POPLAR ISLAND HABITAT RESTORATION PROJECT

POPLAR ISLAND MODIFICATION RECONNAISSANCE STUDY

FINAL REPORT

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EXECUTIVE SUMMARY

The purpose of this reconnaissance report is to summarize the dredging and site engineering aspects of studies related to the modification of the existing Poplar Island Habitat Restoration Project. This study presents six dike alignments that will provide additional tidal wetland and upland habitats at Poplar Island. The habitat restoration project would be constructed through the continued beneficial use of dredged materials removed from the Bay approach channels to the Port of Baltimore. The first five alignments are analogous to the five alignments presented as part of the Poplar Island Modification Conceptual Study, which was prepared for the Maryland Environmental Services (MES) in 2001. The focus of the sixth alignment is to place emphasis on gaining additional capacity compared to Phase I and II, and on protecting Poplar Harbor. Gahagan & Bryant Associates, Inc. (GBA) was retained by MES to conduct a reconnaissance study of the dredging and site engineering aspects of this project.

General site characteristics for the existing Poplar Island Habitat Restoration Project include: 1,134 acres (565 wetland, 569 upland), 39,868 linear feet of perimeter dike, and a site capacity of 33 million cubic yards. The total Phase I and Phase II construction costs were approximately $115 million. These costs include change orders, dike raising to 20 feet Mean Lower Low Water (MLLW) and other costs associated with the project.

This report presents the 6 modification alignments to the existing project, including: dike design, site construction and operation assumptions, and the associated costs needed to assist decision makers in selecting the site layout to be carried to final design. The six alignments and dike cross-sections were developed based on the consideration of coastal, environmental, geotechnical, dredging and site engineering aspects and data. The general location of the Poplar Island site is shown on Figure ES-1.

For each of the six alignments, dike elevations of 10 ft MLLW and 20 ft MLLW were analyzed. A summary of site design characteristics is presented in Table ES-1. A description of site design characteristics for each alignment are presented below:

- ***Site Surface Areas:*** Site surface areas were selected to minimize environmental impact and to not lie in deep waters (depths greater than –12 ft MLLW). The total additional area of each alignment ranges between 313 and 1,129 acres.

- ***Total Baseline Perimeter:*** Total baseline perimeters range between 12,564 linear feet and 39,766 linear feet for the six alignments. The total baseline perimeter is the same for both the 10 ft MLLW dike elevation and 20 ft MLLW dike elevation alternatives. This is due to the fact that the baseline is measured from the roadway on the dike crest and does not change for each alternative.

- ***Neat Dike Fill Volumes:*** The neat dike fill volumes for the 10 ft MLLW and 20 ft MLLW dike elevation alternatives range between 739,000 cy and 5,631,000 cy for the six alignments.

- ***Rock Protection & Quantities:*** Rock protection for the dikes was designed to provide sufficient protection against the adverse effects of high water and waves resulting from a 35-year return period storm (M&N, 2002). Total rock quantities for the six alignments range between 234,000 tons and 1,168,000 tons. These quantities include toe dike, slope stone, and road stone.

- ***Potential Borrow Sources & Volumes:*** There are four potential sand borrow sites within the vicinity of the Poplar Island. Two of the sites are located northeast and northwest of the northern tip of the existing project site and two are located southeast and southwest of the southern end of the project site. The northeast location has a total volume of 7.2 mcy, the northwest location has a total volume of 4.6 mcy, the southeast location has a total volume of 9.1 mcy, and the southwest location has a total available volume of 4.2 mcy. These are total volumes. Estimated available sand volumes may be less, as presented in Figures B-8 through B-13 in Appendix B.

- ***Site Capacity & Operational Life:*** For the 10 ft MLLW dike elevation alternative, site capacity for the six alignments ranges between 7 and 34 mcy. For the 20 ft MLLW dike elevation alternative, site capacity for the six alignments ranges between and 11 and 48 mcy. The site operational life is estimated to range between 3 and 14 years for the six alignments with respect to the 10 ft MLLW dike elevation. The site operational life is estimated to range between 5 and 19 years for the six alignments with respect to the 20 ft MLLW dike elevation.

For the purpose of this report it is assumed that the hydraulic stockpile and truck haul method of dike fill construction (the method previously used) will be used again. It is assumed that a small hydraulic dredge will complete excavation and backfill of the unsuitable foundation material. It is assumed that rock will be transported by barge to the site and then be handled by a crane at or near the dike section. A summary of the estimated completion time for dike construction is presented in Table ES-2. These completion times are based on the following assumptions:.

- The total completion time was based on the time required for the longest construction element (rock placement for the 10 ft dike elevation and hydraulic fill for the 20 ft dike elevation) plus an additional six months to allow for mobilization, demobilization and overlap of the construction elements,
- 30 working days per month at 12 hour days,
- 15,000 cubic yards of dike material are dredged and stockpiled per day,
- 5,000 cubic yards of dike material are placed per day,
- Rock placement includes toe dike, slope stone and road stone, and
- 50 linear feet of stone will be placed per day.

As part of development of the site, 50% of the "modification" area is planned as wetland, including intertidal wetland, high marsh, low marsh, bird islands, mud flats and circulation channels. The remaining 50% would be upland habitat.

This report assumes that once the maintenance dredged material placed at the site approaches the elevation of the bay water level, crust management is implemented in order to maximize the operational life of the site. Also, dried crust resulting from such operations could be a source for building berms and for future dike raising.

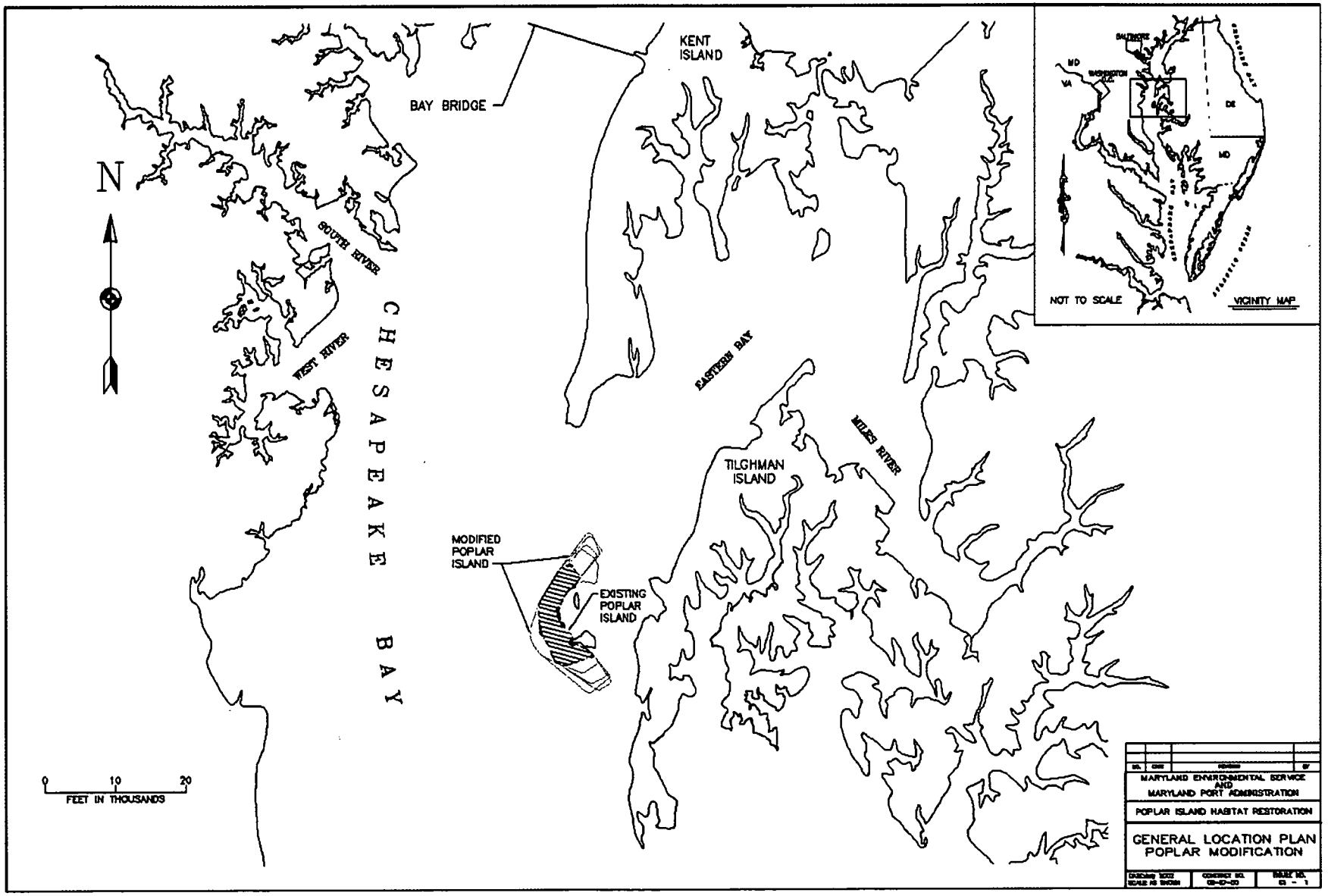

Figure ES-1 Poplar Island Location Map

Table ES-1 Site Design Characteristics and Quantities

Alignment	Total Surface Area (Acres)	Dike Perimeter Length (Lin. Ft.)	Neat Dike Fill Volume (CY)		Dike Rock Placement (Tons)	Site Capacity (Mcy)		Total Site Life (Years)	
			Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW		Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW
1	753	24,487	2,202,000	3,409,000	777,000	22	32	9	13
2	754	33,406	2,274,000	3,480,000	914,000	21	30	8	12
3	754	32,580	2,593,000	4,039,000	870,000	20	29	8	12
4	1,129	39,766	3,639,000	5,631,000	1,168,000	34	48	14	19
5	749	28,560	2,069,000	2,855,000	758,000	21	30	8	12
6	313	12,564	739,000	1,303,000	234,000	7	11	3	5

Table ES-2 Estimated Construction Completion Times

Alignment	Stockpile Completion Time (Days)		Dike Fill Completion Time (Days)		Dike Rock Placement (Tons)	Rock Placement Time (Days)	Total Completion Time (Years)	
	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW			Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW
1	147	227	440	682	777,000	490	1.9	2.4
2	152	232	455	696	914,000	668	2.4	2.4
3	173	269	519	808	870,000	652	2.3	2.7
4	243	375	728	1,126	1,168,000	795	2.7	3.6
5	138	190	414	571	758,000	571	2.1	2.1
6	49	87	148	261	234,000	251	1.2	1.2

The total project costs, in constant 2002 dollars, for the operational life of the facility were generated as the sum of the initial construction costs, habitat development costs, site development costs, and the dredging/transport and placement costs. Table ES-3 presents the costs related to the 10 ft MLLW dike elevation alternative, and the costs related to the 20 ft MLLW dike elevation alternative. The total project costs are the summation of all the above referenced costs. These costs, along with the cost per cubic yard of capacity for the site, are presented to compare the six island modification alignments.

Table ES-3 Summary of Site Costs

Alignment	Total Site Capacity (Mcy)	Total Site Life (Yrs.)	Project Costs ($ Millions)			Cost per CY Capacity ($/CY)
			Apportioned to		Total Project Costs	
			James Island	Channel Projects		
10 Ft. MLLW Dike Elevation:						
1	22	9	222	97	320	14
2	21	9	228	91	320	15
3	20	8	221	86	307	16
4	34	14	351	149	500	15
5	21	9	218	92	309	15
6	7	3	81	32	113	15
20 Ft. MLLW Dike Elevation:						
1	32	13	289	138	427	14
2	30	13	297	132	429	14
3	29	12	292	127	418	14
4	48	20	459	210	669	14
5	30	13	281	132	413	14
6	11	5	109	49	158	14

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1.0 INTRODUCTION

1.1 PROJECT OBJECTIVE

The objective of this project was to conduct a reconnaissance study for the modification of the existing Poplar Island placement site. This study presents various alignments for modifying the site in order to further expand beneficial use of dredged material. Six alignments are presented within this study. Preliminary costs associated with each alignment are also presented.

1.2 PROJECT HISTORY AND DESCRIPTION

The U.S. Army Corps of Engineers, Baltimore District (CENAB) maintains more than 125 miles of federal navigation channels providing access to the Port of Baltimore. Placement of the material removed during maintenance dredging of these channels requires substantial effort and commitment of resources. Beneficial use of dredged material is an important option, providing opportunities for environmental enhancement while also providing for the necessary ongoing activity of port maintenance.

Poplar Island, formerly a 1,000-acre single island in 1847, had nearly disappeared by the mid 1990's, due to increasing natural erosion. Only four small remnants and Coaches Island existed in 1995 (see photo), with a combined landmass of 79 acres. The concept to reconstruct Poplar Island using clean dredged material was developed through the cooperative efforts of several state and federal agencies and private organizations. Former Maryland Governor William Donald Schaefer's Task Force on Dredged Material Management recommended the Poplar Island Environmental Restoration Project on February 1991 as a potential placement site for dredged materials. Subsequent to the Task Force report, the Maryland Port Administration (MPA) with technical support from the Maryland Environmental Service (MES), developed the Dredging Needs and Placement Options Program, a multi-organization program charged with developing a comprehensive dredged material management plan (SOM, 1991). The Poplar Island project was developed as a component of the comprehensive plan. The detailed planning and design of the Poplar Island Restoration began in mid-1994 and completed in 1996 (GBA-M&N, 1996a).

Construction of the site was done in two phases. The Phase I construction contract was awarded February 17, 1998 to the Kiewit Construction Company at a bid price of $45.4 million. Phase I was completed in March 2000. The Phase II contract was awarded on April 7, 2000 to Tidewater Skanska Inc. (TSI) at a 'best value' bid price of $37.8 million. Phase II was completed in the spring of 2002.

General site characteristics are given in Table 1-1. The total Phase I and Phase II construction costs were approximately $115 million. These costs include change orders, dike raising to 20 feet MLLW and other costs associated with the project.

Table 1-1 Site Characteristics

Feature	Phase I	Phase II	Total site
Length of perimeter dike	21,589 ft	18,279 ft	39,868 ft
Initial upland dike elevation, average	10 ft	10 ft	10 ft
Raised upland dike elevation, average	20 ft	20 ft	20 ft
Tidal wetland cells number and area	Two – 312 acres	Two – 253 acres	Four – 565acres
Tidal wetland cells, average elevation	1.4 ft	1.4 ft	1.4 ft
Tidal wetland cells dredged material capacity	4 mcy	3 mcy	7 mcy
Upland cells number and area	One - 326 acres	One – 243 acres	Two – 569 acres
Upland cells dredged material capacity	14 mcy	12 mcy	26 mcy
Total site capacity for dredged material	18 mcy	15 mcy	33 mcy

Source GBA 2002.

1.3 PREVIOUS RELATED STUDIES

A conceptual study for the modification of the existing Poplar Island Restoration Project was prepared for the Maryland Environmental Service in 2001 at the request of MPA. The study consisted of five cell alignment options. Each option included an upland and wetland segment. The purpose of the concept study was to obtain an initial understanding for the continual placement of dredged material and habitat restoration at Poplar Island.

The following reports were referenced in the development of the concept study and for this study:

- "Poplar Island Habitat Restoration Construction Talbot County Maryland." Phase II construction plans and specifications. This document was prepared by USACE, Baltimore District, 2000.

- "Poplar Island Habitat Restoration Dikes and Access Channel Construction Talbot County Maryland." Phase I Construction Plan and Specifications. This document was prepared by USACE, Baltimore District, 1997.

- "Poplar Island Restoration Project Cost Estimate for Dikes and Access Channel Construction." This document was prepared by Gahagan & Bryant Associates, Inc. and Moffatt & Nichol, Engineers in a joint venture, 1996.

- "Poplar Island Restoration Project Site Placement Options." This document was prepared by Gahagan & Bryant Associates, Inc. and Moffatt & Nichol, Engineers in a joint venture, 1995.

- "Poplar Island Restoration Project Alternative Site Layouts." This document was prepared by Gahagan & Bryant Associates, Inc. and Moffatt & Nichol, Engineers in a joint venture, 1995.

- "Poplar Island Habitat Development Report." A technical report prepared by Environmental Concern, Inc. for the Maryland Port Administration, 1995.

- "Pre-Feasibility Report for the Poplar Island Restoration Project." Prepared by Maryland Environmental Service for the Maryland Port Administration, 1994.

- "Poplar Island Restoration Site Development Guidelines." This document was prepared by Gahagan & Bryant Associates, Inc. and Moffatt & Nichol, Engineers in a joint venture, 1994.

1.4 PROJECT SCOPE & ORGANIZATION

The scope of this project is to conduct a reconnaissance study for the modification of the Poplar Island Habitat Restoration Project. Six alignments are presented within this study. The first five alignments are analogous to the five alignments presented as part of the Poplar Island Modification Conceptual Study, 2001. The focus of the sixth alignment is to place emphasis on protecting Poplar Harbor. MES retained four consultants to study the following aspects:

• EA Engineering, Science & Tech., Inc. (EA)	Environmental Investigations
• Engineering Consultation Construction Remediation (E2Cr)	Geotechnical Investigations
• Gahagan & Bryant Associates, Inc. (GBA)	Dredging & Site Engineering Investigation
• Moffatt & Nichol Engineers (M&N)	Coastal Engineering Investigation

MES also coordinated inter-organization and technical and advisory support for the reconnaissance study at the request of MPA. The results of the studies will be incorporated as follows: (i) individual technical report by each of the consultants, (ii) a legislative report providing an executive summary of the four reports to be provided to the Maryland State Legislature, and (iii) a consolidated report summarizing the key aspects of the four study reports. This report outlines the results of the dredging & site engineering investigation conducted by GBA.

2.0 BASE MAPPING

2.1 GENERAL

Poplar Island is located in the Chesapeake Bay about 32 miles southeast of Baltimore Washington International Airport and 35 miles east of Washington D.C. (Figure 1, Appendix A). Site maps for Phase I and Phase II of the project are presented in Figures 2 and 3 in Appendix A.

2.2 GEOTECHNICAL RECONNAISSANCE MAP

Geotechnical Reconnaissance Maps have been generated for the six alignments. Figures B-1 through B-6 in Appendix B show the geotechnical reconnaissance with respect to each alignment. The bathymetric data used to generate the maps was obtained from NOAA charts 12266 and 12270. Boring locations, vane shear locations, and electronic cone penetrometer test locations are presented on the maps. The location and data results were provided by E2CR, 2002.

The locations of the Natural Oyster Bars (NOB) are also presented on the geotechnical reconnaissance maps. Each alignment is sited to avoid impacts to the NOB areas. The data used to identify the NOB areas was digitized from base maps prepared by the Coast and Geodetic Survey for the Department of Natural Resources, State of Maryland, 1961.

2.3 SAND BORROW AREA MAPS

The general location of the potential sand borrow areas are presented in Figure B-7 of Appendix B. There are four potential sand borrow sites within the vicinity of the Poplar Island project. Two of the sites are located northeast and northwest of northern tip of the existing project site and two are located southeast and southwest of the southern end of the project site. Figures B-8 through B-13 present the location and quantities of available sand within each alignment. The data used to generate the Sand Borrow Area maps was referenced from the Geotechnical Pre-Feasibility Study for Poplar Island Modifications (E2CR 2002).

3.0 SITE LAYOUT

3.1 SITE LAYOUT ALIGNMENT 1

The Alignment 1 site layout, depicted in Figure 3-1, consists of the following: the addition of an upland cell adjacent to and extending to the west of Cells 2 and 6, the addition of an upland cell adjacent to the southwest corner of Cell 6, and the addition of a wetland cell adjacent to the southeastern section of Cell 5. Details of the Alignment 1 layout can be obtained from Figure C-1 in Appendix C. The total site is approximately 753 acres.

3.2 SITE LAYOUT ALIGNMENT 2

The Alignment 2 site layout, depicted in Figure 3-1, consists of the following: the addition of a wetland cell adjacent to Cell 1 and 2 and extending in a northeast direction, the addition of an upland cell adjacent to and extending to the west of Cells 2 and 6, and the addition of an upland cell adjacent to and extending to the southeast of Cells 5 and 6. Details of the Alignment 2 layout can be obtained from Figure C-2 in Appendix C. The total site is approximately 754 acres.

3.3 SITE LAYOUT ALIGNMENT 3

The Alignment 3 site layout, a variation to Alignment 2, depicted in Figure 3-1, consists of the following: the addition of a combination upland/wetland cell adjacent to the northern section of Cells 1 and 2 and extending in a northeast direction, the addition of an upland cell adjacent to and extending to the west of Cells 2 and 6, the addition of an upland cell adjacent to the southwest corner of Cell 6, and the addition of a wetland cell adjacent to the southeastern section of Cell 5. Details of the Alignment 3 layout can be obtained from Figure C-3 in Appendix C. The total site is approximately 754 acres.

3.4 SITE LAYOUT ALIGNMENT 4

The Alignment 4 site layout, depicted in Figure 3-1, which is the largest layout and a variation to Alignment 2, consists of the following: the addition of an upland cell adjacent to and extending in a northeast direction from the northern section of Cell 2, the addition of a wetland cell adjacent to and extending to the northeast from the northern section of Cell 1, the addition of an upland cell adjacent to and extending to the west of Cells 2 and 6, the addition of an upland cell adjacent to the southwest corner of Cell 6, and the addition of a wetland cell adjacent to the southeastern section of Cell 5. Details of the Alignment 4 layout can be obtained from Figure C-4 in Appendix C. The total site is approximately 1,129 acres.

3.5 SITE LAYOUT ALIGNMENT 5

The Alignment 5 site layout, depicted in Figure 3-1, consists of the following: the addition of an upland cell adjacent to and extending in a northeast direction from the northern section of Cell 2, the addition of a wetland cell adjacent to and extending to the northeast from the northern section of Cell 1, the addition of an upland cell adjacent to the southwest corner of Cell 6, and the addition of a wetland cell adjacent to the southeastern section of Cell 5. Details of the Alignment 5 layout can be obtained from Figure C-5 in Appendix C. The total site is approximately 749 acres.

3.6 SITE LAYOUT ALIGNMENT 6

The Alignment 6 site layout, depicted in Figure 3-1, the smallest layout, consists of the addition of an upland cell adjacent to and extending in a northeast direction from the northern section of Cell 2 and the addition of a wetland cell adjacent to and extending in an east northeast direction from the northern section of Cell 1. An objective of Alignment 6 is to provide protection to Poplar Harbor. Details of the Alignment 6 layout can be obtained from Figure C-6 in Appendix C. The total site is approximately 313 acres.

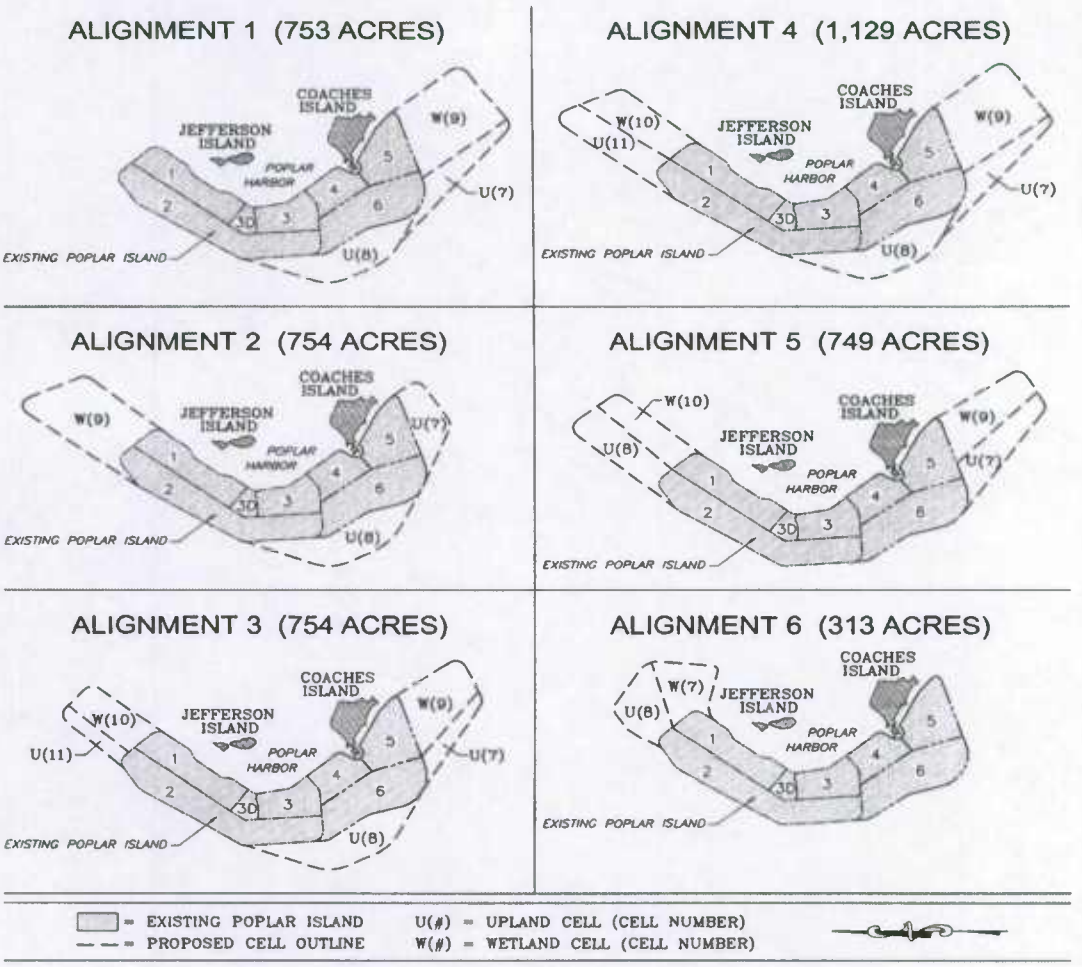

Figure 3-1 Alignment Layouts

4.0 SITE DESIGNS

4.1 GENERAL

Site design for the various alignments involved consideration of the following factors:

- ***Site Surface Areas:*** Site surface areas were selected to minimize environmental impact and to not lie in deep waters (i.e. waters greater than 12 ft MLLW). The total additional area of each alignment ranges between 313 and 1,129 acres. Details of the surface areas are presented in Tables D-1 through D-6 in Appendix D.

