Appendix B. Environmental Sensitivity Maps - Wetland Distribution (Source: NOAA 1997) (South Carolina and North Carolina Information & Sample Map- Example of South Atlantic Estuarine Habitat Distribution Information).

ENVIRONMENTAL SENSITIVITY INDEX: SOUTH CAROLINA

INTRODUCTION

Environmental Sensitivity Index (ESI) maps have been developed for the coastal zone of South Carolina. The ESI maps include information for three main components: shoreline habitats; sensitive biological resources; and human-use resources. Background information, as well as the methods of data collection and presentation, are summarized in the following sections.

SHORELINE HABITAT MAPPING

The intertidal habitats of South Carolina were mapped during overflights conducted over the period from March-October 1995. The aerial surveys were carried out using helicopters provided by the U.S. Coast Guard, flying at elevations of 300-500 feet and slow air speed. A coastal geologist updated the intertidal habitats directly onto 1:24,000 scale U.S. Geological Survey topographic maps. Where appropriate, multiple habitats were delineated for each shoreline segment. Relatively simple changes to the shoreline position and shape were made during the overflights. Where there were complex changes in the shoreline, the most current aerial photographs (January-March 1994) were used to update the shoreline and habitats on the topographic maps. Wetland polygons were mapped using digital National Wetlands Inventory (NWI) data. These data were collapsed into the three ESI categories and merged with the shoreline.

Prediction of the behavior and persistence of oil on intertidal habitats is based on an understanding of the dynamics of the coastal environments, not just the substrate type and grain size. The sensitivity of a particular intertidal habitat is an integration of the following factors:

1) Shoreline type (substrate, grain size, tidal elevation, origin)
2) Exposure to wave and tidal energy
3) Biological productivity and sensitivity
4) Ease of cleanup

All of these factors are used to determine the relative sensitivity of intertidal habitats. Key to the sensitivity ranking is an understanding of the relationships between: physical processes, substrate, shoreline type, product type, fate and effect, and sediment transport patterns. The intensity of energy expended upon a shoreline by wave action, tidal currents, and river currents directly affects the persistence of stranded oil. The need for shoreline cleanup activities is determined, in part, by the slowness of natural processes in removal of oil stranded on the shoreline.

These concepts have been used in the development of the ESI, which ranks shoreline environments as to their relative sensitivity to oil spills, potential biological injury, and ease of cleanup. Generally speaking, areas exposed to high levels of physical energy, such as wave action and tidal currents, and low biological activity rank low on the scale, whereas sheltered areas with associated high biological activity have the highest ranking. The list below includes the shoreline habitats delineated for the entire coastline of South Carolina, presented in order of increasing sensitivity to spilled oil.

1) Exposed Walls and Other Structures Made of Concrete, Wood, or Metal
2A) Exposed Scarps in Clay
2B) Wave-cut Mud Platforms
3A) Fine-grained Sand Beaches
3B) Scarps and Steep Slopes in Sand
4) Medium- to Coarse-grained Sand Beaches
5) Mixed Sand and Gravel (Shell) Beaches
6A) Gravel (Shell) Beaches
6B) Exposed Riprap Structures
7) Exposed Tidal Flats (Sandy)
8A) Sheltered, Solid Man-made Structures
8B) Sheltered Scarps in Marsh/Mud
9) Sheltered Tidal Flats/Oyster Beds (Muddy)
10A) Salt and Brackish-water Marshes
10B) Freshwater Marshes (Herbaceous Vegetation)
10C) Freshwater Swamps (Woody Vegetation)

Each of the shoreline habitats are described on pages 7-13, in terms of their physical description, predicted oil behavior, and response considerations.

SENSITIVE BIOLOGICAL RESOURCES

A marine and coastal biologist with Research Planning, Inc., collected and compiled the biological information presented on the maps with the assistance of biologists and resource managers from the South Carolina Department of Natural Resources (SCDNR) and other agencies. Information collected and depicted on the maps denotes the key biological resources that are most likely at risk in the event of an oil spill. Six major categories of biological resources were considered during production of the maps: marine mammals, terrestrial mammals, birds, reptiles, shellfish, and fish.

Spatial distribution of the species on the maps is represented by polygons and points, as appropriate. Associated with each of these representations is an icon depicting the types of animals that are present. Species have been divided into groups and subgroups, based on their behavior and taxonomic classification. The icons reflect this grouping scheme. The groups are color coded, and the subgroups are represented by different icons:

MARINE MAMMALS


Dolphins

TERRESTRIAL MAMMALS


Small Mammals

BIRDS


Diving Birds


Gulls and Terns


Raptors

Shorebirds


Wading Birds


Waterfowl

REPTILES


Alligators


Turtles

FISH


Anadromous/Others

SHELLFISH


Bivalves


Crabs


Shrimp

The polygon or point color and pattern are the same for all the animals in one group (e.g., birds). When there is more than one group of animals in one polygon, the polygon is then assigned the multigroup color and pattern (black hatch). Also associated with each biological polygon or point feature on the map is a Resources at Risk number (RAR#), located under the icon. This number references a table on the reverse side of the map with a complete list of species found in the polygon as well as the protected status, concentration, seasonality, and life-history information on each species.

There are some species that are found throughout specific geographical areas or habitat types. Displaying the polygons for these species would cover large areas, making the maps very difficult to read. Thus, species which occur over the majority of certain geographic areas or habitats are often identified in a small box which states that they are “Common in ...”, (e.g., “Common in Atlantic Ocean” and “Common in Wetlands”). This approach informs the user of the presence of these species, while maintaining readability of the map. In all instances, data for species listed as “Common in ...” exist as polygons in the digital coverages. The use of “Common in ...” is implemented on a map per map basis, depending on the size and number of polygons present on an individual map.

Some of the more frequently used “Common in ...” designations include “Common in Inland Waters”, “Common in Atlantic Ocean”, “Common in Tidal Creeks”, “Common in Coastal Rivers”, and “Common in Wetlands”. “Inland Waters” refer to all non-oceanic waters, including bays, sounds, estuaries, rivers, creeks, and non-tidal lakes or ponds. “Tidal Creeks” refer to smaller rivers and creeks which are bordered by salt or brackish marshes, excluding the major rivers, and include sheltered flats occurring in or near tidal creeks and marsh shorelines. “Coastal Rivers” refer to the major rivers in the study area, where spawning runs of anadromous fish such as sturgeon occur. “Wetlands” refer to the various wetland habitats where certain groups of species are associated with different types of wetlands. Species listed in RAR#s 11 and 37 are associated with salt and brackish marshes. Species listed in RAR#s 26, 31, and 32 are associated with freshwater marshes. Species listed in RAR#s 25, 29, 32, and 55 are associated with freshwater swamps. Species listed in RAR#s 40 and 67 are associated with impounded wetlands.

