3. EXISTING CONDITIONS

The existing conditions of the environmental, cultural, socioeconomic, and recreational resources within the vicinity of the PIERP are discussed in the following sections.

The **existing project area** is defined as the authorized project as it presently exists, with a footprint of 1,140 acres (Figure 3-1). The existing project is not yet complete. At full project build-out, the project will be completed to its authorized configuration (570 acres wetland habitat and 570 acres upland habitat) and will include activities to close Cell 6 at the PIERP. These activities include the closure of the existing access channel opening at the southern end of Cell 6, raising the Cell 6 perimeter dike to a temporary elevation of +25 MLLW, and construction of a new access channel and turning basin to replace the channel currently located inside of Cell 6 (Figure 3-2). Other tasks include restoration of internal borrow sites within wetland Cell 4 and construction of temporary cross dikes within wetland Cell 5. Borrow areas F and G will be exhausted to complete these activities, and additional borrow will be obtained from the southwestern borrow area to complete the current project (Figure 3-2). The current offloading facilities and fuel farm located on the interior cross-dike between Cells 3 and 6 will be relocated to the Cell 6 southern perimeter, a new unloading dock will be constructed south of Cell 6, and a new personnel pier and will be constructed south of Cell 5 (Figure 3-2).

To accommodate flexibility for specific engineering and site constraints, a 1,080-acre **Study Area** located to the north and northeast of the existing project was evaluated instead of a specific alignment (Figure 3-3). Included within the Study Area is the footprint for the northern access channel that would be required to support the lateral expansion, and the footprint for the proposed sand borrow area located to the northeast of the existing PIERP (Figure 3-3). The southwestern borrow area, Poplar Harbor, Jefferson Island, and Coaches Island were not located within the Study Area, but impacts to these resources associated with construction, dredging, and sand excavation were included in the region of influence (discussed below) for the impacts assessment. The final alignment of the proposed lateral expansion will be constructed within the Study Area. It is anticipated that the preferred alignment will be comprised of an approximate 575-acre dredged material placement area, as calculated from the centerline of the exterior dike. The area from the centerline of the exterior dike outward to the end of the toe dike encompasses approximately 25 acres of bottom. Therefore, the total area of impact from the proposed lateral expansion is a footprint approximately 470 (Recommended Plan) to 600 acres in size.

The **region of influence** is the area used to predict and assess the majority of the socioeconomic impacts and some environmental impacts. The region of influence represents the geographic area or region that the project-induced changes to the socioeconomic impacts will occur, and the environmental impacts. In this document, the region of influence includes resources located outside of the Study Area (described above), but adjacent to the project including the southwestern borrow area, Poplar Harbor, Jefferson Island, and Coaches Island as well as the Middle-Bay (Mid-Bay) region as a reference in this document. The Final Federal DMMP (USACE, 2005a) defines the Middle Bay as the region of the Chesapeake

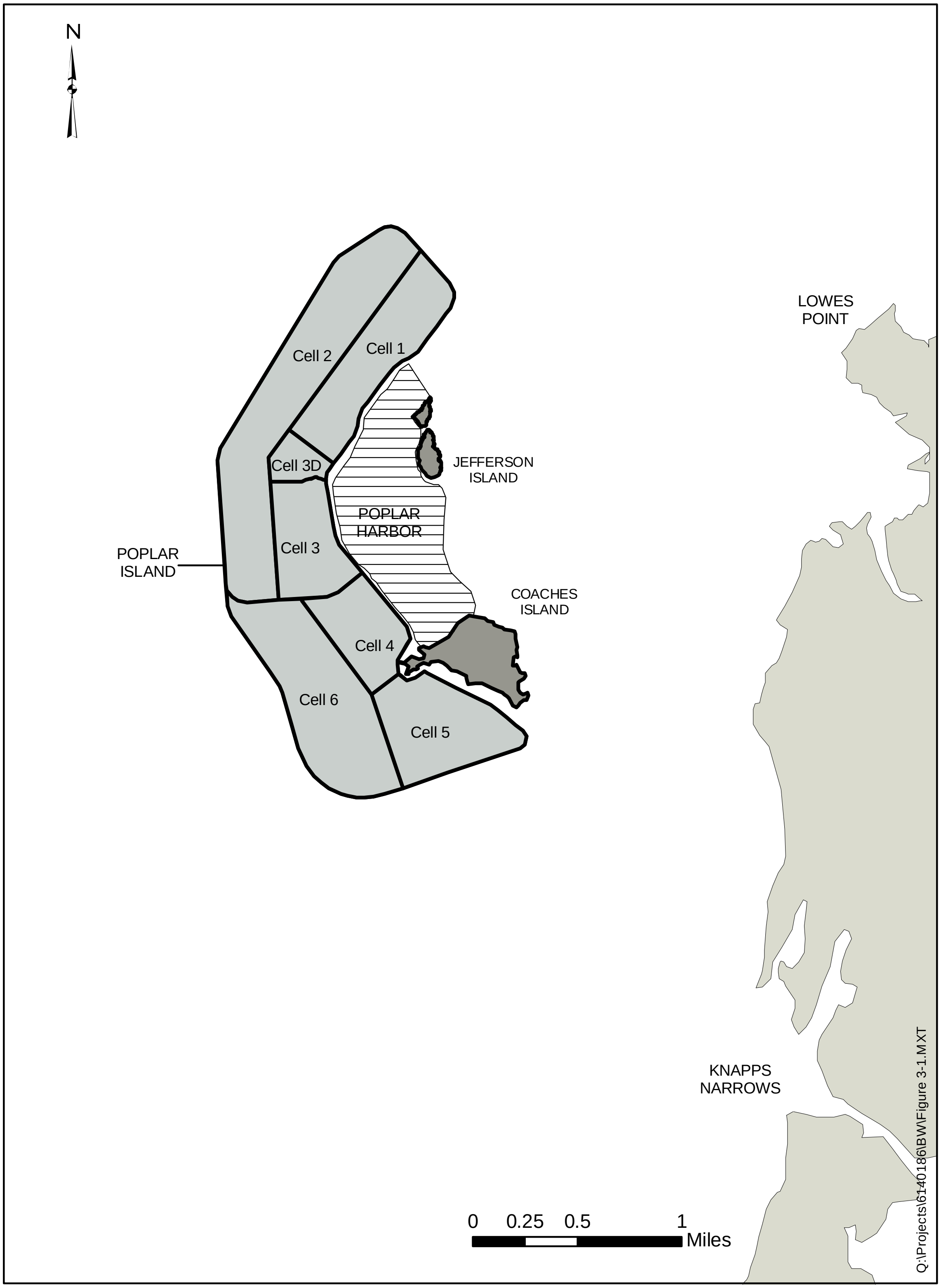


Figure 3-1. Existing Conditions at Poplar Island Environmental Restoration Project

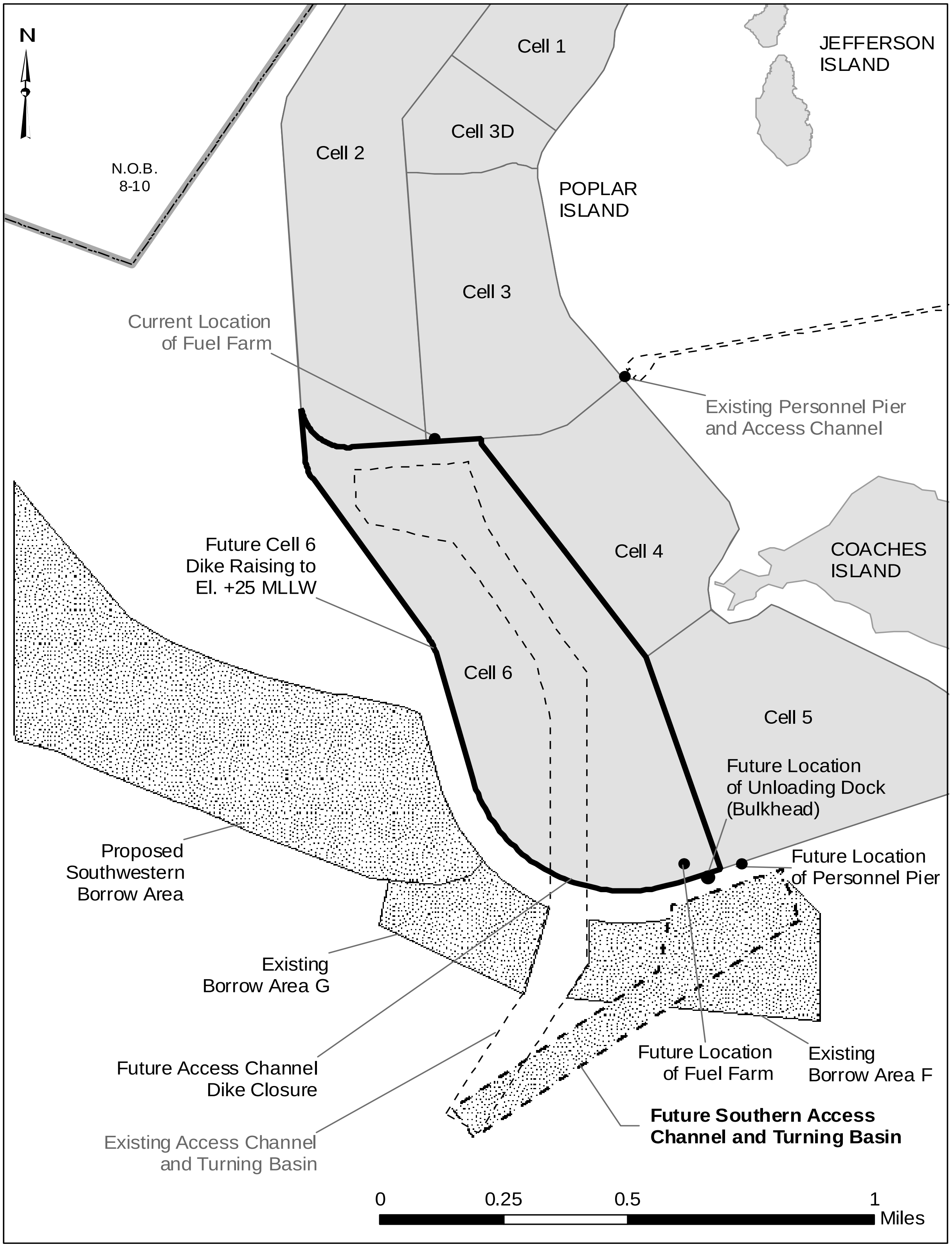


Figure 3-2. Cell 6 Closure Activities

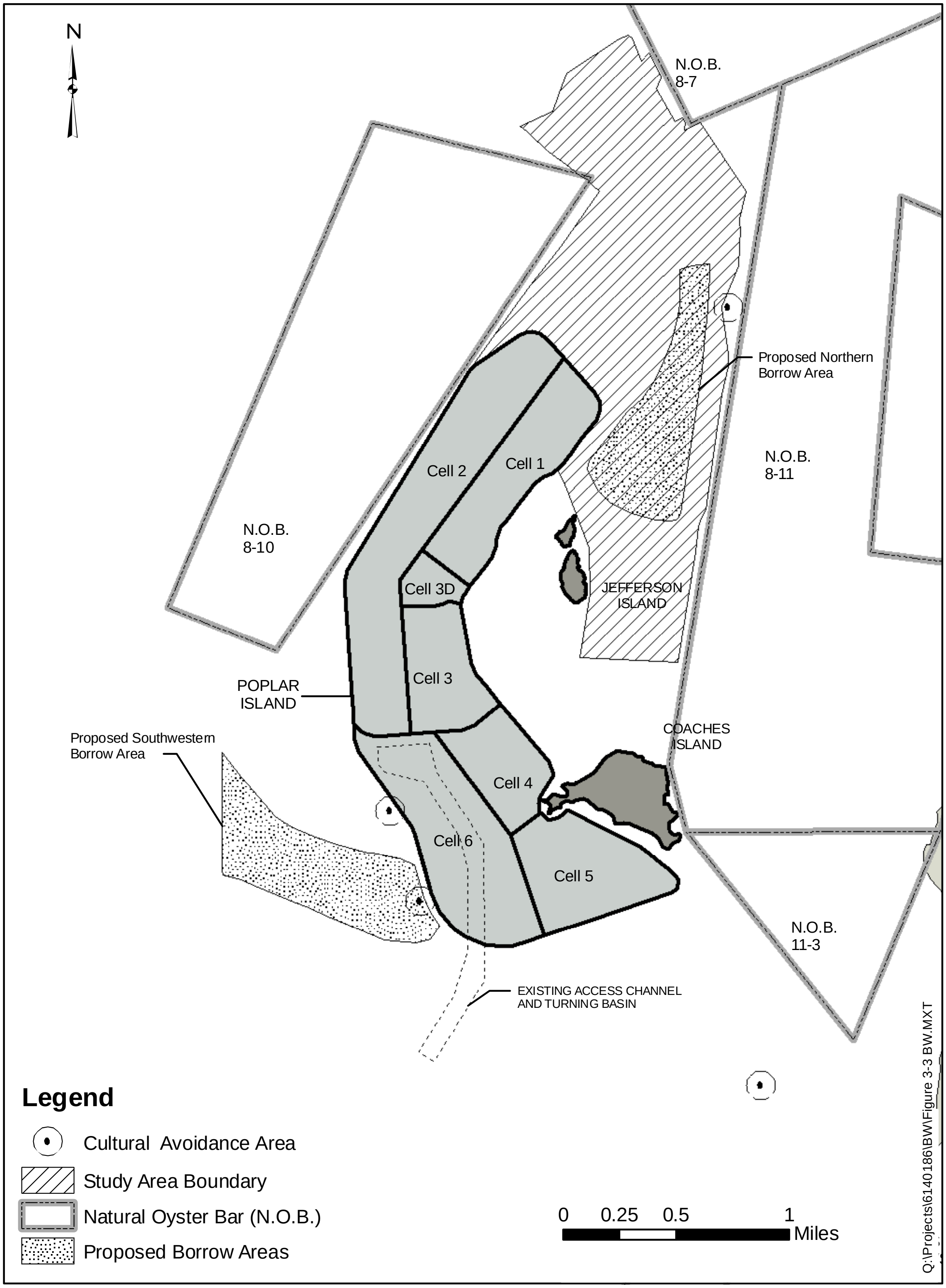


Figure 3-3. Poplar Island Expansion Proposed Study Area, Sand Borrow Areas, and Cultural Avoidance Areas

Bay and its tributaries from the Chesapeake Bay Bridge south to the Virginia State line (Figure 1-8). Tangier Island, although located in Virginia, is also typically included in this region (Figure 1-8).

3.1 ENVIRONMENTAL RESOURCES

3.1.1 Project Setting

3.1.1.a Location The PIERP is located in the upper middle Chesapeake Bay, approximately 34 nautical miles southeast of the Port of Baltimore and two miles northwest of Tilghman Island in Talbot County, Maryland (Figure 1-1). Currently, approximately 40 mcy of dredged material from the Chesapeake Bay Approach Channels to the Port of Baltimore are being used to restore Poplar Island to its approximate size in 1847 (Figure 3-4). The current footprint of the PIERP encompasses approximately 1,140 acres, including the four remnant islands known collectively as Poplar Island, behind 40,000 linear ft of containment dikes. When completed, the PIERP will be 50 percent wetlands (Cells 1, 3D, 3, 4, and 5) and 50 percent uplands (Cells 2 and 6) (Figure 1-2).

Dredged material is placed at the PIERP during annual inflow events, and is then dewatered. Once the target elevations within each cell are reached, the dredged material is graded and planted. Approximately twelve mcy of dredged material from the Port of Baltimore approach channels have been placed at the PIERP through April 2005.

Approximately 80 percent of the wetland areas are planned for low marsh development and 20 percent of the wetland areas are planned for high marsh development. Small islands, ponds, and channels are planned within the marsh areas to increase habitat diversity. Habitat diversity will be increased in the upland areas by constructing small ponds and wetlands, and by planting both forested and relatively open scrub/shrub and meadow areas.

Two privately-owned islands, Coaches Island and Jefferson Island are located adjacent to the PIERP and Poplar Harbor (Figure 3-3). The PIERP is separated from Coaches Island by a narrow tidal gut, and Jefferson Island is located within Poplar Harbor. Poplar Harbor is a 282-acre quiescent area (as defined by USFWS, 2003) located within waters protected by the shorelines of Poplar, Jefferson, and Coaches Islands.

3.1.1.b Climate Talbot County, Maryland has a mild climate with moderate winters and distinct seasons that are tempered by the surrounding waters of the Chesapeake Bay. Table 3-1 presents normal temperatures, annual precipitation, and annual snowfall based upon thirty years of data at the Royal Oak Station in Talbot County. The frequency and severity (rise in water level or storm surge) of extra-tropical storms known as northeasters and hurricanes that have occurred in the vicinity of the project area are discussed in more detail in Section 3.1.3.

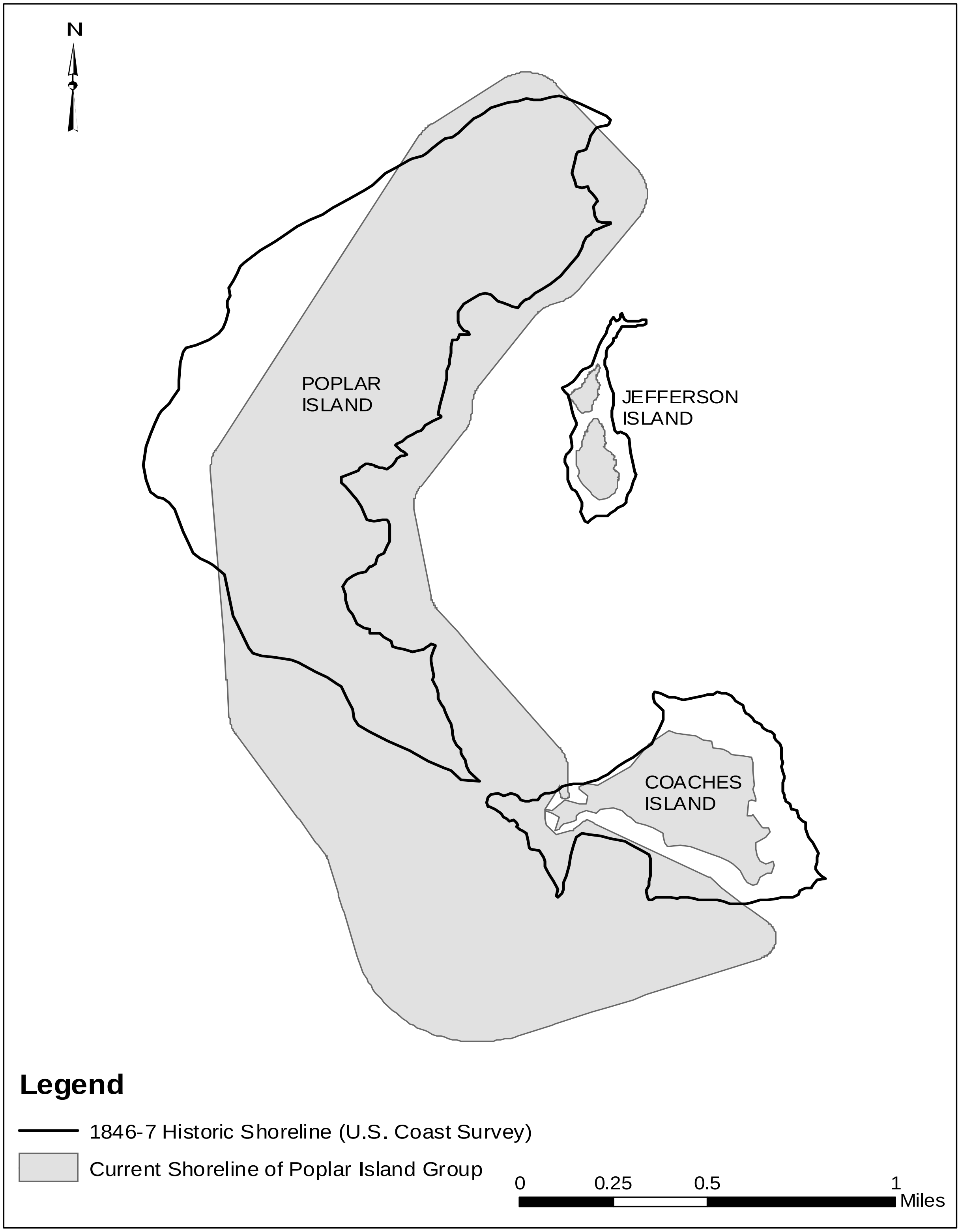


Figure 3-4. Historic 1846-7 Footprint of Poplar Island Compared to Current PIERP Footprint

Table 3-1. Normal Temperatures, Annual Precipitation, and Annual Snowfall at the Royal Oak Station in Talbot County, Maryland

Normal Max. Temperature (°F)	Normal Min. Temperature (°F)	Normal Temperature (°F)	Normal Annual Precipitation (in)	Minimum Annual Snowfall (in)	Max. Annual Snowfall (in)
67.0	48.7	57.9	45.9	1.7	44.7

Source: Maryland State Climatologist Office, 2001.
Note: normals were calculated using data collected from 1971 – 2000.

3.1.2 Physiography, Geology, Soils, and Groundwater

3.1.2.a Physiography The PIERP is located near the eastern shore of the middle portion of the Chesapeake Bay and lies within the Embayed Section of the Atlantic Coastal Plain Physiographic Province (Hunt, 1967). The Coastal Plain is an elevated sea bottom with low topographic relief and extensive marshy tracts. Sloping gradually seaward from its intersection with crystalline rocks of the Piedmont Physiographic Province to the west, the Coastal Plain is characterized by estuarine embayments including the Chesapeake Bay, which divide it into a number of broad and low-lying peninsula tracts. The sea-level in the Chesapeake Bay is currently rising at a rate of about one foot per century (USGS, 1998). As a result of land-drowning (from rising sea level) and shoreline erosion, the open water portion of the Bay increases by several hundred acres per year. Shoreline erosion rates vary throughout the Bay, from inches per year to many tens of feet per year, depending on local wave energy and shoreline character. Land losses occur Bay-wide, but are concentrated in the low-lying lower Eastern Shore (USACE, 1990). Local physiography has influenced anthropogenic settlement and development in the coastal plain. From Long Island (NY) to Cape Lookout (NC), drowned river valleys formed bays favorable for development of sheltered harbors, which encouraged early settlement within these bays all along the Atlantic Coast.

Poplar Island formed over the last 10,000 years (during the Holocene) as rising sea level isolated former topographic highs on the mainland that now constitute the island complex. As inundation progressed, Poplar Island became first a peninsula and then an island. The earliest map to show clearly the configuration of the Poplar Island group is the US Coast Guard 1846-1847 Map of the Eastern Shore of Maryland, from Wade's Point to Low's Point, including Poplar and Sharps Island (Figure 3-5). The map shows that by the mid 1800s Poplar Island was separated from what would become Coaches Island by a thin neck of land, and that Jefferson Island was already separate, even though it is not labeled on the map. Figure 3-5 also includes an approximate configuration of the 1994 shoreline for the Poplar Island remnants. Since 1847, erosion driven by wave action and sea level rise has resulted in the loss of 85 percent of the Poplar Island landmass.

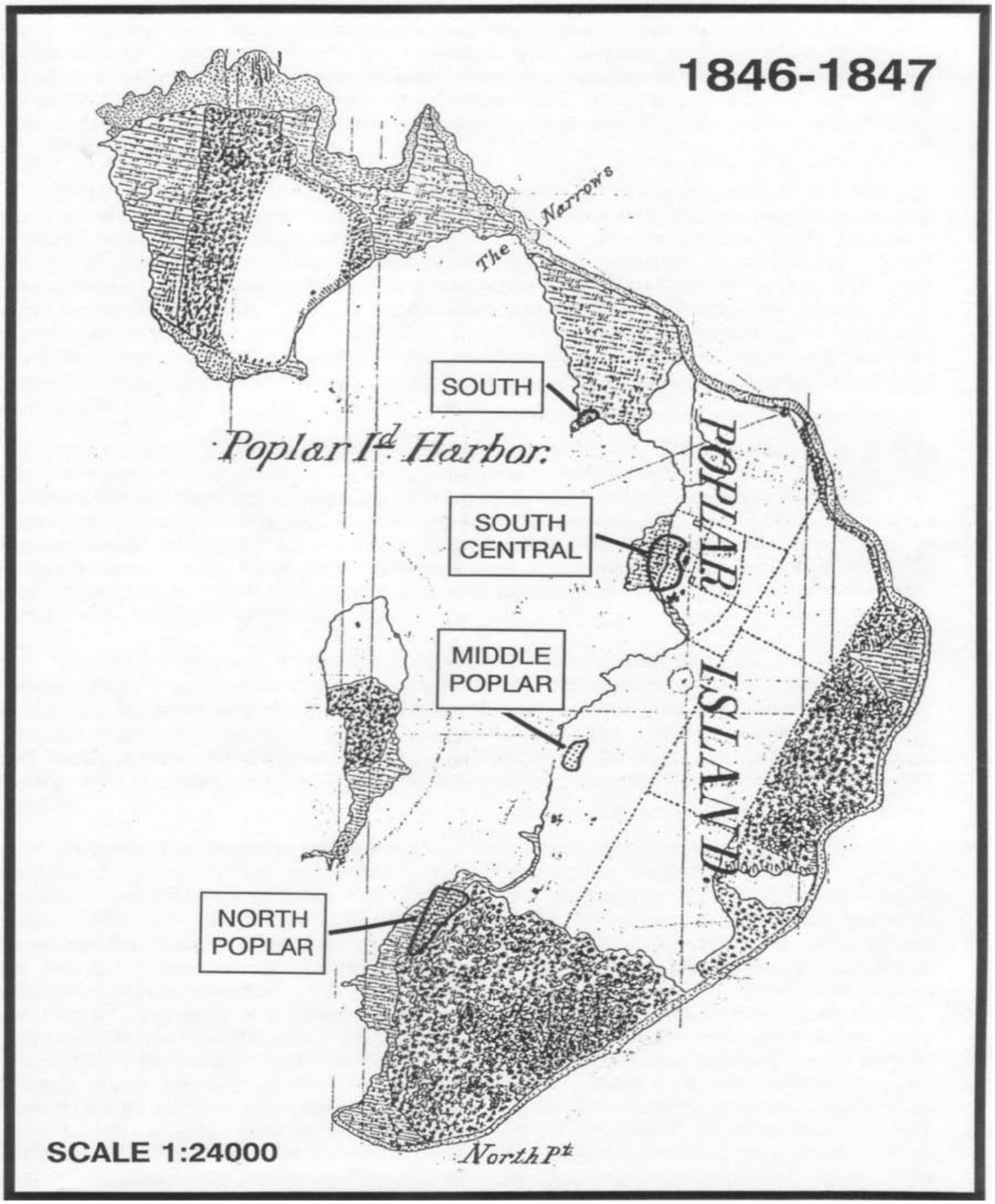


Figure 3-5. Excerpt from U.S. Coast Survey 1846-1847 Map of the Eastern Shore of Maryland, from Wade's Point to Low's Point, including Poplar and Sharps Islands, with an overlay of the approximate configuration of the Poplar Island group in 1994 (original map is oriented north to bottom) *(Source: RCG&A, 2004)*

Erosion rates prior to the construction of the PIERP for Jefferson Island, Coaches Island, and the mainland were calculated by MGS, based on the 1942 and 1994 shorelines (Halka MGS, 2005):

- Jefferson Island - 2.0 ft/yr
- Coaches Island - 2.6 ft/yr
- Mainland from Lowe's Point south to Knapps Narrows - 1.7 ft/yr
- Mainland from Lowe's Point south to Knapps Narrows, excluding the indented coves (Ferry Cove and Front Creek) - 2.4 ft/yr
- West side Tilghman Island - 4.8 ft/yr.

PIERP has been designed and constructed such that the restored, 1,140 acre landmass lying to the west of Coaches and Jefferson Islands will be largely invulnerable to erosion. PIERP provides protection to Coaches and Jefferson Islands from waves from the west, and erosion along the west side of these islands will likely cease. However, these islands continue to erode from waves from the southeast and northeast, respectively. It is anticipated that PIERP will reduce the erosion rate of points on the mainland lying immediately east/southeast of the project from Lowe's Point south to Knapps Narrows to rates slower than those presented above from pre-project conditions.

3.1.2.b Geology The PIERP is underlain by Quaternary lowland sedimentary deposits consisting of gravel, sand, silt, and clay (MGS, 1968). These deposits form the materials of the existing islands and overlie nearby shallows. These deposits are underlain by the Choptank and Calvert Formations, which are Tertiary deposits at a depth of about 200 ft (USACE/MPA, 1996). These formations consist of interbedded brown to yellow fine gravelly sand to gray to bluish-green argillaceous silt, locally indurated to calcareous sandstones and predominant shell beds. These deposits are underlain by older Tertiary and Cretaceous sediments. Late Precambrian and Early Paleozoic crystalline rocks largely comprised of schist, gneiss, and granites, form the basement complex at about 1,000 ft below land surface (USACE/MPA, 1996).

Subsurface borings at the project site conducted as part of a geotechnical reconnaissance study provide more details regarding the site-specific subsurface stratigraphy (E2CR, 2002) (Appendix A). Results from the geotechnical reconnaissance study indicated that the underlying sediment varies considerably from very soft clay, to silty sands and pre-consolidated silty clays. Sediment borings indicated that the subsurface conditions consist of four primary strata (E2CR, 2002). Stratum 1 consisted of very soft gray silty clay/organic clay. Stratum 2 consisted of surficial black, gray, and brown silty sand and was approximately 20 ft thick. On the west side of the PIERP, borings indicated that this stratum also contained pockets of greenish gray to brown silty clay as thick as 15 ft. Stratum 3 consisted of silty sand underlain by soft to stiff, light gray to green gray silty clay. The thickness of this stratum ranged from 10 to 30 ft. Stratum 4 underlies the entire site and consisted of dark gray to greenish gray silty clay with pockets of silty sand; many of the sediment samples from stratum 4 contained shell fragments (E2CR, 2002).

The surficial substrate surrounding the PIERP is predominantly sand and fine sand (USACE, 1996). The substrate in the vicinity of the PIERP is consistent with much of the middle and lower Bay bottom along both the Eastern and Western shores of Maryland, out to about 30 ft in depth (Kerhin *et al*., 1988). Additional information concerning the physical and chemical composition of the sediment and sediment accretion and erosion in the vicinity of the PIERP is provided in Sections 3.1.3.g and 3.1.5, respectively.

The PIERP is situated in a region that has historically experienced a moderate amount of minor earthquake activity. Although many earthquakes have been reported in the region since the early 18th century, none has been major or of catastrophic proportion (USACE/MPA, 1996).

3.1.2.c Soils The original soils of Poplar, Coaches, and Jefferson Islands, as well as those of Talbot County, formed from estuarine marine sediments that were deposited during various geologic epochs (USDA, 1970). Soils that historically formed the islands included those from the Mattapex and Matapeake series, and consisted primarily of deep, moderately well drained, dark-brown soils that are level to gently sloping (USDA, 1970). These soils developed from silty marine sediments and consist primarily of silt loams that retain moisture and are well suited for vegetative growth. They occur through many other areas throughout Talbot County, where these soils typically support cultivated crops, woodlands, and developed areas.

The soil types on Jefferson and Coaches Islands are subject to erosional forces but remain relatively stabilized by vegetation, including woodlands. Soils that currently are found on these islands consist primarily of fine sandy loams and silt loams of the Woodstown, Sassafras, Othello, Mattapex, and Barclay series (USDA, 1970). These soils generally occur on gentle slopes, are well drained, and are well suited for vegetation. Considerable areas of tidal marsh occur on the edges and periphery of both Jefferson and Coaches Islands.

3.1.2.d Groundwater A total of eight aquifers – the Columbia, Miocene, Piney Point, Aquia, Matawan, Magothy, Upper Patapsco, and Lower Patapsco aquifers - supply water to Talbot County (Drummond, 1997). The Aquia formation is a green quartz sand of marine origin with a few lenses of clay (Rasmussen and Slaughter, 1957). The Aquia aquifer is considered important because of its wide extent, good water-bearing properties, and high water quality (Drummond, 1997). The Aquia aquifer is extensively used to supply water for municipal, domestic, and commercial (including irrigation) uses throughout Talbot and the surrounding counties. The top of the Aquia aquifer ranges in depth from about sea level in Queen Anne's County to about 650 ft below sea level in southern Talbot County, and is separated from the overlying Miocene and Piney Point aquifers by clayey confining units in the Nanjemoy and Chesapeake Groups (Drummond, 1997). Brackish water intrusion to the Aquia aquifer has been documented in Kent County, and is a continued threat to water quality within the aquifer because of the increased groundwater withdrawals to supply the growing population in the region (Drummond, 1997).

Similar to the other locations throughout Talbot County, the groundwater for the PIERP is drawn from the Aquia formation. There are currently two groundwater wells at the PIERP, both located along the interior cross-dike between Cells 2 and 6. One well is approximately

375 ft deep and is used for potable water. The second well is a construction well that draws non-potable water (also from the Aquia formation) that is designated for project uses such as sanitation and irrigation. The water withdrawal limits for the both wells are set by a Water Appropriation and Use Permit from MDE [permit number TA19999G005(02)] and are limited to a daily average of 7,200 gallons on a yearly basis and a daily average of 22,000 gallons for the month of maximum use. The current Water Appropriation and Use Permit for the PIERP went into effect in August 2002 and expires in August 2014.

3.1.3 Hydrology and Hydrodynamics

In estuarine systems, hydrodynamics (the movement and cycling of water) influence a variety of factors, including the shape and stability of landmasses, water and sediment quality, and the distribution of aquatic organisms. Water levels in the Chesapeake Bay are dominated by a semidiurnal (two high tides and two low tides per day) lunar tide, although wind effects can be important. Extreme water levels are dictated by storm tides. Significant changes in land masses (i.e., bulkheading, dredging, and island restoration) can alter the hydrodynamics in a region, potentially impacting other landmasses or resources. To establish the existing hydrodynamic conditions in the vicinity of the project area, hydrographic, topographic, and aerial survey data were collected from areas within and adjacent to the Poplar Island archipelago region. Survey data in the following sections are referenced to MLLW based on the 1960 to 1978 tidal epoch, and the Maryland State Plan, North American Datum (NAD) 1983.

3.1.3.a Average Water Depths A bathymetric map of the area surrounding the PIERP is presented in Figure 3-6. The water depth within the Study Area varies from 1 to 14 ft. The proposed containment dikes would be constructed in depths ranging from 5 to 11 ft. Water depths in the Bay, including the tidal tributaries, average approximately 21 ft (Schubel and Pritchard, 1987).

3.1.3.b Tides Astronomical tides dictate the size and period of inundation of the intertidal zone, which is an important and often highly productive area within an estuary. The mean tide level at the PIERP is +0.9 ft MLLW and the mean tidal range is 1.2 ft (NOS, 1997). The spring tidal range is 1.8 ft (NOS, 1997). An important elevation to be considered for habitat creation is the elevation of Mean Spring High Water (MSHW). MSHW is defined to be 2.4 ft above MLLW and is considered the boundary between wetland and upland habitat for this project (M&N, 2004).

3.1.3.c Storm Surge Design water levels in the study area are dominated by storm effects in combination with astronomical tides. Storm surge is a temporary rise in water level generated either by large-scale extra-tropical storms known as northeasters, or by hurricanes. The rise in water level results from wind action, the low pressure of the storm disturbance, and the Coriolis force. The USACE-Engineer Research and Development Center (USACE-ERDC) estimated storm surge levels using simulations of 95 historical storms that traversed the Chesapeake Bay region (USACE-ERDC, 2005c). Fifty-two hurricanes and forty-three northeasters were selected for simulation. Maximum water levels for the 52 hurricanes ranged between 1.08 to 8 ft above mean sea level (MSL). For northeasters, maximum water

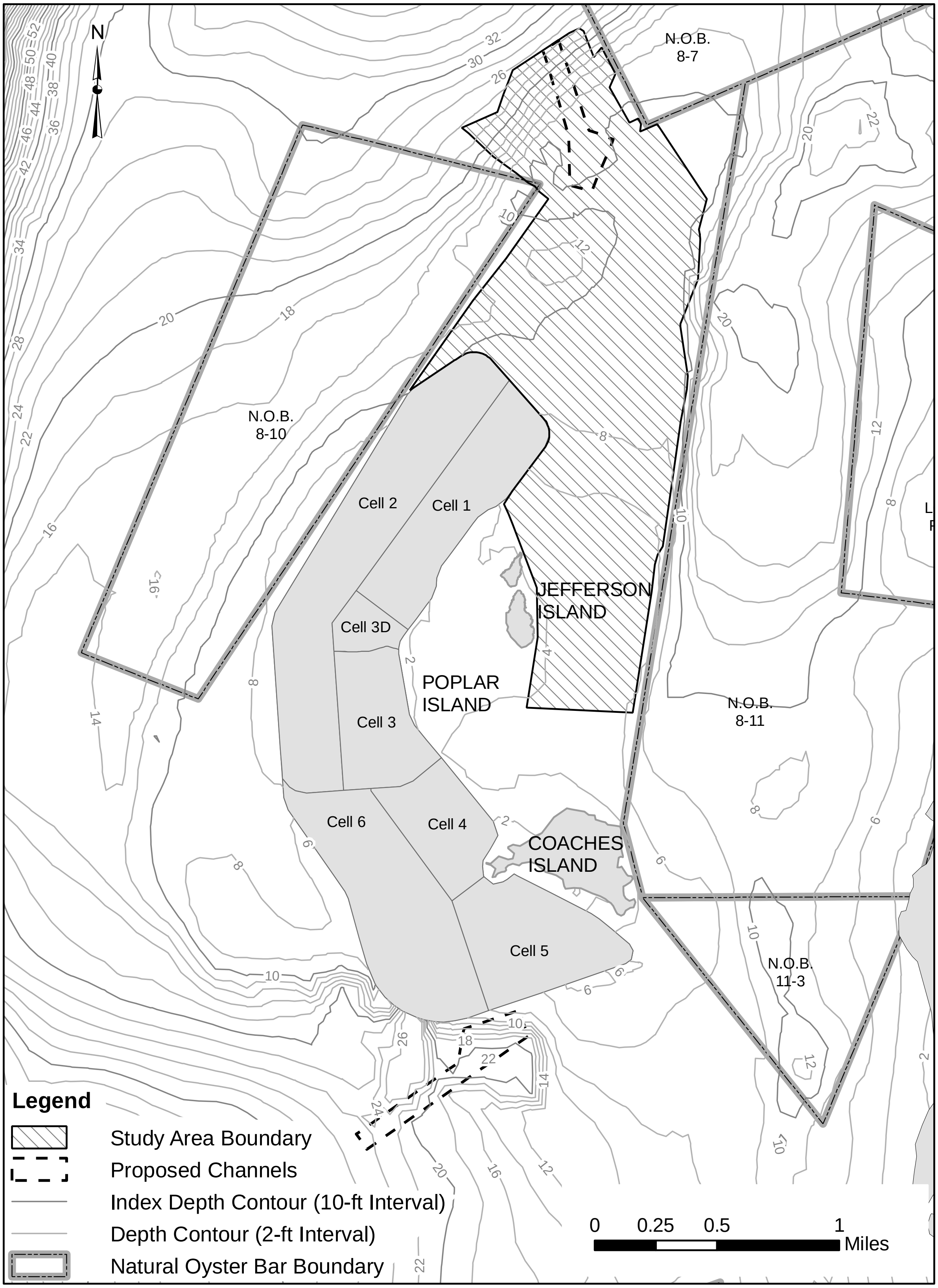


Figure 3-6. Bathymetry Map of Poplar Island and Vicinity

levels ranged from 0.62 to 3.22 ft above MSL. When water depth around the island is increased because of storm surge or tide, the island may be exposed to larger waves (USACE-ERDC, 2005c).

3.1.3.d Tidal Currents Tidal currents are the speed that water floods (flows into) or ebbs (flows out of) an estuarine system. These velocities are variable within a cycle (flood to ebb or vice versa) and within a lunar cycle (full to half, half to new, etc.). The strength and velocity of these currents influence many factors, particularly sediment transport (i.e., erosion) and movement of organisms. Peak ebb currents in the Bay generally move from north to south, and are reversed for peak flood (from south to north). The current direction changes as the flow moves into and out of Eastern Bay and trains along the PIERP – at the north end of the PIERP, the current flow is practically east to west (M&N, 2003). During high and low water, the largest tidal velocities were observed over shallow water areas on the western side of the PIERP and the channel located on the east side of the island (M&N, 2004). East of the south end of the PIERP peak tidal velocities are approximately 1.7 ft/sec for flood currents and 1.0 ft/sec for ebb currents. Approximately 2.5 miles west of the island (in the middle of the Bay), peak flood currents are about 1.0 ft/sec, and peak ebb currents are about 0.8 ft/sec (M&N, 2004).

3.1.3.e Wind Conditions Aside from tidal currents, winds are the predominant hydrodynamic force in the Chesapeake Bay. Large waves form as a result of a combination of high winds, deep water, and long distances over which the wind travels. Wind driven waves are primarily responsible for the erosion of Poplar Island. Design of any structures for construction within the Chesapeake Bay must consider the strength and prevailing direction of wind for the region. On average, nearly 90 percent of yearly wind occurrences are less than 16 mph (13.9 knots) and only 1-2 percent of wind occurrences are greater than 25 mph (21.7 knots) (M&N, 2004). Winds greater than 12.7 mph (11 knots) originate from the north-northwest 90 percent of the time (M&N, 2004).

3.1.3.f Wave Conditions The PIERP is exposed to wind-generated waves from all directions, which are the predominant cause of erosion. The longest fetch distances to which the site is exposed correspond to the north and south directions. In accordance with procedures recommended by the Shore Protection Manual (USACE-WES, 1984), a radially averaged fetch distance was computed for each direction. The radially averaged fetch distances for north, northeast, east, southeast, south, southwest, west, and northwest are 18, 10.4, 2.6, 2.9, 24.2, 10.1, 8.4, and 9.3 miles, respectively. Poplar Harbor is well sheltered from waves generated by winds from a westerly direction. The harbor is exposed to winds from the east although the fetch is short (2.6 miles) from this direction.

3.1.3.g Sedimentation Modeling The Upper Chesapeake Bay Finite Element Model (UCB-FEM) was used to characterize the existing hydrodynamic and sedimentation pattern in the vicinity of the existing PIERP. The UCB-FEM was developed based on the USACE finite element hydrodynamics (RMA-2) and sedimentation (SED-2D) models, collectively known as TABS-2 (Thomas et. al, 1985). The UCB-FEM model evaluated and predicted areas where erosion and accretion were likely to occur. A detailed description of the model grid, equations, assumptions, input parameters and model calibration is located in *Poplar Island*

Modifications, Hydrodynamics and Sedimentation Modeling (M&N, 2003). The finite element mesh used to characterize the existing conditions in the vicinity of the PIERP is shown in Appendix B.

The UCB-FEM sedimentation model was used to examine transport of non-cohesive and cohesive materials (i.e. sand and clay), which characterize sediment in the vicinity of the PIERP. Examination of model results for both non-cohesive (sands) and cohesive sediment (silts and clays) indicated that normal tidal currents in the vicinity of the PIERP are insufficient to directly cause sediment suspension and transport. However, wind generated waves increase bottom shear stresses significantly and can cause sediment suspension. In the immediate vicinity of Poplar, the water depths are shallow enough that waves from any decent storm will impact the bottom and cause sediment transport. Various wind speeds were modeled, and 16-mph (13.9-knot) winds were determined to be the minimum necessary to cause sediment suspension and transport for non-cohesive sediment (sands). Therefore, because wind velocities above 12.7 mph (11 knots) only account for 20 percent of wind occurrences in the vicinity of the PIERP, suspension of non-cohesive sediment (sands) is uncommon. The sediment transport modeling also indicated that 13 mph (11.3 knots) were the minimum necessary would cause substantial sediment suspension and transport for cohesive sediments (silts and clays).

To characterize the sediment erosion and accretion patterns in the vicinity of the PIERP, the UCB-FEM sedimentation model was run for non-cohesive (sands) and cohesive sediment (silts and clays) for each of 16 wind directions (E, ENE, NE, NNE, N, NNW, NW, WNW, W, WSW, SW, SSW, S, SSE, SE, and ESE) for wind speeds of 4-, 13-, and 16-mph (3.5-, 11.3-, and 13.9-knots) (M&N, 2003).

Modeled non-cohesive sediment (sands) transport in the vicinity of the existing PIERP was negligible for 4- and 13-mph (3.5- and 11.3-knot) winds for all directions. Sixteen-mph winds (13.9 knots), when taken cumulatively with lower wind speeds, account for nearly 90 percent of the yearly wind occurrences and cause significant sediment transport for winds from the NNW, N, NNE, S and SW directions, with negligible to moderate sediment transport for winds from other directions. Model results indicating patterns of accretion and deposition for non- cohesive sediment (sands) for 16-mph (13.9 knots) winds from the NNW, N, NNE, S and SW directions are shown in Appendix B.

Modeled cohesive sediment (silts and clays) transport in the vicinity of the existing PIERP was negligible for 4-mph winds. Thirteen-mph winds cause significant sediment transport for winds from the NNW, N, NNE, NE, S and SW as shown in Appendix B, with negligible sediment transport for winds from other directions. Results are shown using a normalized unitless scale due to the empirical use of the sedimentation model and the lack of available data to verify model calibration. In general, for cohesive sediment (silts and clays), the areas of erosion and accretion are larger than for non-cohesive sediment (sands), because the properties of cohesive sediment (silts and clays) (shape, plasticity, electric charge) cause the particles to remain in suspension for relatively long periods of time before they settle out.

Based on the observation that transport of sand down the eastern dike of the existing PIERP may be resulting in movement and accretion of sand around parts of Poplar Harbor (including blockage of the spillway pipes), a morphological model of Poplar Harbor using the Delft3D modeling system was developed to assess the potential for long-term accumulation of sediment (M&N, 2004). Morphological modeling results for the existing PIERP indicated a small accumulation of cohesive sediment (silts and clays) in Poplar Harbor and a negligible accumulation of non-cohesive sediment (sands) over an eight-year period (M&N, 2004). These results indicated that a significant accumulation of both cohesive (silts and clays) and non-cohesive (sands) sediment in Poplar Harbor is not likely to occur (M&N, 2004).

3.1.3.h Residence Time in Poplar Harbor Residence time is the average length of time that an entity of interest remains within the limits of a specified water area. Return of particles to the area is taken into account – that is, particles might leave the area, then return. Residence times for Poplar Harbor were calculated by tracking the movement of neutrally buoyant particles, which represent water exchange (Appendix B). Calculated average residence times for Poplar Harbor were 4.07 days for a low-energy, eight day reference period and 0.69 days for a four day storm period (USACE-ERDC, 2005a) (Appendix B).

3.1.4 Water Quality

Excess nutrients entering Chesapeake Bay from anthropogenic sources, including agricultural activities, wastewater treatment plants, urban runoff, and septic systems, promote algal blooms that impair water clarity and cause low oxygen conditions in bottom waters. Bottom waters below the pycnocline are especially prone to low oxygen events during warmer weather. This process of nutrient enrichment and the resulting poor water quality is known as eutrophication, and it is a primary concern within the Chesapeake Bay watershed. Nitrogen inputs from anthropogenic sources are currently entering the Bay at about seven times greater than natural levels (Howarth *et al*., 2002), and phosphorus inputs from anthropogenic sources are entering the Bay at a rate 16.5 times greater than natural levels (Malone *et al*., 1999). In addition to the anthropogenic sources above, natural causes of poor water quality include wave action that resuspends bottom sediments and erodes the shoreline (reducing water clarity). In contrast, 'good' water quality implies a balanced amount of nutrients and normal fluctuations in salinity and temperature, plus plenty of oxygen and low suspended solids to support a diverse community of aquatic plants and animals.

