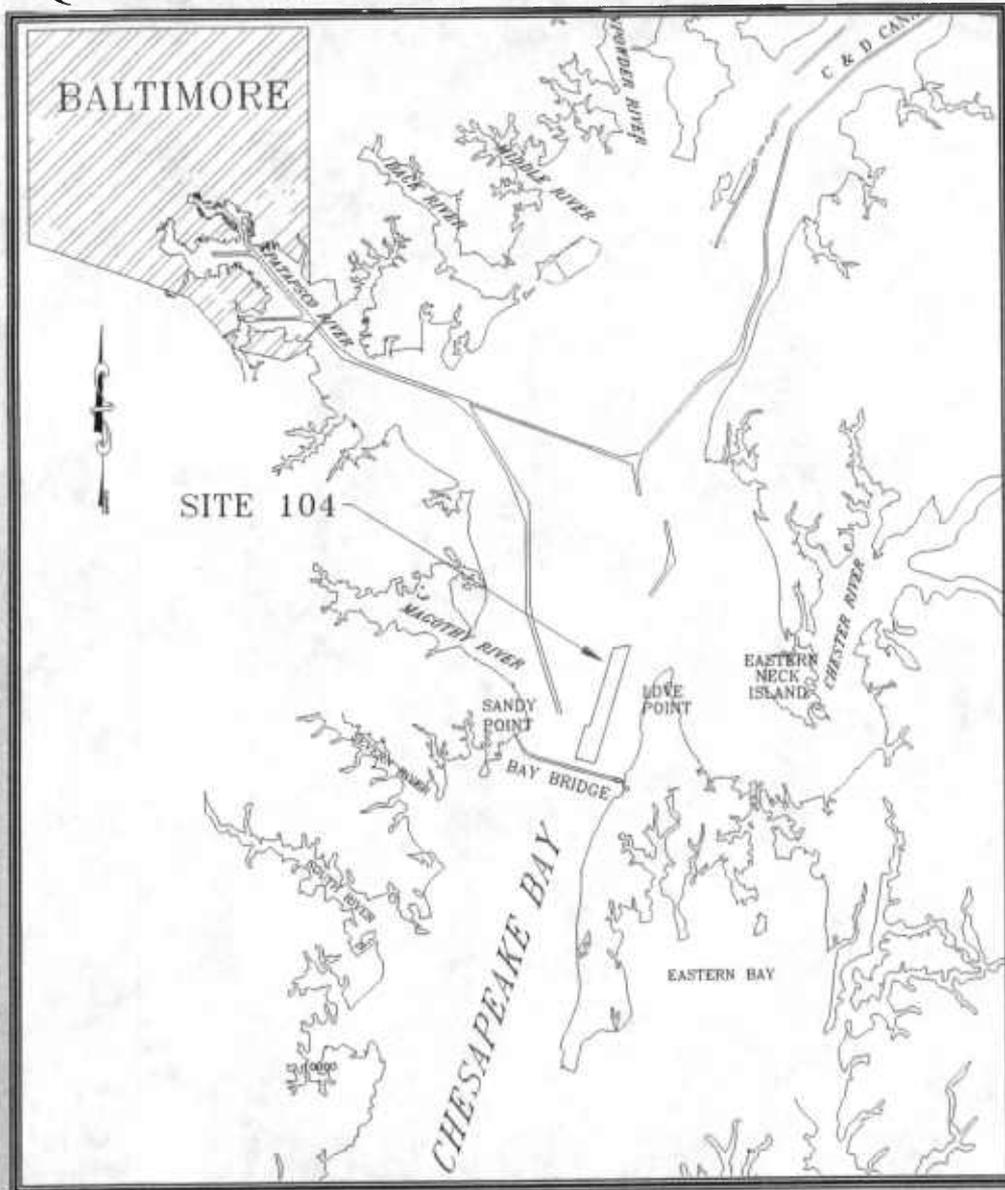


# FINAL DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED OPEN-WATER PLACEMENT OF DREDGED MATERIAL AT SITE 104

QUEEN ANNE'S COUNTY, MARYLAND



U.S. Army Corps of Engineers Baltimore District



US Army Corps  
of Engineers  
Baltimore District

file  
Site 104  
December 21, 2000

Sediment  
Testing

# Notice of Availability

## DRAFT EVALUATION OF DREDGED MATERIAL: UPPER CHESAPEAKE BAY APPROACH CHANNELS TO THE PORT OF BALTIMORE, MARYLAND

**ALL INTERESTED PARTIES:** The U.S. Army Corps of Engineers, Baltimore District, conducted a complex series of tests to assess sediment quality in federal navigation channels in the upper Chesapeake Bay. This study did not include channels in the Patapsco River or Baltimore's Inner Harbor. The testing program followed the guidance in the *Inland Testing Manual* published by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers in 1998. The purpose of the testing was twofold: 1) to determine the quality of the sediments proposed for dredging; and 2) to evaluate the potential effects to Bay resources that could occur from moving the sediment and placing it at another location in the Bay, or placing it at a designated ocean placement site. The study included chemical tests and biological tests that assessed potential effects to larval fish, shrimp, worms, clams, amphipods (marine pillbugs), and larval mussels put in the channel sediments and in water mixed with sediments.

The chemical tests found low concentrations of chemicals in the sediments. These low concentrations were expected because many of these chemicals are found in soils and sediments in the upper Chesapeake Bay area. The overall quality of the sediments in the channels is similar to that found in past studies of areas outside of the navigation channels in the upper Chesapeake Bay. The studies also found that low concentrations of some chemicals were released from sediments into the water when sediments and water were mixed together. This finding was also expected.

Two sets of laboratory tests were performed to evaluate the potential effects of sediment and sediment and water mixtures to aquatic animals. In the first set of tests, bottom-dwelling worms and amphipods were placed in sediments to see if harmful effects occurred. Results of the tests showed that bottom-dwelling worms and amphipods lived in all of the channel sediments in these laboratory tests with no harmful effects. This indicates that aquatic animals could live in sediments dredged from channels in the upper Bay and placed in other areas of the Bay. In the second set of tests, larval fish, shrimp, and larval mussels were placed in water that had been mixed with sediment to see if harmful effects occurred. Larval animals were used because they are the most sensitive life stage and most likely to show any potential for harm. Results of the tests showed that larval fish, shrimp, and larval mussels could live in most of the water and sediment mixtures without harmful effects. However, some of the water and sediment mixtures did have harmful effects on some of one type of larval fish and some of the larval mussels. Therefore, more studies were conducted to compare conditions used in the laboratory tests to what would happen in the Bay during placement of dredged material.

These additional studies showed that aquatic animals in the Bay are not expected to show harmful effects if these sediments were to be dredged and placed in the Bay. In most cases, the water into which the sediment would be placed would meet all water quality standards, and there would be no potential for harmful effects within minutes of placement. However, because the tests indicated that water quality standards might have been exceeded on a limited basis, a mixing zone, or an allowed distance or length of time to achieve standards, would have been required. Since the State of Maryland is striving to phase out the use of mixing zones as one of its Chesapeake Bay Agreement commitments and because of the preliminary finding of potential adverse effects on two of the species tested in the laboratory, the State removed Site 104 from consideration as an open water placement site. For ocean placement, all water quality standards would be met during the four-hour period allowed in the ocean regulations.

Further tests of the sediments were conducted to see if any chemicals found in the sediments could build up inside animals that live in sediments. Aquatic worms and clams were placed in the sediments in the laboratory for four weeks, and then their tissues were tested for build-up of chemicals. Nine of 151 chemicals showed a chance of accumulating to potentially harmful levels over time in the tissue of bottom-dwelling animals. These nine remaining chemicals will be further evaluated to see if the sediments could cause harm to the environment.

In summary, this study shows that the dredged material from the channels is similar in quality to sediments outside the shipping channels in other areas of the upper Chesapeake Bay. The Corps of Engineers concludes that no placement alternatives would be eliminated from consideration based on tests conducted to date. However, the Corps will perform additional studies on nine chemicals to further evaluate the potential of these chemicals to accumulate in aquatic animals. The Corps will use the results of this study to work with the State to find other placement options for sediments dredged from the channels.

This Notice of Availability is being sent to organizations and individuals known to have an interest in the results of the sediment testing. Please bring this notice to the attention of any other individuals with an interest in this matter. Comments on the draft report should be submitted in writing to the following address by February 15, 2001.

District Engineer  
ATTN: CENAB-PL-P  
U.S. Army Corps of Engineers  
Baltimore District  
P.O. Box 1715  
Baltimore, MD 21203-1715

Copies of the draft report are available for review at the following locations:

- Annapolis Public Library, 1410 West Street, Annapolis, MD
- Baltimore County Public Library, North Point Branch, 1716 Merrit Boulevard, Baltimore, MD
- Enoch Pratt Free Library, 400 Cathedral St., Baltimore, Maryland
- Kent County Library 408 High Street, Chestertown, Maryland
- Queen Anne's County Public Library, 121 South Commerce St., Centreville, Maryland
- Talbot County Public Library, 100 W. Dover St., Easton, Maryland

Individuals may obtain a copy of the draft report through the Baltimore District's web site at: <http://www.nab.usace.army.mil/projects/Maryland/sediment.htm>, by writing to the address above, by telephoning Mr. Mark Mendelsohn at (410) 962-9499 or toll free at 1 (800) 295-1610, or by e-mailing Mr. Mendelsohn at [mark.mendelsohn@usace.army.mil](mailto:mark.mendelsohn@usace.army.mil).



CHRISTINA E. CORRALES  
Chief, Operations Division



# MES Develops Fish Habitat Study Method



The Maryland Environmental Service has developed a method to assess the habitat values around the mainland, open waters and islands of the Chesapeake Bay and has used that method to determine whether and where Chesapeake Bay fish use the warmth of deep water as a sort of winter resort.

The method was developed when Site 104 and other areas in the Chesapeake Bay were being actively considered as locations for dredged sediment placement. The U.S. Army Corps of Engineers had received comments from fishermen's groups and scientists from the University of Maryland raising significant questions about whether deep water - of up to 85 feet or more - around Site 104 and around other potential placement sites might serve as a valuable winter refuge for fish in the Chesapeake Bay. The Corps asked MES to try to figure out how to evaluate the appeal of water masses to fish in the Bay.

A total of nine people from various disciplines at MES worked on developing the method, from CADD technicians, geographic information system technicians, water quality and fisheries scientists and engineers.

According to Sue Kelly, a natural resources planner in the Environmental Science and Monitoring Section of MES's Environmental Dredging Division, "there have been general studies which show that fish favor warm water, but no attempt has ever been made to identify whether specific deep waters might have special value."

The MES team combined life histories of the known fish species of the Bay with salinity values, depth, water temperature, and other data accumulated by the Chesapeake Bay Program into a computerized representation of areas in the Bay. Kelly and the team "were able to draw conclusions that the deep water around Site 104 and other sites under consideration represented a very small part of the habitat around the Bay that would attract wintering fish. Actually, there were many more places around the Bay that would attract them."

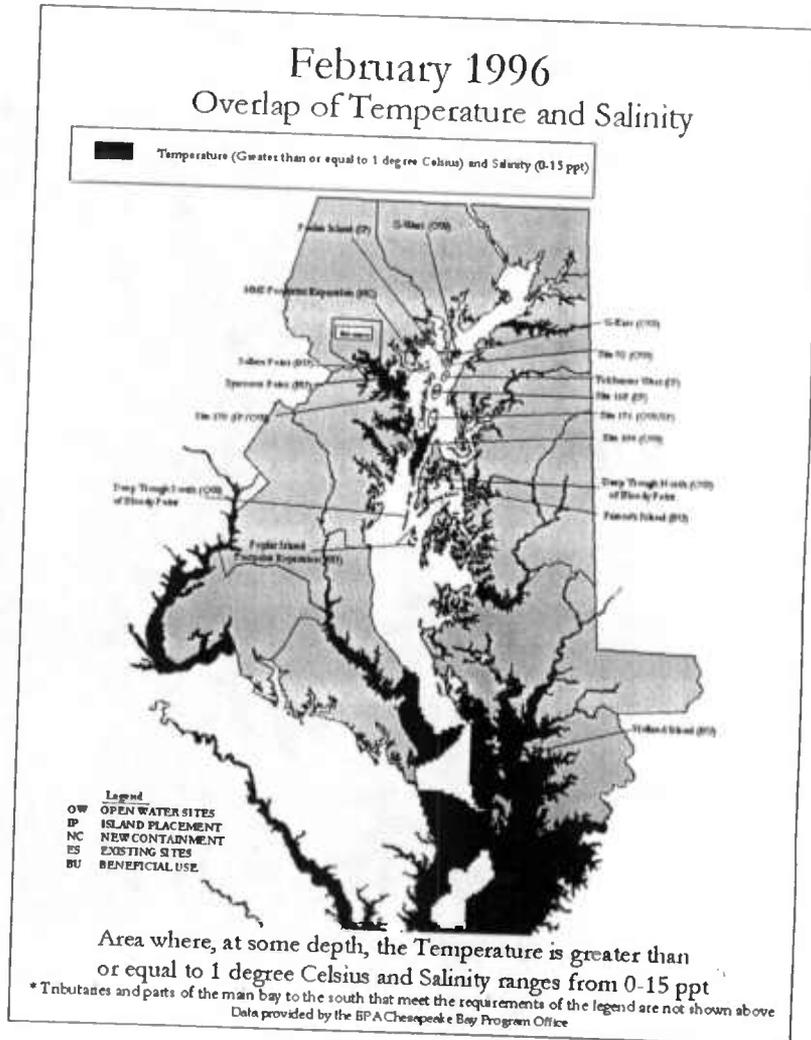
Kelly said that the method her team developed "can be used anywhere in the world, but only if the data sets exist."

She said that the MES team had advice throughout the project from scientists at the University of Maryland, the Department of Natural Resources,



Sue Kelly, a planner for MES, worked on the study of fish habitats for the U.S. Army Corps of Engineers.

the National Marine Fisheries Services, the U.S. Fish and Wildlife Service and from other fisheries experts throughout the region. ■





CIRCULATE

Jim Peck  
JWB  
SW

# MES NEWS

## FibroShore Project Gets MES Assistance



Dr. Raymond Costello (left foreground), of the U.S. Department of Energy, takes a photo of Maryland Del. Rudolph C. Come (left) and MES Director James W. Peck (second from right) as they talk with Rupert Fraser, right, managing director of Fibrowatt, Ltd., of the United Kingdom, as they inspect a truck bio-disinfection area at a plant in Thetford, England.

**A** proposal to burn chicken manure to create electrical power for the Eastern Shore has received a boost from the U.S. Department of Energy. DOE has awarded the Maryland Environmental Service a \$100,000 grant to evaluate the feasibility of a power plant fueled by poultry litter.

The facility would be modeled after similar plants in the United Kingdom that have been in operation for many years. MES Director James W. Peck and Duane A. Wilding, chief of technical services at MES, recently toured those plants after learning of the grant award.

The scope of work will consist of determining how much chicken litter is produced on the Delmarva Peninsula and to explore purchasing agreements for selling the electrical power.

*continued on page 4*

## Montgomery County Recycling Computers



Montgomery County homeowners line up their discarded computers for recycling during a summer drop-off day.

**M**ontgomery County conducted a pilot computer recycling program at its recycling dropoff area, in Derwood. The program was open to all county residents and businesses.

The county began the program after what they called a "highly successful" pilot event the first weekend of last March, at which 15 tons of computers and related equipment were dropped off.

Computer Donation Management, Inc., a Baltimore contractor, supervised the collection and packaging of computers, monitors, and peripheral devices such as modems, mice, and printers. Robert Donald, president of CDM, Inc., the program's contractor said, "it's really important to recycle computer monitors and not dispose of them because a typical monitor contains about six pounds of lead."

The computer recycling program consisted of six collection days, spaced from last June through November. On those days, which were heavily

publicized by the county, residents and county businesses were encouraged to bring old, unwanted computers to the recycling dropoff area.

Over 200 residents and businesses brought a total of more than 11 tons of computers and other related equipment of the center on the two days held in June and July.

Usable computer equipment was donated to schools where computers may not be easily attainable or to non-profit agencies which may not have the financial means to acquire the equipment, according to Tom Kusterer, who coordinated the program for the county.

He said that "participants are genuinely pleased when we tell them that as many contributed computers as possible go to schools that need them."

The county tapped the Maryland Environmental Service to assist with the startup of the program by finding a contractor to transport and recycle the old computers.

*continued on page 5*

**INSIDE THIS ISSUE:**

Director's Letter .....	2
Fish Habitat Study .....	3
Horse Event Tests Tires .....	6

SECTION NO.	Subject	TITLE	OWNER	1st Dft	Editor Rev	STR Rev	Revised	FINAL	REMARKS
1		PURPOSE AND NEED FOR THE ACTION	Mckee (COE)	17-Sep					Requires Input from Port on potential loss of revenues from channel shoaling
	1.1	Purpose and Need	"	"					
	1.2	Study Authority	"	"					
	1.3	Federal Maintenance Req'ts	"	"					
	1.4	Scope of EIS	"	"					
	1.5	Alternative Placement Sites	"	"					
	1.6	Study Area	"	"					
2		ALTERNATIVES INCLUDING THE PROPOSED ACTION	COE/MES/Boraczek	22-Sep					Requires Input from MES and Corps. Need a conference call to discuss during week of 13-Sep
	2.1	Proposed Action	"	"					
	2.2	Alternatives including the Proposed Action	"	"					
3		DECISION-MAKING PROCESS	CoE	1-Oct					Believe this belongs to Wes
	3.1	General Site Selection Process	"	"					
	3.2	Section 404 Guidelines	"	"					
	3.3	Public Interest Review	"	"					
	3.4	Compliance Table	"	"					
4		DESCRIPTION OF PROPOSED ACTION	CoE	1-Oct					McKee
	4.1	Site 104	"	"					
	4.2	Site Management	"	"					
5		AFFECTED ENVIRONMENT/EXISTING CONDITIONS							
	5.1	Existing Resources							
	5.1.1	Setting	Boraczek	no change					
	5.1.2	Physio,Geo,Hydro	Boraczek	21-Sep					
	5.1.3	Hydrodynamics	EA/M&N (Earickson)	21-Sep					Data from SAIC, Etc. overdue. Help from M&N.
	5.1.4	Water Quality	MES/EA (Rue)	21-Sep					
	5.1.5	Sediment	Derrick	1-Oct					
	5.1.6	Aquatic Resources	MES	26-Sep					MES to provide sections
	5.1.7	Avian/Terrestrial Resources	MES	26-Sep					"
	5.1.8	Rare,Threatened and Endangered	MES	26-Sep					"
	5.1.9	Air Quality	EA (Papageorgis)	17-Sep					
	5.1.10	Noise	"	17-Sep					
	5.1.11	HTRW	"	17-Sep					
	5.2	Cultural and Archaeological Res	"	17-Sep					
	5.2.1	Historical Use	"	17-Sep					
5.2.2	Existing Resources	"	17-Sep						
5.3	Socioeco Resources	(EA) Boraczek/Pace	17-Sep					COE/MES input needed; several subsections	
5.4	Aesthetics and Recreation	COE	21-Sep					MES/Corps input needed. Consultations necessary.	
6		POTENTIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION	EA (Boraczek)	1-Oct					Incorporate new data
	6.1	Impacts of the Proposed Action	"	"					
	6.1.1	Setting	"	"					
	6.1.2	Physiography,Geology,Hydrology	"	"					
	6.1.3	Hydrodynamics	"	"					Requires data from contractors from 9/10-9/22. M&N to review
6.1.4	Water Quality	MES& EA (Rue/Jane)	"					Requires MES input	

SECTION  
NO.

SECTION NO.	Subject	TITLE	OWNER	1st Dft	STR			FINAL	REMARKS
					Editor Rev	Rev	Revised		
	6.1.5	Sediment	EA (Derrick)	"					New data being taken. Peddicord to review.
	6.1.6	Aquatic Resources	Boraczek/MES						MES to EA by 10/8
	6.1.7	Avian/Terrestrial Resources	Boraczek/MES						"
	6.1.8	Rare,Threatened and Endangered	Boraczek/MES						"
6			EA (Papageorgis)	8-Oct					Assistance from Jane
	6.1.9	Air Quality	"	"					"
	6.1.10	Noise	"	"					"
	6.1.11	HTRW	"	"					"
	6.2	Cultural and Archaeological Res	"	"					"
	6.3	Socioeconomic Resouces	"	"					COE/MES input by 10/1
	6.4	Aesthetics and Recreation	Boraczek	1-Oct					
	6.5	Irretrievable Commitment of Resources	"	"					
	6.6	Short term use v. LT productivity	"	"					
7		ALTERNATIVES IMPACTS	COE/MES/EA						Boraczek to coordinate
	7.1	Other Alternatives	"	1-Oct					
	7.2	Site 104 Preferred Alternative	"	1-Oct					
8		CUMULATIVE IMPACTS	Boraczek	6-Oct					Papageorgis to help Develop. Peddicord to provide STR
	8.1	Past,Present, Future Dredging in Bay	"	"					
	8.2	Cumulative Negative Impacts	"	"					
	8.2.1	Hydrodynamics	"	"					
	8.2.2	Water Quality	"	"					
	8.2.3	Aquatic Organisms	"	"					
	8.2.4	Air Quality	"	"					
	8.2.5	Noise	"	"					
	8.2.6	Socioeconomics	"	"					
	8.2.7	Aesthetics	"	"					
	8.2.8	Recreational Resources	"	"					
	8.3	Cumulative Positive Impacts	"	"					
	8.3.1	Water Quality	"	"					
	8.3.2	Sediment Quality	"	"					
	8.3.3	Aquatic Resources Habitat and Commercial Fisheries	"	"					
8.3.4	Regional Socioeconomics	"	"						
8.4	Regional Impacts Summary	"	"						
9		SITE 104 MONITORING FRAMEWORK	Pine	26-Sep					
	9.1	Purpose	"	"					
	9.2	Introduction	"	"					
	9.3	Monitoring Elements	"	"					
10		COMPLIANCE W/LAWS, REGS, Eos							
11		RELATIVE COST OF PLACEMENTSITES	COE						Coleman to get data
	11.1	Placement Alternatives	"	26-Sep					
	11.2	Placement Costs	"						
	11.3	Conclusions	"						
12		LIST OF PREPARERS	COE	1-Oct					Coleman
13		PUBLIC INVOLVEMENT/AGENCY COORDINATION	COE	1-Oct					Coleman
14		REFERENCES	EA	6-Oct					
15		GLOSSARY	EA	6-Oct					Earickson/Boraczek
16		List of Agencies,Orgs, Persons EIS sent to	COE						Coleman
Annex E		Alternatives Screening	EA (Earikson/ Boraczek)	6-Oct					
Annex F		Hydrodynamics	"	6-Oct					
Annex G		Nutrients	"	6-Oct					
Annex H		Sediment Quality	"	6-Oct					

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Purpose and Need for the Action

1.1 PURPOSE AND NEED

The Maryland Port Administration (MPA) and the U.S. Army Corps of Engineers (USACE) are responsible for maintaining, through periodic dredging, the 126 miles of Federal navigation channels that serve the Port of Baltimore. Continued maintenance dredging will be required to maintain the efficiency and safety of the approach channels to the Port of Baltimore. Of particular concern are the Chesapeake Bay ~~These approach channels in Maryland, which include~~ the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Swan Point Channel, Tolchester Channel and the southern approach channel to the Chesapeake & Delaware (C&D) Canal (Figure 1-1). ~~This~~ ~~Maintenance dredging of these channels~~ requires the removal of approximately 3.25 million cubic yards (mcy) of material per year. This total is exclusive of approximately 1.5 mcy of material that is dredged from the C&D Canal, ~~and the northern approach channel to the C&D Canal,~~ Virginia channels, and the Baltimore Harbor, and that is deposited in other placement sites. Several new-work dredging projects are currently proposed to ~~increase~~ improve navigation safety and efficiency for the Chesapeake Bay approach channels over the next several years. These new-work projects would require the removal of an additional 18 mcy of dredged material from the Chesapeake Bay approach channels in the next several years.

The management of dredged material is an ongoing concern for the MPA and USACE, Baltimore District (CENAB). The Port of Baltimore ~~continues to~~ has experienced difficulty in establishing placement sites with sufficient capacity to accommodate the dredging needed for navigation safety and to sustain port competitiveness.

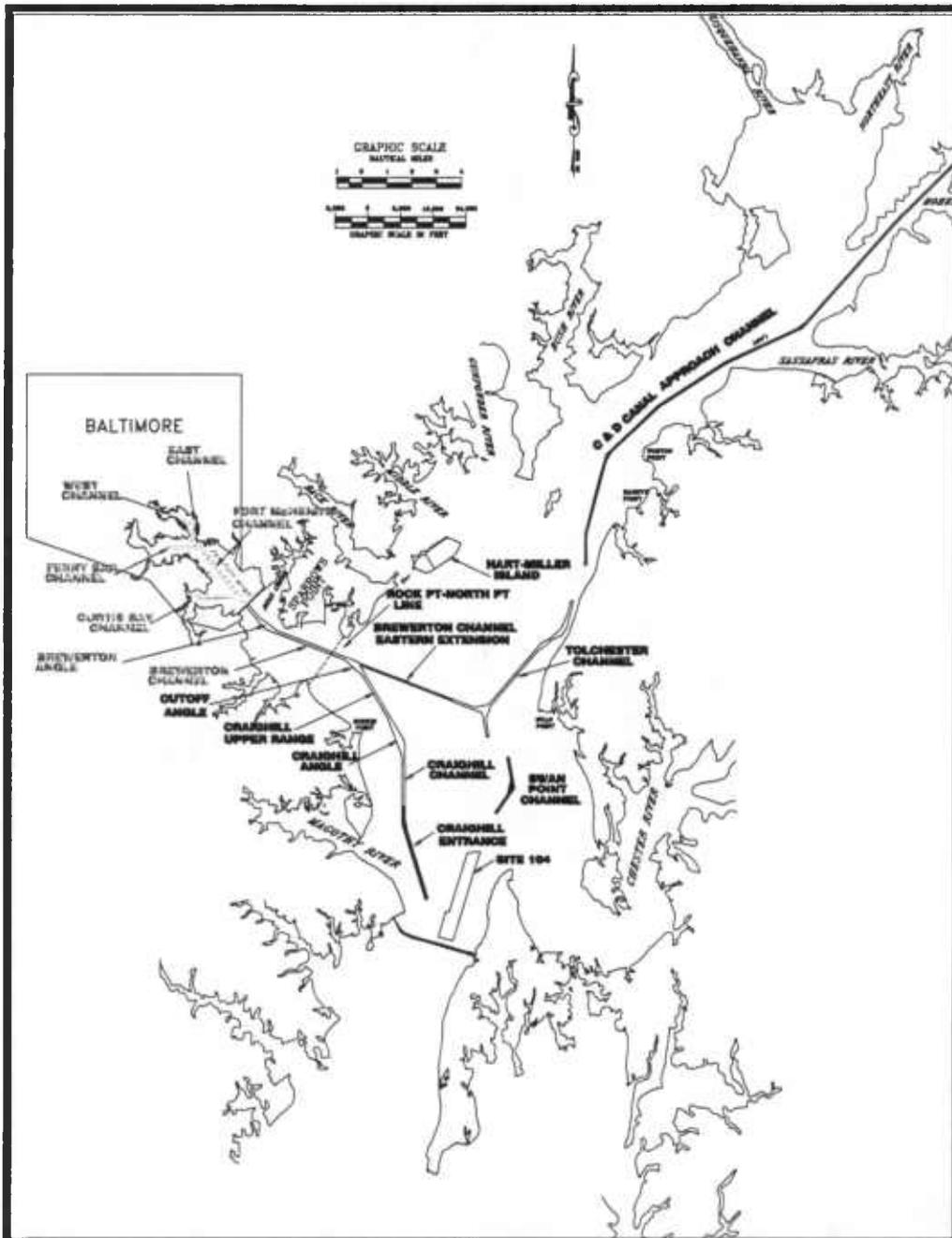
Move the following paragraph to Section 2:

[In July 1990, a broad-based, multi-organizational task force was convened by the Governor of Maryland to review dredged material management options. The task force recommended a continuation of studies on the feasibility of using new open-water placement sites, with an emphasis on environmental considerations. Through its Dredging Needs and Placement Options Program (DNPOP), the MPA, in cooperation with the USACE, state and Federal agencies (FWS, EPA, MDDNR, MDE, and NOAA), and private interest groups (MWA, MCCA, CBE), ~~is~~ developing alternative dredged material placement ~~areas~~ options to accommodate both current and future dredging projects for dredged material from the Baltimore Harbor, and the Baltimore Harbor and C&D Canal Approach Channels in Maryland. Results of the DNPOP program formed the basis of the 1996 State of Maryland's Strategic Plan for Dredged Material Management. ]

The State of Maryland's 1996 Plan estimated that 40 mcy of sediment would have to be dredged over 10 years (1997 to 2007) for maintenance of the channels to the Port of Baltimore (MPA 1996). By 2012, maintenance dredging would generate an additional 20 mcy of sediment and by 2017 it would generate another 20 mcy of sediment. Currently scheduled new work would

*mention that a previous EIS was done;*

*mention  
— OPEN WATER*



AS SITE/DATA/SEPP/5.DWG


**MARYLAND PORT ADMINISTRATION**  

 MARYLAND ENVIRONMENTAL SERVICE  

 US Army Corps of Engineers

**BALTIMORE HARBOR AND APPROACH CHANNELS**  
 FIGURE 1-1

47 ~~generate an additional 28 mcy of sediment by 2007. The 1996 Plan identified 18 mcy of material~~  
48 ~~for placement in an open water site, to fulfill near term dredged material placement needs. This~~  
49 ~~18 mcy placement capacity is needed in addition to the placement volumes that are already~~

50  
51 generate an additional 28 mcy of sediment by 2007. The 1996 Plan identified 18 mcy of material  
52 for placement in an open-water site, to fulfill near-term dredged material placement needs. This  
53 18-mcy placement capacity is needed in addition to the placement volumes that are already  
54 committed to existing sites (Hart Miller Island and Pooles Island open water) and sites that are  
55 currently under development (CSX/Cox Creek and Poplar Island). The designed maximum  
56 annual placement capacities of the existing and developing sites would preclude their utilization  
57 beyond the volumes in the current Dredged Material Management Plans (DMMP) without the  
58 risk of potential environmental impacts (e.g., water quality degradation adjacent to dredged  
59 material placement sites due to placing too much material too quickly), without significantly  
60 reducing the sites' capacity by overfilling, which precludes proper drying and consolidation of  
61 the dredged material.

62  
63 The purpose of this ~~Draft~~ Environmental Impact Statement (EIS) is to evaluate the proposed  
64 placement of up to 18 mcy of clean dredged material in a suitable placement area~~the open water~~  
65 ~~site, known as Site 104, located northeast of the William Preston Lane, Jr. Memorial Bridge~~  
66 ~~(henceforth referred to as the Chesapeake Bay Bridge) as described in Section 1.6 and Section~~  
67 ~~2.1 (Proposed Action). Due to a lack of immediately available capacity for maintenance and new~~  
68 ~~work dredging projects, the Baltimore District and the MPA have a short-term need for~~  
69 ~~additional dredged material placement capacity. Placement alternatives are~~ Site 104 is being  
70 considered as a solution to this need and would be expected to have an operational lifespan of 1-  
71 82 years. Based on its prior use as a placement site from 1924 to 1975, its current available  
72 capacity, its geographic proximity to the approach channels, the potential for dredged material to  
73 improve environmental conditions at the site, and MPA's DNPOP program's evaluation of other  
74 sites options, the MPA identified Site 104 placement site has been identified by the MPA as their  
75 preferred site to receive the 18 mcy of clean dredged material between 1999 to 2008. Dredged  
76 material pPlacement alternatives to ~~Site 104~~ are discussed in Section 2.2 and, ~~along with Site~~  
77 ~~104, are evaluated further in this EIS.~~

WHY NOT  
OPEN  
WATER

## 79 1.2 STUDY AUTHORITY

80  
81 Pursuant to Section 102 of the National Environmental Policy Act (NEPA), the Baltimore  
82 District ~~will will has prepared and circulated an n this draft~~ environmental impact statement for  
83 evaluation of the proposed proposed placement of dredged material placement alternatives at Site  
84 104, Chesapeake Bay, Queen Anne's County, Maryland. The dredged material to be placed at  
85 Site 104 would be clean material from Federal navigation channels in the main stem of the  
86 Chesapeake Bay leading to Baltimore Harbor and the Port of Baltimore. Site 104 is located in  
87 the main stem of the Chesapeake Bay, north of the Chesapeake Bay Bridge, and west of Kent  
88 Island and encompasses approximately 1,800 acres. The EIS will include descriptions of the  
89 existing site conditions, dredged material placement alternatives, probable impacts of dredged  
90 material placement, public involvement, and the recommended determination and/or activity.  
91 The Section 404(b)(1) evaluation will investigate the use of alternative placement locations, and

92 equipment and methods for the proposed placement of up to approximately 18 mcy of additional  
93 dredged material ~~in the deepest parts of the site.~~

### 95 1.3 FEDERAL MAINTENANCE REQUIREMENTS

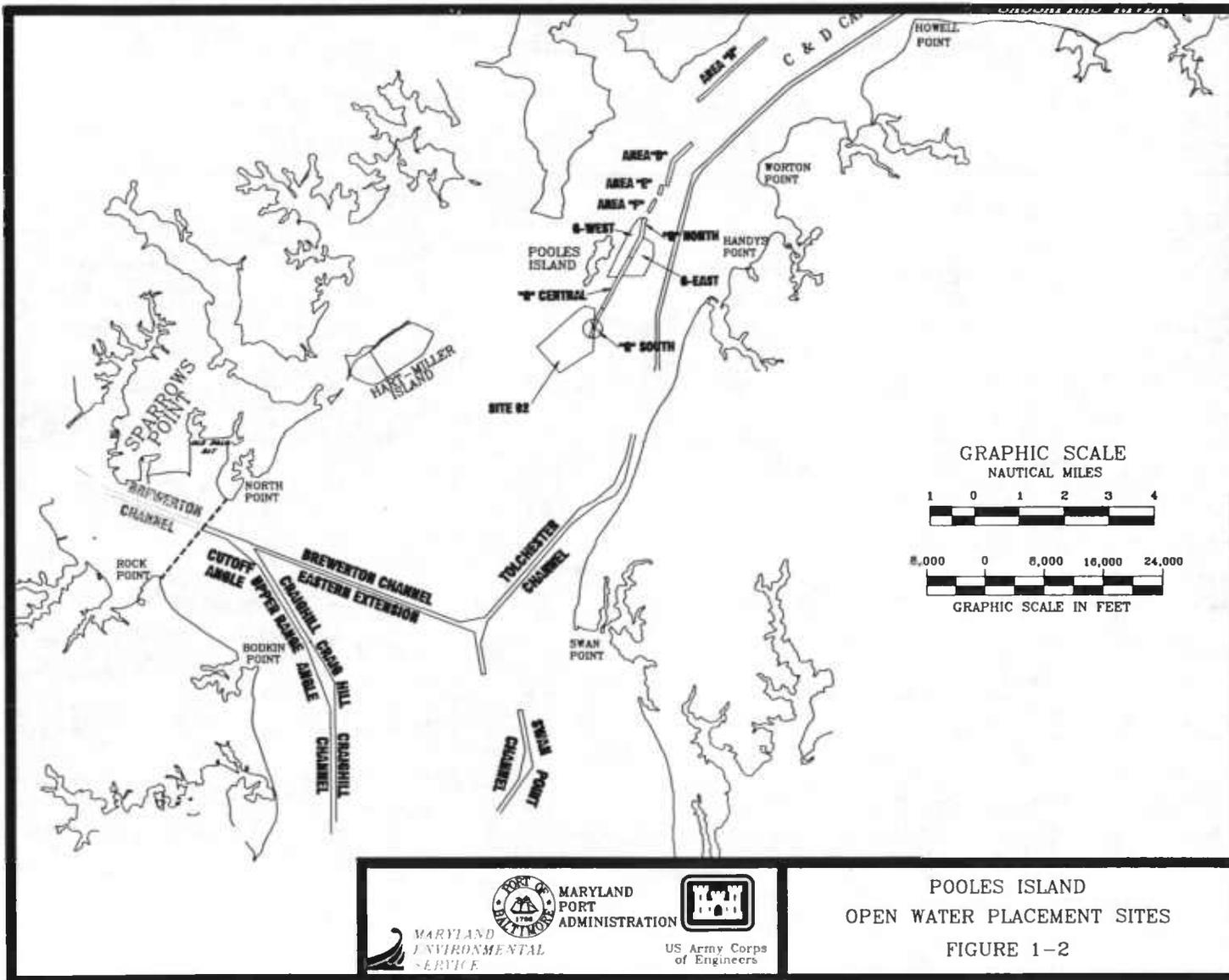
96  
97 The Rivers and Harbor Act of July 3, 1958, authorized the deepening of the main approach  
98 channels to Baltimore Harbor from 39 feetft to 42 feetft and the deepening and widening of the  
99 connecting channels to the C&D Canal from 27 feetft to 35 feetft deep and from 400 feetft to 600  
100 feetft wide. The connecting channels are comprised of the Brewerton Channel Eastern Extension  
101 and the Tolchester and Swan Point Channels. ~~The approximate length of the northern approach~~  
102 ~~channels is 46 miles. The approximate length of the Brewerton Extension is 6 miles. In~~  
103 ~~addition, the project authorized maintenance of a 39-footft depth in the Northwest Branch,~~  
104 ~~provided that local interests first deepen the channels to that depth. Deepening and maintenance~~  
105 ~~of the Baltimore Harbor and southerly approach channels to a 50-footft depth were authorized~~  
106 ~~under Section 101 of the Rivers and Harbor Act of 1970. Under the 1958 and 1970~~  
107 ~~authorizations, USACE and the MPA are responsible for removing approximately 2.5 mcy per~~  
108 ~~year for maintenance. Approximately 2.0 mcy of this annual need is in the upper Bay. The~~  
109 ~~approximate length of northern approach channels is 25 miles. These projects are under the~~  
110 ~~jurisdiction of USACE Baltimore District (CENAB). The Baltimore Harbor & Channels, MD &~~  
111 ~~VA and Federal Navigation project is maintained annually by the U.S. Army Corps of Engineers,~~  
112 ~~Baltimore District. As the non-Federal sponsor for the project, the Maryland Port Administration~~  
113 ~~is responsible for identifying suitable dredged material placement areas for the material removed~~  
114 ~~from the channels.~~

115  
116 The authority for the Inland Waterway from the Delaware River to the Chesapeake Bay,  
117 Delaware and Maryland project, was adopted by House Document 63-196 in 1919 and modified  
118 several times to deepen and widen the C&D Canal and its approach channels. The latest  
119 modification was authorized by Senate Document 83-123 in 1954 that authorized in part, a  
120 channel 35 feetft deep and 450 feetft wide. This project is under the jurisdiction of USACE,  
121 Philadelphia District (CENAP). CENAP and the MPA are responsible for maintaining the  
122 Inland Waterway from the Delaware River to the Chesapeake Bay, Delaware and Maryland  
123 project.

