3.00 ALTERNATIVES

This section describes the approach that was used to fully satisfy the third step in the planning process – Formulate Alternative Plans (see Section 2.05, above) – and comply with NEPA requirements to analyze alternatives. This section explains the detailed alternatives that the team developed. In addition, Appendix H, 404(b)(1) Evaluation, contains a detailed practicable alternatives analysis, which fully describes and draws together the comprehensive, iterative NEPA alternatives analysis conducted for SHEP, including analysis of other potential options or sites for the project, such as other South Atlantic ports and alternative terminal locations along the Savannah River.

Section 5.0 of the EIS and the system of accounts analysis in Section 11 of the GRR contain information that allows one to compare these alternatives, including the No Action plan.

Since the last major navigation improvements were completed by the Corps in April 1994, Savannah Harbor has experienced significant growth in containerized cargo volume, vessel traffic, and the size and frequency of container ships calling at the Port. The 1994 navigation improvements were designed to accommodate a class of container ships with a dead weight tonnage of approximately 60,000 tons and a maximum capacity of 4,024 TEUs (Twenty-foot Equivalent Units). The design vessel for the 1994 improvements had a length of 951 feet, a maximum operating draft of 42.6 feet, and a Panamax beam (106 feet). The largest vessels currently calling at the Port are rated at more than 6,700 TEUs, with a dead weight tonnage of 85,900 tons, an overall length of 984 feet, a Post-Panamax beam of 131 feet, and a maximum operating draft of 48 feet. Over the intervening years, the Georgia Ports Authority made major investments in landside infrastructure to accommodate increasingly larger vessels and burgeoning trade growth at the Port and the region it serves. At the present time, Savannah Harbor is the second busiest container port on the U.S. east coast, and the fourth busiest in the Nation.

The primary problems identified – and the need for the project -- relate to the inefficient operation of containerships in the Federal navigation channel at Savannah Harbor, which affect the Nation's international trade transportation costs. The following problem statements describe these inefficiencies:

A. Existing shippers are experiencing increased/ inflated operations costs due to light loading and tidal delays;
B. Light loading and tidal delays will increase as present harbor users increase their annual tonnage and as larger, more efficient ships replace older, smaller ones;
C. Existing ships are experiencing problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor;
D. The severity of problems associated with turning capabilities and overall maneuverability in certain reaches of the inner harbor will increase as vessel size increases.

Potential navigation improvements include deepening and widening of navigational channels, Kings Island Turning Basin expansion, and channel wideners. The purpose of these potential improvements is to increase the efficiency of cargo vessel operations and to accommodate larger container ships, which are already calling at the Port and which are projected to use the Port in larger numbers in the near future. The improvements are aimed at alleviating the draft restrictions which impact container ship operations in the harbor. In 2008, approximately 82% of the container ships that called on the Port of Savannah had design drafts that were too deep to allow unrestricted access to the channel. These vessels were required to light-load, use tidal advantage, or both. The number of the larger vessels calling at Savannah is expected to increase in the future.

This study identified and evaluated alternatives that would:

A. Reduce congestion in the river channel;
B. Accommodate recent and anticipated future growth in containerized cargo and container ship traffic;
C. Improve the efficiency of operations for container ships within the Savannah Harbor Navigation Project; and
D. Allow larger and more efficient container ships to use the Port.

Potential methods of solving the navigation problems were identified and examined. Both structural and non-structural means were considered. Management measures that show potential for addressing navigation problem or opportunity were evaluated based on technical, economic, and environmental considerations. The evaluations were conducted in accordance with criteria established in Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (US Water Resources Council, 1983) and the policies and procedures established by ER 1105-2-100, Planning Guidance Notebook, April 22, 2000.

The District conducted analyses in the early stages of the study to examine management measures that could potentially address the identified navigation problems or opportunities. That work included the following measures:

Non-Structural

- Reduce Underkeel Clearance Requirement
- Increase Efficiency of Landside Operations
- Specialization / Optimization of Facilities
- Improve Traffic Management Practices

Structural

- Minor Modifications
    - Passing/Meeting Areas
    - Bend Wideners
    - Aids To Navigation
    - Vessel Traffic Coordination
    - River Straightening
- Alternate Terminal Locations

    - Garden City Terminal
    - East Coast Terminal
    - Ocean Terminal
    - Elba Island
    - Blue Circle
    - Brunswick
    - Disposal Area 12A
    - Disposal Area 14A/14B
    - Jones-Oysterbed Island CDF / Tybee Island National Wildlife Refuge
- Offshore Transshipment Facility
- Harbor Deepening

The Corps prepared a document that described these evaluations and the conclusions (Appendix O, Formulation of Alternatives, May 2005). That document was circulated to State and Federal agencies, and the public for review and comment. As described in Appendix O, most of the conceptual alternatives were judged likely to be ineffective or inefficient in addressing the identified navigation problems or opportunities, so they were eliminated from further consideration.

The analysis included potential alternative sites in and near Savannah, including three sites in Jasper County, SC, Port Royal, SC, Brunswick, GA, and five sites in Georgia along the Savannah River. Four alternate terminal locations were judged as having either a MEDIUM or HIGH potential as a container terminal. Those four sites were then compared on their economics (including mitigation costs). When landside development costs are included, deepening to the Garden City Terminal site is the most cost-efficient project of the alternative terminal locations evaluated. The next most economically efficient site was 45 percent more expensive. Therefore, deepening to the Garden City Terminal site was the location on which the detailed evaluations were performed.

Three of the locations in Jasper County, South Carolina that the Corps considered for a container terminal either had been or have since been considered by others for a "Jasper Terminal". The Jasper County locations included the Corps' analysis included the Savannah Harbor Dredged Material Containment Areas (DMCAs) 12A, 14A/14B, and the Jones-Oysterbed Island DMCA/Tybee National Wildlife Refuge.

Additional navigation aid improvements were judged as not being able to improve the efficiency of cargo movement through the harbor. Ship simulation studies indicated that bend wideners may be needed to allow larger vessels to move safely and efficiently through the harbor, so those features were included in the final channel designs for detailed analyses. Similarly, meeting areas were also identified as measures that were likely to allow larger vessels to move through the harbor more efficiently. The concept of an offshore transshipment facility was judged as being premature at this time to address the problems at the Port of Savannah. The major problem identified with transshipment is that it introduces added transfer, storage, and transaction costs and times.

The Corps also conducted a Regional Port Analysis and a Multiport Analysis. The studies included potential alternative sites in the South Atlantic region (i.e. Norfolk, Wilmington, Charleston and Jacksonville). Those studies assessed the economic and environmental impact of expanding those other South Atlantic ports in lieu of modifying Savannah Harbor. The studies found that (1) the expected growth of container cargo over the next 20 years would exceed the capability of any single existing or future (Greenfield) deepwater container terminal in the South Atlantic region, (2) expansion of any existing container terminal or creation of a new terminal would cause environmental impacts, and (3) improving Savannah Harbor would not cause cargoes to shift from other ports to Savannah. The reports that document those studies are included as Attachments 4 and 6 to Appendix A of the GRR.

Upon completion of the initial steps of the Corps' six-step planning process mentioned above, to the Corps determined that harbor deepening alternatives should be evaluated in detail, with the possible addition of meeting lanes and bend wideners if they were found to be needed. The GRR contains a more detailed alternative analysis.

Six harbor deepening plans (i.e., No Action Alternative or the Without Project Condition, which is the existing project depth of -42 feet MLW, -44 feet MLW, -45 feet MLW, -46 feet MLW, -47 feet MLW, and -48 feet MLW) were developed for detailed evaluation. All of the harbor deepening alternatives would include the existing Kings Island Turning Basin (see Table 3-3), eight berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9), two proposed meeting areas (see Table 3-5), and three proposed bend wideners (see Table 3-6). However, the length of the bar channel extension varies with the proposed depth alternative (Table 3-1).

Table 3-1. Length of Bar Channel Extension Required for Depth Alternatives

Depth (Feet)	Bar Channel Extension (Stations)	Length of Extension (Feet)
44	-60+000B to -95+680B	35,680
45	-60+000B to -96+880B	36,880
46	-60+000B to -97+510B	37,510
47	-60+000B to -97+680B	37,680
48	-60+000B to -98+600B	38,600

Figure 3-1 illustrates the maximum 38,600 foot long extension of the ocean bar channel from Station -60+000B to -98+600B for the proposed 48-foot depth alternative.

All of the proposed deepening alternatives accept a narrower channel at the project depth than currently exists by maintaining the existing side slopes. By slightly decreasing the channel width by maintaining the existing side slopes at different depths, the adjacent

marine and estuarine habitat (substrate and tidal marsh) would not be adversely impacted. Moreover, by not disturbing the existing channel side slopes, sedimentation and shoaling within the new deeper channel would be minimized. The navigation channel side slopes will be 5H:1V for all channel length alternatives in the ocean bar area and 3H:1V in the rest of the harbor. 5H:1V and 3H:1V equates to a 5-foot (and 3-foot, respectively) horizontal distance, for each 1 foot change in vertical distance.

For all dredging alternatives, the proposed dredging depths would include an additional 2 feet of allowable overdepth to ensure the contractor obtains the required dredging template. The dredging depths also include advanced maintenance that help the project remain at the authorized project depth between maintenance events. The existing amounts of advanced maintenance are shown in Table 3-2. The following sections contain more detailed description of these terms.

3.01 Alternative Plans

3.01.1 No Action Alternative (Without Project Condition) - Existing -42 foot depth

The No Action alternative serves as the baseline from which potential project impacts are measured. This plan is also the "Without Project Condition"; those actions which would occur even if the alternative proposed in this EIS is not implemented. The plan consists of continued operation and maintenance of the Savannah Harbor Navigation Project at the existing -42 foot depth. This includes annual dredging to maintain authorized depths in the channel and associated areas, including advance maintenance and allowable overdepth. Federal use of the existing confined disposal areas and the EPA-approved Savannah Harbor Ocean Dredged Material Disposal Site (ODMDS) would continue. Use of the nearshore feeder berm sites or the beach on Tybee Island for deposition of suitable maintenance as authorized in the LTMS would also continue with one exception. The EPA has recently indicated that any dredged material placement sites beyond the 3-mile limit require designation as an ocean dredged material disposal site under the requirements of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA). Therefore, any of the submerged feeder berm sites authorized in the LTMS beyond the 3-mile limit would require site designation studies and additional EPA approval. Figure 3-3 shows the shows the approved unconfined disposal sites for maintenance of the Savannah Harbor entrance channel that are located within the 3-mile limit.