The PIERP is located in the mesohaline portion of the Chesapeake Bay, where salinity can vary widely depending on the volume of freshwater flowing into the Chesapeake Bay. Salinity levels fluctuate both seasonally and from year to year, and salinity levels measured in the vicinity of the PIERP typically range from 5 to 15 ppt (EA, 2004a). Water temperatures also fluctuate widely throughout the year, although the general temperature profile of the Chesapeake Bay is fairly predictable. During spring and summer, increased freshwater inflow combined with warming surface water temperatures result in the formation of a well-defined pycnocline. The pycnocline vertical zone in the water column defined by the density change between warmer, freshwater surface waters and colder, more saline bottom waters. Formation of the pycnocline stratifies the water column and significantly limits the exchange of oxygen and nutrients between surface and bottom waters. During warmer months of the year, the restricted exchange between surface and bottom waters can result in severe reductions in oxygen concentrations in deeper waters within and below the pycnocline. Water with dissolved oxygen concentrations less than 2 mg/L are defined as hypoxic, and are an extremely stressful environment for aquatic organisms. Dissolved oxygen concentrations above 5.0 mg/L are the generally accepted threshold for supporting diverse aquatic life, and the minimum State of Maryland water quality standard for protection of aquatic life for shallow waters in the Chesapeake Bay (COMAR 26.8.2.03-3). While salinity, temperature, and dissolved oxygen levels are widely variable, typical pH levels for Chesapeake Bay waters remain relatively steady, and range between 7.5 and 8.5.

Water quality monitoring of both the water discharged from the PIERP and the exterior Bay water proximal to the PIERP is an important and ongoing part of the current monitoring at the PIERP. Water quality monitoring is conducted in accordance with the PIERP Monitoring Framework (MES, 2003d). To compare data between sampling years, a set of standard sampling locations in the vicinity of the PIERP (exterior monitoring locations) for the Monitoring Framework was established in the *Poplar Island Environmental Restoration Project Baseline Monitoring Study* (MES, 2000a). Nine sampling locations (WQ1 through WQ9) and two reference locations (WQR1 and WQR2) (Figure 3-7) were identified as the exterior sampling locations for water quality, sediment quality, benthic community, and benthic tissue studies. An additional exterior sampling location, WQ10, was added in 2002 on the south side of the PIERP, once Phase II construction was completed.

The primary objective of the water quality monitoring program is to determine the chemical and nutrient characteristics of water in the vicinity of the PIERP, making it possible to assess future water quality changes that could potentially result from operations. There are four major components to the water quality monitoring program: (1) spillway monitoring of water discharged to the Chesapeake Bay, (2) algae monitoring in the ponded water within the PIERP, (3) exterior nutrient monitoring, and (4) exterior water chemistry monitoring.

3.1.4.a Spillway Monitoring – Internal and External The monitoring program for the PIERP spillways is intended to fully characterize the water quality of the discharge from the PIERP spillways (Figure 3-7) directly to the Chesapeake Bay. The dredged material placed in the PIERP consists of anoxic (low to no oxygen) silts and clays dredged from the channel bottoms. As the dredged material dries and dewaters, it is exposed to the atmosphere and oxidizes. As a result of geochemical processes, metals become soluble and the pH decreases, altering the water quality of effluent discharged through the spillways.

The sampling program for the spillway monitoring, including target analytes and sampling frequency, was developed through consultations with MDE. Sampling is conducted at each spillway that is actively discharging to the Bay, at locations outside of the PIERP that are 100-yd from each spillway, and at a reference location (WQR1). Parameters included in the monitoring program are: pH, total suspended solids (TSS), turbidity, salinity, dissolved oxygen (DO), temperature, nutrients, priority pollutant metals, priority pollutant organics, and pesticides. Priority pollutants are concentrations of "listed" metals and organic compounds found in the water column, however they can also be of sediment origin if resuspended and they also include dissolved and colloidal forms in the water column. The spillway water

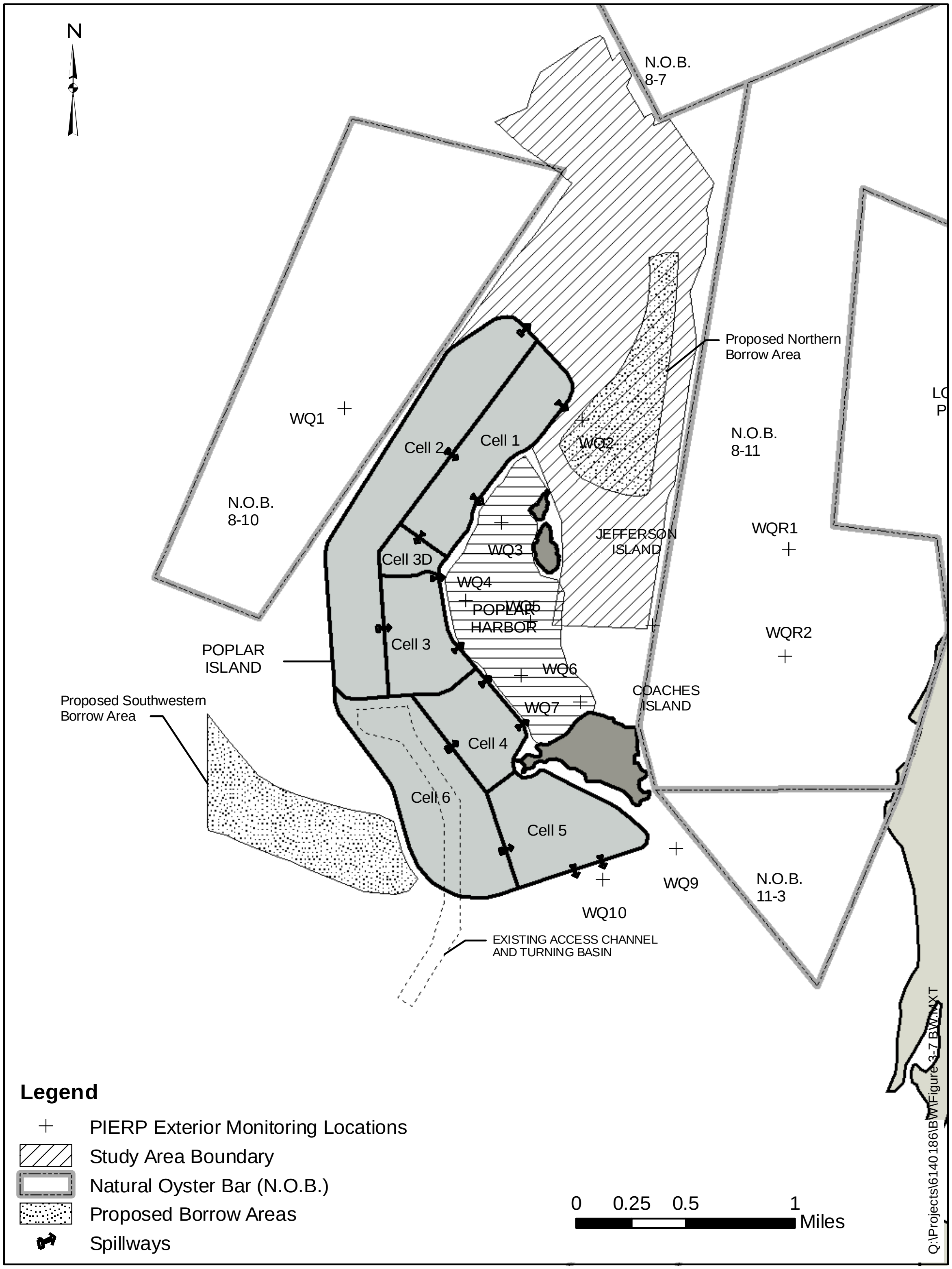


Figure 3-7. Water Quality Sampling Locations and Existing Spillways

quality monitoring program is divided into two different time frames – during dredged material placement (the inflow season) and during the crust management season. During dredged material placement, a greater number of spillways are open and active, discharging a much higher volume of water for a longer period of time. Therefore, the monitoring program in place during dredged material placement is more rigorous. The frequency of the monitoring for each parameter for the inflow and crust management seasons is summarized in Table 3-2.

Table 3-2. Spillway Monitoring Frequencies at the PIERP

INFLOW AND CRUST MANAGEMENT SEASONS

Parameters	Spillways				100-yd Locations and WQR1			
	2000/2001	2002/2003	2003/2004	2004/2005	2000/2001	2002/2003	2003/2004	2004/2005
	Monitoring Frequency				Monitoring Frequency			
pH, TSS, Turbidity Salinity, DO, DO %, Saturation, Conductivity, Temperature	Daily	Daily	Daily	Daily	Weekly	Quarterly	Quarterly	Quarterly
Nutrients*	Weekly (May-Oct); Biweekly (Nov-April)	Weekly (May-Oct); Biweekly (Nov-April)	Weekly (May-Oct); Biweekly (Nov-April)	Weekly (May-Oct); Biweekly (Nov-April)	Weekly (May-Oct); Biweekly (Nov-April)	Quarterly	Quarterly	Quarterly
Priority Pollutant Metals (total & dissolved)	Quarterly	Weekly (crust mgt); Biweekly (inflow)**	Weekly (crust mgt); Biweekly (inflow)**	Weekly (crust mgt); Biweekly (inflow)**	Quarterly	Quarterly	Quarterly	Quarterly
Priority Pollutant Organics	Quarterly	Quarterly	Quarterly	Semi-annual	Quarterly	Quarterly	Quarterly	Semi-annual
Priority Pollutant Pesticides	Quarterly	Quarterly	Quarterly	Semi-annual	Quarterly	Quarterly	Quarterly	Semi-annual

**Nutrients include: nitrite, ammonium, total dissolved phosphorus, total dissolved nitrogen, phosphate, nitrite+nitrate, nitrate, dissolved organic nitrogen, dissolved organic phosphorus.*
***Increase in frequency of metals analysis during 2002/2003 inflow and crust management monitoring was requested by MDE because levels of copper in effluent that exceeded State Water Quality Standards*

Discharge limits for TSS at each spillway (800 mg/L daily maximum; 400 mg/L monthly average) and turbidity resulting from discharge [150 Nephelometric Turbidity Units (NTU) at any time; 50 NTU monthly average] are prescribed in the wetlands license and water quality certification for the PIERP, and are described in more detail below. Limits for turbidity are based on Code of Maryland Regulations (COMAR) (26.8.2.03-3) and were designed for post-discharge surface water conditions. However, for the PIERP the turbidity limits are applied as operational goals at the point of discharge (MES, 2004a). The wetlands license was issued in 1996, and expires in August 2011. The water quality certification was also issued in 1996, and renewed in both 1999 and 2004. Copies of the wetlands license and water quality certification are located in the Project Management Plan (EA, 2004d).

The pH of the water discharged through the spillways is regulated by the State of Maryland. COMAR (26.8.2.03-3) requires that the pH of the discharge be between 6.5 and 8.5. However, for discharges from the PIERP, MDE periodically issues waivers for discharge of water with pH above 8.5 (MES, 2004a). State water quality criteria (COMAR 26.8.2.03-2) are used to evaluate the other target analytes included in the spillway monitoring program.

Results of the spillway monitoring program (spillways, 100-yd locations, and reference location) are detailed in the annual Discharge and Exterior Monitoring Annual Reports (MES, 2002; 2004a; 2005a). Constituents of particular interest to MDE include turbidity, and TSS as required by the water quality certification and wetlands permits. Other constituents of interest to MDE are pH, ammonia and metals concentrations, in particular copper and zinc. During water discharge through the spillways, turbidity is measured every hour. If turbidity levels are getting close to the established limits, the spillways are closed and discharge ended. Similarly, pH is measured daily within the cell prior to the start of discharge. If the pH is too high, discharge does not occur. Generally, the water quality of the discharge from the PIERP has consistently met the pH (within the waivers), TSS, and turbidity limits. Since the start of discharge (April 2001), there have been two exceedances of the turbidity limits and one exceedance of the pH limits (MES, 2002; 2004a). Reports summarizing the water quality from the PIERP spillway monitoring are submitted to MDE quarterly.

To comply with the water quality certification, turbidity monitoring was conducted during the Phase I and Phase II dike construction for the PIERP to ensure that perimeter dike construction did not exceed the prescribed turbidity limit of 150 NTU (instantaneous maximum) in the surface water or 50 NTU monthly average. Turbidity monitoring was conducted at a total of fourteen locations: ten locations on an ellipse that moved relative to the point of construction, two locations requested by MDE, and two reference locations. The major axis for sampling was 4800 ft and oriented in the direction of current flow, and the minor axis was 2650 ft and oriented perpendicular to the current flow. Sampling was conducted according to the following schedule:

- Two of every three construction days for the first 60 construction days.
- One of every three construction days for the next 120 days.
- Once weekly thereafter until the end of construction activity.

Turbidity monitoring during both Phase I and Phase II construction of the PIERP indicated that the turbidity levels quickly diminished to background levels, except during periods of sustained high winds. However, even during periods of sustained high winds turbidity levels were consistent with levels at the reference locations, indicating that the increased turbidity was not solely a result of dike construction.

3.1.4.b Algae Monitoring in Internal Cells Algae monitoring is another component of the monitoring framework for the PIERP (MES, 2003d). MES conducts algae monitoring on a bi-weekly basis between April and October in each cell with ponded water and in both Cell 4DX (wetland cell) and Cell 6 (future upland cell), which currently have open tidal exchange with the Chesapeake Bay. Development has begun in Cell 3D (wetland cell) and tidal exchange with the Bay was opened in March 2005. As a result of open tidal exchange, Cell 3D will now be included in the algae sampling program. The laboratory analysis and identification of algae species is conducted by MDNR's Resource Assessment Service (RAS). Additional confirmatory analysis for known toxic algal species, such as blue green algae and *Pfisteria*, is performed as needed if initial identification and enumeration indicate high concentrations are present. A table of the algal species identified in samples from the PIERP is located in Appendix C, Table C-1. Based on the results of the algae monitoring, algal species at the PIERP have not been detected at toxic concentrations, and there has been no evidence of toxicity from the algae detected to the avian or fish populations at the PIERP (MES, 2005a).

3.1.4.c Monthly Exterior Nutrient Sampling Nutrient concentrations in the water column are important indicators of the overall health of an ecological system. Nutrient concentrations fluctuate seasonally, and are sensitive to physical, chemical, biological, and anthropogenic changes in the environment. Monthly monitoring of the nutrients in the water surrounding the PIERP was conducted to identify the typical seasonal variations in the nutrient concentrations, compare the nutrient concentrations at the PIERP to regional levels over the same time period, and to identify changes to water quality, if any, resulting from the operation at the PIERP.

Monthly nutrient sampling was conducted each month from May 2001 through December 2003 (EA, 2004a), after the start of dredged material inflow and subsequent effluent discharge from the PIERP spillways began in April 2001. Nutrient concentrations were also evaluated in January 2001, prior to the start of dredged material placement at the PIERP, to determine pre-placement nutrient concentrations. Initially, the monthly nutrient sampling was conducted at the same nine monitoring locations and two reference locations that were sampled in the historical (1996) and pre-placement (2001) water quality assessments (MES, 2000a; EA, 2002d). Monthly nutrient sampling at WQ10 was added in December 2002 after the completion of the Phase II exterior dike construction (EA 2004a). The sampling and analyses protocols used were consistent with those used by the USEPA's Chesapeake Bay Program (CBP). Samples from each PIERP location were tested for the following parameters: TSS, dissolved organic carbon, particulate carbon, chlorophyll *a*, phaeophytin *a*, total dissolved nitrogen, particulate nitrogen, nitrite, nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, and phosphate. A summary of the results of the monthly nutrient monitoring is location in Appendix C, Table C-2.

Each month, water depth, water temperature, dissolved oxygen, salinity, and pH data were recorded for each location. Table 3-3 presents a summary of seasonal water quality parameters recorded at the PIERP exterior monitoring locations from January 2001 through December 2003. The results of Table 3-3 indicate that the water quality parameters recorded were within the normal and average ranges for the Mid-Bay region, would be considered within the category of 'good' water quality (as defined above in Section 3.1.4), and can be utilized to define the existing conditions in the vicinity of Poplar Island. Starting in June 2003, water clarity measurements were also collected at each location using a Secchi disk. Nutrient concentrations from the PIERP monitoring and reference locations were compared to average surface water concentrations in water samples from four CBP monitoring locations (EA, 2004a). Two CBP locations are located to the north (4.1C and 4.1E) and two locations are to the south (4.2C and 4.2E) of the PIERP (Figure 3-8). Results from CBP were included as a regional comparison (EA, 2004a).

In general, results of the nutrient analyses from the PIERP (EA, 2004a) indicated that the concentrations of each of the tested parameters detected at the monitoring locations are generally consistent with concentrations measured at the reference locations and at the CBP sampling locations. The exception to that trend was the TSS concentrations, which were consistently higher than Chesapeake Bay concentrations at both the PIERP monitoring and reference locations. However, the elevated TSS concentrations tended to occur in the spring/summer months each year at the Poplar Harbor sampling locations. The Poplar Harbor locations are located in a shallow, quiescent area, protected from active wind and wave action, resulting in fine-grained sediment deposition and higher biological activity, both of which may contribute to the elevated TSS concentrations measured at the Poplar Harbor locations.

Regional and local precipitation influences several of the nutrient parameters that are monitored in the vicinity of the PIERP by changing the chemical and physical properties of the surface water. Generally, the variability in the concentrations of the 13 nutrient parameters measured on a monthly basis from January 2001 to September 2003 at the PIERP monitoring and reference locations was within the natural variability of the mid-Chesapeake Bay region (EA, 2004a).

Table 3-3. Summary of Seasonal Water Quality Parameters at PIERP Exterior Monitoring Locations*

	Winter	Spring	Summer	Fall
Temperature (^{o}C)	4.3	13.4	25.3	15.7
pH	8	8.3	8.2	8.1
Dissolved Oxygen (mg/L)	14	12.2	8.9	9.2
Salinity (ppt)	15.6	11.2	11.8	14.3

Source: EA 2004a.

**Based on results from monthly sampling conducted between January 2001 and December 2003.*

<u>3.1.4.d Exterior Water Quality Monitoring</u> Exterior water quality monitoring for target chemical analytes at ten exterior monitoring locations and two reference locations in the vicinity of the PIERP (Figure 3-7) has been conducted twice – a pre-placement (2001) effort (EA, 2002d) and a post-placement (2003) effort (EA, 2004a). The results of the pre-placement (2001) monitoring study are used as the baseline data for the surrounding water quality prior to the discharge of effluent from the PIERP spillways. The post-placement (2003) exterior water quality data were collected to characterize the water quality in the vicinity of the PIERP following dredged material placement and effluent discharge from the PIERP. The water quality data were compared to the pre-placement (2001) data to identify changes, if any, in the water quality surrounding the PIERP.

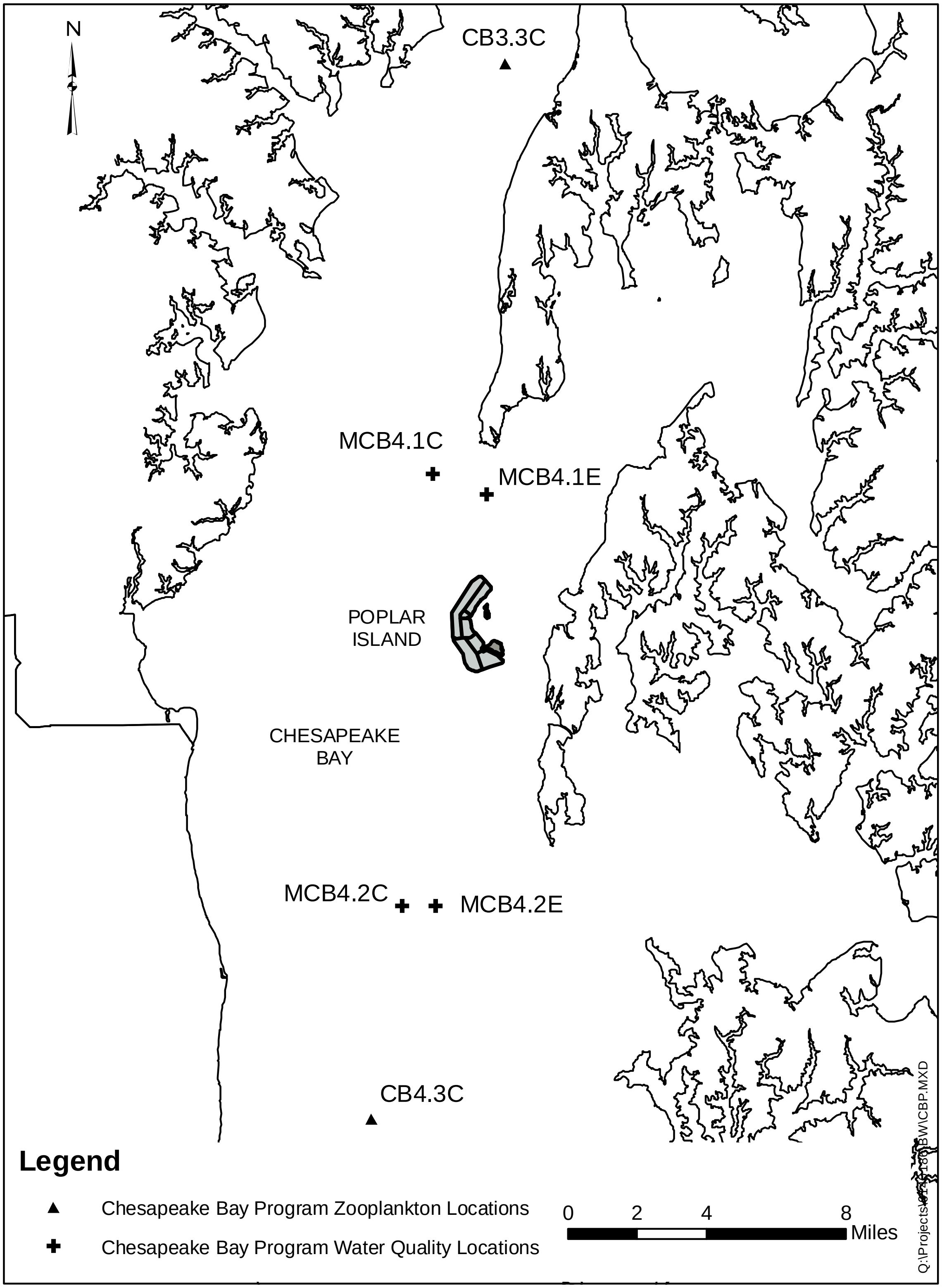


Figure 3-8. Chesapeake Bay Program (CBP) Monitoring Locations in the Vicinity of Poplar Island

Field measurements included temperature, salinity, pH, and DO. Water samples were tested for the following parameters: metals (total and dissolved phases), polychlorinated biphenyl (PCB) congeners, polynuclear aromatic hydrocarbons (PAHs), dioxin and furan congeners, butyltins, chlorinated pesticides, organophosphorus pesticides, semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), cyanide, TSS, sulfide, dissolved organic carbon, particulate carbon, chlorophyll *a*, phaeophytin *a*, total dissolved nitrogen, particulate nitrogen, nitrite, nitrate, ammonium, total dissolved phosphorus, particulate phosphorus, and phosphate. Target analytes, target detection limits, methodologies, and sample holding times were derived from the appropriate guidance documents (USEPA/USACE, 1998; USEPA/USACE, 1995; USEPA, 2001).

Organophosphorus pesticides, VOCs, and SVOCs were only included as part of the pre-placement (2001) exterior water quality testing program. One new location (WQ10), located south of the Cell 5 (Figure 3-7) was added to the water quality monitoring program after completion of the Phase II dike construction.

Results of the pre-placement (2001) chemical analyses indicated that organic constituents and trace metals were present at low concentrations in the water quality samples from each of the exterior monitoring and reference locations (EA, 2002d). Results of the post-placement (2003) exterior water quality evaluation indicated that low levels of trace metals and organics were detected in the water surrounding the PIERP (EA, 2004a). Concentrations of chemical constituents detected at the monitoring locations were generally comparable to concentrations detected at the reference locations (EA, 2004a). Comparisons of the pre-placement (2001) and post-placement (2003) chemical analyses of the PIERP exterior water samples indicated that organic constituents and trace metals were present at similar concentrations from each of the monitoring and reference locations (EA, 2004a).

To meet the requirements of the PIERP Monitoring Framework, concentrations of chemical constituents in the water at the PIERP will continue to be measured as part of future monitoring studies of water quality at the PIERP and to assess the effects, if any, of dredged material placement and effluent discharge on the water quality surrounding the PIERP.

3.1.5 Sediment Quality

The PIERP is underlain by Quaternary lowland sedimentary deposits consisting of gravel, sand, silt, and clay (MGS, 1968). More detailed geologic information concerning the vicinity of the PIERP is included in Section 3.1.2.b. Changes in the physical environment around the PIERP are of particular interest because the sedimentary environment can impact both chemical analyte concentrations and the benthic community structure. The distribution and concentrations of chemical analytes are influenced by the dominant grain size because metals and organics are preferentially bound to fine-grained sediments. The composition of the benthic community is also influenced by the dominant grain size because coarse and fine-grained sediments provide different habitats for organisms. Grain size can also dictate the amount of available organic matter that benthic organisms utilize as a food source. Increases in the concentrations of metals and organic chemicals in the sediments in Poplar Harbor could be indicators of potential effects to benthic infauna. Metal concentrations detected in Poplar Harbor are also important for operational input on wetland function and the need for soil conditioning to increase pH and reduce metal mobilization in the created uplands.

3.1.5.a Surface Sediment Physical Characterization There have been several sampling efforts to characterize the physical characteristics of the surface sediment in the vicinity of the PIERP:

1) pre-construction baseline monitoring, conducted in October 1995/July 1996 (Hill, Park, and Paneotou, 1997);
2) pre-placement sampling, conducted in February 2001 (Hill and Wikel, 2001),
3) post-placement sampling, conducted in December 2001 (Hill and Wikel, 2002),
4) post-placement sampling, conducted in April 2003 (Hill, 2004),
5) the PIERP reconnaissance study sampling, conducted in October 2001 (EA, 2002e),
6) post Hurricane Isabel sediment sampling, conducted in October 2003 (Hill, 2004), and
7) post-placement sampling, conducted in June 2004 (Hill, 2005).

Sediment was collected from the ten sampling locations (WQ1 through WQ10) and two reference locations (WQR1 and WQR2) used for the water quality monitoring, and a set of 'sediment quality only' locations (SQ1 through SQ16) (Figure 3-9) were also identified as monitoring locations for a subset of analyses conducted by MGS. These analyses included grain size, TOC, and metals analyses. Target analytes, target detection limits, methodologies, and sample holding times were derived from the appropriate guidance documents (USEPA/USACE, 1998; USEPA/USACE, 1995; USEPA, 2001).

Sediments collected during the baseline study (Hill, Park, and Panageotou, 1997) and each of the subsequent studies (EA, 2002e; Hill and Wikel, 2001 and 2002; Hill, 2004) indicated that the surface sediments in the vicinity of the PIERP are predominately sand, reflecting the high-energy environment of the area. Finer sediments collected from locations in the vicinity of the PIERP were attributed to erosion from the remnant islands (Hill, Park, and Panageotou, 1997).

The sediment deposition pattern in the vicinity of the PIERP changed as a result of changes in the hydrodynamics in the vicinity of the PIERP as a result of the project's construction. Studies have identified an area of accumulation of fines in the sheltered area east of the PIERP, adjacent to Coaches Island. In addition, increased sand content at locations to the northeast of the PIERP was attributed to the enclosure of North Point within the PIERP perimeter dikes – the erosion of North Point was, most likely, the primary source of the fines

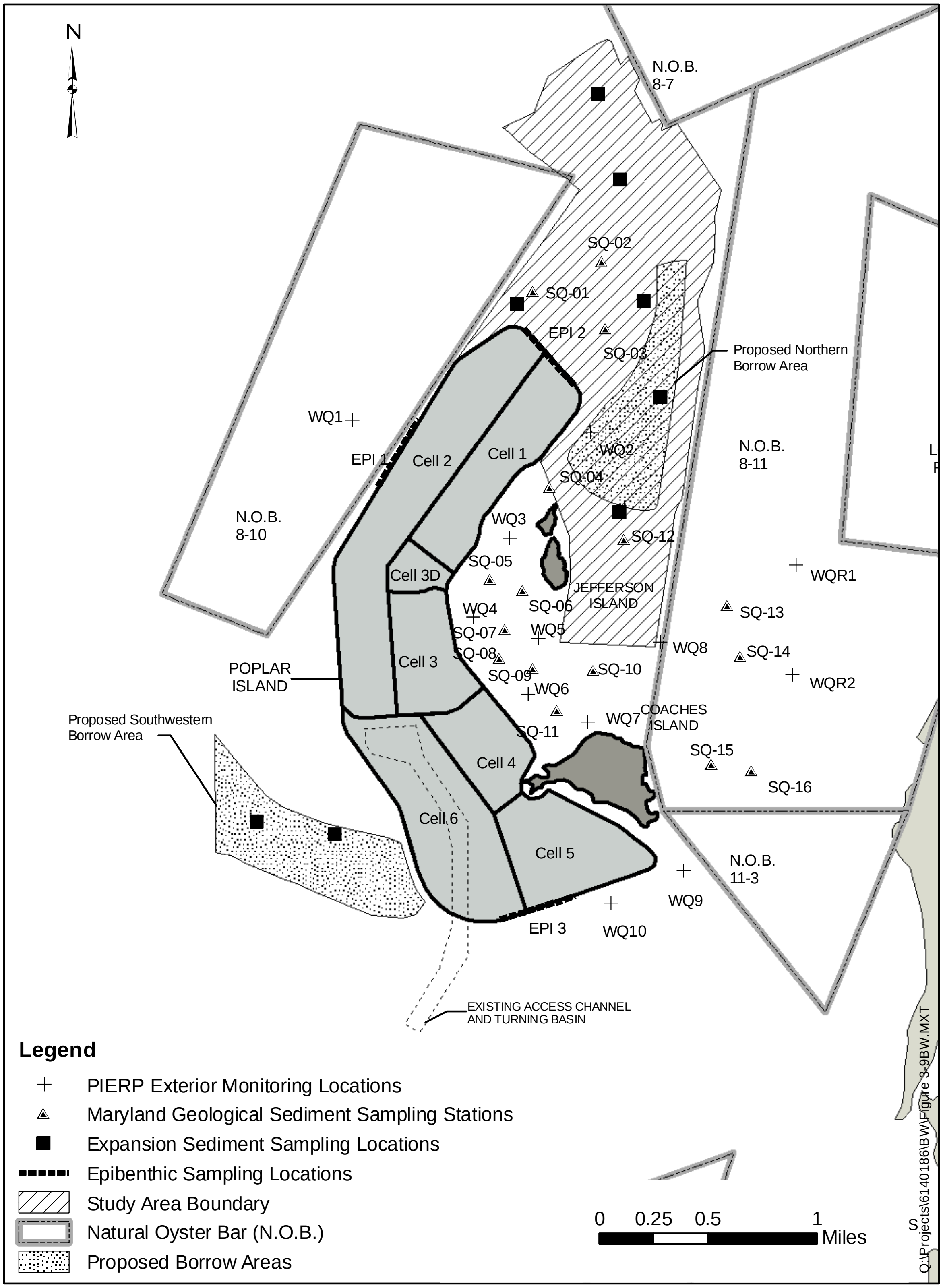


Figure 3-9. Sediment Quality Sampling Locations

in that area. The most recent sediment sampling indicated that deposition of fine-grained sediments at northern locations adjacent to the PIERP is continuing (Hill, 2005).

Tropical Storm Isabel, which came through the Chesapeake Bay area on September 18, 2003, resulted in localized scour and erosion from the high current velocities associated with sustained high winds and a record high storm surge. Sediment sampling conducted to assess the impact of the tropical storm indicated that there were two primary areas of change in the sedimentation patterns – an increase in sand deposition southeast of the PIERP and a slight shift to finer grained sediments northeast of the PIERP. The higher sand proportions were attributed to increased scour as a result of high current velocities from the hurricane, and the fine grained sediment deposition was attributed to a localized thin veneer of sediments from the breach in Cell 1 (Hill, 2004). However, the breaches resulting from Tropical Storm Isabel did not significantly alter the exterior sedimentary environment (Hill, 2004). Subsequent sampling has indicated that the changes to the sedimentary environment from Tropical Storm Isabel are reverting to pre-storm conditions (Hill, 2005).

3.1.5.b Surface Sediment Chemical Characterization There have been two sampling efforts to characterize the chemical characteristics of the surface sediment in the vicinity of the PIERP:

1) pre-placement sampling, conducted in February 2001 (EA, 2002c), and

2) post-placement sampling, conducted in April 2003 (EA, 2004f).

To compare data between sampling years, the same eleven standard sampling locations established in the *Poplar Island Environmental Restoration Project Baseline Monitoring Study* (MES, 2000) (WQ1 through WQ9; WQR1 and WQR2), plus the sampling location added south of the PIERP (WQ10) were sampled for the exterior sediment quality chemical characterization.

Sediment samples from the nine monitoring locations and the two reference locations (WQ1 through WQ9, WQR1 and WQR2) (Figure 3-9) were tested for the following target analytes: grain size, moisture content, ammonia, acid volatile sulfides (AVS)/ simultaneously extracted metals (SEM), BOD, COD, TOC, cyanide, nitrate + nitrite, total Kjeldahl nitrogen (TKN), total phosphorus, specific gravity, sulfide, VOCs, SVOCs, priority pollutant metals, PAHs, PCB congeners, chlorinated pesticides, organophosphorus pesticides, dioxin and furan congeners, butyltins, total carbon, total nitrogen, total phosphorus, total sulfur, and bulk density.

The sediments at the PIERP are comprised predominately of sands, with some silts and clays, resulting in low organic carbon concentrations in the sediments. The lack of a significant fine-grained fraction in the sediment results in low concentrations of metals and hydrophobic organic constituents such as PAHs and PCBs that tend to bind to sediment organic particles before being deposited. Results of the organics analyses from both the pre-placement (2001) and post-placement (2003) chemical analyses revealed low concentrations of pesticides, PAHs, PCB congeners, and dioxin and furan congeners in the sediments from the PIERP (EA, 2002c and 2004f). Concentrations of inorganic nutrients in the sediments were comparable to concentrations measured previously at upper Chesapeake Bay locations (Eskin, 1996; EA, 1996, 2000a, 2000b, and 2003b).

Results from the post-placement (2003) chemical analyses were statistically compared to results from the pre-placement (2001) monitoring to identify any changes in the environment since the PIERP became operational. Results of the post-placement (2003) sediment analyses indicate that low levels of organic constituents and trace metals are present in sediment from the Poplar Island region and generally comparable to results from the pre-placement (2001) study.

3.1.5.c Poplar Island Subsurface Sediments Extensive characterization of the subsurface sediments in the vicinity of the PIERP was conducted as part of the reconnaissance study process to ensure that the proper foundation materials existed to support the potential vertical expansion and/or the potential lateral expansion, and to identify the location of potential sand borrow areas for use in construction. Four studies were conducted to characterize the subsurface sediments in the vicinity of the PIERP:

1) during the design and construction for the PIERP (1994-1996) – provided subsurface information in locations where the proposed lateral expansion would connect to the existing project,

2) reconnaissance study - fifty-six (56) borings were drilled to depths of 30 to 70 ft to investigate the alignments included in the reconnaissance study. Grain size, shear strength and compressibility tests were conducted, and the location, quantity, and quality of the sandy sediments was determined (E2CR, 2002),

3) dike raising investigation - eleven (11) borings along Cells 2 and 6 were drilled to determine the ability of the clay materials under the existing dikes to support the additional loading from the potential dike raising

4) northern expansion investigation - thirty-four (34) borings were drilled to provide additional subsurface information to aid in the design of the potential lateral expansion, including quantity of sand in the borrow area and the location of soft clays to avoid for dike foundations.

Additional information on the subsurface investigations and results, including a map of all the boring locations and results of the geotechnical and laboratory testing, is included in Appendix A. Information from the subsurface investigations was incorporated into the plan formulation and preliminary design phases for both the lateral expansion and the vertical expansion of the existing upland cells.

3.1.5.d Upper Chesapeake Bay Approach Channel Sediments Placed at the PIERP Only dredged material from federally authorized approach channels to the Port of Baltimore specifically identified in the Poplar Island EIS (USACE/MPA 1996) is accepted for placement at Poplar Island. Under the Poplar Island project cooperation agreement between the Department of the Army and the State of Maryland (April 1997), dredged material approved for placement at PIERP is limited to the following Upper Chesapeake Bay Federal navigation channels: the Craighill Entrance Channel, the Craighill Channel, the Craighill Angle, the Craighill Upper Range, the Cutoff Angle, the Brewerton Channel Eastern Extension, the Tolchester Channel, and the Swan Point Channel (Figure 1-3).

Dredged material placement at Poplar Island began in April 2001, and has thus far included dredged material from seven of the eight authorized Upper Chesapeake Bay channels. A total of approximately 9 mcy has been placed at PIERP as of November 2004, and the majority of the material has been placed into Cell 2, which is being developed as an upland area. Dredged material has also been placed into Cells 1 and 3D, which are being developed as wetland areas. To date, Swan Point channel is the only channel authorized for placement at PIERP that has not been dredged since Poplar Island began accepting dredged material in April 2001.

Sediment proposed for dredging in each of these navigation channels is currently tested every three years in accordance with Tier II procedures in the *Inland Testing Manual* (ITM) (USACE/USEPA 1998) to ensure that the material is clean. Studies of the sediment quality in the Upper Chesapeake Bay approach channels were conducted in 1998, 1999/2000 and 2002 (EA 2000a, 2000b, 2003). Results of these sediment testing events have indicated that the physical composition of the channel sediments was predominately comprised of silts and clays, and that concentrations of chemical analytes detected in the Upper Chesapeake Bay Approach Channel sediments was comparable to concentrations detected in previous studies and throughout the upper Chesapeake Bay region.

3.1.6 Aquatic Resources

3.1.6.a Plankton Plankton are tiny open-water plants, animals or bacteria that generally have limited or no swimming ability and are transported through the water by currents and tides. In the Chesapeake Bay, plankton communities serve as a base for the food chain that supports fisheries in general, including commercial and recreational fisheries. Plankton are often used as indicators of environmental and aquatic health because of their high sensitivity to environmental change and short life span. Plankton can be divided into three major size classes (CBP, 2004):

- phytoplankton–microscopic plants and bacteria
- zooplankton–microscopic animals
- macrozooplankton–larger fish eggs and larvae and pelagic invertebrates

Phytoplankton

Like land plants, phytoplankton fix carbon through photosynthesis, making it available for higher trophic levels. The major environmental factors influencing phytoplankton growth are temperature, light, and nutrient availability. Phytoplankton growth is usually limited to the photic zone, and the availability of nutrients such as nitrogen and phosphorus can also limit growth. Phytoplankton can undergo rapid population growth or "algal blooms" when water temperatures rise in the presence of excess nutrients, which typically occurs each spring in the

Chesapeake Bay (CBP, 2004). Phytoplankton blooms can also occur in eutrophic (high nutrient) waters that result from surface water runoff. While increased phytoplankton populations provide food to organisms at higher trophic levels, phytoplankton blooms can harm the overall health of the Chesapeake Bay. During these phytoplankton blooms, most of the phytoplankton die and sink to the bottom, where they decompose, depleting the bottom waters of the dissolved oxygen necessary for the survival of other organisms, including fish and crabs. Major groups of phytoplankton in the Chesapeake Bay include (CBP, 2004):

- diatoms (Bacillariophyta)
- golden-brown algae (Chrysophyta)
- green algae (Clorophyta)
- blue-green algae (Cyanophyta)
- dinoflagellates (Pyrrophycophyta)
- cryptomonads (Cryptophyta)
- microflaggelates (Prasinophyta, Euglenophycota)

Phytoplankton are indicators of environmental conditions within the Chesapeake Bay because phytoplankton populations are especially sensitive to changes in nutrient levels and other water quality conditions because of their limited mobility. General water quality conditions in the Chesapeake Bay can be determined by evaluating key phytoplankton indicators such as chlorophyll *a*, primary production rates, biomass and species composition.

Phytoplankton biomass concentrations in the Chesapeake Bay follow an annual trend, with a peak in the spring (the spring boom) that is often dominated by diatoms (NOAA, 2004). Freshwater inflow to the Chesapeake Bay has a significant control over the timing, duration, and location of the spring bloom since it is the primary source of dissolved inorganic nutrients necessary to fuel phytoplankton growth. Since phytoplankton have little or no mobility, environmental conditions that limit access to dissolved nutrients or light (such as turbidity in the water column, cloud cover, precipitation, and wind strength) will regulate local phytoplankton growth.

Chlorophyll *a* and its degradation product, phaeophytin, are pigments involved in plant photosynthesis. The amount of these photosynthetic compounds detected in water samples is an important estimate of phytoplankton biomass in the surface water. Both chlorophyll *a* and phaeophytin were measured as part of the monthly nutrient monitoring sampling conducted between April 2001 and December 2003 at ten exterior monitoring locations and two reference locations (Figure 3-7) (EA, 2004a). Concentrations measured at the monitoring locations were compared to results from four CBP monitoring locations (4.1C, 4.1E, 4.2C, and 4.2E) located closest to the PIERP (CBP, 2004) (Figure 3-8). Generally, concentrations of chlorophyll *a* and phaeophytin at the monitoring and reference locations were within the natural variability of the upper Chesapeake Bay, with higher concentrations during the typical spring bloom of phytoplankton productivity (EA, 2004a). Concentrations of chlorophyll *a* and phaeophytin were also generally consistent with concentrations detected at the CBP locations, indicating that conditions at the PIERP were typical of those found in other parts of the Chesapeake Bay.

Zooplankton

Zooplankton are planktonic animals that range in size from microscopic rotifers to macroscopic jellyfish. Their distribution within the Chesapeake Bay is governed by salinity, temperature and food availability. Zooplankton are important food for forage fish species and larval stages of all fish, and are the link between primary producers (phytoplankton) and the higher trophic-level organisms. Zooplankton can be classified into three size classes:

- Microzooplankton– (protozoans and rotifers) are usually less than 200 microns in size.
- Mesozooplankton– (including copepods and invertebrate larvae) are between 200 microns and 2 millimeters in size.
- Macrozooplankton– (including amphipods, shrimp, fish larvae and gelatinous zooplankton or jelly fish) are greater than 2 millimeters in size.

Zooplankton, like phytoplankton, are excellent indicators of environmental conditions within the Bay, because they are sensitive to changes in water quality. They respond to low dissolved oxygen, high nutrient levels, toxic contaminants, poor food quality or abundance and predation. Spatial and temporal changes in zooplankton community composition and abundance have been observed in response to freshwater input in the Chesapeake Bay, and the distribution of zooplankton biomass in Chesapeake Bay appears to vary significantly throughout the year.

Zooplankton studies in the area around Poplar Island were conducted prior to the construction of the PIERP, during the environmental conditions surveys for the Poplar Island EIS during 1994 and 1995 (EA, 1995). Since the zooplankton sampling for the PIERP did not indicate that the area around the PIERP was unique habitat for zooplankton, no additional zooplankton studies were conducted during the expansion study. The CBP conducted zooplankton sampling between 1984 and 2002 at 16 locations in the Maryland portion of the Chesapeake Bay and its tributaries. The two zooplankton locations included in the sampling closest to the PIERP were stations CB3.3C and CB4.3C (Figure 3-8). From 1994 to 2002, monthly zooplankton sampling was conducted in March, June, September, October, and December. From 1994 to 2002 bi-monthly sampling was conducted in April, May, July, and August. Generally, the zooplankton collected as part of the CBP were typical of middle region of the Bay.

3.1.6.b Fisheries The middle section of the Chesapeake Bay (which includes the PIERP) supports a diverse fish community, including many fish species that support valuable commercial and recreational fisheries. A list of finfish species commonly found in the mesohaline areas of the Chesapeake Bay, including species that spend their entire life cycle in the Bay, migratory species, and species only occasionally encountered in the Bay is included in Appendix C, Table C-4. Smaller species such as silversides (*Menidia* sp. or *Membras* sp.), gobies (*Microgobius* sp. or *Gobiosoma* sp.), anchovies (*Anchoa* sp.) and killifish (*Fundulus* sp. or *Cyprinodon* sp.) are typical resident forage species in this reach of the Bay. These species feed on zooplankton and small benthic invertebrates, providing a vital link between macroinvertebrates and larger predatory species. Winter flounder and hogchokers (*Trienctes maculates*) are residents that spawn within this reach of the Bay and feed preferentially on benthic invertebrates. Hogchokers are abundant and ubiquitous within the Bay and are important forage for some obligate bottom feeders.

Anadromous species [including striped bass (*Morone saxatilus*), white perch (*Marone Americana*), various herring (*Alosa* spp.) species] spend the majority of their life in saline waters, but spawn in the tributaries of the Chesapeake Bay. Their young are an important forage base for larger resident and seasonal marine species within the Bay. Adult striped bass and adult white perch are among the top predators within the Bay ecosystem. The Bay also supports marine migratory species that spawn in the ocean or saltier reaches of the Bay, but as juveniles and adults utilize the Bay for forage and refuge. The most common marine species utilizing the middle reaches of the Bay during warmer months include bluefish (*Pomatomus saltatrix*), drum species [spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulates*), and weakfish (*Cynoscion regalis*)], summer flounder (*Paralichthys dentatus*), and Atlantic menhaden (*Brevoortia tyrannus*). Each of these marine species, except menhaden, are predators that typically feed on small fish and macroinvertebrates. Atlantic menhaden are planktivores that feed prodigiously throughout most reaches of the Bay and provide a trophic link between the primary productivity and predatory fish species. Although most menhaden spawning occurs offshore (in the ocean), some menhaden spawning has been documented within the mid-to-lower reaches of the Bay. Menhaden continue to support one of the most productive fisheries in the Bay, and are also the preferred prey of many larger Bay predators.

Information documenting a species' general distribution within the Bay does not completely address habitat preferences known to occur within a salinity regime. To assess fisheries utilization of the waters surrounding the PIERP and within the Study Area, seasonal finfish surveys were conducted in 2004 (EA, 2005a). In addition, two finfish utilization studies have been conducted by NOAA – one in 2001 to examine the effect of the construction of the PIERP on fisheries, and a baseline fisheries study for finfish utilization of Cell 4DX in 2003 (NOAA, 2001; 2003). The results of the seasonal fisheries studies are summarized in the following paragraphs and a brief discussion of the commercially important finfish species follows the results of the fisheries studies.

2004 Seasonal Finfish Surveys

Three seasonal fish surveys at the PIERP were conducted to document fish utilization within and adjacent to the expansion Study Area. Fisheries studies were conducted in May (Spring), August (Summer), and October (Fall) 2004 (EA, 2005a). Locations were chosen to include sampling within the proposed alignment areas as well as in reference areas with similar habitat characteristics to the Study Area. Three sampling methods - beach seining, bottom trawling, and gillnetting - were employed to evaluate the finfish community and utilization of the waters within and around the Study Area during the spring, summer and fall seasons (Figure 3-10). A total of 28 species were collected in the seasonal fish studies, 13 of which were commercially and recreationally important and included: blueback herring (*Alosa aestivalis*), Atlantic menhaden, alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), Atlantic croaker, weakfish, red drum (*Sciaenops ocellatus*), spot, bluefish, striped bass, white perch, and summer flounder (Appendix C, Table C-5).

