Table 3.3-6
SCDNR Coastal Plain Water Well Records in the Study Area

Well Number	Elevation (ft)	Owner	Use	Depth (ft)	Year Drilled
CHN-2	12	Charleston Naval Shipyard	Industrial	2026	1943
CHN-49	30	Raybestos-Manhattan	Industrial	440	1951
CHN-136	15	Exxon Co.	Unused	504	1960
CHN-137	15	Exxon Co.	Abandoned	510	1961
CHN-460	30	J. T. Bunn	Unused	325	1965
CHN-476	20	U. S. Naval Shipyard	Unused	315	0
CHN-582	0	W. R. Grace Co.	Industrial	240	0
CHN-583	0	W. R. Grace Co.	Industrial	220	0
CHN-607	12	Macalloy Corp.	Industrial	394	1987
CHN-610	10	Macalloy Corp.	Industrial	399	1987

Source: SCDNR 2007. Disclaimer: The SCDNR does not guarantee the accuracy of this well information. In many cases, our well information comes from old records, and as a result, some of the information, such as the well owner or the well use, may no longer be accurate. This is in no way a complete inventory of all the water wells in the South Carolina Coastal Plain.

Groundwater quality within the shallow aquifer is vulnerable to contamination throughout most of the Santee Basin and varies greatly in the sub-basin. Contaminants from fertilizers, pesticides, and spills or leaks at or near the land surface can move quickly to the water table, especially in areas where sandy soils offer little opportunity for filtration or degradation of pollutants. Under the Project site, groundwater quality within the surficial aquifer has been affected by contaminants associated with anthropogenic activities in the area (see Section 3.15 – Hazardous, Toxic, and Radioactive Waste); however, protection of deeper aquifers is provided by the Cooper Formation, a geological formation that functions as an effective confining unit, inhibiting downward movement of groundwater (Park 1985).

Statewide ambient groundwater monitoring activities are currently suspended (SCDHEC 2013b, 2014c, 2015a); however, site-specific groundwater monitoring is ongoing at potentially contaminated sites. These efforts are addressed in more detail in Section 4.15 (Hazardous, Toxic, and Radioactive Waste).

3.4 VEGETATION AND WILDLIFE

3.4.1 Introduction

The affected environment for vegetation and wildlife includes numerous aquatic and terrestrial land cover classes, vegetation communities, and wildlife species. Species listed as threatened, endangered,

or candidate by the USFWS pursuant to the ESA of 1973, as amended[52], as well as species associated with Essential Fish Habitat (EFH), are addressed in Sections 3.6 and 3.7, respectively.

The Vegetation and Wildlife study area encompasses Alternative 1 (Proposed Project) and the six Alternatives, which includes the River Center project site, and covers any related activities and adjacent areas that extend west to Spruill Avenue and I-26 (Figure 3.4-1).

3.4.2 Vegetation

The study area is located entirely in the Sea Islands/Coastal Marsh (Level IV) ecoregion (Griffith et al. 2002). The Sea Islands/Coastal Marsh ecoregion contains the lowest elevations in South Carolina and is a highly dynamic environment affected by ocean wave, wind, and river action. Quaternary unconsolidated sand, silt, and clay have been laid down as beach, dune, barrier beach, saline marsh, terrace, and nearshore marine deposits. Mostly sandy soils are found on the barrier islands, while organic and clayey soils often occur in the freshwater, brackish, and salt marsh areas. Maritime forests of live oak (*Quercus virginiana*), eastern red cedar (*Juniperus virginiana*), slash pine (*Pinus elliottii*), and cabbage palmetto (*Sabal palmetto*) grow on parts of the barrier islands, and various species of cordgrass (*Spartina* spp.), saltgrass (*Distichlis* spp.), and rushes (*Juncus* spp.) are dominant in the marshes. The dunes are dominated by sea oats (*Uniola paniculata*), which play a primary role in stabilizing the dunes. Other dune plants include bayberry (*Myrica* spp.), dogfennel (*Eupatorium capillifolium*), bitter panic grass (*Panicum amarum*), broomsedge (*Andropogon virginicus*), wax myrtle (*Morella cerifera*), and Spanish bayonet (*Yucca aloifolia*) (Griffith et al. 2002).

