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WETLAND AND NEOTROPICAL SONGBIRD HABITAT ENHANCEMENT STUDY NAVAL SUPPORT ACTIVITY MIDSOUTH MILLINGTON SUPPACT TN
6/12/2006
ENSAFE INC

WETLAND AND NEOTROPICAL SONGBIRD HABITAT ENHANCEMENT STUDY

NAVAL SUPPORT ACTIVITY MID-SOUTH
MILLINGTON, TENNESSEE

Revision: 0

Prepared for:

Naval Support Activity Mid-South
5722 Integrity Drive
Millington, Tennessee 38054-5045

Prepared by:

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(901) 372-7962
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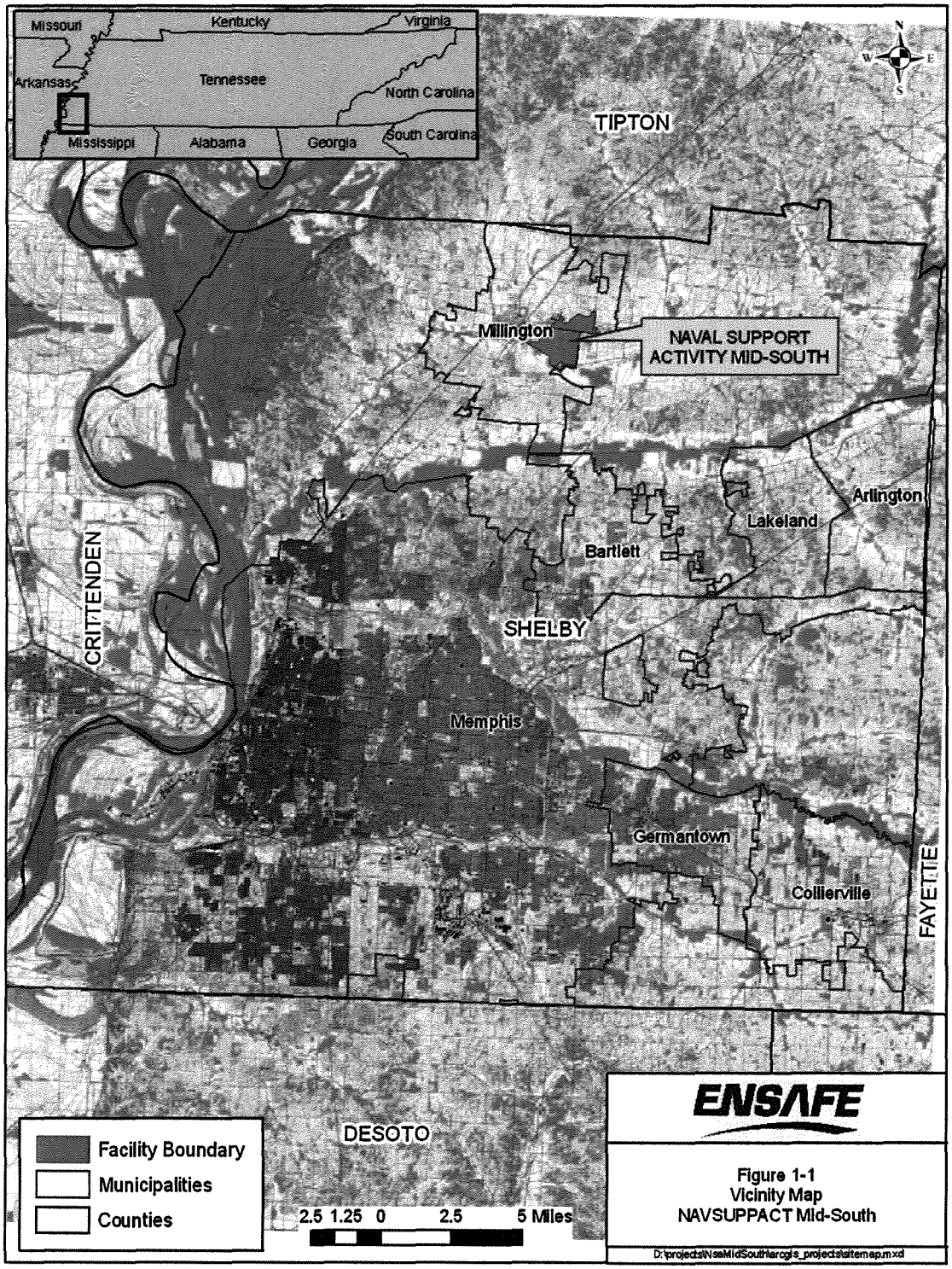
1.0 INTRODUCTION

In 2001, an Integrated Natural Resources Management Plan (INRMP) (e^2M, 2001) was developed for the Office of the Chief of Naval Operations and for the Naval Support Activity Mid-South (NAVSUPPACT Mid-South) located in Millington, Tennessee (Figure 1.1). The INRMP outlines the goals, objectives, and actions for the management of natural resources on the 1,600 acre NAVSUPPACT Mid-South installation over a 10 year period. The protection and management of wetlands and floodplains on the NAVSUPPACT Mid-South 1,600 acre installation are two of several natural resource management goals identified in the INRMP.

The specific wetland and floodplains management goals for NAVASUPPACT Mid-South are as follows:

- Remain in compliance with U.S. Army Corps of Engineers (USACE) and Tennessee Division of Water Pollution Control (WPC) wetlands regulations
- Minimize the operational impact of NAVSUPPACT Mid-South missions on wetlands and floodplains
- Maintain healthy, functional wetlands that can sustain minor operational influences and minor, inadvertent encroachments
- Enhance wetland functionality to maximize societal-based wetland values within local ecosystems
- Maximize floral and faunal diversity of wetland communities in the ecosystem
- Manage for no net loss of wetland and floodplain acreage, functions, and values
- Retain and restore vegetation buffers on waterways/riparian corridors

Management issues that compromise the ability of NAVSUPPACT Mid-South to achieve the wetland and floodplain goals were also presented in the INRMP. These management issues formed the basis for several wetland and floodplain management objectives and actions designed to meet the goals. One of the objectives for meeting wetland and floodplain management goals at NAVSUPPACT Mid-South is the enhancement of functions and values of two wetlands, Wetlands 7 and 8, located along the southern boundary of the installation. These two wetlands were identified in the INRMP as having the potential for reclamation and for supporting a variety of future uses including recreational fishing habitat or available wildlife habitat.