- ***Dike Sections and Fill Volumes:*** Dike elevations of +10 ft MLLW and +20 ft MLLW were analyzed for this study. Typical dike sections are presented in Drawings C-7 through C-12 (Appendix C). The neat dike fill volumes for the +10 ft MLLW and +20 ft MLLW dike elevation alternatives are presented in Table 4-1. Details of the neat dike fill volumes are presented in Tables D-1 through D-6 in Appendix D.

- ***Rock Protection & Quantities:*** Rock protection for the dikes was designed to provide sufficient protection against the adverse effects of high water and waves resulting from a 35-year return period storm (M&N 2002). In order to provide a high degree of protection, the armor layer was designed to a height greater than the maximum level of wave runup during storm surges. In general, the rock sections consist of a toe protection structure, geotextile filter fabric, underlayer stones, and armor stones (see Drawings C-7 through C-12 in Appendix C). Where a berm was included in the dike section due to geotechnical requirements, the berm was to be used to limit wave runup and to reduce the armor size. Details of the coastal protection design can be obtained from the coastal engineering investigation reconnaissance study for the Poplar Island modifications (M&N 2002). The required volumes of rock armor, underlayer stones, geotextile fabric, and quarry run are presented in Table 4-1. Details of the armoring quantities are presented in Tables D-1 through D-6 in Appendix D.

- ***Potential Borrow Sources & Volumes:*** There are four potential sand borrow sites within the vicinity of the Poplar Island project. Figure B-7 in Appendix B shows the general location of the four borrow areas. Two of the sites are located northeast and northwest of the northern tip of the existing project site and two are located southeast and southwest of the southern end of the project site. The northeast location has a total volume of 7.2 mcy, the northwest location has a total volume of 4.6 mcy, the southeast location has a total volume of 9.1 mcy, and the southwest location has a total available volume of 4.2 mcy. These are total volumes referenced from the Geotechnical Pre-Feasibility Study for Poplar Island Modifications (E2CR 2002). Portions of these borrow sites are not accessible, as they are under the footprint of dikes. Estimated available sand volumes may be less, as presented in Figures B-8 through B-13 in Appendix B.

- ***Site Capacity & Operational Life:*** The calculation of site capacity and operational life involves three primary considerations: (i) volume occupied by dredged material (accounts for

material bulking during dredging, and consolidation and desiccation of dredged material following placement at the site), (ii) placement rates and lift thickness, and (iii) site area and site capacity-dike elevation relationship. For the analysis in this report, a volume occupied (VO) ratio of 0.65 was assumed above water (material placed above 0 ft MLLW) and a value of 0.75 was assumed below water (material placed below 0 ft MLLW). The calculation of the site life was determined by dividing the site capacity by the annual channel cut volume (2.5 mcy). To account for ponding and freeboard in the site capacity computations, an allowance of 2.0 ft was provided for the upland cells and an allowance of 3 ft was provided for the wetland cells. Total site capacity and operational life values for the 10 ft MLLW and 20 ft MLLW alternatives are presented in Table 4-2 at end of this section.

Table 4-1 Estimated Material Pay Quantities

Alignment	Perimeter Length (LF)	Neat Dike Fill (CY)		Quarry Run (Tons)	Under Layer (Tons)	Armor Stone (Tons)	Toe Armor (Tons)	Roadway Stone (Tons)	Geotextile Fabric (Tons)
		Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW						
1	24,487	2,202,000	3,409,000	152,000	148,000	333,000	144,000	35,000	437,000
2	33,406	2,274,000	3,480,000	181,000	172,000	395,000	166,000	36,000	571,000
3	32,580	2,593,000	4,039,000	146,000	172,000	396,000	156,000	44,000	578,000
4	39,766	3,639,000	5,631,000	249,000	209,000	494,000	216,000	57,000	712,000
5	28,560	2,069,000	2,855,000	172,000	131,000	314,000	141,000	42,000	515,000
6	12,564	739,000	1,303,000	32,000	43,000	112,000	47,000	18,000	224,000

Note Neat dike fills includes backfill of excavated unsuitable material.

4.2 SITE DESIGN ALIGNMENTS

Six design alignments have been analyzed for the modification of Poplar Island. Dike elevations of +10 ft MLLW and +20 ft MLLW have been analyzed for this study. Site areas varied from 313 to 1,129 acres. Table 4-2 presents a summary of the planning estimates, site capacity, operational life, and neat dike fill for the six site design alignments.

Total site capacity calculations include a volume occupied ratio of 0.65 above water and 0.75 below water. A freeboard height of 2 ft was included for the upland cells and a freeboard height of 3 ft was included for the wetland cells.

Table 4-2 Site Design Alignments - Planning Estimates

Alignment	Upland Baseline Area (Acres)	Wetland Baseline Area (Acres)	Total Baseline Area (Acres)	Average Water Depth (Ft. MLLW)	Total Site Capacity (mcy)	Total Site Life (Yrs)	Neat Dike Fill (mcy)
10 Ft. MLLW Dike Elevation:							
1	376	377	753	5	22	9	2.2
2	377	377	754	5	21	8	2.3
3	377	377	754	8	20	8	2.6
4	564	565	1,129	11	34	14	3.6
5	374	375	748	8	21	8	2.1
6	157	157	313	6	7	3	0.7
20 Ft. MLLW Dike Elevation:							
1	377	377	753	5	32	13	3.4
2	377	377	754	5	30	12	3.5
3	377	377	754	8	29	12	4.0
4	564	565	1,129	11	48	19	5.6
5	374	375	749	8	30	12	2.9
6	157	157	313	6	11	5	1.3

5.0 SITE CONSTRUCTION & OPERATION

5.1 GENERAL

The significant element of construction is the containment dike system, which includes the perimeter and interior dikes. The perimeter dike consists of the dike core (mostly sand), a stone toe dike, slope stone and a stone roadway. The interior dikes consist of the dike core and a stone roadway.

The major construction elements are listed below in their order of work:

1. Borrow areas excavation
2. Placement of temporary sand stockpile
3. Excavation/Backfill of unsuitable foundation materials
4. Exterior toe dike (quarry run and armor stone)
5. Geotextile fabric placement
6. Dike (sand and silty sand, hauled from stockpile)
7. Dike armor stone (2 layers armor and under-layer)
8. Stone roadway
9. Ancillary items (spillways, a service pier, and habitat vegetation)

5.2 GENERAL SITE CONSTRUCTION

The six alignments are generally located, in varying combinations, along the south, southeast and northeast areas of the Poplar Island Site. Fill material is assumed to be excavated from different borrow areas, as shown on Figures B-8 through B-13 in Appendix B.

5.3 CONSTRUCTION TECHNIQUES

Dredged material containment sites may be constructed using several techniques. Construction possibilities for the fill material include, direct placement using pipelines from hydraulic dredges, pump-out from hydraulic unloaders, and hydraulic stockpile trucked to the dike section. For the purpose of this report it is assumed that the hydraulic stockpile and truck haul method of dike fill construction (the method previously used) will be used again. It is assumed that a small hydraulic dredge will complete excavation and backfill of the unsuitable foundation material. It is assumed that rock will be transported by barge to the site and then be handled by a crane at or near the dike section.

5.4 MATERIAL PLACEMENT OPERATIONS

For dredged material placement operations, it is assumed that future maintenance materials are dredged/transported by clamshell/barge and placed within the island site by hydraulic unloader. Annual dredging volumes from Baltimore Harbor Outer Channels and the C&D Approach

Channel, requiring placement at this site is assumed to be on average 3.5 mcy (GBA 2002). The dredging volumes include material from the following channels: (i) C&D Canal Approach, (ii) Tolchester Channel, (iii) Swan Point Channel, (iv) Brewerton Channel Extension, (v) Craighill Upper Range Channel (including Craighill Angle, Craighill Upper Range, and Cutoff Angle Channels). Weighted average one-way transport distances were computed from these channels to the site based on estimated dredging quantities and the shortest distance from the centroid of the dredging locations to the site, giving due consideration of the draft requirements for the barges.

5.5 SITE OPERATIONS

As part of development of the site, 50% of the modification area is planned as wetland, including intertidal wetland, high marsh, low marsh, bird islands, mud flats and circulation channels. The remaining 50% would be upland habitat.

This report assumes that, once the maintenance dredged material placed at the site approaches the elevation of the bay water level, crust management is implemented in order to maximize the operational life of the site. Also, dried crust resulting from such operations could be a valuable source for building berms and for future dike raising.

The progress and effectiveness of site construction and operation should be evaluated using site surveys and monitoring procedures. These typically include pre-construction environmental monitoring (contaminants, benthos, biota, etc), pre-construction surveys, quality assurance surveys, post-construction surveys, annual surveys, and post-construction environmental monitoring (ground water, TSS, effluent/runoff quality). A detailed monitoring and surveying plan (number, location, and spacing of stations and/or samples) should be developed based on site-specific factors.

General site geometries and construction quantities for the six alignments are presented in Table 5-1 for the 10 ft MLLW and 20 ft MLLW dike elevation alternatives. Table 5-1 also presents the estimated completion times for construction of the site. These completion times are based on the following assumptions:

- The total completion time was based on the time required for the longest construction element (rock placement for the 10 ft dike elevation and hydraulic fill for the 20 ft dike elevation) plus an additional six months to allow for mobilization, demobilization and overlap of the construction elements,
- 30 working days per month at 12 hour days,
- 15,000 cubic yards of dike material are dredged and stockpiled per day,
- 5,000 cubic yards of dike material are placed per day,
- Rock placement includes toe dike, slope stone and road stone, and
- 50 linear feet of stone will be placed per day.

Details for the Alignment costs related to construction, site development, habitat development and operation are discussed in Section 6 and are presented in Appendix E.

Table 5-1 Estimated Construction Completion Times

Alignment	Neat Dike Fill Volume (CY)		Stockpile Completion Time (Days)		Dike Fill Completion Time (Days)		Dike Perimeter Length (Lin. Ft.)	Dike Rock Placement (Tons)	Rock Placement Time (Days)	Total Completion Time (Years)	
	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW	Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW				Dike Elev. 10 ft MLLW	Dike Elev. 20 ft MLLW
1	2,202,000	3,409,000	147	227	440	682	24,487	777,000	490	1.9	2.4
2	2,274,000	3,480,000	152	232	455	696	33,406	914,000	668	2.4	2.4
3	2,593,000	4,039,000	173	269	519	808	32,580	870,000	652	2.3	2.7
4	3,639,000	5,631,000	243	375	728	1,126	39,766	1,168,000	795	2.7	3.6
5	2,069,000	2,855,000	138	190	414	571	28,560	758,000	571	2.1	2.1
6	739,000	1,303,000	49	87	148	261	12,564	234,000	251	1.2	1.2

6.0 SITE MODIFICATION COSTS

The project expansion costs for the various island alignments consist of the following items:

- **Initial Construction Costs:** This includes construction of the dikes to the desired initial elevation, dike stabilization costs (armor, underlayer, and toe protection), installation of spillways/outlet structures, and site infrastructure. Also included in the initial construction costs are the study costs. The study costs consist of the conceptual study, pre-feasibility (reconnaissance) study, and feasibility study costs.

- **Habitat Development Costs:** This is the annual costs for the site and includes planning, design, implementation of channels, planting and seeding, operation and maintenance (O&M), and site monitoring for the life of the site.

- **Site Development Costs:** This includes dredged material management, site maintenance, site monitoring and reporting.

- **Dredging, Transport and Placement (DTP) Costs:** This includes costs for mobilization and demobilization, dredging the navigation channels, transport to the placement site, and unloading of the dredged material at the placement site for the operational life of the site. The DTP costs are the most significant of the four major items at about 50% of the total site costs and are further broken down and appropriated as follows:

  - ***DTP Costs Appropriated to Navigation Channels:*** DTP costs charged to a designated USACE navigation channel must be apportioned to that project consistent with the disposal plan identified as the Federal Standard or National Economic Development (NED) disposal plan for that project. For the purposes of this analysis we are using $3.80/cy as the estimate for the DTP costs apportioned to the USACE navigation channels. It should be noted that this NED apportionment is subject to revision and that the ongoing Dredged Material Management Plan being developed by the USACE had the potential to alter this estimate significantly.

  - ***DTP Costs Apportioned to The Poplar Island Project***: The DTP incremental costs, over and above the federal share of the NED disposal plan for that project are apportioned to the Poplar Island Project.

Based on the above factors, the total project costs for this operational life of the site equal the sum of the initial construction, habitat development costs, site development costs, and all apportioned dredging, transport and placement costs. The total project cost, along with the cost per cubic yard of capacity, were generated to compare the various island alignments.

The cost estimates for the initial construction are developed by averaging previous bid and construction costs from the Poplar Island projects and escalating them to 2002 (See Table E-15 in Appendix E). The basis for the habitat and site development costs and the dredging , transport

and placement costs are shown in Tables E-3 through E-14 in Appendix E. A 15% contingency is added to the totals of the cost estimates. It is felt that this will provide a good approximation of current day costs, suitable for these reconnaissance cost estimates and for comparing the various design alignments presented herein.

6.1 TOTAL SITE MODIFICATION COSTS

The total project costs in constant 2002 dollars for the six alignments is presented in Table 6-1 for the 10 ft MLLW dike elevation and in Table 6-2 for the 20 ft MLLW dike elevation. The cost tables for the individual alignments are presented in Tables E-1 through E-15 (Appendix-E).

A review of Tables 6-1 and 6-2 shows that the initial construction costs range from 19% to 24% of total project costs for the 10 ft dike elevation and from 16% to 20% for the 20 ft dike elevation. Similarly, the dredging, transport and placement costs range from 48% to 53% of the total project costs for the 10 ft dike elevation and from 53% to 56% for the 20 ft dike elevation. The site development costs and habitat development costs average approximately 10% and 5% respectively for both the 10 ft and 20 ft dike elevations.

Table 6-1 Total Project Cost for 10 ft Upland Dike Elevation

	Alignment					
	1	2	3	4	5	6
Site Capacity and Life:						
Net Capacity (Million Cubic Yards)	22	21	20	34	21	7
Net Annual Placement (Million Cubic Yards)	2.5	2.5	2.5	2.5	2.5	2.5
Life (Years)	9	9	8	14	9	3
Total Project Cost ($ Million):						
A. Initial Construction	63	70	73	94	63	25
B. Site Development	29	32	29	57	29	10
C. Habitat Development	17	17	16	25	17	8
D. Dredging, Transport and Placement	169	159	148	258	160	56
Subtotal $	278	278	267	435	269	99
Contingency @ 15%	42	42	40	65	40	15
Total Project Cost $	**320**	**320**	**307**	**500**	**309**	**113**
Cost per Cubic Yard Capacity $	**14**	**15**	**16**	**15**	**15**	**15**
Apportioned Costs to Channel Projects ($ Million):						
Dredging, Transport and Placement	85	79	74	130	80	28
Contingency @ 15%	13	12	11	19	12	4
Total Channel Apportioned Cost $	**97**	**91**	**86**	**149**	**92**	**32**
Summary of Costs ($ Million):						
Total Project Cost	320	320	307	500	309	113
Less Apportioned Costs to Channels	(97)	(91)	(86)	(149)	(92)	(32)
Total Poplar Isl. Apportioned Cost $	**222**	**228**	**221**	**351**	**218**	**81**

Note: Numbers may not add up due to rounding.

Table 6-2 Total Project Cost for 20 ft Upland Dike Elevation

	Alignment					
	1	2	3	4	5	6
Site Capacity and Life:						
Net Capacity (Million Cubic Yards)	32	30	29	48	30	11
Net Annual Placement (Million Cubic Yards)	2.5	2.5	2.5	2.5	2.5	2.5
Life (Years)	13	13	12	20	13	5
Total Project Cost ($ Million):						
A. Initial Construction	72	79	83	108	69	29
B. Site Development	39	43	41	78	40	13
C. Habitat Development	21	21	20	31	21	10
D. Dredging, Transport and Placement	239	231	220	365	230	86
Subtotal $	371	373	364	582	359	137
Contingency @ 15%	56	56	55	87	54	21
Total Project Cost $	**427**	**429**	**418**	**669**	**413**	**158**
Cost per Cubic Yard Capacity $	**14**	**14**	**14**	**14**	**14**	**14**
Apportioned Costs to Channel Projects ($ Million):						
Dredging, Transport and Placement	120	115	110	183	115	43
Contingency @ 15%	18	17	17	27,417	17	6
Total Channel Apportioned Cost $	**138**	**132**	**127**	**210**	**132**	**49**
Summary of Costs ($ Million):						
Total Project Cost	427	429	418	669	413	158
Less Apportioned Costs to Channels	(138)	(132)	(127)	(210)	(132)	(49)
Total Poplar Isl. Apportioned Cost $	**289**	**297**	**292**	**459**	**281**	**109**

Note: Numbers may not add up due to rounding.

7.0 SUMMARY

7.1 COST-BASED ALIGNMENT COMPARISON

For a cost-based analysis of each alignment, project costs and unit costs for the each alignment were considered, which included the following:

- Initial construction costs (i.e., the costs to make the site operational),
- Habitat Development Costs (annual costs that include planning, design, monitoring, implementation of channels and planting/seeding, and O&M),
- Site development costs (includes initial construction costs, annual costs, and dike raising costs),
- Dredging/transport and placement costs,
- Contingency costs

The baseline perimeter length, total surface area, and total site capacity are important factors in estimating the costs to construct and operate the site. Unit costs are determined by dividing the total cost by the site capacity. Table 7-1 presents the site design data and associated project costs and unit cost for each of the six alignments with respect to the 10 ft MLLW and 20 ft MLLW dike elevations.

Table 7-1 Site Design Summary

Alignment	Baseline Perimeter Length (Ft.)	Total Surface Area (Acres)	Total Site Capacity (Mcy)	Total Site Life (Yrs.)	Project Costs ($ Millions)			Cost per CY Capacity ($/CY)
					Apportioned to		Total Project Costs	
					Poplar Island	Channel Projects		
10 Ft. MLLW Dike Elevation:								
1	24,487	753	22	9	222	97	320	14
2	33,406	754	21	9	228	91	320	15
3	32,580	754	20	8	221	86	307	16
4	39,766	1,129	34	14	351	149	500	15
5	28,560	749	21	9	218	92	309	15
6	12,564	313	7	3	81	32	113	15
20 Ft. MLLW Dike Elevation:								
1	24,487	753	32	13	289	138	427	14
2	33,406	754	30	13	297	132	429	14
3	32,580	754	29	12	292	127	418	14
4	39,766	1,129	48	20	459	210	669	14
5	28,560	749	30	13	281	132	413	14
6	12,564	313	11	5	109	49	158	14

7.2 COMPARISON OF ALTERNATIVES

7.2.1 10 ft MLLW Dike Elevation

Figure 7-1 presents the total project costs versus the total surface area for each alignment with respect to the 10 ft MLLW dike elevation design alternative. Review of Figure 7-1 shows what is expected. Alignment 6 has the smallest total surface area (313 acres) and results in the lowest total cost ($113 million). Inversely, Alignment 4 has the greatest surface area (1,129 acres) and

has a total cost of ($500 million). Alignments 1, 2, 3 and 5 have similar surface area, which result in similar total costs.

Figure 7-2 presents the unit cost per cubic yard of capacity versus the total surface area for each alignment with respect to the 10 ft MLLW dike elevation design alternative. Alignment 1 has the smallest unit cost at $14/cy and Alignment 3 has the largest unit cost at $16/cy. Alignments 2, 4, 5 and 6 have a unit cost of $15/cy. This suggests that the unit cost is sensitive to the total site capacity resulting from the site design.

7.2.2 20 ft MLLW Dike Elevation

Figure 7-3 presents the total project cost versus the total surface area for each alignment with respect to the 20 ft dike elevation design alternative. Review of Figure 7-3 again shows what is expected. Alignment 6 has the smallest total surface area (313 acres) and results in the lowest total cost ($158 million). Inversely, Alignment 4 has the greatest surface area (1,129 acres) and has a total cost of ($669 million). Alignments 1, 2, 3 and 5 have similar surface area, which result in similar total costs. It should be noted that the total surface area does not change as a result of an increase in dike elevation. This is due to the fact that the surface area is calculated with respect to the design baseline, which does not change.

Figure 7-4 presents the unit cost per cubic yard of capacity versus the total surface area for each alignment with respect to the 20 ft MLLW dike elevation design alternative. All of the alignments have a unit cost of approximately $14/cy.

Figure 7-1 Total Project Cost vs. Surface Area
(for 10 ft MLLW Dike Elevation)

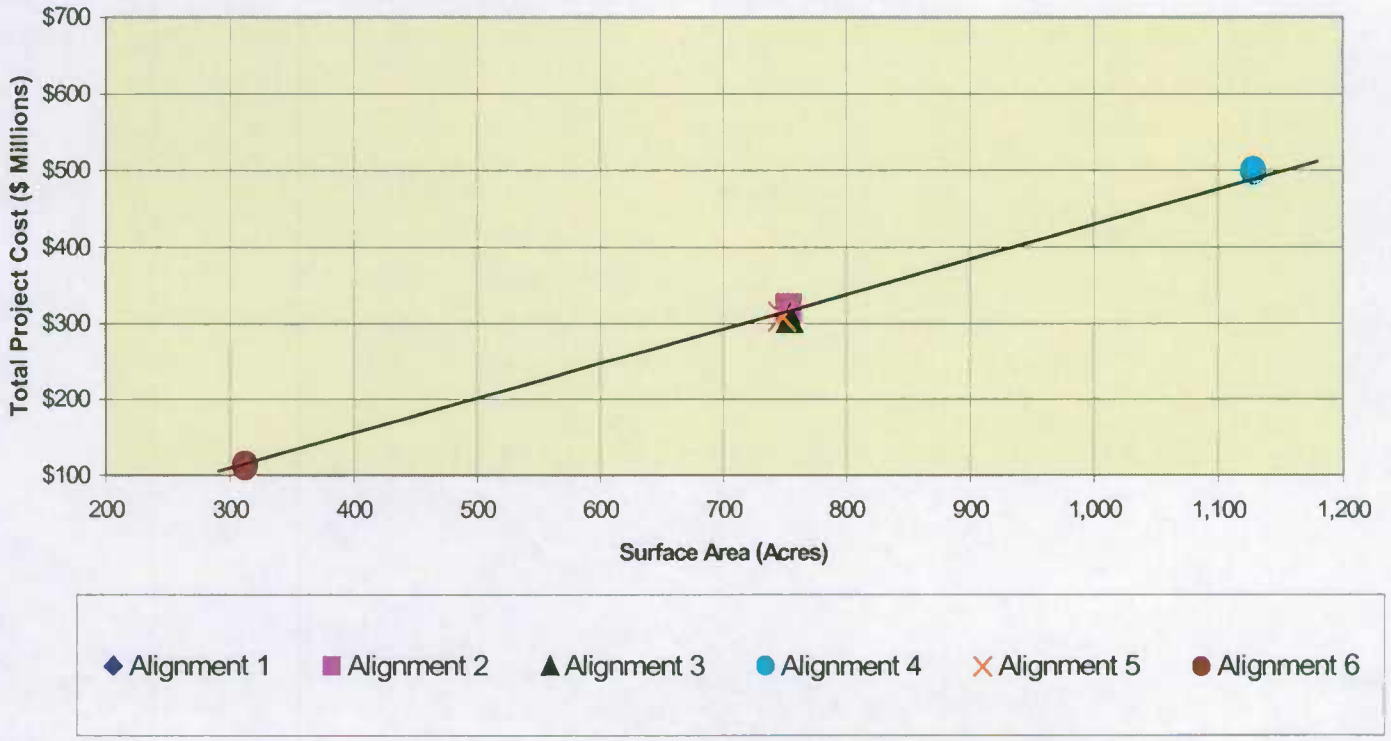

Figure 7-2 Unit Cost per CY of Capacity vs. Surface Area
(for 10 ft MLLW Dike Elevation)