For many biological resources, information and expert knowledge may not be available for all geographic locations. For this reason, absence of a resource on a map does not necessarily mean it is not present.

MARINE MAMMALS

Bottlenose dolphins are the only marine mammal depicted in the atlas. The endangered West Indian manatee also occurs in the study area, in riverine, estuarine, and nearshore environments, but only in limited numbers during warmer summer months, generally when water temperatures are above 75°F. Bottlenose dolphins are likely to be present throughout the study area, in nearly all estuarine and nearshore waters of the Atlantic. Dolphins are only depicted, however, in locations where concentration areas for fish were also indicated: in the vicinity of major inlets; estuaries; bays; and in nearshore waters along the open-coast. Calibogue Sound is one area which is recognized by experts as a dolphin concentration area. Also, though not fully depicted by the nearshore ocean polygons, bottlenose dolphins are generally present from the

shoreline to three miles offshore. Expert contacts for marine mammals (including manatees) in South Carolina are Sally Murphy (SCDNR), 803/762-5051 and Thomas Murphy (SCDNR), 803/844-2473.

Bottlenose dolphin distributions are displayed on the maps as a black hatch (multigroup) polygon. A black hatch pattern is used due to the presence of fish in the same polygon. A brown icon with a dolphin silhouette is used to indicate the presence of marine mammals. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. Bottlenose dolphins are not listed as threatened or endangered, but are protected under the Marine Mammal Conservation Act. The next column provides an estimate of the concentration of the species at the site. The concentration field has been left blank for dolphins because the number of individuals present at any given time and location can vary. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column.

TERRESTRIAL MAMMALS

Terrestrial mammals shown on the South Carolina maps include small, semi-aquatic, fur-bearing species (beaver, meadow vole, mink, muskrat, northern raccoon, and river otter). Depending on the species, these mammals are likely to occur where rivers, streams, estuaries, impoundments, and especially wetlands are present. Terrestrial mammal distributions depicted on the maps are largely habitat based, by wetland vegetation type and salinity. Though not particularly evident on the maps, impounded wetlands often hold the largest concentrations of certain species. Based on local expert opinion, mink and river otter are the species most susceptible to water-borne contaminants. In terms of commercial and recreational harvest, northern raccoon is the most important small fur-bearer in the state. Semi-aquatic, fur-bearing mammals can be severely impacted by swimming through oil slicks or coming into contact with oiled wetland vegetation. An expert contact for semi-aquatic, fur-bearing mammals in South Carolina is Buddy Baker (SCDNR), 803/734-3609.

Terrestrial mammal distributions are shown as polygons with a brown hatch pattern. If species in addition to terrestrial mammals are included in the polygon, a black hatch (multigroup) pattern is used. A brown icon with a small mammal silhouette is used to indicate the presence of terrestrial mammals. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. No threatened or endangered terrestrial mammals are shown on the maps. The next column provides an estimate of the concentration of species at the site. Concentration is usually indicated as "HIGH", "MED", or "LOW". For terrestrial mammals, these estimates are subjective, based on expert knowledge of several years of harvest data. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. For many species there is a temporal shift in seasonality with spatial changes in location. Temporal information included in the tables is specific to the one polygon or point that it references.

BIRDS

Birds are divided into several species subgroups based on behavior and taxonomy. The species table lists all the birds included on the maps, sorted by subgroup. These species were included either because of their likelihood of impact by an oil spill or special protection status as threatened or endangered. Much of the bird data included in the atlas is the result of expert knowledge or digital location data gathered during resource surveys, including: bald eagle nesting surveys; colonial waterbird nesting surveys; migratory and wintering shorebird surveys; and mid-winter waterfowl surveys. Other bird concentration data included in the atlas are habitat based, as suggested by resource experts. Expert contacts for diving birds, gulls, terns, shorebirds, wading birds, and raptors in South Carolina are Philip Wilkinson (SCDNR), 803/546-3226 and Thomas Murphy (SCDNR), 803/844-2473. Additional contacts for these species groups are Mark Spinks (SCDNR), 803/546-3226 and Mark Dodd (SCDNR), 803/844-2473. An expert contact for waterfowl and "webless" game species (coots, rails, etc.) is Thomas Strange (SCDNR), 803/546-8665.

Bird distributions are shown on the maps as polygons with a green hatch pattern. If species in addition to birds are included in the polygon, a black hatch (multigroup) pattern is used. Special bird concentration sites, mainly nesting sites and some protected species locations, are displayed as point locations using a green dot. For polygon and point data, a green icon with the appropriate bird silhouette (diving bird, waterfowl, etc.) is used to indicate the presence of birds. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column indicates whether the species is listed as threatened (T) or endangered (E) on state (S) and/or federal (F) lists. The next column provides an estimate of the concentration of each species at the site. For bird polygon data, concentration is usually indicated as "HIGH", "MED", or "LOW". These concentration estimates are subjective, based on local expert opinion on relative concentrations in the area. For bird point data, the number of nests is indicated in the concentration column. For nesting species, concentrations refer to numbers recorded during the 1995 nesting season. Historical nesting sites or rookeries which were not used during the 1995 nesting season, but are likely to be used by nesting birds in the future, have "0" indicated in the concentration column. Nesting densities at any particular site may fluctuate seasonally and annually based on local conditions. The species seasonality is shown in the next twelve columns representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. The last column denotes the nesting season for each species, if nesting occurs in an area or at a site. For many species there is a temporal shift in seasonality and reproduction along with spatial changes in location. Temporal information included in the tables is specific to the one polygon or point that it references.

REPTILES

Reptiles depicted in the South Carolina atlas include marine or sea turtles and the American alligator. Sea turtle areas displayed on the maps are limited to nesting beaches for the loggerhead sea turtle. Sea turtle nesting beaches include sand beach areas where sea turtles come ashore to nest. Nesting sea turtle beaches indicated on the maps correspond closely to beaches examined during aerial surveys conducted by SCDNR during the 1990-1992 nesting seasons. In addition to nesting locations, loggerhead, green, Kemp's ridley, and leatherback sea turtles also occur throughout the coastal, estuarine, and/or marine waters of South Carolina. Juvenile loggerhead, green, and Kemp's ridley sea turtles are most abundant from April through October. Migrating leatherback sea turtles are most abundant from April through June. All sea turtles are protected as threatened or endangered species.