Missouri
Kentucky
Virginia
Arkansas
Tennessee
North Carolina
Mississippi
Alabama
Georgia
South Carolina
TIPTON
Millington
NAVAL SUPPORT ACTIVITY MID-SOUTH
Arlington
Lakeland
Bartlett
CRITTENDEN
SHELBY
Memphis
Germantown
Collierville
FAYETTE
DESOTO
Facility Boundary
Municipalities
Counties
2.5 1.25 0 2.5 5 Miles
ENSAFE
Figure 1-1
Vicinity Map
NAVSUPPACT Mid-South

2.0 PURPOSE

In September 2005, NAVSUPPACT Mid-South contracted with EnSafe Inc. (EnSafe) of Memphis, Tennessee, to complete a wetland and neotropical songbird habitat enhancement study for Wetlands 7 and 8 at NAVSUPPACT Mid-South. The specific objectives identified by NAVSUPPACT Mid-South for the wetland enhancement study were to:

- Evaluate the soils and hydrology within these wetlands
- Determine which local plant species will thrive for the enhancement of neotropical songbird habitat
- Provide recommendations on potential measures that can be implemented to enhance the wetlands for neotropical migrants and opportunities for bird-watching by the public
- Prepare a report that summarizes the findings of this study

3.0 DESCRIPTION OF PROJECT AREA

3.1 Location and Size

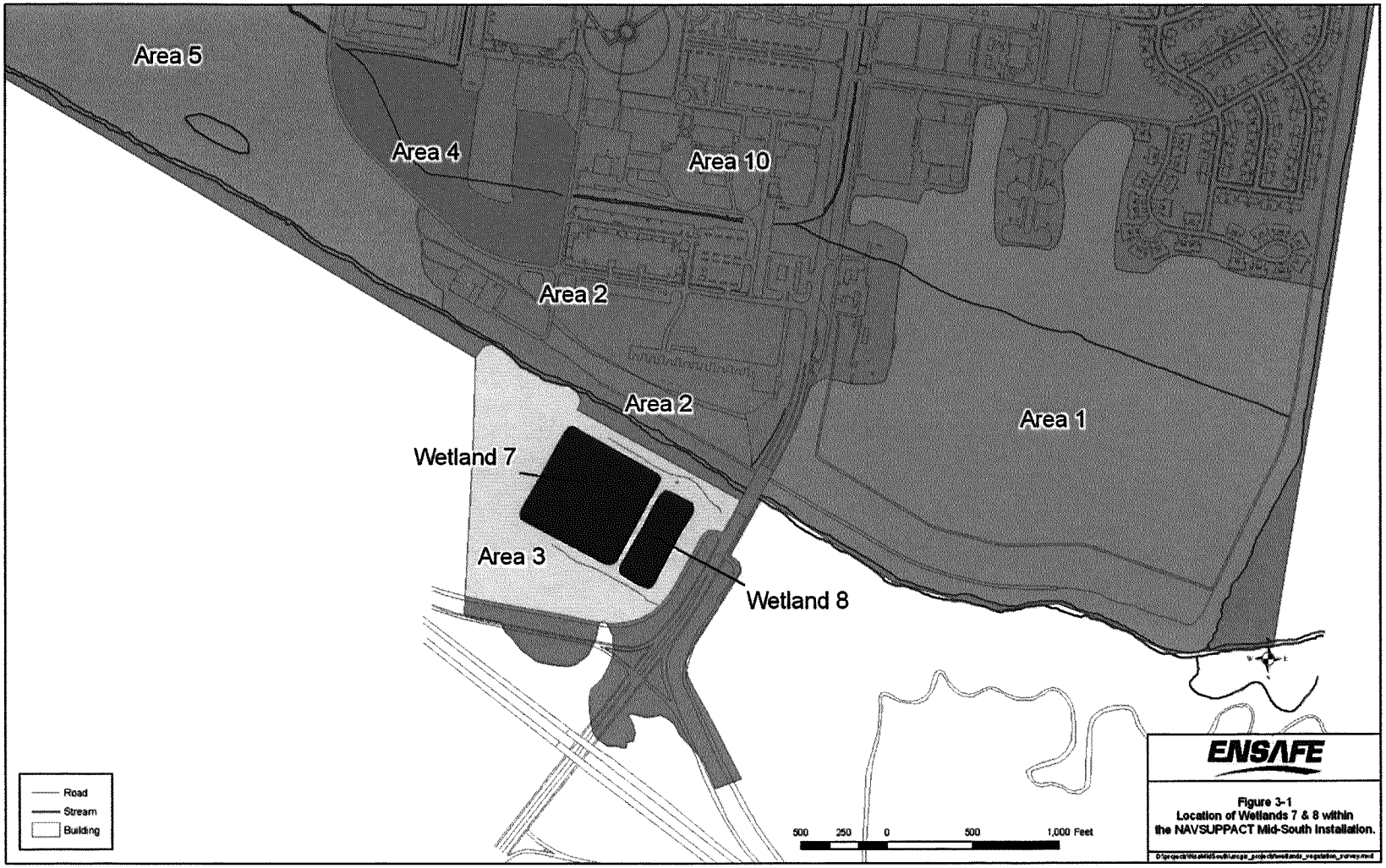
Wetlands 7 and 8 lie in the southern portion of the NAVSUPPACT Mid-South property (Figure 3.1). More specifically, these wetlands lie adjacent to and south of the Big Creek drainage canal, north and east of State Highway 385 and Jones Boyd Road, and west of Singleton Parkway. Forested areas lie to the west and a narrow dirt road encircles them.

Wetlands 7 and 8 are open water basins that are generally rectangular in shape and are separated by an earthen berm. Wetland 7, the larger of the two wetlands, is approximately 9.2 acres in size. Wetland 8, the smaller of the two wetlands, is approximately 3.2 acres in size.

3.2 Former Land Use

Wetlands 7 and 8 are the locations of two former wastewater treatment lagoons at the NAVSUPPACT Mid-South. These lagoons were used from 1969 to 1978 as part of the NAVSUPPACT Mid-South's wastewater treatment system receiving domestic and industrial wastewater from the installation's former aircraft maintenance operations (EnSafe, 2005). Past operations included metal plating, manufacturing, and other operations that involved the use of toxic and hazardous materials. These basins were abandoned in 1978 when aircraft maintenance operations ceased at the installation.

The former wastewater treatment lagoons currently are identified as Solid Waste Management Unit 9 (SWMU 9) regulated under the NAVSUPPACT Mid-South's Resource Conservation and Recovery Act (RCRA) permit. A corrective action remedy that institutes land-use controls, specifically fishing and drinking water bans, has been proposed for these wetlands for protection of public health and the environment. This proposed remedy is currently undergoing public review and comment. Depending on the outcome of the public review process, a final corrective action remedy will be approved for these wetland areas.


Area 5
Area 4
Area 10
Area 2
Area 2
Area 1
Wetland 7
Area 3
Wetland 8
Road
Stream
Building
500 250 0 500 1,000 Feet
ENSAFE
Figure 3-1
Location of Wetlands 7 & 8 within
the NAVSUPPACT Mid-South Installation.

4.0 METHODS

The collection and review of available literature on the habitat requirements of and conservation needs for neotropical migratory birds was conducted by EnSafe ecologists prior to the completion of an onsite evaluation of Wetlands 7 and 8. *The North American Landbird Conservation Plan* (Rich et al., 2004) and regional landbird conservation plans for the Mississippi Alluvial Valley (Twedt et al., 1999) and East Gulf Coastal Plains (American Bird Conservancy, n.d.) physiographic regions were reviewed to identify regional habitat and species conservation and management needs and priorities.