124  
125 If approved, Site 104 will only be used to receive dredged material from the Port of Baltimore  
126 approach channels and C&D Canal approach channels. Maintenance dredging from both sets of  
127 approach channels is estimated to generate 3.5 mcy per year. No material from within the Port of  
128 Baltimore (areas west of the North Point/Rock Point line) will be placed at Site 104 (Figure 1-2).

129  
130 ~~CENAP and the MPA are responsible for maintaining the Inland Waterway from the Delaware~~  
131 ~~River to the Chesapeake Bay, Delaware and Maryland project. This requires the dredging of~~  
132 ~~approximately 1.5 mcy of material annually from the reaches between Pooles Island and the~~  
133 ~~Sassafras River. This material is usually has historically been placed in the Pooles Island open-~~  
134 ~~water placement areas located west of the C&D Canal southern approach channel (Figure 1-2).~~

135  
136 ~~If approved, Site 104 will only be used to receive dredged material from the Chesapeake Bay~~  
137 ~~approach channels to the Port of Baltimore and C&D Canal approach channels. Maintenance~~



138 dredging from both sets of approach channels is estimated to generate 3.5 mey per year. No  
139 material from within the Port of Baltimore (areas west of the North Point/Rock Point line) will  
140 be placed at Site 104 (Figure 1-2).  
141

142 These channels can be divided into several distinct geographical areas, the Virginia channels, the  
143 Maryland Bay channels, and the Baltimore Harbor channels, which comprise the Baltimore  
144 Harbor & Channels project; and the southern and northern approach channels to the Chesapeake  
145 and Delaware (C&D) Canal, and the C&D Canal which comprise the Inland Waterway from the  
146 Delaware River to the Chesapeake Bay, C&D Canal project.  
147

148 The Virginia Channels are comprised of the Cape Henry, York Spit, and Rappahannock Shoal  
149 Channels. The channels are authorized to 50 feetft deep and are located in the Virginia Portion  
150 of the Chesapeake Bay. The Cape Henry and York Spit Channels are dredged periodically,  
151 removing an average of approximately 425,000 cubic yards annually. The Rappahannock Shoal  
152 Channel experiences little shoaling and has not been maintained since it was deepened to 50  
153 feetft in 1987. Dredged material from the Cape Henry channel is placed at the Dam Neck Ocean  
154 placement area in the Atlantic Ocean. Dredged material from the York Spit Channel is placed at  
155 the Wolf Trap Alternate open water placement area in the Chesapeake Bay. Material previously  
156 dredged from the Rappahannock Shoal Channel was placed in the Rappahannock Deep Alternate  
157 placement area in the Chesapeake Bay. Since adequate dredged material placement capacity  
158 currently exists for these channels, this Environmental Impact Statement will not address these  
159 channels.  
160

161 The Maryland Bay channels include the Craighill Entrance, Craighill Channel, Craighill Angle,  
162 Craighill Upper Range, and Cutoff Angle which are authorized to 50 feetft deep and extend from  
163 just north of the Chesapeake Bay Bridge to the entrance to the Patapsco River; and the Brewerton  
164 Channel Eastern Extension, Tolchester Channel, and Swan Point Channel, which are authorized  
165 to 35 feetft deep and extend from the Tolchester and Pooles Island areas to the mouth of the  
166 Patapsco River. Maintenance dredging is performed annually with approximately 2 million  
167 cubic yards of material being dredged from the channels. Shoaling rates and dredging  
168 frequencies vary from channel to channel. Material dredged from these channels over the past 15  
169 years has been placed at either the Hart-Miller Island Containment Facility in Baltimore County,  
170 or at the Pooles Island open water placement areas in the Chesapeake Bay. The Poplar Island  
171 Habitat Restoration Project is currently being constructed to receive dredged material from these  
172 channels. Phase I, to construct 640 of the 1100-acre site is scheduled for completion by  
173 December 1999. Phase II is scheduled to start in the spring of 2000 and be completed by the fall  
174 of 2001.  
175

176 The Baltimore Harbor Channels extend from the mouth of the Patapsco River into the Northwest  
177 and Middle Branches of the Patapsco River, Curtis Bay, and Curtis Creek. These channels are  
178 maintained annually, removing approximately 500,000 to 600,000 cubic yards of material.  
179 Shoaling rates and dredging frequencies vary from channel to channel. Material dredged from  
180 these channels over the past 15 years has been placed at the Hart-Miller Island Containment  
181 Facility, and is precluded from being placed in open waters of the Chesapeake Bay by State of  
182 Maryland law. Material dredged from these channels will continue to be placed in the Hart-

183 Miller Island Containment Facility and potentially in the proposed CSX/Cox Creek Containment  
184 Facility which is currently under study.  
185

186 The southern approach channel to the Chesapeake and Delaware Canal extends from the Pooles  
187 Island Area to the Sassafras River. The northern approach channel extends from the Sassafras  
188 River to the entrance to the C&D Canal at Town Point. The C&D Canal extends from Town  
189 Point in the Chesapeake Bay to Reedy Point in the Delaware River. Maintenance dredging is  
190 performed annually in the channel areas maintained by the Philadelphia District, removing  
191 approximately 1.5 mcy of material, although not all reaches require dredging each year.  
192

193 The material dredged from the southern approach channel to the C&D Canal (stations 250+000  
194 to 163+000) has been deposited in five previously used open water placement areas designated as  
195 Pooles Island areas D, E, F, G, and H (Figure ). These sites are south of the Sassafras River and  
196 have been permitted for Corps use by the State of Maryland periodically since the 1970's. The  
197 Maryland Department of Natural Resources has allowed fill up to minus 8.5 feetft Mean Low  
198 Water (MLW) for area D, minus 11 feetft MLW for areas E, F, and G, minus 12 feetft MLW for  
199 area H, and minus 14 feetft MLW for Site 92. The annual quantity placed in open water (1977 to  
200 1998) from this segment is approximately 1,200,000 cubic yards.  
201

202 Based upon the amount of material that must be dredged from the Maryland portion of the  
203 project, approximately 4 mcy must be dredged annually to maintain the channels. This amounts  
204 to a dredging need of 80 mcy over a twenty-year dredging period.  
205

206 In addition to maintenance dredging, there are several congressionally authorized new work  
207 projects and several new work projects in the planning or engineering and design phase. The  
208 following projects have been authorized for construction:  
209

210 The Brewerton Channel Eastern Extension is authorized to 35 feetft deep and 600 feetft wide.  
211 The channel was deepened to 35 feetft in 1986 and widened to 450 feetft wide. The eastern  
212 nautical mile of the channel was widened to the authorized 600-feetft width in 1989-90.  
213 Widening of the western five miles of channel requires the dredging and placement of 2.3 mcy of  
214 material. Congress has appropriate funds to complete this work in Fiscal Year (FY) 2000.  
215 Congress has directed the Corps to straighten the Tolchester Channel S-Turn. Straightening the  
216 Tolchester Channel S-Turn will require the dredging of 2.8 mcy of material. Congress  
217 appropriated a portion of the funds to initiate construction in FY 2000. Congress has also  
218 approved several improvements to under the Baltimore Harbor Anchorages and Channels  
219 project. These improvements will require the dredging of 4.5 mcy. Congress has not  
220 appropriated funds to initiate this work. The C&D Canal and approach channels area currently  
221 being studied to determine the Federal interest in deepening the channels beyond 35 feetft deep.  
222 Preliminary information indicates that approximately 10 mcy of material would have to be  
223 dredged to deepen the project to 40 feetft mean lower low water ( MLLW). In addition, the State  
224 of Maryland currently proposes to construct a new 50-feetft deep berth at either Dundalk or  
225 Seagirt Marine Terminals, and construct a new container facility at Masonville.  
226

227 In order to accommodate the planned maintenance dredging and new work dredging over the  
228 next twenty years, an estimated 110 million cubic yards of material must be dredged in the upper  
229 Chesapeake Bay area.

230

#### 231 **1.4 SCOPE OF THE EIS**

232

233 The decision of whether to accomplish the work proposed in this EIS will be based on an  
234 evaluation of the probable impact, including cumulative impacts, of the proposed work ~~on or in~~  
235 the public interest. The decision will reflect the national concern for the protection and  
236 utilization of important resources. The benefits that may reasonably be expected to accrue from  
237 the proposed project must be balanced against its reasonably foreseeable detriments. This EIS  
238 documents and analyzes the potential environmental and socioeconomic effects associated with  
239 the action described in Section 2.1, "Proposed Action" and alternatives to the proposed action.  
240 The study area for this EIS includes the upper Chesapeake Bay proposed Site 104 area and the  
241 potential region of influence (ROI) within the communities surrounding the proposed sites. ~~The~~  
242 ~~ROI for this project consists of the Chesapeake Bay itself and Queen Anne's, Anne Arundel, and~~  
243 ~~Kent Counties.~~

244

#### 245 ~~1.5 ALTERNATIVE PLACEMENT SITES~~

246

247 ~~Placement alternatives to Site 104 are discussed in Section 2.2 and, along with Site 104, are~~  
248 ~~evaluated further in this EIS.~~

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## 1.5 ALTERNATIVE PLACEMENT SITES

Dredged material placement alternatives to Site 104 are discussed in Section 2.2 and, along with Site 104, are evaluated further in this EIS.

### MOVE THE FOLLOWING PARAGRAPHS TO SECTION 2:

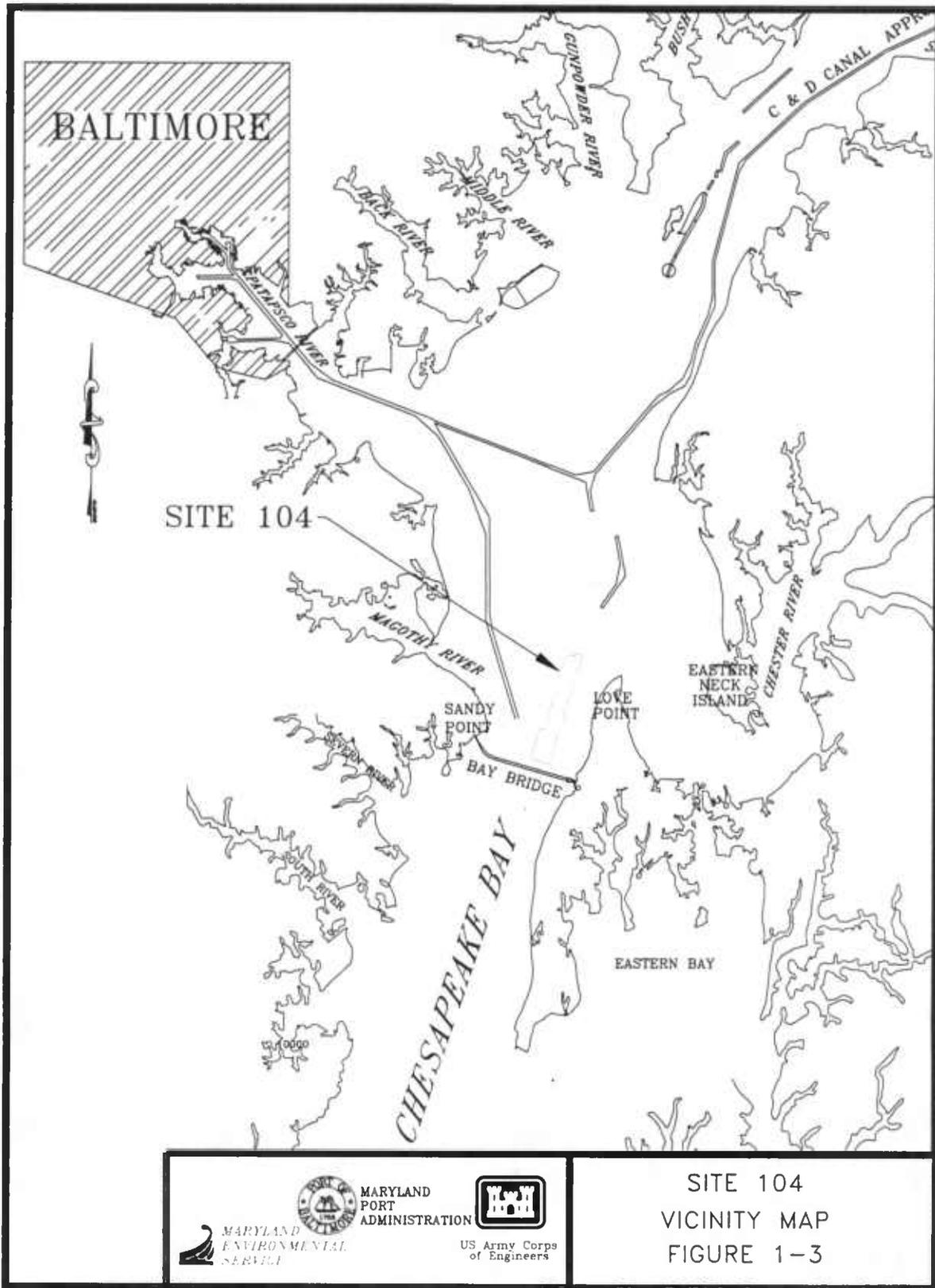
#### 1.6 STUDY AREA

##### **1.6.1 Site Location**

Site 104 is a previously used 1,800-acre open-water placement site located approximately 2,000 feet north of the Chesapeake Bay Bridge, and east of the Craighill navigational channel, and one mile west of Kent Island (Figure 1-3).

##### **1.6.2 Site Description**

The Site 104 placement area was established in 1924 by the U.S. Army Corps of Engineers, and was used for the placement of dredged material through 1975. The last known use of the site occurred in 1975, with the placement of approximately 850,000 cubic yards dredged from the inbound or eastern side of the Brewerton cut-off and Craighill Angles. Currently, the site is approximately 6.8 km (4.2 miles) long and 1.1 km (0.65 miles) wide. The depth ranges from -12.8 to -23.3 meters (-42 to -76.8 feet) mean lower low water (MLLW). Placement would be restricted to areas deeper than the -14 meter (-45 feet) contour interval to achieve a final site elevation of not higher than -14 meters (-45 feet) MLLW.



<p>MARYLAND ENVIRONMENTAL SERVICE</p>	<p>MARYLAND PORT ADMINISTRATION</p>	<p>US Army Corps of Engineers</p>
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SITE 104  
VICINITY MAP  
FIGURE 1-3

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## Section 2

### Alternatives Including the Proposed Action

The dredged material placement alternatives analyzed in this RDEIS are reviewed in this section. The proposed Site 104 open-water placement project is described in Section 2.1. The criteria used to screen the placement alternatives placement options are described in Sections 2.2.1 and 2.2.2. Other placement options alternatives that have been considered are then described in Sections 2.2.3 and 2.2.4. Appendix xx Annex E describes each of these placement options and their derivation in more detail and applies screening criteria (described in Section 2.x.x) to determine which placement options were appropriate for consideration as alternatives in this RDEIS. As required by NEPA, the No Action alternative is included and evaluated in this document. The potential impacts of the proposed action are described in Section 6. Potential impacts of dredged material placement alternatives are described in Section 7.

#### 2.1 Proposed Action

Open water placement is proposed for approximately 18 mcy of dredged material from the mainstem Chesapeake Bay channels in Maryland serving leading to the Port of Baltimore. The Maryland Port Administration (MPA) has recommended the use of Master Plan Site 104 (generally coinciding with the southern two thirds of the site also known as "Kent Island Deep") for open water placement of approximately 18 mcy of clean suitable sediment beginning in 2000 1999 or as soon thereafter to fulfill the open water placement element of the State of Maryland's Strategic Plan. The southern border of Site 104 is located in the Chesapeake Bay approximately one mile north of the Chesapeake Bay Bridge (Figure 1-3). Placement is not proposed for the northern portion of the Kent Island Deep which has depths of 45 feet or less. (This latter area generally coincides with Master Plan Site 105.)

Selection of Site 104 open water placement for NEPA investigation was based on a cooperative effort involving the U.S. Army Corps of Engineers (USACE), North Atlantic Division, Baltimore (CENAB); USACE, North Atlantic Division, Philadelphia District (CENAP); and the MPA, state and federal natural resource and regulatory agencies, local governments, and environmental and public interest groups. Site 104 was one of the preferred open water alternatives resulting from multi-agency consultations during the Master Planning process (MPA, 1989, 1990) and was selected identified as the most viable open water optional alternative with through multiple levels of screening through by participants in the MPA sponsored Dredging Needs and Placement Options Program (DNPOP).

CENAB developed and applied Additional screening criteria were applied by CENAB in determining which of these options that was previously considered and which additional options would be was suitable for inclusion and consideration as alternatives in this DEIS in addition to Site 104, as discussed below.

#### 2.1.1 Overview of the Proposed Site 104 Open-Water Placement Project

46 Clean ~~s~~Sediment would be dredged from the Federally maintained navigation channels in the  
47 main stem of the Bay and placed in open water Site 104, over a period of up to 1-9 years,  
48 depending upon the dredging sequence, dredging need and other factors. These channels include  
49 the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle,  
50 Brewerton Channel Eastern Extension, Swan Point Channel, Tolehester Channel, and the  
51 southern approach channel to the C&D Canal. Dredged material from Baltimore Harbor  
52 channels (Figure 1-1) would not be placed in open water at Site 104.

53  
54 As set forth in Section 40 CFR § 230.11 (d) a determination must be made as to the degree to  
55 which dredged material will introduce, relocate, or increase contaminants within a placement  
56 area. The quality of estuarine sediment planned for dredging and placement is determined by  
57 applying the tiered testing protocol prescribed by the Environmental Protection Agency (EPA) in  
58 the Inland Testing Manual (EPA and USACE, 1998), as discussed in. Screening criteria have  
59 been developed by the Chesapeake Bay Program and will be used as the tool for satisfying the  
60 requirements of the ITM (Section 5.1.5.b). Sediments that are determined to be non-  
61 contaminated following the EPA protocol are characterized in this DEIS referred to as "clean"  
62 "suitable" to distinguish them from contaminated sediments.

63  
64 As used in this DEIS, "unclean" "contaminated" dredged material means dredged material that  
65 would contain ~~would be classified as~~ contaminant ~~contaminated using the ITM protocols and~~  
66 would introduce, relocate, or increase these contaminants. Typically, these materials would be  
67 unacceptable for unconfined open water placement in the Chesapeake Bay, although this material  
68 could potentially be placed in open water and capped. "Unclean" The term "prohibited" also  
69 pertains to a legislative definition of dredged material that lies upstream of a line legislatively  
70 drawn across the mouth of the Patapeseo River between Rock Point and North Point (Figure 1-2),  
71 and that is prohibited by State law from being placed in open waters of the Chesapeake Bay  
72 (Figure 1-2). By Code of Maryland Regulation, Title 8, Section 8-1602(a) "*A person may not*  
73 *...deposit... in an unconfined manner spoil from Baltimore Harbor into or onto any portion of the*  
74 *water or bottomland of the Chesapeake Bay or of the tidewater portions of any of the*  
75 *Chesapeake Bay's tributaries outside of Baltimore Harbor.*"

76  
77 Sediments proposed for placement in Site 104 open water will be limited to sediments that have  
78 been determined to be suitable for open water placement following the EPA testing protocol.  
79 Contaminated ~~Prohibited~~ sediments from Baltimore Harbor which are considered to be  
80 contaminated by sState law, cannot be placed in Site 104 or any other open water site under the  
81 jurisdiction of the State of Maryland.

### 82 83 **2.1.2 Proposed Use of Site 104 for Dredged Material Placement**

84  
85 The MPA designated and recommended Site 104 for investigation for open water placement. Site  
86 104 had been ranked highest among the open water options that were identified and technically  
87 screened through the DNPOP program.

88  
89 Open water Pplacement proposed at Site 104 would be limited to areas deeper than the -45 ft  
90 MLLW contour interval to achieve a final site elevation of -45 ft MLLW and composed of

91 ~~cleansuitable dredged material. Based on existing contours within the proposed site, placement~~  
92 ~~would occur within the site in the area south of the lighted red and white buoy for Love Point~~  
93 ~~(RW "LP" buoy (Figure 2-1)). Two concepts were originally advanced for placement at Site~~  
94 ~~104: placement with and without a berm. **The latter was a proposal that a berm be**~~  
95 ~~**constructed along the southern and western edge of the site if needed to minimize the**~~  
96 ~~**potential for prevent material drift to migrate from Site 104 after placement into the area**~~  
97 ~~**defined by State legislation as the Deep Trough. Both placement approaches options are**~~  
98 ~~**discussed later in this chapter.**~~  
99

### 100 2.1.23 Historical Use of Site 104 as a Dredged Material Placement Area

101  
102 The Site 104 was established as a designated open water dredged material placement area by the  
103 USACE in 1924. The site was used for that purpose from 1924 to 1975. The original site  
104 boundaries began at approximately 1.75 miles northwest of Love Point and extended 2.7 nautical  
105 miles south-southwestward along a natural deep channel to a position due east of Sandy Point  
106 Light. In 1950, the southern boundary was extended 1 nautical mile south to latitude 39°00' N.  
107 Then in 1960, the following changes were made (1) the southern boundary was extended another  
108 2,500 ft south to a line running parallel to and 2,000 ft north of the Bay Bridge; (2) the southern  
109 1.1 nautical miles of the site was widened to the west by an additional 1,000 ft; and (3) the  
110 depths along the original site axis were 70 ft to 73 ft MLLW and the added areas had depths to  
111 95 ft MLLW.

112  
113 Originally, it was intended that the site depths be raised to no higher than 50 ft MLLW;  
114 however, in September 1960 depths were raised to 40 ft MLLW in a portion of the site to  
115 provide additional placement capacity (CENAB 1997a). If Site 104 is found suitable for open-  
116 water placement, then bathymetric monitoring would be conducted to insure that the final  
117 elevation of the currently proposed placement would not increase the bottom elevation above the  
118 proposed 45 ft MLLW.

### 119 120 2.1.34 SELECTION OF Site 104 OPEN-WATER PLACEMENT AREA - PLANNING 121 PROCESSES

122  
123 The USACE, CENAB and CENAP, and the MPA have been involved in at least three major  
124 sState-sponsored and two USACE-sponsored dredged material placement planning efforts since  
125 1986. These efforts have been conducted to identify suitable placement options and locations  
126 through screening level evaluations. Environmental, economic, and capacity needs were  
127 evaluated, and sites were rated or ranked to identify those that warranted further evaluation and  
128 study. The State-sponsored planning activities occurred in succession, and provided a conceptual  
129 framework and information resource for subsequent placement planning activities that led to the  
130 current proposed placement action. These initiatives are summarized below and presented in  
131 more detail in Appendix XX Annex E. The USACE dredged material management initiatives  
132 occurred concurrently with the State-sponsored efforts, which served as information resources.  
133 This planning process is depicted in Figure 2-1.

### 134 135 2.1.314.a MPA Master Plan - 1986

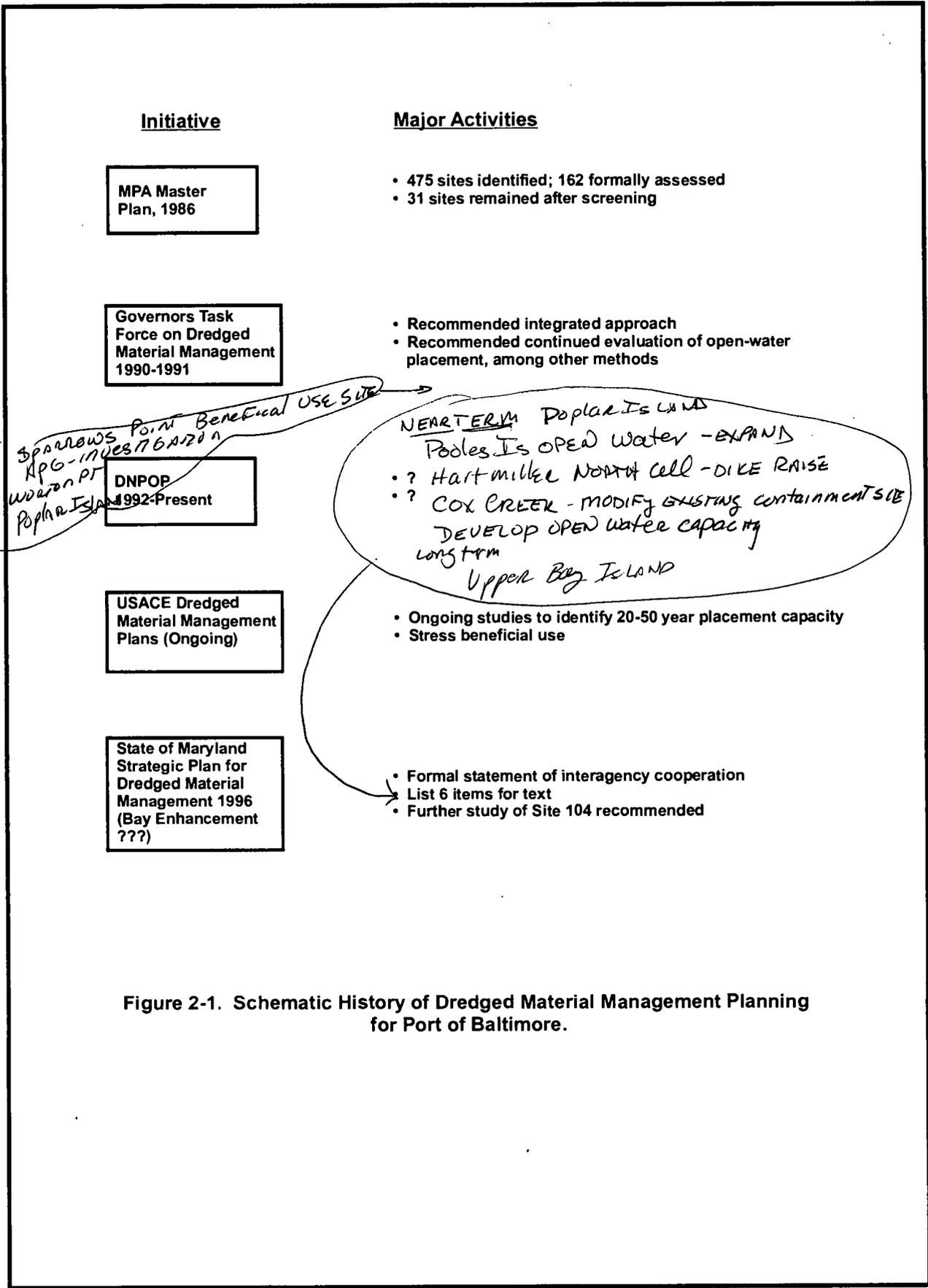


Figure 2-1. Schematic History of Dredged Material Management Planning for Port of Baltimore.



136 ~~The Hart Miller Island Dredged Material Containment Facility began receiving dredged~~  
137 ~~materials in May 1984. The availability of this large-scale confined disposal facility (CDF)~~  
138 ~~removed the immediate pressure for resolving long-term placement needs, and decision~~  
139 ~~making on future options languished. In this regard, a case study by the National Research~~  
140 ~~Council observed, as a lesson learned from the Hart Miller Island experience, that "the~~  
141 ~~availability of a large CDF can become a convenient excuse to delay or avoid making~~  
142 ~~politically sensitive, difficult and controversial decisions to resolve critical dredging~~  
143 ~~problems, shortening CDFR capacity for contaminated sediments in the process" (NRC,~~  
144 ~~1997). Nevertheless, efforts were continued to develop an acceptable long-term solution~~  
145 ~~based on a cooperative, interdisciplinary process (Hamons, 1988); Hamons and Young,~~  
146 ~~1999).~~

147  
148 The Master Plan effort was a multidisciplinary MPA-sponsored planning initiative that began in  
149 1986 as a participatory process to resolve long-term dredged material placement needs. The goal  
150 was to develop a comprehensive, consensus-based, long-term plan for the management of  
151 dredged material. The initiative and  
152 eventually involved representatives from a  
153 range of state and Federal resource and  
154 regulatory agencies, local USACE Districts,  
155 county and local governments, and public  
156 interest groups (Box 2-1) (Hamons, 1988;  
157 Hamons and Young, 1999).

158  
159 During Phase I of the Master Plan, over 475  
160 sites for dredged material placement were  
161 initially identified. Of the identified sites, all  
162 475 were considered to have sufficient merit  
163 as to warrant preliminary formal screening.  
164 Of the 475, and 162 of these were given  
165 serious consideration formally assessed for  
166 potential dredged material placement based  
167 upon their potential feasibility in Phase II.  
168 The MPA prepared a summary report titled  
169 "Port of Baltimore; Dredged Material  
170 Management Master Plan" (MPA 1989,  
171 1990), which recommended various dredged  
172 material placement options.

173  
174 The Master Plan set forth a specific set of  
175 screening criteria that formed the conceptual  
176 basis for future dredged material site  
177 screening; it included both environmental  
178 and cost factors (Box 2-2). With the  
179 cooperation and input of key local and  
180 regional natural resource agencies (e.g.,

**BOX 2-1**  
**PARTICIPANTS IN MASTER PLAN**  
**DEVELOPMENT**

**Master Plan Regulatory Advisory Committee**

- Maryland Department of the Environment
- Maryland Department of Natural Resources
- Chesapeake Bay Critical Areas Commission
- Environmental Protection Agency, Region III
- U.S. Army Corps of Engineers, Baltimore District
- U.S. Army Corps of Engineers, Philadelphia District
- U.S. Department of Commerce, National Marine Fisheries Service
- U.S. Department of Interior, U.S. Fish and Wildlife Service
- Regional Planning Council

**Master Plan Citizens Advisory Committee**

- Chesapeake Bay Foundation
- Citizens Advisory Committee to the Chesapeake Bay Program
- Coastal Resources Advisory Committee
- Maryland Wetlands Committee
- State Water Quality Advisory Committee
- Maryland Chamber of Commerce
- National Association of Dredging Contractors
- Upper Chesapeake Watershed Association, Inc.
- Baltimore City, Mayor's Office
- Baltimore County Executive
- Anne Arundel County Executive
- Harford County Commissioners
- Board of Cecil County Commissioners
- Board of Kent County Commissioners
- Board of Queen Anne's County Commissioners
- Hart-Miller Island Citizen's Oversight Committee

24 Private Sector Port Advisory Committee

DO NOT  
INCLUDE  
SCREENING  
MATERIAL  
SOMEWHERE

181 MDE, USFWS, DNR, NOAA/NMFS, EPA) a suite of environmental factors of regional  
182 significance were identified. The factors considered included: water quality, groundwater  
183 recharge areas, hydrology, shoreline erosion control, substrate, tidal and non-tidal wetlands,  
184 submerged aquatic vegetation, fisheries resources, shellfish, endangered species, forest resources,  
185 waterfowl use areas, archaeological and historical sites, and population centers. Existing  
186 ~~conditions~~ Information about existing conditions was gathered for each resource of concern at  
187 each of the 162 sites listed for ~~rigorous consideration~~ formal assessment.  
188

**BOX 2-2**  
**SCREENING CRITERIA FOR MPA MASTER PLAN**

**Process.** Screening criteria were developed for preliminary screening in Phase I and comprehensive screening in Phase II.

**Participants.** Screening criteria were developed through a participatory process involving State and Federal dredged material management and natural resource agencies, counties and local governments, and public interest groups (see Box 2-21). The U.S. Army Engineer Waterways Experiment Station provided technical advisory services.

**Screening Criteria.** The following screening factors were applied to placement categories (upland sites, land creation, overboard, shore stabilization/wetlands development)

Phase I Screening Criteria	Phase II Screening Criteria
<ul style="list-style-type: none"> <li>• <u>distance from dredging area</u></li> <li>• <u>minimum depth of water</u></li> <li>• <u>maximum depth of water scow transport distance from dredging area mapped oyster bed</u></li> <li>• <u>wildlife refuge</u></li> <li>• <u>historical areas</u></li> <li>• <u>parks</u></li> <li>• <u>substantially built up area</u></li> </ul>	<p align="center"><b>Environmental Screening Factors</b></p> <p><u>Water Resources</u></p> <ul style="list-style-type: none"> <li>• <u>Water quality</u></li> <li>• <u>Ground water</u></li> </ul> <p><u>Physical Features</u></p> <ul style="list-style-type: none"> <li>• <u>Hydrology</u></li> <li>• <u>Erosion</u></li> <li>• <u>Substrate</u></li> </ul> <p><u>Ecology</u></p> <ul style="list-style-type: none"> <li>• <u>Tidal wetland</u></li> <li>• <u>Nontidal wetland</u></li> <li>• <u>Submerged aquatic vegetation</u></li> <li>• <u>Finfish spawning or rearing area</u></li> <li>• <u>Shellfish</u></li> <li>• <u>Rare, threatened, or endangered species</u></li> <li>• <u>Forest</u></li> <li>• <u>Waterfowl use area</u></li> </ul> <p><u>Social/Public Welfare</u></p> <ul style="list-style-type: none"> <li>• <u>Archaeology</u></li> <li>• <u>History</u></li> <li>• <u>Population center</u></li> </ul>
	<p align="center"><b>Cost Screening Factors</b></p> <ul style="list-style-type: none"> <li>• <u>Pumping distance</u></li> <li>• <u>Hauling distance</u></li> <li>• <u>Water depth</u></li> </ul>

Source: MPA, 1990

189 The environmental data, in conjunction with estimates of site development costs, were used to  
 190 identify fatal flaws among the 162 listed sites, resulting in a list of ~~Thirty-one~~ ~~two~~ ~~32~~ potential  
 191 placement areas survived this rigorous evaluation process. Based upon the environmental data, a  
 192 score was assigned to each site reflecting the presence/absence and quality of the various  
 193 resources; each resource was assigned an (agency negotiated) scoring factor that reflected the  
 194 relative importance of various resources in the region. The sum of the scores allowed for a  
 195 ranking of the site based upon environmental factors. Additionally, detailed costs were

196 developed for each of the 32 potential placement areas based upon a range of potential dredging  
197 options and placement scenarios. This allowed for a ranking of the potential placement options  
198 by cost.

199  
200 The Master Plan initiative was discontinued as a public policy response to public controversy  
201 over the proposed use of the area known as the "Deep Trough" for open-water placement.  
202 Nevertheless, the Master Planning process was the foundation for resource agency consensus  
203 building with respect to selection of dredged material placement options within the State.  
204 Subsequent planning efforts (the Governor's Task Force, the DNPOP Program, and Maryland's  
205 Strategic Plan for Dredged Material Placement Management) have all included multi-  
206 organizational working (advisory) groups and have utilized a similar multi-factor approach to  
207 placement site screening. Although some environmental factors have been added or changed  
208 since 1990, the basic multi-factor environmental screening approach has been the basis for all  
209 subsequent site selections and preliminary evaluations. The 32 potential sites identified as part  
210 of this process were carried to the DNPOP program and analyzed more rigorously.