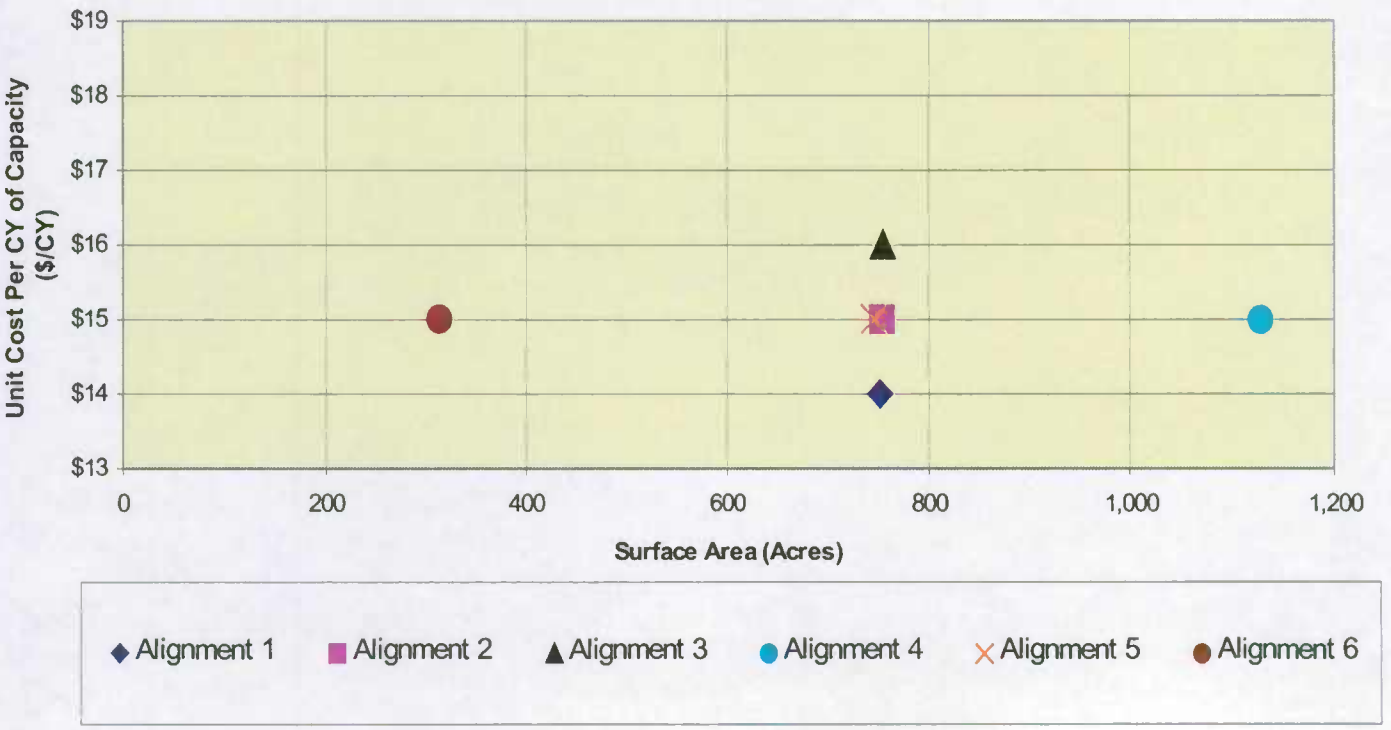

Figure 7-3 Total Project Cost vs. Surface Area
(for 20 ft. MLLW Dike Elevation)

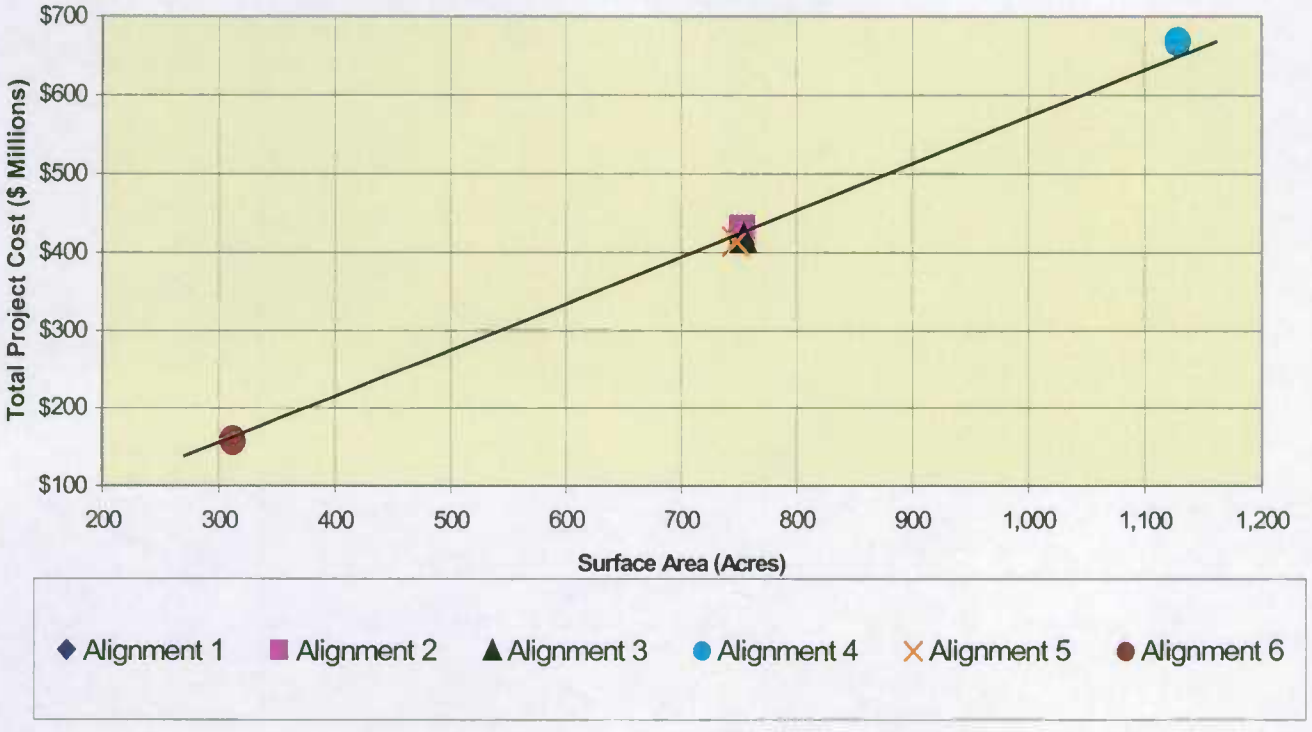

Figure 7-4 Unit Cost per CY of Capacity vs. Surface Area
(for 20 ft. MLLW Dike Elevation)

8.0 REFERENCE

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APPENDIX A

SITE LOCATION MAPS

N

BAY BRIDGE

KENT ISLAND

SOUTH RIVER

WEST RIVER

CHESAPEAKE BAY

EASTERN BAY

MILES RIVER

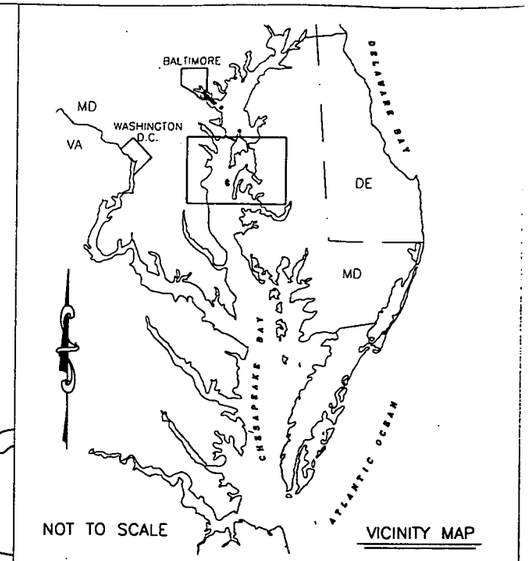
TILGHMAN ISLAND

MODIFIED POPLAR ISLAND

EXISTING POPLAR ISLAND

10000 0 10000 20000

FEET IN THOUSANDS



NOT TO SCALE

VICINITY MAP

GBA
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NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

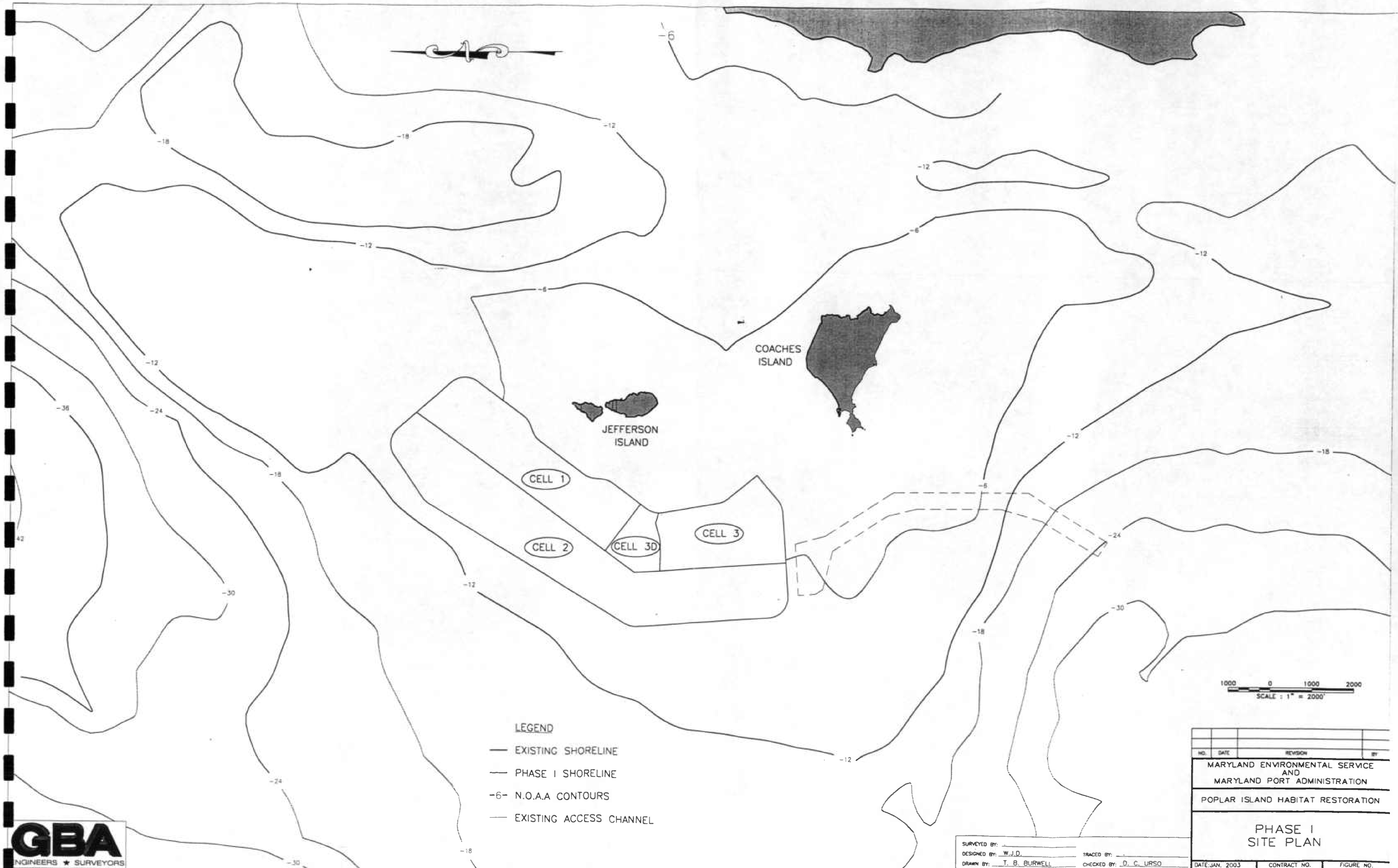
GENERAL LOCATION PLAN POPLAR MODIFICATION

SURVEYED BY: _____
DESIGNED BY: W.J.D. TRACED BY: _____
DRAWN BY: T. B. BURWELL CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: AS SHOWN

CONTRACT NO. 02-07-30

FIGURE NO. A - 1



COACHES ISLAND
JEFFERSON ISLAND
CELL 1
CELL 2
CELL 3D
CELL 3
-6
-12
-18
-24
-30
-36
42
LEGEND
EXISTING SHORELINE
PHASE I SHORELINE
-6- N.O.A.A CONTOURS
EXISTING ACCESS CHANNEL
1000 0 1000 2000
SCALE : 1" = 2000'
NO. DATE REVISION BY
MARYLAND ENVIRONMENTAL SERVICE AND MARYLAND PORT ADMINISTRATION
POPLAR ISLAND HABITAT RESTORATION
PHASE I SITE PLAN
SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO
DATE: JAN. 2003
SCALE: 1"= 2000'
CONTRACT NO. 02-07-30
FIGURE NO. A - 2
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COACHES ISLAND

JEFFERSON ISLAND

CELL 1

CELL 2

CELL 30

CELL 3

CELL 4

CELL 5

CELL 6

-6

-12

-18

-24

-30

-36

LEGEND

— EXISTING SHORELINE

— PHASE II SHORELINE

-6- N.O.A.A CONTOURS

— EXISTING ACCESS CHANNEL

1000 0 1000 2000

SCALE : 1" = 2000'

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MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

PHASE II SITE PLAN

SURVEYED BY: _____

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DRAWN BY: T. B. BURWELL

TRACED BY: _____

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SCALE: 1" = 2000'

CONTRACT NO.
02-07-30

FIGURE NO.
A - 3

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APPENDIX B

GEOTECHNICAL RECONNAISSANCE MAPS & SAND BORROW AREA MAPS

N.O.B. 8-7

N.O.B. 8-11

N.O.B. 8-10

N.O.B. 11-3

COACHES ISLAND

JEFFERSON ISLAND

CELL 1

CELL 2

CELL 30

CELL 3

CELL 4

CELL 5

CELL 6

CELL 7

CELL 8

CELL 9

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- 6 — N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0 / 2.5 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

17.5 / 5.0 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

1000 0 1000 2000
SCALE : 1" = 2000'

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POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 1

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CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	8 - 1

N.O.B. 8-7

N.O.B. 8-11

N.O.B. 8-10

N.O.B. 11-3

COACHES ISLAND

JEFFERSON ISLAND

CELL 1

CELL 2

CELL 3

CELL 4

CELL 5

CELL 6

CELL 7

CELL 8

CELL 9

CELL 30

-6

-12

-18

-24

-30

-36

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- —6— N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0 — STRIP (CLAYS AND SILTS)
2.5 — SAND LAYER THICKNESS
17.5 — STRIP (CLAYS AND SILTS)
5.0 — SAND LAYER THICKNESS

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1000 0 1000 2000
SCALE : 1" = 2000'

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POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 2

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TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	B - 2

N.O.B. 8-7

N.O.B. 8-10

N.O.B. B-11

N.O.B. 11-3

COACHES ISLAND

JEFFERSON ISLAND

CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 30

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- -6- N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0 / 2.5 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

17.5 / 5.0 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

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1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE AND MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 3

SURVEYED BY:
DESIGNED BY: W.J.O.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	8 - 3

N.O.B. 8-7

N.O.B. 8-11

N.O.B. 11-3

N.O.B. 8-10

COACHES ISLAND

JEFFERSON ISLAND

CELL 1 CELL 2 CELL 3 CELL 4 CELL 5 CELL 6 CELL 7 CELL 8 CELL 9 CELL 10 CELL 11 CELL 30

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- 6 N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0 STRIP (CLAYS AND SILTS)
2.5 SAND LAYER THICKNESS
17.5 STRIP (CLAYS AND SILTS)
5.0 SAND LAYER THICKNESS

GBA ENGINEERS ★ SURVEYORS

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE AND MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 4

SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 2000'	02-07-30	B - 4

N.O.B. 8-7

N.O.B. 8-11

N.O.B. 11-3

N.O.B. 8-10

COACHES ISLAND

JEFFERSON ISLAND

CELL 1 | CELL 2 | CELL 3 | CELL 4 | CELL 5 | CELL 6 | CELL 7 | CELL 8 | CELL 9 | CELL 10 | CELL 30

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- 6 — N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0 / 2.5 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

17.5 / 5.0 — STRIP (CLAYS AND SILTS) SAND LAYER THICKNESS

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 5

SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	8 - 5

GBA
ENGINEERS ★ SURVEYORS

N.O.B. 8-7

N.O.B. 8-11

N.O.B. 8-10

N.O.B. 11-3

COACHES ISLAND

JEFFERSON ISLAND

CELL 1

CELL 2

CELL 3

CELL 3D

CELL 4

CELL 5

CELL 6

CELL 7

CELL 8

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- —6— N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- CONTRACT FOUNDATION BORINGS
- CONTRACT BORROW BORINGS
- CONTRACT SHALLOW WATER BORINGS
- CONTRACT FOUNDATION CONE PENETROMETER TESTS
- CONTRACT BORROW CONE PENETROMETER TESTS
- CONTRACT VANE SHEAR AND CONE PENETROMETER TESTS
- HYNES AND ASSOCIATES, INC. SUPPLEMENTAL BORINGS
- PROPOSED FOUNDATION BORINGS
- PROPOSED BORROW BORINGS
- PROPOSED FOUNDATION CONE PENETROMETER TESTS

0.0	STRIP (CLAYS AND SILTS)
2.5	SAND LAYER THICKNESS
17.5	STRIP (CLAYS AND SILTS)
5.0	SAND LAYER THICKNESS

1000 0 1000 2000
SCALE : 1" = 2000'

GBA ENGINEERS ★ SURVEYORS

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MARYLAND ENVIRONMENTAL SERVICE AND MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

GEOTECHNICAL RECONNAISSANCE MAP OPTION 6

SURVEYED BY: —
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DRAWN BY: T. B. BURWELL
TRACED BY: —
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	8 - 6

NORTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.6 MCY

NORTH EAST BORROW
LOCATION
TOTAL VOLUME = 7.2 MCY

SOUTH EAST BORROW
LOCATION TOTAL
VOLUME = 9.1 MCY

SOUTH WEST BORROW
LOCATION TOTAL
VOLUME = 4.2 MCY

EXISTING POPLAR ISLAND

JEFFERSON
ISLAND

CELL 1
CELL 2
CELL 3D
CELL 3
CELL 4
CELL 5
CELL 6

-6
-12
-18
-24
-30
-36
-42

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- -6- N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- AVAILABLE SAND 10 FT.
- AVAILABLE SAND 20 FT.
- PROPOSED ALIGNMENT

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES

SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1" = 2000'

CONTRACT NO.
02-07-30

FIGURE NO.
8 - 7

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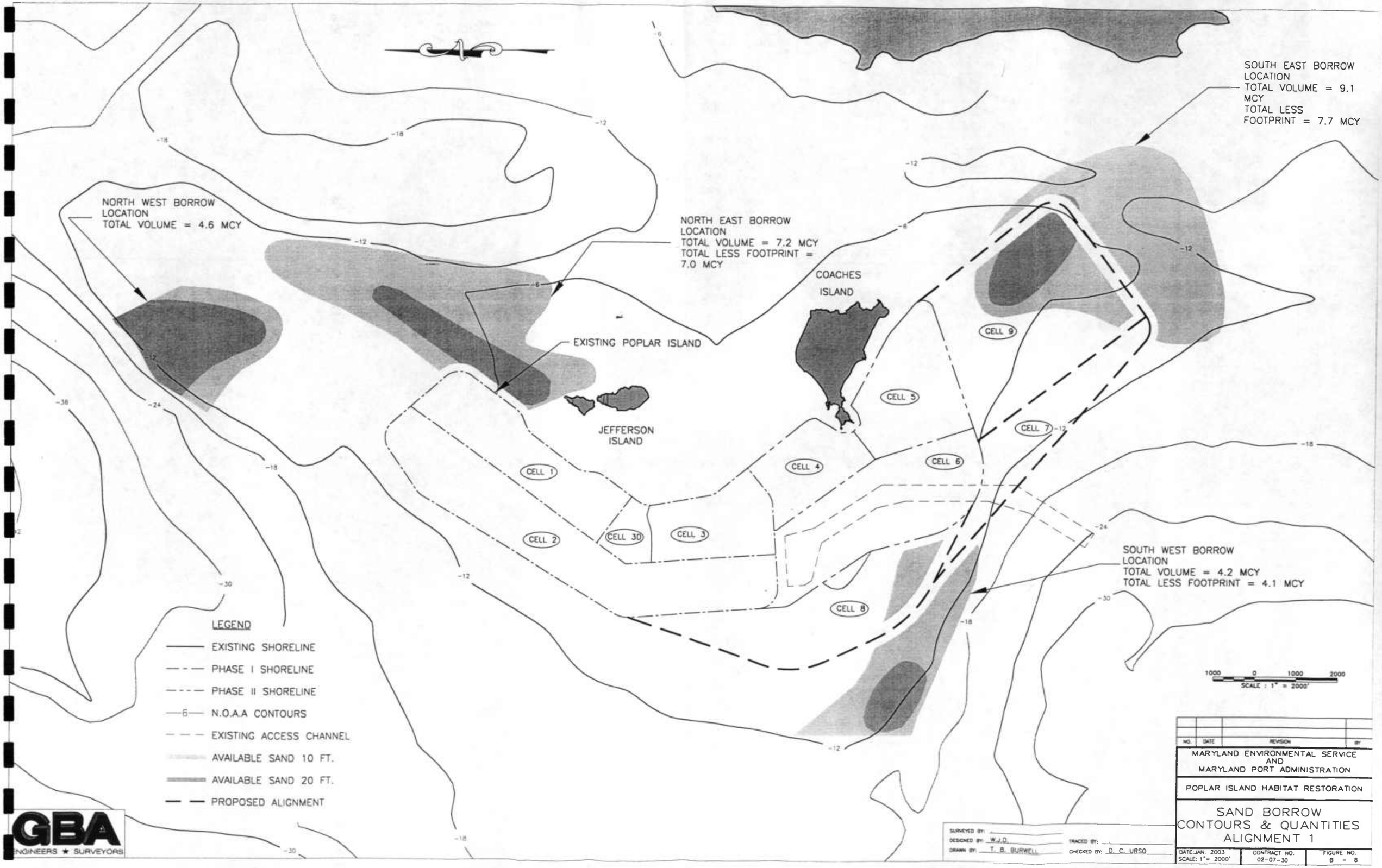

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ENGINEERS ★ SURVEYORS

NO.	DATE	REVISION	BY

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MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES ALIGNMENT 1

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DRAWN BY: T. B. BURWELL
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DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 2000'	02-07-30	8 - 8

SOUTH EAST BORROW
LOCATION
TOTAL VOLUME = 9.1
MCY
TOTAL LESS
FOOTPRINT = 8.8 MCY

NORTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.6 MCY
TOTAL LESS FOOTPRINT =
3.8 MCY

NORTH EAST BORROW
LOCATION
TOTAL VOLUME = 7.2 MCY
TOTAL LESS FOOTPRINT =
5.8 MCY

COACHES
ISLAND

EXISTING POPLAR ISLAND

JEFFERSON
ISLAND

CELL 1
CELL 2
CELL 30
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9

SOUTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.2 MCY
TOTAL LESS FOOTPRINT = 3.6 MCY

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- AVAILABLE SAND 10 FT.
- AVAILABLE SAND 20 FT.
- PROPOSED ALIGNMENT

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES ALIGNMENT 2

SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 2000'
CONTRACT NO. 02-07-30
FIGURE NO. 8 - 9

GBA
ENGINEERS ★ SURVEYORS

NORTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.6 MCY
TOTAL LESS FOOTPRINT =
4.5 MCY

NORTH EAST BORROW
LOCATION
TOTAL VOLUME = 7.2 MCY
TOTAL LESS FOOTPRINT =
6.1 MCY

SOUTH EAST BORROW
LOCATION
TOTAL VOLUME = 9.1
MCY
TOTAL LESS
FOOTPRINT = 7.9 MCY

SOUTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.2 MCY
TOTAL LESS FOOTPRINT = 3.6 MCY

EXISTING POPLAR ISLAND

JEFFERSON
ISLAND

COACHES
ISLAND

CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 30

-6
-12
-18
-24
-30
-36
-42

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- 6 N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- AVAILABLE SAND 10 FT.
- AVAILABLE SAND 20 FT.
- PROPOSED ALIGNMENT