In addition to direct oiling, sea turtle adults, nests, and young may also be at risk from response activities and equipment. Beach cleanup operations and heavy machinery can disturb both adult and hatchling turtles, as well as their nests. Ruts left on the beach by heavy equipment can entrap hatchlings trying to get to the water, resulting in death from exposure or predation. Hatchlings may also be killed by entrapment behind booms placed to protect the shoreline. Flood lights used for night operations or security could disorient adult turtles or hatchlings, causing them to move towards oiled areas or roads. An expert contact for sea turtles in South Carolina is Sally Murphy (SCDNR), 803/762-5051.

American alligators can occur throughout freshwater and estuarine habitats in South Carolina, particularly in wetlands, coastal rivers, ponds, and impoundments. Due to widespread abundance, alligators are only depicted on the maps in areas where impounded wetlands were identified by expert sources. Impounded wetlands are likely to hold some of the largest concentrations of alligators in the coastal zone. An expert contact for alligators in South Carolina is Walter Rhodes (SCDNR), 803/795-7124.

Reptile distributions are depicted as polygons with a red hatch pattern. If species in addition to reptiles are included in a polygon, a black hatch (multigroup) pattern is used. A red icon with a turtle or alligator silhouette is used to indicate the presence of reptiles. The number under the icon references a table on the reverse side of the map. In the tables, the first column gives the species name. The second column denotes whether the species has been designated as endangered (E) or threatened (T) on state (S) and/or federal (F) lists. The next column provides an estimate of the concentration of the species at a site. For alligators, all concentration estimates are listed as "HIGH". For sea turtle nesting beaches, concentrations are based on nesting densities recorded during aerial surveys. Nesting densities are defined as follows: <10 nests/km = "LOW"; 10-30 nests/km = "MEDIUM"; 31-50 nests/km = "HIGH"; and >50 nests/km = "VERY HIGH". The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an 'X' is placed in the month column. For sea turtles and alligators, the last two columns indicate nesting and hatching time periods. Nesting refers to the time when adults construct nests and deposit eggs. Hatching refers to the time when young are hatching and emerging from the nests. For many species there is a temporal shift in seasonality and reproduction along with spatial changes in location. Temporal information included in the tables is specific to the one polygon that it references.

SHELLFISH

Shellfish included in the South Carolina atlas include crustaceans and mollusks. The species table lists all the shellfish shown on the maps, sorted by subgroup. Commercially or recreationally important species are included. Oyster distribution is indicated primarily by habitat type, with oysters depicted in tidal salt marsh creeks and on sheltered tidal flats. Oyster bars delineated during SCDNR surveys are also indicated in a limited number of locations. For quahog (hard clams), only shellfish beds delineated during SCDNR surveys from 1973-1977 are depicted. Absence of oysters or clams on some maps does not necessarily indicate that these resources are not present. For blue crabs and shrimp, only juvenile nursery habitats are depicted on the maps. An expert/emergency contact for oysters, clams, and related shellfish harvest in South Carolina is William Anderson (SCDNR), 803/762-5089 (day) or 803/881-5757 (night). An expert contact for crustacean shellfish is Lawrence DeLancey (SCDNR), 803/795-6350.

The distributions of shellfish are shown as polygons with an orange hatch pattern. If species in addition to shellfish are included in the polygon, a black hatch (multigroup) pattern is used. Orange icons are associated with the polygons, and the silhouette of the subgroup is shown. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. No shellfish have such designations. The next column provides an estimate of the concentration of species at the site. No concentration data are listed for oysters. The oyster resource expert listed above should be consulted for information on specific sites. For clams, concentrations are based on sampling densities recorded in the field. Clam densities are defined as follows: 1-5 clams/sq. yard = "LOW"; 6-10 clams/sq. yard = "MEDIUM"; 11-15 clams/sq. yard = "HIGH"; and 16+ clams/sq. yard = "VERY HIGH". The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at a location in a particular month, an 'X' is placed in the month column. The last three columns indicate dates for spawning, mating, and the presence of juveniles. Spawning refers to the release of gametes to the water column during reproductive periods, or the mass release of larvae. Mating applies to shellfish which form temporary reproductive pairs for fertilization of gametes (e.g., blue crabs), with later release of more developed larval young. For many species there is a temporal shift in seasonality and reproduction along with spatial changes in location. Temporal information included in the tables is specific to the one polygon that it references.

FISH

Fishes included in the South Carolina atlas include estuarine-dependent species (especially juvenile life stages), anadromous species, fishes associated with nearshore ocean and offshore artificial reef habitats, and sharks, skates, and rays. Species of commercial, recreational, or conservation interest are emphasized, although other species are included. Fish distributions are based largely on expert opinion, and incorporate a combination of resource survey data, field experience, and habitat based designations. Expert contacts for estuarine, nearshore ocean, and artificial reef fishes are William Roumillat (SCDNR), 803/795-6350 and Charles Wenner (SCDNR), 803/762-5051. Expert contacts for anadromous fishes are Billy McCord (SCDNR), 803/762-5421, Ted Smith (SCDNR), 803/762-5047, and Mark Collins (SCDNR), 803/762-5008. An expert contact for sharks is Glenn Ulrich (SCDNR), 803/762-5080.

The distributions of fish are shown as polygons with a blue hatch pattern. If species in addition to fish are included in the polygon, a black hatch (multigroup) pattern is used. Blue icons with the silhouette of a fish are associated with the polygons. The number under the icon references a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated endangered (E) or threatened (T) on either the state (S) or federal (F) list. The next column provides an estimate of the concentration of species at the site. Concentration is usually indicated as "HIGH", "MED", or "LOW". Concentration estimates are subjective, based on expert opinion. In many cases, concentrations are not listed due to the inherent variability in the numbers of fish present at any given location and time. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at a location in a particular month, an 'X' is placed in the month column. The last columns indicate dates for sensitive life-history time periods, such as spawning and the presence of juveniles. For most species, spawning generally refers to the release of gametes to the water column during reproductive periods. For anadromous species, the spawning time period also refers to spawning related migrations or "runs" up coastal rivers. For sharks, spawning actually refers to the parturition or "birthing" time period, when live-birth occurs. For the anadromous species in general, larval/juvenile life stages can be present year round. For selected locations however, including Winyah Bay, Charleston Harbor, Santee Bay, St. Helena Sound, and the lower ten miles of the Savannah River, November through March is a particularly critical time period for juvenile anadromous fishes, especially for juvenile and subadult life stages of the protected shortnose sturgeon. For many species there is a temporal shift in seasonality and reproduction along with spatial changes in location. Temporal information included in the tables is specific to the one polygon that it references.