The island, marsh, and estuary systems of this ecoregion form an interrelated ecological web, with processes and functions valuable to humans, but also sensitive to human alterations and pollution. The coastal marshes, tidal creeks, and estuaries are important nursery areas for fish, crabs, shrimp, and other marine species. Charleston Harbor is one of the largest container ship ports on the East Coast, and it also contains one of the largest commercial shrimp fisheries in the state, raising concerns about the health of the estuary, coastal marshes and associated flora and fauna. The Sea Islands/ Coastal Marsh ecoregion has a long history of human alterations (Griffith et al. 2002).

Four vegetative land cover classes occur in the study area based on the USGS Gap Analysis Program (GAP) Analysis of South Carolina (USGS 2001) (see Table 3.4-1) (Figure 3.4-2). The GAP analysis is a raster data layer with a resolution of approximately 900 square meters per pixel. The goals of the classification system were to map the vegetation to the dominant species level and to use this data to analyze the protection level, biodiversity and habitats of various tracts of lands. The system was not meant to identify wetlands or classify vegetation below the dominant crown cover. As a result, there may be wetland or other land cover types that are present in small areal extents in the study area, but not present in the GAP data. The GAP classification system includes 28 land cover classes, four of

[52] 16 U.S.C. 1536

which are found in the study area. Two of the land cover classes are natural communities and two are land use/non-natural communities that have been modified through the actions of humans. Each class is briefly described below.

Table 3.4-1
Original GAP Land Cover Classes Within the Study Area

Class Number	Class Name	Class Description	Acreage within the Study Area
Natural Communities			
2	Marine Water	Salt or estuarine water	15
3	Marsh	High and low marsh, non-forested wetland	108
Land Use/Non-Natural Communities			
24	Urban Development (high intensity)	Industrial development, central business district, large highways	1,068
25	Urban Development (low intensity)	Residential development	118
		Total	**1,309**

Source: Atkins 2016, USGS 2001.

3.4.2.1 Vegetation Classes

3.4.2.1.1 Marsh

Brackish Marsh—Brackish marsh is an estuarine plant community that is found on the edges of estuaries, generally upland from adjacent salt marshes; drained by dendritic or sinuous tidal creeks. These communities often are recognized by a nearly dominant growth of blackneedle rush (*Juncus roemerianus*), with a few other predominant species of grasses and sedges. Other species common to this community include big cordgrass (*Spartina cynosuroides*), saltmeadow cordgrass (*S. patens*), saltmeadow bulrush (*Scirpus robustus*), Olney's bulrush (*Scirpus americana*), dwarf spikerush (*Eleocharis parvula*), arrow-grass (*Triglochin striata*), coastal saltgrass (*Distichlis spicata*), annual beard grass (*Polypogon monspeliensis*), seashore dropseed (*Sporobolus virginicus*), annual wildrice (*Zizania aquatica*), water millet (*Ziazniopsis miliacea*), sawgrass (*Cladium jamaicense*), fourangle flatsedge (*Cyperus tetragonus*), narrowleaf cattail (*Typha angustifolia*), tidal-marsh amaranth (*Amaranthus cannabinus*), eastern grasswort (*Lilaeopsis chinensis*), Carolina sealavender (*Limonium carolinianum*), and seaside goldenrod (*Solidago sempervirens*) (Nelson 1986). Brackish marshes are associated upstream from salt marsh, salt shrub thicket, and intertidal mud/sand flats.

Salt Marsh—Salt marsh is an estuarine plant community that occurs on regularly flooded flat areas dominated by salt-tolerant grasses. This community is often totally dominated by cordgrass species such as smooth cordgrass (*S. alterniflora*). Saltmeadow cordgrass and coastal saltgrass are commonly

associated with the smooth cordgrass (Nelson 1986). Salt marshes are regularly flooded and are associated downstream from intertidal mud/sand flats and upstream from brackish marshes.

Intertidal Mud/Sand Flat—Intertidal mud/sand flats are marine and estuarine communities that form on unconsolidated mud, sand, sediment, and silt separated from or continuous with permanently immersed land masses. Intertidal mud/sand flats generally are not vegetated, because there is not enough time during exposure to allow for rooting of seeds and/or vegetative fragments. These areas are often ephemeral sites that are commonly just below the water surface while the tide is in, and are usually subject to some wave action (Nelson 1986). Intertidal mud/sand flats are often at the edges of salt marshes in estuaries.