Based on the management objectives and actions identified in the INRMP for the conservation of shorebird habitat at these wetlands, EnSafe also obtained and reviewed literature and information on shorebird habitat requirements. *The U.S. Shorebird Conservation Plan* (Brown et al., 2001) and the regional *U.S. Shorebird Conservation Plans for the Mississippi Alluvial Valley* (Elliott and McKnight, 2000) and the *Southeastern Coastal Plains — Caribbean Region* (Hunter, 2002) were reviewed to identify shorebird habitat conservation and management priorities relevant to NAVSUPPACT Mid-South.

Previous bird studies completed on the NAVSUPPACT Mid-South by the U.S. Fish and Wildlife Service in 1996 (Merritt and Bingham, 1997) and by e^2M for the preparation of the INRMP (e^2M, 2001) also were reviewed to identify the known or potential occurrences of neotropical migrants and shorebirds on the NAVSUPPACT Mid-South installation. EnSafe ecologists contacted local and regional experts for information or unpublished data and/or studies on neotropical migrants and habitat preferences in the southern region. EnSafe also contacted the Shelby County Planning Commission's representative on the Inter-State Greenway Commission to obtain copies of the proposed regional plan to implement an inter-state "greenway," but was unable after a number of attempts to obtain this information.

Other site-specific information including black and white aerial photography, soil data (Soil Conservation Service [SCS], 1970), the list of hydric soil map units and map units containing hydric inclusions for Shelby County (Natural Resources Conservation Service, 1990), and other site background materials were obtained and reviewed. A water and sediment quality study conducted by EnSafe (EnSafe, 2000; EnSafe, 2005) within Wetlands 7 and 8 (i.e., the former wastewater treatment lagoons) also was reviewed to obtain information on the current quality of water and sediments in these wetlands.

A one-day field evaluation of these wetlands was completed on October 19, 2005, to evaluate soils, hydrology, and existing conditions of the wetlands. Soil cores were collected and observed for general soil texture, redoximorphic features, and other indicators of wetland soils. Soil samples were collected from a minimum of three locations within each wetland. Estimates of water depths and dominant plant species present in these wetlands also were recorded for each wetland. Hydrologic information also was obtained from other studies completed on the NAVSUPPACT Mid-South in previous years and from fish surveys conducted by EnSafe at NAVSUPPACT Mid-South in the fall and winter of 2005. Detailed hydrologic studies to characterize seasonal water depths were not included as part of the current study.

5.0 RESULTS

5.1 Wetland Characteristics

5.1.1 Hydrologic Characteristics

The INRMP states that surface water generally is present in Wetlands 7 and 8 year round, but that significant drawdown occurs over the course of the summer months when average monthly precipitation drops. The onsite habitat evaluation conducted in October 2005 confirmed this observation. An estimated 85% of the wetland was inundated during the October 2005 site reconnaissance following a 10 month period of below average monthly precipitation levels.

Water levels are deeper in Wetland 8, the smaller of the two wetlands, and were estimated during the 2005 fishery survey conducted by EnSafe to range from 0 inches to approximately 24 inches deep. Water depths in Wetland 7 ranged from 0 inches to approximately 18 inches deep (EnSafe, 2006a).

These wetlands are non-flow-through hydrologic systems that depend primarily on and are limited to direct precipitation for hydrologic inputs. Hydrologic outputs are limited primarily to evaporation from the water surface of the wetlands and transpiration from vegetation around the edge of the wetlands. There does not appear to be a hydrologic connection between the wetlands and Big Creek drainage, which lies to the north of the wetlands and approximately 50 feet below the ground surface. Based on the October 2005 site evaluation, there does not appear to be any outlets or overflow spillways around the perimeter of these wetlands.

On a seasonal basis, water levels are deepest in these ponds during the winter and spring when direct precipitation inputs exceed evapotranspiration. Water levels drop slowly over the course of the summer months and into the fall as evapotranspiration exceeds precipitation. As a result, as surface water levels drop naturally throughout the summer months, more shoreline edge and exposed mud flats appear (Figure 5.1). Personal communication with NAVSUPPACT Mid-South personnel indicate that the ponds generally maintain water over 60% of the surface area even during the driest periods of the year (Rob Williamson, interview). In some years, these wetlands dry out completely during the late summer and early fall months.

Figure 5.1 Exposed mudflats from natural drawdown of water in Wetland 7 during summer months.

5.1.2 Vegetation

Wetlands 7 and 8 are classified as a palustrine, open water, excavated, unconsolidated bottom wetland using the Cowardin classification system (Cowardin et al., 1979). In this wetland type, vegetation is generally lacking; the area is less than 20 acres in size; active wave-formed or bedrock shoreline features are lacking; water depth in the deepest part of basin is less than 6 feet at low water; and salinity due to ocean-derived salts is less than 0.5 percent.

A zone or fringe of emergent vegetation exists around the open water body. Based on a review of available photographs and the 2005 site visit, three distinct vegetative zones appear to exist within these wetlands. Directly adjacent to the open water are unvegetated or sparsely vegetated mudflats, herein referred to as Zone 1. Zone 1 is colonized by nonpersistent, low-growing annuals or perennials. During October 2005, this zone was approximately 1.5 to 2.5 feet wide with 35% herbaceous cover and 65% bare ground (Figure 5.2). Based on a review of other photographs taken of the wetlands, this zone may be 6 to 7 feet wide during the driest times of the year. No woody vegetation exists within Zone 1 in either wetland and species diversity is low.

Star chickweed *(Stellaria pubera)* and marsh pennywort *(Hydrocotyle umbellate)* were the dominant herbaceous species observed at the time of the onsite survey in this zone (Table 5.1).

Figure 5.2 Wetland 8 showing open water surrounded by three distinct vegetative zones during late summer-early fall of 2005.

Table 5.1
Dominant Species Observed in Wetlands 7 and 8
October 2005

Common Name	Species Name	Zone 1	Zone 2	Zone 3
Sycamore	*Platanus occidentalis*			●
Persimmon	*Diospyros virginiana*			●
Box Elder	*Acer negundo*			●
Tulip Tree	*Liriodendron tulipifera*			●
Barnyard Grass	*Echinochloa crus-galli*		●	
Bulrush	*Juncus effusus*		●	
Caric-Sedge	*Carex sp.*		●	
Rice Cutgrass	*Leersia oryizoides*		●	
Marsh Pennywort	*Hydrocotyle umbellifera*	●		
Star Chickweed	*Stellaria pubera*	●		

Note:
● — Specie observed in zone

Upslope or higher-up in elevation along the shoreline gradient is a zone of persistent, emergent, perennial wetland plants, and grasses that is approximately 3 to 5 feet wide, herein referred to as Zone 2. Vegetation in Zone 2 is dense with approximately 80 to 100% herbaceous cover and 0 to 20% bare ground (Figure 5.3) and is dominated more by perennial species than Zone 1. Dominant herbaceous species observed in Zone 2 at the time of the survey included barnyard grass *(Echinochloa crus-galli),* common bulrush *(Juncus effusus),* a caric-sedge *(Carex sp.)* and rice cutgrass *(Leersia oryizoides)* (Table 5.1).