HUMAN-USE FEATURES

The human-use features depicted on the maps are those that either could be impacted by an oil spill or could provide access for response operations. All the features are represented by icons indicating the type of human-use resource.

Airport—Locations of airfields or airports whether they are manned or unmanned. The locations were obtained from visual observations during the overflights or from U.S. Geological Survey (USGS) topographic maps.

Aquaculture—Locations of aquaculture sites and facilities including coastal shrimp, crawfish, and finfish farms and ponds, clam pens, hatcheries, and research/resource management facilities. Aquacultures sites are indicated as point locations. Aquaculture information was provided by Jack Whetstone, South Carolina/Sea Grant Marine Extension Program, 803/546-4481 and Al Stockes, Waddell Mariculture Center (SCNDR), 803/837-3795.

Boat ramp—Locations of boat ramps. This information was gathered from overflight observations and from digital data provided by SCDNR.

Coast Guard—Locations of Coast Guard facilities. This information was obtained from topographical maps and local experts.

Historic site—Locations of historic sites including National Register sites, historic structures, etc. Digital data for historic sites were provided by the South Carolina Department of Archives and History (SCDAH), current to 1988. A contact person for historic sites is Thomas Shaw (SCDAH), 803/734-8614. See disclaimer at end of text.

Marina—Locations of marinas. This information was gathered from overflight observations and from digital data provided by SCDNR.

Marine sanctuary—Locations of areas managed under the NOAA Sanctuaries and Reserves Division. In South Carolina, two National Estuarine Research Reserve (NERR) sites fall under this category.

National park—Locations of areas managed by the National Park Service, including national parks, national seashores, and national monuments. Boundaries were obtained from USGS topographic maps.

State park—Locations of areas managed by the South Carolina Department of Parks, Recreation, and Tourism (SCDPRT). Boundaries for these areas were obtained from USGS topographic maps and from SCDPRT.

Recreational beach—Locations of recreational beaches. Recreational beaches were identified using the South Carolina Public Beach and Coastal Access Guide (1988).

Recreational fishing—Locations recognized as recreational fishing sites, including fishing piers, artificial reefs, certain beaches and bridges, and other locations. Recreational fishing locations were provided in digital format by SCDNR. Fishing sites were also identified using the South Carolina Public Beach and Coastal Access Guide (1988). Various expert sources also contributed information on recreational fishing sites.

Water intake—Locations of water intakes maintained by municipal utilities, industrial facilities, and aquaculture operations. Municipal and industrial water intake locations were provided by R. Berry, W. Fanning, and S. Knight with South Carolina Department of Health and Environmental Control (SCDHEC). Julie Lott (803/869-4119) coordinated water intake data collection for SCDHEC. Water intake locations for aquaculture sites were provided by Jack Whetstone, South Carolina/Sea Grant Marine Extension Program, 803/546-4481 and Al Stokes, Waddell Mariculture Center (SCDNR), 803/837-3795.

Water quality stations—Locations of water quality monitoring stations for the Charleston Harbor watershed are included in this atlas. These stations were established as part of the Charleston Harbor Project and are maintained by SCDHEC. For more information concerning these water quality stations, contact James Hackett (SCDHEC), 803/747-4323.

Wildlife refuge—Locations of areas managed as National Wildlife Refuges (NWR) by the U.S. Fish and Wildlife Service. Boundaries for the NWR's were obtained from USGS topographic maps and from Fairey and Berry (1986).

For aquaculture sites and water intakes, the name of the resource, the manager/owner, an emergency contact person, and a telephone number are provided. The information is listed on the reverse side of the maps, when available. The names and telephone numbers of various managed lands/waters are listed below.

NAME	TELEPHONE
NATIONAL PARK SERVICE (NPS)	
Fort Sumter National Monument (includes Fort Moultrie)	803/883-3123
NATIONAL WILDLIFE REFUGES (USFWS)	
ACE Basin National Wildlife Refuge (not shown on maps)	803/889-3084
Cape Romain National Wildlife Refuge	803/928-3368
Pinckney Island National Wildlife Refuge	912/652-4415

NAME	TELEPHONE
NATIONAL WILDLIFE REFUGES (USFWS)	
Savannah National Wildlife Refuge	912/652-4415
Tybee National Wildlife Refuge	912/652-4415
NATIONAL MARINE SANCTUARIES (NOAA/SCDNR)	
ACE Basin National Estuarine Research Reserve	803/762-5062
North Inlet-Winyah Bay National Estuarine Research Reserve	803/546-3623
STATE PARKS (SCDPRT)	
Charles Towne Landing	803/556-4450 803/852-4200
Edisto Beach State Park	803/869-2156 803/869-2756
Hunting Island State Park	803/838-2011 803/838-2152
Huntington Beach State Park	803/237-4440
Myrtle Beach State Park	803/238-5325

GEOGRAPHIC INFORMATION SYSTEM DATA

The entire atlas product is stored in digital form in a Geographic Information System (GIS). The information is stored as geographic layers and associated databases. The format for the data varies depending on the type of information or features for which the data are being stored. The three major formats are shoreline habitat classification, biological resources, and human-use features.

Under separate cover is a metadata document which details the data dictionary, processing techniques, and descriptive information for the digital data sets and maps that were used to create this atlas. Below is a brief synopsis of the information contained in the digital version. Refer to the metadata file for a full explanation of the data and its structure.

SHORELINE HABITAT CLASSIFICATION

The shoreline habitat classification is stored as lines and polygons with the data identifying the habitat type. In many cases, a shoreline may have two or three different classifications. These multiple classifications are represented on the maps by double or triple color combinations and in the data by ESI#1/ESI#2, where ESI#1 is the landward-most classification and ESI#2 is the seaward-most classification. The wetland habitat polygons were generated from digital NWI data provided by the SCDNR Water Resources Commission, the SCDNR Land Resources Commission, and the University of South Carolina's Baruch Institute.

SENSITIVE BIOLOGICAL RESOURCES

Biological resources are stored as points or polygons. Associated with each feature is a unique identification number which is linked to a series of databases that further identify the resources. The first data set consists of a list of the species and the concentration of each species. This dataset is then linked to a dataset that describes the life history of each species (temporal presence and reproductive/life-history time periods at monthly resolution) for the specified map feature. Other databases linked to the first data set are the species identification database, which includes common and scientific names for all species and their threatened or endangered status, and the sources database, which provides source metadata at the feature level.

