Savannah Harbor Expansion Project
Dredged Material Management Plan Update

January 2012
Updated March 2012

This report will be broken down into two parts, the inner harbor and the outer harbor or bar channel. This disposal plan report covers both operations and maintenance material and new work material.

1.0 INNER HARBOR SEDIMENT PLACEMENT PLAN

1.1 DISPOSAL AREAS

Based on the observed long term average, approximately 6,225,000 cubic yards (CY) of sediments are available to be removed each year from the inner harbor of the Savannah Harbor Navigation Project by the Corps. However, due to funding constraints, only 5,900,000 CY are actually removed. The dredged material is placed in nine dredged material containment areas (DMCA) located throughout the project (Table 1) which have been designated by the non-Federal sponsor for use for the Project. The DMCAs with their station location and acreage are listed in Table 1.

Table 1: Dredged Material Containment Areas (DMCA)

DMCA	Location(Station)	Acreage
2A	93+000 to 103+000	240
12A	6+500BR to 10+500BR*	1040
13A	47+800 to 57+000 (2+000BR)	1307
13B	42+000 to 47+800	540
14A	37+000 to 42+000	647
14B	28+000 to 37+000	703
Jones/Oysterbed (JOI)	10+000 to 27+000	890

*BR refers to Back River or that portion of the channel located in the Back River

DMCA 14B receives dredged material from both the Savannah Harbor Navigation Project and the Atlantic Intracoastal Waterway (AIWW), another waterway managed by the US Army Corps of Engineers. The non-Federal sponsor for the Georgia portion of the AIWW project is the Georgia Department of Transportation (GDOT). The South Carolina Department of Health and Environmental Control Office of Ocean and Coastal Resource Management (SC DHEC-OCRM) is the sponsor for the South Carolina portion of the AIWW. The other confined disposal areas only receive material from the Savannah Harbor Navigation Project, including the navigation channel, turning basins, the Sediment Basin, and berthing areas.

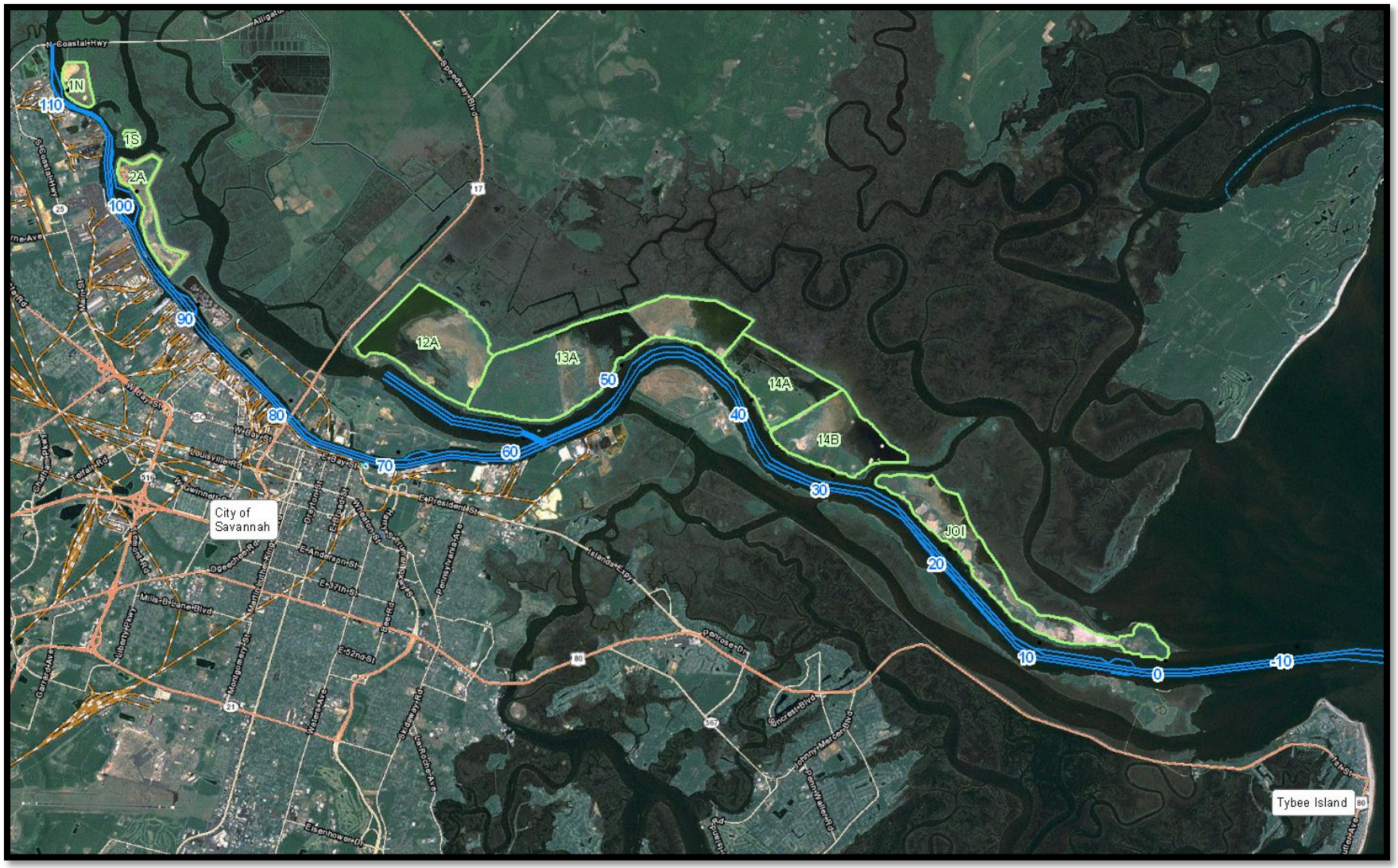

Figure 1 – Savannah Harbor Dredged Material Containment Areas

1.2 O&M SEDIMENT CHARACTERIZATION

The sediment dredged from the Savannah Harbor is a mixture of sands, silts, and clays. Sands are dredged from the lower and upper reaches of the project, while the predominant material removed from the middle harbor and Sediment Basin is silt. The inner harbor sediments are primarily silts and clays from Station 56+000 to 103+000. The reach from Station 28+000 to 56+000 is a transition reach that has a higher percentage of sand in its distributions than the sediment distributions of the upstream reach. A notable exception is in the vicinity of Station 36+000, which has a high percentage of silts and clays and almost no sand. This location is near the confluence of the inner harbor channel and both Elba Island and Fields Cut. The inner channel sediment distributions from Station 28+000 to the mouth of the Savannah River are primarily sand, which indicates that the source of sediment from this reach is offshore. A breakdown of sediment characteristics by dredging reach is shown in Table 2.