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES ALIGNMENT 3

SURVEYED BY:
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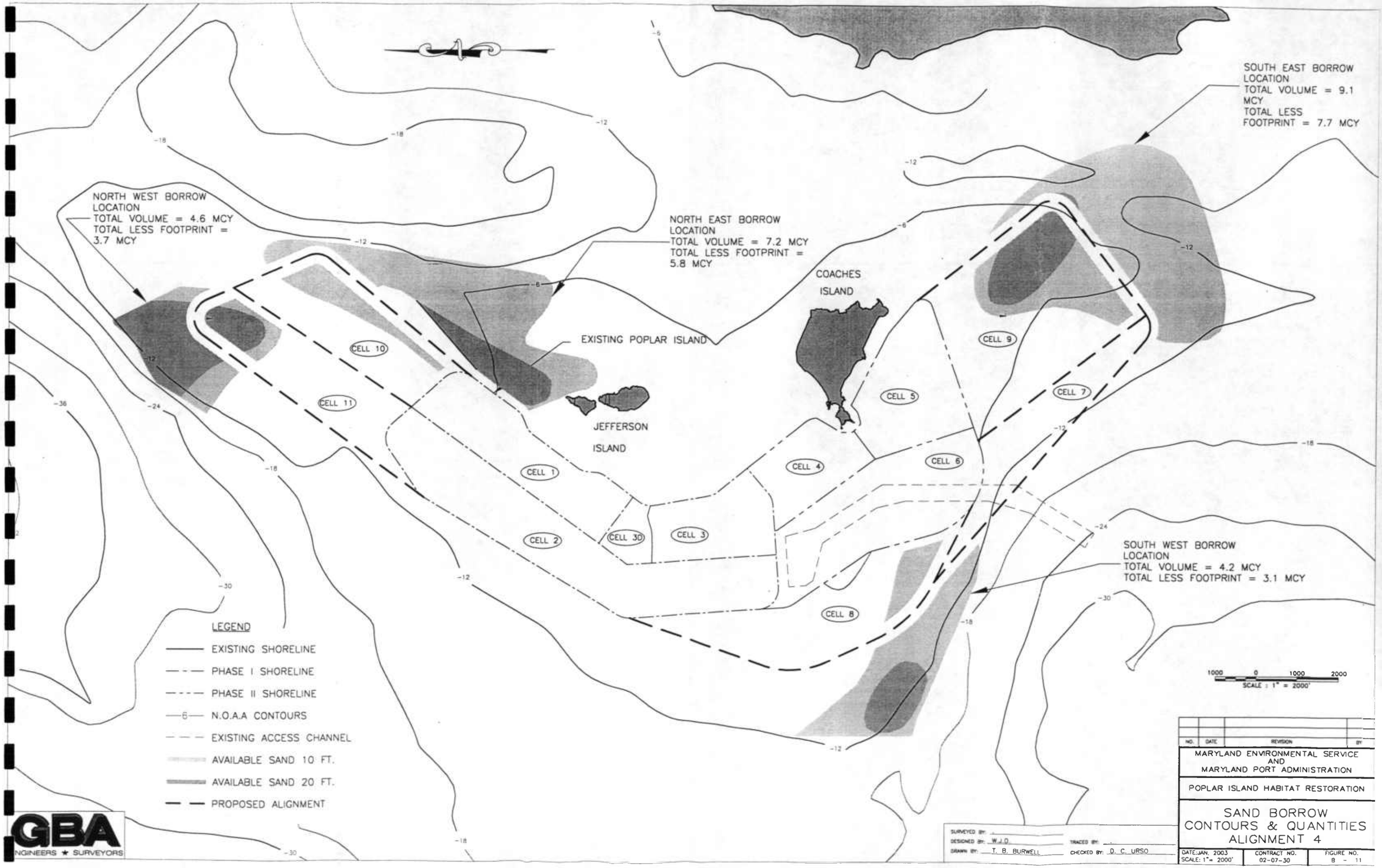
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 2000'

CONTRACT NO.
02-07-30

FIGURE NO.
8 - 10

GBA
ENGINEERS ★ SURVEYORS



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ENGINEERS ★ SURVEYORS

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TRACED BY:
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POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES ALIGNMENT 4

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 2000'	02-07-30	8 - 11

NORTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.6 MCY
TOTAL LESS FOOTPRINT =
4.3 MCY

NORTH EAST BORROW
LOCATION
TOTAL VOLUME = 7.2 MCY
TOTAL LESS FOOTPRINT =
5.8 MCY

SOUTH EAST BORROW
LOCATION
TOTAL VOLUME = 9.1
MCY
TOTAL LESS
FOOTPRINT = 7.7 MCY

SOUTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.2 MCY
TOTAL LESS FOOTPRINT = 4.1 MCY

EXISTING POPLAR ISLAND

JEFFERSON
ISLAND

COACHES
ISLAND

CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 30

-6
-12
-18
-24
-30
-36

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- 6 N.O.A.A CONTOURS
- EXISTING ACCESS CHANNEL
- AVAILABLE SAND 10 FT.
- AVAILABLE SAND 20 FT.
- PROPOSED ALIGNMENT

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

SAND BORROW CONTOURS & QUANTITIES ALIGNMENT 5

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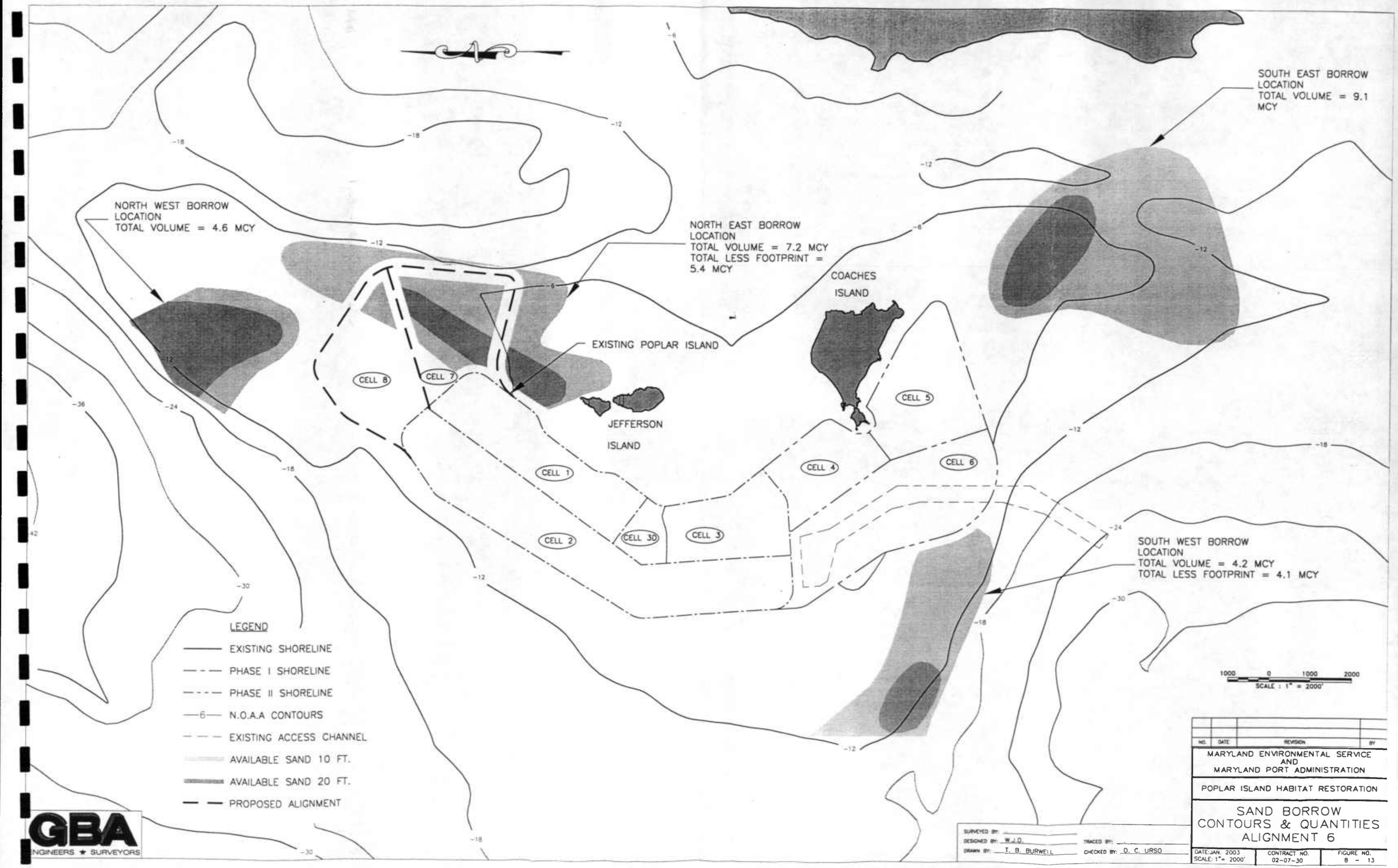
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 2000'

CONTRACT NO.
02-07-30

FIGURE NO.
8 - 12

GBA
ENGINEERS ★ SURVEYORS


SOUTH EAST BORROW
LOCATION
TOTAL VOLUME = 9.1
MCY
NORTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.6 MCY
NORTH EAST BORROW
LOCATION
TOTAL VOLUME = 7.2 MCY
TOTAL LESS FOOTPRINT =
5.4 MCY
COACHES
ISLAND
EXISTING POPLAR ISLAND
JEFFERSON
ISLAND
CELL 1
CELL 2
CELL 30
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
SOUTH WEST BORROW
LOCATION
TOTAL VOLUME = 4.2 MCY
TOTAL LESS FOOTPRINT = 4.1 MCY
LEGEND
EXISTING SHORELINE
PHASE I SHORELINE
PHASE II SHORELINE
N.O.A.A CONTOURS
EXISTING ACCESS CHANNEL
AVAILABLE SAND 10 FT.
AVAILABLE SAND 20 FT.
PROPOSED ALIGNMENT
1000 0 1000 2000
SCALE : 1" = 2000'
NO. DATE REVISION BY
MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION
POPLAR ISLAND HABITAT RESTORATION
SAND BORROW
CONTOURS & QUANTITIES
ALIGNMENT 6
SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO
DATE: JAN. 2003
SCALE: 1"= 2000'
CONTRACT NO.
02-07-30
FIGURE NO.
8 - 13
GBA
ENGINEERS ★ SURVEYORS

APPENDIX C

DESIGN PLAN VIEWS & CROSS-SECTIONS

COACHES ISLAND

JEFFERSON ISLAND

POPLAR HARBOR

WETLAND

UPLAND

UPLAND

CELL 1

CELL 2

CELL 3D

CELL 3

CELL 4

CELL 5

CELL 6

CELL 7

CELL 8

CELL 9

4

3A

3B

13

1

11

2

EXISTING POPLAR ISLAND

C H E S A P E A K E B A Y

-6 -12 -18 -24 -30 -36 -42

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- PROPOSED ALIGNMENT
- EXISTING ACCESS CHANNEL

1000 0 1000 2000

SCALE : 1" = 2000'

GBA

ENGINEERS ★ SURVEYORS

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MARYLAND ENVIRONMENTAL SERVICE
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POPLAR ISLAND HABITAT RESTORATION

POPLAR MODIFICATION PLAN ALIGNMENT 1

SURVEYED BY: _____
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: _____
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 2000'	02-07-30	C - 1

4B
5
4A
3
2B
2C
2A
WETLAND
CELL 9
JEFFERSON ISLAND
COACHES ISLAND
UPLAND
CELL 7
CELL 5
POPLAR HARBOR
CELL 1
CELL 4
CELL 6
CELL 2
CELL 30
CELL 3
UPLAND
CELL 8
EXISTING POPLAR ISLAND
-6
-12
-18
-24
-30
-36
-42

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- PROPOSED ALIGNMENT
- EXISTING ACCESS CHANNEL

C H E S A P E A K E B A Y

1000 0 1000 2000
SCALE : 1" = 2000'

GBA
ENGINEERS ★ SURVEYORS

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POPLAR ISLAND HABITAT RESTORATION

POPLAR MODIFICATION PLAN ALIGNMENT 2

SURVEYED BY:
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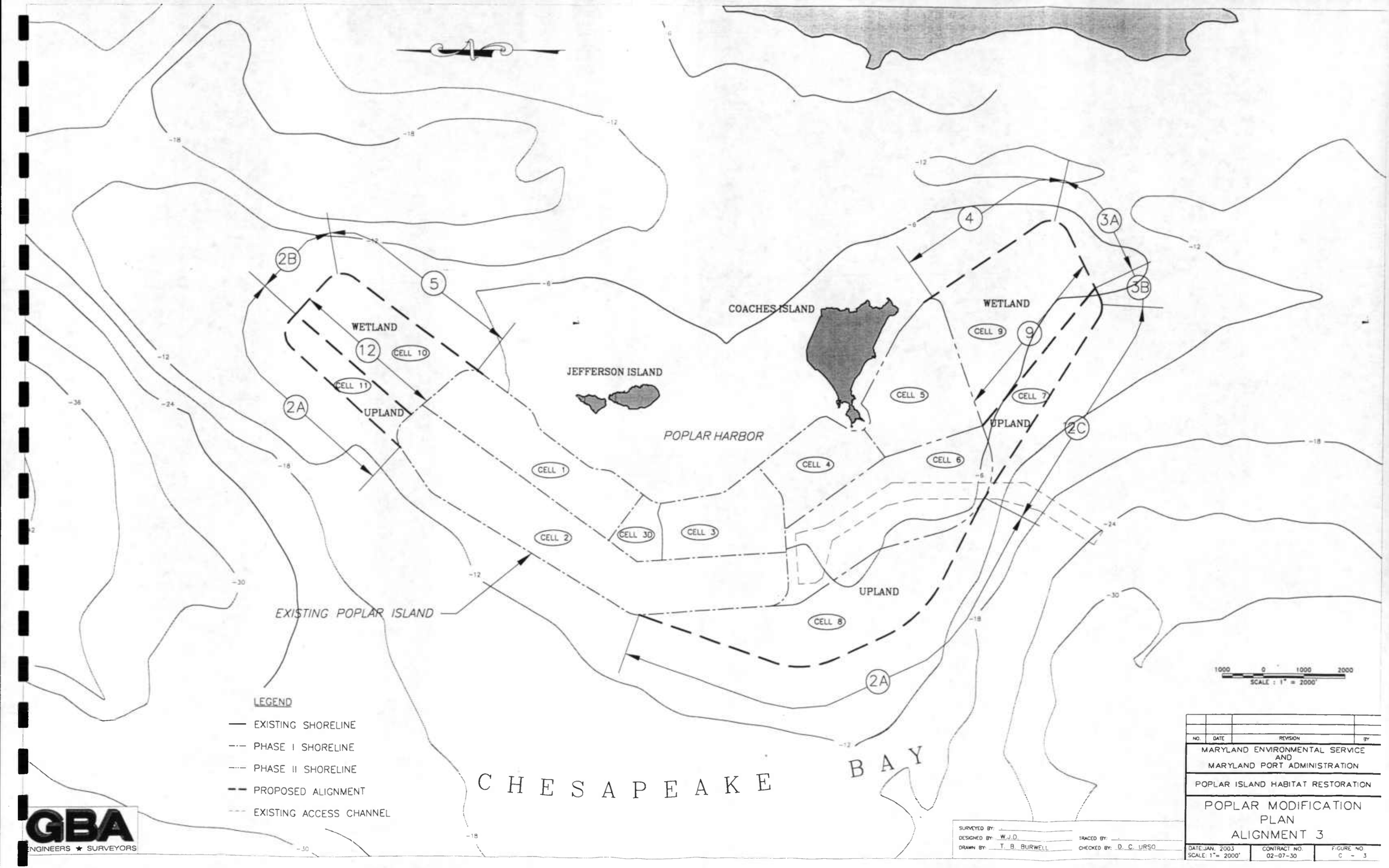
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 2000'	02-07-30	C - 2



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POPLAR ISLAND HABITAT RESTORATION

POPLAR MODIFICATION PLAN ALIGNMENT 3

SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 2000'	02-07-30	C - 3

WETLAND
UPLAND
WETLAND
UPLAND
UPLAND
COACHES ISLAND
JEFFERSON ISLAND
POPLAR HARBOR
EXISTING POPLAR ISLAND
CELL 1
CELL 2
CELL 30
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 12
4C
4D
5
4
3A
3B
13
13
2A
2A
1
11
-6
-12
-18
-24
-30
-36

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- PROPOSED ALIGNMENT
- EXISTING ACCESS CHANNEL

C H E S A P E A K E B A Y

1000 0 1000 2000
SCALE : 1" = 2000'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
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POPLAR ISLAND HABITAT RESTORATION

POPLAR MODIFICATION PLAN ALIGNMENT 4

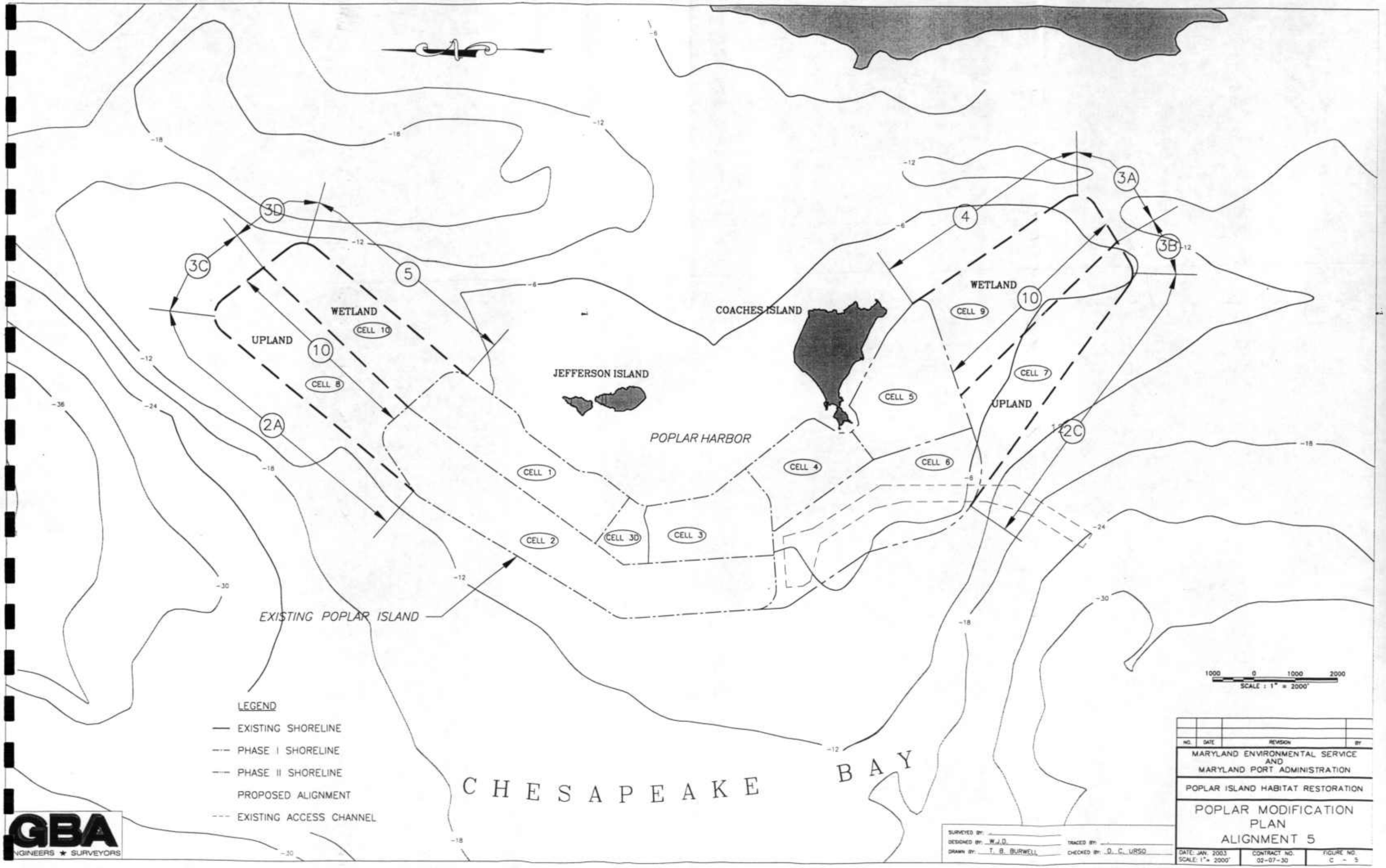
SURVEYED BY:
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 2000'

CONTRACT NO.
02-07-30

FIGURE NO.
C - 4

GBA
ENGINEERS ★ SURVEYORS


3D
3C
5
WETLAND
CELL 10
UPLAND
10
CELL 8
2A
JEFFERSON ISLAND
COACHES ISLAND
POPLAR HARBOR
CELL 1
CELL 2
CELL 30
CELL 3
CELL 4
CELL 5
CELL 6
4
3A
3B
WETLAND
CELL 9
10
CELL 7
UPLAND
2C
EXISTING POPLAR ISLAND
CHESAPEAKE BAY
-6
-12
-18
-24
-30
-36
1000 0 1000 2000
SCALE : 1" = 2000'
LEGEND
EXISTING SHORELINE
PHASE I SHORELINE
PHASE II SHORELINE
PROPOSED ALIGNMENT
EXISTING ACCESS CHANNEL
GBA
ENGINEERS ★ SURVEYORS
NO. DATE REVISION BY
MARYLAND ENVIRONMENTAL SERVICE AND MARYLAND PORT ADMINISTRATION
POPLAR ISLAND HABITAT RESTORATION
POPLAR MODIFICATION PLAN ALIGNMENT 5
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DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO
DATE: JAN. 2003
SCALE: 1"= 2000'
CONTRACT NO. 02-07-30
FIGURE NO. C - 5

8A
8B
9
7
6
CELL 7
WETLAND
CELL 8
UPLAND
JEFFERSON ISLAND
COACHES ISLAND
POPLAR HARBOR
CELL 1
CELL 2
CELL 3D
CELL 3
CELL 4
CELL 5
CELL 6
EXISTING POPLAR ISLAND
CHESAPEAKE BAY
-6
-12
-18
-24
-30
-36

LEGEND

- EXISTING SHORELINE
- PHASE I SHORELINE
- PHASE II SHORELINE
- PROPOSED ALIGNMENT
- EXISTING ACCESS CHANNEL

1000 0 1000 2000
SCALE : 1" = 2000'

GBA
ENGINEERS ★ SURVEYORS

NO.	DATE	REVISION	BY

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AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

POPLAR MODIFICATION PLAN ALIGNMENT 6

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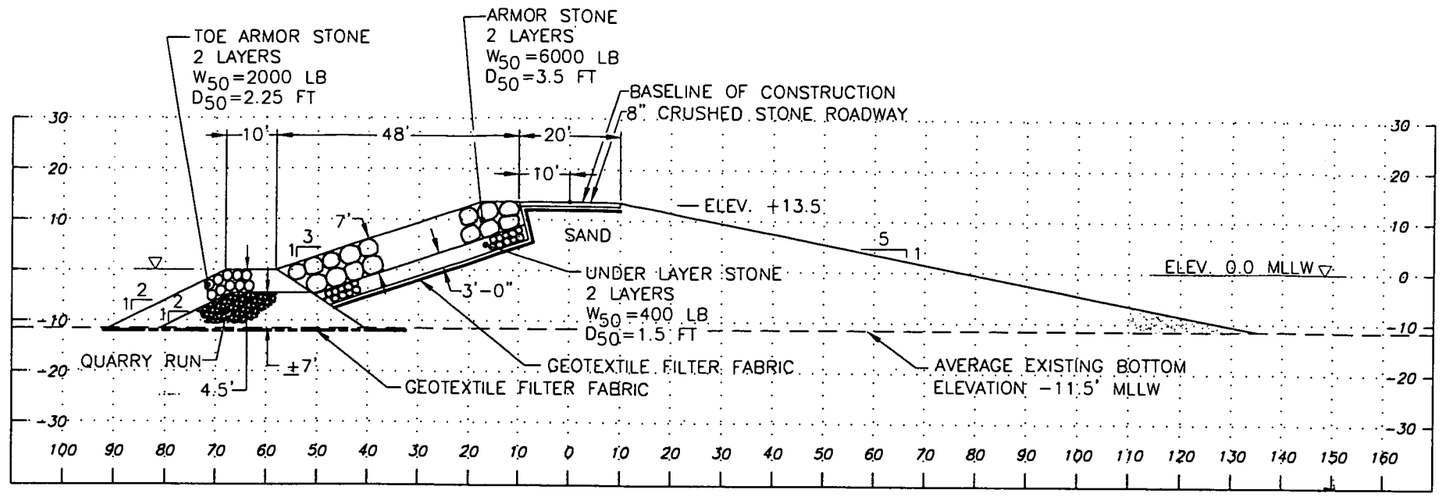
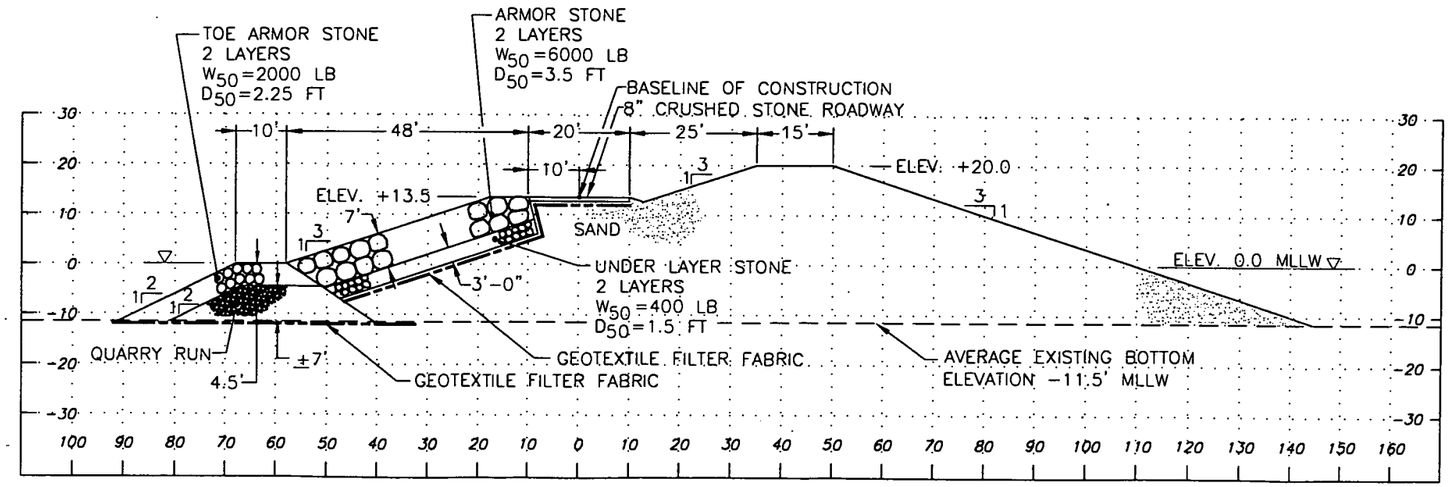
DESIGNED BY: W.J.O.
DRAWN BY: T. B. BURWELL
TRACED BY:
CHECKED BY: D. C. URSO