HUMAN-USE FEATURES

Human-use features are represented as lines, points, or polygons. The resource types, names, and the sources for providing information are included in the database. All metadata sources are documented at the feature level.

REFERENCES

Listed below are the major hardcopy reference materials used during this project. In some instances, reference materials were not directly used as source materials, but were instead used or interpreted by scientists or resource managers who provided expert knowledge or personal communication concerning resources depicted in the atlas.

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SPECIES LIST*

Common Name	Species Name
MAMMALS	
MARINE MAMMALS	
Bottlenose dolphin	*Tursiops truncatus*
TERRESTRIAL MAMMALS	
Beaver	*Castor canadensis*
Meadow vole	*Microtus pennsylvanicus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Northern raccoon	*Procyon lotor*
River otter	*Lutra canadensis*
BIRDS	
DIVING BIRDS	
Anhinga	*Anhinga anhinga*
Brown pelican	*Pelecanus occidentalis*
Common loon	*Gavia immer*
Double-crested cormorant	*Phalacrocorax auritus*
Red-throated loon	*Gavia stellata*
GULLS AND TERNS	
Black skimmer	*Rynchops niger*
Common tern	*Sterna hirundo*
Gull-billed tern	*Sterna nilotica*
Laughing gull	*Larus atricilla*
Least tern	*Sterna antillarum*
Royal tern	*Sterna maxima*
Sandwich tern	*Sterna sandvicensis*
RAPTORS	
Bald eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Swallow-tailed kite	*Elanoides forficatus*
SHOREBIRDS	
American oystercatcher	*Haematopus palliatus*
Black-bellied plover	*Pluvialis squatarola*
Dowitcher	*Limnodromus spp.*
Dunlin	*Calidris alpina*
Greater yellowlegs	*Tringa melanaleuca*
Killdeer	*Charadrius vociferus*
Lesser yellowlegs	*Tringa flavipes*
Marbled godwit	*Limosa fedoa*
Peep	*Calidris spp.*
Piping plover	*Charadrius melodus*
Purple sandpiper	*Calidris maritima*
Red knot	*Calidris canutus*
Ruddy turnstone	*Arenaria interpres*
Semipalmated plover	*Charadrius semipalmatus*
Semipalmated sandpiper	*Calidris pusilla*
Spotted sandpiper	*Actitis macularia*
Willet	*Catoptrophorus semipalmatus*
Wilson's plover	*Charadrius wilsonia*
WADING BIRDS	
American avocet	*Recurvirostra americana*
Black-crowned night heron	*Nycticorax nycticorax*
Black-necked stilt	*Himantopus mexicanus*
Cattle egret	*Bubulcus ibis*
Clapper rail	*Rallus longirostris*
Glossy ibis	*Plegadis falcinellus*
Great blue heron	*Ardea herodias*
Great egret	*Casmerodius albus*
Green-backed heron	*Butorides striatus*
Least bittern	*Ixobrychus exilis*
Little blue heron	*Egretta caerulea*
Snowy egret	*Egretta thula*
Tricolored heron	*Egretta tricolor*
White ibis	*Eudocimus albus*
Wood stork	*Mycteria americana*
Yellow-crowned night heron	*Nyctanassa violacea*
WATERFOWL	
American coot	*Fulica americana*
American wigeon	*Anas americana*
Black duck	*Anas rubripes*
Black scoter (common)	*Melanitta nigra*
Blue-winged teal	*Anas discors*
Bufflehead	*Bucephala albeola*
Canvasback	*Aythya valisineria*
Common goldeneye	*Bucephala clangula*
Common merganser	*Mergus merganser*
Gadwall	*Anas strepera*
Greater scaup	*Aythya marila*
Green-winged teal	*Anas crecca*
Hooded merganser	*Lophodytes cucullatus*

SPECIES LIST*

Common Name	Species Name
BIRDS (continued)	
WATERFOWL (continued)	
Lesser scaup	*Aythya affinis*
Mallard	*Anas platyrhynchos*
Mottled duck	*Anas fulrigula*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Oldsquaw	*Clangula hyemalis*
Red-breasted merganser	*Mergus serrator*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Ruddy duck	*Oxyura jamaicensis*
Snow goose	*Chen caerulescens*
Surf scoter	*Melanitta perspicillata*
Wood duck	*Aix sponsa*
FISH	
ANADROMOUS	
Atlantic sturgeon	*Acipenser oxyrhynchus*
Herring and shad	*Alosa spp.*
Shortnose sturgeon	*Acipenser brevirostrum*
SPECIAL	
Atlantic croaker	*Micropogonias undulatus*
Atlantic menhaden	*Brevoortia tyrannus*
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*
Atlantic stingray (stingaree)	*Dasyatis sabina*
Black drum	*Pogonias cromis*
Black seabass	*Centropristis striata*
Blacktip shark	*Carcharhinus limbatus*
Bluefish	*Pomatomus saltatrix*
Cobia	*Rachycentron canadum*
Crevalle jack	*Caranx hippos*
Florida pompano	*Trachinotus carolinus*
Gag grouper	*Mycteroperca microlepis*
Grunts	
Gulf kingfish	*Menticirrhus littoralis*
King mackerel	*Scomberomorus cavalla*
Mummichog	*Fundulus heteroclitus*
Porgies	
Rays	
Red drum	*Sciaenops ocellatus*
Seatrout (weakfish)	*Cynoscion regalis*
Sharks	
Sheepshead	*Archosargus probatocephalus*
Skates	
Snappers	
Southern flounder	*Paralichthys lethostigma*
Southern kingfish (whiting)	*Menticirrhus americanus*
Spanish mackerel	*Scomberomorus maculatus*
Spiny dogfish	*Squalus acanthias*
Spot	*Leiostomus xanthurus*
Spotted seatrout	*Cynoscion nebulosus*
Striped mullet	*Mugil cephalus*
Summer flounder	*Paralichthys dentatus*
Tarpon	*Megalops atlanticus*
Tautog	*Tautoga onitis*
REPTILES	
TURTLES	
Loggerhead sea turtle	*Caretta caretta*
ALLIGATORS	
American alligator	*Alligator mississippiensis*
SHELLFISH	
BIVALVES	
American oyster (eastern)	*Crassostrea virginica*
Quahog spp. (hard clam)	*Mercenaria spp.*
CRABS	
Blue crab	*Callinectes sapidus*
SHRIMP	
Penaeid shrimp	*Penaeus spp.*

* Threatened and endangered species are designated by underlining.