3.4.2.1.2 Marine Water

Marine water plant community occurs in the subtidal zone and is constantly inundated. No sea-water dilution ever occurs. The bottom is composed of consolidated or unconsolidated sand, mud, sediments, shells, shell fragments, and other non-living detritus. Benthic macrophytes may occur, but at a depth that precludes the development of extensive plant and/or animal colonies (Nelson 1986).

3.4.2.1.3 Urban Development (High Intensity and Low Intensity)

Developed areas are a land use type that lacks natural vegetation communities; these are barren or planted and maintained grass in lawns, golf courses, or industrial sites. Developed lands also include areas of low-intensity residential units, such as single-family house lots, paved roadways, sidewalks, and city parks. Industrial sites include both historical and current operations, such as roads, parking lots, railways, rail yards, overburden stockpiles, shipyards, industrial buildings, and warehouses.

3.4.2.2 Noxious Plants

Noxious plants have been observed within the study area. According to surveys conducted in July 2014 and January 2016, 16 noxious plants, including 2 introduced tree species, occur within the study area as listed in Table 3.4-2. An additional plant, cogongrass, has been observed within the study area (personal communication, Stu Healy, CDM Smith, June 24, 2016). Such species can dominate or displace native vegetation and can occur in nearly single-species colonies or stands that present a lowered structural diversity and poor wildlife habitat.

Table 3.4-2
Noxious Plants within the Study Area

Common Name	Scientific Name	State Noxious Status	Threat Category
Trees			
Tree of Heaven	*Ailanthus altissima*	None	Severe Threat[1]
Mimosa	*Albizia julibrissin*	None	Significant Threat[2]
Shrubs			
Chinese privet	*Ligustrum sinense*	None	Severe Threat
Multiflora rose	*Rosa multiflora*	None	Significant Threat
Nandina	*Nandina domestica*	None	Alert[3]
Vines			
English ivy	*Hedera helix*	None	Severe Threat
Japanese honeysuckle	*Lonicera japonica*	None	Severe Threat
Kudzu	*Pueraria montana* var. *lobata*	None	Severe Threat
Chinese wisteria	*Wisteria sinensis*	None	Severe Threat
Common periwinkle	*Vinca minor*	None	Significant Threat
Porcelain berry	*Ampelopsis brevipedunculata*	None	Not designated
Herbs and Grasses			
Chinese lespedeza	*Lespedeza cuneata*	None	Severe Threat
Common reed	*Phragmites australis*	ILAP, PP[4]	Severe Threat
Cogongrass	*Imperata cylindrica*	PP	Severe Threat
Parrotfeather	*Myriophyllum aquaticum*	None	Not designated
Alligatorweed	*Alternanthera philoxeroides*	ILAP, PP	Not designated
Creeping liriope	*Liriope spicata*	None	Alert

[1] Severe Threat—Invasive exotic plant species that are known to pose a severe threat to the composition, structure, or function of natural areas in the State of South Carolina.

[2] Significant Threat—Invasive exotic plant species that are established in natural areas, spreading independently, and causing significant damage to natural communities; but may not be as widespread or difficult to manage as "Severe Threat" species.

[3] Alert—Exotic plant species known to pose a severe threat to natural areas in adjacent states or in the southeast with a limited distribution in South Carolina or not currently recorded here. More distribution information is needed for most of these species.

[4] ILAP—Invasive aquatic plant; PP—Plant pest.

Source: SCEPPC 2014.

3.4.3 Wildlife

Many wildlife species occupy the vegetation communities of the study area. Field studies of the Vegetation and Wildlife Resources Study Area have documented the presence of wildlife, both

terrestrial and aquatic, that are typical to the Sea Islands/Coastal Marsh ecoregion. This section describes the terrestrial and aquatic wildlife known to occur within the study area.

