2.4 ECOLOGY

2.4.1 Terrestrial Ecology

The terrestrial ecology of the Calvert Cliffs Nuclear Power Plant (CCNNP) site, including the CCNPP Unit 3 construction area, was characterized in a series of field studies conducted over a one year period extending from May 2006 to April 2007. The field studies include a flora survey, a faunal survey, rare tiger beetles, rare plants, and wetlands delineation. The subsections below summarize relevant information from each of these studies and provide other data on existing terrestrial ecology in accordance with the guidance in NUREG-1555 (NRC, 1999a). In addition, a Forest Stand Delineation Report and a Forest Conservation Plan were finalized in July, 2008.

A topographic map of the site is provided as Figure 2.3-4.

2.4.1.1 Terrestrial Habitats

The flora survey covers each plant community type (terrestrial habitat type) observed on the CCNPP site in 2006 and 2007. A map of the plant community types is presented in Figure 2.4-1, and each plant community type is briefly discussed below.

Lawns and Developed Areas

(Gray in Figure 2.4-1) - Lawns and developed areas occur over a broad area in the east-central part of the CCNPP site (surrounding the two existing CCNPP reactor units) and in Camp Conoy. Camp Conoy includes several athletic fields and other lawn areas surrounding recreational facilities. Other than scattered trees and shrubs planted as ornamental landscaping, the lawns on the CCNPP site consist only of a groundcover stratum. Most of the lawns consist of cool season grasses (grasses that typically seed during spring and fall) such as tall fescue (*Festuca arundinacea*), bluegrass (*Poa pratensis*), large crabgrass (*Digitaria sanguinalis*), and Bermuda grass (*Cynodon dactylon*). Common broadleaf weeds typical of lawns are also present, such as white clover (*Trifolium repens*), broadleaf plantain (*Plantago major*), dandelion (*Taraxicum officinale*), and yellow hawkweed (*Hieracium pretense*).

Old Field (Yellow and Light Brown in Figure 2.4-1) - The largest area of old field vegetation in the CCNPP site is on the dredge spoils deposited since the early 1970s on lands extending west from CCNPP Units 1 and 2 (Yellow in Figure 2.4-1). The dredge spoils are covered by a dense stand of phragmites (Phragmites australis). Phragmites is a perennial grass that can grow to more than 10 ft (3 m) tall and typically infests brackish and fresh tidal and non-tidal marshes. Its presence on the dredge spoil piles is likely a result of propagules (seeds and rhizome fragments) carried with dredge spoils excavated from the shoreline. Other plants typical of old fields, such as common blackberry (Rubus allegheniensis) and tall fescue (Festuca arundinacea), are also present on the dredge spoils but are not as prevalent as phragmites.

Old field vegetation is also located in some small fields in the northwestern part of the CCNPP Unit 3 construction area, in scattered forest clearings around the perimeter of the dredge spoils, and in other developed areas on the CCNPP site, as well as along roadsides (Light Brown in Figure 2.4-1). Many such areas were disturbed during construction of CCNPP Units 1 and 2 and various support facilities, such as the Independent Spent Fuel Storage Installation (ISFSI). Vegetation in these areas is dominated by tall fescue, sericea lespedeza (*Lespedeza cuneata*), common blackberry, Canada goldenrod (*Solidago canadensis*), and asters (*Aster sp.*).

Mixed Deciduous Forest

(Light Green in Figure 2.4-1) - Most forested uplands on the CCNPP site, as well as the southern and western parts of the CCNPP Unit 3 construction area, support deciduous forest dominated by tulip poplar (*Liriodendron tulifera*); chestnut oak (*Quercus prinus*); white oak (*Quercus alba*); red oaks such as black oak (*Quercus velutina*), southern red oak (*Quercus falcata*), and scarlet oak (*Quercus coccinia*); American beech (*Fagus grandifolia*); and Virginia pine (*Pinus virginiana*). Other canopy trees include hickories such as pignut hickory (*Carya glabra*) and bitternut hickory (*Carya cordiformis*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), swamp chestnut oak (*Quercus michauxii*), and black gum (*Nyssa sylvatica*). The forest understory consists of dense patches of mountain laurel (*Kalmia latifolia*), pawpaw (*Asimina trilobata*), and American holly (*Ilex opaca*), with scattered but frequent saplings of canopy species. Ground cover is sparse except where recently fallen trees have left gaps in the tree canopy. Scattered patches of the following species are present in the groundcover: partridgeberry (*Mitchella repens*), Christmas fern (*Polystichum acrostichoides*), common violet (*Viola papilionacea*), and large whorled pogonia (*Isotria verticillata*).

Mixed Deciduous Regeneration Forest

(Dark Green in Figure 2.4-1) - Several areas of relatively level highlands that formerly supported mixed deciduous forest have been subjected to timber harvest activities within the past 20 years. These areas presently support dense thickets of deciduous trees and Virginia pines. The deciduous trees consist of tulip poplar, oaks, sweet gum, and red maple. Virginia pine is generally more frequent in the regenerating forest than in adjoining areas of mature mixed deciduous forest. The regenerating forest lacks a distinct understory but does contain scattered mountain laurel and American holly. Little groundcover is present other than along fire roads or in other small openings.

Well-Drained Bottomland Deciduous Forest

(Light Red in Figure 2.4-1) - Areas of well-drained soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams on the CCNPP site support bottomland deciduous forest dominated by tulip poplar, American beech, sweet gum, black gum, and red maple. This vegetation represents an ecotone (transition) between the mixed deciduous forest on the adjoining upland slopes and the bottomland hardwood forest in wetter areas closer to the stream channel. The understory is generally sparse, although some mountain laurel and American holly are present. While groundcover is generally sparse, dense patches of New York fern (*Thelypteris noveboracensis*) are frequent. (Note: Bottomland deciduous forest outside of the area addressed by the wetland delineation is mapped as a single unit (purple) rather than separated into well-drained and poorly drained components.)

Poorly Drained Bottomland Deciduous Forest

(Dark Red in Figure 2.4-1) - Areas of poorly-drained, seasonally saturated soils in lowlands adjoining Johns Creek, Goldstein Branch, their headwaters, and other streams on the CCNPP site support bottomland hardwood forest dominated by red maple, sweet gum, and black gum. The shrub layer is generally sparse. The groundcover is generally dense, dominated by ferns such as New York fern, sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*); sedges and rushes such as tussock sedge (*Carex stricta*), eastern bur-reed (*Sparangium americanum*), and soft rush (*Juncus effusus*); and forbs such as lizard tail (*Saururus cernuus*) and skunk cabbage (*Symplocarpus foetidus*). (Note: Bottomland deciduous forest outside of the area addressed by the wetland delineation is mapped as a single unit (purple) rather than separated into well-drained and poorly drained components.)

Herbaceous Marsh Vegetation

(Light Blue in Figure 2.4-1) - Herbaceous marsh vegetation occurs throughout much of the broad bottomland areas adjoining Johns Creek in the western part of the CCNPP site as well as in localized gaps in the forest cover in the narrower bottomlands adjoining the headwaters of Johns Creek, Goldstein Branch, and other streams. It is dominated in many places by phragmites. Other areas are dominated by sedges, rushes, and bulrushes; lizard tail, which forms localized dense patches; and various other wetland forbs such as dotted smartweed (*Polygonum punctatum*), Pennsylvania smartweed (*Polygonum pensylvanicum*), jewelweed (*Impatiens capensis*), and halberd-leaved tearthumb (*Polygonum arifolium*). These areas include a marshy fringe surrounding the shore of Lake Conoy, two smaller impoundments on the stream carrying the outflow from Lake Conoy to the Chesapeake Bay, a constructed wetland in the northwestern part of the CCNPP site, and a marshy fringe surrounding a stormwater detention pond west of a dock on the Chesapeake Bay.

Successional Hardwood Forest

(Dark Brown in Figure 2.4-1) - Small patches of forest on recently disturbed lands in the central part of the CCNPP site support forest cover dominated by fast-growing tree species that establish in sunny areas such as old fields. Dominant tree species include black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), and eastern redcedar (*Juniperus virginiania*). The understory generally consists of the same shrub, vine, and herbaceous species described for old field vegetation. Most of the canopy trees are less than 10 in (25.4 cm) diameter at breast height (DBH). The canopy trees cast only weak shade and allow dense undergrowth by old field species.

As noted in the Forest Stand Delineation Report ("FSD"), of these plant communities, only the Mixed Deciduous Forest, Mixed Deciduous Regeneration Forest, Bottomland Deciduous Forest (Well-Drained and Poorly Drained), and Successional Hardwood Forest meet the definition of "Forest" established under the Maryland Forest Conservation Act. These forest areas were further characterized, mapped and quantified. Table 1 of the FSD lists each stand studied in the FSD, and describes the type of tree cover found in the stand and the size of the stand. The FSD also identifies priority areas for forest retention, including Sycamore-Sweetgum-American Elm, and Chestnut Oak forest stands. The Forest Conservation Plan ("FCP") draws on the baseline data developed in the FSD, identifies the impact of the proposed project on forest stands, and outlines the mitigation requirements under the Maryland Forest Conservation Act.

Most lands elsewhere on the CCNPP site support the habitats described above. Where the Chesapeake Bay shoreline has not been developed with the existing reactor units and barge dock, it consists of a narrow sandy beach at the base of steep, sandy cliffs. The beach is generally less than 20 ft (6 m) wide during normal low tides. There are no tidal marshes on the CCNPP site. However, small tidal marshes are present in the Flag Ponds Natural Area north of the CCNPP site and on the shoreline of tidal reaches of St. Leonard's Creek and its tributaries. Some forested areas close to the Chesapeake Bay or other tidal waters support forest dominated by loblolly pine (*Pinus taeda*), and some inland areas support forest dominated by Virginia pine. The latter consist primarily of recently abandoned farmlands or other lands recently disturbed and left to naturally regenerate.

2.4.1.2 Important Terrestrial Species and habitats

NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the

structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems. Floral and faunal surveys that document observations made on the CCNPP site between May 2006 through April 2007 are summarized herein.

Three plant communities occurring on the CCNPP site are identified as important habitats: herbaceousmarsh vegetation, poorly drained bottomland deciduous forest, and well-drained bottomland deciduous forest and are shown in Figure 2.4-1. Herbaceous marsh vegetation and poorly-drained bottomland deciduous forest meet the definition of wetlands established in 33 CFR 328.3 for the Federal Clean WaterAct and COMAR 26.23.01.01(B)(62) for the Maryland Nontidal Wetland Protection Act. The exact boundaries of wetlands in the CCNPP site area were delineated between May 2006 and September 2006 using routine onsite procedures in the Corps of Engineers Wetlands Delineation Manual. The wetland boundaries were marked in the field using sequentially numbered flags. The coordinates for each flag were determined in the field as part of a land survey. Well-drained bottomland deciduous forest habitat in the CCNPP site area occurs in stream valley lands that are too well-drained to meet the regulatory definition of a wetland but still occur in floodplains.

Table 2.4-1 lists each species and habitat identified as important for the CCNPP site and surrounding area according to the criteria in NUREG-1555 (NRC, 1999a). Each species deemed an important species is discussed in more detail below.

2.4.1.2.1 Mammals

The only mammal species meeting the NUREG-1555 criteria for important is the white-tail deer (*Odocoileus virginianus*). White-tail deer is a recreationally valuable species that is valued for hunting in most rural counties in Maryland, including Calvert County.

2.4.1.2.1.1 Population Abundance and Distribution

White-tail deer were observed in all habitats on the CCNPP site during the 2006 fauna survey. Although other mammal species were observed, none were as frequent or widespread over all habitats as white-tail deer.

