhattan Campus Site. Manhattan would provide water and sewer; therefore, no on-site groundwater wells are anticipated for the primary laboratory facilities. The proposed NBAF would have specific areas of varying storm water components as well as potential groundwater recharge constituents. The proposed NBAF would trigger the need for a SPCC plan as previously described. No indirect groundwater effects are anticipated from potential contaminants or recharge area alterations.

3.7.4.3.4 Floodplains

The Manhattan Campus Site is not located within the 100-yr floodplain; therefore, there would be no direct effects from operations on flood storage or floodways. The quality and volume of potential surface water leaving the site would be managed through approved storm water and erosion control permit stipulations, thereby eliminating or minimizing indirect off-site flooding effects. Operation of the NBAF at the Manhattan Campus Site would not result in an adverse effect on the 100-yr floodplain.

3.7.5 Flora Industrial Park Site

3.7.5.1 Affected Environment

3.7.5.1.1 Surface Water

The Flora Industrial Park Site is within the Big Black River watershed, which covers approximately 3,400 square miles and encompasses all or parts of 13 counties. The watershed is generally hilly and forested, but cattle ranching and farming are present. The area is not heavily populated; however, Hinds County and Madison County to the south are experiencing considerable growth.

Table 3.7.5.1.1-1 lists the surface water features located on the Flora Industrial Park Site, which are further described below:

- A 3.12-acre pond is north-centrally located and serves as a livestock watering source. This pond collects upland surface water drainage; however, there is no outlet feature connecting this pond to a discharging stream or creek.
- A 3.05-acre pond, located in the west-southwest area of the site, is a recently added aesthetic feature to the Primo Manufacturing site. Based on its design, any pond overflow during a significant rain event would move through one of the two on-site ephemeral drainage ways.
- Two narrow, shallow ephemeral drainage features are in the south-central area of the site, where they form the top of a “Y”. These two features direct storm water flow to an unnamed intermittent stream that feeds Town Creek and eventually Balfour Creek. Town Creek and Balfour Creek are both located off-site and east of the Illinois Central Gulf Railroad. Both creeks flow north, ultimately discharging into the Big Black River.
- An on-site intermittent stream is located in the southeast area of the site and it moves surface runoff in an east-northeasterly direction. This surface drainage feature completes the previously mentioned “Y” and has an approximate bottom width of 10 feet, with bank heights approaching 5 feet.

Table 3.7.5.1.1-1 — Flora Industrial Park Site Surface Water Features

Feature	Function	Acreage	Linear Footage	Predominant Flow Direction
Pond	Livestock Water Source	3.12		none
Pond	Aesthetics	3.05		East Northeast[a]
Two Ephemeral	Site, Storm Event Drainage	0.11	1,292.7	East Northeast[a]
One Intermittent	Site Drainage	0.68	295.7	East Northeast

[a]Storm event flow.

MDEQ has developed and enforces an anti-degradation approach to preserving and enhancing waters of the state, citing that, "In no event, however, may degradation of water quality interfere with, or become injurious to, existing in stream water uses." MDEQ has developed the following water quality classifications and criteria:

- Public Water Supply: A source of raw water supply for drinking and food processing purposes.
- Shellfish Harvesting: Used for propagation and harvesting shellfish for sale or use as a food product.
- Recreation: Suitable for recreational purposes, including contact activities, such as swimming and water skiing.
- Fish and Wildlife: Intended for fishing and propagation of fish, aquatic life, and wildlife.
- Ephemeral Stream: Waters in this classification do not support a fisheries resource and are not usable for human consumption or aquatic life.

The state has classified all waters within the Big Black River watershed as Fish and Wildlife waters (MEDQ 2007b). These waters are intended for fishing and aquatic life propagation and are also suitable for secondary contact uses short of full-body immersion. The state has listed the Big Black River as impaired for pesticides (including the pesticide DDT), sediment/siltation, and the insecticide Toxaphene. The state has established TMDLs for DDT and Toxaphene and is preparing pesticide and sediment TMDL submittals. The waste load allocation factors for the DDT and Toxaphene TMDLs are zero. There are no known permitted sources for DDT or Toxaphene in Mississippi (EPA 2008).

Wild and Scenic Rivers

Black Creek, located in the DeSoto National Forest near Wiggins, Mississippi, is listed in the Wild and Scenic River inventory (WSR 2008). The "Scenic" attribute is applicable to 21 miles in a segment from Fairley Bridge Landing upstream to Moody's Landing. Black Creek features deep, black water with contrasting white sand bars. Wiggins is approximately 100 miles east southeast of Flora.

3.7.5.1.2 Storm Water

The Flora Industrial Park Site lies in a FEMA flood Zone X, an area outside the 100-yr floodplain (FEMA 1994) and is a few hundred feet west of Town Creek and Balfour Creek, the nearest designated U.S. waters.

The site has a gently sloping topography of 3 to 5% and generally drains to the east (FEMA 1994). The site does not currently possess drainage structures other than natural conveyances, although two ponds previously described and located at the NBAF Flora Industrial Park Site collect the non-infiltrating storm water. The state has plans to develop storm water control infrastructure onsite at an estimated cost of $750,000 (MS 2007). Mississippi has EPA-delegated authority over both NPDES storm water and wastewater permitting.

3.7.5.1.3 Groundwater

Over 93% of drinking water supplies in the state originate from groundwater resources. Mississippi public water well systems have an average depth of approximately 780 feet and obtain their water from deep confined aquifers (MEDQ 2007c). In November 1991, MDEQ adopted groundwater standards equal to EPA drinking water standards or Maximum Contaminant Levels. There are several groundwater aquifers within the Big Black River watershed, and virtually the entire population within the watershed uses a groundwater aquifer as a water source. Flora withdraws its groundwater from three deep wells: one near Madison and two in downtown Flora, between Center Street and Jackson Street. These wells draw groundwater from the Sparta Aquifer for potable, industrial, and irrigation uses. The groundwater flow direction of the Sparta Aquifer in this area is south, and this deep aquifer is protected by semi-confining layers of clays and shale.

During a preliminary geotechnical investigation at the Flora Industrial Park Site, two soil borings were dry-augered to determine on-site groundwater levels. Groundwater was encountered at approximately 17 feet bls in one boring and was not encountered in a second boring that reached 20 feet bls. Historical site research revealed the former presence of on-site cisterns; however, these cisterns were removed for safety reasons in the mid- to late-1990s. No other potential on-site or off-site source of groundwater contamination was documented (Mike Goff, Wildlife Technical Services, 2007).

3.7.5.1.4 Floodplains

Elevations at the Flora Industrial Park Site range from 210 to 240 feet above mean sea level, with a primarily east-northeast surface drainage pattern, which intercepts an unnamed intermittent stream that carries surface water off-site. The intermittent stream is located in the south-central portion of the site, continues to the east-northeast beneath the Illinois Central Gulf rail lines, and discharges into Town Creek, which feeds Balfour Creek, and ultimately discharges into the Big Black River. FEMA has mapped the proposed site in a Zone X, an area outside the 100-yr floodplain.

3.7.5.2 Construction Consequences

3.7.5.2.1 Surface Water

Based on a conceptual site drawing, the NBAF Flora Industrial Park Site would not directly affect any surface water features; therefore, there would be no direct effects to surface water resources with the construction of the NBAF Flora Industrial Park Site. However, potential indirect surface water effects would occur from potential construction storm water runoff. Construction would disturb more than 5 acres, triggering the need for a MDEQ Large Construction General Permit (LCGP), which authorizes storm water discharges from a proposed construction activity. The LCGP covers land clearing, grading, and site construction. Discharges from these activities cannot cause or contribute to a violation of state water quality standards, jeopardize continued existence of listed or endangered species, or adversely impact critical habitat. A Large Construction Notice of Intent must be submitted to, and approved by, MDEQ. The permit holder may discharge construction-related storm water only after receiving written authorization of the LCGP coverage or issuance of an individual NPDES Stormwater Permit. Through proper coordination with MDEQ and implementation of approved storm water and erosion control abatement measures, construction of the NBAF Flora Industrial Park Site would result in no adverse indirect effects to surface waters or downstream resources.

3.7.5.2.2 Storm Water

Construction of the NBAF at the Flora Industrial Park Site would result in the disturbance of previously undeveloped areas and an increase in impervious surfaces. During the construction phase, a SWPPP would be prepared and notice given as required by MDEQ. Under the SWPPP, BMPs would be implemented to manage and prevent construction-related storm water runoff. Because of the measures required under a SWPPP, the construction of the NBAF would have no anticipated adverse indirect effect on local surface waters.

Information regarding design and mitigation measures have been previously described and would be applicable to the Flora Industrial Park Site.

3.7.5.2.3 Groundwater

Construction of the NBAF would have no anticipated adverse effects on groundwater resources. However, on-site construction dewatering could occur but would be temporary and would have no effect on groundwater supply wells for Flora, which are located approximately 2 miles south-southeast in downtown Flora. Flora would provide water and sewer; therefore, no on-site groundwater wells are anticipated for the NBAF Flora Industrial Park Site. Site-specific BMPs and good engineering practices would be implemented as part of the industrial SWPPP for the facility to minimize or prevent indirect effects of both horizontal and vertical pollutant transport. The proposed NBAF would be required to prepare a SPCC plan. This spill plan would describe potential spill sources, locations, volumes, flow directions, and response/mitigation tactics. Construction of the NBAF at the Flora Industrial Park Site would have no anticipated adverse effect on the groundwater resources of the area.

3.7.5.2.4 Floodplains

The Flora Industrial Park Site is not located within the 100-yr floodplain; therefore, there would be no direct effects from construction activities on flood storage or floodways. The quality and volume of potential surface water leaving the site would be managed through approved storm water and erosion control permit stipulations. Construction of the proposed NBAF would have no anticipated adverse direct or indirect effects on the 100-yr floodplain or off-site flooding.

Refer to Sections 3.7.3.2.1, 3.7.3.2.2, 3.7.3.2.3, 3.7.3.3.1, 3.7.3.3.2, and 3.7.3.3.3 for additional water resource information.

3.7.5.3 Operations Consequences

3.7.5.3.1 Surface Water

Operation of the NBAF at the Flora Industrial Park Site would have no direct effect on surface water resources. However, indirect surface water runoff effects have the potential to occur. The Flora Industrial Park Site would have several areas where BMPs vary, and each would be individually evaluated and included in a site-wide SWPPP. The proposed facility would trigger the need for a SPCC plan. The development and implementation of a SWPPP, a SPCC plan, and good housekeeping techniques would minimize or curtail downstream effects on Town Creek, Balfour Creek, and the Big Black River. Refer to Section 3.7.1 for additional SPCC information.

<u>Wild and Scenic Rivers</u>

The NBAF would have no adverse effects on Black Creek, a designated Wild and Scenic River, located approximately 100 miles east southeast of Flora.

3.7.5.3.2 Storm Water

Operation of the NBAF at the Flora Industrial Park Site would have a direct effect on storm water, although the design of the NBAF, using LID approaches, would minimize and mitigate these effects. The LID site design goal is to minimize runoff volume and preserve existing flow patterns (NDP 2007b). The presence of the NBAF Flora Industrial Park Site would result in an increase of 270,000 square feet (6.2 acres) or 0.4% of impervious area and result in 248,000 cubic feet (1,852,000 gallons) of total runoff based on a site-specific 100-yr, 24-hr, 11-inch storm event. The paved facility footprint is, 270,000 square feet (6.2 acres), compared to the total 150 acre site area.

Mississippi has EPA-delegated authority for both NPDES wastewater and storm water permitting. A NPDES SWPPP would be required for operation of the facility. Some discharge points could be preceded by a detention facility to mitigate flow to the local drainage or receiving waters. The ultimate receiving water body from the NBAF Flora Industrial Park Site would be the Big Black River. Operation of the NBAF at the Flora Industrial Park Site would have no anticipated adverse effect on the local surface water resources.

<u>Cumulative Impacts</u>

According to the Metro Jackson Chamber of Commerce, there are several new residential projects being planned in the Town of Flora or in Madison County. Terra Subdivision is located within the town limits of Flora with 19 lots available and 60 acres being developed. Depending on the density allowed for the subdivision, there is a potential of up to 240 additional lots. Another future development project is Andover Subdivision, which is located off State Highway 22 within 5 miles of the proposed site in an unincorporated area. Phase I of the subdivision has approximately 73 lots. Numerous phases are predicted for this development over the next 5 years, but data are not available on the additional number of lots to be developed. The Highlands Subdivision is another future planned project located off Mount Leopard and would be accessed from Highway 22. It is within 5 miles of the proposed NBAF site. The data provided did not state the number of lots predicted for this development, but all of the lots would be greater than 5 acres. Other noted subdivisions that have not announced their density allocations are Magnolia Heights and Woodlands of Flora.

There is a proposed major development (Galeria-Madison) approximately 15-20 miles from the proposed NBAF site and includes a mix of single-family homes, condominiums, an office park, and a shopping center. The acreage, square footages, and density numbers are not available for this development. There are other developments occurring but they are not of major regional significance.

The Flora Industrial Park Site is located in the Big Black River basin. Due to the size of the basin, the ROI for water resources is limited to the Town Creek and Balfour Creek sub-basin. Groundwater from the Sparta Aquifer is the source of potable water for the area. While Flora has sufficient water and sewer capacity to serve the NBAF site, it has initiated a new water and sewer expansion and enhancement plan, which will include the construction of a new elevated water storage tank, a fourth groundwater deep well, installing and extension of a new main sewer discharge line, and installing additional water and sewer line extensions including a back-up water line for an outlying area. Due to the substantial population growth in the area, it can not be determined if there is sufficient future capacity to handle the potable water for the ROI and the Town of Flora. There is projected to be 132,000 gpd water use from the proposed NBAF; this is an 18% increase in demand from the current consumption of potable water in the Town of Flora. Additional demand on water supply would result from the proposed developments listed above.

3.7.5.3.3 Groundwater

No direct groundwater effect is expected from operation of the NBAF at the Flora Industrial Park Site. Flora would provide the NBAF with water; therefore, no on-site groundwater wells are anticipated. The below grade structural feature at the NBAF would represent a potential groundwater diversionary attribute. Any down-gradient groundwater-fed features such as wetlands or ponds would be potentially affected by the delayed or redirected groundwater flow as a post-construction site attribute. The NBAF is anticipated to have no adverse indirect effect on area groundwater resources.

3.7.5.3.4 Floodplains

The Flora Industrial Park Site is not located in the 100-yr floodplain; therefore, there would be no direct effects from operations of the NBAF Flora Industrial Park Site on flood storage or floodways. Operation of the NBAF would have no anticipated indirect adverse effect on flood storage, floodways, or downstream facilities/resources.

3.7.6 Plum Island Site

3.7.6.1 Affected Environment

3.7.6.1.1 Surface Water

Surface water features on and surrounding Plum Island are generally described in Section 3.7.2.1.1. On-site surface water features are limited to 54 acres of freshwater wetlands located several hundred feet south of the Plum Island Site. These surface water features are not used as an industrial water resource for any Plum Island activities.

3.7.6.1.2 Storm Water

Storm water features at the Plum Island Site are described in Section 3.7.2.1.2. The Plum Island Site is adjacent and east of the current PIADC. Runoff from the site is minimal since soils are described as well drained. No storm water collection system is currently associated with the NBAF Plum Island Site.

3.7.6.1.3 Groundwater

General groundwater features at Plum Island are described in Section 3.7.2.1.3. Historical records indicate the Plum Island Site was formerly used as a dumping area for various PIADC waste streams. The buried refuse varied from pesticides, petroleum products, solvents, laboratory wastes, to miscellaneous debris. As part of a complete Plum Island survey, site-specific investigations have been completed for 21 waste management areas and 15 areas of potential concern. Two waste management areas and two areas of potential concern are located near or within the Plum Island Site. These areas have been initially excavated, segregated, and screened to remove residual steel, aluminum, and treated regulated medical waste. Confirmation soil and groundwater field sampling have been completed, but the laboratory analysis and results have yet, to be finalized (Terracon 2007a).

3.7.6.1.4 Floodplains

The FEMA Flood Insurance Rate Map shows that the Plum Island Site in a Zone X, an area not within the 100-yr floodplain (Figure 3.7.6.1.4-1). Refer to Section 3.7.2.1.4 for additional Plum Island floodplain information.

3.7.6.2 Construction Consequences

3.7.6.2.1 Surface Water

Construction of the NBAF at the Plum Island Site would not be expected to affect the surrounding surface waters or the fresh water wetlands Long Island Sound. A NYSDEC erosion control authorization and storm water authorization would be required prior to construction. Through erosion control measures, construction storm water best management practices, and general good housekeeping, construction of the NBAF Plum Island Site would be anticipated to have no adverse effect on surface waters. Indirect surface water effects from potential construction runoff would be minimized or mitigated through appropriate BMPs.

3.7.6.2.2 Storm Water

Construction of the NBAF at the Plum Island Site would result in the disturbance of previously undeveloped areas. During the construction phase, a SWPPP would be prepared and notice given as required by NYSDEC. Under the SWPPP, BMPs would be implemented to prevent construction storm water runoff; therefore, the construction phase of the NBAF would not be expected to affect local surface waters. Information regarding design and mitigation measures have been previously described and would be applicable to the Plum Island Site.

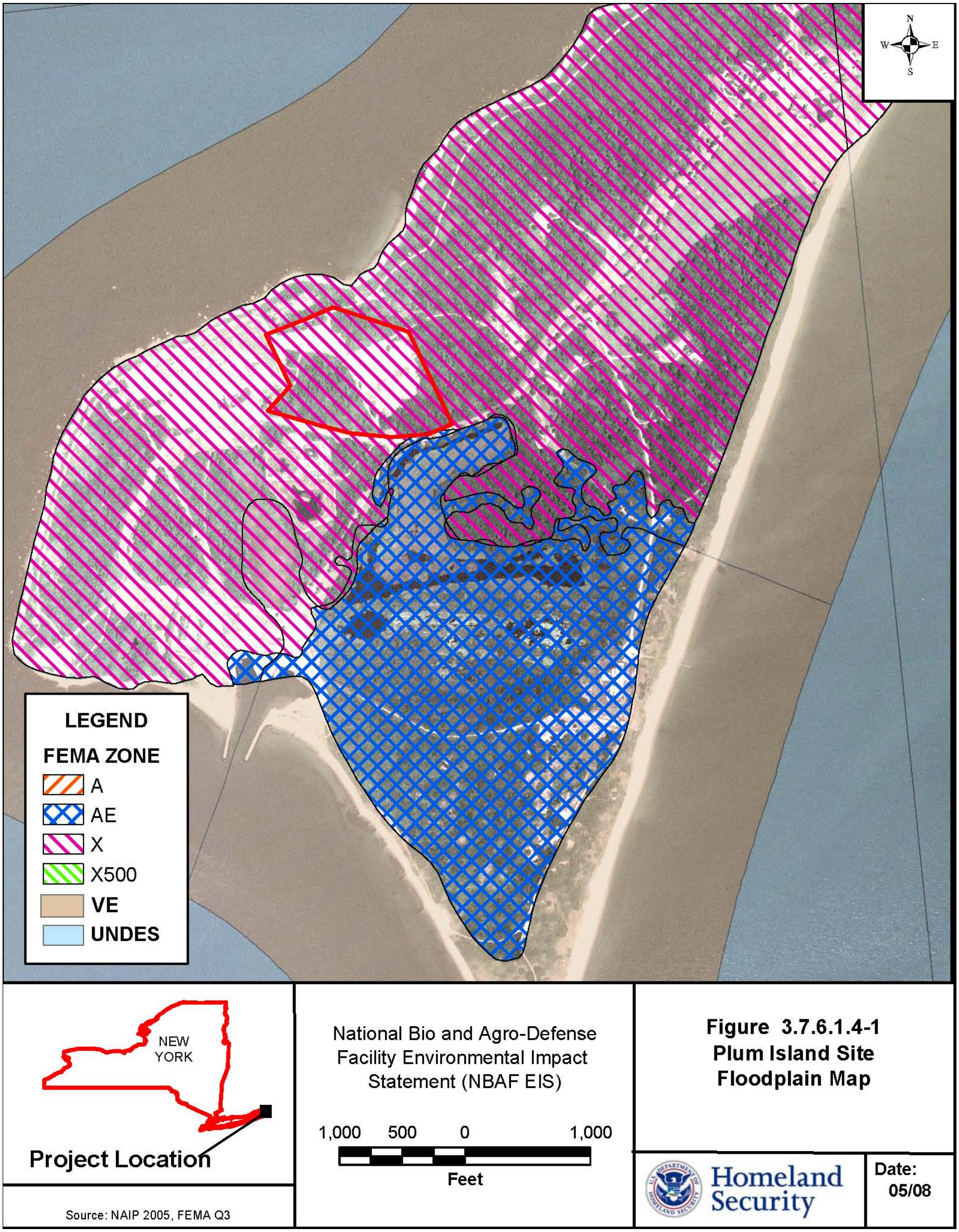


Figure 3.7.6.1.4-1 — Plum Island Site FEMA Map

3.7.6.2.3 Groundwater

There would be no direct groundwater effect from construction of the NBAF at the Plum Island Site. Indirect effects have the potential to occur but would be minimized through appropriate construction BMPs. A detailed groundwater management plan would be prepared specifying protocols for the proper handling, storing, testing, and disposing of potentially contaminated groundwater. Proper construction management would minimize or curtail surface water pollutant transport and sediment erosion. Potential downstream or indirect groundwater impacts would be minimized through NYSDEC project oversight, permit(s) stipulations, and BMPs. Any construction dewatering would be temporary; however, considering the current PIADC facility groundwater withdrawal rates, the estimated groundwater safe yield for the island, and the likely interaction with contaminated groundwater. Construction dewatering would have to be evaluated and potential engineering options considered.

3.7.6.2.4 Floodplains

Construction of the NBAF at the Plum Island Site would not directly affect floodplains. The proposed site is outside the 100-yr floodplain and the coastal inundation zones. Coastal flooding may occur during large storm events, and coastal wetlands may become temporarily inundated. The Plum Island Site is outside these areas and no effect would be anticipated. Construction of the NBAF at the Plum Island Site would include appropriate storm water management measures appropriate for both normal and extreme climatic conditions to minimize potential indirect effects.

Refer to Sections 3.7.3.2.1, 3.7.3.2.2, 3.7.3.2.3, 3.7.3.3.1, 3.7.3.3.2, and 3.7.3.3.3 for additional water resource information.

3.7.6.3 Operation Consequences

3.7.6.3.1 Surface Water

Long Island Sound surrounds Plum Island and would be the receiving water for treated storm water and wastewater from the NBAF. Plum Island contains no streams or rivers, and the surface water features on the island are freshwater wetlands. As for other site locations, the Plum Island Site would have several areas where BMPs vary, and each would be individually evaluated and included in a site-wide SWPPP. The proposed NBAF would trigger the need for a SPCC plan. The development and implementation of a SWPPP, a SPCC plan, and good housekeeping techniques would minimize or curtail any effects on on-site or tidal wetlands and the surrounding waters of Long Island Sound. Refer to Section 3.7.1 for additional SPCC information.

3.7.6.3.2 Storm Water

New York has EPA-delegated authority for both NPDES wastewater and storm water permitting. As a baseline, a SPDES SWPPP would be required for the facility. The receiving water body at Plum Island is the Long Island Sound and the facility would require multiple storm drain service lines.

The NBAF would result in an increase of 270,000 square feet (6.2 acres) of impervious area, or 25.8% of the 24-acre site, and result in 180,000 cubic feet (1,347,000 gallons) of total runoff based on a site-specific 100-yr, 24-hr, 8-inch storm event. Operation of the NBAF at the Plum Island Site would have no anticipated adverse effect on the local surface water resources.

The current PIADC facility has a hazardous weather plan that is storm strength dependant. Typically, for any such hazardous weather event, there are essential personnel that remain on the island, the facility goes on generator power, precautions are taken (e.g., securing facilities, monitoring weather to maintain up-to-date information on extreme weather), and all non-essential personnel are removed from the island well in advance of a storm or potential flooding (C. Wenderoth, PIADC Facility Engineer, e-mail to A. Galbraith, Tetra Tech, Inc., February 8, 2008).

3.7.6.3.3 Groundwater`

Operation of the NBAF at the Plum Island Site would directly affect groundwater. Groundwater is the fresh water source for the island, and operations at the NBAF Plum Island Site would require 37 million gpy [average 101,000 gpd (NDP 2007b)]. This projected consumption rate, while representing a 212% demand increase compared to the 2006 PIADC average production of 47,704 gpd, is within the recommended water budget of 150,000 gpd for sustainable groundwater withdrawal with an excess capacity of approximately 32%. The existing PIADC water supply source would have sufficient capacity to meet the potable water needs for the NBAF.

Operational indirect groundwater effects of the NBAF would be minimized or eliminated by finalizing previous remedial efforts, completing a thorough geotechnical and groundwater analysis, preparing construction protocols for groundwater management, and by implementing NYSDEC storm water and erosion control permit stipulations. Refer to Section 3.7.3.3.3 for additional groundwater information.

3.7.6.3.4 Floodplain

Plum Island has three defined FEMA zones: Zone X, areas outside the 100-yr floodplain; Zone AE, wetlands inundated within the 100-yr floodplain; and Zone VE, coastal inundation with energy (wave) influence. The Plum Island Site is located within an area classified as a FEMA Zone X, outside the 100-yr floodplain. The NBAF would not be operated in a FEMA-defined AE Zone for wetlands or VE Zone for potential wave velocity effects. Operation of the NBAF Plum Island Site would have no anticipated adverse effects on the 100-yr floodplain.

3.7.7 Umstead Research Farm Site

3.7.7.1 Affected Environment

3.7.7.1.1 Surface Water

Lake Holt Reservoir is a primary surface water feature located less than 3 miles north northeast of the Umstead Research Farm Site. Lake Holt is one of several source water impoundments located within the Upper Neuse River Watershed. The Knap of Reeds Creek located southeast of Old Route 75 is the immediate receiving stream for surface water leaving the site. The Umstead Research Farm Site is approximately 249 acres of mainly undeveloped woodlands surrounded primarily by agricultural activities and forests. The site has several surface water features including perennial streams, intermittent streams, wetlands, and a small pond. Elevations at the site range from 350 to 490 feet above mean sea level, falling generally from north to south; therefore, the predominant surface water flow through the on-site surface water features is toward the south. These unnamed tributaries eventually feed the Knap of Reeds Creek located off-site and southeast of Old Route 75. Table 3.7.7.1.1-1 lists the surface water features on the NBAF Umstead Research Farm Site.

Table 3.7.7.1.1-1 — Umstead Research Farm Site Surface Water Features

Surface Water Feature	Acres	Linear Footage
Perennial & Intermittent Streams		6,937
Wetlands	0.6	

The Umstead Research Farm Site is located in the Upper Neuse River Watershed between the Lake Holt Reservoir (Lake Butner) and the Falls Lake system. The Upper Neuse River Basin covers approximately 770 square miles and drains to the Falls Lake Reservoir, the primary water source for Raleigh. Three major tributaries—the Flat River, the Little River, and the Eno River—and nine public drinking water supply reservoirs are located in the Upper Neuse River Watershed (NCDENR 1998). The North Carolina Department of Environment and Natural Resources (NCDENR) has classified the Upper Neuse River Watershed as Water Supply IV (WS-IV) and as Nutrient Sensitive Waters (NSW). A WS-IV classification, usually located within a highly developed region, is protected as a drinking and food processing water source. WS-IV waters are also protected for Class C uses such as, but not limited to, secondary recreation, wildlife, and fish consumption.

Table 3.7.7.1.1-2 provides a brief description of the primary water supply watershed classifications developed by NCDENR.

Table 3.7.7.1.1-2 — Water Supply Watershed Classifications

Class	Watershed Description
Class WS-I	Natural and undeveloped
Class WS-II	Predominantly undeveloped
Class WS-III	Low to moderately developed
Class WS-IV	Moderately to highly developed
Class WS-V	Upstream or draining to Class WS-IV waters
Class B	Primary recreation & Class C uses
Class C	Fishing, wildlife, & secondary recreation

In 2000, the North Carolina General Assembly enacted legislation that included a mandatory 50-foot buffer for areas directly adjacent to Neuse River Basin surface waters (Riparian Buffer Protection Rules for the Neuse and Tar-Pamlico River Basins, Non-Point Source Management Program). NSW is a supplemental classification for waters needing additional nutrient management as a result of the potential for excessive microscopic or macroscopic vegetative growth. These protected riparian areas enable the vegetative buffers to continue functioning as a natural nutrient and sediment removal mechanism. The applicability of the 50-foot buffer is determined by the presence of intermittent streams, perennial streams, lakes, ponds, and/or estuaries denoted on either soil survey maps of the or the most recent USGS 1:24,000 scale (7.5 min) quadrangle topographic maps.

Most Piedmont Region streams have relatively sandy substrates; however, in some portions of the Upper Neuse Basin, including parts of Granville County, the larger tributaries have stream substrates composed of larger rocks and boulders. The smaller tributaries within this Slate Belt such as the Knap of Reeds Creek have gravel, sand, clay, and silt substrate and are very susceptible to and impacted by low flow or drought conditions (NCDENR 2006a). The Knap of Reeds Creek runs from the Lake Butner Dam and eventually discharges into the Falls Lake system. NCDENR conducts surface water monitoring near Butner on the Knap of Reeds Creek and determined in 1998 that a portion of the creek was only partially supporting biological activity. Currently, 5.2 miles of the Knap of Reeds Creek from Lake Butner to Falls Lake is considered impaired for biological activity. The NCDENR ambient surface water monitoring program has documented elevated manganese, fecal coliform bacteria, and low dissolved oxygen in Knap of Reeds Creek. NCDENR is currently evaluating the need for advanced treatment options of current dischargers, as well as investigating potential contributing sources that may be exacerbating the impaired biological activity of the stream. As of 2004, potential contaminant sources have not been determined, and TMDLs have not been established (EPA 2008c). North Carolina has EPA-delegated authority for both NPDES storm water and wastewater permitting.

3.7.7.1.2 Storm Water

The Umstead Research Farm Site does not currently possess drainage structures other than natural conveyances. In general, the 249-acre tract slopes to the southeast, directing surface flow through on-site perennial and intermittent streams. Storm water from the NBAF Umstead Research Farm Site flows along the natural topographic slopes recharging the groundwater by infiltration, and ultimately discahrges into the Knapp of Reeds Creek. The NBAF Umstead Research Farm Site is outside the 100-yr floodplain. The closest

100-yr floodplains are located approximately 0.5 mile directly to the west and 0.5 mile to the southeast of the Umstead Research Farm Site.

3.7.7.1.3 Groundwater

The Surficial and the Fractured Bedrock are the two primary aquifer systems in the North Carolina Piedmont Region. The regolith materials of the surficial system form the unconfined aquifer that is hydraulically connected to the lower aquifer system. The Fractured Bedrock System acts as a confining or semi-confining layer and normally allows recharge from the Surficial Aquifer. As the thickness of the Surficial Aquifer increases, the groundwater yield from the fractured bedrock improves. The primary source of potable groundwater for the Butner area is typically found in the Fractured Bedrock System.

Based on topography alone, the groundwater flow appears to be in a general southern direction. During a preliminary subsurface inspection, nine test borings were advanced to assess the site soils (GTI 2007). During this inspection, no groundwater was encountered in borings ranging from approximately 13 to 16 feet bls. However, the fine grain soils found near the surface are indicative of a potential perched groundwater during wet periods, and the soil characteristics also suggests a fluctuating seasonal groundwater table. Groundwater is not currently being used for any on-site purpose.