211  
212 **2.1.324-b Governor's Task Force on Dredged Material Management - 1990 to 1991**

213  
214 —To facilitate development of a broadly supported dredged material management plan,  
215 placement options within the State, Governor William Donald Schaefer convened a Task Force  
216 to provide a recommended recommendations for placement  
217 alternatives that used dredged sediments as a  
218 natural resource approach as a replacement for  
219 the Master Plan. The membership of the task  
220 force was broadly based, representing state,  
221 Federal, and local governments, members of  
222 the academic community, groups concerned  
223 with protection of the environment, parties  
224 involved in maritime commerce, and parties  
225 whose livelihood is dependent upon the quality  
226 of Chesapeake Bay waters (Box 2-3). In a  
227 1991 report, the Task Force recommended an  
228 integrated approach to dredged material  
229 management, with a desire to increase the  
230 beneficial uses of dredged material. It also  
231 recognized that the use of existing placement  
232 sites and creation or designation of new sites  
233 including containment sites, open-water  
234 placement sites, and upland placement sites  
235 would be required to accommodate both short-  
236 and long-term demand for placement of  
237 dredged materials.

238  
239 The Task Force further recommended a  
240 continuation of studies on the feasibility of

**BOX 2-3**  
**GOVERNOR'S 1991 TASK FORCE**  
**PARTICIPATING ORGANIZATIONS**

Association of Maryland Pilots  
Baltimore County  
Chesapeake Bay Commission  
Chesapeake Bay Foundation  
Environmental Protection Agency, Region III  
John Hopkins University  
Maryland Department of the Environment  
Maryland Department of Natural Resources  
Maryland Department of Transportation  
Maryland Governor's Science Advisory Council  
Maryland House of Delegates (3 delegates)  
Maryland Saltwater Sportsfishermen's Association  
Maryland Watermen's Association  
National Marine Fisheries Service  
Queen Anne's County Administration  
Rukert Terminals  
State Water Quality Advisory Committee  
U.S. Army Corps of Engineers, Baltimore District  
U.S. Army Corps of Engineers, Philadelphia District  
U.S. Fish and Wildlife Service  
W.J. Browning Company, Inc.

Source: MDOT, 1991

241 using new open-water placement sites with an emphasis on the environmental considerations.

242  
243 **2.1.334.e Dredging Needs and Placement Options Program (DNPOP) - 1992~~3~~ to Present**

244  
245 —The MPA is currently pursuing various options for the management of dredged material  
246 through its Dredging Needs and Placement Options Program (DNPOP). Like the Task Force,  
247 this is a multidisciplinary, interorganizational program that was formed by the MPA, with  
248 assistance from the Maryland Environmental Service (MES). The DNPOP program was  
249 specifically developed to implement the recommendations of the Governor's 1991 Task Force.  
250 Participants initiated their planning and advisory activities by focusing on identifying and  
251 evaluating beneficial use opportunities. Over 35 beneficial use options have been considered  
252 since 1992. The effort to find suitable placement sites included beneficial use, open-water,  
253 upland, and containment sites and innovative use opportunities. This effort was assisted by  
254 Ffederal and sState resource and regulatory agencies. In 1996, representatives of the natural  
255 resource agencies prepared a high value living resource area map covering the area north of the  
256 southern end of Kent Island. The map was intended to identify sites for within-Bay projects that  
257 would have the least impacts on living resources if used for the placement of dredged material  
258 (Crockett, circa 1996). The map was used as a resource in an effort to find new options and to  
259 perform preliminary screening of existing options. For example, the expansion of the Pooles  
260 Island open-water sites that have been implemented (Sites 92 and G-East) and (Site 104) all lie in  
261 areas that were identified as  
262 having the least potential impact  
263 to living resources.

264  
265 The DNPOP program includes  
266 Executive and Management  
267 Committees (Box 2-4), and  
268 Citizen's Committees (Box 2-5),  
269 and working groups. Moderator  
270 and staff support for the  
271 Committees and program  
272 management is coordinated by  
273 the MPA. Professional staff  
274 support for the working groups,  
275 facilitation and technical services  
276 for the DNPOP Program are  
277 provided by MES under  
278 arrangements with the MPA. The  
279 participating organizations  
280 involved included many of the  
281 state and Federal agencies  
282 involved in the development of  
283 the Master Plan as well as special  
284 interest and citizen's groups such  
285 as the Maryland Waterman's

→ should this be deleted

**BOX 2-4**  
**DNPOP EXECUTIVE AND MANAGEMENT COMMITTEES**

**Executive Committee**

- Maryland Department of the Environment
- Maryland Department of Natural Resources
- Maryland Department of Transportation
- U.S. Army Engineers, Baltimore District
- U.S. Army Corps of Engineers, Philadelphia District
- Maryland Port Administration (Executive Secretary)

**Management Committee**

- Aberdeen Proving Ground
- Association of Maryland Pilots
- Chesapeake Bay Commission
- Chesapeake Bay Foundation
- EPA Region III Chesapeake Bay Program
- Great Lakes Dredged & Dock Company
- Maryland Department of the Environment
- Maryland Department of Natural Resources
- Maryland Department of Transportation
- Maryland Environmental Service
- Maryland Port Administration
- National Marine Fisheries Service
- NOAA Chesapeake Bay Office
- Office of Congressman Wayne T. Gilchrest
- Ruekert Terminal
- State Water Quality Advisory Committee
- U.S. Fish and Wildlife Service

Source: MPA

286 Association, the Chesapeake Bay Foundation, and the Maryland Charterboat Captain's  
287 Association, and representatives of local governments.

288  
289 The objective of the program is to identify and develop short-term to long-term dredged material  
290 placement options for the Port of Baltimore and its approach channels, seeking consensus  
291 whenever possible. ~~Many~~Some of the original ~~32~~ Master Plan sites have been considered under  
292 this program, ~~and although some additional other~~ options were also added. ~~In all cases, t~~The  
293 program first identifies and distributes readily available information about the option. The option  
294 ~~is and then screens~~ placement options through by a technical working group using local and  
295 expert knowledge and available information. The working group is comprised of individuals  
296 with relevant professional and local knowledge, called the Bay Enhancement Phase II (BEP II)  
297 Working Group. Site visits have been conducted and documented for certain sites in order to  
298 provide basic information needed for preliminary screening purposes.

299  
300 The results of BEP II working group activities are reported to the Management and Citizen's  
301 Committees, and, where appropriate, to the Executive Committee. Multidisciplinary,  
302 interorganizational working groups are established, usually on a project- or area-specific basis, to  
303 provide technical and advisory support for pre-feasibility or feasibility studies, and where  
304 appropriate, for placement activities.

305  
306 A broad-consensus on specific placement  
307 options proved to be elusive despite the  
308 dredging need and widespread interest  
309 and involvement in finding a solution to  
310 the placement problem. An intense  
311 effort was undertaken to implement the  
312 beneficial use recommendation of the  
313 Governor's 1991 Task Force, yet only the  
314 restoration of Poplar Island had achieved  
315 the necessary support to advance from  
316 concept to implementation. Describing  
317 this effort, Hamons and Young (1999)  
318 report that . . . "Linking the beneficial use  
319 concept to specific sites focuses attention  
320 on site-specific environmental, social and  
321 economic tradeoffs that, in most cases,  
322 work individually or collectively against  
323 project acceptability. Conversion of  
324 habitat from one form to another,  
325 especially fisheries habitat, has been a  
326 major factor in determining whether or not the environmental value that would be gained would  
327 in turn justify modifications to existing site conditions." By mid-1995, it became apparent that  
328 the beneficial use approach alone would not resolve the placement need, and that urgent action  
329 was needed to overcome an imminent large-scale deficit in placement capacity. This situation led  
330 to development of the State of Maryland Strategic Plan for Dredged Material Management,

**BOX 2-5**  
**DNPOP CITIZENS COMMITTEE**

Anne Arundel County  
Baltimore County Government  
Baltimore County Watermen's Association  
Baltimore Gas and Electric  
Canal Bank Study Committee  
Cecil County Government  
Dorchester County Government  
Essex-Middle River Civic Council  
Kent County Government  
Harford County Government  
Hart-Miller Island Citizens Oversight Committee  
Maryland Charter Boat Association  
Maryland Saltwater Sportfishermen's Association  
Maryland Watermen's Association  
North Point Peninsula Community Coordination Council  
Queen Anne's County  
Upper Bay Charter Captains Association

Source: MPA

331 which is discussed in section 2.1.4.e (BEP II, 1995x; Hamons and Young, 1999).

#### 332 333 **2.1.34.d USACE Dredged Material Management Plans**

334  
335 —The CENAP and CENAB are each working closely with MPA to develop multi-phased studies  
336 called Dredged Material Management Plans (DMMP) for each District. These efforts are part of  
337 a USACE program to provide a more complete and consistent dredged material management  
338 planning nationwide for Federal navigation projects that require dredging. The objective of each  
339 study is to identify placement capacity for the next 20 to 50 years, as required by USACE policy.  
340 Plan formulation was initiated in Federal Fiscal Year 1995 and will include consideration of all  
341 dredging maintenance and construction of Federal projects, as well as state and private projects.  
342 The studies are planned to stress long-term solutions and additional beneficial uses of dredged  
343 material, insofar as practicable and consistent with the regulatory requirement for selection of the  
344 least cost, environmentally acceptable alternative (33 CFR ADD CITATION). The prior and  
345 ongoing multi-disciplinary planning and broad-based interorganizational coordination for Federal  
346 navigation projects serving the Port of Baltimore and the Chesapeake and Delaware (C&D)  
347 Canal provide an invaluable resource to facilitate the development of USACE DMMPs, as does  
348 the environmental documentation and NEPA process for the placement action addressed by this  
349 DEIS. However, as dredging needs are continuing requirements, the proposed action must  
350 necessarily be considered prior to completion of The USACE DMMPs are several years away  
351 from completion, thus necessitating interim solutions to the dredged material placement capacity  
352 deficit.

#### 353 354 **2.1.354.e State of Maryland Strategic Plan for Dredged Material Management – 1996**

355  
356 —The results of the DNPOP activities formed the basis for and have been incorporated into the  
357 *State of Maryland Strategic Plan for Dredged Material Management* (MPA 1996). The  
358 Strategic Plan is supported by a formal statement of cooperation among several state and Federal  
359 agencies to assure full opportunity for review of each proposed dredged material placement site  
360 without pre-judgment and with recognition that each placement action would need to be  
361 considered in compliance with applicable laws and regulations (MDOT 1996a). Signatories that  
362 affirmed support for the State of Maryland's effort to establish a balanced, long-term,  
363 environmentally sound, dredged material placement plan included the U.S. Fish and Wildlife  
364 Service (USFWS); U.S. Environmental Protection Agency (EPA), Region III; National Oceanic  
365 and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS);  
366 Maryland Department of the Environment (MDE); Maryland Department of Natural Resources  
367 (DNR); USACE (CENAB & CENAP), and Maryland Department of Transportation (MDOT).

368  
369 —The State of Maryland Strategic Plan contains the following elements:

- 370  
371
- 372 • Expanded use of open-water placement sites in the immediate vicinity of Pooles
  - 373 Island.
  - 374 • Raising the north cell dike system at the Hart-Miller Island Dredged Material
  - 375 Containment Facility.

- 376
- 377
- 378
- 379
- 380
- 381
- 382
- 383
- 384
- Restoring Poplar Island (Phase I: 640 acres) by beneficial use of dredged material.
  - Reactivating the CSX and Cox Creek Containment Facility cells.
  - Establishing open-water sites for near-term placement of dredged material.
  - Constructing a new upper Bay containment island with a beneficial use component.

385 All of the above elements are in the planning phase, construction phase, or have been completed.

386

387 The DNPOP Bay Enhancement Phase II Working Group (BEP II), in response to program  
388 management guidance from the Management and Executive Committees and the MPA, held a  
389 series of meetings in 1995 to evaluate and rate placement sites for consideration by the DNPOP  
390 Committees and the MPA (DNPOP, 1995x,x,x,x,x). These deliberations included open-water  
391 placement options that were subsequently advanced as candidate sites to satisfy the open-water  
392 placement ~~option~~ component of the State of Maryland Strategic Plan for Dredged Material  
393 Management.

394

395 On March 15, 1995, the ~~multi-disciplinary and multi-organizational~~ BEP II Working Group  
396 ~~recommended to the Management Committee further study of Site 104 and nine other options~~  
397 (BEP II, 1995x) to the Management Committee. On August 2, 1995, based on BEP II Working  
398 Group findings, the Management Committee determined that an accelerated program would be  
399 needed to address the impending dredged material placement deficit. The Management  
400 Committee also determined ~~and~~ that institutionally constrained options (e.g., raising the HMI  
401 dikes, Sparrows Point beneficial use project, use of the Deep Trough), needed to be reconsidered  
402 (MPA, 1995x). The matter was referred to the Executive Committee ~~that which,~~ in response,  
403 initiated accelerated action that led to establishment of the State of Maryland's Strategic Plan for  
404 Dredged Material Management.

405

406 In December 1995, at the direction of the Executive Committee, the BEP II Working Group  
407 prepared a special report for further consideration of certain placement options. The BEP II  
408 Working Group ~~that~~ provided consensus-based preliminary implementation plans including  
409 NEPA requirements for specified placement options including the area defined as the Deep  
410 Trough and Site 104. The BEP II Working Group noted that CENAB was performing surveys to  
411 determine potential capacity of Site 104, and that an EIS would be necessary for implementation  
412 (BEP II, 1995x).

413

414 DNPOP activities, with respect to the open-water placement component of the State's plan, were  
415 subsequently directed away from the Deep Trough in response to a policy decision by the  
416 Governor. The BEP II Working Group then held a series of meetings to assist in the  
417 identification and ranking of open-water placement sites.

418

419 The BEP II Working Group recommended to the Management Committee in February 1996 that  
420 Site 104 merited ~~for~~ fast-track investigation due to the potentially available capacity and

421 immediate need (BEP II, 1996x). The Working Group assisted with the scoping of necessary  
422 environmental studies for the EIS.

423  
424 A meeting was held on April 22, 1996 to identify, characterize on the basis of technical merit,  
425 and conduct a prioritization of prospective upper Bay placement sites to meet the open-water  
426 component of the State's plan. The working group reviewed and updated the group's screening  
427 criteria, resulting in 21 ranking parameters that were used to estimate option suitability (Box 2-  
428 6). The Working Group identified the better of the available open-water sites and then ranked  
429 Site 104, along with Site 171 (Swan Point West) and Worton Point Open-water, for further study.  
430 The working group recognized that the Worton Point open-water option did not have sufficient  
431 capacity, but reluctantly included it to provide a more complete set of alternatives for the  
432 merits of open-water sites. Because the Working Group was not able to develop a consensus  
433 recommendation, the group used a "forced ranking" technique to develop a numerical score that  
434 in turn was used to prioritize the three options. This approach and the results were reported to  
435 the Management Committee on April 24, 1996 (BEP II, 1996x).

436  
437 The Management Committee which accepted Site 104 as the preferred open-water alternative  
438 (MPA, 1996x). On April 29, 1996, the Executive Committee accepted the Site 104 selection as  
439 the open-water placement option for the *State of Maryland Strategic Plan for Dredged Material*  
440 *Management*. The MPA then requested that MES provide a detailed implementation plan for  
441 Site 104, including scoping for environmental documentation and studies. The State's Strategic  
442 Plan for Dredged Material Management was formally announced by the Maryland Governor  
443 Parris Glendening in September 1996 (MDOT, 1996).

444  
445 **2.1.64.f Site 104 Public Outreach Committee**

446  
447 In March 1997, the Maryland Department of Transportation established the Site 104 Public  
448 Outreach Committee (Box 2-7). The objective was to provide an organized means to provide a  
449 forum for sharing information about the proposed use of Site 104 among State and Federal  
450 agencies, representatives of county governments, and public interest groups.

<p>BOX 2-6 PARAMETERS USED TO PRIORITIZE OPEN-WATER PLACEMENT SITES</p> <p>The Working Group updated a list of screening factors that were then used as ranking parameters for prioritizing open-water placement sites which had been previously proposed and incorporated into the Phase II option list. The parameters were specifically chosen to include environmental factors that would need to be considered during the NEPA process.</p> <p>Geographic location relative to placement</p> <ul style="list-style-type: none"><li>• Bathymetry/hydrography relative to placement</li><li>• Hydrodynamic effects</li><li>• Geotechnical factors</li><li>• Construction materials</li><li>• Groundwater</li><li>• Water quality</li><li>• Living resources: fish</li><li>• Living resources: benthics</li><li>• Living resources: wildlife</li><li>• Living resources: rare, threatened or endangered species</li><li>• Fishing activity - commercial and recreational</li><li>• Recreational activity (less fishing)</li><li>• Cultural resources</li><li>• Marine safety</li><li>• Institutional factors</li><li>• Public and community interests</li><li>• Placement and transportation costs</li><li>• Time required to implement</li></ul>
---

Source: MES, 1996

2-12  
hard to read text

*This section should be decreased  
prior to EA deletion  
need a cut-off date*

## 2.2 SELECTION OF ALTERNATIVES TO THE PROPOSED ACTION

A wide range of placement options are being considered for the purposes of providing large-scale, near-term dredged material placement options on the scale needed to meet the placement needs of the State navigation infrastructure channels in Maryland serving the Port of Baltimore. References used to gather information on the alternatives included, among others, the engineering report for the selection and preliminary design of a large-scale containment facility (Green and Trident, 1970), MPA Master Plan (MPA 1990), DNPOP meeting documentation from the BEP II Working Group, MES project files for supplemental reconnaissance work on several beneficial use options, and the MDOT-MPA Prefeasibility Study for the Upper Bay Island Placement Sites Long Term Placement Option, January 1998, and a case study of beneficial use in the upper Chesapeake Bay (Hamons and Young, 1999).

Placement options potentially available as alternatives to the proposed action are those which were included in the DEIS of February 1999 and site-specific options identified during the public comment period on the DEIS which ran from February 26, 1999 to July 31, 1999. The cutoff date for options that would be screened as possible alternatives was July 31, 1999, the effective closure date of the public comment period. It is possible that new or additional options may be identified in conjunction with ongoing dredged material management planning subsequent to the cutoff date for this DEIS. Consideration in this DEIS of new options would only serve to delay essential decision making on the important operational need and associated public policy issues that are addressed in this DEIS. The imminent placement crisis that necessitated the State's 1996 Strategy for Dredged Material Management resulted from the substitution of new approaches and new options for difficult decision-making in the face of public controversy (Hamons, 1988; Hamons and Young, 1999; MDOT, 1996; NRC, 19XX). In this regard, the public comment period on the first DEIS yielded many comments to effect that not enough has been done to find placement options. In fact, extensive efforts have been made, as discussed and documented in this Chapter section.

The public comment period also yielded various suggestions regarding placement concepts. However, placement concepts are not actual options, per se, and would not be considered as a possible alternative. The exception is when there is a site specific option or there is specific work in progress to implement a concept for the navigation infrastructure in Maryland. In this DEIS, the innovative use of dredged material as an economic resource is one such option. Interest has been expressed by several private parties regarding the possibility of using certain commercial facilities or sites for dredged material management applications. To date, this interest has involved proprietary information. In general, CENAB and the MPA are precluded or constrained by their

**BOX 2-7**  
**SITE 104 PUBLIC OUTREACH COMMITTEE**

Chesapeake Bay Foundation  
Delegate Wheeler Baker  
Delegate Ronald Guns  
Delegate Mary Roe Walkup  
Kent County Commissioners  
Maryland Department of the Environment  
Maryland Environmental Service  
Maryland Department of Natural Resources  
Maryland Port Administration  
Maryland Watermen's Association  
Office of Congressman Wayne T. Ggilchrest  
Queen Anne's County Commissioners  
State Senator Walter Baker  
U.S. Army Corps of Engineers, Baltimore District  
2-13

496 contractual regulations from publicly discussing certain contractual matters. Options in this latter  
497 category are not included as options for consideration as alternatives in this DEIS. However,  
498 such an option may be considered at a later date in the manner described in the next section.  
499

500 New or additional options identified subsequent to the option cutoff date for this DEIS and  
501 concepts or existing options not selected as an alternative that subsequently are successfully  
502 brought to practical application would be considered on their own merits at that time. If an  
503 option in these categories were found to be feasible and analysis determines that the option could  
504 be the least cost, environmentally acceptable alternative relative to open water placement, then  
505 the USACE can file a supplemental EIS. The USACE could take a similar action for if a higher  
506 cost, environmentally acceptable option is offered in substitution of open water placement by the  
507 local sponsor with a commitment by the local sponsor to fund an appropriate share of  
508 incremental costs. The USACE also can make adjustments during operations in order to  
509 accommodate changed conditions, consistent with applicable rules and regulations, either to  
510 respond to information in a supplemental EIS or as is common practice with respect to changed  
511 operating conditions.  
512

513 Alternatives for dredged material placement at Site 104 of 18 million cubic yards of sediments  
514 dredged from the approach channels in the upper Bay are presented summarized in the following  
515 sections and presented in detail in Appendix XX Annex E. These alternatives include other open-  
516 water placement sites; upland placement; island creation/restoration; and beneficial uses that  
517 typically focus on habitat creation and restoration, recycling or construction use. In addition,  
518 placement options included combinations of viable smaller capacity options that (together) would  
519 meet the placement need within 9 years. The alternatives were generally derived from the results  
520 of the MPA Master Plan initiative (MPA 1990), the Governor's Task Force recommendations  
521 (MDOT 1991), various DNPOP documents, and the State of Maryland's Strategic Plan for  
522 Dredged Material Management (MDOTPA, 1996c), comments on the February 1999 DEIS, and  
523 CENAB's review of additional possible options, some of which are currently institutionally  
524 constrained.  
525

### 526 2.2.1 Screening Criteria

527

528 Because the list of potential placement sites considered for short-term placement needs is so  
529 extensive, a screening process was developed to identify a range of potential viable options for  
530 in-depth consideration and impact analysis. Primarily sites that were considered viable options  
531 in the succession of multi-agency dredged material management programs (including some  
532 options from the Master Plan process and DNPOP program) are considered here. These options  
533 were previously subjected to screening processes using criteria that were developed by Federal  
534 and state agency and citizen participants (ADD CITATIONS). Several additional options that  
535 were identified during the course of NEPA documentation for this DEIS were also considered.  
536

537 Each option which that made it through the subsequent previous levels of screening was weighed  
538 against a list of carefully considered criteria developed specifically for this DEIS by CENAB.  
539 These screening criteria were developed after review of recent NEPA documents pertaining to  
540 some other proposed actions including the Poplar Island restoration project, open-water

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study has  
been  
completed

15.2

541 placement sites G-East and Site 92, and the Oakland, California, deepening project. The  
542 screening approach that was used for selecting alternatives for the Oakland EIS (CITATION)  
543 provided a logic-based, straightforward approach that was adapted for use in this RDEIS. The  
544 criteria were chosen to identify viable options for placement of 18 mcy of material dredged from  
545 the Baltimore Harbor approach channels which options merited consideration as an alternative to  
546 Site 104. The results of this analysis are summarized below. The criteria considered were  
547 developed based on CENAB's preliminary assessment of principal environmental and economic  
548 factors, dredging need, and implementation potential. Most screening criteria had to be met in  
549 order for a placement option to be considered as a realistic serious option (alternative) to provide  
550 the short-term need for the <sup>15.2</sup>18 mcy of placement capacity specified by the State of Maryland's  
551 Strategic Plan for Dredged Material Management for the projected deficit in capacity over the  
552 next 9 years. CENAB's estimate of the dredging need is presented in Section xxxxxxxx.  
553 Placement options included not only single sites but also combinations of viable smaller capacity  
554 options that (together) would meet the short-term placement need within 9 years. Placement is  
555 projected to occur in up to 5 years during this period. This variable time frame was selected  
556 because it is not possible to predict when the Congress will authorize and appropriate funds for  
557 new work dredging projects. Presently, four placement cycles are contemplated. The actual  
558 number of placement years may vary, and would be addressed during operations as necessary and  
559 appropriate for whatever alternative or alternatives are approved and implemented.

560  
561 Screening Criteria:

- 562
- 563 1. **Dredging Need**—The proposed placement option (whether it be a single optionsite or  
564 combination of multiple smaller capacity optionsites) has the potential to provide  
565 approximately <sup>15.2</sup>10 to 18 mcy of placement capacity to meet at least half 50 percent of the  
566 short-term placement deficit need to which the proposed action is directed between now and  
567 20 XXXX.
  - 568
  - 569 2. **Real Estate**—The property owner is willing or has indicated a willingness to accept dredged  
570 material.
  - 571
  - 572 3. **Preliminary Environmental Suitability**—Preliminary evaluations, based upon existing  
573 information (outlined in Section 2.1.3), indicated that environmental impacts at the site are  
574 probably not significant enough to preclude the site from use.
  - 575
  - 576 4. **Infrastructure Considerations**—Infrastructure is in place, or expected to be in place, not  
577 later than October 15, 1999 in sufficient time to enable for the placement alternative to be  
578 available option to receive dredged material when the capacity is needed. Infrastructure  
579 includes dikes, docking facilities, access channels, and berms, where applicable.  
580 Alternatively, with regard to using a combination of sites, infrastructure for the first site to be  
581 used is in place or expected to be in place in sufficient time no later than 15 October 1999 to  
582 meet dredging needs for the first placement site with infrastructure for subsequent sites  
583 expected to be in place prior to previously developed site or sites reaching capacity.
  - 584

585 5.(a) ~~The total cost for use of the placement alternative can be feasibly borne by the Federal and~~  
586 ~~local project sponsors under existing rules, and regulations, and planned budgets to fund~~  
587 ~~delivery, monitoring and management of the dredged material that is placed;~~  
588

589 5. Institutional Constraints—OR (b) There is a reasonable prospect that any institutional  
590 constraint (e.g. statute preventing site development or placement, CERCLA liability, etc.)  
591 that would otherwise preclude use of a placement alternative could be resolved or removed as  
592 an impediment not later than six months prior to the first planned placement. This planning  
593 factor is necessary because of lead times required for dredging contracting. Alternatively,  
594 with regard to using a combination of sites, the institutional constraint for the first can be  
595 resolved or removed no later than six months prior to the first planned placement and the  
596 constraints for each subsequent site can be removed prior to the previous site reaching  
597 capacity.  
598

599 6. Economic Viability—The cost for using the placement alternative can be feasibly borne by  
600 the Federal and local project sponsors under existing rules, and regulations, except that no  
601 option would be screened out solely on the basis of cost if screening factors 1 through 5  
602 would otherwise result in the option being considered an alternative to the proposed action;  
603

604 ~~6.7. Environmental Trade-Offs—U~~ Use of the placement alternative may either potentially  
605 provide a net environmental improvement with respect to existing conditions and/or avoid or  
606 substantially reduce any of the significant environmental impacts of a potential placement  
607 activity.  
608

## 609 2.2.2 Rationale for Screening Criteria.

610  
611 2.2.2.a —Dredging Need. The placement action proposed by the MPA on behalf of the State of  
612 Maryland is based on the MPA's assessment of dredging needs. The MPA projection is updated  
613 at least annually and is based on historical averages for maintenance dredging and dredging  
614 engineering projections for sediments that would need to be dredged for improvements as  
615 modified based on prevailing conditions. Changes in need are reflected in the State's projections  
616 as changes they occur. CENAB made its own assessment of projected needs, consistent with the  
617 fifty-year planning window used by the USACE, including contingencies to account for changes  
618 in excess of average conditions.

619  
620 MPA-Dredged Material Planning. As reported by Hamons and Young (1999), "The MPA uses a  
621 20-year, forward-looking planning window for managing dredged material. . . . Planning data  
622 are continually updated to reflect changes in actual or projected dredging needs. The long-term  
623 planning approach allows for consideration of the magnitude of the dredging need: dredging  
624 needs beyond the 20-year window; time needed to advance placement projects from concept  
625 through implementation; prospective environmental conditions; changes in technology (for  
626 dredging, placement, ships, and intermodal transportation); and, associated implications to  
627 dredged material management, port infrastructure requirements and port competitiveness. A  
628 longer planning horizon moves beyond what can be reasonably managed, except for  
629 implementation options that begin within the 20-year window." The MPA planning approach

630 acknowledges the potential for supplemental dredging needs but does not include a specific  
631 contingency for increased dredging requirements such as might result from abnormal shoaling  
632 resulting from episodic storms with long return periods. Because the MPA planning approach  
633 does not include a formal contingency, when additional maintenance dredging is required or an  
634 infrastructure need is identified, the MPA must increase the dredging need above that which has  
635 been previously projected. The MPA's dredging need projections are therefore by design  
636 conservative, although they have been questioned by opponents of specific placement projects,  
637 including comments received by CENAB in response to the DEIS issued n.

638  
639 CENAB Dredging Need Projection. CENAB analyzed the State of Maryland's Strategy for  
640 Dredged Material Management and current dredging need projections provided by the MPA.  
641 CENAB then prepared the District's an estimate of dredging needs over the USACE fifty-year  
642 planning window. CENAB's assessment included a 10 percent contingency to account for  
643 unanticipated dredging needs, such as could may result from major storm events, per the  
644 following discussion and analysis.

645  
646 Dredging need increased by XX percent in 1996 as a result of increased sediment loading caused  
647 by a combination of snow melt from major winter storms, rainfall which exacerbated snow melt  
648 and runoff, and resulting freshets from the Susquehanna River which transported the sediments  
649 to the upper Bay. Fifteen million tons of sediment were delivered to the Chesapeake Bay during  
650 the January 1996 flood event (one ton of sediment is approximately equivalent to one cubic yard  
651 of channel sediment). This is about 16 times the annual sediment loading of the Bay from the  
652 Susquehanna River (the scoured river basins would be filled in about 5 to 6 years) (Langland,  
653 1998). The actual quantity of sediment dredged from the southern half of the northern approach  
654 channels between the Sassafras River and Pooles Island increased by 60 percent, from a recent  
655 annual average of 1.2 mcY to 2.0 mcY (unpublished CENAP data). (The recent annual average  
656 has decreased somewhat from historical averages. Except for the 1996 flood event, this decrease  
657 is believed to be related to drought conditions which have resulted in lower than normal inflow  
658 from the Susquehanna River and fewer winter storms during the same period.) The actual  
659 quantity of sediment dredged from the Brewerton Extension increased from an annual average of  
660 XX mcY to XX mcY, an increase of XX percent (Unpublished CENAB data).

661  
662 Although it is not possible to make a direct correlation between added sediment loads from the  
663 Susquehanna River and shoaling rates, the data do support an approximation of cause and effect.  
664 In the cited example, the overall increase in dredging need that occurred following the flood  
665 event was XX mcY, or approximately XX percent of the additional sediment loading. The  
666 decreasing holding capacity of the Conowingo Dam on the lower Susquehanna River has  
667 increased the potential for increased sedimentation from future events of similar or greater  
668 magnitude. Furthermore, on average, several million tons or more of sediment could flow  
669 annually into the upper Bay from the Susquehanna River once the basin behind the Conowingo  
670 Dam is at equilibrium, that is, once full sediment-storage capacity is reached. Equilibrium could  
671 occur as soon as 17 to 20 years (Langland, 1998; Seay, 1995). The magnitude of sediment  
672 discharge following equilibrium can only be roughly estimated, and would be affected by flood  
673 events as well as by effort to reduce erosion and sedimentation in the watershed (Seay, 1995).

674

675 The annual loading will vary according to environmental conditions, and equilibrium could be  
676 delayed as the result of scouring from another major flood during the next 20 years.  
677 Substantially larger than average sediment loads could result from major flood events within the  
678 watershed (Langland; 1998; Seay; 1995). For example, Tropical Storm Agnes in June 1972  
679 resulted in the discharge of 33 million tons of suspended sediment in a one-week period. This  
680 quantity was equivalent to the sediment input of 30 average years. Of this quantity, about 75  
681 percent was deposited in the northernmost 28 miles of the Bay. The deposit averaged about 20  
682 centimeters thick. Another 11 million tons of sediment were discharged as a result of Hurricane  
683 Eloise in September 1975 (SEAY; 1995). Abnormally high sediment loadings resulting from  
684 flood events would increase the potential for shoaling of upper Bay shipping channels, including  
685 the Brewerton Extension which is especially prone to shoaling from freshets because of its  
686 perpendicular orientation relative to the current flow. Based on the preceding data and analysis, a  
687 contingency of 10 percent is reasonable to approximate prospective increased needs for which a  
688 precise prediction is not possible.

689  
690 The CENAB analysis of dredging needs is included as Appendix XY. [HERE INSERT A  
691 SUMMARY OF THE CENAB DREDGING NEED ASSESSMENT] Based on CENAB's  
692 assessment of the need with contingency requirements, up to XX mcy could potentially be need  
693 to be dredged during the 9 year placement window considered in this RDEIS. Furthermore, any  
694 capacity not used resulting from due to changes in new work or reduced maintenance dredging  
695 projects would still be needed within the 50-year USACE planning window.

696  
697 In consideration of its dredging need assessment, CENAB determined that the MPA's projection  
698 of 18 mcy [understates/approximates/overstates? – text depends upon CENAB needs  
699 analysis. Remaining text presumes an understated need] the prospective dredging need. This  
700 conclusion is supported by the fact that MPA's projection does not include a contingency.  
701 Furthermore, the MPA's 1996 projection of an 18 mcy need did not include the quantity of  
702 suitable sediment that would have to be reprogrammed from placement at Hart-Miller Island to  
703 allow for improvements to berthing infrastructure needed to support the next generation of  
704 container ships. The MPA's current projection also do not include any allowance for increased  
705 sedimentation from the Susquehanna River, although the sediment basin behind the Conowingo  
706 Dam is likely to fill in during the period. CENAB also determined that more than one alternative  
707 might be needed to provide for the unmet dredging placement need over the next 9 years. In  
708 order to meet this need, a large-scale alternative or multi-option combination of alternative will  
709 be needed.

710  
711 Based on the preceding analysis and the scale of the unmet placement need, the principal  
712 alternative (or combination of smaller options) should be capable of satisfying a major portion of  
713 that need. CENAB believes that in order to make a serious reduction in the placement deficit, at  
714 least 50 percent of the need should be accommodated by the principal alternative that is selected.  
715 In order to meet 100 percent of the 18 mcy need, a combination of alternatives may ultimately  
716 may be needed. Furthermore, in applying need criteria for screening purposes, consideration  
717 was given to the fact that, with respect to use of a specific placement site, the substitution of  
718 sediments dredged from one location for sediments dredged from another would not, by itself,  
719 reduce the deficit in placement capacity that is being addressed through this RDEIS.

1970 MD site survey  
1976 - EIS HMA  
1981 - Cons.  
1984 - OPS Began

720  
721 2.2.2.b —Real Estate. The USACE requires that the local sponsor provide all real estate needed  
722 for placement projects. However, in order to determine whether or not a placement option is  
723 realistic as an alternative, it is necessary to make a preliminary determination as to whether or not  
724 sufficient real estate would be available so as to allow implementation of the alternative.  
725 Although condemnation of property is within the State's prerogatives, the CENAB does not  
726 assume that condemnation actions would be taken or successful.

727  
728 2.2.2.c —Preliminary Environmental Suitability. Considerable information is available about  
729 certain placement options. A number of options have been subjected to one or more screening  
730 processes. Sufficient information is available to determine if there are specific environmental  
731 conditions that would make a specific option unacceptable.

732  
733 2.2.2.d —Infrastructure Considerations. Infrastructure requirements vary significantly by type of  
734 placement option and project-specific conditions. Physical structures are required for many  
735 placement options, for example, the perimeter dike system at the Hart-Miller Island Dredged  
736 Material Containment Facility and the Poplar Island Environmental Restoration Project. The  
737 Hart-Miller Island project took XX years from concept to completion of construction. The  
738 Poplar Island restoration project was conceived by prior to release of the final report of the  
739 Governor's Task Force on Dredged Material Management in February 1991 (MDOT, 1991).  
740 Formal planning for the project began in mid-1992. A prefeasibility report was completed in  
741 May 1994 (MES, 1994b). A comprehensive feasibility and design study was completed in 19XX  
742 (CITATION). Construction is projected for completion in 2001. Thus, a total of some 10 years  
743 will have passed from concept to completion of the island enclosure and full readiness to receive  
744 dredged sediments. Therefore, placement options need to be screened to determine whether or  
745 not the needed infrastructure can reasonably be expected to be completed in sufficient time to  
746 allow use of the option when needed.

747  
748 2.2.2.e —Preliminary Economic Viability. The cost of placement alternatives varies  
749 greatly by type of project and location. USACE policy requires selection of the least cost,  
750 environmentally acceptable alternative. The local sponsor's cost share requirement can  
751 vary significantly depending upon alternative-specific conditions, location of the  
752 alternative, prospective funding sources, the "base plan" used by the USACE for cost share  
753 calculations, and other factors. Currently, the highest overall cost option is Poplar Island at  
754 \$xx.xx per cubic yard. For the purposes of determining whether an option is reasonable  
755 from a total cost perspective, an upper threshold of 250% of the current high cost option  
756 rounded up to the next dollar (\$xx.xx) was used.