3.4.3.1 Terrestrial

Bird species were observed and recorded during site visits of the study area in July 2014 and January 2016. The dominant species observed were the Carolina wren (*Thryothorus ludovicianus),* laughing gull *(Leucophaeus atricilla)*, and American crow (*Scorvus brachyrhynchos*). The other species observed included the blue jay (*Cyanocitta cristata*), great blue heron (*Ardea herodius*), northern cardinal (*Cardinalis cardinalis*), snowy egret (*Egretta thula*), and white ibis (*Eudocimus albus*), as well as two raptor species: the red-shouldered hawk (*Buteo lineatus*) and the turkey vulture (*Cathartes aura*). No active bird nests were observed during either of the site visits.

In general, diversity and densities of birds tend to be low in newly abandoned, developed land and increase as succession proceeds. Common summer residents to the study area include the northern cardinal, northern mockingbird (*Mimus polyglottos*), mourning dove (*Zenaida macroura*), buntings (*Passerina* spp.), and sparrows (Passeridae). Other species typical to this area include the common yellowthroat (*Geothlypis trichas*), brown thrasher (*Toxostoma rufum*), eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), and common grackle (*Quiscalus quiscula*). Other raptors known to inhabit the study area include the red-tailed hawk (*Buteo jamaicensis*) and barred owl (*Strix varia*), which feed primarily on small animals.

Terrestrial habitats (i.e., urban development) make up the majority of the study area and contain fewer unique niches than the aquatic habitats described below, and therefore, have a less diverse mammalian community. Typical mammals common to the study area include marsupials, insectivores, bats, rabbits, rodents, carnivores, and hooved mammals. Many mammals are widely distributed and can be found in a variety of habitats; however, they often tend to exhibit a preference for a specific habitat. Mammal species were observed and recorded during site visits of the study area in July 2014 and January 2016. The dominant species observed were white-tailed deer (*Odocoileus virginianus*), beaver (*Castor canadensis*), raccoon (*Proycon lotor*), opossum (*Didelphis marsupialis*), eastern gray squirrel (*Sciurus carolinensis*), and eastern cottontail rabbit (*Sylvilagus flordanus*).

Other mammals known to inhabitat the study area include the old field mouse (*Peromyscus polionotus*) and striped skunk (*Mephitis mephitis*). Most of the upland areas have been converted to open fields and/or residential and commercial disturbed land. Areas where cleared fields are interspersed with wooded lots provide habitat for a number of mammalian species, such as eastern cottontail rabbit, old field mouse, eastern harvest mouse (*Reithrodontomys megalotis*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), and white-tailed deer.

Typical reptiles that are known to occur within the study area include the eastern box turtle (*Terrapene carolina*), green anoles (*Anole carolinensis*), six-lined racerunner (*Cnemidophorus* [*Aspidoscelis*] *sexlineatus*), black racer (*Coluber constrictor*), and eastern garter snake (*Thamnophis sirtalis*). The reptile species observed in the Vegetation and Wildlife study area during site visits in July 2014 and January 2016 include the yellow-bellied slider (*Trachemys scripta scripta*) and the five-lined skink (*Eumeces* [*Plestiodon*] *fasciatus*).

3.4.3.2 Aquatic

The aquatic ecosystems of the study area (i.e., marshes and marine water) provide habitat to a wide array of aquatic species. Crustaceans are abundant throughout the tidal salt marsh found within the study area. The most abundant crustaceans observed during August 2014 field surveys include the blue crab (*Callinectes sapidus*), fiddler crab (*Uca pugnax* and *Uca pugilator*), and barnacle (*Chthamalus stellatus*). Other crustaceans known to occur within the study area include stone crab (*Menippe mercenaria*), crayfish species (*Cambarus* spp.) and penaeid shrimp, such as grass shrimp (*Palaemonetes vulgaris*, *P. pugio*), brown shrimp *(Farfantepenaeus aztecus*), and white shrimp (*Litopenaeus setiferus*). The federally managed species, such as brown and white shrimp, that may use EFH within the study area is described further in Section 3.7 – Essential Fish Habitat.

The shrimp fishery is the most commercially important fishery in South Carolina, followed by fisheries for blue crab and oysters. Blue crabs are harvested commercially and recreationally in South Carolina, with crab traps, or pots as the primary method used in their harvesting. Grass shrimp have no commercial or recreational value as food for humans, but the brown and white shrimp are both commercially viable species in South Carolina. A serious threat to the penaeid shrimp population is loss of nursery areas due to filling, dredging, and draining of critical marsh habitat. Mollusks, such as the eastern oyster (*Crassostrea virginica*) and hard clams (*Mercenaria mercenaria*), are most abundant in the intertidal brackish waters of the study area. The eastern oyster is also an important commercially viable species to South Carolina.