State and federal records document minor petroleum underground storage tank releases, operations, and closures in proximity of the site (GTI 2007). However, there were only two sites of noteworthy groundwater contamination near the NBAF Umstead Research Farm Site. The Federal Hazardous Substance Disposal Sites and the state Inactive Hazardous Waste Sites databases reference a site known as the Range Road Burn Site, which is located approximately 2,600 feet northeast of the Umstead Research Farm Site, just north of SR 1121 or Range Road. In the 1950s and 1960s, a local manufacturing corporation produced polyvinyl chloride film and laminates. The company disposed of their hazardous waste by-products by burning the material at a nearby military firing range, now called the Range Road Burn Site. There is no confirmation of a complete groundwater/soil site assessment and the North Carolina Inactive Hazardous Waste Section includes the Range Road Burn Site on the State Priority List. The Umstead Research Farm Site is separated from the Range Road Burn Site by SR 1121, undeveloped woodlands, and an unnamed tributary of the Knap of Reeds Creek that flows north to south.

As part of the Department of Defense's Environmental Restoration Program (DERP) in August 2004, USACE, Wilmington District, sampled several drinking water wells in the former area of the Camp Butner training facility (USACE 2007b). Multiple residential drinking water wells were sampled and analyzed to determine if the area groundwater had been affected by former Department of Defense (DOD) activities. The sample locations were selected from areas of historical ordnance use and explosive waste discoveries. USACE sampling and analysis did not confirm whether DOD activities at Camp Butner had impacted the area groundwater quality. However, the detected levels of perchlorate and lead justify further DOD investigation (USACE 2007b). USACE sampling locations were primarily north of Range Road and in the vicinity of Lake Holt Reservoir. Additional information on existing hazardous, toxic, or radiological waste at the site is found in Section 3.12.7.1

3.7.7.1.4 Floodplains

The Umstead Research Farm Site is located west of Old Route 75, south of SR 1121, and approximately 5 miles west of U.S. Interstate 85 in Granville County. Elevations at the site range from 350 to 480 feet above mean sea level, with a southern surface drainage pattern. Unnamed, perennial, and intermittent on-site streams carry surface and storm water off-site and ultimately discharge into the Knap of Reeds Creek located southeast of Old Route 75.

FEMA has mapped the Umstead Research Farm Site in a Zone X, an area outside the 100-yr floodplain (FEMA 2006). The closest 100-yr floodplains are located approximately 0.5 mile directly to the west and 0.5 mile to the southeast of the Umstead Research Farm Site.

3.7.7.2 Construction Consequences

3.7.7.2.1 Surface Water

The Umstead Research Farm Site is approximately 249 acres of primarily undeveloped woodlands. The NBAF Umstead Research Farm Site would encompass approximately 30 acres with 500,000 square feet of enclosed research facilities. Based on a conceptual site drawing, the proposed facility can be accommodated on the Umstead Research Farm Site without directly affecting surface water features.

Construction of the NBAF at the Umstead Research Farm Site has the potential to indirectly affect surface water resources. Construction would disturb more than 1 acre, triggering the requirement for a NCDENR Erosion and Sedimentation Control Permit, which authorizes land clearing, grading, and site construction. The need for a State Stormwater Permit is also triggered by the issuance of the Erosion Control authorization. The State Stormwater Management Program protects sensitive receiving waters by requiring a low density of impervious surfaces, use of vegetative buffers, and vegetated storm water conveyance swales. High-density developments would require the design and installation of structural best management practices that collect, retain, and treat the storm water runoff from the facility. The Upper Neuse River Watershed is classified as WS IV-NSW and would require BMPs to control the runoff from a 1-inch storm event and removal of 85% of the total suspended solids. By implementing an approved Erosion Control Plan and by facilitating good engineering practices and good construction techniques, downstream facilities/resources such as the Dillon School and the Knap of Reeds Creek would not be adversely affected by construction of the NBAF.

3.7.7.2.2 Storm Water

Construction of the NBAF at the Umstead Research Farm Site would result in the direct disturbance of previously undeveloped areas. During the construction phase, a SWPPP would be prepared and notice given as required by NCDENR (NCDENR 2008). Construction of the proposed NBAF would have no indirect adverse effect on local surface waters or downstream facilities/resources with appropriate BMPs to minimize potential construction runoff. Information regarding design and mitigation measures have been previously described and would be applicable to the Umstead Research Farm Site.

3.7.7.2.3 Groundwater

No direct groundwater effects would occur from construction of the NBAF. The potential for indirect groundwater effects from construction runoff does exist; however, by implementing NCDENR permit(s) stipulations and developing good engineering and best management practices, potential downstream or infiltration impacts would be minimized or eliminated. Any surficial groundwater dewatering during construction would be temporary and would have no effect on drinking water supplies for Butner.

3.7.7.2.4 Floodplains

The NBAF would not be built in a floodplain; therefore, the construction would not directly affect flood storage or floodways. The quality and volume of potential surface water leaving the site would be managed through approved storm water and erosion control permit stipulations, minimizing potential indirect effects.

Refer to Sections 3.7.3.2.1, 3.7.3.2.2, 3.7.3.2.3, 3.7.3.3.1, 3.7.3.3.2, and 3.7.3.3.3 for additional water resource information.

3.7.7.3 Operation Consequences

3.7.7.3.1 Surface Water

Operation of the NBAF at the Umstead Research Farm Site would produce a direct surface water effect as a result of supplying potable water needs. Refer to Section 3.3.7.3.1 for a description of potable water operation effects. The NBAF would be supplied water and sewer service by a local source such as the SGWASA. The Lake Holt Reservoir has a storage capacity of approximately 10 billion gallons of potable water and is a major source of local potable water. Based on the current SGWASA water system operating capacity of 3.0 mgd, an additional 3.5 mgd in water system treatment and delivery design capacity and the ability to access nearby surface water sources for future capacity requirements, the SGWASA would have sufficient capacity to provide the NBAF demand without adversely affecting the water supply for the region.

The daily wastewater effluent from the NBAF would be quantified by volume and constituents to ensure that the receiving wastewater treatment plant can integrate the additional load requirements of the NBAF without adversely affecting the capacity or permitted effluent stipulations of the treatment plant.

Based on a conceptual site drawing, the NBAF can be positioned without directly impacting surface water features. The Umstead Research Farm Site receives surface flows from areas north of the site, primarily the North Carolina State University cattle research facility. The Umstead Research Farm Site would have several areas where BMPs would vary and each potential on- and off-site source would be individually evaluated and included in a site-wide SWPPP. The proposed NBAF would trigger the need for a SPCC plan. Refer to Section 3.7.1 for additional SPCC information.

Cumulative Impacts

According to the Granville County Economic Development Commission (Leon Turner, EDC, February 20, 2008), there are currently no major new projects being planned in Granville County. Development Services has permitted around 3,000 new homes, but it is uncertain how many will be built with the current housing slowdown. It is unknown when the housing market will return to its level of previous years.

The ROI for the cumulative analysis for the Umstead Research Farm Site is the Upper Neuse River Watershed between the Lake Holt Reservoir (Lake Butner) and the Falls Lake system. The Upper Neuse River Basin covers approximately 770 square miles and drains to the Falls Lake Reservoir—the City of Raleigh's primary water source.

Water in Southern Granville County is provided by the SGWASA. SGWASA currently has 3,000,000–4,000,000 gpd of excess potable water capacity with more available from Lake Holt if needed (Leon Turner, EDC, February 20, 2008). Much of the southeastern United States is undergoing a severe drought. Although the SGWASA has demonstrated the capacity to meet the potable water demands of the proposed NBAF (11,000 gpd – less than 0.4% of the total current capacity), it would still contribute to the cumulative use of surface water in the region.

Wild and Scenic Rivers

The nearest North Carolina Rivers designated in the Wild and Scenic River inventory are the New River, located in the New River State Park 153 miles west, and the Lumber River, located in the Lumber River State Park 116 miles south (WSR 2008). The NBAF would have no adverse effects on the state-designated Wild and Scenic Rivers.

3.7.7.3.2 Storm Water

Operation of the NBAF at the Umstead Research Farm Site has the potential to affect storm water. The LID site design goal is to minimize runoff volume and preserve existing flow patterns (NDP 2007a). The presence of the NBAF would result in an increase of 270,000 square feet (6.2 acres) of impervious area and result in 180,000 cubic feet (1,347,000 gallons) of total runoff based on a site-specific 100-yr, 24-hr, 8-inch storm event (NDP 2008).

The paved facility footprint is 270,000 square feet (6.2 acres), compared to the total 249-acre site area. The associated hydrologic effect would be expected to be minimal. North Carolina has EPA-delegated authority for both NPDES storm water and wastewater permitting. As a baseline, a NPDES SWPPP would be required for the facility and multiple storm drain service lines may be required.

3.7.7.3.3 Groundwater

The SGWASA would provide the NBAF Umstead Research Farm Site with water and sewer service; therefore, no on-site groundwater wells are anticipated for the primary laboratory facilities. The NBAF Umstead Research Farm Site is anticipated to have no adverse effect on the area groundwater resources.

3.7.7.3.4 Floodplains

The Umstead Research Farm Site is primarily undeveloped woodlands with a predominant southern surface flow drainage pattern. FEMA has mapped the Umstead Research Farm Site in a Zone X, an area outside the 100-yr floodplain. Operation of the NBAF Umstead Research Farm Site would not have an adverse effect on the flood storage or floodways for the area.

3.7.8 Texas Research Park Site

3.7.8.1 Affected Environment

3.7.8.1.1 Surface Water

No surface water features exist on the Texas Research Park Site; however, two natural drainage ways are found elsewhere on the Research Park. The topography of the site is rounded hills and valleys with over 200 feet of relief. The area's regional slope tends toward the southeast. The primary drainage pattern at the Park takes surface water to the southeast and drains into Lucas Creek, located just south of Farm Road 1957 in eastern Medina County, and runs southeast for 10 miles to Leon Creek, 2 miles northwest of Macdona in southwestern Bexar County. The other natural drainage conveyance takes surface water to the west and drains into Big Sous Creek. Big Sous Creek is located 3 miles southwest of Riomedina in eastern Medina County and runs southeast for 8 miles to the Medina River, located 3 miles west of Macdona in western Bexar County.

Lucas Creek and Big Sous Creek are the surface water features nearest to NBAF Texas Research Park Site within approximately 2 miles, and both are tributaries of the Medina River. The state has listed bacteria, low dissolved oxygen, and PCBs in fish tissue as impairments for Lower Leon Creek. As of 2004, no potential contaminant sources have been reported or TMDLs established (EPA 2008d).

3.7.8.1.2 Storm Water

The Texas Research Park Site does not currently possess drainage structures other than natural conveyances. Storm water at the NBAF Texas Research Park Site follows the natural topographic contours while infiltrating into the subsurface (BSA 2007). In general, the 100-acre tract slopes to the southeast into intermittent drainage ways and should not be affected by storm flooding (BSA 2007).

3.7.8.1.3 Groundwater

Three aquifers exist within the vicinity of the Texas Research Park Site: Edwards, Buda, and Austin aquifers, named for the respective geologic feature where they are found. Each aquifer system is geologically isolated. Water quality within the Buda and Austin aquifers is generally below drinking water standards. Currently these two aquifers are used primarily for watering livestock and crop irrigation.

The Edwards Aquifer lies approximately 450 to 750 feet bls and is the sole drinking water source for San Antonio. The Edwards Aquifer is also an important water resource to the five-county area surrounding San Antonio. The Edwards Aquifer is a feature in the Edwards Group, a geologic classification for the limestone, chert, and dolomite that comprise the rock types of the area. This feature is, on average, over 500 feet thick and is very permeable. Underlying this feature is a formation comprised of marly limestone and clay called the Glen Rose formation. This feature, along with the Del Rio formation, confines water within the Edwards Group to form the Edwards aquifer.

3.7.8.1.4 Floodplains

The Texas Research Park Site is not within a 100-yr floodplain (FEMA 2007b; BSA 2007). The closest floodplain to the Texas Research Park Site is just over 0.5 miles to the east.

3.7.8.2 Construction Consequences

3.7.8.2.1 Surface Water

Construction of the NBAF at the Texas Research Park Site would have no direct effect on surface water resources. On-site surface flow during heavy rain periods would move through natural drainage ways, but indirect adverse effects would not likely occur within the Lucas Creek or Big Sous Creek systems. The development and implementation of a SWPPP, a SPCC plan, and the development of good housekeeping techniques would minimize potential surface water effects.

3.7.8.2.2 Storm Water

Construction of the NBAF would result in disturbance of previously undeveloped areas. During the construction phase, a SWPPP would be prepared and notice given as required by TCEQ.

Under the SWPPP, BMPs would be implemented to prevent construction storm water runoff and to protect the quality of local surface waters. Construction of the NBAF would have no adverse effect on local surface waters or downstream resources/facilities. Information regarding design and mitigation measures have been previously described and would be applicable to the Texas Research Park Site.

3.7.8.2.3 Groundwater

Previous studies have concluded that utilizing the areas within the Texas Research Park would not directly or indirectly effect water quality within the Edwards aquifer (Raba-Kistner 1987). The Texas Research Park Site is south of any known transition or aquifer system recharge zones, and there is a low probability that any contamination would occur from activities relating to the construction of the NBAF at the Texas Research Park Site.

3.7.8.2.4 Floodplains

The Texas Research Park Site is not located within the 100-yr floodplain; therefore, there would be no direct effects from construction activities on flood storage or floodways. The quality and volume of potential surface water leaving the site would be managed through approved storm water and erosion control permit stipulations. Construction of the NBAF would result in no indirect adverse effect on the 100-yr floodplain.

Refer to Sections 3.7.3.2.1, 3.7.3.2.2, 3.7.3.2.3, 3.7.3.3.1, 3.7.3.3.2, and 3.7.3.3.3 for additional water resource information.

3.7.8.3 Operation Consequences

3.7.8.3.1 Surface Water

Operation of the NBAF at the Texas Research Park Site would not have a direct effect on surface water resources. Indirect surface water effects could occur from runoff. To minimize potential effects to surface water quality, a site-wide SWPPP and SPCC plan would be prepared. All potential surface water contaminant sources would be evaluated during development and implementation of the storm water pollution prevention plan and SPCC plan, including daily operational housekeeping techniques. Operation of the NBAF would result in no adverse effect on local surface waters or downstream resources/facilities. Refer to Section 3.7.1 for additional SPCC information.

Wild and Scenic Rivers

The nearest Texas river designated in the Wild and Scenic River inventory is the Rio Grande River. The Rio Grande flows from its headwaters in the San Juan Mountains of southern Colorado for 1,865 miles to the Gulf of Mexico near Brownsville, Texas. The NBAF would not affect the Rio Grande River or its designation as a Wild and Scenic River, since it is several hundred miles southwest of the Texas Research Park Site.

3.7.8.3.2 Storm Water

The proposed design of the NBAF uses LID approaches. The LID site design goal is to minimize runoff volume and preserve existing flow patterns (NDP 2007a). The presence of the NBAF would result in an increase of 270,000 square feet (6.2 acres) of impervious area and result in 300,150 cubic feet (2,245,422 gallons) of total runoff based on a site-specific 100-yr, 24-hr, 10-inch storm event (Department of Commerce 2008). The paved facility footprint is 270,000 square feet (6.2 acres), compared to the total 100-acre site area; therefore, any associated hydrologic effect would be expected to be minimal. Texas has EPA-delegated authority for both NPDES storm water and wastewater permitting. As a baseline, a NPDES SWPPP would be required for facility operation.

3.7.8.3.3 Groundwater

Operation of the NBAF at the Texas Research Park Site would not result in direct effects to groundwater resources. San Antonio would provide the proposed NBAF with water; therefore, no on-site groundwater wells are anticipated. The below-grade structural feature of the NBAF would represent a potential groundwater diversionary attribute. Potential indirect effects from groundwater contamination would be minimized through BMPs, as previously described.

3.7.8.3.4 Floodplains

The Texas Research Park Site is not located in a 100-yr floodplain; therefore, there would be no direct effects from operations of the NBAF on flood storage or floodways. Operation of the NBAF at the Texas Research Park Site would have no anticipated adverse indirect effect on flood storage, floodways, or downstream facilities or resources.

Cumulative Impacts

Prior to the mid 20th century, Bexar County was predominately agricultural, with cash crops, cotton, and livestock as the main economic drivers. World War II saw Bexar County’s already large military presence grow, spurring development trends. The area’s military presence has remained an important economic driver. During the 1980s and 1990s, as a result of attempts to diversify the area's economy, San Antonio and Bexar County became the site of a number of electronics and biotechnology companies. A number of BSL facilities are located in the San Antonio and Bexar County region. The Southwest Foundation for Biomedical Research currently operates three BSL-3 laboratories and one BSL-4 laboratory; the University of Texas Health Science Center at San Antonio operates three BSL-3 laboratories; the Brooks City Base has two BSL-3 laboratories, one of which is operated by the San Antonio Metropolitan Health District; and the University of Texas at San Antonio, the Veterans Administration, the Wilford Hall Medical Center, and the Brooks Army Medical Center all operate one BSL-3 laboratory.

In Bexar County, there are several other public and private activities proposed or ongoing that would have potential to impact water resources. Future planned projects in the vicinity of the Texas Research Park Site include a number of new residential development projects that would result in over 13,000 new residential units in the region. The estimated population generated from these planned developments would be 31,200 people for just residential, not including commercial, office, or industrial population from employment in the area.

The ROI for water resources is the BMWD, which supplies potable water to the area including the Texas Research Park. As previously discussed in Section 3.3.4, operation of the NBAF would result in the use of approximately 164,000 gpd (60 mgy). The NBAF would receive potable water from the BMWD Texas Research Park Public Water Supply System, and future upgrades planned for 2008 would be able to meet the proposed NBAF demands. However, the additional water consumption from the planned residential developments would exert additional pressure on the water supply capacity for the region.

3.8 BIOLOGICAL RESOURCES

3.8.1 Methodology

The ecological context for each site was established by characterizing the natural vegetation of each region based on review of regional natural community guides and other pertinent literature. Site-specific plant community descriptions were based primarily on floristic surveys conducted specifically for the proposed NBAF project. In addition, known occurrences of rare or significant natural communities in the vicinity of the sites were identified through review of state natural heritage program data. The naturalness and quality of plant communities at the proposed sites were evaluated based on the degree of departure from communities that would be expected to occur in the region under natural conditions. Factors such as community structure, species composition, recent or historical disturbance, and presence of non-native species were considered in evaluating the quality of plant communities. Vegetation effects were then assessed based on the quality and rarity of the affected communities and the extent of impacts.

Plant community composition and quality were used to predict wildlife utilization of on-site habitats. Additional resources that were used to evaluate wildlife resources included state Gap Analysis Program (GAP) documents and distribution maps, state wildlife action plans, species lists from adjacent nature preserves, and other relevant literature resources. Effects on wildlife were then evaluated based on the quality and rarity of the affected habitat and the extent of impacts.

Federally listed species are protected under the *Endangered Species Act* (ESA) of 1973, as amended (16 U.S.C. 1531-1543), which requires federal agencies to ensure that any actions they authorize, fund, or carry out do not jeopardize the “continued existence” of listed species or result in the destruction or adverse modification of habitat designated as critical to their existence. Site-specific plant community descriptions were used to evaluate the potential for on-site occurrences of state and federally listed threatened and endangered species. Additional resources that were used to evaluate potential occurrences of threatened and endangered species included review of state natural heritage program databases, review of U.S. Fish and Wildlife Service (USFWS) and natural heritage program county species lists, and direct correspondence with regional USFWS field offices and state natural heritage programs. When warranted, site-specific surveys for listed species and/or potential habitat were conducted. Effects were evaluated based on known occurrences of listed species and the presence of potential habitat at the sites.

The discharge of dredge or fill material into “Waters of the U.S.” is regulated under Section 404 of the *Clean Water Act* (CWA), as amended. “Waters of the U.S.” include wetlands and other water bodies such as streams, rivers, lakes, and tidal waters. USACE (33 CFR 328.3), and the EPA (40 CFR 230.3) define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." In accordance with this definition, areas classified as wetlands must possess the following three diagnostic characteristics: a predominance of hydrophytic vegetation, hydric soils, and wetland hydrology.

Site visits by qualified professionals and analysis of National Wetland Inventory (NWI) and county soil survey maps were used to evaluate potential on-site occurrences of Section 404 jurisdictional wetlands. When warranted, site-specific wetland delineations were conducted by qualified professionals using methods specified in the (USACE 1987). Wetland delineations included on-site stream mapping, the description of stream channel characteristics and aquatic habitats, and the evaluation of any applicable wetland or stream buffer zone requirements. Data from the wetland delineations were used to describe on-site wetland communities and aquatic habitats, and surveyed delineation maps were used to evaluate wetland and stream impacts. The evaluation of aquatic resources (habitats and aquatic fauna) also included the review of river basin management plans, aquatic resource data collected by state agencies, and other pertinent literature resources.

3.8.2 No Action Alternative

3.8.2.1 Affected Environment

3.8.2.1.1 Vegetation

Regional Vegetation

Plum Island is located in the Coastal Lowland ecozone of the Atlantic Coastal Plain physiographic province (Edinger et al. 2002). Characteristic natural communities of the Coastal Lowland ecozone include maritime beach and dune, maritime grassland, salt marsh, maritime shrubland, maritime forest, coastal hardwood forests, pitch pine-oak forests, and freshwater wetlands.

Maritime beaches are characterized by a sparse herbaceous stratum that typically includes beachgrass (*Ammophila breviligulata*), sea-rocket (*Cakile edentula* ssp. *edentula*), seaside atriplex (*Atriplex patula*), seabeach atriplex (*A. arenaria*), seabeach sandwort (*Honkenya peploides*), salsola (*Salsola kali*), seaside spurge (*Chamaesyce polygonifolia*), and seabeach knotweed (*Polygonum glaucum*). Dunes are dominated by grasses, forbs, and low shrubs. Characteristic dune species include beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), beachgrass, cyperus (*Cyperus polystachyos* var. *macrostachyus*), seaside goldenrod (*Solidago sempervirens*), beach pinweed (*Lechea maritima*), jointweed (*Polygonella articulata*), sand rose (*Rosa rugosa*), bayberry (*Myrica pensylvanica*), beach plum (*Prunus maritima*), and poison ivy (*Toxicodendron radicans*). Maritime grasslands occur on rolling outwash plains within the influence of ocean winds and salt spray. The dominant grasses are little bluestem (*Schizachyrium scoparium*), common hairgrass (*Deschampsia flexuosa*), and poverty grass (*Danthonia spicata*) (Edinger et al. 2002).

Maritime shrubland communities are characterized by a dense, tall assemblage of shrubs and tree saplings. Typical species include shadbush (*Amelanchier canadensis*), bayberry (*Myrica pensylvanica*), black cherry (*Prunus serotina*), arrowwood (*Viburnum dentatum*), shining sumac (*Rhus copallinum*), beach plum, sand rose, wild rose (*Rosa virginiana*), eastern red cedar (*Juniperus virginiana*), American holly (*Ilex opaca*), black oak (*Quercus velutina*), and sassafras (*Sassafras albidum*). Maritme forests are dominated by various combinations of salt-pruned, stunted trees that are heavily influenced by coastal processes such as high winds and salt spray. Characteristic canopy trees include black oak, post oak (*Quercus stellata*), scarlet oak (*Q. coccinea*), white oak (*Q. alba*), eastern red cedar, beech (*Fagus grandifolia*), and American holly. Areas that are protected from coastal processes contain a number of deciduous coastal forest communities that are dominated by various combinations of hardwood species. Common hardwoods include white oak, black oak, scarlet oak, chestnut oak (*Q. montana*), hickories (*Carya* spp.), beech, red maple (*Acer rubrum*), sugar maple (*A. saccharum*), and yellow poplar (*Liriodendron tulipifera*). Pitch pine-oak communities occur on stabilized dunes and well drained sandy soils on glacial till and outwash plains. Characteristic species include pitch pine (*Pinus rigida*), white oak, scarlet oak, black oak, post oak and/or scrub oaks that include bear oak (*Quercus ilicifolia*) and dwarf chinkapin oak (*Q. prinoides*) (Edinger et al. 2002).

Hardwood and shrub swamp communities occur in poorly drained, freshwater depressions. Common trees of hardwood swamps include maple (*Acer rubrum*), ashes (*Fraxinus* spp.), elms (*Ulmus* spp.), yellow birch

(*Betula alleghaniensis*), and swamp white oak (*Quercus bicolor*). Characteristic shrubs of hardwood and shrub swamp communities include spicebush (*Lindera benzoin*), alders (*Alnus* spp.), viburnums (*Viburnum* spp.), highbush blueberry (*Vaccinium corymbosum*), common elderberry (*Sambucus canadensis*), dogwoods (*Cornus* spp.), swamp azalea (*Rhododendron viscosum*), and willows (*Salix* spp.).

Freshwater marshes occur in the lower portions of depressions where the soils are subject to near-permanent inundation or saturation. Common emergent aquatic plants include cattails (*Typha* spp.), wild rice (*Zizania aquatica*), bur-reeds (*Sparganium* spp.), pickerel weed (*Pontederia cordata*), bulrushes (*Scirpus* spp.), arrowhead (*Sagittaria latifolia*), arrowleaf (*Peltandra virginica*), rice cutgrass (*Leersia oryzoides*), bayonet rush (*Juncus militaris*), water horsetail (*Equisetum fluviatile*), and bluejoint grass (*Calamagrostis canadensis*) (Edinger et al. 2002). Salt marshes and salt shrub communities occupy the intertidal zone along coastal shorelines that are sheltered from high-energy ocean waves. The lower portions of salt marshes are dominated by near-monospecific stands of cordgrass (*Spartina alterniflora*). Dominant species within the upper portion of the marsh include salt-meadow grass (*Spartina patens*), spikegrass (*Distichlis spicata*), black-grass (*Juncus gerardii*), and glassworts (*Salicornia* spp.) (Edinger et al. 2002).

<u>Plum Island Vegetation</u>

Natural communities on Plum Island have been heavily impacted by human activities that include livestock grazing, establishment of a coastal artillery fort (Fort Terry 1879 - 1948), and development associated with the existing PIADC. Existing communities are fragmented by an extensive network of roads. In addition, numerous structures, historical artillery batteries, trenches, borrow pits, utility corridors, and other mowed or disturbed areas are common across the island. Natural vegetation on the island is influenced by maritime processes that include high winds, salt spray, overwash, and dune formation and shifting. The island contains characteristic maritime communities that include beach, dune, and maritime shrub/forest. Additional communities include an extensive complex of freshwater herbaceous/shrub wetland communities on the southwestern portion of the island, and coastal hardwood forests on elevated moraine deposits that are protected from ocean salt spray and overwash. The back side of the island on Long Island Sound is actively eroding, resulting in vertical bluffs that are adjoined by unvegetated beaches consisting of sand and glacial till (gravel, cobble, and boulder). Consequently, the island lacks tidal marshes and salt shrub communities that are characteristic of barrier islands and other moraine islands in Long Island Sound.

<u>Rare and Significant Natural Communities</u>

The New York Natural Heritage Program (NYNHP) has identified the maritime dune community on the southeastern portion of Plum Island as a significant natural area with high ecological and conservation value. The NYNHP describes this area as a low dune field with scattered blowouts and patches of low shrubby vegetation. The report indicates that many non-native species are present along old roads within the dunes; however, the community is described as a fairly large occurrence in good condition (NYNHP 2007).

3.8.2.1.2 Wetlands

The southern portion of Plum Island contains approximately 54 acres of freshwater wetlands (Figure 3.8.2.1.2-1). These freshwater wetlands include marshes, shrub-dominated wetlands, and areas of open water. Common hydrophytic herbaceous species include cattail (*Typha latifolia*), sedges (*Carex* spp.), and rushes (*Juncus* spp.) Typical hydrophytic shrubs include button bush (*Cephalanthus occidentalis*), high bush blueberry (*Vaccinium corymbosum*), sweet pepper bush (*Clethra alnifolia*), swamp black gum (*Nyssa biflora*), and multiflora rose (*Rosa multiflora*). Section 404 jurisdiction also extends landward to the high-tide line along the unvegetated intertidal shorelines that fringe the island. The eastern intertidal shoreline consists primarily of unvegetated sand. The western edge of the island is actively eroding, resulting in vertical bluffs and unvegetated beaches consisting of sand and glacial till (gravel, cobble, and boulder). The island lacks tidal salt marsh communities that are characteristic of other islands in Long Island Sound.

In addition to the wetland areas that are regulated under Section 404 of the CWA, the State of New York regulates a 100-foot buffer zone around all freshwater wetlands and a variable buffer zone adjacent to tidal wetlands. The width of the tidal wetland buffer zone varies with the topography of the adjacent land. The regulated inland extent of the tidal buffer zone ends at the elevation contour of 10 feet above mean sea level or at the topographic crest of an adjacent bluff that is crossed by the 10-foot contour or at a distance of 300 feet inland from the wetland boundary, whichever is closest to the wetland boundary. In the vicinity of the existing PIADC, most of the tidal buffer zone along the western shoreline ends at the topographic crest of an adjacent bluff.

3.8.2.1.3 Aquatic Resources

Freshwater aquatic habitats on Plum Island consist of permanently flooded areas within the complex of freshwater wetlands on the southernmost portion of the island. These small ponds are shallow, groundwater-fed water bodies that occupy shallow depressions in the outwash plain of terminal moraine deposits. Semi-aquatic turtles that occur in freshwater habitats on or near Plum Island include snapping turtle (*Chelydra serpentina*), spotted turtle (*Clemmys guttatea*), eastern painted turtle (*Chrysemys picta picta*), and diamondback terrapin (*Malaclemys terrapin terrapin*). Information regarding amphibians that may inhabit these freshwater ponds is lacking; however, species may include those associated with similar freshwater habitats on nearby islands: spotted salamander (*Ambystoma maculatum*), marbled salamander (*Ambystoma opacum*), eastern spadefoot toad (*Scaphiopus holbrookii*), spring peeper (*Pseudacris crucifer*), American bullfrog (*Rana catesbeiana*), northern green frog (*R. clamitans*), wood frog (*R. sylvatica*), and gray tree frog (*Hyla versicolor*) (NYSCDR 2002). Fishes that are characteristic of permanently flooded coastal plain depressions include chain pickerel (*Esox niger*), banded sunfish (*Enneacanthus obesus*), and eastern mudminnow (*Umbra pygmaea*) (Edinger et al. 2002).

Plum Island is surrounded by the estuarine/marine waters of Long Island Sound, Plum Gut, Block Island Sound, and Gardiners Bay. Fish typical of the nearshore zone of the Atlantic Ocean include Atlantic menhaden (*Brevoorita tyrannus*), weakfish (*Cynoscion regalis*), striped bass (*Morone saxatilis*), winter flounder (*Pleuronectes americanus*), summer flounder (*Paralichthys dentatus*), bluefish (*Pomatomus saltatrix*), tautog (*Tautoga onitis*), Atlantic mackerel (*Scomber scombrus*), black sea bass (*Centropristis striata*), Atlantic croaker (*Micropogonias undulatus*), northern kingfish (*Menticirrhus saxatilis*), spot (*Leiostomas xanthurus*), American sandlance (*Ammodytes americanus*), and silversides (*Menidia menidia*). Surf clams (*Spisula solidissima*) are abundant in nearshore benthic habitats. Marine sea turtles that occur in the nearshore zone during migration include Atlantic (Kemp's) ridley turtle (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and loggerhead sea turtles (*Caretta caretta*). All five sea turtles are federally listed under the ESA (see Section 3.8.2.1.5). The nearshore zone provides winter habitat for harbor seals (*Phoca vitulina*) and gray seals (*Halichoerus grypus*). Other frequently occurring marine mammals include the finback whale (*Balaenoptera physalus*), minke whale (*B. acutorostrata*), and humpback whale (*Megaptera novaeangliae*). Additional commonly occurring marine mammals include the common dolphin (*Delphinus delphis*), bottlenosed dolphin (*Tursiops truncatus*), white-sided dolphin (*Lagenorhynchus acutus*), striped dolphin (*Stenella coerulealba*), and pilot whale (*Globicephala melaena*) (Edinger et al. 2002).