Table 2: Sediment Characterization by Reach

Stations	O&M (CY)	Sand (%)	Sand (CY)	Fines (%)	Fines (CY)
0+000 to +4+000	76,000	90%	68,400	10%	7,600
4+000 to 24+000	225,000	92%	207,000	8%	18,000
24+000 to 40+000	364,000	15%	54,600	85%	309,400
40+000 to 50+000	900,000	30%	270,000	70%	630,000
50+000 to 70+000	2,076,000	23%	477,480	77%	1,598,520
70+000 to 79+000	294,000	8%	23,520	92%	270,480
79+000 to 97+750	605,000	16%	96,800	84%	508,200
97+750 to 102+000	1,456,000	54%	786,240	46%	669,760
102+000 to 103+0000	51,000	64%	32,640	36%	18,360
103+000 to 112+000	178,000	80%	142,400	20%	35,600
TOTAL	**6,225,000**		**2,159,080**		**4,065,920**

1.3 DISPOSAL AREA ROTATION FOR O&M MATERIAL

Tables 3 through 5 detail the disposal area rotation for the disposal of O&M dredged material for the next 50-years for Savannah Harbor. The schedule is based on the channel reaches (station to station) and quantities described in Table 2. O&M dredging will be performed in conjunction with the new work dredging and will not impact the required 20-year capacity required by the DMMP. Dike construction (raising) requirements associated with this rotational schedule are included in Table 6. Any loss in sediment storage capacity to new work material will be replaced by the new work project. Deposition of the new work sediments is shown beginning in 2014 and ending in 2016 (background color = burnt orange).

Table 3: Inner Harbor New Work & Annual Maintenance Material Disposal Plans 2010 - 2026 (47 ft MLLW Project Depth)

	Confined Disposal Area							TOTALS		
Fiscal Year*	**2A**	**12A**	**13A**	**13B**	**14A**	**14B**	**J/O**	**O&M**	**New Work**	**O&M & New Work**
2010	229,000	4,431,000	BUILD DIKE Breach X dike	782,500	BUILD DIKE	782,500	DRYING	6,225,000		
2011	229,000	DRYING	4,431,000	1,565,000	BUILD DIKE	DRYING	BUILD DIKE	6,225,000		
2012	229,000	DRYING	4,431,000	1,565,000	BUILD DIKE	BUILD DIKE	BUILD DIKE	6,225,000		
2013	229,000	BUILD DIKE	4,431,000	782,500	DRYING	DRYING	782,500	6,225,000		
2014	DRYING	4,828,500	DRYING	782,500	DRYING	2,299,000	248,815	5,611,000	2,547,815	8,158,815
2015	DRYING	2,323,084 1,685,000	DRYING	26,719	4,575,780	2,364,278	0	1,711,719	9,263,142	10,974,861
2016	DRYING	4,823,753 2,370,000	BUILD DIKE	DRYING	2,336,482 DRYING	1,860,000 DRYING	1,489,000	3,859,000	9,020,235	12,879,235
2017	FULL	DRYING	4,660,000	DRYING	DRYING	DRYING	1,565,000	6,225,000		
2018		DRYING	4,660,000	DRYING	BUILD DIKE	BUILD DIKE	1,565,000	6,225,000		
2019		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2020		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2021		4,660,000	DRYING	DRYING	782,500	782,500	BUILD DIKE	6,225,000		
2022		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2023		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2024		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2025		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2026		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		

Table 4: Inner Harbor New Work & Annual Maintenance Material Disposal Plans 2027 - 2050 (47 ft MLLW Project Depth)

	Confined Disposal Area							TOTALS		
Fiscal Year*	**2A**	**12A**	**13A**	**13B**	**14A**	**14B**	**J/O**	**O&M**	**New Work**	**O&M & New Work**
2027		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2028		4,660,000	DRYING	782,500	DRYING	DRYING	782,500	6,225,000		
2029		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2030		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2031		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2032		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2033		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2034		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2035		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2036		DRYING	4,660,000	782,500	BUILD DIKE	DRYING	782,500	6,225,000		
2037		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2038		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2039		4,660,000	DRYING	BUILD DIKE	782,500	782,500	DRYING	6,225,000		
2040		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2041		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2042		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2043		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2044		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2045		4,660,000	DRYING	DRYING	782,500	782,500	BUILD DIKE	6,225,000		
2046		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2047		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2048		DRYING	4,660,000	782,500	DRYING	BUILD DIKE	782,500	6,225,000		
2049		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2050		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		

Table 5: Inner Harbor New Work & Annual Maintenance Material Disposal Plans 2051 - 2066 (47 ft MLLW Project Depth)

	Confined Disposal Area							TOTALS		
Fiscal Year*	**2A**	**12A**	**13A**	**13B**	**14A**	**14B**	**J/O**	**O&M**	**New Work**	**O&M & New Work**
2051		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2052		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2053		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2054		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2055		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2056		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2057		4,660,000	DRYING	BUILD DIKE	782,500	782,500	DRYING	6,225,000		
2058		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2059		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2060		DRYING	4,660,000	782,500	DRYING	BUILD DIKE	782,500	6,225,000		
2061		BUILD DIKE	4,660,000	DRYING	782,500	782,500	DRYING	6,225,000		
2062		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2063		4,660,000	DRYING	DRYING	782,500	782,500	DRYING	6,225,000		
2064		4,660,000	BUILD DIKE	782,500	DRYING	DRYING	782,500	6,225,000		
2065		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		
2066		DRYING	4,660,000	782,500	DRYING	DRYING	782,500	6,225,000		

Reach	**Maintenance Volume**	
0 to 50	1,565,000	JOI, 14B, 14A, 13B: Split Annual Volume in half to two available areas each year
50 to 102	4,431,000	12A, 13A: Use Area Available
102 to 112	229,000	2A or 12A, 13A: Use 2A when available
Total	6,225,000	

**** Based on Federal Fiscal Year 1 October to 30 September.***

***** 2A will be full in FY 2017 and no longer Available for use.***

Table 6: Dike Construction Schedule

Dredged Material Containment Area (DMCA)	Dikes Construction Years
2A	2017 Area Full
12A	2013, 2019, 2025, 2031, 2037, 2043, 2049, 2055, 2061
13A	2010, 2016, 2022, 2034, 2040, 2046, 2052, 2058, 2064
13B	2039, 2057
14A	2010, 2011, 2012, 2018, 2036
14B	2012, 2018, 2048, 2060
Jones/Oysterbed	2011, 2012, 2045

1.4 NEW WORK DREDGING

The total amount of New Work material for all depths (alternatives) considered to be dredged from the Inner Harbor by reach is shown in Table 7 below. The volume to be dredged is based the required additional navigation depth for each alternative, plus 100% of the 2-foot overdepth below the authorized depth. Under normal conditions the new work dredged material would be placed in the same available site used for O&M based on which DMCAs are available at the time and the 3-year rotation shown in Tables 3 through 5. Identification of elevated levels of cadmium during sediment testing and analyses of new work sediments in 1997 and 2001 changed the scenarios for the placement of that material.