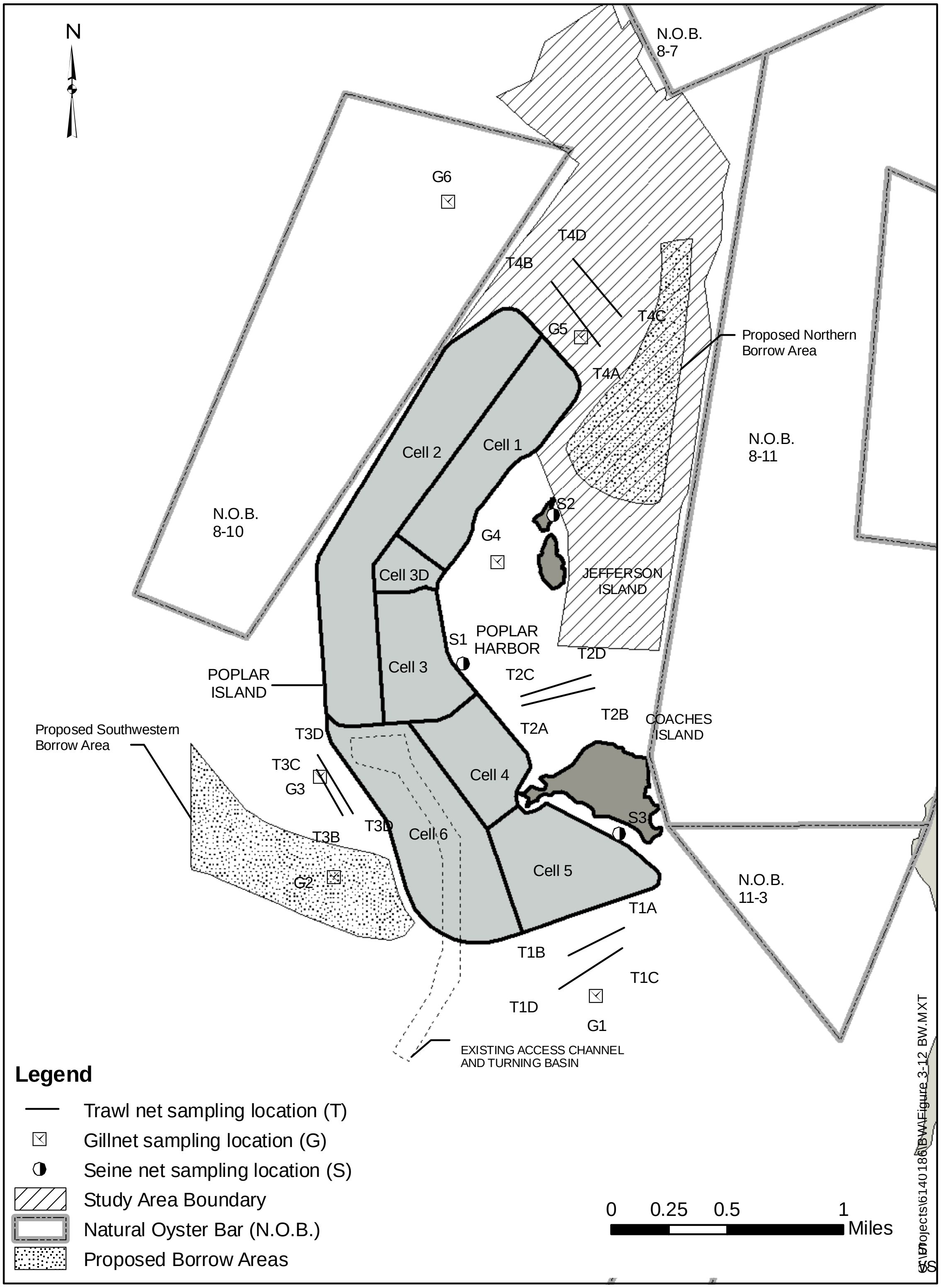


Figure 3-10. Finfish Survey Sampling Locations, 2004

Seining in the shore-zone habitat produced the highest composition and abundance of fish with 11,736 individuals representing 21 species collected (EA, 2005a). The composition of fish collected in the shore-zone habitat consisted of prey species, such as Atlantic silverside (*Menidia menidia*) and bay anchovy (*Anchoa mitchilli*), and juveniles of larger species, including striped bass, which use these areas for cover and to feed until they are mature enough to move into deeper waters. Bottom trawling in the pelagic areas around the island yielded 1,635 individuals representing eleven species and seven families during the three seasonal surveys (EA, 2005a). Gillnet collections targeted the transient fishes that were moving in and out of the archipelago (presumably to feed). Gillnetting yielded 1,338 individuals representing fifteen species and seven families, including important migratory fish species. The dominant species collected during gillnetting were Atlantic menhaden, spot, and striped bass. A list of species found and the time of year they were present is located in Appendix C, Table C-5.

The capture of a variety of life stages for many species (including ichthyoplankton and young-of-the-year) indicates that successful spawning and rearing of resident species, as well as migration of anadromous and seasonal utilization by marine and estuarine species occur within the waters surrounding the PIERP. From the composition of the observed fish community, several inferences can be made about the quality of fish habitat and availability of food within the Study Area. The presence of young, juvenile, and adult life stages of such species as striped bass, winter flounder (*Pluronectes americanus*), Atlantic menhaden, and bluefish throughout the year reflects the diversity of cover available within the Study Area. Bay anchovy, Atlantic menhaden, and juveniles of species such as silversides feed predominantly on plankton. Juvenile striped bass, blue fish, and drum species feed on a variety of small fish and invertebrates. The abundance of these fish species within the Study Area during various seasons reflects the generally good forage opportunities.

The PIERP and nearby waters appear to be meeting the food and physical habitat needs of many fish species in the region, supporting a diverse fish community. The absence or low abundance of regionally common resident species from fisheries collections [i.e., mummichogs (*Fundulus heteroolitus*), young gobies] indicates that some fish habitats, such as sand beaches, vegetated wetlands, and SAV, may be scarce within the Study Area. The low catches in trawl collections throughout the year support this assumption. Abundance of preferred forage species, such as silversides, will attract larger seasonally abundant predators to the Study Area.

The shallow-water area between the PIERP and Coaches Island (the “notch”) supports a variety of shallow water habitat finfish species. The finfish species found in these areas are similar to those found in shallow water areas near James Island (USACE, 2005b). The notch and the sampling locations within Poplar Harbor also support a substantial number of commercially and recreationally important species, as well as forage species (EA, 2005a). Seining efforts in the notch produced a total of 8,982 individuals representing sixteen species during the three seasons of fish surveys in 2004 (EA, 2005a). The notch specifically provides habitat for large numbers of forage fish, including rough silversides (*Membras martinica*) and sheepshead minnows (*Cyprinodon variegatus*), which were not found at other locations. Seining efforts in the notch yielded the largest abundance of fish at any location or with any sampling method. Additionally, the seining location in the notch was the only location where juvenile red drum were collected. The most productive trawl location and one of the most productive gillnet locations were located in Poplar Harbor, yielding the largest numbers of Atlantic menhaden and striped bass. The results of the expansion finfish study indicate that Poplar Harbor supports a substantial number of commercially and recreationally important species as well as substantial numbers of forage species.

The seasonal finfish studies revealed that the gillnet station sampled in the southwestern borrow area (Figure 3-10) was among the highest of those areas surveyed for diversity (average of six discrete species) and abundance (average of over 120 total species) of finfish species for all three seasons. However, finfish sampled by trawl (Figure 3-10) in the vicinity of the southwestern borrow area had extremely low diversity (one discrete species) and abundance (one total species) for each season. Gillnet collections were most likely productive because of the deeper water that exists in the southwest portion of the PIERP and the access channel and turning basin. Additionally, the submerged rock pilings are also located in the vicinity that may provide habitat to finfish species.

The depth in immediate vicinities surrounding the PIERP is considered relatively shallow, with water depths ranging from -6 to -10 ft MLLW. Deeper areas of the Chesapeake Bay (depths of 25 ft or more) are known to act as thermal refuges for large schools of resident finfish in winter (MDNR, 2005b). The depths within the proposed Study Area are, therefore, too shallow to provide thermal refuge to over-wintering finfish.

2001 and 2003 NOAA Nekton Surveys

NOAA conducted a nekton survey in the spring, summer, and fall of 2001 to examine the effect of the construction of the PIERP on nekton use of the adjacent habitats, as compared to the 1995-96 baseline survey (NOAA, 2001). NOAA also conducted a nekton survey in the spring of 2003 (NOAA, 2003) to assess baseline conditions of nekton use of the shallow water habitats within Poplar Harbor prior to the construction of Cell 4DX.

The 2001 nekton surveys in Poplar Harbor were conducted using gillnets, otter trawl, and throw traps during the spring, summer, and fall seasons. The results of the 2001 survey concluded that trawling efforts yielded the greatest abundance of fish in summer 2001, and striped bass and bay anchovy were the dominant species recovered (NOAA, 2001). Gillnetting was the most successful during fall 2001 sampling with Atlantic menhaden and bluefish dominating catches. In April 2003, nekton surveys conducted in Poplar Harbor using gillnets and trawls yielded nine species of fish (NOAA, 2003). Gillnet sampling efforts produced the greatest abundance of fish, with Atlantic menhaden and striped bass dominating collections. Striped bass were more prevalent in shallow water areas (such as Poplar Harbor) than the deeper water sampling locations.

Commercially Important Finfish Species

The PIERP is located in Segment 4 of the Chesapeake Bay (MDNR waterbody code 027), which includes the area south of the Bay Bridge to the Patuxent River. The area in the vicinity of PIERP supports fisheries that include shellfish (oysters and clams), blue crabs, and finfish. Details of commercial harvested shell species are included in the Section 3.1.6.b.

The PIERP is within the center of the commercial seafood-harvesting region of Maryland, and details about the commercial landings in the vicinity of the PIERP are included in Section 3.3.3. The waters surrounding the PIERP and within Segment 4 support pound net and gillnet harvests of a variety of finfish. The most significant finfish harvests within Segment 4 include Atlantic menhaden and striped bass. Other species that support significant harvests include white perch, croaker, spot, common eel (*Anguilla anguilla*), bluefish, and summer flounder. Details of finfish harvests are discussed in Section 3.3.3b.

Because landing data in this area of the Bay are aggregated over such a large area, it is difficult to assess landings associated only with the 1,080-acre project Study Area (relative to the rest of Segment 4). Assessments of harvests within the project Study Area compared to commercial harvest within Segment 4 are made in Section 3.3.3.b, and indicate that the project Study Area likely supports a small percentage of the commercial harvesting within this segment. The site-specific fisheries studies conducted within the Study Area at the PIERP indicated that the area supports fairly typical species compositions and relative abundances for this part of the Bay.

The fisheries distributions around the PIERP are also typical of this reach of the Bay as compared to results of fisheries collections from James and Barren Islands and the Chesapeake Bay Fishery-Independent Multispecies Survey (CHESFIMS). The CHESFIMS is a NOAA-funded research program conducted co-operatively by researchers from UMCES/CBL, University of Maryland – College Park, and the MDNR. CHESFIMS is conducted to determine biological production potential and the temporal and spatial variability in the Chesapeake Bay ecosystem and has been conducted from 1995 – 2000. Results of the site-specific surveys for the proposed Mid-Chesapeake Bay Island Ecosystem Restoration study at James and/or Barren Islands (located south of the PIERP, Figure 1-8) yielded similar fisheries results compared to Poplar Island results (USACE, 2005b). Studies at Poplar Island, James Island, and Barren Island identified Atlantic silverside (a key forage species) as one of the most abundant fish in seine surveys, which is consistent with the MDNR seine surveys conducted in the Choptank River (MDNR, 2004a). Bay anchovy (another key forage species) was among the most abundant species in both the 2004 and 1995-96 surveys at the PIERP, as discussed above. This is consistent with the findings near James and Barren Islands and with the CHESFIMS results from summer and fall 2002 and spring 2003 (CHESFIMS, 2004), although this survey used a slightly larger meshed trawl. Other species of abundance in the CHESFIMS program included Atlantic croaker and spot, both of which were collected near the PIERP in seasonal surveys. Atlantic menhaden were collected throughout the year in the vicinity of the PIERP in 1995-96 and 2004 in various gears, but were seasonally abundant in the gillnets in the spring and fall. This is consistent with the results of the James Island surveys, which indicates another similarity in the fisheries distributions around these two areas and as an additional indication that fisheries distributions around the PIERP are typical of this reach of the Bay.

3.1.6.c Essential Fish Habitat (EFH) The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), (16 USC 1801 et seq. Public Law 104-208) reflects the Secretary of Commerce and Fishery Management Council authority and responsibilities for the protection of essential fish habitat (EFH). The Act specified that each Federal agency shall consult with the Secretary with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by such agency that may adversely affect any EFH identified under this act. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

Based on review of EFH designations for the Choptank River estuary, which is geographically adjacent to and has a comparable salinity regime to the project area, the Study Area lies within waters designated as EFH for the following species and their life stages: summer flounder, juvenile and adult life stages; bluefish, juvenile and adult life stages; windowpane flounder (*Scopthalmus aquosus*), juvenile and adult life stages; cobia (*Rachycentron canadum*), all life stages; red drum (*Sciaenops ocellatus*), all life stages; king mackerel (*Scomberomorus cavalla*), all life stages; and Spanish mackerel (*Scomberomorus maculatus*), all life stages (NMFS, 2005a).

Based on initial USACE coordination with NMFS, it was determined that of the species with EFH designated in the project area, only juvenile and adult summer flounder and adult and juvenile bluefish are likely occur within the Study Area (Nichols NMFS, 2004). Subsequent consultations with NMFS indicated that an assessment of impacts on red drum EFH should also be included for this project (Nichols NMFS, 2004). The detailed EFH Assessment is included in Appendix D.

Juvenile and adult summer flounder and juvenile bluefish were collected in the vicinity of the site during the site-specific investigations in support of the EIS for the PIERP (USACE/MPA, 1996) and during the more recent 2004 spring, summer, and fall expansion surveys (EA, 2005a). Both species have also been collected during NOAA fisheries monitoring of the project and nearby waters (NOAA, 2001). Juvenile red drum have been collected in Poplar Harbor (NOAA, 2001), and in the notch area between the PIERP and Coaches Island (EA, 2005a). Based on this observation, and in coordination with NMFS, juvenile red drum was added to the list of species and life history stages evaluated as part of the EFH assessment.

EFH habitat that is judged to be particularly important to the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation, is identified as habitat areas of particular concern (HAPC) to help provide additional focus for conservation efforts. In addition to EFH, some regions of the Chesapeake Bay have also been designated as HAPC. HAPC are areas of special importance within EFH that may require additional protection from adverse effects. HAPC is defined on the basis of its ecological importance, sensitivity, exposure, and rarity of the habitat (Dobrzynski and Johnson, 2001). The regional council that oversees the Chesapeake Bay, the Mid-Atlantic Fisheries Management Council (MAFMC), has designated HAPC for the summer flounder, and has specifically identified SAV and macroalgae beds in nursery habitats as HAPC for juvenile and larval summer flounder. However, the MAFMC has not specifically identified map locations or geographic coordinates associated with HAPC for the Chesapeake Bay.

NMFS identifies HAPC in the Chesapeake Bay areas associated with juvenile and adult summer flounder and juvenile red drum. Juvenile and adult summer flounder HAPC is defined as areas with native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed and as loose aggregations, which are the general reach for summer flounder EFH (NMFS, 2005b). Because small beds of SAV have been observed in Poplar Harbor, this area could be considered HAPC for summer flounder. Juvenile red drum HAPC is defined as all coastal inlets, all State-designated nursery habitats of particular importance to red drum, and anywhere that SAV occurs – SAV is considered an extremely important habitat for red drum (NMFS, 2005b). The mouth of the Chesapeake Bay is considered a coastal inlet, but the middle and upper portions of the Bay are designated as coastal embayments. Because the PIERP is located in the Mid-Bay, only areas with SAV, including Poplar Harbor, are considered HAPC for juvenile red drum.

3.1.6.d Benthic and Epibenthic Invertebrates Benthic invertebrates are used extensively as indicators of estuarine environmental status and trends because numerous studies have demonstrated that benthos respond predictably to many kinds of natural and anthropogenic stress (Weisberg *et al*., 1997). Benthos refers to the benthic invertebrate community that includes the group of animals that live on or in the bottom sediments of the Chesapeake Bay; the benthic community includes a wide variety of organisms. Benthic invertebrates are important indicators of anthropogenic stress in aquatic systems because they are relatively sedentary and can integrate the effects of environmental conditions over long periods of time. The composition of the benthic invertebrate community depends on the physical, chemical, and biological characteristics of the surrounding substrate. Benthic invertebrates are often important components of fish diets, and thus provide an important link to higher trophic levels. Several macroinvertebrate species, such as oysters, clams, and blue crabs support significant commercial harvests within this reach of the Chesapeake Bay and are discussed in more detail in the *commercially important macroinvertebrate species* section below**.**

Benthic Community

The purpose of the benthic community monitoring was two-fold: (1) to document the reestablishment of benthic communities in the vicinity of the PIERP, and (2) to characterize the epibenthic colonization on the dike. The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) was developed by Weisberg *et al*. (1997) to assess benthic community health and environmental quality in the Chesapeake Bay. The B-IBI evaluates the ecological condition of a sample by comparing values of key benthic community attributes to reference values expected under non-degraded conditions in similar habitat types (Versar, 2002). The Chesapeake Bay B-IBI combines the calculation of five metrics – the Shannon-Weiner species diversity index, total species abundance, percent abundance of pollution-indicative taxa, percent abundance of pollution-sensitive taxa, and percent abundance of carnivores and omnivores **–** for comparison to reference conditions.

The B-IBI assigns a score to each of the five metrics listed above to describe benthic communities and provide an assessment of benthic community conditions. Based on the B-IBI scores, the Chesapeake Bay Benthic Monitoring Program classifies the benthic community according to the following four levels (Versar, 2002):

- Meets goals (B-IBI that is greater than 3.0)
- Marginally degraded (B-IBI of 2.7 to 2.9)
- Degraded (B-IBI of 2.1 to 2.6)
- Severely degraded (B-IBI that is less than 2.0)

The B-IBI is used to establish benthic restoration goals for the Chesapeake Bay (Weisberg *et al*., 1997). The Chesapeake Bay Restoration Goal Index (RGI) (Ranasinghe *et al*., 1994) was developed based on the same approach used to develop the Index of Biotic Integrity (IBI) for freshwater systems (Karr *et al*., 1986). A Chesapeake Bay RGI value of 3.0 represents the minimum restoration goal. RGI values of less than 3 are indicative of a stressed community. Values of 3 or greater indicate habitats that meet or exceed the restoration goals (Ranasinghe *et al*., 1994).

There have been a total of five sampling efforts to characterize the benthic community in the vicinity of the PIERP:

1) pre-construction baseline monitoring, conducted in September 1995, May 1996, and July 1996 (Dalal *et al*., 1996);

2) pre-placement sampling, conducted in October 2000 (EA, 2002a);

3) post-placement sampling, conducted in October 2002 (EA, 2004b);

4) the PIERP reconnaissance study sampling, conducted in October 2001 (EA, 2002e);

5) the PIERP expansion existing conditions study, conducted in September 2004 (EA, 2005a) .

Pre-placement (2000) and post-placement (2002) benthic community sampling was conducted for the ten sampling locations (WQ1 through WQ10) and two reference locations (WQR1 and WQR2) used for the water and sediment quality monitoring (Figure 3-11). Additional locations within the Study Area were sampled for the reconnaissance (2001) and expansion (2004) studies (Figure 3-11). The benthic community assessment was divided into three components - a benthic infaunal survey, an epibenthic characterization along the dike, and benthic tissue analysis. Epibenthic sampling and benthic tissue analyses were not included in the reconnaissance study (EA, 2002e) or the expansion existing conditions study (EA, 2005a).

Prior to the construction of the PIERP, a baseline benthic community study was conducted in September 1995, May 1996, and July 1996 (Dalal *et al*. 1996). The ranges of the B-IBI scores were similar during each sampling events, however the predominance of one species, the amethyst gem clam (*Gemma gemma*), at most locations had a significant influence on the B-IBI scores. The number of locations that meet the Restoration Goal in the baseline benthic community assessment varied between sampling events – one (September 1995), seven (May 1996), and six (July 1996) (Dalal *et al*., 1996).

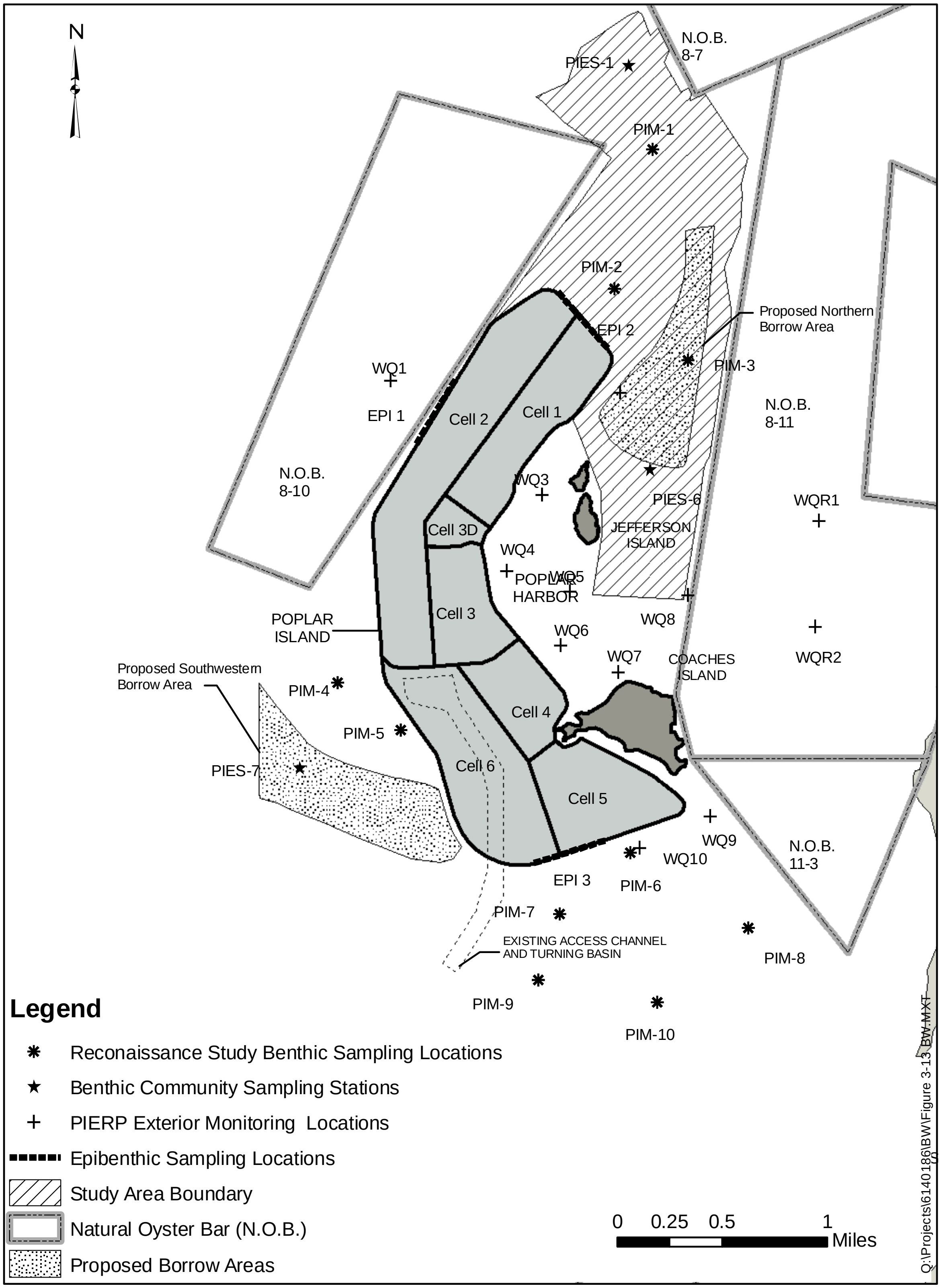


Figure 3-11. Benthic/Epibenthic Community and Benthic Tissue Sampling Locations for Expansion, Reconnaissance, Monitoring, and Reference Location

A total of 34 unique taxa were collected during the pre-placement (2000) study, 46 unique taxa were identified in the reconnaissance (2001) study, 35 unique taxa were collected during the post-placement (2002) study, and 16 unique taxa were identified in the expansion (2004) study (Appendix C, Table C-6). B-IBI scores from the reconnaissance (2001) study ranged from 1.8 to 3.8, with the two locations south of the PIERP meeting the Chesapeake Bay restoration goal (EA, 2002e). Compared to the pre-placement (2000), the mean B-IBI at the monitoring locations decreased slightly from 2.1 to 2.0, and the mean B-IBI at the reference locations increased from 2.6 to 2.8. Location WQR1 (reference) was the only location that met the Restoration Goal during the post-placement (2002) sampling (EA, 2004b).

The existing benthic community in the vicinity of the PIERP is generally classified as a stressed community, with B-IBI scores less than the Chesapeake Bay Restoration Goal Index (RGI) of 3 (Ranasinghe *et al*., 1994). The low B-IBI scores were largely affected by low diversity and the dominance of one species, Amethyst gem clam, a phenomena seen in the results from each of the benthic community studies conducted at the PIERP (EA; 2002e, 2002b, 2004b, 2005a). Compared to similar areas throughout the Chesapeake Bay, the benthic habitat surrounding the PIERP supports fewer benthic taxa and lower diversity (EA, 2002e). The benthic habitat in the vicinity of the PIERP is not rare given the extent of the benthic habitat throughout the Mid-Bay region.

Epibenthic Community

The epibenthic community along the exterior perimeter dikes was sampled to identify and quantify epibenthic colonization of the newly constructed dike at two locations in the pre-placement (2000) sampling and for three locations in the post-placement (2002) sampling (Figure 3-11). The results of both the pre-placement (2000) and post-placement (2002) studies indicated that the epibenthic organisms located on the exterior dikes at the PIERP were abundant and served as an important food source for finfish and shellfish species that forage in the area (EA, 2002a). Altogether, 14 unique epibenthic taxa were identified in each of pre-placement (2000) and post-placement (2002) studies (Appendix C, Table C-7) (EA, 2002a and 2004b).

Commercially Important Macroinvertebrate Species

A number of benthic macroinvertebrate species are commercially important in the vicinity of the PIERP and include oysters, clams, and blue crabs. A more detailed discussion of each species is included in the following sections.

<u>Oysters</u>

The American oyster (*Crassotrea virginica*) is a commercially and ecologically important species to the Chesapeake Bay. Compared to historic levels, the oyster population in the Chesapeake Bay has experienced a 99 percent population decline because of diseases/parasites and overfishing (Newell and Ott, 1999). The impacts of increased nutrient loadings to the Chesapeake Bay (Section 3.1.4) are compounded by loss of oysters because oysters filter suspended sediments and plankton from the water column (Newell and Ott, 1999). NOBs are designated by the MDNR as a resource of special significance, and oyster recovery is a goal of the Chesapeake Bay 2000 Agreement (Appendix C, Table C-3). NOBs were used historically to map approximate boundaries of early 20th century commercially productive oyster grounds. The present locations and classifications of the legally defined NOBs were formally adopted in 1983 following extensive changes to the original charted bar boundaries, and assignment of coded numbers to individual oyster bars. Many NOBs are no longer either commercially or ecologically productive oyster beds and haven't been for many years (MDNR, 2005a).

There are four oyster bars in the vicinity of the PIERP that are designated as NOBs by MDNR - NOB 8-7, NOB 8-10, NOB 8-11, and NOB 11-3 (Figure 3-12). NOB 8-10 is the closest oyster bar to the PIERP, located approximately 130 ft from the rock dike, west of the PIERP. NOB 8-7 is located to the north of the PIERP, and NOB 8-11 and 11-3 are located to the northeast and southeast of the PIERP, respectively. A fifth oyster bar, NOB 11-2 is located approximately 1.5 miles south of the PIERP.

Survey lines defining existing NOBs in the vicinity of the PIERP are the legal bar boundaries, and include buffer areas to protect existing oysters from other activities occurring near the actual bar boundaries. A side-scan sonar survey was conducted by MDNR at the southern portion of NOB 8-11 and portions of NOB 11-3. The survey results indicated that there was little oyster shell identified within the surveyed boundaries of NOB 8-11 to the east or southeast of Coaches Island and that no commercially harvestable shells are located in close proximity to the dike construction area to the east of the PIERP (Halka and Ortt, 2002a). In December 2004, MDNR conducted an acoustic sounding and dredge survey within NOBs 8-7, 8-10, and the northern portion of NOB 8-11 (Tarnowski MDNR, 2005). The survey was not designed to determine definitive populations of oysters, and the results are presented below to discuss locations of live oysters that have been observed in the vicinity of the PIERP. A large number of live oysters were recovered at four locations (P6, P7, P8, and P9) along a transect in NOB 8-11, located east of the PIERP (Figure 3-12). These areas of live oyster recovery in NOB 8-11 would be considered a productive oyster bar because of the volume of oysters recovered (Tarnowski MDNR, 2005). However, these locations have not been quantified at a detailed level.

Oyster shell reefs were created through placement of oyster shells in a recently permitted oyster sanctuary and a harvest reserve in NOB 8-10, located west of the PIERP in November 2003 by the USACE (MES, 2003c). The oyster shell was recovered from dredged material placed at the PIERP from dredging in the shipping channels of the upper Chesapeake Bay. The 7-acre oyster sanctuary is located approximately 0.5 nautical miles (NM) due west of the PIERP and approximately 2.5 acres of shell (1,870 cy) were placed in this area. The oyster harvest reserve site was approximately 0.3 NM northwest of the north end of the PIERP, and approximately 2.5 acres of shell (1,870 cy) were planted in this area. The results of the oyster shell planting are not yet available, although future monitoring may be conducted.

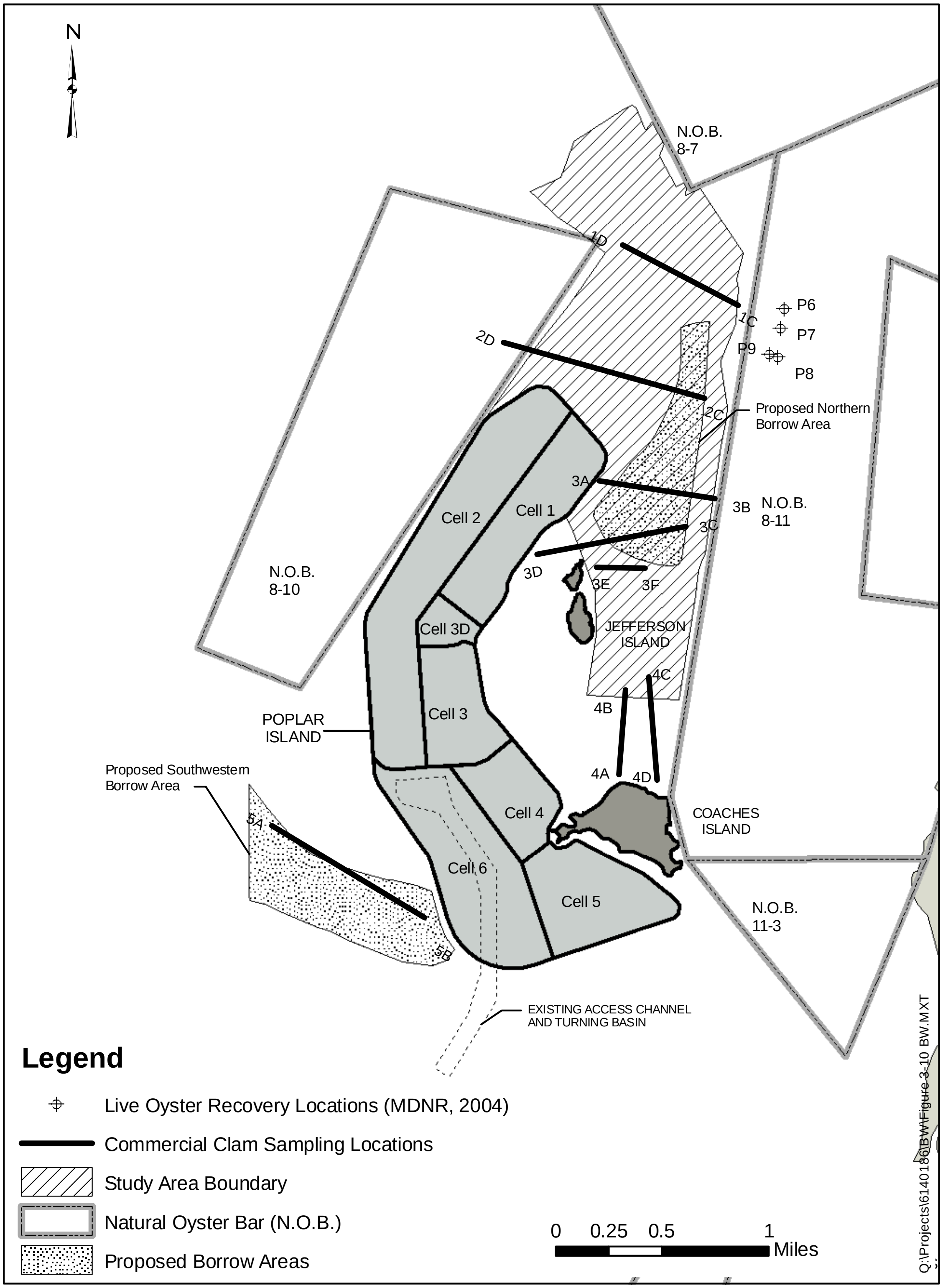


Figure 3-12. Live Oyster Recovery Locations and Commercial Clam Survey Transect Locations

A shellfish bed sedimentation study was completed by MGS in August 2000 to determine if impacts to NOB 8-10 had resulted from the construction of the containment dike surrounding the PIERP (Halka and Ortt, 2002b). This study included pre- and post-construction sedimentation studies and bathymetry mapping. The results of this study indicated that sediment mobility within the boundary of NOB 8-10 was naturally high and that sandy sediment had completely covered some areas of shell present on the bottom (Halka and Ortt, 2002b). Prior to construction activities, sediment movement was occurring naturally in the vicinity of the PIERP (Halka and Ortt, 2002b). The post-construction sedimentation study indicated that some minor sedimentation occurred over NOB 8-10, to the northwest of PIERP. This sedimentation cannot be definitively be linked to the construction of the PIERP, but the proximity of the sandy sediment to the dike suggests that the sedimentation was related to construction activities. Subsequent surveys did not indicate additional sedimentation (Halka and Ortt, 2002b). An additional oyster bar study was completed by MGS in August 2001 to determine if impacts to NOBs 8-11 and 11-3 had resulted from the construction of the perimeter dike during Phase II of the PIERP (Halka and Ortt, 2002a). This study included pre- and post-construction side-scan sonar surveys, and results indicated that no additional sediment or sand moved into the boundary of NOB 8-11 or 11-3 as a result of perimeter dike construction (Halka and Ortt, 2002a).

Clams

The soft-shell clam (*Mya arenaria*) and the razor clam (*Tagelus plebius*) are commercially important clam species in the middle or mesohaline portion of the Chesapeake Bay. Soft-shell clams in the Chesapeake Bay spawn up to two times in one year. Spawning times are dependent primarily on temperature, and typically occur in the spring when temperatures reach approximately 10^{o}C and may be repeated in the fall when temperatures decrease to 20^{o}C (Abraham 1986). Soft-shell clam eggs develop into larvae and remain in the water column for approximately 2 to 6 weeks. Soft-shell clams are also impacted by anoxia, which restricts their distribution to waters less than 33 ft (10 m) deep (Abraham, 1986).

A commercial clam study was conducted in the expansion Study Area to document clam distribution, density, and harvesting rates, and to determine if productive soft-shell clam or razor clam bars exist adjacent to and in the vicinity of the PIERP (Figure 3-12) (EA, 2005a). A total of five areas were sampled for clams in the vicinity of the PIERP at targeted water depths between 3 and 14 ft. Commercial watermen collect clams using a tong method or a hydraulic dredge; due to the length of the dredge, areas deeper than approximately 14 ft are normally not sampled for clam collections. Targeted sampling areas included the locations of the proposed lateral alignments, sand borrow areas, and access channels (EA, 2005a). Soft-shell clams were separated into legal (>2 inches length) and sub-legal (<2 inches length) clams and counted. No minimum legal length for razor clams has been established by MDNR because razor clams are typically used for bait. Harvesting rates were calculated using a Catch-Per-Unit-Effort (CPUE) protocol, approved by MDNR. As defined by the COMAR (08.02.08.11), a productive natural clam bar has an existing or potential harvesting rate of either 0.5 bushels per hour (bu/hr) for soft-shell clams or 1.5 bu/hr for razor clams. Based on the results of the commercial shellfish study, none of the five sampling areas in the vicinity of the PIERP, including those within the northern Study Area and southwestern borrow area, would be classified by MDNR as a productive clam bar for soft-shell clams or razor clams

(EA, 2005a). Although below commercially harvestable levels, the most productive razor clam areas of those surveyed were within the northern Study Area, but these areas are not currently known to be heavily utilized by clammers (Gary MDNR, 2003). These commercial shellfish study results are representative of current conditions surrounding Poplar Island, although, areas in Poplar Harbor with known occurrences of SAV were not sampled in this study to avoid disturbance to SAV beds. Poplar Harbor may presently or in the future support more productive clam bars as SAV continues to reestablish in this area.

<u>Blue Crabs</u>
The blue crab (*Callinectes sapidus*) supports one of the dominant commercial fisheries in the middle reaches of the Chesapeake Bay, and the waters surrounding the PIERP support a local blue crab fishery (EA, 2003c). To assess the commercial crab fishery/utilization in the expansion Study Area, visual density (crabpots/acre) estimates for crabpots were conducted monthly (one day a month) for four consecutive months during peak utilization periods (June through September 2004) (Figure 3-13) (EA, 2005a). Generally, Poplar Harbor had the greatest individual crabpot and crabpot line usage. Crabpot usage appeared to increase from June to August, and then decreased by September (EA, 2005a).

NOAA conducted nekton (freely swimming organisms that include fish, shrimp, and crabs) surveys in the spring, summer, and fall of 2001 to examine the effect construction of the PIERP had on nekton use of the adjacent habitats, as compared to usage documented in the 1995-96 baseline monitoring study (NOAA, 2001). NOAA also conducted a nekton survey in the spring of 2003 (NOAA, 2003) to assess baseline nekton use of the shallow water habitats within Poplar Harbor prior to the construction of Cell 4DX.

The results of the spring, summer, and fall 2001 surveys conducted by NOAA concluded that gillnetting and trawling methods yielded a low abundance of blue crabs. Crabpots set in Poplar Harbor during the summer (2001) yielded a mean number of 1.7 individuals per 24-hour crab pot set, which was slightly higher than reference site abundances of 1.4 crabs per 24 hour set (NOAA, 2001). The results of the 2003 survey conducted by NOAA concluded that blue crab abundance in Poplar Harbor increased slightly compared to the 2001 surveys (NOAA, 2003).

Blue crabs overwinter throughout the Chesapeake Bay, and the majority of crabs overwintering in Maryland waters are males and juveniles. The MDNR has been estimating overwintering crab densities in various areas of the Chesapeake Bay since 1990. In the Upper Bay (area of lower salinity), depths greater than 40 ft tend to be the most significant overwintering areas. In the Maryland waters of the Mid-Bay (Bay Bridge to the Poplar Island), areas shallower than 40 ft can be important areas for overwintering, and therefore, portions of the Study Area may be utilized as crab overwintering habitat. Actual crab densities in the Mid-Bay during the winter months at depths less than 40 ft are discussed in more detail in Section 3.3.3.b.

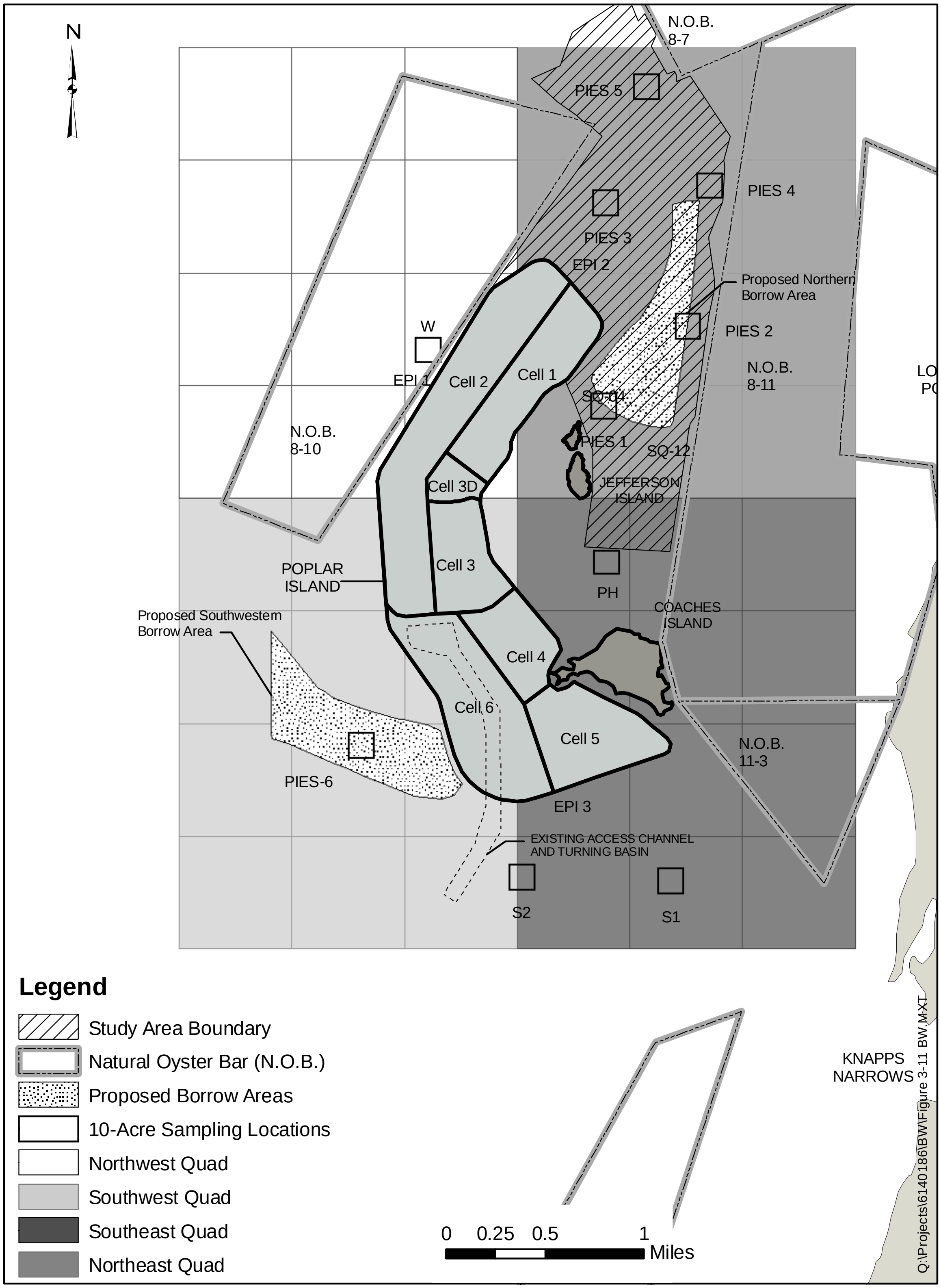


Figure 3-13. Crabpot Density Classification Grid Survey and Sampling Locations

Benthic Tissue Analysis

The benthic tissue analyses were conducted to study the potential bioaccumulation of chemicals in benthic tissue as a result of the construction or operation of the PIERP. Bioaccumulation of contaminants in the tissue of aquatic invertebrates can be detrimental to the health of the organisms themselves, as well as detrimental to higher level food chain organisms that feed on aquatic invertebrates. The clams tested for tissue analyses were collected *in situ* from the sediments in the vicinity of the PIERP, and therefore had been exposed to the conditions around the PIERP for their entire life history.

Baseline assessments for benthic tissue concentrations were conducted in 1996 to provide baseline line for future comparisons to assess impacts, if any, from operations at the PIERP on the biological communities that surround the PIERP. Soft-shelled clams and razor clams were collected in situ at Poplar Island during January and June 1996 for tissue analysis from locations WQ2, WQ3, WQ4, WQ6, and WQR1 (Dalal *et al*., 1999). Tissue residue analyses for pesticides, metals, PAHs, and PCBs indicated that the concentrations of analytes in clam tissue were within the normal range for Chesapeake Bay benthic organisms, and that there was no significant difference in tissue concentrations from reference sites in the Bay.

Sampling for the pre-placement (2000) and post-placement (2002) benthic tissue analysis was conducted at four of the exterior monitoring locations (WQ2, WQ3, WQ4, and WQ6) and one reference site location (WQR1) in October 2000 (Figure 3-11). Location WQ10 was added in to the post-placement (2002) sampling after the completion of Phase II dike construction (EA, 2004c). Three species of clams - soft shelled clams, razor clams, and baltic clams (*Macoma balthica*) were targeted for collection using a commercial clamming vessel. Concentrations of chemical constituents detected in bivalve tissue were low and generally comparable to results from the 1996 baseline study. Trace metal concentrations in the soft-shelled clams were statistically significantly lower in the pre-placement (2000) study compared to the baseline (1996) study. Concentrations of organic constituents in the pre-placement (2000) study were statistically higher at the Poplar Harbor monitoring locations as compared to the reference location (WQR1). However, overall concentrations of metals and organic constituents detected in clam tissue from the pre-placement study (2000) were low and consistent with tissue concentrations in baseline (1996) studies (Dalal *et al*., 1999).

Concentrations of chemical constituents detected in the benthic tissue indicated that the low levels of organic constituents detected were generally comparable to results from the pre-placement (2000) benthic tissue study. Based on the comparisons to the pre-placement (2000) tissue results, it is likely that the difference in tissue concentrations between pre-placement (2000) and post-placement (2002) results is not biologically or ecologically significant, and there are no apparent trends that indicate the accumulation of organic or inorganic contaminants in bivalve tissue in Poplar Harbor.

3.1.6.e Submerged Aquatic Vegetation (SAV) SAV (vascular plants that grow completely underwater) is an important water quality indicator and critical habitat and food source for estuarine species. SAV beds produce oxygen, provide nursery habitat for many species of fish and invertebrates, remove excess nutrients (such as nitrogen and phosphorus) from the water column, improve water clarity, and protect shorelines from erosion (EA, 2005a). SAV beds provide spawning, nursery, feeding, and refuge habitat for numerous species of waterfowl, finfish, and shellfish; absorb nutrients and oxygenate the water column; and reduce wave energy and promote settling of suspended solids (Funderburk, 1991). Light penetration, turbidity, water depth, salinity (mesohaline species require 5 to 18 ppt), and nutrient availability influence the distribution, growth and viability of SAV.

SAV is generally limited to depths at which light penetration permits the growth of rooted aquatic plants. SAV in the Chesapeake Bay historically occurred in maximum water depths of approximately 10 ft. However, SAV is more likely to be found in depths of three to five ft or less in the Bay because of increased turbidity levels (Batiuk et. al, 1992). Secchi depth is the most common method to determine the clarity of surface waters, and will SAV typically grow to about the secchi depth. Based on measurements in the vicinity of the PIERP from 1985 to 2003, the secchi depth ranged from approximately 3.6 to 6.6 ft (1.1 to 2.0 m) (MDNR, 2005b). Therefore, based on secchi depth measurements, the maximum depth that SAV could potentially grow in the vicinity of the PIERP would be approximately 6.6 ft.

Historically, SAV once grew in abundance throughout the Chesapeake Bay. Based on studies of historical aerial photographs, SAV is estimated to have occupied 185,000 acres in the 1930s. In 2003, a total of only 64,709 acres of SAV was estimated to be present in the Chesapeake Bay (VIMS, 2004). The SAV presence has diminished greatly, and coincides with the loss of island acreage to the Chesapeake Bay. The dramatic baywide decline of SAV species has been correlated with increased nutrient and sediment inputs from development of the surrounding watershed (VIMS, 2004). Section 3.1.4 discusses more details concerning water quality. Recently, mapped SAV acreage in the Chesapeake Bay has varied from year to year, and mapped SAV beds from 1994 to 2003 occupied only about 35 to 50 percent of the total historic acreage that SAV has occupied since the 1930s.

Poplar Harbor once supported large colonies of SAV, but in recent years only remnant beds have been detected. A MDNR Bay-wide SAV survey conducted in 1978 documented aquatic plant beds adjacent to all of the six islands in the Poplar Island archipelago (USACE/MPA 1996). A 1995 field investigation prior to the construction of the PIERP found only a few scattered areas of low density SAV (USACE/MPA, 1996) in Poplar Harbor.

To assess the progress of SAV restoration throughout the Chesapeake Bay, the Chesapeake Bay Program (CBP) established a tiered set of SAV distribution restoration targets for each monitoring segment of the Bay. The targets represent increases in SAV distribution anticipated in response to improvements in water quality. The Tier I target is the restoration of SAV to areas currently or previously inhabited by SAV as mapped through regional and Baywide aerial surveys from 1971 through 1990 (Batiuk *et al*., 1992; Dennison *et al*., 1993). The Tier II target is the restoration of SAV to all shallow water areas delineated as existing or potential SAV habitat down to the 1-meter depth contour (CBP, 2000). The Tier III target is the restoration of SAV to all shallow water areas delineated as existing or potential SAV habitat down to the 2-meter depth contour (CBP, 2000).

In 2004, a SAV study at the PIERP was completed to document SAV distribution and density within the Study Area. Sampling was conducted during two seasons to adequately sample both early (spring) and late (summer) SAV species, as required by VIMS. The spring survey was conducted in May of 2004 and the summer survey was conducted in August of 2004. Only areas within the Study Area with water depths of 6.6 ft or less (Tier II or Tier III habitat) were included in the survey (CBP, 2000).

A total of 182 locations within the expansion Study Area were sampled during the spring 2004 survey (74 locations were within the potential northern expansion area and 108 locations were within the potential southwestern borrow area), and a total of 180 locations within the expansion Study Area were sampled during the summer 2004 survey (75 locations in the potential northern expansion area and 105 locations in the potential southwestern borrow area) (Figure 3-14). SAV was not collected at any of the sampling locations in either the spring or the summer 2004 surveys, indicating that SAV was not present at the time of the survey. These results also indicated that the Study Area and the southwestern borrow area do not currently support SAV beds (EA, 2005a).