DATE: JAN. 2003 SCALE: 1"= 2000'	CONTRACT NO. 02-07-30	FIGURE NO. C - 6



TYPICAL DIKE SECTION NO. 1 TO 13.5 FEET



TYPICAL DIKE SECTION NO. 1 TO 20 FEET

15 0 15 30
SCALE : 1" = 30'

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

GBA
ENGINEERS ★ SURVEYORS

NO.	DATE	REVISION	BY

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MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

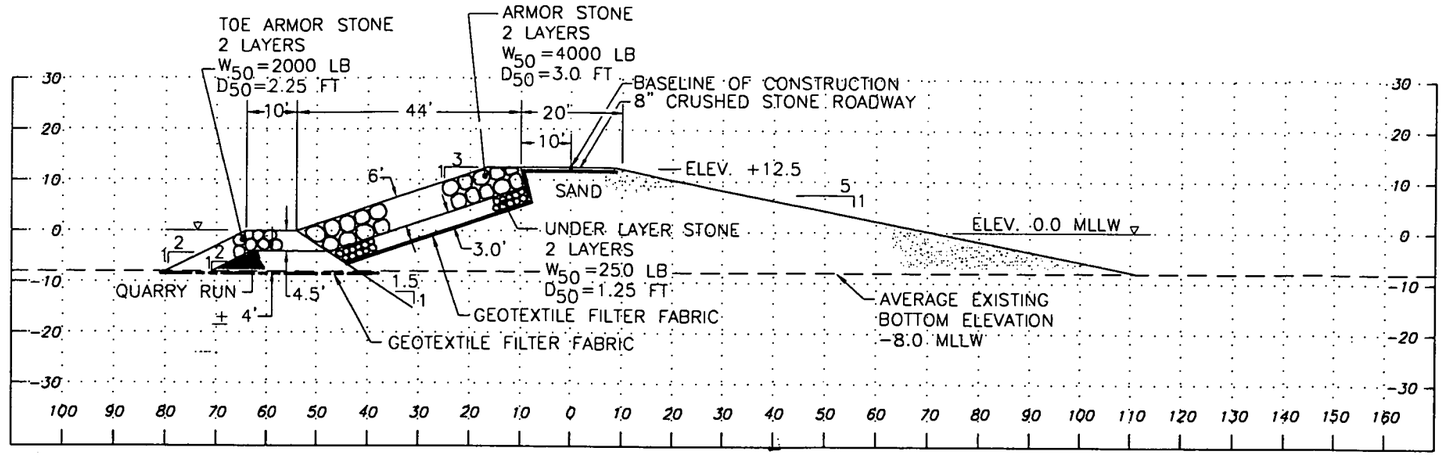
TYPICAL DIKE SECTION
NO. 1

SURVEYED BY: _____
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: _____
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1" = 30'

CONTRACT NO.
02-07-30

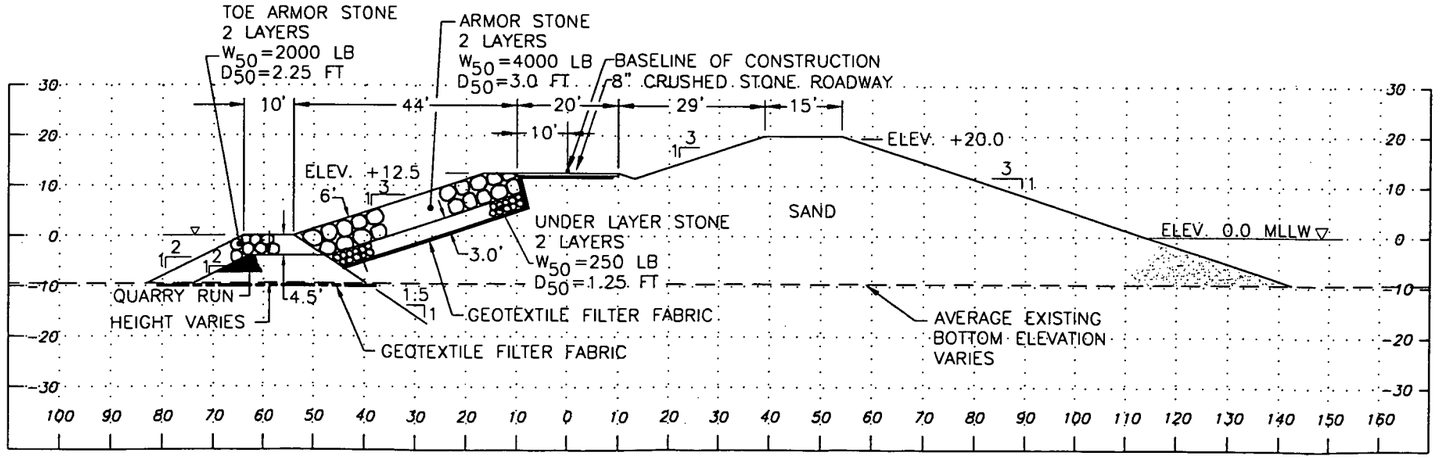
FIGURE NO.
C - 7



TYPICAL DIKE SECTION NO. 2 TO 12.5 FEET

NOTE: 1. This is the typical dike section for 2B corresponding to the 10 ond 20 ft. dike elevation alternatives for Option 2.

2. This is the typical dike section for 2, 2A ond 2C corresponding to the 10 ft. dike elevation alternotive for Options 1 through 5.



TYPICAL DIKE SECTION NO. 2 TO 20 FEET

NOTE: 1. This is the typicol dike section for 2, 2A and 2C corresponding to the 20 ft. dike elevation alternotive for Options 1 through 5.

LEGEND

- — — — EXISTING GROUND
- ——— PROPOSED DIKE
- —·—·— GEOTEXTILE

15 0 15 30
SCALE : 1" = 30'

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

TYPICAL DIKE SECTION NO. 2

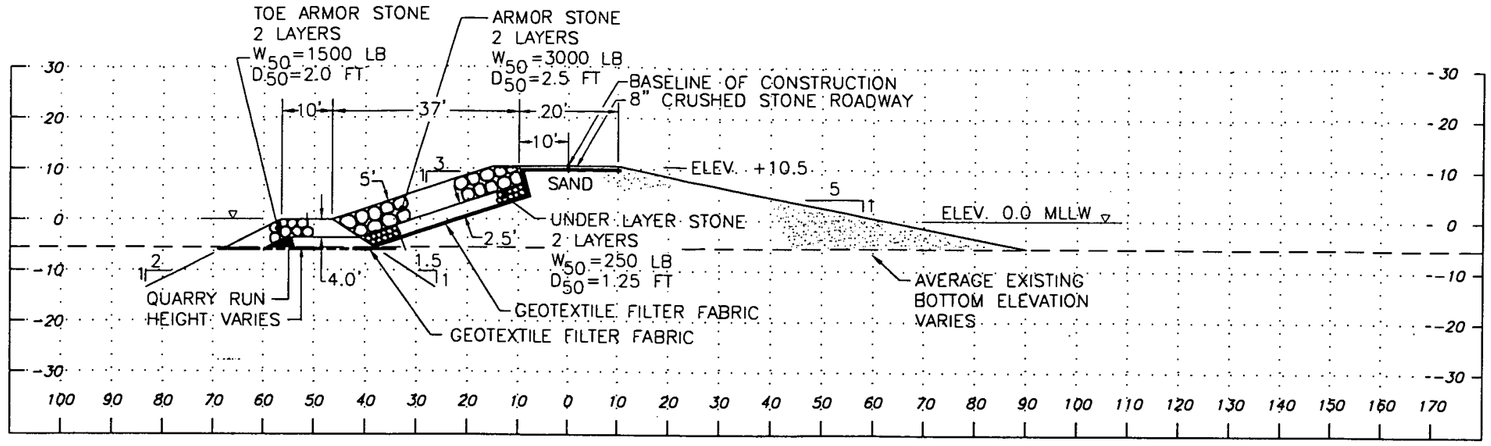
SURVEYED BY: _____
DESIGNED BY: W.J.D. TRACED BY: _____
DRAWN BY: T. B. BURWELL CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 30'

CONTRACT NO. 02-07-30

FIGURE NO. C - 8

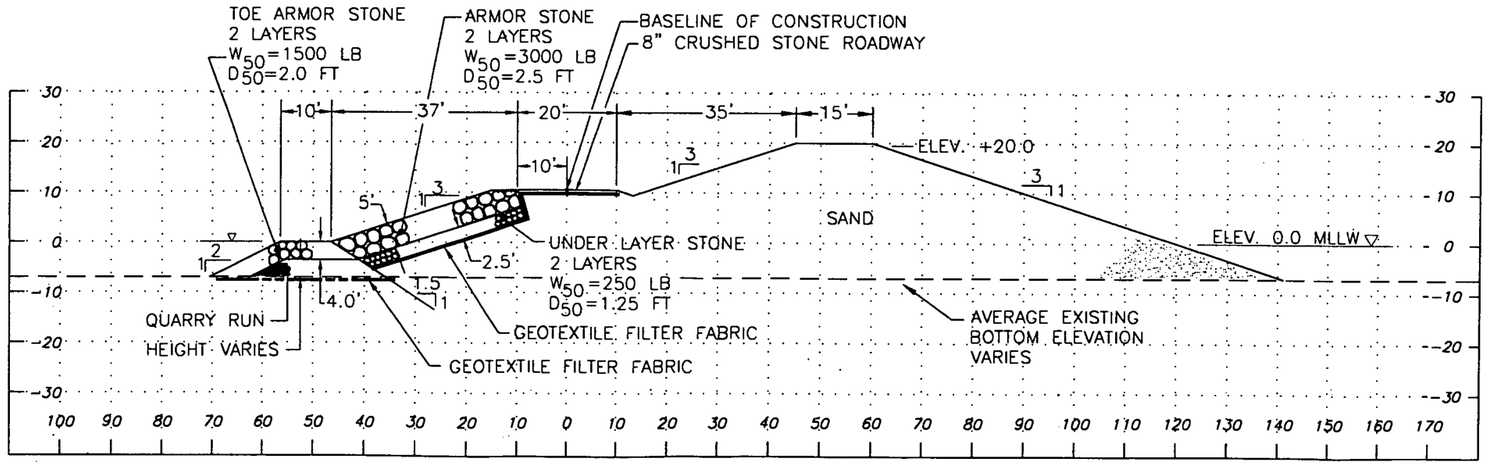
GBA
ENGINEERS ★ SURVEYORS



TYPICAL DIKE SECTION NO. 3 TO 10.5 FEET

NOTE: 1. This is the typical dike section for 3A ond 3D corresponding to the 10 and 20 ft. dike elevation alternatives for Option 1 and Options 3 through 5.

2. This is the typical dike section for 3, 3B and 3C corresponding to the 10 ft. dike elevation alternative for Options 1 through 5.



TYPICAL DIKE SECTION NO. 3 TO 20 FEET

NOTE: This is the typical dike section for 3, 3B and 3C corresponding to the 20 ft. dike elevation alternative for Options 1 through 5.

15 0 15 30
SCALE : 1" = 30'

LEGEND

EXISTING GROUND

PROPOSED DIKE

GEOTEXTILE

GBA
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NO.	DATE	REVISION	BY

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AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

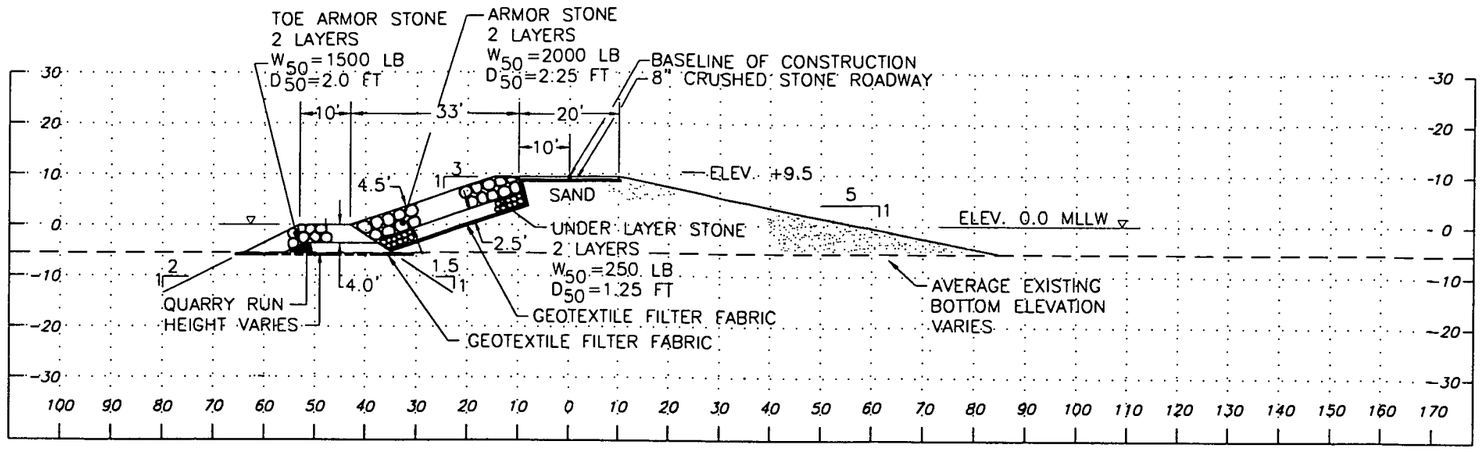
TYPICAL DIKE SECTION
NO. 3

SURVEYED BY: —
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: —
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1" = 30'

CONTRACT NO.
02-07-30

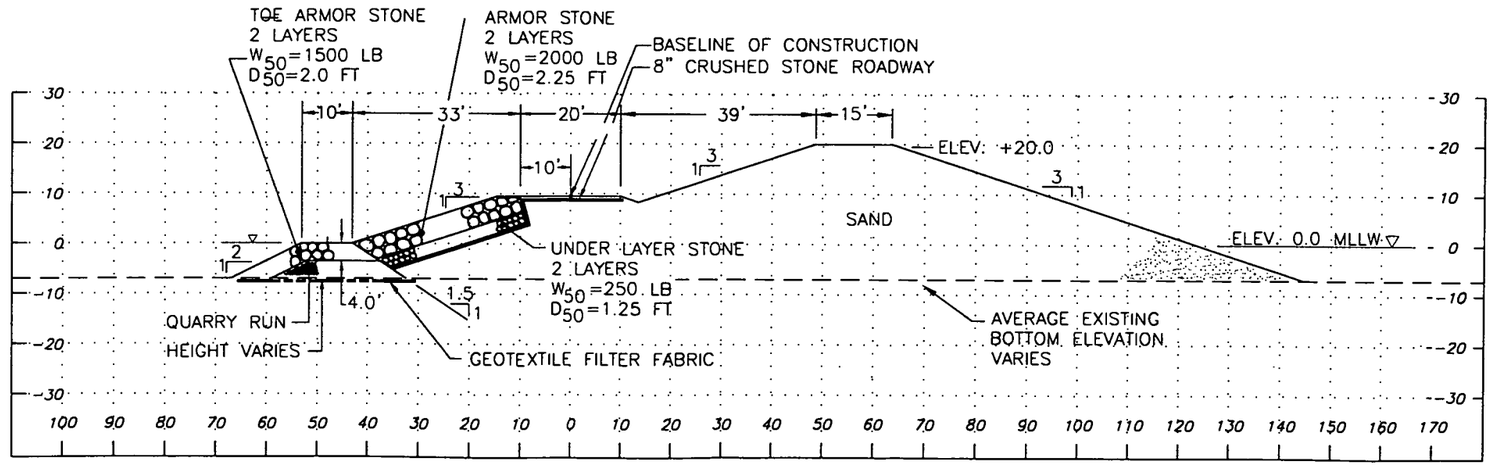
FIGURE NO.
C - 9



TYPICAL DIKE SECTION NO. 4 TO 9.5 FEET

NOTE: 1. This is the typical dike section for 4, 4B and 4C corresponding to the 10 and 20 ft. dike elevation alternatives for Options 1 through 5.

2. This is the typical dike section for 4A and 4D corresponding to the 10 ft. dike elevation alternative for Options 1 through 5.



TYPICAL DIKE SECTION NO. 4 TO 20 FEET

NOTE: This is the typical dike section for 4A and 4D corresponding to the 20 ft. dike elevation alternative for Options 1 through 5.

15 0 15 30
SCALE : 1" = 30'

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

GBA
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NO.	DATE	REVISION	BY

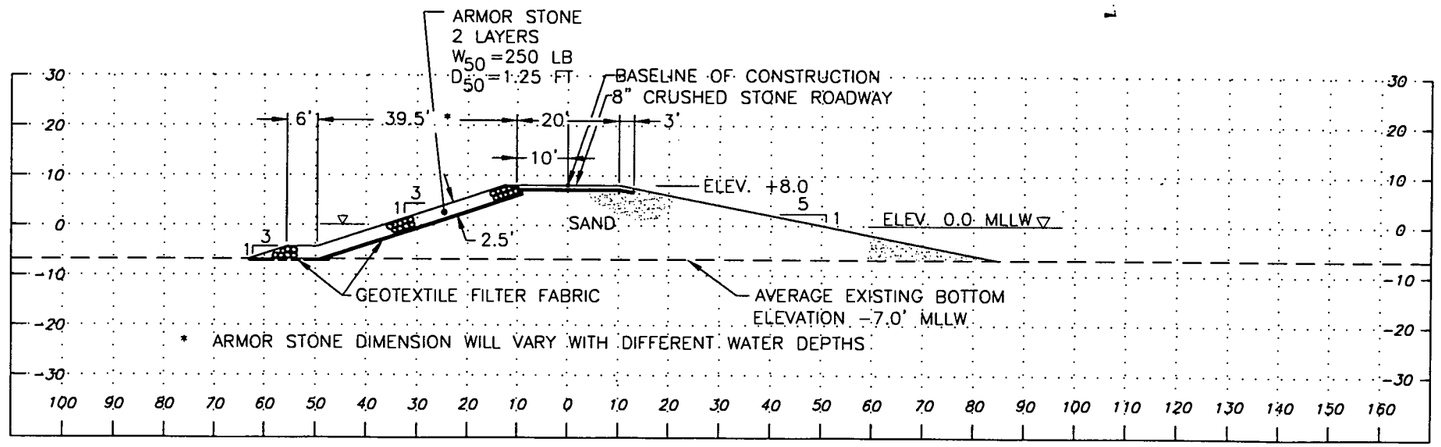
MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

TYPICAL DIKE SECTION
NO.4

SURVEYED BY: _____
DESIGNED BY: W.J.D. TRACED BY: _____
DRAWN BY: T. B. BURWELL CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 30'	02-07-30	C - 10



TYPICAL DIKE SECTION NO. 5 TO 8 FEET

15 0 15 30
SCALE : 1" = 30'

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

GBA
ENGINEERS ★ SURVEYORS

NO.	DATE	REVISION	BY

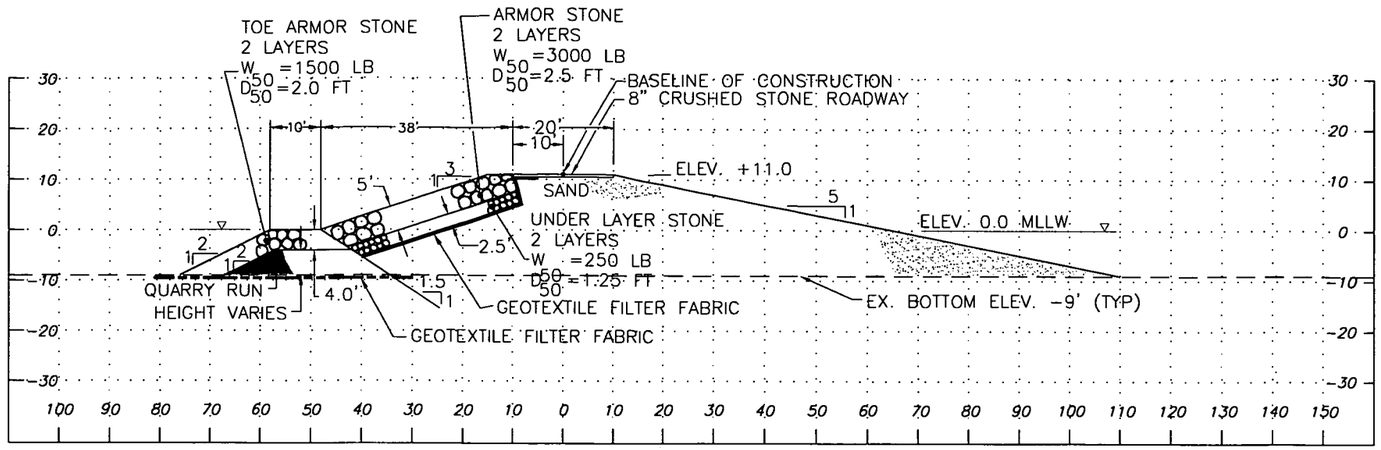
MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

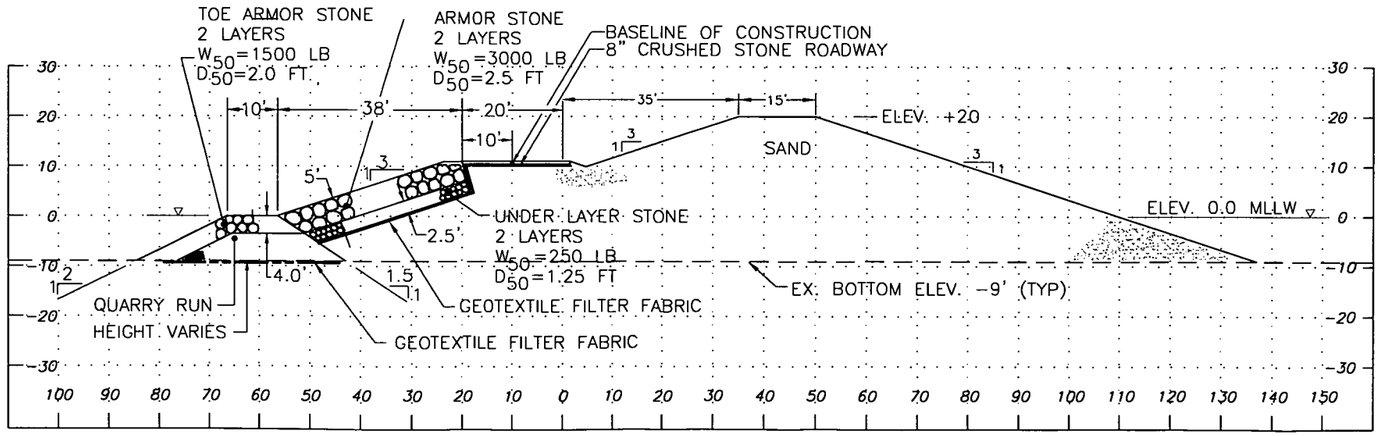
TYPICAL DIKE SECTION NO. 5

SURVEYED BY: _____
DESIGNED BY: W.J.D. TRACED BY: _____
DRAWN BY: T. B. BURWELL CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1"= 30'	02-07-30	C - 11



TYPICAL DIKE SECTION NO. 6 TO 11 FEET



TYPICAL DIKE SECTION NO. 6 TO 20 FEET

15 0 15 30
SCALE : 1" = 30'

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

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NO.	DATE	REVISION	BY

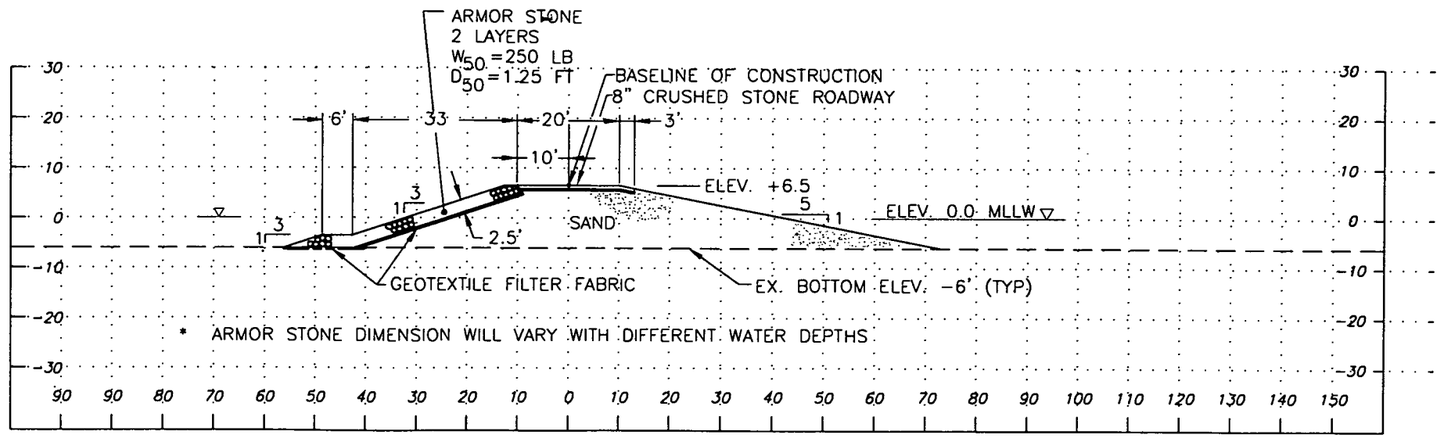
MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