Cargoes would continue to move through the harbor. The volumes and types of those cargoes would depend on both the demand for those goods and options for ways in which those demands can be met (sources of supply, transportation methodologies and routes, etc.). Previous investigations (See Paragraph 5.4.2 of the GRR) indicate that demand for goods moving through Savannah Harbor, particularly as containerized cargoes, will increase in the future. In addition, due to ongoing ship-building trends, the size of the vessels calling at ports in the southeastern US is expected to increase. These trends are described in detail in the Economics Appendix of the GRR.

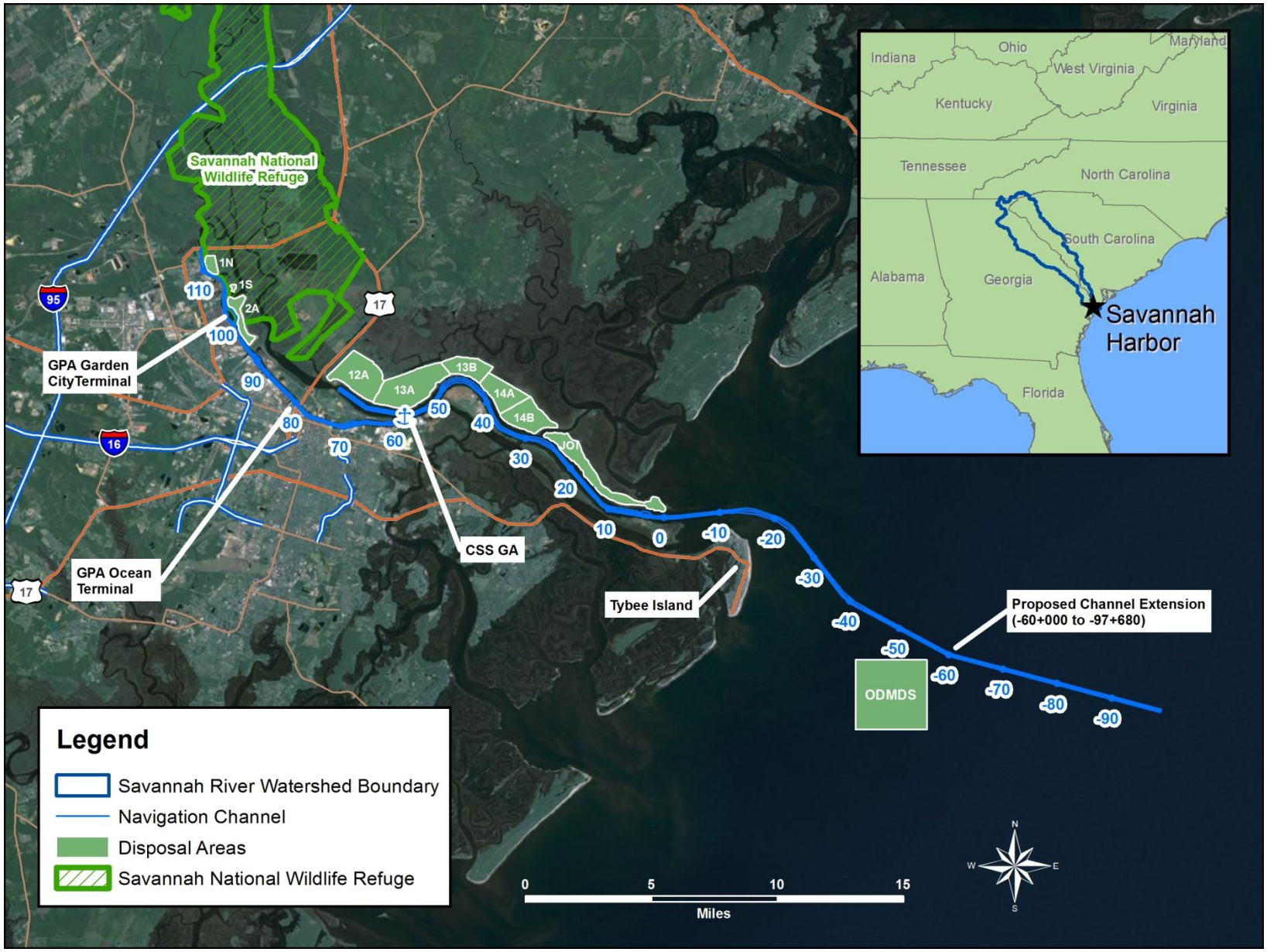

Figure 3-1. Overview map of Savannah Harbor.

Improvements to the Panama Canal are expected to be complete in 2014. Those improvements will allow larger vessels to move through the Canal and call at East Coast ports. The economic analysis contains a fleet forecast that predicts shifts to larger container vessels in the southeastern US after the Panama Canal is enlarged. The Regional Port Analysis and a Multiport Analysis found that (1) the expected future growth of container cargo along the East Coast would require expansion in the capacity of several deepwater container terminals, and (2) expansion of any existing container terminal or creation of a new terminal would cause environmental impacts. Such construction would need environmental approvals, which require a process of impact avoidance, minimization, and mitigation similar to that followed for the proposed deepening of Savannah Harbor.

The existing Savannah Harbor Federal Navigation Project is described in the paragraphs below.

3.01.1.1 General Description. Savannah Harbor is a deep-draft harbor on the South Atlantic coast 75 statute miles south of Charleston Harbor, South Carolina, and 120 north of Jacksonville Harbor, Florida. Within the inner harbor limits, the Savannah River is generally divided into two channels by a series of islands. From the Atlantic Ocean (Station 0+000) to Station 52+800 (River Mile 10), where the river converges, the harbor is separated into South and North Channels. Within this area, the navigation channel is maintained in the North Channel. After divergence of the river into Front and Back Rivers at Station 58+080 (River Mile 11), the navigation channel is maintained in Front River and passes by the business district of the City of Savannah. The navigation channel is maintained in Front River to the upper limits of the harbor at Station 112+500 (River Mile 21.3).

Figure 3-1 shows the station numbering convention that is used in the harbor. The oceanward extent of the ocean bar channel is presently at Station -60+000B (or 60,000 feet east or oceanward of the river entrance at Fort Pulaski and B stands for Ocean **B**ar Channel). The entrance to the river is at Station 0+000 (or near the Fort Pulaski National Monument in Georgia). Upstream of the river entrance is Fort Jackson and the CSS Georgia at Stations 55+000 to 60+000 (or 55,000 to 60,000 feet upstream of the Fort Pulaski National Monument). The upstream end of the proposed deepening of the harbor at the Garden City Terminal is at Station 103+000 (or 103,000 feet upstream of the river entrance).

A separate navigation project – the Savannah River below Augusta Project – extends from the upper limits of the harbor to River Mile 202.6 at Augusta, Georgia. The authorized channel is 9-feet deep and 90-feet wide, although it has not been maintained since 1978.

The Atlantic Intracoastal Waterway (AIWW) crosses the deep-draft navigation channel at approximately Station 26+000 (River Mile 5). The authorized depth of that channel is 12-feet deep, while the width varies from 90-feet inland and cuts to 150-feet in open waters.

3.01.1.2 Inner Harbor (Stations 112+500 to 0+000). The authorized navigation channel in the inner harbor is 42-feet below Mean Low Water and 500-feet wide upstream of Station 0+000. From Station 103+000 (River Mile 19.5) to the upstream end of the Argyle Island Turning Basin Station 105+000 (River Mile 19.9), the channel is 36-feet deep and 400-feet wide upstream. From Station 105+000 (River Mile 19.9) to the harbor's upstream limit at Station 112+500 (River Mile 21.3), the channel is 30-feet deep and 200-feet wide.

The Federal channel was last modified in 2006 through two small realignments in the upper portion of the harbor (USACE 2006). These actions consisted of a realignment of the Federal navigation channel along Ranges 37 and 38 (here on referred to as the CB-8 realignment) and a separate realignment along Ranges 41, 42, and 43 (here on referred to as the Upper Harbor realignment). The CB-8 realignment consisted of a 1,652-foot shift in the channel in the area of Ranges 37 and 38 across from GPA Container Berth 8 (CB-8). The 1,652-foot segment of the channel was moved roughly 53 feet to the north. The realignment occurred in an area that was dredged in 2005 during construction of the GPA CB-8, therefore; no new dredging was required. The Upper Harbor realignment consisted of a 100-foot realignment in Ranges 41 through 43, which create a bend in the Savannah River upper harbor near Port Wentworth (downstream of Station 103+000). That action increased the width in the bend along the northern edge of the existing channel. Width changes on the three ranges making up the bend vary from 50 to150 feet. The centerline and the southern edge of the channel did not change. The proposed widening is located in an area with natural depths at or below the authorized project depth, so no new dredging was required.

Sections of eroding shoreline along the CDFs located in South Carolina have been protected through several actions since 1996. Portions of CDFs 13A and 13B were armored with bank protection in 2006. Environmental approvals for this work were obtained through coordination of an Environmental Assessment (USACE 2005). The work included bank protection along 4,400 feet of eroding riverbank in five non-continuous areas between Stations 43+700 and 55+250. This bank protection project has been completed. In 2009, additional bank protection was funded under the American Resource and Recovery Act. Areas 13A/B received 8,735 feet of armor stone between a Stations 56+900 and 45+500. Area 14B received 6,050 feet of armor stone along Stations 33+500 to 33+1655 and Stations 31+500 to 27+75. All work was completed in 2011. Additional bank protection work is underway at Jones/Oysterbed Island and scheduled to be completed in January 2013.

The commercially-owned, Southern Liquefied Natural Gas-El Paso (SLNG-El Paso) Terminal, on Elba Island, near Station 36+000 expanded its facility when it completed construction of a fourth storage tank in 2005. This expansion included construction of a berthing slip to accommodate larger Liquefied Natural Gas (LNG) carriers. SLNG-El Paso is presently constructing a fifth storage tank to further expand the Elba Island Facility. This tank is expected to be placed in service by 2012. These facility expansions are expected to result in increases in the number of LNG vessels calling at the SLNG-El Paso Terminal. The Economics Appendix in the GRR provides more detailed information on the expected extent of that growth.