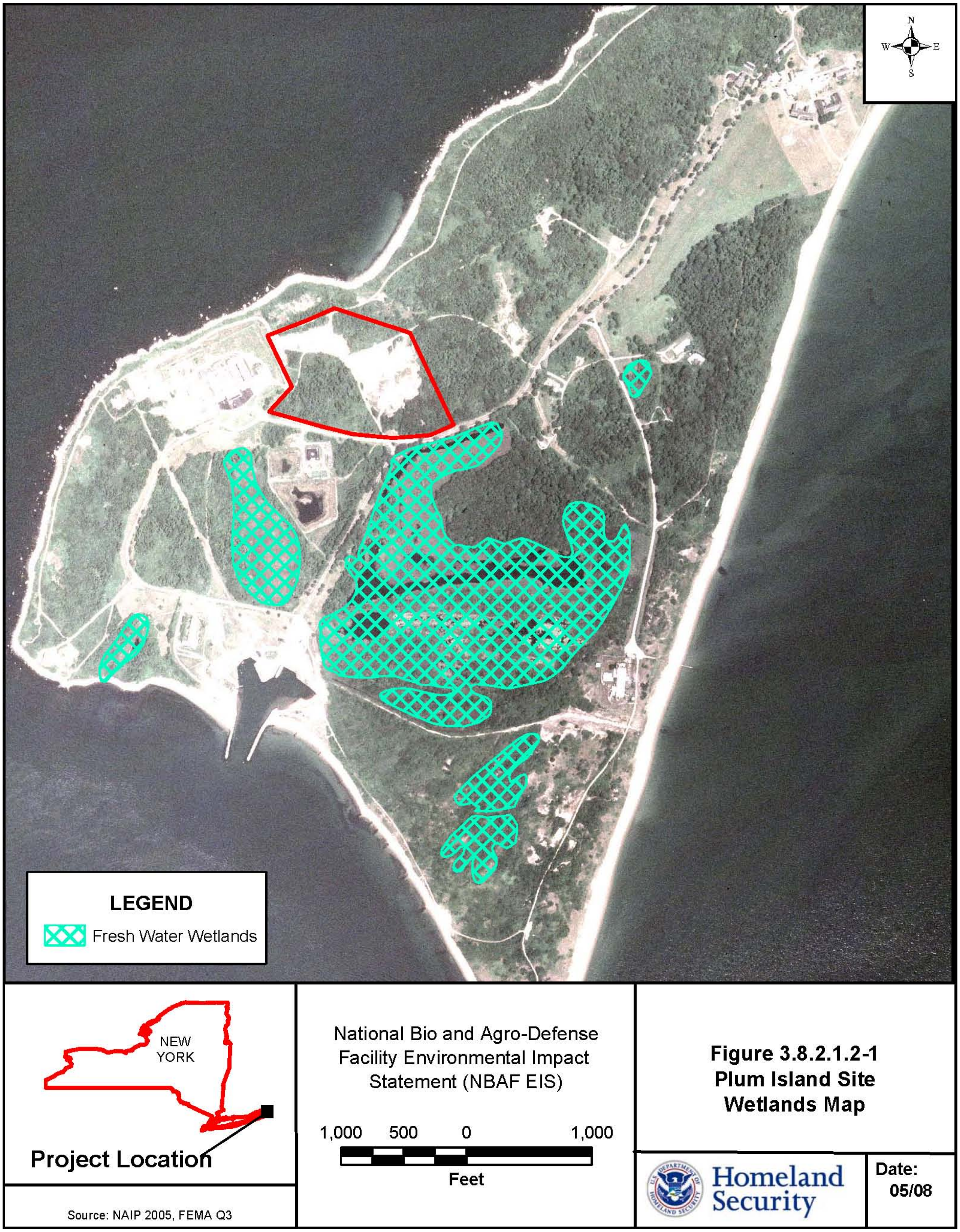


Figure 3.8.2.1.2-1 — Plum Island Site Adjacent Wetlands

The New York State Coastal Atlas, which delineates the State's Coastal Area Boundary, identifies all of Plum Island as "Federally Excluded Land" (NYSCDR 2008). Federal lands are not subject to the States Coastal

Consistency Review Process. NYSDCR has designated Plum Gut (the area of open water between Plum Island and Orient Point) as Significant Coastal Fish and Wildlife Habitat. Plum Gut is a deep channel covering an area of approximately 500 acres. Plum Gut provides important foraging habitat for significant concentrations of fishes that include striped bass, bluefish, tautog, summer flounder, and scup (*Stenotomus chrysops*). Consequently, Plum Gut is an important recreational and commercial fishing resource. Plum Gut is one of two major passage corridors for striped bass, which move into Long Island Sound during the spring and fall migrations to and from their spawning grounds. Plum Gut is also considered a major corridor for Atlantic salmon (*Salmo salar*) during the spring as they return to their spawning grounds in the Connecticut and Pawtucket Rivers. Plum Gut also provides important habitat for marine mammals, particularly bottlenosed dolphin, harbor porpoise (*Phocoena phocoena*), and harbor seal. Sea turtles, especially juvenile Atlantic ridley and loggerhead sea turtles, also utilize Plum Gut (NYSDCR 2005). In addition to coastal consistency review, projects that affect designated Significant Coastal Fish and Wildlife Habitats are subject to review under Policy 7 of the New York State Coastal Policies. Policy 7 prohibits activities that "destroy or significantly impair" the viability of significant habitats.

The *Marine Mammal Protection Act* (MMPA) of 1972 (as amended through 1997) prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the United States. The definition of "take" is "to harass, hunt, capture, or kill; or attempt to harass, hunt, capture or kill any marine mammal." In addition to the species mentioned above, marine mammals that may occur in deepwater estuarine or marine habitats in New York include the harp seal (*Phoca vitulina*), hooded seal (*Cystophora cristata*), Rissols dolphin (*Grampus griseus*), white-beaked dolphin (*Lagenorhynchus albirostris*), sperm whale (*Physeter catodon*), pygmy sperm whale (*Kogia breviceps*), sei whale (*Balaenoptera borealis*), and right whale (*Eubalaena glacialis*) (NYSDEC 2007). Harbor seals are known to haul-out (leave the water) on the southeastern shoreline of Plum Island for resting and sunning.

3.8.2.1.4 Terrestrial Wildlife

The New York GAP has developed models that predict the statewide distribution of terrestrial vertebrate species that are known to breed in New York. The New York GAP list of breeding species for the Coastal Lowlands ecozone includes 36 mammals, 158 birds, 18 reptiles, and 18 amphibians (Smith et al. 2001). Plum Island contains a diverse assemblage of wildlife habitats that include maritime beaches and dunes, rocky shorelines, maritime shrub communities, hardwood forests, freshwater wetlands, freshwater ponds, and marine habitats. The area encompassing Orient Beach State Park, Plum Island, and Plum Gut is an important foraging and breeding area for colonial waterbirds, and the North Fork Audubon Society (NFAS) has designated this area as an Important Bird Area (IBA). The NFAS conducted spring, summer, and fall bird surveys on Plum Island in 2007 (NFAS 2007). A total of 72 bird species were sighted on Plum Island. Results included 11 confirmed breeding species and six probable breeders (Table 3.8.2.1.4-1).

Beach and dune habitats along the southeastern shoreline of the island have supported large nesting colonies of great black-backed gulls. Herons, egrets, and ibises are also known to nest in the vicinity of the freshwater wetlands on the southern portion of the island. The NYNHP conducts great egret nesting surveys once every 3 years, and the past three surveys have documented an average of eight pairs on Plum Island (NYNHP 2007). Roseate and common terns from the nearby Gull Island colony frequently forage within Plum Gut, and these species utilize the rocky shoreline of southern Plum Island as resting habitat during feeding periods. Piping plovers have nested on the island in the past, and the island supports a large breeding population of Canada geese. As many as 18 active osprey nests have been documented on Plum Island during the breeding season. The 2007 NFAS surveys documented seven confirmed active osprey nests and an additional five potentially active nests (NFAS 2007). A total of 17 nesting platforms have been constructed to encourage osprey nesting on the island. The Orient Point-Plum Island IBA is also an important waterfowl wintering area for Canada geese, American black ducks, mallards, canvasbacks, scaup, long-tailed ducks, scoters, buffleheads, common goldeneyes, and red-breasted mergansers (NFAS 2007).

Table 3.8.2.1.4-1 — Results of Audubon Society 2007 Plum Island Breeding Bird Survey

Scientific Name	Common Name
Confirmed Breeders	
Pandion haliaetus	Osprey
Pipilo erythrophthalmus	Eastern towhee
Melospiza melodia	Song sparrow
Branta canadensis	Canada goose
Dumetella carolinensis	Gray catbird
Troglodytes aedon	House wren
Riparia riparia	Bank swallow
Phalacrocorax auritus	Double-crested cormorant
Somateria mollissima	Common eider
Turdus migratorius	American robin
Dendroica petechia	Yellow warbler
Probable Breeders	
Agelaius phoeniceus	Red-winged blackbird
Carduelis tristis	American goldfinch
Molothrus ater	Brown-headed cowbird
Vireo griseus	White-eyed vireo
Cathartes aura	Turkey vulture
Bombycilla cedrorum	Cedar waxwing

Mammals that are known to occur on Plum Island include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), muskrat (*Ondratra zibethicus*), white-footed mouse (*Percomyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), and feral cats. As a standard safety procedure, measures to control the white-tailed deer population are conducted on an annual basis and none have been found on the island since 2004. Reptiles that are known to occur on Plum Island include the eastern box turtle (*Terrapene carolina carolina*), snapping turtle, and diamondback terrapin. Additional semi-aquatic turtles that are likely to occur in the freshwater ponds on the island include the spotted turtle and eastern painted turtle. Snakes that are common in the Coastal Lowlands ecozone include the common garter snake (*Thamnophis sirtalis*), northern black racer (*Coluber constrictor constrictor*), northern water snake (*Nerodia sipedon sipedon*), and northern brown snake (*Storeria dekayi dekayi*). Although no snakes have been reported on Plum Island, potential habitats for all of these species are present. Amphibians that may occur on Plum Island are discussed in Section 3.8.2.1.3.

The regional distribution of ungulate (hoofed mammal) populations has particular relevance, since they are susceptible to many of the diseases that may be studied at the existing PIADC. In addition to white-tailed deer, which occur throughout the state, moose are also known to occur in New York. The predicted New York GAP distribution for moose is limited to the northern upstate portion of New York, with the southern edge of the predicted range approximately 110 miles northwest of Plum Island (Smith et al. 2001). Therefore, moose are not likely to occur in the vicinity of Plum Island.

3.8.2.1.5 Threatened and Endangered Species

The USFWS reviews federal actions that may result in negative effects on federally listed terrestrial plants and animals and freshwater aquatic organisms. USFWS jurisdiction over sea turtles is limited to nesting habitat. The National Marine Fisheries Service (NMFS) has jurisdiction over federally listed sea turtles in the water, as well as listed marine mammals, saltwater fishes, and other marine species. Marine mammals are also protected under the MMPA, which is addressed in Section 3.8.2.1.3. Additional animal species that are listed by the state as endangered or threatened and plant species that are listed by the state as endangered, threatened, rare, or exploitably vulnerable are afforded protection under the Environmental Conservation Law of New York (Sections 11-0535 and 9-1503) and 6 New York Codes, Rules, and Regulations (NYCRR)

Parts 182 and 193. Federally listed species that are likely to occur in Suffolk County include the piping plover, roseate tern, shortnose sturgeon, five species of sea turtles, and three species of plants (Table 3.8.2.1.5-1). A list of state protected species that have been reported from the Town of Southold (including Plum Island) is provided in Table 3.8.2.1.5-2.

Federally Listed Species

Piping Plover

Piping plovers breed on dry sandy beaches, often near dunes in areas with little or no beach grass. Piping plovers begin to arrive at their breeding grounds in early March. Nests consist of shallow scrapes that are sometimes lined with pebbles and/or shells. They are usually placed well above the high-tide mark on open, generally grassless sand beaches or dredged spoil areas. An average clutch of four eggs is laid during May and June. Incubation takes 25-31 days, and the young leave the nest shortly after hatching and fledge in about 28-35 days. Piping plovers depart for their wintering areas by early September. The presence of a piping plover nest was confirmed on the northern portion of Plum Island in 2002 (NYSDEC 2008).

Table 3.8.2.1.5-1 — USFWS List of Federally Threatened and Endangered Species Suffolk County, New York (USFWS 2007b)

Scientific Name	Common Name	Federal Status	State Status	Habitat Utilized in New York	Habitat Present on Plum Island
Charadrius melodus	Piping plover	E	T	Maritime beaches	Yes
Sterna dougallii	Roseate tern	E	E	Maritime beaches and salt marsh islands	Yes
Caretta caretta	Loggerhead turtle	T	T	Ocean and estuaries	Yes
Chelonia mydas	Green turtle	T	T	Ocean and estuaries	Yes
Dermochelys coriacea	Leatherback turtle	E	E	Open ocean	Yes
Eretmochelys imbricata	Hawksbill turtle	E	E	Ocean and estuaries	Yes
Lepidochelys kempii	Kemp's ridley turtle	E	E	Ocean and estuaries	Yes
Acipenser brevirostrum	Shortnose sturgeon	E	E	Ocean and estuaries	Yes
Agalinis acuta	Sandplain geradia	E	E	Coastal grasslands	Yes
Amaranthus pumilus	Seabeach amaranth	T	E	Maritime beaches	Yes
Isotria medeoloides[a]	Small whorled pogonia	T	E	Hardwood stands with an open understory	Yes

[a]Record is historic, and this species is believed to be extirpated in New York.

Table 3.8.2.1.5-2 — Federally and State-Protected Species List for the Town of Southold, New York (Including Plum Island, Gull Island, and Fishers Island) (Adapted from Scopaz 2004)

Scientific Name	Common Name	State Status[a]	Federal Status[b]
Ambystoma tigrinum	Tiger salamander	E	-
Kinosternon subrubrum	Eastern mud turtle	E	-
Charadrius melodus	Piping plover	E	E
Sterna antillarum	Least tern	T	-
Sterna dougallii	Roseate tern	E	E
Sterna hirundo	Common tern	T	-
Angelica lucida	Angelica	E	-
Aster subulatus	Saltmarsh aster	T	-
Atriplex glabriuscula	Seaside orach	E	-
Bartonia paniculata	Screw-stem	E	-
Carex hormathodes	Marsh straw sedge	T	-
Carex mitchelliana	Mitchell's sedge	T	-
Carex straminea	Straw sedge	E	-
Carex typhina	Cat-tail sedge	T	-
Chenopodium berlandieri var. *macrocalycium*	Large calyx goosefoot	E	-
Chenopodium rubrum	Red pigweed	T	-
Coreopsis rosea	Rose coreopsis	R	-
Cyperus lupulinus var. *lupulinus*[c]	Hop sedge	T	-
Cyperus polystachyos var. *texensis*	Coastal flatsedge	E	-
Digitaria filiformis	Slender crabgrass	T	-
Diplachne maritime	Salt-meadow grass	E	-
Eleocharis engelmannii	Engelmann's spikerush	E	-
Eleocharis fallax	Creeping spikerush	E	-
Eleocharis halophila	Salt-marsh spikerush	T	-
Erechtites hieraciifolia var. *megalocarpa*	Fireweed	E	-
Gnaphalium purpureum	Purple everlasting	E	-
Helianthemum dumosum	Bushy rockrose	T	-
Iris prismatica	Slender blue flag	T	-
Lemna perpusilla	Minute duckweed	E	-
Ligusticum scothicum	Scotch lovage	E	-
Myriophyllum pinnatum	Green parrot's feather	E	-
Paspalum leave	Field beadgrass	E	-
Plantago maritima ssp. *juncoides*	Seaside plantain	T	-
Polygonum glaucum	Seabeach knotweed	R	-
Polygonum hydropiperoides var. *opelousanum*	Opelousa smartweed	T	-
Polygonum setaceum var. *interjectum*	Swamp smartweed	E	-
Populus heterophylla	Swamp cottonwood	T	-
Potamogeton pulcher	Spotted pondweed	T	-
Potentilla anserina ssp. *egedii*	Silverweed	T	-
Rotala ramosior	Tooth-cup	T	-
Rumex maritimus var. *fueginus*	Golden dock	E	-

Table 3.8.2.1.5-2 — Federally and State Protected Species List for the Town of Southold, New York (Including Plum Island, Gull Island, and Fishers Island) (Adapted from Scopaz 2004) (Continued)

Scientific Name	Common Name	State Status[a]	Federal Status[b]
Salicornia bigelovii	Dwarf glasswort	T	-
Scirpus maritimus	Seaside bulrush	E	-
Solidago elliottii	Coastal goldenrod	E	-
Spiranthes vernalis[d]	Spring ladies'-tresses	E	
Tipularia discolor	Cranefly orchid	E	-
Tripsacum dactyloides	Northern gamma grass	T	-

[a]E = Endangered, T = Threatened, R = Rare, P = Protected
[b]E = Endangered
[c]Reported by Lamont (2006)
[d]Reported by Stalter et al. (2003)

Roseate Tern

A marine coastal species, the roseate tern breeds on salt marsh islands and beaches with sparse vegetation. Roseate terns arrive on the breeding grounds between late April and early May and begin nesting 1 month later. In New York, roseate terns are always found nesting with common terns. The nest is a depression in sand, shell, or gravel and may be lined with bits of grass and other debris. Nests are usually located in dense grass clumps. Eggs are incubated for approximately 23 days, and the young fledge in 22-29 days. Roseate terns depart for their wintering areas in late summer. Based on behavioral observations, the roseate tern was identified as a possible breeder on Plum Island in 2003 (NYSDEC 2008).

Atlantic Hawksbill

The Atlantic hawksbill rarely occurs in New York. Preferred habitat consists of warm, coastal shoal water less than 50 feet deep with abundant submerged vegetation. Coral reefs, lagoons, inlets, and bays are ideal habitats. Nesting occurs on isolated beaches in the Gulf of Mexico and the Caribbean Sea (NYSDEC 2008).

Green Sea Turtle

In the Atlantic Ocean, green sea turtles are found from Massachusetts south to Florida. They inhabit shallow waters such as shoals and lagoons with submerged vegetation. Inlets, bays, and estuaries are preferred habitats. Nesting occurs in all subtropical to tropical oceans of the world between 35 degrees north and south latitude, in waters that remain above 68°F during the coldest months (NYSDEC 2008).

Kemp's Ridley

Juvenile Kemp's ridleys inhabit the Atlantic Coast from Florida to Canada, possibly following the warm Gulf Stream. Preferred habitats include sheltered areas along the coastline such as large estuaries, bays, and lagoons. Nesting grounds are restricted to a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico. Long Island waters have been identified as critical habitat for immature Kemp's ridleys, providing important habitat for development during the early stages of life (2-5 years) (NYSDEC 2008).

Leatherback Sea Turtle

Leatherback sea turtles are the most pelagic of the sea turtles. In the North Atlantic Ocean, leatherback sea turtles are found regularly off the coast of New England and in Long Island, New York, waters. Nesting occurs on the islands of St. Croix, Vieques, and Culebra and on the mid-Atlantic coast of Florida. Recent isolated nestings have been recorded along the southeastern Atlantic coast from Georgia to North Carolina (NYSDEC 2008).

Loggerhead

In the western Atlantic, loggerheads occur from Canada south to Argentina. Loggerheads inhabit warm waters on continental shelves and areas among islands. Estuaries, coastal streams, and salt marshes are preferred habitats. In the western Atlantic, loggerheads nest along the southeastern coast of the United States, with 90% of nests occurring in Florida (NYSDEC 2008).

Shortnose Sturgeon

The shortnose sturgeon is anadramous, migrating from salt water to spawn in freshwater. Shortnose sturgeon spawn in the Hudson River from April to May. Adult sturgeon migrate upriver from their mid-Hudson River overwintering areas to freshwater spawning sites north of Coxsackie. In New York State, the shortnose sturgeon is only found in the lower portion of the Hudson River from the southern tip of Manhattan upriver to the federal dam at Troy (NYSDEC 2008).

Sandplain Gerardia

Six of the 12 known extant populations occur in coastal grassland natural communities on Long Island. The endangered status of this species is attributed primarily to loss of habitat from development and encroachment by invasive exotic competitors (NYSDEC 2008).

Seabeach Amaranth

Seabeach Amaranth is found on sandy beaches of the Atlantic coast, where it grows on shifting sands between dunes and the high-tide mark. Habitat degradation is attributed to the construction of beach stabilization structures that inhibit the natural movement of sand (NYSDEC 2008).

Small Whorled Pogonia

Small whorled pogonia occurs in dry to mesic deciduous or deciduous-coniferous forests, generally in forests with an open understory. Small whorled pogonia was historically known from Central and Eastern New York and Long Island. The NYNHP ranks this species as historical, which indicates that the species has not been seen in New York in at least 20-30 years (Young 2007).

<u>State-Listed Species</u>

Plum Island contains suitable habitat for many of the state-protected species that are listed in Table 3.8.2.1.5-2. State-protected species that are known to occur on Plum Island include the state endangered great egret, which is a recurring breeder on Plum Island. The state-threatened common tern utilizes shoreline habitats on Plum Island as resting habitat. The state-threatened northern harrier utilizes Plum Island for foraging and breeding. State-listed endangered and threatened plants that have been reported from Plum Island include hop sedge (*Cyperus lupulinus* var. *lupulinus*), coastal sedge (*C. polystachyos* var. *texensis*), and spring ladies'-tresses (*Spiranthes vernalis*). Although not protected under state law, additional state species of concern animals that occur on Plum Island include osprey and diamondback terrapin. The osprey is a recurring breeder on Plum Island, and diamondback terrapins are common in and around the freshwater ponds on the island.

3.8.2.2 Construction Consequences

3.8.2.2.1 Vegetation

New construction would occur on previously disturbed grounds adjacent to the existing PIADC facility and, therefore, would have no adverse effect on native vegetation or natural communities. Repair or replacement of utility lines would have temporary adverse effects on previously disturbed vegetation within existing utility right-of-ways. Repair or replacement of other utility structures would be restricted to existing developed and/or previously disturbed areas. Therefore, the No Action Alternative would not have adverse effects on native vegetation or natural communities.

3.8.2.2.2 Wetlands

New construction of approved PIADC upgrades would occur on previously disturbed grounds adjacent to the existing PIADC facility. The proposed construction area does not contain wetlands, and no portion of the area falls within a wetland buffer zone. Therefore, new construction would have no adverse effect on wetlands.

Although wetlands in the vicinity of the utility lines have not been delineated, New York State Department of Environmental Conservation (NYSDEC) freshwater wetland maps indicate that the existing utility lines do not intersect wetlands or wetland buffer zones. However, portions of the utility lines do intersect NYSDEC check zones, which are areas that should be evaluated for the presence of wetlands. If the current NYSDEC wetland maps are accurate, repair or replacement of utility lines would have no adverse effect on wetlands or buffer zones. However, prior to the initiation of construction, additional investigations should be conducted to determine the exact locations of wetland and buffer zone boundaries in relation to utility lines.

3.8.2.2.3 Aquatic Resources

New construction of approved PIADC upgrades would occur on previously disturbed grounds adjacent to the existing PIADC facility. The waters of Long Island Sound are approximately 300 feet northwest of the proposed construction area, and freshwater ponds occur approximately 1,500 feet to the southeast. Utility lines to be repaired or replaced are located on upland areas. New construction or utility line improvements would not have any direct adverse effect on aquatic resources. Earth disturbance would be minimal, and implementation of an erosion and sedimentation control plan would minimize the potential for indirect adverse effects associated with sediment transport.

3.8.2.2.4 Terrestrial Wildlife

New construction of approved PIADC upgrades would occur on previously disturbed grounds adjacent to the existing PIADC facility and, therefore, would have no direct adverse effect on native wildlife habitat. Construction noise and dust creation could potentially discourage wildlife utilization of habitats that are immediately adjacent to the proposed construction area; however, these effects would subside with completion of the project. Repair or replacement of existing underground utility lines would have minor, temporary adverse effects on previously disturbed wildlife habitat within existing utility easements. Disturbed soils in utility corridors would be rapidly recolonized by the same weedy species that currently occupy these areas. No significant long-term impacts would result from the No Action Alternative.

3.8.2.2.5 Threatened and Endangered Species

New construction of approved PIADC upgrades would occur on previously disturbed grounds adjacent to the existing PIADC facility and, therefore, would have no direct adverse effect on federally or state-listed species. Although piping plover and roseate tern breeding activity has been extremely rare on Plum Island, both species could potentially nest on the island. However, the western shoreline in the vicinity of the PIADC is actively eroding and does not contain suitable nesting habitat for either of these species. Therefore, noise and dust creation from new construction activities would be unlikely to discourage or adversely affect breeding activity. Sea turtles do not come ashore to nest in the northeastern United States. Since these species do not occur on the island, the No Action Alternative would have no adverse effect on sea turtles. The shortnose sturgeon only occurs in the lower Hudson River and would not be affected by the No Action Alternative. Sandplain gerardia and seabeach amaranth are not known to occur on Plum Island. These species occur in grassland natural communities and maritime beach communities. No potential habitat would be affected and, therefore, the No Action Alternative would have no adverse effect on these species. Repair or replacement of existing underground utility lines would have minor, temporary adverse effects on disturbed habitat within existing utility easements and, therefore, would not result in adverse effects on listed species.

3.8.2.3 Operation Consequences

3.8.2.3.1 Vegetation

The No Action Alternative would have no adverse effect on vegetation.

3.8.2.3.2 Wetlands

The No Action Alternative would have no adverse effect on wetlands.

3.8.2.3.3 Aquatic Resources

The No Action Alternative would have no adverse effect on aquatic resources.

3.8.2.3.4 Terrestrial Wildlife

The No Action Alternative would have no adverse effect on wildlife. The current risk of an accidental pathogen release and the associated potential effects on wildlife populations would not be affected by the No Action Alternative.

3.8.2.3.5 Threatened and Endangered Species

The No Action Alternative would have no adverse effect on threatened or endangered species.

3.8.3 South Milledge Avenue Site

3.8.3.1 Affected Environment

3.8.3.1.1 Vegetation

<u>Regional Vegetation</u>

The South Milledge Avenue Site is located in the Piedmont physiographic province (Kramer et. al. 2003). Dominant natural plant communities of the southern Piedmont can be broadly categorized as dry oak-hickory forests, mesic hardwood forests, and floodplain hardwood forests. Dry oak-hickory forests occur on ridgetops, upper portions of slopes, south-facing slopes, and other dry to dry-mesic upland areas. Dominant trees include post oak (*Quercus stellata*), southern red oak (*Q. falcata*), white oak (*Q. alba*), black oak (*Q. velutina*), blackjack oak (*Q. marilandica*), mockernut hickory (*Carya alba*), and pignut hickory (*C. glabra*). Disturbed dry oak-hickory forests have greater numbers of pines and weedy hardwoods such as red maple (*Acer rubrum*) and sweet-gum (*Liquidambar styraciflua*). Typical understory trees and shrubs include sourwood (*Oxydendrum arboreum*), flowering dogwood (*Cornus florida*), blackgum (*Nyssa sylvatica*), and blueberries (*Vaccinium* spp.). The herbaceous stratum is typically sparse in dry oak-hickory communities. Dry sites that were formerly cultivated are typically dominated by even-aged pine stands, and areas that have been heavily logged may have a mixture of hardwoods and pines (Schafale and Weakley 1990).

Mesic hardwood forests occur on lower slopes, steep north-facing slopes, and ravines. The overstory includes mesophytic species such as beech (*Fagus grandifolia*), yellow poplar (*Liriodendron tulipifera*), northern red oak (*Quercus rubra*), red maple, and southern sugar maple (*Acer floridanum*). Disturbed mesic communities typically have pines and greater numbers of weedy hardwoods such as yellow poplar and sweet-gum. Typical understory trees and shrubs include flowering dogwood, hop-hornbeam (*Ostrya virginiana*), red maple, American holly, American strawberry-bush (*Evonymus americana*), and blueberries. Generally, mesic hardwood communities have a herbaceous stratum that is moderately dense and diverse (Schafale and Weakley 1990).

The overstory of larger floodplain forests is dominated by flood-tolerant species such as sweet-gum, yellow poplar, red maple, cherrybark oak (*Quercus pagoda*), swamp chestnut oak (*Q. michauxii*), overcup oak (*Q. lyrata*), willow oak (*Q. phellos*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), swamp cottonwood (*Populus heterophylla*), bitternut hickory (*Carya cordiformis*), and shagbark hickory (*C. ovalis*). Understory trees and shrubs include red maple, southern sugar maple, ironwood (*Carpinus caroliniana*), winged elm (*Ulmus alata*), pawpaw (*Asimina triloba*), hollies (*Ilex* spp.), cane (*Arundinaria gigantea*), and American strawberry-bush. Swamp forests are dominated by the most flood tolerant trees and generally have sparse shrub and herbaceous strata. Bottomland forests are more diverse and usually have a well-developed herbaceous stratum. Alluvial forests of smaller rivers and streams lack the distinct fluvial landforms of larger floodplains. These smaller alluvial communities have a mixture of mesophytic and bottomland species and typically include species such as river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), and box-elder (*Acer negundo*) (Schafale and Weakley 1990).

<u>Site Vegetation</u>

Approximately 80% of the South Milledge Avenue Site consists of fenced pasture that is utilized as a grazing area for livestock. Groundcover within the pasture area is dominated by cultivated forage grasses. Natural forested communities occur on the extreme northwestern, western, and southwestern portions of the property. In addition, a narrow forested ravine extends from the western property boundary into the central portion of the property. Dry-mesic oak-hickory forest is the dominant community type at the proposed NBAF site. Typical overstory species include white oak, southern red oak, water oak, pignut hickory, mockernut hickory, yellow poplar, and sweet-gum. Understory trees and shrubs include beech, flowering dogwood, hop-hornbeam, winged elm, red maple, chalk maple (*Acer leucoderme*), painted buckeye (*Aesculus sylvatica*), and sparkleberry (*Vaccinium arboreum*). The outer edges of the forested areas have been colonized by non-native, invasive species such as Chinese privet (*Ligustrum sinense*), tree of heaven (*Ailanthus altissima*), and Japanese honeysuckle (*Lonicera japonica*). Forests in the ravine and the southwestern corner of the property are inside the pasture fence line, and livestock have compacted soils and eliminated the herbaceous stratum in these areas. Herbaceous species are very sparse to absent in the remaining forested areas, with groundcover consisting primarily of leaf litter.

A first-order tributary of the Middle Oconee River originates within the ravine, and a small (0.01-acre) alluvial hardwood forest community occurs on the narrow floodplain associated with this stream. Overstory trees include red maple, green ash, sweet-gum, water oak, and river birch. Understory trees and shrubs include ironwood, Chinese privet, and hardwood saplings. Scattered herbaceous species include lurid sedge (*Carex lurida*), false nettle, and smartweed (*Polygonum cepitosum*).