TYPICAL DIKE SECTION NO. 6

SURVEYED BY: .
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: .
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1"= 30'
CONTRACT NO. 02-07-30
FIGURE NO. C - 12



TYPICAL DIKE SECTION NO. 7 TO 6.5 FEET

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

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15 0 15 30
SCALE : 1" = 30'

NO.	DATE	REVISION	BY

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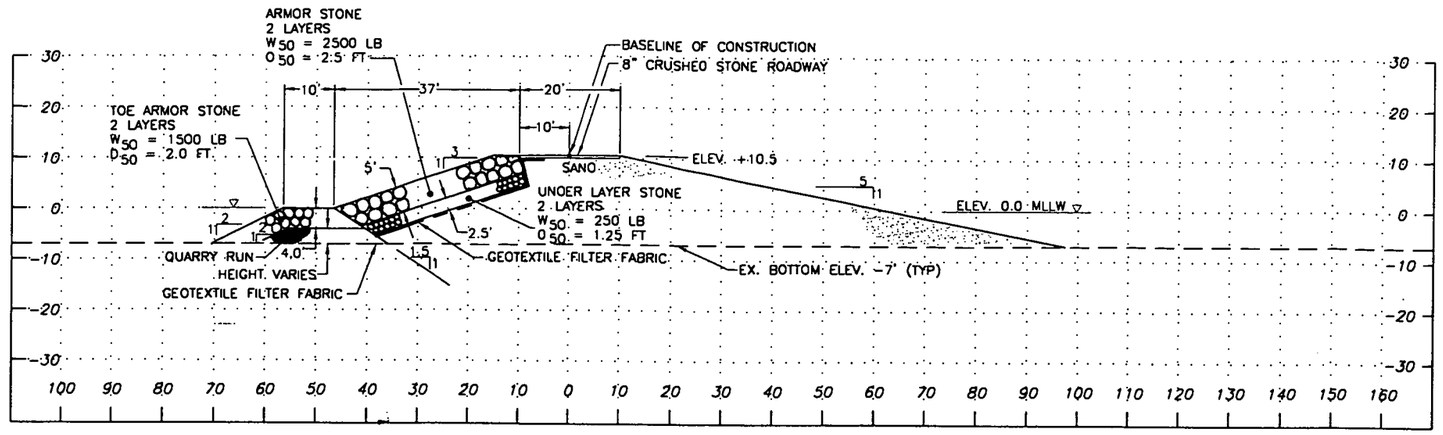
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

TYPICAL DIKE SECTION NO. 7

SURVEYED BY: —
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: —
CHECKED BY: D. C. URSO

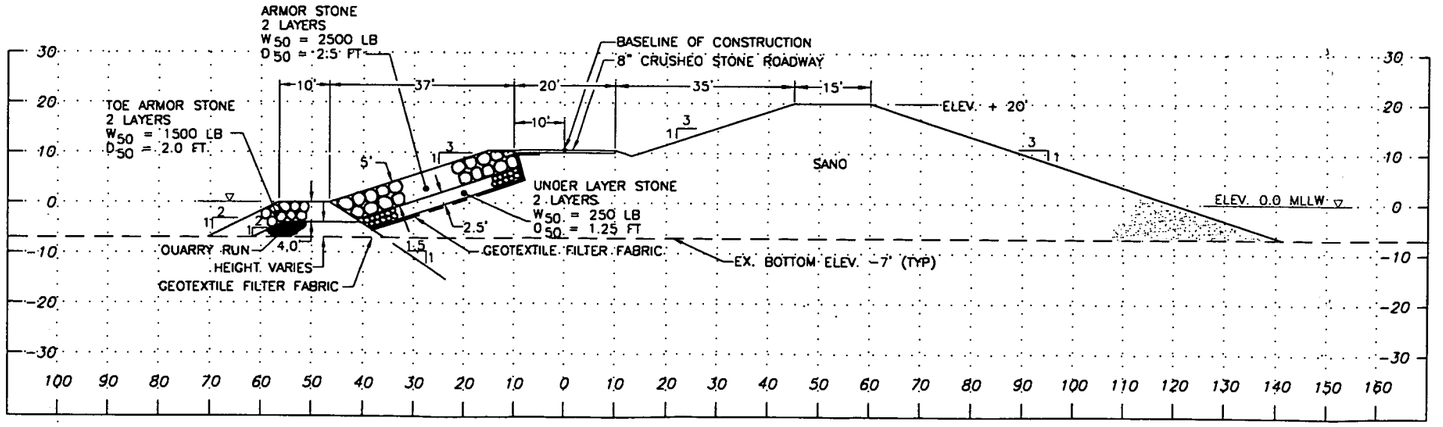
DATE: JAN. 2003
SCALE: 1" = 30'
CONTRACT NO. 02-07-30
FIGURE NO. C - 13



TYPICAL DIKE SECTION NO. 8 TO 10.5 FEET

NOTE: 1. This is the typical dike section for 8A corresponding to the 10 and 20 ft. dike elevation alternotives for Option 6.

2. This is the typical dike section for 8B corresponding to the 10 ft. dike elevation alternative for Option 6



TYPICAL DIKE SECTION NO. 8 TO 20 FEET

NOTE: This is the typical dike section for 8B corresponding to the 20 ft. dike elevotion alternative for Option 6

15 0 15 30
SCALE : 1" = 30'

LEGEND

- EXISTING GROUND
- PROPOSED DIKE
- GEOTEXTILE

GBA
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NO.	DATE	REVISION	BY

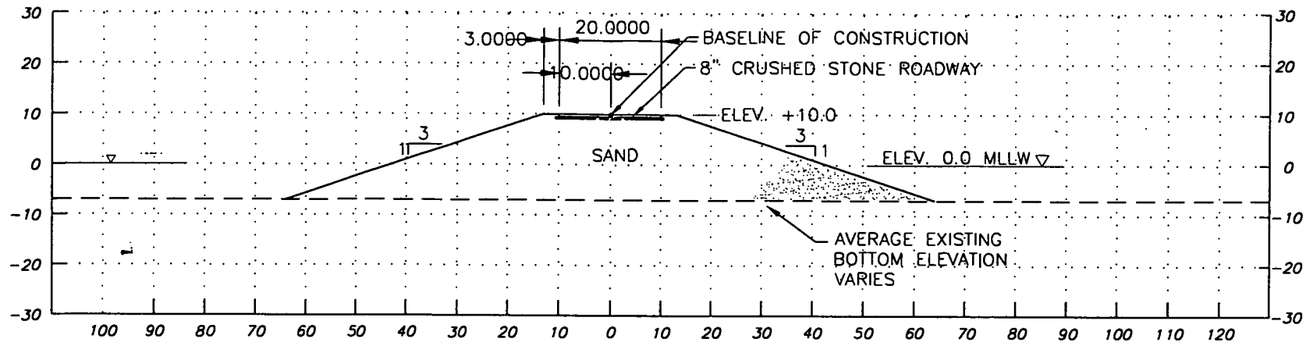
MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

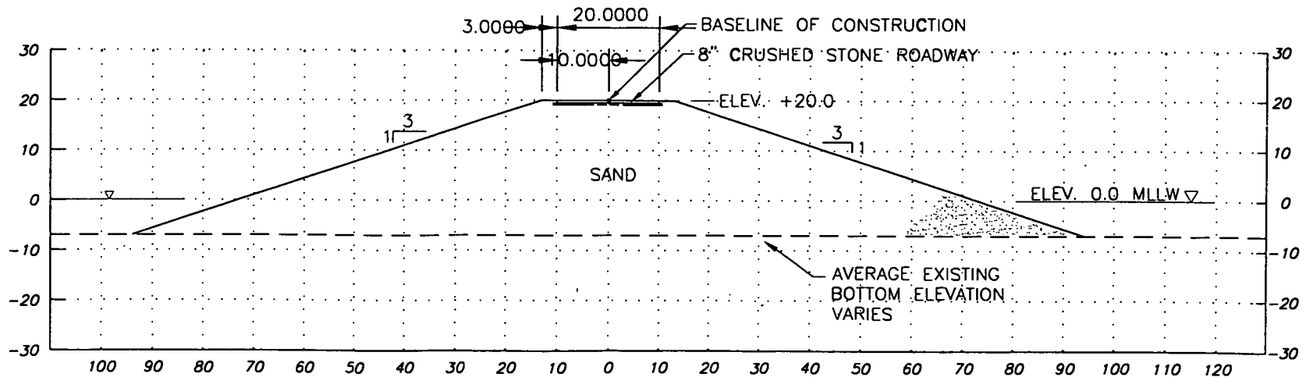
TYPICAL DIKE SECTION
NO. 8

SURVEYED BY: _____
DESIGNED BY: W.J.D. TRACED BY: _____
DRAWN BY: T. B. BURWELL CHECKED BY: D. C. URSO

DATE: JAN. 2003	CONTRACT NO.	FIGURE NO.
SCALE: 1" = 30'	02-07-30	C - 14



TYPICAL LONGITUDINAL DIKE SECTION TO 10 FEET



TYPICAL LONGITUDINAL DIKE SECTION TO 20 FEET

15 0 15 30
SCALE : 1" = 30'

LEGEND

EXISTING GROUND

PROPOSED DIKE

GEOTEXTILE

GBA
ENGINEERS ★ SURVEYORS

NO.	DATE	REVISION	BY

MARYLAND ENVIRONMENTAL SERVICE
AND
MARYLAND PORT ADMINISTRATION

POPLAR ISLAND HABITAT RESTORATION

TYPICAL DIKE SECTION NO. 9

SURVEYED BY: _____
DESIGNED BY: W.J.D.
DRAWN BY: T. B. BURWELL
TRACED BY: _____
CHECKED BY: D. C. URSO

DATE: JAN. 2003
SCALE: 1" = 30'

CONTRACT NO. 02-07-30

FIGURE NO. C - 15

APPENDIX D

PRELIMINARY SITE CHARACTERISTICS & MATERIAL QUANTITIES

Poplar Island Modification Habitat Development

Table D-1 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 1

	Alignment 1 (20ft)			Alignment 1 (10ft)		
SITE CHARACTERISTICS						
Upland Baseline Area -	377	Acres		378	Acres	
Upland Baseline Perimeter -	21,888	LF		21,888	LF	
Upland Site Volume below sea level -	4.58	MCY		4.58	MCY	
Upland Site Volume above sea level -	10.93	MCY		4.86	MCY	
Upland Volume -	15.52	MCY		9.43	MCY	
Upland Site Capacity -	22.93	MCY		13.57	MCY	
Wetland Baseline Area -	377	Acres		377	Acres	
Wetland Baseline Perimeter -	12,781	LF		12,781	LF	
Wetland Site Volume below sea level -	5.47	MCY		5.47	MCY	
Wetland Site Volume above sea level -	0.91	MCY		0.91	MCY	
Wetland Volume -	6.38	MCY		6.38	MCY	
Wetland Site Capacity -	8.69	MCY		8.69	MCY	
Total Baseline Area -	753	Acres		753	Acres	
Total Baseline Perimeter -	24,467	LF		24,487	LF	
Total Volume -	21.89	MCY		15.81	MCY	
Total Site Capacity -	31.62	MCY		22.27	MCY	
QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			317,000			317,000
Upland Perimeter Dike Section 1 To 20' -	8,148	129.9	1,058,000			
Upland Perimeter Dike Section 1 To 13.5' -				8,146	89.8	731,000
Upland Perimeter Dike Section 2 To 20' -	8,315	108.1	899,000			
Upland Perimeter Dike Section 2 To 12.5' -				8,315	81.9	514,000
Wetland Perimeter Dike Section 3A To 10.5' -	3,575	33.5	120,000	3,575	33.5	120,000
Upland Perimeter Dike Section 3B To 20' -	336	102.3	34,000			
Upland Perimeter Dike Section 3B To 10.5' -				336	47.8	18,000
Wetland Perimeter Dike Section 4 To 9.5' -	4,115	30.0	123,000	4,115	30.0	123,000
Longitudinal Dike Section 11 to 20' -	2,093	106.7	223,000			
Longitudinal Dike Section 11 to 10' -				2,093	47.9	100,000
Longitudinal Dike Section 13 To 20' -	5,091	124.8	635,000			
Longitudinal Dike Section 13 To 10' -				5,091	55.3	281,000
Total -	31,671		3,409,000	31,671		2,202,000
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 1 -	8,146	17.8	145,000	8,146	17.8	145,000
Under Layer Stone Dike Section 1 -	8,146	7.1	58,000	8,146	7.1	58,000
Toe Armor Dike Section 1 -	8,146	8.4	68,000	8,146	8.4	68,000
Quarry Run Dike Section 1 -	8,146	11.7	95,000	8,146	11.7	95,000
Armor Stone Dike Section 2 -	8,315	14.1	117,000	8,315	14.1	117,000
Under Layer Stone Dike Section 2 -	8,315	6.6	55,000	8,315	6.6	55,000
Toe Armor Dike Section 2 -	8,315	5.8	48,000	8,315	5.8	48,000
Quarry Run Dike Section 2 -	8,315	5.2	44,000	8,315	5.2	44,000
Armor Stone Dike Section 3A & 3B -	3,911	9.8	38,000	3,911	9.8	38,000
Under Layer Stone Dike Section 3A & 3B -	3,911	4.8	18,000	3,911	4.8	18,000
Toe Armor Dike Section 3A -	3,575	3.4	12,000	3,575	3.4	12,000
Quarry Run Dike Section 3A -	3,575	1.8	6,000	3,575	1.8	6,000
Toe Armor Dike Section 3B -	336	4.7	2,000	336	4.7	2,000
Quarry Run Dike Section 3B -	336	4.2	1,000	336	4.2	1,000
Armor Stone Dike Section 4 -	4,115	7.9	33,000	4,115	7.9	33,000
Under Layer Stone Dike Section 4 -	4,115	4.1	17,000	4,115	4.1	17,000
Toe Armor Dike Section 4 -	4,115	3.4	14,000	4,115	3.4	14,000
Quarry Run Dike Section 4 -	4,115	1.4	8,000	4,115	1.4	8,000
Total -	24,487		777,000	24,487		777,000
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	31,671	1.1	35,000	31,871	1.1	35,000
Perimeter Geotextile -	24,467	14.5	355,000	24,467	14.5	355,000
Roadway Geotextile -	31,871	2.8	82,000	31,871	2.8	82,000

Poplar Island Modification Habitat Development

Table D-2 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 2

	Alignment 2 (20ft)			Alignment 2 (10ft)		
SITE CHARACTERISTICS						
Upland Baseline Area -	377	Acres		377	Acres	
Upland Baseline Perimeter -	18,128	LF		18,126	LF	
Upland Site Volume below sea level -	2.96	MCY		2.96	MCY	
Upland Site Volume above sea level -	10.95	MCY		4.87	MCY	
Upland Volume -	13.91	MCY		7.83	MCY	
Upland Site Capacity -	20.80	MCY		11.44	MCY	
Wetland Baseline Area -	377	Acres		377	Acres	
Wetland Baseline Perimeter -	15,280	LF		15,280	LF	
Wetland Site Volume below sea level -	8.08	MCY		6.08	MCY	
Wetland Site Volume above sea level -	0.91	MCY		0.91	MCY	
Wetland Volume -	8.99	MCY		6.99	MCY	
Wetland Site Capacity -	9.50	MCY		9.50	MCY	
Total Baseline Area -	754	Acres		754	Acres	
Total Baseline Perimeter -	33,408	LF		33,408	LF	
Total Volume -	20.90	MCY		14.82	MCY	
Total Site Capacity -	30.30	MCY		20.94	MCY	
QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			334,000			334,000
Upland Perimeter Dike Section 2A To 20' -	10,408	108.1	1,125,000			
Upland Perimeter Dike Section 2A To 12.5' -				10,408	61.9	644,000
Wetland Perimeter Dike Section 2B To 20' -	7,080	124.9	884,000			
Wetland Perimeter Dike Section 2B To 12.5' -				7,080	78.4	541,000
Upland Perimeter Dike Section 2C To 20' -	3,511	114.7	403,000			
Upland Perimeter Dike Section 2C To 12.5' -				3,511	67.6	237,000
Upland Perimeter Dike Section 3 To 20' -	2,765	86.1	238,000			
Upland Perimeter Dike Section 3 To 10.5' -				2,765	35.7	99,000
Upland Perimeter Dike Section 4A To 20' -	1,442	83.3	120,000			
Upland Perimeter Dike Section 4A To 9.5' -				1,442	30.0	43,000
Wetland Perimeter Dike Section 4B To 9.5' -	3,711	47.9	178,000	3,711	47.9	178,000
Wetland Perimeter Dike Section 5 To 8' -	4,489	44.0	196,000	4,489	44.0	198,000
Total -	**33,406**		**3,480,000**	**33,406**		**2,274,000**
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 2A, 2B, & 2C -	20,998	14.1	295,000	20,998	14.1	295,000
Under Layer Stone Dike Section 2A, 2B, & 2C -	20,998	6.6	138,000	20,998	6.6	138,000
Toe Armor Dike Section 2A -	10,408	5.8	60,000	10,408	5.6	80,000
Quarry Run Dike Section 2A -	10,408	5.2	55,000	10,408	5.2	55,000
Toe Armor Dike Section 2B -	7,080	7.1	50,000	7,080	7.1	50,000
Quarry Run Dike Section 2B -	7,080	10.2	72,000	7,080	10.2	72,000
Toe Armor Dike Section 2C -	3,511	6.3	22,000	3,511	8.3	22,000
Quarry Run Dike Section 2C -	3,511	7.0	25,000	3,511	7.0	25,000
Armor Stone Dike Section 3 -	2,765	9.6	27,000	2,765	9.8	27,000
Under Layer Stone Dike Section 3 -	2,765	4.8	13,000	2,765	4.8	13,000
Toe Armor Dike Section 3 -	2,765	3.6	10,000	2,765	3.6	10,000
Quarry Run Dike Section 3 -	2,765	1.8	5,000	2,765	1.8	5,000
Armor Stone Dike Section 4A & 4B -	5,153	7.9	41,000	5,153	7.9	41,000
Under Layer Stone Dike Section 4A & 4B -	5,153	4.1	21,000	5,153	4.1	21,000
Toe Armor Dike Section 4A -	1,442	3.4	5,000	1,442	3.4	5,000
Quarry Run Dike Section 4A -	1,442	1.4	2,000	1,442	1.4	2,000
Toe Armor Dike Section 4B -	3,711	5.2	19,000	3,711	5.2	19,000
Quarry Run Dike Section 4B -	3,711	5.9	22,000	3,711	5.9	22,000
Armor Stone Dike Section 5 -	4,489	7.1	32,000	4,489	7.1	32,000
Total -	33,406		914,000	33,406		914,000
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	33,406	1.1	36,000	33,406	1.1	36,000
Perimeter Geotextile -	33,406	14.5	484,000	33,406	14.5	484,000
Roadway Geotextile -	33,406	2.6	87,000	33,406	2.6	87,000

Poplar Island Modification Habitat Development

Table D-3 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 3

	Alignment 3 (20ft)			Alignment 3 (10ft)		
SITE CHARACTERISTICS						
Upland Baseline Area -	377	Acres		377	Acres	
Upland Baseline Perimeter -	29,209	LF		29,209	LF	
Upland Site Volume below sea level -	4.05	MCY		4.05	MCY	
Upland Site Volume above sea level -	10.94	MCY		4.86	MCY	
Upland Volume -	14.99	MCY		9.91	MCY	
Upland Site Capacity -	22.23	MCY		12.86	MCY	
Wetland Baseline Area -	377	Acres		377	Acres	
Wetland Baseline Perimeter -	19,551	LF		19,551	LF	
Wetland Site Volume below sea level -	4.00	MCY		4.00	MCY	
Wetland Site Volume above sea level -	0.91	MCY		0.91	MCY	
Wetland Volume -	4.91	MCY		4.91	MCY	
Wetland Site Capacity -	6.74	MCY		6.74	MCY	
Total Baseline Area -	754	Acres		754	Acres	
Total Baseline Perimeter -	32,580	LF		32,580	LF	
Total Volume -	19.90	MCY		13.82	MCY	
Total Site Capacity -	28.97	MCY		19.91	MCY	
QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			407,000			407,000
Upland Perimeter Dike Section 2A To 20' -	14,959	106.1	1,917,000			
Upland Perimeter Dike Section 2A To 12.5' -				14,959	61.9	925,000
Wetland Perimeter Dike Section 2B To 12.5' -	1,609	91.9	100,000	1,609	61.9	100,000
Upland Perimeter Dike Section 2C To 20' -	5,636	121.5	685,000			
Upland Perimeter Dike Section 2C To 12.5' -				5,636	73.4	414,000
Wetland Perimeter Dike Section 3A To 10.5' -	1,926	38.0	73,000	1,926	38.0	73,000
Upland Perimeter Dike Section 3B To 20' -	523	95.9	50,000			
Upland Perimeter Dike Section 3B To 10.5' -				523	42.7	22,000
Wetland Perimeter Dike Section 4 To 9.5' -	3,771	32.1	121,000	3,771	32.1	121,000
Wetland Perimeter Dike Section 5 To 12.5' -	4,155	44.0	183,000	4,155	44.0	183,000
Longitudinal Dike Section 9 To 20' -	4,346	90.0	391,000			
Longitudinal Dike Section 9 To 10' -				4,346	38.7	160,000
Longitudinal Dike Section 12 To 20' -	3,744	110.1	412,000			
Longitudinal Dike Section 12 To 10' -				3,744	50.3	188,000
Total -	**40,670**		**4,039,000**	**40,670**		**2,593,000**
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 2 -	22,205	14.1	312,000	22,205	14.1	312,000
Under Layer Stone Dike Section 2 -	22,205	9.9	146,000	22,205	6.9	146,000
Toe Armor Dike Section 2A -	14,959	5.9	86,000	14,959	5.9	86,000
Quarry Run Dike Section 2A -	14,959	5.2	78,000	14,959	5.2	78,000
Toe Armor Dike Section 2B -	1,609	5.9	9,000	1,609	5.9	9,000
Quarry Run Dike Section 2B -	1,609	5.2	9,000	1,609	5.2	9,000
Toe Armor Dike Section 2C -	5,636	9.9	38,000	5,636	6.9	38,000
Quarry Run Dike Section 2C -	5,636	9.1	51,000	5,636	9.1	51,000
Armor Stone Dike Section 3A & 3B -	2,449	9.9	24,000	2,449	9.8	24,000
Under Layer Stone Dike Section 3A & 3B -	2,449	4.9	11,000	2,449	4.9	11,000
Toe Armor Dike Section 3A -	1,926	3.9	7,000	1,926	3.9	7,000
Quarry Run Dike Section 3A -	1,926	1.9	3,000	1,926	1.6	3,000
Toe Armor Dike Section 3B -	523	4.3	2,000	523	4.3	2,000
Quarry Run Dike Section 3B -	523	2.7	1,000	523	2.7	1,000
Armor Stone Dike Section 4 -	3,771	7.9	30,000	3,771	7.9	30,000
Under Layer Stone Dike Section 4 -	3,771	4.1	15,000	3,771	4.1	15,000
Toe Armor Dike Section 4 -	3,771	3.9	14,000	3,771	3.9	14,000
Quarry Run Dike Section 4 -	3,771	1.3	5,000	3,771	1.3	5,000
Armor Stone Dike Section 5 -	4,155	7.1	30,000	4,155	7.1	30,000
Total -	**32,580**		**870,000**	**32,580**		**870,000**
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	40,670	1.1	44,000	40,670	1.1	44,000
Perimeter Geotextile -	32,580	14.5	472,000	32,580	14.5	472,000
Roadway Geotextile -	40,670	2.6	106,000	40,970	2.6	106,000