In July 2009, GPA completed the deepening of four container berths located at the Garden City Terminal. Berths 2, 3, 8, and 9 were deepened from -42 feet MLW to -48 feet MLW.

3.01.1.3 Outer Harbor or Ocean Bar Channel (Stations 0+000 to -60+000B). Station 0+000 is located at the mouth of the harbor near the Fort Pulaski National Monument. The entrance channel is located north of Tybee Island and proceeds out to deep water in the ocean. The existing navigation channel is 44 feet deep and 600 feet wide from deep water in the ocean (mile 11.17B or Station -60+000B) to the channel between the jetties (mile 2.6B or Station -14+000B), then 42 feet deep and 500 feet wide to the harbor entrance (River Mile 0.0 Station 0+000). The existing project includes allowable over depth and advance maintenance dredging (see Table 3-2, below).

3.01.1.4 Annual Maintenance Dredging. The Corps removes approximately 7 million cubic yards of sediments each year from the Savannah Harbor Navigation Project. The dredged sediments are placed in the CDFs and the Savannah Harbor ODMDS. The nearshore feeder berm sites authorized in the LTMS are also available for the deposition of maintenance material. The LTMS also authorized the placement of suitable maintenance material onto the Tybee Island beach.

3.01.1.5 Allowable Overdepth and Advance Maintenance Dredging. The following information is provided pursuant to Guidance Memorandum dated January 17, 2006, and ER 1130-2-520: *Congress specifically authorizes Federal navigation channels by specific depth and width. There is inherent imprecision in dredging processes which vary with the physical conditions (tides, currents, and waves); the dredged material characteristics (silt, clay, sand, gravel, rock, etc.); the channel design (depths being dredged, side slopes, etc.); and the type of dredging equipment (mechanical, hydraulic, hopper, etc.). Due to these variables and the resulting imprecision associated with the dredging activity, Corps engineering design, cost estimating and construction contracting documents recognize that dredging below the Congressionally authorized project dimensions will occur and is necessary to assure the required depth and width as well as cost effective operability. To balance project construction requirements against the need to limit dredging and disposal to the minimum required to achieve the designed dimensions, a paid or allowable overdepth (including side slopes) is incorporated into the project-dredging prism. Material removed from this allowable overdepth is paid under the terms of the dredging contract. Material removed beyond the limits of the allowable overdepth is not paid.*

This subject is also discussed in a Technical Note (ERDC/TN EEDP-04-37) published by the Corps' Engineer Research and Development Center (ERDC) in June 2007 on overdepth and advanced maintenance.

Dredging contracts for the Savannah Harbor include a 2-foot allowable overdepth. To ensure the contractor obtains the required dredging template, the Corps pays the contractor for up to 2-feet of sediment that he may remove below that required depth.

When deepening with the type of dredging equipment currently available, an additional depth of sediments may be disturbed in the dredging process but not removed. This depth is typically greater with larger cutterhead dredges. The rotating cutterhead that loosens the deposited sediments extends below the elevation of the suction pipe, and the suction is only sufficient to lift sediments that have been loosened and slurried by the rotating cutterhead. However, sediments below the elevation of the suction pipe, which are also disturbed by the rotating cutterhead, will not be removed through the dredge pipe line. Slurried sediments are carried through a pipe to the dredge and ultimately pumped into a CDF for disposal. For the large 30-inch cutterhead dredges, this disturbance depth can be 3 feet. Equipment such as hopper dredges or clamshell dredges would have a disturbance depth of less than 1 foot.

Advance maintenance dredging extends the length of time during which authorized channel depths are available. This reduces the frequency of dredging, thereby increasing efficiency and reducing overall maintenance costs. This sediment management technique is performed by enlarging the channel cross-section to provide storage for deposited sediments outside the authorized navigation channel. This storage is typically below the elevation of the navigation channel, but can be on the side of a channel if sediment deposition patterns reveal that such a design would be effective. This technique increases dredging efficiency by concentrating the sediments to be removed. This lowers the unit cost of dredging thereby reducing overall maintenance costs. Under present Corps policy, a District office must request approval for all advance maintenance from higher Corps offices. Decisions to implement advance maintenance can be made at any time upon review of sediment accumulation records, and they are effective until future information indicates they are no longer necessary or cost effective. Compliance with all environmental, engineering, and economic criteria is required prior to implementation of authorized advance maintenance features. The currently authorized advance maintenance allowances by reach are displayed in Table 3-2.

Table 3-2. Present Advance Maintenance Sections

Begin Station	End Station	Authorized Advanced Maintenance (ft)	Required Contract Depth (ft below MLW)
Inner Harbor			
112+500	105+500	2.0	32.0
105+500	103+000	2.0	38.0
103+000	102+000	0.0	42.0
102+000	100+000	2.0	44.0
100+000	79+600	2.0	44.0
79+600	70+000	2.0	44.0
70+000	50+000	4.0	46.0
50+000	37+000	4.0	46.0
37+000	35+000	6.0	48.0
35+000	24+000	4.0	46.0
24+000	0+000	2.0	44.0

Begin Station	End Station	Authorized Advanced Maintenance (ft)	Required Contract Depth (ft below MLW)
Port Wentworth TB		0.0	30.0
Argyle Island TB		0.0	30.0
Kings Island TB		8.0	50.0
Marsh Island TB		0	34.0
Fig Island TB		4.0	38.0
Entrance Channel			
0+000	-14+000(B)	2	44.0
-14+000(B)	-60+000(B)	0	44.0

No advance maintenance is presently performed between Stations 58+000 and 59+000 to reduce potential impacts to the CSS *Georgia*, which is located along that reach. It should be noted that the allowable overdepths and advance maintenance depths remain the same for each depth alternative.

3.01.1.6 Turning Basins. Six authorized turning basins are located along the navigation channel to allow ships to be turned before transiting the harbor. There is also a private turning basin at Elba Island between the Jones/Oysterbed and Fig Island Turning Basins. This basin is used by the LNG vessels calling at Elba Island. The turning basins are described in Table 3-3 and shown in Figure 1-1.

Table 3-3. Existing Turning Basins in Savannah Harbor

Name	Length (ft)	Width (ft)	Depth (ft below MLW)	River Mile	Station
Port Wentworth	600	600	30	20.9	111+363 to 109+757
Argyle Island	600	600	30	19.6	104+185 to 103+085
Kings Island	1,600	1,500	50	18.8	103+085 to 97+750
Marsh Island	900	1,000	34	17.1	91+610 to 89+485
Fig Island	1,500	1,000	34	13.0	69+740 to 67+386
Elba Island (LNG Private)	2,300	1,500	42	6.8	Not Maintained
Oysterbed Island	1050	1,200	40	0.7	4+395 to 2+345
Rehandling Basin	5,000	300	40		10+175 to 4+395

3.01.1.7 Existing Upland Confined Disposal Facilities (CDFs). The Georgia DOT (non-Federal sponsor) has provided seven confined upland disposal facilities for use in the Savannah Harbor. Those areas are as follows:

Table 3-4 Existing Savannah Harbor CDFs

Area Number/Name	Location (Channel Stations)	Size (Acres)
Jones/Oysterbed	0+000 to 27+000	754
14B	28+000 to 37+000	765
14A	38+000 to 42+000	815
13B	43+000 to 47+800	628
13A	6+600BR to 57+000 (-2+000BR)	1,400
12A	6+500BR to 10+100BR	1,123
2A	93+000 to 103+000	185

NOTE: "BR" indicates the stationing in Back River as shown on the Annual Survey.

The Corps works with the Georgia DOT to develop and refine the overall management strategy for CDFs and maximize the useful life of the dredged material placement areas. As an overall strategy, beneficial uses would be pursued for the dredged sediment to (1) reduce the ultimate storage volume required, and (2) increase secondary benefits resulting from the storage and/or disposal operations. To reduce the required storage volume, sediments deposited in the CDFs will be used when fill material is needed to raise the height of the confining dikes. Disposal Area 1N is a disposal site that is no longer used. The site is within the Savannah National Wildlife Refuge, and Refuge managers have requested the Corps only deposit sands, which can be readily reused and/or removed, at that site. Disposal Area 1S is no longer used because it is not diked. Disposal Area 2A is limited to approximately 125,000 cubic yards (CY) of maintenance material every three years and will be closed in 2027. Underdrains have been installed in Disposal Areas 12A, 13A, and 13B to shorten the sediment drying time. This aids the sediment consolidation process, thereby extending the useful life of the disposal sites. A rotational program is being followed at Disposal Areas 12A, 13A, 13B, 14A, 14B, and Jones/Oysterbed Island to (1) provide wildlife habitats which the sites are being used, and (2) allow sufficient time for drying of the sediment so that construction equipment can safely work on the floor of the CDFs to remove sediments for dike raising. Based on information in the 1996 EIS, the District uses a suspended solids content standard of 500 mg/l for acceptability of its weir effluents. This ensures the discharges do not cause unacceptable impacts to aquatic life in the receiving waters. Selective placement of entrance channel sediments and other suitable sediments would be pursued when beneficial uses would be derived. As a component of the design process for maintenance dredging work, a review would be conducted of potential beneficial uses -- specifically alternative placement sites -- for sediments to be excavated during that contract. The placement location to be used for a specific dredging contract would be decided during project design and award based on identification of the least cost, environmentally-acceptable option. If placement at a certain location is found to be more desirable for environmental or other reasons, but would be more costly than one of the other

acceptable options, it can be pursued with appropriate cost sharing using Section 933 (WRDA 1986) or Section 204 (WRDA 1992) authorities.

3.01.1.8 Unconfined Placement Sites. The EPA-designated Savannah Ocean Dredged Material Disposal Site (ODMDS) is the primary unconfined placement site that has received the most material to date. Additional unconfined placement sites are feeder berm sites within the nearshore area off Tybee Island and sites adjacent to the entrance channel (see Figure 3-3). The feeder berm sites were authorized through the Savannah Harbor Navigation Project's Long Term Management Strategy (USACE 1996) pursuant to Section 404 of the Clean Water Act. The LTMS also authorized the placement of suitable maintenance material on the beach at Tybee Island.