Figure 5.3 Wetland 7 showing open water surrounded by three distinct vegetative zones during winter 2005.

The upland banks surrounding the wetlands, herein referred to as Zone 3, lie outside of the zone of soil saturation or inundation and contain a mixture of herbaceous and woody upland species. Woody vegetation in this zone is dominated by small- to medium-sized trees and numerous grasses that could not be identified during the fall survey. Dominant tree species in Zone 3 included persimmon *(Dyospyros virginiana),* sycamore *(Platanus occidentalis),* tulip tree *(Liriodendron tulipifera),* and box elder *(Acer negundo)* (Table 5.1). The vegetation in this zone is highly disturbed as a result of berm and road construction around the former lagoons.

Wetlands 7 and 8 are surrounded by a sycamore — eastern cottonwood — red maple — pawpaw floodplain forest community (EnSafe, 2006b). This forest community lies adjacent to these wetlands to the west and south.

5.1.3 Soils

The Soil Survey for Shelby County (SCS, 1970) maps the soils in the area of Wetlands 7 and 8 as the Fayala silt loam and the Waverly silt loam map units, with Waverly silt loam being the dominant map unit in the area. Fayala silt loam is somewhat poorly drained and has been characterized as a very silty soil with high available water capacity (SCS, 1970). The soil reaction is described by SCS (1970) as medium acid to strong acid and the content of phosphorus and potassium is moderately high. Fayala silt loam is well suited to many summer annuals that provide food and cover for wildlife including bobwhite, quail, doves, and rabbits. Plants (i.e., crops) respond to lime and fertilizer. Low areas within Fayala silt loam can be developed as feeding places for waterfowl by establishing food-producing plants and then flooding (SCS, 1970).

Fayala silt loam is not a listed hydric (i.e., wetland) soil but possibly contains inclusions of hydric soil map units. A typical profile of soils in the Fayala series is a brown (10YR 4/3) silt loam in the upper 6 inches, and a brown (10YR 5/3) silt loam with medium to light brownish-gray and pale-brown mottles in the 6 to 18 inches layer (SCS, 1970).

The Waverly silt loam map unit, which is the dominant map unit in the vicinity of these wetlands, is a hydric soil map unit that is poorly drained. Waverly silt loam is described as a silty soil with high available water capacity (SCS, 1970). The soil reaction is medium or strong acid. Waverly silt loam has moderate natural fertility, and generally, the content of potassium is low and the content of phosphorus medium (SCS, 1970). Similar to Fayala silt loam map unit, the response to lime and fertilizer is good. The soils are seasonally saturated and can be developed as feeding areas for waterfowl.

A typical profile of soils in the Waverly soil series is dark grayish-brown silt loam in the upper 8 inches (10YR 4/2), and a gray (10YR 5/1) silt loam with grayish-brown and yellowish brown mottles in the 8 to 20 inches layer (SCS, 1970).

Because the soils within these wetlands are inundated or saturated for the majority of the year, the soils are predominantly reduced (i.e., anaerobic) year round. Soil samples collected from within the ponds during the October 19, 2005, site visit were evaluated for indicators of hydric soils including:

low chroma matrix soil colors, oxidized rhizospheres, concretions, sulfidic odor, histic epipedon, etc. With the exception of gleyed or low chroma colors, no other indicators of hydric soils were observed in any of the soil cores extracted from within the ponds. The typical profile of soil cores extracted from the wetlands is brown (10YR 4/2) silt loam in the upper 1 to 2 inches, gleyed (5GY 6/1) silty clay in the 2 to 12 inch subsurface layer, with yellowish-brown prominent mottles (7.5YR 5/6) in the lower half of the core from 6 to 12 inches. Based on the soil cores collected in October 2005, soils within the pond appear to contain a large amount of silt and clay in the upper 0 to 6 inches and larger amounts of clay with some silt in the lower 6 to 12 inches. No attempt to formally classify soils or determine soil textures was made as part of this survey.

5.1.4 Sediment and Surface Water Quality

EnSafe completed an investigation of contaminants in surface water, groundwater, sediments, and fish within the former wastewater treatment lagoons (i.e., wetlands) in 2000 in accordance with the NAVSUPPACT Mid-South's RCRA permit. A complete summary of this investigation can be found in the *RCRA Facility Investigation Report, Revision 2* (EnSafe, 2000). Volatile and semivolatile organic constituents, petroleum hydrocarbons, pesticides, polychlorinated biphenyls (PCBs), herbicides, and metals were detected in sediment samples collected from these wetlands (EnSafe, 2005). In addition, PCBs, metals, and pesticides were detected in fish tissue samples collected from the lagoons. A number of inorganic constituents, pesticides, and semivolatile constituents were detected in surface water samples collected from the wetlands.

Ecological risks to terrestrial and aquatic receptors as a result of exposure to constituents in surface water and sediments in Wetlands 7 and 8 were calculated by EnSafe in 2000. Although the ecological risk assessment did not specifically evaluate risks to shorebirds, wading birds, or waterfowl that may utilize these wetlands, an assessment was completed of risk to the belted kingfisher *(Ceryle alcyon)* as a result of exposure to surface water, fish, and sediments. The belted kingfisher is a year-round resident whose diet is composed mainly of fish, but also includes aquatic invertebrates, insects, and small aquatic vertebrates (Cornell Lab of Ornithology, 2003). Risks to aquatic organisms (fish and invertebrates) as a result of exposure to surface water and sediments also were estimated. Based on the ecological risk assessment, current and future risks to terrestrial and aquatic receptors as a result of exposure to surface water, sediments, or fish ingestion within these wetlands were determined to be acceptable.

5.2 Bird Populations at NAVSUPPACT Mid-South

A number of avian studies have been completed at NAVSUPPACT Mid-South since 1995 (Meritt and Bingham, 1996; e^2M, 2001; EnSafe, 2006a). Most of the bird species observed on the installation are common species that are considered generalists (i.e., species that have adapted to a wide range of undeveloped and developed habitats). These studies indicate that transient migratory songbird species may occur on the installation during the spring, summer, and fall; however, to date, transient migratory birds have not been observed on the installation. A few species of shorebirds, wading birds, and waterfowl have been documented as utilizing the wetlands. These sightings however are relatively infrequent and generally are of a single individual or a small number of individual species.