Table 7: Total New Work Material by Depth Evaluated and by Reach

Stations	48-ft New Work (CY)	47-ft New Work (CY)	46-ft New Work (CY)	45-ft New Work (CY)	44-ft New Work (CY)
4+000 to 6+375	217,263	174,073	130,559	87,346	48,128
6+375 to 30+000	2,775,041	2,308,262	1,840,479	1,372,897	913,871
30+000 to 45+000	2,181,609	1,802,866	1,426,462	1,052,928	684,583
45+000 to 51+000	1,088,128	892,307	699,013	508,740	324,752
51+000 to 57+000	1,025,450	883,874	743,122	602,960	464,032
57+000 to 67+000	1,242,896	1,035,585	828,620	621,905	415,297
67+000 to 80+125	1,446,786	1,196,291	944,611	691,727	444,210
80+125 to 90+000	1,132,066	946,436	759,169	570,368	380,724
90+000 to 103+000	2,895,175	2,533,434	2,169,594	1,803,823	1,438,457
Channel Subtotal CY	**14,004,414**	**11,773,128**	**9,541,629**	**7,312,694**	**5,114,054**
Long Island Meeting Area	484,231	450,941	417,783	384,096	350,859
Oglethorpe Meeting Area	446,541	426,336	405,461	384,089	362,348
Passing Lane Subtotal	**930,772**	**877,277**	**823,244**	**768,185**	**713,207**
Total New Work (CY)	**14,935,186**	**12,650,405**	**10,364,873**	**8,080,879**	**5,827,261**

1.4.1 Placement of Cadmium-Laden Material

1.4.1.1 Initial Cadmium Issue

Sediment testing and analyses in 1997 and 2001 for the Savannah Harbor Expansion Project indicated a potential for elevated levels of naturally-occuring cadmium associated with the Miocene clay layer. Because of this potential, Phase 2 sediment testing was performed in 2005, to examine the concentration and distribution of cadmium within new work sediments. Approximately 350 sediment samples were taken at 2-foot intervals from 45 cores distributed throughout the harbor but concentrating in areas believed to contain Miocene clays. This core data was initially analyzed and used to estimate the potential average cadmium concentration in new work sediment by station. This resulted in Stations 17+000 to 45+000 having an average cadmium concentration of 21.45 mg/kg. None of the other ranges had an average cadmium concentration of greater than 6.89 mg/kg, which is well below the Effects Range Median (ERM) of 9.6 mg/kg indicating little potential for environmental impact. It was determined that this reach between Stations 17+000 and 45+000 would be treated differently from the other harbor new work sediments. The criteria established for the treatment of this sediment was to place it all in one DMCA, and to cover it with a 2-foot layer of other new work sediment. The 2-foot covering layer was determined to be sufficient for biological purposes and also sufficient to ensure that underlying sediment would not be disturbed during future dike raisings.

The amount of cadmium laden new work material in this reach is 3,429,575 CY. This material plus a 2-foot cap of approximately 1,860,000 CY, yields a total of 5,289,575 CY must be able to fit into a single DMCA.

With the location of the cadmium being between Stations 17+000 to 45+000, DMCAs 14A, 14B, and Jones/Oysterbed were evaluated for placement of the material due to their proximity to that reach. Characteristics of the three DMCAs considered are shown in Table 8. All of these DMCAs met the initial requirements of being close to the reach containing the cadmium laden material and being able to contain all of the cadmium in one disposal site.

Table 8: DMCA Characteristics

DMCA	Acres	Current Capacity(CY)	Dike Raising Schedule
14A	647	7,000,000	2010/2012
14B	703	6,800,000	2012
Jones/Oysterbed (JOI)	550	5,340,000	2011

DMCA 14A was selected over the other two areas as the best site for the following reasons:

- Its elevation was lower than the adjacent disposal sites, allowing the cadmium-laden material to be placed at a lower elevation;

- After covering, there would be greater future potential to extend the life of the disposal area by subsequent dike raisings than the other disposal areas that were at a higher elevation; and

- This area would afford greater protection as the entire front side of the dike has erosion protection in the form of rip rap, already in place.

1.4.1.2 Finding of Additional Areas of Higher Cadmium Concentration

The initial review of the "Savannah Harbor Expansion Project, Cadmium Report (August 2006)" on cadmium within the navigation channel was based on average cadmium (mg/kg) per reach and identified the reach between stations 17+000 and 45+000 with 3,429,575 cubic yards (CY) of cadmium laden material as the only area in the harbor that needed special handling. That amount, plus the cover amount of 1,860,000 CY produce a total volume for cadmium-laden material of 5,289,575 CY, which could easily fit in DMCA 14A (7,000,000 CY capacity). A later review of cadmium concentration taking into account individual high points of concentration as well as average cadmium concentration per reach resulted in additional reaches being designated as having high concentrations of cadmium and, therefore, special handling requirements. Table 9 contains this information.

Table 9: Reaches with Elevated Cadmium Levels

Range	Material (CY)
Station 6+375 to 45+000	4,562,069 CY
Station 51+000 to 57+000	1,101,114 CY
Station 80+125 to 90+000	946,436 CY
TOTAL	6,609,619 CY

The resultant increase in the amount of material and differing locations meant that all of the material could not be placed in DMCA 14A; therefore, another site for the placement of the excess cadmium (beyond what was to be placed in 14A) needed to be identified.

The initial re-evaluation of DMCAs resulted in DMCAs 12A, 13A, and 13B being eliminated due to having underdrains to aid in the drying out of the disposal area (cadmium stays bonded to clay when in a wet/moist state). That left DMCAs 14B, and Jones/Oysterbed to be further evaluated for placement of the cadmium-laden new work sediments.

The initial re-evaluation of DMCA's 14B and Jones/Oysterbed (Jones Island portion) indicated that the Jones Island Site best met the engineering requirements for the placement of the cadmium sediments due to the ability to place the cadmium at a lower elevation and the DMCA being closer to the reach containing the cadmium. However, a major drawback to its use was the high erosion rate along the dikes on the Savannah River side of this DMCA. These dikes would need to be armored before the cadmium-laden material could be placed here. Armoring the dikes for this DMCA would cost approximately $20.5M. The dikes along DMCA 14B have recently been armored to

protect against existing erosion problems, making it a viable site for placement of cadmium-laden sediments. Based on the available technical information and the costs for use, DMCA 14B was selected as the second site to receive the cadmium laden material.

Additional investigations would be performed during the PED phase of the project. Those studies could identify a way that all cadmium-laden sediments (and the covering sediment) could be contained in a single DMCA. Should the detailed engineering analyses lead to that conclusion, the Corps would deposit all the cadmium-laden sediments in a single DMCA.