2.4.1.2.1.1.1 Habitat Requirements

White-tail deer are large herbivorous (plant-eating) mammals favoring fragmented brushy woods interspersed with abandoned fields and thickets.

2.4.1.2.1.1.2 Life History

Rutting season extends from late September through February, with a peak in November. Gestation takes between 200 and 210 days. Does reproduce only once a year, in May or June, and usually produce one fawn the first year, but may produce twins or even triplets in the following years, if food is plentiful. Fawns remain in the den for the first couple of weeks, and are weaned between the ages of four and eight months, but begin to graze before this time. They lose their white spots in the fall. Males reach puberty at around 18 months, and begin growing their first rack in the spring following their birth. Deer are more social in winter and congregate in herds, and tend to disperse and become more solitary in spring.

2.4.1.2.1.1.3 Population Dynamics

Natural predators in Maryland were historically limited to large carnivores such as wolves and mountain lions. Elimination of these predators coupled with a recent increase in forest fragmentation has resulted in very high white-tail deer populations in Maryland and Virginia.

Today, white-tail deer are a pest species that damage forest and landscape vegetation and cause numerous automobile collisions.

2.4.1.2.2 Birds

Two bird species have been identified as important according to NUREG-1555 (NRC, 1999a). They are the bald eagle (*Haliaeetus leucocephalus*) and the scarlet tanager (*Piranga olivacea*).

2.4.1.2.2.1 Bald Eagle

2.4.1.2.2.1.1 Population Abundance and Distribution

The bald eagle, a federal protected species, and a state threatened species, is the only bird species observed during the 2006 to 2007 field surveys or anecdotally reported by site personnel to occur on the CCNPP site that is designated threatened or endangered on the federal or state level, or candidates for such listing. As of the end of 2006, three bald eagle nests were known to exist on the CCNPP Site as shown in Figure 2.4-2. All were outside of the Project Area. Chicks were reported at two of the three nest locations during site reconnaissance conducted in April 2008; i.e., a nest located along Johns Creek near the Lake Davies Dredge Disposal Area and a nest located at Rocky Point to the east of Camp Conoy Road. The third eagle nest, which was located to the northwest of CCNPP Units 1 and 2, blew down prior to 2007. In April 2007, a new active bald eagle nest was observed in a Virginia pine tree close to Camp Conoy Road, near the southwestern corner of a baseball field. Parent bald eagles were observed circling the nest, suggesting that it was active and contained eggs or recently hatched chicks. However, one of the previously recognized nests (located near the shoreline north of the existing reactors) was reported by site personnel to be inactive in April 2007.

2.4.1.2.2.1.2 Habitat Requirements

Bald eagles prefer to nest in tall trees within sight of lakes, rivers, and other open waters. Bald eagles feed primarily on fish but also feed on waterfowl, seagulls, and small mammals. The optimal bald eagle nesting habitat on the CCNPP site is therefore the forested areas at the top of the cliffs overlooking the Chesapeake Bay. Two of the known nesting locations are in such areas, to the north and south of the project area. The Camp Conoy nest is more than 1,500 feet inland from the Chesapeake Bay but is within sight of the Camp Conoy Fishing Pond. The western nest is situated even farther inland but directly adjoins a large marshy area with pools of open water formed by beaver dams on Johns Creek. The mixture of forest cover and open water present throughout the CCNPP site and surrounding region therefore provides potentially suitable bald eagle habitat.

2.4.1.2.2.1.3 Life History

In Maryland and Virginia, bald eagles typically lay eggs in March or April. They typically hatch about 35 days later, and the young typically begin to fly about 12 weeks after hatching.

2.4.1.2.2.1.4 Population Dynamics

Bald eagle population levels have rebounded in the eastern U.S., including Maryland and Virginia, in recent years.

2.4.1.2.2.2 Scarlet Tanager

The scarlet tanager is included as an important species because it can serve as a biological indicator of effects related to forest fragmentation. Given the relatively high frequency of

observance at the CCNPP site and its forest interior habitat preference, a rarity or absence of observations could indicate a degradation of forest interior habitat.

2.4.1.2.2.2.1 Population Abundance and Distribution

The scarlet tanager (*Piranga olivacea*) represents the most frequently observed forest interior bird (FIB) species observed in the CCNPP site area during the late spring and summer of 2006 (as expected, this migratory species was not observed during fall 2006 or winter or early spring 2007). All of the FIB species were observed in forested areas in the southern, southwestern, and western part of the project site area.

2.4.1.2.2.2.2 Habitat Requirements

FIB species are birds requiring large forested areas to breed successfully and maintain viable populations. Most FIB species have suffered noticeable population declines in Maryland and elsewhere in the eastern United States concurrent with increased fragmentation of forest cover by urban development in the last 50 years. The Chesapeake Bay Critical Area Commission has identified an objective of preserving habitat for FIBs in lands surrounding the Chesapeake Bay (CAC, 2000).

2.4.1.2.2.2.3 Life History

The scarlet tanager breeds in woodland areas, constructing open-cup nests in the mid-story/ canopy. Eggs are laid in clutch sizes of 3 to 5, with an incubation period of 13 to 14 days. Nine to 11 days are needed to fledge.

2.4.1.2.2.2.4 Population Dynamics

The scarlet tanager is a neotropical migrant that breeds in Maryland but winters primarily in Central and South America. Most of the FIB species that have suffered the greatest population declines over the last 50 years are neotropical migrants. Neotropical migrant FIB species are sensitive not only to changes in their breeding habitats in eastern North America but also to changes to their wintering habitats in Central and South America. The scarlet tanager typically occupies its breeding grounds in Maryland between May 25 and August 10 (CAC, 2000).

2.4.1.2.3 Insects

The Puritan Tiger Beetle (*Cicindela puritana*) and the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) have been identified as important because they are Federally threatened beetle species known to occur on sandy cliffs and beaches in Calvert County.

2.4.1.2.3.1 Puritan Tiger Beetle

2.4.1.2.3.1.1 Population Abundance and Distribution

The Puritan Tiger Beetle (*Cicindela puritana*), is known to presently inhabit only three locations: the Chesapeake Bay shoreline in Calvert County, around the mouth of the Sassafras River in eastern Maryland, and along the Connecticut River in Connecticut and Massachusetts. The Calvert County population has fluctuated greatly from peak numbers of over 9,000 in 1998 and 1988 to less than 6,000 in the past three years. A population of the Puritan Tiger Beetle has been known to be present at the shoreline of the CCNPP site since 1997. This site, like all others, has exhibited dramatic fluctuations in population size since that time. Counts of adults at the CCNPP site have varied more than some other locations, with the following estimates of adult numbers (USFWS, 1993):

YEAR	COUNT
1997	119
1998	616
1999	49
2000	367
2002	80
2003	226
2004	121
2006	111

2.4.1.2.3.1.2 Habitat Requirements

The Puritan Tiger Beetle has very specific habitat requirements. In Maryland, the larvae live in deep burrows, which they dig in sandy deposits on non-vegetated portions of bluff faces. They may also burrow at the base of bluffs in sediment deposits that have eroded from bluff faces. Chesapeake Bay populations are most abundant where bluffs are long and high, with little or no vegetation, and composed at least in part of yellow or red sandy soil. Wave-producing storms and concomitant erosion of bluffs are necessary to maintain the bare-bluff faces required for larval habitat. Larvae will not utilize densely vegetated bluffs; no tiger beetle larvae or adults were found to occupy bluffs stabilized by kudzu at Calvert Beach, though individuals were numerous on adjacent natural bluffs.

2.4.1.2.3.1.3 Life History

Puritan Tiger Beetles typically undergo a two-year larval period before emergence. Larvae hatch in late July or August as first instars. This stage lasts 2 to 4 weeks; larvae then molt and become second instars. Larvae generally over-winter as second instars and become active again (as evidenced by open burrows) the following spring, when they molt to the third instar.

2.4.1.2.3.1.4 Population Dynamics

Population variations are caused by year-to-year variations in climatic and other factors that affect survival and reproduction. Variations in recorded populations may, to a lesser extent, depend on survey conditions.

2.4.1.2.3.2 Northeastern Beach Tiger Beetle

2.4.1.2.3.2.1 Population Abundance and Distribution

There are two extant populations of *C. dorsalis* in southeastern Massachusetts, and the beetle has been found in the Chesapeake Bay region at 55 sites in Virginia and 13 sites in Calvert County, Maryland. The Chesapeake Bay populations include 15 with more than 500 adults (USFWS, 1994).

This species does not have an established population within the boundaries of the CCNPP site, and consequently this site has not been one of the target sites that are annually surveyed for *C. dorsalis* in Calvert County. However, in some years small numbers of adults (<25 individuals) have been observed at the far north end of the CCNPP site. These adults were found to be confined to an approximate 328 ft (100 m) section bordering Flag Ponds Nature Park, having apparently moved south from that area where a breeding population exists. No larvae or other evidence of a breeding population of *C. dorsalis* has been known in this northern section of the CCNPP site. No adults were found on the CCNPP site in 2006, nor were there any in the bordering section of Flag Ponds Nature Park. At Flag Ponds Nature Park, most of the adults

and all larvae of *C. dorsalis* are restricted to the northern half of this area, and only occasionally are small numbers of adults found in the southern end near the CCNPP site boundary.

2.4.1.2.3.2.2 Habitat Requirements

The beach ecosystem conducive to *C. dorsalis* survival is undisturbed by heavy human use, highly dynamic, and subject to natural erosion and accretion processes.

2.4.1.2.3.2.3 Life History

Larvae dig vertical burrows over a relatively narrow band of the upper intertidal to high drift zone, capturing small arthropod prey passing nearby. In the Chesapeake Bay region, adults emerge in mid-June, reach peak abundance by very early July, and begin to decline through August. The adults are active on warm, sunny days along the water's edge, where they are commonly seen feeding, mating, or basking. Mating and egg laying occur from late June through August. Egg laying occurs in burrows.

2.4.1.2.3.2.4 Population Dynamics

Populations are highly variable from year to year; the beetle is subject to local population extinctions and capable of dispersal and recolonization. The extirpation of *C. dorsalis* from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat from shoreline developments, beach stabilization structures, and high recreational use.

2.4.1.2.4 Plants

Several plant species have been identified as important according to NUREG-1555 (NRC, 1999a). They are the showy goldenrod (*Solidago speciosa*), Shumard's oak (*Quercus shumardii*), spurred butterfly pea (*Centrosema virginianum*), tulip poplar (*Liriodendron tulipifera*), chestnut oak (*Quercus prinus*), mountain laurel (*Kalmia latifolia*), and New York fern (*Thelypteris noveboracensis*). The rare plant inspections were conducted in late July/early August 2006, October 2006, and April 2007 so as to coincide with the flowering period for each plant listed by the Maryland Department of Natural Resources as rare, threatened, or endangered for Calvert County, Maryland.

2.4.1.2.4.1 Showy Goldenrod

The showy goldenrod (*Solidago speciosa*) is listed as threatened by the State of Maryland. Showy goldenrod is a perennial forb with showy yellow flower heads that typically flowers in August and September in Maryland. The tops typically die in late October, and the roots over-winter underground and regenerate new tops in spring. Patches of showy goldenrod were observed in several locations around Camp Conoy in October 2006.

2.4.1.2.4.2 Shumard's Oak

The Shumard's oak (*Quercus shumardii*) is listed as threatened by the State of Maryland. Shumard's oak is a deciduous tree whose leaves and bark closely resemble the more common red oak (*Quercus rubra*). Trees appearing to be Shumard's oak were observed at multiple locations in the Johns Creek floodplain in 2006 and 2007.