In 1987, EPA completed formal designation of the ODMDS pursuant to Section 103 of the MPRSA and approval of the offshore site located 3.7 nautical miles east of the coastline and about 0.25 nautical miles (1,500 feet) south of the navigation channel as a dredged material disposal site. The site center is located at 31 56'54"N and 80 45'34"W. This designated site has been used for many years for placement of sediments removed from the entrance channel. Sediments are excavated from the entrance channel by hopper dredges and then transported to the Savannah ODMDS for disposal, with transport and disposal of sediments evaluated by the district in accordance with Section 103 of the MPRSA. The most recent O&M project evaluation was conducted in July 2010 and concurrence received from EPA by letter in December 2010. The site's designation as a sediment placement site extends until the site is full. Recent analyses indicate, assuming routine placement of maintenance material, the ODMDS would reach capacity in 55 years. More details on the historic use of this site can be found in Appendix R, ODMDS Placement Evaluation.

The LTMS (USACE 1996) also authorized a nearshore bird island that was constructed approximately 10,000 feet offshore of Turtle Island, about 3,000 feet north of the north jetty in South Carolina waters that averaged 6 feet of depth. The island is horseshoe in shape with flat crown at +14 feet MLW with a minimum size of 2 acres. The side slopes from Elevation (EL) +14 to +8 feet MLW are expected to be 1:10, with the slopes below +8 feet MLW being 1:35.

3.01.1.9 Sediment Control Works. The Sediment Control Works were constructed as a specifically authorized project and were added as general navigation features to the existing Savannah Harbor Navigation Project. Authorized sediment control works in the harbor consist of the Tidegate structure across Back River and a sediment basin immediately downstream of the Tidegate. These structures were designed to concentrate sedimentation outside the navigation channel in a location close to confined disposal facilities. Both the concentration of sediment and the short pumping distance, which the shoaling location provided, contributed to a reduction in the cost of sediment removal in the harbor. The Sediment Basin was authorized at a 40-foot depth, 600-foot width and approximately 2-mile length, with an entrance channel 38 feet deep and 300 feet wide. The Tidegate became operative in May 1977, but was taken out of service due to adverse environmental impacts in October 1990. A drainage canal, known as New Cut, located across Argyle Island was constructed along with the Tidegate. New Cut was closed in

1990 to reduce salinity levels in the Savannah National Wildlife Refuge (SNWR), restore approximately 4,000 acres of freshwater marsh, and reduce the flushing of striped bass eggs and larvae into the Front River.

3.01.1.10 Freshwater Control Works. The Sediment Control Works also include a Freshwater Control System. During the development of the harbor deepening and sediment control features in the 1970s timeframe, it was recognized that the saltwater wedge would move further upstream as a result of these projects. This would have produced an unacceptable level of adverse impacts at the SNWR freshwater supply intake on Little Back River and on freshwater marshes in the SNWR. To offset these impacts, a freshwater supply system was included in the project. This system had the following five components:

A. a 5,500-foot long canal through McCoombs Cut to provide freshwater to the SNWR. The canal was constructed with a 200-foot bottom width at EL -7' MLW and 2H:1V side slopes. The design flow through McCoombs Cut was 4,000 CFS.

B. a channel in Middle River with a 90-foot bottom width at EL -6' MLW and 2H:1V side slopes. The design flow in Middle River was 1,500 CFS.

C. a channel in Little Back River with a 200-foot bottom width at EL -5.1' MLW and 2H:1V side slopes. The design flow in Little Back River was 2,500 CFS.

D. a 28,000-foot long freshwater supply canal with a 28-foot bottom width at EL -4' MLW, 2H:1V side slopes, and water control structures.

E. a 3,700-foot long connecting canal with a 6-foot bottom width at EL -4' MLW, 2H:1V side slopes.

Congress also authorized a freshwater canal extending from the SNWR to private lands located north of the US Highway 17A Bridge on the South Carolina side of the river. That canal was designed with a 6-foot bottom width at EL -4' MLW and 2H:1V side slopes.

The Federal government is responsible for maintenance of the Diversion Canal, the channels in Little Back River and Middle River, and the canals and control works for the SNWR. The non-Federal project sponsor is responsible for the canal serving private lands southeast of the SNWR. In 1982, the non-Federal sponsor entered into a supplemental agreement with the private property owners, transferring responsibility for normal dike maintenance for facilities on the private lands to those property owners. The sponsor has delivered sand to the area for the property owners' use in dike maintenance. No major rehabilitation of the system has been performed since it was constructed in the 1970's. The system continues to function, but the reliability is very low. Failure of the intake gates would drastically reduce water management ability of both the SNWR and the private landowners. Moreover, an inability to control water levels could render the SNWR unable to meet its primary mission -- providing habitat to migrating waterfowl. In October 2009, the Corps' South Atlantic Division concurred with Savannah District's

determination that this system needed to be rehabilitated. In May 2010, the Corps entered into a contract to rehabilitate a major portion of the project. The work began in July 2010. The rehabilitation work on the portion of the Freshwater Control System located on Federal lands was completed in December 2011.

3.01.2 -44 Foot Alternative (2 Feet Deeper)

The 44-foot channel depth alternative would deepen the existing project by two feet. [The existing project is defined as the current authorized depth of -42 feet MLW, plus 2 feet of allowable overdepth and any authorized advance maintenance depths (See Table 3-2).] This plan would involve dredging the inner harbor (described in Section 3.01.1, above) to -44 feet (2 feet deeper) from the mouth of the harbor (Station 0+000) to the end of the project Station 103+000. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9). Inner harbor channel deepening would also require the construction of two meeting areas (see Table 3-5, below) and two bend wideners (see Table 3-6, below). Improvements in the entrance channel would involve deepening the existing channel to -46 feet MLW from Stations -14+000B to -60+000B and construction of a bend widener. The depth of -46 feet MLW would extend an additional 35,682 feet for the ocean bar channel extension (from Stations -60+000B to -95+680B). The entrance channel would be -44 feet MLW from Station -14+000B to Station 0+000. The total volume of excavated new work sediment associated with this project is about 10.3 million cubic yards. Estimated annual volume for maintenance dredging would be approximately 7.1 million cubic yards. Analysis of post-project shoaling conditions indicates that shoaling rates and locations would not change appreciably. Therefore, the advance maintenance requirements shown in Table 3-2 would remain the same for each depth alternative.

Table 3-5. Proposed Two New Meeting Areas

Location	Description
GA waters: Station 14+000 to 22+000	The existing 400 foot wide channel would be widened 100 feet on the south to provide an average width of 500 feet. Side slopes would be 3H:1V.
GA and SC waters: Station 55+000 to 59+000	The existing 400 foot wide channel would be widened 100 feet to the north to provide an average width of 500 feet. Side slopes would be 3H:1V.

Table 3-6. Proposed New Channel Bend Wideners

Widener	Location	Description
1	SC waters: Stations -23+000 to -14+000	76-foot bottom width plus side slope of ~20 feet. North side of channel.
2	GA waters: Stations 27+500 to 31+500	156-foot bottom width plus side slope of less than 100 feet. South side of channel.
3	SC waters: Stations 52+250 to 55+000	76-foot bottom width plus side slope of less than 100 feet. North side of channel.

3.01.3 -45 Foot Alternative (3 Feet Deeper)

The 45-foot channel depth alternative would deepen the existing project by three feet. [The existing project is defined as the current authorized depth of -42 feet MLW plus two feet of allowable overdepth and any authorized advance maintenance depths (See Table 3-2).] This plan would involve dredging the inner harbor (described in Section 3.01.1, above) to -45 feet MLW (3 feet deeper) from the mouth of the harbor (Station 0+000) to the end of the project Station 103+000. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9). Inner harbor channel deepening would also require the construction of two meeting areas (see Table 3-5, above) and two bend wideners (see Table 3-6, above). Improvements in the entrance channel would involve deepening the existing channel to -47 MLW from Stations 000+000B to -60+000B and construction of a bend widener. The depth of -47 feet MLW would extend an additional 36,880 feet for the ocean bar channel extension (from Stations -60+000B to -96+880B). The depth of the entrance channel would be -45 feet MLW from Station -14+000B to Station 0+000. The total volume of excavated new work sediment associated with this project is about 14.6 million cubic yards. Estimated annual volume for maintenance dredging would be approximately 7.1 million cubic yards. Analysis of post-project shoaling conditions indicates that shoaling rates and locations would not change appreciably. Therefore, the advance maintenance requirements shown in Table 3-2 would remain the same for each depth alternative.

3.01.4 -46 Foot Alternative (4 Feet Deeper)

The 46-foot channel depth alternative would deepen the existing project by four feet. [The existing project is defined as the authorized depth of -42 feet MLW, plus 2 feet of allowable overdepth and any authorized advance maintenance depths (See Table 3-2).] This plan would involve dredging the inner harbor (described in Section 3.01.1, above) to -46 feet MLW (4 feet deeper) from the mouth of the harbor (Station 0+000) to the end of the project Station 103+000. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9).

Inner harbor channel deepening would also require the construction of two meeting areas (see Table 3-5, above) and two bend wideners (see Table 3-6, above). Improvements in the entrance channel would involve deepening the existing channel to -48 feet MLW from Stations 000+000B to -60+000B and the construction of a bend widener. The depth of -48 feet MLW would extend an additional 37,502 feet for the ocean bar channel extension (from Stations -60+000B to -97+510B). The depth of the entrance channel from Station -14+000B to Station 0+000 would be -46 feet MLW. The total volume of excavated new work sediment associated with this project is about 19.0 million cubic yards. Estimated annual volume for maintenance dredging would be approximately 7.1 million cubic yards. Analysis of post-project shoaling conditions indicates that shoaling rates and locations would not change appreciably. Therefore, the advance maintenance requirements shown in Table 3-2 would remain the same for each depth alternative.

3.01.5 -47 Foot Alternative (5 Feet Deeper)

The 47-foot channel depth alternative would deepen the existing project by five feet. The existing project is defined as the current authorized depth of -42 feet MLW plus 2 feet of allowable overdepth and any authorized advance maintenance depths (See Table 3-2). This plan would involve dredging the inner harbor (described in Section 3.01.1, above) to -47 feet MLW (5 feet deeper) from the mouth of the harbor (Station 0+000) to the end of the project Station 103+000. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9). Inner harbor channel deepening would also require the construction of two meeting areas (see Table 3-5, above) and two bend wideners (see Table 3-6, above). Improvements in the entrance channel would involve deepening the existing channel to -49 feet MLW from Stations 0+000B to -60+000B and construction of a bend widener. The depth of -49 feet MLW would extend an additional 37,675 feet for the ocean bar channel extension (from Stations -60+000B to -97+680B). The depth of the entrance channel would be -47 feet from Station -14+000B to Station 0+000. The total volume of excavated new work sediment associated with this project is about 23.6 million cubic yards. Estimated annual volume for maintenance dredging would be approximately 7.1 million cubic yards. Analysis of post-project shoaling conditions indicates that shoaling rates and locations would not change appreciably. Therefore, the advance maintenance requirements shown in Table 3-2 would remain the same for each depth alternative.