Although no amphibians were observed within the study area during site visits in July 2014 and January 2016, numerous amphibian species are common to the Sea Islands/Coastal Marsh ecoregion. The study area contains habitat for several amphibian species including the Southern toad (*Bufo* [*Anaxyrus*] *terrestris*), bullfrog (*Rana* [*Litobates*] *catesbeiana*), and marbled salamander (*Ambystoma opacum*). The aquatic reptile species known to occur within the study area are the American alligator (*Alligator mississippiensis*) and diamondback terrapin (*Malaclemys terrapin*) (personal communication, Stu Healy, CDM Smith, June 24, 2016), which are a moderate and high, respectively, conservation priority species in South Carolina (SCDNR 2015a).

The fish communities of the study area consist of diverse assemblages of estuarine and coastal marine species. Species assemblages are generally associated with physical characteristics in the

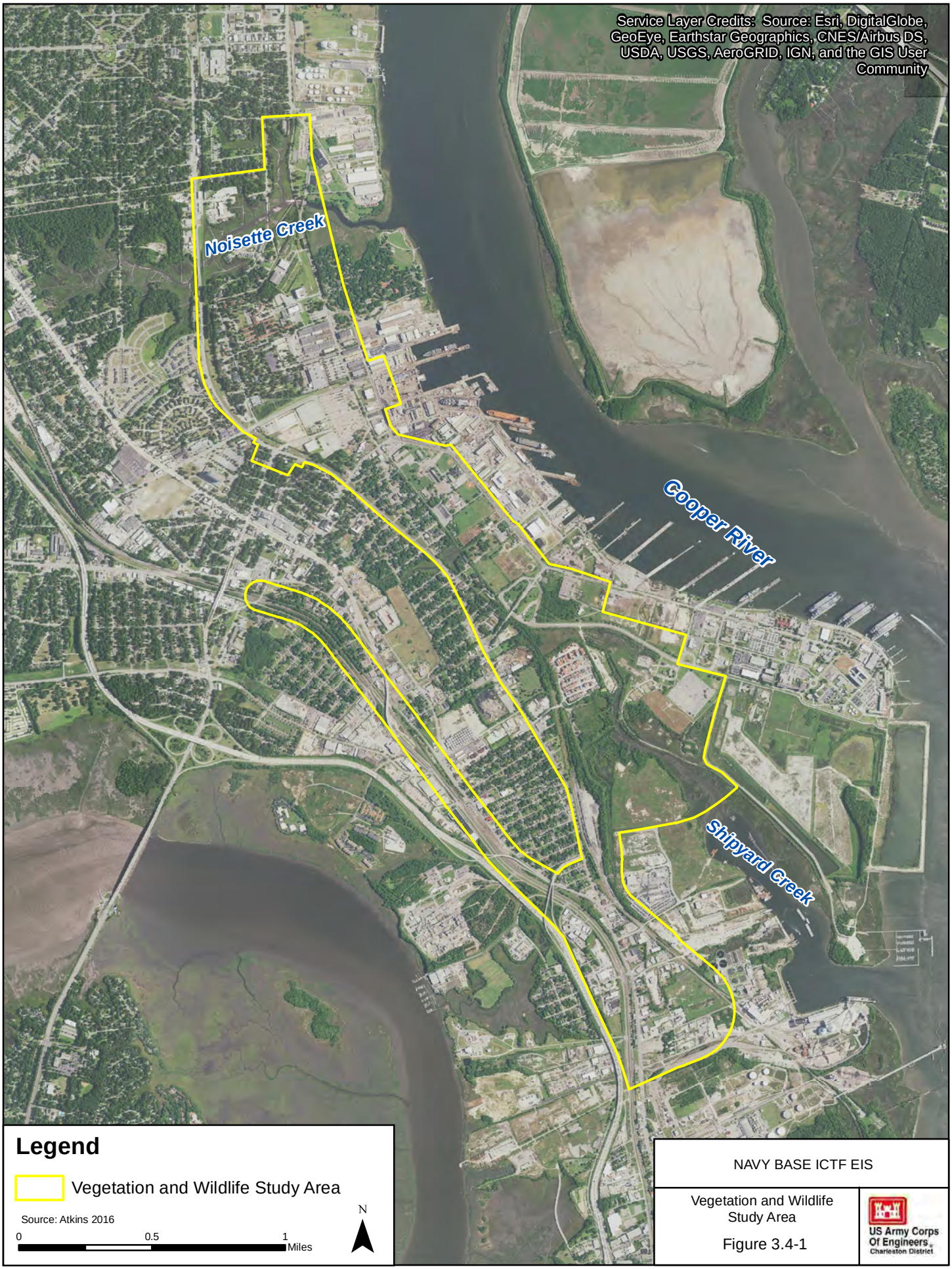
aquatic ecosystem, such as salinity, vegetation, and bottom substrate. The anadromous fish community common to the Sea Islands/Coastal Marsh ecoregion include the American shad (*Alosa sapidissima*), hickory shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), striped bass (*Morone saxatilis*), and Atlantic sturgeon (*Acipenser oxyrinchus*). All of these species are transients that travel from the coastal marine environment, through estuaries, to riverine areas during spawning migrations. Juveniles of anadromous species utilize estuaries as nursery grounds, but spend most of their lives in coastal marine waters.