Both the USFWS and the Virginia Institute of Marine Science (VIMS) map SAV in the vicinity of the PIERP on a regular basis. Since 2001, the USFWS has conducted SAV monitoring in Poplar Harbor (Figure 3-14). In 2001 and 2002, the USFWS conducted transect sampling for SAV in Poplar Harbor; in 2003 and 2004, the USFWS conducted grid-based sampling in Poplar Harbor (Figure 3-14). Results of these surveys indicated the presence of three species of SAV in Poplar Harbor including widgeon grass (*Ruppia maritime*), sago pondweed (*Stuckenia pectinata*) and horned pondweed (*Zannichellia palustis*). Overall, SAV densities in each of the 2001, 2002, 2003, and 2004 surveys by USFWS in Poplar Harbor gradually increased, but were low compared to reference locations, and the distribution of identified species was widely scattered throughout the sampling area (USFWS, 2001a, 2003 and 2004a) (Figure 3-15). Additionally, VIMS uses aerial photography to identify and quantify SAV annually throughout the Chesapeake Bay. Overflight data from the waters in the immediate vicinity of the PIERP in 2001, 2002, and 2003 did not detect the presence of SAV beds in the proposed expansion area (VIMS, 2004).

In addition to the SAV mapping conducted by USFWS and VIMS in the harbor, Poplar Island has served as a test site for evaluating various methods of establishing SAV by Dr. Stephen Ailstock at AACC. The "notch" area and Cell 4DX have been planted with both vegetative propagules, seeds and transplants of the dominant SAV species of the Mid-Bay region, widgeon grass and redhead grass (*Potamogeton perfoliatus*). The most promising SAV technique has involved the deployment of seeds by direct scatter and slow deployment by seed wrack dispersal buoys; several hundred pounds of this material has been deployed. Unfortunately, shortly after the first deployments in the fall of 2003, hurricane Isabel made landfall and the excessive flooding served to flush the seeds from the test areas. In the fall of 2004, the areas were seeded again using the same techniques. Over winter of 2004, the viability of the seeds used for these plantings was tested and the seeds were determined viable and capable of a high percentage of germination. The SAV planted areas will then be monitored over the seasons to evaluate plant success.

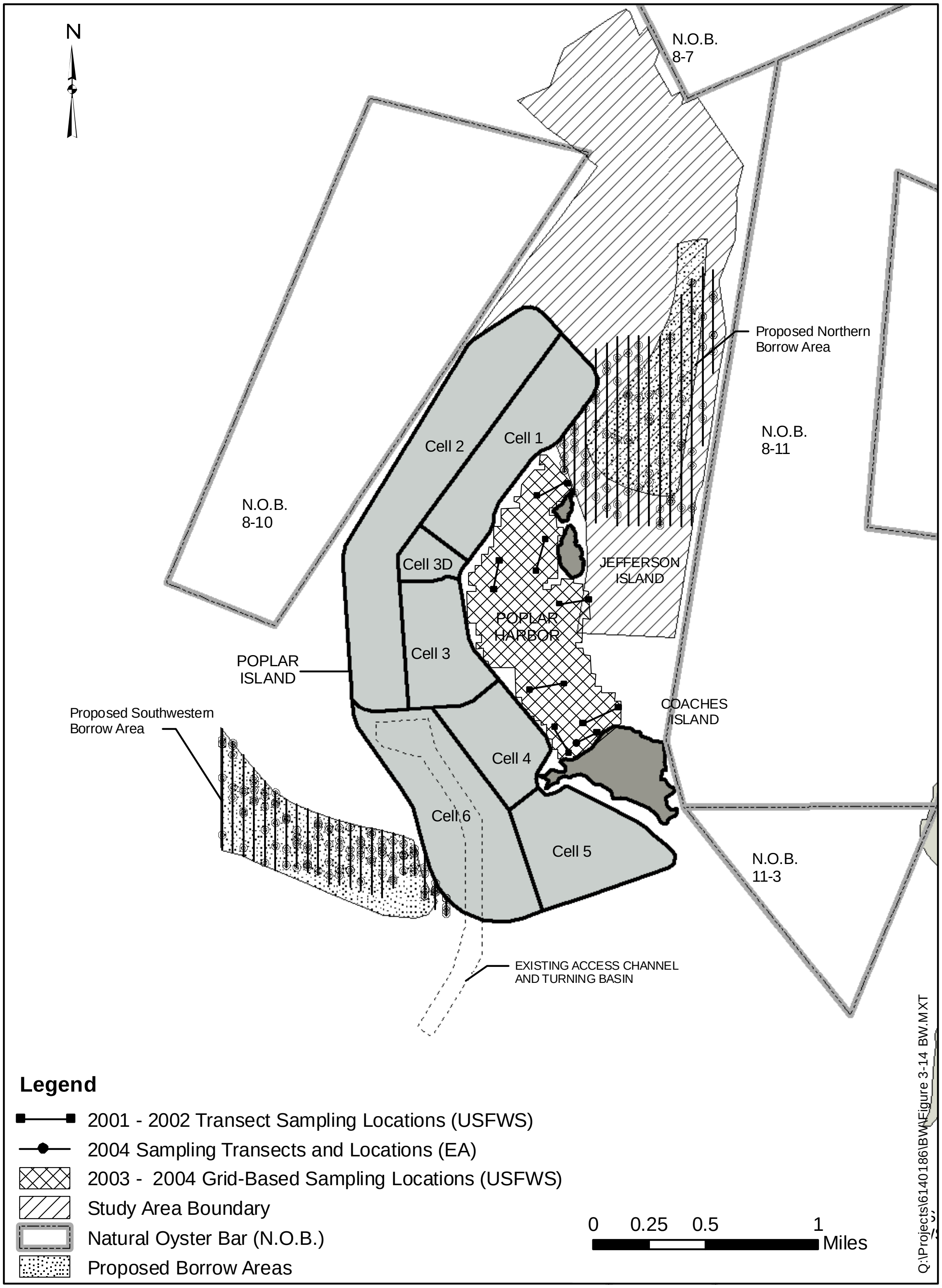


Figure 3-14. Poplar Island Integrated Submerged Aquatic Vegetation (SAV) Sampling, 2001-2004

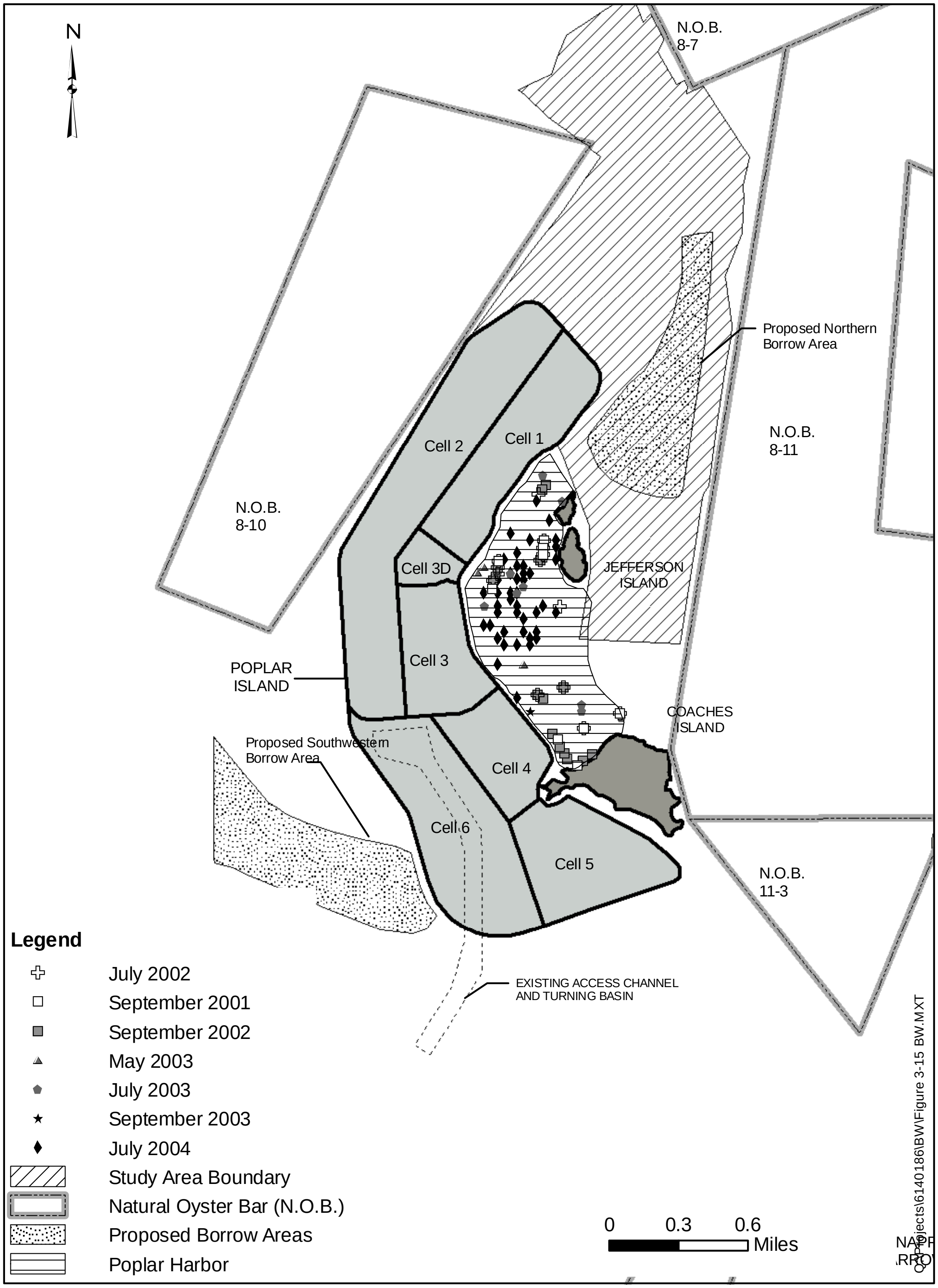


Figure 3-15. Submerged Aquatic Vegetation Locations, USFWS 2001-2004

3.1.6.f Perimeter Dike and Rock Reef Habitat The existing dikes at the PIERP consist of a sand interior protected from the elements of the Chesapeake Bay by an exterior of armor stone. The perimeter dike of the existing project was approximately 40,000 ft (MES, 2004b). The primary design goal of the armor dike is to protect the PIERP from the natural forces of the Chesapeake Bay, however, the perimeter dikes also provides approximately 34 acres of underwater benthic habitat (not including interstitial area) (MES, 2004b). Additionally, artificial reefs were constructed off the northern portion of the PIERP in October 1999 to provide forage habitat for fish and to replace the snag habitat lost during the construction of the PIERP (MES, 2004b) and to create in-water refugia and physical habitat. The armor stone used to construct the reef is similar to the armor stone used in the exterior dikes. The artificial reef consists of 16 conical stone piles separated into groups of eight, located off the northeastern and northwestern corners of the PIERP, where water was expected to be more energetic (MES, 2004b). The base diameters of the stone piles range from 25 ft to 50 ft, depending on water depth, and they extend above MLLW by approximately 2 ft so that the tops of the stone are visible during tidal cycles. The piles are spaced 100 ft apart in two staggered lines parallel to the PIERP dikes, 75 to 100 ft from the face of the northern dike (Figure 3-16).

The habitat objectives of the exterior dike and the artificial reef were to replace forage fish habitat lost when construction of the PIERP displaced the snag habitat along the eroding shoreline of the Poplar Island remnants (MES, 2004b), and to replace or increase in-water refugia and physical habitat. Although artificial in nature, the area below the water line on the existing exterior dikes, and the stacked armor stone used for building the artificial reef are habitat for epibenthic species colonization (MES, 2004b) and utilization by fish species (NOAA, 2001).

Environmental monitoring is conducted at locations on the exterior dikes and artificial reefs to document utilization by fish and other aquatic species, as part of the Monitoring Framework for the PIERP. The artificial reef habitat was constructed in October 1999, and a fisheries utilization study of the artificial reef habitat was conducted by NOAA in 2001. Fish species observed utilizing the artificial reef habitat in 2001 included striped bass, bluefish, Atlantic menhaden, spot, and white perch (NOAA, 2001).

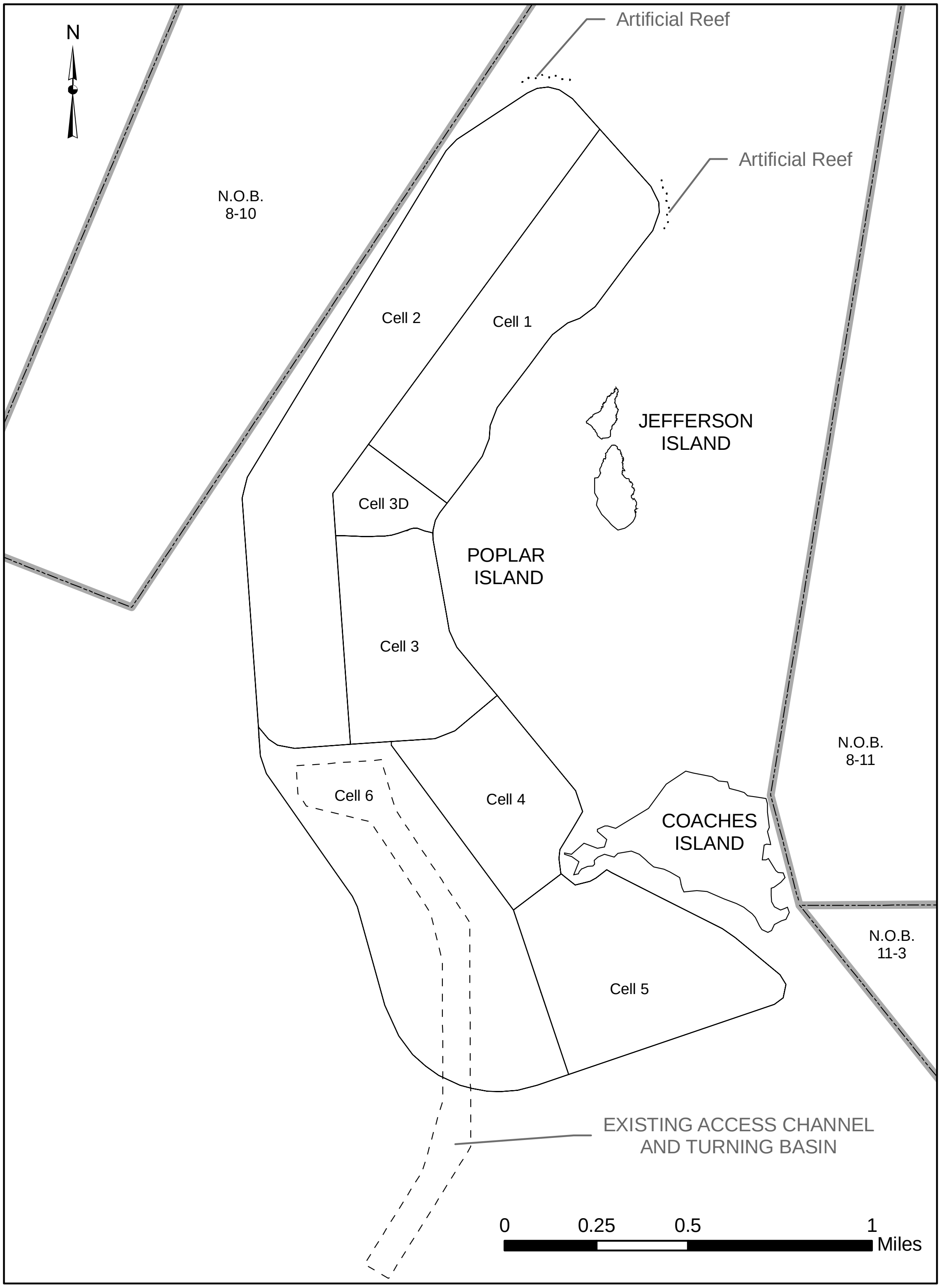


Figure 3-16. Existing Poplar Island Artificial Reef Locations

<u>3.1.6.g Shallow Water Habitat (SWH)</u> Shallow water habitat is defined as open water areas with a depth less than 6.5 ft (approximately 2 meters) found at the edge of shorelines. Shallow waters continuously shift with the tides, and therefore undergo extreme temperature fluctuations throughout the year and are constantly affected by climatic change. Sediments are suspended in the water column and salinity is constantly changing during storm events in shallow waters (CBP, 2005). Fluctuations in temperature and DO are more frequent in shallow water, and, as a result, the shallow subtidal environment has the potential to be more stressful than deeper benthic environments (Day *et al.,* 1989). However, SWH is rarely prone to hypoxic/anoxic conditions that routinely impact deeper waters below the pycnocline. Shallow water habitats may also include high marsh tide pools that typically are flooded during spring high tides and serve as refuge habitat for larval and juvenile saltmarsh-oriented species. Shallow water areas can typically be penetrated by light to the bottom and can, therefore, typically support SAV species (Section 3.1.6.e). Shallow water habitat less than 6.5 ft (2 m) deep is considered to be habitat that SAV could potentially recolonize if water clarity increases. Unvegetated shallow waters less than 3.2 ft (1 m) deep are considered to be areas of high potential for SAV recovery, and are included in the Tier II SAV recovery zone of the Chesapeake Bay Program; unvegetated shallows between 3.2 and 6.4 ft (1 and 2 m) deep are contained in the Tier III recovery zone. Shallow water areas, particularly those with SAV or other suitable cover, are important refuges for older juveniles and soft crabs (Van Heukelem, 1991).

Although shallow-water habitat can be a harsh environment, a large diversity of aquatic life inhabits these areas (CBP, 2005) and many Chesapeake Bay species depend on vegetated shallow-water habitats at some point during their life cycle. Shallow-water habitat is defined as near-shore and other shallow water habitats supporting a wide variety of finfish and crab species dependent on SAV. Grass shrimp (*Palaemonetes pugio*), killifish, and juveniles of larger fish species use shallow-water shorelines as nursery areas and for refuge, including the blue crab during shedding periods. Predators, including blue crabs, spot, striped bass, summer flounder, waterfowl, colonial waterbirds, and raptors forage in shallow-water habitat for prey. Prey species that utilize shallow-water habitat include species such as grass shrimp, bay opossum shrimp (*Neomysis americana*), Atlantic silversides (*Menidia menidia*), and bay anchovy. The EFH species, juvenile red drum, utilizes the shallow backwaters of estuaries as nursery areas, as was seen in the collection of juvenile red drum at the “notch” area during existing conditions surveys (EA 2005a).

The predominant areas of shallow water habitat at the PIERP include Poplar Harbor and the open water areas surrounding Jefferson and Coaches Islands. Approximately 300 acres of SWH are within the 1,080-acre expansion Study Area, which includes areas adjacent to Poplar Island, including the areas surrounding Jefferson Island.

<u>3.1.6.h Shoreline Habitats</u>

Island and Mainland Shorelines

The Chesapeake Bay is undergoing extensive erosion along the shorelines and the islands, in particular, are eroding and disappearing at a relatively fast rate (USACE, 2002b). The University of Maryland’s Laboratory for Coastal Research has determined that at least 13 islands in the Chesapeake Bay have disappeared entirely since the region was first mapped and discovered by Europeans (USEPA, 2002b). Island habitats are being lost in the Chesapeake Bay as a result of the erosion and inundation from rising sea level, which is occurring at a rate more rapidly than new islands are being created (Wray *et al*., 1995). In contrast, the Chesapeake Bay is expanding by up to several hundred acres per year, also as a result of rising sea level. Sea level rise is continuously producing new open-water habitat, including shallow water habitat. Land losses occur Chesapeake Bay wide, but are concentrated in the low-lying lower Eastern Shore (USACE, 1990).

The PIERP is restoring over 1,100 acres of island habitat, half uplands and half tidal wetlands, by making beneficial use of dredged material from Federal navigation channels in the upper Chesapeake Bay. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed. These islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. The Chesapeake Bay, including the PIERP, lies within the Atlantic Flyway, which is an important migration route for neotropical migrants and migrating waterfowl and is a significant nesting area for resident birds (CBP, 2002a). Shallow waters, the abundance of wetlands, and the temperate climate of the Chesapeake Bay cause the Bay islands to be preferentially selected by migratory birds over other stopovers. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Federally-threatened and State-threatened Bald Eagle (*Haliaeetus leucocephalus*).

In addition to the islands in the Bay, the mainland shorelines of the Chesapeake Bay are naturally erosional, except for in isolated sites where spits form from erosion of adjacent headlands, and locally where rivers draining into Bay have produced deltas. Shorelines have been erosional throughout the existence of the Bay, although the rate of shoreline erosion probably increased at about 1850 following the end of Little Ice Age (Kearney, 1996 and 2000). The mainland shoreline in the vicinity of Poplar Island from Lowes Point south to Knapps Narrows is currently eroding at a rate of approximately 1.7 ft/yr (Halka MDNR, 2005). As a result, shorelines are widely being armored in Bay to minimize erosion (Titus, 1998). Many aquatic species, including the diamondback terrapin and the Least and Common Terns, are dependent upon natural shorelines as nesting habitats.

Intertidal Flats Habitat

Intertidal flats, also referred to as tidal mudflats or intertidal sandflats, are the areas of a shoreline or tidal wetland between mean high and mean low tides that are usually not vegetated, but may be dissected by shallow drainage channels sometimes vegetated by saltmarsh species (White, 1989). Intertidal flats are generally low gradient, low energy unvegetated environments that may consist of either mud or sand substrates with carbon and organic components present, such as oyster shell (USFWS, 1997) and are alternately exposed to the air and then flooded by tides. In areas of higher wave energy, these areas are generally the lower part of a beach because wave conditions destabilize the substrate and preclude marsh occurrence. In areas where wave energy is low, intertidal substrate above mean water elevation is generally vegetated by tidal marsh plants. However, in low-wave energy areas where sediments have been recently deposited to form substrate at elevations between mean water and mean high water, tidal flats will occur until the time that the area is colonized by marsh vegetation. These conditions also occur on recently placed dredged materials at intertidal elevations. Generally, the larger the tidal range, the greater the area of tidal flats. It has been estimated that more than half of the coasts of most estuaries are surrounded by tidal flats, and that the extent is determined by both the shape of the estuary and the tidal range. Approximately 99,000 acres of tidal flats have been mapped in Chesapeake Bay by NOAA using USFWS the National Wetlands Inventory data (Field *et al*., 1991). Although the Chesapeake Bay tidal range is not high compared to other areas of the country, there are substantial acres of tidal flats as a consequence of the complicated shoreline that results from the Bay's geologic history as a drowned river valley.

Both biological and physical factors influence the distribution, abundance, and species composition of intertidal habitats, including such physical factors as the exposure and impact of waves, substrate composition, texture and slope of the substrate, dessication, water temperature, and light (USFWS, 1997). Biological influences include competition and predation. Intertidal flats support rich and productive ecosystems comprising of organisms living on the surface, called benthos, and organisms living within the sediments, called infauna (USFWS, 1997). The benthos and infauna species attract larger and more conspicuous organisms such as wading birds and, when tides cover the flats, macro-invertebrates and finfish, which feed on smaller organisms (USFWS, 1997). Therefore, the intertidal flats habitat is extremely valuable to a diversity of species. Mudflat habitats are created during cell development at the PIERP and provide interim habitats to many avian species. Currently, mudflat habitats are also being designed and created as permanent habitat in Cell 3D.

There are currently five sparsely vegetated islands, a total of 4.4 acres, being managed for colonial waterbird nesting in the wetland cells of the PIERP. The five existing sparsely vegetated nesting islands in Cells 1 and 3 were created during Phase I construction, and additional islands in Cell 4 were constructed during Phase II construction. Once complete, the habitat islands will be constructed with sand and covered with shell and will be nearly bare of vegetation. Therefore, the habitat islands will be intertidal habitat once free tidal exchange between the Chesapeake Bay and the cells is created. The design criteria for the sparsely vegetated shell nesting islands targeted the creation of Least Tern (*Sterna antillarum*) habitat, and included flat, unvegetated substrate that is generally unconsolidated such as sand, soil, shell, or gravel. The nesting substrate included in the design criterion for Least Terns consisted of sand with small pieces of oyster shell to make the “scrape,” a small shell-lined depression in the sand where the eggs are laid. Least Tern nesting success and utilization is recorded at the PIERP as part of the avian monitoring activities. Although Least Tern nesting attempts largely failed, the presence of tern nesting colonies is an encouraging sign since no nesting colonies were observed in previous existing conditions studies (EA, 1995a). A discussion of Least Tern utilization and nesting at PIERP is included in more detail in Sections 3.1.7.a and 3.1.8.

3.1.7 Terrestrial Resources

3.1.7.a Avian Community Monitoring Remote, isolated islands in the Chesapeake Bay provide important habitat for a variety of migratory, over wintering, and breeding bird species. Frequent bird census monitoring on the PIERP is conducted throughout the year to determine the seasonal and long-term bird utilization of each interim habitat type and cell at the PIERP (MES, 2003a). Monitoring is conducted from dike roads to document the occurrence and abundance (numbers of birds) of bird species using the existing PIERP habitats (MES, 2003a). The surveys are generally conducted monthly depending on bird activity; however, more frequent surveys generally occur during the waterbird nesting period (May-June) and shorebird migration period (July to September). During heavy bird usage periods, the survey frequency occurs approximately every 12 days. Currently, biweekly surveys are scheduled, conducted, and the results are submitted to the USACE on a monthly basis and annual basis (to summarize yearly results). This section includes annual avian monitoring data from October 2002 through October 2003 (MES, 2003a) and from October 2003 through October 2004 (MES, 2004) and monthly data up until May 2005 – the list of cumulative bird species observed at the PIERP is described from May 2001 through May 2005.

During the avian survey period of October 2002 through October 2003, despite adverse and extreme weather conditions (including a drought and Tropical Storm Isabel), a total of 102 species were observed on and around the PIERP. During the avian survey period of October 2003 through October 2004, the regional weather during this period generally provided average precipitation with cooler than average temperatures that prevailed through spring and most of the summer. In spite of the intense construction and management activities that took place during much of the survey year, 118 total species were observed on and around the PIERP.

From May 2001 through May 2005, a total of 116 avian species have been observed during bird monitoring surveys, which include the biweekly surveys from September 2002 through March 2005 (Appendix C, Table C-8) (MES, 2005a). Bird count totals observed by month and location at the PIERP during the period March 2003 through March 2005 are presented in Table 3-4. During this period, the total number of individuals of all avian species observed at the PIERP, including the adjacent offshore areas was over 200,000 individuals. The month of August in 2003 was by far the month with the highest usage of the PIERP, with over 25,000 birds being observed at the PIERP. However, because the number of surveys per month varied from one to four, the number of survey dates are also included in Table 3-4. Cell 1 (62,189 birds) experienced the highest avian usage and Cell 3D (1,829 birds) experienced the lowest avian usage at the PIERP from March 2003 through March 2005. Because the area of cell sizes varies at Poplar Island, the total monthly bird counts by cell number were then normalized based upon total birds per acre by cell in Table 3-4. Cell 4 had the highest total number of birds per acre (709) and Cell 5 had the lowest (70) total number of birds per acre.

Table 3-4. Total Bird Counts by Month and Location, March 2003 through March 2005

Date(s) of Survey	Cell 1	Cell 2	Cell 3	Cell 3D	Cell 4	Cell 5	Cell 6	Total	Offshore	Grand Total
12-Mar-03	567	6	72	5	26	149	25	850	300	**1,150**
15, 26 April 03	1,320	10	111	49	18	96	316	1,920	800	**2,720**
14, 29 May 03	2,815	2,813	822	135	159	262	312	7,318	701	**8,019**
4, 10, 20, 25 June 03	4,067	1,071	695	267	406	173	525	7,204	327	**7,531**
7, 9, 21, 31 July 03	7,050	1,335	2,140	378	793	150	1,944	13,790	407	**14,197**
13, 21, 23, 29 August 03	6,971	7,627	4,610	445	119	437	5,087	25,296	997	**26,293**
8, 15, 24 Sept 03	1,181	905	1,991	15	66	53	1,159	5,370	394	**5,764**
8, 31, 18 Oct/Nov 03	444	1,782	749	39	59	403	1,723	5,199	1,230	**6,429**
1, 23 Dec 03	209	114	6,623	0	73	135	215	7,369	1,065	**8,434**
13-Jan-04	3	0	135	0	14	841	46	1,039	2,126	**3,165**
20-Feb-04	10	19	115	0	71	1,753	23	1,991	1,264	**3,255**
1-Mar-04	267	29	184	12	20	642	48	1,202	185	**1,387**
9, 29 April 04	1,905	801	557	23	81	195	322	3,884	1,831	**5,715**
11, 21 May 04	5,354	16	3,463	0	98	551	160	9,640	642	**10,282**
1, 15, 30 June 04	5,721	595	937	33	618	409	191	8,504	757	**9,261**
13, 29 July 04	4,899	314	688	46	159	343	843	7,292	802	**8,094**
9, 18, 26 August 04	6,034	575	3,264	73	456	498	645	11,610	1,621	**13,231**
3, 10-12, 25-27 Sept 04	4,888	586	1,500	111	661	470	1,039	9,255	1,001	**10,256**
2, 26 October 04	1,967	316	671	0	67	193	966	4,180	230	**4,410**
11, 26, November 04	642	6,916	400	0	280	427	308	8,973	2,522	**11,495**
8, 30 December 04	636	4,673	958	0	757	790	330	8,144	4,204	**12,348**
12-Jan-05	711	180	411	0	214	182	101	1,799	1,338	**3,137**
8, 22 Feb 05	1,249	367	656	93	229	1,392	186	4,172	3,114	**7,286**
7, 30 March 05	3,279	79	42	105	735	1,144	310	5,694	14,252	**19,946**
Total Birds By Cell	**62,189**	**31,129**	**31,794**	**1,829**	**6,179**	**11,688**	**16,824**	**161,695**	**42,110**	**203,805**
Total Birds Per Acre	**371**	**95**	**287**	**58**	**709**	**74**	**70**	**142**	**---**	**---**

= shading depicts highest bird counts

Source: MES, 2004; 2003a

The 2002 through 2004 annual avian monitoring surveys concluded that expansive, shallow-water habitats located in Cells 1, 2, 3, 4C, and 5 are important feeding and resting locations for migrant waterfowl and shorebirds (MES, 2003a; 2004). Most shorebird activity occurred in waters less than four inches deep and most waterfowl activity occurred in waters less than six inches deep (MES, 2003a). The rock dikes surrounding the PIERP were thought to be the most reliable and favorable feeding area for wintering shorebirds (MES, 2003a). The PIERP proved to be a desirable resting area for gulls and terns despite disruptions from construction and weather events (MES, 2003a). In August 2003, over 3,200 Great Black-Backed Gulls (*Larus marinus*) and 1,698 individuals of other species of gulls and terns were observed at the project site, and may correspond to the greatest number of Great Black-Backed Gulls ever observed at a single location in the Chesapeake Bay (MES, 2003a). The wetlands in Cell 4DX that were opened to Chesapeake Bay tidal waters in May 2003 have already been utilized by many bird species, and as the area develops into a more cohesive ecosystem, more species are expected to utilize this area. Furthermore, as construction continues and the island habitats become more stable, more species are expected to utilize the entire PIERP.

The birds identified during the monitoring surveys included transitory migrants (primarily spring and fall), overwintering birds, and breeding season residents. Many different groups or guilds of birds were observed, including colonial waterbirds (gulls and terns, long-legged waders, and other waterbirds); shorebirds and marsh birds; waterfowl; predatory and scavenging birds; and miscellaneous land birds. Avian species observed at the PIERP and surrounding areas are categorized into the following groups for a more detailed discussion: waterfowl; predatory and scavenging birds; shorebirds and marsh birds; and miscellaneous birds. Many nesting birds have also been observed at the PIERP, and a waterbird nesting assessment is conducted annually to document nest successes, which is included at the end of the bird group discussions. Certain native and non-native avian species observed at the PIERP are considered invasive. To alleviate incompatibilities with nesting by targeted species or with vegetation planted in the cells, some of these invasive species are controlled at the PIERP. Details on the control of invasive species at the PIERP are included in the paragraphs that follow the waterbird nesting discussion.

Gulls, Terns, and Skimmers

The family Laridae includes avian species such as gulls, terns, and skimmers. Seven species of gulls, eight species of terns, and one skimmer, the Black Skimmer (*Rynchops niger*), have been observed at the PIERP and vicinity. The avian monitoring surveys conducted between 2002 through 2003 suggested that the PIERP is a desirable resting area for gulls and terns despite disruptions from construction and weather events (MES, 2003a). Gulls have been observed in the PIERP Study Area during all seasons. In August 2003, over 3,200 Great Black-Backed Gulls and 1,698 individuals of other species of gulls and terns were observed at the project site.

Of particular note, during the avian monitoring period of June to July 2003, four species of terns were observed at the PIERP. A Gull-Billed Tern (*Sterna nilotica*) was observed flying around the nesting islands in Cell 4C. Historically, this tern species nested in coastal Maryland, but was extirpated decades ago, and their occurrence anywhere in Maryland is rare today. The coastal Sandwich Tern (*Sterna sandvicensis*) has the same history in Maryland and was observed at Cell 4C. Additionally, a Caspian Tern (*Sterna caspia*) was observed in Cell 1 and a Black Tern (*Chlidonias niger*) was noted resting among a flock of gulls and terns in Cell 3. The PIERP provides suitable nesting habitat for both these species, although the Caspian and Black Terns are species that nest primarily at interior lake and marsh locations - both species are casual coastal vagrants in summer. (Appendix C, monitoring months 06/07-03). To date, all tern nesting has been generally unsuccessful at the PIERP. Red fox have been observed on the PIERP and are suspected to be a major predator and contributing cause of tern nest failures, although this supposition has not been confirmed.

Waterfowl

Waterfowl are one of the most abundant and most observed avian groups within the Chesapeake Bay. Twenty-seven (27) species of waterfowl were observed at the PIERP and in the surrounding waters, including ducks (dabbling ducks, diving ducks, and sea ducks), geese, loons, grebes, and swans. The expansive shallow-water habitats in Cells 1, 2, 3, 4C, and 5 are important feeding and resting locations for migrant waterfowl.

Dabbling ducks observed in the PIERP vicinity include Mallard *(Anas platyrhynchos)* and American Black Duck *(Anas rubripes)* (Erwin, 2003). Black Ducks and probable Mallard/Black Duck hybrids were observed successfully nesting in the Study Area (Erwin, 2003). There were over 100 American Black Ducks wintering at the site through 2004 (Appendix C, monitoring month 01-04).

Ducks grouped as "divers" observed in the PIERP Study Area are primarily identified during fall and winter months (MES, 2003a). These seasonal migrants and winter residents were primarily identified resting or foraging in open water areas and flying throughout the Study Area. Diving ducks observed include Bufflehead (*Bucephala albeola*), Lesser Scaup (*Aythya affinis*), and Canvasback (*Aythya valisineria*).

Sea ducks, which also have a propensity for diving, are often grouped separately from other diving ducks because of their predominantly open Bay and inshore coastal water habitation. Sea ducks identified in the PIERP vicinity include Long-Tailed Duck (*Clangula hyemalis*), Black Scoter (*Melanitta nigra*), White-Winged Scoter (*Melanitta fusca*), and Surf Scoter (*Melanitta perspicillata*).

Larger waterfowl, including geese and swans, are normally associated with island habitats and adjacent near-shore shallow waters. The three species observed at the PIERP included Mute Swan (*Cygnus olor*), Tundra Swan (*Cygnus columbianus*), and Canada Goose (*Branta canadensis*) (MES, 2003a). Both Canada Geese and Mute Swans were observed nesting at the PIERP (Erwin, 2004).

Other duck-like birds that are considered waterfowl and are normally observed in the open water areas surrounding the PIERP include the Common Loon (*Gavia immer*), the Horned Grebe (*Podiceps auritus*), and the Red-Necked Grebe (*Podiceps grisegena*) (MES, 2003a).

Predatory and Scavenging Birds

This group of birds includes opportunistic predator-scavengers that consume many different prey species. A total of 14 predatory and scavenging birds were observed at the PIERP; many of these birds were observed feeding on prey at the PIERP or nearby Coaches Island (Appendix C, monitoring month 10-02). Species observed at the PIERP and surrounding areas includes members of the families Accipitridae [hawks (*Accipiter* sp. or *Buteo* sp.), Bald Eagles, and Ospreys (*Pandion haliaetus*)], Corvidae (jays, magpies and crows), Falconidae (falcons), Strigidae (owls), and Cathartidae (vultures). A transient species, the Short-Eared Owl (*Asio flammeus*), was flushed from a grassy area by construction activity at Cell 2 in early November 2003 (Appendix C, monitoring month 11-03).

Bald Eagles present in the Study Area vicinity were historically associated with a nest located on Jefferson Island. However, the pair of Bald Eagles that nested on Jefferson Island moved to a nest on Coaches Island in 1999 and have since been observed flying in the area, sitting on the nest, and perching on snags. Juvenile and adult Bald Eagles are regularly observed at the PIERP, on Jefferson Island, on Coaches Island (including activity associated with the nest there), and in the general area. (Appendix C, monitoring months 11-02 and 07-03).

Ospreys have successfully nested in several locations on the PIERP during the years 2002, 2003, and 2004 (Erwin, 2004). In Cell 1, Ospreys were incubating a nest located on an artificial pole/platform structure in the northern section, and on three widely spaced nests on the abandoned barges. On the east side of the east dike road in the north portion, an Osprey was attending an empty nest located on a rip-rap groin. Offshore of the PIERP, an Osprey incubated a nest on the rock pile off the west side of Cell 6, an offshore duckblind east of Cell 1 contained an Osprey with a partial nest, and another was incubating a nest on a pier at Jefferson Island (Appendix C, monitoring month 04-03). Additionally, Northern Harriers (*Circus cyaneus*) were observed patrolling the grassy dike around Cell 2 on numerous occasions, potentially feeding on mammals on the island (MES, 2003a), although the Harriers were most likely passing migrants (Appendix C, monitoring month 10-02).

Pelicans, Cormorants, and Gannets

This group of birds represents a variety of bird families that have been observed at the PIERP, including Pelecanidae (pelicans), Phalacrocoracidae (cormorants), and Sulidae (gannets). Four species of pelicans, cormorants, and gannets have been observed at the PIERP to date. Hundreds of colonial nesting birds, including large numbers of Double-Crested Cormorants *(Phalacrocorax auritus)* utilize the PIERP for nesting. Cormorant colonies build densely clustered nests made of sticks and other vegetation fragments, and typically occupy dead snags and barren ground underneath. Cormorant young production was not estimated, but in July 2004 there were 435 nests with 2-3 large young in the colony, suggesting good production (Erwin, 2004). Historically, Double-Crested Cormorants had a nesting colony on Middle Poplar Island that was estimated to contain as many as 500 nesting pair of cormorants (USACE/MPA, 1996). Also of particular note, in December 2002, a Brown Pelican (*Pelecanus occidentalis*) was observed resting on a float in Cell 6 and in January 2004, three wintering Brown Pelicans were flushed from the rocks at the mouth of Cell 6 on the rock dike during avian monitoring (Appendix C, monitoring month 01-04). The 11 May 2004 sighting of an American White Pelican (*Pelacanus erythrorhynchos*) in Cell 3A constitutes the fourth consecutive year this mid-west vagrant has appeared at the project site (Appendix C, monitoring month 04/05-04). Populations of both pelicans and cormorants have been observed as increasing in the State of Maryland.

Shorebirds and Marsh birds

This category of birds represents a variety of bird families grouped together by habit and areas of occurrence (namely shoreline areas and intertidal flats habitat). Shorebirds identified at the PIERP Study Area include species from the families Scolopacidae (sandpipers, willets, dunlins, and dowitchers), Ardeidae (herons and egrets), Charadriidae (plovers), Haematopdidae (oystercatchers), and Recurvirostidae (avocets). Thirty (30) species of shorebirds have been observed at the PIERP to date. Nesting pairs of Willet (*Catoptrophorus* *semipalmatus*), and Killdeer (*Charadrius vociferus*) were observed on the PIERP (Erwin, 2004). Two American Oystercatchers (*Haematopus palliates*), a bird of concern and listed as rare in Maryland, were observed on the PIERP during the summer of 2004 near the created islands in Cell 4DX, but documentation of the nesting success was not verified (Erwin, 2004). Additionally, Snowy Egrets (*Egreta thula*) and Cattle Egrets (*Bubulcus ibis*) have nested on the island in Cell 1 at the PIERP.

Marsh birds are characterized as those identified in the low and high marsh areas. Marsh birds identified at the PIERP included the families Rallidae (rails) and Icteridae (blackbirds and grackles). Three species of marsh birds have been observed at the PIERP to date and include Red-Winged Blackbird (*Agelaius phoneiceus*), Common Grackle (*Quiscalus quiscula*), and Virginia Rail (*Rallus limicola*) (Appendix C, Table C-8). Nesting pairs of Red-Winged Blackbirds were observed on the PIERP, but the nesting success was not verified (MES, 2003a).

Miscellaneous Land Birds

This category of birds includes several bird species typically associated with mainland terrestrial habitats, including forests, scrub-shrub, and field habitats. A variety of common migratory songbirds have been observed at the PIERP. Families of these land birds observed at the PIERP include Hirundinidae (martins and swallows), Alcedinidae (kingfishers), Parulidae (warblers), Emberizidae (sparrows, buntings, and juncos), Troglodytidae (wrens), Bombycillidae (waxwings), Sturnidae (starlings), Motacillidae (pipits), Columbidae (doves), Apodidae (swifts), and Cardinalidae (cardinals). A total of 20 species of land birds have been observed at the PIERP to date, and of these, the Tree Swallow (*Tachycineta bicolor*) and European Starling (*Sturnus vulgaris*) have nested on the PIERP (MES, 2003a).

Waterbird Nesting Assessment

One of the original habitat objectives of the PIERP EIS (USACE/MPA 1996) included the creation of island nesting habitat for ground nesting and wading colonial waterbirds. Currently, there are five sparsely vegetated islands (a total of 4.4 acres) managed for colonial waterbird nesting in the wetland cells of the PIERP. The habitat islands are constructed with sand, covered with shell, and are nearly bare of vegetation; there is also a moat surrounding the islands to deter predators. Two shell islands are located in Cell 4, two are located in Cell 1, and one is located in Cell 3. Seven other habitat islands have been created at the PIERP, some of which have become naturally vegetated since their inception (MES, 2004b). Currently, individual habitat islands are located in Cells 1, 3D, 3, 4DX, and three habitat islands are located in Cell 5. In 2003, the island in Cell 4DX was planted with trees and shrubs to create appropriate vegetated cover (MES, 2004b).

Waterbird nesting surveys were completed in 2002 and 2003 (Erwin, 2003 and MES, 2003a), and an assessment of waterbird nesting was conducted in May 2004 through July 2004 to document avian use of the habitats, including the created island habitats at the PIERP, and estimates of breeding populations, fecundity, and productivity (Erwin, 2004). Waterbirds are defined as waterfowl, colonial waterbirds, shorebirds (sandpipers, plovers, etc), rails, bitterns, Bald Eagles, Ospreys, and harriers (Erwin, 2004). The assessment conducted in 2004 focused on the Common Tern (*Sterna hirundo*) and the Least Tern; both species are of high priority in

Maryland. Many different groups or guilds of birds were observed nesting at the PIERP, including colonial waterbirds (gulls and terns), shorebirds, waterfowl, predatory and scavenging birds, and miscellaneous land birds.

Fifteen (15) species of birds were confirmed to be nesting at the PIERP during the October 2002 through October 2003 avian monitoring survey, although not all nesting species were successful and not all breeding pairs were counted (MES, 2003a). The nesting species observed included Double-Crested Cormorant, Canada Goose, Mute Swan, Mallard, Osprey, Killdeer, Willet, Herring Gull (*Larus argenatus*), Great Black-Backed Gull, Common Tern, Least Tern, Tree Swallow, European Starling, Red-Winged Blackbird, and Common Grackle. Table 3-5 includes the estimates of breeding pairs from the PIERP nesting population monitoring from 2002 through 2003 (Erwin, 2003). Note that not all nesting species observed at the PIERP have estimated counts for breeding pairs. Vegetation will require management on islands designed for Common and Least Terns in perpetuity to maintain sites in sparsely vegetated conditions to meet these birds' nesting habitat requirements.

Table 3-5. Results of the PIERP Waterbird Nesting Population Monitoring, 2002 through 2003

Common Name	Scientific Name	Total Number of Breeding Pairs	
		2002	2003
Common Tern	*Sterna hirundo*	340-400	827
Least Tern	*Sterna antillarum*	40	62
Osprey	*Pandion haliaetus*	5	6
Snowy Egret	*Egretta thula*	>40	0
Cattle Egret	*Bubulcus ibis*	~1	0
Double-crested Cormorant	*Phalacrocorax auritus*	80-90	405
Canada Goose	*Branta canadensis*	>20	5-10
Great Black-Backed Gull	*Larus marinus*	>25	5+
Herring Gull	*Larus argenatus*	>300	190
Mute Swan	*Cygnus olor*	3	Removed

Source: Erwin 2003

The nesting populations of terns showed a marked increase from 2002 to 2003. Least Terns expanded from one colony (40 pairs) on a created island to approximately 62 pairs in June 2003 using a created island and a sand flat in Cell 4C. The Common Tern population also expanded from approximately 350 pairs using three created islands in 2002, to approximately 827 pairs between 2002 and 2003 using the same islands, plus two other created islands in Cell 4.

Other priority species of interest in the 2002 to 2003 survey included the Osprey, American Oystercatcher, and Snowy Egret. Ospreys nested at 6 locations, with 3 nests on the old barges in Cell 1, one on a west islet, one on a spillway structure in Cell 1, and another on an artificial wall in Cell 2. All of the Osprey nests (except for the nest on the spillway) produced at least two young. Because gulls had encroached on the former Snowy Egret nesting area on the remnant island in Cell 1, the Snowy Egrets and Cattle Egrets abandoned the nesting site in 2003. In 2004, personnel from USFWS, USGS, and MES placed plastic egret decoys on the island remnant in an effort to attract a higher number of nesting Snowy Egrets. Subsequently, Snowy Egret nesting success was high in 2004, with an estimated 100 birds fledged (Appendix C, monitoring month 11-04). One pair of Oystercatchers was seen during spring and summer 2004 at different locations at the PIERP, but nesting was not confirmed (Erwin, 2004). Willets nested on the created island in Cell 3 and Killdeer nests were found at several locations on the PIERP in 2004, but the success of both species was unknown (Erwin, 2004).

During the May 2004 through July 2004 nesting assessment, the estimated pairs of nesting waterbirds and the number of young were recorded. Ten waterbird species were observed nesting at the PIERP, five species of which fledged young (Table 3-6) (Erwin, 2004). Production was sufficient to maintain populations of Osprey and Snowy Egrets, with one or more young produced on average per nest (Erwin, 2004). Many Double-Crested Cormorant nests were observed with two to three large young in the colony, suggesting high production. Production of gulls, geese, and swans was very low, primarily as a result of control efforts by USDA. Also two pairs of American Black Ducks (possibly Mallard hybrids) were observed and one nest hatched at least 10 eggs at Cell 4DX. Willets nested on the created islands and Killdeer nests were found at several locations on the PIERP, but the success of both species was unknown. Similar to 2003, a pair of Oystercatchers was seen during summer at different locations at the PIERP, but nesting was not confirmed. In 2004, nesting avian species were also observed and recorded in concurrence with the biweekly avian monitoring surveys. Additional species that nested at the PIERP in 2004 included a Barn Swallow that nested on a in the repair garage (MES, 2004).

Common and Least Tern nesting was generally unsuccessful in both the 2003 and 2004 surveys. Despite nesting failures in 2003, thought to be a result of inclement weather including periodic flooding, nearly the same number of nesting terns returned to the island in 2004. Nesting attempts in 2004 also failed (Erwin, 2004). Although tern nesting attempts largely failed, the presence of tern nesting colonies is an encouraging sign since no nesting colonies were observed in previous existing conditions studies (EA, 1995a).

Mammalian predator control is currently recommended for nesting successes of Common Terns, Least Terns, and other avian species. The "moat" or island system, as it is developed for each wetland cell, will successfully function as a natural mammalian predator barrier. Details of mammalian predation will be more appropriately addressed in the wildlife management plan that is currently under development by USFWS as part of the adaptive management process.