Avian species documented as occurring in the vicinity of Wetlands 7 and 8 (Meritt and Bingham, 1996; e^2M, 2001; EnSafe, 2006) include a number of wading birds, and shorebirds including the semipalmated sandpiper *(Calidris pusilla),* great blue heron *(Ardea herodias),* killdeer *(Charadrius vociferous),* upland sandpiper *(Bartramia longicauda),* the solitary sandpiper *(Tringa solitaria),* and several waterfowl species (Table 5.2).

Table 5.2
Bird Species Observed in 2005

Common Name	Scientific Name	Observed=X Potential=P
American Robin	*Turdus migratorius*	X
Blue Jay	*Cyanocitta cristata*	X
Yellow Shafted Flicker	*Colaptes auratus*	X
Northern Cardinal	*Cardinalis cardinalis*	X
Slate-Colored Junco	*Junco hyemalis*	X
Mockingbird	*Mimus polyglottos*	X
Red-Shouldered Hawk	*Buteo lineatus*	X
Red-Tailed Hawk	*Buteo jamaicensis*	X
Tufted Titmouse	*Baeolophus bicolor*	X
Turkey	*Meleagris gallopavo*	X
Great Blue Heron	*Ardea herodias*	X
Killdeer	*Charadrius vociferous*	X
Semipalmated Sandpiper	*Calidris pusilla*	X
Solitary Sandpiper	*Tringa solitaria*	X
Upland Sandpiper	*Bartramia longicauda*	X
Bufflehead	*Bucephala albeola*	X

Table 5.2
Bird Species Observed in 2005

Common Name	Scientific Name	Observed=X Potential=P
Common Snipe	*Capella gallinago*	X
Belted Kingfisher	*Ceryle alcyon*	X
Hooded Merganser	*Lophodytes cucullatus*	X
Mallard	*Anas platyrhynchos*	X
Ruddy Duck	*Oxyura jamaicensis*	X
Great Egret	*Ardea alba*	X
Black-Crowned Night-Heron	*Nycticorax nycticorax*	P
Yellow-Crowned Night-Heron	*Nyctanassa violacea*	P
Cattle Egret	*Bubulcus ibis*	P
Green-Backed Heron	*Butorides virescens*	P
Little Blue Heron	*Egretta caerulea*	P
Snowy Egret	*Egretta thula*	P

5.3 Migratory Bird Conservation Needs in the Region

Neotropical migratory birds are defined as birds that spend approximately eight months of the year wintering in Mexico, Central America, South America, and the Caribbean, and migrate annually between their breeding grounds in North America and their wintering areas (Hamilton and Fischer, 2001; NJ Audubon Society, 2004). Approximately half of all bird species that nest in the United States are classified as neotropical migratory birds. Many songbirds, shorebirds, some waterfowl, and birds of prey make up the approximately 360 species of neotropical migrants that breed in the United States (Hamilton and Fischer, 2001).

Since the early 2000s, much attention has been given to neotropical migrants because of significant declines in their numbers. These declines have largely been attributed to loss of wintering habitat in Mexico, the Caribbean, and Central and South America, and fragmentation or loss of breeding habitat in the United States and Canada (U.S. Fish and Wildlife Service [USFWS], 2002).

Historically, the vast expanses of floodplain and upland forests, native grasslands, and open waters in the Mississippi Alluvial Valley provided a wide range of nesting, feeding, and resting habitats important to neotropical migrants. The conversion of significant acreages of forestlands and subsequent hydrological modifications (e.g., drainage) has led to significant declines in stable breeding populations in the region. In addition to direct impacts as a result of habitat loss

and fragmentation, indirect impacts from parasitism (e.g., cow birds) have also contributed to the decreased numbers of neotropical migrants locally and globally.

Nevertheless, the Mississippi Alluvial Valley is the largest forested floodplain in North America and still remains as an important area for neotropical migratory birds (Elliott and McKnight, 2000). In addition to providing forested habitat for breeding birds, the Mississippi Alluvial Valley area serves as a major waterfowl wintering area, supplying food and cover from both forested and agricultural habitats. Resident and migrant long-legged wading birds as well as transient shorebirds exploit natural floodwater, flooded farm fields, and aquaculture ponds.

A number of initiatives have been instituted since the early 1900s to conserve migratory bird habitats; they include the Shorebird Conservation Program, Mississippi Alluvial Valley Migratory Bird Initiative, Partners in Flight programs, North American Waterfowl Management Plan, and others (Natural Resources Conservation Service [NRCS], 2000). These programs, which have identified regional conservation plans for the Mississippi Alluvial Valley and the Upper East Gulf Coastal Plain physiographic regions, represent the general physiographic regions at NAVSUPPACT Mid-South. The major conservation goals and needs identified in these plans for shorebirds and landbirds are presented in the following sections.

5.3.1 Shorebirds

The Mississippi Alluvial Valley is rich with a variety of shorebird habitats. Forty-three species of shorebirds have been recorded in the region, with approximately 29 to 31 of these species occurring as regular inhabitants of this region (Elliott and McKnight, 2000). Only a few shorebird species are known to breed and winter in the region (Robbins et al., 1986). Most shorebird species are transient, passing through the region as they migrate during spring (April through mid-May) and fall (August through October) between breeding areas to the north and wintering areas to the south (Reid et al., 1983; Helmers, 1994; Twedt et al., 1998).

Only one shorebird species, the piping plover *(Charadrius melodus),* is considered highly imperiled in the region and is listed as threatened by the U.S. Fish and Wildlife Service. Other species of high concern in the region include the American golden-plover *(Pluvialis dominica),* American woodcock *(Scolopax minor),* Wilson's plover *(Charadrius wilsonia),* buff-breasted sandpiper *(Tryngites subruficollis),* ruddy turnstone *(Arenaria interpres),* red knot *(Calidris canutus),* Sanderling *(Calidris alba),* and marbled godwit *(Limosa fedoa).* All of these species are found in a variety of habitats and span a number of foraging guilds,

including terrestrial gleaners, terrestrial/aquatic gleaners/probers, aquatic/terrestrial gleaners, aquatic probers/gleaners, and aquatic gleaners. The conservation goals for shorebirds in the Mississippi Alluvial Valley, therefore, do not focus on single species or specific habitat types. Instead, the greatest conservation need identified for shorebirds within the Mississippi Alluvial Valley is the conservation of foraging habitats during migration (Elliott and McKnight, 2000).

Typically, receding winter floodwater during early spring and agricultural flood irrigation during late spring provide abundant mudflat and shallow-water foraging habitat during the northward migration of shorebirds. During southward migration in late summer and fall however, naturally occurring floodwater is rare because of high evapotranspiration and seasonally low precipitation (Reinecke et al., 1988). Also, agricultural fields are purposely kept dry at this time to facilitate harvest of crops. Thus, the period from mid-July through the end of September has been identified as the time interval when foraging habitat for migrating shorebirds is least available. In addition, providing the necessary mix of water depth and vegetative structure for shorebirds at the appropriate times is the most important management issue in this region.