2.4.1.2.4.3 Spurred Butterfly Pea

The spurred butterfly pea (*Centrosema virginianum*) is designated by Maryland as rare It is not Federally-listed or listed by the State of Maryland as threatened or endangered. The Maryland Natural Heritage Program has a record of occurrence of the spurred butterfly pea on the CCNPP site southwest of the CCNPP Unit 3 construction area (MDNR, 2006). The plant was

observed at multiple locations in early August 2006 in Johns Creek floodplain but well west of the CCNPP Unit 3 construction area. It is a perennial, climbing, leguminous vine with light purple flowers with a wide tolerance of habitat conditions.

2.4.1.2.4.4 Tulip Poplar

Tulip poplar (*Liriodendron tulipifera*) is the most numerous and widespread tree in upland forests on the CCNPP site. It is a tall, fast-growing deciduous tree that favors upland habitats with mesic (deep, rich, and moist) soils. Many tulip poplars in the CCNPP Unit 3 construction area are over 20 inches (50 cm) DBH. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.5 Chestnut Oak

Chestnut oak (*Quercus prinus*) is another common tree on the CCNPP site, dominating on dry, sloping lands adjoining forested stream valleys. Tulip poplar and chestnut oak together comprise the majority of the tree canopy in forested areas on and surrounding the CCNPP site.

The chestnut oak is a tall, slow-growing deciduous tree that occurs in primarily dry soils. Acorns from chestnut oaks on the CCNPP site provide a key food source for gray squirrels, blue jays, and many of the other observed wildlife species. Chestnut oak is the principal tree stabilizing many steep slopes adjoining the Johns Creek and Goldstein Branch floodplains. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.6 Mountain Laurel

Mountain laurel (*Kalmia latifolia*) is the most widespread shrub on the CCNPP site. It forms dense shrub thickets in the understory of upland forests throughout the CCNPP site and the CCNPP Unit 3 construction area, including most of the steep slopes adjoining the Johns Creek and Goldstein Branch floodplains. Although primarily a shrub, many mountain laurels on the steep slopes near Johns Creek and south of Camp Conoy are exceptionally large, reaching heights of over 20 ft (6 m). It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.4.7 New York Fern

New York fern (*Thelypteris noveboracensis*) is the most widespread groundcover plant in the CCNPP Unit 3 construction area and elsewhere on the CCNPP site. It forms large, dense patches of groundcover throughout most of the forested floodplain lands, and many of the patches extend to adjoining slopes. Mountain laurel and New York fern together comprise the majority of the understory and groundcover vegetation in forested areas on and surrounding the CCNPP Unit 3 construction area. It is a key contributor to the overall structure and ecological function of the plant communities and serves as an indicator of the overall ecological stability.

2.4.1.2.5 Habitats

Three plant communities occurring on the CCNPP site are identified as important habitats: herbaceous marsh vegetation, poorly drained bottomland deciduous forest, and well-drained bottomland deciduous forest and are shown in Figure 2.4-1. Herbaceous marsh vegetation and poorly drained bottomland deciduous forest meet the definition of wetlands established in 33 CFR 328.3 for the Federal Clean Water Act (CFR, 2007b) and COMAR 26.23.01.01(B)(62) for the Maryland Nontidal Wetland Protection Act (COMAR, 2007). The exact boundaries of

wetlands in the CCNPP site area were delineated between May 2006 and September 2006 using routine onsite procedures in the Corps of Engineers Wetlands Delineation Manual (USACE, 1987). The wetland boundaries were marked in the field using sequentially numbered flags. The coordinates for each flag were determined in the field as part of a land survey. Well-drained bottomland deciduous forest habitat in the CCNPP site area occurs in stream valley lands that are too well-drained to meet the regulatory definition of a wetland but still occur in floodplains.

Two areas outside of but close to the CCNPP site are also identified as important habitats. The first is the Flag Ponds Natural Area, situated immediately north of the CCNPP site. The second is Calvert Cliffs State Park, situated immediately north of the CCNPP site.

2.4.1.3 Habitat Importance

White-tail Deer: White-tail deer are habitat generalists but tend to favor areas at the edge of forests. Because of the ability of the white-tail deer to adapt to a variety of habitats, their populations are not generally sensitive to localized habitat changes.

Bald Eagle: Bald eagles tend to return and reuse nests from previous years. Any construction close to the active bald eagles nests on the CCNPP site as shown in Figure 2.4-2 could discourage use of those nests in the future. Trees on top of the cliffs adjoining the Chesapeake Bay along the eastern edge of the CCNPP site provide some of the best bald eagle habitat in Calvert County. Local populations of bald eagle would be sensitive to loss or degradation of forested habitats adjoining the cliffs.

Scarlet Tanager (and other Forest Interior Birds): Recent aerial photographs of southern Calvert County suggest that the forested areas in the northern, southern and southwestern parts of the CCNPP site, including areas within the Unit 3 construction area draining to Johns Creek, provide some of the largest remaining blocks of unfragmented forest habitat in the region. Most areas of Calvert County outside of the CCNPP site and adjoining state parks (Calvert Cliffs State Park and Flag Ponds Natural Area) have experienced fragmentation caused by agricultural land uses, road construction, and construction of rural residences and small residential subdivisions. Therefore, the forested areas on the CCNPP site, including those close to Johns Creek in the CCNPP Unit 3 construction area, are likely valuable in sustaining localized populations of the scarlet tanager and other forest interior birds.

Puritan and Northeastern Beach Tiger Beetles: The undeveloped cliffs and beaches on the CCNPP site provide some of the best remaining habitat, both locally and nationally, for these two insect species with very specific habitat requirements.

Plants: None of the plant species identified as important are highly dependent on the CCNPP Unit 3 construction area or CCNPP site for their survival. Loss of suitable habitats in the CCNPP Unit 3 construction area would cumulatively contribute to the risk for population declines for each species but not likely result in immediate declines in regional populations.

2.4.1.4 Disease Vector and Pest Species

A disease vector is an organism (commonly an insect) that carries disease agents (commonly bacteria or fungi) to a receptor host, which can be man, domestic or wild animals, or crops or wild plants. The only disease vector known to occur on the CCNPP site is the deer tick (*Ixodes scapularis*), which transmits Lyme Disease to humans. Lyme Disease is a non-fatal but debilitating disease whose victims can display fever and severe joint pain. The causal agent is

a bacterium, *Borrelia burgdorferi*, which is transmitted by the deer tick from white-tail deer, squirrels, rodents, and other mammalian wildlife to humans.

No pest species are known to be widespread over the CCNPP site and surrounding areas. However, two non-native invasive plant species were found to be prevalent at several locations on the CCNPP site in 2006. The most widespread is phragmites, which forms dense stands over large areas of wetlands and dredge spoils in the CCNPP site. Phragmites is a perennial grass species with hollow culms (stems) that can grow to more than 10 ft (3 m) in height. Flowers develop by mid summer and are arranged in tawny spikelets with tufts of silky hair. Flowering and seed set occur between July and September. Germination occurs in spring on exposed moist soils. Vegetative spread by below-ground rhizomes (roots) can result in dense patches with up to 20 stems per square foot (200 stems per square meter). Phragmites is capable of vigorous vegetative reproduction and often forms dense, nearly monospecific stands. Although some phragmites stands are of genotypes native to North America, most large stands of phragmites in North America today are considered to be of non-native genotypes.

Another non-native invasive plant species, Japanese stiltgrass (*Microstegium vimineum*), forms scattered patches in the groundcover of some forested areas in the CCNPP site. It occurs mostly in areas with a history of soil disturbance, such as along the sides of roadways and trails. Where it occurs, it has likely precluded the development of other more ecologically valuable groundcover.

2.4.1.5 Wildlife Travel Corridors

Wildlife tends to move across landscapes using distinct corridors of favorable habitat. Movement of most forest wildlife across fragmented agricultural and suburban landscapes is enhanced by linear corridors of forest that can consist of forested hedgerows, forested stream valleys, or forested ridge tops. The minimum width for a forest corridor to benefit wildlife is not known but may vary among wildlife species depending on body size. Wildlife movement is also enhanced by strings of closely spaced patches of favorable habitat that form "stepping stones" across areas of unfavorable habitat. For forest wildlife, such stepping stones can consist of woodlots in agricultural landscapes or parks and other undeveloped forest tracts in suburban landscapes.

The landscape of southern Calvert County consists predominantly of forest land broken by small agricultural fields, small developed areas referred to as "town centers," rural residences on lots of one to a few acres, and small subdivisions of single-family houses on small lots. The landscape is crossed by a network of forested stream valleys that consist of forested floodplains adjoined by steep forested slopes. These stream valleys form corridors that facilitate the movement of forest wildlife around farm fields and developed areas.

The central part of the CCNPP site consists mostly of open land surrounding the existing reactors. The remainder of the CCNPP site, the Calvert Cliffs State Park to the south, and the Flag Ponds Natural Area to the north include large blocks of forest land. The forested stream valley surrounding Goldstein Branch and its tributaries along the western perimeter of the project site forms a corridor that may facilitate the north-south movement of wildlife. The forested stream valley surrounding Johns Creek and its tributaries may facilitate east-west movement.

2.4.1.6 Existing Natural and Man-Induced Ecological Effects

While most of the CCNPP site area north and south of the CCNPP Unit 3 construction area consists of contiguous forest cover, forest cover in the central part of the CCNPP site, including the north-central and northwestern parts of the CCNP Unit 3 construction area, has been fragmented by development of facilities serving the existing reactors, by dredge material disposal, and by development of recreational facilities at Camp Conoy. This fragmentation has reduced the habitat value of some forested areas in the northern part of the CCNPP Unit 3 construction area and adjoining Camp Conoy for wildlife such as the forest interior bird species that require large blocks of forest to successfully live and nest. However, the observation of several forest interior bird species in forest lands south of Camp Conoy and along Johns Creek, indicates that forest cover in those areas qualifies as forest interior dwelling habitat.

Several areas of mixed deciduous forest on uplands west of Camp Conoy Road were clear cut for timber within the last 20 years but presently support robust stands of regenerated deciduous tree saplings. Some of the former clear cuts are on slopes near Johns Creek where forest interior bird species were observed in 2006. Although the clear cuts may have temporarily reduced habitat quality for forest interior bird species, the effects seem to have diminished with regeneration of tree cover. However, large canopy trees over 12 in (30 cm) DBH are limited to areas not recently clear cut, mostly on steep slopes and lands east of Camp Conoy Road. Prescribed burns are not conducted to manage vegetation anywhere on the CCNPP site, and there have not been any substantial wild fires in the past several decades.

Several upland areas in the northern part of the CCNPP Unit 3 construction area were used for farming until recently. These areas presently support old field vegetation. No areas on the CCNPP site are presently used for farming or grazing, although several large areas around the existing reactors, along paved roads, and in Camp Conoy are kept regularly mowed. Areas under several electric transmission lines in the CCNPP Unit 3 construction area and elsewhere on the CCNPP site are periodically mowed and treated with herbicides to prevent regeneration of trees under the conductors.

There is no evidence that the CCNPP Unit 3 construction area has been subjected to substantial recent environmental stresses such as insect or disease outbreaks or storm damage. Occasional fallen canopy trees were observed throughout forested areas of the CCNPP Unit 3 construction area, especially on the slopes adjoining Johns Creek and its headwaters. These trees may have been felled by the winds from Hurricane Isabel, which passed through Calvert County on September 19, 2005. Large areas of oak-dominated forests in central Maryland experienced multiple rounds of defoliation by gypsy moths in the late 1980s. However, large numbers of dead trees as might have resulted from a localized gypsy moth (Lymantria dispar) outbreak were not observed anywhere within the CCNPP Unit 3 construction area during the 2006 floral survey.