Table 3-6. Summary of Documented Nesting Waterbirds at the PIERP, May through July 2004

Common Name	Scientific Name	Location of Nest	Estimated Pairs and Number of Young*
Common Tern	*Sterna hirundo*	1. Cell 1-A 2. Cell 1-B 3. Cell 1-C 4. Cell 4DX 5. Cell 4A 6. Cell 4B 7. N. Jefferson Island	1. 226 (No young) 2. 217 (No young) 3. 106 (No young) 4. 260 (No young) 5. 55 (No young) 6. 11 (No young) 7. 40 (No young)
Least Tern	*Sterna antillarum*	Cell 5 – islands, sand flats	50 - 60 pairs (No young)
Herring Gull and Great Black-Backed Gull**	*Larus argenatus* and *Larus marinus*	Cell 1 - created/remnant island, few on dikes	50-75 pairs (> 20 produced young)
Double-Crested Cormorant	*Phalacrocorax auritus*	Cell 1 - island	435 pairs (many young)
Snowy Egret	*Egretta thula*	Cell 1 - island	40-50 pairs (100 fledged)
Osprey	*Pandion haliaetus*	Scattered - 4 on barges	7 pairs (7 fledged)
Mute Swan	*Cygnus olor*	Cell 1	2 pairs
Canada Goose**	*Branta canadensis*	Scattered	5-6 pairs (few broods)
American Black Duck	*Anas rubripes*	Cell 4DX	2 pairs (at least 10 young)

Source: Erwin, 2004
**Estimates are the number of pairs of nesting birds.*
***Gulls and geese controlled largely by USDA personnel*

Management of Avian Species

The management of selected avian species currently occurs at the PIERP to control predation, nuisance species, and disease outbreaks. During the October 2002 through October 2003 avian monitoring survey, a number of potentially invasive and nuisance avian species took advantage of habitats at the PIERP, including Mute Swans, Double-Crested Cormorants, resident Canada Geese, Herring Gulls (*Larus argentatus*), and Great Black-Backed Gulls (*Larus marinus*). These species are considered invasive and nuisance because resident Canada Geese have damaged new wetland plantings, and Herring Gulls and Great Black-Backed Gulls are likely predators of nesting colonies of both Least and Common Terns. Both of these gull species and the Double-Crested Cormorants occupy nesting habitats that would otherwise be available to target species. In 2004, the Double-Crested Cormorant population alone increased more than four-fold to more than 400 nests on the habitat island in Cell 1A.

The Mute Swan is non-native and threatens SAV recovery at the PIERP and throughout the Chesapeake Bay. As a result of the invasive and nuisance species observed at the island, a control program was initiated at the PIERP at the request of the USACE by the USDA in 2003. As of 2004, all avian control work is performed by the USDA in conjunction with the USFWS and the USACE but is coordinated and directed by the USFWS. A Federal Migratory Bird Treaty Act Permit is obtained annually by the USACE from the USFWS Region 5 office in Hadley, MA (Miller USFWS, 2005). The permit allows the taking of adults and juveniles of the species named in the permit, as well as a specific number of nests of named species. The 2005 permit includes the following species: Herring Gulls, Great Black-Backed Gulls, and the Canada Goose; Mute Swans have not been included in the permit since 2003, although Mute Swan control at the PIERP may resume in the future. The permit is intended to result in reductions of Canada Goose, Herring Gull, and Great Black-Backed Gull populations. A permit is not required for acts that "discourage nesting," such as breaking up nests before eggs are laid. Double-Crested Cormorant nesting may be discouraged in future years at the PIERP, but will be determined at a later date and will be dependent on their location, spatial expansion, and influence on nesting by priority species. (Miller USFWS, 2005)

In addition to controlling invasive or nuisance avian species, avian diseases are also managed at the PIERP, when necessary. In the fall of 2004, an outbreak of avian botulism was identified at the PIERP following the death of a minimum of 200 birds. This disease was controlled through the joint effort of USFWS, MDNR, MES, and TriState Bird Rescue and Research by collecting and disposing of bird carcasses on the island. Several birds (approximately 20) diagnosed with avian botulism were also successfully rehabilitated and released. Avian botulism is a disease naturally occurring in waterfowl and shorebird populations, and the outbreak at the PIERP was primarily centered in Cell 1A, specifically in the shallow-water habitats. Steatitis, a natural condition that results in significant, rapid increases in fatty tissue buildup in avian species, was identified in the Great Blue Heron colony on Coaches Island in the fall of 2004. Steatitis affected the herons by displacing organs and inhibiting the birds' ability to digest food.

3.1.7.b Mammals Some common mammalian species have been observed at the PIERP, including white-tailed deer (*Odocoileus virginianus*), river otter (*Lutra caadensis*), raccoon (*Procyon lotor*), house mouse (*Mus musculus*), and beaver (*Castor Canaensis*). With the exception of the house mouse, mammal species observed at the PIERP most likely swam or crossed the ice to the PIERP from Coaches and Jefferson Islands or from the mainland areas of Talbot County. Additional mammal species may colonize the PIERP in the future. Red fox (*Vulpes vulpes*) have also been observed and are suspected to be a major predator and contributing cause of tern nest failures. The USFWS obtains trapping permits from MDNR to control the red fox population at the PIERP. Four foxes were trapped in Spring 2004 to reduce predation on nesting birds, but at least one fox remained on the island throughout the summer (Erwin, 2004). A dead Norway rat (*Rattus norvegicus*) was also found on the central dike road between Cells 1 and 2, showing evidence of small mammalian species on the island (MES, 2003a).

<u>3.1.7.c Reptiles and Amphibians</u> Several species of reptiles and amphibians have been observed at the PIERP, including the brown water snake (*Nerodia taxispilota*), diamondback terrapin, and American toad (*Bufo americanus*). Cavities within the rock riprap around the island provides excellent habitat for brown water snakes (MES, 2003a). These snakes are currently uncommon but may become more abundant at the site within a few years. The snakes eat mostly small fish and are preyed upon by a variety of birds, including cormorants, herons, egrets, Osprey, Bald Eagles, and large gull species (MES, 2003a).

Diamondback Terrapin Surveys

A long-term diamondback terrapin monitoring program was initiated in 2002 to track the changes in the PIERP diamondback terrapin population as the PIERP progresses (Roosenburg, 2003). The diamondback terrapin is the only North American turtle that lives in exclusively brackish water and prefers unpolluted tidal areas (Appendix C, Table C-3). Terrapin mating occurs in May, and female terrapins prefer sandy or loamy shoreline beaches above the mean high tide to lay eggs during the months of June and July. Hatching normally occurs from August through October, depending on temperatures (Appendix C, Table C-3).

Diamondback terrapin surveys have been conducted by Ohio University terrapin researchers at the PIERP in 2002, 2003, and 2004 to identify major terrapin nesting beaches at the PIERP, to quantify nest and hatching success rates, and to mark and release hatchlings (Roosenburg, 2003). The diamondback terrapin has used the PIERP extensively for nesting, since the island provides excellent nesting habitat that includes accessible sandy areas above the mean high tide (Roosenburg, 2003). To a lesser extent, the PIERP also provides hatchling and juvenile habitat that includes the salt flats and fringe marsh common along the Chesapeake Bay shoreline (Roosenburg, 2003). The PIERP appears to provide the nesting and hatchling/juvenile habitat resources to allow terrapin populations to grow (Roosenburg, 2003). Terrapin nesting only occurs in areas where there are accessible sandy beaches on the outside of the dike; when rock portions of dike are located immediately adjacent to the shoreline, terrapins are prevented from accessing these areas for nesting at the PIERP.

A total of 68 nests and 565 hatchlings were observed in 2002, a total of 63 nests and 387 hatchlings were observed in 2003, and a total of 180 nests and approximately 1,200 hatchlings were observed in 2004 (Figure 3-17). Hurricane Isabel contributed to the loss of some nests and hatchlings in 2003, along with a reduced field effort to record nests and hatchlings (Roosenburg, 2003). The majority of the nests in 2002 and 2003 were located in the "notch" area of Cell 5 that faces Coaches Island (Figure 3-17). Table 3-7 presents a summary of the terrapin egg survivorship by monitoring year.

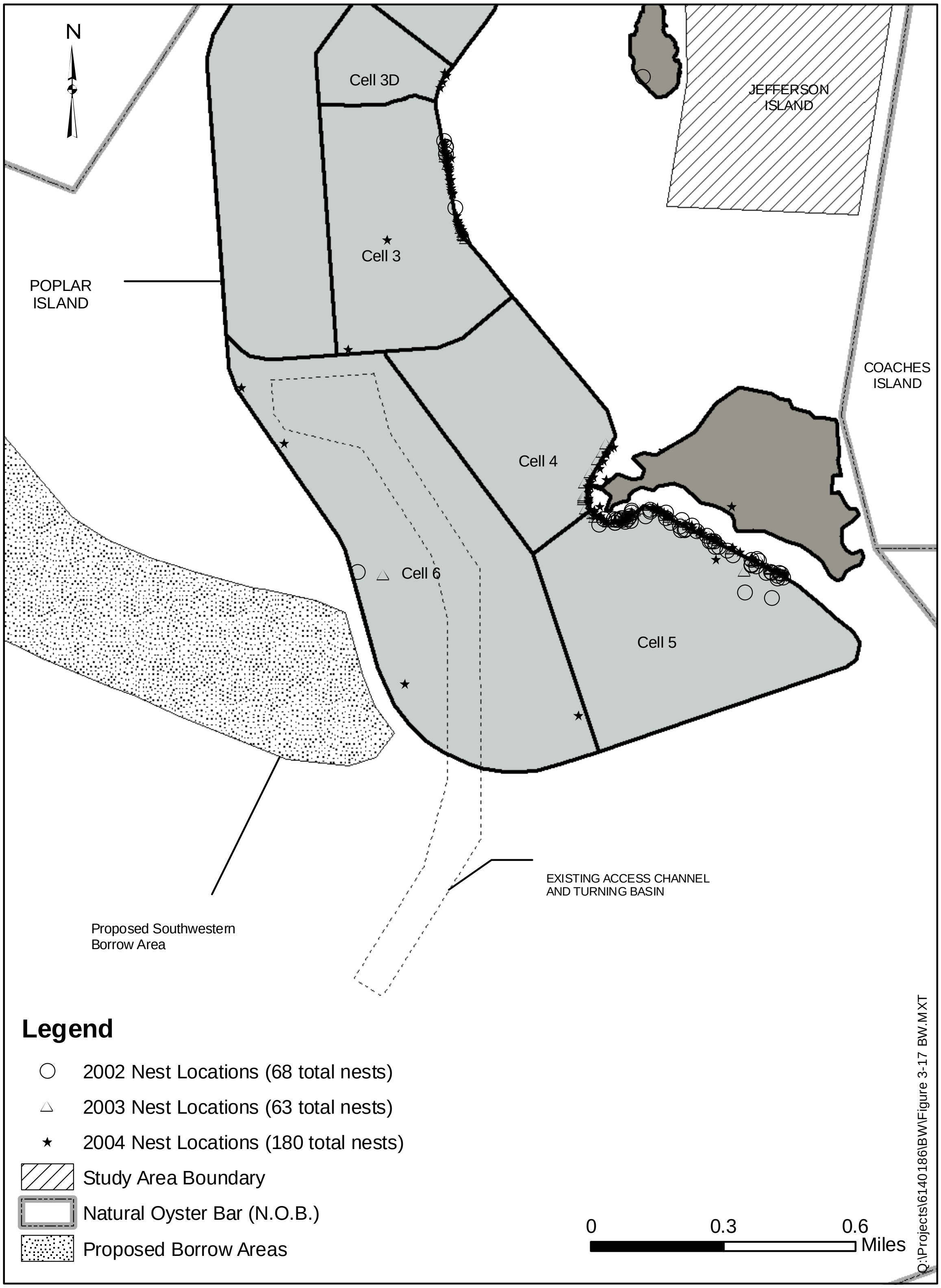


Figure 3-17. Diamondback Terrapin Nest Locations, 2002-2004

Table 3-7. Summary Statistics of Terrapin Egg Survivorship Observed at the PIERP During the 2002 and 2003 Terrapin Monitoring Surveys

Type of Survivorship Studied	2002	2003
Number of Nests Studied	30	30
Total Number of Eggs	329	389
Total Number of Hatchlings	305	354
Hatchling Success Rate (%)	92.7	91
Range of Egg Survivorship (%)	33 - 100	29 - 100
Mean Clutch Size	10.97	13.0

The diamondback terrapin nesting studies indicate that portions of the PIERP are excellent terrapin nesting habitat. Both the large number of nests discovered and the rate of egg development into hatchlings are comparable to other nesting areas in the Chesapeake Bay. Nest predators occurrences on the PIERP are significantly lower than near other nesting areas studied elsewhere, which contributes to increased hatchling survival (Roosenburg, 2003). The preliminary results from 2004 indicate that the number of nests almost tripled compared to 2002 and 2003

3.1.7.d Invertebrates Horseshoe crab (*Limulus polyphemus*) spawning populations occupy an important ecological niche in estuarine and coastal habitats along the Mid-Atlantic coast (MDNR, 2003a). Adult horseshoe crabs are food for sea turtles, sharks and terrestrial species such as raccoons and foxes and their eggs are a vital food source for shorebirds, which feed on horseshoe crab eggs deposited in the sand on mid-Atlantic beaches each spring (MDNR, 2003a). Horseshoe crabs are nocturnal spawners that prefer sand beaches. Spawning habitat within the Chesapeake Bay is vanishing as a result of shoreline stabilization structures that diminish the creation of new beaches because of erosion. As a result, the horseshoe crab population is decreasing. However, the primary cause of horseshoe crab populations declines is overfishing. Conservation efforts are underway in Maryland and other States to maintain the stability of the horseshoe crab population (MDNR, 2003a). Recent surveys at James and Barren Islands have confirmed spawning activity in late May and June (BBL, 2004; Harms, 2004). During the spring 2004 finfish survey at Poplar Island, incidental catches during gillnetting efforts yielded low abundances (0 to 5 individuals) of the invertebrate species. Horseshoe crab spawning habitat is likely to still exist on Jefferson and Coaches Islands, although no direct surveys have been conducted. No horseshoe crab spawning habitat occurs within the Study Area.

Twenty-eight (28) other invertebrate species, including butterflies, moths, spiders, grasshoppers, crickets, and dragonflies, have been observed at the site since May 2001 (Appendix C, Table C-9). Despite the unattractive butterfly habitat and lack of showy flowering plants at the PIERP, hundreds of butterflies have been observed. One possible attractant may be the abundance of saturated and wet surface substrates at the project site, while some cell materials may be rich in butterfly nutrients (Reese, 2004). Another possibility is that butterfly eggs and pupae may have been imported to the site with vegetative plantings, machinery, equipment, and supplies. Some butterfly species [Angel-wing, Mourning Cloak (*Nymphalis antiopa*)] may occur on nearby islands with mature vegetative communities and then immigrate to the PIERP. Other species observed on the PIERP are long distance migrants [Monarch (*Danaus plexippus*), Buckeye (*Junonia coenia*)] or vagrants [Cloudless sulphur (*Phoebis sennae*)] that are common transients (Reese, 2004).

3.1.7.e Wetland Habitat The USACE and the USEPA jointly define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions" (USACE-WES, 1987). Wetlands are highly valuable resources because they are vital to the health and productivity of the Chesapeake Bay and its tributaries (CBP, 2005). Wetlands function to restore and maintain water quality by removing and retaining nutrients contained in stormwater runoff that would otherwise flow directly into the water column; provide critical habitat for a diversity of plants and animals, including fish, shellfish, waterfowl, shorebirds, wading birds, songbirds, and mammals; provide flood control and reduce the effects of storm damage by retaining water, which slowly dissipates to protect and minimize the erosion in coastal areas; and buffer coastal ponds and shores from highly erosive nearshore wave action (CBP, 2005).

There is insufficient data available to estimate long-term trends of tidal wetlands acreage in the Chesapeake Bay; however, it is known that the Chesapeake Bay has suffered a net loss of tidal wetlands as a consequence of development, agriculture, and rising sea level (CBP, 2005). The Chesapeake Bay has lost approximately nine percent of tidal wetlands to dredging, filling, and impoundments activities that occurred between the 1950s and early 1980s (USGS, 1998). It has been estimated that nearly 1.5 million acres of wetlands currently occur in the watershed of the Chesapeake Bay, although wetlands cover only about four percent of the 64,000-square mile Bay watershed (CBP, 2005). Approximately 1.3 million acres of the Bay's wetlands are nontidal palustrine wetlands and approximately 200,000 acres are tidal estuarine wetlands (CBP, 2005). Estuarine wetlands are deep-water tidal habitats with brackish water, and are found primarily along the shores of the Chesapeake Bay and its tidal rivers; palustrine wetlands are freshwater nontidal, and are situated on the floodplains bordering rivers and streams, fringing the shorelines of lakes and ponds, filling isolated depressions, and covering broad flat areas at or near sea level (CBP, 2005).

Wetland habitat at the PIERP includes high marsh, low marsh, mudflat/intertidal areas, and bird islands. Because the PIERP is a reconstructed island, the vegetation is largely planted or of recent colonization by opportunistic species. The PIERP is divided into six cells that accept dredged material inflow and will be restored as either upland or wetland habitat (Figure 3-18). Habitat restoration within these cells is currently in progress, under development, or has not yet been initiated to date. In addition, the shallow-water area located between the PIERP and Coaches Island and outside of Cells 4 and 5 (referred to as the notch) has also been restored using wetland plants. This section presents the existing and current conditions of wetland habitat at the PIERP, as well as the future plans for cell development (for cells where material inflow is not yet complete) as discussed in the *Poplar Island Environmental Restoration Project, Habitat Development Framework* (MES, 2004b).

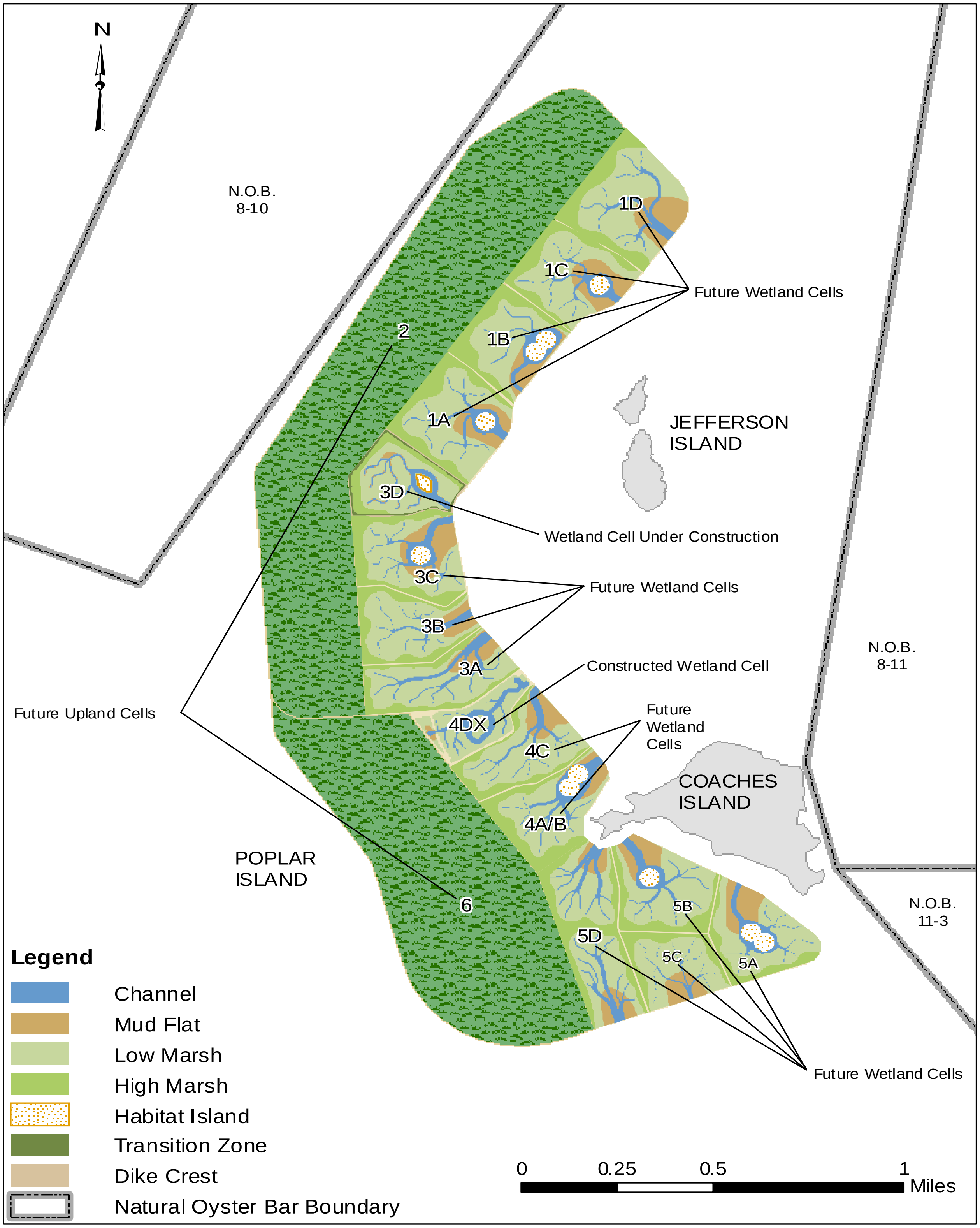


Figure 3-18. Existing Poplar Island Planting Plan

Four wetland cells (Cells 1, 3, 4 and 5) on the eastern side of the PIERP will be created to support wetland vegetation. The wetland areas will consist of 80 percent low marsh and 20 percent high marsh areas. Cell 3D is currently under development, Cell 4D and Cell 4DX have been constructed and planted, and inflow has not yet been completed for Cells 1, 3, and 5. As each wetland cell is completely filled and shaped, permanent habitat restoration will occur (MES, 2004b). Wetland habitat types and vegetation that were specified in the EIS (USACE/MPA, 1996) to be created and restored as part of the wetland cells at the PIERP included low tidal marsh, high tidal marsh, bird-nesting islands in the marsh, tidal and non-tidal pools in the marsh, freshwater wetlands in the uplands, and mudflats. These habitats are currently in various stages of development. Although some wetland cells may not be complete, interim habitats are still available at the sites, including mudflats that are extensively used by shorebirds. The interim habitats available at the PIERP, including wetlands, uplands, open water, and island habitats are presented in Figure 3-19. Other habitats created at the PIERP such as armor dikes and rock reefs are discussed with aquatic resources in Section 3.1.6.f.

Approximately 570 total acres will be restored as wetlands at the PIERP. Between 430 and 480 acres will be created as low marsh and between 108 and 120 acres will be created as high marsh. The designated wetland cells at the PIERP will be Cells 1, 3, 4, and 5 (Figure 3-19). Cells are divided into sub-cells of approximately 24 to 51 acres to facilitate dewatering and habitat restoration operations during dredged material inflow (sub-cells are also presented in Figure 3-18). The sub-cells in Cells 1, 3, and 4 are completed, and construction of the sub-cell cross dikes in Cell 5 is anticipated to be completed around 2005. The flow patterns of the individual sub-cells will ultimately be merged to create one large interconnected marsh. Three wetland "development" cells have been constructed to test restoration methods and include Cell 3D, Cell 4D/Cell 4DX (Cell 4D was incorporated into Cell 4DX in Summer 2003). Within the created wetlands at the PIERP, four low marsh ponds, four high marsh ponds, and between 8 and 16 nesting islands will be constructed. The low marsh will consist of adequate channels for complete tidal flushing, and the high marsh will contain tidal ponds with infrequent flushing. When complete, the wetland design will support resident marsh nekton species (fish, shrimp, and crabs) that currently utilize reference marshes near the PIERP and other marshes within the geographic region.

Prior to activities, a cell development plan and planting plan is created for each proposed wetland cell. The target for total coverage for the vegetated wetlands is between 80 and 90 percent (MES, 2004b). The dominant species selected for the low marsh plantings include smooth cordgrass (*Spartina alterniflora*) and the high marsh plantings include salt hay (*Spartina patens*). Other selected marsh species chosen for the PIERP based on adjacent natural and reference marshes in the vicinity include saltmarsh bulrush (*Scirpus robustus*), Olney's threesquare (*Shoenoplectus americanus),* salt grass (*Distichlis spicata*), saltmarsh aster (*Aster tenuifolius),* black needlerush (*Juncus roemerianus*)*,* marsh elder (*Iva frutescens*), and groundsel tree (*Baccharis halimifolia)*. Indigenous plant species will only be used for the wetland establishment project at the PIERP; no non-native or exotic plant species will be included in the planting plan. Current progress for wetland cell development is summarized below.

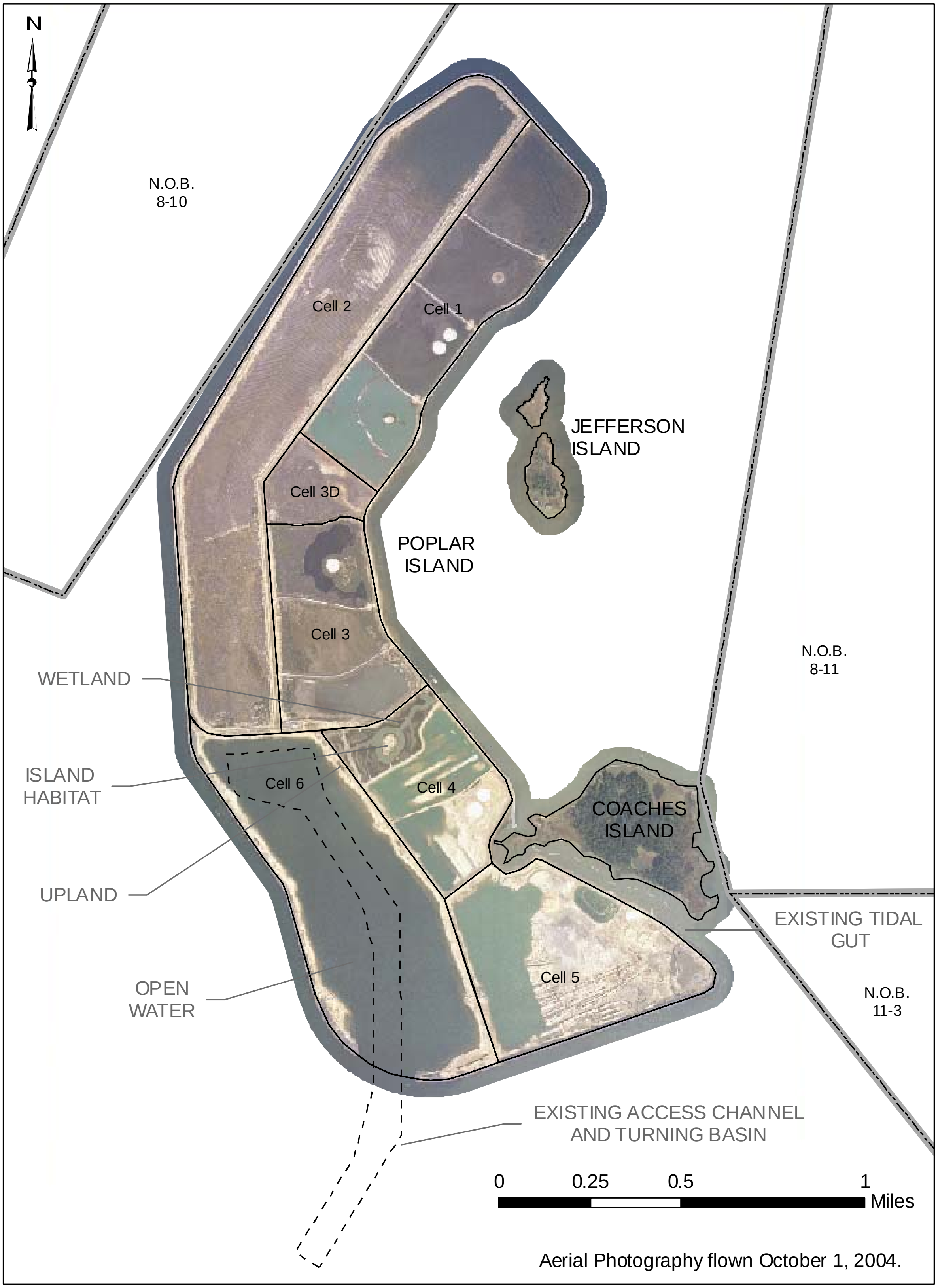


Figure 3-19. Typical Interim Habitats Created at Poplar Island

Cells 1 and 3. Inflow to Cells 1 and 3 is not currently complete. Based on the current dredged material placement analysis (Appendix A, Attachment C) inflow into Cells 1 and 3 is scheduled for completion in approximately 2010.

Cell 3D. This cell is 26 acres in size and is currently under development, including marsh vegetation germination experiments conducted by UMCES. Cell 3D was graded in 2004, is currently connected to the Bay with a control structure of 8 pipes, and was opened to tidal flow in March 2005. Planting Cell 3D will be initiated and completed in 2005 and will consist of approximately 540,000 wetland and upland plantings (Figure 3-20). Smooth cordgrass will be planted in the low marsh and saltmarsh hay will be planted in the high marsh; both species will be planted in the marsh transition zone. Figure 3-21 presents the detailed planting plans, including tree and shrub species proposed, for the habitat island proposed for Cell 3D.

Cell 4D. This cell was constructed and planted in the spring and summer of 2002. Cell development consisted of a 1-acre upland and buffer area, a 1-acre wetland area, and an approximately 0.2 acre tidal pond for a total of 2.2 acres. The wetlands were divided into three elevation zones for planting: low marsh, transition, and high marsh zones. Approximately 10,000 plug seedlings were planted in Cell 4D, which included smooth cordgrass, salt hay, and black needlerush. Cell 4D appeared to have good plant establishment after the first growing season (MES, 2004b).

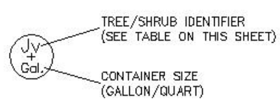
Cell 4DX. The development of Cell 4DX began in late fall of 2002 and planting was completed in summer 2003. The tidal system of Cell 4D was linked to Cell 4DX during construction. Together, Cell 4D and 4DX consist of approximately 15 acres of wetlands, including a 1.5-acre nesting island and 7.62 acres of channels. The Cell 4DX wetlands were constructed with sand, and include four test plots comparing various amounts and mixtures of dredged material and sand (Figure 3-22). Planting included salt hay plugs in the high marsh and smooth cordgrass plugs in the low marsh. Potted trees planted in the upper portion of the high marsh zone and on the nesting island included marsh elder and groundsel trees. The transition zone between high and low marsh was planted with black needlerush, salt grass, and salt bulrush.

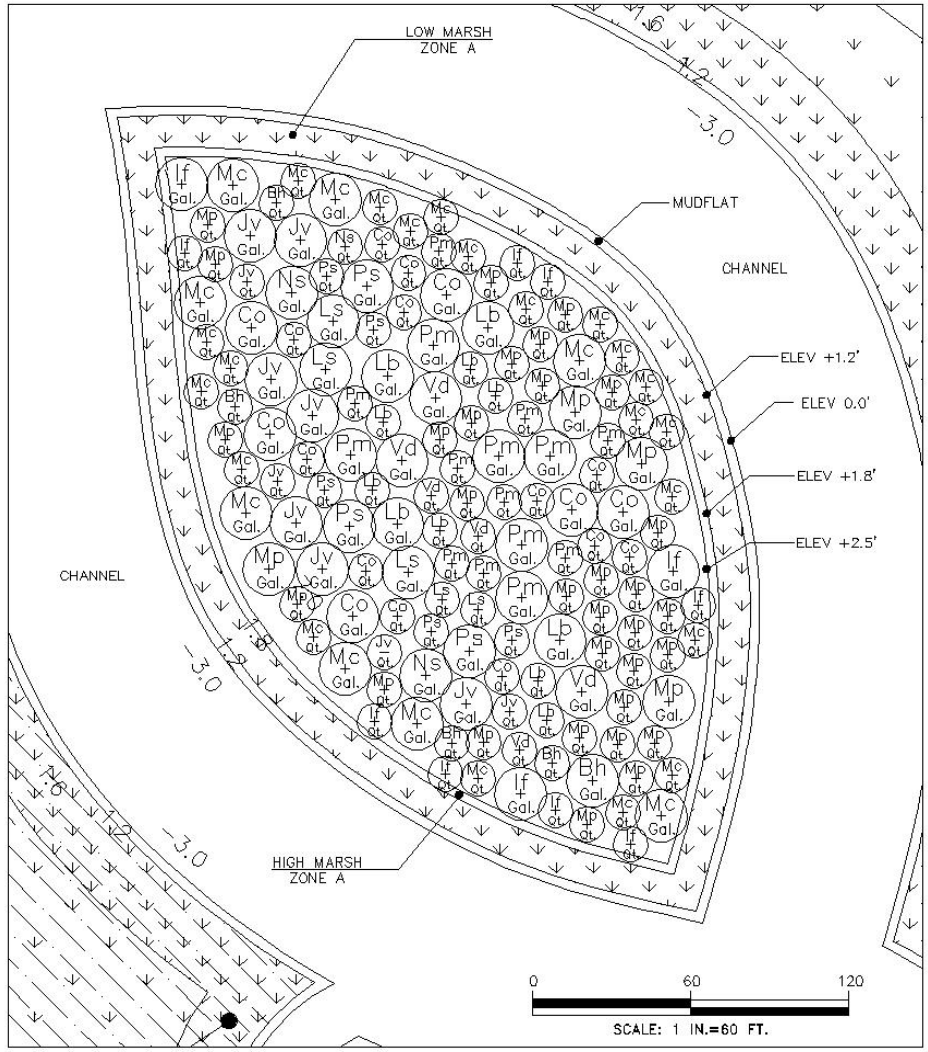
The created marsh in Cell 4DX was sampled in August 2003, only shortly after the wetland plantings were completed in 2003. It was observed that nearly all plantings appeared to be in excellent condition with extremely low mortality. Areal coverage by salt hay and smooth cordgrass had already begun to coalesce from the initial planted spacing (USFWS, 2004c). Cell 4DX was also sampled in early fall 2004 and the preliminary results (which are not yet published) indicated that the 4DX planting was successful (Miller USFWS, 2005b).

Figure 3-20. Planting Plan Proposed for Cell 3D

TREE AND SHRUB SPECIES IDENTIFICATION KEY		
IDENTIFIER	BOTANICAL NAME	COMMON NAME
Bh	BACCHARIS HALIMIFOLIA	GROUNDSEL TREE
If	IVA FRUTESCENS	MARSH ELDER
Lb	LINDERA BENZOIN	SPICEBUSH
Mc	MYRICA CERIFERA	WAX MYRTLE
Mp	MORELLA PENSYLVANICA	NORTHERN BAYBERRY
Vd	VIBURNUM DENTATUM	ARROWWOOD
Co	CELTIS OCCIDENTALIS	HACKBERRY
Jv	JUNIPERUS VIRGINIANA	RED CEDAR
Ls	LIQUIDAMBAR STYRACIFLUA	SWEETGUM
Ns	NYSSA SYLVATICA	BLACK GUM
Pm	PRUNUS MARITIMA	BEACH PLUM
Ps	PRUNUS SEROTINA	BLACK CHERRY

LEGEND:





HABITAT ISLAND CONTAINER STOCK PLAN

Figure 3-21. Detailed Cell 3D Proposed Habitat Island Planting Plan

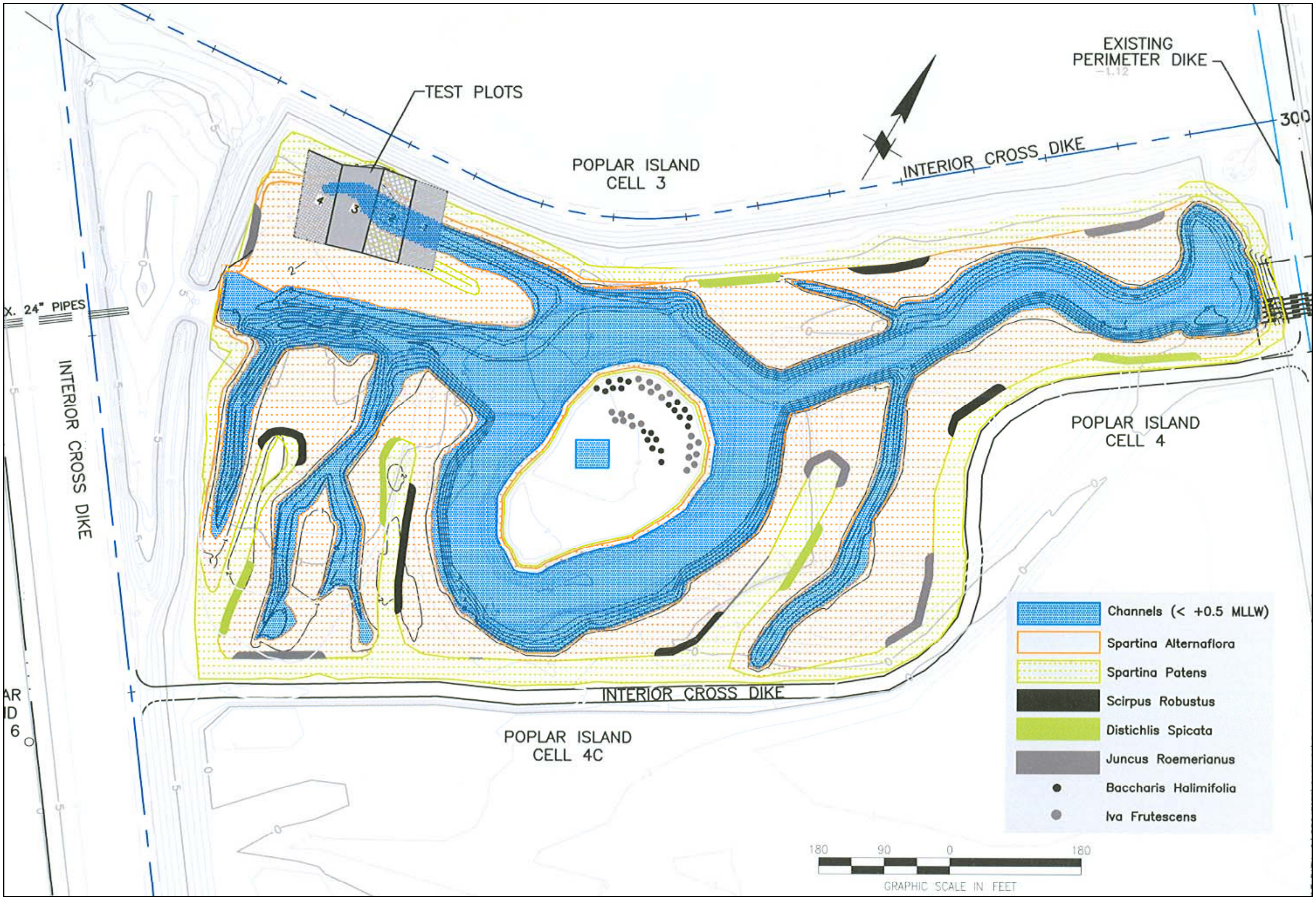


Figure 3-22. Detailed Planting Plan for Cell 4DX

During the avian monitoring surveys conducted from October 2003 to October 2004, the condition and utilization of Cell 4DX was also recorded. Of particular note was the movement of diurnal tides within the cell, the successful growth and seed production of smooth cordgrass covering the sub-tidal portion of the cell. Pioneers of the new habitat at Cell 4DX included small fish and crabs in the shallow waters preying on invertebrates and utilizing the protective cover in the smooth cordgrass, while attracting predatory larger fish and wading birds. Six species of wading birds were observed in Cell 4DX including the uncommon Tri-colored Heron, Green Heron, and Black-crowned Night Heron. Additionally, predators such as the Osprey, Royal tern and Common Tern have been noted fishing over the cell (MES 2004c). The abundantly produced smooth cordgrass seeds have attracted seed-eating species that include the Song Sparrow and Brown-headed Cowbird migrants, and nesting Red-winged Blackbirds to the system (MES 2004c).

The Notch. The area referred to as the "notch" is located outside of the perimeter dikes at Cells 4 and 5, between Coaches and the PIERP. The notch was planted with salt hay plugs in the high marsh and smooth cordgrass plugs in the low marsh and the plantings were generally considered successful.

3.1.7.f Upland Habitat Two upland cells (Cells 2 and 6) on the western side of the facility will contain the majority of the dredged material and will become upland habitat; inflow has not yet been completed for Cell 2 or initiated for Cell 6. Although the upland cells are not complete, interim habitats are still available at the sites, including mudflats that are extensively used by shorebirds. The interim habitats available at the PIERP, are presented in Figure 3-19. The following section presents the existing and current conditions of upland habitat at the PIERP, as well as the future plans for cell development (for cells where material inflow is not yet complete) as discussed in the *Poplar Island Environmental Restoration Project, Habitat Development Framework* (MES, 2004b).

A total of approximately 570 acres will be restored as uplands consisting of wooded, scrub-shrub, and freshwater wetland habitats. One acre of upland habitat was also created in Cell 4D to test the vegetation success. Once wetlands are established, all discharge from the uplands will flow through wetlands during crust management. Therefore, with the exception of a relatively small amount of wetland acreage, the majority of the upland cell will be an approximate 50 percent-50 percent split between scrub/shrub and wooded habitat. Species selected for planting will be native to the PIERP region and tolerant of the dredged material substrate and conditions in which they will be planted.

Cell 4D. This cell was constructed and planted in spring 2002 and planting was completed in summer 2002. Cell 4D consists of a 1-acre upland and buffer area, a 1-acre wetland area, and an approximately 0.2 acre tidal pond. A 20 ft wide and 1 ft thick strip of dredged material was placed on the western side of the cell and were seeded with upland grass species and wildflower mix. A list of Cell 4D tree, shrub, and dike seed mix plantings is presented in Appendix C, Table C-10. In fall 2002, a woody species survival survey was conducted in Cell 4D of all trees and shrubs. The results indicated that 50 percent of all woody species survived from the time of planting to the fall of 2002. A detailed list of survival by species for Cell 4D is included in Appendix C, Table C-11.

Cells 2 and 6. The total area of Cell 2 and Cell 6 is approximately 570 acres; inflow to these cells is not yet complete. The EIS states that 50 percent of the acreage should be restored as forested uplands, and the remaining 50 percent restored as scrub-shrub habitat, which is a total area of 285 acres for each habitat type (USACE/MPA 1996). The vegetation coverage will include forested uplands, scrub-shrub habitat, and freshwater wetlands.

Development and design of the proposed plantings for the wooded areas is still in progress and will be based on species included in wooded habitat observed on nearby Chesapeake Bay islands. This list may include plant species described in Appendix C, Table C-11. The plant species proposed for the uplands could include those species observed at James and Barren Islands, species proposed in the EIS, and species that were successful in the Cell 4D plantings. Design will be developed and finalized through the adaptive management process.

Island Nesting Habitat for Colonial Waterbirds – Sparsely Vegetated Habitat Islands

A total of eight acres of sparsely vegetated habitat islands will be created in the wetland restoration cells as island nesting habitat for ground nesting colonial waterbirds, including the Black Skimmer (*Rynchops niger*), Common Tern, and the Least Tern (USACE/MPA, 1996). The five existing sparsely vegetated nesting islands in Cells 1 and 3 were created during Phase I construction and the islands in Cell 4 were constructed during Phase II construction. These islands consist of sand covered with oyster shell and approximately half their area (estimated to be 4.4 acres) above the high tide line. Each habitat island is surrounded by a moat to deter predators. The estimated elevation of the shell nesting islands is +7.5 ft MLLW. The islands range from 230 to 260 ft in diameter, and from 288 to 533 ft away from the perimeter dikes. Little or no vegetation is maintained on the nesting islands as tern habitat.

Vegetated Habitat Islands for Colonial Wading Birds –Vegetated Habitat Islands

The habitat goal of creating vegetated islands is to provide nesting habitat for colonial wading birds that breed in the Chesapeake Bay from mid-March to mid-June and then migrate south for the winter (MES, 2004b). These avian species prefer woody vegetation isolated from human impact and predators. Currently, there are seven sand islands constructed at the PIERP, some have been naturally vegetated over time since their original creation, and others are planned for planting. An existing remnant island at the north end of Cell 1 is vegetated, and sand islands are located in Cells 1, 3D, 3, 4DX, and 5 (Figure 3-19). In 2003, the island in Cell 4DX was planted with trees and shrubs to create appropriate vegetated cover.

The vegetation on these nesting islands will consist of shrubs, mostly greater than 3.0 ft tall to optimize nesting habitat and utilization by colonial wading birds (MES, 2004b). The shrub species that are being considered for planting on the islands include northern bayberry (*Myrica pennsylvanica*), arrowwood (*Viburnum dentatum*), spicebush (*Lindera benzoin*), sweet pepperbush (*Clenthra alnifolia*), marsh-elder, groundsel-tree, wax myrtle (*Myrica cerifera*), and beach plum (*Prunus maritime*).

The constructed island in Cell 4DX is 1.35 acres, with an elevation near +5.0 ft MLLW. The species that were planted on the nesting island in Cell 4DX during the summer of 2003; smooth cordgrass was planted in the low marsh zone, salt hay was planted in the high marsh zone, marsh elder and groundsel tree were planted in the upper high marsh zone and redtop grass (*Agrostis alba*) was planted in the central part of the island. Cell 3D is a 26 acre cell adjacent to the north end of Cell 3; demonstration tests for seed germination were conducted in fall 2001. Based on results from the demonstration tests, the planting plan for Cell 3D has been developed (Figure 3-21) and the cell is proposed for planting in 2005.

Other Habitats

A variety of habitats have been and will be constructed at the PIERP to achieve the habitat restoration objective of the PIERP and to benefit a wide range of fish and wildlife. Ponds, totaling 28 acres of open water, including channels and moats, will be constructed within the high and low marshes of the wetland cells. Each wetland cell is currently planned to contain one pond in its low marsh and one in its high marsh, for a total of eight ponds throughout the PIERP. As the project progresses and more is learned, it is likely that additional habitats will be created through the adaptive management process.

Coaches Island Vegetation

Coaches Island, located southeast of the PIERP, is approximately 74 acres. Habitat communities present on Coaches Island include upland forest areas with wetland inclusions, low and high tidal marshes, and man-made impoundments and maintained turf areas, primarily associated with the dwelling on the island. A portion of the northern shore of the island, adjacent to Poplar Harbor, is protected by rip-rap. The discussion of vegetation at Coaches Island included in this section was originally presented in the EIS (USACE/MPA, 1996), since no additional vegetation surveys have been conducted since 1995.

The tidal saltmarsh areas on Coaches Island account for approximately 22 acres, or 30 percent of the island's land area (EA, 1995a). The high marsh areas are dominated by saltmeadow cordgrass (*Spartina patens*), with saltgrass also present. Other herbaceous plants are also present, with relatively homogeneous stands of black needlerush occurring in discrete areas. Other plants observed are presented in Appendix C, Table C-12. The primary plant species present in the low marsh bands, which appear to be continuously eroding, is smooth cordgrass with colonization of the upper shore-zone by common reed (*Phragmites austaralis*). Upland areas of Coaches Island are dominated by a mixed woodland of deciduous and evergreen trees that occupy approximately 42 acres or 57 percent of the island. Sweet gum (*Liquidambar stryaciflua*) and several oak species dominate the interior of the wooded area that is interspersed with loblolly pine (*Pinus taeda*). Other plants observed in the woodlands at Coaches Island are presented in Appendix C, Table C-12.

The managed fields occupy approximately six acres, or eight percent of Coaches Island, and generally include mowed grasses such as fescues *(Festuca* spp.), broomsedge *(Andropogon virginicus)*, and panic grass (*Panicum amarum*). Three impoundments, which appear to be manmade, exist on Coaches Island. The areas around these ponds are maintained by mowing. Plant species identified in and around the edges of these ponds are included in Appendix C, Table C-12.

Jefferson Island Vegetation

The habitat and vegetation at Jefferson Island is similar to Coaches Island and includes low and high saltmarsh communities, sandy beaches, and upland areas with mature loblolly pines. A detailed vegetation survey of Jefferson Island has not been conducted to date.

3.1.8 Rare, Threatened, and Endangered Species

Certain species of plants and animals are protected by Federal and State regulations under the Endangered Species Act (ESA) of 1973 and the Maryland Nongame and Endangered Species Conservation Act of 1975. Rare, threatened, and endangered (RTE) species are those plant and animal species that are most in need of conservation efforts since they are elements of both the United States' and the State of Maryland's natural diversity. RTE species include those occurring in Maryland that are listed or candidates for listing on the *Federal list of Endangered and Threatened Wildlife and Plants*, species currently on the *Rare, Threatened, and Endangered Animals of Maryland* list, and species listed by County by the MDNR Natural Heritage Program on the *Current and Historical Rare, Threatened, and Endangered Species of Talbot County, Maryland*.