3.01.6 -48 Foot Alternative (6 Feet Deeper)

The 48-foot channel depth alternative would deepen the existing project by 6 feet. [The existing project is defined as the current authorized depth of -42 feet MLW, plus 2 feet of allowable overdepth and any authorized advance maintenance depths (See Table 3-2).] This plan would involve dredging the inner harbor (described in Section 3.01.1, above) to -48 feet MLW (6 feet deeper) from the mouth of the harbor (Station 0+000) to the end of the project Station 103+000. Dredging improvements in the inner harbor would also include deepening and expanding the Kings Island Turning Basin and deepening of the eight container vessel berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9). Inner harbor channel deepening would also require the construction of two meeting areas

(see Table 3-5, above) and two bend wideners (see Table 3-6, above). Improvements in the entrance channel would involve deepening the existing channel to -50 feet MLW from Stations 000+000B to -60+000B and the construction of a bend widener. The depth of -50 feet MLW would extend an additional 38,600 feet for the ocean bar channel extension (from Stations -60+000B to -98+600B). The depth of the entrance channel from Station -14+000B to Station 0+000 would be -48 feet MLW. The total volume of excavated new work sediment associated with this project is about 28.3 million cubic yards. Estimated annual volume for maintenance dredging would be approximately 7.1 million cubic yards. Analysis of post-project shoaling conditions indicates that shoaling rates and locations would not change appreciably. Therefore, the advance maintenance requirements shown in Table 3-2 would remain the same for each depth alternative.

3.02 Plans Considered in Detail

The five detailed alternative plans of improvement (i.e., 44-foot depth, 45-foot depth. 46-foot depth, 47-foot depth and 48-foot depth) were evaluated to identify their impacts to the environment. Although the Corps strives to avoid adverse impacts to the environment, rarely can a major construction project be implemented without causing some adverse effects. The type, location, and level of these impacts must be known before actions can be evaluated to reduce those impacts. Most impacts that could be expected to occur from this proposed project would result from either loss of uplands adjacent to the (expanded) navigation channel or changes to the aquatic environment within the harbor. Other potential impacts could also result, such as changes in shoreline erosion, salinity intrusion into the groundwater, air emissions, traffic levels, tourism, etc.

A more detailed impact analysis for these five alternatives is described in Section 5-Environmental Consequences of the Proposed Action and the Mitigation Plan in Appendix C.

3.03 Comparative Impacts of Alternatives

To evaluate changes to the aquatic system, the Corps used the services of consultants and in-house staff to enhance and apply state-of-the-art hydrodynamic and water quality models to assess potential impacts from the project. The Corps and the Cooperating Agencies followed this approach to produce the best information that could be reasonably developed to identify expected changes resulting from the project. Development and approval of these models was initiated in 1999 and completed in 2005. The process for implementing use of the models is described in detail in the Engineering Appendix that accompanies the GRR. As the models were being developed, the Corps consulted with natural resource agencies to determine what type of information they would like to see to evaluate all aspects of the proposed project. After the agencies approved use of the models, the tools were applied and the modeling was performed (2006 and 2007). This was somewhat of an iterative process. On occasion, the agencies discovered their requested model runs and analysis were not helpful. Subsequently, the agencies identified other informational needs that did enable a thorough evaluation of project impacts. Several reports were ultimately produced as a result of this process. On occasion, several versions of a particular report were produced as more information

became available, or if the Corps later responded to agency requests for additional data and different perspectives. The project-related impacts (without mitigation) predicted from the various alternatives are summarized in Table 3-7.

After the expected impacts to these resources were identified, the Corps used the hydrodynamic and water quality models to evaluate ways to reduce those impacts. A flow re-routing plan was developed for each depth alternative that minimized impacts to freshwater tidal wetlands, the resource which the agencies identified as being most at risk from this project. Additionally, for dissolved oxygen impacts, the Corps used a separate study which identified injection of dissolved oxygen (DO) as being the best method to improve DO levels in the harbor.

Using the selected flow re-routing plans, the water quality model was reevaluated to determine if changes would be required to the preliminary design of the DO injection systems. Ultimately, the need for modifications was confirmed. Changes and updates were then added to subsequent model runs to identify the remaining impacts to fishery resources.

This iterative modeling revealed that the proposed mitigation features (flow re-routing plans and oxygen injection systems) would substantially reduce project impacts to freshwater wetlands, dissolved oxygen, American shad, and Southern flounder. Table 3-8 summarizes the impacts of the depth alternatives after avoiding and reducing project impacts. The mitigation plan found in Appendix C of the EIS further discusses these issues.

3.04 Rationale for Plan Selection

The Corps developed and evaluated five channel deepening alternatives, in addition to the No Action Alternative. The following two pages summarize the results of the impact analyses for the alternative depths that were considered in detail as compared to the No Action alternative. Each channel deepening alternative contains mitigation features to address adverse environmental impacts that they would otherwise produce. With inclusion of the mitigation features, each depth alternative is environmentally acceptable. The 47-foot depth alternative is the National Economic Development (NED) Plan, the plan that maximizes net economic benefits to the Nation (See GRR). Under current Federal planning policy, the NED plan would be recommended for implementation unless there are overriding considerations that favor recommendation of another plan. Benefits that would accrue from the deepening of Savannah Harbor include reductions in light loading of vessels and vessel delays. Shippers will also be able to use larger, more efficient vessels. The economic benefits increase with each additional increment of channel deepening. Environmental impacts associated with a shallower depth would be less than those associated with the NED plan, but the lesser impacts of the 44-foot depth, 45-foot depth, and 46-foot depth alternatives are not considered sufficient to justify recommendation of these alternatives instead of the NED Plan.

Table 3-7. Summary of Project-Related Impacts without Mitigation

	---------- DEPTH ALTERNATIVES ----------				
	44-Foot	**45-Foot**	**46-Foot**	**47-Foot**	**48-Foot**
Salinity	Move further into estuary	Same effect, but greater amount	Same effect, but greater amount	Same effect, but greater amount	Same effect, but greater amount
Freshwater Wetlands	-551 acres	-967 acres	-1,057 acres	-1,177 acres	-1,212 acres
Brackish marsh	-7.2 acres	Same	Same	Same	Same
Dissolved Oxygen	Reductions at mid-depth and bottom	Same effect, but greater amount	Same effect, but greater amount	Same effect, But greater amount	Same effect, but greater amount
Fisheries	**Loss (-) of Acceptable Habitat**				
- Striped bass spawning	- 8.0 % (-83.0 acres)	- 12.2 % (-127.0 acres)	- 13.0 % (-135.0 acres)	-18.1 % (-188.0 acres)	- 19.7 % (-205.0 acres)
- Striped bass eggs	-9.7 % (-163.0 acres)	- 11.2 % (-188.0 acres)	- 15.9 % (-266.0 acres)	-20.5 % (-344.0 acres)	-24.5 % (-411.0 acres)
- Striped bass larvae	-13.5% (-76.0 acres)	- 18.6 % (-105.0 acres)	- 21.0 % (-119.0 acres)	-13.8 % (-78.0 acres)	- 13.8 % (-78.0 acres)
- American shad (Jan)	0 %	0 %	0 %	0%	0 %
- American shad (May)	0 %	0 %	0 %	0%	0 %
- American shad (Aug)	0 %	0 %	0 %	0 %	0 %
- Shortnose sturgeon adult (January)	- 0.5% (-20.0 acres)	- 0.5 % (-20.0 acres)	-0.8 % (-32.0 acres)	-0.8% (-32.0 acres)	-1.1 % (-44.0 acres)
- Shortnose sturgeon adult (August)	- 3.2 % (- 45.0 acres)	- 6.4 % (- 89.0 acres)	- 9.5 % (- 132.0 acres)	-13.3 % (-185.0 acres)	- 15.80 % (- 220.0 acres)
- Shortnose sturgeon juvenile (January)	-5.0 % (-86.0 acres)	-10.4 % (-179.0 acres)	-15.9 % (-274.0 acres)	- 19.0 % (-328.0 acres)	- 21.6 % (-373.0 acres)
- Southern flounder	- 0.3 % (-6.0 acres)	- 2.4 % (-45.0 acres)	- 2.4 % (-45.0 acres)	-7.8 % (-146.0 acres)	0.0 %
Chlorides @ City's M&I Water Treatment Plant	Max hourly increase of 77 mg/L	Max hourly increase of 105 mg/L	Max hourly increase of 121 mg/L	Max hourly increase of 149 mg/L	Max hourly increase of 170 mg/L
Drinking Water Aquifer	Same type of effect, but less than 45-foot alternative	Same type of effect, but less than 46-foot alternative	Same type of effect, but less than 47-foot alternative	Same type of effect, but less than 48-foot alternative	Increase flow through confining unit by 3-4%
Hurricane Surge	Minor, max increase in WSE of 0.3 feet	Minor, max increase in WSE of 0.5 feet	Minor, max increase in WSE of 0.6 feet	Minor, max Increase in WSE of 0.8 feet	Minor, max increase in WSE of 0.9 feet
Beach Erosion	Minor; within accuracy of evaluation	Same	Same	Same	Same
Bank Erosion due to ship traffic	No measurable addition to ongoing erosion	Same	Same	Same	Same
Shoaling	Minimal upstream shift	Same	Same	Same	Same
Velocity	Theoretical reduction, but not measurable	Same	Same	Same	Same