1.4.1.3 Dike Raising Considerations

The decision to use DMCA 14B for the placement of cadmium laden material created another problem. This DMCA contains approximately 2,000,000 CY of good quality dike raising material which is needed for the dike raisings at DMCAs 14A (2010/2012) and 14B (2012). This material was used to raise the dikes on DMCA 14A (FY2010 with Stimulus funds). The timing of the dike raising on DMCA 14A and the subsequent use of DMCA 14B for the placement of excess cadmium laden material is important because the Corps is expected to begin raising dikes on DMCAs 14A/14B in Mar 2012 and will complete that work in Oct 2013. Outside of the Expansion Project, the Corps intends to begin raising the dikes on Jones/Oysterbed FY 2012(contract 2011/construction 2012). If after these dike raisings there is material remaining in DMCA 14B, it could be used to raise the dikes on DMCA 13B to recapture the capacity lost to new work material. Table 10 contains the quantities of dike raising materials required for the following projects:

Table 10: Dike Raising Scenarios

Description	Quantity (CY)	Begin Construction
Current 14A Dike Raising	500,000	FY 2010 (Comp 2011)
Next 14A Dike Raising (Begin SHEP)	700,000	FY 2012
14B Dike Raising (for cadmium-laden sediments)	600,000	FY 2012
TOTAL	1,800,000	

1.4.2 Dredging Sequence for the 47-Foot Project

For all Project depths considered: 44-, 45-, 46-, and 47-foot; except for the 48-foot project, all of the material, new work and O&M, could be placed in DMCA's 14A and 14B without having to remove the O&M material first.

For the 47-foot depth alternative, all of the material including the cadmium-laden material between Stations 6+375 and 30+000 would be placed in DMCA 14B. The coverage for this material will come from the reach between Stations 90+000 and 103+000. The cadmium-laden material between Stations 30+000 and 45+overage for this material will also come from the reach between Stations 90+000 and 103+000. The material in both DMCAs, 14A and 14B, would be allowed to consolidate for at least 9 months before the cover material is placed. Table 11 lays out the sequencing for the dredging process for all alternatives considered.

Table 11: Project Dredging Sequence using DMCAs 14A and 14B for Cadmium Disposal

48-Foot Project				
Description	**Stations**	**CY Material**	**DMCA**	**Notes**
O&M Dredging	4+000 to 57+000	3,563,754	13A	
New Work Dredging	4+000 to 6+375	217,263	JOI	
New Work Dredging	6+375 to 30+000	3,259,272	14B	Cadmium
New Work Dredging	30+000 to 45+000	2,181,609	14A	Cadmium
New Work Dredging	51+000 to 57+000	1,251,494	14A	Cadmium
New Work Dredging	80+125 to 90+000	1,555,112	14A	Cadmium
New Work Dredging	45+000 to 51+000	1,088,128	13A	
New Work Dredging + O&M	57+000 to 67+000	2,631,872	13A	
New Work Dredging + O&M	67+000 to 80+125	2,387,645	13A	
New Work Dredging + O&M	90+000 to 93+280	1,259,825	13A	
New Work Dredging + O&M	93+280 to 98+140	1,860,000	14B	Cap for DMCA 14B
New Work Dredging + O&M	98+140 to 103+000	1,860,000	14A	Cap for DMCA 14A
Total		23,115,974		

47-Foot Project				
Description	**Stations**	**CY Material**	**DMCA**	**Notes**
New Work Dredging + O&M	4+000 to 6+375	248,815	JOI	
New Work Dredging + O&M	6+375 to 36+000	4,663,278	14B	Cadmium
New Work Dredging + O&M	36+000 to 45+000	1,825,726	14A	Cadmium
New Work Dredging + O&M	51+000 to 57+000	1,857,054	14A	Cadmium
New Work Dredging + O&M	80+125 to 90+000	1,369,482	14A	Cadmium
New Work Dredging + O&M	45+000 to 51+000	1,698,443	13A	
New Work Dredging + O&M	57+000 to 67+000	2,021,557	13A	
New Work Dredging + O&M	67+000 to 80+125	2,528,753	13A	
New Work Dredging + O&M	90+000 to 103+000	898,084	13A	
New Work Dredging + O&M	90+000 to 103+000	1,860,000	14B	Cap for DMCA 14B
New Work Dredging + O&M	90+000 to 103+000	1,860,000	14A	Cap for DMCA 14A
Total		20,831,192		

46-Foot Project				
Description	**Stations**	**CY Material**	**DMCA**	**Notes**
New Work Dredging + O&M	4+000 to 6+375	205,301	JOI	
New Work Dredging + O&M	6+375 to 30+000	2,972,789	14B	Cadmium
New Work Dredging + O&M	30+000 to 45+000	2,638,870	14A	Cadmium
New Work Dredging + O&M	51+000 to 57+000	1,707,141	14A	Cadmium
New Work Dredging + O&M	80+125 to 90+000	1,182,215	14A	Cadmium
New Work Dredging + O&M	45+000 to 51+000	1,505,149	13A	
New Work Dredging + O&M	57+000 to 67+000	2,214,851	13A	
New Work Dredging + O&M	67+000 to 80+125	1,865,100	13A	
New Work Dredging + O&M	90+000 to 103+000	534,244	13A	
New Work Dredging + O&M	90+000 to 103+000	1,860,000	14B	Cap for DMCA 14B
New Work Dredging + O&M	90+000 to 103+000	1,860,000	14A	Cap for DMCA 14A
Total		18,545,660		

Table 11(cont'd): Project Dredging Sequence using DMCAs 14A and 14B for Cadmium Disposal

45-Foot Project				
Description	**Stations**	**CY Material**	**DMCA**	**Notes**
New Work Dredging + O&M	4+000 to 6+375	162,088	JOI	
New Work Dredging + O&M	6+375 to 30+000	2,482,781	14B	Cadmium
New Work Dredging + O&M	30+000 to 45+000	2,254,075	14A	Cadmium
New Work Dredging + O&M	51+000 to 57+000	1,557,444	14A	Cadmium
New Work Dredging + O&M	80+125 to 90+000	993,414	14A	Cadmium
New Work Dredging + O&M	45+000 to 51+000	1,314,876	14B	Cap for DMCA 14B
New Work Dredging + O&M	57+000 to 67+000	545,124	14B	Cap for DMCA 14B
New Work Dredging + O&M	57+000 to 67+000	1,860,000	14A	Cap for DMCA 14A
New Work Dredging + O&M	67+000 to 80+125	1,563,391	13A	
New Work Dredging + O&M	90+000 to 103+000	3,888,473	13A	
Total		16,621,666		

44-Foot Project				
Description	**Stations**	**CY Material**	**DMCA**	**Notes**
New Work Dredging + O&M	4+000 to 6+375	122,870	JOI	
New Work Dredging + O&M	6+375 to 30+000	2,003,174	14B	Cadmium
New Work Dredging + O&M	30+000 to 45+000	1,873,074	14A	Cadmium
New Work Dredging + O&M	51+000 to 57+000	1,408,733	14A	Cadmium
New Work Dredging + O&M	80+125 to 90+000	803,770	14A	Cadmium
New Work Dredging + O&M	45+000 to 51+000	1,130,888	14B	Cap for DMCA 14B
New Work Dredging + O&M	57+000 to 70+000	729,112	14B	Cap for DMCA 14B
New Work Dredging + O&M	57+000 to 70+000	1,612,556	14A	Cap for DMCA 14A
New Work Dredging + O&M	70+000 to 73+100	247,444	14A	Cap for DMCA 14A
New Work Dredging + O&M	73+100 to 80+125	553,320	13A	
New Work Dredging + O&M	90+000 to 103+000	3,523,107	13A	
Total		14,008,048		

1.4.3 Capacity Replacement

The Savannah Harbor Expansion Project will place 12,650,405 CY of new work material in DMCAs established by the project sponsor for the placement of sediments for the Savannah Harbor Navigation Project. As part of that placement, the Expansion Project would replace the sediment storage capacity that it used to place the new work material.