<u>Rare and Significant Natural Communities</u>

A review conducted by the Georgia Natural Heritage Program did not identify any rare or significant natural communities at the proposed NBAF site or within a 1-mile radius of the site (GNHP 2008). The Rock and Shoals Outcrop Natural Area is located approximately 2.5 miles east of the proposed NBAF site. Natural Areas are designated and managed by the GDNR for the conservation of rare species and natural communities. Granite outcrops contain thin layers of soil, small depression pools, and seepage areas that contain numerous rare, threatened, and endangered plant species. The Rock and Shoals outcrop contains occurrences of four state-listed plant species. Additional information regarding rare species at this site is provided in Section 3.8.3.1.5.

3.8.3.1.2 Wetlands

Jurisdictional wetlands and waters at the South Milledge Avenue Site were delineated by Nutter and Associates Incorporated (2007). The area of investigation was expanded to include areas immediately outside of the proposed NBAF site boundary. Jurisdictional wetlands and other waters within the actual boundaries of the proposed NBAF site include a single 0.01-acre wetland area and 1,136 linear feet of streams. The on-site wetland area occurs on the narrow floodplain of a small headwater stream near the western property boundary. Wetland hydrology is driven by a combination of overbank flooding and seepage at the base of the adjacent upland slope. Soils consist of sandy, silt, and clay loams with a low chroma matrix and high chroma mottles. Vegetation consists of an alluvial hardwood forest community (see Section 3.8.3.1.1). Additional jurisdictional wetlands occur just outside the eastern and southeastern property boundaries.

Other jurisdictional waters on the property include three small perennial headwater stream segments, all of which originate within the boundaries of the site. The primary tributary originates in the central portion of the proposed NBAF site and flows west for approximately 575 feet before exiting the property. The primary tributary eventually discharges into the Middle Oconee River approximately 1,700 feet southwest of the proposed NBAF site. An additional tributary originates in the northwestern portion of the property and flows southwest along the property boundary, eventually discharging into the primary tributary just outside the western property boundary. The third segment is a short spur that connects to the northwestern tributary near the western-central property boundary. All of the streams that occur within the site boundaries are small headwater streams with average widths ranging from 2 to 6 feet. Additional jurisdictional waters occur just outside the eastern and southeastern property boundaries. These additional areas are described in the jurisdictional determination report (Nutter and Associates, Inc. 2007).

Current and historical land use practices at the South Milledge Avenue Site have resulted in degradation of streams and wetlands within the investigation area. Although forested buffers currently exist along the streams, deforestation and soil compaction within the pasture areas has accelerated storm water runoff. As a result, streams at the site exhibit deep-channel incision (downward erosion of the stream channel) and large headcuts (backward erosional migration of the incised channel). Once incised, overbank flooding events are reduced, and groundwater levels adjacent to the stream channel are lowered. Both of these effects can have negative impacts on adjacent wetlands by reducing the input and retention of water.

3.8.3.1.3 Aquatic Resources

The South Milledge Avenue Site is located within the Upper Oconee watershed [Hydrologic Unit Code (HUC) 03070101], which comprises part of the Oconee River basin. The Middle Oconee River joins with the North Oconee River approximately 1.75 miles southeast of the site to form the Oconee River. The Oconee River basin is dominated by a warm-water fishery. Species of recreational importance include largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), crappie (*Pomoxis* spp.), chain pickerel (*Esox niger*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), and several species of sunfish (*Lepomis* spp.). The diverse fish fauna of the Oconee River basin includes 74 species representing 13 families. Species belonging to the minnow family (*Cyprinidae*) comprise the most diverse group of fishes in the Oconee River basin. Additional families that are represented by large numbers of species include the sunfish family (*Centrarchidae*), catfish family (*Ictaluridae*), and sucker family (*Catostomidae*). Fauna recorded from the Oconee River include 37 amphibians (17 salamanders and 20 frogs), 11 semi-aquatic turtle species, and 7 snake species that are strongly associated with aquatic habitats (Environmental Protection Division 1998). The GDNR has designated the North Oconee River as a high-priority stream for the conservation of aquatic biodiversity (GDNR 2005). The Middle Oconee River contains occurrences of the state-threatened Altamaha shiner (*Cyprinella xaenura*), and the Oconee River between Milledgeville and Dublin supports the healthiest known population of the state endangered robust redhorse sucker (*Moxostoma robustum*). GDNR has documented the occurrence of 65 fish species in the Piedmont portion of the Oconee River basin (GDNR 2005). Merrill (2001) conducted sampling of five wadeable streams in the Middle Oconee River watershed, which resulted in the collection of 22 fish species (Table 3.8.3.1.3-1). Mussels identified by Wharton (1978) as occurring in the Oconee River basin are listed in Table 3.8.3.1.3-2.

Table 3.8.3.1.3-1 — Fish Species Collected by Merrill (2001) at Five Sampling Stations in the Middle Oconee Watershed

Scientific Name	Common Name
Ameiurus brunneus	Snail bullhead
Ameiurus platycephalus	Flat bullhead
Campostoma pauciradii	Bluefin stoneroller
Cyprinella callisema	Ocmulgee shiner
Cyprinella xaenura	Altamaha shiner
Esox niger	Chain pickerel
Etheostoma inscriptum	Turquoise darter
Hybopsis rubrifrons	Rosyface chub
Hypentelium nigricans	Northern hogsucker
Lepomis auritus	Redbreast sunfish
Lepomis cyanellus	Green sunfish
Lepomis macrochirus	Bluegill
Micropterus salmoides	Largemouth bass
Moxostoma collapsum	V-lip redhorse
Nocomis leptocephalus	Bluehead chub
Notropis cummingsae	Dusky shiner
Notropis hudsonius	Spottail shiner
Notropis lutipinnis	Yellowfin shiner
Noturus insignis	Margined madtom
Percina nigrofasciata	Blackbanded darter
Scartomyzon rupiscartes	Striped jumprock
Semotilus atromaculatus	Creek chub

All of the streams that occur within the site boundaries are small headwater streams with average widths ranging from 2 to 6 feet. These streams have moderate sinuosity and coarse sand, gravel, and cobble substrate. Accelerated runoff from the adjacent pasture areas has resulted in channel incision (downward erosion of the stream channel) and headcuts (backward erosional migration of the incised channel). Although impacted by erosion and sedimentation, these streams have retained riffle and pool habitats that are likely to support occurrences of many common aquatic species that are typically associated with small headwater streams of the Georgia Piedmont.

Table 3.8.3.1.3-2 — Mussels of the Oconee River (Wharton 1978)

Scientific Name	Common Name
Villosa delumbis	Eastern creekshell
Elliptio complanata	Eastern elliptio
Elliptio hopetonensis	Altamaha slabshell
Elliptio lanceolata	Yellow lance
Elliptio icterina	Variable spike
Lampsilis splendida	Rayed pink fatmucket
Uniomerus tetralasmus	Pondhorn

3.8.3.1.4 Terrestrial Wildlife

The Georgia GAP has developed models that predict the statewide distribution of terrestrial vertebrate species that are known to breed in Georgia (Kramer et. al. 2003). Flaute et al. (2005) used Georgia GAP data to predict species occurrences in the Clarke County area. The resulting Clarke County list of potential breeding species includes 44 mammals, 110 birds, 41 reptiles, and 27 amphibians. Non-breeding species that occur in

Georgia consist primarily of over-wintering or transient migratory bird species. The list of all birds reported from Georgia includes over 400 species (Georgia Ornithological Society 2007).

Audobon has officially recognized the State Botanical Garden and Whitehall Forest as an IBA. The IBA program identifies areas that are essential for bird conservation. The State Botanical Garden and Whitehall Forest are important to many species of high conservation priority in Georgia. Significant numbers of land birds, particularly woodpeckers and neotropical migrants such as warblers, vireos, and thrushes, use this area for breeding, winter habitat, and spring and fall migration (Audubon 2008). The proposed NBAF site is located between the State Botanical Garden and Whitehall Forest. The State Botanical Garden adjoins the northwestern boundary of the proposed NBAF site, and Whitehall Forest is located west of the proposed NBAF site on the opposite side of Whitehall Road. The State Botanical Garden and Whitehall Forest are connected by a forested riparian corridor along the Middle Oconee River. This connecting corridor, which is located on the proposed NBAF site, provides an important link between the two IBA properties.

As described in Section 3.8.3.1.1, habitats at the South Milledge Avenue Site include pasture, dry-mesic hardwood forest, alluvial hardwood forest, and small headwater streams. Relatively dense forest edge habitats also contribute to habitat diversity at the site. Approximately 80% of the South Milledge Avenue Site is composed of highly disturbed pastures that do not contain native natural plant communities. Pasture areas are dominated by cultivated forage grasses, which are actively grazed by livestock. Due to their disturbed condition, lack of native vegetation, and lack of wildlife food and cover, the pasture areas have limited wildlife habitat value. Consequently, wildlife utilization of the pasture areas is most likely limited to a relatively low number of generalist species that have adapted to highly disturbed environments. However, remaining portions of the site contain valuable wildlife habitat consisting of dry-mesic forested uplands, forest edge habitats, a small area of alluvial forest, and small streams. These natural habitats represent potential habitat for many of the common species that are predicted to occur in the Clarke County area. Hard mast–producing trees (e.g., oaks/hickories) and soft mast-producing shrubs (e.g., sparkleberry) in the forested areas provide a valuable food source for wildlife. In addition, forested areas along the Middle Oconee River represent an important dispersal corridor and refuge for wildlife within the more developed portions of Clarke County.

Many of the species not covered by the Georgia GAP consist of migratory waterfowl. Athens is located within the Atlantic flyway migratory bird route, and area reservoirs serve as important resting areas for migrating waterfowl. Farm ponds may occasionally be used as resting habitat by migratory waterfowl. Most reservoirs and farm ponds are too deep for the amount of food production that is required to hold waterfowl over the winter. During the fall and winter, beaver ponds are used extensively by migrating and wintering wood ducks (*Aix sponsa*), mallards (*Anas platyrhynchos*), and teal (*Anas* spp.), and these wetlands provide valuable nesting sites for resident wood ducks during the breeding season (Balkcom et al.). A small farm pond and a complex of three small beaver ponds are located just outside of the South Milledge Avenue Site boundary. Migratory waterfowl may occasionally use these areas as resting habitat, and resident wood ducks could potentially use these areas during the breeding season. There are no managed waterfowl impoundments or extensive shallow water wetlands that would hold large numbers of waterfowl in the vicinity of the proposed NBAF site.

The distribution of ungulate populations has particular relevance, since they are susceptible to many of the diseases that may be studied at the proposed NBAF. Ungulates that occur in Georgia include white-tailed deer (*Odocoileus virginianus*) and wild boar (*Sus scrofa*). The white-tailed deer is a common species throughout Georgia, and this species is likely to occur in forested habitats at the South Milledge Avenue Site. The wild boar is widely distributed in the northern mountain and southern Coastal Plain regions of Georgia; however, the Georgia GAP predicted distribution does not include Clarke County (Kramer et. al. 2003). The predicted Georgia GAP distribution does include northwestern Jackson County approximately 25 miles northwest of the South Milledge Avenue Site. The wild boar is a non-native invasive species with the potential to negatively impact natural communities and native species. Consequently, Georgia conservation priorities include controlling wild boar populations to conserve high-priority habitats and species (GDNR 2005).

3.8.3.1.5 Threatened and Endangered Species

Federally listed status species that are known to occur in Clarke County include the federally endangered gray bat (*Myotis grisescens*) and the federal candidate Georgia aster (*Symphyotrichum georgianum*). Additional animal and plant species that are listed by the state as endangered, threatened, rare, or unusual are protected under the *Endangered Wildlife Act* of 1973 (O.C.G.A. §27-3-130) and the *Wildflower Preservation Act* of 1973 (O.C.G.A. § 12-6-170). In addition to the federally listed species mentioned above, Georgia Natural Heritage Program (GNHP) occurrence records for Clarke County include five species that are listed by the state as endangered, threatened, or rare (Table 3.8.3.1.5-1). Additional GNHP records for Clarke County include three special concern species that are not listed or protected by the state (Table 3.8.3.1.5-1).

GNHP is responsible for tracking occurrences of both federally and state-listed species within the State of Georgia. A database review conducted by GNHP did not identify any occurrences of rare, threatened, or endangered species at the proposed NBAF site or within a 1-mile radius of the site (GNHP 2008). However, occurrences of seven protected species were identified within a 3-mile radius of the proposed NBAF site (Table 3.8.3.1.5-2). These occurrences include four state-listed plants that are endemic to granite outcrops. These outcrop endemics occur at the Rock and Shoals Outcrop Natural Area approximately 2.5 miles east of the proposed NBAF site. Clarke County records include three occurrences of the state-listed Altamaha shiner (*Cyprinella xaenura*) within a 3-mile radius of the proposed NBAF site. Specific Altamaha shiner sites include the Oconee River 1 mile northeast of the proposed NBAF site, the Oconee River 2 miles southeast of the proposed NBAF site, and the Middle Oconee River 1 mile northwest of the proposed NBAF site. Additional occurrences of protected species within a 3-mile radius include the federal candidate Georgia aster at a location approximately 3 miles northeast of the site and the state-listed broadleaf bunchflower (*Melanthium latifolium*) from an unknown location in the vicinity of the proposed NBAF.

Table 3.8.3.1.5-1 — Athens-Clarke County Endangered, Threatened, and Rare Species

Scientific Name	Common Name	Federal[a] Status	State[b] Status	Habitat	Habitat Present at NBAF Site
Vertebrates					
Myotis grisescens	Gray bat	E	E	Caves with flowing water	No
Myotis austroriparius	Southeastern myotis	-	-	Caves and buildings near water	No
Cyprinella xaenura	Altamaha shiner	-	T	Medium-sized streams in runs or pools over sand to gravel substrate	No
Plants					
Anemone berlandieri	Glade windflower	-	-	Granite outcrop ecotones; openings over basic rock	No
Draba aprica	Sun-loving draba	-	E	Granite and amphibolite outcrops, usually in red cedar litter	No
Eriocaulon koernickianum	Dwarf hatpins	-	E	Granite outcrops	No
Melanthium latifolium	Broadleaf bunchflower	-	-	Mesic deciduous hardwood forests	Yes
Nestronia umbellula	Indian olive	-	R	Mixed with dwarf shrubby heaths in oak-hickory-pine woods; often in transition areas between flatwoods and uplands	Yes
Sedum pusillum	Granite stonecrop	-	T	Granite outcrops, often in mats of Hedwigia moss under *Juniperus virginiana*	No
Symphyotrichum georgianum	Georgia aster	C	T	Upland oak-hickory-pine forests and openings; sometimes with *Echinacea laevigata* or over amphibolite	Marginal

[a]Federal Status: E = Endangered, C = Candidate, FSC = Federal Species of Concern.
[b]State Status: E = Endangered, T = Threatened, R = Rare.

As described in Section 3.8.3.1.1, approximately 80% of the South Milledge Avenue Site is composed of highly disturbed, actively grazed pasture. Natural forested communities occupy the extreme northwestern, western, and southwestern portions of the property. Forested habitats are composed primarily of dry-mesic to mesic hardwood forests, with the addition of a small (0.01-acre) area of alluvial hardwood forest. Aquatic habitats include two perennial first-order streams within the forested areas.

<u>Federally Listed Species</u>

Gray Bat

Gray bats are strongly cave dependant and use caves or cave-like habitats for both winter hibernation and summer roosting. Winter roosting sites in Georgia include caves in the northwestern corner of the state and an isolated location in a tunnel beneath Sanford Stadium on the UGA campus. Summer roosting sites are typically caves. Summer roosting sites in Georgia include two caves in the northwestern corner of the state (Menzel et al. 2000). The Georgia GAP predicted breeding distribution is limited to the extreme northwestern corner of the state and does not include Clarke County (Kramer et al. 2003). The roosting site beneath Sanford Stadium is approximately 3.5 miles north of the proposed NBAF site. No suitable roosting sites are present at the South Milledge Avenue Site; however, gray bats could potentially forage over the Middle Oconee River to the south of the South Milledge Avenue Site.

Georgia Aster

Georgia aster is known to occur in habitats that include dry, rocky woodlands; woodland borders; roadbanks; powerline right-of-ways; and thin soils around granite flatrocks. It is found primarily in dry habitats that formerly would have burned and likely would have been post oak, blackjack oak woodlands, or savannas (Weakley 2007). Although the South Milledge Avenue Site contains extensive woodland borders, the woodlands that occur at the site are composed of dry-mesic to mesic hardwood communities. The forested areas do not contain any relict post oaks, blackjack oaks, or other species that are indicative of more xeric hardwood communities. In addition, this species was not observed during a floristic survey of the proposed project area.

State-Listed Species

Habitat for the Altamaha shiner consists of medium-sized streams in runs or pools over sand to gravel substrate (GNHP 2008). Streams that occur within the boundaries of the South Milledge Avenue Site are small headwater streams that have average widths ranging from 2 to 6 feet. These streams have moderate sinuosity and coarse sand, gravel, and cobble substrate. Accelerated runoff from the adjacent pasture areas has resulted in channel incision and the formation of headcuts. Based on the small size of these streams and the history of disturbance, the Altamaha shiner is not likely to occur within the project area. However, project area streams drain to the Middle Oconee River, which does contain suitable habitat for this species.

Suitable habitat for two state-listed plant species, broadleaf bunchflower and nestronia (*Nestronia umbellula*), may occur on forested slopes at the South Milledge Avenue Site. However, these species were not observed during a floristic survey of the project area. The South Milledge Avenue Site does not contain suitable habitat for any of the other state-listed species that are known to occur in Clarke County (Table 3.8.3.1.5-1).

3.8.3.2 Construction Consequences

3.8.3.2.1 Vegetation

Construction of the proposed NBAF would affect approximately 30 acres of land at the South Milledge Avenue Site. Under the current conceptual design plan, earth-disturbing activities would be restricted almost entirely to the pasture areas. The only exception would be construction of a fence and security road that would transect the upper portion of the forested ravine. The perimeter road and fence would affect approximately 0.2 acre of dry-mesic oak hickory forest and approximately 50 linear feet of stream. The ravine is inside the existing fence line, and the oak-hickory forest has been heavily impacted by grazing livestock. Livestock have compacted the soils and eliminated the understory strata. Based on the small area of impact and the degraded condition of the community, adverse affects on vegetation would not be significant. Off-site connected actions involving the installation of new potable water, sewer, and electrical lines would occur within existing, disturbed right-of-ways and, therefore, would not have any significant impacts on vegetation.

Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, natural communities that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on vegetation.

3.8.3.2.2 Wetlands

Earth-disturbing activities would be restricted almost entirely to upland pasture areas and therefore would have no direct impact on streams or wetlands. The only exception would be construction of a perimeter security fence and road that would cross a stream in the upper portion of the forested ravine. Under the current conceptual design plan, the road and fence would affect approximately 50 linear feet of stream, as well as the buffer zone on either side of the stream. If the final design does not incorporate additional avoidance measures, the project could require a Section 404 permit from the USACE, a Section 401 Certification from the state, and a buffer variance from Clarke County.

Potential indirect impacts during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, wetlands and streams that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. The requirement for an approved erosion and sedimentation control plan would minimize the potential for sedimentation impacts.

3.8.3.2.3 Aquatic Resources

Construction of the proposed NBAF would affect approximately 30 acres of land at the South Milledge Avenue Site. Earth-disturbing activities for the main facility would be restricted to the pasture areas and, therefore, construction would have no direct impact on streams, aquatic habitats, or existing vegetated buffers at the site. The perimeter road and fence would have minor adverse effects on aquatic resources. Aquatic organisms would be displaced from approximately 50 linear feet of stream. However, a properly designed road crossing should have little or no effect on downstream aquatic resources.

Potential indirect effects would include erosion and sedimentation during the construction process. Removal of vegetation and soil disturbance within the proposed construction area would expose soils to potential erosion during storm events. Sediments that are transported into stream channels can degrade water quality by increasing turbidity. The deposition of sediments in stream channels can impact aquatic communities through the homogenization of habitat. The requirement for an approved erosion and sedimentation control plan would minimize the potential for sedimentation impacts.

3.8.3.2.4 Terrestrial Wildlife

Construction of the proposed NBAF would permanently impact approximately 30 acres of actively grazed pasture that is dominated by cultivated forage grasses. Due to their disturbed condition, lack of native vegetation, and lack of wildlife food and cover, the pasture areas have limited wildlife habitat value. The loss of pasture habitat would affect a relatively low number of generalist species that are adapted to a wide range of habitats. The perimeter road and fence would affect approximately 0.2 acre of dry-mesic oak hickory forest and approximately 50 linear feet of stream. The affected area is inside the existing fence line, and the forest has been heavily impacted by grazing livestock. The forested area has reduced wildlife value due to compacted soils and the absence of understory strata. Based on the small area of impact and the degraded condition of the community, adverse affects on vegetation would not be significant. Land-clearing activities, construction noise, and dust creation would likely discourage wildlife utilization of habitats that are adjacent to the proposed construction area; however, these impacts would subside with completion of the project. Construction of the proposed NBAF would not result in significant direct impacts on native terrestrial wildlife.

Construction would have no direct effect on the State Botanical Garden/Whitehall Forest IBA. The forested riparian corridor that connects Whitehall Forest with the State Botanical Garden would be preserved and, therefore, construction would not result in habitat fragmentation or disruption of wildlife dispersal. Construction of a fence and security road would have minor impacts on forested habitats that are immediately adjacent to pasture areas. Since the forested portion of the proposed NBAF site will be minimally affected, no significant impacts on the State Botanical Garden/Whitehall Forest IBA are likely to occur.

3.8.3.2.5 Threatened and Endangered Species

Informal Section 7 consultation has been initiated with the USFWS Georgia Field Office. A database review conducted by GNHP did not identify any known occurrences of rare, threatened, or endangered species at the proposed NBAF site or within a 1-mile radius of the site. Earth-disturbing activities would be restricted primarily to the existing pasture areas. The perimeter road and fence would affect approximately 0.2 acre of degraded dry-mesic oak hickory forest and approximately 50 linear feet of stream. The affected forested area does not represent suitable habitat for any rare, threatened or endangered species. Therefore, construction would have no direct impact on protected species or potential habitat.

Soil disturbance during the construction process would expose soils to potential erosion. Erosion and subsequent sedimentation in stream channels have the potential for adverse impacts on aquatic organisms. Although the state-threatened Altamaha shiner is not likely to occur in the small streams of the project area, it is known to occur in the Middle Oconee River. Therefore, any increase in sediment transport could have an adverse effect on this species. However, erosion and sedimentation control measures would minimize the potential for such impacts.

3.8.3.3 Operation Consequences

3.8.3.3.1 Vegetation

Operation of the proposed NBAF would have no direct effects on native vegetation or natural communities. Indirect effects on riparian vegetation can result from increases in storm water runoff. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in stream flow volume and velocity can cause stream channel incision and/or widening, resulting in the loss of adjacent terrestrial vegetation and alteration of the hydrological regime within adjacent plant communities. Storm water management systems would be designed in accordance with applicable storm water BMPs. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.3.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on stream channels and adjacent terrestrial vegetation.

3.8.3.3.2 Wetlands

Operations at the proposed NBAF would have no direct impacts on wetlands; however, increases in impervious surface area and storm water runoff have the potential for indirect wetland impacts. Potential impacts from storm water runoff would be similar to those described in Section 3.8.3.3.1.

3.8.3.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct effects on aquatic communities; however, increases in impervious surface area and storm water runoff have the potential for indirect impacts on water quality and aquatic communities. Storm water runoff from impervious surfaces such as buildings and parking lots can transport pollutants such as automotive fluids, fertilizer, pesticides, bacteria, and heavy metals into surface waters. Furthermore, rapid runoff from impervious surface areas increases the rate of flow in receiving streams. Increases in stream flow volume and velocity can cause stream channel erosion, resulting in increased turbidity and sedimentation downstream. However, the storm water management measures described in Section 3.8.3.3.1 would mitigate most of the potential adverse effects on aquatic resources.

3.8.3.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on wildlife. In the event of a power outage, the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on wildlife.

Operations at the proposed NBAF site would have no direct effect on the State Botanical Garden/Whitehall Forest IBA. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on the IBA.

3.8.3.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species; however, the accidental or intentional release of a pathogen would have the potential for adverse effects on mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on native wildlife and endangered species. The gray bat is the only listed mammal that occurs in Clarke County. There is no evidence that bats would be susceptible to the diseases that could be studied at the proposed NBAF (see Section 3.8.9). Therefore, operations would not be likely to have adverse effects on listed species that occur in the vicinity of the proposed NBAF site.

3.8.4 Manhattan Campus Site

3.8.4.1 Affected Environment

3.8.4.1.1 Vegetation

<u>Regional Vegetation</u>

The Manhattan Campus Site is located in the Flint Hills Uplands physiographic region (Cully et al. 2002). Natural vegetation of the Flint Hills region is dominated by communities and species associated with the tallgrass prairie ecosystem. Tallgrass prairie once occupied an estimated 400,000 square miles and covered much of the midwestern United States; however, it is now nearly extinct with less than 4% of the ecosystem remaining nationwide. Historically, the structure and composition of natural tallgrass prairie communities were maintained by a combination of grazing, fire, and climate. Land use conversion to row crop agriculture has eliminated most of the tallgrass prairie ecosystem; however, the predominance of shallow, rocky soils in the Flint Hills region has discouraged row crop agriculture, thereby preserving significant remnants of the ecosystem in this region (NPS 2000).

The Konza Prairie Preserve, which is located approximately 6 miles south of the proposed NBAF site, contains natural communities that are representative of the Flint Hills region. Tallgrass prairies at the Konza Prairie Preserve are dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*), along with a diverse mixture of other graminoids and forbs. Shrubs that are locally common within the tallgrass prairie include lead plant (*Amorpha canescens*), rough-leaved dogwood (*Cornus drummondii*), smooth sumac (*Rhus glabra*), fragrant sumac (*Rhus aromatica*), and prairie wild rose (*Rosa arkansana*). Deciduous forest communities occur in bands along the margins of streams and rivers. Dominant tree species include bur oak (*Quercus macrocarpa*), chinquapin oak (*Q. muehlenbergii*), hackberry (*Celtis occidentalis*), and American elm (*Ulmus americana*). Although poorly represented, wetland communities are associated with intermittent and perennial streams, springs, and seepage areas on slopes. These wetland communities are dominated by a diverse mixture of hydrophytic herbaceous species (Freeman 1998).

Site Vegetation

The Manhattan Campus Site is located in a highly disturbed area that does not contain native natural communities. Most of site is covered by buildings, livestock pens, and livestock holding areas. The site is currently used by the Kansas State University (KSU) College of Veterinary Medicine and Department of Animal Science for provisional cattle grazing, animal care, and research. Vegetation at the site consists primarily of cultivated forage grasses and early successional weeds. This herbaceous assemblage is dominated by smooth brome (*Bromus inermis*), a non-native forage grass that has been planted around the facilities. Interspersed within the smooth brome are numerous non-native annual species that are characteristic of highly disturbed sites [e.g., bristle grass (*Setaria viridis*), hairy crab grass (*Digitaria sanguinalis*), and rough pigweed (*Amaranthus retroflexus*)]. Other early-successional annual herbaceous species that are abundant at the site include horseweed (*Conyza canadensis*), annual ragweed (*Ambrosia artemisiifolia*), snow-on-the-mountain (*Euphorbia marginata*), and buffalo-bur nightshade (*Solanum rostratum*). In lowlying areas, several non-native Siberian elm (*Ulmus pumila*) trees are established, with the shaded areas dominated by Kentucky bluegrass (*Poa pratensis*), poison-hemlock (*Conium maculatum*), and Japanese brome (*Bromus japonicus*). Numerous other non-native species are also prevalent [e.g., dandelion (*Taraxacum officinale*), musk-thistle (*Carduus nutans*), and curly dock (*Rumex crispus*)]. The portion of the property to the east of Serum Plant Road is occupied by native and non-native woody species such as Siberian elm, eastern red-cedar (*Juniperus virginiana*), honey locust (*Gleditsia triocanthos*), cottonwood (*Populus deltoides*), and amur honeysuckle (*Lonicera maackii*). The understory vegetation is composed predominantly of annual and biennial species such as bristle grass, annual ragweed, annual sunflower (*Helianthus annuus*), and woolly mullein (*Verbascum thapsus*).

Rare and Significant Natural Communities

A review conducted by the Kansas Natural Heritage Inventory did not identify any sensitive or rare natural communities at the Manhattan Campus Site or within a 1-mile radius of the site. As described above, the Manhattan Campus Site is located in a heavily disturbed area that lacks native natural communities.

3.8.4.1.2 Wetlands

An on-site wetland evaluation of the Manhattan Campus Site was conducted by Dial Cordy and Associates, Inc., on November 6, 2007. No jurisdictional surface water bodies, streams, or wetlands were observed on or immediately adjacent to the proposed NBAF site. In addition, a botanical survey conducted by KSU grassland biologist Dr. Gene Towne on November 27, 2007 found no hydrophytic vegetation or other evidence of wetlands or intermittently wet areas at the site. The nearest jurisdictional feature is Campus Creek, which originates approximately 1,500 feet south of the proposed NBAF site. NWI maps do not show any wetlands along the KSU portion of Campus Creek.

3.8.4.1.3 Aquatic Resources

The Manhattan Campus Site is located within the Upper Kansas watershed (Hydrologic Unit Code 10270101), which comprises part of the Kansas-Lower Republican River basin. Sampling conducted by the Kansas Department of Wildlife and Parks (KDWP) from 1994 to 2004 identified 50 fish species (Table 3.8.4.1.3-1) and 16 mussel species (Table 3.8.4.1.3-2) within the Upper Kansas watershed (KDWP 2006). The KDWP uses an Index of Biological Integrity (IBI) to rate the stability of fish communities as either "good," "fair," or "poor." IBI values for the 20 Upper Kansas watershed sampling stations indicate "good" fish community stability at 18 of the sites and "fair" stability at the remaining 2 sites. The KDWP also uses a Macroinvertebrate Biotic Index (MBI) as an indicator of water quality. The overall MBI value for the Upper Kansas watershed indicates that it is highly impacted by nutrient and oxygen demanding pollutants (KDWP 2006).