Table 3-8. Summary of Project-Related Impacts with Mitigation

	---------- DEPTH ALTERNATIVES ----------				
	44-Foot	**45-Foot**	**46-Foot**	**47-Foot**	**48-Foot**
Salinity	Move further into estuary up Front River	Same effect, but greater amount	Same effect, but greater amount	Same effect, but greater Amount	Same effect, but greater amount
Freshwater Wetlands (Conversion)	+ 322 acres	- 32 acres	- 201 acres	-223 acres	- 337 acres
Brackish Marsh (Conversion)	+ 488 acres	+ 861 acres	+959 acres	+964 acres	+1068 acres
Salt Marsh (Conversion)	- 808 acres	-828 acres	-757 acres	-740 acres	-730 acres
Brackish Marsh (Loss)	-15.68 acres	Same	Same	Same	Same
Dissolved Oxygen	Minimal Net improvement	Same	Same	Same	Same
Fisheries	**Loss (-) or Gain (+) of Acceptable Habitat**				
- Striped bass spawning	- 2.9 % (-30.0 acres)	- 9.2 % (-96.0 acres)	- 10.0 % (-104.0 acres)	-13.5 % (-140.0 acres)	- 16.1 % (-167.0 acres)
- Striped bass eggs	- 9.4 % (-157.0 acres)	+5.2 % (+87.0 acres)	0 %	-11.1 % (-186.0 acres)	-10.8 % (-181.0 acres)
- Striped bass larvae	-5.6 % (-32.0 acres)	+ 1.7 % (+9.0 acres)	+ 5.6 % (+32.0 acres)	-5.0 % (-28.0 acres)	-3.5 % (-20.0 acres)
- American shad (Jan)	-0.2 % (- 9.0 acres)	-0.2 % (-9.0 acres)	- 0.2 % (-9.0 acres)	-0.2 % (-9.0 acres)	- 0.2 % (-9.0 acres)
- American shad (May)	- 0.2 % (-12.0 acres)	- 0.2 % (-11.0 acres)	- 0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)	- 0.2 % (-11.0 acres)
- American shad (Aug)	-0.3 % (-16.0 acres)	-0.3 % (-15.0 acres)	-0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)	-0.2 % (-11.0 acres)
- Shortnose sturgeon adult (January)	-3.9 % (-153.0 acres)	-4.6 % (-179.0 acres)	-6.2 % (-240.0 acres)	- 6.9 % (-266.0 acres)	- 8.4 % (-326.0 acres)
- Shortnose sturgeon adult (August)	+19.0 % (+260.0 acres)	+9.8 % (+134.0 acres)	+7.3 % (+100.0 acres)	+6.5 % (+89.0)	+2.8 % (+39.0 acres)
- Shortnose sturgeon juvenile (January)	- 6.7% (-220.0 acres)	- 7.0 % (-231.0 acres)	-7.3 % (-238.0 acres)	-7.6% (-251.0 acres)	-11.5 % (-376.0 acres)
- Southern flounder	+74.1 % (+1387.0acres)	+ 54.2 % (+1014.0acres)	+ 57.3 % (+1072.0acres)	+57.3 % (+1072.0acres)	+ 52.9 % (+989.0 acres)
Chlorides @ City's M&I Water Treatment Plant	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L	Max hourly increase of 4 mg/L
Drinking Water Aquifer	Same type of effect, but less than 45-foot alternative	Same type of effect, but less than 46-foot alternative	Same type of effect, but less than 47-foot alternative	Same type of effect, but less than 48-foot alternative	Increase flow through confining unit by 3-4%
Hurricane Surge	Minor, Max increase in WSEL = 0.5 ft	Minor, Max increase in WSEL = 0.6 ft	Minor, Max increase in WSEL = 0.7 ft	Minor, Max Increase in WSEL= 0.8ft	Minor, Max increase in WSEL = 0.8 ft
Beach Erosion	Minor; within accuracy of evaluation	Same	Same	Same	Same
Bank Erosion due to ship traffic	No measurable addition to ongoing erosion	Same	Same	Same	Same
Shoaling	Minimal upstream shift	Same	Same	Same	Same
Velocity	Theoretical reduction, but not measurable	Same	Same	Same	Same

Prior to release of the Draft GRR and EIS for agency and public comment, the State of Georgia asked the Corps to consider the 48-foot depth alternative as the Locally Preferred Plan. As a result of comments received and subsequent discussions with the sponsor, the Corps declined to select the 48-foot alternative for implementation.

The 47-foot depth alternative is the Selected Plan. However, the environmental impacts of all of the channel depth alternatives considered are provided in this document to allow comparison of the impacts associated with each plan.

3.05 Selected Plan

The Selected Plan is the NED Plan (plan that maximizes net economic benefits to the Nation), which is the 47-foot depth alternative. The following paragraphs describe the features of the 47-foot depth alternative. The locations of these improvements are shown on Figure 3-1.

Deepening of the existing channel from the ocean bar to the Port of Savannah is the central feature of the proposed action. The total length of improvements is approximately 38 miles (from an upstream river limit Station 103+000 to end of the ocean bar channel -97+680B). The proposed five foot deepening (-47 feet MLW) of the Federal navigation channel would require the removal of approximately 23.6 million cubic yards of new work sediment. Subject to the availability of funds, the construction period for the entire project would be about four years.

The Selected Plan provides for an ocean bar navigation channel of -49-feet MLW deep and 564-feet wide (Station -97+680B) from the Atlantic Ocean to the channel between the jetties (Station -14+000B). The ocean bar channel would continue at -47-feet MLW and 464-feet wide from the jetties to the harbor entrance just north of Tybee Island (Stations -14+000B to 0+000). From the harbor entrance (Station 0+000) to the upstream limit of the improvements (Station 103+000) the river navigation channel would continue at -47-feet MLW and 464-feet wide. The existing Kings Island Turning Basin, the eight berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9), three channel bend wideners and two meeting areas would also be deepened to -47 feet MLW. The recommended improvements end at the Garden City Terminal (Station 103+000), but the Savannah Harbor Federal Navigation Project extends to Station 112+500.

Channel side slopes from the oceanward end of the bar channel would be 5H:1V. Side slopes for the remaining project (including Kings Island Turning Basin, the eight berths at Garden City Terminal (Berths 2, 3, 4, 5, 6, 7, 8, and 9), three channel bend wideners and two meeting areas would be 3H:1V. Because the side slopes of the navigation channel do not change, the estimated average annual maintenance dredging is about 7.1 million cubic yards.

Two feet of allowable overdepth and up to 6 feet of advance maintenance in selected areas (see Table 3-2, above) would also be included for the proposed action.

3.06 Initial Dredging and Sediment Placement Methods

Excavation methods include use of cutterhead pipeline, mechanical (i.e., bucket and barge), and hopper dredges. A cutterhead pipeline dredge and/or mechanical dredge would be used to deepen the inner harbor channel (from Stations 4+000 to 103+000) and a hopper dredge, mechanical and/or ocean certified pipeline dredges would be used to deepen the entrance channel from Stations 4+000 to -97+680B). Approximately 13 million cubic yards of newly excavated material from the Inner Harbor channel would be placed in the seven upland CDFs. Approximately 10.6 million cubic yards of newly excavated sediment from the entrance channel would be placed in the Savannah Harbor ODMDS.

3.07 Alternative Disposal Methods or Beneficial Use of Dredged Sediments

As part of the proposed actions, a number of alternative disposal methods or beneficial use of dredged sediments were evaluated, including nearshore placement and beach nourishment, creation of shorebird nesting habitat, restoration of the riverine shoreline, creation of tidal marsh and wetlands, production of bricks, capping of the cadmium-laden sediments, and use of material for future dike raisings. Beneficial use opportunities will be employed for a portion of the inner harbor dredged materials. Material from stations 67+000 to 80+125 and from 90+000 to 103+000 will be used as either capping material for cadmium-laden sediments in 14A/B or for future dike raising materials in 13A as detailed in the GRR Engineering Appendix Section 11.0. A discussion of the use of dredged materials for nearshore placement and beach renourishment is included later in this section. Other proposed beneficial uses of the inner harbor material that were considered as part of SHEP are detailed below:

A. Using dredged material to create shorebird nesting habitat is a practice currently employed by the District. In accordance with past mitigation requirements, the District has created several “bird islands” within the existing CDFs. When the CDFs are maintained in a wet condition, these islands provide nesting and roosting habitat for shorebirds, including threatened and endangered species. Implementation of the proposed action will not affect this ongoing activity.

B. To offset shoreline erosion, the Corps considered placement of dredged materials to restore and protect the riverine shoreline in the inner harbor. The Corps determined, however, that the size of the dredging equipment employed to remove the sediments could potentially cause adverse impacts (turbidity, destruction of habitat) if the sediments were pumped onto the riverbank in large quantities.

C. Similar to shoreline restoration, the Corps evaluated using dredged materials to create tidal marsh or wetlands. The Corps determined that discharge of dredged material in open waters to create wetlands would result in adverse impacts to valuable fish and wildlife habitat in the inner harbor. Creation of such environments in the ocean is not cost effective, as the benefit of its construction would be offset by costs required to protect the created habitat from wave action.

D. The non-Federal sponsor has funded studies to assess using dredged materials within the CDFs to manufacture bricks. Should the non-Federal sponsor wish to pursue this option as beneficial use, then the Corps would support its implementation.

In light of the volume of new work sediments that would need to be removed to deepen the harbor and the limited window (December through March) in which hopper dredges are allowed to work in Savannah, the Corps evaluated other equipment and placement options that could be used to reduce the total construction period and minimize new work dredging and deposition costs. Several alternative plans were considered, including beneficial uses of dredged sediments.

The Corps followed an iterative process to develop a plan for the new work entrance channel sediments. The work started with an engineering determination of sediment quantities to be removed at various channel depths and the composition (i.e., percent fines and percent sands) of those sediments. A review of previous information was conducted, including: the LTMS (USACE 1996); the Draft 2003 ERDC Report on Nearshore Placement at Tybee Island; and changes to the GA CZM Program that incorporate Georgia House of Representatives Bill 727 (HB 727).

The LTMS (USACE 1996) authorized placing maintenance sediments in feeder berm sites within the nearshore area off Tybee Island and adjacent to the entrance channel. The LTMS also authorized placing maintenance sediments on eroded portions of Tybee Island.

Based on the sites designated and approved in the LTMS for the deposition of maintenance material into nearshore feeder berm sites, the 2003 ERDC Report refined the analyses identified several specific nearshore sites that would feed sediment to Tybee Island beach and dampen wave action on the coastline. The sites were identified in locations that would minimize subsequent migration of the sediments into the navigation channel.