2.4.1.7 Ongoing Ecological and Biological Studies

The only ecological or biological investigations performed on the CCNPP site within the last 5 years were the surveys described herein. Those studies are now complete.

2.4.1.8 Regulatory Consultation

The Maryland Natural Heritage Program, operated by the Maryland Department of Natural Resources, was consulted for information on known occurrences of Federally-listed and State-listed threatened, endangered, or special status species and critical habitats (MDNR,

2006). Identification of the important species discussed above was based in part on information provided by that consultation.

2.4.1.9 Offsite Transmission and Access Corridors

There are no new offsite transmission or access corridors associated with the construction and operation of CCNPP Unit 3.

2.4.2 Aquatic Ecology

2.4.2.1 Aquatic Habitats

2.4.2.1.1 Freshwater Bodies Onsite

Freshwater bodies at the CCNPP site are described in Section 2.3.1. A topographic map is provided as Figure 2.3-4 which shows the aquatic habitats. In addition, a separate wetlands delineation study was conducted. It describes the area as a steeply rolling landscape dissected by a dendritic pattern of stream valleys with narrow floodplains adjoined by steep side slopes whose grade exceeds 25% in places. Large areas in the north-central part of the site have been graded to accommodate existing facilities and the dredge spoil disposal area. The eastern part of the site, including most lands east of Camp Conoy Road, drains directly into the Chesapeake Bay. Drainage enters a series of unnamed intermittent and first-order perennial streams that flow generally eastward. The streams become increasingly incised as they approach the cliffs and then cascade over the cliffs and across the narrow beach into the bay. All stream reaches on the site are non-tidal; the cliffs prevent tidal influence from extending west of the beach.

In the north-central part of the site, large areas have been graded to accommodate existing facilities and a dredge spoil disposal area. The eastern part of the site, including most lands east of Camp Conoy Road, drains directly into the Chesapeake Bay. Drainage enters a series of unnamed intermittent and first-order perennial streams that flow generally eastward. The streams become increasingly incised as they approach the cliffs and discharge across the narrow beach into the Bay. All stream reaches on the site are nontidal; the cliffs prevent tidal influence from extending west of the beach.

The western part of the site, west of Camp Conoy Road, drains toward the Patuxent River. Lands west of Camp Conoy Road drain into intermittent headwaters of Johns Creek, which flows west under Maryland Route 2/4 and ultimately to the Patuxent River. Most lands in the northwestern part of the CCNPP site flow into the headwaters of the Goldstein Branch. Goldstein Branch flows south, close to the western CCNPP site perimeter, entering Johns Creek just east of Maryland Route 2/4. A small area in the northern part of the CCNPP site drains to the north and east into small streams that flow to the Chesapeake Bay north of the CCNPP Units 1 and 2; these are shown as Branch 1 and Branch 2 on Figure 2.3-2. The dredge spoil disposal area drains to the man-made Lake Davies, which discharges into a tributary to Goldstein Branch as well as through wetlands to Johns Creek. Three other ponds retain surface water onsite before discharging to Chesapeake Bay: Camp Conoy Fishing Pond, Pond 1 and Pond 2.

Surveys of the benthic macroinvertebrates and fish inhabiting selected onsite streams and ponds were conducted during September 2006 and March 2007. Benthic invertebrates were collected using techniques developed for low gradient, non-tidal streams (USEPA, 1999). Fish sampling followed the guidance provided in the Maryland Biological Stream Survey Sampling Manual (MDNR, 2001). At each sampling station, standard water quality field measurements were made, and water samples were collected for laboratory analysis of nutrients and other physico-chemical parameters. At the same time, habitat quality was assessed using the survey

sampling guidance (MDNR, 2001). The results of the surveys are summarized for each water body in the following sections.

2.4.2.1.1.1 Johns Creek

Two locations in Johns Creek were sampled: one upstream and one downstream of a dewatered reach that had filled in with an invasive reed (*Phragmites*). Water quality at both locations indicated a healthy stream. Benthic invertebrate and fish assemblages at the downstream location were excellent, and the overall habitat assessment produced an optimal score. The upstream location, however, supported only one species of fish, the eastern mudminnow (*Umbra pygmaea*), which is a common stream species that is extremely tolerant of poor water quality.

Differences in the benthic community of the two reaches were also apparent. The upstream location was numerically dominated by oligochaetes and chironomids; the downstream location by amphipods during the fall and amphipods and ostracods during the spring. However, both locations supported at least two of the three groups of aquatic insects that are considered indicators of nondegraded streams (Ephemeroptera, Plecoptera, and Trichoptera). Although both locations scored in the "optimal" category on the habitat assessment, an evaluation of the subscores reveals that the upstream site has poor pool variability, marginal epifaunal substrate and cover, and suboptimal pool substrate, sediment deposition, and channel sinuosity. The difference in the overall scores of the two reaches is attributable to substrate, cover, and pool variability. Johns Creek downstream station had the highest score of all locations sampled during both fall and spring.

Results of the biological survey are presented in Table 2.4-2. Water quality data are in Table 2.3-28 through Table 2.3-31.

2.4.2.1.1.2 Goldstein Branch

One location in Goldstein Branch, upstream from its confluence with Johns Creek, was sampled. This location had similar dissolved oxygen and pH, but higher conductivity, alkalinity, and total dissolved solids (TDS), compared with Johns Creek. Despite water quality indicators of a healthy stream, only one species of fish, the American eel (*Anguilla rostrata*), was collected at Goldstein Branch. Benthic invertebrate diversity and abundance were lower than in Johns Creek during fall, but higher during spring. The reach supported all three groups of aquatic insects that are considered indicators of nondegraded streams (Ephemeroptera, Plecoptera, and Trichoptera). The overall habitat assessment produced an optimal score; individual subscores were similar to the upstream location at Johns Creek.

Results of the biological survey are presented in Table 2.4-3. Water quality data are presented in Table 2.3-28 through Table 2.3-31.

2.4.2.1.1.3 Impoundments

The four ponded waterbodies are neither functionally related nor similar in water quality. They are discussed here together for purposes of conciseness only.

Water quality in Lake Conoy was representative of a healthy pond. Six species of fish were collected; the eastern mosquitofish (*Gambusia affinis*) and the bluegill (*Lepomis macrochirus*) were numerically dominant, which is typical of an impoundment of this nature. The benthic invertebrate assemblage was more diverse than in the other three impoundments. Two of the three taxa of aquatic insects that are sensitive to degraded aquatic conditions, mayflies and

caddisflies, were present in Lake Conoy; the stoneflies (Plecoptera) were absent from all impoundments at the site.

Neither Lake Davies nor the ponds had adequate dissolved oxygen (greater than 5 ppm) to be considered a healthy habitat during fall, but dissolved oxygen was high and similar to the other sampling locations during the spring survey. In Lake Davies, the dissolved oxygen dropped as low as 2.2 ppm at the bottom. In Pond 2, dissolved oxygen was less than 1.0 ppm. Fish species in the ponds were the same as those collected in Lake Conoy, except for the absence of the larger gamefish (white crappie (*Pomoxis annularis*) and largemouth bass (*Micropterus salmoides*)). Benthic invertebrate assemblages were dominated by chironomids in the two lakes, and by oligochaetes in the two ponds. Neither caddisflies nor stoneflies occurred in any samples from Lake Davies or the ponds, although mayflies were present.

Results of the biological survey are presented in Table 2.4-4. Water quality data are in Table 2.3-28 through Table 2.3-31. Invertebrate and fish data represent the cumulative totals from all samples in each water body. No federal or state rare, threatened or endangered aquatic species was reported during site surveys. However, the American eel (*Anguilla rostrata*) was collected from every water body sampled, except Lake Davies.

2.4.2.1.1.4 Nontidal Wetlands

Nine assessment areas were described based on field surveys conducted in 2006 and early 2007. Wetland Assessment Areas are defined as contiguous wetland and aquatic areas with a high degree of hydrological interaction and biological similarity. Assessment Areas I, II, and III correspond to small unnamed watersheds that drain directly to the Chesapeake Bay (Assessment Area III flows out of the proposed project plant and construction area before reaching the Chesapeake Bay). Assessment Areas IV, V, and VI form the Johns Creek watershed (upstream of Goldstein Branch). Assessment Area IV constitutes the up-gradient headwaters to Johns Creek and their adjoining wetlands, while Assessment Area V constitutes the main channel and adjoining wetlands of Johns Creek. Assessment Area VI comprises a sequence of man-made basins carrying runoff from the Lake Davies dredged material disposal area to Johns Creek. Assessment Area VII constitutes the headwaters, main channel, and associated wetlands of Goldstein Branch. Assessment Area VIII consists of a small cluster of seepages and headwaters that flow north to ultimately contribute to Woodland Branch and St. Leonard Creek, which eventually drain into the Patuxent River. Assessment Area IX comprises a series of seepages and headwaters that drain into a storm drain system under the existing developed portion of the CCNPP site. Wetland functions and values for the nine assessment areas at the site are provided in Table 2.4-5.

The greatest overall functions and values are provided by Assessment Area V, which consists of the main channel of Johns Creek and its adjoining wetlands. Within the CCNPP site, Johns Creek remains largely free of human disturbance. It flows through a stream valley bounded throughout on both sides by mature deciduous forest cover free of agricultural or urban development. The channel is generally diffuse and poorly defined, spreading its flow through dense wetland vegetation that is more than 100 ft (30.5 m) in width at many locations. The vegetation is capable of attenuating flow velocity, filtering out dissolved nutrients or contaminants in the water and causing suspended sediment to settle out before flowing downstream to the tidal waters of St. Leonard's Creek.

Many of the same functions and values are provided by Assessment Area IV, which consists of the seepages, springs, and headwaters that flow into the upper end of Johns Creek. The reach

of Johns Creek east of Maryland Route 2/4 constitutes one of the largest remaining systems of headwaters and stream whose watershed is still largely forested.

The Camp Conoy fishing pond (part of Assessment Area II) has a long history of enjoyment by Constellation employees and their families; recreation is therefore identified as a principal function for Assessment Area II.

2.4.2.1.2 Chesapeake Bay

2.4.2.1.2.1 Importance of the Bay as a Resource

The Chesapeake Bay is fed by freshwater flows from a 64,000 square mile (166,000 km^2) drainage basin that touches parts of 6 states, as well as the District of Columbia. This freshwater is mixed in almost equal proportions with saline water from the Atlantic Ocean, forming, the largest estuary in the U.S. In addition to its role as a center of commerce and shipping, the Bay is home to dozens of species of wildlife and produces millions of pounds of seafood for domestic and international markets. In recent years, government, industry, and the public have focused efforts on reversing the processes that have led to a decline in the quality of the bay for both wild species and the human population. Pollution, nutrient enrichment, and over-harvesting of estuarine species are among the key threats to the health of the bay.

2.4.2.1.2.2 Review of Key Data Sources

Key data sources of information on the Chesapeake Bay are found with the following Federal, State, and private organizations:

- The Chesapeake Bay Program (CBP) is a regional partnership responsible for developing and implementing restoration plans for the Chesapeake Bay. The CBP includes state and federal government resource managers as well as citizen advisory groups in the Chesapeake Bay area. In addition to annual reports on the overall condition of the Chesapeake Bay and progress of the restoration, the CBP provides data on the life history, distribution, abundance, and harvest of numerous estuarine and marine species in the Chesapeake Bay.

- The Maryland Department of Natural Resources (MDNR) provides commercial landings data for a variety of fish and shellfish species. Crab, oyster, and striped bass data are available for the Chesapeake Bay region; all other species are reported on a statewide basis. The MDNR data is used to describe trends in commercial harvest, and to support the designation of a species as "important."