757  
758 2.2.2.e —Institutional Constraints. Various placement options have institutional constraints that  
759 may preclude their use. These constraints include certain State laws that are directed to specific  
760 placement options and locations, lack of remediation standards for unexploded ordnance, and  
761 liability issues also associated with unexploded ordnance. For the purposes of determining  
762 whether an option is realistic from an institutional constraint perspective, there is no indication  
763 that UXO institutional constraints would be resolved within the timeframe addressed by this  
764 RDEIS. Inasmuch as the State is considering a number of placement islands that lie within or

765 partially within 5 miles of the Hart-Miller-Pleasure Island Chain, CENAB did not apply the State  
766 statute that prohibits construction of a containment facility within 5 miles of the chain in  
767 Baltimore County (CITATION). The State law that prohibits placement in the area defined as  
768 the "Deep Trough" was applied inasmuch as the Maryland General Assembly has given no  
769 indication of willingness to consider a modification to this statute (CITATION).  
770

771 **2.2.2.f** —Preliminary Economic Viability. Cost is a fundamental, but not exclusive, component  
772 of federal decision making. The U.S. Code of Federal Regulations requires selection of the least  
773 cost, environmentally acceptable alternative [CITATION]. An exception can occur for higher  
774 cost, environmentally acceptable alternatives where the local sponsor is willing to fund all or a  
775 portion of the incremental costs in excess of the least cost, environmentally acceptable  
776 alternative, depending upon other applicable authorizations [CITATION]. The cost of  
777 placement alternatives varies greatly by type of project and location. The local sponsor's cost  
778 share requirement can vary significantly depending upon alternative-specific conditions, location  
779 of the alternative, prospective funding sources and funding criteria, the "base plan" used by the  
780 USACE for cost-share calculations, and other factors, including incremental costs that are solely  
781 the responsibility of the local sponsor.

782 *OF CAPACITY OR OF VOLUME (CONSTRUCTION OPS TIME)*

783 For the purposes of determining whether an option is realistic from a cost perspective, both unit  
784 cost (that is, cost per cubic yard) and total cost are issues. However, unit cost provides a  
785 reasonable measure for comparative analysis among the various placement options, and was used  
786 for screening purposes. An upper threshold of 200% of the highest unit cost for an actual  
787 placement project for the Port of Baltimore, rounded up to the next dollar, was used. Currently,  
788 the highest unit cost option is Poplar Island at \$11 per cubic yard. Therefore, the upper threshold  
789 used for screening purposes was calculated to be \$22 [CENAB PLEASE VERIFY]. In  
790 applying this criteria, an option that would have been screened out solely on the basis of cost was  
791 nevertheless carried forward for consideration as an alternative if screening factors 1 through 5  
792 would otherwise have resulted in its selection as an alternative.  
793  
794

795 **2.2.2.g** —Environmental Tradeoffs. The ~~sixth~~ seventh screening criteria was included to  
796 recognize potential benefits of a site that might compensate for environmental ~~other~~ flaws  
797 deficiencies identified. For example, a site may be deemed too costly for development under  
798 normal conditions but the potential benefits may compensate by providing significant habitat  
799 preservation, enhancement, or creation.  
800

### 801 **2.2.23 Application of Screening Criteria to Alternatives**

802

803 As the first step in the screening process of alternatives for this document, an analysis of each  
804 alternative was developed and is included in Appendix ~~xx~~ Annex E. The screening criteria  
805 (identified above) were applied to each siteplacement option. The results are summarized in  
806 Table 2-1 [EA ADD TABLE] and the criteria are keyed to the numbers presented in Section  
807 2.2.1. Each site was assigned a designation of 0 (meets criteria), X (doesn't meet criteria). In  
808 many cases of site availability, the site was designated with a "P" indicating that the state would  
809 consider accepting material pending issuance of a water quality certification. The information

810 used to derive the screening designation are ~~is~~ summarized in Table 2-2 ~~EA ADD TABLE~~ and  
 811 detailed (by site) in Sections 2.2.3 and 2.2.4. All sites listed in Table 2-1 are ~~detailed~~ addressed  
 812 in the following sections based upon their viability as an alternative for Site 104. A series of  
 813 locator maps displaying the site locations by placement type are available for reference (Figures  
 814 2-2 through Figure 2-7). Section 2.2.4.a.5 explores the option of combining several smaller sites  
 815 to meet the 15 to 18 mcyc short-term placement need quantity.

816  
 817 **2.2.23.a** —Non-Viable Options. The following options are assessed in Appendix ~~XX~~Annex  
 818 E and were found to be not viable as an alternative to the proposed action. However, options  
 819 denoted by an asterisk had sufficient potential to be considered in combination with certain other  
 820 options. Non-suitability of an option for consideration as an alternative in this RDEIS does not  
 821 necessarily mean that a particular option is not or could not eventually become suitable at some  
 822 future date. However, the screening that was performed in Appendix ~~XX~~Annex E resulted in a  
 823 determination that they were not suitable as an alternative to the proposed action.

824  
 825 TABLE 2-1 NON-VIABLE OPTIONS

826

827	<u>Beneficial Use</u>	849	• <u>Rocky Point</u>
828	• <u>APG Beneficial Use</u>	850	• <u>Sollers Point</u>
829	• <u>APG upland upland sites</u>	851	<u>Sparrows Point</u>
830	• <u>Artificial Reefs (small to medium</u>	852	• <u>Swan Point Peninsula</u>
831	<u>scale)*</u>	853	• <u>Thoms Cove/Hawkins Point</u>
832	• <u>Barren Island restoration</u>	854	• <u>Worton Point Beneficial Use</u>
833	• <u>Bodkin Island*</u>	855	• <u>Innovative use of dredged material</u>
834	• <u>Bodkin Point</u>	856	
835	<u>C&amp;D Canal Upland Sites</u>	857	<u>Open Water</u>
836	• <u>Eastern Neck National Wildlife</u>	858	
837	<u>Refuge</u>	859	• <u>Pooles Island Open Water</u>
838	• <u>Davis Tract</u>	860	• <u>Deep Trough Site 170b</u>
839	• <u>Grove Neck</u>	861	• <u>Tolchester S-Turn Channel</u>
840	<u>Hawkins Point</u>	862	
841	• <u>Holland Island (small-scale)*</u>	863	<u>Containments</u>
842	• <u>Holland Island (large-scale)</u>	864	• <u>Bay Bridge Airport</u>
843	• <u>Holly Neck Farm</u>	865	• <u>Hart-Miller Island north cell</u>
844	• <u>James Island</u>	866	<u>Hart-Miller Island south cell</u>
845	• <u>Parsons Island*</u>	867	<u>Cox Creek containment facility</u>
846	• <u>Poplar Island Phase I</u>	868	• <u>Masonville</u>
847	• <u>Poplar Island Phase II</u>	869	
848	• <u>Queenstown</u>		

870  
 871 The following non-viable options from the preceding list either received considerable attention in  
 872 the public comments on the first draft February 1999 DEIS, could potentially be environmentally  
 873 acceptable but for an institutional constraint (denoted by a double asterisk), or both. They are  
 874 discussed in the main text along with the reasons why they were found to be not suitable for

875 consideration as an alternative to the proposed action or as a component of a multi-option  
876 alternative.

877  
878 TABLE 2-2 NON-VIABLE OPTIONS WHICH RECEIVED SIGNIFICANT PUBLIC  
879 COMMENT—DEIS

881	• <u>Hart-Miller Island south cell**</u>	889	• <u>APG upland**</u>
882	• <u>Hart-Miller Island north cell**</u>	890	• <u>Sparrows Point**</u>
883	• <u>Cox Creek containment facility</u>	891	• <u>Eastern Neck Wildlife Refuge</u>
884	• <u>C&amp;D Canal upland sites</u>	892	• <u>James Island</u>
885	• <u>Beneficial Use (general concept)</u>	893	• <u>Innovative use of dredged material</u>
886	• <u>Poplar Island Phase I</u>	894	• <u>Pooles Island open water</u>
887	• <u>Poplar Island Phase II</u>	895	• <u>Deep Trough**</u>
888	• <u>APG beneficial use**</u>		

896  
897 **2.2.23.b** —Viable Alternatives.— The options shown in the following categories survived the  
898 screening process that was applied in ~~Appendix XX~~ Annex E and were ~~determined to be~~  
899 viable designated by CENAB as alternatives for consideration in this RDEIS:

- 900  
901  
902
- No action
  - Open-water sites (Site 104, Site 171 open water, Worton Point open water, Shad Battery Shoal, Ocean Placement)
  - Existing site (none – see preceding discussion)
  - New containment options (Cox Creek, Hart-Miller Island new cell)
  - Beneficial use (Poplar Island wetland cell conversion to upland, Poplar Island footprint expansion, Holland Island, James Island)
  - Island placement site (Pooles Island area, Tolchester West, Site 168, Site 170, Site 171)
  - Combination of smaller sites options
- 903  
904  
905  
906  
907  
908  
909  
910

911  
912 **2.2.3 NON-VIABLE OPTIONS Alternatives**

913  
914 ~~[INSERT NUMBER]~~ of placement options were considered in determining which were suitable  
915 for consideration as practicable alternatives for the placement of 18 mcy of dredged material.  
916 ~~Appendix XX~~ Annex E presents detail about each of the options and applies the screening criteria  
917 and rationale described in Section 2.2.X. ~~[INSERT NUMBER]~~ of options passed through the  
918 initial screening and were carried forward to this chapter for characterization as alternatives.  
919 ~~[INSERT NUMBER]~~ of options did not screen successfully as options. ~~[Some of these received~~ SS  
920 considerable attention in the public comments on the first draft EIS, could potentially be  
921 environmentally acceptable but for an institutional constraint, or both.] Both categories are further  
922 discussed in this section in response to public interest in them or because they would have been  
923 considered alternatives had not institutional constraints made their further consideration  
924 impractical.

925  
926 ~~2.2.3.a Small Scale Placement Alternatives with Other Constraints.~~ Many of the sites that have  
927 been considered as placement options have very limited capacity. Developed by themselves,  
928 limited capacity sites would not meet the short-term dredging need that necessitates  
929 consideration of Site 104 at this time. Several limited capacity sites together may be able to meet  
930 the short-term placement needs (Section 2.2.4 e). However, the development and transportation  
931 costs may be prohibitive and multiple sites could result in greater cumulative impacts (Section  
932 7.1.5).

933  
934 The sites that have limited capacity (those with a "X" in the first column of Table 2-1) may also  
935 have other constraints that would preclude them as viable placement alternatives at this time.  
936 Generally those other constraints are expectations for significant environmental impacts or  
937 institutional constraints (laws) that prohibit placement. Limited capacity sites that may not be  
938 available for placement immediately or that would probably involve a higher cost are considered  
939 separately (Section 2.2.3.b).

940  
941 The sites that were not considered viable because of low capacity and other constraints are:

- 942  
943 Queenstown  
944 C&D Canal Upland Sites  
945 Swan Point Peninsula  
946 Grove Neck  
947 APG Beneficial Use  
948 Rocky Point  
949 Worton Point Beneficial Use  
950 Barren Island restoration  
951 Bodkin Island  
952 Parsons Island  
953 Davis Tract  
954 Holly Neck Farm  
955 Tolchester S-Turn Channel

956 Shad Battery Shoal  
957 Worton Point (Open water)  
958 Masonville  
959 Sollers Point  
960 Hawkins Point/Thoms Cove  
961 Dredged Material Recycling  
962

### 963 **2.2.3.a.1 Queenstown (Upland Placement, Fastland Creation)**

964

965 This site was proposed during the MDOT Master Plan process. There are 520 acres under  
966 consideration for placement, with a capacity of 9 mey (Figure 2-4). There are tidal and non-tidal  
967 wetlands near and on the project, as well as forested areas. The exact amount of acreage of  
968 wetlands is approximately 9 acres. As a worst case assessment, therefore, approximately 500  
969 acres of forested area would be impacted. The site is adjacent to SAV beds. There is access  
970 from deep water and there are no known archeological or historical sites on or near the property.  
971 The site is far from both CENAB and CENAP channels which would add as much as \$1.70 per  
972 cubic yard to the cost of placement (relative to Site 104) (Section 7). For these reasons the site is  
973 impracticable at the current time.  
974

### 975 **2.3.1 Hart-Miller Island Dredged Material Containment Facility**

976

977 HMI is an existing state-owned and operated confined placement facility (Figure 2-6) Hart-Miller  
978 Island is located in the Upper Chesapeake Bay, at the entrance to the Back River. The site is  
979 approximately 14 miles due east of Baltimore City, near the mouth of Back River in Baltimore  
980 County. Initial construction of the placement site began in 1981 and was concluded in December  
981 of 1983. HMI covers 1140 acres and has approximately 6 miles of dike. It is oval shaped and is  
982 approximately 2 miles long by 1 mile wide.

983  
984 -The facility has received maintenance sediments dredged annually from Baltimore Harbor and  
985 the approach channels since 1984. Sediments from the Inner Harbor area are considered to be  
986 contaminated and are required by the Code of Maryland Regulations (COMAR) to be placed in a  
987 ? containment facility, [or within the Inner Harbor.] The facility has also received sediments from  
988 the 50-foot channel deepening project, as well as smaller volumes of dredged sediments from  
989 state, local, and private channel maintenance projects.  
990 *NEW WORK AND*

991 Hart Miller Island is located in the Upper Chesapeake Bay, north of the mouth of the Patapsee  
992 River. The site is approximately 14 miles due east of Baltimore City, near the mouth of Back  
993 River in Baltimore County. Initial construction of the placement site began in 1981 and was  
994 concluded in December of 1983. HMI covers 1140 acres and has approximately 6 miles of dike.  
995 It is oval shaped and is approximately 2 miles long by 1 mile wide.

996  
997 The sand dikes were originally constructed to an elevation of +5.5 m (+18 ft) above MLW, a  
998 width of 164 ft at MLLW, with 3 horizontal (H) to 1 vertical (V) outer slopes, and 5H:1V inner  
999 slopes. The dike has a 20-foot-wide roadbed on top. The side slopes are protected by a  
1000 revetment consisting of filter cloth on the sand dike, covered by a layer of gravel, which is in turn

SUBSEQUENT to this event, during 1996  
the north cell dike was raised  
an additional XX m (16) to a  
height of 44'. The South  
cell was inactivated  
July 1997.

1001 covered by a layer of riprap weighing up to 8,500 pounds per stone along the sides exposed to the  
1002 Chesapeake Bay. The original +18 ft MLW high dikes were raised an additional 3.1 m (10 ft) to  
1003 a height of +8.5 m (+28 ft) above MLW during the summer and fall of 1988 to provide additional  
1004 capacity for the expedited completion of the 50-foot deepening project. The 1140-acre oval  
1005 placement site holds approximately 62 mcy of dredged material to an elevation of 7.6 m (25 ft).  
1006 The +8.5 m (+28 ft) raised portion of the dike has 2H:1V outer slopes, 3H:1V inner slopes, with  
1007 a 10-ft-wide road bed on top. The site is divided into two cells, a North Cell (approximately 800  
1008 acres) and a South Cell (approximately 300 acres).-

1010 2.3.1.a Hart-Miller Island South Cell Reconstruction and Reactivation

1011  
1012 Use of the South Cell was discontinued in 1990 after it was filled to near capacity. The south  
1013 cell is currently being developed for environmental restoration and passive recreation under a  
1014 provision of Section 1135, Water Resources Development Act of 199X. To facilitate habitat  
1015 development in the 300-acre South Cell, the last 3.1 m (10 ft) of dredged material was suitable  
1016 channel material from outside of the harbor. The south cell is under the day to day management  
1017 of the Maryland Environmental Service, which is providing these services under the terms of an  
1018 Interagency Agreement with the MPA in support of an intergovernmental agreement between the  
1019 MPA and the Maryland Department of Natural Resources (MDNR). MDNR is responsible for  
1020 habitat and recreational development of both cells.

1021  
1022 The South Cell crust management and grading program has been underway since October 1990  
1023 to prepare a foundation for habitat and passive recreational development. Other actions taken to  
1024 prepare the cell include management and discharge of rainwater to facilitate consolidation of the  
1025 crust, phragmites eradication and control measures including controlled burns, and vegetative test  
1026 plots. The 300-acre south cell is currently at +22 ft MLW average elevation.

1027  
1028 Most of the South Cell's upland tier dike was excavated for use in the north cell dike raising.  
1029 Sand that had previously been placed within the South Cell and stockpiled was mined as a  
1030 resource for reconstructing the North Cell dike to an elevation of +44 feet MLLW, discussed  
1031 below. The North Cell dike raising motivated legislation by the Maryland General Assembly  
1032 that required substantial development of the south cell for recreation and habitat within 5 years.  
1033 The law also prohibited the south cell from receiving any more dredged material. The same  
1034 legislation mandated that the dike system could not be raised higher than +44 feet, that placement  
1035 into the North Cell must be completed by the end of calendar year 2009, and that the cell was  
1036 to be substantially developed for recreation and habitat within 5 years of closure (Annotated code  
1037 of the Public General Laws of Maryland, Environmental Article, § 16-202 (e)(1)(ii)).

1038  
1039 The State requested that CENAB conduct a Section 1135. CENAB performed the study with the  
1040 MPA as the local sponsor. The study has identified several approaches for providing ponds,  
1041 wetlands and uplands that would provide important habitat for migratory birds (CITATIONS).

1042  
1043 CENAB subsequently examined the south cell to determine if it could serve as an alternative to  
1044 open-water placement. As discussed in Appendix XX, the south cell dike system could be  
1045 reconstructed in stages to a final elevation of approximately XX feet. With optimal lifts of

1046 approximately ~~XX mecy~~ per annual dredging cycle and aggressive crust management, the cell  
1047 could hold approximately ~~XX mecy~~ of dredged material. The cost of reconstructing the south cell  
1048 and the cost of operating the south cell for placement of 18 mecy of sediments would be  
1049 approximately ~~SXXXX million~~, or about ~~SX.XX~~ per cubic yard. Inasmuch as Hart Miller Island  
1050 is a state facility, all reconstruction and operations costs would be the responsibility of the state.

1051  
1052 ~~Use of the south cell would result in nutrient releases at approximately the same rate as for an~~  
1053 ~~equivalent amount of sediment in the north cell (see Section X.X.X). Inasmuch as the facility~~  
1054 ~~already exists, there would be no conversion of Bay bottom. The existing vegetation in the cell,~~  
1055 ~~which has begun a natural transition from phragmites domination to various indigenous species,~~  
1056 ~~would be covered if the cell is returned to active placement operations. The State's and Federal~~  
1057 ~~investments in initial preparation of the cell for conversion would be lost.~~

1058  
1059 ~~The MPA is constrained from making the cell available for reconstruction because of a~~  
1060 ~~commitment made to the public by the Maryland Department of Transportation to accelerate the~~  
1061 ~~development of the south cell for habitat and recreation. Furthermore, it would be illegal for any~~  
1062 ~~party a State agency to reactivate the cell for placement because of the aforementioned sState~~  
1063 ~~law. The Maryland General Assembly, having only recently established this law, is unlikely to~~  
1064 ~~reverse itself. For this latter reason, reconstruction and reactivation of the south cell is not viable~~  
1065 ~~as an alternative to open water placement.~~

#### 1066 1067 2.3.1.b Use of Existing North Cell Capacity.

1068  
1069 ~~The approximately 800-acre north cell was increased in elevation to 14.6 meters (+44 ft) MLW~~  
1070 ~~by the MPA in 1997. With optimal crust management and consolidation, an estimated 24 mecy of~~  
1071 ~~capacity will remain following inflow operations during the 1998-1999 dredging cycle.~~  
1072 ~~Eventually, the entire site will be converted to habitat and passive recreation in compliance with~~  
1073 ~~State law after dredged material placement ceases in the year 2009. The 21 mecy of capacity that~~  
1074 ~~is still available in the north cell has been programmed to receive various maintenance and new~~  
1075 ~~work dredging projects over the remaining service life of the project. The potential capacity will~~  
1076 ~~be decreased during placement of up to 3.2 mecy during the October 1999-March 2000 dredging~~  
1077 ~~cycle. The potential remaining capacity following crust management during Summer 2000~~  
1078 ~~would be approximately 19.5 mecy, depending upon environmental conditions.~~

1079  
1080 ~~CENAB subsequently examined the north cell to determine if it could serve as an alternative to~~  
1081 ~~open water placement. As discussed in Appendix XX, the north cell dike system was~~  
1082 ~~reconstructed and increased in elevation to +44 feet MLLW. State law prohibits the dike from~~  
1083 ~~being increased above +44 feet in elevation. Although there is a limited potential to further~~  
1084 ~~increase the north cell dike elevation, this is not a viable option under existing state law. The~~  
1085 ~~Maryland General Assembly, having only recently established this law, is unlikely to reverse~~  
1086 ~~itself. In this regard, recent legislative sessions have seen continuing efforts to continue to~~  
1087 ~~impose additional constraints on placement options.~~

1088  
1089 ~~The north cell can only receive an annual maximum of 2.5 mecy without overburdening. The~~  
1090 ~~available capacity is being programmed for Harbor sediments that are unsuitable for open water~~

1091 placement, insofar as practicable, consistent with other placement needs which have been  
1092 programmed to HMI to correspond with dredging needs because other large scale placement  
1093 options are not yet available. CENAB's analysis of dredging needs indicates that there is no  
1094 excess capacity available in the north cell. Diversion of material planned for open water  
1095 placement would not only be substituted for other existing needs, but would also result in a  
1096 reduction in the north cell's ability to receive dredged material, as described below.

1097  
1098 Operational records for the HMI facility document the ability to dewater and consolidate  
1099 sediments in order to reduce sediment volume and regain a portion of used placement capacity.  
1100 The operating history indicates that placement of quantities in excess 2.5 mecy would result in  
1101 water being trapped between the crust prior to placement and the crust that forms following  
1102 placement. This would have the effect of reducing the facility's overall capacity, because the  
1103 state law that mandates a closure date does not allow time for a hiatus in placement operations to  
1104 enable extended crust management operations to offset any overburdening. The prospective  
1105 potential outcomes of overburdening the site would therefore be a shortened service life because  
1106 the site would be filled more quickly, inadequate time available between placements for optimal  
1107 dewatering and consolidation, and a reduction in the north cell's overall capacity. The resulting  
1108 reduction in the north cell's optimal capacity would exacerbate the placement deficit that the  
1109 proposed action under investigation by the DEIS is intended to relieve.

1110  
1111 The diversion of additional sediments to HMI would therefore result in one or a combination of  
1112 (1) substituting sediments dredged from one location for another without resolving the  
1113 underlying placement need, (2) an increase rather than reduce the deficit in placement capacity  
1114 through overburdening, and (3) deferral of planned dredging due to lack of capacity. In view of  
1115 the preceding analysis, use of the existing capacity of the north cell is not viable as an alternative  
1116 to open water placement.

1117

### 1118 2.3.2 CSX/Cox Creek Dredged Material Containment Facility

1119

1120 The CSX/Cox Creek Dredged Material Containment Facility (DMCF) is located approximately 1  
1121 mile south of the Francis Scott Key Bridge, on the west bank of the Patapsco River, near  
1122 Foreman's Corner in Anne Arundel County, Maryland (Figure 2-6). The two cells were  
1123 originally constructed under contract to CENAB in the 1960's for the containment of dredged  
1124 material from the deepening of the Baltimore Harbor Federal channels from 11.9 m (39.0 ft) to  
1125 12.8 m (42.0 ft). The MPA has acquired the cells and plans to renovate the facility for the  
1126 placement of an additional 6 mecy of maintenance dredged material from the Inner Harbor  
1127 channels.

1128

1129 Maintenance dredged material targeted for placement in open water will originate from the  
1130 upper Bay channels located outside (east) of the North Point to Rock Point line. Placement of  
1131 suitable dredged material from Bay Channels at CSX/Cox Creek would limit its further use for  
1132 placement of contaminated dredged material from Inner Harbor channels. As placement options  
1133 for sediments from Inner Harbor channels are much more limited, filling CSX/Cox Creek with  
1134 clean Bay channel material is not a prudent commitment of resources. In addition, site

1135 configuration will limit placement to a maximum of 500,000 cy per year to optimize its capacity  
1136 over a planned 12-year service life.

1137  
1138 The CSX containment cell was constructed in the early 1960s, and has been used periodically by  
1139 non-Federal interests for dredged material placement throughout the 1970s. The site was  
1140 purchased by the State of Maryland in July 1993. The cell was previously permitted for  
1141 placement of material obtained from dredging operations in the Patapsco River and Baltimore  
1142 Harbor areas. The area of the dredged material placement cell is 72 acres. Its dikes have been  
1143 raised periodically throughout its use and presently have a height of +6.1 m (+20.0 ft) MLLW.  
1144 The last reported use of the site for the placement of dredged material was in 1984; it has been  
1145 part of the MPA's long-term planning for dredged material management since 1979.

1146  
1147 The Cox Creek containment cell, as it was formally known, is bordered on the west by the  
1148 former Cox Creek Refining Company upland property (now owned by the MPA) and on the east  
1149 by the Patapsco River. The cell is surrounded by dikes that are presently at a height of +4.9 m  
1150 (+16.0 ft) MLLW. The site was originally developed in the mid-1960's. Although the cell has  
1151 not been actively used as a placement site since that time, it has been part of the MPA's long-  
1152 term planning for dredged material management since 1979. Roughly 15 acres of the Cox Creek  
1153 containment cell is occupied by an existing pond that was determined not to be jurisdictional  
1154 wetlands waters of the United States under Federal rules and regulations. The pond receives  
1155 water in the form of precipitation and stormwater runoff from the Cox Creek upland adjacent to  
1156 the pond property. The pond is not open to tidal interaction; it is served by a spillway that is  
1157 passively discharging into the Patapsco River. The stormwater system has been rerouted so that  
1158 it no longer discharges into the pond.

1159  
1160 Harbor sediments may not be placed in open water, but may be placed in containment facilities.  
1161 Currently, the Hart Miller Island DMCF is the only facility that is able to receive contaminated  
1162 sediments. The combined capacity of the Cox Creek cells and Hart Miller (which also receives  
1163 sediments from outside of the harbor for which other placement capacity is not available and  
1164 which is prohibited by State law from receiving material after 2009) is not sufficient to  
1165 accommodate all of the dredged material from the harbor during the next 20 years. For these  
1166 reasons, the capacity at Cox Creek must be reserved for harbor sediments. This site is not  
1167 suitable as an alternative to Site 104 due to the relatively low capacity and the need to dedicate  
1168 the available capacity for Inner Harbor sediments.

### 1170 2.3.3 C&D Canal Upland Sites [CENAB TO REVISE AND UPDATE THIS SECTION]

1171  
1172 There are currently 17 Federal upland sites designated along the C&D Canal for dredged material  
1173 placement (Figure 2-6). These sites are strategically located to accommodate certain channel  
1174 reaches within the C&D Canal and the northern portion of the approach channels. Periodic  
1175 expansion of these sites has been necessary to accommodate maintenance needs of those channel  
1176 reaches. Placement site capacity expansion is presently needed to accommodate existing C&D  
1177 canal channels. The sites have limited capacity at present, and are in the process of being  
1178 investigated for jurisdictional wetland delineation by CENAP. After this evaluation is complete,  
1179 availability of these sites as placement options would not occur for 4-6 years. Use of these sites  
1180 for the CENAB or CENAP southern reaches would reduce the long-term potential of these sites

1181 for the channel reaches they now serve. Furthermore, the required pumping distances and  
1182 elevations make use of these sites for reception of materials from the southern CENAB and  
1183 CENAP reaches uneconomical and inefficient from both fiscal and engineering standpoints  
1184 (MDOT 1996; MPA 1996).

1185

### 1186 2.3.2 Beneficial Use (General Concept)

1187

1188 A concept that has gained considerable popularity is the use of suitable dredged sediment as a  
1189 natural and economic resource rather than as a byproduct of dredging that has traditionally been  
1190 treated as a waste stream, although most dredged material does not classify as contaminated  
1191 sediments (NRC, 1989, 1994, 1997). The practical application of the beneficial use concept was  
1192 introduced to the Chesapeake Bay as early as the mid-1970s by the USACE. A few small-scale  
1193 marsh restoration and oyster reef creation projects were undertaken (Garbarino *et al.*, 1994;  
1194 NRC, 1994). The possibility of using dredged material as an economic resource was studied for  
1195 application in the Port of Baltimore in 1974 (Weston, 1974) and then again in the mid-1980s  
1196 (Kidde Consultants, 1984, 1986). Although these earlier initiatives proved impractical at the  
1197 time, the concept of using dredged material as a resource has continued to be of interest to the  
1198 USACE, MPA, natural resource agencies, and the public (Hamons and Young, 1999).  
1199 Expanding from small-scale demonstration projects to large-scale application was proposed as a  
1200 way to resolve the Port of Baltimore's placement needs in a manner that would contribute to  
1201 Chesapeake Bay restoration efforts (MDOT, 1991). It was also thought that the beneficial use  
1202 concept would help overcome longstanding controversy about dredged material management.

1203

1204 Moving the beneficial use concept into practical application for the navigation infrastructure  
1205 servicing the Port of Baltimore has proven very difficult, including the implementation of the  
1206 Poplar Island restoration project. That project will have taken over ~~XX~~ years to advance from  
1207 concept to completion of construction, which is projected for 2001. Over the past decade, over 35  
1208 beneficial use projects have been proposed for locations in the upper Bay that would use dredged  
1209 material as a natural resource. With the exception of Poplar Island, none of these options has  
1210 been capable of implementation. Hamons and Young (1999) documented the results of the  
1211 continuing efforts to find beneficial use projects capable of obtaining the support necessary for  
1212 implementation and identified reasons why more beneficial use projects have not been  
1213 implemented.

1214

1215 *Linking the beneficial use concept to specific sites focuses attention on site-*  
1216 *specific environmental, social and economic tradeoffs that, in most cases, work*  
1217 *individually or collectively against project acceptability. Conversion of habitat*  
1218 *from one form to another, especially fisheries habitat, has been a major factor in*  
1219 *determining whether or not the environmental value that would be gained would*  
1220 *in turn justify modifications to existing site conditions (Hamons and Young,*  
1221 *1999).*

1222

1223 A number of beneficial use options were screened as possible alternatives for this RDEIS, as  
1224 discussed in section 2.2.2. Most were found to be not suitable as either standalone alternatives or  
1225 as a component of a combined options alternative, as discussed in Appendix ~~XX~~ Annex E and

1226 further discussed in the following subsections for specific beneficial use options. Some  
1227 beneficial use options screened successfully as possible options to the proposed action, and were  
1228 included as alternatives in Section 2.4. No options were screened out as possible alternatives  
1229 solely on the basis of cost. Nevertheless, cost is a mandatory consideration in determining the  
1230 least cost, environmentally acceptable option, as discussed in Section 2.2. Beneficial use projects  
1231 are, in general, ~~not only more expensive per cubic yard utilized than substantially more expensive~~  
1232 ~~than more traditional placement options, but have usually been substantially more expensive.~~  
1233 The cost factor makes large-scale beneficial use projects extremely difficult to implement,  
1234 because the federal beneficial use authority provided by Section 204 of the ~~XXXXXX~~ is directed  
1235 to small-scale projects. For example, despite widespread support for the Poplar Island project, it  
1236 took special legislation by the U.S. Congress in order to obtain sufficient funding for the project,  
1237 which greatly exceeded the \$15 million annual national cap on normal funding of federal  
1238 beneficial use projects. Except for the Poplar Island project, Section 204 funds have not been  
1239 appropriated to the maximum annual amount and are competed for nationally. The beneficial use  
1240 options that were screened as possible alternatives ranged in cost from tens of millions to  
1241 hundreds of millions of dollars more than the proposed action, as discussed in Appendix  
1242 ~~XX~~Annex E. Although the beneficial use concept continues to enjoy popular and institutional  
1243 conceptual support, each beneficial use option was considered on its own merits as to whether or  
1244 not it could serve as a practical alternative to the proposed action.

### 1245 1246 **2.3.53 — Poplar Island Restoration Project**

1247  
1248 Island restoration sites using dredged material are placement areas created by constructing a  
1249 physical structure to enclose an estuarine or marine area on the site of existing or previously  
1250 existing islands. Poplar Island, like many islands in the Chesapeake Bay, has been severely  
1251 eroded. It was determined that island restoration/creation could be an ideal solution to the  
1252 dredged material management problem facing the Port of Baltimore. The group of islets known  
1253 as Poplar Island are located in the upper middle Chesapeake Bay, approximately 34 nautical  
1254 miles southeast of the Port of Baltimore and 2 miles northwest of Tilghman Island, Talbot  
1255 County, Maryland (Figure 2-7).

1256  
1257 Through the cooperative efforts of many state and Federal agencies, as well as private  
1258 organizations, a project has been developed to reconstruct Poplar Island to its approximate size in  
1259 1847. This ~~will be~~ being accomplished using ~~clean~~ suitable dredged material from the  
1260 approach channels that are part of the Baltimore Harbor and Channels Federal navigation project.  
1261 Although Poplar Island is farther from some of the areas needing maintenance, the additional  
1262 costs were offset by the significant beneficial use outputs of the project. The accepted restoration  
1263 plan, when fully implemented, would create a 1,100-acre dredged material placement area within  
1264 a 35,000-foot perimeter dike. The area would then be filled with ~~clean~~ suitable dredged material  
1265 obtained from periodic maintenance dredging of Federal navigation approach channels that serve  
1266 the Port of Baltimore. The site can then be developed into low and high marsh wetlands and  
1267 uplands. The planned placement capacity of this island restoration is 38 mcy.

1268  
1269 CENAB is considering the application of an innovative technique to prepare the restoration  
1270 project to receive dredged material. The concept being considered is enhanced dewatering of the

1271 placement cells and drying and consolidation from the existing mud line up. This will involve  
1272 continual pumping of the cell to keep it dry once initially dewatered. In theory, this approach  
1273 could result in a reduction of pore water in the bottom sediments. The associated consolidation  
1274 might nominally lower the bottom elevation, thereby increasing cell volume to a limited extent.  
1275 Any increase in foundation strength that might result could potentially allow an increase in dike  
1276 height. The principal reason for advance dewatering is to allow installation of underdrains in the  
1277 cells to aid in the dewatering of the first several placements of dredged material. The underdrain  
1278 system is anticipated to decrease markedly in capability following the first two placement cycles  
1279 as the fine grained material clogs, and in effect, seals the underdrains. The additional capacity  
1280 that might be gained cannot be effectively predicted. As the cell elevation is below the  
1281 surrounding water level, the ability to keep it dewatered will depend upon environmental  
1282 conditions encountered. Extremely wet conditions would reduce the potential effectiveness of  
1283 this approach. Additionally, there have been additional requests for use of Poplar Island for the  
1284 placement of suitable dredged material, including material from the proposed Wilson Bridge  
1285 reconstruction project. Decisions on these requests are pending. Therefore, it is not clear  
1286 whether any of the additional capacity that might be gained from the innovative approach  
1287 discussed above would actually be available for sediments from the approach channels to the  
1288 Port of Baltimore. For these reasons, the potential for increased capacity through enhanced  
1289 dewatering techniques is not included in capacity estimates for Poplar Island Phases I and II.  
1290 CENAB could address any substantial increase in capacity through a supplemental EIS, if  
1291 circumstances warrant.

1292  
1293 **2.3.53.a** Phase I. Construction of the Phase I Poplar Island project (670 acres, 19 mecy) began  
1294 in mid-1998 and the dike system will be ready for inflow operations in 1999 2000. The current  
1295 placement capacity for the site has already been designated for uses other than those proposed for  
1296 Site 104. Annual capacity at Poplar Island is limited because of it's environmental restoration,  
1297 construction, and operation schedule. It is currently planned to accept 3 million cubic yards in  
1298 the Year 2000 and 2 million cubic yards in Years 2001 and 2002. After that, it will be limited to  
1299 1.5 mecy annually. Because Poplar Island has an annual maximum designed placement capacity  
1300 limit of 2 mecy (beyond which the site may not meet its environmental restoration specifications),  
1301 additional materials cannot be placed in this site without adversely affect restoration objectives or  
1302 reducing the potential capacity of the upland component of the project due to trapping of water in  
1303 successive sediment layers. Consequently, Poplar Island can not provide the capacity for the  
1304 near-term shortfall that necessitates considering the Proposed Action.