The Corps then developed a sediment placement plan with cost identified as a priority criterion. The plan was reviewed from an environmental perspective with consultation from the Georgia Department of Natural Resources-Coastal Resources Division (GA DNR-CRD), which provided additional placement scenarios to consider. The Corps also discussed the work with The City of Tybee Island's (Tybee Island) coastal engineering consultant. The proposed plan was subsequently revised to incorporate the views of GA DNR-CRD and Tybee Island's consultant. During that period, Corps engineers were also consulted to determine pumping distances that could be achieved without the use of booster pumps (which would greatly increase cost) and what placement designs would not cause adverse currents or result in rapid migration of deposited sediments toward the shipping channel. The previously described information was then synthesized and integrated into a revised sediment placement plan.

The Corps provided GA DNR-CRD staff and Tybee Island's coastal engineering consultant with the updated plan at a meeting on July 13, 2006. Following the meeting,

the plan was again revised to address items identified during the meeting. The plan was later presented to the Stakeholders Evaluation Group in September 2006 and the Corps again received comments.

The proposed plan was based on a compilation of information provided by Corps geotechnical engineers; discussions with Corps coastal engineers; discussions with GA DNR-CRD for information on CZM and HB 727 compliance, recreational and commercial boat usage off of Tybee Island, and general environmental acceptability issues; and information from Tybee Island's coastal engineering consultant concerning issues that directly affect the Tybee Island beaches.

The Corps included the following assumptions in the design of the sediment placement plan for the entrance channel sediments:

A. A 30-inch pipeline dredge can pump sediment a total distance of about 3 miles without a booster pump and without substantially reducing its productivity. The placement design would be based on there not being a need for a booster pump.

B. A loaded hopper dredge generally needs about 25 feet of water under its keel. Hopper dredges (with pump ashore capability) may not be able to reach all locations, since the nearshore water depths off Tybee Island are less than 15 feet mean high water.

C. For each entrance channel reach from Stations 4+000 to -98+600, the dredge quantities in cubic yards for the greatest dredging depth (i.e., -48 foot depth) was used for all placement sites.

As a result of the extensive coordination with GA DNR-CRD and the City of Tybee Island, the Corps proposed in the DEIS to place new work and maintenance sediments in the nearshore area off Tybee Island which would provide beneficial use of dredged material and comply with the Georgia Coastal Management Program, including the changes that incorporate Georgia HB 727. The proposed dredged material placement plan also included two sites (Site 11 and Site 12) which would have been constructed from material from the entrance channel extension to provide additional fish habitat in the area. The sediment placement sites identified in this plan are shown in Figure 3-2 and described below:

A. MLW 200 has a total capacity of 217,000 cubic yards and is located west of the North Groin on Tybee Island. The sediment would be deposited at the mean low water (MLW) line and be allowed to mound up to mean sea level (MSL) or mid-tide. When filled to capacity, the placement would create a mid-tide berm about 200 feet wide and 3,200 feet long.

B. MLW 500 has a total capacity of 1.9 MCY and is located south of the North Groin on Tybee Island. The sediment would be deposited at the MLW line and be allowed to mound up to MSL or mid-tide. When filled to capacity, the placement would create a mid-tide berm about 500 feet wide and 11,000 feet long.

C. ERDC Nearshore has a total capacity of 1.2 MCY and is located below the MLW contour in the nearshore area off Tybee Island. At total capacity, the top elevation of the placement site would be -4 feet so as not to interfere with boaters but allow potential for movement of material towards the Tybee Island shoreline by wave action.

D. Site 2 has a total capacity of 3.2 MCY and is located below the MLW contour in the nearshore area off Tybee Island. At total capacity, the top elevation of the placement site would be at mean high water (Elevation +8 feet MLW). Site 2 would also provide bird and fish habitats.

E. Site 2 Extension has a total capacity of 4.4 MCY and is located below the mean low water contour (MLW) in the nearshore area off Tybee Island. At total capacity, the top elevation of the placement site would extend to -4 feet MLW.

F. Sites 3, 4, 5, and 6 are located south of the entrance channel and between the Site 2 and the ODMDS. These sites were authorized within the LTMS (USACE 1996). The top elevation of these placement sites would be at -5 feet MLW, as described in the LTMS.

G. Savannah Harbor Ocean Dredged Material Disposal Site (ODMDS). The USEPA-approved ODMDS is a 4.26 square mile (or 2,726.4 acres) site and is centered at 31 56' 54" N and 80 45' 34" W. Total capacity is about 56.8 MCY and at capacity the top elevation would be -26 feet MLW.

H. Site 11 has a total capacity of 2.1 MCY and is located below the mean low water contour (MLW) in the nearshore area off Tybee Island. At total capacity, the top elevation of the placement site would extend to -10 feet MLW. This mound would provide fish habitat. This site was authorized within the LTMS (USACE 1996).

I. Site 12 has a total capacity of 3.0 MCY and is located below the mean low water contour (MLW) in the nearshore area off Tybee Island. At total capacity, the top elevation of the placement site would extend to -10 feet MLW. This mound would provide fish habitat by establishing a variation in contours of the water bottoms.

Most of the sites were authorized in the LTMS to receive maintenance material from the Savannah Harbor entrance channel. Sites 11 and 12 were developed during SHEP planning to provide fish habitat. The specific Site 2 Extension design was developed to provide a pathway for sediments to migrate to the shoreline. The ERDC Nearshore site is also a design development of the previously approved “feeder berm” and is considered a part of the feeder berm system approved under the LTMS.

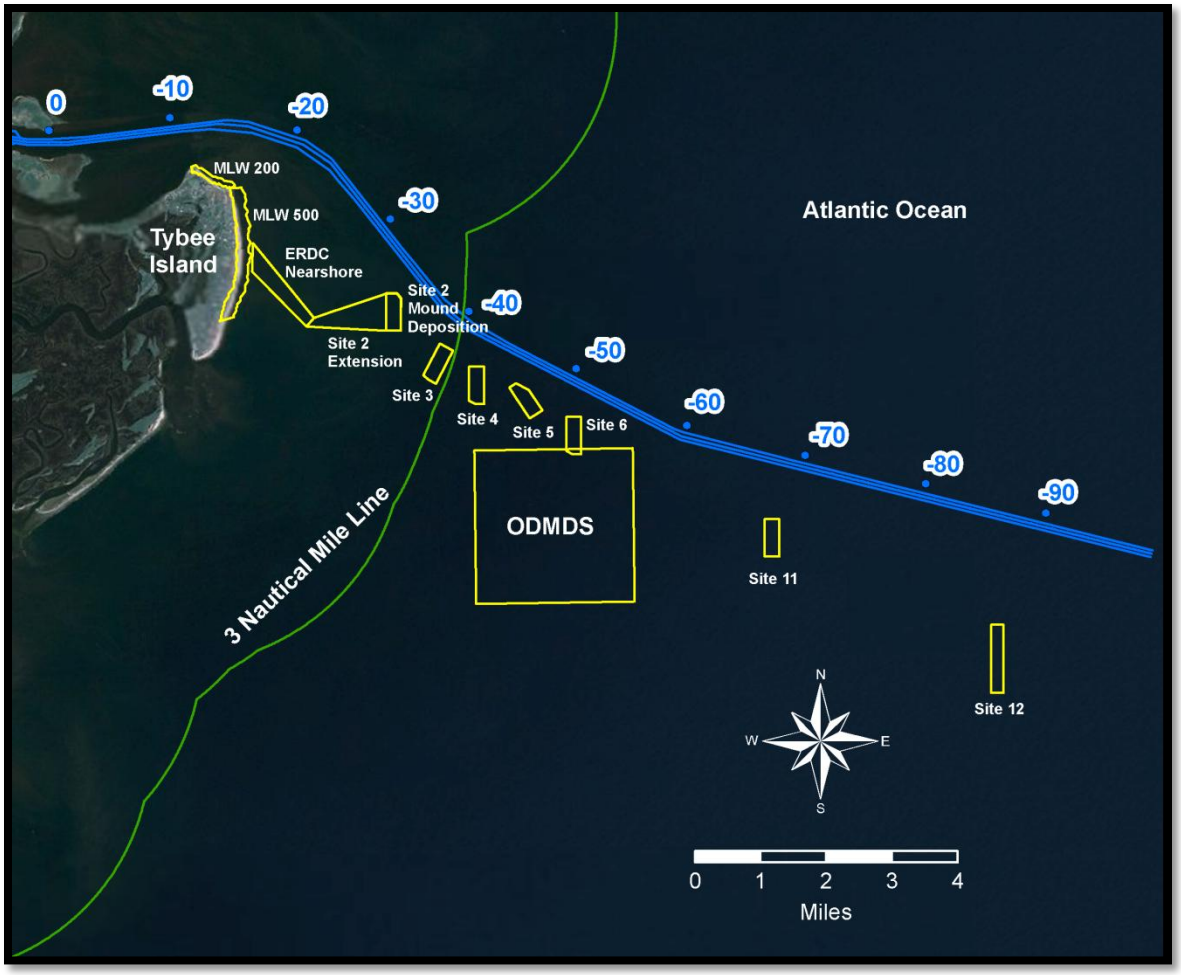

Figure 3-2. Unconfined placement areas for new work and maintenance material as initially proposed.

The new work sediment that would have been placed into the nearshore feeder berm sites would have been material with a fines content of 20 percent or less. The GA DNR-CRD and the City of Tybee Island have since requested that these sites not be used for new work sediment from the project because they prefer material with a fines content of 10 percent or less. They also requested that Sites 11 and 12 not be used because of potential adverse effects to fish habitat and commercial and recreational fishing. Based on comments from EPA, Site 4, Site 5, Site 6, Site 11, and Site 12 are beyond the 3-mile line and would also require site designation studies. Consequently, use of these dredged material placement sites for new work material was removed from the project. New work dredged sediments from the SHEP would be placed into the existing CDFs or the approved ODMDS.

For maintenance material, placing inner harbor sediments into the existing upland CDFs and entrance channel sediments into the Savannah Harbor ODMDS or Site 2 and Site 3 is the least-cost environmentally acceptable disposal alternative (Base Plan) for long-term maintenance of the proposed harbor deepening project. However, suitable maintenance sediments from both the inner harbor and entrance channel of the deepened project could be used for beach renourishment or placed into the other nearshore feeder berm sites

(MLW 200, MLW 500, ERDC Nearshore, and Site 2 Extension) approved as part of the LTMS. The Corps would coordinate with the appropriate natural resource agencies prior to initial placement in areas other than the ODMDS or existing CDFs. A non-Federal sponsor would be required to pay the expected additional costs to deposit the maintenance sediments in areas that are not included in the Base Plan (least cost and environmentally acceptable disposal alternative). Figure 3-3 shows the approved dredged material placement sites for maintenance material from the entrance channel as well as suitable material from the first portion of the inner harbor channel.