Habitats in the region that possess the greatest potential for shorebirds include agricultural fields, moist-soil impoundments, semi-permanent impoundments, and aquaculture ponds. The restoration of foraging habitat within Wetlands 7 and 8 at NAVSUPPACT Mid-South as identified in the INRMP is consistent with the regional conservation goals for shorebirds in the region.

5.3.2 Landbirds

At least 107 neotropical migratory bird species, excluding shorebirds, wading birds, and colonial nesting waterbirds, have been documented as nesting regularly in the Mississippi Alluvial Valley (Twedt et al., 1999). Most of these species utilize and can be found in more than one habitat type in the region (e.g., grasslands, coastal beaches and dunes, forested wetlands, and mature upland hardwood forests). Forest breeding species however, remain the most important component of the migratory landbird avifauna, despite the loss of nearly 80% of the forested wetlands in this region.

Regional landbird conservation plans for the Mississippi Alluvial Valley and Gulf Coastal Plains indicate that at least 70 species of landbirds occur in bottomland hardwoods as a primary habitat. Greater than 20% of the breeding populations of Swainson's warbler *(Limnothlypis swainsonii),* prothonotary warbler *(Protonotaria citrea),* and swallow-tailed kite *(Elanoides forficatus)* are found

within the Mississippi Alluvial Valley (Twedt et al., 1999; American Bird Conservancy, n.d.) Typical species found in bottomland hardwood forests include the northern parula *(Parula Americana),* Swainson's warbler, prothonotary warbler, red-shouldered hawk *(Buteo lineatus),* and red-headed woodpecker *(Melanerpes erythrocephalus)* (Twedt et al., 1999). Surveys conducted in west Tennessee watersheds in the 1990s indicated that 90 species were observed in forested habitats; an average of 113 individuals and 28 species occurred at 59 sites sampled (American Bird Conservancy, n.d.)

At least 62 species occur in upland oak-hickory forests, although many of these species occur in bottomland hardwoods as well. Approximately 25 species occur in scrub-shrub habitats and 18 species occur in grassland habitats in the Mississippi Alluvial Valley. Seven species are dependent on water and wetlands habitat, and 19 species occur in a variety of other habitats, such as open water or river banks.

Breeding bird species composition, relative abundance, and densities may vary widely among forested wetlands. In western Tennessee, the highest breeding bird densities occur in watersheds characterized by large forest tract size and relatively normal flood regimes; while highest species richness occurs near major continental rivers, such as the Mississippi and Tennessee Rivers (American Bird Conservancy, n.d.)

Priority bird species targeted for conservation in the Mississippi Alluvial Valley and the Eastern Gulf Coastal Plain regions (Twedt et al., 1999; American Bird Conservancy, n.d.) include Swainson's warbler, swallow-tailed kite, cerulean warbler *(Dendroica cerulea),* Mississippi sandhill crane *(Grus canadensis),* red-cockaded woodpecker *(Picoides borealis),* Bachman's sparrow *(Aimophila aestivalis),* Bewick's wren *(Thryomanes bewickii),* American kestrel *(Falco sparverius),* chuck-will's-widow (*Caprimulgus carolinensis*), prairie warbler *(Dendroica discolor),* worm-eating warbler *(Helmitheros vermivorum),* northern bobwhite *(Colinus virginianus),* and yellow-billed cuckoo *(Coccyzus americanus).* Winter residents include yellow rail *(Coturnicops noveboracensis),* piping plover, sedge wren *(Cistothorus platensis),* Nelson's and saltmarsh sharp-tailed sparrows *(Ammodramus nelsoni* and *A. caudacutus),* and Henslow's sparrow *(Ammodramus henslowii).* Priority transient species include buff-breasted sandpiper, black tern *(Chlidonias niger),* Bicknell's thrush *(Catharus bicknelli),* black-throated blue warbler *(Dendroica caerulescens),* and bobolink *(Dolichonyx oryzivorus).*

The conservation or restoration of greater than 1.5 million hectare (ha) of predominantly mature, forested wetlands of varying patch size (e.g., 100 patches of contiguous forest including 13 patches of >40,000 ha, 36 patches >8,000 ha, and 13 patches >4,000 ha) is listed as a priority for the Mississippi Alluvial Valley. Management of these forests to promote the structural diversity necessary to support source populations of breeding birds (i.e., scrub/shrub forest, forest-edge habitat, or forest openings) and to consolidate adjacent forest patches also is a priority for the conservation of neotropical landbirds in the Mississippi Alluvial Valley.

Other elements within the plan include enhancement of the quality of backyard and woodlot habitats with native fleshy-fruit bearing trees and shrubs and water for food and cover, and the conservation or restoration of 4,000 to 8,000 ha of native, warm-season grassland-cropland complexes.

5.4 Habitat Requirements for Neotropical Migrants

The following sections provide additional detailed information on the habitat requirements of neotropical migratory birds including shorebirds, wading birds, and landbirds. These habitat requirements form the basis for the selection of plant species for enhancement of Wetlands 7 and 8 at NAVSUPPACT Mid-South.

5.4.1 Shorebirds and Wading Birds

As indicated in Section 5.3.1, most of the shorebirds found in this region utilize the area as migratory stopover habitat. Open water habitats, mudflats, and vegetated and non-vegetated shorelines provide important foraging areas to migrating species. The correct mix of water depth and vegetative structure at the appropriate times is most important for shorebirds.

Shorebird habitat requirements range from moist, short-grass or plowed fields, to very shallow water less than 10 centimeters (cm) deep for small shorebirds, to deeper water approximately 15 cm deep for larger shorebirds (Helmers, 1992). Other groups of wetland birds such as diving ducks, grebes, and loons prefer water deeper than 15 cm but will utilize intermediate depths (Harrington and Streever, 1999). Optimal shorebird foraging habitat is drawn down gradually during migration to expose new foraging habitat for each of the foraging groups (Helmers, 1992).

Shorebird species prefer habitats with less than 25% vegetative cover, unless the vegetation is short and visibility of surrounding horizons in not obscured. During the breeding season, most species prefer thickly vegetated wetlands, which provide cover for nests and nestling species (Elliott and McKnight, 2000).

Spring shorebird migration in the Mississippi Alluvial Valley/Gulf Coastal Plain occurs between mid-February and late May (Helmers, 1992). Moist-soil units suitable for spring shorebird management require fall flooding approximately one month before the first heavy freeze and maintenance of flooded conditions over winter to enable chironomids *(Chironomus spp.)* and other invertebrates to re-populate, as well as to assure survival of larvae over winter. During the spring migratory period, units should be drawn down slowly, 2-3 cm per week to allow for continuous availability of invertebrates (Rundle and Fredrickson, 1981; Hands et al., 1991). Units planned for spring shorebird management should have extensive areas of open water with generally less than 25-50% dense emergent vegetation. This will allow shorebirds to forage in open shallow water and mudflats as drawdown occurs (Rundle and Fredrickson, 1981; Hands et al., 1991; Helmers, 1991). If more than one unit is being drawn down for shorebirds, staggering the initial drawdown dates will extend the availability of habitat and provide resources throughout the migratory period. This slow and staggered drawdown of moist-soil units will not only provide resources for shorebirds and other species, but will also promote a diversity of vegetation communities (Fredrickson, 1991).