Table 3.8.4.1.3-1 — Fish Species Collected in the Upper Kansas Watershed (KDWP 2006)

Scientific Name	Common Name	Scientific Name	Common Name
Ameiurus melas	Black bullhead	*Lythrurus umbratilis*	Redfin shiner
Ameiurus natalis	Yellow bullhead	*Micropterus punctulatus*	Spotted bass
Aplodinotus grunniens	Freshwater drum	*Micropterus salmoides*	Largemouth bass
Campostoma anomalum	Central stoneroller	*Morone chrysops*	White bass
Carpiodes carpio	River carpsucker	*Moxostoma erythrurum*	Golden redhorse
Carpiodes cyprinus	Quillback	*Moxostoma macrolepidotum*	Shorthead redhorse
Catostomus commersonii	White sucker	*Notropis atherinoides*	Emerald shiner
Cycleptus elongatus	Blue sucker	*Notropis percobromus*	Carmine shiner
Cyprinella lutrensis	Red shiner	*Notropis rubellus*	Rosyface shiner
Cyprinus carpio	Common carp	*Notropis stramineus*	Sand shiner
Dorosoma cepedianum	Gizzard shad	*Notropis topeka*	Topeka shiner
Etheostoma nigrum	Johnny darter	*Noturus exilis*	Slender madtom
Etheostoma spectabile	Orangethroat darter	*Noturus flavus*	Stonecat
Extrarius aestivalis	Speckled chub	*Percina caprodes*	Logperch
Gambusia affinis	Western mosquitofish	*Percina phoxocephala*	Slenderhead darter
Ictalurus furcatus	Blue catfish	*Phenacobius mirabilis*	Suckermouth minnow
Ictalurus punctatus	Channel catfish	*Phoxinus erythrogaster*	Southern redbelly dace
Ictiobus bubalus	Smallmouth buffalo	*Pimephales notatus*	Bluntnose minnow
Ictiobus niger	Black buffalo	*Pimephales promela*	Fathead minnow
Lepisosteus osseus	Longnose gar	*Pimephales vigilax*	Bullhead minnow
Lepisosteus platostomus	Shortnose gar	*Pomoxis annularis*	White crappie
Lepomis cyanellus	Green sunfish	*Pylodictus olivaris*	Flathead catfish
Lepomis macrochirus	Bluegill	*Scaphirhynchus platorynchus*	Shovelnose sturgeon
Lepomis megalotis	Longear sunfish	*Semotilus atromaculatus*	Creek chub
Luxilus cornutus	Common shiner		

No water bodies or aquatic habitats are present within the boundaries of the Manhattan Campus Site. Surface water runoff from the site travels south towards Campus Creek, which originates approximately 1,500 feet to the south. Campus Creek flows southeast through the KSU campus for approximately 4,500 feet, before turning east towards the Big Blue River. Campus Creek discharges into the Big Blue River approximately 2.5 miles east of the proposed NBAF site. The Big Blue River flows south and discharges into the Kansas River approximately 3 miles southeast of the proposed NBAF site.

Table 3.8.4.1.3-2 — Mussel Species Collected in the Upper Kansas Watershed (KDWP 2006)

Scientific Name	Common Name
Amblema plicata	Threeridge
Corbicula fluminea	Asian clam
Fusconaia flava	Wabash pigtoe
Lasmigona complanata	White heelsplitter
Leptodea fragilis	Fragile papershell
Ligumia subrostrata	Pondmussel
Obovaria olivaria	Hickorynut
Potamilus ohiensis	Pink papershell
Pyganodon grandis	Giant floater
Quadrula pustulosa	Pimpleback
Quadrula quadrula	Mapleleaf
Sphaeriidae	Fingernail clam
Strophitus undulatus	Creeper
Toxolasma parvus	Lilliput
Tritogonia verrucosa	Pistolgrip
Uniomerus tetralasmus	Pondhorn

3.8.4.1.4 Terrestrial Wildlife

The Kansas GAP has developed models that predict the statewide distribution of terrestrial vertebrate species that are known to breed in Kansas. The Kansas GAP list of breeding species for the Flint Hills Uplands physiographic province includes 59 mammals, 162 birds, 63 reptiles, and 19 amphibians (Cully et al. 2002). Non-breeding species that occur in Kansas consist primarily of migratory birds that occur only during the non-breeding season. The list of all birds reported from Kansas includes 467 species (Kansas Ornithological Society 2007).

Major wildlife preservation and management areas in the vicinity of the proposed NBAF site include the Tuttle Creek Wildlife Management Area (approximately 5 miles north of the proposed NBAF site) and the Konza Prairie Preserve (approximately 6 miles to the south of the proposed NBAF site). Wildlife habitats at the Konza Prairie Preserve are representative of natural tallgrass prairie habitats that occur in the Flint Hills region. The fauna of the Konza prairie includes 36 species of mammals, 208 species of birds, and 34 species of reptiles and amphibians. Manhattan is located within the Central Flyway migratory bird route, and large flocks of waterfowl and shorebirds utilize the Tuttle Creek Lake Wildlife Management Area during migration periods.

As described in Section 3.8.4.1.1, the proposed Manhattan Campus Site is located in a highly disturbed area that lacks native natural plant communities. Vegetated portions of the property are dominated by smooth brome, a non-native species that has been planted as a forage grass. The area is used for cattle grazing; and no native plant communities, wetlands, or aquatic habitats occur on the property. Generally, domestic perennial forage grasses that are used in Kansas are of low value to wildlife (KDWP 2004). Due to its disturbed condition, lack of native vegetation and lack of wildlife food and cover, the Manhattan Campus Site has very limited wildlife habitat value. Consequently, wildlife utilization is most likely limited to a relatively low number of generalist species that have adapted to highly disturbed environments. Mammals that may occur at the proposed NBAF site include Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), northern raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), red fox (*Vulpes vulpes*), house mouse (*Mus musculus*), deer mouse (*Peromyscus maniculatus*), Norway rat (*Rattus norvegicus*), eastern mole (*Scalopus aquaticus*), northern short-tailed shrew (*Blarina brevicauda*), and meadow vole (*Microtus pennsylvanicus*). Birds that may occur at the proposed NBAF site include killdeer (*Charadrius vociferous*), rock pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), northern flicker (*Colaptes* *auratus*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), black-capped chickadee (*Poecile atricapillus*), tufted titmouse (*Baeolophus bicolor*), American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottus*), European starling (*Sturnus vulgaris*), northern cardinal (*Cardinalis cardinalis*), common grackle (*Quiscalus quiscula*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*). Reptiles and amphibians that may occur at the proposed NBAF site include the common garter snake (*Thamnophis sirtalis*), lined snake (*Tropidoclonion lineatum*), black rat snake (*Elaphe obsoleta*), woodhouse's toad (*Bufo woodhousii*), and American toad (*Bufo americanus*).

The distribution of ungulate populations has particular relevance, since they are susceptible to many of the diseases that may be studied at the proposed NBAF. Ungulates that occur in Kansas include white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), bison (*Bison bison*), elk (*Cervus elaphus*), and wild boar (*Sus scrofa*). The Kansas GAP predicted distribution of white-tailed deer includes nearly all of Kansas, and its recorded distribution includes Riley County. The Kansas GAP predicted distribution for mule deer includes the western half of the state and a small outlying area centered on Riley County, and its recorded distribution includes Riley County. The Kansas GAP predicted distribution of pronghorn includes the western third of Kansas and a multi-county area in the vicinity of the Tallgrass Prairie National Preserve approximately 50 miles south of Manhattan. The recorded distribution of pronghorn includes Chase and Lyon counties approximately 50 miles south of Manhattan. The Kansas GAP program does not predict the distributions of bison or elk, as these species are considered to be extirpated and reintroduced, respectively (Cully et al. 2002). Captive herds of bison occur 6 miles south of Manhattan at the Konza Prairie Preserve and at additional scattered locations throughout Kansas. In 1981, a free-ranging herd of elk was reestablished on the Cimarron National Grassland in the extreme southwestern corner of the state; however, most animals migrated to adjacent states, and only a few elk currently remain (Fort Riley Undated). Fort Riley currently has a reintroduced, free-ranging elk herd that currently numbers 100 to 150 animals. An isolated population of wild boar was discovered on Fort Riley in 1993. However, it appears that vigorous control efforts have substantially reduced the size of this population (Fort Riley 2001). An additional isolated population of wild boar has been reported from south-central Kansas (Sweeny et al. 2003). The wild boar is a non-native invasive species with the potential to negatively impact natural communities and native species. Kansas Wildlife Action Plan conservation strategies include assessing the threat posed by feral hogs and developing a management plan for control and possible elimination (Wasson et al. 2005).

3.8.4.1.5 Threatened and Endangered Species

A total of seven federally listed species are known to occur in Riley County (Table 3.8.4.1.5-1). In addition, Kansas Natural Heritage Inventory (KNHI) occurrence records for Riley County include four species listed by the state as endangered or threatened and 16 "species in need of conservation" (Table 3.8.4.1.5-1). Species listed by the state as endangered or threatened are protected under the *Non-Game and Endangered Species Conservation Act* of 1975 (K.S.A. 32-957 – 32-963, 32-1009 – 32-1012, 32-1033, 32-960a and 32-960b, and amendments thereto). Activities that impact state-listed species require special action permits from the KDWP. The state also tracks occurrences of "species in need of conservation"; however, these species are not afforded protection under state laws.

Table 3.8.4.1.5-1 — Riley County Endangered, Threatened, and Rare Species (KDWP 2008)

Scientific Name	Common Name	Federal Status [a]	State Status [b]	Habitat[c]	Habitat Present at NBAF Site
Nicrophorus americanus	American burying beetle	E	E	Upland grassland and grassland/forest transition zones	No
Numenius borealis	Eskimo curlew [d]	E	E	Plowed fields, heavily grazed or burned grasslands, prairie dog colonies	No
Sterna antillarum	Least tern	E	E	Barren areas near water such as sand bars in river beds, shores of large impoundments, and salt flats	No
Charadrius melodus	Piping plover	T	T	Sparsely vegetated shallow wetlands and open beaches and sandbars adjacent to streams and impoundments	No
Macrhybopsis gelida	Sturgeon chub	C	T	Large, turbid, sandy rivers with small gravel and sand substrate	No
Notropis topeka	Topeka shiner	T	E	Small prairie streams with high water quality, Occurs near headwaters of streams over gravel, bedrock, or silt substrate	No
Grus americana	Whooping crane	E	E	Remote wetlands with low, sparse vegetation in level to moderately rolling terrain	No
Spilogale putorius	Eastern spotted skunk	-	T	Forest edges and upland prairie grasslands, especially those with rock outcrops and shrub clumps, woody fence rows, and abandoned farm buildings	No
Falco peregrinus	Peregrine falcon	-	E	Prefer areas near marshes, lakes, and rivers where concentrations of waterfowl and other birds provide ample prey	No
Macrhybopsis storeriana	Silver chub	-	E	Large sandy rivers	No
Haliaeetus leucocephalus	Bald eagle	-	T	Around large impoundments, rivers, and marshes	No
Charadrius alexandrinus	Snowy plover	-	T	Salt flats, beaches and bars of rivers, and wetlands	No

[a] Federal Status Codes: E = Endangered, T = Threatened, C = Candidate.
[b] State Status Codes: E = Endangered, T = Threatened.
[c] Source: KDWP Web Site, Species Information Pages.
[d] Considered extirpated in Kansas.

KNHI is responsible for tracking occurrences of both federally and state-listed species within the State of Kansas. Database reviews conducted by KNHI and KDWP did not identify any occurrences of rare, threatened, or endangered species at the proposed NBAF site or within a 1-mile radius of the site. In addition, both of these state agencies concluded that the project area does not appear to contain suitable habitat for any federal- or state-listed species. As described in Section 3.8.4.1.1, the Manhattan Campus Site is located in a highly disturbed area that lacks native natural communities. Furthermore, no wetlands or aquatic habitats occur at the site. In the absence of suitable habitat, the occurrence of any federally or state-listed species at the Manhattan Campus Site is unlikely.

3.8.4.2 Construction Consequences

3.8.4.2.1 Vegetation

Construction of the proposed NBAF would impact approximately 30 acres of land at the Manhattan Campus Site. The site is located in a highly disturbed area that does not contain native natural communities. Earth-disturbing activities would impact pasture areas that are dominated by cultivated forage grasses. Therefore, construction of the proposed NBAF would have no direct effect on natural plant communities. Since no natural communities are located adjacent to the site, construction of the proposed NBAF would have no indirect effect on natural plant communities. Off-site connected actions involving the installation of new electrical lines would occur within existing right-of-ways and, therefore, would not have any significant impacts on vegetation.

3.8.4.2.2 Wetlands

No wetlands or streams occur on or immediately adjacent to the Manhattan Campus Site. Therefore, construction would have no direct effects on streams or wetlands. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Although Campus Creek is 1,500 feet from the proposed NBAF site, sediments transported by storm water could potentially end up in the stream channel. However, erosion and sedimentation control measures would minimize the potential for adverse effects on streams and wetlands.

3.8.4.2.3 Aquatic Resources

Earth-disturbing activities would be restricted to upland pasture areas and, therefore, construction would have no direct impact on streams or aquatic habitats. Potential indirect effects from erosion and sedimentation would be the same as those described in Section 3.8.4.2.2.

3.8.4.2.4 Terrestrial Wildlife

Construction of the proposed NBAF at the Manhattan Campus Site would impact approximately 30 acres of disturbed, actively grazed pasture that is dominated by cultivated forage grasses. Domestic perennial forage grasses that are used in Kansas are considered to have low value as wildlife habitat (KDWP 2004). The areas that would be impacted do not contain native vegetation or significant wildlife food or cover. Therefore, the loss of pasture habitat would affect a relatively low number of generalist species that are adapted to a wide range of habitats. Construction of the proposed NBAF at the Manhattan Campus Site would not result in significant direct impacts on native terrestrial wildlife.

3.8.4.2.5 Threatened and Endangered Species

Informal Section 7 consultation was conducted with the USFWS Kansas Field Office. The USFWS determined that no suitable endangered species habitats occur within the project area. The USFWS requested an assessment of the potential effects of an accidental pathogen release on federally listed species that occur in the vicinity of the site (least tern, piping plover, and Topeka shiner). The potential effects of an accidental release are assessed in Sections 3.8.4.3.5 and 3.8.9. Reviews conducted by KNHI and KDWP did not identify any occurrences of rare, threatened, or endangered species at the Manhattan Campus Site or within a 1-mile radius of the site. In addition, both KNHI and KDWP concluded that the project area does not appear to contain suitable habitat for any federally or state-listed species. The Manhattan Campus Site is located in a highly disturbed area that lacks native natural communities, and no wetlands or aquatic habitats occur at the site. Therefore, the proposed NBAF would have no direct adverse impact on listed species. Approximately 2 miles southeast of the project area, the Kansas River is designated as critical habitat for the least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), and sturgeon chub (*Macrhybopsis gelida*); however, the KNHI determined that the project would not be likely to impact these species.

Soil disturbance during the construction process would expose soils to potential erosion during storm events. Erosion and subsequent sedimentation in stream channels have the potential for adverse impacts on aquatic organisms. Although Campus Creek is located 1,500 feet south of the project area, sediment transported by storm water runoff could potentially end up in Campus Creek and receiving downstream water bodies that include the Kansas River. However, erosion and sedimentation control measures would minimize the potential for adverse effects on protected aquatic species and critical habitat in the Kansas River basin.

3.8.4.3 Operation Consequences

3.8.4.3.1 Vegetation

The surrounding area is highly urbanized, and there are no natural plant communities in the general vicinity of the site. Therefore, operations would have no potential for direct or indirect impacts on native natural communities.

3.8.4.3.2 Wetlands

Operations at the proposed NBAF would have no direct impacts on wetlands; however, increases in impervious surface area and storm water runoff would have the potential for indirect wetland impacts. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in impervious surface area can increase storm water runoff and stream flow after storm events. Increases in stream flow volume and velocity can cause stream channel incision and/or widening, resulting in the loss of adjacent wetland vegetation and alteration of the hydrological regime within adjacent wetlands. The storm water management system would be designed in accordance with applicable storm water BMPs. In addition, the proposed NBAF would employ an LID approach that would further minimize storm water runoff (see Section 3.7.4.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse impacts on streams and wetlands.

3.8.4.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct impacts on aquatic communities; however, storm water runoff from the proposed NBAF would eventually be discharged to Campus Creek. Increases in impervious surface area and storm water runoff have the potential for indirect impacts on water quality and aquatic communities. Runoff from impervious surfaces such as buildings and parking lots can transport pollutants such as automotive fluids, fertilizer, pesticides, bacteria, and heavy metals into surface waters. Furthermore, rapid runoff from impervious surface areas can affect aquatic habitats by increasing the rate of flow in receiving streams (see Section 3.8.4.3.2). These effects can include increased turbidity and sedimentation downstream. The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on streams. The proposed NBAF would have the potential for minor adverse effects associated with pollutant transport. Minor quantities of pollutants such as automobile engine fluids and fertilizers may avoid capture in the storm water management system and could end up in area streams. However, LID development techniques and BMPs would minimize the potential for these types of impacts.

3.8.4.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on wildlife. In the event of a power outage, the noise associated with the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on wildlife.

3.8.4.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species; however, the accidental or intentional release of a pathogen would have the potential for adverse effects on mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. No federally listed mammals occur in Riley County. Federally listed birds that occur in Riley County are not likely to be adversely affected by operations at the proposed NBAF site. The state endangered eastern spotted skunk (*Spilogale putorius*) is known to occur in Riley County. Suitable habitat for the spotted skunk does not occur in the immediate vicinity of the proposed NBAF site. However, suitable habitat does occur in rural areas outside of the City of Manhattan. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on native wildlife and endangered species.

3.8.5 Flora Industrial Park Site

3.8.5.1 Affected Environment

3.8.5.1.1 Vegetation

Regional Vegetation

The Flora Industrial Park Site is located in the Upper East Gulf Coastal Plain ecoregion (Vilella et al. 2003). The Dominant natural plant communities of this ecoregion can be broadly categorized as dry to dry-mesic hardwood forests, mesic upland forests, and bottomland hardwood/swamp forests. Dry and dry-mesic hardwood forests occur on dry ridgetops, upper slopes, and dry to moderately moist mid and lower slopes. Dominant trees include post oak (*Quercus stellata*), southern red oak (*Q. falcata*), white oak (*Q. alba*), blackjack oak (*Q. marilandica*), water oak (Q. nigra), mockernut hickory (*Carya alba*), sand hickory (*C. pallida*), and pignut hickory (*C. glabra*). Common understory species include sparkleberry (*Vaccinium arboreum*), white ash (*Fraxinus americana*), flowering dogwood (*Cornus florida*), beech (*Fagus grandifolia*), sourwood (*Oxydendrum arboreum*), and hop-hornbeam (*Ostrya virginiana*). Many of the dry and dry-mesic communities in the region have been converted to loblolly pine (*Pinus taeda*) plantations (MMNS 2005).

Mesic upland forests occur on lower slopes and high terraces of streams and rivers. Dominant trees include sweetgum (*Liquidambar styraciflua*), water oak, white oak, cherrybark oak (*Quercus pagoda*), swamp chestnut oak (*Q. michaxii*), willow oak (*Q. phellos*), pignut hickory, bitternut hickory (*Carya cordiformis*), and shagbark hickory (*C. ovalis*). Understory trees and shrubs include ironwood (*Carpinus caroliniana*), winged elm (*Ulmus alata*), red maple (*Acer rubrum*), possumhaw (*Viburnum nudum*), hackberry (*Celtis laevigata*), and pawpaw (*Asimina triloba*) (MMNS 2005).

Bottomland hardwood forests occur on low floodplain terraces and other wet lowland flats. Dominant trees include willow oak, water oak, overcup oak (*Quercus lyrata*), Nuttall oak (*Q. nutallii*), swamp laurel oak (*Q. laurifolia*), pecan (*Carya illinoinensis*), water hickory (*C. aquatica*), hackberry, American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and sweet-gum. Cypress-gum swamps occur on low floodplain terraces, bottomland flats, and backwater areas that are seasonally to semipermanently flooded. Dominant trees include bald cypress (*Taxodium distichum*), black-gum (*Nyssa biflora*), water tupelo (*N. aquatica*), water oak, and other flood-tolerant hardwoods (MMNS 2005).

Site Vegetation

The Flora Industrial Park Site is located in a highly disturbed area that does not contain native natural communities. Most of the site consists of pasture that has been used for livestock grazing since at least 1946

(Holman 1993). Vegetation at the site consists primarily of non-native cultivated forage grasses and early successional weeds. Open field habitat consists of grasses used for cattle grazing, such as fescue (*Festuca* sp.), bahia grass (*Paspalum notatm*), and dallis grass (*Paspalum dilatatum*). The pasture areas are currently maintained by regular mowing. Woody vegetation occurs along an old fence line that transects the northern portion of the property. Woody species include native and non-native species. Native trees and shrubs include water oak, willow oak, post oak, American elm, winged elm, hackberry, eastern red cedar (*Juniperus virginiana*), and black cherry (*Prunus serotina*). Non-native species include osage orange (*Maclura pomifera*), chinaberry (Melia azedarach), Japanese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*). Historically, osage orange was used as a hedgerow plant throughout the United States. Similar woody vegetation occurs along the banks of drainageways in the southeastern corner of the property.

Rare and Significant Natural Communities

A database review conducted by the Mississippi Natural Heritage Program (MNHP) did not identify any records of rare or significant natural communities within the boundaries of the proposed NBAF site. As described above, the Flora Industrial Park Site is located within a highly disturbed area that lacks native natural communities.

3.8.5.1.2 Wetlands

Jurisdictional wetlands and waters at the Flora Industrial Park Site were delineated on April 23, 2007 (WTS 2007a). Jurisdictional wetlands and other waters within the boundaries of the site include two ephemeral stream channels with a combined length of 1,293 feet and one intermittent stream channel with a length of 296 feet (Figure 3.8.3.1.2-1). The ephemeral streams originate in the southeastern corner of the site and drain towards the southeast. The two ephemeral streams join to form the intermittent stream, which drains to the southeast for a distance of 296 feet before exiting the southeastern property boundary. No jurisdictional wetlands occur along the margins of the streams. The property also contains two isolated, non-jurisdictional ponds. These two ponds include a historical farm pond on the northeastern portion of the property and a recently excavated pond near the southwestern boundary of the site. As non-jurisdictional features, these ponds are not subject to Section 404 regulations or permitting requirements.

3.8.5.1.3 Aquatic Resources

The Flora Industrial Park Site is located in the Big Black River basin (HUC 8060202). The site contains two short ephemeral stream segments that originate near the southeastern boundary of the site. These ephemeral streams drain to the southeast and join to form an intermittent stream that exits the property. This unnamed intermittent stream flows northeast to Town Creek. Town Creek is a tributary of Balfour Creek, which discharges to the Big Black River approximately 3 miles northwest of the Flora Industrial Park Site.

The Big Black River discharges to the Mississippi River approximately 55 miles southwest of Flora. Many tributaries of the Big Black River have been channelized, and the main stem has experienced extensive erosion in recent years, resulting in destabilization of the stream channel. Agriculture and other land-use practices on adjacent lands are also impacting the Big Black River and its tributaries (MMNS 2005). Generally, the Big Black River and most of its tributaries, especially in the northern part of the basin, carry large amounts of suspended sediment and are very turbid most of the time. Some of the streams in the basin are muddy and slow flowing, while others have relatively clear water and are swift with sandy bottoms. Overall, the water quality in the basin is rated as fair (MDEQ 2003).

Common fishes of the Big Black River include flathead catfish, blue catfish, channel catfish, smallmouth buffalo, bigmouth buffalo, black buffalo, freshwater drum, white crappie, black crappie, largemouth bass, gizzard shad, bluegill, longnose gar, spotted gar, blue sucker, paddlefish, blacktail shiner, emerald shiner, striped shiner, creek chubsucker, freckled madtom, blackspotted topminnow, central stoneroller, scaly sand darter, slough darter, logperch, and dusky darter (Brown et al. 2005). A total of 38 mussel species have been reported from the Big Black River. Common mussels include the mucket, rock pocketbook, butterfly mussel, southern pocketbook, and southern mapleleaf (Brown et al. 2005).

Streams on the Flora Industrial Park Site have been degraded by agricultural practices. The ephemeral streams function mainly as shallow storm water conveyances for runoff from the agricultural fields. Vegetated buffers are essentially absent, and these streams are exposed to accelerated runoff and sediment transport from the adjacent pasture areas. Due to their ephemeral nature and degraded condition, the ephemeral streams are not likely to contain significant aquatic resources. The intermittent stream has been channelized and is currently deeply incised to a depth of 5 feet below the adjacent upland areas. The intermittent stream also has limited vegetative buffers and is adversely affected by accelerated runoff and sedimentation. The perennial stream is most likely occupied by a limited number of generalist aquatic species that are able to tolerate degraded habitat conditions. Depending on stocking history, the farm pond may contain fishes such as large mouth bass, bluegill, and various species of sunfish. Semi-aquatic reptiles and amphibians that may occur onsite are described below.

3.8.5.1.4 Terrestrial Wildlife

The Mississippi GAP has developed models that predict the statewide distribution of terrestrial vertebrate species that are known to breed in Mississippi. The Mississippi GAP list of breeding species for the Flora area includes 96 birds, 46 mammals, 46 reptiles, and 27 amphibians (Vilella et al. 2003). Non-breeding species that occur in Mississippi consist primarily of migratory birds that occur only during the non-breeding season.

As described in Section 3.8.5.1.1, the proposed Flora Industrial Park Site is located in a highly disturbed area that lacks native natural plant communities. Vegetation on the site consists primarily of pasture that is dominated by non-native forage grasses. Due to its disturbed condition, lack of native vegetation, and lack of wildlife food and cover, the Flora Industrial Park Site has limited wildlife habitat value. Wildlife utilization of the site is most likely limited to a relatively low number of generalist species that have adapted to highly disturbed environments. Common mammals that are likely to occur at the site include white-tailed deer (*Odocoileus virginianus*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), nine-banded armadillo (*Dasypus novemcinctus*), northern raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), white-footed mouse (*Peromyscus leucopus*), hispid cotton rat (*Sigmodon hispidus*), eastern harvest mouse (*Reithrodontomys humulis*), and eastern mole (*Scalopus aquaticus*). Common birds that may occur at the proposed NBAF site include killdeer (*Charadrius vociferous*), mourning dove (*Zenaida macroura*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchos*), Carolina chickadee (*Poecile carolinensis*), tufted titmouse (*Baeolophus bicolor*), American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottus*), brown thrasher (*Toxostoma rufum*), European starling (*Sturnus vulgaris*), northern cardinal (*Cardinalis cardinalis*), common grackle (*Quiscalus quiscula*), Carolina wren (*Thryothorus ludovicianus*), eastern bluebird (*Sialia sialis*), eastern towhee (*Pipilo erythrophthalmus*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), and American kestrel (*Falco sparverius*). In addition, the farm pond may attract common wading birds such as the great blue heron (*Ardea herodias*) and green heron (*Butorides virescens*).

Figure 3.8.5.1.2-1 — Flora Industrial Park Wetland Map

Common reptiles and amphibians that may occur at the site include the eastern box turtle (*Terrapenne carolina*), common garter snake (*Thamnophis sirtalis*), black rat snake (*Elaphe obsoleta*), black racer (*Coluber constrictor*), green anole (*Anolis carolinensis*), fence lizard (*Sceloperus undulatus*), southeastern five-lined skink (*Eumeces inexpectatus*), woodhouse's toad (*Bufo woodhousii*), American toad (*Bufo americanus*), southern cricket frog (*Acris gryllus*), green treefrog (*Hyla cinerea*), and gray treefrog (*H. versicolor*). The farm pond may provide habitat for additional semi-aquatic turtles and amphibians such as the common snapping turtle (*Chelydra serpentina*), yellow-bellied slider (*Trachemys scripta*), eastern mud turtle (*Kinosternum subrubrum*), bullfrog (*R. catesbeiana*), green frog (*R. clamitans*), and pickerel frog (*R. palustris*).

The distribution of ungulate populations has particular relevance, since they are susceptible to many of the diseases that may be studied at the proposed NBAF. Ungulates that occur in Mississippi include white-tailed deer (*Odocoileus virginianus*) and wild boar (*Sus scrofa*). Both species occur throughout the state (Shropshire 1998).

3.8.5.1.5 Threatened and Endangered Species

A total of three federally listed species and one federal candidate species are known to occur in Madison County (Table 3.8.5.1.5-1). MNHP occurrence records for Madison County include four additional species listed by the state as endangered or threatened and 16 "species of concern" (Table 3.8.5.1.5-1). Animal species that are listed by the state as endangered or threatened are protected under the Mississippi *Nongame and Endangered Species Conservation Act* (Miss. Code Ann. 49-5-101 et seq.). Although the state tracks occurrences of animal "species of concern," these species are not afforded protection under state laws. Although the MNHP tracks occurrences of rare plant species, plants are not protected by state laws.

Table 3.8.5.1.5-1 — Federally and State-Protected Species of Madison County (MNHP 2007)

Scientific Name	Common Name	Federal [a] Status	State [b] Status	Habitat	Habitat Present at NBAF Site
Nicrophorus americanus [c]	American burying beetle	E	E	Not fully understood. Has been found in oak-pine woodlands, open fields, oak-hickory forest, open grasslands, and edge habitats.	No
Acipenser oxyrinchus desotoi	Gulf sturgeon	T	E	All saltwater habitats during the non-breeding period and major rivers that empty into the Gulf of Mexico during the spawning season.	No
Graptemys oculifera	Ringed map turtle	T	E	Generally inhabits clean rivers having a moderate current, an open canopy, and numerous nesting beaches and basking logs.	No
Falco peregrinus [d]	Peregrine falcon	-	E	Open habitats such as coastal dunes, shorelines, marshes, grasslands, cultivated fields, and cities.	Yes
Thryomanes bewickii	Bewick's wren	-	E	Open habitat with clumps of vegetation. Farmyards and rural dwellings. Windrows or slash piles created from clear-cutting operations.	Yes
Alosa alabamae	Alabama shad	C	SC	Found along sand and gravel bars in medium to large freshwater rivers.	No

[a] Federal Status Codes: E = Endangered, T = Threatened, = C = Candidate.
[b] State Status Codes: E = Endangered, SC = Species of Concern.
[c] Source: Considered extirpated in Mississippi.
[d] Non-breeder with no definable occurrences. Consequently, not of practical conservation concern in the state.

MNHP is responsible for tracking occurrences of both federally and state-listed species within the State of Mississippi. A review conducted by MNHP did not identify any state or federally listed species occurrences at the site. Correspondance from the USFWS Jackson Field Office also stated that no listed species are known to occur on the site. As described in Section 3.8.5.1.1, the proposed NBAF site is located in a highly disturbed area that lacks native natural communities. The state endangered Bewick's wren is sometimes found in farmyard habitats that are similar to those within the project area. Due to the poor quality of habitats that are present, occurrences of any additional federally or state-listed species at the site are unlikely.

3.8.5.2 Construction Consequences

3.8.5.2.1 Vegetation

Construction of the proposed NBAF would impact approximately 30 acres of land at the Flora Industrial Park Site. Earth-disturbing activities would impact pasture areas that are dominated by cultivated forage grasses and disturbed woody vegetation along an old fence row. None of the vegetated areas that occur along streams would be affected. Construction of the proposed NBAF would have no direct effect on natural plant communities. Adjacent areas consist primarily of agricultural lands with similar vegetation. Therefore, no indirect effects on natural plant communities are anticipated. Off-site connected actions involving the installation of a new gas line beneath the adjacent railroad tracks and improvements to U.S. Highway 49 at the entrance to the proposed NBAF site would affect previously disturbed areas and, therefore, would not have any significant impacts on vegetation.

3.8.5.2.2 Wetlands

Construction would occur on the northern portion of the property and would have no direct effect on jurisdictional streams that occur in the southeastern corner of the property. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, wetlands and streams that are located downslope of the proposed construction area could be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on streams and wetlands.

3.8.5.2.3 Aquatic Resources

Construction would occur on the northern portion of the property and would have no direct effect on streams that occur in the southeastern corner of the property. The farm pond on the northwestern portion of the property would be retained and incorporated into the grounds of the proposed NBAF. The additional pond along the southwestern boundary of the property would not be affected by construction. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, wetlands and streams that are located downslope of the proposed construction area could be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on streams and wetlands.

3.8.5.2.4 Terrestrial Wildlife

Construction of the proposed NBAF at the Flora Industrial Park Site would impact approximately 30 acres of disturbed, actively grazed pasture and a small area of disturbed woody vegetation along an old fence row. The areas that would be impacted do not contain natural plant communities or significant wildlife food or cover. The loss of these disturbed habitats would affect a relatively low number of generalist species that are adapted to a wide range of habitats. Construction of the proposed NBAF at the Flora Industrial Park Site would not result in significant direct impacts on native terrestrial wildlife.