Under the consistency clause (Section 7[a]) of the ESA, Federal agencies are required to consult with the USFWS and NMFS (where appropriate) if a prospective permit or license applicant has reason to believe that Federally endangered or threatened species may be present in the area or affected by a proposed project. The primary State law that allows and governs the listing of endangered species is the Nongame and Endangered Species Conservation Act (Annotated Code of Maryland 10-2A-01). This Act is supported by regulations (COMAR 08.03.08) that contain the official State Threatened and Endangered Species list. Normally, the species that are listed by the State of Maryland as endangered, threatened, extirpated, or in need of conservation or are considered rare by the MDNR Wildlife and Heritage Service, have no required legal protection by the Federal government. However, because this project is cost-shared with the MPA, a State agency, and permits will be requested from MDE, also a State agency, protection is required for State-listed species as well as Federally-listed species as part of this project.

The applicable Federally-listed species of importance for this project include the Federally threatened Bald Eagle, the Federally endangered shortnose sturgeon (*Acipensaer brevirostrum*), and several Federally-listed sea turtles (discussed in more detail below). A discussion of the State-listed and rare species listed through MDNR's Natural Heritage Program is included in more detail following the Federally-listed species discussion.

Restrictions on human activities and construction are currently in place at the PIERP to reduce noise disturbances to wildlife, including the Federally and State-listed Bald Eagle and four species of State-listed terns (Figure 3-23). Bald Eagle restrictions include no construction activities at any time in the immediate radius (660 ft) of the nest on Coaches Island and no construction activities from December 15 to June 15 in the general radius (1,320 ft) of the nest on Coaches Island (Figure 3-23). To reduce noise impacts to State-listed tern species, all activities must be avoided near tern nests from May 1 to July 31. There are currently no formal restrictions for noise associated with the diamondback terrapin, which the

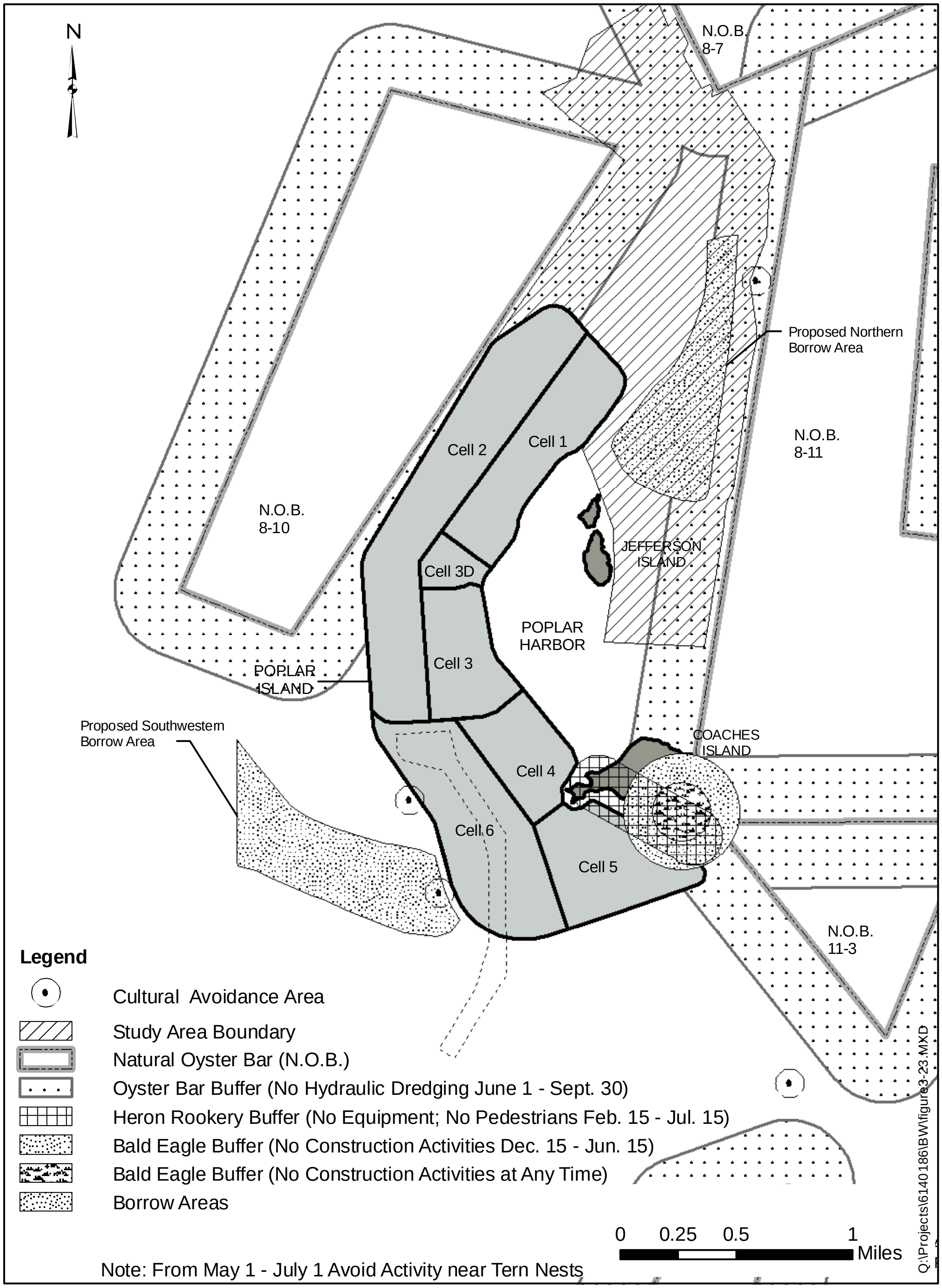


Figure 3-23. Environmental Restrictions Currently in Place at Poplar Island

MDNR, Division of Natural Heritage is currently reviewing for inclusion on the *RTE Animals of Maryland List*.

Recently, the USFWS and NMFS cited shortnose sturgeon, a Federally listed endangered species, as a concern within the Chesapeake Bay. In 1996, USFWS initiated a Reward Program for incidental catches of sturgeon in commercial gear. In 1997, USFWS and USACE initiated sampling programs in the vicinity of the existing dredged material placement sites, within several old placement areas, and within the mainstem channels, which generally covered the area between the C&D Canal and The William Preston Lane, Jr. Memorial Bridge (The Chesapeake Bay Bridge). The USACE-Baltimore District prepared a Biological Assessment (BA) of the potential impacts of dredging and dredged material placement operations in the upper Chesapeake Bay on SNS and sea turtles. The BA included the most current data concerning SNS catches as of 5 June 2005 and sea turtle strandings as of 2003. Individual project Section 7 consultations for the SNS and sea turtles in the vicinity of the PIERP expansion has occurred and is complete (Appendix E).

3.1.8.a Agency Coordination In accordance with the Federal and State requirements for endangered species, consultation was conducted with the USFWS Chesapeake Bay Field Office in Annapolis, Maryland; the Habitat and Protected Resources Division of the NMFS in Gloucester, Massachusetts; and MDNR's Wildlife and Heritage Service located in Annapolis, Maryland (coordination and responses are included in Appendix F). Information requested from these agencies included Federal and State-listed threatened and endangered species, designated or proposed critical habitat, and candidate taxa occurring in the project area.

A response letter from NMFS dated 22 January 2004 provided a list of endangered and threatened aquatic species within this agency's jurisdiction that may occur within the project area, which included the shortnose sturgeon and several species of sea turtles (Appendix F). NMFS stated that the NOAA Fisheries recovery plan (1998) indicates that shortnose sturgeon were found in the Chesapeake Bay and its tributaries. The response letter from NMFS dated 22 January 2004 (Appendix F) stated that as of May 2003, 54 shortnose sturgeon were captured via the sturgeon reward program in the Chesapeake Bay and its tributaries. Of the 54 sturgeon captured, two recovered south of the Bay Bridge near Kent Island were closest in proximity to the PIERP.

In 1996, the USFWS, the MDNR, and the CBF initiated a sturgeon reward program in the Chesapeake Bay to record incidental catches of sturgeon in the Maryland portion of the Chesapeake Bay. As part of the program, fishermen are asked to hold alive any sturgeon captured and to contact the Maryland Fisheries Resource Office of the USFWS.

The most updated shortnose sturgeon data provided by the USFWS from the reward program has indicated that 68 shortnose sturgeon have been captured in the Maryland portion of the Chesapeake Bay, but no shortnose sturgeon have been captured in the vicinity of the PIERP site as of June 5, 2005. Although not captured during field activities, two shortnose sturgeon were recovered in 1996 south of the Bay Bridge near Kent Island (approximately eight miles and 15 miles north of the PIERP, as part of the sturgeon reward program managed by the USFWS (Appendix E). The nearest shortnose sturgeon catch to date has been approximately six miles to the west of the PIERP near Herring Bay (on the western shore) and was caught with a gillnet on 2 January 2000 as part of the sturgeon reward program (Figure 3-24). This site was not sampled as part of the USFWS/USACE sturgeon study. No shortnose sturgeon were captured near the PIERP during any of the site-specific studies conducted in the area since 1995 (NOAA; 2003, 2001 and EA, 2005a). In a letter dated 9 August 2005, NMFS also stated that surveys conducted in the waters surrounding Poplar Island in 1994, 1995, 2001, 2003, and 2004 failed to capture any shortnose sturgeon, indicating that this area is not likely a high use area for shortnose sturgeon (Appendix F).

The species of sea turtles specified by NMFS as 'known to be present' in the Chesapeake Bay include leatherback sea turtles (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempi*), and green sea turtles (*Chelonia mydas*) (Appendix E). These sea turtles are all present in the Mid-Atlantic region during the late spring, summer, and early fall seasons (Lutcavage and Musick, 1985; Keinath *et al*., 1987). Most species are more prevalent in Virginia waters than in Maryland, although the loggerhead, leatherback, and Kemp's ridley have all been stranded in Maryland water as far north as the Magothy and Chester Rivers (Evans *et al*., 1997). Based on recently collected data, loggerhead and Kemp's ridley are the species of sea turtles most likely to be found in waters of the Chesapeake Bay, while leatherback and green sea turtles may also be found in the area (Appendix E). The Marine Mammal and Sea Turtle Stranding Program was established by the MDNR at the Cooperative Oxford Laboratory in the fall of 1990. The network is responsible for the retrieval and examination of all dead stranded marine mammals and sea turtles in Maryland. A total of 308 dead stranded sea turtles were reported in Maryland between 1991 and 2003, 123 of which were found in the Chesapeake Bay (Kimmel, 2004).

Leatherbacks are largely an offshore pelagic species but rare strandings have been recorded in the Bay as far north as the Chester River (Evans *et al*., 1997). Green sea turtle sightings and strandings have been recorded in the Bay, but no occurrences were recorded in recent data summaries for Maryland (Evans *et al*., 1997). Kemp's ridley observations in the Bay have occurred for many years, but tend to occur near Calvert Cliffs and south of the Choptank River (Evans *et al*., 1997). Loggerhead sea turtles are the most likely species to occur near the project area. The majority of sightings and strandings in Maryland during the period of 1991 to 1995, occurred near Calvert Cliffs and along the western shore of Kent Island. In 1993, a loggerhead was stranded on one of the Poplar Island remnants (Evans *et al*., 1997). Even considering all of these recent observations, sea turtles (including loggerheads) are migratory individuals that are seasonal transients to Poplar Island and the project area. On average, only 18 sea turtles are stranded annually in State of Maryland waters (including the Atlantic Beaches), and on average, less than 4 sea turtles per year (of the 18) are stranded north of the Choptank River. Sea turtles generally nest on high-energy sand beaches along the eastern seaboard, south of the State of Maryland. No nesting is known to occur within the Chesapeake Bay (Evans *et al*., 1997).

Figure 3-24. Shortnose Sturgeon Reward Program Catches in the Vicinity of Poplar Island

The response letter from USFWS dated 14 April 2004 stated that the Bald Eagle nest within the vicinity of the project, identified as nest TA-98-01, is located near the southeast corner of Coaches Island (Appendix F). The agency also stated that any construction or forest clearing activities within one-quarter mile of active nests may impact Bald Eagles and that further consultation would be necessary. Because all activities associated with the proposed lateral expansion will occur outside of the one-quarter mile buffer, no additional coordination concerning the Bald Eagle with the USFWS was necessary. However, further coordination with the MDNR Natural Heritage Division was suggested and was completed by the USACE. The MDNR Natural Heritage Division responded to the USACE with a letter dated 8 August 2005 stating that they had no comments in regards to bald eagle nest protection on activities proposed outside of the ¼ mile buffer from the nest and that waterbird colonies (herons and terns) should also be protected with a ¼ mile buffer (Appendix F).

In addition to agency coordination, the MDNR's Talbot County list of RTE species was accessed to determine which RTE species could potentially occur in the PIERP project area (MDNR, 2004b). Because the State of Maryland is a partner in the PIERP and would be a partner in the expansion study, State-listed species would require protection as part of this project. The Talbot County list includes six bird species, two mussel species, one amphipod, two beetles, one amphibian, one mammal, and 35 plant species. Two of the listed bird species, the Bald Eagle and the Least Tern have been observed at the PIERP. The remaining four species of birds could potentially occur at the PIERP, and include American Bittern (*Botaurus lentiginosus*), Common Moorhen (*Gallinula chloropus*), Least Bittern (*Ixobrychus exilis*), and Black Rail (*Laterallus jamaicensis*). The two listed mussel species, the dwarf wedge mussel (*Alasmidonta heterodon*) and the triangle floater (*Alasmidonta undulata*), the listed amphipod, tenuis amphipod (*Stygobromus tenuis tenuis*), and the carpenter frog (*Rana virgatipes*) are unlikely to occur at the PIERP because they are freshwater species. Unless introduced, it is also unlikely that that the Delmarva fox squirrel (*Sciurus niger cinereus*) would occur at the PIERP. Of the 35 listed botanical species, the most likely to occur at the PIERP when the habitat is established include coastal or saltmarsh species such as sea-beach sedge (*Carex silicea*), marsh fleabane (*Pluchea camphorata*), evergreen bayberry (*Myrica heterophylla*), salt-marsh bulrush, large marsh St. Johns-wort (*Triadenum tubulosum*), and coastal juneberry (*Amelanchier obovalis*). Other upland and freshwater listed plant species may occur at the PIERP as the ecosystem and created habitats mature. The species discussed above with Federal and State status would require legal protection, although only six bird species and six plant species could potentially occur at the PIERP. Of these twelve species, only the Bald Eagle and the Least Tern have been observed at the PIERP.

In addition to listed plants and animals, the MDNR Fisheries Service maintains an official list of game and commercial fish species that are designated as endangered, threatened, or in need of conservation in Maryland. The list of Endangered and Threatened Fish Species is listed in COMAR 08.02.12 and includes the endangered shortnose sturgeon and fish species in need of conservation. The following species are listed as in need of conservation: striped bass, American shad, hickory shad, yellow perch (*Perca flavescens*), and American oyster, all species that have been collected at the PIERP during fisheries studies (except the oyster, which has been collected on NOB 8-11 by MDNR). As specified in COMAR 08.02.12, "A person may take, possess, transport, export, process, sell, or offer for sale, or ship those species designated as in need of conservation unless prohibited by regulations adopted by the Department for each individual species."

3.1.8.b Listed Avian Species Observed at the PIERP Since 1994, existing conditions, reconnaissance studies, and monitoring surveys have been conducted at the PIERP to document wildlife species and habitats in the project area. These studies demonstrated that the PIERP provides breeding and foraging grounds for several Federal or State-listed species. Table 3-8 presents a list of Federal or State-listed species that have been observed at the PIERP during avian monitoring studies, conducted biweekly from May 2001 to January 2005. Since May 2001, 18 listed avian species have been observed at the PIERP. Of these 18 avian species, one species is Federally and State-listed and six species are State-listed. The remaining 11 listed avian species are considered rare by the State of Maryland.

The available detailed accounts of the State or Federally-listed RTE species that were observed during the avian monitoring surveys are summarized below.

- The State and Federally-listed threatened Bald Eagles present in the Study Area vicinity were historically associated with a nest located on Jefferson Island. However, the pair of Bald Eagles that historically nested on Jefferson Island moved to a nest on Coaches Island in 1999 before the initial construction of the PIERP, because of storm damage to the original nest (Appendix C, Table C-3). The Bald Eagles have since been observed flying in the area, sitting on the nest, and perching on snags. In November 2002, Bald Eagles were observed during the avian monitoring fishing offshore or sitting in trees on adjacent islands, but not actively hunting at the restoration site (Appendix C, monitoring month 11-02). In April 2003, a pair of Bald Eagles was sitting in trees in vicinity of their tree nest on the east side of the "notch" at Cell 5. In July 2003, a Bald Eagle fledging was observed on the dike at Cell 6 on a few occasions, demonstrating a successful nesting year (Appendix C, monitoring month 07-03). Additionally, juvenile and adult Bald Eagles are regularly observed on PIERP, on Jefferson Island, on Coaches Island (including the activity associated with the nest there), and in the general area.
- The State-listed rare Northern Harriers have been observed patrolling the grassy dike around Cell 2 on numerous occasions, potentially feeding on mammals on the island (MES, 2003a).
- The State-listed endangered Royal Tern (*Sterna maxima*) and State-listed endangered Gull-Billed Tern (*Sterna nilotica*) have been observed on the island, as well as the State-listed threatened Least Terns that have attempted to nest (and were unsuccessful) at the PIERP in 2003 and 2004 (Erwin, 2004).
- A pair of the State-listed rare American Oystercatchers was observed on the PIERP near the created islands in Cell 4DX, but the successes were not quantified (MES, 2003a).

Table 3-8. Rare, Threatened, and Endangered Species Observed at the PIERP During Avian Monitoring Activities, May 2001 through May 2005

Common Name	Scientific Name	Global Rank*	State Rank*	State Status*	Federal Status*
American Oystercatcher	*Haematopus palliatus*	G5	S3B	-	-
Bald Eagle	*Haliaeetus leucocephalus*	G4	S2S3B	T	LT
Northern Harrier	*Circus cyaneus*	G5	S2B	-	-
Blue-winged Teal	*Anas discors*	G5	S2B	-	-
Brown Pelican	*Pelecanus occidentalis*	G4	S1B	-	-
Peregrine Falcon	*Falco peregrinus anatom*	G4T3	S2	I	-
Royal Tern	*Sterna maxima*	G5	S1B	E	-
Double-crested Cormorant	*Phalacrocorax auritus*	G5	S1B	-	-
Sharp-shinned Hawk	*Accipiter striatus*	G5	S1S2B	-	-
Gadwall	*Anas strepera*	G5	S2B	-	-
Spotted Sandpiper	*Actitis macularia*	G5	S3S4B	-	-
Laughing Gull	*Larus atricilla*	G5	S1B	-	-
Least Tern	*Sterna antillarum*	G4	S2B	T	-
Gull-Billed Tern	*Sterna nilotica*	G5	S1B	E	-
Sandwich Tern	*Sterna sandvicensis*	G5	S1B	-	-
Short-eared owl	*Asio flammeus*	G5	S1B	E	-
Bank Swallow	*Riparia riparia*	G5	S3S4B	-	-
Black Skimmer	*Rynchops niger*	G5	S1B	E	-

Source: MDNR, 2003b

***Natural Heritage Rankings:**

Global Rankings:
G1: extremely rare throughout range
G2: very rare throughout range
G3: rare to common throughout range
G4: common throughout range
GU: possibly rare, status uncertain
G_Q: questionable taxonomic assignment
G_T_: rank of a subspecies or variety
G5: very common throughout range
?: ranking uncertain

Federal Status:
LT: listed threatened
LE: listed endangered
SOC: species of concern
SC: special candidate

State Rankings:
S1: extremely rare; usually 5 or fewer populations or occurrences in the State
S2: very rare; usually 5-20 populations or occurrences in the State
S3: rare to uncommon; 20-100 populations or occurrences in the State
S4: common; >100 populations or occurrences in the State
S5: very common
SU: status uncertain
?: ranking uncertain
B: Migratory species - rank refers only to the breeding status of the species
SH: Historically known but not verified

State Status:
E: endangered
I: in need of conservation
T: threatened
X: endangered extirpated

- In December 2002, a State-listed rare Brown Pelican was observed resting on a float in Cell 6 and in January 2004, a total of three wintering Brown Pelicans were flushed from the rocks at the mouth of Cell 6 on the rock dike during avian monitoring (Appendix C, monitoring month 01-04).
- The State-listed rare Spotted Sandpiper (*Actitis macularia*) was observed in July 2003 and potentially used the PIERP for nesting, although nesting was not confirmed (Appendix C, monitoring month 07-3,).
- In November 2003, a State-listed endangered Royal Tern and a State-listed "in need of conservation" Peregrine Falcon (*Falco pergrinus*) were observed migrating through the vicinity of PIERP (Appendix C, monitoring month 11-03).
- Also in November 2003, at least two transient State-listed endangered Short-Eared Owls frequented the dike grass of Cell 2 when construction disturbance flushed them during daylight. (Appendix C, monitoring month 11-03)
- In July 2004 there were many State-listed rare Double-Crested Cormorant nests with 2-3 large young in the colony, suggesting good production (Erwin, 2004).

3.1.8.c Listed Aquatic Species Observed at the PIERP No listed aquatic species have been observed in the vicinity of the PIERP during the field activities. Although not captured during field activities, two shortnose sturgeon were recovered south of the Bay Bridge near Kent Island (approximately 8 miles and 15 miles north of the PIERP, as part of the sturgeon reward program managed by the USFWS (Appendix E), and one shortnose sturgeon catch was approximately six miles to the west of the PIERP near Herring Bay, caught by a gillnet on 2 January 2000 (Figure 3-24). Although direct monitoring was not performed, there were no sea turtles identified in any of the finfish surveys or wildlife monitoring during the 1994-1995 baseline surveys, the NOAA 2001 and 2003 fisheries surveys or the 2004 seasonal surveys at Poplar Island. As stated above, a loggerhead was stranded on one of the Poplar Island remnants in 1993 (Evans *et al*., 1997).

In an agency correspondence letter dated 9 August 2005, NMFS stated that no sea turtles and/or shortnose sturgeon have been encountered in previous dredging operations at Poplar Island (Appendix F).

3.1.9 Air Quality

The PIERP is located in Talbot County, Maryland, which is part of the Eastern Shore Intrastate Air Quality Control Region. The area is in attainment for all of the National Ambient Air Quality Standard (NAAQS) criteria pollutants, which include particulate matter (both PM_{10} and $PM_{2.5}$), sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, and ozone. A summary of the pollutant characteristics is provided in Table 3-9.

Table 3-9. Air Pollutants and Their Characteristics

Pollutant	Characteristics
Particulates (PM_{10} and $PM_{2.5}$)	• Mixture of solid particles and liquid droplets • Fine particles (less than 10 and 2.5 micrometers) produced by fuel combustion, power plants, and diesel buses and trucks • Can aggravate asthma, produce acute respiratory symptoms, including aggravated coughing and difficult or painful breathing, and chronic bronchitis • Impairs visibility
Sulfur Dioxide (SO_2)	• Can cause temporary breathing difficulties for people with asthma • Reacts with other chemicals to form sulfate particles that are major cause of reduced visibility in many parts of the country • Main contributor to acid deposition
Nitrogen Oxides (NO_x)	• High temperature fuel combustion exhaust product • Can be an irritant to humans and participates in the formation of ozone • Reacts with other pollutants to form nitrate particles that are a significant contributor to visibility reduction in many parts of the country • Contributor to acid deposition
Carbon Monoxide (CO)	• Odorless, colorless gas produced by fuel combustion, particularly mobile sources • May cause chest pains and aggravate cardiovascular diseases, such as angina • May affect mental alertness and vision in healthy individuals
Lead (Pb)	• Can cause damage to the kidneys, liver, brain and nerves, and other organs • Can cause high blood pressure and increases heart disease • Can cause reproductive damage in some aquatic life and cause blood and neurological changes in fish
Ozone (O_3)	• Not directly emitted by mobile, stationary, or area sources • Formed from complex reactions between NO_X and VOC emissions in the presence of sunlight • Occurs regionally due to multiplicity of sources • Can irritate the respiratory system • Can reduce lung function • Can aggravate asthma and increase susceptibility to respiratory infections • Can inflame and damage the lining of the lungs • Interferes with the ability of plants to produce and store food, which makes them more susceptible to disease, insects, other pollutants, and harsh weather • Damages the leaves of trees and other plants
Volatile Organic Compounds (VOCs)[1]	• Fuel combustion exhaust product • Consists of a wide variety of carbon-based molecules • Participates in the formation of ozone

[1] *Not an NAAQS criteria pollutant*

Although Talbot County is in attainment for all criteria pollutants, the entire State of Maryland is part of the Northeast Ozone Transport Region (OTR), which was established in the 1990 Clean Air Act Amendments in recognition of the longstanding ozone nonattainment problems in the northeast. The OTR is the area consisting of the Northeast and Mid-Atlantic States that historically has a ground level ozone problem, a large amount of which is accounted for by emissions generated outside the region. The Ozone Transport Commission (OTC), which is a multi-State organization, provides oversight of the region and is responsible for advising USEPA on transport issues and for developing and implementing regional solutions to the ground-level ozone problem.

Currently, there are numerous pieces of earthmoving equipment used to place and manage dredged material within the upland and wetland cells. Table 3-10 summarizes the types of equipment currently operating on the island. Since operating hour data were not readily available, it was assumed that each piece of equipment would operate approximately 1,000 hours per year. Emissions were then estimated using these data and diesel engine emission factors, which are a function of engine size.

Table 3-10. Estimated Air Emissions from the PIERP Earthmoving Equipment Operations

Number	Construction Equipment	Average Rated HP	Usage (hrs/yr)[1]	Emissions (lbs/yr)			
				CO	NO_X	VOC	PM_{10}
3	Dozer	260	2,098	3,290	7,059	886	761
2	Trencher	260	20	31	66	8	7
4	Dump Truck	220	2,956	2,288	7,845	705	654
1	Fuel & Lube Truck	260	894	1,402	3,009	378	324
6	Excavator	260	4,621	7,247	15,550	1,952	1,676
1	Loader	260	338	530	1,138	143	123
1	Compactor	260	29	46	98	12	11
1	Grader	260	194	303	651	82	70
Total			**(lbs):**	15,137	35,416	4,166	3,625
			(tons):	7.57	17.71	2.08	1.81

Source*:* The above estimates were calculated using the methodology and information provided in the *Nonroad Engine and Vehicle Emission Study--Report, US EPA Doc 21A-2001, 1991.*

[1] Annual usage estimated from extrapolation of equipment operating hours from Jul 2004 – Feb 2005.

Emissions also are generated by diesel pickup and utility trucks used at the PIERP. Although no data on their operating characteristics are readily available, they are assumed to be minor relative to the level of emissions generated by the large earthmoving equipment noted in Table 3-10 above.

To put these emission data into some perspective, they are compared to estimates of annual emissions generated in Talbot County. These county-level data were obtained from the 1999 National Emission Inventory maintained by the USEPA and are summarized in Table 3-11. The data in Table 3-11 indicate that annual air emissions from operational equipment on Poplar Island are less that 0.1 percent of CO, VOC, and PM_{10}, and less than 1 percent of NO_X emissions generated in Talbot County.

Table 3-11. Estimated Annual Emissions from the PIERP and Talbot County

Area	Emissions (tons/yr)			
	CO	NO_X	VOC	PM_{10}
PIERP Equipment Operations	8	18	2	2
Talbot County	14,000	3,000	2,440	2,730

3.1.10 Noise

For purposes of regulation, noise is measured in dBA or A-weighted decibels. This unit uses a logarithmic scale and weights sound frequencies. Individuals with good hearing perceive a change in sound of 3 dB as just noticeable, a change of 5 dB as clearly noticeable, and 10 dB is perceived as doubling (or halving) of the sound level. Values above 85-90 dBA would be considered very loud (Table 3-12) and have the potential to harm hearing given sufficient exposure time. Noise levels above 140 dBA can cause damage to hearing after a single exposure.

- *Sound* – A vibratory disturbance created by a vibrating object, which, when transmitted by longitudinal pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- *Noise* – Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- *Decibel* – A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
- *A-Weighted Decibel (dBA)* – An overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear.

Noise transmission depends on many factors including air temperature, wind and atmospheric conditions. Two common rules of thumb for noise transmission are that sound drops by 6 dBA for every doubling of distance over land and by 5 dBA per doubling of distance over water (Komanoff and Shaw, 2000). In other words, a person on land that hears an 88 dBA sound level at 50 ft, will hear a sound level of 82 dBA if he doubles the distance between himself and the noise source by moving to 100 ft from the noise source. As a result of this relationship, sound generally drops off rapidly with distance. For example, in an open setting, the loud noise of a truck (~88 dBA at 50 ft) would drop to nearly background levels (56 dBA) in 2,000 ft.

Table 3-12. Typical Noise Levels and Subjective Impressions

Source	Decibel Level (dBA)	Subjective Impression
Normal breathing	10	Threshold of hearing
Soft whisper	30	---
Library	40	Quiet
Normal conversation	60	---
Television audio	70	Moderately loud
Ringing telephone	80	---
Snowmobile	100	Very loud
Shouting in ear	110	---
Thunder	120	Pain threshold

3.1.10.a Existing Noise Sources Given the predominance of residential land uses (Section 3.3.3) along the mainland in the vicinity of PIERP, noise sources are largely limited to activities within private yards, operation of boats and personal watercraft, activities associated with the PIERP, and vehicle traffic. These activities can vary widely in the amount of noise produced, but according to the League for the Hard of Hearing (LHH), background noise levels are about 40 dBA on a quiet residential street. A typical maximum permitted sound level in rural and suburban areas is 55 dBA (i.e., Talbot County, 2004).

While the background noise level for residents along the mainland in the vicinity of the PIERP might typically be 40 dBA, a resident may also hear acute noise sources, particularly in the daytime, associated with suburban neighborhoods such as a power mower, which will generate 65-95 dBA at 50 ft or a leafblower (110 dBA at 50 ft). Mainland residents and boaters are exposed to noise from various types of commercial and recreational watercraft. Powerboats and personal watercraft (PWC) generate noise levels typically in the range of 70-85 dBA at 50 ft (Noise Unlimited, 1995), and by law in many States cannot exceed 86-90 dBA from 50 ft away. However, sound levels up to 109 dBA for racing boats have been recorded and PWC noise may be perceived as particularly annoying, despite a moderate decibel reading, because of the high pitch and variable nature of the sound. By comparison, freeway traffic is in the range of 70 dBA at 50 ft, although large trucks may typically generate 90 dBA (LHH, 2004). Nighttime noise levels in the vicinity of the PIERP are likely to be quite low.

3.1.10.b Current Temporary Noise Levels Associated with the PIERP The existing PIERP creates noise associated with dredge and barge operation (associated with offloading and inflow of dredged material), dike maintenance, truck traffic, heavy equipment usage and crew boat usage. Future activities associated with the PIERP include continued inflow of dredged material, crust management and grading until about 2021 (Appendix A, Attachment C). The highest daytime noise levels associated with these activities will be from truck traffic and backup beepers (85-110 dBA at 50 ft), crew boats and rock placement for dike repairs (~100 dBA at 50 ft). Nighttime noise is associated with pumps used during inflow and generators used to power lighting equipment at spillways or other equipment.

Based on a 5-dBA reduction in noise level with doubling of distance over water (Komanoff and Shaw, 2000), roughly ten residences on the adjacent shoreline of Tilghman Island are close enough to hear these operational noises reach above background levels (about 50 dBA) under normal atmospheric conditions. A variety of factors control sound propagation and in particular, temperature inversions common at dusk during spring and fall, may increase the sound levels to these homes and carry noise farther than this simple model suggests.

3.1.10.c Existing Noise Effects on Wildlife Restrictions on human activities and construction are currently in place at the PIERP to reduce noise disturbances to wildlife, including Bald Eagles, terns, and herons (Figure 3-23). Bald Eagle restrictions include no construction activities at any time in the immediate radius (660 ft) of the nest on Coaches Island and no construction activities from December 15 to June 15 in the general radius (1,320 ft) of the nest on Coaches Island (Figure 3-23). To reduce noise impacts to terns, activities must be avoided near tern nests from May 1 to July 31. For heron protection, no equipment and no pedestrians are allowed along the southeastern shoreline of the PIERP, near Coaches Island from February 15 to July 15. There are currently no restrictions imposed by MDNR for activities associated with the diamondback terrapin, except for restrictions on the take and possession of terrapins and the possession of terrapin eggs, which are included in COMAR 08.02.06.02.

A discussion of types of current noises at the PIERP that may influence avian utilization of the habitats at the PIERP and a discussion of the existing noise on diamondback terrapins at the PIERP is included below.

Avian Species

The effects of construction and management activities on avian species were evaluated concurrent with the avian monitoring surveys during the period of October 2002 through October 2003 to determine if disturbance from construction occurred (MES, 2003a). Construction activities associated with noise involved the creation of temporary pump stations for stormwater removal from within individual cells; excavating drainage ditches along the interior base of enclosed cell dikes; construction of new dissecting dikes in Cells 1, 3 and 4; mining substrate materials from Cells 4, 4C and 5 for construction and maintenance use; and deposition of marine dredge materials in Cells 1, 2, 3 and 3D (MES, 2003a).

Most temporary pump stations create noise, but are located in areas that are not constantly frequented by large numbers of birds. However, feeding or resting birds may temporarily leave or find other suitable locations nearby when pumps are being checked and/or maintained by personnel. Conversely, noise and human activity at pump sites (near permanent outfalls 5 and 11) may be close enough to influence potential avian nesting on habitat islands in Cells 3D and 4C. Additionally, temporary pump noise and related human activity were potentially responsible for failure of a 2003 Osprey nest on a rock groin near outfall station 2 in Cell 1 (MES, 2003a).

The excavation of drainage ditches along cell dikes and the construction of new dissecting dikes may have caused noises that affected avian species. These noises may have caused feeding or resting birds to temporarily abandon locations along the dike; timing and location of these activities was a concern. Ditch excavation occurs to remove stormwater from cells, and has been proven to disturb avian activity. Ditching adjacent to occupied nest islands in Cells 1 and 3 appeared to cause some flushing and/or agitation among nearby nesting birds creating opportunities for egg and/or young predation by other nesters or predators (MES, 2003a). Similar bird behavior was noted during dike construction subdivision adjacent to the nest island in Cell 3. Dike construction subdivision occurred in Cell 1, located directly adjacent to the northern-most nest island, which was not utilized by nesting birds. This construction occurred in May when many potential nesting species first arrived at the project site, and may have contributed to failure of the island to be utilized by nesting birds (MES, 2003a).

Another construction activity that potentially disturbed avian utilization of the PIERP includes mining substrate materials. Mining substrate materials in Cell 4 did not appear to have an effect on avian activity, since a multitude of birds utilize Cell 4. However, the mining site is accessed by haul roads, one of which was located in the northwest corner of Cell 4C and within a few feet of an active Least Tern colony on shells. It appears this colony failed largely as a result of flooding from frequent rain during the period, but on two occasions young terns were observed hiding in the tracks of haul trucks or within a few feet of the haul road. This observation suggests colony flushing and/or some young fatalities that may have occurred as a result of proximity of the colony to the temporary roadway (MES, 2003a).

Dredged material operations and placement at the PIERP may have caused bird abandonment of the area of activity. Material placement occurred from November through December 2002, after the nesting season and the majority of the fall bird migration had occurred. Placement occurred from the barge just a few hundred feet directly into the south end of Cell 2 and created no disturbance to avian species (MES, 2003a). Conversely, dredged material placement in 2003 involved construction activity along the central dike from Cell 6 to the north end of the PIERP from late September through to mid-November, after the nesting season, but during the fall migration period. It appeared that feeding shorebird and resting gulls abandoned the locations of construction activity for more favorable locations within the PIERP during this period (MES, 2003a).

Various trucks and machinery moving along the PIERP dike roads appeared to infrequently cause resting, feeding, or nesting birds within cells to flush. Many of these incidences appeared to be associated with loud noises. Flightless young gulls, Willets, Red-Winged Blackbirds, adult gulls, and Mallards have also been found struck by vehicles while traveling along dike roads (MES, 2003a).

Diamondback Terrapins

The effects of construction and management activities on terrapin species were noted concurrent with the annual terrapin monitoring surveys, conducted in 2002, 2003, and 2004. The diamondback terrapin has used the PIERP extensively for nesting, since the island provides excellent nesting habitat that includes accessible sandy areas above the mean high tide (Roosenburg, 2003). Terrapins will abandon nesting when disturbed, resulting in incomplete nests (Roosenburg, 2003). It has been determined that the PIERP construction activity may disturb terrapin nesting when it occurs in close vicinity to nesting beaches, but if the construction activity occurs far from nesting beaches, it does not seem to disturb nesting females (Roosenburg, 2003). There was evidence in 2002 of abandonment of nesting by disturbed females (Roosenburg, 2003). Terrapin nests are normally laid during June and July and hatching occurs from August to October (Appendix C, Table C-3).

3.1.11 Light

The shoreline adjacent to the Study Area is dominated by detached single family homes interspersed with agricultural fields and forest patches. This type of land development has few major light sources. Existing light sources in the vicinity include occasional street lights in public spaces and commercial establishments, car headlights along local roads, and indoor and outdoor lighting of private homes. Therefore, the overall level of existing light in residential areas is low. Within the waterway, light sources include: lighted aids to navigation (i.e., buoys), lighthouses off Kent Island and off the southern end of Tilghman

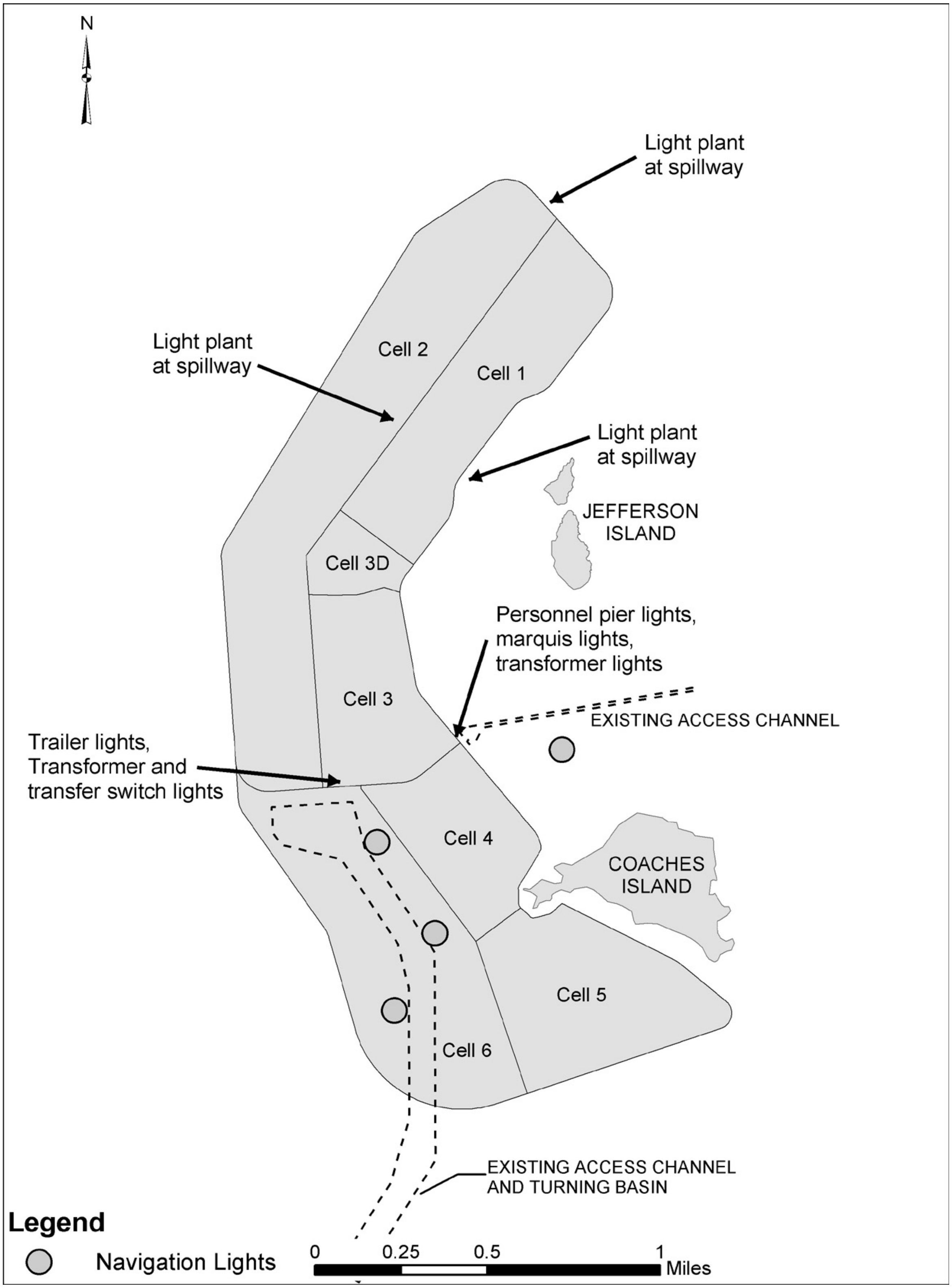
Island, low wattage dock lights, signage, lights on pilings or posts marking marinas and entrance channels, and lights associated with the PIERP.

- *Glare* – Light emitted at an intensity great enough to reduce a viewer's ability to see, and in extreme cases causing momentary blindness
- *Light trespass* – Light that shines beyond the boundaries of the property on which it is located and onto areas where it is unwanted or interferes with land use

3.1.11.a Current Temporary Light Levels Associated with the PIERP Inflow operations at the existing PIERP are expected to continue to 2015 (Appendix A, Attachment C) and therefore have the potential to generate nighttime light through that period. Nighttime activities associated with the existing island project are currently limited to inflow operations. During inflow (September through March, depending on the yearly dredging need), spillways on the island are lit by a mobile, adjustable-height units containing four 1000-Watt mercury vapor bulbs, which may be set at a maximum height of 12 ft and are shielded. Similar lights are used at the unloader and all outflow points. Barges delivering dredged material are required to have a masthead light, visible for three to five miles depending on barge length (U.S. Coast Guard, 1999). The masthead light shines horizontally in all directions when the boat is at anchor and therefore is likely to cause some light trespass to neighbors in residences or boats.

Other lights continuously in use at the PIERP are (1) red and green navigation lights in Poplar Harbor and in the channel in the southwest cell (Cell 6) of the island, which are designed to be seen for 2 nautical miles, (2) a dozen low-wattage incandescent lights used on trailers, and (3) 300-Watt incandescent lights, directed downward along the personnel pier (6 lights) and on the island near the pier (2 pairs of 2 lights) (Figure 3-25). This level of lighting would not be expected to produce glare that would interfere with activities near the island. Lights are visible to houses along the shoreline and boaters.

Lighting at the PIERP was used to judge probable light sources associated with the new phases of construction (Tables 3-13 and 3-14). Much of the on-site light levels are specified by the USACE safety manual and American National Standards Institute (ANSI) regulations and are, therefore, not flexible. Brightness of navigation lights are mandated by the U.S. Coast Guard and are typically designed to be visible for 2 miles. Lights on barges must be visible for 3-5 miles depending on size of the barge, and mast lights should be visible from 360° when boats are at anchor (U.S. Coast Guard, 1999), such as when offloading dredged material.



Note: light plants at spillways are mobile; therefore, this configuration is subject to change

Figure 3-25. Existing lights at Poplar Island

Table 3-13. Lights used during operations at the PIERP

Location	Lights (#)	Wattage	Type	Height	Shielded?
Personnel pier	6	300 W	Incandescent	10 ft above dock	Yes, Down
Welcome marquis	2	300 W	Incandescent	12 ft	Yes, Down
Transformer at trailer complex	2	300 W	Incandescent	12 ft	Yes, Down
Building complex	6	60 W	Incandescent	7-8 ft	Yes
Transfer switch	1	60 W	Incandescent	5 ft	Yes
Navigation lights – buoys	1	2-4 candela	Incandescent		No
Navigation lights – Cell 6	3	2-4 candela	Incandescent		No

Table 3-14. Lights Used During Inflow at the PIERP

Location	Lights (#)	Wattage	Type	Height	Shielded
Spillway 1	4	1000 W	Mercury vapor	~12 ft	Yes
Spillway 3	4	1000 W	Mercury vapor	~12 ft	Yes
Spillway 4	4	1000 W	Mercury vapor	~12 ft	Yes

3.1.11.b Future Light Levels Associated with the PIERP Completion of the PIERP will include the construction of permanent structures on the island. An operations building and a maintenance building will be located next to each other on the east-west dike between Cells 3 and 6. The buildings will have exterior lights of two types distributed around their exteriors (Table 3-15). The 100-Watt metal halide lights to be used at the operations building will be located under the overhangs over several patios and will shine downward. The flagpole will be located next to the operations building on its east side. Lights aimed upward to illuminate the flag will be located on opposite sides of the flagpole.

Table 3-15. Future Exterior Lighting at the PIERP Operations and Maintenance Buildings

Location	Lights (#)	Wattage	Type	Height	Shielded (yes/no)
Operations building	7	250	Metal halide	9 ft above ground	No
Operations building	7	100	Metal halide	Under overhangs	Yes
Maintenance building	12	250	Metal halide	9 ft above ground	No
Flagpole	2	150	High pressure sodium	Ground level	No

3.1.12 Hazardous, Toxic, Radioactive Wastes (HTRW), and Unexploded Ordnance (UXO)

Federal regulations require documentation of all hazardous, toxic, and radioactive wastes that generally present a threat to human health and the environment through repeated and accumulated exposures to certain contaminants above acceptable exposure limits. The PIERP has three 8,000-gallon diesel fuel tanks and nine other oil storage tanks with a total storage volume of all tanks equaling 27,320 gallons. All of the storage tanks are located above ground. The 8,000-gallon tanks are double walled and equipped with leak detection systems. The fuel farm is currently located along the longitudinal dike section that separates the southern portion of Cells 2 and 3 from Cell 6 (Figure 3-26). The fuel farm will be relocated to the end of the longitudinal dike in the southern portion of Cell 6 in the future (Figure 3-26). The possibility of the tanks leaking and causing a spill is remote. In the event of a leak, the spill would flow either southward toward Cell 6 or northward toward Cell 3. Future plans for Cell 6 call for completing the construction of the dike to fully enclose the cell and would therefore contain all spills within the cell. Cell 3 is currently an operating cell and is therefore fully enclosed by dikes, which would contain any spills. The other smaller fuel tanks are in the same area as the 8,000-gallon tanks and the flow of spills would act similarly (MES, 2003b).

A Spill Prevention Control and Countermeasure (SPCC) Plan has been prepared for the PIERP to comply with applicable requirements of EPA Regulations on Oil Pollution Prevention regulations contained in Title 40, Code of Federal Regulations, Part 112 (40 CFR 112) and COMAR 26.10.03. The SPCC plan is required for facilities that could discharge oil into or upon the navigable waters of the United States, and have a total above ground storage tank capacity that exceeds 1,320 gallons. The PIERP is equipped with spill control equipment such as spill kits, booms, pumps, leak detection systems, and level indicators. Furthermore, inspections are performed daily to check fuel levels and for possible leaks. The PIERP facility also has operating personnel on site at all times maintaining surveillance of the site (MES, 2003b).

Meetings are held routinely to assure that personnel are familiar with the SPCC Plan, safety and emergency procedures, and fuel tank farm operations and maintenance procedures. In case of a spill or other emergency situation, the emergency coordinator shall immediately activate internal facility alarms or communication systems and notify appropriate Federal, State, and local agencies. Spills that discharge more than 1,000 gallons of fuel oil into or upon navigable waters or adjoining shorelines in a single event, or two or more discharges of over 42 gallons in any 12-month period are reported to the USEPA and MDE. In addition, an oil spill from the site that discharges into a storm drain, penetrates into the groundwater, or enters any body of water shall be reported immediately to the MDE Emergency Response Division (MES, 2003b).