- The Atlantic States Marine Fisheries Commission coordinates the conservation and management of the near shore fishery resources shared among the 15 Atlantic states. The Atlantic States Marine Fisheries Commission provides data on the life history, distribution, abundance, and status of the marine finfish and shellfish that it manages.

- The NOAA Fisheries Office of Science and Technology provides commercial landing data for either statewide or a Maryland-specific portion of the Chesapeake Bay.

- The Chesapeake Bay Foundation is a not-for-profit organization devoted to improving the overall environment of the Chesapeake Bay area. The foundation produces an annual report summarizing the condition of key components of the Chesapeake Bay ecosystem and issues a "health index" for the Chesapeake Bay.

2.4.2.1.2.3 Overall Condition of Chesapeake Bay Ecosystem

Both government and non-government reports on the status of the Chesapeake Bay reach the same conclusion: the overall health of the ecosystem remains degraded. Much of the extensive restoration effort expended during the last 20 years has merely kept the Chesapeake Bay from becoming even more severely impacted by the growing human population in the area.

The Chesapeake Bay Foundation assigned the Chesapeake Bay an overall score of 29 (out of a possible 100) based on measures of pollution, habitat, and fisheries. Despite the failing grade, the score was 2 points higher than in the last three years, indicating a slight improvement.

The CBP annual health assessment reached the following conclusions:

- Water Quality – Most of the Chesapeake Bay's waters are degraded. Each summer, a large expanse of its waters does not hold enough oxygen to support striped bass, crabs and oysters. Algal blooms fed by nutrient pollution block sunlight from reaching the underwater bay grasses needed to support aquatic life. Sediment from urban development and agricultural lands is carried into the Chesapeake Bay, clouding its waters and covering critical oyster reef habitat. Currently, about one-third of the Chesapeake Bay water quality goals are being met.

- Habitats and Lower Food Web – The Chesapeake Bay's critical habitats and food webs are at risk. Nutrient and sediment runoff have harmed bay grasses and bottom habitat. Excessive algae growth has pushed the Chesapeake Bay food web out of balance. A large portion of the Chesapeake Bay's wetlands has been lost to development. Currently, the Chesapeake Bay's habitats and lower food web are at about a third of desired levels.

- Benthic Organisms - In 2005, about 41% of the Chesapeake Bay's benthic habitat was considered healthy as measured by the composite Benthic Index of Biotic Integrity. This decline is likely due to persistent low dissolved oxygen levels during the summer. Reduced amounts of nutrients, sediment and chemical contaminants flowing into the Chesapeake Bay will help these bottom dwelling communities improve.

- Phytoplankton – microscopic plants commonly called algae are an excellent indicator of the health of the Chesapeake Bay's surface waters, as they are especially sensitive to changes in nutrient pollution and water clarity. Phytoplankton form the base of the food web. While increased populations provide more food to organisms further up the food web, too much or the wrong type of algae can harm the overall health of the Chesapeake Bay. In some cases, harmful algal blooms can impact human health. Scientists assess microscopic algal community health with a Phytoplankton Index of Biotic Integrity. Data from Spring 2005 show that about 9% of the Chesapeake Bay's phytoplankton communities were considered healthy.

- Fish and Shellfish - Many of the Chesapeake Bay's fish and shellfish populations are below historic levels. The number of adult blue crabs is below the long term average for the seventh straight year and oyster populations are at or near historic lows. American Shad are recovering slowly, while other species like striped bass show mixed signals. Current striped bass populations exceed restoration goals, but approximately 60% to 70% are infected by a disease called mycobacteriosis. Researchers are currently working to understand the extent and severity of the disease and the extent to which environmental conditions in the Chesapeake Bay influence it.

2.4.2.2 Identification of Important Estuarine Species

NUREG-1555 (NRC, 1999a) defines important species as: 1) species listed or proposed for listing as threatened, endangered, candidate, or of concern in 50 CFR 17.11 and 50 CFR 17.12 (CFR, 2007a), by the U.S. Fish and Wildlife Service, or the state in which the project is located; 2) commercially or recreationally valuable species; 3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; 4) species critical to the structure and function of local terrestrial ecosystems; or 5) species that could serve as biological indicators of effects on local terrestrial ecosystems.

A list of species considered important in the project area was compiled based on these criteria and summarized in Table 2.4-6. A single species may meet more than one of the five criteria. A 6th criterion, status as a potential nuisance to plant operation, is not discussed, as no nuisance aquatic species are expected to occur in the vicinity of the project area.

- Species Under Special Protection - Threatened, Endangered, or Candidate Species: Any species that is known to occur or could occur in the Chesapeake Bay or near the CCNPP site that is afforded special protection under the federal Endangered Species Act, or under the equivalent State of Maryland law, is defined as an important species.

- Commercially Harvested Species: Finfish and shellfish that rely on habitat in the vicinity of the CCNPP site during any life stage, and are commercially harvested to a substantial degree, are considered important resources.

- Recreational Target Species: Finfish and shellfish that rely on habitat in the vicinity of the CCNPP site during any life stage, and are preferentially taken by recreational anglers or trappers to a substantial degree are considered important resources.

- Keystone Species: Any species that is essential to maintaining the structure and function of the estuarine ecosystem in the vicinity of the CCNPP site will be identified as important.

- Indicator Species: A species whose abundance, distribution, or condition is known or believed to be a reliable predictor of the status of another species of interest is considered an important species.

In addition, Section 5.3.1.2 includes information regarding additional estuarine and marine species not discussed in this section, e.g., Weakfish (Cynoscion regalis), Summer Flounder (Paralicthys dentatus), Spotfin Killifish (Fundulus luciae), and the Soft Shell Clam (Mya arenaria). These estuarine and marine species were determined not to be important species as defined above, because they do not meet any of the six criteria.

2.4.2.2.1 Description of Important Species

Each important species is described in terms of the following parameters, which provide a context within which site-related effects may be measured and interpreted:

- Critical life support (natural history) requirements, including spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes (including maps)

- Temporal and three-dimensional spatial distribution and abundance, especially in the discharge area and receiving water body (including maps)

- Seasonal catch data (location, volume, and value) for commercially and recreationally important species
- Existing stressors and adverse effects not related to the proposed project

2.4.2.2.2 Threatened or Endangered Species

Two fish and two sea turtle species in the project area are afforded special protection under the Endangered Species Act: the Shortnose and Atlantic Sturgeon, and the Loggerhead and Kemp's Ridley Turtle.

2.4.2.2.2.1 Shortnose Sturgeon

The Shortnose Sturgeon (*Acipenser brevirostrum*) is an anadromous bony fish that has historically inhabited sluggish tidal rivers and nearshore marine waters of the western Atlantic coast, including Chesapeake Bay. The ancestral range of this species is believed to extend from the St. John River in New Brunswick, Canada, to the St. Johns River in Florida. It moves up river channels to spawn in fresh water. Although this fish once supported an enormous international export business, the stock plummeted during the 1900s due to overharvesting. The Shortnose Sturgeon was listed as federally endangered in 1967, and is considered extremely rare under Commonwealth of Maryland law. Deteriorating water quality (especially low dissolved oxygen) and placement of dams that restrict its access to historical spawning grounds have likely inhibited the strong comeback that could have been expected once legal protections were put in place.

In 1979, Baltimore Gas and Electric researchers captured a Shortnose Sturgeon during trawl studies in the vicinity of the CCNPP site. Other isolated individuals may use the area intermittently; however, no Shortnose Sturgeon is known to have spawned in the Chesapeake in decades. In August, 2006, a female with eggs was captured as she swam up the Potomoc, supposedly to spawn. It is not known whether she spawned, but biologists consider it doubtful, since males are exceedingly rare in the area. Another female was captured near the Choptank River entrance in 2007. Intensive efforts by biologists to document the presence of this species in the Chesapeake are ongoing. No Shortnose Sturgeon has been captured in impingement samples at CCNPP Units 1 and 2.

2.4.2.2.2.2 Atlantic Sturgeon

A larger, longer-lived relative of the Shortnose Sturgeon, the Atlantic Sturgeon (*Acipenser oxyrhynchus*) once supported a robust fishery in the Chesapeake Bay. It is currently on the candidate species list maintained by NOAA Fisheries, because it is undergoing a status review under the Endangered Species Act. The decline of the Atlantic Sturgeon was not as sudden or steep as that of the Shortnose Sturgeon, but its populations are currently depleted. In late 1997, a moratorium on the harvest of wild Atlantic Sturgeon was implemented and remains in effect until there are at least 20 protected year classes in each spawning stock, which may take up to 40 or more years.

The sturgeon's dependence on both estuarine and freshwater habitat makes it susceptible to harm from habitat degradation due to pollution, physical barriers to spawning areas, channelization or elimination of backwater habitats, de-watering of streams, and physical destruction of spawning grounds.

The MDNR conducted a trial stocking experiment in 1996 to investigate the viability of juvenile hatchery fish that were released on the Eastern Shore. During the subsequent 5 years, 14% of the juveniles were recaptured, suggesting that habitat conditions were adequate to

support growth and survival. Recent changes to the water quality goals in the Chesapeake Bay are expected to result in habitat improvements for both sturgeon species.

2.4.2.2.2.3 Atlantic Loggerhead Turtle

Loggerheads (*Caretta caretta*) occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. The Loggerhead is the most abundant species of sea turtle found in U.S. coastal waters, including the Chesapeake Bay. Approximately 2,000 to 10,000 young Loggerheads forage in the bay each summer for horseshoe crabs, jellyfish, and mollusks. They are most often seen near the mouths of rivers, in water greater than 13 ft (4 m) deep. Most sightings are in the Virginia portion of the bay, where salinity is higher. In addition to the well-known juveniles, it has been reported that up to 5% of the Loggerheads in Chesapeake Bay are adult females who are taking time off between nesting efforts.

The stock structure of the U.S. population of Loggerheads is poorly understood. Some evidence suggests that individuals nesting in Georgia represent a population distinct from the Florida nesters. If so, the northern population may be more severely threatened. NOAA Fisheries suggests that it may become necessary to consider listing them as endangered. Adult Loggerheads are known to make extensive migrations between foraging areas and nesting beaches. The Virginia Institute of Marine Science Sea Turtle Program actively tracks individuals that nest on Virginia beaches in an effort to determine the migration routes of these turtles. At present, the place of origin of an individual turtle cannot be determined. Turtles feeding in the Chesapeake Bay may represent a number of nesting populations worldwide.

At the global level, the primary threat to Loggerhead turtle populations is incidental capture in fishing gear, especially in longlines and gillnets, but also in trawls, traps and pots, and dredges. NOAA Fisheries is currently implementing a program to evaluate the incidence of bycatch of sea turtles in various types of gear, including pound nets in the Chesapeake Bay.

2.4.2.2.2.4 Kemp's Ridley Turtle

The Kemp's Ridley Turtle (*Lepidochelys kempii*) is one of the smallest of the sea turtles, with adults reaching about 2 ft (0.6 m) in length and weighing up to 100 lbs. The Kemp's Ridley Turtle has been on the endangered species list since 1970. Nesting occurs in spring on Mexican beaches. After leaving the nesting beach, hatchlings are believed to become entrained in eddies within the Gulf of Mexico, where they are dispersed within the Gulf and Atlantic by oceanic surface currents until they reach about 7.9 in (20 cm) in length, (or about two years of age) at which size they enter coastal shallow water habitats.

A sizeable group of the Kemp's Ridley Turtle spends the summers in the Chesapeake Bay, although most remain in the higher salinity waters of the Virginia portion of the bay. This turtle is a shallow water benthic feeder with a diet consisting primarily of crabs.