Fish species expected to dominate the subtidal marsh areas of the study area include star drum (*Stellifer lanceolatus*), Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), spotted seatrout (*Cynoscion nebulosus*), striped mullet (*Mugil cephalus*), weakfish (*Cynoscion regalis*), and red drum (*Sciaenops ocellatus*). The bay anchovy (*Anchoa mitchilli*), black cheek tonguefish (*Symphurus plagiusa*), southern flounder (*Paralichthys lethostigma*), white catfish (*Ictalurus catus*), Atlantic bumper (*Chloroscombrus chrysurus*), Atlantic menhaden (*Brevoortia tyrannus*) hogchoker (*Trinectes maculatus*), and spotted hake (*Urophycis regia*) are also common to this habitat type.

The study area contains intertidal salt marsh areas that provide habitat for resident species, such as killfish and gobies, which seek refuge from predators amongst the emergent vegetation during periods of high tide. Most fish species that inhabit the marsh surface are larval or juvenile stages of seasonal transients. Other species such as silver perch (*Bairdiella chrysoura*), southern flounder, spotted sea trout, and striped mullet take advantage of intertidal mud/sand flat areas to gain access to vegetated areas on the more elevated portion of the marsh.

No marine mammals were observed during site visits of the study area in July 2014 and January 2016; however, numerous marine mammal species are known to occur in the Sea Islands/Coastal Marsh ecoregion. Marine mammals include cetaceans (whales and dolphins), pinnipeds (seals), sirenians (manatees) and sea otters, all of which are protected by the Marine Mammal Protection Act (MMPA) of 1972[53]. Cetaceans, seals, and manatees all occur periodically in South Carolina waters. The bottlenose dolphin (*Tursiops truncatus*) is the only common inshore mammal, but many species of cetaceans can be found offshore. Manatees and seals are seasonal visitors to South Carolina. Florida manatees expand their range north and west every summer and routinely move into South Carolina waters each year. Seals are usually winter visitors, and thus may or may not show up every year. Most seals in South Carolina waters are harbor seals. The study area contains habitat for several species, such as the bottlenose dolphin and West Indian manatee (*Trichechus manatus*). Dolphins are not threatened or endangered, but are protected under the MMPA. The West Indian manatee is currently federally listed as an endangered species for Charleston County, South Carolina and is described in greater detail in Section 3.6 (Protected Species).

[53] 16 U.S.C. 1361 et seq.