1305  
1306 **2.3.53.b** Phase II. Construction of Phase II of the Poplar Island restoration project (450 acres,  
1307 19 mecy) is projected to begin in <sup>2001</sup>19XX. Two additional wetland cells are projected to be ready  
1308 for inflow operations in <sup>2000</sup>19XX. It is anticipated that the Phase II wetland cells would be filled  
1309 within three year of initial availability. The exterior dike for this cell is planned to remain open to  
1310 <sup>-7</sup>the Bay for approximately XX years so as to serve as a sheltered harbor and staging area for  
1311 filling of the Phase I and II wetland cells and the Phase I upland cell. The Phase II upland cell  
1312 would not be available for use until the exterior dike is closed in approximately 19XX. The  
1313 Phase II upland cell capacity is estimated to be XX mecy. The actual capacity may vary from this  
1314 estimate depending upon how much sand is excavated for dike construction. It is anticipated that  
1315 there would be a more limited opportunity to increase capacity of the Phase II upland cell through

1316 enhanced dewatering because the depth and configuration of the excavated borrow area will  
1317 likely inhibit the installation of an underdrain system throughout the cell. Once the upland cell is  
1318 available, it would be capable of receiving an average annual inflow into it will be approximately  
1319 X.X mcy. Higher inflow rates are anticipated during the first X to Y years of cell filling may be  
1320 possible because the available volume of the borrow area provides substantially more capacity  
1321 than had the cell not served as a borrow area. Once the sediment placed into the upland cell rises  
1322 above the ambient Bay water level, the annual optimum placement potential will be reduced to a  
1323 maximum of X.X mcy.

1324  
1325 **2.2.3.a.3 Swan Point Peninsula Restoration (Beneficial Use, Upland Placement, Farmland**  
1326 **Creation)**

1327  
1328 Swan Point in Kent County has been severely eroded. Projects proposed as DNPOP placement  
1329 options on Swan Point have included a beneficial use project or a containment project for clean  
1330 dredged material. It is estimated that a beneficial use project would result in approximately 2 to  
1331 5 mcy of capacity. It is estimated that a dike system connected to Swan Point for containment  
1332 could result in approximately 10 mcy of capacity. This area is known to provide fish nursery  
1333 habitat, is a waterfowl use area, has viable oyster and clam bars in the immediate vicinity, and  
1334 listed Rare, Threatened or Endangered species (eagles) have been preliminarily identified by  
1335 resource agencies as present near or in the project area. Although time of year restrictions on  
1336 placement may be sufficient to protect fisheries resources, the other natural resources at the site  
1337 would still be vulnerable. The extent of wetland and forest acreage in the area has not yet been  
1338 determined by studies performed to date. A conservative estimate would be that 18 acres of  
1339 wetlands and forest would be lost to placement site development. Due to these constraints, the  
1340 alternative was dropped from further consideration.

1341  
1342 **2.2.3.a.4 Grove Neck (Upland Placement)**

1343  
1344 Grove Neck is an upland site on the Eastern Shore of the Upper Bay in Cecil County (Figure 2-  
1345 3). This site was first introduced as part of the Master Plan process, and was forwarded for  
1346 consideration to the DNPOP Bay Enhancement Phase II Working Group for consideration. The  
1347 site has an estimated 280 acres under consideration, with up to 5 mcy of placement capacity. It is  
1348 a forested site at a high elevation along the Sassafras River. Up to 280 acres of forest could be  
1349 lost to placement site development. The entire site would likely be within Maryland critical  
1350 areas, in that it is located within 1,000 feet of the Chesapeake Bay and its tidal tributaries  
1351 (Chesapeake Bay Critical Area Commission 1986). This adds increased logistical problems  
1352 because there would be special requirements for land use, permitting, stormwater management,  
1353 wetlands impacts and forest buffer impacts. Grove Neck is closer to CENAP channels than to  
1354 CENAB channels which would add as much as \$6.50 per cubic yard to the cost of placement  
1355 (Section 7).

1356  
1357 **2.3.456 Aberdeen Proving Ground Beneficial Use Options**

1358  
1359 Given the large amount of shoreline controlled by Aberdeen Proving Ground (APG) on the  
1360 western side of the upper Bay, CENAB, CENAP and the MPA have maintained a continuing

1361 interest in finding opportunities for the placement of dredged material at APG. The DNPOP  
1362 program has, since its inception, actively pursued identification and evaluation of upland  
1363 placement sites within the boundaries of the U.S. Army, Aberdeen Proving Grounds (APG). The  
1364 APG-controlled area totals approximately 72,000 acres located on the northern upper Chesapeake  
1365 Bay shoreline in Harford and Baltimore Counties. Approximately 40,000 acres consists of Bay  
1366 waters and tributaries. Of the remaining 32,000 acres, a significant percentage is either in use for  
1367 military missions or is wetlands or forested areas. Alternatives being evaluated have the  
1368 potential to provide material for beneficial use projects at APG such as shoreline stabilization,  
1369 habitat restoration, and encapsulation of hazardous materials and unexploded ordnance (UXO).  
1370 APG representatives are participating in the DNPOP, and continue to discuss the development of  
1371 alternative placement options for APG. CENAB, CENAP and the MPA have been involved in  
1372 continuing efforts to establish placement sites within the APG area, as discussed in the following  
1373 paragraphs. However, the interest in APG for dredged material management must be considered  
1374 in the context of an active military installation with important national security missions that are  
1375 the primary considerations for use of land and water areas controlled by the U.S. Army.

1376  
1377  
1378 CENAB commissioned a major study of the potential for use of APG upland areas for the  
1379 disposal of dredged material. The study began in 1984 and was completed in 1987 (Century  
1380 Engineering, 1987). Three technically feasible sites that would have the least environmental  
1381 impacts were identified after detailed investigation of areas not affected by operating areas or  
1382 critical military missions, areas with endangered species or historical attributes, water and land  
1383 access, and areas with tidal wetlands. Detailed investigation was carried out for the most  
1384 promising upland site which was located at the end of Abbey Point. The site had a potential  
1385 capacity of 2.8 mcy. Deposition of dredged material would cover unexploded ordnance (UXO)  
1386 to a depth of some 5 to 7 feetft. It was subsequently determined that this use of the site for  
1387 dredged material placement disposal would severely restrict range and recovery operations. The  
1388 engineering consultant study ultimately concluded that "... there is no significant acceptable  
1389 dredged material disposal area at Aberdeen Proving Ground" (Century Engineering, 1987).

1390  
1391 The MPA Master Plan initiative from 1986 to 1990 considered a number of potential placement  
1392 sites in the APG-controlled water area. Potential sites were identified in the vicinity of Pooles  
1393 Island, Cherry Tree Point, and Shad Battery Shoal. The Master Plan recommended use of the  
1394 then existing open-water sites until their capacity was exhausted, with all dredged sediments  
1395 designated for open-water disposal thereafter being placed in the Deep Trough (MPA, 1990). In  
1396 lieu of implementing the Master Plan recommendations, the Maryland Governor established a  
1397 task force to develop another approach to dredged material management, as previously discussed.

1398  
1399 The DNPOP program has, since its inception, continued the active pursuit of placement options  
1400 within the boundaries of APG. Alternatives that have been identified and evaluated have the  
1401 potential to provide material for beneficial use projects at APG such as shoreline stabilization,  
1402 habitat restoration, and encapsulation of hazardous materials and unexploded ordnance (UXO).  
1403 APG representatives are participating in the DNPOP, and continue to discuss the development of  
1404 alternative placement options for APG.

1405

1406 The Maryland Environmental Service, at the request of the MPA, prepared a multi-objective  
1407 screening of the potential of four beneficial use sites for dredged material placement in support of  
1408 the C&D Deepening Study that was being performed by CENAP. Three of the sites – Weir  
1409 Point, Spry Island Shoal, and Pooles Island were largely within the APG controlled area. The  
1410 screening addressed endangered species, waterfowl, fisheries, benthos, wetlands, shallow water  
1411 habitat, colonial waterbirds, submerged aquatic vegetation, ownership and jurisdiction, and  
1412 institutional constraints (MES, 1994). The report served as a technical resource for subsequent  
1413 efforts to find suitable placement options at APG and identified various environmental factors  
1414 and institutional constraints that would require further investigation. The possibility of  
1415 encountering munitions was identified, but was not a factor that was specifically addressed  
1416 during the environmental screening. The presence of UXO as a fatal flaw for projects at APG  
1417 became apparent as the results of subsequent efforts to find placement sites at APG, as discussed  
1418 in a following paragraphs.

1419  
1420 A DNPOP working group identified 5 areas (Carroll Island, Spry Island Shoal, Graces Quarters,  
1421 Gunpowder Neck and Pooles Island) with 16 individual concepts for creating or restoring  
1422 intertidal marshes. Most of these sites are within the perimeter of APG. Many areas of APG are  
1423 in Harford County but within the five mile radius of Hart-Miller Island. Use of the sites may  
1424 require a modification of the State law that prohibits establishment of a containment facility  
1425 within 5 miles of the Hart-Miller-Pleasure Island Chain in Baltimore County. -APG, Federal and  
1426 state natural resource agencies, and commercial fisherman expressed concerns regarding the  
1427 environmental and economic issues related to each of the sites. Rare, threatened or endangered  
1428 species (RTE) habitat, estuarine and palustrine wetlands, finfish nursery and spawning grounds,  
1429 and CERCLA and UXO liability issues have all been part of the aquatic and terrestrial resources  
1430 and environmental impacts discussed regarding use of APG sites for dredged material placement.

1431  
1432 The most significant concerns voiced related to the safety, liability, and cleanup cost for use of a  
1433 site that contains so much UXO and is currently on the National Priority List (NPL) of hazardous  
1434 waste sites. EPA Region III advised the DNPOP program participants who were considering a  
1435 demonstration project at J-Field on Gunpowder Neck that there is no national standard for  
1436 remediation of -UXO. EPA and stated that there are no laws or regulations specifically  
1437 addressing the liability of UXO. In the absence of definitive legal requirements, EPA Region III  
1438 advised that DNPOP planning should use the CERCLA legal requirements and precedents as  
1439 planning factors, including removal of UXO as the worse case remediation requirement. Thus,  
1440 any dredged material placement project might have to be removed in order to remediate UXO.  
1441 Furthermore, any party which constructed a project that later required UXO remediation could be  
1442 considered a Potentially Responsible Party by the EPA and, if so designated, would become  
1443 liable for the cost of removing UXO. Due to these concerns, Neither the Army Corps of  
1444 Engineers nor the Maryland Port Administration can accept the associated risk and liability.  
1445 Therefore, active investigation of all potential sites and configurations within the APG boundary  
1446 has been suspended from further evaluation. -although the concepts will be reconsidered should  
1447 conditions change. and therefore APG sites are not suitable as alternatives to the proposed open-  
1448 water for placement of dredged material (DNPOP, 1995b).

1450 Given the large amount of shoreline controlled by APG on the western side of the upper Bay, the  
1451 DNPOP program has maintained a continuing interest in finding opportunities for the placement  
1452 of dredged material. Many areas of APG are within the five mile radius of Hart-miller Island and  
1453 are, therefore, unavailable for containment site development under current Maryland law.  
1454 However, other smaller scale concepts such as shoreline stabilization/beneficial use have been  
1455 explored. Placement options involving APG have resulted in the inclusion of two APG related  
1456 alternatives to Site 104; Encapsulation of UXO using dredged material at two APG sites (J-Field  
1457 [on Gunpowder Neck] and Graces Quarters) was actively pursued during 1994 and 1995 (Figure  
1458 2-7). One is a small scale demonstration project combining waste encapsulation and shoreline  
1459 stabilization, known as the J-Field project. This project concept is described below. The second  
1460 is the expansion of Pooles Island in conjunction with development of a new island containment  
1461 facility with an estimated capacity of 80 million cubic yards (mcy). Rare, threatened or  
1462 endangered species (RTE) habitat, estuarine and palustrine wetlands, finfish nursery and  
1463 spawning grounds, and CERCLA and UXO liability issues have all been part of the aquatic and  
1464 terrestrial resources and environmental impacts discussed regarding use of APG sites for dredged  
1465 material placement. The Pooles Island dredged material island concepts are described and  
1466 evaluated in Section 2.2.3.b.2.4.X.

1467

#### 1468 J-Field Site

1469

1470 A small scale demonstration project combining encapsulation and beneficial use was considered  
1471 for J-Field, which is an APG Superfund site (Figure 2-7). The site also has a unique "floating  
1472 marsh" that is in danger of being lost through shoreline erosion. In 1995, APG determined that  
1473 incorporating the project into the facility's installation restoration program (IRP) was potentially  
1474 feasible. The demonstration project would have had about 1.5 mcy capacity, and would have  
1475 only provided a partial short term solution for the C&D Canal southern approach channels.  
1476 During the course of investigating the concept, it was learned that the shoreline and water reaches  
1477 within the restricted area controlled by APG are contaminated by the presence of between 3 and  
1478 30 million rounds of UXO, creating significant concerns for safety. There is also substantial  
1479 uncertainty about the degree to which the placement of dredged material would create exposure  
1480 to future responsibility or costs if the encapsulated ordnance would need to be excavated or  
1481 removed. There is also a technical limitation in locating UXO once buried in sediments. As a  
1482 result, the proposed J-Field project to encapsulate UXO and to protect an eroding shoreline with  
1483 a protective marsh has been indefinitely delayed and is not likely to be available to accommodate  
1484 any of the near term placement needs for the C&D Canal northern or southern approach  
1485 channels.

1486

#### 1487 Graces Quarters

1488

1489 Two beneficial use concepts were investigated for Graces Quarters, which is an APG Superfund  
1490 site (Figure 2-7): (1) A 36 acre wetland creation and shore stabilization project with an  
1491 approximate capacity of 400,000 cy and (2) a 36 acre encapsulation for shore protection with an  
1492 approximate capacity of 400,000 to 824,000 cy, depending on fill elevation. Consideration of  
1493 both concepts was discontinued due to: (1) the low capacity of the site, particularly if it had to be  
1494 diked; (2) poor boat/scow access (very shallow water and poor truck access to most of the site;

1495 (3) difficulties in getting the materials to the identified areas even with a hydraulic dredge; (4) the  
1496 need for dewatered, consolidated materials to make the concept work; and (5) existence of prime  
1497 tiger beetle (endangered species) habitat. The potential presence of UXO at this site (see above)  
1498 would also indefinitely delay its use for accommodating any of the near-term placement needs for  
1499 the C&D Canal northern or southern approach channels.

1500

1501 2.3.7 Sparrows Point Habitat Development

1502

1503 A 300-acre habitat development project was planned for the eastern end of Sparrows Point in  
1504 Baltimore County (Figure 2-7). The project was planned to reclaim establish a habitat  
1505 enhancement project contiguous to industrial shoreline by converting and enhance relatively poor  
1506 bottom to aquatic and intertidal wetlands, high marsh, and upland nesting areas in order to  
1507 benefit living resources. The habitat that would have been created was also envisioned as  
1508 providing aesthetic relief for the entrance to the harbor. An estimated 10 mecy of capacity was  
1509 projected. The MPA investigated use of this site, with preliminary conceptual designs and pre-  
1510 feasibility environmental studies. Preliminary engineering determined that a project at the site  
1511 was feasible. However, poor foundation conditions would necessitate highly specialized  
1512 construction techniques in order to "float" a structure to enclose the site (GBA et al., 1992;  
1513 Hamons and Young, 1999; MES and MPA, 1993). An environmental study determined that the  
1514 area's biological productivity was similar to that of other areas inside the harbor, but less  
1515 productive than the Bay (MES, 1995a).

1516

1517 Institutional difficulties exist from the prohibition in current state law for construction of a  
1518 containment facility within a 5 mile radius of the Hart Miller Pleasure Island chain. Although  
1519 the proposed project was intended to improve habitat, it nevertheless would have required the  
1520 water area to be fully enclosed because of site specific conditions. Public support would be  
1521 required to change the current law in order to put a containment facility at this site. The  
1522 campaign to change a law is expected to be long and potentially unsuccessful. Attempts on  
1523 behalf of the MPA to secure citizen support for the beneficial use project and for a revision to the  
1524 law were not successful. Local citizens, citing past filling of open water in the area by  
1525 Bethlehem Steel, objected to any further conversion of open water in the area (Hamons and  
1526 Young, 1999). Based on these factors, the site in the absence of support for removal of the  
1527 institutional constraint associated with this project, habitat development has been maintained as a  
1528 DNPOP option but efforts to implement the project have been suspended indefinitely put on hold  
1529 indefinitely. The existing institutional constraint is considered a fatal flaw for this option, and it  
1530 is not feasible or practicable as an alternative to the proposed action.

1531

1532 2.3.5 Eastern Neck Island National Wildlife Refuge

1533

1534 Eastern Neck Island National Wildlife Refuge is located on Maryland's Eastern Shore at the  
1535 mouth of the Chester River. It encompasses all of Eastern Neck Island. The refuge is the  
1536 responsibility of the U.S. Fish and Wildlife Service (USFWS). The refuge was previously the  
1537 location of a small beneficial use project. The possibility of further beneficial use options at the  
1538 refuge are listed is considered as an option in the MPA's DNPOP Program. Use of Eastern Neck  
1539 for beneficial use applications in lieu of the proposed open-water placement was advocated by a

1540 various public officials and private citizens. The potential of Eastern Neck Island for additional  
1541 beneficial use applications was evaluated to determine whether it could serve as an alternative to  
1542 the proposed open-water placement or as a component of a multi-option alternative.

1543  
1544 The beneficial use application is an outgrowth of shore erosion and control measures for a  
1545 portion of the island's western shoreline. The project was necessitated because the island was  
1546 experiencing a significant loss of acreage due to shore erosion. Five stone segmented breakwaters  
1547 were installed in 1992. The USFWS installed several sand-filled geotubes immediately southeast  
1548 of the stone breakwaters, configuring them to extend the segmented breakwater system. After  
1549 the geotubes were installed, CENAB deposited approximately 34,380 cubic yards of fine-grained  
1550 sand between the tubes and the shoreline. About 77,000 wetlands plants were planted along the  
1551 shoreline. The habitat value of the shallow water area between the breakwater system and the  
1552 shoreline has subsequently improved significantly (Gill, et. al., 1995; Hurt, 1995).

1553  
1554 The BEP II working group considered the potential of Eastern Neck Island in 1995. The working  
1555 group believed that although there was some potential for a small-scale beneficial use project at  
1556 the refuge, large-scale placement options were needed to meet near-term needs. Eastern Neck  
1557 Island was not considered a realistic option for meeting that need due to the limited potential for  
1558 placement capacity. However, supplemental information was subsequently assembled for use in  
1559 DNPOP planning and was available for this RDEIS.

1560  
1561 The refuge provides habitat for nesting bald eagles, Delmarva fox squirrels, and migratory  
1562 birds. There are also tidal wetlands, high value upland forest areas, diverse forage for fish, and  
1563 agricultural fields. Cultural resources are believed to exist within the refuge boundaries. The  
1564 southern portion of the western shoreline of the island is relatively low and dominated by fringe  
1565 marsh. This portion of the shoreline is somewhat exposed, and minimal submerged vegetation  
1566 (SAV) has been reported. Bottom conditions along the southern portion and immediately  
1567 offshore of the western shoreline appear to be similar to conditions that exist in the vicinity  
1568 of the segmented breakwaters. The success of the breakwater system and fill with fine-grained  
1569 sand suggests that a similar result could be obtained from a similar project to the south. A  
1570 segmented breakwater could be designed and installed, subject to suitable foundation conditions.  
1571 Such a project would preserve the general character of the area. An estimated 50,000 cy of  
1572 dredged sediments could be potentially be placed. Greater placement potential on the order of  
1573 100,000 to 200,000 cy would necessitate creating a closed dike system and constructing marshes  
1574 or upland, thereby substantially changing the character of the shoreline. The shallow water areas  
1575 along the eastern side of the island have historically supported considerable SAV and the  
1576 shoreline has considerable tidal marshes (Orth, et. al., 1997, 1998). Informal coordination  
1577 resulted in a finding that the USFWS is only willing to accept material that is mostly sand for a  
1578 beneficial use project that would maintain the character of the area. Therefore, only the smaller-  
1579 scale sand option would be considered by the agency.

1580  
1581 The southwestern shore of Eastern Neck Island is 11 miles northeast of Site 104 by water. It is  
1582 approximately 4 miles greater in distance from the CENAB channels that would be dredged than  
1583 is Site 104. The increased transportation cost which would be borne by the State would be  
1584 approximately \$0.40 per cubic yard. There would be additional costs for environmental

1585 documentation, engineering design, site preparation/construction, mobilization and  
1586 demobilization of equipment to Eastern Neck Island, and vegetation following completion of  
1587 placement. The total cost of a beneficial use project to continue the extend the existing  
1588 beneficial use project is estimated between \$20 to \$85 per cubic yard depending upon design,  
1589 construction materials, foundation conditions, and other factors. Total costs could be on the  
1590 order to \$3 to \$10 million. These costs are within the funding limits of Section 204, although  
1591 funds from this source are competed for nationally.

1592  
1593 Eastern Neck Island was not selected as an alternative to open-water placement because the  
1594 the-USFWS will only accept sandy material, and the materials from the channels to be dredged is  
1595 primarily fine silts and clays, and there is no practical way to separate out a minor amount of  
1596 sand that may be dredged. It is unlikely that the estimated 50,000 cubic yard capacity could be  
1597 used, although this capacity would likely be available within the five-year planned placement  
1598 window.

### 1599 2.3.96 James Island

1600  
1601  
1602 Although the Poplar Island restoration project is not yet constructed nor filled and vegetated, the  
1603 prospect that the project will ultimately be successful has stimulated interest in the possibility of  
1604 other large-scale island restoration projects. The potential for an island restoration project at  
1605 James Island at the mouth of the Little Choptank River has been informally suggested to the  
1606 MPA for possible inclusion as an option in the DNPOP program, and information is being  
1607 assembled to provide a resource for consideration of the island's restoration potential and  
1608 restoration options by the BEP II Working Group. During the course of the NEPA process for the  
1609 proposed open-water placement which is the subject of this RDEIS, the possibility of restoring  
1610 James Island was suggested as a possible alternative. The preliminary DNPOP information was  
1611 made available to CENAB. Additional information was developed by CENAB to aid in  
1612 determining whether or not restoration of James Island might effectively serve as an alternate.

1613  
1614 The existing James Island Archipelago was formed as a result of natural processes of shoreline  
1615 change that affect the Chesapeake Bay region. James Island is portrayed on 18<sup>th</sup> century maps as  
1616 being connected to the mainland of Taylors Island by a marsh. By 1847, survey data indicated  
1617 that connection was nearly breached. At that time, James Island consisted of about 1253 acres of  
1618 upland and fringe marshes. By 1942, the two remnant islands were still connected but the  
1619 connection to Taylors Island had been breached and consisted of open-water. By 1994, the  
1620 remaining island was breached into two principal remnants consisting of a total of 106 acres. The  
1621 islands today are estimated to be less than 100 acres. The southernmost island is separated from  
1622 Taylors Island by about a mile of shallow open-water (Stevenson and Kearney, 1996). The  
1623 remaining remnants are privately held by different parties.

1624  
1625 The shallow waters west and north of the existing remnants provide shallow water habitat for  
1626 foraging. The area is exposed and does not currently support the growth of SAV (Orth *et al.*,  
1627 1997, 1998). The bathymetric break between the more shallow waters and the deeper waters that  
1628 form the ancient bed of the Susquehanna River provide an edge that is exploited to some extent  
1629 by sportfishermen. There is a designated small natural oyster bar (14-6) of 16 acres size

*↑  
as the main identification  
of the bar*

1630 immediately southeast of the southernmost island remnant.

1631  
1632 The progressive erosion of James Island is believed to have contributed to increased erosion of  
1633 Dorchester County shorelines that were once in the shadow of the island complex. Oyster Cove,  
1634 located at the northwest tip of Taylors Island, was once enclosed on the west by the peninsula  
1635 that preceded the current James Island Archipelago. This area is one of the Dorchester County  
1636 shorelines that has experienced increased erosion that appears to be associated with the  
1637 progressive loss of the protection that had been provided by James Island.

1638  
1639 Conceptually, James Island could potentially be restored either as an island or as a peninsula  
1640 reconnected to Taylors Island. Potentially, †The area could be restored in similar manner to  
1641 Poplar Island with overall size of perhaps 1,000 to 1,200 acres and capacity also similar to that of  
1642 the full Poplar Island restoration project, depending upon the project configuration. In order to  
1643 be consistent with the historic footprint, the restoration would need to be on the west side of the  
1644 Archipelago. Inasmuch as an upland island existed at this location, it is assumed that an upland  
1645 island could be constructed to similar elevations planned for Poplar Island. Restoring the  
1646 island with a reconnection to Taylors Island could potentially reduce physical energy affecting  
1647 the east side of the James Island Archipelago and Oyster Cove, thereby improving conditions  
1648 potentially favorable to colonization and growth of SAV.

1649  
1650 Assuming that sufficient sand is available in deposits on site for dike construction, and that there  
1651 would be no mitigation requirements, a planning estimate of the cost (with a standard  
1652 contingency for unanticipated conditions) for a large-scale restoration is \$20 per cubic yard. This  
1653 planning estimate would increase if there were a need to import dike construction materials and if  
1654 mitigation were required for the conversion of shallow water habitat (mitigation was not required  
1655 for Poplar Island because the environmental benefits were assessed as greater than the  
1656 environmental impacts resulting from construction). Whether or not a large-scale project can  
1657 achieve the broad-based support necessary for implementation including special funding by the  
1658 U.S. Congress and funding by the Maryland General Assembly of the local sponsor cost share is  
1659 speculative in view of the legislative history of the Poplar Island restoration project. A small-  
1660 scale restoration project on the order of 0.5 to 2.0 mecy within the Section 204 discretionary  
1661 authority could cost on the order of \$50 to \$100 per cubic yard, depending upon site  
1662 configuration, habitat types, and construction requirements. A small-scale restoration would be  
1663 problematic on the west side of the Archipelago because the location is very exposed. A  
1664 substantial armored dike system similar to the western dike of the Poplar Island project would be  
1665 needed for either a large-scale or small-scale restoration.

1666  
1667 The full developmental time frame for such a project would be at least as long as the Poplar  
1668 Island restoration project which was fast-tracked, on the order of 10 to 14 years (the actual time  
1669 frame will vary according to various factors including legislative schedules for consideration of  
1670 funding authorizations). Based on the experience in building a consensus regarding the  
1671 appropriateness of a large scale restoration project for Poplar Island, especially the environmental  
1672 tradeoffs that were involved, it would take approximately 2 to 3 years to establish whether or to  
1673 what extent a large-scale beneficial use project would be practicable at James Island. Although  
1674 restoration of James Island is already under consideration as part of long term dredged material

?  
fishery  
needs.

1675 management planning, the ability to implement a project at this location is far from certain and  
1676 would need to be developed on its own merits. Furthermore, the time frame for such  
1677 development extends beyond the placement need addressed by the RDEIS. Therefore,  
1678 restoration of James Island to accommodate 18 mecy of dredged material is not practical as an  
1679 alternative to the proposed action, although it may prove to be suitable and acceptable as a  
1680 beneficial use project at a future date.

1681

### 1682 2.3.407 Innovative Use of Dredged Material

1683

1684 The concept of using dredged material as a non-traditional or economic resource (e.g., turning it  
1685 back into soil products), a form of "beneficial use," has been widely discussed as a constructive  
1686 approach to managing dredged material. For the purpose of this RDEIS, the concept of using  
1687 dredged sediments as an economic or non-traditional resource for the production of products or  
1688 for non-traditional end uses is referred to as "innovative use" to distinguish it from more  
1689 traditional habitat enhancement and restoration applications. For example, innovative uses  
1690 would include the concept of applying dredged sediments to farmlands, with or without the  
1691 subsequent addition of amendments (Dalrymple, 1997; Landin, 1997; PIANC, 1992; Price, *et*.  
1692 *al.*, 1997). ~~Indeed,~~ This concept has been used in small-scale farm applications in Maryland  
1693 and elsewhere. Although reported to be successful, there currently is limited data to support  
1694 general application in agriculture (Duff and Corletta, 1997). Both the USACE and MPA are  
1695 conducting applied research into potential soil applications. Applied research and development  
1696 into the innovative use of dredged sediments is also being pursued elsewhere, including  
1697 applications for New Jersey waters in the New York Harbor area [REVISE SO PUBLIC CAN  
1698 UNDERSTAND]. This latter research involves federal funding through the Water Resources  
1699 Development Acts of 1990, 1992 and 1996 as well and over \$100 million in funding from the  
1700 State of New Jersey in an effort to advance from concept to practical application (Jones, *et al.*,  
1701 1999; McDonough, *et al.*, 1999; Stern *et al.*, 1997, 1998a,b).

1702 The innovative use of dredged sediments is not a new issue for the Port of Baltimore nor are the  
1703 many suggestions that dredged material be recycled for the reclamation of mines and sand and  
1704 gravel pits. The innovative use of dredged material for the production of various products  
1705 including natural and synthetic aggregates, shells, bricks, mineral wools and other materials was  
1706 previously studied for the Port of Baltimore. The manufacture of lightweight synthetic  
1707 aggregates was assessed as feasible, but the potential market was not available. All other  
1708 products were found to be unfeasible for a various technical and economic reasons (Weston,  
1709 1974). A study was undertaken for the U.S. Department of Transportation and Baltimore City  
1710 between 1984 and 1986 to examine the treatment of contaminated dredged materials (Kidde  
1711 Consultants, 1984, 1986). The facility now referred to as the Cox Creek DMCF was identified as  
1712 the prospective location for a recycling facility. Conceptual designs, an economic analysis, and  
1713 cost estimates were developed. However, the approach was not practical for implementation,  
1714 because ~~Neither~~ either the containment cells nor a market were available.

1715 Innovative use has more recently been addressed by the Maryland Port Administration in the  
1716 form of conceptual options suggested through the DNPOP Program for which the MPA has  
1717 sponsored research and has announced intentions to request proposals for innovative uses.  
1718 Considering these developments, the use of dredged sediments was screened to determine

1719 whether or not a specific application or applications of the innovative use concept could serve as  
1720 a practicable alternative for managing up to 18 mcy of dredged sediments for the Port of  
1721 Baltimore. The state of practice in innovative use of dredged sediments is reviewed in Appendix  
1722 XXAnnex E and summarized below.

1723 Most research and development into the innovative use of dredged material has been directly  
1724 related to initiatives intended to find solutions for the remediation of contaminated sediments.  
1725 Development of pretreatment and treatment technologies have involved both low through high-  
1726 technology solutions. Inasmuch as the national focus has been predominantly on contaminated  
1727 sediments, the applications that have been tested have tended towards higher technologicis.  
1728 These have included thermal destruction technologies (incineration, pyrolysis, high-pressure  
1729 oxidation, and vitrification), thermal desorption technologies (high-temperaturetemperature  
1730 thermal processor, low-temperature thermal treatment system, proprietary thermal desorption  
1731 systems, desorption and vaporization extraction systems, low-temperature thermal aeration  
1732 systems, and anaerobic thermal processor systems), immobilization technolgiestechnologies,  
1733 extraction technologies (including soil washing), chemical treatment technologies (chelation  
1734 processes, dechlorination processes, chemical dehalogenation treatment, base-catalyzed  
1735 dechlorination, ultrasonically assisted detoxification, oxidation processes, and chemical and  
1736 biological treatment), and bioremediation technologies (bioslurry processes, contained land  
1737 treatment systems, composting, and contained treatment facilities). In general, research and  
1738 testing have found that pyrolysis, oxidation, and bioslurry processes have performed within  
1739 acceptable limits for both silts and clays, and soil washing, solvent extraction, composting, and  
1740 contained treatment facility processes have performed within acceptable limits for silts (EPA;  
1741 1994).

1742  
1743 Technologically, there have been significant advances in the technological capability to produce  
1744 products and innovative end uses from dredged marine and estuarine sediments. Technologies  
1745 and techniques that are under development include the manufacturing and blending to create soil  
1746 products (Amiran; et al.; 1999; Graalum and Randall; 1997; Palazzo; et al.; 1997; Sturgis; et al.;  
1747 1997a,b), soil washing (Amiran; et al.; 1999; Olin and Bowman; 1997); conversion into  
1748 lightweight construction aggregates (Weston; 1974), use in landfill construction (MES; 1995b),  
1749 production of construction grade cements (Rehmat; et al.; 1999), forming cementitious products  
1750 for mine reclamation (CTI; 1998; McDonough; et al.; 1999; O'Donnel and Hennington; 1999),  
1751 manufacture of bricks (Cousins; et al.; 1997), production of commercial tiles (McLaughlin; et al.;  
1752 1999), and manufactured material using waste products such as automobile shredder byproduct  
1753 and dredged sediments to produce structural and non-structural fill (McDonough; et al.; 1999;  
1754 Willix and Graalum; 1999). Most of these applications have been targeted towards contaminated  
1755 sediments, primarily because these are the more difficult of dredged sediments for which to  
1756 secure final depositionplacement. Other applications, such as farm applications, are intended to  
1757 use suitable, uncontaminated dredged material (Corletta and Duff; 1997; Dalymple; 1997;  
1758 Landin; 1997; Price; et al.; 1997). Transforming these approaches into practicable applications  
1759 requires that the technology be capable of adaptation to local sediment conditions, a particular  
1760 need for contaminated sediments.

1761  
1762 Certain specific innovative use applications involving the products have been demonstrated to be

1763 capable of pilot scale application on the order of 100 to 500 cubic yards. Some processes have  
1764 been demonstrated to be capable of undergone demonstration or modest scale production on the  
1765 order of 30,000 to 40,000 cubic yards and others are anticipated to go to this scale in the next  
1766 year. For example, about 19,000 cy of contaminated sediments from Perth Amboy, New Jersey,  
1767 were converted to a cementitious product and successfully placed at Bark Camp Mine in  
1768 Pennsylvania as a strip mine remediation demonstration project at a cost of approximately \$85  
1769 per cubic yard (CTI, 1998). The research program sponsored by the State of New Jersey is  
1770 planning to advance selected processes from pilot scale (up to 30,000 cy) to full-scale  
1771 commercial production of 100,000 cubic yards per year for the management of contaminated  
1772 marine sediments. The goal is to develop a suite of marketable products and end uses that in  
1773 combination would result in the annual conversion of up to 500,000 cy of contaminated  
1774 sediments into marketable products or end uses. Implementation of the concept to date indicates  
1775 that sufficient markets exist or could be developed in the New York and northern New Jersey  
1776 metropolitan area (Amiran, *et al.*, 1999; McDonough, *et al.*, 1999; McLaughlin, *et al.*, 1999).  
1777 However, market conditions, particular for soil products, is significantly different in Maryland  
1778 where soil and fill material is readily available to meet existing demand. For this reason, the  
1779 market for innovative products and end uses will need to be expanded or created in order for a  
1780 technology...

1781  
1782 The majority of testing has been performed at bench, pilot and demonstration test scales  
1783 (Amiran, *et al.*, 1999; CTI, 1998; EPA, 1994; Jones, *et al.*, 1999; McLaughlin, *et al.*, 1999;  
1784 Rehmat, *et al.*, 1999). The costs of treatment for remediation technologies for contaminated  
1785 sediments range from about \$45 per ton to over \$500 per ton (EPA, 1994, 1998a; McLaughlin, *et*  
1786 *al.*, 1999). Although this RDEIS addresses suitable sediments, that is, those that can be  
1787 characterized as clean, the technology for contaminated sediments can be applied to  
1788 uncontaminated sediments as well. The high cost of remediation technologies detracts from their  
1789 economic viability for innovative applications on a large scale, even for contaminated sediments.  
1790 For example, the State of New Jersey's program to develop innovative use as an integral part of  
1791 dredged material management has established a maximum of \$35 per cubic yard as the amount  
1792 the State is willing to pay for each cubic yard that is processed and removed from the dredged  
1793 material management stream. Vendors will be responsible for covering any costs in excess of  
1794 this amount (State of New Jersey, 1998). Research to date has resulted in prospective State costs  
1795 of from \$28 to \$35 dollars. Gross costs (including the State's costs) are estimated to be in the  
1796 \$45 to \$120 dollar range, exclusive of dredging costs and the cost of delivery of material to  
1797 innovative use vendors (Jones, *et al.*, 1999; McLaughlin, *et al.*, 1999; O'Donnell and  
1798 Henningson, 1999; Rehmat, *et al.*, 1999). The prospective high costs, however, have prompted  
1799 efforts to find lower cost approaches for application to suitable sediments, such as the applied  
1800 research efforts of the USACE and the MPA regarding soil products and farm applications.

1801  
1802 Assuming that a technology or technique is viable, a fundamental determinant of success is the  
1803 ability to establish adequate markets and end uses in order to complete the transition from  
1804 dredged sediment to viable innovative products or end uses. A successful technology or  
1805 technique would not become a successful application unless products produced from dredged  
1806 material can be effectively utilized (including the development of markets for these products) or  
1807 suitable end uses can be found on a scale that would make a meaningful contribution to dredged

1808 material management. High-technology applications generally result in specialty products that  
1809 have small markets. Low-technology applications generally combine lesser production costs  
1810 (relative to high-technology approaches) and flexibility for small through large-scale applications  
1811 such as reclamation of sand and gravel pits and strip mines (use of deep mines has not been  
1812 attempted), provided that suitable properties become available. In general, end uses rather than  
1813 products appear to provide the potential for larger scale applications. Uses that require  
1814 deposition at a specific site, such as a gravel pit, would require a site-specific environmental *and engineering*  
1815 evaluation to determine the site's suitability to receive the material, and environmental  
1816 documentation as appropriate. Engineering design would also be required. Pertinent regulatory  
1817 requirements would also have to be met. An economic analysis would also have to be performed  
1818 to determine economic feasibility. Implementation may require the installation of offloading  
1819 facilities. Use of specific sites typically would involve contractual negotiations and proprietary  
1820 information. There are a considerable number of additional implementation issues that would  
1821 also need to be addressed (EPA, 1994). Even if a specific site is offered for use and appears to  
1822 merit consideration, contractual rules and regulations impose requirements on procurements that *Is this*  
1823 may preclude consideration of such a site in environmental documentation as a possible *TPSSB?*  
1824 alternative to a proposed action.