SHORELINE HABITAT DESCRIPTIONS

EXPOSED WALLS AND OTHER SOLID STRUCTURES MADE OF CONCRETE, WOOD, OR METAL ESI = 1

DESCRIPTION

- These structures are solid, man-made structures such as sea-walls, groins, revetments, piers, and port facilities.
- Many structures are constructed of concrete, wood, or metal.
- Often there is no exposed substrate at low tide, but multiple habitats are indicated if present.
- They are built to protect the shore from erosion by waves, boat wakes, and currents, and thus are exposed to rapid natural removal processes.
- Attached animals and plants are sparse to moderate.

PREDICTED OIL BEHAVIOR

- Oil is held offshore by waves reflecting off the steep, hard surface in exposed settings.
- Oil readily adheres to the dry, rough surfaces, but it does not adhere to wet substrates.
- The most resistant oil would remain as a patchy band at or above the high-tide line.

RESPONSE CONSIDERATIONS

- Cleanup is usually not required.
- High-pressure water spraying may be conducted to:
  - remove persistent oil in crevices;
  - improve aesthetics; or
  - prevent leaching of oil.

EXPOSED SCARPS IN CLAY ESI = 2A

DESCRIPTION

- These shoreline types are created by eroding bluffs that are cut by waves, thus they are steep and narrow.
- The clay is usually hard packed and stiff, with an irregular, cracked surface.
- Attached animals and plants are sparse.
- There can be accumulations of wood debris and wrack at the base of the scarp.

PREDICTED OIL BEHAVIOR

- Oil will not adhere to the clay surface because it is impermeable, wet, and steep.
- Oil can penetrate intertidal sediments, if present.
- Persistence of oil is usually short term, except in crevices.

RESPONSE CONSIDERATIONS

- Cleanup is usually not required.
- Access and trafficability are usually poor.
- Where the high-tide area is accessible, it may be feasible to remove heavy oil accumulations and oiled debris.

WAVE-CUT MUD PLATFORMS ESI = 2B

DESCRIPTION

- These shoreline types form by wave or boat wake erosion of muddy substrates along navigable channels, estuarine and outer shorelines.
- They are characterized by a narrow shelf or platform that can be flooded depending on water levels.
- This shoreline type is dominant along the outer coast of Cape Island.
- There can be burrowing animals in the mud.

PREDICTED OIL BEHAVIOR

- Oil will not adhere to the wet clay surface but could penetrate the burrows if present.
- Persistence of oil is usually short term, except in wave shadows or where the oil was deposited high above normal wave activity.

RESPONSE CONSIDERATIONS

- Cleanup is usually not required.
- Where the high-tide area is accessible, it may be feasible to remove heavy oil accumulations and oiled debris.
- The muddy substrate cannot support heavy equipment, and even foot traffic could disrupt the sediments and mix oil deeper.

FINE-GRAINED SAND BEACHES ESI = 3A

DESCRIPTION

- These beaches are generally flat and hard-packed.
- Though they are predominately fine sand, there is often a small amount of shell or shell hash.
- There can be heavy accumulations of wrack present.
- They are utilized by birds and turtles.
- Upper beach fauna include ghost crabs and amphipods; lower beach fauna can be moderate, but highly variable.

PREDICTED OIL BEHAVIOR

- Light oil accumulations will be deposited as oily swashes or bands along the upper intertidal zone.
- Heavy oil accumulations will cover the entire beach surface; oil will be lifted off the lower beach with the rising tide.
- Maximum penetration of oil into fine-grained sand is about 10 cm.
- Burial of oiled layers by clean sand within the first week after a spill typically will be less than 30 cm along the upper beach face.
- Organisms living in the beach sediment may be killed by smothering or lethal oil concentrations in the interstitial water.
- Biological impacts include temporary declines in infauna, which can affect important shorebird foraging areas.

RESPONSE CONSIDERATIONS

- These beaches are among the easiest shoreline types to clean.
- Cleanup should concentrate on removing oil and oily debris from the upper swash zone once oil has come ashore.
- Traffic through both oiled and dune areas should be severely limited, to prevent contamination of clean areas.
- Manual cleanup, rather than road graders and front-end loaders, is advised to minimize the volume of sand removed from the shore and requiring disposal.
- Activity through both oiled and dune areas should be limited, to prevent contamination of clean areas.
- All efforts should focus on preventing the mixture of oil deeper into the sediments by vehicular and foot traffic.
- Mechanical reworking of lightly oiled sediments from the high-tide line to the upper intertidal zone can be effective along outer beaches.

SCARPS AND STEEP SLOPES IN SAND ESI = 3B

DESCRIPTION

- This shoreline type occurs where sandy bluffs are undercut by waves or currents and slump.
- They normally form along embankments of sandy dredge-spoil material and at cutbanks in rivers; they also form where tidal creeks intercept old sandy beach ridge deposits.
- Some scarps are fronted by narrow beaches, if the erosion rates are moderate and episodic.
- Trees growing at the top of these slopes are eventually undercut and the logs can accumulate at the base of the scarp.
- Biological utilization by birds and infauna is low.

PREDICTED OIL BEHAVIOR

- Any stranded oil will concentrate at the high-water line and may penetrate sandy sediments.
- Oil will also adhere to the dry surfaces of any logs that have accumulated at the base of the scarp.
- There is little potential for burial except when a major slumping of the bluff occurs.
- Active erosion of the scarp will remove the oil.

RESPONSE CONSIDERATIONS

- In most cases, cleanup is not necessary because of the short residence time of the oil
- The need for removal of oiled sediments and debris should be carefully evaluated because of the potential for increased erosion.
- Closely supervised manual labor should be used so that the minimal amount of material is removed during cleanup.

MEDIUM- TO COARSE-GRAINED SAND BEACHES ESI = 4

DESCRIPTION

- These beaches have relatively steep beach faces with wide, unvegetated upper beach.
- They are composed of quartz sand and carbonate sediments.
- The amount of wrack varies considerably.
- They are heavily utilized by people, birds, and turtles.

PREDICTED OIL BEHAVIOR

- Light oil accumulations will be deposited as oily swashes or bands along the upper intertidal zone.
- Heavy oil accumulations will cover the entire beach surface; oil will be lifted off the lower beach with the rising tide.
- Maximum oil penetration is about 20 cm.
- Burial of oiled layers by clean sand within the first week after a spill typically can be up to 50 cm.
- Organisms living in the beach sediments may be killed by smothering or lethal oil concentrations in the interstitial water.
- Biological impacts include temporary declines in infauna, which can affect important shorebird foraging areas.