1.4.3.1 New Work Dike Raising Considerations

The costs for the recently completed dike raisings at DMCAs 14A and 14B are reflected in Table 12. The amount of cadmium-laden new material to be dredged required the use of more than one DMCA, so the decision was made to use both DMCAs 14A and 14B. This also requires that the Corps raise those dikes before it begins dredging for SHEP.

Currently, there is approximately 2,000,000 CY of good quality material in DMCA 14B that can be used for this dike raising. As shown in the Table 13 below, 1,800,000 CY would be used in the actual dike raisings, which would leave 200,000 CY remaining. This material would be used to raise the dikes on DMCA 13B to recapture the capacity lost to new work material. The cost for moving this remaining material from DMCA 14B to DMCA 13B was calculated as follows.

- The average one-way haul distance is 15,000 feet (use 3 miles) (the distance from middle of DMCA 14B to the middle of DMCA 13B),
- The average speed of a tractor/pan is 8 mph, the time for a round trip is 45 minutes (0.75 hr).
- It costs $65/ hour to operate a tractor with 2 pans (each hauling 7 CY each),
- This results in a haul cost of $3.48/ CY ($65*0.75/14),
- This yields a total cost to move the excess material (200,000cy X $3.48) of $696,000 in additional costs above the dike raising costs at DMCAs 14A and 14B (Table 12 – other).

Table 12: Costs for Dike Raisings at DMCAs 14A and 14B

Dike Raised	Contract Back Dike	Contract All Dikes	S&A	Total	Contingencies 25%
14A	$399,845.00	$2,777,283.00	$220,182.00	$3,397,310.00	$4,246,637.50
14B		$2,741,322.00	$221,305.00	$2,962,627.00	$3,703,283.75
*Other				$696,000.00	$870,000.00
Total Cost					$8,819,921.25

* the cost to move the remaining material from 14B to 13B.

Table 13: Dike Raising Scenarios

Description	Quantity (CY)	Begin Construction
Current 14A Dike Raising	500,000	FY 2010(comp 2011)
Next 14A Dike Raising (Begin SHEP)	700,000	FY 2012
14B Dike Raising (for cadmium placement)	600,000	FY 2012
TOTAL	1,800,000	

As stated above, DMCA 14B contained approximately 2,000,000 CY of good quality dike raising material which is being used for the dike raisings at DMCAs 14A (2010/2012) and 14B (2012). This material was used to raise the dikes on DMCA 14A (FY2010 with stimulus funds). The timing of the dike raising on DMCA 14A and the subsequent use of DMCA 14B for the placement of excess cadmium-laden material is important because the Corps intends to begin raising dikes on DMCAs 14A/14B in Dec 2011 with completion in Mar 2012. As an O&M requirement the dikes would be raised on Jones/Oysterbed starting in FY 2011.

1.4.3.2 Replacement of DMCA Sediment Storage Capacity used by SHEP

The Savannah Harbor Expansion Project would place 12,650,405 CY of new work material in existing DMCAs that are presently used for placement of O&M sediments for the Savannah Harbor Navigation Project. As part of the SHEP, the Expansion Project will replace the sediment storage capacity that it uses to deposit new work material.

To more accurately capture the costs for capacity replacement the most recent dike raising costs were used from the dike raising project at DMCA 14B. For that project the dikes were raised 6-feet at a cost of $5,600,000 (included both dikes and weirs). The total amount of dike construction material required was 499,000 cubic yards (CY). Dividing the project cost by the amount of material (CY) to build the project yields a cost of $11.22/CY for dike construction (including embankment, weirs, silt fence, etc.). This construction created 6,805,040 CY of capacity (6-feet x 703 acres x 43,560 ft^2/acre / 27ft^3/CY). This cost equates to $5,600,000 / 6,805,040 CY = $0.83/CY of capacity. This equates to the following cost to replace the capacity lost to new work material for each depth considered for the Savannah Harbor Expansion project (Table 14).

Table 14: Capacity Replacement Costs for Depths Considered

Dredged Material	48-foot Project	47-foot Project	46-foot Project	45-foot Project	44-foot Project
Total	23,115,974	20,831,192	18,545,660	16,621,666	14,008,048
New Work	14,935,186	12,650,405	10,364,873	8,080,879	5,827,261
Cost to Provide 1 CY of Capacity	$0.83	$0.83	$0.83	$0.83	$0.83
Total Cost to Provide Lost Capacity	$12,396,204.38	$10,499,836.15	$8,602,844.59	$6,707,129.57	$4,836,626.63

The majority of the material is associated with cadmium concentrations and cap for the cadmium-laden sediment. A summary of the material is in Table 15 below:

Table 15: Cadmium and Cadmium Cap Placement

Disposal Area	Cadmium Volume (CY)	Cover Volume (CY)	Non-Cadmium New Work (CY)	Total (CY)
JOI	0	0	174,073	174,073
14A	3,960,517	1,860,000	0	5,820,517
14B	2,649,102	673,434	0	3,322,536
12A	0	0	3,333,279	3,333,279
Total	6,609,619	2,533,434	3,507,352	12,650,405

The capacity consumed is initially compensated by multiplying the total yards by $0.83/CY as defined in the DMMP. This yields a cost of $12,396,000.

The secondary impact of SHEP on DMCAs 14A&B is the requirement to raise the dike after deepening is completed to restore the used storage capacity. The cadmium-laden sediments and cover material cannot be used in the crust method for borrow in future

dike raisings. Sediments to construct the dike embankment would need to be hauled from DMCAs 12A, 13A or 13B. The cost of the increased haul distance needs to be included.

For DMCA 14B, assume a 6-foot dike raising uses 499,000 cubic yards of embankment to create 6,805,040 cubic yards of capacity. For DMCA 14A, assume a 6-foot dike raising (front and back dikes only) uses 250,000 cubic yards of embankment and creates 6,088,720 cubic yards of capacity. Therefore, a total of 749,000 cubic yards of material needs to be hauled resulting in 12,893,760 cubic yards of capacity.

Using an average one-way haul distance of 25,000 feet (use 5 miles) (the distance from the middle of DMCA 13A front to the front of dike between DMCAs 14A and 14B for an average), an average speed of a tractor/pan of 8 mph, the time for a round trip is 75 minutes (1.25 hr). If a contractor charges $65/ hour to operate a tractor with 2 pans (each hauling 7 CY each) the additional haul cost is $5.80/CY. This yields 749,000 CY X $5.80 = $4,344,200 additional funds for the 12,893,760 CY capacity created, which results in $0.34 added cost for DMCA 14A&B embankment fill. This results in $0.34 times 11,952,788 cubic yards (cadmium-laden and cover quantities above) equals $4,063,947.92 additional dollars. The total cost for capacity consumed is $12,396,204.38 + $4,063,947.92 = $16,460,000.