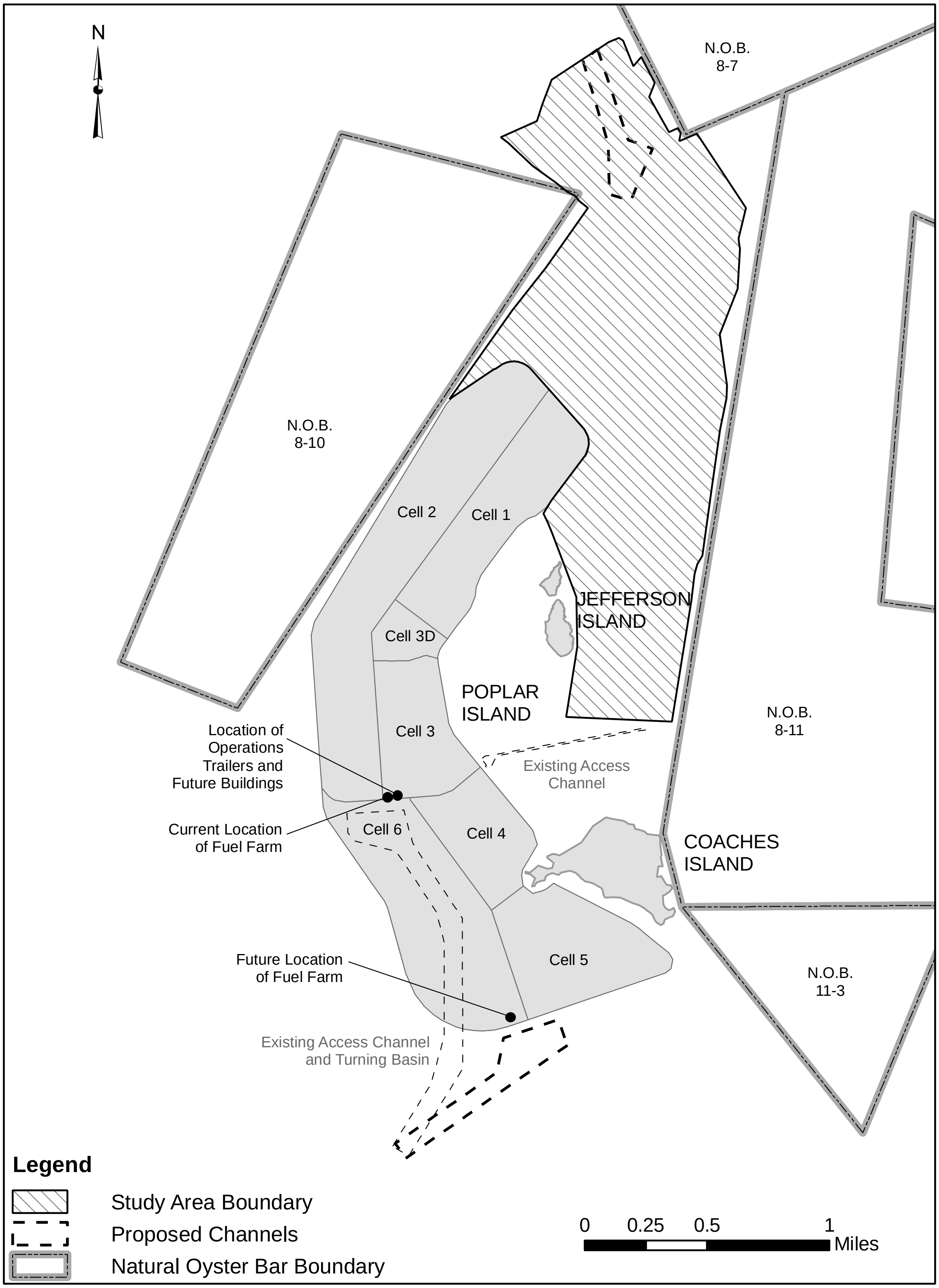


Figure 3-26. Location of Fuel Farm and Operations Building

Unexploded ordnance (UXO) consists of any munitions, weapon delivery system, or ordnance items that may contain explosives, propellants, and/or chemical agents and that are armed or remain unexploded. All UXO present a potential hazard and can appear intact, in parts or in fragments. UXO presents an immediate risk of acute physical injury from fire or explosion resulting from accidental or unintentional detonation. All shapes, size, and types of explosive ordnance may have been used in the Chesapeake Bay region, and may potentially be encountered during the dredging of channels and anchorages. Small UXO, including hand grenades and projectiles have been occasionally deposited by hydraulic placement at containment facilities. Recent discovery of small UXO on Poplar Island, as a result of dredged material placement into Cell 2, was identified as WWI and WWII hand grenades. A total of 63 UXO were found in the south end of Cell 2, while excavating oyster shell from the inflow point. All UXO discovered during dredged material placement at Poplar Island has been and will be disposed of in accordance with safety protocols established by USACE and is outlined in the Poplar Island Site Safety and Health Plan.

3.1.13 Navigation/Transportation

The PIERP lies in shallow water and does not affect any commercial boat navigation routes. Outside of the Study Area and the Region of Influence, the major Chesapeake Bay shipping channel, which runs the length of the Chesapeake Bay mainstem and connects Baltimore Harbor with other East Coast and international shipping destinations, is located approximately 2 miles west of the expansion of the PIERP. There are several, smaller local navigation channels within the region of influence that support the commercial fishing in Talbot and southern Queen Anne's Counties and recreational boaters. Local commercial navigation routes used by watermen exist in the vicinity of the project.

Use of the Study Area by commercial fishermen is addressed in 3.3.3.b, and use by recreational fishermen is addressed in Section 3.4.1.a.

3.1.14 Coastal Zone Management

The Coastal Zone Management Act of 1972 (CZMA) was enacted by Congress to encourage States to protect, preserve, develop, and, when possible, restore or enhance valuable natural coastal resources. The CZMA is a Federal law requiring Federal projects in the coastal zone (or affecting the coastal zone) to determine that they are consistent with Federal, State, and local laws relating to the coastal zone. The CZMA of 1972 gives States with Federally-approved coastal programs (including Maryland) the lead in coastal zone management activities of all levels of government. Specifically, the CZMA gives State coastal programs the ability to require Federal agencies to carry out their activities within the coastal zone in ways that are consistent with the State costal program's policies.

The State of Maryland's Coastal Zone Management Program (CZMP) is a comprehensive and coordinated program, based on existing laws and authorities, for the protection, preservation, and orderly development of the State's coastal resources. MDNR is the lead agency for the State's CZMP. The Chesapeake Bay Critical Area Protection Program is one example of a

Maryland State program passed to support the CZMA (see detailed discussion below in Section 3.1.16).

Because the PIERP is located in the Chesapeake Bay, the CZMA is applicable and a coastal zone Federal consistency determination is required for the proposed project. The CZMA Federal consistency applies to Federal actions, including the proposed expansion of Poplar Island, as stated in the Annotated Code of Maryland [§307(c)(1) and (2) and 15 CFR part 930, subpart C]. A coastal zone consistency determination was applied for through MDE for this project (will be included in Appendix F after MDE responds to draft SEIS) to ensure compliance between the Federal, State, and local coastal zone management programs.

3.1.15 Coastal Barriers

The Coastal Barriers Resource Act of 1982 (CBRA), PL 97-348, was enacted to "minimize the loss of human life, wasteful expenditure of Federal revenues, and damage to fish, wildlife, and other natural resources associated with coastal barriers along the Atlantic and Gulf of Mexico coasts" (USFWS, 2004b). The Coastal Barrier Improvement Act (CBIA), passed in 1990, tripled the size of the established CBRA and included additional areas, such as secondary barriers within large embayments. Coastal barriers are landscape features that shield the mainland from the full force of wind, wave, and tidal energies (USFWS, 2004b). The barriers can take on a variety of forms including islands or spits and may be described by their relationships to the mainland as bay barriers, tombolos, barrier spits, and barrier islands. The USFWS service is responsible for maintaining the official maps of the Coastal Barrier Resources System, referred to as Coastal Barrier Resource System Map Units.

Coastal barriers may include barrier islands, which are coastal barriers completely detached from the mainland. Examples of mapped coastal barrier islands in the Chesapeake Bay include Holland Island, Barren Island, and Deal Islands (USFWS, 2004b). The PIERP is not currently mapped as a barrier island and therefore the CBRA is not applicable to the project.

3.1.16 Chesapeake Bay Critical Areas

The Maryland General Assembly approved the Chesapeake Bay Critical Area Protection Program in 1984, because of concerns about the decline of certain natural resources of the Chesapeake Bay (Redman *et al*., 2003) and the need to implement the CZMA at the State level. The State of Maryland created a Critical Area Commission for the Chesapeake and Atlantic Coastal Bays. As a result, Talbot County established a local program to implement the requirements of the Act by enacting The Talbot County Chesapeake Bay Critical Area Plan in 1989. The Maryland Chesapeake Bay Critical Area Commission established the criteria required in this plan, with emphasis on directing new development to minimize impacts to water quality, plant, fish, and wildlife habitat (Redman et. al., 2003).

The critical areas in Talbot County include all lands and waters as defined in Title 8, Subtitle 18, Chapter 7 (8.18.07) of COMAR 2004. The critical area is normally defined as shoreline areas within 1000 ft of tidal waters and tidal tributaries. Specifically, the Critical Area includes "all waters of and lands under the Chesapeake Bay and its tributaries to the head of tides as indicated on the State wetland maps, and all State and private wetlands designated under Title 16 of the Environment" (State of Maryland Critical Area Commission, 2003). The PIERP falls under the Critical Area regulations outlined in COMAR, Title 27 – Chesapeake Bay Critical Area Commission, Subtitle 02 – Development In The Critical Area Resulting From State And Local Agency Programs (27.02) (Kerri Gallo, Critical Area Commission 2004). The PIERP was completed in compliance with the Maryland Critical Area Commission and was approved as being consistent with COMAR 27.02 (Kerri Gallo, Critical Area Commission 2004).

In addition to agency correspondence, the Chesapeake Bay Critical Area Commission, overseen by the MDNR, publishes Chesapeake Bay Critical Area Line maps for the State of Maryland with critical area designations. According to the most recent map (published in 2001), Poplar Island is currently designated as a "Wetland" area and a "State" area. The "Wetland" area includes "areas designated as wetland or open water that are not included within the Critical Area boundary line, although in some locations the wetlands are included within the Critical Area Line" (MDNR, 2001). These areas are also defined as tidal wetlands or tidal bodies of water from which the Critical Area boundary line was determined. Poplar Island also has a "State" designation "created specifically for the Poplar Island area to emphasize that that island still comes under the jurisdiction of Critical Area Legislation and, therefore, special exemptions were put into place for the Poplar Island Project" (MDNR, 2001). Both Jefferson and Coaches Islands are designated as "Wetland" areas and "Resource Conservation Areas" (RCAs). RCAs are "areas dominated by natural environments such as wetlands, forests, and abandoned fields or areas of resource utilization activities such as agriculture, forestry, fisheries or aquaculture; at the time of initial mapping, these areas had housing density less than one dwelling unit per five acres; and dominant land uses were agriculture, wetland, forest, barren land, surface water, or open space" (MDNR, 2001).

The State of Maryland's Chesapeake Bay Critical Area Protection Program would normally not apply to Federal projects. However, because the State of Maryland is a partner in the PIERP, the Chesapeake Bay Critical Area Protection Program is applicable. The State of Maryland Critical Area Commission conducts a review process of the project and drafts a staff report to determine consistency with COMAR 27.02 and to determine conditions of the project, if approval is granted during the review process. Appropriate coordination with the Commission has occurred and is included in Appendix F.

3.1.17 Floodplains

Floodplain Management, Executive Order 11988 issued May 24, 1977, and the U.S. Department of Agriculture (USDA) Department Regulation 9500-3 *Land Use Policy* directs all Federal agencies to avoid both long- and short-term adverse effects associated with occupancy, modification, and development in the 100-year floodplain, when possible. Specifically, growth in the floodplain should not be encouraged, unless there are no alternatives. Floodplain value and habitat should be protected. Floodplains are defined in the executive order as "the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum, that area subject to a one percent greater chance of flooding in any given year." The 100-year floodplain is described as a 1 percent chance in any given year that floodwaters will meet or exceed the base flood elevation. The Code of Talbot County, Maryland, *Chapter 70 – Floodplain Management*, includes the local floodplain development requirements and addresses approaches to floodplain management, including the issuance of permits by the County (Talbot County, 2004). Additional Federal and State programs concerned with floodplain management include the National Flood Insurance Program (44 CFR 59-79); the State Waterway Construction Permit Program for Nontidal Floodplains; the State Tidal and Nontidal Wetlands Permit Programs; the USACE Sections 10 and 404 Permit Programs; and the Maryland Coastal Zone Management Program

The Poplar Island archipelgo, Jefferson, and Coaches Islands are located completely within the 100-year floodplain, as described in the 1985 Flood Insurance Rate Map (FIRM). A FIRM map with the updated PIERP configuration is not available. The 100-year floodplains mapped on the islands include Zone V8, Base Flood Elevation (BFE) 9, which is the height of the base flood, in feet, in relation to the National Geodetic Vertical Datum of 1929 (FEMA, 1985). Zones V1 to V30 are areas of the flood insurance rate zone that correspond to the 100-year coastal floodplains that have additional hazards associated with storm waves, referred to as the Coastal High Hazard Area. The base flood elevations (BFEs) or depths and flood hazard factors have been determined within this zone, described as elevations. Furthermore, any development in the 100-year floodplain zones V1 to V30 requires a variance to the County's Floodplain Management Regulations.

Because the Federal government is self-insured, flood insurance is not necessary for the PIERP and a variance to the County's Floodplain Management Regulations is not applicable.

3.1.18 Wild and Scenic Rivers

The Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) was passed on October 2, 1968. It declares that certain "selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments, shall be protected for the benefit and enjoyment of present and future generations." There are no designated wild and scenic rivers on the PIERP. In addition, there are no streams on the National Park Service's Nationwide Inventory, Final List of Rivers, potential Scenic Rivers or existing or potential State Scenic Byways on the PIERP.

3.1.19 Prime and Unique Farmland

The Farmland Protection Policy Act (FPPA) authorized USDA to develop criteria for identifying the effects of Federal programs on the conversion of farmland to non-agricultural use. USDA Land Use Policy designates prime farmland as land with the definitive combination of both the "physical and chemical characteristics for producing (and its use is available) for food, feed, forage, fiber, and oilseed crops." In general, prime farmland has the necessary and essential combination of soil quality, growing season, and moisture supply needed to produce economically, sustained high yields of crops when treated and managed according to acceptable farming methods. In addition, unique farmlands are classified by

USDA as any land other than prime farmland that is used for the "production of specific high-value food and fiber crops." According to the FPPA, farmland (either prime or unique) does not include farmland already "in or committed to urban development." The FPPA does not apply to the PIERP because none of the soil types are considered farmland.

3.2 CULTURAL RESOURCES

3.2.1 Prehistoric and Historic Background

Previous cultural resource investigations conducted for the PIERP (RCG&A, 1994; 1995; and 1996) contain detailed information on the prehistoric and historic background of the project area, as well as the history of previous cultural resource investigation in the region. Additional cultural resources studies were conducted in 2003 and 2004 to characterize the cultural resources in the Study Area (RCG&A 2004; 2005).

The earliest map to show clearly the configuration of the Poplar Island group is the US Coast Guard 1846-1847 Map of the Eastern Shore of Maryland, from Wade's Point to Low's Point, including Poplar and Sharps Island (Figure 3-5). The map shows that by the mid 1800s Poplar Island was separated from what would become Coaches Island by a thin neck of land, and that Jefferson Island was already separate, even though it is not labeled on the map. Figure 3-27 shows a series of historic maps with the approximate 1994 Poplar Island configuration superimposed over them.

<u>3.2.1.a Prehistoric Background</u>. Although little is known about the prehistoric cultural activity on Poplar Island, occasional discoveries of prehistoric stone tools and the application of regional settlement and activity models indicated the likely use of the island during Native American occupation of the region.

The earliest evidence of prehistoric activity on Poplar Island occurred during the Early Archaic Phase (8,500 – 6,700 BC). The Native American groups in the area were no longer able to subsist exclusively on large game animals and were beginning to diversify by foraging into interior wetlands for small game animals and plants. The discovery of stone tools in the poorly drained interior wetlands on Poplar Island was evidence of this procurement shift.

The earliest clear evidence for prehistoric occupation of Poplar Island dates to the Late Archaic Period (3,000 – 1,000 BC), when the earliest attempts were being made to cultivate crops, and a larger focus was given to the collection of shellfish. Remnant oyster shell middens on Poplar Island suggest that this was one of the many important harvesting sites in the Chesapeake Bay. One prehistoric site, 18TA218, was identified in the northwestern corner of the South Central Poplar Island Remnant (Lowery, 1992) (Figure 3-5). Artifacts recovered from the site suggest that it was probably was a short-term resource procurement site dating from the Late Archaic and Middle Woodland periods. The Phase I investigation of this site in 1994 (RCG&A, 1994) indicated that no further investigations were needed, and that the site was not eligible for the National Register of Historic Places. The South Central Poplar Island Remnant is now located within the perimeter dikes of the existing PIERP.

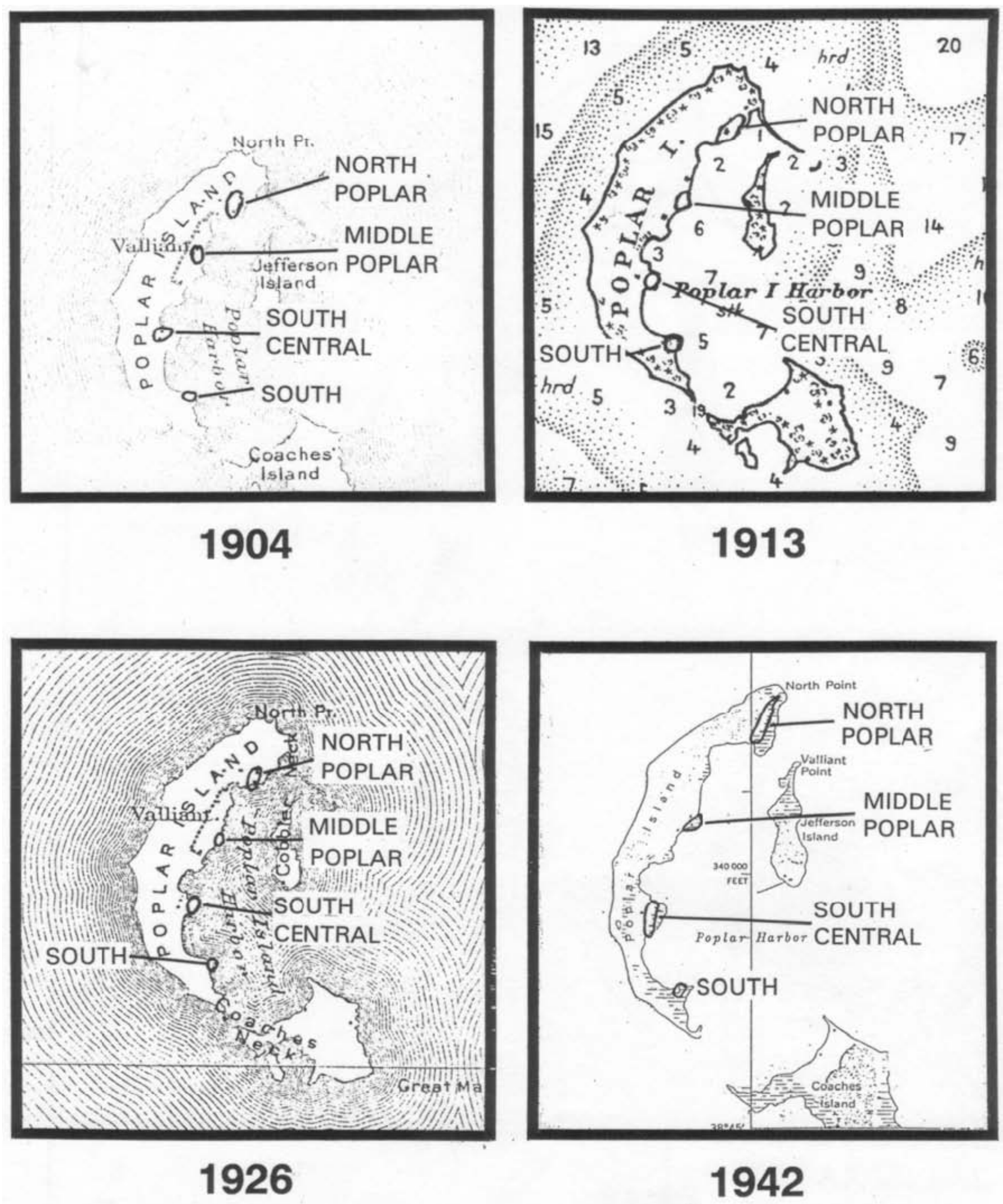


Figure 3-27. Excerpts from 1904 USGS; 1913 Coast and Geodetic Survey; 1926 Coast and Geodetic Survey; and 1942 USGS maps of Poplar Island, with overlays of the approximate configuration of the Poplar Island Group in 1994 (*Source: RCG&A, 2004*).

The Woodland Period, from 1,000 BC to 1,400 AD, witnessed the development of stable prehistoric communities based on agriculture, which was supplanted by small game and shellfish that could be relatively easily and consistently collected with a minimum of effort. It appears likely that Poplar Island continued throughout this period as an important food resource for coastal populations, but there was little to no evidence of any stable, long standing occupation of the island.

3.2.1.b Prehistoric Occupation of the Poplar Island Group. Two previously recorded prehistoric sites were located on the shoreline of Coaches Island (Lowery, 1992; 1995). Both sites are multi-component sites with evidence of occupation from the Archaic through Late Woodland periods. An eroding shell midden associated with a Woodland occupation was identified at one site, and the sites likely functioned as resource procurement sites and as micro-band base camps (Lowery, 1992). North Point Island contained one previously recorded archeological site that was thought to date from the Early Archaic through the Late Woodland period. This site has probably been lost to erosion. Middle and South Poplar Islands each contained a prehistoric archeological site, and a shell midden was reported on Middle Poplar Island. The sites on these islands ranged in age from the Early Archaic through Middle Woodland periods, and probably represent short-term procurement sites.

3.2.1.c Historic Background. During the historic period, ownership of Poplar Island is dated as early as 1631, and occupation dates to the establishment of a farm on the island by Richard Thompson in 1634. Throughout the seventeenth and eighteenth centuries, the island was largely owned by one individual at a time, and provided sufficient landmass to support farming, mainly tobacco. As late as the mid-19th century, Middle Poplar Island was cleared of vegetation and was used for limited farming.

By the nineteenth century, the increase of the viability of the shellfish market in the Maryland Tidewater led to the eventual abandonment of Poplar Island as a location of permanent farming, replaced by transitory hunting and fishing activities which continued into the 20th century. In the late 19th century the land was leased to individuals with the sole purpose of establishing oyster beds around the islands. A map of 1914 illustrates a small community of approximately 10 homes, a post office, school house, and graveyard on the island, with oyster bars clearly associated with the occupants of the island (RCG&A, 2004). Additionally, the use to the Poplar Island area as a favorite fishing location, combined with the numerous shoals which surrounded the island, resulted in a number of known and potential shipwrecks around the island.

However, during the mid to late 20th century, sea level rise and increased erosion throughout the Bay led to the original Poplar Island becoming broken into a chain of three islands, with much of the 19th century land mass was simply washed into the Bay. Although Poplar Island was inhabited during both prehistoric and historic times, no standing structures survived to the end of the 20th century. In the 1990s, prior to the ongoing restoration project, the islands had served primarily as isolated conservation land for use by wildlife.

3.2.1.d Historic Occupation of the Poplar Island Group. Archaeological evidence of the historic occupation of the island group was identified on both Middle and South Central

Islands. On Middle Island, a well shaft, hand pump, and brick features and foundation piers were once observable. On South Central Island, a possible eighteenth to nineteenth century site was located on the western side of the island, as represented by the remains of a wooden structure. On the north end of the island, a site dating from the seventeenth and eighteenth centuries was identified. In addition to artifacts, the site contained a brick floor.

3.2.2 Previous Investigations

Cultural resource investigations were conducted prior to the construction of the existing PIERP (RCG&A, 1994; 1995; and 1996). The Phase I marine survey identified six target areas for which subsurface testing was recommended. Phase II marine investigations were later conducted, and four of the six anomalies were relocated and recommended for additional investigation. All of the four anomalies were mollusk beds, discrete geological deposits, and small concentrations of modern refuse that were determined ineligible for inclusion in the National Register of Historic Places. The remaining two anomalies could not be relocated, but were likely to be too small to be historically significant, buried, or were moved or destroyed by winds and tidal currents. None of the six targets were determined eligible to the National Register of Historic Places (RCG&A, 1996).

3.2.3 Phase I Survey Results for the Study Area

Phase I-level cultural resource investigations were conducted in 2004 in the Study Area and the southwestern sand borrow area (Figure 3-28). The investigations included background archival investigations and a marine archeological remote sensing survey. The marine archeological remote sensing survey utilized a differential global positioning system, a digital recording side scan sonar, a recording cesium vapor magnetometer, a fathometer, and hydrographic navigational computer software to identify and characterize potential cultural resources within the Study Area. The survey was conducted with a lane spacing of 50 ft (15.2 m) to ensure the greatest detail in coverage. The initial Phase I survey area consisted of approximately 2,000 acres immediately adjacent to the island. The survey was subdivided into five blocks, encompassing from 4.83 to 195.82 linear miles of survey trackline coverage. In total, approximately 353.66 linear miles (569.16 km) of seabed were surveyed around the PIERP (RCG&A, 2004). Two additional survey blocks located adjacent to the PIERP were later included for additional Phase I investigations. These blocks, called the North Block and the Jefferson Island Block, included an additional 51 linear miles of bay floor that was surveyed (RCG&A, 2005). The North Block and Jefferson Island Block were investigated using the same survey methods described above. A Phase II investigation of two targets, described below, was conducted at the same time as the additional Phase I investigation.

During the Phase I and Phase II cultural resource remote sensing surveys, numerous magnetic and acoustic anomalies were recorded (RCG&A, 2004 and 2005). The overwhelming majority of these anomalies were single source ferrous debris consistent with crab traps, ground tackle, and other modern materials lost in the waters around the PIERP. In some cases, multiple spatially overlapping anomalies were grouped into targets. Each of these targets was examined for characteristics consistent with submerged watercraft or other possible cultural resources.

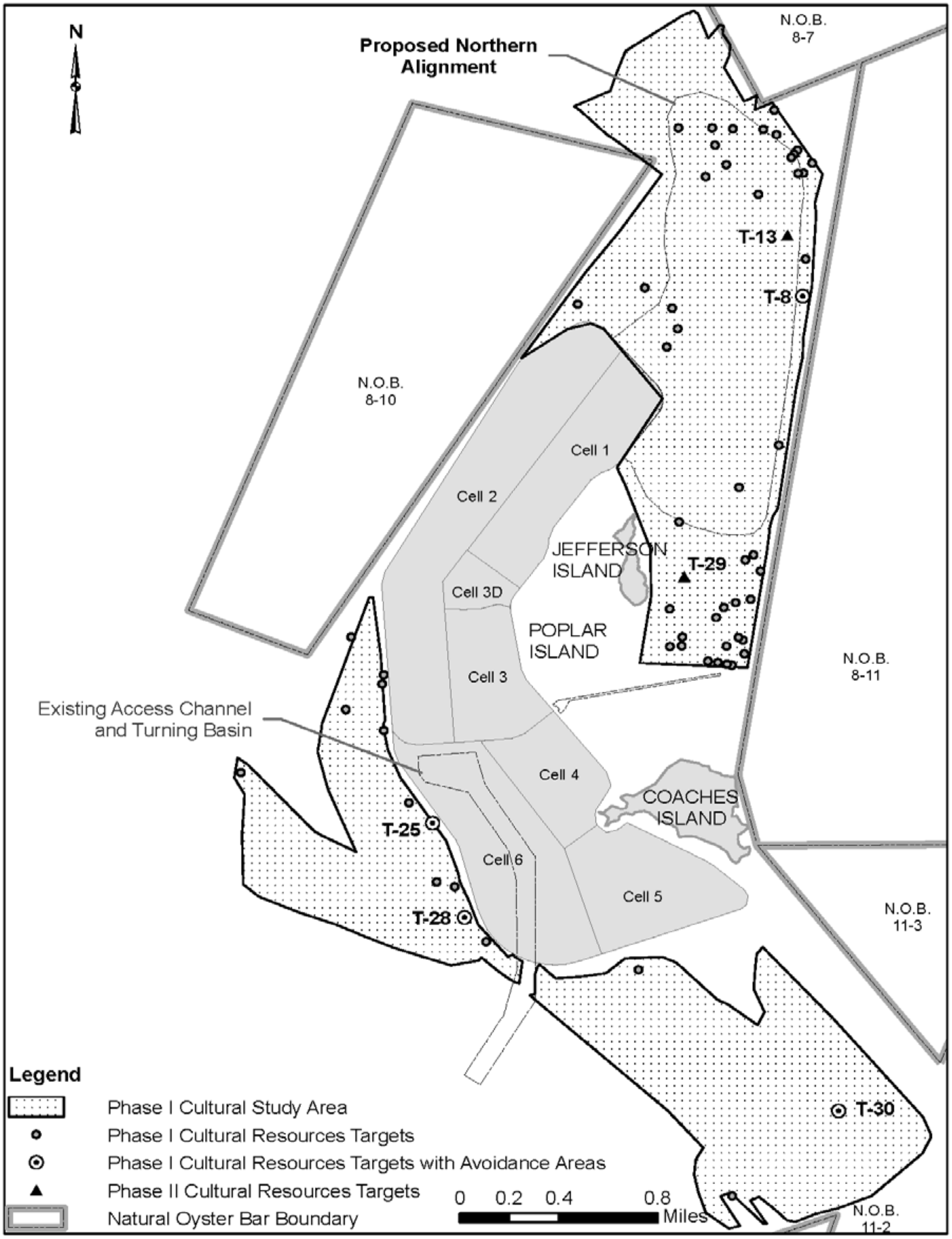


Figure 3-28. Cultural Resources Phase I and Phase II Survey Areas and Identified Targets

Anomalies that were identified as linear and non-linear ferrous debris, or defined as being geologic in nature, isolated debris, or related to the fishing industry, were excluded from further consideration as significant cultural resources. The remote sensing survey of the five original blocks, plus the North Block and Jefferson Island Blocks, resulted in the identification of six targets determined to have the potential to be significant cultural resources. A total of six targets were identified that could have represented archeological resources eligible for listing on the National Register of Historic Places. These anomalies were identified as Targets 8, 13, 25, 28, 29, and 30 (Figure 3-28), and are briefly described below. Magnetic contour maps and acoustic images of these targets can be found in *Phase I Cultural Resource Survey for the Poplar Island Expansion Supplemental Impact Statement (SEIS) Project* (RCGA, 2004).

Target #8 was made up of two magnetic anomalies, but there was no acoustic anomaly correlation in this location. Anomalies that have long durations and exhibit linear features typically represent geological features, such as changes in bathymetry. When this target was plotted spatially, the linear feature clearly followed a bathymetric contour where the water depth changes from 7 to 22 ft MLLW. However, the configuration of this target also is consistent with a possible cultural feature. An acoustic correlate may be masked by the bathymetric change.

Target #13 consisted of one magnetic anomaly and three acoustic anomalies. The acoustic anomalies associated with this target showed some type of wreckage or debris, with clear parallel slat-type objects. Target 13 had a complex magnetic signature, high amplitude, long duration, and a correlating unidentified acoustic image that indicated some type of wreckage.

Target #25 included five anomalies. The acoustic image showed an elongated area of high reflectivity measuring approximately 81 by 21 ft, with an unnatural feature at the end showing rounded edges and a linear feature in the center. This elongated anomaly could represent a portion of bank line or shoreline, as it is located directly next to the current shoreline. However, the irregular shape of the bank line's end suggested something other than a natural feature.

Target #28 had two magnetic anomalies and five acoustic anomalies. The magnetic contour plot shows a relatively complex magnetic perturbation measuring at least 100 ft in diameter. The most clear acoustic image shows three linear objects roughly parallel to one another with wreckage or debris strewn among them. The three linear objects appear to round towards one another at one end, which is typical of barge construction.

Target #29 had a single acoustic anomaly, and showed two linear objects with irregular protuberances extending up from the center. Measuring 25 ft in length, the object was thought to potential represent the floor and keel timbers from the hull of a wooden vessel.

Target #30 is composed of three magnetic anomalies and one acoustic anomaly. The acoustic image shows an area of high reflectivity measuring 46 by 30 ft. At least one rounded object can be seen that measures three feet in height.

3.2.4 Phase II Survey Results for the Study Area

Two of the six targets identified in the Phase I survey (Target #13 and Target #29) were further investigated using archeological diver investigation (RCGA, 2005). Target #13 was located on the northeast side of PIERP and was identified during the initial remote sensing survey conducted during December 2003 (Figure 3-28). Target #29 was located on the eastern side of Jefferson Island and identified during the additional Phase I survey (Figure 3-28). These targets were further investigated in a Phase II survey because the two anomalies were located within the areas proposed for the northern alignment.

The research objectives for the Phase II investigation were: (1) to relocate and identify both anomalies selected for investigation using archeological diver investigation; (2) to assess the significance of any identified cultural resources; and, (3) to provide management or treatment recommendations for said resources. These objectives were met through a combination of archival research and archeological investigations.

The Phase II diver investigations were completed in accordance with the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (NPS, 1983). The additional study areas were located on the northeast side of the PIERP in approximately 10 ft of water (Target #13), and on the east side of Jefferson Island in approximately 6 ft of water (Target #29). Each study area measured less than 100 ft in diameter.

Target 13 [Site 18TA380], identified during the initial remote sensing survey in December 2003, was located on the northeast side of the PIERP. The diving revealed a badly fragmented wooden shipwreck measuring approximately 15 by 50 ft. A detailed description of the shipwreck is provided in *Additional Phase I Cultural Resource Survey of Two Survey Blocks and Archeological Diver Investigation of Two Targets Adjacent to Poplar Island, MD* (RCG&A, 2005). The bow of the vessel had separated from the body, and lay 30 ft to the north at a 90^{o} angle to the linear axis of the wreck (Figure 3-29). The wreck has been identified as a possible schooner (bugeye or pungie), a vernacular vessel form typically seen on the Chesapeake Bay during the last quarter of the nineteenth century and into the twentieth century. This type of vessel is well documented in numerous sources; in fact, a handful of restored schooners currently exist in personal and museum collections. Because this boat form is well documented, and because it did not appear unique in any fashion, this poorly preserved wreck did not appear to be eligible for listing on the National Register of Historic Places. In addition, Target 13 did not meet any criteria set forth in the National Register criteria for evaluation, primarily because of poor site integrity (RCG&A, 2005). Based upon these findings, Target 13 was not eligible for the National Register of Historic Places, and no further archeological work was warranted or recommended.

Target 29 lay in six ft of water and was located a few hundred feet east of Jefferson Island. The acoustic image from the Phase I survey showed two linear objects with irregular protuberances extending up from the center. Measuring 25 ft in length, the object was thought to possibly represent floor timbers from the hull of a wooden vessel. Thus, it was recommended for further investigation. Upon entering the water, the diver immediately encountered two downed tree trunks lying adjacent to each other. Each trunk measured

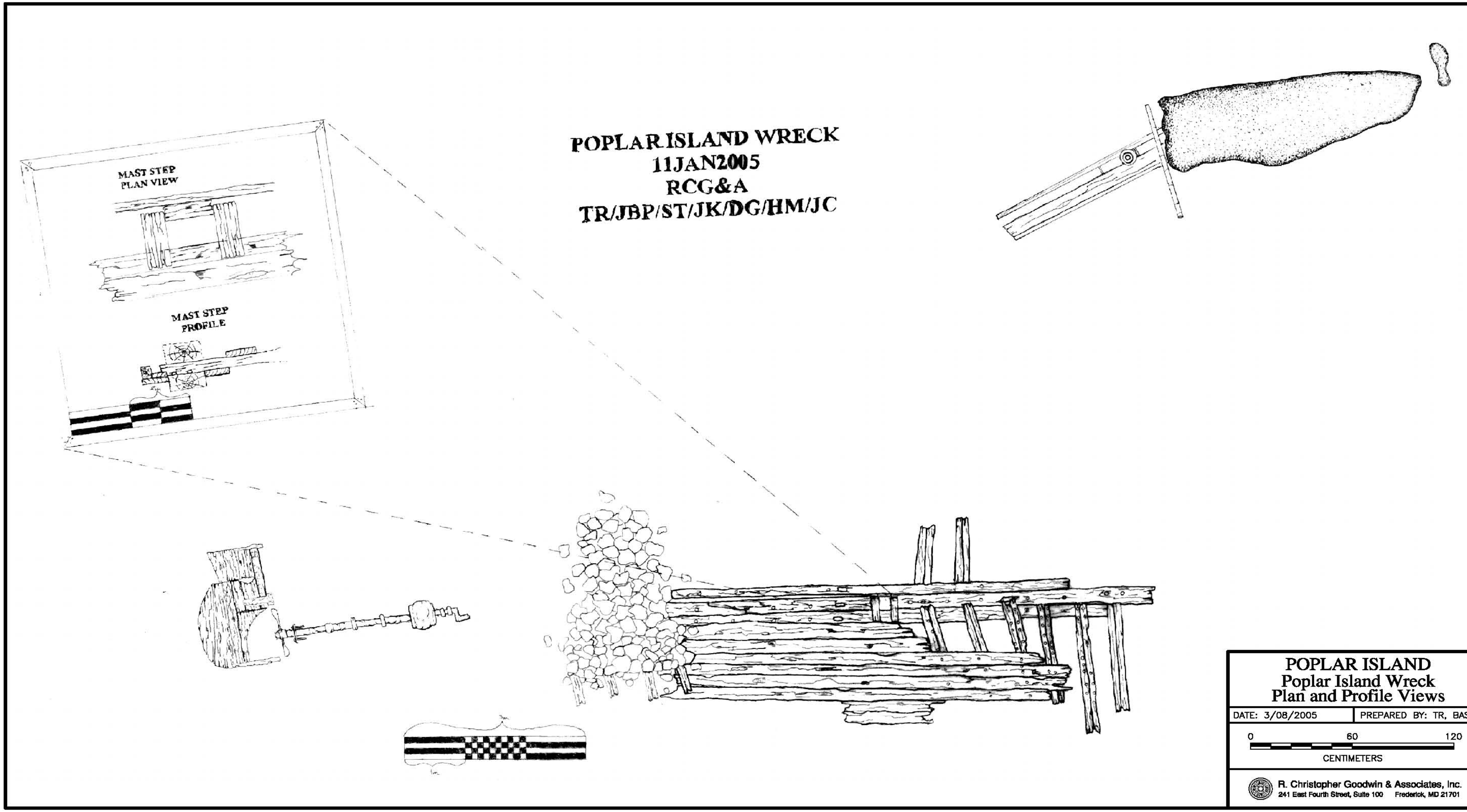


Figure 3-29. Site Map of the Poplar Island Wreck (*Source: RCG&A, 2005*)

approximately 25 ft in length and 24 inches in diameter. After the initial discovery, the diver searched in the vicinity of the two trees to ensure that no other objects were located near the marker buoy. The size, shape, and position of the two trees matched those seen in the acoustic record. This target proved not to be a cultural resource.

The Phase I and Phase II cultural resource investigations were conducted to comply with Section 106 of the National Historic Preservation Act (NHPA). Both informal and formal consultation was conducted with the State Historic Preservation Office (SHPO) to discuss the results of the surveys. Details of the coordination process are included in Chapter 9. Following the results of all surveys and agency coordination, the Maryland Historic Trust (MHT) makes a determination of the effect on historic properties or features (discussed in more detail in Chapter 5 and Appendix F).

3.3 SOCIOECONOMICS

3.3.1 Demographics

3.3.1.a Regional Setting The PIERP is located within Talbot County on Maryland's Eastern Shore and is near the border of Queen Anne's County to the north. The area surrounding the PIERP is rural with low population density relative to the State average. Talbot County's population accounts for less than 1 percent of Maryland's population, and has a low average population density of 125.6 persons per square mile (Table 3-16). Several of the county's demographic characteristics diverge from the State averages. The population includes a relatively high proportion of seniors, with 20.4 percent of persons aged 65 years or older. The county is predominantly white with much lower percentages of minorities and foreign-born individuals than the State. A below-average number of people hold Bachelor's degrees or higher degrees, compared to Maryland's total population, but an average number of residents have achieved high school graduation.

The county appears to be relatively wealthy based on per capita income, but fairly large income disparities exist in the county (Table 3-17). Per capita income, at $28,164, is higher than the State average ($25,614) and U.S. average ($21,587). However, median household income of $43,532 is well below the median State level of $52,868, but above the $41,994 median U.S. level. This difference between the average income per person and median income per household suggests that income is distributed unevenly across the population. According to 2000 data from Maryland Department of Planning and the IRS, "the top 20 percent of households in Talbot County controlled 54.9 percent of all aggregate income" which represents the highest income disparity in Maryland. Yet, the poverty rate is not high in the county, with levels slightly below the State levels. Home ownership rates are high at 71.6 percent and the median value of owner-occupied housing of $149,200 is $3,200 above the State level.

Table 3-16. Geographic and Population Characteristics for Talbot County Compared with Maryland State Characteristics

Geography	Talbot County	Maryland
Land area, 2000 (square miles)	269	9,774
Persons per square mile, 2000	125.6	541.9
Population, 2000	33,812	5,296,486
Population, percent change, 1990 to 2000	10.7 %	10.8 %
Persons under 5 years old, percent, 2000	5.2 %	6.7 %
Persons 5-17, percent, 2000	16.5 %	18.9 %
Persons 18-24, percent, 2000	5.6 %	8.5 %
Persons, 25-64, percent, 2000	52.4 %	54.6 %
Persons 65 years old and over, percent, 2000	20.4 %	11.3 %
White persons, not of Hispanic/Latino origin, percent, 2000	81.2 %	62.1 %
Black or African American persons, percent, 2000 (a)	15.4 %	27.9 %
Persons of Hispanic or Latino origin, percent, 2000 (b)	1.8 %	4.3 %
Living in same house in 1995 and 2000, pct age 5+, 2000	56.6 %	55.7 %
Foreign born persons, percent, 2000	3.3 %	9.8 %
Language other than English spoken at home, pct age 5+, 2000	5.7 %	12.6 %
High school graduates, percent of persons age 25+, 2000	84.4 %	83.8 %
Bachelor's degree or higher, pct of persons age 25+, 2000	27.8 %	31.4 %
Persons with a disability, age 5+, 2000	6,093	854,345
Mean travel time to work, workers age 16+ (minutes), 2000	22.4	31.2

Source: U.S. Census Bureau
(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

Table 3-17. Housing and Income Characteristics for Talbot County Compared with Maryland State Characteristics

Housing and Income Characteristics	Talbot	Maryland
Housing units, 2000	16,500	2,145,283
Homeownership rate, 2000	71.6 %	67.7 %
Housing units in multi-unit structures, percent, 2000	14.3 %	25.8 %
Median value of owner-occupied housing units, 2000	$149,200	$146,000
Households, 2000	14,307	1,980,859
Persons per household, 2000	2.32	2.61
Median household money income, 1999	$43,532	$52,868
Per capita money income, 1999	$28,164	$25,614
Persons below poverty, percent, 1999	8.3 %	8.5 %
Families below poverty, percent, 1999	5.3 %	6.1 %

Source: U.S. Census Bureau

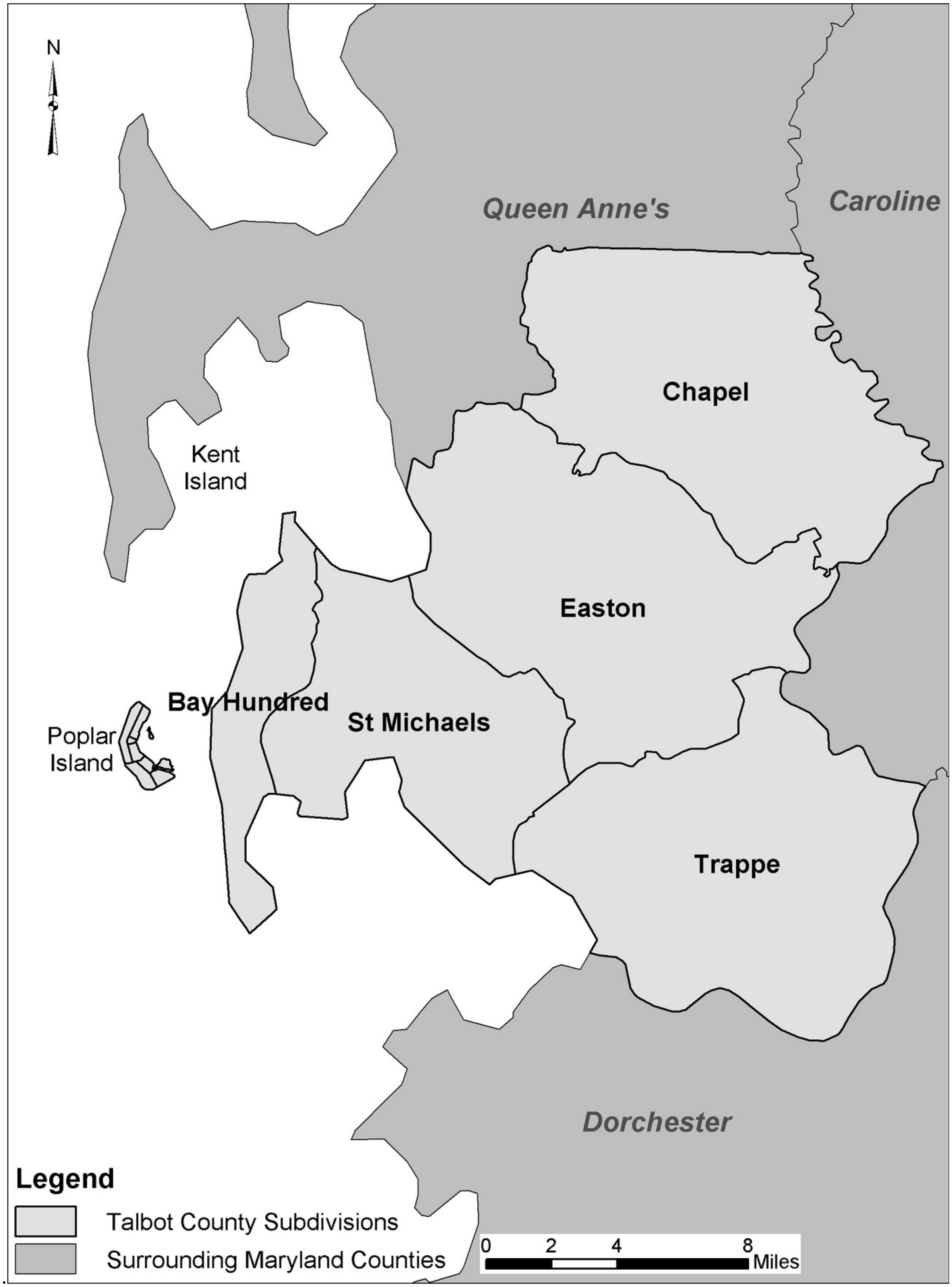
<u>3.3.1.b Local Setting and Population Growth</u> For the county subdivision of Bay Hundred (Figure 3-30), which encompasses the peninsula and island complex to the east of the PIERP, the population was 1,949 persons in 2000 (U.S. Census). The population density for Bay Hundred is similar to the Talbot County average of 120 persons per square mile. On Kent Island (Queen Anne's County) (see Figure 3-30), which has views of the PIERP, the population density is much higher, at 531 persons per square mile within the Kent Island county subdivision.

The population of Bay Hundred has remained fairly constant for the past 20 years (Table 3-18) and discussions with the Talbot County planning office officials (Moore Talbot County Planning, 2004) indicated that no major development is planned for that area. Overall, the county's population is expected to grow 9.4 percent from the 2000 level of 33,812 to 37,000 people in 2010 and continue to grow another 4.7 percent to 38,750 by 2020 (Maryland Dept. of Planning).

Table 3-18. Talbot County Regional Population Growth by County Subdivision, 1980-2000

County Subdivision	1980 Census	County Population (%)	1990 Census	County Population (%)	2000 Census	County Population (%)	1980-2000 % change
Easton	12,172	47.5	15,470	50.6	17,621	52.1	44.8
St. Michaels	4,639	18.1	5,298	17.3	5,527	16.3	19.1
Trappe	3,495	13.7	4,111	13.5	4,567	13.5	30.7
Chapel	3,337	13.0	3,755	12.3	4,148	12.3	24.3
Bay Hundred	1,961	7.7	1,915	6.3	1,949	5.8	-0.6

Source: U.S. Census Bureau



Source: U.S. Census, 2000

Figure 3-30. County Subdivisions of Talbot County

3.3.2 Employment and Industry

Consistent with the small population, Talbot County's economy is also small, accounting for roughly 1 percent of all private non-farm employment in Maryland (Table 3-19). The largest economic sectors in terms of the dollar value of output are the Services sector and the Wholesale and Retail Trade sector. The Services sector employed more than twice as many people as Wholesale and Retail trade in 2000, accounting for 35 percent of workers in the county compared to 14 percent (Table 3-20). The Manufacturing sector employed about 10 percent of workers, which was above the State average.