3.8.5.2.5 Threatened and Endangered Species

Informal Section 7 consultation was conducted with the USFWS Jackson Field Office. The USFWS determined that no federally listed species occur within the project area. In addition, database reviews conducted by the MNHP did not identify any known occurrences of rare, threatened, or endangered species at the Flora Industrial Park Site. MNHP stated that the use of BMPs would preclude any impacts on listed species. The proposed NBAF site is located in a highly disturbed area that lacks native natural communities. However, the state endangered peregrine falcon and the state endangered Bewick's wren are known to utilize disturbed open areas such as farmyards. The peregrine falcon is a non-breeding species in Mississippi, and occurrences consist of migrating birds that may occur in a variety of open habitats during migration periods. Due to the lack of definabale occurrences (i.e., nesting sites), this species is not of practical conservation concern in the state. The state endangered Bewick's wren could potentially occur on the property. However, suitable farmyard habitats are abundant in the region; therefore, this species is not likely to be adversely affected by habitat loss asscociated with construction of the proposed NBAF.

3.8.5.3 Operation Consequences

3.8.5.3.1 Vegetation

No natural plant communities occur on or in the general vicinity of the Flora Industrial Park Site. Therefore, operations would have no potential for direct or indirect impacts on native natural communities.

3.8.5.3.2 Wetlands

Operations of the proposed NBAF at the Flora Industrial Park Site would have no direct impacts on wetlands; however, increases in impervious surface area and storm water runoff would have the potential for indirect impacts on jurisdictional streams that occur on and adjacent to the proposed NBAF site. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in impervious surface area can increase storm water runoff and stream flow after storm events. Increases in stream flow volume and velocity can cause stream channel incision and/or widening, resulting in the loss of adjacent wetland vegetation and alteration of the hydrological regime within adjacent wetlands. The storm water management system would be designed in accordance with applicable storm water BMPs. In addition, the proposed NBAF would employ an LID approach that would further minimize storm water runoff (see Section 3.7.4.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse impacts on streams and wetlands.

3.8.5.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct impacts on aquatic resources; however, storm water runoff from the proposed NBAF would eventually be discharged to area streams. Increases in impervious surface area and storm water runoff have the potential for indirect impacts on water quality and aquatic communities. Runoff from impervious surfaces such as buildings and parking lots can transport pollutants such as automotive fluids, fertilizer, pesticides, bacteria, and heavy metals into surface waters. As described above, rapid runoff from impervious surface areas can affect aquatic habitats by increasing the rate of flow in receiving streams. These effects can include increased turbidity and sedimentation downstream. The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on streams. The proposed NBAF would have the potential for minor adverse effects associated with pollutant transport. Minor quantities of pollutants such as automobile engine fluids and fertilizers may avoid capture in the storm water management system and could end up in area streams. However, the measures described above would minimize the potential for these types of impacts.

3.8.5.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse effects on wildlife. In the event of a power outage, the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides an in-depth evaluation of the potential effects of an accidental release on native wildlife.

3.8.5.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species. The accidental or intentional release of a pathogen would have the potential for adverse effects on listed mammals; however, no federally or state-listed mammals are known to occur in Madison County. Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF (see Section 3.8.9). Therefore, normal operations would not be likely to have adverse effects on listed species that occur in the vicinity of the proposed NBAF site. Section 3.8.9 provides an in-depth evaluation of the potential effects of an accidental release on native wildlife and listed species.

3.8.6 Plum Island Site

3.8.6.1 Affected Environment

3.8.6.1.1 Vegetation

Regional Vegetation

An overview of the Coastal Lowlands ecozone and Plum Island is provided in Section 3.8.2.1.1.

Site Vegetation

A substantial portion of the Plum Island Site consists of severely disturbed lands that have been impacted by road construction, sand mining, and other past clearing/earth-disturbing activities. The sand mine and other areas with severe soil disturbance are either devoid of vegetation or contain a sparse to moderately dense coverage of weedy herbaceous species such as woolly mullein (*Verbascum thapsus*), broom-sedge (*Andropogon virginicus*), seaside goldenrod (*Solidago sempervirens*), crown vetch (*Coronilla varia*), and pokeweed (*Phytolacca americana*). Remaining portions of the project area contain a dense shrub-scrub stratum comprised of native and non-native woody plants. Typical native species include eastern red cedar (*Juniperus virginiana*), bayberry (*Myrica pennsylvanica*), sassafrass (*Sassafras albidum*), winged sumac (*Rhus copallinum*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), blackberry (*Rubus allegheniensis*), grape (*Vitis* sp.), and poison ivy (*Toxicodendron radicans*). Non-native species include Norway maple (*Acer platanoides*), tree of heaven (*Ailanthus altissima*), mutliflora rose (*Rosa multiflora*), Tartarian honeysuckle (*Lonicera tatarica*), and Japanese honeysuckle (*L. japonica*). The site also contains patches of larger mature trees that are interspersed within the shrub-scrub communities.

Rare and Significant Natural Communities

A database review conducted by the New York Natural Heritage Program (NYNHP) did not identify any records of rare or significant natural communities within the boundaries of the Plum Island Site; however, the NYNHP has identified a maritime dune community on the southeastern portion of Plum Island as a significant natural area with high ecological and conservation value. This natural area is located approximately 0.5 mile south of the proposed NBAF site. The NYNHP describes this area as a low dune field with scattered blowouts and patches of low shrubby vegetation. The report indicates that many non-native species are present along old roads within the dunes; however, the community is described as a fairly large occurrence in good condition (NYNHP 2007).

3.8.6.1.2 Wetlands

Wetlands in the vicinity of the Plum Island Site were delineated by B. Laing Associates on November 7, 2007 (B. Laing Associates 2007). No wetlands were found on-site; however, jurisdictional wetlands were identified approximately 300 feet northwest and 200 feet southeast of the site (Figure 3.8.2.1.2-1). Descriptions of these wetlands and a discussion of applicable regulations are included in Section 3.8.2.1.2.

3.8.6.1.3 Aquatic Resources

No aquatic resources occur within the boundaries of the Plum Island Site. Adjacent freshwater and marine aquatic resources are described in Section 3.8.2.1.3.

3.8.6.1.4 Terrestrial Wildlife

Wildlife resources that occur on Plum Island are described in Section 3.8.2.1.4.

3.8.6.1.5 Threatened and Endangered Species

Threatened and endangered species that may occur on Plum Island are described in Section 3.8.2.1.5.

3.8.6.2 Construction Consequences

3.8.6.2.1 Vegetation

Construction of the proposed NBAF would affect approximately 24 acres of land at the Plum Island Site. The project would affect heavily disturbed areas with sparse weedy herbaceous vegetation and previously disturbed upland shrub-scrub communities that are dominated by native and non-native species. Construction would not affect any rare or significant natural plant communities. Based on the poor quality of vegetation in the affected area, the project would not have significant direct adverse effects on natural plant communities. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, natural communities that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on vegetation.

3.8.6.2.2 Wetlands

The Plum Island Site does not contain wetlands, and no portion of the site falls within the state-regulated wetland buffer zones associated with adjacent wetlands. Therefore, construction would have no direct adverse effect on wetlands. Potential indirect effects during the construction process would include erosion and sedimentation. However, there are no conveyances connecting the site with adjacent wetlands, and the distances between the site and adjacent wetlands are considerable. These factors and the implementation of erosion and sedimentation control measures would minimize the potential for adverse effects on wetlands.

3.8.6.2.3 Aquatic Resources

The Plum Island Site does not contain aquatic resources and, therefore, construction would have no direct adverse effect on aquatic resources. Potential indirect effects during the construction process would include erosion and sedimentation. Adjacent water bodies that are located downslope of the proposed construction area could be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on aquatic resources.

3.8.6.2.4 Terrestrial Wildlife

Construction of the proposed NBAF would clear approximately 24 acres of land. Affected habitats would include upland shrub-scrub vegetation and heavily disturbed areas that are either devoid of vegetation or sparsely vegetated by weedy herbaceous species. No wetlands or aquatic habitats would be affected. Construction of the facility would have short-term and long-term effects on wildlife. Land-clearing activities, construction noise, and dust creation would likely discourage wildlife utilization of habitats that are immediately adjacent to the proposed construction area; however, these effects would subside with completion of the project. Long-term effects would result from habitat loss and permanent displacement of wildlife from the project area. Species that are likely to be affected include small mammals and songbirds. However, given the abundance of shrub-scrub habitat on the island, construction of the facility would not be likely to have significant long-term impacts on local wildlife populations.

3.8.6.2.5 Threatened and Endangered Species

Informal Section 7 consultation has been initiated with the USFWS Long Island Field Office. The Plum Island Site does not contain suitable habitat for listed species; therefore, construction would not have any direct adverse effects on listed species or potential habitat. Land-clearing activities, construction noise, and dust creation would likely discourage wildlife utilization of habitats that are immediately adjacent to the proposed construction area; however, no listed species are likely to occur in the immediate vicinity of the site. Although piping plovers and roseate terns could potentially nest on the island; suitable nesting habitat is limited primarily to the northern and eastern shorelines. The western shoreline in the vicinity of the Plum Island Site is actively eroding and does not contain suitable nesting habitat for either of these species. Suitable nesting habitats do occur on the eastern and northern beaches of Plum Island; however, the distance between the site and and potential nesting habitat would preclude any adverse effects from construction activities. Sea turtles do not come ashore to nest in the northeastern United States; thus, sea turtle occurrences are limited to marine waters that surround the island. Since sea turtles do not nest or come ashore on Plum Island, construction would have no direct or indirect effect on these species. The shortnose sturgeon only occurs in the lower Hudson River and would not be affected by the project.

3.8.6.3 Operation Consequences

3.8.6.3.1 Vegetation

Operation of the proposed NBAF would have no direct effects on native vegetation or natural communities. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in storm water runoff have the potential to cause erosion within adjacent plant communities. However, the use of LID development techniques and BMPs would mitigate most of the potential for erosion-related effects. Storm water management systems would be designed in accordance with the applicable storm water BMPs. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.3.3.2).

3.8.6.3.2 Wetlands

Operations at the proposed NBAF would have no direct impacts on wetlands. Increases in impervious surface area and storm water runoff have the potential for indirect erosion and sedimentation impacts on wetlands. However, there are no conveyances connecting the site with adjacent wetlands, and the distances between the site and adjacent wetlands are considerable. These factors, and the use of LID development techniques and BMPs, would mitigate most of the potential for erosion-related effects on wetlands.

3.8.6.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct impacts on aquatic resources. Potential effects associated with storm water runoff would be the same as those described above for wetlands. No adverse effects on aquatic resources would be expected.

3.8.6.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on wildlife. In the event of a power outage, the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on wildlife.

3.8.6.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species. The accidental or intentional release of a pathogen would have the potential for adverse effects on mammals; however, no federally or state-listed mammals are known to occur in the vicinity of Plum Island. Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Therefore, operations would not be likely to have adverse effects on listed species that occur in the vicinity of the proposed NBAF site. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on native wildlife and endangered species.

3.8.7 Umstead Research Farm Site

3.8.7.1 Affected Environment

3.8.7.1.1 Vegetation

Regional Vegetation

The Umstead Research Farm Site is located in the Piedmont physiographic province (McKerrow et al. 2006). Natural plant communities of the southern Piedmont region are described in Section 3.8.3.1.1.

Site Vegetation

Approximately 90% of the Umstead Research Farm Site was clear-cut in the fall of 2001 (Terracon 2007e). The clear-cut areas are currently dominated by very dense thickets of early successional shrub-scrub vegetation. The shrub-scrub community is characterized by a very dense sapling/shrub stratum that is dominated by weedy mesic hardwood saplings such as sweet-gum, yellow poplar, and red maple. Additional saplings and shrubs include loblolly pine, winged-elm, persimmon (*Diospyros virginiana*), eastern red cedar (*Juniperus virginiana*), winged sumac (*Rhus copallina*), groundsel tree (*Baccharis halimifolia*), and blackberry (*Rubus* sp.). Weedy herbaceous species have colonized logging roads and other small areas where soils were severely disturbed by logging operations. Logging operations also created several small depressions that are holding water on top of compacted soils. These wet disturbed areas have been colonized by hydrophytic herbaceous species such as cattail (*Typha latifolia*), cottongrass bulrush (*Scirpus cyperinus*), black bulrush (*Scirpus atrovirens*), spikerush (*Eleocharis* sp.), common rush (*Juncus effusus*), and leathery rush (*Juncus coriaceus*). A small area of mature hardwood forest occurs near the northeastern boundary of the site. It is a closed-canopy, mesic to dry-mesic community with an overstory dominated by southern red oak, white oak, sweet-gum, yellow poplar, southern sugar maple, and loblolly pine.

The clear-cut areas contain numerous small natural wetland seeps, which occur at the upper ends of streams and at the base of the slope along streams. These seepage areas are dominated primarily by hydrophytic herbaceous species such as common rush, hop sedge (*Carex lupilina*), false nettle (*Boehmeria cylindrica*), spotted touch-me-not (*Impatiens capensis*), and netted chain-fern (*Woodwardia areolata*). These seeps also contain occasional flood-tolerant trees such as red maple and sweet-gum.

Rare and Significant Natural Communities

There are large intrusions of mafic rocks in Granville County, especially in the vicinity of Butner. These rocks weather into less acidic, circumneutral soils, which are associated with numerous occurrences of rare natural communities and rare plant species (NCNHP 2007). The Umstead Research Farm Site is located in the vicinity of the Butner Natural Areas Macrosite, a collection of seven significant natural areas associated with diabase intrusions. These natural areas include two nationally significant registered natural areas that are located approximately 1 mile from the southern boundary of the proposed NBAF site. The Knap of Reeds Creek Diabase Levee and Slopes natural area contains 12 rare plant species, including one of the best populations of the federally endangered smooth coneflower in the United States. The Knap of Reeds Creek Diabase Forest and Glades natural area contains a rare diabase glade community and occurrences of two rare plant species. Additional information regarding rare plant species at these sites is provided in Section 3.8.7.1.5.

3.8.7.1.2 Wetlands

Jurisdictional wetlands and other waters at the Umstead Research Farm Site were delineated on December 12, 2007 (Withers and Ravenel 2007). Jurisdictional wetlands and waters that were identified within the property boundaries include 0.62-acre of wetlands and 6,937 linear feet of intermittent and perennial streams (Figure 3.8.7.1.2-1). A total of 10 wetland polygons ranging in size from 0.002 to 0.16 acre were delineated on the property. Wetlands at the Umstead Research Farm Site consist of seepage areas at the upper ends (headwaters) of streams or at the base of the slope adjacent to streams. The surrounding uplands have been recently clear-cut, and these seepage areas are currently dominated primarily by hydrophytic herbaceous species such as common rush, sedge (*Carex lupilina*), false nettle, spotted touch-me-not, and netted chain-fern. These seeps also contain occasional flood-tolerant trees such as red maple and sweet-gum.

The proposed NBAF site contains numerous small intermittent and perennial headwater stream segments, all of which originate within the boundaries of the site. All of these streams drain either directly or via other tributaries to Knap of Reeds Creek, which flows south from Lake Butner to Falls Lake. The longest stream segment on the proposed NBAF site originates near the north-central boundary of the property and flows south for approximately 3,000 feet before exiting the property. After crossing the property boundary, this stream continues southward and eventually discharges into Knap of Reeds Creek on the south side of Old Route 75. Numerous additional stream segments are scattered throughout peripheral portions of the property. These additional segments all exit the property before discharging to other tributaries of Knap of Reeds Creek. Streams on the property have average widths ranging from approximately 2 to 5 feet and are characterized by occasional to frequent meanders.

3.8.7.1.3 Aquatic Resources

The Umstead Research Farm Site is located in the Upper Neuse watershed (HUC 03020201), which comprises part of the Neuse River Basin. Freshwater fish species of recreational importance in the Neuse River and its tributaries include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), redbreast sunfish (*Lepomis auritus*), pumpkinseed (Lepomis gibbosus), warmouth (*Lepomis gulosus*), black crappie (*Pomoxis nigromaculatus*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), blue catfish (*Ictalurus furcatus*), flathead catfish (Pylodictis olivaris), chain pickerel (*Esox* niger), yellow perch (*Perca flavescens*), and white perch (*Morone americana*). Nongame species commonly encountered include bowfin (*Amia calva*), common carp (*Cyprinus carpio*), longnose gar (*Lepisosteus osseus*), pirate perch (*Aphredoderus sayanus*), satinfin shiner (*Cyprinella analostana*), v-lip redhorse (*Moxostoma collapsum*), swallowtail shiner (*Notropis procne*), silvery minnow (*Hybognathus regius*), and tessellated darter (*Etheostoma olmstedi*) (NCDENR 2002b).

The site contains numerous small intermittent and perennial headwater stream segments, all of which originate within the boundaries of the site. All of these streams drain either directly or via other tributaries to Knap of Reeds Creek, which flows south from Lake Butner to Falls Lake. The historical confluence of Knap of Reeds Creek and the Neuse River is now inundated by Falls Lake. The longest stream segment on the proposed NBAF site originates near the north-central boundary of the property and flows south for approximately 3,000 feet before exiting the property. After crossing the property boundary, this stream continues southward and eventually discharges into Knap of Reeds Creek on the south side of Old Route 75. Numerous additional stream segments are scattered throughout the peripheral portions of the property. These additional segments all exit the property before discharging to tributaries of Knap of Reeds Creek. Streams on the property have average widths ranging from approximately 2 to 5 feet and are characterized by occasional to frequent meanders. Streams on the property have been disturbed by a recent clear-cut timber harvest, which has caused minor sedimentation within the stream channels and a dramatic reduction in shading. However, these streams currently have aquatic habitats (e.g., riffles and pools) that are likely to support many of the common aquatic and semi-aquatic species that are typically associated with small headwater streams of the Piedmont. Fish species collected in Knap of Reeds Creek are listed in Table 3.8.7.1.3-1 (NCDENR 2007h). Mussels collected at 44 sampling stations in the Upper Neuse watershed are listed in Table 3.8.7.1.3-2 (Levine et al. 2003). The North Carolina Natural Heritage Program (NCNHP) database includes occurrence records for two state-listed threatened mussels and one state significantly rare mussel from Knap of Reeds Creek: Carolina fatmucket (*Lampsilis radiata conspicua*) (state-threatened), Creeper (*Strophitus undulatus*) (state-threatened), and Chameleon lampmussel (*Lampsilis* sp. 2) (state significantly rare).

The North Carolina Wildlife Action Plan identifies Knap of Reeds Creek as a priority area for freshwater habitat conservation (NCWRC 2005). The North Carolina Division of Water Quality (NCDWQ) Biological Assessment Program conducted fish sampling within Knap of Reeds Creek in 2004 (Table 3.8.7.1.3-1). A total of 19 species were collected, with bluegill comprising 42% of the total catch (NCDENR 2007h). The state uses the North Carolina Index of Biological Integrity (NCIBI) to assess the ecological health of streams. Based on the 2004 fish data, Knap of Reeds Creek received an NCIBI rating of good-fair. The good-fair rating reflected less than optimal species richness and composition (absence of darters, suckers, and other intolerant species) (NCDENR 2006c).

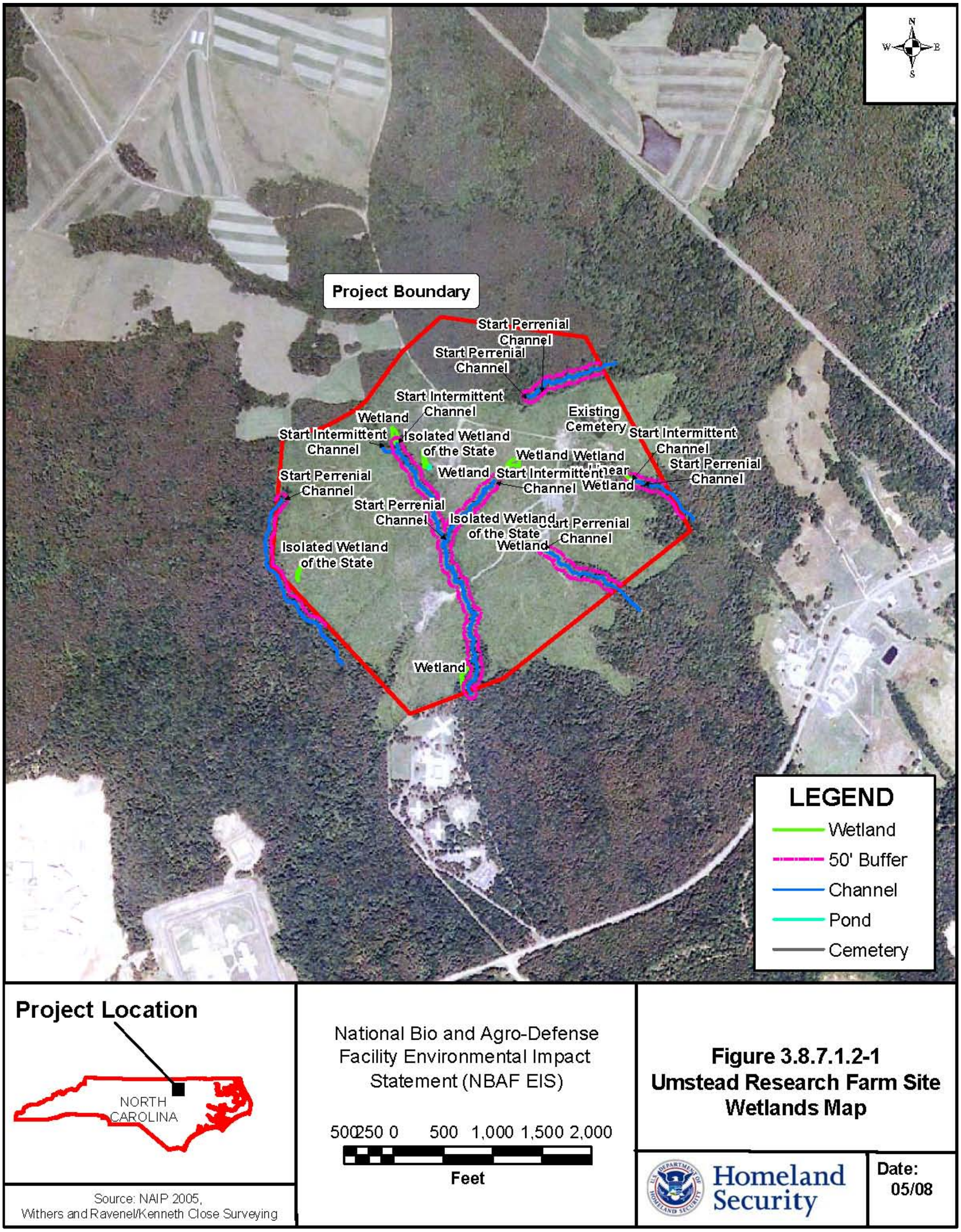


Figure 3.8.7.1.2-1 — Umstead Research Farm Site Wetlands Map

Table 3.8.7.1.3-1 — Species Collected in Knap of Reeds Creek (NCDENR 2007h)

Scientific Name	Common Name
Ameiurus brunneus	Snail bullhead
Ameiurus catus	White catfish
Ameiurus natalis	Yellow bullhead
Centrarchus macropterus	Flier
Cyprinella analostana	Satinfin shiner
Dorosoma cepedianum	Gizzard shad
Esox americanus	Redfin pickerel
Gambusia holbrooki	Eastern mosquitofish
Lepomis auritus	Redbreast sunfish
Lepomis cyanellus	Green sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis gulosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis microlophus	Redear sunfish
Micropterus salmoides	Largemouth bass
Morone americana	White perch
Nocomis raneyi	Bull chub
Perca flavescens	Yellow perch
Umbra pygmaea	Eastern mudminnow

Table 3.8.7.1.3-2 — Mussels Collected at 44 Survey Locations in the Upper Neuse River Watershed (Levine et al. 2003)

Common Name	Scientific Name	Number Found
Eastern elliptio	*Elliptio complanata*	24,836
Creeper	*Strophitus undulates* [a]	191
Notched rainbow	*Villosa constricta* [b]	189
Eastern floater	*Pyganodon cataracta*	164
Eastern lampmussel	*Lampsilis radiata* [a]	54
Yellow lampmussel	*Lampsilis cariosa* [c]*	45
Lampmussel	*Lampsilis* sp.	37
Atlantic pigtoe	*Fusconaia masoni* [c]	31
Green floater	*Lasmigona subviridis* [c]	2
Paper pondshell	*Utterbackia imbecilis*	1

[a] State threatened [b] State special concern [c] State endangered.

3.8.7.1.4 Terrestrial Wildlife

The North Carolina GAP has developed models that predict the statewide distributions of terrestrial vertebrate species that are known to breed in North Carolina (McKerrow et al. 2006). Non-breeding species that occur in North Carolina consist primarily of over-wintering or transient migratory bird species. The accepted list of all birds for North Carolina includes 464 species. The North Carolina GAP list of breeding species for the Upper Neuse River basin includes 50 mammals, 128 birds, 59 reptiles, and 48 amphibians. Documented fauna from the Falls Lake State Recreation Area (3 miles south of the proposed NBAF site) includes 30 mammals, 293 birds, 35 reptiles, and 21 amphibians (North Carolina Division of Parks and Recreation 2008).

The Umstead Research Farm Site is located within the Butner-Falls of Neuse Gameland. The gameland has a total area of 40,899 acres and includes most of the surface area of Falls Lake. The Umstead Research Farm Site is managed as part of the gameland through a lease agreement between the North Carolina Department of Agriculture and the NCWRC (NCWRC 2007). Game species that are targeted include white-tailed deer

(*Odocoileus virginianus*), red and gray fox (*Vulpes vulpes* and *Urocyon cinereoargenteus*), common raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), wild turkey (*Meleagris gallopavo*), northern bobwhite (*Colinus virginianus*), mourning dove (*Zenaida macroura*), and waterfowl. The gameland includes several managed waterfowl impoundments that are located just south of the proposed NBAF site along the Flat River and Knap of Reeds Creek. The Falls Lake State Recreation Area is located approximately 3 miles south of the proposed NBAF site. The Falls Lake State Recreation Area is a collection of seven state parks that adjoin Falls Lake and the Neuse River.

As described in Section 3.8.7.1.1, approximately 90% of the Umstead Research Farm Site has been recently clear-cut and is dominated by early successional shrub-scrub vegetation. This shrub-scrub community is characterized by a very dense shrub stratum that is dominated by mesic hardwood saplings. Additional habitats include a small area of mature mesic to dry-mesic hardwood forest near the northeastern site boundary, small pockets of wetland vegetation, and small headwater streams with narrow forested buffers. Early successional shrub-scrub communities provide valuable habitat for white-tailed deer, small mammals, and numerous resident and migratory birds. Breeding birds that are most commonly associated with early successional or shrub-scrub habitats in North Carolina are listed in Table 3.8.7.1.4-1. Although mature upland hardwood forests and wetland communities comprise only a small portion of the property, these areas increase habitat diversity and increase the potential for occurrences of additional species. In addition, the numerous small headwater streams on the property represent potential habitat for numerous amphibians and other aquatic and semi-aquatic species (see Section 3.8.7.1.3 for a discussion of aquatic communities). Based on the diversity of habitats that are present, many of the species documented at the Falls Lake State Recreation Area (North Carolina Division of Parks and Recreation 2008) are also likely to occur at the Umstead Research Farm Site (excepting most waterfowl and wading birds).

Table 3.8.7.1.4-1 — Successional/Scrub-Shrub Breeding Birds in North Carolina (Sauer et al. 2007)

Scientific Name	Common Name
Colinus virginianus	Northern bobwhite
Spizella pusilla	Field sparrow
Vireo griseus	White-eyed vireo
Passerina cyanea	Indigo bunting
Geothlypis trichas	Common yellowthroat
Dendroica discolor	Prairie warbler
Dumetella carolinensis	Gray catbird
Cardinalis cardinalis	Northern cardinal
Passerina caerulea	Blue grosbeak
Carduelis tristis	American goldfinch
Troglodytes aedon	House wren
Thryothorus ludovicianus	Carolina wren
Icteria virens	Yellow-breasted chat
Toxostoma rufum	Brown thrasher
Melospiza melodia	Song sparrow
Pipilo erythrophthalmus	Eastern towhee

Note: List includes species encountered on more than 14 Breeding Bird Survey routes.

The distribution of ungulate populations has particular relevance, since they are susceptible to many of the diseases that may be studied at the proposed NBAF. Ungulates that occur in North Carolina include white-tailed deer and wild boar (*Sus scrofa*). The white-tailed deer is a common species throughout North Carolina. White-tailed deer are likely to occur in all the habitats at the proposed NBAF site. In North Carolina, the wild boar is known to occur in the mountains, extreme western piedmont, and extreme northeastern corner of the state; however, the North Carolina GAP predicted distribution also includes most of the Coastal Plain physiographic province (McKerrow et. al. 2006). The nearest known population is located in western Wilkes

County, approximately 150 miles west of the proposed NBAF site. The wild boar is a non-native invasive species with the potential to negatively impact natural communities and native species. North Carolina Wildlife Action Plan priorities include investigating these impacts and possibly controlling wild boar populations in the near future (NCWRC 2005).

3.8.7.1.5 Threatened and Endangered Species

Federally listed species that are known to occur in Granville County include three endangered species: dwarf wedge mussel (*Alisma heterodon*), smooth coneflower (*Echinacea laevigata*), and haperella (*Ptlimnion nodosum*). An additional 29 species that are known to occur in Granville County are listed by the state as endangered, threatened, or special concern (Table 3.8.7.1.5-1). Animal and plant species that are listed by the state as endangered, threatened, or special concern are afforded protection under the *North Carolina Endangered Species Act* (G.S. 113-331 – 113-337) and the *North Carolina Plant Protection Act of 1979* (G.S. 196 106-202.12 – 106-202.19). The state also tracks occurrences of species that are considered to be significantly rare in North Carolina; however, these species are not afforded protection under state laws. Other rare species that occur in Granville County include 37 species that are considered significantly rare in North Carolina (NCNHP 2008); however, these species have no legal protection.

A database review conducted by the NCNHP did not identify any known occurrences of rare, threatened, or endangered species within the boundaries of the proposed NBAF site or within a 0.7-mile radius of the site. However, occurrences of the federally endangered smooth coneflower (*Echinacea laevigata*), multiple state-listed plant species, and several state-listed mussels were identified just outside of the 0.7-mile radius.

Most of the rare plant species that occur in Granville County are associated with intrusions of mafic rocks such as diabase and gabbro. There are large intrusions of mafic rocks in Granville County, especially in the vicinity of Butner. These rocks weather into less acidic, circumneutral soils, which are associated with numerous occurrences of rare natural communities and plant species (NCNHP 2007). The Umstead Research Farm Site is located in the vicinity of the Butner Natural Areas Macrosite, a collection of seven significant natural areas associated with diabase intrusions. These natural areas include two nationally significant registered natural areas that are located approximately 1 mile from the southern boundary of the proposed NBAF site. The Knap of Reeds Creek Diabase Levee and Slopes natural area contains 12 rare plant species, including one of the largest populations of the federally endangered smooth coneflower in the United States. Additional rare species at this site include the state-listed endangered tall larkspur (*Delphinium exaltatum*) and six additional plant species that are considered significantly rare in North Carolina: Carolina thistle (*Cirsium carolinianum*), Indian physic (*Gillenia stipulata*), prairie dock (*Silphium terebinthinaceum*), hoary puccoon (*Lithospermum canescens*), Douglass's bittercress (*Cardamine douglassii*), Earle's blazing star (*Liatris squarrulosa*), Pursh's wild-petunia (*Ruellia purshiana*), and glade milkvine (*Matelea decipiens*). The Knap of Reeds Creek Diabase Forest and Glades natural area contains a rare diabase glade natural community. Rare species at this site include two significantly rare plant species: glade bluecurls (*Trichostema brachiatum*) and Pursh's wild-petunia (NCNHP 2007).