Poplar Island Modification Habitat Development

Table D-4 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 4

	Alignment 4 (20ft)			Alignment 4 (10ft)		
SITE CHARACTERISTICS						
Upland Baseline Area -	564	Acres		564	Acres	
Upland Baseline Perimeter -	35,376	LF		35,376	LF	
Upland Site Volume below sea level -	7.38	MCY		7.37	MCY	
Upland Site Volume above sea level -	18.39	MCY		7.28	MCY	
Upland Volume -	23.77	MCY		14.65	MCY	
Upland Site Capacity -	35.05	MCY		21.03	MCY	
Wetland Baseline Area -	565	Acres		565	Acres	
Wetland Baseline Perimeter -	24,850	LF		24,850	LF	
Wetland Site Volume below sea level -	8.19	MCY		8.19	MCY	
Wetland Site Volume above sea level -	1.37	MCY		1.37	MCY	
Wetland Volume -	9.55	MCY		9.55	MCY	
Wetland Site Capacity -	13.02	MCY		13.02	MCY	
Total Baseline Area -	1,129	Acres		1,129	Acres	
Total Baseline Perimeter -	39,766	LF		39,766	LF	
Total Volume -	33.32	MCY		24.20	MCY	
Total Site Capacity -	46.07	MCY		34.05	MCY	
QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			521,000			521,000
Upland Perimeter Dike Section 1 To 20' -	8,146	129.9	1,058,000			
Upland Perimeter Dike Section 1 To 13.5' -				8,146	89.8	731,000
Upland Perimeter Dike Section 2A To 20' -	8,315	108.1	899,000			
Upland Perimeter Dike Section 2A To 12.5' -				8,315	61.9	514,000
Upland Perimeter Dike Section 2A To 20' -	7,129	124.8	890,000			
Upland Perimeter Dike Section 2A To 12.5' -				7,129	76.4	545,000
Wetland Perimeter Dike Section 3A To 10.5' -	3,575	38.0	136,000	3,575	38.0	136,000
Upland Perimeter Dike Section 3B To 20' -	336	102.3	34,000			
Upland Perimeter Dike Section 3B To 10.5' -				336	47.8	16,000
Wetland Perimeter Dike Section 4 To 9.5' -	4,115	30.0	123,000	4,115	30.0	123,000
Wetland Perimeter Dike Section 4C To 9.5' -	2,491	47.9	119,000	2,491	47.8	119,000
Upland Perimeter Dike Section 4D To 20' -	1,220	115.8	141,000			
Upland Perimeter Dike Section 4D To 9.5' -				1,220	52.7	64,000
Wetland Perimeter Dike Section 5 To 8' -	4,439	44.0	195,000	4,439	44.0	195,000
Longitudinal Dike Section 11 To 20' -	2,093	113.7	238,000			
Longitudinal Dike Section 11 To 10' -				2,093	52.8	110,000
Longitudinal Dike Section 13 To 20' -	10,230	124.8	1,277,000			
Longitudinal Dike Section 13 To 10' -				10,230	55.3	565,000
Total -	**52,089**		**5,631,000**	**52,089**		**3,639,000**
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 1 -	8,146	17.8	145,000	8,146	17.8	145,000
Under Layer Stone Dike Section 1 -	8,146	7.1	58,000	8,146	7.1	58,000
Toe Armor Dike Section 1 -	8,146	8.4	68,000	8,146	8.4	68,000
Quarry Run Dike Section 1 -	8,146	11.7	95,000	8,146	11.7	95,000
Armor Stone Dike Section 2A & 2A -	15,444	14.1	217,000	15,444	14.1	217,000
Under Layer Stone Dike Section 2A & 2A -	15,444	8.8	101,000	15,444	8.8	101,000
Toe Armor Dike Section 2A -	8,315	5.8	46,000	8,315	5.8	46,000
Quarry Run Dike Section 2A -	8,315	5.2	44,000	8,315	5.2	44,000
Toe Armor Dike Section 2A -	7,129	7.1	50,000	7,129	7.1	50,000
Quarry Run Dike Section 2A -	7,129	10.2	73,000	7,129	10.2	73,000
Armor Stone Dike Section 3A & 3B -	3,911	8.8	38,000	3,811	9.8	38,000
Under Layer Stone Dike Section 3A & 3B -	3,911	4.8	18,000	3,911	4.8	18,000
Toe Armor Dike Section 3A -	3,575	3.8	14,000	3,575	3.8	14,000
Quarry Run Dike Section 3A -	3,575	1.8	8,000	3,575	1.8	8,000
Toe Armor Dike Section 3B -	336	4.7	2,000	336	4.7	2,000
Quarry Run Dike Section 3B -	336	4.2	1,000	336	4.2	1,000
Armor Stone Dike Section 4, 4C, & 4D -	7,827	7.9	62,000	7,827	7.8	62,000
Under Layer Stone Dike Section 4, 4C, & 4D -	7,827	4.1	32,000	7,827	4.1	32,000
Toe Armor Dike Section 4 -	4,115	3.4	14,000	4,115	3.4	14,000
Quarry Run Dike Section 4 -	4,115	1.4	6,000	4,115	1.4	6,000
Toe Armor Dike Section 4C -	2,491	5.2	13,000	2,491	5.2	13,000
Quarry Run Dike Section 4C -	2,491	5.9	15,000	2,491	5.9	15,000
Toe Armor Dike Section 4D -	1,220	5.7	7,000	1,220	5.7	7,000
Quarry Run Dike Section 4D -	1,220	7.8	9,000	1,220	7.8	9,000
Armor Stone Dike Section 5 -	4,439	7.1	32,000	4,439	7.1	32,000
Total -	**39,766**		**1,166,000**	**39,766**		**1,166,000**
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	52,089	1.1	57,000	52,089	1.1	57,000
Perimeter Geotextile -	39,766	14.5	577,000	39,766	14.5	577,000
Roadway Geotextile -	52,089	2.8	135,000	52,089	2.8	135,000

Poplar Island Modification Habitat Development

Table D-5 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 5

	Alignment 5 (20ft)			Alignment 5 (10ft)		
SITE CHARACTERISTICS						
Upland Baseline Area -	374	Acres		374	Acres	
Upland Baseline Perimeter -	26,112	LF		26,112	LF	
Upland Site Volume below sea level -	5.09	MCY		5.13	MCY	
Upland Site Volume above sea level -	10.86	MCY		4.82	MCY	
Upland Volume -	15.95	MCY		9.95	MCY	
Upland Site Capacity -	23.50	MCY		14.25	MCY	
Wetland Baseline Area -	375	Acres		375	Acres	
Wetland Baseline Perimeter -	22,802	LF		22,802	LF	
Wetland Site Volume below sea level -	3.99	MCY		3.99	MCY	
Wetland Site Volume above sea level -	0.91	MCY		0.91	MCY	
Wetland Volume -	4.90	MCY		4.90	MCY	
Wetland Site Capacity -	6.72	MCY		6.72	MCY	
Total Baseline Area -	749	Acres		749	Acres	
Total Baseline Perimeter -	28,560	LF		28,560	LF	
Total Volume -	20.85	MCY		14.85	MCY	
Total Site Capacity -	30.22	MCY		20.97	MCY	
QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			387,000			387,000
Upland Perimeter Dike Section 2A To 20' -	6,479	124.9	809,000			
Upland Perimeter Dike Section 2A To 12.5' -				6,479	78.4	495,000
Upland Perimeter Dike Section 2C To 20' -	8,901	118.1	815,000			
Upland Perimeter Dike Section 2C To 12.5' -				8,901	70.5	486,000
Wetland Perimeter Dike Section 3A To 10.5' -	1,411	40.3	57,000	1,411	40.3	57,000
Upland Perimeter Dike Section 3B To 20' -	678	92.5	81,000			
Upland Perimeter Dike Section 3B To 10.5' -				878	40.3	35,000
Upland Perimeter Dike Section 3C To 20' -	1,677	115.5	194,000			
Upland Perimeter Dike Section 3C To 10.5' -				1,677	57.7	97,000
Wetland Perimeter Dike Section 3D To 10.5' -	1,135	50.1	57,000	1,135	50.1	57,000
Wetland Perimeter Dike Section 4 To 9.5' -	4,913	46.5	228,000	4,913	46.5	228,000
Wetland Perimeter Dike Section 5 To 8' -	5,166	44.0	227,000	5,166	44.0	227,000
Longitudinal Dike Section 10 To 20' -	10,177	86.8	883,000			
Longitudinal Dike Section 10 To 10' -				10,177	38.9	396,000
Total -	**38,737**		**2,855,000**	**38,737**		**2,069,000**
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 2A & 2C -	13,379	14.1	188,000	13,379	14.1	188,000
Under Layer Stone Dike Section 2A & 2C -	13,379	8.8	88,000	13,379	8.8	88,000
Toe Armor Dike Section 2A -	8,479	7.1	46,000	8,479	7.1	46,000
Quarry Run Dike Section 2A -	8,479	10.2	66,000	8,479	10.2	88,000
Toe Armor Dike Section 2C -	8,901	8.8	45,000	8,901	8.8	45,000
Quarry Run Dike Section 2C -	8,901	8.1	56,000	8,901	8.1	56,000
Armor Stone Dike Section 3A, 3B, 3C & 3D -	5,102	9.8	50,000	5,102	9.8	50,000
Under Layer Stone Dike Section 3A, 3B, 3C & 3D -	5,102	4.8	23,000	5,102	4.8	23,000
Toe Armor Dike Section 3A & 3B -	2,289	4.1	9,000	2,289	4.1	9,000
Quarry Run Dike Section 3A & 3B -	2,289	2.1	5,000	2,289	2.1	5,000
Toe Armor Dike Section 3C -	1,877	5.7	10,000	1,677	5.7	10,000
Quarry Run Dike Section 3C -	1,677	7.8	13,000	1,677	7.8	13,000
Toe Armor Dike Section 3D -	1,135	4.9	8,000	1,135	4.9	8,000
Quarry Run Dike Section 3D -	1,135	5.0	8,000	1,135	5.0	6,000
Armor Stone Dike Section 4 -	4,913	7.9	39,000	4,913	7.9	39,000
Under Layer Stone Dike Section 4 -	4,913	4.1	20,000	4,913	4.1	20,000
Toe Armor Dike Section 4 -	4,913	5.1	25,000	4,913	5.1	25,000
Quarry Run Dike Section 4 -	4,913	5.4	26,000	4,913	5.4	26,000
Armor Stone Dike Section 5 -	5,166	7.1	37,000	5,166	7.1	37,000
Total -	**28,560**		**758,000**	**28,560**		**758,000**
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	38,737	1.1	42,000	38,737	1.1	42,000
Perimeter Geotextile -	28,560	14.5	414,000	28,560	14.5	414,000
Roadway Geotextile -	38,737	2.6	101,000	38,737	2.8	101,000

Poplar Island Modification Habitat Development

Table D-6 Preliminary Site Characteristics and Quantities for Concept 5 Alignment 6

SITE CHARACTERISTICS	Alignment 6 (20ft)		Alignment 6 (10ft)	
Upland Baseline Area -	157	Acres	157	Acres
Upland Baseline Perimeter -	9996	LF	9996	LF
Upland Site Volume below sea level -	1.52	MCY	1.52	MCY
Upland Site Volume above sea level -	4.55	MCY	2.02	MCY
Upland Volume -	6.06	MCY	3.54	MCY
Upland Site Capacity -	9.02	MCY	5.13	MCY
Wetland Baseline Area -	157	Acres	157	Acres
Wetland Baseline Perimeter -	9758	LF	9758	LF
Wetland Site Volume below sea level -	1.26	MCY	1.26	MCY
Wetland Site Volume above sea level -	0.38	MCY	0.38	MCY
Wetland Volume -	1.64	MCY	1.64	MCY
Wetland Site Capacity -	2.27	MCY	2.27	MCY
Total Baseline Area -	313	Acres	313	Acres
Total Baseline Perimeter -	12,564	LF	12,564	LF
Total Volume -	7.71	MCY	5.16	MCY
Total Site Capacity -	11.26	MCY	7.40	MCY

QUANTITIES	LF	CY/LF	CY	LF	CY/LF	CY
Hydraulic Fill Material						
Unsuitable Backfill -			66,000			66,000
Upland Perimeter Dike Section 6 To 20' -	3,537	115.9	410,000			
Upland Perimeter Dike Section 6 To 11' -				3,537	60.6	214,000
Wetland Perimeter Dike Section 7 To 6.5' -	3,094	21.6	67,000	3,094	21.6	67,000
Wetland Perimeter Dike Section 8A To 10.5' -	3,069	38.0	117,000	3,069	38.0	117,000
Upland Perimeter Dike Section 8B To 20' -	2,864	99.0	284,000			
Upland Perimeter Dike Section 8B To 10.5' -				2,864	47.2	135,000
Longitudinal Dike Section 9 To 20' -	3,595	99.6	359,000			
Longitudinal Dike Section 9 To 10' -				3,595	38.9	140,000
Total -	**16,159**		**1,303,000**	**16,159**		**739,000**
	LF	Tons/LF	Tons	LF	Tons/LF	Tons
Perimeter Dike Section Stone Work						
Armor Stone Dike Section 6 -	3,537	9.9	35,000	3,537	9.9	35,000
Under Layer Stone Dike Section 6 -	3,537	4.5	16,000	3,537	4.5	16,000
Toe Armor Dike Section 6 -	3,537	4.7	17,000	3,537	4.7	17,000
Quarry Run Dike Section 6 -	3,537	4.2	15,000	3,537	4.2	15,000
Armor Stone Dike Section 8A & 8B -	5,933	9.6	58,000	5,933	9.6	58,000
Under Layer Stone Dike Section 8A & 8B -	5,933	4.5	27,000	5,933	4.5	27,000
Toe Armor Dike Section 8A & 8B -	5,933	5.0	30,000	5,933	5.0	30,000
Quarry Run Dike Section 8A & 8B -	5,933	2.9	17,000	5,933	2.9	17,000
Armor Stone Dike Section 7 -	3,094	6.1	19,000	3,094	6.1	19,000
Total -	**40,976**		**234,000**	**40,976**		**234,000**
	LF	SY/LF	SY	LF	SY/LF	SY
Miscellaneous						
Road Stone -	16,159	1.1	16,000	16,159	1.1	16,000
Perimeter Geotextile -	12,564	14.5	182,000	12,564	14.5	182,000
Roadway Geotextile -	16,159	2.6	42,000	16,159	2.6	42,000

APPENDIX E

COST TABLES

Poplar Island Modification Habitat Development

Table E-1 Preliminary Construction Costs - 10 ft. Alternative (Costs are Estimated in 2002 Dollars)

	Unit	Unit Rate $	Alignment 1 (10 ft)		Alignment 2 (10 ft)		Alignment 3 (10 ft)		Alignment 4 (10 ft)		Alignment 5 (10 ft)		Alignment 6 (10 ft)	
			Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $
Mobilization/Demobilization & Bonds	L.S.	4,800,000.00	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000
Road Stone	S.Y.	12.00	35,000	420,000	36,000	432,000	44,000	528,000	57,000	684,000	42,000	504,000	18,000	215,000
Geotextile	S.Y.	4.00	437,000	1,748,000	571,000	2,284,000	578,000	2,312,000	712,000	2,848,000	515,000	2,060,000	224,000	896,000
Personnel Pier	L.S.	250,000.00	Job	250,000	Job	250,000	Job	250,000	Job	250,000	Job	250,000	Job	250,000
Unsuitable Foundation Excavation	C.Y.	12.00	317,000	3,804,000	334,000	4,008,000	407,000	4,884,000	521,000	6,252,000	387,000	4,644,000	88,000	792,000
Borrow Method														
Dike Fill Hydraulic Excavation - Mechanical Placement from Onsite	C.Y.	7.00	2,202,000	15,414,000	2,274,000	15,918,000	2,593,000	18,151,000	3,639,000	25,473,000	2,069,000	14,483,000	739,000	5,173,000
Upland Dike Stone Work														
Perimeter Dike Section 1 Armor Stone	Ton	40.00	145,000	5,800,000	N/A	0	N/A	0	145,000	5,800,000	N/A	0	N/A	0
Perimeter Dike Section 2 Armor Stone	Ton	40.00	117,000	4,680,000	295,000	11,800,000	312,000	12,480,000	217,000	8,680,000	188,000	7,520,000	N/A	0
Perimeter Dike Section 3 Armor Stone	Ton	39.00	38,000	1,482,000	27,000	1,053,000	24,000	936,000	38,000	1,482,000	50,000	1,950,000	N/A	0
Perimeter Dike Section 4 Armor Stone	Ton	39.00	33,000	1,287,000	41,000	1,599,000	30,000	1,170,000	52,000	2,418,000	39,000	1,521,000	N/A	0
Perimeter Dike Section 5 Armor Stone	Ton	39.00	N/A	0	32,000	1,248,000	30,000	1,170,000	32,000	1,248,000	37,000	1,443,000	N/A	0
Perimeter Dike Section 7 Armor Stone	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	19,000	
Perimeter Dike Section 8 Armor Stone	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	35,000	1,365,000
Perimeter Dike Section 8 Armor Stone	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	58,000	2,262,000
Perimeter Dike Section 1 Underlayer	Ton	39.00	58,000	2,262,000	N/A	0	N/A	0	58,000	2,262,000	N/A	0	N/A	0
Perimeter Dike Section 2 Underlayer	Ton	39.00	55,000	2,145,000	138,000	5,382,000	146,000	5,694,000	101,000	3,939,000	88,000	3,432,000	N/A	0
Perimeter Dike Section 3 Underlayer	Ton	39.00	18,000	702,000	13,000	507,000	11,000	429,000	18,000	702,000	23,000	897,000	N/A	0
Perimeter Dike Section 4 Underlayer	Ton	39.00	17,000	663,000	21,000	819,000	15,000	585,000	32,000	1,248,000	20,000	780,000	N/A	0
Perimeter Dike Section 8 Underlayer	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	16,000	624,000
Perimeter Dike Section 8 Underlayer	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	27,000	1,053,000
Perimeter Dike Section 1 Toe Armor	Ton	52.00	68,000	3,536,000	N/A	0	N/A	0	68,000	3,536,000	N/A	0	N/A	0
Perimeter Dike Section 2 Toe Armor	Ton	52.00	48,000	2,496,000	132,000	6,864,000	133,000	8,918,000	98,000	5,096,000	91,000	4,732,000	N/A	0
Perimeter Dike Section 3 Toe Armor	Ton	51.00	14,000	714,000	10,000	510,000	9,000	459,000	16,000	816,000	25,000	1,275,000	N/A	0
Perimeter Dike Section 4 Toe Armor	Ton	51.00	14,000	714,000	24,000	1,224,000	14,000	714,000	34,000	1,734,000	25,000	1,275,000	N/A	0
Perimeter Dike Section 8 Toe Armor	Ton	51.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	17,000	867,000
Perimeter Dike Section 8 Toe Armor	Ton	51.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	30,000	1,530,000
Perimeter Dike Section 1 Quarry Run	Ton	38.00	95,000	3,810,000	N/A	0	N/A	0	95,000	3,810,000	N/A	0	N/A	0
Perimeter Dike Section 2 Quarry Run	Ton	38.00	44,000	1,672,000	152,000	5,776,000	137,000	5,206,000	117,000	4,446,000	122,000	4,636,000	N/A	0
Perimeter Dike Section 3 Quarry Run	Ton	38.00	7,000	266,000	5,000	190,000	4,000	152,000	7,000	266,000	24,000	912,000	N/A	0
Perimeter Dike Section 4 Quarry Run	Ton	38.00	6,000	228,000	24,000	912,000	5,000	190,000	30,000	1,140,000	26,000	988,000	N/A	0
Perimeter Dike Section 8 Quarry Run	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	15,000	570,000
Perimeter Dike Section 8 Quarry Run	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	17,000	646,000
Spillways	Each	250,000.00	7	1,750,000	7	1,750,000	10	2,500,000	10	2,500,000	8	2,000,000	3	750,000
A1 TOTAL CONSTRUCTION COST				**50,443,000**		**67,326,000**		**59,528,000**		**91,230,000**		**50,102,000**		**21,794,000**
Unit Cost per CY of Site Capacity				2.71		3.22		3.54		2.88		2.87		2.95

Poplar Island Modification Habitat Development

Table E-2 Preliminary Conatruction Costs - 20 ft. Alternative (Costs are Estimated in 2002 Dollars)

	Unit	Unit	Alignment 1 (20 ft)		Alignment 2 (20 ft)		Alignment 3 (20 ft)		Alignment 4 (20 ft)		Alignment 5 (20 ft)		Alignment 6 (20 ft)	
		Rate $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $	Quantity	Cost $
Mobilization/Demobilization	L.S.	4,800,000.00	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000	Job	4,800,000
Road Stone	S.Y.	12.00	35,000	420,000	36,000	432,000	44,000	528,000	57,000	684,000	42,000	504,000	18,000	216,000
Geotextile	S.Y.	4.00	437,000	1,748,000	571,000	2,284,000	578,000	2,312,000	712,000	2,848,000	515,000	2,060,000	224,000	896,000
Personnel Pier	L.S.	250,000.00	Job	250,000	Job	250,000	Job	250,000	Job	250,000	Job	250,000	Job	250,000
Unsuitable Foundation Excevetion	C.Y.	12.00	317,000	3,804,000	334,000	4,008,000	407,000	4,884,000	521,000	6,252,000	387,000	4,644,000	66,000	792,000
Borrow Method														
Dike Fill Hydraulic Excavation - Mechanical Placement from Onsite	C.Y.	7.00	3,409,000	23,863,000	3,480,000	24,360,000	4,038,000	28,273,000	5,631,000	39,417,000	2,655,000	18,985,000	1,303,000	8,121,000
Upland Dike Stone Work														
Perimeter Dike Section 1 Armor Stone	Ton	40.00	145,000	5,800,000	N/A	0	N/A	0	145,000	5,800,000	N/A	0	N/A	0
Perimeter Dike Section 2 Armor Stone	Ton	40.00	117,000	4,680,000	285,000	11,800,000	312,000	12,480,000	217,000	8,680,000	188,000	7,520,000	N/A	0
Perimeter Dike Section 3 Armor Stone	Ton	38.00	38,000	1,482,000	27,000	1,053,000	24,000	936,000	38,000	1,482,000	50,000	1,950,000	N/A	0
Perimeter Dike Section 4 Armor Stone	Ton	39.00	33,000	1,287,000	41,000	1,599,000	30,000	1,170,000	62,000	2,418,000	39,000	1,521,000	N/A	0
Perimeter Dike Section 5 Armor Stone	Ton	38.00	N/A	0	32,000	1,248,000	30,000	1,170,000	32,000	1,248,000	37,000	1,443,000	N/A	0
Perimeter Dike Section 7 Armor Stone	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	19,000	
Perimeter Dike Section 8 Armor Stone	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	35,000	1,365,000
Perimeter Dike Section 8 Armor Stone	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	58,000	2,262,000
Perimeter Dike Section 1 Underlayer	Ton	38.00	58,000	2,262,000	N/A	0	N/A	0	58,000	2,262,000	N/A	0	N/A	0
Perimeter Dike Section 2 Underlayer	Ton	38.00	55,000	2,145,000	136,000	5,382,000	148,000	5,894,000	101,000	3,939,000	88,000	3,432,000	N/A	0
Perimeter Dike Section 3 Underlayer	Ton	39.00	18,000	702,000	13,000	507,000	11,000	429,000	18,000	702,000	23,000	897,000	N/A	0
Perimeter Dike Section 4 Underlayer	Ton	38.00	17,000	663,000	21,000	818,000	15,000	585,000	32,000	1,248,000	20,000	780,000	N/A	0
Perimeter Dike Section 5 Underlayer	Ton	39.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	16,000	624,000
Perimeter Dike Section 8 Underlayer	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	27,000	1,053,000
Perimeter Dike Section 1 Toe Armor	Ton	52.00	68,000	3,536,000	N/A	0	N/A	0	68,000	3,536,000	N/A	0	N/A	0
Perimeter Dike Section 2 Toe Armor	Ton	52.00	48,000	2,496,000	132,000	6,864,000	133,000	6,916,000	98,000	5,096,000	81,000	4,732,000	N/A	0
Perimeter Dike Section 3 Toe Armor	Ton	51.00	14,000	714,000	10,000	510,000	9,000	458,000	15,000	815,000	25,000	1,275,000	N/A	0
Perimeter Dike Section 4 Toe Armor	Ton	51.00	14,000	714,000	24,000	1,224,000	14,000	714,000	34,000	1,734,000	25,000	1,275,000	N/A	0
Perimeter Dike Section 5 Toe Armor	Ton	51.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	17,000	867,000
Perimeter Dike Section 8 Toe Armor	Ton	51.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	30,000	1,530,000
Perimeter Dike Section 1 Quarry Run	Ton	38.00	85,000	3,810,000	N/A	0	N/A	0	95,000	3,810,000	N/A	0	N/A	0
Perimeter Dike Section 2 Quarry Run	Ton	38.00	44,000	1,672,000	152,000	5,776,000	137,000	5,206,000	117,000	4,446,000	122,000	4,636,000	N/A	0
Perimeter Dike Section 3 Quarry Run	Ton	38.00	7,000	266,000	5,000	190,000	4,000	152,000	7,000	266,000	24,000	912,000	N/A	0
Perimeter Dike Section 4 Quarry Run	Ton	38.00	6,000	228,000	24,000	912,000	5,000	190,000	30,000	1,140,000	26,000	988,000	N/A	0
Perimeter Dike Section 5 Quarry Run	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	15,000	570,000
Perimeter Dike Section 8 Quarry Run	Ton	38.00	N/A	0	N/A	0	N/A	0	N/A	0	N/A	0	17,000	648,000
Spillways	Each	250,000.00	7	1,750,000	7	1,750,000	10	2,500,000	10	2,500,000	8	2,000,000	3	750,000
A1 TOTAL CONSTRUCTION COST				**68,892,000**		**75,768,000**		**78,648,000**		**105,174,000**		**66,804,000**		**25,742,000**
Unit Cost per CY of Site Capacity				2.18		2.50		2.75		2.18		2.17		2.28