The 2003 annual unemployment rate was 4.2 percent, lower than the State unemployment rate of 4.5 percent. Annual unemployment rates in the county for 1994-2003 were consistently lower than the State's, but monthly unemployment showed a seasonal trend with unemployment peaking in January and February and surpassing the State level during those months. This likely reflects the seasonal nature of tourism-related jobs in the area.

The economy of Talbot County is tightly linked to commercial and recreational activities associated with use of the Chesapeake Bay. The two economic sectors that have the potential to be most affected by activity at the PIERP contain a higher proportion of workers than at the State level. The sector that includes Agriculture, Forestry, Mining and Fishing accounts for 3.5 percent of workers compared to 0.6 percent Statewide; and the Arts, Entertainment and Tourism sector accounts for 8.7 percent of workers compared to 6.8 percent Statewide. The total number of county workers in these two sectors is just under 2,000 full-time equivalents. The Services sector includes many jobs, particularly those of Accommodations and Food Service that are derived from Bay-related tourism.

Table 3-19. Business Characteristics for Talbot County Compared with Maryland State Characteristics

Business Characteristics	Talbot County	Maryland
Private non-farm establishments, 2001	1,485	129,301
Private non-farm employment, 2001	17,476	2,091,198
Private non-farm employment, percent change 2000-2001	3.4 %	1.6 %
Nonemployer establishments, 2000	3,398	322,819
Manufacturers shipments, 1997 ($1,000)	836,090	36,505,948
Retail sales, 1997 ($1,000)	457,504	46,428,206
Retail sales per capita, 1997	$13,977	$9,116
Minority-owned firms, percent of total, 1997	3.7 %	20.6 %
Women-owned firms, percent of total, 1997	22.8 %	28.9 %
Housing units authorized by building permits, 2002	387	29,293
Federal funds and grants, 2002 ($1,000)	212,425	49,537,440
Annual Unemployment, 2003	4.2 %	4.5 %

Source: U.S. Census Bureau

Table 3-20. Employment by Sector for Talbot County in 2000.

Region	Employed Civilian Population	Agriculture, Forestry, Mining, Fishing (%)	Construction (%)	Manufacturing (%)	Wholesale & Retail Trade (%)
United States	129,721,512	2,426,053 (1.9%)	8,801,507 (6.8%)	18,286,005 (14.1%)	19,888,473 (15.3%)
Maryland	2,608,457	16,178 (0.6%)	181,280 (6.9%)	189,327 (7.3%)	345,960 (13.3%)
Talbot County	16,208	567 (3.5%)	1,532 (9.5%)	1,632 (10.1%)	2,367 (14.6%)

Source: U.S. Census Bureau

Region	Transportation & Utilities (%)	Information & Finance (%)	Services (%)	Arts, Entertainment & Tourism (%)	Public Administration (%)
United States	6,740,102 (5.2%)	12,931,536 (10.0%)	44,225,526 (34.1%)	10,210,295 (7.9%)	6,212,015 (4.8%)
Maryland	127,294 (4.9%)	289,510 (11.1%)	1,007,608 (38.6%)	177,341 (6.8%)	273,959 (10.5%)
Talbot County	537 (3.3%)	1,535 (9.5%)	5,750 (35.5%)	1,414 (8.7%)	874 (5.4%)

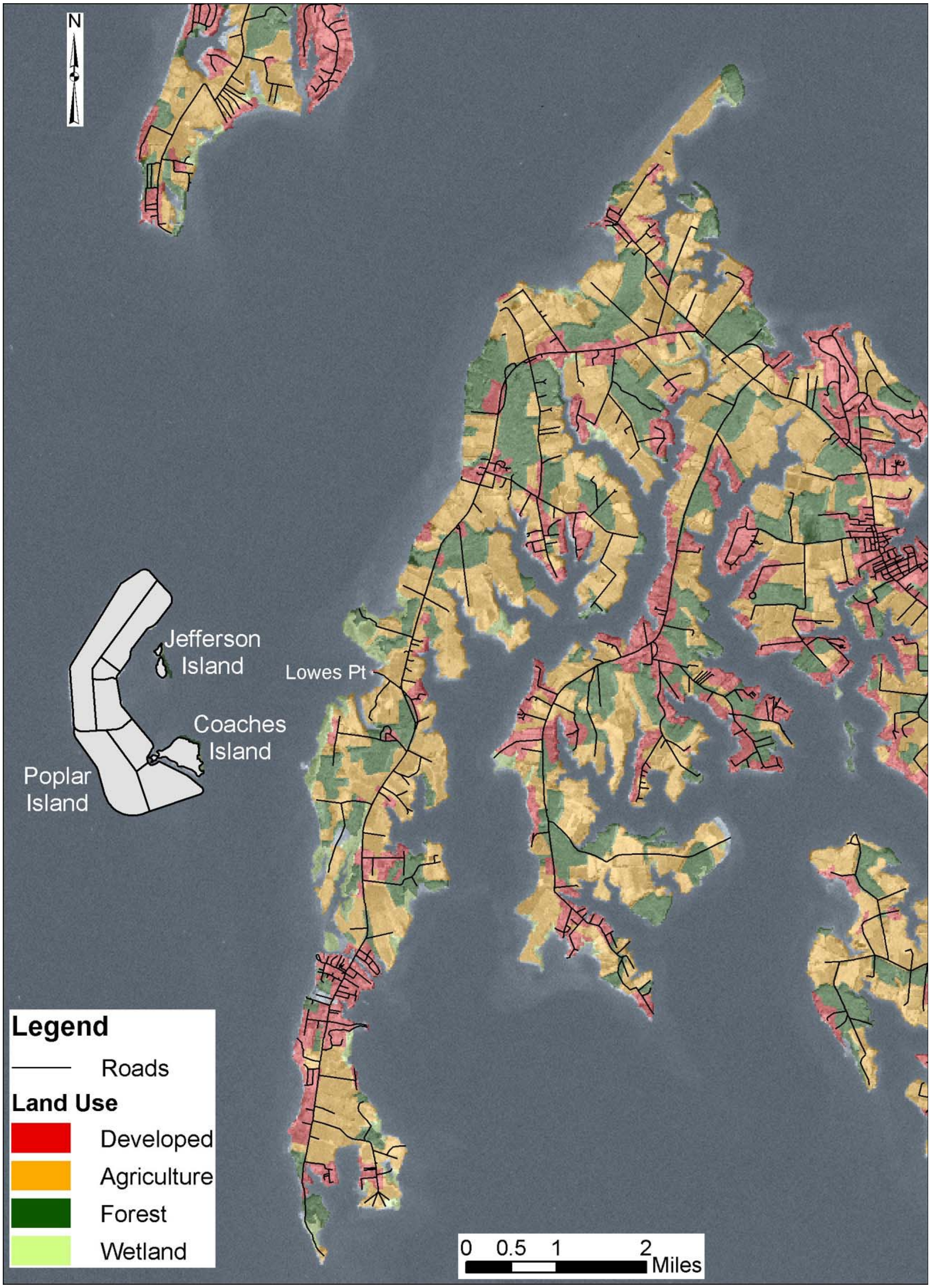
Source: U.S. Census Bureau

3.3.3 Land and Water Use

3.3.3.a Local and Regional Land Use Land use along the mainland in the proximity of the PIERP is predominantly agricultural or open fields, wooded patches, low-density residential land use and limited commercial uses (Figure 3-31). The area along the shoreline facing the PIERP is privately owned and includes little public access. Access along the shore to non-residents is limited to one common-access viewing spot roughly 2 1/2 miles from the proposed Study Area, at the end of Bay Shore Road. This site is not developed for public access and is not marked with signs. A private marina provides the only water access on the adjacent shoreline. The 1,140-acre the PIERP currently being developed is publicly owned and will eventually support natural land cover of wetlands, scrub-shrub lands and forests.

In the future, the open agricultural areas on the shoreline area adjacent to the PIERP, have the potential to be subdivided and converted to residential uses, which would increase the number of residences in proximity to the project. To evaluate the potential scope of future development, a survey of recent real estate transactions and current sale listings of parcels greater than five acres was conducted. The results indicated that several parcels with views of the proposed lateral expansion have recently been sold or are currently on the market. These lots varied in size from 21 to 68 acres, and some are improved while others are completely undeveloped. Two of the parcels are on the Bay, with a combined total of 2,700 ft of shorefront. Another parcel that recently sold was an unimproved 68-acre parcel, with no development rights, so no more than one dwelling could be built on it. While potential for subdivision and development of the other parcels exists, it was not possible to ascertain how these parcels will be used in the future. When contacted, the Talbot County planning office described only one major waterside project in the county. That project, in Easton, is a school for the training of merchant marines and is not expected to be affected by the expansion of the PIERP.

In areas farther away from the project, land use is more intense. Inland, the central business district of Talbot County is Easton, which has higher population density than the shoreline, and well-developed commercial zones (Figure 3-31). In Queen Anne's County, Kent Island is the only land area close to the proposed Study Area, and that island is dominated by low to medium-density residential and commercial areas. Several large agricultural parcels were sold in 2004 to corporations suggesting that some agricultural land may soon be converted to residential development. Potential development of these recently sold parcels would not be in view of the PIERP, but this potential development does suggest that some infill may occur in Talbot County in the near future.



Source: Maryland Department of Planning, 2002.

Figure 3-31. Land Use Near Poplar Island

3.3.3.b Water Use The waters in the vicinity of the PIERP are used by recreational and commercial vessels and vessels engaged in research and education. Two common recreational boating destinations, St. Michaels and Oxford are along the two rivers whose mouths are to the North (Miles River) and South (Choptank River), respectively, of the peninsula adjacent to PIERP (Figure 3-32). Recreational boaters from all along the Bay and beyond seek out these picturesque and historic towns. Many recreational boaters, therefore, pass east or west of the PIERP to reach these destinations. The channel to the east of the PIERP is a popular route for vessels traveling between Knapps Narrows/Choptank River and Kent Island/Eastern Bay. The PIERP is also a tourist destination itself, although visits to the island are scheduled and supervised by MES.

Future recreational water use would be expected to follow trends for tourism in general. Tourism in Talbot County, as in Maryland overall, has been holding steady following the post-September 11, 2001 decline (Maryland Office of Tourism Development, 2003). Certain recreational water uses are either declining slightly or holding steady, depending on which statistics are used (USFWS, 2001c). The number of participants in fishing has declined nationwide, although the number of fishing days has recently increased. Hunting participation nationwide is down slightly overall, but waterfowl hunting is holding steady. The statistics for Maryland show no significant change in either hunting or fishing participation in recent years.

Major commercial water users include fishermen, workers involved in the operations and maintenance of the PIERP, and shipping boat operators. A major shipping channel, which runs the length of the Bay mainstem and which connects Baltimore Harbor with other East Coast and international shipping destinations, is about 2 miles west of the Study Area.

Fishing, crabbing, and shellfishing are common activities in the waters surrounding the PIERP (Figure 3-33). Commercial watermen set pound nets, gill nets and crab pots in the waters surrounding the PIERP and boats have historically worked the clam and oyster bars when abundance has been sufficient. Striped bass and menhaden provide the bulk of the value of the finfish catches for the region. However, blue crabs are currently the highest value commercial fishery within the Bay and the waters around the PIERP are used extensively by watermen for setting crab pots. The value of finfish catches for the South Central waterbody segment (Sandy Point south to Cove Point, as defined by MDNR) has held steady for the past 6 years (Table 3-21), while the blue crab catch value has declined slightly.

Winter crab abundance is dependent on water depth and salinity. The range of water depth in the vicinity of Poplar Island is -6 to -10 ft (-1.8 to -3 m). During 1992 to 2000, crab densities in the Mid-Bay during the winter at depths of less than 40 feet, ranged from 2.46 (2000) to 20.11 (1996) crabs/1,000 m^2. In addition, from 1992 to 2000, the crabs captured at depths of less than 40 feet, comprised 0.70 percent (1998) to 3.28 percent (1992) of all crabs captured Baywide during the study. This represents 0.23×10^{-5} percent to 0.88×10^{-5} percent of the average estimated Baywide blue crab population during 1991-1997. Therefore, this region does not constitute a large component of overwintering crab habitat.

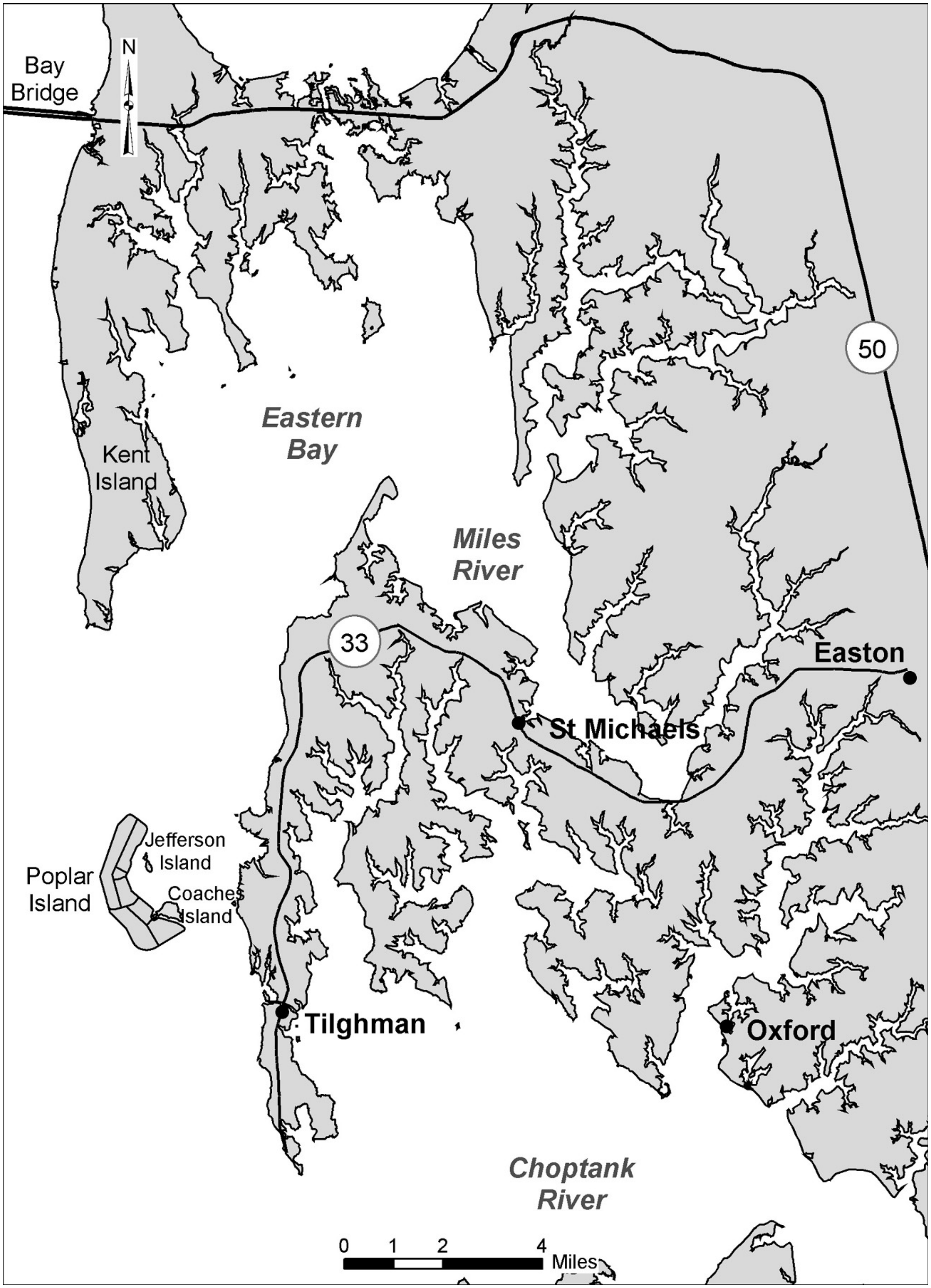
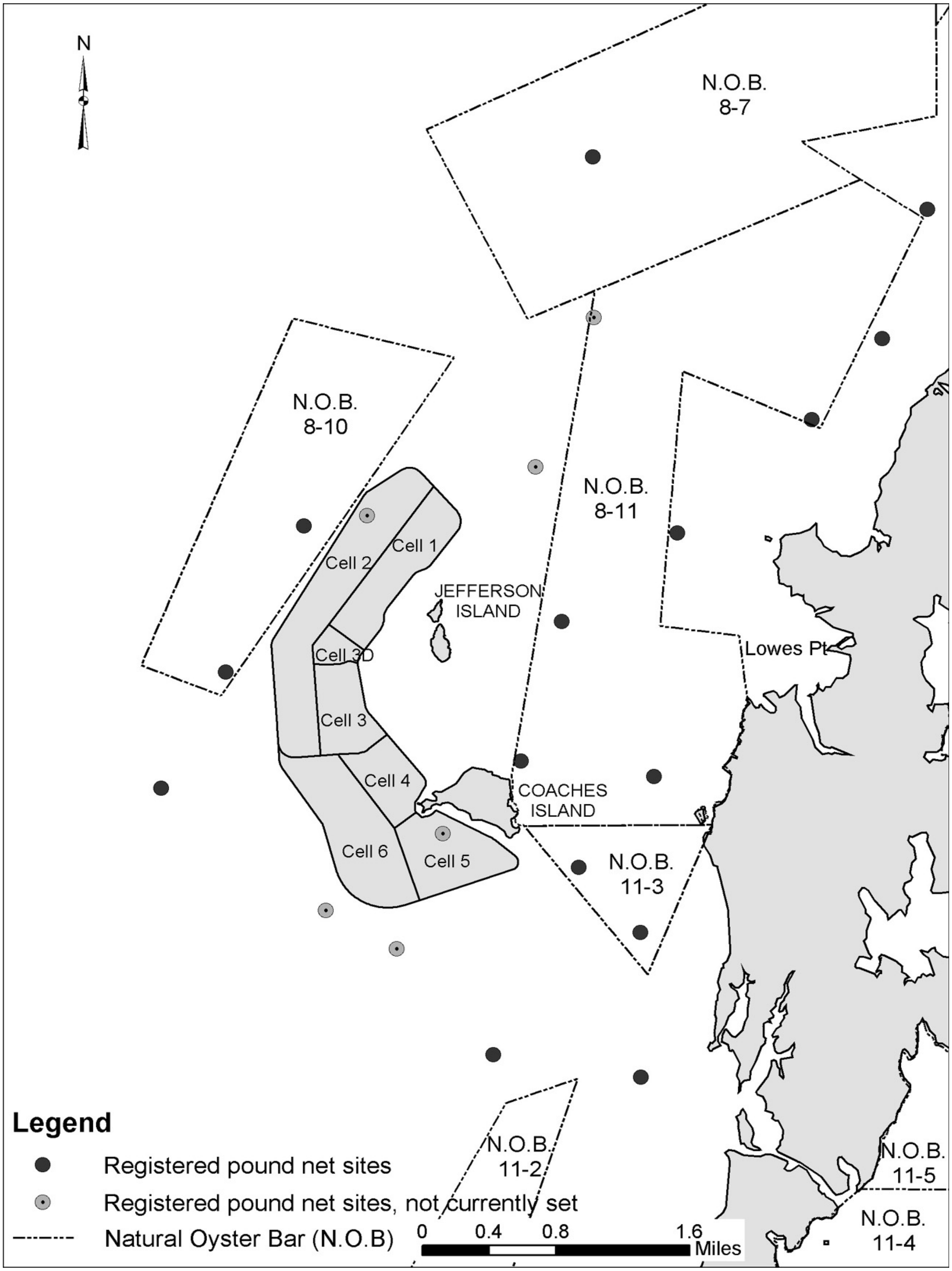


Figure 3-32. Vicinity of Poplar Island Showing Points of Interest



Note: Pound net locations are based on initial locations registered with MDNR, but nets are typically repositioned within the local vicinity of the initial sites.

Figure 3-33. Natural Oyster Bars and Pound Nets in the Vicinity of Poplar Island

In recent years, shellfish harvests have declined dramatically Baywide (see Table 3-21), although 2004 was an exception to the trend in some areas of the Bay. Although NOBs are abundant in the vicinity of Poplar Island and clam beds are present in waters adjacent to the PIERP (Dize; Maryland Watermen's Association, 2004), local harvest of oysters and soft clams has been minimal in recent years according to local watermen. Clam productivity surveys conducted in 2004 show a lack of productive soft clam beds (see Section 3.1.6). Razor clam densities were higher but still fell short of being commercially productive beds, as defined by MDNR.

Table 3-21. Volume and Value of Fisheries in South Central Bay Segment (MDNR waterbody code 027)

Year	Fishery							
	Blue Crabs		Soft Clams		Oysters		Finfish	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
1998	6,027,588	$5,979,995	113,237	$772,777	279,533	$913,393	1,329,367	$939,372
1999	6,629,981	$5,756,791	65,129	$433,067	182,947	$536,181	1,962,384	$1,129,631
2000	4,211,210	$4,728,700	82,886	$504,617	59,706	$187,499	1,892,971	$1,385,482
2001	4,489,051	$4,856,868	12,312	$62,860	24,698	$73,152	1,786,933	$1,030,142
2002	5,119,869	$4,760,557	86,448	$330,461	12,688	$54,281	1,879,490	$1,185,776
2003	4,429,076	$4,517,560	5,754	$40,495	6,368	$31,757	1,119,532	$1,152,047

Source: MDNR, 2004c

Total fishing effort in the area of the proposed project is difficult to quantify because of methods of data aggregation used by government agencies, but the level of effort appears significant. A total of 21 pound net sites are registered to 10 people in waters within the island's vicinity, from Knapps Narrows to two miles north of the PIERP (Figure 3-33). However, only some of these nets are currently set (Luisi MDNR, 2005). Pound nets are a type of passive, stationary gear used in the live entrapment of a variety of commercially important finfish species, including striped bass, bluefish, catfish, croaker, flounder, menhaden, perch, spot, weakfish, and river herring. Pound nets are typically set in 12 to 20 feet of water, perpendicular to shore such that when fish swimming along shore encounter the net, they turn away from shore into the "crib" from which they cannot escape. The fish are then harvested from the crib. Commercial watermen are not required to put nets in the exact location registered and nets are typically moved throughout the season.

From 1998 through 2003, Atlantic menhaden were the most abundant fish in commercial catches in the mid-Bay (Table 3-22). Menhaden made up more than 48 percent of the total commercial catch and 6 percent of total value. Striped bass were the most commercially valuable species, comprising over 82 percent of the total value of finfish caught. Other commercially important species caught in considerable quantities in this waterbody segment were white perch and croaker (Table 3-22). Spot, American eel (*Anguilla rostrata*), bluefish, summer flounder, and red drum have historically been commercially important species, but were caught at low levels during this time period.

Another measure of commercial fishing effort in the region is the number of striped bass permits granted locally. A total of 42 commercial striped bass collection permits were issued in 2004 to residents of the Bay Hundred county subdivision (Figure 3-30). This number represents 3 percent of the 1,231 permits issued Statewide and includes any fish taken using pound nets, gill nets, or hook and line.

Finally, the research component of local and regional water use includes several fixed monitoring stations used in Bay-wide research on the condition of the estuarine ecosystem. Data on water quality and biota are collected at fixed stations as part of regional and long-term data sets used by researchers, educators, and resource managers.

Table 3-22. Total Catch and Value of Commercially Important Finfish Species within South Central Bay Segment, 1998 – 2003

Species	Catch (lbs)	Value
Atlantic menhaden	4,815,760	$434,334
Striped bass	3,530,328	$5,617,523
White perch	767,355	$412,160
Croaker	492,372	$168,473
Spot	52,578	$28,798
Common eel	35,330	$45,058
Bluefish	26,630	$12,580
Summer flounder	14,569	$24,545
Red drum	447	$214
All other species	235,308	$78,765
Total	9,970,677	$6,822,450

Source: MDNR, 2004c

3.4 RECREATIONAL RESOURCES AND AESTHETICS

The existing PIERP and Study Area lie within the Mid-Bay mainstem, close to the Eastern Shore of Maryland. The landscape is characterized by low topographic relief, numerous areas of open water, and extensive wetlands. Many peninsulas and islands mark the transition from land to water along the coastline. The area has an open feel because of the abundance of water views, open fields, grassed marshes and long vistas. The developed areas are dominated by one to two-story buildings and commercial and industrial areas are small.

The existing PIERP represents a restoration of Poplar Island roughly to its extent in the mid-1800s and is a feature widely visible from the shoreline and water. The perimeter of the project is marked by 8-10 foot tall containment dikes on the wetland (east) side and 23 foot dikes on the upland (west) side which will eventually be reduced to 20-foot dikes. The dikes are faced in armor stone and sand bars have built up in some places outside the dikes. The island has roads and office trailers.

Currently, vegetation is sparse and the island looks bare from a distance. When the vegetation grows in and matures, the land cover is designed to be approximately 50 percent upland and

50 percent wetland. The uplands will contain scattered small ponds and forests and relatively open scrub-shrub areas. The wetlands will be approximately 20 percent high marsh and 80 percent low marsh interspersed with islands, ponds and tidal guts to increase diversity of the land use. When vegetation has grown, the land cover will look similar to Coaches and Jefferson Islands and existing shoreline land use.

Wide expanses of water surround the PIERP on all sides except where the remnant islands of Coaches and Jefferson are close to the island. Coaches and Jefferson have mature trees and block parts of the view of the restored Poplar Island from the east side. Other than the island remnants, the nearest land is more than one mile away from the PIERP's perimeter at the southern tip of the project.

There are no National Scenic Byways in Talbot or Queen Anne's Counties, but a State Scenic Byway (Route 33) runs along the shoreline and has views of the PIERP in several places (Figure 3-32).

3.4.1 Recreational Resources

The middle Chesapeake Bay, which encompasses the PIERP region, is a valued recreational resource used by many different individuals in a variety of activities. Tourism and recreational activities are important to Talbot County's economy, and the recreational activities in the vicinity of the PIERP are typical of most mid-Bay areas and include fishing, boating, birding, hunting, and sightseeing (EA, 2003a). These activities are generally not centered around the PIERP because of restricted access during construction activities. However, charter boat and private recreational fishing occur in the vicinity of the rock reefs of the north end of Cell 1.

Recreational boating is one of the most significant recreational activities in the area, and the waters around the PIERP have traditionally supported a variety of boating activities. Some of the waters adjacent to Poplar Harbor are too shallow for deep draft sailing vessels. However, the channel east of the archipelago (Poplar Island Narrows) is a popular thoroughfare for both power and sailing vessels traveling between Knapps Narrows/Choptank River and Kent Island/Eastern Bay. The region around the PIERP is used for a variety of recreational uses, but the dominant uses are boating and fishing. In general, a major focus of Talbot County's outdoor recreation is on water sports, and the scenic quality of the shoreline areas is a major attraction to tourists. Other recreational uses of the adjacent land and water areas include, but are not limited to: sightseeing, wildlife viewing, hunting, swimming, walking, biking and outdoor social activities, such as backyard picnics. No large parks are located in Talbot County, but there are several privately held small sanctuaries or wildlife preserves. The PIERP is among the largest publicly accessible tracts of lands within the county, although access to the island is currently managed by the MES, and visitors must schedule tours to access the island.

3.4.1.a Recreational Fishing and Boating The water areas around the PIERP are used for sailing, motorboats and non-motorized boats. Charter boats and private boats access nearby waters for fishing, and many boats travel through the waters on their way to popular tourist destinations. For safety during construction at the PIERP, warning signs for recreational boaters are located at the mouth of the exiting access channel in Cell 6 and at the submerged rock reefs located in the northeast portion of the PIERP. The MDNR police cooperates with the State to enforce the existing restrictions at the PIERP, when necessary.

To quantify the level of current recreational boating use in the vicinity of the project, three techniques were used: 1) proximity of marinas and boat ramps, 2) the number of registered boats likely to use the area near the PIERP, and 3) the number of boats observed in the area within ½ mile of the PIERP during aerial surveys. Each technique indicated that the PIERP has average popularity compared to other islands in the mid-Bay for boating and fishing. However, overall usage levels are lower in the mid-Bay area than in the northern Bay.

The analysis of marinas and boat ramps in the region indicated the potential for moderate recreational boat traffic near the PIERP. Based on a Geographic Information System (GIS) analysis of the Maryland Department of Planning's 2003 Property View database, there are 65 marinas within ten miles of the Study Area in the vicinity of the PIERP (many on the Western Shore), six marinas within five miles, and no marinas within 1 mile. From the Maryland DNR boat ramp database, eight boat ramps were identified within ten miles of the proposed footprint, three ramps within five miles, and no ramps within one mile.

Data on marina locations and registered boats by county were used to estimate the potential number of recreational motorboats using the waters near the PIERP. The analysis showed that a significant number of motorboaters have the potential to access areas near the island, although the number was significantly lower than that for islands closer to more populated areas (Figure 3-34). The total number of registered motorboats with access to PIERP was estimated to be about 4,616, which represents about 2 percent of the state total (Table 3-23) (although only motorboats in Anne Arundel, Calvert, Queen Anne's, Talbot, and Dorchester Counties are represented in Table 3-23).

Based on the estimated number of registered motorboats and estimates of the number of annual user-days for different types and sizes of boats, the annual number of recreational user days was calculated to be about 130,000 in the vicinity of the PIERP. A survey of recreational boat owners demonstrated that 30% to 60% of motorboat outings were primarily for fishing, depending on whether the boat was trailered or in-water (Lipton, 2004). Using these results, annual recreational fishing days in the vicinity of the PIERP were estimated to be about 48,000.

The estimates of boats and user-days were derived by first selecting the portion of motorboats registered in each nearby county that would be most likely to use the waters in the vicinity of the PIERP. For a boat to be selected, it had to be of sufficient size to be likely to make a trip equal to at least 5, 10, or 15 miles. Then the number of boats selected per county was based on the proportion of a county's marinas that fell within a zone of 5, 10, or 15 miles from the PIERP. The estimated number of motorboats was multiplied by an estimated number of annual user-days to arrive at the annual potential user-days. Marina location was used as a proxy for the location of registered boats in the county, not just boats in marinas. This estimate does not consider out-of-state recreational users, sail boats, non-motorized boats, or

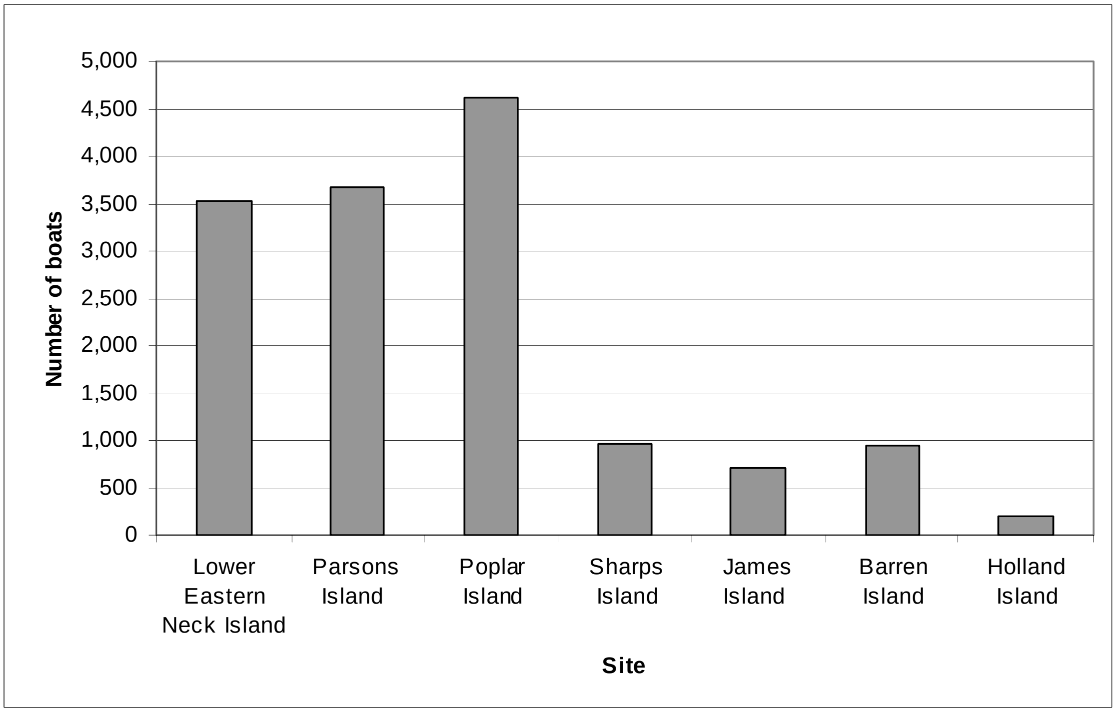


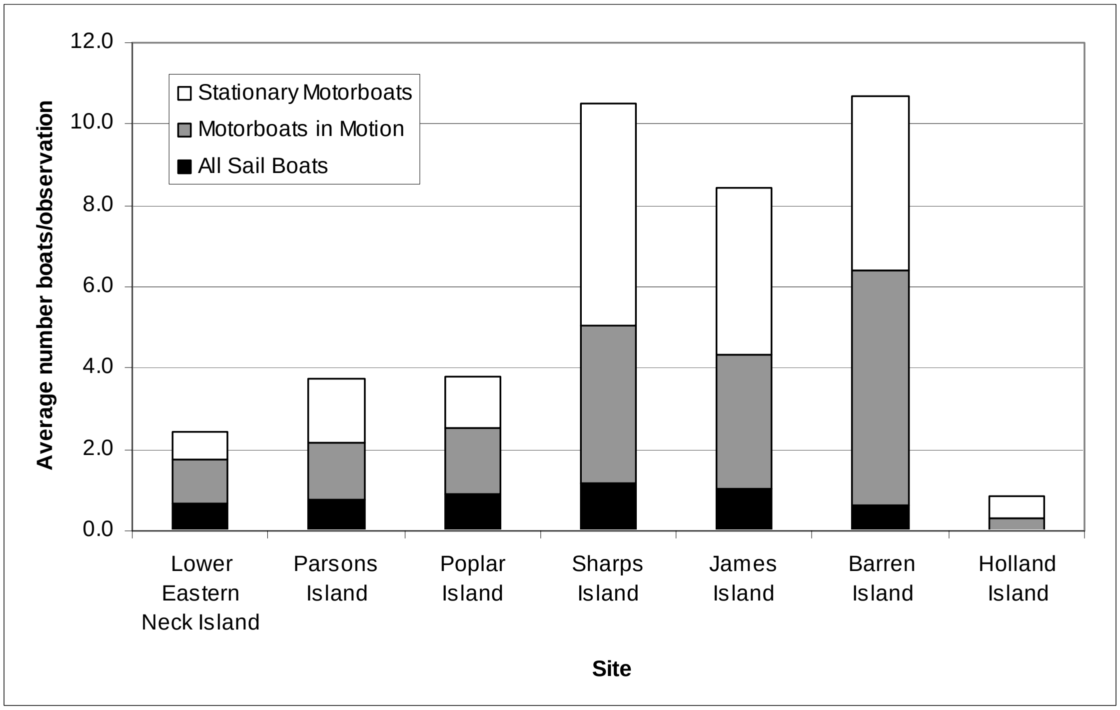
Figure 3-34. Registered Motorboats in the Vicinity of PIERP as Compared to Other Mid-Bay Islands.

boaters traveling from counties farther than 15 miles away. Nonetheless, the figure gives some sense of the size of the pool of the most frequent recreational boaters and fishers of the areas near the PIERP.

Table 3-23. Total Registered Motorboats by County in 2002 and Estimated Boats with Access to Waters near PIERP

County	Trailered Motor	In Water Motor	Motorboats near PIERP
Anne Arundel	25,737	13,121	3,123
Calvert	5,870	1,028	229
Queen Anne	4,777	2,820	509
Talbot	3,383	1,900	752
Dorchester	2,565	1,171	3
Total	**42,332**	**20,040**	**4,616**

An aerial survey of recreational boating in the Maryland portion of the Chesapeake Bay was conducted between June through October 2000 and April through July 2001 to compare and contrast relative intensity of use by recreational fishing vessels. A total of 99 boats were observed within a ½ mile of the PIERP in 26 observations, for an average of 3.8 boats per observation (Figure 3-35) (EA, 2003a). Of those boats, 33 were stationary motorboats, which were assumed to be fishing boats. When compared to other mid-Bay islands (from Lower



Source: EA Engineering, 2003.

Figure 3-35. Aerial Survey Data of Recreational Boat Usage Within One-Half Mile of PIERP as Compared to Other Mid-Bay Islands.

Eastern Neck to Holland Island), the PIERP had an average number of sailboats per aerial photo observation and a below average number of motorboats per observation (EA, 2003a).

Several indicators of the level of recreational fishing suggest substantial interest in recreational fishing in the area. About one third of the boats observed aerially near the PIERP are likely to have been engaged in fishing. However, Poplar Island was among the least utilized sites in terms of recreational fishing boats per observation in the Maryland portion of the Bay (EA, 2003). Several charter boat establishments operate in the area, and Tilghman Island has a substantial charter fishing fleet. Suggested recreational fishing grounds, as delineated by MDNR, are present in the vicinity of the PIERP, but are not within the Study Area. Most of the marked grounds are in waters deeper than the area immediately adjacent to the footprint, although one spot to the east of the island, Poplar Island Narrows, is less than ½ a mile from the Study Area.

<u>3.4.1.b Hunting</u> Maryland hosts over 145,000 hunters annually, including both residents and non-residents (USFWS, 2001c). Deer and waterfowl are the main species of interest to Maryland hunters. Coaches Island supports active waterfowl and deer hunting. During the winter months, sea duck hunting is a popular activity and at least one local establishment offers guided sea duck hunting packages. Historically, Poplar Island was considered an excellent waterfowl hunting area and hunting camps were established on the island during the 1940's and 1950's (MES, 1994). The decline in waterfowl populations followed by restrictive hunting seasons contributed to the decline of waterfowl hunting Baywide, including on Poplar Island. Most notably, migratory Canada geese, the waterfowl most closely identified with the Chesapeake Bay, reached such low numbers that goose hunting was banned. The six year moratorium between 1995 and 2001 halted a 40 to 50 million dollar industry on the Eastern Shore (Blankenship, 2004). Maryland accounted for about 46 percent of the total Atlantic Coast goose harvest in 2001, the first hunting season since the moratorium (MDNR, 2003b). Waterfowl hunting opportunities are improving as Canada goose and duck populations increase and hunting regulations are relaxed. Furthermore, sea duck hunting is still a popular activity in the area during the winter months, and licensed gunning rigs operate in the PIERP vicinity (USACE/MPA, 1996). However, no public hunting is currently allowed and will not be allowed in the future at the PIERP or with the proposed expansion.

Coaches and Jefferson Islands were historically well-known hunting camps and evidence of recently spent shell casings and decoys were observed on Coaches Island during seasonal baseline surveys. Several active waterfowl blinds are located on Coaches Island, one is located on Jefferson Island, and one is located in Poplar Harbor, adjacent to the PIERP. It is likely that hunting for sea duck species [i.e., eiders (*Somateria mollissima*), scoters (*Melanitta* sp.), long-tailed ducks] occurs in the waters around the PIERP. Concentrations of these species were observed during winter bird monitoring surveys (MES, 2003a). Generally, hunting locations for these species are well offshore and change with the seasonal patterns of the ducks hunted.

3.4.1.c Other Recreational Activities Poplar Island was once a well-known bird rookery where herons, egrets, cormorants, and other species utilized the remnant islands during nesting season, especially during the spring and fall migration periods. The existing PIERP is an attraction to birds and other wildlife that are of interest to birdwatchers. The monitoring program has recorded 115 species of birds in and around the island including 27 species of waterfowl (MES, 2003a). Since May 2001, 18 listed avian species have been observed at the PIERP, which may be of particular interest to birders (See Section 3.1.8 for more details on RTE species). Currently, most bird-watching activity occurs on Coaches and Jefferson Islands, although bird utilization of the placement cells at the PIERP is increasing (EA, 2003c).

Waterfowl were the most watched birds in a recent national survey of birders; 78 percent of birders reporting watching them (USFWS, 2001c). In addition, 56 percent of surveyed birders watched other waterbirds such as herons and shorebirds, which are also present at the PIERP. The PIERP is likely to be a particularly valuable resource to birders because it is publicly accessible land, although visitors must schedule tours with MES.

Several birdwatching associations have made trips to the PIERP in the past 2 years and more are planned. As of October 2004, at least 10 groups of birders, for a total of about 150 people, had taken trips to the island for the primary purpose of birdwatching. Two more birding trips with a total of 50 people are already planned for early 2005. Birdwatching activity is highest during spring and fall when populations are migrating (Albanese MES, 2004).

Numerous educational trips have been conducted in the past 2 years to the PIERP and more are planned. Over 25 school groups have visited the island in the past two years. Children of many different ages have learned about wetland ecology, history of the Bay and restoration techniques through their visits.

Sightseeing is another recreational activity that occurs in the vicinity of the PIERP. Interest in the island has been stimulated by a number of books, articles, and television programs that have featured the PIERP. This contributes to the number of sightseers who visit the area and participate in tours of the island.

3.4.2 Infrastructure/Facilities

3.4.2.a Poplar Island Buildings Two permanent buildings – an Operations Building and a Vehicle Storage/Maintenance Building – are approved for construction along the longitudinal dike section that separates Phase I from Phase II (between Cells 3 and 4) (Figure 3-26). Although the buildings have been designed, construction is currently on hold (indefinitely) as a result of budgetary constraints. The operations building is planned to be a two story structure approximately 124 ft long, 44 ft wide, and 44 ft high that will house offices, two conference rooms, a lunch room, locker rooms, a small laboratory space, and support spaces. The vehicle storage/maintenance building is planned to a single story structure, approximately 145 ft long, 77 ft wide, and 54 ft high, that will have exterior bay doors and interior space devoted to the repair and storage of construction vehicles used at the PIERP. Aggregate surfaced pavement (gravel hardstand) will be used for access and parking areas around the proposed buildings. The site is currently the location of several mobile office trailers.

The design for both the operations building and the vehicle storage/maintenance building incorporated components of sustainable design and development (SDD) that were scored using the Sustainable Project Rating Tool (SPiRiT). SPiRiT credits are given for inherent design features and operational procedures that are deemed to be sustainable features in design features such as erosion control, storm water management, water use reduction, use of local/regional materials in construction, optimizing energy efficiency, and light pollution reduction.

Buildings will be tied into the existing 25KV underground electrical lines and existing telecommunications lines. Exterior lighting for both buildings will be controlled by photocell, and geothermal heat will be used in the HVAC system. Waste from the septic system will be treated onsite, and the septic drain field will consist of a sand mound approximately 26 ft by 90 ft. located just west of the operations building.

3.4.2.b Site Operations Staging Area The site operations staging area for the PIERP is located on Tilghman Island, and consists of a small trailer (primarily for receipt of deliveries) and a parking area. The staging area supports the MES and USACE staff that work at the PIERP on a daily basis. During normal site operations, approximately 25 staff members are working at the PIERP during the day. During inflow operations, inspectors are on-site 24 hours a day. The crew boat typically runs once a day, leaving Tilghman Island at 7 AM each morning and leaving the PIERP at 3:30 PM each afternoon. During inflow operations, the crew boat will run at later hours (5:30 and 7 PM) to accommodate staff hours.

3.5 ENVIRONMENTAL PERMITS

The environmental permits currently required for the PIERP include:

- Tidal Wetlands Permit – issued by State of Maryland Board of Public Works
- Clean Water Act Section 404 – State Water Quality Certification – issued by MDE
- Federal Migratory Bird Act Treaty Permit – Federal Fish and Wildlife Depredation Permit issued to USACE that allows authorized taking of specified avian species. The 2005 permit includes herring gulls, great black-backed gulls, and the Canada goose; mute swans have not been included in the permit since 2003; renewed annually
- MDNR Wildlife Permit/License – Letter of Authority issued to USFWS for red fox lethal control; renewed annually
- Coastal Zone Consistency Determination – Federal consistency determination issued by MDE and State staff report and review determination issued by MDNR
- Water Appropriation and Use Permit – from MDE to draw potable and non-potable groundwater [current permit number TA19999G005(02) – expires August 2014]

These existing permits may be amended and/or expanded to include the proposed project.

3.6 MOST PROBABLE FUTURE WITHOUT PROJECT CONDITIONS

The without project condition is defined as the most likely condition expected to prevail over the length of the planning period (in this case, 50 years) in the absence of USACE-Baltimore District implementing a plan of improvement. The without-project condition provides the baseline condition for impacts associated with the proposed project.

The existing PIERP involves placing approximately 40 million cubic yards of dredged material behind 40,000 feet of containment dikes to create a 1,140-acre island with equal shares of tidal marsh and upland habitat. Of the proposed 570 acres of tidal marsh, 80 percent will be developed as low marsh and 20 percent as high marsh. Small islands, ponds, and dendritic guts or channels will be created within the marsh areas to increase habitat diversity. Habitat diversity will be increased in the 570 acres of upland by constructing small ponds and wetlands within forest and scrub/shrub areas. The ecosystem restoration project includes construction of containment dikes, access channels, docks and spillways; transportation and disposal of dredged material; shaping of the restored island; planting of vegetation; and monitoring. The existing project is not yet completed, and site operations – dredged material placement and habitat development – are ongoing at the PIERP. Several additional project actions are required to complete the existing project (see Section 5.3). These actions include raising the existing upland temporary dikes from +23 ft MLLW to +25 ft MLLW, Cell 6 closure activities, and recreational/educational opportunities. These activities were evaluated as part of this SEIS, but were not associated with a specific expansion alternative, because the activities will occur regardless of which alternative is ultimately selected.

Without the expansion of the PIERP, USACE and MPA would face a critical shortfall of placement options for dredged material from the upper Chesapeake Bay approach channels to the Port of Baltimore. The existing PIERP would remain the only placement alternative for the estimated 3.2 mcy of material dredged from the upper Chesapeake Bay approach channels to the Port of Baltimore. Hart-Miller Island is slated for closure (by State law) in 2009, and Pooles Island is mandated for closure (by State law) in 2010. Because of the amount of time required to identify and develop new placement sites, without this project, maintenance and new work dredging projects would need to be deferred until alternative sites were developed and built. Placement at the PIERP would become less efficient, shortening the planned life of the project by overloading the cells with dredged material before complete dewatering and consolidation has occurred.

Without the project, no additional protection from erosion would be afforded to Jefferson and Coaches Islands and the mainland. If Jefferson Island continues to erode, water clarity would continue to decrease and sedimentation in Poplar Harbor would continue to occur. Without the protection from wave action provided by the proposed lateral expansion, both the upland and wetland habitats located on Jefferson and Coaches Island will continue to be lost. The Bald Eagle nest currently located on Coaches Island would potentially require relocation in the future due to shoreline erosion. Remote island habitat in the Chesapeake Bay provided by Jefferson, Coaches, and Poplar Island is a valuable resource to a variety of aquatic and terrestrial species – additional remote island wetland and upland habitat would not be created without the project and would not be available to avian species, finfish species, EFH species, diamondback terrapins, and other wildlife species. Offshore islands are a unique ecosystem component in the Chesapeake Bay watershed. Remote islands are preferentially selected by many migratory birds and waterbirds as resting and nesting locations. Although similar vegetative communities may occur on the mainland, the isolation, relative lack of human disturbance, and reduced number of predators make islands more desirable as nesting sites for colonial waterbirds and other avian species, including the Bald Eagle. Without the project, the additional created wetlands and tidal gut habitat that provides valuable nursery and refuge area for a variety of finfish and EFH species would not be available.

Without the project, the upland cells at the PIERP will continue to be developed and planted as planned, and the ecosystems will continue to mature to support the repopulation of wildlife species. No delays will occur from the environmental benefits identified for Cells 2 and 6.

Without the project, no additional protection will be provided to Poplar Harbor. This quiescent area provides for the continued reestablishment of SAV and repopulation of clams. Without the project, EFH, SWH and Tier II/III SAV habitat would still be available for the potential reestablishment of SAV, clam species, benthics, avian species, and finfish species. Poplar Harbor and areas located adjacent to the PIERP rock dike and rock reefs will continue to be utilized by benthic, finfish, and EFH species. The highly utilized Poplar Harbor area and areas located adjacent to the PIERP rock dike will continue to be used by commercial watermen for blue crabs and finfish species without any space-use time conflicts.