1825  
1826 As part of long-term planning for the management of dredged material, MPA has sponsored  
1827 research of potential farm applications and has announced that the agency plans to issue a request  
1828 for proposals for an innovative use system with initial focus on the management of harbor  
1829 sediments. The MPA has publicly stated that the agency's goal is to progressively develop a  
1830 capability to innovatively use dredged sediments at a meaningful scale. The MPA has set a  
1831 conceptual goal of 500,000 cy annual throughput, to the extent that this proves feasible,  
1832 practicable and cost effective. If the concept proves successful, the MPA would like to expand  
1833 its application significantly over the next decade, insofar as practicable and cost competitive as a  
1834 component of the overall dredged material management program (Hamons and Young, 1999).

1835  
1836 The objective of the MPA's agricultural applications research is to identify which soil  
1837 amendments might be needed and to determine crop suitability. Bench scale testing is currently  
1838 in progress to collect and assess leachate and soil quality changes over time from both untreated  
1839 and amended sediments from approach channels outside of the harbor. The germination and  
1840 production of various crops are also being studied. The results of the bench testing will be  
1841 applied to assess geophysical conditions that would be suitable for the placement of sediments on  
1842 agricultural lands. The results of the bench tests will also be used to guide the planting,  
1843 monitoring and analysis of field test plots. Bench-scale testing is also being performed for  
1844 industrial and agricultural residuals which could potentially be combined with dredged sediments  
1845 to produce value-added agricultural products. If the results of these experiments is favorable, a  
1846 field demonstration project would be undertaken, provided that a suitable location can be  
1847 identified, is made available, and is capable of being permitted under applicable rules and  
1848 regulations. A site-specific evaluation would be required, as would compliance with applicable  
1849 rules and regulations. Whether or not a suitable test location can be found is assessed as  
1850 problematic. (A private venture to apply dredged material to two farms in Kent County  
1851 encountered substantial public opposition. The proposal was withdrawn [(Hamons and Young,  
1852 1999]).

1853  
1854  
1855  
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Preliminary unpublished results suggest that up to 500,000 cy per year could be placed in an environmentally acceptable manner on farmland. Sediments would be placed in thin layers, naturally dried, and amended, with the farm returned to active agricultural production thereafter. Although this approach has been successfully accomplished in Maryland on a very small scale (Corletta and Duff, 1997), the large-scale approach is still experimental. Whether or not sufficient farmland would become available to enable annual placements is highly uncertain. Even if a 500,000 cy annual placement potential were realized, it would take 36 years to manage 18 mcy of dredged sediments. For these reasons, farm application is not a practicable alternative to the proposed open-water placement as either a standalone option or a component of a multi-option alternative. Should the farm application concept become viable at some future date, it could be reconsidered on its merits at that time.

*How much area is required*

In addition to the MPA's farm applications research, the MPA has indicated that the agency plans to issue a solicitation that would be intended to progressively develop a capability for the innovative use of dredged sediments. The upland property adjoining the Cox Creek Dredged Material Containment Facility has been identified as potentially suitable for the siting of an innovative use system. The MPA is hopeful that "perpetual" capacity might be achieved for the Cox Creek containment cell prior to it being filled to capacity. The Cox Creek site is also envisioned as a potential staging area for both contaminated and clean dredged sediments as resources for the innovative use system (Hamons and Young, 1999). State procurement rules and regulations preclude the MPA from discussing the specific content of its solicitation prior to its public release. Based on similar initiatives for the Great Lakes (EPA, 1994) and for the New York Harbor area, it can be anticipated that it would take several years for initial testing and evaluation to determine whether or not or to what extent innovative uses might become practicable for managing sediment from the Baltimore Harbor and its approach channels. Inasmuch as innovative use for the port is at the initial concept stage and in consideration of the uncertainty of the marketability for products or end uses, an estimate of the potential for innovative use as a viable component of dredged material management would be speculative. Innovative use systems would therefore not constitute an alternative to the proposed open water placement. Should a significant annual capability be developed at some future date, the capability could be considered on its merits at that time relative to the dredging program.

### 2.3.418 Pooles Island Open-Water

The area immediately east of Pooles Island is a natural depression that has been used for many years for open-water placement of dredged sediments was identified years ago as an important placement area within the upper Bay. There are remaining and new placement capacity of the eight eleven existing and two newly designated open-water placement sites in the Pooles Island area were considered as possible alternatives to Site 104 (Figure 1-2). Although historical placement records are incomplete, an estimated 50-55 mcy of material has been dredged from the C&D Canal approach channels in the upper Bay since the approach channels were deepened to 27 feet in the mid-1930s (CITATION). The areas have also been used for maintenance and new work dredging of the approach channels to Baltimore Harbor. Records prior to 1965 indicate open-water placement was within about 1,500 feet of the channels. All of the presently

1898 designated sites are further from the channel than 1,500 feet, and are not known to have received  
 1899 dredged material prior to 1965. During deepening of the approach channels in 1965-1968, much  
 1900 of the material was placed within open-water sites encompassed by currently designated sites.  
 1901 All open-water placement of maintenance dredging material ~~since from 1977 until 1998~~ occurred  
 1902 within designated Areas D, E, F, G and H. ~~The status of the various placement areas is as~~  
 1903 ~~follows:~~

- 1904
- 1905 ~~— Areas A, B, — Historical placement areas with~~
- 1906 ~~& C: — unknown original capacities; filled~~
- 1907
- 1908 ~~— Area D: — Filled to capacity.~~
- 1909
- 1910 ~~— Area E: — Filled to capacity.~~
- 1911
- 1912 ~~— Area F: — Filled to capacity.~~
- 1913
- 1914 ~~— Area G:~~
- 1915 ~~— South — Filled to near capacity (further investigation needed prior to any~~
- 1916 ~~— further use), now partially designated as Site 92.~~
- 1917 ~~— North — Filled to capacity.~~
- 1918 ~~— Central — Removed from open water placement designation due to high~~
- 1919 ~~— relief fisheries habitat.~~
- 1920 ~~— West — Filled to near capacity during 1997/1998 dredging season;~~
- 1921 ~~— < 0.5 mecy of capacity left~~
- 1922 ~~— East — New site, 1.2 mecy capacity.~~
- 1923
- 1924 ~~— Area H: — Dispersive site (not used).~~
- 1925
- 1926 ~~— Site 92: — New site, 3.7 mecy capacity; planned for use during 1998/1999~~
- 1927 ~~— dredging season.~~

1928

1929 The location and general configuration of these sites is depicted in Figure 1-2. Each of the sites  
 1930 has been designated for the open-water placement of dredged material. Two new sites, one in  
 1931 area G (site G-East) and Site 92 (per its designation in the MPA Master Plan), have been  
 1932 designated for open-water placement for the purpose of implementing the Pooles Island open-  
 1933 water component of the State's Strategy for Dredged Material Management (MDOT, 1996c).  
 1934 These sites are close to the C&D approach channels between the Sassafra River and the north  
 1935 end of the Tolchester S-Turn.

1936

1937 The NEPA documentation and the Environmental Assessment for this placement option was  
 1938 completed with a "finding of no significant impact" and released to the public (MES 1997a).  
 1939 Both sites have predicted short-term near field impacts from disturbance to the benthic  
 1940 community and turbidity in the water column during placement. —An estimated combined  
 1941 capacity of approximately 4.9 mecy was is initially projected for G-East (1.2 mecy) and Site 92  
 1942 (3.7 mecy) with limited residual capacity in some of the other sites (G-West and G-South)

1943 following the 1997-1998 dredging cycle (MES 1997a). The NEPA documentation and the  
1944 Environmental Assessment EIS for this placement option have been finalized was completed  
1945 with a "finding of no significant impact" and released to the public (MES, 1997). Site 92 is  
1946 planned for placement to the 14 foot contour. G-East is planned for placement to the 16 foot  
1947 contour. Both sites have predicted short term (<2 year) near field (within the placement area)  
1948 impacts from disturbance to the benthic community and turbidity in the water column during  
1949 placement. These sites are close to CENAP and CENAB the C&D approach channels between  
1950 the SassafRAS River and the north end of the Tolchester S Turn. The bathymetry for Site 92 was  
1951 subsequently reassessed using more recent survey data. This resulted in a revised total estimated  
1952 → capacity of 6.0 mcy which was available prior to first use of the site, which occurred during the  
1953 1998-1999 dredging cycle. The placement capacity for the unfilled remaining Pooles Island  
1954 open-water sites prior to the commencement of the 1999-2000 dredging cycle (G-West, G-East,  
1955 G-South, and Site 92) is estimated at 4.9 mcy.

CK W/FLH  
+ CHART  
FOR CAPY

1957 Over the past several dredging cycles, relatively low flow conditions from the Susquehanna  
1958 River watershed and less severe winter conditions have resulted in a lower than average dredging  
1959 need for the upper Bay approach channels to the C&D Canal. Consequently, the availability of  
1960 the Pooles Island open-water placement sites may be extended for a year or so beyond initial  
1961 projections if average conditions prevail over the next several years. Any such extension would  
1962 help compensate to a small extent for delays experienced in implementing the placement deficit  
1963 that is addressed by this RDEIS and the delay experienced in the construction of Phase I of the  
1964 Poplar Island restoration project. However, flood events would likely result in abnormal  
1965 shoaling and an associated increase in dredging need. With respect to placement planning, flood  
1966 events that result in massive delivery of sediment to the Bay cannot be predicted beyond  
1967 statistical analysis of return periods. Floods which resulted in such exceptional conditions  
1968 occurred in 1972, 1975 and 1996. The average dredging need used in planning was based on  
1969 typical low through high flow conditions and did not take into consideration extreme events.  
1970 Whether another flood will occur during the remaining estimated service life of the Pooles Island  
1971 sites-open-water sites cannot be predicted. Therefore, it is not possible to precisely estimate  
1972 actual placement needs. Should such conditions develop, they would most likely result in the  
1973 available capacity being used quicker than projections that are based on average conditions.  
1974 Variabilities of this type are normally accounted for by a contingency to accommodate  
1975 uncertainty. However, a contingency to cover an extreme event would have to be very large  
1976 relative to the remaining capacity and projected service, and would not be representative of  
1977 prospective near-term needs. At the same time, the potential for flood-related shoaling cannot be  
1978 ignored. Given the limited remaining service life, best management of the existing capacity is  
1979 accomplished through operational adjustments to projected needs based on actual conditions that  
1980 are experienced.

maint  
a comm

1981  
1982 In view of the variability in shoaling rates and dredging need that have been experienced in  
1983 recent years for the C&D approach channels, it cannot be assumed with confidence that any  
1984 potential capacity at the Pooles Island sites in excess of the aforementioned capacity estimates  
1985 could be substituted for a corresponding portion of the placement deficit addressed by this  
1986 RDEIS. The additional capacity estimated by updated surveys may or may not be needed to  
1987 respond to increased shoaling during the site's projected remaining service life. If so, the

CK w) DNDOP chart

1988 USACE can reprogram this capacity to the extent available to compensate for delays in  
1989 implementing the appropriate action to provide for the dredging need addressed by this  
1990 RDEIS or to satisfy a portion of the placement deficit if not fully covered by the proposed action  
1991 (or other alternative).

1992  
1993 2.3.12 Deep Trough

1994  
1995 An area referred to as the The Deep Trough (located south of the Bay Bridge) (Figure 2-2) has  
1996 been considered several times as a potential open water placement site (DNPOP, 1995a,c;  
1997 Gucinski and Ecological Associates, 1984; MPA, 1990; Versar, 1990a,b). The area was  
1998 reconsidered as part of this DEIS to determine whether or not the Deep Trough could serve as a  
1999 practicable alternative to Site 104.

2000  
2001 The Deep Trough is part of a trench of very deep water, up to 48.8 m (160 ft) in depth, that is  
2002 generally aligned along a north-south axis in the eastern center of the main stem of the  
2003 Chesapeake Bay. This trench is a remnant of the ancient Susquehanna River channel when this  
2004 portion of the Bay was a riverine environment. The trench is approximately 32.2 km long (20  
2005 miles) beginning offshore of Kent Island, in the vicinity of the Bay Bridge, and extending south  
2006 to the mouth of the Little Choptank River. It is an area encompassed by the 18.3 m (60 ft)  
2007 MLLW depth contour which extends 32.2 km (20 miles) south from the Chesapeake Bay Bridge  
2008 to a shallower sill of a depth of 18.3 m to 21.3 m (60 ft to 70 ft) MLLW opposite the mouth of  
2009 the Little Choptank River (Versar 1990). Placement capacity at the Deep Trough is estimated to  
2010 exceed 100 mecy depending upon the depth of placement.

2011  
2012 Although this trench is broadly referred to as the Deep Trough, only a portion is legally defined  
2013 using the term "Deep Trough." According to Title 8, Section 8-1601, subsection (a)(6) of the  
2014 Annotated Code of Maryland,

2015  
2016 *"Deep Trough" means any region that: (i) Is south of the Chesapeake Bay Bridge and*  
2017 *north of a line extending westerly from Bloody Point; and (ii) Has a depth that exceeds*  
2018 *60 ft [18.3 m]."*

2019  
2020 was investigated by DNPOP as a potential site for placement of dredged material from the  
2021 Baltimore Harbor outer channels (Figure 2-2). It was specified in t A field study was undertaken  
2022 by the Maryland Department of Natural Resources in 1984 to determine the ecological value of  
2023 the Deep Trough in that portion of the trench that had depths between 80 and 175 feet. Although  
2024 there were some uncertainties due to data limitations, the study results suggested that placement  
2025 of approximately 20 mecy of sediments with an increase in bottom elevation of not more than 6  
2026 meters would probably result in short term effects of limited duration to benthos and other living  
2027 resources. The potential for long term effects from protracted placements was not studied  
2028 (Gucinski and Ecological Analysts, 1984).

2029  
2030 The Deep Trough was included in the MPA Master Plan initiative and was assessed and  
2031 subsequently selected as a principal option. A draft feasibility report and an impact assessment  
2032 were sponsored by the Maryland Department of Natural Resources on behalf of the MPA

2033 (Versar, 1990a,b). The draft environmental assessment (EA) The draft feasibility assessment  
2034 considered a demonstration placement of sediment from the Craighill Channel. The sediment  
2035 that would be placed was to have a larger grain size than material that had been naturally  
2036 deposited at the proposed placement site. The draft assessment reported that use of the Deep  
2037 Trough for bottom placement of clean material would have the advantages of containment within  
2038 this natural bathymetric features that would form a barrier to sediment migration structure as  
2039 well as the lower costs associated with open water placement (Versar, 1990a). The EA for the  
2040 proposed use of the Deep Trough was prepared as a draft technical report. Concerns that were  
2041 identified related to potential nutrient releases, commercial fisheries, and benthic community  
2042 impacts, as well as public nuisance concerns about the possible environmental effects, combined  
2043 to result in t Consideration of the site not being was discontinued when the Master Plan  
2044 investigated further for placement after 1989. was not implemented (Section 2.1.4.a). The  
2045 substantial public controversy that was associated with the proposed use of the Deep Trough  
2046 promoted legislation by the Maryland General Assembly. In 1991, the State legislature amended  
2047 Title 8, section 8-1602 of the Annotated Code of Maryland to prohibit the placement of dredged  
2048 material in the Deep Trough. According to Title 8, Section 8-1602 subsection (d):

2049  
2050 *"Material excavated from Bay. A person may not dump, deposit, or scatter any earth,*  
2051 *rock, soil, waste matter, muck, or other material excavated or dredged from the*  
2052 *Chesapeake Bay or its tidal tributaries into or onto the area of the bottomlands or waters*  
2053 *of the Chesapeake known as the Deep Trough."*

2054  
2055 Use of the site Deep Trough was reconsidered under the DNPOP program in 1995 as part of  
2056 efforts to develop a consensus based plan to overcome an imminent shortfall in placement  
2057 capacity. The DNPOP Management Committee requested a review and compilation of the  
2058 current technical status of the Deep Trough as a placement option. Representatives of the  
2059 Federal and State resource and permitting agencies were consulted in order to provide additional  
2060 information to assist decision makers in determining the technical merits of Deep Trough as an  
2061 option prior to coordination with the Maryland General Assembly regarding the legal issues  
2062 (DNPOP, 1995a). A consensus based study approach consisting of studies and closely controlled  
2063 and monitored test placements was developed at the request of the DNPOP Executive Committee  
2064 by the Bay Enhancement Phase II Working Group (DNPOP, 1995c). Subsequently, the Deep  
2065 Trough was not included in the State of Maryland Strategic Plan for Dredged Material  
2066 Management due to the state law prohibiting placement in this area (see below) and in response  
2067 to an environmental policy decision by the Governor Parris Glendening not to further reconsider  
2068 use of the site.

2069  
2070 The available studies are dated and nonconclusive with respect to the environmental acceptability  
2071 of the Deep Trough as a long term placement option. The available data suggest that use of the  
2072 site would likely result in short term, near field effects. The site has more than ample capacity  
2073 for 18 mecy. However, the institutional constraints that apply to the Deep Trough preclude its  
2074 designation by the State as a placement site. The legal prohibition essentially prevents required  
2075 participation by the local sponsor. In order for this the Deep Trough to be a viable alternative,  
2076 public opinion would have to force a change in the current law, the aforementioned institutional  
2077 constraints would need to be modified to enable. Then, the site investigations would have to be

2078 completed, culminating in the preparation of an EIS the MPA to designate the site for placement  
2079 as the local sponsor and request the USACE to evaluate the site in accordance with applicable  
2080 rules and regulations. Prior to use, legal prohibitions on placement would need to be removed or  
2081 waived by the Maryland General Assembly.

2082  
2083 The Deep Trough is part of a trench of very deep water, up to 48.8 m (160 ft) in depth, that is  
2084 generally aligned along a north-south axis in the eastern center of the main stem of the  
2085 Chesapeake Bay. This trench is a remnant of the ancient Susquehanna River channel when this  
2086 portion of the Bay was a riverine environment. The trench is approximately 32.2 km long (20  
2087 miles) beginning offshore of Kent Island, in the vicinity of the Bay Bridge, and extending south  
2088 to the mouth of the Little Choptank River. It is an area encompassed by the 18.3 m (-60 ft)  
2089 MLLW depth contour which extends 32.2 km (20 miles) south from the Chesapeake Bay Bridge  
2090 to a shallower sill of a depth of 18.3 m to 21.3 m (-60 ft to 70 ft) MLLW opposite the mouth of  
2091 the Little Choptank River (Versar 1990).

2092  
2093 Although this trench is broadly referred to as the Deep Trough, only a portion is legally defined  
2094 using the term "Deep Trough." According to Title 8, Section 8-1601, subsection (a)(6) of the  
2095 Annotated Code of Maryland,

2096  
2097 *"Deep Trough" means any region that: (i) Is south of the Chesapeake Bay Bridge and*  
2098 *north of a line extending westerly from Bloody Point; and (ii) Has a depth that exceeds*  
2099 *60 ft [18.3 m]."*

2100  
2101 In 1991, the State legislature amended Title 8, section 8-1602 of the Annotated Code of  
2102 Maryland to prohibit the placement of dredged material in the Deep Trough. According to Title  
2103 8, Section 8-1602 subsection (d):

2104  
2105 *"Material excavated from Bay.—A person may not dump, deposit, or scatter any earth,*  
2106 *rock, soil, waste matter, muck, or other material excavated or dredged from the*  
2107 *Chesapeake Bay or its tidal tributaries into or onto the area of the bottomlands or waters*  
2108 *of the Chesapeake known as the Deep Trough."*

2109  
2110 Any future proposals to place dredged material in the Deep Trough will be evaluated on a  
2111 project-by-project basis in accordance with the Clean Water Act Section 404 (b)(1) Guidelines  
2112 and other applicable laws and regulations. Although some previous reports suggest that  
2113 placement of material at the Deep Trough is environmentally acceptable and is a cost-effective  
2114 dredged material placement alternative, the existing state law essentially prohibits the required  
2115 participation by the local sponsor. The legally defined Deep Trough was considered as an  
2116 alternative to the use of Site 104. Placement capacity at the Deep Trough is estimated to exceed  
2117 100 mecy depending upon the depth of placement. The Deep Trough is not feasible for  
2118 consideration as an alternative to Site 104 because of institutional constraints.

2119  
2120 2.4 — ALTERNATIVES

2121  
2122 [REVISED SECTION UNDER DEVELOPMENT]

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**2.4.1 No Action**

**2.4.2 Open-Water Sites**

**2.4.2a Site 104 (Proposed Action).** Open-water placement is proposed for approximately 18 mcy of dredged material from the mainstem Chesapeake Bay channels in Maryland serving the Port of Baltimore. The Maryland Port Administration (MPA) has recommended the use of Master Plan Site 104 (generally coinciding with the southern two-thirds of the site known as "Kent Island Deep") for open-water placement of approximately 18 mcy of suitable sediment beginning in 2000 or as soon thereafter to fulfill the open-water placement element of the State of Maryland's Strategic Plan. The southern border of Site 104 is located in the Chesapeake Bay approximately 1 mile north of the Chesapeake Bay Bridge (Figure 1-3). Placement is not proposed for the northern portion of Kent Island Deep, which has depths of 45 ft or less. (This latter area generally coincides with Master Plan Site 105.)

Selection of open-water placement for this NEPA investigation was based on a cooperative effort involving the U.S. Army Corps of Engineers (USACE), Baltimore District (CENAB); USACE, Philadelphia District (CENAP); the MPA, state and Federal natural resource and regulatory agencies, local governments, and environmental and public interest groups. Site 104 was one of the open-water alternatives resulting from multi-agency consultations during the Master Planning process (MPA 1989, 1990) and was identified as the most viable open-water option through multiple levels of screening by participants in the MPA-sponsored Dredging Needs and Placement Options Program (DNPOP).

CENAB developed and applied screening criteria in determining which of the options that was previously considered and which additional options would be suitable for inclusion and consideration as alternatives in this RDEIS in addition to Site 104, as discussed below.

**Overview of the Proposed Open-Water Placement Project**

Sediment dredging is planned from the Federally maintained navigation channels in the mainstem of the Bay and placed in open water, over a period of up to 9 years, depending upon the dredging sequence, dredging need, and other factors. These channels include the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern Extension, Swan Point Channel, Tolchester Channel, and the southern approach channel to the C&D Canal. Dredged material from Baltimore Harbor channels (Figure 1-1) west of the [redacted] Point to [redacted] Point line would not be placed in open water.

As set forth in 40 CFR § 230.11 (d), a determination must be made as to the degree to which dredged material will introduce, relocate, or increase contaminants within a placement area. The quality of estuarine sediment planned for dredging and placement is determined by applying the tiered testing protocol prescribed by the Environmental Protection Agency (EPA) in the Inland Testing Manual (ITM) (EPA and USACE, 1998), as discussed in Section 5.1.5.b. Sediments that are determined to be non-contaminated following the EPA protocol are characterized in this

2168 RDEIS as "suitable" to distinguish them from contaminated sediments. As used in this RDEIS,  
2169 "contaminated" dredged material means dredged material that would be classified as  
2170 contaminated using the ITM protocols. Typically, these materials would be unacceptable for  
2171 unconfined open-water placement in the Chesapeake Bay, although this material could  
2172 potentially be placed in open water and capped.

2173  
2174 Dredged material that lies upstream of a line legislatively drawn across the mouth of the Patapsco  
2175 River between Rock Point and North Point is considered to be prohibited by State law from  
2176 being placed in open waters of the Chesapeake Bay (Figure 1-2). By Code of Maryland  
2177 Regulation, Title 8, Section 8-1602(a) "A person may not . . . deposit . . . in an unconfined manner  
2178 spoil from Baltimore Harbor into or onto any portion of the water or bottomland of the  
2179 Chesapeake Bay or of the tidewater portions of any of the Chesapeake Bay's tributaries outside  
2180 of Baltimore Harbor."

2181  
2182 Sediments proposed for placement in open water will be limited to sediments that have been  
2183 determined to be suitable for open-water placement following the EPA testing protocol.  
2184 Prohibited sediments from Baltimore Harbor, which are considered to be contaminated by State  
2185 law, cannot be placed in any other open-water site under the jurisdiction of the State of  
2186 Maryland.

2187

#### 2188 **Proposed Use of Site 104 for Dredged Material Placement**

2189  
2190 The MPA <sup>has</sup> ~~designated~~ and recommended Site 104 for investigation for open-water placement. Site  
2191 104 had been ranked highest among the open-water options that were identified and technically  
2192 screened through the DNPOP program.

2193  
2194 Open-water placement proposed at Site 104 would be limited to areas deeper than the -45 ft  
2195 MLLW contour interval to achieve a final site elevation of -45 ft MLLW. Based on existing  
2196 contours within the proposed site, placement would occur within the site in the area south of the  
2197 lighted red-and-white buoy for Love Point (RW "LP" buoy [Figure 2-1]). Two concepts were  
2198 originally advanced for placement at Site 104: placement with and without a berm. **The latter**  
2199 **included a berm to be constructed along the southern and western edge of the site if needed**  
2200 **to minimize the potential for material to migrate from Site 104 after placement into the**  
2201 **area defined by State legislation as the Deep Trough. Both placement approaches are**  
2202 **discussed in this chapter.**

2203

#### 2204 **Historical Use of Site 104 as a Dredged Material Placement Area**

2205  
2206 Site 104 was established as a designated open-water dredged material placement area by the  
2207 USACE in 1924. The site was used for that purpose from 1924 to 1975. The original site  
2208 boundaries began at approximately 1.75 miles northwest of Love Point and extended 2.7 nautical  
2209 miles south-southwestward along a natural deep channel to a position due east of Sandy Point  
2210 Light. In 1950, the southern boundary was extended 1 nautical mile south to latitude 39°00' N.  
2211 Then in 1960, the following changes were made: (1) the southern boundary was extended  
2212 another 2,500 ft south to a line running parallel to and 2,000 ft north of the Bay Bridge, and (2)

2213 the southern 1.1 nautical miles of the site was widened to the west by an additional 1,000 ft. The  
2214 depths along the original site axis were -70 ft to -73 ft MLLW and the added areas had depths to -  
2215 95 ft MLLW.

2216  
2217 Originally, it was intended that the site depths be raised to no higher than -50 ft MLLW;  
2218 however, in September 1960 depths were raised to -40 ft MLLW in a portion of the site to  
2219 provide additional placement capacity (CENAB 1997a).

2220  
2221 **2.4.2.b Site 171 Open Water.**

2222  
2223 The open area of deep water immediately west of the Swan Point ship channel was designated as  
2224 Site 171 in the MPA Master Plan initiative (Figure 2-2). This site was raised as a potential open-  
2225 water placement site during both the 1990 Master Plan process and the DNPOP screening  
2226 process. Factors considered in the screening process included natural and cultural resources,  
2227 capacity, economic feasibility, navigation safety, institutional factors (\$state restrictions on area  
2228 and timing of placement), beneficial use opportunity and public and community interests. The  
2229 screening process was conducted with all Sstate and Federal resource agencies, as well as  
2230 commercial and recreational interests. As an open water site, it is estimated to be able to provide  
2231 up to [ ] mcy of capacity. Site 171 is also being considered as a possible location for  
2232 construction of a new island containment facility so the significant resource issues associated  
2233 with this site have been detailed previously (Section 2.2.3.b.2). Site 171 is also being considered  
2234 as a possible location for construction of a new island containment facility.

2235  
2236 As part of the island creation this latter effort, the suitability of Site 171 is currently being  
2237 investigated by MPA for construction of a containment facility or a submerged placement island  
2238 with approximately 80 mcy80-mcy capacity. The submerged island plan would place material  
2239 within an underwater containment area to a final elevation of -10 feet, with sand substrate used  
2240 for capping. This submerged site is listed as an open-water site, although plans would be to cap  
2241 it. It has also been noted in the pre-feasibility report (MPA 1998) that an improved water quality  
2242 and bottom substrate habitat could result from capping. Water depths in this area are currently -  
2243 24 to -26 feet. Although the existing benthic communities are stressed, the site supports some  
2244 commercial fisheries harvests in winter. Hydrodynamic modeling of this site is currently being  
2245 conducted to assess the potential impacts to regional current dynamics. Two potential concerns  
2246 are that island construction could impact larval fish distributions and salinity. Concerns over  
2247 potential impacts to ship handling in the adjacent channels have also been raised.

2248  
2249 An open water site would be available after placement in the short-term (after permitting). The  
2250 estimated time to complete the permitting for this site is 3-5 years. The costs associated with  
2251 developing this option are [ ].

2252  
2253 **2.4.2.c Worton Point Open Water.** *who's lead*

2254  
2255 **2.4.2.d Shad Battery Shoal.** *- who's lead*

2256  
2257 **2.4.2.e Ocean Placement.** *- MES/GBA*

2258  
2259 2.4.2.f Deep Trough.  
2260  
2261 An area referred to as the Deep Trough (located south of the Bay Bridge) (Figure 2-2) has been  
2262 considered several times as a potential open-water placement site (DNPOP 1995a,c; Gucinski  
2263 and Ecological Associates 1984; MPA 1990; Versar 1990a,b). The area was reconsidered as part  
2264 of this RDEIS to determine whether or not the Deep Trough could serve as a practicable  
2265 alternative to Site 104.  
2266  
2267 The Deep Trough is part of a trench of very deep water, up to 48.8 m (160 ft) in depth, that is  
2268 generally aligned along a north-south axis in the eastern center of the main stem of the  
2269 Chesapeake Bay. This trench is a remnant of the ancient Susquehanna River channel when this  
2270 portion of the Bay was a riverine environment. The trench is approximately 32.2 km long (20  
2271 miles) beginning offshore of Kent Island, in the vicinity of the Bay Bridge, and extending south  
2272 to the mouth of the Little Choptank River. It is an area encompassed by the -18.3 m (-60 ft)  
2273 MLLW depth contour which extends 32.2 km (20 miles) south from the Chesapeake Bay Bridge  
2274 to a shallower sill of a depth of -18.3 m to -21.3 m (-60 ft to -70 ft) MLLW opposite the mouth of  
2275 the Little Choptank River (Versar 1990). Placement capacity at the Deep Trough is estimated to  
2276 exceed 100 mcy depending upon the depth of placement.  
2277  
2278 Although this trench is broadly referred to as the Deep Trough, only a portion is legally defined  
2279 using the term "Deep Trough." According to Title 8, Section 8-1601, subsection (a)(6) of the  
2280 Annotated Code of Maryland,  
2281  
2282 *"Deep Trough" means any region that: (i) Is south of the Chesapeake Bay Bridge and*  
2283 *north of a line extending westerly from Bloody Point; and (ii) Has a depth that exceeds*  
2284 *60 ft [18.3 m]."*  
2285  
2286 A field study was undertaken by the Maryland Department of Natural Resources in 1984 to  
2287 determine the ecological value of the Deep Trough in that portion of the trench that had depths  
2288 between 80 and 175 ft. Although there were some uncertainties due to data limitations, the study  
2289 results suggested that placement of approximately 20 mcy of sediments with an increase in  
2290 bottom elevation of not more than 6 m would probably result in short-term effects of limited  
2291 duration to benthos and other living resources. The potential for long-term effects from  
2292 protracted placements was not studied (Gucinski and Ecological Analysts 1984).  
2293  
2294 The Deep Trough was included in the MPA Master Plan initiative and was assessed and  
2295 subsequently selected as a principal option. A draft feasibility report and an impact assessment  
2296 were sponsored by the Maryland Department of Natural Resources on behalf of the MPA (Versar  
2297 1990a,b). The draft feasibility assessment considered a demonstration placement of sediment  
2298 from the Craighill Channel. The sediment that would be placed was to have a larger grain size  
2299 than material that had been naturally deposited at the proposed placement site. The draft  
2300 assessment reported that use of the Deep Trough for bottom placement of clean material would  
2301 have the advantages of natural bathymetric features that would form a barrier to sediment  
2302 migration as well as the lower costs associated with open-water placement (Versar, 1990a).

2303 Concerns that were identified related to potential nutrient releases, commercial fisheries, and  
2304 benthic community impacts, as well as public concern about the possible environmental effects.  
2305 Consideration of the site was discontinued when the Master Plan was not implemented (Section  
2306 2.1.4.a). The substantial public controversy that was associated with the proposed use of the  
2307 Deep Trough promoted legislation by the Maryland General Assembly. In 1991, the State  
2308 legislature amended Title 8, section 8-1602 of the Annotated Code of Maryland to prohibit the  
2309 placement of dredged material in the Deep Trough. According to Title 8, Section 8-1602  
2310 subsection (d):

2311  
2312 *"Material excavated from Bay: - A person may not dump, deposit, or scatter any earth,*  
2313 *rock, soil, waste matter, muck, or other material excavated or dredged from the*  
2314 *Chesapeake Bay or its tidal tributaries into or onto the area of the bottomlands or waters*  
2315 *of the Chesapeake known as the Deep Trough."*  
2316

2317 Use of the Deep Trough was reconsidered under the DNPOP program in 1995 as part of efforts  
2318 to develop a consensus-based plan to overcome an imminent shortfall in placement capacity.  
2319 The DNPOP Management Committee requested a review and compilation of the current  
2320 technical status of the Deep Trough as a placement option. Representatives of the Federal and  
2321 State resource and permitting agencies were consulted in order to provide additional information  
2322 to assist decision makers in determining the technical merits of the Deep Trough as an option  
2323 prior to coordination with the Maryland General Assembly regarding the legal issues (DNPOP,  
2324 1995a). A consensus-based study approach consisting of studies and closely controlled and  
2325 monitored test placements was developed at the request of the DNPOP Executive Committee by  
2326 the Bay Enhancement Phase II Working Group (DNPOP 1995c). Subsequently, the Deep  
2327 Trough was not included in the State of Maryland Strategic Plan for Dredged Material  
2328 Management in response to an environmental policy decision by Governor Parris Glendening not  
2329 to further reconsider use of the site.

2330  
2331 The available studies are dated and nonconclusive with respect to the environmental acceptability  
2332 of the Deep Trough as a long-term placement option. The available data suggest that use of the  
2333 site would likely result in short-term, near-field effects. The site has more than ample capacity  
2334 for 18 mcv. However, the institutional constraints that apply to the Deep Trough preclude its  
2335 designation by the State as a placement site. The legal prohibition essentially prevents required  
2336 participation by the MPA. In order for the Deep Trough to be a viable alternative, , the  
2337 mentioned institutional constraints would need to be modified to enable the MPA to  
2338 designate the site for placement as the local sponsor and request the USACE to evaluate the site  
2339 in accordance with applicable rules and regulations. Prior to use, legal prohibitions on placement  
2340 would need to be removed or waived by the Maryland General Assembly.

2341  
2342 Any future proposals to place dredged material in the Deep Trough will be evaluated on a  
2343 project-by-project basis in accordance with the Clean Water Act Section 404 (b)(1) Guidelines  
2344 and other applicable laws and regulations. The Deep Trough is not feasible for consideration as  
2345 an alternative to Site 104 because of institutional constraints.

2346  
2347 1982-1983 Studies

insert (?)

2348  
2349 The Deep Trough was extensively studied in the early 1980s as part of an assessment related to a  
2350 proposal to place up to 25 million yards of dredged material from maintenance and deepening of  
2351 the approach channels. Dissolved oxygen (DO) depletion was found to occur during the summer  
2352 months throughout the Deep Trough. At depths between 30 and 60 ft, the waters would be  
2353 considered oxygen stressed with concentrations < 5 ppm. The Deep Trough was found to become  
2354 completely anoxic during the summer months at depths greater than 60 ft. The areas proposed  
2355 for dredged material placement are in waters which are greater than 60 ft in depth. Material  
2356 would be placed in an average thickness of 5 ft.

2357  
2358 Stratification occurs during the summer months and little oxygen is transferred below the  
2359 pycnocline (the boundary [something missing here])

2360  
2361 Benthic community organisms are significantly affected by the summer low DO concentrations.  
2362 During the 1982 studies, DO concentrations in bottom waters remained at 0.0 ppm. This  
2363 resulted in near elimination of all benthic organisms during the summer period. Recolonization  
2364 by pioneer species such as polychaete worms was noted by November, followed by a mollusk  
2365 (*Mulinia lateralis*) in February. Total recovery to an expected normal diversity or density (when  
2366 compared to shallow reference areas) never occurred.