The summer/fall shorebird migration period is much more extended than the spring migration, generally occurring between mid-July and late October. Management for summer/fall shorebird habitats includes two different strategies. Moist-soil units that remained flooded through spring and early summer can be drawn down or units that are dry can be reflooded. If units were flooded through spring and early summer to provide habitats for breeding herons and rails, then natural evaporation or slow drawdowns make invertebrates available to shorebirds and concentrate prey for other waterbirds (Elliott and McKnight 2000).

If dry units are to be flooded for shorebirds, units should be shallowly flooded 10-15 cm, two to three weeks before summer/fall migration begins. This will allow invertebrates to repopulate the newly created habitats (Rundle and Fredrickson, 1981; Hands et al., 1991; Helmers, 1991). Usually the vegetation must be manipulated by disking before reflooding to assure shorebird response. The type of disking is critical since the rationale behind this manipulation is to convert plant biomass to a detrital base attractive to invertebrates. Deep disking that completely buries

plant material is less desirable than shallow disking that only partially buries plant biomass. Thus, shallow disking acts as man-induced senescence and provides excellent substrates for invertebrates, whereas deep disking buries the plant biomass and reduces the availability of plant material for invertebrate processing (Fredrickson and Reid, 1986).

Moist-soil units may need reconditioning every several years to remove undesirable vegetation. Reconditioning units through shallow disking and reflooding can provide excellent opportunities for shorebird management during the summer. As with spring management, staggering the manipulations within several units extends the availability of habitats.

Drawdown management of units through retention of water retained from spring is perhaps the most desirable approach to providing shorebird habitat in managed units (Twedt et al., 1998). First, floodwater typically is scarce in late summer/fall, and pumping can be expensive. Second, weedy vegetation can rapidly invade areas that have been disked and flooded. Finally, bird densities on areas that have been drawn down tend to be high, probably due to high invertebrate densities (Twedt et al., 1998).

Short, sparse vegetation, shallowly flooded during early spring, can provide foraging habitats within emergent vegetative zones (Colwell and Oring, 1988). Summer/fall drawdowns from natural evaporation also provide habitats for south-bound migrants. During periods of natural drawdown, dense emergent vegetation can be reduced by burning or mowing the edges. When basins are reflooded from precipitation or winter snow melt, shallowly flooded habitats will be available at wetland edges the following spring. Removing dense vegetation from wetlands by burning or mowing after basins have dried in late summer or fall will provide additional foraging areas for migrant shorebirds the following spring.

5.4.2 Migratory Landbirds/Songbirds

The habitat requirements of individual neotropical migratory bird species vary between species. Habitat requirements for resident interior forest species, as well as suitable stopover habitat for transient species generally include large tracts of mature forest (i.e., generally greater than 4,000 ha in size) that typically incorporate a wide diversity of microhabitats (e.g., openings, scrub/shrub habitats, early successional habitats, etc.) In addition, these habitats are not significantly fragmented and contain large trees towering above a multilayered canopy structure (Hamel, 1992a; Robbins et al., 1992). These large blocks of forest are necessary to maintain stable populations that are free from edge-related predation (Keller et al., 1993; Robbins et al.,

1989). Optimal habitat includes forests with gradual rather than abrupt edges both in openings in the interior and at forest edges (Suarez et al., 1997). Additionally, retention of scattered patches of tall trees that are greater than 25 meters tall, will provide potential nest site locations.

Recent studies have also shown that riparian habitats along large and mid-order streams, rivers, and lakes appear to be very important to the continued existence and maintenance of many migratory bird species populations. These corridors are important for species movement in landscapes where large blocks of forest have been converted to other land uses (Twedt et al., 1999). Studies of optimum riparian zone width in bottomland hardwood wetland ecosystems in the southern region have indicated that narrow bottomland hardwood strips can support an abundant and diverse avifauna, but that riparian buffer zones of at least 500 meters wide are necessary to maintain the complete avian community (Fischer, 2000). In general, buffer zones of 100 meters or less tend to be inhabited by resident or short-distance migrants (Fischer, 2000; Triquet, McPeek, and McComb, 1990). Riparian zones that are less than these recommended minimum widths tend to support forest edge species.

Open water habitats, such as lakes and reservoirs, also have been documented as important resting, stopover, breeding, and nesting habitat for migrating species during the spring and fall. In addition, open water bodies provide important wintering habitat for birds that reside in North America year-round (Hamilton and Fischer, 2001).

6.0 RECOMMENDATIONS FOR ENHANCEMENT OF WETLANDS 7 AND 8

Wetlands 7 and 8 are semi-permanently flooded impoundments that undergo natural drawdown beginning in late spring and continuing into late fall. As drawdown occurs, unvegetated to sparsely vegetated mudflats are exposed. These mudflats have the potential to be ideal foraging areas for migratory shorebirds and waterfowl, but have little potential to provide suitable habitat for neotropical songbirds. Therefore, the enhancement of these wetlands for the purpose of providing high-quality shorebird resting and foraging habitat is recommended. This recommendation is consistent with the goals outlined in the INRMP and also is aligned with conservation and management goals for creating, restoring, or managing foraging habitats for shorebirds and other migratory species on public lands in the region.

6.1 Current Habitat Limitations

In their current condition, Wetlands 7 and 8 have significant limitations for shorebird foraging habitat. Water depths within the wetlands are uniformly too deep, water clarity is poor, and soil organic content is low. Aquatic invertebrates, crustaceans, and insects are lacking, and a minimal fishery exists (EnSafe, 2006a). An overall restoration of the wetlands following general guidelines for shorebird habitat management (Conservation Commission of Missouri, 1995 - 2006c) and similar management actions similar to those employed in moist-soil management units (Conservation Commission of Missouri, 1995-2006a, Fredrickson and Taylor, 1982) and is needed to enhance the functions of these wetlands.

6.2 Management Actions

Figure 6.1 provides a number of management actions that will enhance the functions of these wetlands, specifically for providing foraging and resting habitat for a diversity of shorebirds, wading birds, and waterfowl. Each of these elements is briefly described below.

- **Create additional shallow water depths within the wetlands** — Shorebirds require shallow water for foraging activities. The creation of more shallow water areas ranging from 0 cm to 10 cm deep and 10 cm to 18 cm deep will be needed to encourage shorebird use. Deeper water habitats ranging from 18 cm to greater than 60 cm also can be created in isolated areas to support waterfowl species and fish.

- **Create a diversity of shoreline and upland habitats** — The creation of earthen hummocks, fingers, or small islands within the wetlands will enhance the area for shorebirds. These drier sites provide resting, preening, and feeding areas along the water edge.