Table 3.8.7.1.5-1 — Granville County Federally and State-listed Protected Species

Scientific Name	Common Name	State Status [a]	Federal Status [b]	Habitat	Habitat Present at NBAF Site
Haliaeetus leucocephalus	Bald eagle	T	-	Mature forests near large bodies of water.	No
Lanius ludovicianus	Loggerhead shrike	SC	-	Fields and pastures.	No
Crotalus horridus	Timber rattlesnake	SC	-	Rocky upland forests.	No
Hemidactylium scutatum	Four-toed salamander	SC	-	In the Piedmont, occurs in ponds, springs, floodplain pools, marshes, and streams adjacent to or surrounded by forest with sections of dense moss and/or grass-sedge ground cover are preferred (NCGAP).	Marginal
Etheostoma collis pop. 2	Carolina darter - Eastern Piedmont population	SC	-	Backwater pools or near banks in slow-moving small streams.	Yes
Necturus lewisi	Neuse river waterdog	SC	-	Rivers and large streams.	No
Alasmidonta heterodon	Dwarf wedgemussel	E	E	Found in large rivers and small streams, often burrowed into clay banks among the root systems of trees. They may also be found associated with mixed substrates of cobble, gravel, and sand. Occasionally, they may be found in very soft silt substrates.	Yes
Alasmidonta undulata	Triangle floater	T	-	Demonstrates no particular habitat preference across its range, having been collected from silt/sand in slower moving waters, gravel/sand in riffles and runs, and from crevices in bedrock.	Yes
Alasmidonta varicosa	Brook floater	E	-	Inhabits medium size streams and rivers. It prefers clean, swift waters with stable gravel, or sand and gravel substrates.	No
Elliptio lanceolata	Yellow lance	E	-	Prefers clean, coarse to medium-sized sands as substrate. On occasion, specimens are also found in gravel substrates. This species is found in the main channels of drainages down to streams as small as 3 feet across.	Yes
Fusconaia masoni	Atlantic pigtoe	E	-	Inhabits mostly medium to large streams. It prefers clean, swift waters with stable gravel, or sand and gravel substrate.	No
Lampsilis cariosa	Yellow lampmussel	E	-	Many different habitats. Appears to slightly prefer the shifting sands downstream from large boulders in relatively fast flowing, medium-sized rivers and medium to large creeks.	No

Table 3.8.7.1.5-1 — Granville County Federally and State-listed Protected Species (Continued)

Scientific Name	Common Name	State Status [a]	Federal Status [b]	Habitat	Habitat Present at NBAF Site
Lampsilis radiata conspicua	Carolina fatmucket	T	-	Found in gravel, cobble, or boulder substrates as well as in impounded habitats.	Yes
Lasmigona subviridis	Green floater	E	-	Small- to medium-size streams. It is intolerant of very strong currents and often is found in quiet pools and eddies with gravel and sand substrate.	Yes
Orconectes carolinensis	North Carolina spiny crayfish	SC	-	Small to large streams in the Neuse and Tar Basins; under cover; rock substrates.	Yes
Orconectes virginiensis	Chowanoke crayfish	SC	-	Sluggish streams or swamps on sand or gravel substrates Chowan and Roanoke basins.	No
Strophitus undulatus	Creeper	T	-	Silt, sand, gravel, and mixed substrates. Found from headwater streams to large rivers and lakes.	Yes
Villosa constricta	Notched rainbow	SC	-	Streams with sand/gravel substrates, often in stable banks among tree root mats.	Yes
Baptisia minor var. aberrans	Prairie blue wild indigo	T	-	Glades, barrens, and open woodlands over limestone (or other calcareous rocks) and diabase (or other mafic rocks) in areas that were formerly prairies, barrens, glades, or oak savannas.	No
Delphinium exaltatum	Tall larkspur	E-SC	-	Dry to moist soils over calcareous (such as dolostone, especially Elbrook Formation) or mafic rocks (such as amphibolite, metagabbro, greenstone, and diabase).	No
Echinacea laevigata	Smooth coneflower	E-SC	E	Open woodlands and glades over mafic or calcareous rocks such as diabase, limestone, and dolostone.	No
Isoetes piedmontana	Piedmont quillwort	T	-	In seepage on granitic flatrocks; diabase glades.	No
Portulaca smallii	Small's portulaca	T	-	Granite flatrocks and diabase glades.	No
Ptilimnium nodosum	Harperella	E	E	Rocky riverbeds.	No
Ruellia humilis	Low wild-petunia	T	-	Diabase glades and woodlands.	No
Solidago ptarmicoides	Prairie goldenrod	E	-	Prairie-like barrens over mafic, ultramafic, or calcareous rock, serpentine woodlands.	No
Talinum mengesii	Large-flowered fameflower	E	-	In shallow soil over felsic rocks (granite), where periodically wet by seepage.	No

[a] State Status Codes: E = Endangered, T = Threatened, SC = Special Concern.
[b] Federal Status Codes: E = Endangered.

Federally Listed Species

Smooth Coneflower

The federally endangered smooth coneflower occurs in open woodlands and glades over mafic or calcareous rocks, such as diabase, limestone, and dolostone. Rare occurrences have also been documented in oak-pine savannas of the upper Coastal Plain over circumneutral clay sediments (Weakley 2007). Occurrences in the vicinity of the Umstead Research Farm Site are associated with diabase glades. Withers and Ravenel biologists conducted a walking survey for suitable habitat at the proposed NBAF site on June 29, 2007 (Withers and Ravenel 2007). This survey did not identify any suitable habitat for smooth coneflower at the proposed NBAF site. As described in Section 3.8.7.1.1, approximately 90% of the site is currently occupied by a very dense shrub-scrub stratum that is dominated by weedy mesic hardwoods. A small area of mature forest at the site is a closed canopy dry-mesic to mesic hardwood forest. No dry open woodlands or glade habitats were observed at the site.

Harperella

In North Carolina, habitat for the federally endangered harperella (*Ptilimnium nodosum*) consists of rocky or gravelly shoals of clear, swift-flowing streams (NCNHP 2001). Streams occurring within the project area are small first-order headwater streams, which do not represent suitable habitat for this species.

Dwarf Wedge Mussel

The federally endangered dwarf wedge mussel is found in large rivers and small streams, often burrowed into clay banks among the root systems of trees. They may also be found in mixed substrates of cobble, gravel, and sand. Occasionally they occur in very soft silt substrates. Stream banks are stable with extensive root systems holding soils in place. The associated landscape is largely wooded, especially near streams. Trees near the stream are relatively mature and tend to form a closed canopy over smaller streams, creeks, and headwater river habitats. Water quality is typically good to excellent. In Granville County, the dwarf wedge mussel is known to occur in the Upper Tar River subbasin. The only known extant population in the Upper Neuse watershed is located in the Eno River in Orange County; however, recent sampling indicates that this population may also be extirpated (NCWRC Undated). No mussel surveys have been conducted within streams at the proposed NBAF site. However, given the recent disturbance associated with a clear-cut timber harvest and the absence of known extant populations in the area, its occurrence in the project area appears to be unlikely. Since construction of the NBAF would not affect wetlands, streams, or stream buffer zones (see Section 3.8.7.2.5), surveys are not anticipated. However, surveys would be conducted if requested by the USFWS through informal consultation.

State-Listed Species

All of the state-listed (endangered, threatened, or special concern) plant species that occur in Granville County are associated with xeric open woodlands and/or rare communities such as diabase glades that occur over intrusions of mafic rocks (i.e., diabase and gabbro). Although specific surveys for state-listed species were not conducted, surveys for the federally endangered smooth coneflower indicate that the proposed NBAF site does not contain any rare communities that would support occurrences of these species (Withers and Ravenel 2007).

The NCNHP database includes occurrence records for two state-listed threatened mussels and one state significantly rare mussel from Knap of Reeds Creek: Carolina fatmucket (*Lampsilis radiata conspicua*) (state threatened), creeper (*Strophitus undulatus*) (state threatened), and chameleon lampmussel (*Lampsilis* sp.) (state significantly rare). Small streams within the project area may represent potential habitat for the Carolina darter, North Carolina spiny crayfish, and several species of mussels that are listed by the state (Table 3.8.7.1.5-1). No aquatic surveys have been conducted within streams at the proposed NBAF site. However, given the recent disturbance associated with a clear-cut timber harvest and the absence of known extant populations in the area, the occurrence of these species in the project area appears to be unlikely. Since construction of the NBAF would not affect wetlands, streams, or stream buffer zones (see Section 3.8.7.2.5), surveys are not anticipated. The project area does not contain suitable habitat for the remaining species that are listed by the state as endangered, threatened, or special concern (Table 3.8.7.1.5-1).

3.8.7.2 Construction Consequences

3.8.7.2.1 Vegetation

Construction of the proposed NBAF would affect approximately 30 acres of land at the Umstead Research Farm Site. All effects would occur within upland shrub-scrub communities that are dominated by a very dense assemblage of shrubs and weedy mesic hardwoods. The affected area has been severely disturbed by a recent clear-cut timber harvest and does not contain rare or significant natural plant communities. Based on the poor quality of vegetation in the affected area, the project would not have significant direct effects on natural plant communities. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, natural communities that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on vegetation. Off-site connected actions involving the installation of new electrical lines, potable water lines, sewer lines, and gas lines would occur within existing right-of-ways and/or within existing roadside easements and, therefore, would not have any significant impacts on vegetation. Improvements to the existing dirt road between the proposed NBAF site and Range Road would have insignificant vegetation impacts along the margins of the existing road. The construction of acceleration and deceleration lanes at Range Road would affect existing roadside easements and, therefore, would not have any significant impacts on vegetation.

3.8.7.2.2 Wetlands

Earth-disturbing activities would be restricted to upland shrub-scrub areas and, therefore, would have no direct effect on streams or wetlands. Potential indirect construction effects include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, wetlands and streams that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. Sedimentation in stream channels can impact both water quality and aquatic habitats (see Section 3.8.7.2.3). However, erosion and sedimentation control measures would minimize the potential for adverse effects on aquatic resources.

3.8.7.2.3 Aquatic Resources

Construction of the proposed NBAF would affect approximately 30 acres of land. Earth-disturbing activities would be restricted to upland areas and would not impact streams, aquatic habitats, wetlands, or the 50-foot vegetated stream buffers that are required in the Neuse River Basin. Therefore, the project would have no direct effect on aquatic communities. Potential indirect effects include erosion and sedimentation during the construction process. Removal of vegetation and soil disturbance within the proposed construction area would expose soils to potential erosion during storm events. Sediments that are transported into stream channels can degrade water quality by increasing turbidity, and the deposition of sediments in stream channels can impact aquatic communities through the homogenization of habitat. However, erosion and sedimentation control measures would minimize the potential for adverse effects on aquatic resources.

3.8.7.2.4 Terrestrial Wildlife

Construction of the proposed NBAF would affect approximately 30 acres of disturbed, upland shrub-scrub vegetation. The site would retain approximately 200 acres of shrub-scrub habitat, and none of the other existing habitat types on the property would be impacted. The small area of mature forest that occurs on the property would not be impacted by construction of the facility, no wetlands or streams would be affected, and all 50-foot forested stream buffers would be retained. Construction of the facility would have short-term and long-term effects on wildlife. Land-clearing activities, construction noise, and dust creation would likely discourage wildlife utilization of habitats that are adjacent to the proposed construction area; however, these effects would subside with completion of the project. Long-term effects would result from habitat loss and permanent displacement of wildlife within the 30-acre project area. However, given the retention of habitat diversity and a large area (~200 acres) of shrub-scrub habitat within the boundaries of the property, construction of the facility is not likely to have significant long-term impacts on local wildlife populations.

3.8.7.2.5 Threatened and Endangered Species

Informal Section 7 consultation has been initiated with the USFWS Raleigh Field Office. A review conducted by NCNHP did not identify any occurrences of rare, threatened, or endangered species within the boundaries of the Umstead Research Farm Site. As described above, the general area surrounding the site contains numerous occurrences of federally and state-listed plant species that are associated with rare diabase rock communities; however, surveys of the project area on did not identify any community types that would support occurrences of these species (Withers and Ravenel 2007a). The project area does contain several small headwater stream segments that represent potential habitat for the federally endangered dwarf wedge mussel, the state-listed Carolina darter, and several state-listed mussels (Table 3.8.7.1.5-1). Since construction of the proposed NBAF would not affect wetlands, streams, or the 50-foot vegetated stream buffer zones required in the Neuse River basin, specific surveys for these species have not been conducted. Earth-disturbing activities would be restricted to disturbed upland shrub-scrub areas and, therefore, would have no direct impact on protected species or potential habitat. Soil disturbance during the construction process would expose soils to potential erosion during storm events. Erosion and subsequent sedimentation in stream channels have the potential for adverse impacts on aquatic organisms. Therefore, any increases in sediment transport could have negative impacts on potential habitat for listed aquatic species. However, retention of vegetated stream buffers and the requirement for an approved erosion and sedimentation control plan would minimize the potential for such impacts.

3.8.7.3 Operation Consequences

3.8.7.3.1 Vegetation

The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in impervious surface area increase storm water runoff and stream flow after storm events. Increases in volume and velocity of stream flow can cause stream channel incision and/or widening, resulting in the loss of adjacent terrestrial vegetation and alteration of the hydrological regime within adjacent plant communities. Potential stream effects are especially relevant to the Knap of Reeds Creek Diabase Levee and Slopes Natural Area. This natural area contains a rare diabase levee community along the banks of Knap of Reeds Creek. Natural levees are depositional features that are formed by flooding events. Levees are positioned along the margins of streams and, therefore, are susceptible to effects associated with alterations of stream flow.

Storm water management systems would be designed in accordance with applicable storm water BMPs and additional requirements that are specific to the Neuse River basin. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.7.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on stream channels and adjacent terrestrial vegetation.

3.8.7.3.2 Wetlands

Operations of the proposed NBAF would have no direct impacts on wetlands; however, increases in impervious surface area and storm water runoff have the potential for indirect wetland impacts. Increases in impervious surface area can increase storm water runoff and stream flow after storm events. Increases in stream flow volume and velocity can cause stream channel incision and/or widening, resulting in the loss of adjacent wetland vegetation and alteration of the hydrological regime within adjacent wetlands. The storm water management system would be designed in accordance with applicable storm water BMPs and specific Neuse River basin requirements. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.7.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on aquatic resources.

3.8.7.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct effects on aquatic communities; however, increases in impervious surface area and storm water runoff have the potential for indirect impacts on water quality and aquatic communities. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Storm water runoff from impervious surfaces such as buildings and parking lots can transport pollutants such as automotive fluids, fertilizer, pesticides, bacteria, and heavy metals into surface waters. Furthermore, rapid runoff from impervious surface areas increases the rate of flow in receiving streams. Increases in stream flow volume and velocity can cause stream channel erosion, resulting in increased turbidity and sedimentation downstream. The storm water management system would be designed in accordance with applicable storm water BMPs and specific Neuse River basin requirements. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.7.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on aquatic resources.

3.8.7.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on wildlife. In the event of a power outage, the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on wildlife.

3.8.7.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species. The accidental or intentional release of a pathogen would have the potential for adverse effects on mammals; however, no federally or state-listed mammals are known to occur in Granville County. Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Therefore, operations would not be likely to have adverse effects on listed species that occur in the vicinity of the proposed NBAF site. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on native wildlife and endangered species.

3.8.8 Texas Research Park Site

3.8.8.1 Affected Environment

3.8.8.1.1 Vegetation

Regional Vegetation

The Texas Research Park Site is located at the convergence of several ecoregions that include the South Texas Plains, the Edwards Plateau, and the Blackland Praires (TPWD 2005). Texas Parks and Wildlife has mapped the area as the Mesquite-Live Oak-Bluewood Parks vegetation type (McMahan et al. 1984). The Mesquite Live Oak-Bluewood Parks vegetation type is associated with the South Texas Plains ecoregion. Common species include mesquite (*Prosopis glandulosa*), live oak (*Quercus fusiformis*), bluewood (*Condalia hookeri*), huisache (*Acacia smallii*), whitebrush (*Aloysia gratissima*), spiny hackberry (*Celtis pallida*), and lotebush (*Ziziphus obtusifolia*).

Site Vegetation

Vegetation on the Texas Research Park Site is characterized by scrubby and sparse woody vegetation intermixed with areas that are dominated by herbaceous species. The eastern and southern portions of the Texas Research Park Site contain plant communities that are representative of this community type. These portions of the site are characterized by live oak mottes with little to moderate understory. Live oak trees occur primarily in large patches that are separated by grass-dominated breaks. Additional woody species that are present in both the understory and canopy of the mottes include mesquite, bluewood, Texas mountain laurel (*Sophora secundiflora*), and Texas persimmon (*Diospyros texana*). Cedar elms (*Ulmus crassifolia*) occur as solitary individuals along the edges of the mottes. Other common understory species that are associated with the mottes include Texas kidneywood (*Eysenhardtia texana*), prickly pear (*Opunita lindheimeri*), and Arkansas yucca (*Yucca arkansana*). Additional species include guayacan (*Guajacum angustifolium*), agarita (*Berneris trifoliolata*), twist-leaf yucca (*Yucca rupicola*), Lindheimer senna (*Senna lingheimeri*), croton (*Croton manoanthogynus*), frostweed (*Verbesina virginica*), velvet-leaf mallow (*Wissadula holosericea*), Indian mallow (*Abutilon incanum*), rough cocklebur (*Xanthium strumamium*), snakeweed (*Gutierrezia dracunculoides*), and snapdragon vine (*Maurandya antirrhiniflora*) and hackbery (*Celtis reticulata*) seedlings (SWCA 2007b).

Species that are common in the grass-dominated openings include Johnsongrass (*Sorghum halepense*), bristlegrass (*Setaria* sp.), Bermudagrass (*Cynodon dactylon*), sideoats grama (*Bouteloua curtipendula*), straggerler’s daisy (*Calyptocarpus vialis*), pricklypear, Arkansas yucca, and toothleaf goldeneye (*Viguiera dentate*). Additional species in the grass-dominated areas include hooded windmill grass (*Chloris cucullata*), little bluestem (*Schizacyyriu, scoparium*), lovegrass (*Eragrotis trichodes*), and deergrass (*Muhlenbergia rigens*).

The western and central portions of the Texas Research Park Site contain many of the same species; however, woody vegetation is very scrubby and herbaceous species are dominant. Scattered trees consist primarily of mesquite, Texas mountain laurel, and Texas persimmon. There are a few pecan trees (*Carya illinoensis*) along the western edge of the property, and a few scattered Ashe junipers (*Juniperus ashei*) and mature hackberry trees on the central portion of the site.

3.8.8.1.2 Wetlands

Based on a preliminary wetland review conducted by Terracon (2007d), it was determined that further wetland investigations were not warranted. The preliminary review included a walking survey of the site and review of NWI maps, USGS quadrangle maps, FEMA Flood Insurance Rate Maps, and recent aerial photography. This preliminary review did not identify any wetland indicators at the proposed NBAF site. USGS quadrangle maps show two unnamed intermittent tributaries of Lucas Creek that originate just outside the northern and southern boundaries of the proposed NBAF site. Since these features occur outside of the property boundary, their jurisdictional status was not investigated.

3.8.8.1.3 Aquatic Resources

No aquatic resources occur within the boundaries of the proposed NBAF site. However, USGS quadrangle maps show two unnamed intermittent tributaries of Lucas Creek that originate just outside the northern and southern boundaries of the proposed NBAF site. These tributaries drain southeast for approximately 1 mile before joining to form Lucas Creek. Lucas Creek drains southeast for approximately 6 miles and discharges to Leon Creek just before its confluence with the Medina River. Fish communities within Lucas Creek and its tributaries are probably limited by the empheral nature of the streams (i.e., lack of permanent water). Fish species that occur in the Medina River include central stoneroller (*Campostoma anomalum*), blacktail shiner (*Cyprinella venusta*), Texas shiner (*Notropis amabilis*), sand shiner (*Notropis stramineus*), mimic shiner (*Notropis volucellus*), gray redhorse (*Moxostoma congestum*), channel catfish (*Ictalurus punctatus*), western mosquitofish (*Gambusia affinis*), redbreast sunfish (*Lepomis auritus*), green sunfish (*Lepomis cyanellus*), warmouth (*Lepomis gulosus*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis mega loti*), guadalupe bass (*Micropterus treculi*), and Rio Grande cichlid (*Cichlasoma cyanoguttatum*) (Linum et al. 2002).

3.8.8.1.4 Terrestrial Wildlife

The proposed NBAF site contains habitats that are representative of natural communities in the region. Therefore, the site probably supports a diverse assemblage of wildlife species that are characteristic of these habitats. Mammals that may occur in the vivinity of the proposed NBAF site include Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus*), eastern cottontail (*Silvilagus floridanus*), black-tailed jackrabbit (*Lepus californicus*), hispid pocket mouse (*Chaetodipus hispidus*), fulvous harvest mouse (*Reithrodontomys fulvescens*), Texas mouse (*Peromyscus attwateri*), white-footed mouse (*Peromyscus leucopus*), hispid cotton rat (*Sigmodon hispidus*), coyote (*Canis latrans*), common gray fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), and white-tailed deer (*Odocoileus virginianus*).

Resident birds that may occur in the vivinity of the proposed NBAF site include turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), killdeer (*Charadrius vociferus*), rock dove (*Columba livia*), white-winged dove (*Zenaida asiatica*), mourning dove (*Zenaida macroura*), greater roadrunner (*Geococcyx californianus*), golden-fronted woodpecker (*Melanerpes aurifrons*), blue jay (*Cyanocitta cristata*), Carolina chickadee (*Poecile carolinensis*), tufted titmouse (*Baeolophus bicolor*), Carolina wren (*Thryothorus ludovicianus*), Bewick’s wren (*Thryomanes bewickii*), northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), northern cardinal (*Cardinalis cardinalis*), lark sparrow (*Chondestes grammacus*), eastern meadowlark (*Sturnella magna*), great-tailed grackle (*Quiscalus mexicanus*), brown-headed cowbird (*Molothrus ater*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*). Numerous additional summer resident and migratory species are also likely to occur in the vivinity of the proposed NBAF site.

Reptiles that may occur in the vivinity of the proposed NBAF site include green anole (*Anolis carolinensis*), Texas spotted whiptail (*Aspidoscelis gularis gularis*), Texas greater earless lizard (*Cophosaurus texanus texanus*), Texas alligator lizard (*Gerrhonotus infernalis*), prairie lizard (*Sceloporus consobrinus*), Texas spiny lizard (*Sceloporus olivaceus*), little brown skink (*Scincella lateralis*), short-lined skink (*Eumeces tetragrammus brevilineatus*), eastern yellow-bellied racer (*Coluber constrictor flaviventris*), Texas ratsnake (*Elaphe obsoleta*), western coachwhip (*Masticophis flagellum testaceus*), Texas patch-nosed snake (*Salvadora grahamiae lineata*), checkered gartersnake (*Thamnophis marcianus*), Texas toad (*Bufo speciosus*), Gulf Coast toad (*Bufo nebulifer*), and Couch’s spadefoot toad (*Scaphiopus couchii*).

3.8.8.1.5 Threatened and Endangered Species

A total of 15 federally listed species are known to occur in Bexar and Medina Counties (Table 3.8.8.1.5-1). Texas Parks and Wildlife Department (TPWD) occurrence records for Bexar and Medina Counties include an additional seven species that are listed by the state as endangered or threatened (Table 3.8.8.1.5-1). Species listed by the state as endangered or threatened are protected under Chapters 67 and 68 of the Texas Parks and Wildlife Code and Sections 65.171 – 65.176 of Title 31 of the Texas Administrative Code.

Federally Listed Species

Golden-cheeked Warbler

Typical nesting habitat for the golden-cheeked warbler consists of tall, dense, mature stands of Ashe juniper (blueberry cedar) mixed with broadleaf hardwoods. Warblers require a combination of mature Ashe juniper and hardwood trees in their nesting habitat, and nesting is dependent on the presence of Ashe juniper for fine bark strips used in nest construction. Generally, Ashe juniper trees required for nesting habitat are at least 15 feet tall with a trunk diameter of about 5 inches at 4 feet above the ground. Juniper trees must have shredding bark, at least near the base of the tree. Although the composition of woody vegetation varies within suitable warbler habitat, Ashe juniper is often the dominant species (Campbell 2003). The proposed NBAF site does not contain dense woody vegetation, and Ashe junipers are limited to a few individual trees along the edges of live oak mottes. In addition, other broad-leaved hardwoods that are preferred by this species do not occur on the site (SWCA 2007). Therefore, golden-cheeked warblers are not likely to nest or occur regularly at the proposed NBAF site.

Black-Capped Vireo

In south-central Texas, vireo habitat occurs on rocky limestone soils of the Edwards Plateau. Although Black-capped Vireo habitat throughout Texas is highly variable with regard to plant species, vegetation structure is similar. Vireos require broadleaf shrub vegetation with foliage reaching to ground level for nesting cover. They typically nest in shrublands and open woodlands with a patchy structure. Typical habitat is characterized by shrub vegetation extending from the ground to approximately 6 feet or more and covering approximately 30% to 60% or greater of the total area. In the Edwards Plateau Region, vireo habitat consists of scattered hardwoods with abundant low cover. The plant species composition appears to be less important than the presence of suitable broad-leaved shrubs with foliage to ground level and a mixture of open grassland and woody cover (Campbell 2003). The composition and structure of vegetation at the proposed NBAF site is not characteristic of typical vireo habitat in the region. The proposed NBAF site does not contain dense shrublands or extensive dense shrub patches (SWCA 2007). Therefore, black-capped vireos are not likely to nest or occur regularly at the proposed NBAF site.

Interior Least Tern

Nesting habitat for the Interior Least Tern includes bare or sparsely vegetated sand, shell, and gravel beaches; sandbars; islands; and salt flats associated with rivers and reservoirs. Feeding habitat consists of shallow water with an abundance of small fish. In Texas, Interior Least Terns nest at three reservoirs along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River. Wintering areas include counties that border the Gulf of Mexico. Bexar County is not within the known breeding or wintering range of this species (Campbell 2003). The proposed NBAF site does not contain suitable habitat for this species.

Table 3.8.8.1.5-1 — Protected Species of Bexar and Medina Counties (TPWD 2008)

Scientific Name	Common Name	Federal Status [a]	State Status [b]	Habitat	Habitat Present at NBAF Site
Dendroica chrysoparia	Golden-cheeked warbler	E	E	Mature woodlands with broad-leaved trees.	No
Vireo atricapilla	Black-capped vireo	E	E	Semi-open dense shrublands.	No
Sterna antillarum athalassos	Interior least tern	E	E	Barren areas near water such as sand bars in river beds, shores of large impoundments, and salt flats.	No
Charadrius melodus	Piping plover	E	E	Sparsely vegetated shallow wetlands and open beaches and sandbars adjacent to streams and impoundments.	No
Grus americana	Whooping crane	E	E	Remote wetlands with low, sparse vegetation in level to moderately rolling terrain.	No
Ursus americanus	Black bear	T/SA	T	Bottomland hardwoods and large tracts of inaccessible forest. Currently restricted to Trans Pecos mountain ranges.	No
Falco peregrinus anatum	American peregrine falcon	-	E	Wide range of habitats during migration.	Yes
Falco peregrinus tundrius	Arctic peregrine falcon	-	T	Wide range of habitats during migration.	Yes
Buteo albonotatus	Zone-tailed hawk	-	T	Arid open country, open deciduous or pine-oak woodland, wooded canyons and tree-lined rivers. Often near water.	No
Mycteria americana	Wood stork	-	T	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water.	No
Plegadis chihi	White-faced ibis	-	T	Freshwater marshes, sloughs, and irrigated rice fields.	No
Eurycea latitans complex	Cascade Caverns salamander	-	T	Springs and caves in Medina River.	No
Eurycea tridentifera	Comal blind salamander	-	T	Springs and waters of caves.	No
Circurina baronia	Robber baron cave meshweaver	E	-	Karst features.	No

Table 3.8.8.1.5-1 — Protected Species of Bexar and Medina Counties (TPWD 2008) (Continued)

Scientific Name	Common Name	Federal Status [a]	State Status [b]	Habitat	Habitat Present at NBAF Site
Cicurina madla	Madla cave meshweaver	E	-	Karst features.	No
Cicurina venii	Braken bat cave meshweaver	E	-	Karst features.	No
Cicurina vespera	Government Canyon bat cave meshweaver	E	-	Karst features.	No
Texella cokendolpheri	Cokendolpher cave harvestman	E	-	Karst features.	No
Batrisodes venylvi	Helotes mold beetle	E	-	Karst features.	No
Neoleptoneta microps	Government Canyon bat cave spider	E	-	Karst features.	No
Rhadine exilis	A ground beetle	E	-	Karst features.	No
Rhadine infernalis	A ground beetle	E	-	Karst features.	No

[a] Federal Status: E = Endangered, T/SA = Threatened due to similarity of appearance.
[b] State Status: E = Endangered, T = Threatened.

Piping Plover

In Texas, piping plovers occur as wintering birds during the non-breeding season. The wintering range in Texas includes counties that border the Gulf of Mexico. Piping Plovers in Texas prefer coastal habitats that include bare or very sparsely vegetated tidal mudflats, sand flats, or algal flats (Campbell 2003). The proposed NBAF site does not contain suitable habitat for this species.

Whooping Crane

In Texas, Whooping Cranes occur as wintering birds during the non-breeding season. Whooping Cranes use various habitats during their long migrations between northern Canada and the Texas coast. Croplands are used for feeding, and large wetlands are used for feeding and roosting. In Texas, principal wintering habitat consists of marshes and salt flats within the Aransas National Wildlife Refuge (Campbell 2003). The proposed NBAF site does not contain suitable habitat for this species.

Karst Invertebrates

A total of nine federally listed invertebrate species are known from karst features (limestone formations containing caves, sinks, fractures, and fissures) in north and northwest Bexar County. Karst areas occur where subsurface drainage leads to passages or other openings within the underground rock formations. Some of the features that develop in karst areas include cave openings, holes in rocks, cracks, fissures, and sinkholes. Habitat required by the nine karst invertebrate species consists of underground, honeycomb limestone. The USFWS has issued specific guidance for use in determining the presence or absence of karst features that may contain these species. This guidance stipulates that surveys must be conducted in accordance with Texas Commission on Environmental Quality (TCEQ) guidelines for geological assessments in the Edwards Aquifer recharge/transition zones (TCEQ 2004). A survey for karst features at the proposed NBAF site was conducted in accordance with these guidelines (SWCA 2007). This survey found no evidence of karst formations at the proposed NBAF site.

<u>State-Listed Species</u>

Suitable state-listed species habitats at the proposed NBAF site are limited to the Arctic and American peregrine falcons, which occur in a wide variety of habitats. Ocurrences of these species in the region consist of non-breeding, migratory birds that are not associated with a particular site or habitat type.

3.8.8.2 Construction Consequences

3.8.8.2.1 Vegetation

Construction of the proposed NBAF would clear approximately 30 acres of native vegetation at the Texas Research Park Site. Potential indirect effects during the construction process would include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, natural communities that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on vegetation. Off-site connected actions involving the installation of a new electrical and sewer lines would occur within existing, disturbed right-of-ways and, therefore, would not have any significant adverse effects on vegetation. Construction of an emergency exit off of Lambda Drive would affect the existing road right-of-way and, therefore, would not have any significant adverse effects on vegetation.