The principal threats to this species occur on the nesting beaches, where both deliberate and accidental disturbances interfere with nesting success and in accidental take by fisheries vessels. Restoration of the species requires protecting sub-adult and adult animals by the use of turtle excluder devices on shrimp trawls wherever turtles occur.

2.4.2.2.3 Harvested Fish

Nine species of fish that are harvested commercially or recreationally in the Chesapeake Bay are considered important in the project area, as shown in Table 2.4-6.

2.4.2.2.3.1 American Shad

The American Shad (*Alosa sapidissima*) is one of six shad and herring species to occur in the Chesapeake Bay. From January to June, shad older than about four years old enter the Chesapeake Bay to spawn in fresh or near-fresh tributaries as far north as the Susquehanna River. Shad usually complete the spawning run without feeding and move far enough upstream for the eggs to drift downstream and hatch before reaching saltwater. After spawning, the adult either dies or resumes its long pelagic migration. Within a month, young fish are feeding on zooplankton in the Chesapeake Bay. More than 70% die before leaving the estuary.

Historically, it is likely that American Shad spawned in suitable waters across the Atlantic coast. Current spawning runs are limited by physical barriers as well as degraded water quality. These impediments to spawning, added to overharvesting, spurned Maryland to implement a fishing moratorium in 1980. Virginia concurred in 1994, making it illegal to harvest American Shad anywhere in the Chesapeake Bay. Stocks are being enhanced in three ways: (1) Restoring native spawning habitat by removing dams or building fishways; (2) supplementing wild stocks with hatchery fish; and (3) improving water quality.

A low of several hundred American Shad per year was reported in the early 1980s. The most recent data available show an average of 101,140 per year between 2003 and 2005. The increased abundance falls short of the long term restoration goal of two million fish per year. The Atlantic States Marine Fisheries Commission has identified habitat areas of particular concern for the American Shad, including spawning sites; nursery areas; inlets that provide access to coastal bays, estuaries and riverine habitat upstream to spawning grounds; and sub-adult and adult nearshore ocean habitat.

The abundance of the closely related Hickory Shad (*Alosa mediocris*) dropped so low in the Chesapeake Bay in the late 1970s that a moratorium on commercial and recreational capture in Maryland's portion of the Chesapeake Bay was implemented in 1981. Although the population is increasing, the moratorium remains in place. Ocean landings of hickory shad are still allowed and Maryland recorded landings less than 4000 lb (1800 kg) in 2004.

2.4.2.2.3.2 Bay Anchovy

The Bay Anchovy (*Anchoa mitchilli*) is the most abundant fish in the Chesapeake Bay. Through predator-prey relationships, the Bay Anchovy forms a link between zooplankton and top game fish. Striped bass, bluefish, and other sport fish, as well as some birds and mammals, depend on the abundance of Bay Anchovy to sustain them. In one study, Bay Anchovy accounted for up to 65% of the biomass consumed by striped bass in the Bay.

The Bay Anchovy spawns throughout the Bay. In summer months from 1995 to 2000, Bay Anchovy eggs comprised more than 94% of the fish eggs in the plankton of the Middle Bay portion of the Chesapeake Bay. More than 75% of all larval fish collected in ichthyoplankton tows were Bay Anchovy.

The Bay Anchovy is not commercially harvested. However, Bay Anchovy populations in the Chesapeake Bay fluctuate annually. Since 1994, the Bay Anchovy population in the Chesapeake Bay has been on a long term decline, the first ever recorded for the species. In recent years, recruitment of Bay Anchovy has been lower than expected, based on the various trawl surveys. Although the specific causes of the decline are not well understood, it is known that oxygen levels below 3.0 mg/l can be lethal to eggs and larvae. Dissolved oxygen greater than 2.0 mg/ l is critical for adult survival.

2.4.2.2.3.3 Atlantic Menhaden

Like the Bay Anchovy, the Atlantic Menhaden (*Brevoortia tyrannus*) is a key component of the estuarine food web, consuming plankton and small fish while being consumed by larger predatory fish. Adults are present in near proximity to the CCNPP site year round. In the Middle Bay, spring egg collections were comprised of more than 80% menhaden. Unlike the Bay Anchovy, however, the Atlantic Menhaden is directly targeted by commercial harvesters. In 2004, more than 3 million lb (1.4 million kg) were landed in Maryland.

Atlantic Menhaden stocks across the Atlantic coast are stable. However, reduced abundance in the Chesapeake Bay, a key nursery area, has been reported. Due to the concern over the steady decline in recruitment in the Chesapeake Bay, fisheries managers have recently (starting in 2006) capped the commercial harvest of Atlantic Menhaden for 5 years. The limits on harvest of Atlantic Menhaden are based on the importance of Atlantic Menhaden to predatory fish, including the striped bass and bluefish.

2.4.2.2.3.4 Atlantic Croaker

The Atlantic Croaker (*Micropogonias undulates*) is one of the top ten recreational finfish in the Chesapeake Bay. Adults are abundant in the bay from March to October. They move offshore and south along the Atlantic coast in the fall. Juveniles are present essentially year round. Spawning occurs over the shelf in fall and winter.

The Atlantic Croaker is a bottom-feeding generalist, consuming benthic invertebrates and some fish. It is associated with muddy substrates in depths less than 400 ft (120 m), in a wide range of salinity and temperature conditions. All of the major predatory fish in the Chesapeake Bay, including striped bass, flounder, shark, spotted seatrout, other croaker, bluefish and weakfish, include croaker in their diet.

The Atlantic Croaker is a perennial favorite of the human population, as well, ranking within the top 10 species caught by anglers. Historically, the Chesapeake Bay region accounted for the majority of Atlantic Coast croaker landings. Recreational landings in the region have been declining since 1986.

After a sharp decline in commercial landings during the 1970s and 1980s, Atlantic croaker landings in Maryland increased to close to 1 million lb (454,000 kg) per year for most of the 1990s. In fact, commercial landings in 2001 were higher than at any time since 1956, indicating a rebound of the Atlantic Croaker fishery in the Chesapeake Bay.

2.4.2.2.3.5 Striped Bass

The Striped Bass (*Morone saxitilis*) is the dominant predator in the Chesapeake Bay. Juveniles and adults occur in the Chesapeake Bay year round. The abundance and distribution of the Striped Bass affect countless other species, including the Atlantic Menhaden. Juvenile Striped Bass feed on zooplankton and benthic invertebrates. Adults eat a variety of other important fish, including Bay Anchovy, Atlantic Menhaden, Spot, Atlantic Croaker, and White Perch.

This large anadromous species has a complex life history that centers on the Chesapeake Bay, where historically, about 90% of the Atlantic population spawned. Distribution patterns are influenced by the age, sex, degree of maturity and the river in which they were born. Successful completion of the striped bass life cycle requires a variety of habitats including spawning sites, nursery areas, passages between inland spawning and estuarine nursery habitats, and offshore wintering grounds.

Commercial and recreational landings in the Chesapeake Bay generally increased from the 1930s through the mid-1970s, then declined sharply through the mid-1980s. Aside from direct overfishing, it is thought that low dissolved oxygen increased stress on the fish, making them susceptible to disease. A moratorium on all striped bass fishing in Maryland in 1985, and in Virginia in 1989, allowed the population to rebound. According to the Maryland Department of Natural Resources (MDNR), 602,506 lb (273,292 kg) of striped bass were harvested from the south central area of the Chesapeake Bay near the CCNPP site in 2004. This was one of the top 10 years of greatest harvest since data collection began in 1944. Concerns about the future of this fishery remain. A large percentage of striped bass appear to be malnourished and up to 70% of the population is infected with mycobacteriosis, a type of wasting disease. The impact of this disease of sustainability of the stock is not well understood at this time.

2.4.2.2.3.6 Spot

The Spot (*Leiostomus xanthurus*), like the Atlantic Croaker, occupies a middle position in the Chesapeake Bay food web, as a consumer of benthic invertebrates and as prey for striped bass, bluefish, weakfish, shark and flounder. The Spot is a generalized omnivorous bottom feeder that ranges throughout the Chesapeake Bay from April through October. The Spot is broadly tolerant of temperature and salinity fluctuations. Spawning occurs offshore, then the young move into the estuary for rearing.

In addition to their central role in the food web, Spot are important to both commercial harvesters and recreational anglers. Inter-annual variability in spawning conditions leads to unpredictable landings. No long term declines, however, have been noted. Commercial landings are highest during the fall migration out of the Chesapeake Bay, when they are taken as by-catch from the pound net fishery in the lower Bay. According to MDNR, commercial catches in Maryland have exceeded 100,000 lb (45,000 kg) annually since 1998.

2.4.2.2.3.7 White Perch

White Perch (*Morone americana*) migrate from the open Chesapeake Bay into the tidal-fresh portions to spawn from April to June over the sandy bottoms of brackish or tidal-fresh rivers. Young White Perch remain nearshore downstream from their hatching areas for several months, foraging for insect larvae and crustaceans. Adult White Perch overwinter in the deeper channels of the Chesapeake Bay. They never move into the open ocean. White Perch are heavy consumers of fish eggs, including those of the striped bass.

The White Perch is considered a delicious table fish, and supports an important recreational fishery in the Chesapeake Bay. It is also commonly taken as by-catch by commercial harvesters. Large schools of White Perch are vulnerable to capture when they aggregate in large schools to feed on herring. According to MDNR, commercial catches in Maryland have exceeded 1 million lb (453,000 kg) annually since 1995.

2.4.2.2.3.8 Bluefish

The migratory Bluefish (*Pomatomus saltatrix*) visits the Chesapeake Bay area from spring to fall; it spawns offshore in the Chesapeake region in July. Juvenile Bluefish move into the bay during late summer. Larger juveniles and adult bluefish have broad habitat tolerances, and range throughout the Chesapeake Bay in search of forage fish. Its diet is varied, consisting of fish species at all depths, including Atlantic Menhaden, Weakfish, and Croaker. As a large, mobile predator, it competes with the striped bass for food.

About 20% of the Bluefish caught commercially in the U.S. are landed in the Chesapeake Bay, making bluefish a significant fishery in the area. The majority of the catch is in the Virginia

portion of the Chesapeake Bay. Historic highs and lows in the harvest have occurred during the last 70 years. Until about 1992, commercial landings of Bluefish in Maryland routinely exceeded 200,000 lb (90,000 kg) annually. Although overall stocks of Bluefish in the Atlantic are increasing, landings in the Chesapeake Bay are on the decline, possibly due to over harvesting. According to MDNR, about 52,000 lb (23,000 kg) of Bluefish were landed by commercial fishermen in 2004.

The Bluefish ranked first in number and weight among sportfish in the Chesapeake Bay for nearly 20 years, until the current decline began in 1990. Recreational landings outnumber commercial landings by at least 5 times. MDNR implemented a management plan in 1990 in response to concerns about declining regional bluefish stocks.

2.4.2.2.3.9 American Eel

The American, or common, Eel (Anguilla rostrata) is a widely distributed catadromous species, which lives predominately in rivers, lakes and estuaries, but spawns in the Atlantic Ocean. The American Eel is abundant year-round in all tributaries to the Chesapeake Bay. During the 5 to 20 years the American Eel spends in the Chesapeake Bay, it feeds at night on insects, mollusks, crustaceans, worms, and other fish.

In all its life stages, the American Eel is an important prey species, as it is consumed by a variety of fish, aquatic mammals, and birds. The American Eel is caught in commercial eelpots. Most eels landed in the Chesapeake Bay area are juveniles, or "glass eels," which are exported to Europe and Asia. Recreational anglers do not typically target the eel for consumption, although they are often bought for use as bait for striped bass and other sport fish.