2367  
2368 Finfish populations were found to be moderately abundant during the winter months when both  
2369 dissolved oxygen and availability of food organisms were favorable. The dominant juvenile  
2370 species were Atlantic croaker and menhaden. The seasonal occurrence in the Deep Trough is ~~is~~  
2371 likely related to the timing of their migrations through the area and possible overwintering. In  
2372 addition, blueback herring, alewife, and American eel use the general area during winter months.  
2373 Spawning of Bay Anchovy occurred in the spring, but the Trough is not considered a significant  
2374 spawning area for any finfish species. Utilization of the deepest waters occurred during the  
2375 winter months when lower temperatures resulted in DO concentrations >5 ppm.

2376  
2377 Most fish species, however, use the <sup>DEEP</sup> Trough as a migration route to more northern waters. The  
2378 utilization of the Trough was found to be highly seasonal and limited in summer months by  
2379 higher temperatures, low to non-existent dissolved oxygen, and lack of food source. Bottom fish  
2380 were virtually absent during summer months. Fish abundance and diversity were very low in  
2381 summer and significantly higher in winter. Commercial fish such as striped bass and white  
2382 perch were present in the area but inconsistently from year to year. In the winter sampling of  
2383 1982-1983, virtually no striped bass or white perch were caught.

2384  
2385 Blue crabs were found to be very low in number during most of the year, but lowest in summer.  
2386 The Trough was found not to be a significant habitat for blue crabs.

2387  
2388 The Deep Trough is not considered a significant habitat for either finfish or blue crabs. While  
2389 winter utilization by finfish does occur, the overall ecological value is restricted to fall and winter  
2390 and to only a limited number of species. It is also not considered a significant spawning area.

2391  
2392

2393 REFERENCES?? NEED MORE CURRENT ONES IF THEY EXIST.

2394  
2395  
2396 Site Impacts

2397  
2398 The environmental impacts of placement of dredged materials from the approach channels into  
2399 the Deep Trough are both physical and chemical. Toxic effects are not expected due to the  
2400 similarity of the channel sediments to those already in the site. Particle sizes and moisture  
2401 content of the materials are virtually identical to those currently present in the Deep Trough.  
2402 This comparison was made in the early 1980s and would be considered the same today. The  
2403 main difference between the nature of the materials to be dredged today is that they are cleaner.  
2404 The nutrient concentrations are expected to be similar. The direct physical effects would be  
2405 smothering of existing benthic communities.

2406  
2407 Winter Placement

2408  
2409 If the placement occurred during the winter months, short-term impacts upon finfish and blue  
2410 crabs would be expected. The smothering of that year's benthic community would also occur.  
2411 Recovery of the community (to the limited extent that it would recover normally) would not  
2412 occur until all placement had ceased. The Trough is not, however, considered a significant  
2413 source of food for migrating fish at any time of the year.

2414  
2415 Nutrient impacts would be expected to be minimal and potentiation of phytoplankton densities  
2416 would be minimal because of low temperatures and limited migration of deep waters to the  
2417 surface 10 m depths. Displacement of anoxic waters would be minimal since the winter DO  
2418 concentrations are typically >7.0 ppm. Placement would decrease the average depth by 5 ft. No  
2419 significant raising of the minimum depth of anoxic waters would be expected, therefore.

*Can this be stated some no nutrient release studies were performed*

2420 Summer Placement

2421  
2422 Summer placement (which is not likely because of general restrictions on time of year placement  
2423 throughout the Bay) would have little effect upon the benthic community since it is virtually  
2424 eliminated anyway due to natural anoxia below 60 ft. Finfish and blue crab populations would  
2425 not be significantly affected since they are not found in the deeper portions of the Trough during  
2426 summer months. Short term nutrient effects above the pycnocline (the boundary, usually at 15-  
2427 20 ft deep, formed by salinity and temperature gradients) might occur, although this would be  
2428 expected to relate to dispersion of nutrients during initial dumping and not from movement from  
2429 the bottom after placement. The depths of the <sup>Deep</sup>Trough are such that there would be significant  
2430 dispersion of nutrients released from anoxic sediments during the summer months when  
2431 phytoplankton effects might be expected to occur. Some short-term increases in turbidity at the  
2432 surface would reduce light penetration slightly and tend to inhibit phytoplankton growth. Some  
2433 minor upwelling of deoxygenated water might occur on a very short-term basis when the dredged  
2434 material displaced water at the bottom of the trough.

*deep*

2435  
2436 There would not be any environmentally significant long term effects of dredged material  
2437 placement at the Deep Trough site.

2438  
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### 2.4.3 Existing Sites

#### 2.4.3.a South Cell of HMI.

Hart-Miller Island South Cell Reconstruction and Reactivation. Use of the South Cell was discontinued in 1990 after it was filled to near capacity. The south cell is currently being developed for environmental restoration and passive recreation under a provision of Section 1135, Water Resources Development Act of 1986. To facilitate habitat development in the 300-acre South Cell, the last 3.1 m (10 ft) of dredged material was suitable channel material from outside of the harbor. The south cell is under the day-to-day management of MES, which is providing these services under the terms of an Interagency Agreement with the MPA in support of an intergovernmental agreement between the MPA and the Maryland Department of Natural Resources (MDNR). MDNR is responsible for habitat and recreational development of both cells.

The South Cell crust management and grading program has been underway since October 1990 to prepare a foundation for habitat and passive recreational development. Other actions taken to prepare the cell include management and discharge of rainwater to facilitate consolidation of the crust, phragmites eradication and control measures including controlled burns, and vegetative test plots. The 300-acre south cell is currently at +22 ft MLW average elevation.

Most of the South Cell's upland tier dike was excavated for use in the north cell dike raising. Sand that had previously been placed within the South Cell and stockpiled was mined as a resource for reconstructing the North Cell dike to an elevation of +44 ft MLLW, discussed below. The North Cell dike raising motivated legislation by the Maryland General Assembly requiring substantial development of the south cell for recreation and habitat within 5 years. The law also prohibited the south cell from receiving any more dredged material. The same legislation mandated that the dike system could not be raised higher than +44 ft, that placement into the North Cell must be completed by the end of calendar year 2009, and that the cell was to be substantially developed for recreation and habitat within 5 years of closure (Annotated code of the Public General Laws of Maryland, Environmental Article, § 16-202 (e)(1)(ii)).

The State requested that CENAB conduct a Section 1135. CENAB performed the study with the MPA as the local sponsor. The study has identified several approaches for providing ponds, wetlands and uplands that would provide important habitat for migratory birds (CITATIONS).

CENAB subsequently examined the south cell to determine if it could serve as an alternative to open-water placement. As discussed in Annex E, the south cell dike system could be reconstructed in stages to a final elevation of approximately 44 ft. With optimal lifts of approximately 1.3 me<sup>3</sup> per annual dredging cycle and aggressive crust management, the cell could hold approximately 14 me<sup>3</sup> of dredged material

The cost of reconstructing the south cell and the cost of operating the south cell for placement of 18 me<sup>3</sup> of sediments would be approximately \$XXXX million, or about \$X.XX per cubic yard.

2483 Inasmuch as Hart-Miller Island is a state facility, all reconstruction and operations costs would be  
2484 the responsibility of the state.

2485  
2486 Use of the south cell would result in nutrient releases at approximately the same rate as for an  
2487 equivalent amount of sediment in the north cell (see Section X.X.X). As the facility already  
2488 exists, there would be no conversion of Bay bottom. The existing vegetation in the cell, which  
2489 has begun a natural transition from phragmites domination to various indigenous species, would  
2490 be covered if the cell is returned to active placement operations. The State and Federal  
2491 investments in initial preparation of the cell for conversion to wildlife habitat and recreation  
2492 would be lost.

2493  
2494 The MPA is constrained from making the cell available for reconstruction because of a  
2495 commitment made to the public by the Maryland Department of Transportation to accelerate the  
2496 development of the south cell for habitat and recreation. Furthermore, it would be illegal for a  
2497 State agency to reactivate the cell for placement because of the aforementioned State law. The  
2498 Maryland General Assembly, having only recently established this law, is unlikely to reverse  
2499 itself. For this latter reason, reconstruction and reactivation of the south cell is not viable as a  
2500 dredged material placement alternative.

2501  
2502 Use of Existing North Cell Capacity. The approximately 800-acre north cell was increased in  
2503 elevation to 14.6 m (+44 ft) MLW by the MPA in 1997. With optimal crust management and  
2504 consolidation, an estimated 21 mcy of capacity will remain following inflow operations during  
2505 the 1998-1999 dredging cycle. Eventually, the entire site will be converted to habitat and passive  
2506 recreation in compliance with State law after dredged material placement ceases in the year 2009.  
2507 The 21 mcy of capacity that is still available in the north cell has been programmed to receive  
2508 various maintenance and new work dredging projects over the remaining service life of the  
2509 project. The potential remaining capacity following crust management during Summer 2000  
2510 would be approximately 19.5 mcy, depending upon environmental conditions.

2511  
2512 CENAB examined the north cell to determine if it could serve as an alternative to open-water  
2513 placement. As discussed in Annex E, the north cell dike system was reconstructed and increased  
2514 in elevation to +44 ft MLLW. State law prohibits the dike from being increased above +44 ft in  
2515 elevation. Although there is a limited potential to further increase the north cell dike elevation,  
2516 this is not a viable option under existing state law. The Maryland General Assembly, having  
2517 only recently established this law, is unlikely to reverse itself. In this regard, recent legislative  
2518 sessions have seen continuing efforts to continue to impose additional constraints on placement  
2519 options.

2520  
2521 The north cell can only receive an annual maximum of 2.5 mcy without overburdening. The  
2522 available capacity is being programmed for Harbor sediments that are unsuitable for open-water  
2523 placement, insofar as practicable. However, other placement needs have been programmed to  
2524 HMI to correspond with dredging needs. CENAB's analysis of dredging needs indicates that  
2525 there is no excess capacity available in the north cell. Diversion of material planned for open-  
2526 water placement would not only be substituted for other existing needs, but would also result in a  
2527 reduction in the north cell's ability to receive dredged material, as described below.

2528  
2529 Operational records for the HMI facility document the ability to dewater and consolidate  
2530 sediments in order to reduce sediment volume and regain a portion of used placement capacity.  
2531 The operating history indicates that placement of quantities in excess 2.5 mcy would result in  
2532 water being trapped between the crust prior to placement and the crust that forms following  
2533 placement. This would have the effect of reducing the facility's overall capacity, because the  
2534 state law that mandates a closure date does not allow time for a hiatus in placement operations to  
2535 enable extended crust management operations to offset any overburdening. The prospective  
2536 potential outcomes of overburdening the site would therefore be a shortened service life because  
2537 the site would be filled more quickly, inadequate time available between placements for optimal  
2538 dewatering and consolidation, and a reduction in the north cell's overall capacity. The resulting  
2539 reduction in the north cell's optimal capacity would exacerbate the placement deficit that the  
2540 proposed action under investigation by the RDEIS is intended to relieve.

2541  
2542 The diversion of additional sediments to HMI would therefore result in one or a combination of  
2543 (1) substituting sediments dredged from one location for another without resolving the  
2544 underlying placement need, (2) an increase in the placement capacity deficit through  
2545 overburdening, and (3) deferral of planned dredging due to lack of capacity. In view of the  
2546 preceding analysis, use of the existing capacity of the north cell is not a viable alternative.

2547  
2548 **2.4.3.b C&D Canal Upland Sites. [CENAB TO REVISE AND UPDATE THIS SECTION]**

2549  
2550 There are currently 17 Federal upland sites along the C&D Canal designated for dredged material  
2551 placement (Figure 2-6). These sites are strategically located to accommodate certain channel  
2552 reaches within the C&D Canal and the northern portion of the approach channels. Periodic  
2553 expansion of these sites has been necessary to accommodate maintenance needs of those channel  
2554 reaches. Placement site capacity expansion is presently needed to accommodate existing C&D  
2555 canal channels. The sites have limited capacity at present, and are in the process of being  
2556 investigated for jurisdictional wetland delineation by CENAP. After this evaluation is complete,  
2557 availability of these sites as placement options would not occur for 4-6 years. Use of these sites  
2558 for the CENAB or CENAP southern reaches would reduce the long-term potential of these sites  
2559 for the channel reaches they now serve. Furthermore, the required pumping distances and  
2560 elevations make use of these sites for reception of materials from the southern CENAB and  
2561 CENAP reaches uneconomical and inefficient from both fiscal and engineering standpoints  
2562 (MDOT 1996c; MPA 1996).

2563  
2564 **2.4.4 New Containment Options**

2565  
2566 **2.4.4.a Hart-Miller Island**  
2567 **Expansion.**

2568  
2569 Hart and Miller Island is an existing state-owned confined placement facility located at the mouth  
2570 of Back River in the Upper Chesapeake Bay. The facility is currently utilized for dredged  
2571 material placement from the Baltimore Harbor channels. The proposed alternative would  
2572 involve the extension of the existing dikes either to the east or to the south to encompass

2573 approximately 700 acres. There are three basic options for expansion of the existing HMI  
2574 facility.

2575  
2576 Option 1 would involve extending the dikes to the east. This would result in an elongated cell or  
2577 cells bounded on the west by the existing eastern dike of the existing facility and on the north,  
2578 east, and south by new dikes. Average depths in the vicinity of the proposed new eastern dike  
2579 alignment average between -15 and -18 feet MLW. The capacity would be increased by up to up  
2580 to 20-mey depending upon the area encompassed and the height of the dikes. The existing  
2581 facility currently encompasses 1140 acres in two cells, with a projected final capacity of  
2582 approximately 85-mey. The north cell is at elevation +44 feet MLW, while the south cell is  
2583 limited to +22 feet MLW. Any extension to the east would likely be restricted to the +22 feet  
2584 unless the south cell restriction is modified by law. This option would incorporate the existing  
2585 dike and would be adjacent to an area already affected by dredged material placement. It would  
2586 not affect the view from the mainland, an issue raised with respect to the existing facility. Noise  
2587 effects would be minimized since construction activities would be buffered by the existing  
2588 facility. For all options, construction would be easier because of the presence of the existing  
2589 dike, which would function as access and material transport. If the existing off loading facility  
2590 could continue to be used, no additional access channel would be needed for movement of the  
2591 dredged material to the facility.

2592  
2593 Construction of Option 1 would eliminate existing clean Bay bottom and aquatic habitat. Reef  
2594 effects presently related to the eastern dike of the existing facility would be temporarily lost  
2595 during construction but would return once the new eastern dike had been completed.

2596  
2597 Option 2 would be expansion to the south of the existing facility and would extend the dikes to  
2598 Pleasure Island. This would be a longer and narrower configuration than Option 1, and would  
2599 increase capacity up to 15-mey. Average depths in the area are between +5 and -12 feet MLW.  
2600 Depths along the eastern dike alignment are between -8 and -12 feet MLW. The actual capacity  
2601 would vary depending upon the length of the expansion. It would, however, utilize the existing  
2602 southern dike of the HMI facility and would utilize the upland of Pleasure as the footprint for the  
2603 new western dike. This would be a more costly configuration than Option 1.

2604  
2605 As with Option 1, the second option would eliminate existing clean Bay bottom and aquatic  
2606 habitat. Reef effects presently related to the southern dike of the existing facility would be  
2607 temporarily lost during construction but would return once the new southern dike had been  
2608 completed. Existing recreation on Pleasure Island would be interrupted and modified. The  
2609 existing flow through the channel between HMI and Pleasure Island would be eliminated. Since  
2610 the major flow out of Back River is to the northeast on the west side of Pleasure Island, this  
2611 should have minimal effect upon the flushing characteristics of Back River. Since a portion of  
2612 Pleasure Island would be used for the base of the western dike, there would be losses of tidal  
2613 wetlands and potentially terrestrial habitat. The upland habitat could be mitigated through the  
2614 development of new habitat on the diked facility following completion of dredged material  
2615 placement. The view from the mainland would be affected by this option since it would involve  
2616 construction of a new dike along the eastern edge of Pleasure Island and between Pleasure and  
2617 the existing HMI facility.

*a new dike could help to ~~maintain~~ stabilize adjacent shore lines and reduce erosion impacts*

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illustrate*

*graphic  
illustrate*

2618  
2619 Option three would be the combination of Options 1 and 2, which would result in the greatest  
2620 capacity, but also the greatest, relative impact. This combination would cover approximately  
2621 1100 acres, would result in up to 50-mcy capacity, and would be the most cost effective.

2622  
2623 The construction of any of these options would increase the area for passive recreation and/or  
2624 beneficial habitat development. It would eliminate recreational and commercial fishing in the  
2625 area of construction, but these would be expected to shift to the east following completion of the  
2626 dikes. In addition, any of the expansion options would be in violation of current agreements  
2627 between the citizens and government of Baltimore County and MPA. This agreement states that  
2628 no new island dredged material placement site shall be constructed within a five-mile radius of  
2629 the existing HMI facility.

2630  
2631 The cost for this option would range between \$2 - \$3 per cu. yd.

2632 *In view of two analysis options 1 or 2 are not considered viable*

2633  
2634  
2635 **2.4.5 Beneficial Use**

2636  
2637 **2.4.5.a Poplar Island Wetland Cell Conversion to Upland.**

2638  
2639 **2.4.5.b**  
2640 **Modification of the Authorized Poplar Island Project**

2641  
2642 The project at Poplar Island could be modified to allow additional capacity. This could be  
2643 accomplished by laterally expanding the island, elevating one or more of the upland cells,  
2644 replacing one or more of the wetlands cells with upland cells, or a combination of all three.

2645  
2646 Lateral expansion would involve the creation of a new cell(s) for containment of dredged  
2647 material. Expansion to the north is limited by a poor foundation condition. Expansion to the  
2648 west is limited by a natural oyster bar. Expansion to the east is limited by the potential for  
2649 submerged aquatic vegetation. As part of the planning process for the Poplar Island project, a  
2650 1,340-acre alternative was investigated and eventually dropped due to cost considerations. This  
2651 alternative is similar to the current project for Poplar Island, except that the southern portion of  
2652 the project follows the -8-foot MLLW contour, expanding the island footprint by 230 acres. To  
2653 maximize capacity, the expansion should be entirely upland. This yields an additional capacity  
2654 of 12.7 mcy. Because the area of placement has increased, both the overall capacity and the  
2655 optimum annual placement capacity will increase. An additional 14,000 lf of containment  
2656 would be required, and this option is expected to cost approximately \$75 million. The unit cost  
2657 would be about \$6/cyd.

2658  
2659 A second option would be to raise the western upland dikes to allow additional capacity. The  
2660 raising would be accomplished using sand obtained from a borrow site immediately south of the  
2661 project on either side of the approach channel, or sand generated by channel dredging work.  
2662 Current capacity in the two upland cells is about 32 million cubic yards. Each foot of elevation

*OPTION 1 - documents*

2663 of the dikes will result in an additional 1.2 mecy of capacity. To meet the expected dredged  
2664 material placement need of 18 mecy, the elevation of the two upland cells would have to be raised  
2665 from +20 MLLW to +35 MLLW. Because the area of placement will not increase for this  
2666 option, the overall capacity will increase, but the optimum annual placement capacity will remain  
2667 the same. In other words, the additional capacity will be gained by extending the life of the  
2668 project instead of increasing the amount that can be placed at the site in any given year. The cost  
2669 to raise the dikes the initial 10 feet from +10 MLLW to +20 MLLW was estimated to be about  
2670 \$3.7 million. Raising them an additional 15 feet to +35 MLLW would cost about \$5.6 million.  
2671 Transportation costs for the 18 mecy of dredged material would be about \$45 million. The total  
2672 estimated cost for this option, \$50.6 million, results in a unit cost of about \$3/cyd.

2673  
2674 A third option is to raise the dikes on one or more of the wetland cells. The total capacity for the  
2675 four wetlands cells are about 6.3 mecy. Raising the dikes on the wetland cells from +8 MLLW to  
2676 the presently proposed upland elevation of +20 MLLW will result in an additional 3.4 – 6.9 mecy  
2677 of additional capacity. To meet the 18mcy capacity shortfall, all four dikes would have to be  
2678 raised to +20 MLLW, providing additional capacity of just over 21 mecy. Raising the dikes to  
2679 +20 MLLW is expected to cost about \$4.5 million. The transportation cost for the 21 mecy of  
2680 dredged material would be about \$52.5 million. The total cost of about \$57 million equates to a  
2681 unit cost of about \$3/cyd. Such an option would compromise the proposed wetland habitat.  
2682 However, because the area of placement has increased, both the overall capacity and the  
2683 optimum annual placement capacity will increase.

2684  
2685 P:\Federal\DOD\ARMY\projects\6095793\NewDraft\Revised DEIS\Chapter\_02\Poplar Island.doc  
2686

#### 2687 2688 2.4.5.c Holland Island.

#### 2689 2690 2.4.5.d Sparrows Point Habitat Development.

2691  
2692 A 300-acre habitat development project was planned for the eastern end of Sparrows Point in  
2693 Baltimore County (Figure 2-7). The project was planned to establish a habitat enhancement  
2694 project contiguous to industrial shoreline by converting relatively poor bottom to aquatic and  
2695 intertidal wetlands, high marsh, and upland nesting areas in order to benefit living resources.  
2696 The habitat that would have been created was also envisioned as providing aesthetic relief for the  
2697 entrance to the harbor. An estimated 10 mecy of capacity was projected. The MPA investigated  
2698 use of this site, with preliminary conceptual designs and pre-feasibility environmental studies.  
2699 Preliminary engineering determined that a project at the site was feasible. However, poor  
2700 foundation conditions would necessitate highly specialized construction techniques in order to  
2701 "float" a structure to enclose the site (GBA et al. 1992; Hamons and Young 1999; MES and  
2702 MPA 1993). An environmental study determined that the area's biological productivity was  
2703 similar to that of other areas inside the harbor, but less productive than the Bay (MES 1995a).

2704  
2705 Institutional difficulties exist from the prohibition in current state law for construction of a  
2706 containment facility within a 5 mile radius of the Hart-Miller-Pleasure Island chain. Although  
2707 the proposed project was intended to improve habitat, it nevertheless would have required the  
2708 water area to be fully enclosed because of site-specific conditions. Attempts on behalf of the

*graphic  
illustration*

2709 MPA to secure citizen support for the beneficial use project and for a revision to the law were not  
2710 successful. Local citizens, citing past filling of open-water in the area by Bethlehem Steel,  
2711 objected to any further conversion of open-water in the area (Hamons and Young 1999). In the  
2712 absence of support for removal of the institutional constraint associated with this project, habitat  
2713 development has been maintained as a DNPOP option but efforts to implement the project have  
2714 been suspended indefinitely. The existing institutional constraint is considered a fatal flaw for  
2715 this option, and it is not feasible or practicable as an alternative to the proposed action.

2716

2717 **2.4.6 Island Placement Site** *Redundant content on 2-66*

2718

2719

2720 **2.2.3.b.2 Proposed Upper Bay Island Long-Term Placement Site**

2721

2722 The possibility of developing a new containment island was revisited under the DNPOP  
2723 beginning in mid-1995. This possibility received additional emphasis as a result of the Joint  
2724 Chairman's Report from the 1996 legislative session in Maryland, which required a report on the  
2725 development of a plan for a dredged material placement island as a possible alternative to the  
2726 second phase of the Poplar Island restoration project (MDOT 1996b). The Joint Chairman's  
2727 Report required MDOT to "identify two or more sites in the Upper Chesapeake Bay for the  
2728 development of artificial islands with sufficient capacity to meet the anticipated needs of the Port  
2729 for at least 20 years (MDOT 1996b)."

2730

2731 The MPA, with technical and coordination assistance from the MES and advice of DNPOP  
2732 participants, used its existing list of placement options to identify and conduct a preliminary  
2733 multidisciplinary screening of possible island sites. Screening criteria included capacity, natural  
2734 resources sensitivity, technical feasibility (based upon geotechnical and engineering evaluations),  
2735 and practicability (based upon costs in association with engineering constraints). [Of the sites  
2736 that were identified and screened by the DNPOP Bay Enhancement Phase II Working Group, all  
2737 of the sites except Site 170 were advanced to prefeasibility studies by the MPA following  
2738 presentation to the DNPOP Management, Citizens and Executive Committees. Site 170 was  
2739 removed from short-term consideration due to concerns about prospective adverse hydrodynamic  
2740 effects on circulation in the lower Patapsco River, Baltimore Harbor, Rock Creek, and Stony

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- Tolchester West (vicinity of Gales Lumps)
- Site 168 (old placement site at the intersection of the Brewerton Extension and Tolchester Channels)
- Site 171 (Swan Point West)
- Pooles Island area
- Site 170 at the mouth of the Patapsco River - (evaluated but not advanced to prefeasibility phase study)

2754 The information presented in the following sections was developed during the prefcasibility  
2755 investigation of the above-listed sites by MPA in 1997 and 1998 (MPA 1998). Prefeasibility  
2756 investigations were based largely on existing information, although some site-specific substrate  
2757 and water quality information was collected. [Preliminary Hydrodynamic modeling was  
2758 conducted for all sites, but in-depth hHydrodynamic investigations of all proposed island  
2759 configurations are ongoing. Is this still true??]. All would involve dike construction  
2760 construction, which that is a significant infrastructure constraint in the near-term.

*discuss of case  
are there 2 sites  
now*

2762 All of the proposed sites lie north of the Bay Bridge but south of Worton Point. The Bay within  
2763 this reach is oligohaline or mesohaline. Water quality from the two Chcsapeake Bay Program  
2764 stations within this reach (MCB3.1 and MCB2.2) indicate that anoxie or hypoxic conditions can  
2765 be expected in the deeper areas of this reach during the warmer months. Similar to other deep  
2766 areas of the Bay, nitrogen concentrations (particularly ammonium) tend to decrease with  
2767 increasing temperature until anearobic nutrient cycling allows for increased releases to the water  
2768 column. Phosphorus concentrations in this reach tend to peak in fall and early spring. These  
2769 conditions can be expected in any of the deeper water areas considered for island construction.  
2770 The shallower areas within this reach (i.e., those <2 meters) tend to remain oxygenated  
2771 throughout the year and provide high value living resources habitat (for fish and shellfish) in the  
2772 warmer months. Some deeper areas have been shown to be significant overwintering areas for  
2773 resident and semi-anadromous fish species. Male blue crab overwintering can be expected in  
2774 some of the deeper areas, but is more prevalent south of Swan Point. Site- specific engineering  
2775 considerations and resource issues are detailed below.

*graphs*

2776  
2777 Tolchester West Island Creation Site

2778  
2779 This site was included in the DNPOP planning as a possible site for construction of an island  
2780 containment facility and was subsequently advanced to the pre feasibility study phase. The  
2781 estimated capacity as a containment facility is approximately 80 my. This is among the  
2782 shallower sites considered for island creation and is the site of a prehistoric island. The bottom  
2783 substrates are sandy and the benthic community demonstrates little apparent signs of stress. The  
2784 site is near a significant recreational fish haven (Gales Lump Reef). The site probably supports  
2785 soft-shell clams. This site is currently within a 5-mile radius of Hart Miller Island (HMI), and  
2786 current sState law would thus preclude construction. This site is adjacent to the Tolchester  
2787 Channel and concerns related to hydrodynamic impacts on channel traffic are being investigated  
2788 in the pre feasibility studies. It is expected that construction of this potential site, if sState law  
2789 preclusions were removed, could take approximately 7 to 14 years based upon whether or not an  
2790 accelerated implementation process were feasible.

2791  
2792 Site 168 Island Creation Site

2793  
2794 The area immediately north of the Brewerton Extension at the intersection with the Tolchester  
2795 Channel was previously used as a placement site for material dredged from the Brewerton  
2796 Extension (Figure 2-3) and is being considered for dredged material placement. This general  
2797 area was previously designated as Site 168 and was considered as a possible open water  
2798 placement site under the DNPOP program, but was dropped from consideration for open water

2799 placement because it had never been used, and there was no natural depression to aid in materials  
2800 containment and the strong tidal currents in the area would likely move material into the adjacent  
2801 channels. As an open water site, it would have a relatively low capacity due to the average  
2802 depths, and would lose the potential for island development. It is estimated to have about an 80  
2803 meq capacity if used as the location for a new containment island. Water depths in the  
2804 area range from 4.9 to 8.5 meters ( 16 to 28 feet) MLLW. There are weak foundation soils and  
2805 a soft to very soft substrate that could make construction less practicable. No significant  
2806 fisheries are known to exist in the project area. The existing benthic community is stressed due  
2807 to periodic summer anoxia and poor substrate. This site provides significant commercial fishing  
2808 opportunities in winter, although hypoxia makes it unsuitable as fish/crab habitat during most  
2809 summers. This is considered a long term site for dredged material placement that would take  
2810 approximately 7 to 14 years based upon whether or not an accelerated implementation process  
2811 was feasible.

2812

### 2813 Pooles Island Area Island Creation Site

2814

2815 There are currently three potential configurations at Pooles Island that are being evaluated as part  
2816 of the Prefeasibility Study for Upper Bay Island Placement Sites. Two of these configurations  
2817 are attached to the island, and one is removed and to the south. The two configurations that are  
2818 attached to the island would be 825 to 1475 acres in size; the site which is site that is removed  
2819 from Pooles Island ranges in size from 680 to 780 acres. The capacity of each site would be 80  
2820 meq for the connected sites, and 40 meq for the site that does not connect to the island. Water  
2821 depths in the area under study range from 1.2 to 10.4 meters ( 4 to 34 feet). Two of the  
2822 configurations are completely removed from the APG designated area while one site does  
2823 partially lie within the APG boundary.

2824

2825 The majority of the sites are underlain by soft substrates that would require removal and thus  
2826 higher site development costs. Unexploded Ordnance (UXO) are likely to be present in all  
2827 sites. Dike construction over areas containing UXO would be a slow and costly process. If any  
2828 UXO is buried or encapsulated by placement activities, there is a potential that it would have to  
2829 be removed at a later time involving additional costs and uncertain responsibilities. Because  
2830 APG is currently an National Priority List (NPL) site for hazardous wastes, any party that places  
2831 dredged material placement in the area would likely be considered a potentially responsible party  
2832 (PRP). This potentially implicates all parties that place material in the area to future hazardous  
2833 waste mitigation actions under CERCLA.

2834

2835 The sites attached to the island have terrestrial, historical, and archeological resources of value  
2836 and rare threatened, or endangered RTE species on or near the project area that could potentially  
2837 be impacted by placement activities. Although Pooles Island is south of the State designated  
2838 striped bass spawning grounds, areas near the island have been identified by APG and USFWS  
2839 environmental managers as providing fish spawning and juvenile fish habitat, although a winter  
2840 placement window could reduce the potential for impacts. Pooles Island also supports a heronry  
2841 as well as nesting habitat for many other bird species. The area is also known to provide  
2842 significant waterfowl habitat, particularly in fall/winter. It is anticipated that an island site near  
2843 Pooles Island would take 7 to 14 years to develop based upon whether or not an accelerated

2844 implementation process was feasible.

2845

#### 2846 Site 171 Island Creation Site

2847

2848 The open area of deep water immediately west of the Swan Point ship channel was designated as  
2849 Site 171 in the MPA Master Plan initiative (Figure 2-3). Site 171 was included in DNPOP  
2850 program planning as a possible site for construction of an island containment facility and was  
2851 subsequently advanced to the prefeasibility study phase. As part of this latter effort, the  
2852 suitability of Site 171 for construction of a submerged placement island is also being considered.  
2853 The estimated capacity as a containment facility is approximately 80 mecy. Capacity as a  
2854 submerged island of up to approximately 80 mecy has also been considered, with varying  
2855 acreages. A submerged island is a partially contained mound of material that stops at 4 m (12  
2856 ft); the concept may include a beneficial use component as the benthic environment is currently  
2857 impacted by poor sediment quality and water quality due to seasonal anoxia. This site provides  
2858 significant commercial fishing opportunities in winter, although hypoxia makes it unsuitable as  
2859 fish/crab habitat during most summers. This site is not within a 5-mile radius of Hart-Miller  
2860 Island (within which no dikes can currently be constructed under Sstate law), and would not  
2861 currently be precluded by law for creation of a containment facility. Hydrodynamic modeling is  
2862 being conducted on this site, and others, to determine if unacceptable hydrodynamic and water  
2863 quality changes could result from construction of an island or a submerged island in this location.  
2864 It is expected that further environmental study, permitting, funding funding, and construction of  
2865 this site would take approximately 7 to 14 years based upon whether or not an accelerated  
2866 implementation process was feasible previous projects (HMI).

2867

#### 2868 Site 170 Island Creation Site

2869

2870 Site 170, previously described, was considered as a possible location for a containment island  
2871 under the DNPOP program (Figure 2-3). Use for containment is estimated to result in an  
2872 approximate capacity of 80 mecy. This site was dropped from further consideration due to a  
2873 combination of hydrodynamic concerns, as the site was seen as likely to reduce the cross-  
2874 sectional area of Patapsco River and inhibit circulation in the Harbor and nearby tributaries. [Can  
2875 we still say this?????]. The location could also affect navigation near the Harbor entrance.

2876

#### 2877 2.4.6 Island Placement Site

2878

2879 The possibility of developing a new containment island was revisited under the DNPOP  
2880 beginning in mid-1995. This possibility received additional emphasis as a result of the Joint  
2881 Chairman's Report from the 1996 legislative session in Maryland, which required a report on the  
2882 development of a plan for a dredged material placement island as a possible alternative to the  
2883 second phase of the Poplar Island restoration project (MDOT 1996b). The Joint Chairman's  
2884 Report required MDOT to "identify two or more sites in the Upper Chesapeake Bay for the  
2885 development of artificial islands with sufficient capacity to meet the anticipated needs of the Port  
2886 for at least 20 years (MDOT 1996b)."

2887

2888 The MPA, with technical and coordination assistance from the MES and advice of DNPOP

*Is this a repeat*

2889 participants, used its existing list of placement options to identify and conduct a preliminary  
2890 multidisciplinary screening of possible island sites. Screening criteria included capacity, natural  
2891 resources sensitivity, technical feasibility (based upon geotechnical and engineering evaluations)  
2892 and practicability (based upon costs in association with engineering constraints). [Of the sites  
2893 that were identified and screened by the DNPOP Bay Enhancement Phase II Working Group, all  
2894 of the sites except Site 170 were advanced to prefeasibility studies by the MPA following  
2895 presentation to the DNPOP Management, Citizens and Executive Committees. Site 170 was  
2896 removed from short-term consideration due to concerns about prospective adverse hydrodynamic  
2897 effects on circulation in the lower Patapsco River, Baltimore Harbor, Rock Creek, and Stony  
2898 Creek. CAN WE STILL SAY THIS????]. The goal of the Upper Bay Containment Island is to  
2899 provide between 50 and 100 mcy of placement capacity. The general locations of five potential  
2900 arcas for island creation are listed below and are presented in Figure 2-3:

2901

- 2902 • Tolchester West (vicinity of Gales Lumps)
- 2903 • Sitc 168 (old placement site at the intersection of the Brewerton Extension and  
2904 Tolchester Channels)
- 2905 • Pooles Island Area
- 2906 • Site 170 at the mouth of the Patapsco River - (evaluated but not advanced to  
2907 prefeasibility phase study)
- 2908 • Sitc 171 (Swan Point West)

2909

2910 The information presented in the following sections was developed during the prefeasibility  
2911 investigation of the above-listed sites by MPA in 1997 and 1998 (MPA 1998). Prefeasibility  
2912 investigations were based largely on existing information, although some site-specific substrate  
2913 and water quality information was collected. Preliminary Hydrodynamic modeling was  
2914 conducted for all sites, but in-depth hydrodynamic investigations of all proposed island  
2915 configurations are ongoing. All would involve dike construction, which is a significant  
2916 infrastructure constraint in the near-term.

2917

2918 All of the proposed sites lie north of the Bay Bridge but south of Worton Point. The Bay within  
2919 this reach is oligohaline or mesohaline. Water quality from the two Chesapeake Bay Program  
2920 stations within this reach (MCB3.1 and MCB2.2) indicate that anoxic or hypoxic conditions can  
2921 be expected in the deeper areas of this reach during the warmer months. Similar to other deep  
2922 areas of the Bay, nitrogen concentrations (particularly ammonium) tend to decrease with  
2923 increasing temperature until anaerobic nutrient cycling allows for increased releases to the water  
2924 column. Phosphorus concentrations in this reach tend to peak in fall and early spring. These  
2925 conditions can be expected in any of the deeper water areas considered for island construction.  
2926 The shallower areas within this reach (i.e. those <2 meters) tend to remain oxygenated  
2927 throughout the year and provide high value living resources habitat (for fish and shellfish) in the  
2928 warmer months. Some deeper areas have been shown to be significant overwintering areas for  
2929 resident and semi-anadromous fish species. Male blue crab overwintering can be expected in  
2930 some of the deeper areas, but is more prevalent south of Swan Point. Site specific engineering  
2931 considerations and resource issues are detailed below.