3.8.8.2.2 Wetlands

No wetlands occur on the site; consequently, construction would have no direct effect on wetlands. Potential indirect construction effects include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, streams that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on wetlands.

3.8.8.2.3 Aquatic Resources

No water bodies occur on the site; consequently, construction would have no direct effect on aquatic resources. Potential indirect construction effects include erosion and sedimentation. Removal of vegetation and soil disturbance within the proposed construction area would expose upland soils to potential erosion during storm events. Consequently, streams that are located downslope of the proposed construction area would be vulnerable to sedimentation impacts. However, erosion and sedimentation control measures would minimize the potential for adverse effects on aquatic resources.

3.8.8.2.4 Terrestrial Wildlife

Construction of the proposed NBAF would affect approximately 30 acres of native vegetation. Construction of the facility would have short-term and long-term effects on wildlife. Land-clearing activities, construction noise, and dust creation would likely discourage wildlife utilization of habitats that are adjacent to the proposed construction area; however, these effects would subside with completion of the project. Long-term effects would result from habitat loss and permanent displacement of wildlife within the 30-acre project area. However, given the abundance of similar habitats in the area, construction of the facility is not likely to have significant long-term impacts on local wildlife populations.

3.8.8.2.5 Threatened and Endangered Species

Informal Section 7 consultation has been initiated with the USFWS Austin Field Office. The Texas Research Park Site does not contain suitable habitat for federally listed species and, therefore, construction would have no effect on federally listed species. In the region containing the proposed NBAF site, the state-listed Arctic and American peregrine falcons are non-breeding, migratory species. Therefore neither of these species is likely to be adversely affected by construction.

3.8.8.3 Operation Consequences

3.8.8.3.1 Vegetation

Operation of the proposed NBAF would have no direct effects on native vegetation or natural communities. The proposed NBAF would create 270,000 square feet of impervious surface area, which would result in 22,500 cubic feet of runoff during a 1-inch rainfall event. Increases in storm water runoff have the potential to cause erosion within adjacent plant communities. However, the use of LID development techniques and BMPs would mitigate most of the potential for erosion-related effects. Storm water management systems would be designed in accordance with the applicable storm water BMPs. In addition to meeting the minimum state requirements for storm water management, the proposed NBAF would employ a LID approach that would minimize storm water runoff (see Section 3.7.8.3.2).

3.8.8.3.2 Wetlands

Operations at the proposed NBAF would have no direct impacts on wetlands; however, increases in impervious surface area and storm water runoff would have the potential for indirect impacts on streams that occur just outside of the property boundary. Increases in impervious surface area can increase storm water runoff and stream flow after storm events. Increases in stream flow volume and velocity can cause stream channel incision and/or widening, resulting in the loss of adjacent wetland vegetation and alteration of the hydrological regime within adjacent wetlands. The proposed NBAF storm water management system would be designed in accordance with applicable storm water BMPs. In addition, the proposed NBAF would employ an LID approach that would further minimize storm water runoff (see Section 3.7.4.3.2). The use of LID development techniques and BMPs would mitigate most of the potential adverse impacts on streams and wetlands.

3.8.8.3.3 Aquatic Resources

Operations at the proposed NBAF would have no direct impacts on aquatic communities; however, storm water runoff from the proposed NBAF may eventually be discharged to adjacent streams. Increases in impervious surface area and storm water runoff have the potential for indirect impacts on water quality and aquatic communities. Runoff from impervious surfaces such as buildings and parking lots can transport pollutants such as automotive fluids, fertilizer, pesticides, bacteria, and heavy metals into surface waters. Furthermore, rapid runoff from impervious surface areas can affect aquatic habitats by increasing the rate of flow in receiving streams (see Section 3.8.8.3.2). These effects can include increased turbidity and sedimentation downstream. The use of LID development techniques and BMPs would mitigate most of the potential adverse effects on streams. The proposed NBAF would have the potential for minor adverse effects associated with pollutant transport. Minor quantities of pollutants such as automobile engine fluids and fertilizers may avoid capture in the storm water management system and could end up in area streams. However, the measures described above would minimize the potential for these types of impacts.

3.8.8.3.4 Terrestrial Wildlife

Normal operations would have no direct effect on native wildlife. Routine operations would result in minimal noise emissions (see Section 3.5.3). Therefore, noise associated with normal operations would not have significant adverse impacts on wildlife. In the event of a power outage, the use of back-up generators could discourage wildlife utilization of habitats immediately adjacent to the proposed NBAF site. However, power outages would be rare, short-term events that would not have significant long-term effects on wildlife. The accidental or intentional release of a pathogen would have the potential for adverse effects on native mammals (especially ungulates). Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on wildlife.

3.8.8.3.5 Threatened and Endangered Species

Normal operations would have no direct effect on threatened and endangered species. The accidental or intentional release of a pathogen would have the potential for adverse effects on mammals; however, no extant populations of federally or state-listed mammals are known to occur in Bexar or Medina Counties. Other wildlife groups (birds, reptiles, amphibians, and fishes) are not susceptible to the diseases that could be studied at the proposed NBAF. Therefore, operations would not be likely to have adverse effects on listed species that occur in the vicinity of the proposed NBAF site. Section 3.8.9 provides a detailed evaluation of the potential effects of an accidental release on native wildlife and endangered species.

3.8.9 Potential Operational Consequences for Wildlife

This section evaluates the potential adverse effects associated with the accidental or intentional release of a pathogen that subsequently infects native or non-native wildlife populations. This section does not evaluate the risk or probability of a release. Section 3.14 evaluates the potential for accidental and intentional releases of pathogens from the proposed NBAF. The scope of this section is limited to potential post-release impacts on wildlife populations. Potential effects on human populations are addressed in Section 3.14. For purposes of evaluating the effects of a release, representative pathogens that bound the range of potential consequences were identified for detailed analysis. The representative pathogens selected for the detailed analysis include Foot and Mouth Disease (FMD) virus, Rift Valley fever (RVF) virus, and Nipah virus. The basis for the selection of these pathogens is presented in Section 3.14.

3.8.9.1 Foot and Mouth Disease (FMD)

The host range for FMD is limited to ungulates. FMD is known to be highly contagious, with the ability to spread through aerosol transmission, animal to animal contact, and mechanical transmission via humans, animals, and inanimate objects (e.g., automobiles). Mechanical transmission involves the transport of virus particles by an uninfected organism or object. FMD also has the potential for severe effects on ungulates, and most native ungulates are known to be susceptible to this disease.

The only known occurrence of FMD in native wildlife in the United States occurred in 1924 when the virus was transmitted from cattle to mule deer (Rhyan et al. 2006). During this outbreak, over 22,000 deer were killed in an effort to eliminate a potential reservoir for the virus (USGS 2007). A study at PIADC in 1974 involved the exposure of 10 white-tailed deer to the FMD virus (McVicar et al. 1974). All 10 deer developed FMD and 4 died as a result of contracting the disease. All of the surviving deer tested positive for the virus 5 weeks after the initial exposure, and one deer tested positive at 11 weeks. The 1974 study also documented transmission from deer to deer, deer to cattle, and cattle to deer. The preliminary results of a more recent study at PIADC indicate susceptibility of other native North American ungulates to the FMD virus (Rhyan et al. 2006). This study involved the exposure of mule deer, bison, pronghorn, elk, and domestic cattle to the FMD virus. Clinical disease occurred in all inoculated animals and in all contact-exposed bison, mule deer, and pronghorn. Clinical disease did not develop in contact-exposed elk or cattle exposed to inoculated elk. All species developed oral and foot lesions. Oral lesions were described as mild in pronghorn and elk and severe in bison, mule deer, and cattle. Foot lesions were described as mild in elk and severe in all other species. Intra- and interspecific transmission occurred between all species except elk. This study indicates that bison, mule deer, and pronghorn are susceptible to FMD and are capable of transmitting the disease. Furthermore, the researchers who conducted this study concluded that the severity of the symptoms suggests the potential for high mortality in the event of a natural outbreak.

Based on the studies described above, it is apparent that white-tailed deer, mule deer, bison, and pronghorn are susceptible to FMD and are capable of intra- and interspecific transmission. Although these studies demonstrate the potential for significant impacts in the event of an accidental release, there are many uncertainties regarding transmission in the wild. Transmission of FMD within populations of wild ungulates in their native habitats may not necessarily mimic the results of direct intentional exposure in a confined laboratory setting or transmission within a large, confined herd of cattle. Distribution patterns, social interactions, habitat preferences, and other behavioral characteristics of free-ranging ungulates are likely to have a significant influence on the severity of an FMD outbreak in wildlife populations.

To prevent a widespread outbreak among wildlife and domestic livestock, an accidental release of the FMD virus would require an immediate and intensive coordinated response by federal, state, and local agencies. Given the need for rapid response, DHS would have publicly accepted, site-specific Standard Operating Procedures (SOPs) and response plans in place prior to the initiation of research activities at the facility. DHS would develop its SOPs and response plans in coordination with the public, local government, and state and federal agencies. All interested parties would have the opportunity to review the draft response plan and provide comments that DHS would consider in formulating the final document. During this process, DHS would coordinate closely with the public, state wildlife agencies, the Animal and Plant Health Inspection Service (APHIS), the National Park Service (NPS), and the USFWS. In the event of an accidental release, DHS would have the advantage of on-site diagnostic capabilities; rapid detection; site-specific SOPs and response plans; and pre-coordinated, rapid-response capabilities by local, state, and federal agencies.

In the event of an accidental release, response measures could potentially include a wide range of actions depending on site conditions, characteristics of local wildlife populations, and the nature of the outbreak. Existing applicable response plans that are already in place include the APHIS FMD response plan (USDA 2007) and the NPS Interim FMD Response Plan (NPS 2001). These existing response plans provide insight into some of the measures that could potentially be employed to protect both livestock and wildlife in the event of an accidental release from the proposed NBAF. The APHIS FMD response plan calls for the establishment of various zones of response to control and eradicate an FMD outbreak. These zones include an infected zone, a buffer surveillance zone around the infected zone, a control zone, and an outer surveillance zone. The initial infected zone includes the infected locations and an area extending outward for a distance of at least 6.2 miles beyond the perimeter of the infected site. However, the boundaries of the infected zone may be modified as surveillance results become available and other factors become better defined. The buffer surveillance zone surrounds the infected zone. The buffer surveillance zone has no minimum size, and it may initially include the entire state or states that have infected premises or known contact premises. The surveillance zone separates the buffer surveillance zone from the FMD-free zone. The surveillance zone encompasses an area that is at least 6.2 miles from the outer boundary of the buffer surveillance zone.

Although the APHIS FMD response plan focuses primarily on domestic livestock, it does contain strategies that pertain specifically to wildlife. The APHIS FMD response plan calls for the implementation of an active surveillance program to detect FMD virus that may be present in the wildlife population within the infected zone. A veterinarian or wildlife biologist trained to recognize signs of FMD would investigate suspect cases in wildlife within 24 hours. Measures include the development of a wildlife management plan within 48 hours of the identification of an index case and an assessment of the risk that wildlife pose for the transmission of FMD virus within 7 days of confirmation of an index case. Assessment of the risks posed by wildlife would consider wildlife density and distribution, social organization, habitat, contact with domestic livestock, and the length of time that wildlife could have been exposed to the virus. This assessment would be used to determine the required level of management and control measures to be applied, potentially including population reduction (if ecologically sound) or procedures to prevent or limit wildlife and livestock interaction. If wildlife populations are determined to be infected with FMD virus or otherwise pose a risk to livestock, wildlife management principles would be used to reduce exposure of wildlife to livestock. If it is determined that wildlife populations are not infected or are not a risk for transmission of FMD virus to livestock, a wildlife management plan would be implemented to prevent wildlife populations from acting as mechanical vectors. The NPS Interim FMD Response Plan relies on APHIS to establish buffer zones. Other potential NPS response strategies are outlined in Table 3.8.9-1.

Ungulates that occur in the vicinity of each of the proposed NBAF sites are described in Sections 3.8.2.1.4, 3.8.3.1.4, 3.8.4.1.4, 3.8.5.1.4, 3.8.7.1.4, and 3.8.8.1.4. At all of the potential sites, white-tailed deer would have the highest potential for infection in an accidental release scenario. White-tailed deer are abundant and widespread in the vicinity of all of the sites (except on Plum Island, where no deer have been found since 2004 resulting from a removal program), and they commonly occur near urban and suburban areas. Other native species of wild ungulates are either rare or absent in the vicinity of the sites. However, white-tailed deer generally occur as solitary individuals or in small groups. Small group size and limited interaction between groups may potentially limit the spread of FMD within white-tailed deer populations. Differing habitat preferences and lack of interaction among ungulate species would likely limit interspecific transmission of FMD.

In a worst-case scenario, in which white-tailed deer are infected and become effective vectors for FMD, disease-induced mortality and the potential use of depopulation control measures could have an adverse effect on local populations. Although the local effects of mortality and depopulation measures could be significant, depopulated areas would be repopulated by deer from adjacent areas, and this process could be augmented through the translocation of deer from other areas. White-tailed deer are capable of rapid population growth, and populations are increasing throughout most of their range. Therefore, the effects of mortality or depopulation control measures would most likely be localized and short term. An accidental release of FMD could have a temporary adverse effect on white-tailed deer within a localized area, but is not likely to have long-term impacts on local or regional populations. None of the six states that contain the proposed NBAF sites have populations of federally or state-listed threatened or endangered ungulate species. Given the limited host range (i.e., ungulates) and the regional absence of listed ungulates at each of the sites, an accidental release of FMD is not likely to have adverse effects on federally or state-listed species.

Table 3.8.9-1 — National Park Service Potential Strategies and Considerations for FMD Response (NPS 2001)

Potential Strategy	Considerations
Providing education to workers, residents, and the public.	One of the most cost-effective, and most likely, strategies.
Identify the boundaries of and establish both an infected zone and a surveillance/movement control zone.	Actual zones will be established by APHIS. APHIS may be willing to negotiate some aspects of the zones, especially toward the outer boundaries.
Completely close all or part of either the infected zone or the surveillance/movement control zone.	Would have significant impacts on facilities, employees, and residents in the closed area(s).
Restrict human travel, activities, and uses in either the infected zone or the surveillance/movement control zone.	Could have significant impacts on the local tourist industry and retail trade. Restrictions may vary considerably, especially if used in conjunction with mitigating strategies such as decontamination.
Limiting the movement of animals in and around established zones.	Could have significant impacts on the local livestock industry. Limitations may vary considerably.
Require the decontamination of humans, equipment, and other property being moved out of the infected zone or the surveillance/movement control zone.	May be used as a mitigating strategy to reduce the need for travel restrictions. Will likely be required for incident personnel and equipment.
Exclude or eliminate livestock in either the infected zone or the surveillance/movement control zone.	Would have significant impacts on the local livestock industry. The most likely strategy to be used by APHIS.
Control feral and non-native species in either the infected zone or the surveillance/ movement control zone.	May or may not meet legal or policy requirements and management goals for parks or state wildlife management agencies. Consider bringing in expert assistance. Could be operationally difficult to carry out.
Vaccinate animals within the infected zone or the surveillance/movement control zone.	Research suggests that this strategy is not very effective, especially given the effort and expense that would be required to carry it out. Consider bringing in expert assistance. Operationally, this could be a very difficult strategy to carry out.
Reduce or depopulate infected wildlife in either the infected zone or the surveillance/movement control zone.	May or may not meet legal or policy requirements and management goals for parks or state wildlife management agencies. Could have significant impacts on wildlife populations for years to come. Research is inconclusive as to the efficacy of this strategy. Consider bringing in expert assistance. Consider other strategies or combinations of strategies to avoid this choice, if needed. Could be operationally difficult to carry out.

3.8.9.2 Rift Valley Fever (RVF)

RVF is a mosquito-born illness that was first reported in the Rift Valley region of Kenya in 1930. It has since spread as far north as Egypt and has crossed over to Saudi Arabia and Yemen (Kasari et al. 2008). Documented occurrences of RVF are currently limited to Africa and the Arabian Peninsula. The virus that causes RVF is transmitted primarily by infected mosquitoes. The virus is transmitted transovarially from female mosquitoes to their eggs, and the eggs that hatch give rise to a new generation of infected mosquitoes that perpetuate the outbreak. An exacerbating factor is the ability of mosquito eggs to remain viable through extended periods of desiccation. The virus can also be transmitted from an infected host to other mosquitoes, although the host must develop a very high level of viremia (presence of virus in blood) before transmission can occur (Kasari et al. 2008).

RVF is primarily a disease of domestic ungulate livestock (Britch et al. 2007); however, the disease has been reported in numerous species of mammals. The following summary of information regarding vertebrate host susceptibility to both experimental and natural RVF infection is drawn from Kasari et al. (2008).

Ungulates: Domestic sheep (*Ovis aires*), goats (*Capra aegagrus hircus*), and cattle (*Bos taurus* and *Bos indicus*) are highly susceptible to RVF. These domestic species exhibit severe clinical signs of disease that include abortion rates of 40% to 100% in sheep and goats, and abortion rates of 15% to 40% in cattle. Fatality rates are high in newborn sheep (90% to 100%), newborn goats (70% to 100%), and newborn cattle (20% to 100%). Adult fatality rates range from 20% to 70% in sheep, 10% to 70% in goats, and 10% to 30% in cattle. Domestic pigs (*Sus scrofa domestica*) are resistant or experience inapparent (i.e., asymptomatic) infection with brief viremia. Horses experience inapparent, transient (i.e., short-term) infection. Adult camels (*Camelus* spp.) experience inapparent infection, with the exception of a high risk for abortions. Newborn camels are at high risk for illness with some fatalities. Wild African buffalo (*Syncerus caffer*) experience transient viremia with possible abortions and a fatality rate of less than 10%. Waterbuck (*Kobus ellipsipyrmnus*) have tested positive for RVF antibodies; however, symptoms and fatality rates for this species are unknown.

Other Mammals: Newborn domestic puppies and kittens experience fatality rates of 60% to 100% and 70% to 100%, respectively. Juvenile and adult dogs (*Canus familiaris*) and cats (*Felis catus*) experience inapparent infection, although some females may abort. Domestic ferrets (*Mustela putorius furo*), mice, and field voles (*Microtis agrestis*) experience very high fatality rates. Several species of rats experienced highly variable fatality rates. The potential for high viremia in native African rats suggests that they may be a reservoir for the virus during interepizootic periods. The only native North American species to be evaluated is the gray squirrel (*Sciurus carolinensis*). The experimental infection of two gray squirrels resulted in the death of one of the animals, and squirrel blood was found to be infective to mice. Experimentally inoculated bats showed no clinical signs and had low amounts of virus antigen. Birds, reptiles, and amphibians have shown evidence of resistance to both natural and experimental RVF infection (Kasari et al. 2008).

Information regarding the susceptibility of native North American wildlife is essentially nonexistent, and the ability to infer potential effects based on phylogenetic relationships is very limited. Of the ungulate genera that occur in the vicinity of the proposed NBAF sites, none are represented in Africa and information regarding other North American mammals is limited to one species (gray squirrel) and two genera (ferrets and field voles). Domestic and wild African rodents generally have low resistance to RVF infection, and there is concern that wild African rodents may develop a level of viremia that is sufficient to infect other mosquitoes (Kasari et al. 2008). The susceptibility of domestic and wild African rodents suggests the possibility that North American rodents (Rodentia) could be susceptible. In addition, the high susceptibility of domestic ferrets suggests the possibility that North American members of the weasel family (Mustelidae) could be susceptible. Limited experimental data suggest that bats, birds, reptiles, and amphibians are resistant to RVF infection.

RVF is transmitted primarily by mosquitoes, although the virus can be transmitted by other biting arthropods. Experiments have documented RVF vector capability among North American arthropods of the genera *Aedes*, *Anopheles*, and *Culex*, and the range of capable vector species encompasses the entire continental United

States (Kasari 2008). The virus that causes RVF is transmitted transovarially from infected mosquitoes to their eggs, thus leading to new generations of infected vectors. In addition, the eggs of some mosquito species can remain dormant through lengthy dry spells, only to hatch and emerge with the onset of rainfall. Transovarial infection and egg dormancy are important, since these factors eliminate the requirement for continuous host-vector-host transmission. Furthermore, some mosquitoes overwinter as adults, thus prolonging the period of potential transmissibility. Another concern is the short incubation and viremia phase of infection, which may allow infected animals to go undetected (Britch et al. 2007). The ability of RVF to persist in the absence of continuous host-vector-host transmission, combined with the wide range of hosts and the short detection window for infected individuals, could limit the effectiveness of eradication efforts. Therefore, there is concern that an outbreak could lead to the permanent establishment of RVF in North America.

Animal to animal contact transmission is not significant, and the virus is not readily transmitted among animals through aerosols (Kasari et al. 2008). Therefore, the initiation of an outbreak would require the accidental release of an infected vector (i.e., mosquito). If the infected mosquito finds a suitable host on which to feed and survives long enough to develop viable eggs and find suitable reproductive habitat, then an outbreak could occur through transovarial transmission of the virus that causes RVF. Assuming that the release is detected, the infected mosquito would also have to survive the aerial application of insecticides. If the initial host is infected with RVF and the host animal develops a sufficient level of viremia, then an outbreak could occur through the infection of other adult mosquitoes that subsequently feed on the initial host. The use of sterile mosquitoes in the laboratory would eliminate the potential for the initiation of an outbreak through transovarial transmission; however, an outbreak could still result from host infection. RVF infection of the initial host would establish the potential for infection of numerous adult mosquitoes, which could subsequently perpetuate the outbreak through transovarial transmission and/or the infection of additional host animals. However, it should be noted that viremia in the host must reach a very high threshold level before transmission of the virus from host to mosquito can occur (Kasari et al. 2008).

In contrast to FMD, the United States does not currently have an effective national action plan or the capability for national response in the event of an RVF outbreak (Britch et al. 2007). In order to prevent a widespread outbreak among wildlife and domestic livestock, an accidental release of vector-borne RVF would require an immediate and intensive coordinated response by federal, state, and local agencies. Given the need for rapid response, DHS would have publicly accepted, site-specific SOPs and response plans in place prior to the initiation of research activities at the proposed NBAF. RVF SOPs and response plans would likely include strategies that are similar to those described above for FMD. However, the RVF response plan would also include a mosquito control action plan. The mosquito control action plan would most likely include the aerial application of insecticides within the infection zone. Due to the ability of RVF to persist in infected mosquito eggs, repeated aerial spraying may be required over an extended time period.

The susceptibility of some domestic and wild African ungulates suggests the possibility that some North American ungulates could be susceptible to RVF infection. Among ungulates that occur in the vicinity of the proposed NBAF sites, white-tailed deer would have the highest potential for exposure in an accidental release scenario. White-tailed deer are abundant and widespread in the vicinity of all of the proposed NBAF sites, and they commonly occur near urban and suburban areas. Other native species of wild ungulates are either rare or absent in the vicinity of the proposed NBAF sites. The low resistance of some domestic and wild African rodents to RVF infection (Kasari et al. 2008) suggests the possibility that wild North American rodents could also be susceptible to infection. In addition, the low resistance of domestic ferrets (Kasari et al. 2008) suggests the possibility that native North American members of the weasel family could be susceptible to infection. However, it should be noted that these inferred potential effects are based on a very limited amount of data involving experimental inoculations. Additional data are needed before definitive conclusions can be drawn regarding the susceptibility of North American mammal taxa and the potential for RVF to spread horizontally through wildlife populations.

In a worst-case scenario, in which native wildlife species are infected and become effective reservoirs for RVF, disease-induced mortality and the potential use of depopulation control measures could have adverse effects on wildlife populations. Effects would vary depending on the extent of the outbreak and the species affected. If an outbreak is contained in close proximity to the center of origin, adverse effects on wildlife populations would most likely be localized and short term. The taxa that are most likely to be affected (i.e., white-tailed deer, rodents, and weasels) generally have high reproductive capacity. Following cessation of a contained outbreak, it is likely that the affected areas would be rapidly repopulated by animals from adjacent unaffected areas. The effects of an uncontained outbreak leading to the long-term establishment of RVF over a wide area are unknown. In Africa, clinical disease, widespread abortions, and death have not been definitively determined in wildlife. Under a worst-case scenario, in which RVF spreads horizontally through multiple counties or states, disease-induced mortality and the potential use of depopulation control measures could potentially result in significant long-term adverse effects on wild mammal populations. However, it must be reiterated that additional data is needed before definitive conclusions can be drawn regarding the susceptibility of North American taxa and the potential for RVF to spread horizontally through wildlife populations. These potential adverse effects must be weighed against the extremely low probability of an accidental release (see Section 3.14) and the potential wildlife benefits (see Section 3.8.9.4) that would be associated with the proposed NBAF.

Of the seven counties in which the proposed NBAF sites are located, none have populations of federally or state-listed ungulate species. Therefore, a contained outbreak would not affect any listed ungulate species. Occurrence records of other listed mammals in the seven counties include the federally endangered gray bat in Clarke County, Georgia; the state-threatened black bear in Medina County, Texas; and state-threatened eastern spotted skunk in Riley County, Kansas. The resistance of experimentally inoculated bats (Kasari et al. 2008) suggests that the gray bat would not be adversely affected by an accidental release of RVF. In Texas, the black bear has become restricted to the mountain ranges found within the Trans Pecos region in the extreme western portion of the state (Parker et al. 2003). Therefore, the black bear would not be adversely affected by a contained outbreak. Due to the absence of suitable habitat, the eastern spotted skunk is not likely to occur in the immediate vicinity of the Manhattan Campus Site; however, potential habitat does occur within a few miles of the site. No information is available regarding the susceptibility of members of the skunk family (Mephitidae) and, therefore, the potential for adverse effects on the eastern spotted skunk is unknown. Due to the absence of susceptible federally listed species in all of the counties containing the proposed NBAF sites, a contained outbreak would have no adverse effects on federally listed species, regardless of the point of origin. The eastern spotted skunk in Riley County is the only state-listed mammal that could potentially be exposed to RVF under a contained outbreak scenario; however, the potential for adverse effects on this species is unknown.

The effects of an uncontained outbreak leading to the long-term establishment of RVF over a wide area are unknown. A widespread outbreak originating from any of the proposed NBAF sites could affect multiple states and expose numerous federally and/or state-listed mammal species to RVF. In the absence of regional data pertaining to the susceptibility of specific taxa, it must be assumed that a widespread RVF outbreak could potentially have adverse effects on listed mammals, regardless of the point of origin. As previously stated, these potential adverse effects must be weighed against the extremely low probability of an accidental release (see Section 3.14) and the potential wildlife benefits (see Section 3.8.9.4) that would be associated with the proposed NBAF.

3.8.9.3 Nipah Virus

Compared to FMD and RVF, there have been relatively few outbreaks of disease associated with Nipah virus. Nipah virus was first reported from peninsular Malaysia in 1998 and 1999. An additional outbreak occurred in Singapore in 1999, and outbreaks were subsequently confirmed in Bangladesh in 2004 and 2005. The virus causes severe respiratory illness in pigs and severe encephalitis in humans. Transmission to humans occurs through direct contact with infected pigs, contact with bodily fluids, or aerosolization of respiratory or urinary fluids. In addition, the 2005 outbreak in Bangladesh was apparently initiated by human consumption of contaminated palm fruit juice (Center for Food Security and Public Health 2005).

Bats of the genus *Pteropus* (flying foxes and fruit bats) are the natural carrier of Nipah virus, although the bats themselves are not affected. The virus has been found in bat urine and partially eaten fruit (Center for Food Security and Public Health 2005). The world distribution of flying foxes and fruit bats extends from the sub-Himalayan region of Pakistan and India through Southeast Asia, the Philippines, Indonesia, New Guinea, the Southwest Pacific Islands, and Australia. Their range also encompasses the western Indian Ocean islands of Mauritius, Madagascar, and Comoro. They are not found on mainland Africa, Europe, Asia, or North and South America (Field et al. 2001). All of the reported outbreaks have occurred within the range of flying foxes and fruit bats.

There are few reports of infections in animals other than domestic pigs. During the first outbreak in Malaysia, Nipah virus was reportedly transmitted to domestic cats, dogs, and horses. Experimental studies subsequently confirmed the susceptibility of domestic cats. During the viremic phase, experimentally infected cats shed Nipah virus through the nasopharynx and in urine. One of the two cats recovered with a high level of neutralizing antibodies. Infected cats reportedly exhibit fever, depression, and severe respiratory signs. Of 32 cats that were captured in the immediate vicinity of a *Pteropus* bat colony, none had detectable levels of antibodies to Nipah virus (Epstein et al. 2006). Dogs reportedly exhibit distemper-like signs, with fever, respiratory distress, and nasal and ocular discharge (Center for Food Security and Public Health 2005). The serological examination of over 3,000 horses in Malaysia identified neutralizing antibodies to Nipah virus in two animals, and a third horse with a history of neurological symptoms tested positive for Nipah virus infection. All three horses came from a single property that was surrounded by infected pig farms. Field et al. (2001) sampled peridomestic small mammals and birds from disease-endemic areas of Malaysia. Species tested included domestic dog, house rat (*Rattus rattus*), other old-world rats (*Rattus* spp.), house shrew (*Suncus murinus*), jungle fowl (*Gallus gallus*), pigeons (*Columba livia*), domestic chickens, and domestic ducks. All rats, shrews, and birds tested negative for the presence of antibodies. Out of 465 dogs that were tested, 72 had antibodies to Nipah virus. Subsequent opportunistic dog testing near the end of the Malaysian outbreak found antibodies in 46 of 92 dogs that were tested. Intensive transect sampling following the cessation of the outbreak found only 4 antibody-positive dogs out of 249 animals tested. Although dogs readily acquired infection during close association with pigs, the relatively low prevalence of antibodies and restriction of infected dogs within a 3.1-mile radius of the endemic area indicates that Nipah virus does not spread horizontally within dog populations (Field et al. 2001). Additional testing of wild boar, dogs used to hunt wild boar, and rodents from infected pig farms found no evidence of antibodies (Yob et al. 2006).

Fruit bats and flying foxes do not occur in North America, and these species are the only known reservoir for the Nipah virus. Therefore, it is unlikely that an accidental release from the proposed NBAF would result in a sustained outbreak of disease. Based on the limited data described above, the disease is apparently spread through close contact with infected pigs and has little or no capability for horizontal transmission among wildlife populations. Therefore, an accidental release of Nipah virus would be unlikely to have significant adverse effects on native wildlife or listed species.

3.8.9.4 Beneficial Effects

Although there are many uncertainties regarding transmission in the wild, available data clearly demonstrate that additional research is needed to determine the potential adverse effects of foreign animal diseases on North American wildlife. Available data also demonstrate the need for effective wildlife vaccines for diseases such as FMD, RVF, and Nipah virus. Compared to an accidental release from the proposed NBAF, an unintentional foreign introduction, or an intentional introduction of a foreign animal disease as an agent of bioterror, it might go undetected for a much longer period of time. Response mobilization would take longer, thus further delaying containment of the outbreak. Delays in detection and response would increase the potential for a widespread outbreak among wildlife populations. In the event of a widespread outbreak, knowledge of potentially affected species and the availability of effective vaccines for wildlife could prevent devastating impacts on wildlife populations and could be the only means of preventing the extirpation of endangered or otherwise vulnerable native species. Therefore, the proposed NBAF has the potential to provide significant positive benefits for native wildlife.