In 2005 the Atlantic States Marine Fisheries Commission determine that eel abundance had fallen since the late 1970s to mid-1980s, and was at or near historic lows along the entire Atlantic coast. The decline was not attribute to any particular cause although several possible factors such as harvest, habitat loss, predation, hydroturbine mortality, disease, parasitism, and reduced fecundity resulting from pollution were noted. The commercial catch in 1981 was more than 700,000 lb (317,000 kg) in both Maryland and Virginia, but has been declining ever since.

The American Eel is currently being considered for special protection under the Endangered Species Act, which may affect the way the species is managed by the Atlantic States Marine Fisheries Commission. The American Eels mature slowly (reproducing at age 8 to 24 years), and are vulnerable to targeted harvest during seasonal migrations, which occur before the first spawning of new adults.

2.4.2.2.4 Harvested Invertebrates

Two species of invertebrates have been historically important to commercial and recreational harvesters near the CCNPP site, and throughout the Chesapeake Bay: the Blue Crab and the American Oyster. Both species are now severely depleted, and under strict management provisions.

2.4.2.2.4.1 Blue Crab

The Blue Crab (*Callinectes sapidus*) plays a vital role in the Chesapeake Bay region as both predator and prey. The Chesapeake Bay is the largest producer of crabs in the country, supporting major commercial and recreational fisheries. In most years, at least 30% of the nation's Blue Crabs come from Chesapeake Bay waters. According to the CBP, annual commercial harvests can approach 100 million lb (45.4 million kg) of crab.

Blue Crabs range from the upper Chesapeake Bay near freshwater tributaries down to the mouth of the Chesapeake Bay. Although mating occurs in the areas near the CCNPP site, the females typically migrate down-bay to a spawning and hatching area approximately 70 mi (110 km) south of the CCNPP site, where an appropriate salinity of approximately 23 to 28 parts per thousand occurs.

The number of mature female Chesapeake Bay Blue Crabs, or spawning stock, remains below the long term average. The 2006 winter survey conducted by MDNR showed that the total number of crabs in the Chesapeake Bay was low compared with historical averages, but stable. In 2006, the Chesapeake Bay Foundation issued a Chesapeake Bay score of 38%, or grade C for the Blue Crab. Reasons for the observed reduction in harvest are complex, but may include over-harvesting, loss of habitat, and degradation of water quality. Juvenile crabs are closely tied to submerged aquatic vegetation, and may suffer a decline when submerged aquatic vegetation is unavailable for use as habitat and nursery grounds. Crabs are bottom feeders, and can be sensitive to low dissolved oxygen near the substrate.

2.4.2.2.4.2 American Oyster

The American Oyster (*Crassostrea virginica*) is highly valued in the Chesapeake Bay, but has been declining since the late 1800s due to over-harvesting, parasites, and poor water quality. After 2 to 3 weeks in the plankton, or as weak swimmers, larval oysters attach to the Chesapeake Bay substrate in a place where they will become permanently attached as adults. From there, a healthy oyster provides many services to the Chesapeake Bay ecosystem, including filtering the water, producing planktonic larvae that feed a variety of larval fish, and creating a physical structure with its shell that many other animals use for shelter and foraging.

Efforts to restore the oyster fishery include expanding the amount of clean, hard surfaces for oyster spat (juvenile oysters) to settle, increasing the number of breeding adult oysters and developing methods for controlling oyster diseases.

Oyster breeding and nursery areas occur near the CCNPP site. New beds were created during CCNPP Units 1 and 2 construction to mitigate habitat loss. However, oysters have not occurred in sufficient number for commercial fishery near the CCNPP site since at least 1971.

2.4.2.2.5 Other Important Resources

In addition to the fish and invertebrates already mentioned, submerged aquatic vegetation and plankton are considered important resources in the project area.

2.4.2.2.5.1 Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) includes a group of about 16 rooted plant species that live within the shallows of the Chesapeake Bay and its tributaries. This vital resource provides refuge and nursery habitat for numerous organisms, increases the structural complexity of the bottom, adds oxygen to the water, and prevents erosion and sedimentation. In addition, microscopic algae and protozoa use the leaves of SAV as attachment locations. Small fish are attracted to these areas for feeding. Decaying leaves are consumed by zooplankton, which are then eaten by larval fish.

SAV is considered an indicator group because the plants respond quickly and dramatically to degradation of water quality. At one time, SAV covered about 200,000 shallow and shoreline acres (81,000 hectares) of the Chesapeake Bay. Acreage has fluctuated widely over the past few decades. In 2004, bay grasses covered 72,935 acres (29,516 hectares). Although this value

represented an increase over previous years, it is still only about 42% of what experts believe to be necessary for complete restoration of function. Acreage of SAV in the middle and lower Chesapeake Bay has diminished even more significantly over the past decade. In addition, late in 2005 much of the SAV in the lower Chesapeake Bay died, possibly due to high temperatures.

In 2006, the Chesapeake Bay Foundation issued a Chesapeake Bay score of 18% (failing grade) in the SAV category. No SAV were located during the surveys conducted to support CCNPP Unit 3 in the immediate vicinity of the CCNPP site.

2.4.2.2.5.2 Plankton (Phytoplankton and Zooplankton)

The term plankton refers to organisms of the open water that drift on currents and tides. Phytoplankton are plants or algae that manufacture their own food using nutrients in the water. Zooplankton are animals that generally consume phytoplankton. A small but significant component of the plankton consists of bacterial cells. Although most plankton are tiny, they range in size from microscopic bacteria and plants to larger animals, such as jellyfish.

In the Chesapeake Bay, plankton provides the nutritional support for the entire fisheries industry. Plankton are short-lived and highly responsive to both positive and negative environmental changes. As such, plankton are useful indicators of overall environmental quality. Phytoplankton abundance is a readily visible measure of invisible nutrient loads in the Chesapeake Bay. The composition and abundance of zooplankton are predictors of near term fisheries abundance, as most larval fish rely on zooplankton to grow to a size large enough to compete as a predator. Some species, such as Blueback Herring, Alewife, and Shad, rely on mesozooplankton food their entire lives. The influence of zooplankton on Striped Bass and White Perch in Chesapeake Bay is well-documented. Striped Bass, White Perch, and Yellow Perch depend on mesozooplankton and microzooplankton as larvae, and shift to larger prey as they grow. The role of zooplankton in the Chesapeake Bay is an area of active research.

Zooplankton are categorized by size as the barely visible microzooplankton (20 µm - 0.2 mm) and mesozooplankton (0.2 - 20 mm), and the more familiar macrozooplankton (20 mm - 20 cm), which includes ctenophores (Comb Jellyfish), shrimp, amphipods, euphausiids, and larval fish. The megazooplankton (20 cm - 2 m) are the true jellyfish.

The overall health of the zooplankton in the Chesapeake Bay is suboptimal, and worsening in most reaches:

- Despite universal improving trends, zooplankton food levels for migratory fish larvae are currently inadequate in most major spawning/nursery areas.
- Sharp declines in mesozooplankton abundance were noted in almost all of the middle and lower Chesapeake Bay mainstem and lower tributary reaches. At the station nearest to the CCNPP site (just north of the CCNPP site), a 32% drop in abundance from 1984 to 2002 was reported.
- In contrast, abundances of the smaller microzooplankton increased in the mid Chesapeake Bay. The overall zooplankton food base for important forage fish such as bay anchovy, menhaden, and immature stages of other resident species is declining and shifting to smaller sizes.

However, some positive trends have been documented, likely in response to improvements in water quality.

- Significant increases in mesozooplankton abundance indicate an improving trend in the overall food base for fish in some areas, especially where water quality significantly improved, as in the Patuxent River.

Relationships among various components of the plankton are complex, and not well-understood. For example, phytoplankton food quality, which is influenced by water quality, appears to be an important factor affecting mesozooplankton. However, high phytoplankton biomass does not necessarily produce high mesozooplankton abundances. The specific phytoplankton groups, such as diatoms, influence the success of the zooplankton that consume them.

Monitoring of phytoplankton using a Phytoplankton Index of Biotic Integrity showed that about 9% of the Chesapeake Bay's phytoplankton communities were considered healthy in Spring 2005.

2.4.2.2.6 Nuisance Species

No nuisance aquatic species occur in the vicinity of the CCNPP site.

2.4.2.3 Habitat Importance

Onsite streams and ponds were described in terms of the typical surface water habitats in the area. Headwater streams in general are considered important; however, there is nothing of regional significance about these particular streams. All of the onsite aquatic species mentioned in this section are common in the area. No loss of onsite stream and pond critical habitat is expected.

The Chesapeake Bay is considered important estuarine habitat to most, if not all, of the estuarine species identified in the area. However, none of the important species in the vicinity of the project are endemic to Chesapeake Bay. All of them range widely throughout the mid-Atlantic coast, and most occur in the Gulf of Mexico, as well.

The portion of the Chesapeake Bay nearest the CCNPP site is of lower relative importance than other areas of the bay. Estuarine species that use the bay as nursery grounds need the submerged aquatic vegetation (SAV) and tidal marshes for nutrient-rich forage for the larvae and young of the year, as well as for protective cover from predators. The area near the CCNPP site has no SAV, and does not provide critical habitat for any species.

The National Marine Fisheries Service (NMFS) designated Essential Fish Habitat (EFH) for each life stage of federally managed marine fish species in the Chesapeake Bay area; the bluefish is the only important species in the project area that is federally managed, and for which EFH has been designated. EFH is defined in Title 50 CFR Section 600.10 (CFR, 2007c) implementing the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (USC, 1996) as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Bluefish eggs and larvae are found only offshore, so no EFH occurs in Chesapeake Bay. For juvenile bluefish, all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida, are EFH. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones. Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries from May through January in the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the

schools. Bluefish are generally found in normal shelf salinities (greater than 25 parts per thousand).

Four threatened and endangered aquatic species known to occur in the area include two species of sturgeon and two species of sea turtles. No sturgeon is known to have spawned in the Chesapeake in decades. The sea turtles that occasionally use the Chesapeake Bay spawn much further south, outside the Chesapeake Bay watershed.

2.4.2.4 Other Preexisting Environmental Stresses

Pollution, nutrient enrichment, and over-harvesting of estuarine species are among the key threats to the health of the Chesapeake Bay. Based on conditions throughout 2006, the Patuxent River Watershed portion of the Chesapeake Bay received a grade of D- (23%) based on very poor water clarity and chlorophyll *a*, moderate dissolved oxygen conditions, poor benthic and phytoplankton scores, and loss in bay grasses.

Section 2.4.2.1.2.3 includes information on the types of stresses that organisms have experienced.

2.4.2.5 Transmission and Access Corridors

There are no new offsite transmission or access corridors associated with CCNNP Unit 3.