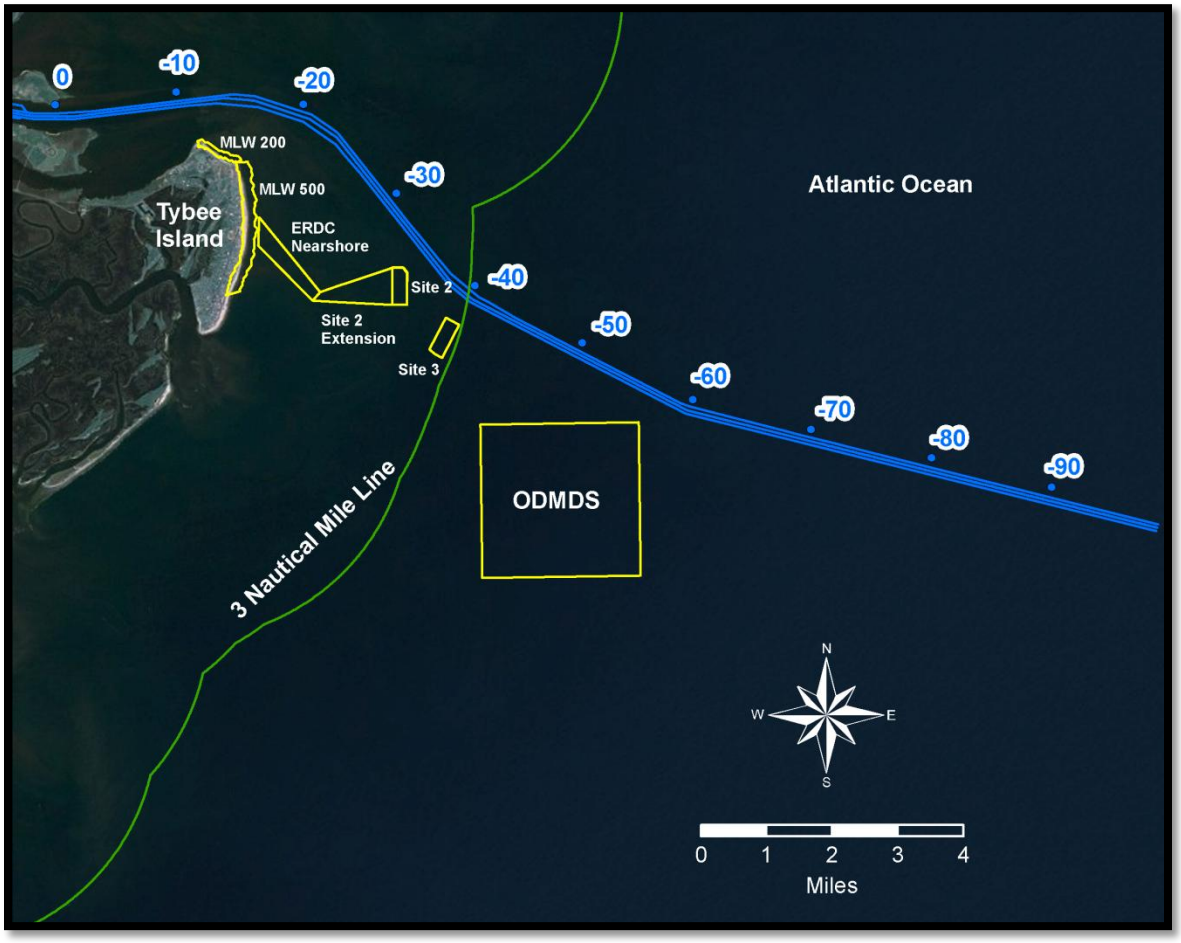

Figure 3-3. Approved unconfined placement areas for maintenance material.

3.08 Dredging Quantities for Construction of Selected Plan

The estimated volumes for construction of the Selected Plan (47-foot depth) are indicated in Tables 3-9 and 3-10 below.

Table 3-9. Estimated New Work Sediment by Reach for the Inner Harbor

Station		Estimated Total Cubic Yards
0+000 to 4+000		305,674
4+000 to 6+375		174,073
6+375 to 30+000		2,759,203
30+000 to 45+000		1,802,866
45+000 to 51+000		892,307
51+000 to 57+000		1,101,114
57+000 to 67+000		1,244,681
67+000 to 80+125		1,196,291
80+125 to 90+000		946,436
90+000 to 103+000 *		2,533,434
TOTAL		**12,956,079**

NOTE: Volume in Reach 90+000 to 103+000 includes 170,000 cubic yards to be removed from the GPA Container Berths at the Garden City Terminal.

Table 3-10. Estimated New Work Sediment by Reach for the Entrance Channel (Ocean Bar Channel)

Stations		Estimated Total Cubic Yards
0+000 to -10+000B		917,064
-10+000B to -20+000B		1,311,322
-20+000B to -30+000B		1,352,115
-30+000B to -40+000B		1,305,921
-40+000B to -53+500B		1,632,346
-53+500B to -57+000B		391,437
-57+000B to -97+680B		3,736,308
TOTAL		**10,646,413**

3.09 Maintenance Dredging Requirements

The amount of sediment entering the inner harbor (Stations 103+000 to 0+000) is dependent on river discharge while current velocities and the location of the mixing zone between fresh and salt-water influence the distribution of the shoaling. Past increases in channel depth have improved conveyance so that the full tidal prism reaches the upstream limit of the harbor. The last channel deepening in 1993/1994 did not substantially change the shoaling volume or distribution. Since the channel already captures all of the sediment that enters the harbor, future depth increases will not increase the volume of sediment that settles in the channel. An additional feature of the proposed channel deepening, which supports the prediction of no increase in dredging volume, is future depth increases would extend down along the existing channel side slopes. Deepening along the existing side slopes actually decreases the bottom width of the channel.

The ocean bar channel is a sediment sink that captures the littoral sediment. After the last deepening project (1993/1994), the annual shoaling volume initially appeared to increase. However, when longer term records were incorporated into the analysis, the data indicate that the long term shoaling volume did not increase. That said, a small increase in sediment volume is predicted with the -47-foot deepening alternative based on a 37,680-foot increase in length of the entrance channel.

The improvements included in the recommended plan would be maintained in conjunction with maintenance of the overall Savannah Harbor Navigation Project. Maintenance dredging would continue to be conducted at the same frequency, generally

every 1 to 5 years depending on the shoaling rate. Dredging methods described above (i.e., pipeline and hopper dredges, mechanical (i.e., bucket and barge), or similar equipment) will be used for maintenance. Sediment placement locations for the maintenance of the deepened channel would remain the same, that is;

A. Inner harbor maintenance sediments would continue to be placed in the upland CDFs, and

B. Entrance channel maintenance sediment would primarily be placed in the Savannah ODMDS with some material possibly being placed in a CDF or Site 2 and Site 3 south of the entrance channel. Suitable material could also be placed on the beach at Tybee Island or in the nearshore area of Tybee Island (Sites MLW 200, MLW 500, ERDC Nearshore, and Site 2 extension) provided a non-Federal sponsor pays the additional costs involved in placing the material in those locations.

Average annual maintenance dredging requirements for the recommended plan and alternatives would be essentially the same. Table 3-11 includes total maintenance dredging requirements.

3.10 50-Year Maintenance Plan and Periodic Review

Sediment placement sites have been identified that could accommodate both new work sediments and those that would result from maintenance of the authorized project. Those sites include existing CDFs and the Savannah Harbor ODMDS for new work and maintenance material. Site 2 and Site 3 submerged berms may also be used for maintenance material from the project. Dikes at the CDFs would have to be raised periodically over the 50-year life of the project to provide the needed sediment storage capacity. Similarly, the boundaries of the ODMDS would have to be expanded after capacity is exceeded, which is expected to occur in approximately 42 years. The long-term maintenance of Savannah Harbor will be reviewed periodically to consider new dredging technologies, shoaling rates, environmental conditions, laws and regulations. The GRR Engineering Appendix contains an update to Savannah Harbor's Dredged Material Management Plan. That update describes the analyses the Corps conducted to ensure sufficient sediment placement capacity would be available to maintain a deepened harbor over the 50-year evaluation period. A summary of the capacity analysis is also included as part of Appendix R of the EIS.

3.11 Future Conditions Without the Project

In excess of 80% of the vessels do not call on Savannah Harbor at their maximum capacity or design draft. The "light loading" of vessels increase costs to the shipper, which are eventually passed onto the consumer. Less efficient vessels also generally result in higher shipping costs. If the proposed project is not constructed, vessel operators will continue to incur costs due to vessel delays and light loading of vessels.

3.12 Relationship of Proposed Action to Other Federal Projects in Savannah Harbor

As indicated in Section 3.01 of the EIS, the proposed action assumes that the project features associated with the LTMS (USACE 1996), Bank Protection for CDFs 13A, 13B, 14A, and 14B and the realignment of the Federal Navigation Channel (USACE 2006) have been completed.

Table 3-11. Estimated Average Annual Maintenance Dredging Quantities Selected Plan of Improvement (in Cubic Yards)

Range	Volume of Maintenance Sediments (Cubic Yards)
Entrance Channel	
-98+600B to -57+000B	124,000
-57+000B to –53+500B	3,000
-53+500B to -40+000B	54,000
-40+000 to -30+000	325,000
-30+000B to -20+000B	281,000
-20+000 to -10+000	163,000
-10+000 to 0+000	155,000
0+000 to +4+000	76,000
Subtotal	**1,181,000**
Inner Harbor	
4+000 to 24+000	225,000
24+000 to 40+000	364,000
40+000 to 50+000	900,000
50+000 to 70+000	2,076,000
70+000 to 79+000	294,000
79+000 to 97+500	605,000
97+500 to 102+000	1,456,000
102+000 to 103+000	51,000
Subtotal	**5,971,000**
Total Annual	**7,038,000**