- **Plant non-invasive, low-growing vegetation at low densities** — Plants make up a minor part of shorebird diets but play an important role in providing cover and adding organic matter into soils. The decomposing vegetation provides the substrate needed to support a wide array of aquatic insects, invertebrates, and crustaceans, which make up the majority of shorebirds' diets.

- **Monitor plantings and vegetation establishment** — The uncontrolled spread of invasive and/or noxious species that may become established within the wetlands after planting can significantly alter the target vegetation densities and cover and lead to failure of the wetland restoration and enhancement project. Routine monitoring of wetland plantings is necessary to prevent the growth and spread of invasive or noxious plant species.

- **Manage vegetation to maintain open shorelines and mudflats** — Shorebirds prefer habitats where vegetative cover is less than 25 percent. Disking, burning, mowing, and water level manipulation are vegetation management tools that can be employed to maintain open shorelines and exposed mudflats and prevent possible invasion by woody plants. Shallow disking is also important in adding organic material to the soil.

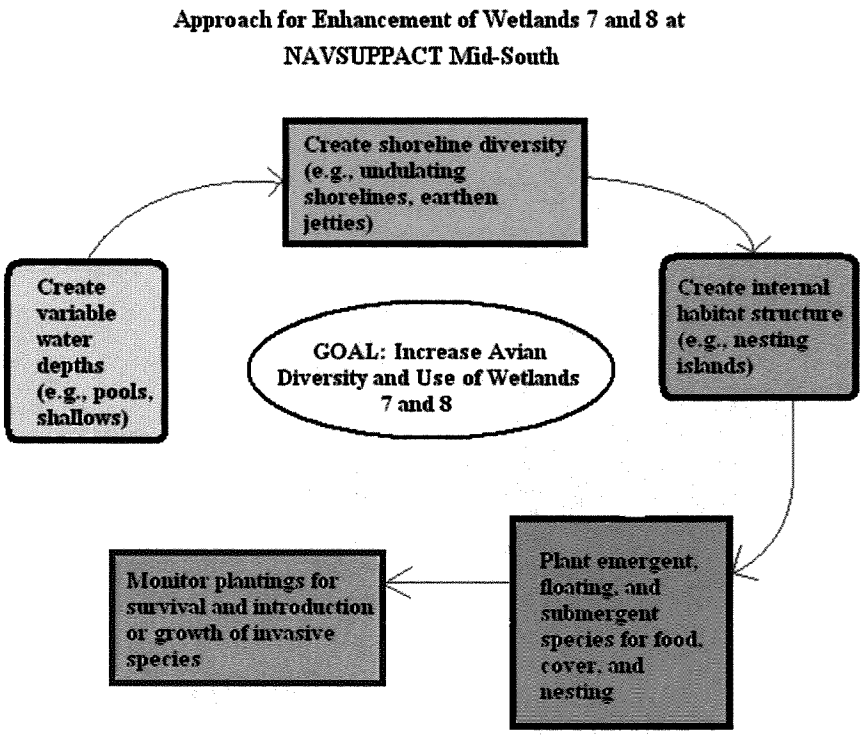


Figure 6.1 Proposed approach for enhancement of Wetlands 7 and 8 at NAVSUPPACT Mid-South.

6.3 Recommended Vegetation Plantings

Although vegetation is a minor component of shorebird diets, it is important in providing organic matter to the soil and in providing food for waterfowl that also may utilize these wetlands. Generally, noninvasive, low-growing annual and perennial wetland and aquatic plants are ideal for shorebird habitats. These types of plants also will provide adequate food for waterfowl that may utilize the wetlands for resting and feeding habitat. Vegetation similar to that used in moist-soil impoundments is recommended. Table 6.1 provides a list of potential plant species that could be planted in these wetlands.

Table 6.1
Potential Plant Species for
Enhancement of Shorebird and Waterfowl Habitat

Common Name	Scientific Name	Shallow Areas 0 to 10 cm	Intermediate Shallow Areas 10 to 18 cm	Deep Areas >18 cm	Nesting Islands and Fingers
Pennsylvania Smartweed[1]	*Polygonum pennsylvanicum*	•	•		
Blunt-Tip Spike Rush	*Eleocharis obtusa*	•			
Rice Cutgrass[1]	*Leersia oryzoides*				•
Beggarticks	*Bidens aristosa*	•			
Pea Sweetclover	*Melilotus sp.*				•
Panic Grass	*Panicum sp*	•			
Dock	*Rumex spp*	•			
Curltop Ladysthumb	*Polygonum lapathifolium*	•			
Chufa	*Cyperus esculentus*	•			
Sedge Red-Rooted Sedge	*Cyperus erythrorhizos*	•	•		
Wild Millet[1]	*Echinochloa crusgalli var. frumentacea*	•			
Crabgrass [1]	*Digitaria sp.*		•		
Aster	*Aster spp*		•		
Nodding Smartweed	*Polygonum spp.*	•			
Wild Rice	*Zizania aquatica*	•			
Powdery Alligator Flag	*Thalia dealbata*	•	•		•
Duck Potatoes[2]	*Sagittaris spp*	•	•		
Bulrushes [2]	*Scirpus spp.*	•	•		
Pondweeds [2]	*Potamogeton spp*	•	•	•	
Coontail[2]	*Ceratophyllum demersum*	•	•	•	
Chara Of Muskgrass [2]	*Chara spp.*		•	•	
Pin Oak [2]	*Quercus palustris*				•

Notes:
1 — 1995-2006a Conservation Commission of Missouri
2 — 1995-2006b Conservation Commission of Missouri
• — Plant species suitable for area

6.4 Additional Considerations

6.4.1 RCRA Permit

Since Wetlands 7 and 8 are identified as a SWMU in NAVSUPPACT Mid-South's RCRA permit, the Tennessee Department of Environment and Conservation should be consulted before beginning any enhancement projects in this area. Enhancement projects could potentially conflict with the

SWMUs final corrective action remedy or the overall RCRA program objective (i.e., protection of public health and the environment).

6.4.2 Section 404 Permit

The placement of fill material into wetlands or other waters of the U.S. requires a Section 404 permit from the U.S. Army Corps of Engineers. The creation of shallow water habitats in Wetlands 7 and 8 likely will require the deposition of fill materials into these wetlands. Depending on the jurisdictional status of Wetlands 7 or 8, a general permit may be required. Communication with the Memphis District Corps of Engineers Regulatory Branch to determine jurisdictional status of these wetlands and to verify authorization of the restoration activities under a nationwide permit for wetland restoration activities should be conducted six months prior to any plan for construction or initiation of enhancement activities that would involve the deposition of fill material into wetlands.

6.4.3 Site-Specific Hydrology

Understanding the natural hydrologic regime and dynamics within these wetlands is critical in developing high-quality shorebird foraging habitat. Not all shallow water habitats provide good quality shorebird feeding habitat. The completion of a detailed hydrologic study and topographic survey of the wetlands is important to the development of a site-specific plan for restoring these areas as migratory bird habitat.

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