Poplar Island Modification Habitat Development

Table E - 3 Project Cost Analysis for Dike Alignment No. 1 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	22.3	752.8	Site Surface Area (Ac)
Site Operating Life (Years)	8.9	24,086	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	7,179	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				60,443,000	From Table E-1, Alignment 1
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	63,443,000	
B. Site Development Costs:					
Dredged Material Management	8.9	Year	884,000	7,868,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	10.9	Year	1,174,000	12,797,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	11.9	Year	675,000	8,033,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	28,698,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	8.9	Year	500,000	4,450,000	
Implementation					
Channels	376	Acre	6,000	2,258,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	753	Acre	4,400	3,312,000	$4,400 per acre
Operation & Maintenance	8.9	Year	500,000	4,450,000	
Total Habitat Development Costs			$	17,470,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	9.0	Year	2,000,000	18,000,000	Mob & Demob for operating life of site
Dredging	22.3	Mcy	2.00	44,600,000	Clamshell Dredging
Transport	22.3	Mcy	2.50	55,750,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	22.3	Mcy	2.25	50,175,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	168,525,000	
Subtotal Project Cost A+B+C+D			$	278,136,000	
Contingency @	15%			41,720,000	
Total Project Cost A+B+C+D			$	319,856,000	
Total Unit Cost per CY Capacity (Rounded)			$	14.00	per cubic yard

Apportioned Costs to Channel Projects:				
Dredging, Transport & Placement	22.3	Mcy	3.80	84,740,000
Contingency @	15%			12,711,000
Total Apportioned Costs to Channel Projects			$	97,451,000

Summary of Costs:	
Total Project Project Cost	319,856,000
Less Apportioned Cost to Channel Projects	(97,451,000)
Total Apportioned Cost to Poplar Island Project	$ 222,405,000

Poplar Island Modification Habitat Development

Table E - 4 Project Cost Analysis for Dike Alignment No. 2 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	20.9	754.0	Site Surface Area (Ac)
Site Operating Life (Years)	8.4	33,309	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	0	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	*Unit*	*Unit Cost $*	*Item Cost $*	*Comments*
A. Initial Construction Costs:					
Initial Construction Costs				87,326,000	From Table E-1, Alignment 2
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	70,326,000	
B. Site Development Costs:					
Dredged Material Management	8.4	Year	885,000	7,434,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	10.4	Year	1,589,000	16,526,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	11.4	Year	675,000	7,695,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	31,655,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	8.4	Year	500,000	4,200,000	
Implementation					
Channels	377	Acre	8,000	2,262,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	754	Acre	4,400	3,318,000	$4,400 per acre
Operation & Maintenance	8.4	Year	500,000	4,200,000	
Total Habitat Development Costs			$	18,980,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	9.0	Year	2,000,000	18,000,000	Mob & Demob for operating life of site
Dredging	20.9	Mcy	2.00	41,800,000	Clamshell Dredging
Transport	20.9	Mcy	2.50	52,250,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	20.9	Mcy	2.25	47,025,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	159,075,000	
Subtotal Project Cost A+B+C+D			$	278,036,000	
Contingency @	15%			41,705,000	
Total Project Cost A+B+C+D			$	319,741,000	
Total Unit Cost per CY Capacity (Rounded)			$	15.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	20.9	Mcy	3.80	79,420,000	
Contingency @	15%			11,913,000	
Total Apportioned Costs to Channel Projects			$	91,333,000	
Summary of Costs:					
Total Project Project Cost				319,741,000	
Less Apportioned Cost to Channel Projects				(91,333,000)	
Total Apportioned Cost to Poplar Island Project			$	228,408,000	

Poplar Island Modification Habitat Development

Table E - 5 Project Cost Analysis for Dike Alignment No. 3 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	19.6	753.5	Site Surface Area (Ac)
Site Operating Life (Years)	7.8	32,361	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	8,090	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	*Unit*	*Unit Cost $*	*Item Cost $*	*Comments*
A. Initial Construction Costs:					
Initial Construction Costs				69,526,000	From Table E-1, Alignment 3
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	**72,526,000**	
B. Site Development Costs:					
Dredged Material Management	7.8	Year	885,000	8,903,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	9.8	Year	1,546,000	15,151,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	10.8	Year	875,000	7,290,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	**29,344,000**	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	7.8	Year	500,000	3,900,000	
Implementation					
Channels	377	Acre	8,000	2,261,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	754	Acre	4,400	3,315,000	$4,400 per acre
Operation & Maintenance	7.8	Year	500,000	3,900,000	
Total Habitat Development Costs			$	**16,376,000**	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	8.0	Year	2,000,000	16,000,000	Mob & Demob for operating life of site
Dredging	19.8	Mcy	2.00	39,200,000	Clamshell Dredging
Transport	19.8	Mcy	2.50	49,000,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	19.8	Mcy	2.25	44,100,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	**148,300,000**	
Subtotal Project Cost A+B+C+D			$	**266,546,000**	
Contingency @	15%			39,982,000	
Total Project Cost A+B+C+D			$	**306,528,000**	
Total Unit Cost per CY Capacity (Rounded)			$	**16.00**	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	19.8	Mcy	3.80	74,480,000	
Contingency @	15%			11,172,000	
Total Apportioned Costs to Channel Projects			$	**85,652,000**	
Summary of Costs:					
Total Project Project Cost				306,528,000	
Less Apportioned Cost to Channel Projects				(65,652,000)	
Total Apportioned Cost to Poplar Island Project			$	**220,876,000**	

Poplar Island Modification Habitat Development

Table E - 6 Project Cost Analysis for Dike Alignment No. 4 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	34.1	1,129.1	Site Surface Area (Ac)
Site Operating Life (Years)	13.6	39,269	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	12,316	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				91,230,000	From Table E-1, Alignment 4
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	94,230,000	
B. Site Development Costs:					
Dredged Material Management	13.6	Year	1,251,000	17,014,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	15.6	Year	1,857,000	26,969,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	16.6	Year	675,000	11,205,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	57,188,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	13.6	Year	500,000	6,800,000	
Implementation					
Channels	565	Acre	6,000	3,387,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	1,129	Acre	4,400	4,968,000	$4,400 per acre
Operation & Maintenance	13.6	Year	500,000	6,800,000	
Total Habitat Development Costs			$	24,955,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	14.0	Year	2,000,000	28,000,000	Mob & Demob for operating life of site
Dredging	34.1	Mcy	2.00	68,200,000	Clamshell Dredging
Transport	34.1	Mcy	2.50	85,250,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	34.1	Mcy	2.25	76,725,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	258,175,000	
Subtotal Project Cost A+B+C+D			$	434,548,000	
Contingency @	15%			65,182,000	
Total Project Cost A+B+C+D			$	499,730,000	
Total Unit Cost per CY Capacity (Rounded)			$	15.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	34.1	Mcy	3.80	129,580,000	
Contingency @	15%			19,437,000	
Total Apportioned Costs to Channel Projects			$	149,017,000	
Summary of Costs:					
Total Project Project Cost				499,730,000	
Less Apportioned Cost to Channel Projects				(149,017,000)	
Total Apportioned Cost to Poplar Island Project			$	350,713,000	

Poplar Island Modification Habitat Development

Table E - 7 Project Cost Analysis for Dike Alignment No. 5 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	21.0	748.6	Site Surface Area (Ac)
Site Operating Life (Years)	8.4	28,427	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	10,192	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				60,102,000	From Table E-1, Alignment 5
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	63,102,000	
B. Site Development Costs:					
Dredged Material Management	8.4	Year	880,000	7,392,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	10.4	Year	1,369,000	14,236,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	11.4	Year	875,000	7,695,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	29,325,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	8.4	Year	500,000	4,200,000	
Implementation					
Channels	374	Acre	6,000	2,246,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	749	Acre	4,400	3,295,000	$4,400 per acre
Operation & Maintenance	8.4	Year	500,000	4,200,000	
Total Habitat Development Costs			$	16,941,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	9.0	Year	2,000,000	18,000,000	Mob & Demob for operating life of site
Dredging	21.0	Mcy	2.00	42,000,000	Clamshell Dredging
Transport	21.0	Mcy	2.50	52,500,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	21.0	Mcy	2.25	47,250,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	159,750,000	
Subtotal Project Cost A+B+C+D			$	269,118,000	
Contingency @	15%			40,368,000	
Total Project Cost A+B+C+D			$	309,486,000	
Total Unit Cost per CY Capacity (Rounded)			$	15.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	21.0	Mcy	3.80	79,800,000	
Contingency @	15%			11,970,000	
Total Apportioned Costs to Channel Projects			$	91,770,000	
Summary of Costs:					
Total Project Project Cost				309,486,000	
Less Apportioned Cost to Channel Projects				(91,770,000)	
Total Apportioned Cost to Poplar Island Project			$	217,716,000	

Poplar Island Modification Habitat Development

Table E - 8 Project Cost Analysis for Dike Alignment No. 6 (10 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	7.4	313.0	Site Surface Area (Ac)
Site Operating Life (Years)	3.0	16,705	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	3,595	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	10	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				21,794,000	From Table E-1, Alignment 8
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	24,794,000	
B. Site Development Costs:					
Dredged Material Management	3.0	Year	455,000	1,365,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	5.0	Year	842,000	4,210,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	6.0	Year	675,000	4,050,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	9,625,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	3.0	Year	500,000	1,500,000	
Implementation					
Channels	157	Acre	6,000	939,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	313	Acre	4,400	1,377,000	$4,400 per acre
Operation & Maintenance	3.0	Year	500,000	1,500,000	
Total Habitat Development Costs			$	8,316,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	3.0	Year	2,000,000	6,000,000	Mob & Demob for operating life of site
Dredging	7.4	Mcy	2.00	14,800,000	Clamshell Dredging
Transport	7.4	Mcy	2.50	18,500,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	7.4	Mcy	2.25	16,650,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	55,950,000	
Subtotal Project Cost A+B+C+D			$	98,685,000	
Contingency @	15%			14,803,000	
Total Project Cost A+B+C+D			$	113,488,000	
Total Unit Cost per CY Capacity (Rounded)			$	15.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	7.4	Mcy	3.80	28,120,000	
Contingency @	15%			4,218,000	
Total Apportioned Costs to Channel Projects			$	32,338,000	
Summary of Costs:					
Total Project Project Cost				113,488,000	
Less Apportioned Cost to Channel Projects				(32,338,000)	
Total Apportioned Cost to Poplar Island Project			$	81,150,000	

Poplar Island Modification Habitat Development

Table E - 9 Project Cost Analysis for Dike Alignment No. 1 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	31.6	752.6	Site Surface Area (Ac)
Site Operating Life (Years)	12.6	24,086	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	7,179	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				68,692,000	From Table E-2, Alignment 1
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	71,892,000	
B. Site Development Costs:					
Dredged Material Management	12.6	Year	884,000	11,138,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	14.6	Year	1,174,000	17,140,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	15.6	Year	675,000	10,530,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	38,808,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	12.6	Year	500,000	6,300,000	
Implementation					
Channels	376	Acre	6,000	2,258,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	753	Acre	4,400	3,312,000	$4,400 per acre
Operation & Maintenance	12.6	Year	500,000	6,300,000	
Total Habitat Development Costs			$	21,170,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	13.0	Year	2,000,000	26,000,000	Mob & Demob for operating life of site
Dredging	31.6	Mcy	2.00	63,200,000	Clamshell Dredging
Transport	31.6	Mcy	2.50	79,000,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	31.6	Mcy	2.25	71,100,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	239,300,000	
Subtotal Project Cost A+B+C+D			$	371,170,000	
Contingency @	15%			55,676,000	
Total Project Cost A+B+C+D			$	426,846,000	
Total Unit Cost per CY Capacity (Rounded)			$	14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	31.6	Mcy	3.80	120,080,000	
Contingency @	15%			16,012,000	
Total Apportioned Costs to Channel Projects			$	138,092,000	
Summary of Costs:					
Total Project Project Cost				426,846,000	
Less Apportioned Cost to Channel Projects				(138,092,000)	
Total Apportioned Cost to Poplar Island Project			$	288,754,000	

Poplar Island Modification Habitat Development

Table E - 10 Project Cost Analysis for Dike Alignment No. 2 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	30.3	753.4	Site Surface Area (Ac)
Site Operating Life (Years)	12.1	33,309	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	0	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				75,768,000	From Table E-2, Alignment 2
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	78,768,000	
B. Site Development Costs:					
Dredged Material Management	12.1	Year	885,000	10,709,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	14.1	Year	1,589,000	22,405,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	15.1	Year	675,000	10,193,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	43,307,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	12.1	Year	500,000	6,050,000	
Implementation					
Channels	377	Acre	6,000	2,260,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	753	Acre	4,400	3,315,000	$4,400 per acre
Operation & Maintenance	12.1	Year	500,000	6,050,000	
Total Habitat Development Costs			$	20,675,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	13.0	Year	2,000,000	26,000,000	Mob & Demob for operating life of site
Dredging	30.3	Mcy	2.00	60,600,000	Clamshell Dredging
Transport	30.3	Mcy	2.50	75,750,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	30.3	Mcy	2.25	68,175,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	230,525,000	
Subtotal Project Cost A+B+C+D			$	373,275,000	
Contingency @	15%			55,991,000	
Total Project Cost A+B+C+D			$	429,266,000	
Total Unit Cost per CY Capacity (Rounded)			$	14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	30.3	Mcy	3.80	115,140,000	
Contingency @	15%			17,271,000	
Total Apportioned Costs to Channel Projects			$	132,411,000	
Summary of Costs:					
Total Project Project Cost				429,266,000	
Less Apportioned Cost to Channel Projects				(132,411,000)	
Total Apportioned Cost to Poplar Island Project			$	296,855,000	

Poplar Island Modification Habitat Development

Table E - 11 Project Cost Analysis for Dike Alignment No. 3 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	29.0	753.5	Site Surface Area (Ac)
Site Operating Life (Years)	11.6	32,361	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	8,090	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				79,648,000	From Table E-2, Alignment 3
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	82,648,000	
B. Site Development Costs:					
Dredged Material Management	11.6	Year	885,000	10,266,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	13.6	Year	1,546,000	21,026,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	14.6	Year	675,000	9,855,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	41,147,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	11.6	Year	500,000	5,800,000	
Implementation					
Channels	377	Acre	6,000	2,261,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	754	Acre	4,400	3,315,000	$4,400 per acre
Operation & Maintenance	11.6	Year	500,000	5,800,000	
Total Habitat Development Costs			$	20,176,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	12.0	Year	2,000,000	24,000,000	Mob & Demob for operating life of site
Dredging	29.0	Mcy	2.00	58,000,000	Clamshell Dredging
Transport	29.0	Mcy	2.50	72,500,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	29.0	Mcy	2.25	65,250,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	219,750,000	
Subtotal Project Cost A+B+C+D			$	363,721,000	
Contingency @	15%			54,558,000	
Total Project Cost A+B+C+D			$	418,279,000	
Total Unit Cost per CY Capacity (Rounded)			$	14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	29.0	Mcy	3.80	110,200,000	
Contingency @	15%			16,530,000	
Total Apportioned Costs to Channel Projects			$	126,730,000	
Summary of Costs:					
Total Project Project Cost				418,279,000	
Less Apportioned Cost to Channel Projects				(126,730,000)	
Total Apportioned Cost to Poplar Island Project			$	291,549,000	

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Table E - 12 Project Cost Analysis for Dike Alignment No. 4 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	48.1	1,129.1	Site Surface Area (Ac)
Site Operating Life (Years)	19.2	39,269	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	12,318	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				105,174,000	From Table E-2, Alignment 4
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs				$ 108,174,000	
B. Site Development Costs:					
Dredged Material Management	19.2	Year	1,251,000	24,019,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	21.2	Year	1,857,000	39,368,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	22.2	Year	675,000	14,985,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs				$ 78,372,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	19.2	Year	500,000	9,600,000	
Implementation					
Channels	565	Acre	6,000	3,387,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	1,129	Acre	4,400	4,968,000	$4,400 per acre
Operation & Maintenance	19.2	Year	500,000	9,600,000	
Total Habitat Development Costs				$ 30,555,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	20.0	Year	2,000,000	40,000,000	Mob & Demob for operating life of site
Dredging	48.1	Mcy	2.00	96,200,000	Clamshell Dredging
Transport	48.1	Mcy	2.50	120,250,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	48.1	Mcy	2.25	108,225,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs				$ 364,675,000	
Subtotal Project Cost A+B+C+D				$ 581,776,000	
Contingency @	15%			67,266,000	
Total Project Cost A+B+C+D				$ 669,042,000	
Total Unit Cost per CY Capacity (Rounded)				$ 14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	48.1	Mcy	3.80	182,780,000	
Contingency @	15%			27,417,000	
Total Apportioned Costs to Channel Projects				$ 210,197,000	
Summary of Costs:					
Total Project Project Cost				669,042,000	
Less Apportioned Cost to Channel Projects				(210,197,000)	
Total Apportioned Cost to Poplar Island Project				$ 458,845,000	

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Table E - 13 Project Cost Analysis for Dike Alignment No. 5 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	30.2	748.8	Site Surface Area (Ac)
Site Operating Life (Years)	12.1	28,427	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	10,192	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				65,604,000	From Table E-2, Alignment 5
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs				$ 68,604,000	
B. Site Development Costs:					
Dredged Material Management	12.1	Year	880,000	10,648,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	14.1	Year	1,369,000	19,303,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	15.1	Year	875,000	10,193,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs				$ 40,144,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	12.1	Year	500,000	6,050,000	
Implementation					
Channels	374	Acre	6,000	2,248,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	749	Acre	4,400	3,295,000	$4,400 per acre
Operation & Maintenance	12.1	Year	500,000	8,050,000	
Total Habitat Development Costs				$ 20,641,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	13.0	Year	2,000,000	26,000,000	Mob & Demob for operating life of site
Dredging	30.2	Mcy	2.00	60,400,000	Clamshell Dredging
Transport	30.2	Mcy	2.50	75,500,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	30.2	Mcy	2.25	87,950,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs				$ 229,850 000	
Subtotal Project Cost A+B+C+D				$ 359,239,000	
Contingency @	15%			53,886,000	
Total Project Cost A+B+C+D				$ 413,125,000	
Total Unit Cost per CY Capacity (Rounded)				$ 14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	30.2	Mcy	3.80	114,760,000	
Contingency @	15%			17,214,000	
Total Apportioned Costs to Channel Projects				$ 131,974,000	
Summary of Costs:					
Total Project Project Cost				413,125,000	
Less Apportioned Cost to Channel Projects				(131,974,000)	
Total Apportioned Cost to Poplar Island Project				$ 281,151,000	

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Table E - 14 Project Cost Analysis for Dike Alignment No. 6 (20 ft)
(Costs are Estimated in 2002 Dollars)

Basis For Estimate:

Site Capacity (Mcy)	11.3	313.0	Site Surface Area (Ac)
Site Operating Life (Years)	4.5	16,705	Site Perimeter Dike (Ft)
Annual Channel (Cut) Volume (Mcy)	2.5	3,595	Site Interior Dikes (Ft)
Average One-Way Haul Distance (NM)	25	20	Final Dike Elev. (Ft)

	Quantity	Unit	Unit Cost $	Item Cost $	Comments
A. Initial Construction Costs:					
Initial Construction Costs				25,742,000	From Table E-2, Alignment 6
Study Costs				3,000,000	Conceptual, pre-feasibility and feasibility costs.
Total Initial Construction Costs			$	28,742,000	
B. Site Development Costs:					
Dredged Material Management	4.5	Year	455,000	2,048,000	Placement, dewatering and crust management costs for the operating life. $150,000 + ($975 per acre)
Site Maintenance	6.5	Year	842,000	5,473,000	Site Maintenance for operating life plus 2 years following site placement. $90,000 + ($45 per Perimeter Ft.)
Site Monitoring and Reporting	7.5	Year	675,000	5,063,000	Environmental monitoring for operating life, plus 3 years following site placement.
Total Site Development Costs			$	12,584,000	
C. Habitat Development Cost :					
Plan and Design	3.0	Year	1,000,000	3,000,000	
Monitoring	4.5	Year	500,000	2,250,000	
Implementation					
Channels	157	Acre	6,000	939,000	$8/cy x 3 cy/LF x 250 LF/acre
Planting / Seeding	313	Acre	4,400	1,377,000	$4,400 per acre
Operation & Maintenance	4.5	Year	500,000	2,250,000	
Total Habitat Development Costs			$	9,816,000	
D. Dredging, Transportation & Placement Costs:					
Mob and Demob	5.0	Year	2,000,000	10,000,000	Mob & Demob for operating life of site
Dredging	11.3	Mcy	2.00	22,600,000	Clamshell Dredging
Transport	11.3	Mcy	2.50	28,250,000	$0.10 Per One-Way Haul in NM (25 NM)
Placement	11.3	Mcy	2.25	25,425,000	Hydraulic Unloader
Total Dredging, Transport & Placement Costs			$	86,275,000	
Subtotal Project Cost A+B+C+D			$	137,417,000	
Contingency @	15%			20,613,000	
Total Project Cost A+B+C+D			$	158,030,000	
Total Unit Cost per CY Capacity (Rounded)			$	14.00	per cubic yard
Apportioned Costs to Channel Projects:					
Dredging, Transport & Placement	11.3	Mcy	3.80	42,940,000	
Contingency @	15%			6,441,000	
Total Apportioned Costs to Channel Projects			$	49,381,000	
Summary of Costs:					
Total Project Project Cost				158,030,000	
Less Apportioned Cost to Channel Projects				(49,381,000)	
Total Apportioned Cost to Poplar Island Project			$	108,649,000	

TABLE E-15 ESCALATION OF UNIT RATES FROM PREVIOUS POPLAR BIDS

(Based on 1998 Poplar Island Phase I and 2000 Poplar Island Phase II Bids - Escalated to 2002 @ 2.5% per annum)

Item No.	Description	Unit	Poplar Island Phase I - Bid Unit Rates From Four Lowest Bidders					Escalated @ 1.104	Poplar II Escal. 1.051	Combined Avg. Rounded	Use For Poplar Isl.
			Kiewit	Ogden	Weeks	Tidewater	Average				
01	Bonds	LS	400,000.00	300,000.00	225,000.00	500,000.00	356,250.00	393,233.34	188,000.00	291,000.00	300,000.00
02	Mob / Demob	LS	4,670,800.00	4,200,259.00	2,000,000.00	5,948,000.00	4,254,764.75	4,696,464.16	4,203,000.00	4,450,000.00	4,500,000.00
03	Geotechnical Borings	Lin Ft	50.00	75.00	55.00	50.00	57.50	63.47		63.00	63.00
04	Roedwey Stone	Sq Yd	10.00	10.00	10.00	16.00	11.50	12.69	11.00	12.00	12.00
05	Geotextile	Sq Yd	3.00	3.50	3.00	4.00	3.38	3.73	4.00	4.00	4.00
06	Personnel Pier	LS	100,000.00	410,400.00	120,000.00	200,000.00	207,600.00	229,151.56		229,000.00	250,000.00
07	Unsuitable Fdn Excavetion	CY	6.00	7.50	10.00	10.00	6.88	9.60	14.00	12.00	12.00
08	Hydreulic Fill Material	CY	5.50	5.00	4.00	5.94	5.11	5.64	8.00	7.00	7.00
09AA	2000 # Toe Armor Stone	Ton	36.00	55.00	45.00	46.00	48.00	50.76	53.00	52.00	52.00
09AB	1500 # Toe Armor Stone	Ton	36.00	50.00	45.00	48.00	44.75	49.40	53.00	51.00	51.00
09AC	3000 # Armor Stone	Ton	34.00	35.00	45.00	32.00	36.50	40.29	37.00	39.00	39.00
09AD	4000 # Armor Stone	Ton	34.00	34.00	45.00	32.00	36.25	40.01		40.00	40.00
09AE	Underleyer & 250 # Armor	Ton	32.00	36.00	45.00	37.00	37.50	41.39	37.00	39.00	39.00
09AF	Querry Run Stone	Ton	26.00	20.00	24.00	25.00	23.75	26.22	49.00	38.00	38.00
09AG	No. 57 Stone	CY	30.00	40.00	60.00	45.00	43.75	46.29		48.00	46.00
10AA	Type A Spillwey	Each	100,000.00	90,000.00	175,000.00	95,000.00	115,000.00	126,938.48	158,000.00	142,000.00	250,000.00
10AB	Type B Spillwey	Each	200,000.00	200,000.00	360,000.00	175,000.00	233,750.00	258,018.26	315,000.00	267,000.00	250,000.00
10AC	Type C Spillwey	Each	225,000.00	210,000.00	400,000.00	200,000.00	256,750.00	265,611.59		286,000.00	250,000.00
11	Nursery Planting	LS	150,000.00	155,000.00	200,000.00	100,000.00	151,250.00	166,951.70		167,000.00	200,000.00
12AA	Geotextile Tubes	LS	700,000.00	600,000.00	900,000.00	1,349,000.00	937,250.00	1,034,546.63		1,035,000.00	
12AB	Geotextile Tubes Dike Sect.	LS	600,000.00	1,300,000.00	1,000,000.00	1,025,000.00	981,250.00	1,083,116.40		1,083,000.00	
13	Geotextile Tubes Shoreline	LS	60,000.00	217,000.00	250,000.00	285,000.00	203,000.00	224,074.02		224,000.00	
14	Shell Clutch	LS	100,000.00	225,120.00	200,000.00	141,630.00	166,687.50	183,991.61	262,000.00	223,000.00	

Note: $2.00 added to Jemes Island rock unit rates to account for longer haul distance.