For each alternative depth, the added haul cost is the same. The dikes would need to be raised 6 feet for maintenance needs in accordance with the O&M DMMP and dike raising schedule. The SHEP impact would vary for each depth based only on the volume of new work at the $0.83/cy value. Finally, after adding in the haul cost, to get the capacity replacement cost you must subtract out the costs to initially raise DMCAs at the beginning of the project as shown in Table 16 under capacity replacement.

Table 16: Capacity Replacement Costs

	48 Foot	47 Foot	46 Foot	45 Foot	44 Foot
New Work CY	14,935,186	12,650,405	10,364,873	8,080,879	5,827,261
Value @$0.83/CY	$12,396,204	$10,499,836	$8,602,844	$6,707,129	$4,836,626
Add Haul Cost	$4,063,947	$4,063,947	$4,063,947	$4,063,947	$4,063,947
Total	$16,460,152	$14,563,784	$12,666,792	$10,771,077	$8,900,574
14A/14B Dike Raising	$7,949,921	$7,949,921	$7,949,921	$7,949,921	$7,949,921
Capacity Replacement	$8,510,231	$6,613,862	$4,716,871	$2,821,156	$950,653

1.4.4 Risk and Uncertainty

The initial disposal plan developed in 2008 assumed that funding for the dike raising for DMCA 14A in 2009 and the dike raising for the DMCA 12B/13A combination site in 2009 would be available and the construction implemented. This was accomplished with ARRA funds.

1.5 BENEFICIAL USE

Beneficial use opportunities pursued by this new work project are:

- Covering cadmium-laden sediments;
- Material for future dike raisings; and
- Building and maintaining the bird islands now in the disposal areas

New work dredged material from Stations 90+000 to 103+000 are to be placed in DMCAs 14A and 14B as the clean cover for the cadmium-laden sediments.

Those sediments in Stations 67+000 to 80+125 and Stations 90+000 to 103+000 that are scheduled to be placed in DMCA 12A are good quality sediments (suitable for dike-building) and will be used in the future for dike raising and/or maintenance.

1.6 JASPER TERMINAL - IMPACT ON DMCAS

In 2007, the Governors of South Carolina and Georgia agreed to work together to develop a new container terminal on lands that are presently used for the Savannah Harbor Navigation Project. The ports authorities of South Carolina and Georgia are working together (through their Joint Project Office) on the engineering and environmental studies that would be needed to apply for construction permits to build such a facility.

As the non-Federal sponsor for the Savannah Harbor Navigation Project, in 2007 the Georgia DOT asked that the Corps of Engineers release its perpetual dredged material disposal easements on portions of DMCAs 14A and 14B. Since the Corps previously identified those sites as being necessary for the continued maintenance of the Savannah Harbor Navigation Project, if the Corps released its easements, its costs to maintain the Navigation Project would increase as a result of increases in the pumping distances and costs of maintenance dredging. The Corps is working with Georgia DOT and the Joint Project Office to identify how the costs of the Federal Government would not increase (the Government would be made whole) if it released its disposal easements to the sites. If a suitable method is identified and agreed to by the Georgia DOT, the Corps would be willing to release its easements to those properties. The sites would then be available for future use by others, potentially for development of a new container terminal.

The placement of new work sediments on the sites by the Expansion Project would not prohibit the later use of the sites for development of a new container terminal. Instead, such placement would decrease the cost of developing the sites by the placement of a substantial volume of fill, which would raise the elevation of the sites to one more suitable for development as a container terminal.

2.0 OUTER HARBOR SEDIMENT PLACEMENT

2.1 O&M DREDGED MATERIAL DISPOSAL

O&M dredged material removed from the Bar Channel (Stations 0+000 to 60+000B) is placed in the EPA-approved Savannah Ocean Dredged Material Disposal Site (ODMDS). This 4.26 square mile site is centered at 31 56' 54" N and 80 45' 34" W. The site is used for placement of the 1 million cubic yards of material removed by hopper dredges each year from that channel reach. The final designation of the site as an ODMDS was made by EPA on August 3, 1987. A Management Plan for this site is included in the Long Term Management Strategy (1996).

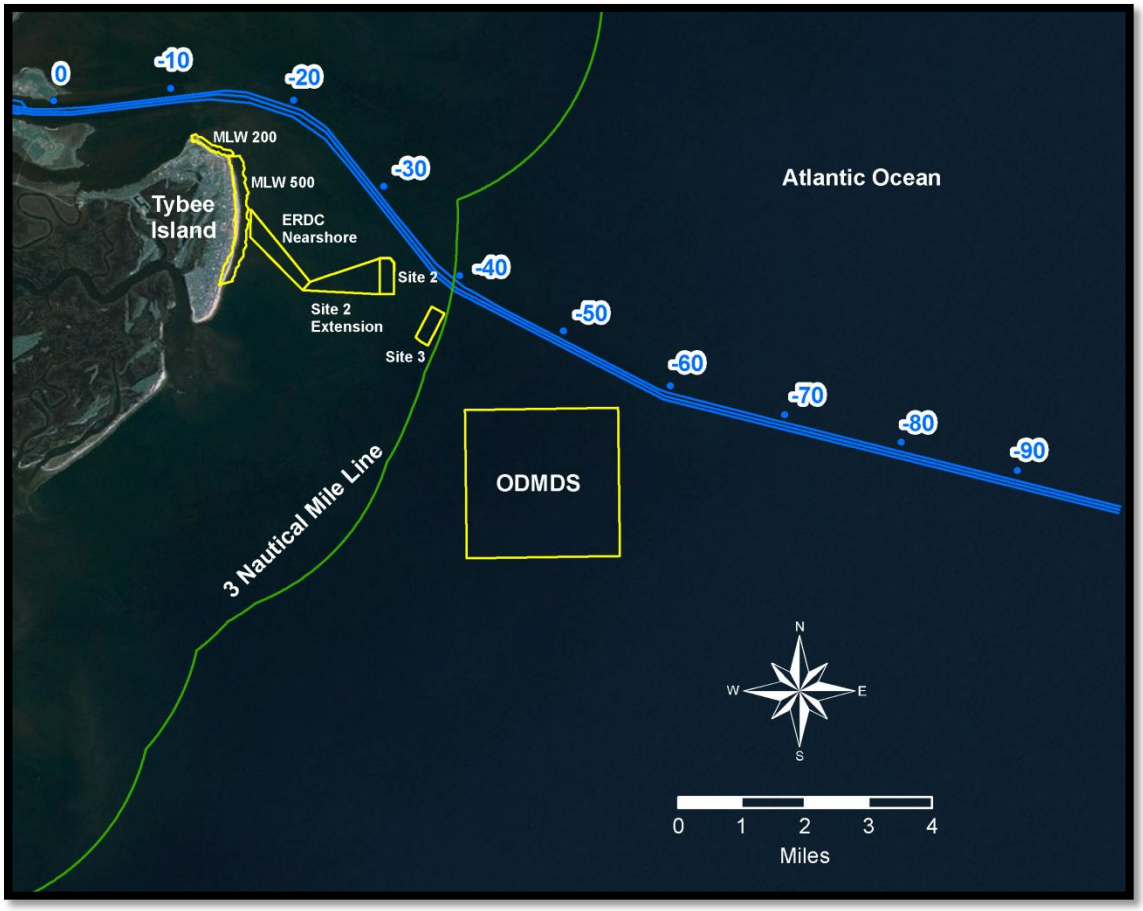

Figure 2: Unconfined Placement Areas for Maintenance Material

In addition to the ODMDS, there were seven sites where maintenance material could be deposited to construct submerged feeder berms which were developed as part of the LTMS pursuant to Section 404 of the Clean Water Act. These sites were located on the south side of the entrance channel at least 2,000 feet away from the channel, in water averaging 15 feet deep. These sites would effectively serve as nearshore disposal areas for use by dredges working in the bar channel. These sites would provide a cost effective