RESPONSE CONSIDERATIONS

- Coarse sand sediments are less trafficable, increasing the risk of mixing oil into the substrate by foot and vehicular traffic.
- Cleanup should concentrate on removing oil and oily debris from the upper swash zone once oil has come ashore.
- Traffic through both oiled and dune areas should be severely limited, to prevent contamination of clean areas.
- Manual cleanup, rather than road graders and front-end loaders, is advised to minimize the volume of sand removed from the shore and requiring disposal.
- All efforts should focus on preventing the mixture of oil deeper into the sediments by vehicular and foot traffic.
- Mechanical reworking of lightly oiled sediments from the high-tide zone to the upper intertidal zone can be effective along outer beaches.

MIXED SAND AND GRAVEL (SHELL) BEACHES ESI = 5

DESCRIPTION

- These beaches are composed of a poorly sorted mixture of sand and shell fragments.
- Fill can be very hard packed with more mobile surface sediment, whereas natural beaches can be quite soft.
- They can occur in both high and low wave energy settings.
- The toe of the beach is generally composed of coarser, better sorted sediment.
- Because of sediment desiccation and mobility on exposed beaches, densities of animals and plants are lower than on sand beaches.

PREDICTED OIL BEHAVIOR

- During small spills, oil will be deposited along and above the high-tide swash.
- Large spills will spread across the entire intertidal area.
- Oil penetration into shelly zones may be up to 50 cm; however, in general oil behavior is much like on a sand beach.
- Burial of oil will only occur on natural beaches, following wave events.
- Oil can be stranded in the coarse sediments on the lower part of the beach, particularly if the oil is weathered or emulsified.

RESPONSE CONSIDERATIONS

- Heavy accumulations of pooled oil from the upper beachface should be removed quickly to prevent penetration into the porous sediments.
- All oiled debris should be removed.
- Sediment removal should be limited as much as possible.
- Mechanical reworking of lightly oiled sediments from the high-tide zone to the upper intertidal zone can be effective along outer beaches.
- In-place tilling may be used to reach deeply buried oil layers in the middle zone on exposed beaches, as an alternative to sediment removal.

GRAVEL (SHELL) BEACHES — ESI = 6A

DESCRIPTION

- Gravel beaches in South Carolina are composed almost entirely of shell.
- They can be very steep, with multiple wave-built berms forming the upper beach.
- Shell beaches are common in near oyster reefs and in the intracoastal waterway along spoil mounds where the spoil is reworked by boat wakes into steep shell berms.
- Because of the high mobility of these sediments on exposed beaches, there are low densities of animals and plants.

PREDICTED OIL BEHAVIOR

- Deep penetration of stranded oil is likely on gravel beaches because of their high permeability.
- Long-term persistence will be controlled by the depth of routine reworking by the waves.
- Along sheltered portions of the shorelines, chronic sheening and the formation of asphalt pavements is likely where accumulations are heavy.

RESPONSE CONSIDERATIONS

- Heavy accumulations of pooled oil should be removed quickly from the upper beach.
- All oiled debris should be removed.
- Sediment removal should be limited as much as possible.
- Low- to high-pressure flushing can be effective, making sure to recover all released oil with skimmers or sorbents.
- Mechanical reworking of oiled sediments from the high-tide line to the lower beachface can be effective in areas regularly exposed to wave activity; the presence of multiple storm berms is evidence of wave activity.
- In-place tilling may be used to reach deeply buried oil layers along the mid-intertidal zone on exposed beaches.

EXPOSED RIPRAP STRUCTURES — ESI = 6B

DESCRIPTION

- Riprap structures are composed of cobble- to boulder-sized blocks of granite or limestone.
- Riprap structures are used for shoreline protection and tidal-inlet stabilization
- Attached biota is sparse on exposed riprap.

PREDICTED OIL BEHAVIOR

- Deep penetration of oil between the blocks is likely.
- Oil adheres readily to the rough surfaces of the blocks.
- Uncleaned oil can cause chronic leaching until the oil hardens.

RESPONSE CONSIDERATIONS

- When the oil is fresh and liquid, high pressure spraying and/or water flooding may be effective, making sure to recover all liberated oil.
- Heavy and weathered oils are more difficult to remove, requiring scrapping and/or hot-water spraying.
- It may be necessary to remove heavily oiled blocks and replace them.

EXPOSED TIDAL FLATS (SANDY) — ESI = 7

DESCRIPTION

- Exposed tidal flats are broad intertidal areas composed primarily of sand and minor amounts of shell and mud.
- The presence of sand indicates that tidal currents and waves are strong enough to mobilize the sediments.
- They are usually associated with another shoreline type on the landward side of the flat, though they can occur as separate shoals; they are commonly associated with tidal inlets.
- Biological utilization can be very high, with large numbers of infauna, heavy use by birds for roosting and foraging, and use by foraging fish.

PREDICTED OIL BEHAVIOR

- Oil does not usually adhere to the surface of exposed tidal flats, but rather moves across the flat and accumulates at the high-tide line.
- Deposition of oil on the flat may occur on a falling tide if concentrations are heavy.
- Oil does not penetrate water-saturated sediments.
- Biological damage may be severe, primarily to infauna, thereby reducing food sources for birds and other predators.

RESPONSE CONSIDERATIONS

- Currents and waves can be very effective in natural removal of the oil.
- Cleanup is very difficult (and possible only during low tides).
- The use of heavy machinery should be restricted to prevent mixing of oil into the sediments.

SHELTERED, SOLID MAN-MADE STRUCTURES ESI = 8A

DESCRIPTION

- These structures are solid man-made structures such as seawalls, groins, revetments, piers, and port facilities.
- Most structures are constructed of concrete, wood, or metal.
- Often there is no exposed beach at low tide, but multiple habitats are indicated if present.
- Most of the structures are designed to protect a single lot, thus their composition, design, and condition are highly variable.
- Attached animal and plant life can be high.

PREDICTED OIL BEHAVIOR

- Oil will adhere readily to the rough surface, particularly along the high-tide line, forming a distinct oil band.
- The lower intertidal zone usually stays wet (particularly if algae covered), preventing oil from adhering to the surface.

RESPONSE CONSIDERATIONS

- Cleanup of seawalls is usually conducted for aesthetic reasons or to prevent leaching of oil.
- Low- to high-pressure spraying at ambient water temperatures is most effective when the oil is fresh.