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Noisette Creek
Cooper River
Shipyard Creek
Legend
Vegetation and Wildlife Study Area
Source: Atkins 2016
0
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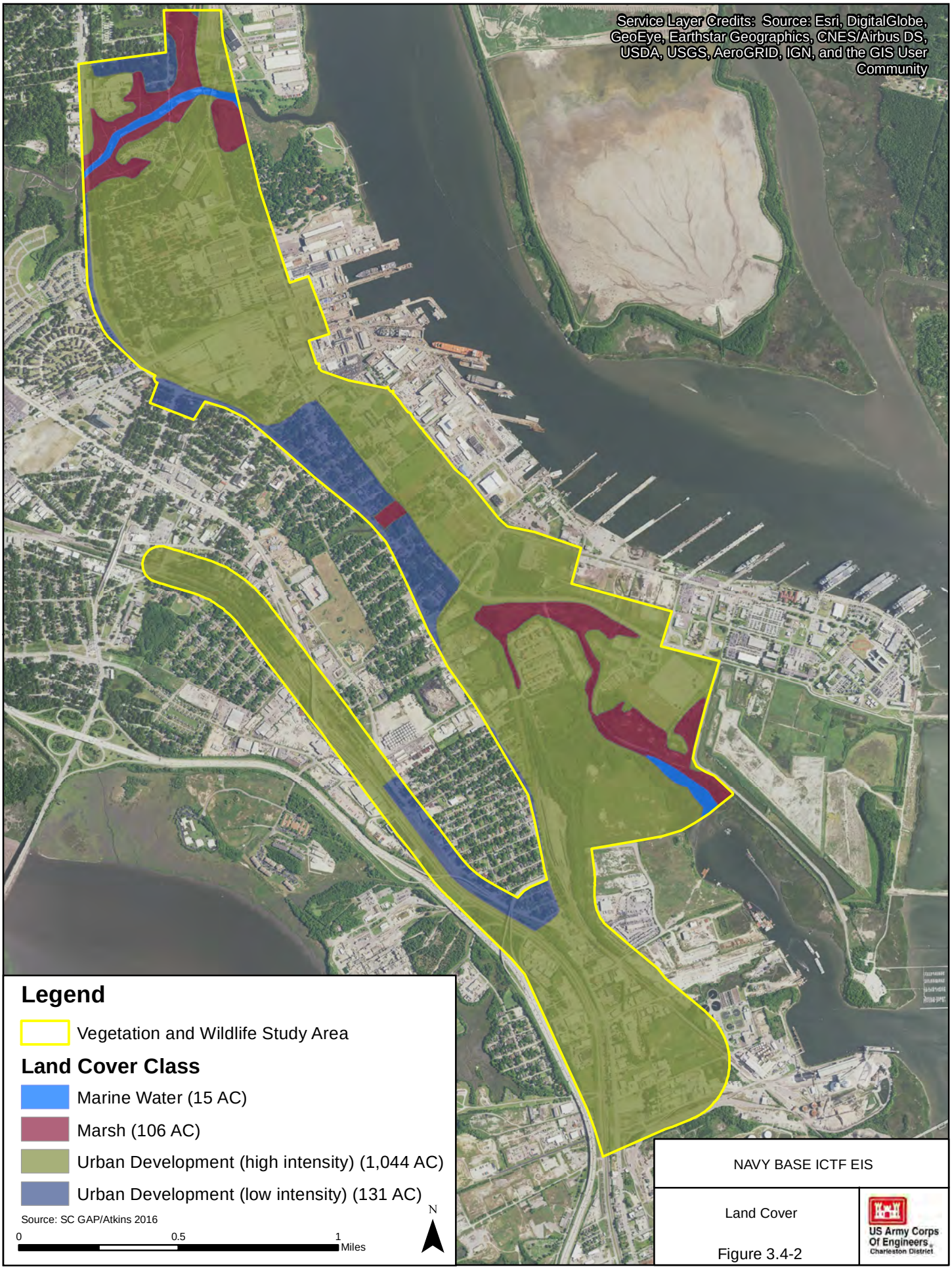
NAVY BASE ICTF EIS
Vegetation and Wildlife Study Area
Figure 3.4-1
US Army Corps Of Engineers
Charleston District


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
Vegetation and Wildlife Study Area
Land Cover Class
Marine Water (15 AC)
Marsh (106 AC)
Urban Development (high intensity) (1,044 AC)
Urban Development (low intensity) (131 AC)
Source: SC GAP/Atkins 2016
0
0.5
1
Miles
N
NAVY BASE ICTF EIS
Land Cover
Figure 3.4-2
US Army Corps Of Engineers
Charleston District