place for the dredges to deposit the dredged material since they are located relatively close to the channel. If constructed, the berms would be constructed with 200,000 to 300,000 CY of material to provide a berm that is elliptical in shape and oriented away from the channel so that tidal currents which converge and diverge away from the channel are not significantly restricted. Sediment placed on these berms would replenish littoral drift.

After the SHEP DEIS was published, the EPA informed the Corps that they consider any dredged material disposal site beyond the 3-mile line to be an ocean dredged material disposal site which requires their authorization pursuant to Section 103 of the Marine Protection, Research and Sanctuaries Act. Consequently, any sites beyond the 3-mile line would require the appropriate Section 103 site designation studies and EPA approval as ocean dredged material disposal sites. Based on this determination from the EPA, only the ODMDS, Sites 2 and 3, and other designated areas (See Figure 2 above) can be used for maintenance material from the entrance channel.

In addition to the disposal sites adjacent to the entrance channel, the LTMS also authorized suitable maintenance material to be placed into the nearshore off Tybee Island. As shown in Figure 2, suitable maintenance material can also be placed into the nearshore off Tybee Island in areas designated as MLW 200, MLW 500, ERDC Nearshore and Site 2 extension. Material placed into these sites would be used to construct feeder berms to benefit the Tybee Island beach. The LTMS also authorized the placement of suitable maintenance material directly onto the beach at Tybee Island.

The Base Plan (most cost effective and environmentally acceptable) for maintenance of the Savannah Harbor entrance channel is to place the material into the Jones-Oysterbed Island CDF, the ODMDS, or Sites 2 and 3. Consequently, any placement of maintenance material into the nearshore sites off Tybee Island or directly onto the beach at Tybee Island would require a non-Federal sponsor willing to pay the additional costs of placing material into these areas.

Maintenance sediments from the bar channel may be placed in these sites. Maintenance sediments from Stations 0+000 to 28+000 may also be placed in these sites when the average fines content does not exceed 15 percent. Maintenance material from the area of the bar channel extension (Station -60+000B to -97+680B) may also be suitable for these sites.

2.2 NEW WORK SEDIMENT PLACEMENT PLAN

The initial plan developed for the placement of new work material from the Bar Channel was for in-water placement in the nearshore zone which would be a beneficial use of the dredged materials. That plan was described in the November 2010 Draft GRR and Draft EIS. However, the Georgia Department of Natural Resources, Coastal Resources Division and the City of Tybee Island expressed concern about the quality of sediments that the Corps proposed to place nearshore. As a result of those concerns, the District revised the sediment placement plan for the entrance channel. The final design now

includes deposition of all new work sediments from the entrance channel into existing disposal areas (either the ODMDS or the Jones/Oysterbed Island CDF). Table 17 depicts the quantity of new work material to be removed by alternative depth evaluated and channel reach.

Table 17: Entrance Channel Placement of Material (cy) for all Project Depths

		Alternative Depths Considered				
Station	**Disposal Site**	**44-foot**	**45-foot**	**46-foot**	**47-foot**	**48-foot**
(-)98+600 to -57+000	ODMDS	1,667,123	2,242,371	2,925,432	3,736,308	4,613,909
(-)57+000 to -53+500	ODMDS	156,623	235,127	313,391	391,437	469,252
(-)53+500 to-40+000	ODMDS	646,796	975,843	1,304,385	1,632,346	1,959,186
(-) 40+000 to -30+000	ODMDS	505,693	771,105	1,038,620	1,305,921	1,573,800
(-)30+000 to -20+000	ODMDS	529,910	801,974	1,076,638	1,352,115	1,628,379
(-)20+000 to -10+000	ODMDS	473,047	746,614	1,028,399	1,311,222	1,594,871
(-) 10+000 to 0+000	ODMDS	346,997	532,621	723,394	917,064	1,110,713
0+000 to +4+000	ODMDS/JOI	101,482	166,705	235,626	305,674	375,403

2.2.1 Ocean Dredged Material Disposal Site (ODMDS) Capacity Analysis

Two approaches were taken to determine future capacity of the ODMDS after placement of materials from the Savannah Harbor Expansion offshore dredging.

- The first analysis assumed that dredged material would primarily consist of sands (with no bulking factor) and that all deposited material would remain in the ODMDS area after placement.

- The alternative approach was to examine the last period of time when the ODMDS was used consistently and compare the dredged volumes removed from the channel that were placed in the ODMDS with the change in capacity of the ODMDS based on placement surveys over the same time period.

Differences in capacity were determined by using software in Bentley InRoads to determine surface areas and to make volume computations. Actual dredging volumes were obtained from dredging reports maintained in the Savannah District office.

The ODMDS boundary is shown in pink on **Figure 3.** To comply with 40 CFR §227.28 disposal shall occur no less than 330 feet (100 meters) inside the site boundaries. The ODMDS footprint (shown in yellow) for placement of material is 3,242 acres.