2.4.3 References

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Table 2.4-1— Important Terrestrial Species and Habitats

(Page 1 of 2)

Name	Common Name	Description	Location	Rationale
Mammals				
Odocoileus virginianus	White-tail Deer	Large, herbivorous mammal. Favors forest edge habitat. Game species.	Observed frequently in all habitats in the CCNPP site area. Likely to be abundant elsewhere on the CCNPP site and surrounding landscape.	Recreationally valuable species
Birds				
Piranga olivacea	Scarlet Tanager	Neotropical migratory bird that breeds in North America in late spring and early summer and winters in Central and South America in fall and winter. Favors large tracts of forest, especially forest with lots of dead or declining trees, for breeding territory.	Heard frequently throughout forested areas on the CCNPP site. Likely common in other forested areas in surrounding landscape.	Designated as "Forest Interior Bird" (FIB) by Maryland Department of Natural Resources
Haliaeetus leucocephalus	Bald Eagle	Large, piscivorous (fish-eating) bird.	Maryland Natural Heritage Program has a record of a nest on the Chesapeake Bay shoreline in the southern part of the CCNPP site, just south of the CCNPP Unit 3 construction area. Observed flying along cliffs east of the CCNPP site.	Federal Protected Maryland Threatened
Insects				
Cicindela dorsalis dorsalis	Northeastern Beach Tiger Beetle	Small beetle inhabiting sandy beaches.	Cliffs and beaches (primarily beaches) on Chesapeake Bay (eastern edge of the CCNPP site and north of CCNPP Units 1 and 2).	Federal Threatened Maryland Endangered
Cicindela puritana	Puritan Tiger Beetle	Small beetle inhabiting sandy shores on fresh and brackish waters. Limited to shorelines of Connecticut River in Connecticut and Chesapeake Bay in Maryland. Feeds on other insects (i.e., insectivorous). Spends approximately 23 months of roughly 2 year life cycle in shallow underground tunnels in sand.	Cliffs and beaches on Chesapeake Bay (eastern edge of the CCNPP site).	Federal Threatened Maryland Endangered
Plants				
Centrosema virginianum	Spurred Butterfly Pea	Perennial forb.	Maryland Natural Heritage Program has record of occurrence on the CCNPP site southwest of the CCNPP Unit 3 construction area. Observed in August 2006 in John's Creek floodplain.	Maryland Rare
Kalmia latifolia	Mountain Laurel	Evergreen woody shrub.	Forms dense stands in the understory of many upland forested areas throughout the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator

Table 2.4-1— Important Terrestrial Species and Habitats

(Page 2 of 2)

Name	Common Name	Description	Location	Rationale
Liriodendron tulipifera	Tulip Poplar	Deciduous tree.	Dominant tree in most upland forest areas in the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator
Quercus prinus	Chestnut Oak	Deciduous tree.	Dominant tree in most sloping and dry upland forest sites in the CCNPP Unit 3 construction area, the CCNPP site, and surrounding landscape.	Ecosystem Critical, Biological Indicator
Quercus shumardii	Shumard's Oak	Deciduous tree.	Possible occurrence in John's Creek floodplain.	Maryland Threatened
Solidago speciosa	Showy Goldenrod	Perennial forb with showy yellow flowerheads consisting of hundreds of small yellow flowers.	Several locations on forest edges in Camp Conoy.	Maryland Threatened
Thelypteris noveboracensis	New York Fern	Perennial fern.	Forms dense groundcover in large patches in Mesic Deciduous Forest and Bottomland Deciduous Forest.	Ecosystem Critical, Biological Indicator
Habitats				
Herbaceous Marsh Vegetation		Dominated by sedges, rushes, bulrushes, and grasses and forbs typical of poorly drained soils.	Fringes of Lake Conoy and other ponds; floodplain areas on the CCNPP Unit 3 construction area and elsewhere on the CCNPP site that lack tree canopy.	Wetland Floodplain
Poorly Drained Bottomland Deciduous Forest		Dominated by red maple, sweet gum, and black gum with understory of ferns.	Primarily in bottoms of stream valleys.	Wetland Floodplain
Well-Drained Bottomland Deciduous Forest		Dominated by tulip poplar, American beech, sweet gum, black gum, and red maple.	Primarily in bottoms of stream valleys.	Wetland Floodplain
Flag Ponds Nature Park		327 acres (132 hectares) park comprising a matrix of sandy beach, tidal marsh, freshwater marsh, freshwater pond, and forest habitats.	Directly north of the CCNPP Unit 3 construction area.	County-Owned Preserve
Calvert Cliffs State Park		3,030 acres (1,226 hectares) forested park containing same upland and wetland habitats as natural areas on CCNPP site area. 1079 acres (436.7 hectares) are designated as wildland area and 550 acres (222.6 hectares) are designated as public hunting area.	Directly south of the CCNPP Unit 3 construction area.	State-Owned Preserve

Table 2.4-2— Survey Results for John's Creek (Fall 2006)

Parameter	Upstream (JCUS-01)**	Downstream (JCDS-01)**
Total Number of Individual Invertebrates	1,628	1,414
Total Number of Invertebrate Taxa	29	33
Total Number of Individual Fish	4	105
Total Number of Fish Species	1	8
Overall Habitat Quality *	147	167

Notes:
* Any value greater than 139 is considered optimal.
** Sample points from biological survey

Table 2.4-3— Survey Results for Goldstein Branch (Fall 2006)

Parameter	GB-01**
Total Number of Individual Invertebrates	1,238
Total Number of Invertebrate Taxa	24
Total Number of Individual Fish	65
Total Number of Fish Species	7
Overall Habitat Quality *	149

Notes:
* Any value greater than 139 is considered optimal.
** Sample point from biological survey

Table 2.4-4— Dip Net Survey Results for Lakes and Ponds (Fall 2006)

Parameter	Lake Davies	Pond 1	Pond 2	Lake Conoy
Total Number of Individual Invertebrates	10,719	2,972	1,817	4,157
Total Number of Invertebrate Taxa	14	20	21	31
Total Number of Individual Fish	81	8	56	213
Total Number of Fish Species	1	4	5	6

Note:
Overall habitat quality values are only calculated for streams.

Table 2.4-5— Summary of Functions and Values for Assessment Areas

Function or Value	Wetland Assessment Areas *								
	I	II	III	IV	V	VI	VII	VIII	IX
Functions									
Groundwater Recharge/Discharge	X	X	X	X	X		X	X	
Floodflow Alteration									
Fish and Shellfish Habitat		X			**X**		X		
Sediment/Toxicant Retention		X	X	X	**X**	X	X	X	
Nutrient Removal		X	X	X	**X**	X	**X**	X	
Production Export		X	X	X	**X**	X	X	X	
Sediment/Shoreline Stabilization		X			X	X			
Wildlife Habitat	X	**X**	**X**	**X**	**X**	X	**X**	**X**	X
Values									
Recreation		**X**	X	X	X		X	X	
Educational/Scientific Value			X	X	X			X	
Uniqueness/Heritage		X	X	**X**	**X**			X	
Visual Quality/Aesthetics		X						X	X

Legend:
X
Function or Value Present

X

Function or Value Principal
Note:
* As shown in the Wetlands Delineation Study

Table 2.4-6— Important Species in the Chesapeake Bay Near the CCNPP Site

Species (*Scientific Name*)	Commercially Harvested	Recreational Target	Keystone Species	Indicator Species
Threatened and Endangered Species				
Shortnose Sturgeon * Acipenser brevirostrum				
Atlantic Sturgeon Acipenser oxyrhynchus	**X (Moratorium since 1997)**			
Atlantic Loggerhead Turtle * Caretta caretta				
Kemps Ridley Turtle * Lepidochelys kempii				
Harvested Fish				
American Shad Alosa sapidissima	**X**			
Bay Anchovy Anchoa mitchilli	**X**		**X**	
Atlantic Menhaden Brevoortia tyrannus	**X**		**X**	**X**
Atlantic Croaker Micropogonias undulatus	**X**	**X**		
Striped Bass Morone saxitilis	**X**	**X**		
Spot Leiostomus xanthurus	**X**	**X**		
White Perch Morone americana	**X**	**X**		
Bluefish Pomatomus saltatrix	**X**	**X**		
American Eel Anguilla rostrata	**X**	**X**		
Harvested Invertebrates				
Blue Crab Callinectes sapidus	**X**	**X**		
American Oyster Crassostrea virginica	**X**			**X**
Other Important Resources				
Submerged Aquatic Vegetation (SAV)			**X**	**X**
Plankton			**X**	**X**

Note:

* Threatened and Endangered Species are not allowed to be taken in the Chesapeake Bay.

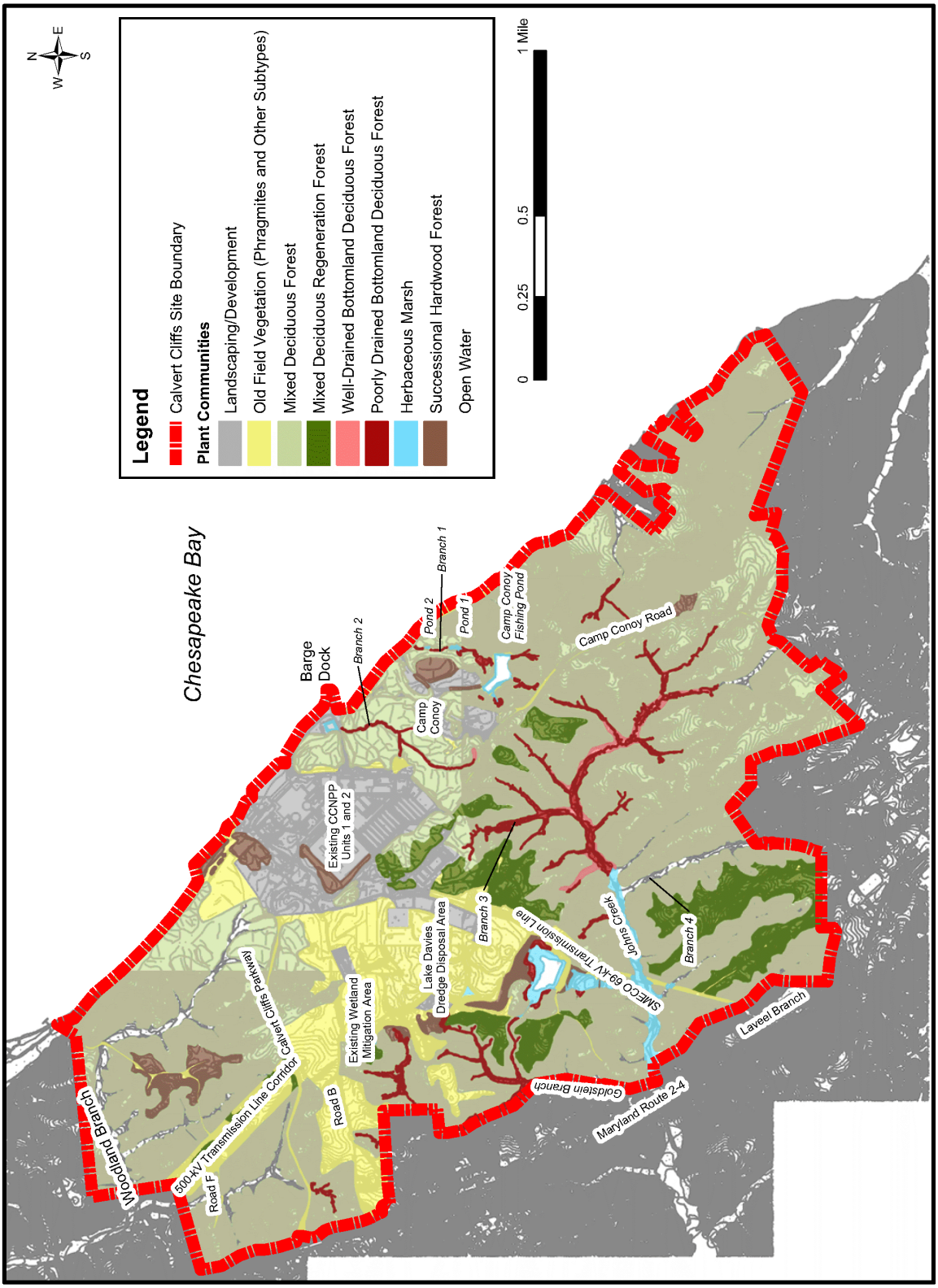

Figure 2.4-1— Plant Community (Natural Habitat Map)

Figure 2.4-2— Approximate Locations of Known Bald Eagle Nests – April 2007