SHELTERED SCARPS IN MARSH/MUD ESI = 8B

DESCRIPTION

- Sheltered scarps form by boat wake erosion of marsh fronts or muddy substrates along navigable channels.
- There may some fringing marsh at the base of the scarp along the edge of the water; it is not significant to map.

PREDICTED OIL BEHAVIOR

- Oil will not adhere to the wet sediment surface but could penetrate burrows if present.
- Stranded oil will persist because of low energy setting.

RESPONSE CONSIDERATIONS

- Where the high-tide area is accessible, it may be feasible to remove heavy oil accumulations and oiled debris.
- The muddy substrate cannot support heavy equipment, and even foot traffic could disrupt the sediments and mix oil deeper.

SHELTERED TIDAL FLATS/OYSTER BEDS (MUDDY) ESI = 9

DESCRIPTION

- Sheltered tidal flats are composed primarily of mud with minor amounts of sand and shell.
- They are present in calm-water habitats, sheltered from major wave activity, and are frequently backed by marshes or mangroves.
- The sediments are very soft and cannot support even light foot traffic in many areas.
- They can be sparsely to heavily covered with algae and/or seagrasses.
- They can have very heavy wrack deposits along the upper fringe.
- There can be large concentrations of shellfish, worms, and snails on and in the sediments.
- They are heavily utilized by birds for feeding.

PREDICTED OIL BEHAVIOR

- Oil does not usually adhere to the surface of sheltered tidal flats, but rather moves across the flat and accumulates at the high-tide line.
- Deposition of oil on the flat may occur on a falling tide if concentrations are heavy.
- Oil will not penetrate the water-saturated sediments, but could penetrate burrows and desiccation cracks or other crevices in muddy sediments.
- In areas of high suspended sediments, sorption of oil can result in deposition of contaminated sediments on the flats.
- Biological damage may be severe.

RESPONSE CONSIDERATIONS

- These are high-priority areas necessitating the use of spill protection devices to limit oil-spill impact; deflection or sorbent booms and open water skimmers should be used.
- Cleanup of the flat surface is very difficult because of the soft substrate; many methods may be restricted.
- Low-pressure flushing and deployment of sorbents from shallow-draft boats may be helpful.

SALT AND BRACKISH-WATER MARSHES ESI = 10A

DESCRIPTION

- Marshes are intertidal wetlands containing emergent, herbaceous vegetation.
- Width of the marsh can vary widely, from a narrow fringe to extensive areas.
- Sediments are composed of organic muds except on the margins of barrier islands where sand is abundant.
- Exposed areas are located along bays with wide fetches and along heavily trafficked waterways.
- Sheltered areas are not exposed to significant wave or boat wake activity.
- Resident flora and fauna are abundant with numerous species with high utilization by birds, fish, and shellfish.

PREDICTED OIL BEHAVIOR

- Oil adheres readily to intertidal vegetation.
- The band of coating will vary widely, depending upon the water level at the time oil slicks are in the vegetation. There may be multiple bands.
- Large slicks will persist through multiple tidal cycles and coat the entire stem from the high-tide line to the base.
- If the vegetation is thick, heavy oil coating will be restricted to the outer fringe, although lighter oils can penetrate deeper, to the limit of tidal influence.
- Medium to heavy oils do not readily adhere to or penetrate the fine sediments, but can pool on the surface or in burrows.
- Light oils can penetrate the top few centimeters of sediment and deeply into burrows and cracks (up to one meter).

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Natural removal processes and rates should be evaluated prior to conducting cleanup.
- Heavy accumulations of pooled oil can be removed by vacuum, sorbents, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Cleanup activities should be carefully supervised to avoid vegetation damage.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.

FRESHWATER MARSHES (HERBACEOUS VEGETATION) ESI = 10B

DESCRIPTION

- Freshwater marshes are grassy wetlands composed of freshwater vegetation.
- They occur upstream of brackish vegetation along major rivers.
- Those along major channels are exposed to strong currents and boat wakes; inland areas are highly sheltered.
- The substrate is seldom exposed since daily water-level changes are low; greater changes result from floods.
- Resident flora and fauna are abundant with numerous species with high utilization by birds.

PREDICTED OIL BEHAVIOR

- Oil adheres readily to intertidal vegetation.
- The band of coating will vary widely, depending upon the water level at the time oil slicks are in the vegetation. There may be multiple bands.
- Large slicks will persist through multiple tidal cycles and coat the entire stem from the high-tide line to the base.
- If the vegetation is thick, heavy oil coating will be restricted to the outer fringe, although lighter oils can penetrate deeper, to the limit of tidal influence or elevated water levels associated with a flood event.

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Natural removal processes and rates should be evaluated prior to conducting cleanup.
- Heavy accumulations of pooled oil can be removed by vacuum, sorbents, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Cleanup activities should be carefully supervised to avoid vegetation damage.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.

FRESHWATER SWAMPS (WOODY VEGETATION) ESI = 10C

DESCRIPTION

- Freshwater swamps consist of shrubs and hardwood forested wetlands, essentially flooded forests.
- They are common along major river valleys such as the Santee, Ashepoo, Combahee, and Edisto.
- The sediment tends to be silty clay with large amounts of organic debris.
- They are seasonally flooded, though there are many low, permanently flooded areas.
- Resident flora and fauna are abundant with numerous species.

PREDICTED OIL BEHAVIOR

- Oil behavior depends on whether the swamp is flooded or not.
- During floods, most of the oil passes through the forest, coating the vegetation above the waterline, which changes levels throughout the flood event.
- Oiled woody vegetation is less sensitive than marshes to oil coating.
- Some oil can be trapped and pooled on the swamp flood plain as water levels drop.
- Penetration into the floodplain soils is usually limited because of high water levels, muddy composition, surface organic debris, and vegetation cover.
- Large amounts of oily debris can remain.
- During dry periods, terrestrial spills flow downhill and accumulate in depressions or reach waterbodies.

RESPONSE CONSIDERATIONS

- Under light oiling, the best practice is to let the area recover naturally.
- Heavy accumulations of pooled oil can be removed by vacuum, sorbents, or low-pressure flushing. During flushing, care must be taken to prevent transporting oil to sensitive areas down slope or along shore.
- Under stagnant water conditions, herding of oil with water spray may be needed to push oil to collection areas.
- Oily debris can be removed where there is access.
- Any cleanup activity must not mix the oil deeper into the sediments. Trampling of the roots must be minimized.
- Cutting of oiled vegetation should only be considered when other resources present are at great risk from leaving the oiled vegetation in place.