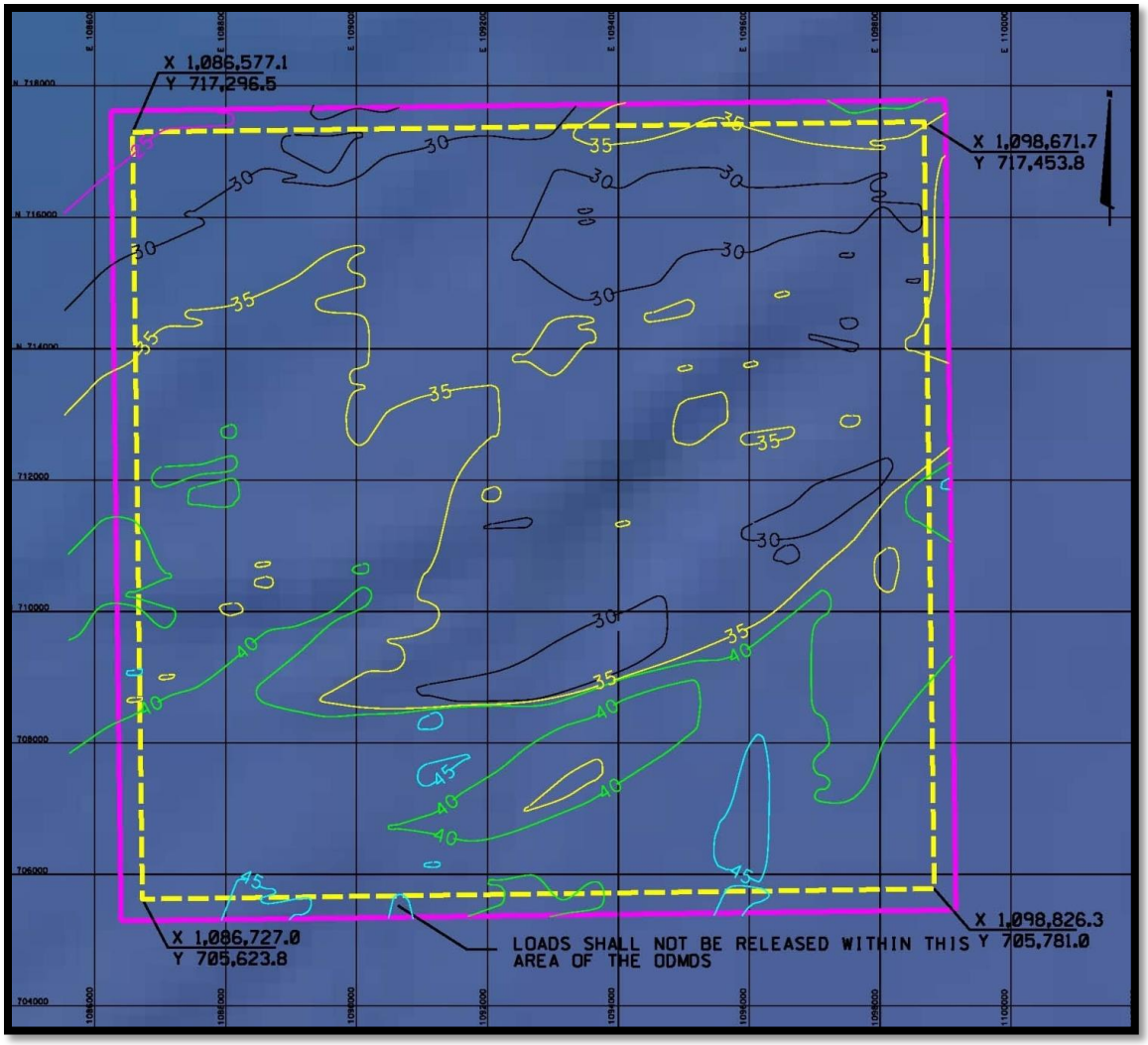

Figure 3: ODMDS Boundary and Bathymetry

Table 18 shows the quantity of material dredged from the entrance channel from 2002 to 2007 as well as the change in capacity of the ODMDS based on placement surveys made over the same time period. Results show that roughly 93% of the material dredged from the channel remains in the ODMDS after placement, possibly because of the presence of fines in the dredged material that do not settle out or may leave the area before settling or losses during the dredging process.

Table 18: Material Dredged versus ODMDS Change in Capacity

Year	Quantity Dredged (cy)	ODMDS Capacity* (cy)	
2002	186,537	57,836,270	
2003	635,163		
2004	620,642		
2005	888,101		
2007	973,463	54,766,930	
Total Dredged	3,303,906		
Change in Capacity		3,069,340	
		percentage placed	93%

*ODMDS capacity is determined from the surface to -25 ft MLLW

Tables 19 and **20** shows results of the remaining capacity of the ODMDS for existing conditions and assuming the material placed from the Savannah Harbor Expansion is either 1) the volume placed is equivalent to the volume dredged or 2) volume placed is equivalent to 93% of the material dredged, based on the results from **Table 18**. Results of both methods are based on the upper limit for material placement in the ODMDS as 25 ft below MLLW. Table 20 shows results for both the 47 ft and 48 ft project. The capacity/life is reduced for a deeper project because of the greater volume of material required to be removed/placed and increased maintenance as the deeper project requires a longer channel to reach naturally-deep water in the ocean. The average annual Operations and Maintenance (O&M) dredge material volumes were developed previously based on historical dredging records. The volume of available undredged material that remains after dredging (primarily due to funding constraints) is also considered.

Table 19: ODMDS Capacity (Existing Conditions)

ODMDS capacity (2012)	57,087,926 cy
Average Annual O&M Dredge Volume	1,057,721 cy
Years Remaining until Capacity is Exceeded (without deepening)	55

Table 20: ODMDS Capacity (with project)

	49 ft depth (47 ft project)	49 ft depth (47 ft project)
Percentage of Dredged Material on ODMDS Floor	100% placed	93% placed
2014 Capacity (after 2 yrs of existing O&M)	54,972,484	54,972,484
New Work Quantity	10,646,413	10,646,413
2017 Capacity (after new work material)	44,326,071	45,071,320
Average Annual O&M Dredging Volume (after expansion)	1,066,778	1,066,778
O&M Dredging Volume (3 yrs during expansion)	3,200,333	3,200,333
2017 Capacity (after expansion new work and O&M)	41,125,738	42,095,010
Years Remaining until Capacity is Exceeded	39	42

Given the constraints for the Savannah ODMDS of a surface area of 3,242 acres and upper height limit of 25 feet below MLLW, with materials added from the offshore channel for the 47 foot project depth, the remaining capacity for the ODMDS would last between 39 and 42 years depending on the volume of material placed for the 47 foot project. Without material from the Savannah Harbor Expansion Project, the ODMDS capacity to hold annually dredged O&M material would last 55 years.

3.0 UPDATE OF THE DMMP

This DMMP Update was prepared to identify the expected effects of the proposed harbor deepening on the existing DMMP for the Savannah Harbor Navigation Project. If the SHEP is constructed, some events will not occur as expected, even though they have been predicted using the best practices available. Savannah District will conduct a detailed and lengthy post-construction monitoring program to identify how the estuary responds to the harbor deepening.

As part of the post-construction monitoring, the Corps will assess the maintenance patterns and identify if any changes in the shoaling patterns occurred as expected. If those patterns are sufficiently different from what is expected, the District may seek approval for changes to the advance maintenance program to allow it to maintain the harbor more efficiently.

As another part of the post-construction monitoring, the District will assess the volume of sediment storage capacity remaining in the Savannah ODMDS. If the storage capacity is substantially less than the predicted 42 years after deepening, the District would likely begin work to modify the ODMDS to restore a 50-year capacity. Modification of an ODMDS or designation of a new site is a complicated process which can take several years. The District would begin the required physical and biological studies no later than when data indicates the ODMDS will not provide the harbor's sediment disposal needs for the next 20 years.

Savannah District expects to develop a full DMMP that addresses all dredging and sediment placement issues in the harbor (to replace the DMMP developed as part of the 1996 LTMS) after data become available from a reasonable portion of the 10-year post-construction monitoring period.