2932

2933 2.4.6.a. Tolchester West Island Creation Site

2934  
2935 This site was included in the DNPOP planning as a possible site for construction of an island  
2936 containment facility and was subsequently advanced to the pre-feasibility study phase. The  
2937 estimated capacity as a containment facility is approximately 80 my. This is among the  
2938 shallower sites considered for island creation (10 to 16 feet) and is the site of a prehistoric island.  
2939 Due to the shallow depths, the site has more living resources habitat value than deeper sites that  
2940 can become anoxic during part of the year. Preliminary results of the hydrodynamic  
2941 investigations of this site indicated that it would cause the least overall changes in regional  
2942 hydrodynamics of all options considered.

2943  
2944 The bottom substrates are sandy and the benthic community is fairly diverse and demonstrates  
2945 few apparent signs of stress. The site is near a significant recreational fish haven (Gales Lump  
2946 Reef) . The site probably supports soft-shell clams. The proposed site is currently within a 5-  
2947 mile radius of Hart-Miller Island (HMI), and current state law would thus preclude construction.  
2948 This site is adjacent to the Tolchester Channel and concerns related to hydrodynamic impacts on  
2949 channel traffic are being investigated in the pre-feasibility studies.

2950  
2951 It is expected that construction of this potential site, if state law preclusions were removed, could  
2952 take approximately 10 to 14 years based upon whether or not an accelerated implementation  
2953 process were feasible. Foundation materials in this area were among the best of all island sites  
2954 considered which makes it among the most technically feasible of the island options. The total  
2955 costs to develop construct this option are 62-70 million dollars. With transportation costs this  
2956 option would be 552 to 562 million dollars with an average cost per cubic yard of placement  
2957 ranging from \$7.91 to \$7.05.

*SP*  
*Is there transport cost for this material?  
what identify these costs?*

2958  
2959 2.4.6.b. Site 168 Island Creation Site

2960  
2961 The area immediately north of the Brewerton Extension at the intersection with the Tolchester  
2962 Channel was previously used as a placement site for material dredged from the Brewerton  
2963 Extension (Figure X-X) and is being considered for dredged material placement. This general  
2964 area was previously designated as Site 168 and was considered as a possible open-water  
2965 placement site under the DNPOP program. It was, however, dropped from consideration for  
2966 open-water placement because it had never been used and there was no natural depression to aid  
2967 in materials containment and the strong tidal currents in the area would likely move material into  
2968 the adjacent channels. Preliminary results of the hydrodynamic modeling of the islands  
2969 indicated that this site would have the greatest potential to increase salinity in the upper reaches  
2970 of the Bay. It also would create the greatest sheer stresses of all options which could be  
2971 problematic for navigation and local erosion. As an open-water site, it would have a relatively  
2972 low capacity due to the average depths, and would lose the potential for island development. It is  
2973 estimated to have about an 80-mey eapaeity if used as the location for a new containment island.

2974  
2975 Water depths in the area range from -4.9 to 8.5 meters (-16 to -28 feet) MLLW. There are weak  
2976 foundation soils and a soft to very soft substrate that could make construction less practicable.  
2977 The existing benthic community is stressed due to periodic summer anoxia and poor substrate.

2978 This site provides significant commercial fishing opportunities in winter, although hypoxia  
2979 makes it unsuitable fish/crab habitat during most summers.

2980  
2981 This is considered a long-term site for dredged material placement that would take approximately  
2982 10 to 14 years based upon whether or not an accelerated implementation process was feasible.  
2983 Due to the foundation conditions, the estimated initial construction cost would be 184 to 199  
2984 million dollars. Within dredging and transport costs of 459 million dollars, the total cost to  
2985 implement this option would be 669 to 685 million dollars (8.37 to 8.54 per cy).

2986  
2987 2.4.6.c. Pooles Island Area Island Creation Site  
2988

2989 There are currently three potential configurations at Pooles Island that are being evaluated as part  
2990 of the Prefeasibility Study for Upper Bay Island Placement Sites. Two of these configurations  
2991 are attached to the island, one is removed and to the south. The two configurations that are  
2992 attached to the island would be 825 to 1475 acres in size; the site that is removed from Pooles  
2993 Island ranges in size from 680 to 780 acres. The capacity of each site would be 80 mcy for the  
2994 connected sites, and 40 mcy for the site that does not connect to the island. Water depths in the  
2995 area under study range from -1.2 to -10.4 meters (-4 to -34 feet). Two of the configurations are  
2996 completely removed from the APG designated area while one site does partially lie within the  
2997 APG boundary. [Can we say anything about the hydrodynamics of the area????]

2998  
2999 The majority of the sites are underlain by soft substrates that would require removal and thus  
3000 higher site development costs. Unexploded Ordnance (UXO) is likely to be present in all sites.  
3001 Dike construction over areas containing UXO would be a slow and costly process. If any UXO is  
3002 buried or encapsulated by placement activities, there is a potential that it would have to be  
3003 removed at a later time involving additional costs and uncertain responsibilities. Because APG is  
3004 currently a National Priority List (NPL) site for hazardous wastes, any party that places dredged  
3005 material placement in the area would likely be considered a potentially responsible party. This  
3006 potentially implicates all parties that place material in the area to future hazardous waste  
3007 mitigation actions under CERCLA.

3008  
3009 The sites attached to the island have terrestrial, historical, and archeological resources of value  
3010 and rare threatened, or endangered species on or near the project area that could potentially be  
3011 impacted by placement activities. Although Pooles Island is south of the state-designated striped  
3012 bass spawning grounds, areas near the island have been identified by APG and USFWS  
3013 environmental managers as providing fish spawning and juvenile fish habitat, although a winter  
3014 placement window could reduce the potential for impacts. Pooles Island also supports a heronry  
3015 as well as nesting habitat for many other bird species. The area is also known to provide  
3016 significant waterfowl habitat, particularly in fall/winter. It is anticipated that an island site near  
3017 Pooles Island would take 10 to 14 years to develop based upon whether or not an accelerated  
3018 implementation process was feasible.

3019  
3020 Due to the substrates and depth of the water access, the two proposed island configurations  
3021 would have moderate to high initial construction costs. Site 4A (east of Pooles Island) would  
3022 cost approximately 283 to 316 million dollars to construct. With transportation costs, this option

3023 would total approximately 766 to 800 million dollars (\$9.52 to \$9.97 per cy). Costs for  
3024 development and use of Site 4B (attached to the Southern portion of Pooles Island) would range  
3025 from 165 to 213 million for construction with total costs of 663 to 712 million (\$8.28 to 8.93 per  
3026 cy). The smaller (40 mcy) configuration proposed for the area south of Pooles Island would have  
3027 among the highest implementation costs of all options (\$10.56 to 10.82 per cy).

3028

3029 2.4.6.d. Site 170 Island Creation Site

3030

3031 Site 170, previously described, was considered as a possible location for a containment island  
3032 under the DNPOP program (Figure X-X). Use for containment is estimated to result in an  
3033 approximate capacity of 80 mcy. This site was dropped from further consideration due to a  
3034 combination of hydrodynamic concerns, as the site was seen as likely to reduce the cross-  
3035 sectional area of Patapsee River and inhibit circulation in the Harbor and nearby tributaries. [Can  
3036 we still say this?????]. The location could also affect navigation near the Harbor entrance.

3037

3038 MES to provide update.....

3039

3040

3041 2.4.6.e Site 171 Island Creation Site

3042

3043 The open area of deep water immediately west of the Swan Point ship channel was designated as  
3044 Site 171 in the MPA Master Plan initiative (Figure X-X). Site 171 was included in DNPOP  
3045 program planning as a possible site for construction of an island containment facility and was  
3046 subsequently advanced to the prefeasibility study phase. As part of this latter effort, the  
3047 suitability of Site 171 for construction of a submerged placement island is also being considered.  
3048 The estimated capacity as a containment facility is approximately 80 mcy. Capacity as a  
3049 submerged island of up to approximately 80 mcy has also been considered, with varying  
3050 acreages. A submerged island is a partially contained mound of material that stops at -4 m  
3051 (-12ft); the concept may include a beneficial use component as the benthic environment is  
3052 currently impacted by poor sediment quality and water quality due to seasonal anoxia. This site  
3053 provides significant commercial fishing opportunities in winter, although hypoxia makes it  
3054 unsuitable fish/crab habitat during most summers. This site is not within a 5-mile radius of Hart-  
3055 Miller Island (within which no dikes can currently be constructed under state law), and would not  
3056 currently be precluded by law for creation of a containment facility. Preliminary results of the  
3057 hydrodynamic modeling for this site indicates that it would create the largest decreases in salinity  
3058 in the upper reaches of the Bay of all sites modeled

3059

3060 It is expected that further environmental study, permitting, funding and construction of this site  
3061 would take approximately 10 to 14 years based upon whether or not an accelerated  
3062 implementation process was feasible previous projects (HMI). As an island option, this site  
3063 would cost approximately 307 to 320 million dollars to construct. The estimated costs to  
3064 implement this option as a containment island would be among the highest of all island options  
3065 (\$10.05 to 10.26 per cy). As a submerged island the construction costs would be relatively low  
3066 (\$9 million dollars) and the total costs for implementation are estimated to be approximately \$7.17  
3067 per cy.

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**2.4.7 Combination of Smaller Sites (Holland, Bodkin, Artificial Reefs, Parsons, Cox Creek)**

**[More Discussion Here]**

**Cox Creek Dredged Material Containment Facility**

The Cox Creek Dredged Material Containment Facility (DMCF) is located approximately 1 mile south of the Francis Scott Key Bridge, on the west bank of the Patapsco River, near Foreman's Corner in Anne Arundel County, Maryland (Figure 2-6). The two cells were originally constructed under contract to CENAB in the 1960's for the containment of dredged material from the deepening of the Baltimore Harbor Federal channels from -11.9 m (-39.0 ft) to -12.8 m (-42.0 ft). The MPA has acquired the cells and plans to renovate the facility for the placement of an additional 6 mcy of maintenance dredged material from the Inner Harbor channels.

Maintenance dredged material targeted for placement in open water will originate from the upper Bay channels located outside (east) of the North Point to Rock Point line. Placement of suitable dredged material from Bay Channels at Cox Creek would limit its further use for placement of contaminated dredged material from Inner Harbor channels. As placement options for sediments from Inner Harbor channels are much more limited, filling Cox Creek with clean Bay channel material is not a prudent commitment of resources. In addition, site configuration will limit placement to a maximum of 500,000 cy per year to optimize its capacity over a planned 12-year service life.

The CSX containment cell was constructed in the early 1960s, and was used periodically by non-Federal interests for dredged material placement throughout the 1970s. The site was purchased by the State of Maryland in July 1993. The cell was previously permitted for placement of material obtained from dredging operations in the Patapsco River and Baltimore Harbor areas. The area of the dredged material placement cell is 72 acres. Its dikes have been raised periodically throughout its use and presently have a height of +6.1 m (+20.0 ft) MLLW. The last reported use of the site for the placement of dredged material was in 1984; it has been part of the MPA's long-term planning for dredged material management since 1979.

The Cox Creek containment cell, as it was formally known, is bordered on the west by the former Cox Creek Refining Company upland property (now owned by the MPA) and on the east by the Patapsco River. The cell is surrounded by dikes that are presently at a height of +4.9 m (+16.0 ft) MLLW. The site was originally developed in the mid-1960's. Although the cell has not been actively used as a placement site since that time, it has been part of the MPA's long-term planning for dredged material management since 1979. Roughly 15 acres of the Cox Creek containment cell is occupied by an existing pond that was determined not to be jurisdictional wetlands under Federal rules and regulations. The pond receives water in the form of precipitation and stormwater runoff from the Cox Creek upland adjacent to the pond property. The pond is not open to tidal interaction; it is served by a spillway that is passively discharging

3113 into the Patapsco River. The stormwater system has been rerouted so that it no longer  
3114 discharges into the pond.

3115  
3116 Harbor sediments may not be placed in open water, but may be placed in containment facilities.  
3117 Currently, the Hart-Miller Island DMCF is the only facility that is able to receive contaminated  
3118 sediments. The combined capacity of the CSX/Cox Creek cells and Hart-Miller (which also  
3119 receives sediments from outside of the harbor for which other placement capacity is not  
3120 available and which is prohibited by State law from receiving material after 2009) is not  
3121 sufficient to accommodate all of the dredged material from the harbor during the next 20 years.  
3122 For these reasons, the capacity at CSX/Cox Creek must be reserved for harbor sediments. This  
3123 site is not suitable as an alternative due to the relatively low capacity and the need to dedicate  
3124 the available capacity for Inner Harbor sediments.

3125  
3126

Section 3

Decision Making Process

3.1 GENERAL SITE SELECTION PROCESS

Environmental evaluation is a preliminary decision making part of the NEPA process that must precede any decision concerning project selection by Federal agencies. CENAB has determined that the proposed action would constitute a major Federal action requiring preparation of an EIS. In addition to the evaluation being performed in this DEIS, CENAB and CENAP, and the MPA have been involved in at least three major state-sponsored dredged material placement area planning efforts since 1986. These efforts have been conducted to identify suitable placement options through screening level evaluations. In these processes, which were discussed in Section 2, environmental, technical, economic, and capacity needs have been evaluated to rate or rank sites that warrant further evaluation and study.

The MPA is currently pursuing various additional options for the continued management of dredged material through its DNPOP program. The program is a multidisciplinary, interorganizational program that was formed by MPA, with assistance from the MES, as a medium for implementing the 1991 Task Force recommendations. The objective of the program is to identify and develop short-term to long-term dredged material placement options for the Port of Baltimore and its approach channels. The DNPOP program is described in Section 2.

CENAP and CENAB are each working closely with the MPA to develop multiphased studies called DMMP for each District. The objective of each study is to identify placement capacity for the next 20 to 50 years. Plan formulation was initiated in Federal Fiscal Year 1995 and will include consideration of all dredging maintenance and construction of Federal projects, as well as state and private projects. The studies will stress long-term solutions and beneficial uses of dredged material rather than the short-term needs that could be satisfied by some of the sites evaluated in this EIS, and will take advantage of the prior planning and evaluations as a resource.

3.2 SECTION 404 GUIDELINES

Section 404(b)(1) guidelines indicate that no discharge of dredged or fill material will be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Further, for non-water dependent projects, a less damaging upland practicable alternative is presumed to exist, and it must be proven that such alternatives do not exist. Consequently, less damaging practicable alternatives that do not include placement of material within waters of the U.S. must be examined. An alternative is considered practicable if it is available and capable of being done after taking into consideration, cost, existing technology, and logistics in light of overall project purpose.

NEPA requires that the Federal government, in conjunction with assistance from the public and state agencies, identify those environmental, social and economic impacts that might occur should a proposed project be implemented. NEPA requires that USACE, as the implementing

48 Federal agency, rigorously explore and objectively evaluate reasonable alternatives. In addition,  
49 for each alternative that was eliminated from further detailed study, USACE is required to  
50 discuss the reason that the alternative was eliminated. NEPA requires the evaluation of the  
51 environmental impacts of all alternatives including the proposed action and any adverse  
52 consequences that cannot be avoided if the proposed action is implemented.  
53

### 54 **3.3 PUBLIC INTEREST REVIEW**

55  
56 Corps policy and guidance emphasize that opportunities for public involvement and agency  
57 coordination must be provided during the planning stages of a project. In addition, Corps  
58 guidance supports many Federal regulations requiring close coordination among all levels of  
59 government and natural resource management agencies. USACE public involvement activities  
60 are a distinct requirement; however, state-sponsored DNPOP activities were used as a resource.  
61 The purpose of USACE public involvement and agency coordination for the Site 104 project is  
62 to ensure that all factions of the public would have timely access to information about the project  
63 and be able to influence decisions about the study and, ultimately, the recommended plan. In  
64 conformity with these aims, a public involvement program was developed early in the Site 104  
65 project to outline the program objectives, a tentative program schedule, and the products desired  
66 from the program. The program included a variety of public involvement techniques, such as  
67 newsletters, public meetings, and comment cards, and extensive agency coordination, including a  
68 Site 104 Working Group and other outreach groups sponsored by the MPA.  
69

#### 70 **3.3.1 Working Group Meetings**

71  
72 The Site 104 Working Group was comprised of representatives from Federal, state, and local  
73 natural resource regulatory and management agencies and commercial and recreational fishing  
74 interests. Agencies represented include the U.S. Environmental Protection Agency (USEPA),  
75 U.S. Fish and Wildlife Service (USFWS), National Marine Fishing Service (NMFS), Maryland  
76 Department of the Environment (MDE), Maryland Department of Natural Resources (MDNR),  
77 Maryland Geological Survey (MGS), Chesapeake Bay Program (CBP), Maryland Waterman's  
78 Association (MWA), Upper Bay Charter Boat Captains Association (UBCBCA), Maryland  
79 Charter Boat Association (MCBA), and the Maryland Saltwater Sportfishing Association  
80 (MSSA), in addition to the MPA, MES, and the Baltimore and Philadelphia Districts of the  
81 Corps of Engineers.  
82

83 The group met regularly and members served as points of contact for the agencies and  
84 organizations they represented. The purpose of the group was to provide input into the planning  
85 process from an agency and professional perspective. The meetings included discussions and  
86 presentations on the status of the study. In addition, the MPA and MES met with the commercial  
87 fisheries representatives in February 1997.  
88

89 **3.3.2 Public Notice**

90  
91 A Notice of Intent (NOI) to prepare as draft EIS was prepared for the project and published in the  
92 Federal Register on July 9, 1997. Prior to the NOI, a meeting notice was published in the  
93 Federal Register on July 1, 1997. In addition to the Federal Register publications, approximately  
94 500 copies of the NOI were mailed to individuals, offices, and agencies on the USACE  
95 Baltimore District's mailing list. The NOI, as well as the meeting notice, included information  
96 about the study and about the scoping meetings that were held on July 15, 17, and 22 at  
97 Chestertown, Centreville, and Annapolis, Maryland, respectively.

98  
99 **3.3.3 Public Workshop Process**

100  
101 Public workshops were held at several stages of the study. At each stage of the study a set of  
102 three workshops was held in Queen Anne's, Kent, and Anne Arundel Counties in order to  
103 provide information about the study to residents throughout the area that would be most affected  
104 by the project, and to solicit input from the public. The meetings at each stage of the study were  
105 planned to be identical in format and information presented, however, the format of each meeting  
106 was modified to appropriately respond to the questions and concerns of meeting attendees. The  
107 numbers of attendees at the meetings was fairly small; however, each meeting produced  
108 numerous questions, comments, and suggestions.

109  
110 Scoping meetings were held on July 15, 17, and 22, 1997, at Chestertown, Centreville, and  
111 Annapolis, Maryland, respectively. A separate scoping and information meeting with  
112 representatives of commercial and recreational fishing organizations was also held on July 28,  
113 1997, at Centreville. A second set of meetings was held on March 24, 25, and 26, 1998, at  
114 Stevensville, Annapolis, and Chestertown, Maryland. The purpose of the March meetings was to  
115 present the results of field investigations and technical studies that were done to date to  
116 characterize the site and predict the potential effects of placing material at Site 104. Lists of the  
117 questions and comments made at the meetings are in Annex A.

118  
119 **3.3.4 NEPA Coordination**

120  
121 Coordination with Federal, state, and local agencies has proceeded in compliance with NEPA  
122 regulations and Corps policy. Early formal and informal coordination was completed at the  
123 project initiation and continued throughout the study. Copies of pertinent agency  
124 correspondence are included in Annex C.

125  
126 **3.4 COMPLIANCE TABLE**

127  
128 For a placement site to be environmentally acceptable, the location, plan and operation must be in  
129 compliance with a suite of environmental protection statutes and executive orders. As part of the NEPA  
130 process, the applicable environmental laws and statutes were reviewed relative to the proposed placement  
131 plan and are discussed in detail in Section 10.

**Section 4****Description of Proposed Action****4.1 SITE 104**

Site 104 is a previously used open water dredged material placement area located in the Chesapeake Bay, just north of the Chesapeake Bay Bridge. The recommended plan for reuse of Site 104 is described in this section along with recommended operational and monitoring requirements. These recommendations have been based upon the results of (1) a combination of literature search and review and (2) field, laboratory, and modeling studies developed specifically to analyze the existing conditions and potential impact of this proposed action.

The reuse of the Site 104 open water dredged material placement area would consist of the placement of approximately 18 mcy of sediments to be dredged from channels located outside Baltimore Harbor, east of the Rock Point/North Point line. The State of Maryland's Strategic Plan proposes 5 years of placement as shown in Table 4-1 (Depending on actual annual need, these volumes and timeframes may vary significantly from year to year; and may occur in non-successive years or may occur less or more than 5 years within the planned 1-9 year window).

It is anticipated that a Record of Decision (ROD) could be made regarding the proposed action in September 1999.

Dredged material placed at the site will only be taken from the Craighill Entrance Channel, the Craighill Channel, the Craighill Upper Reach, the Craighill Angle, the Cutoff Angle, the Brewerton Eastern Extension Channel, the Swan Point Channel, the Tolchester Channel, and the southern approach channels to the Chesapeake and Delaware Canal. No material will be taken to the site from channels within Baltimore Harbor. This Proposed Action does not include construction of a berm at the site (Section 2.2.4.g). The berm option was rejected as an alternative because researchers believed that the berm would not significantly improve off-site drift of materials and would be costly to construct (Section 6.1.3.1).

**4.1.1 Site Design**

Dredged material is to be placed no higher than a final elevation of -13.7 m (-45.0 ft) MLLW and completely within the site boundaries as defined in Section 5.1.1, "Setting." The contractors would be required to use a differential global positioning system (DGPS) to ensure that the material is placed in the intended area. If needed to improve bottom conditions for commercial fishing and elevation control, some smoothing or leveling of the Site 104 bottom contours by dragging a heavy metal bar is to be performed upon completion of the 5 years of planned placement at the site. Dragging may also be performed after the completion of annual placements if needed to ensure that the maximum elevation is not exceeded.

**4.2 SITE MANAGEMENT**

**Table 4-1**  
**Currently Proposed Dredged Material Placement Schedule**

<b>Placement Year</b>	<b>Volume</b>
1	2.5 mcy
2	4.5 mcy
3	3 mcy
4	6 mcy
5	2 mcy
<b>Total</b>	<b>18 mcy</b>

46 If a decision is made to place dredged material at Site 104, a site management plan must be  
47 developed. This section presents information which will be used for developing site  
48 management guidelines for the designated operations. USACE will have management authority  
49 over the dredging contractor during placement of material at Site 104 and for some of the  
50 monitoring. The implemented site management plan will be developed in coordination with  
51 Federal and state resource and regulatory agencies, the local sponsor, and the public. The  
52 purpose of the site management plan is to ensure that project operations are conducted to  
53 minimize any potential impacts to the environment and to human use of the area. Additional  
54 information may be found in Section 4.2.3 Site Management Plan.

#### 55 56 **4.2.1 Dredging and Placement Methods**

57  
58 The following presents a description of the equipment and placement techniques, best  
59 management dredging, and material placement practices that are proposed for use on the action.

60  
61 **4.2.1.a Dredging Methods.** Historically, contract specifications for maintenance dredging of the  
62 channels targeted for dredged material placement at Site 104 and other sites have not required  
63 specific methods for removal of sediments. Rather, equipment has been selected at the discretion  
64 of the dredging contractor. Mechanical dredging with a clamshell bucket has been the most  
65 common method for removal of material in these channels in recent years. Hopper dredges were  
66 used prior to 1975 and hydraulic pipeline dredges have also been used, but in limited  
67 circumstances. The selection of dredging equipment and the method used to perform the  
68 dredging depends on several factors including: the physical characteristics and quantities of the  
69 material to be dredged, the dredging depth, distance to the placement area, the physical  
70 environment of the dredging and placement areas (such as depth of water versus the draft of the  
71 dredge and/or scows), method of placement, production required, types of dredges available, and  
72 costs (EPA/USACE 1992).

73  
74 Mechanical dredging will generally introduce less water into the material being dredged than  
75 hydraulic excavation. Stiffer material (less water content) is less likely to spread or be stripped  
76 during placement, subsequently resulting in less impact to the water column at the site.  
77 However, the eventual impact from placement of material at Site 104 is driven more by the  
78 method of placement employed at the site than by the initial material removal techniques.  
79 Conditions that vary significantly from site to site, such as project geometry, sediment types, and  
80 disposition play a more significant role in the selection of dredging methods. Therefore, it is not  
81 recommended that requirements for the dredging method be placed on the contractor unless there  
82 is a compelling reason to do so.

83  
84 **4.2.1.b Placement Methods.** Dredged material is generally placed at open water placement  
85 locations by mechanical means via bottom- release scows or hopper dredges or through hydraulic  
86 placement means. All of these methods, including combinations of these methods, have been  
87 used for placement of material in the Chesapeake Bay in recent years. The selection of  
88 placement equipment and methods depends upon factors such as the distance between the  
89 dredging and placement areas, the characteristics of the placement site and the material to be  
90 placed, production requirements, equipment availability, potential environmental impacts, and  
91 costs. Modeling efforts performed by Waterways Experiment Station (WES) (1999) were

## NOT UPDATED

92 designed to evaluate potential impacts resulting from both hydraulic and bottom-release  
93 placement of material at Site 104. The modeling studies focused on placement methods using  
94 bottom-release scows and hydraulic unloading of a barge or scow through a pipeline to a location  
95 close to the bottom surface to limit material dispersion.

96  
97 Both techniques were found to be viable options for material placement at Site 104. Split-hull  
98 scow placement of material is a more common placement method and would likely yield a higher  
99 production rate, require less material handling, and be less costly than the alternate method of  
100 hydraulic unloading of a scow through a pipeline to a location close to the bottom surface. The  
101 hydraulic placement method, however, was found to result in less erosion in the model and  
102 would therefore result in less turbidity in the water column. Information concerning the results  
103 of the modeling of impacts from the two placement techniques described above are discussed in  
104 Section 6.1.3.g.

105  
106 Mechanical and hydraulic methods for material placement at the site are described below.  
107 Placement locations and schedules have been evaluated through use of the modeling studies  
108 described in Section 6.1.3. The following sections provide descriptions of the various  
109 mechanical and hydraulic placement methods available.

110

### 111 **Mechanical Dredging**

112

113 Mechanical placement of material at Site 104 was modeled as placement from split hull scows.  
114 Scows and barges are large flat-bottomed container vessels pushed/pulled by tugboats; these  
115 vessels vary in size depending upon availability and location of the dredging operation. Dredged  
116 material scows likely to be used range in size from 3,000 to 6,000 cy. The 4,000 cy scow used  
117 for the modeling effort is a typical, medium sized scow that holds approximately 3,600 cy of  
118 dredged material (scows will not be filled to 100% to preclude overflow of material during  
119 loading, transporting, and unloading operations). The scows will be moved from the dredging  
120 sites to the placement site by tugs, which generally have on-board power of 1,500 horsepower  
121 (hp) to 3,000 hp. Multiple scows are assigned to service each dredge to minimize "down" time  
122 for the dredge. In other words, for maximum operational efficiency, as a full scow leaves the  
123 dredge, an empty scow should just have returned from the placement site. Loaded scows are to  
124 travel through designated channels to reach Site 104.

125

126 The total round trip, from the channels to the site and back, ranges from 2 to 70 nautical miles  
127 depending on what channel is being dredged. The rate of speed should range from 5-10 knots,  
128 depending upon the tugs, and scows utilized, vessel traffic, currents, and weather. Travel speeds  
129 of the tugs and associated scows are reduced to about 1 knot upon arrival at the designated  
130 placement location and during placement of the material. Round trip time would range from 1 to  
131 10 hours. Additional equipment, which might typically be on site, would include a survey/crew  
132 boat, a fuel scow, a crane scow, and at least two tugs to move the dredge and scows.

133

### 134 **Hydraulic Dredging**

135

## NOT UPDATED

136 Hydraulic placement of dredged material at Site 104 was modeled as hydraulic pump out of a  
137 scow through a pipeline to locations near the site bottom. Use of this method would limit  
138 material dispersion during placement. This method is a much more expensive option with  
139 greater human safety concerns during operations, because it requires additional equipment to be  
140 stationed in or near Site 104 during the entire dredging operation, and the method is more  
141 human-resource-intensive.

142  
143 Dredged material could also be brought to Site 104 in a scow and pumped into the site. Though  
144 rehandling of dredged material is inefficient, pumping dredged material from a scow is a possible  
145 option. The most common method used in the area is to use a hydraulic unloader, similar to a  
146 hydraulic dredge, to introduce slurry water from the Bay into the scow and pump the material out  
147 of the scows. Another method is to suspend a pump from a crane, place the suction end of the  
148 pump into the material in the scow and the discharge end into the site. This method requires that  
149 the material be slurried by the introduction of water into the scow sediment for transport, and  
150 offers only low production rates.

151  
152 Some specialized equipment has been developed such as a smaller hydraulic marine excavator  
153 with pump out capability. The excavator backhoe transfers material from the scow to a pump  
154 intake onboard the dredge, where an automated water injection system slurries the material for  
155 pump transport to the site. The production capacity of this system is also relatively low, ranging  
156 from 100 to 300 yd<sup>3</sup> per hour.

157  
158 It may also be possible to pump dredged materials directly to the site from the source. However,  
159 the distance from the dredging site to Site 104 restricts this method to the closer channels.  
160 Distances to Site 104 from some reaches of the southern approach channels of the C&D Canal  
161 may exceed 30 nautical miles. Pipeline transport of material from these distances is not  
162 economically feasible for most projects. Dredged material within a cost-effective pumping  
163 distance of Site 104, such as the Craighill Entrance Channel and Swan Point Channel, could be  
164 pumped directly to the site.

165  
166 The hydraulic discharge pipe in either scenario could be a floating line that would be  
167 repositioned at a constant pace using a small boat or anchor lines to direct the discharge flow as  
168 desired. In some situations, however, a floating line could obstruct existing channels. A  
169 submerged line, or a line held neutrally buoyant at a specified depth above the bottom, could also  
170 be employed to minimize dispersion of sediments being placed at the site.

171  
172 A diffuser can be installed on the end of the discharge pipe to reduce slurry velocity. Various  
173 diffuser configurations are available, but generally the dredged slurry is directed against a baffle  
174 plate or through a larger diameter pipe, or both. During hydraulic placement, it would be  
175 beneficial to direct the flow toward the bottom.

176  
177 Any of these variations of hydraulic placement methods would be chosen to minimize  
178 resuspension and to prevent loss of material from the site boundaries while dredged material is  
179 pumped into the site.

180

181 **4.2.2 Time-of-Year Restrictions**  
182

183 An annual placement window of approximately 15 October through 15 April has been identified  
184 for use of Site 104, in an attempt to limit the release of nutrients and to limit potential adverse  
185 impacts to aquatic and benthic organisms, and to the commercial and recreational fisheries within  
186 Site 104 and its surrounding environment. This window was set primarily to limit water quality  
187 impacts related to release of phosphorus during hypoxic water quality conditions. Table 4-2  
188 presents a summary of the critical life stage periods of species that potentially occur in the Site  
189 104 region and the use of the site by both commercial and recreational fisheries. Also depicted  
190 are the natural changes in salinity, water temperature, dissolved oxygen, phytoplankton blooms,  
191 and periods of hypoxia that could magnify impacts if material were placed during the placement  
192 period indicated. Each of these items was evaluated in depth. The details of these evaluations  
193 are presented in Section 5 and Section 6. Placement operations might also be affected by  
194 weather conditions. The annual window requires dredging and placement of dredged material at  
195 Site 104 during periods of harsh weather, particularly during the winter months when cold  
196 temperatures, ice, and Northeasters make towing difficult. Dredge captains and tug captains will  
197 have the final say as to whether they will risk continuing to dredge and make placement trips  
198 during adverse operating conditions, although the contracting officer's representative may direct  
199 against venturing out in rough water conditions.  
200

201 If approved, the 2000 Federal fiscal year dredging season could be targeted as the first year of  
202 material placement at Site 104.  
203

204 **4.2.3 Site Management Plan**  
205

206 Site management plans are developed to outline standard operating procedures specific to  
207 projects, helping to ensure safe and effective site operations. For the open-water placement of  
208 dredged materials at Site 104, the site management plan should: (1) provide guidelines for  
209 placement of material at the site, (2) specify operating requirements for circumstances where  
210 controls are necessary, (3) detail plans for meeting restrictions imposed by permits, (4) provide  
211 for monitoring of site performance, and (5) detail actions to be taken or respond to monitoring  
212 results.  
213

Table 4-2: SITE 104 Open-Water Placement Area  
Critical Life Stages, Fishing Seasons, and Pertinent Environmental Data

Overlaid with the Recommended Dredging Operations Window (Oct.15 - Apr. 15)

NOTE: [Hatched pattern] Hatching indicates that the Site 104 does not support habitat crucial to critical life stages.  
NOTE: [Dotted pattern] Critical habitat for this species has yet to be determined.

	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE
<b>RECOMMENDED DREDGING WINDOW</b>				[Solid black bar from Oct 15 to Apr 15]								
<b>FISH</b>												
SHORTNOSE STURGEON (Endangered)									[Dotted]	[Dotted]	[Dotted]	
ATLANTIC STURGEON									[Dotted]	[Dotted]	[Dotted]	
ALEWIFE									[Dotted]	[Dotted]	[Dotted]	
AMERICAN SHAD, HICKORY SHAD									[Hatched]	[Hatched]	[Hatched]	
ATLANTIC MENHADEN									[Hatched]	[Hatched]	[Hatched]	
BAY ANCHOVY									[Hatched]	[Hatched]	[Hatched]	
BLUEBACK HERRING									[Hatched]	[Hatched]	[Hatched]	
OYSTER TOADFISH									[Hatched]	[Hatched]	[Hatched]	
STRIPED BASS									[Hatched]	[Hatched]	[Hatched]	
WHITE PERCH									[Hatched]	[Hatched]	[Hatched]	
WINTER FLOUNDER									[Hatched]	[Hatched]	[Hatched]	
YELLOW PERCH									[Hatched]	[Hatched]	[Hatched]	
WEAKFISH					[Hatched]							
<b>SHELLFISH</b>												
BLUE CRAB					[Hatched]							
EASTERN OYSTER					[Hatched]							
SOFT-SHELL CLAM					[Hatched]							
<b>COMMERCIAL FISHERY</b>												
STRIPED BASS DRIFT GILLNET												
STRIPED BASS HOOK AND LINE	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
STRIPED BASS HAUL SEINE	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
STRIPED BASS POUND NET	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
BLUE CRAB SEASON					[Hatched]							
<b>RECREATIONAL FISHERY</b>												
STRIPED BASS SEASON	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
BLUE CRAB SEASON					[Hatched]							
<b>SALINITY (25m)</b>												
MESOHALINE (15 to 19 ppt)	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
<b>WATER TEMPERATURE (25m) **</b>												
> 12 degrees C	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
< 12 degrees C	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
<b>DISSOLVED OXYGEN **</b>												
SHALLOW STATIONS (8m) < 2.0 mg/L	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
SHALLOW STATIONS (8m) > 2.0 mg/L	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
DEEP STATIONS (25m) < 2.0 mg/L	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
DEEP STATIONS (25m) > 2.0 mg/L	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]	[Hatched]
<b>PHYTOPLANKTON BLOOM</b>												

\* Data from *Habitat Requirements for Chesapeake Bay Living Resources* (Funderburk et al., 1991) & Setzler-Hamilton 1987

\*\* Data from MDE Chesapeake Bay Program Stations MCB3 3C.E and W 1984-1997

## NOT UPDATED

214 Site management plans usually require regular documentation of site operations. Through  
215 periodic review of site documentation and data, site management plans can be updated, revising  
216 procedures for better site performance. For Site 104, material placement during the first year  
217 would be planned conservatively for the center of the proposed site with actual data gathered  
218 during monitoring dictating the need and magnitude of operational controls during subsequent  
219 years of placement.

220

221 **4.2.3.a. Material Placement Guidelines.** Material placement guidelines will be designed to  
222 minimize resuspension and dispersion of sediment placed at the site, and to ensure that material  
223 is placed according to designated locations and depths within the placement site. Placement plans  
224 will be developed prior to each year's dredging based upon recent bathymetric and site condition  
225 surveys, and the results of past monitoring.

226

227 Sampling of the expected types of materials to be placed at the site will also play a role in the  
228 annual plan development. The physical characteristics of the material could influence the  
229 chosen method for placement, the placement locations within the site, and the placement timing  
230 including the placement year, time of year, and/or time of day. For example, since coarse-grain  
231 material is less erodible than fine-grained material, the contracting officer may choose to have  
232 the contractor place dredged material from certain locations which contain coarser-grained  
233 material by mechanical means. More fine-grained dredged material would be placed by  
234 hydraulic placement directly to the site bottom. The dredging operation will be monitored to  
235 ensure that specific minimum performance criteria are met. Those criteria will include, but will  
236 not necessarily be limited to, (1) verification of dredging and placement depth by periodic  
237 bathymetric soundings, (2) use of specified routes for travel between the dredging and placement  
238 sites, and (3) verification of dredging and placement location using data from electronic  
239 navigation systems. The first criteria will be performed by the Baltimore District or under  
240 contract. The second and third criteria will be incorporated into the dredging contract. The  
241 contractor will be required to provide the contracting officer with position data in a format and  
242 on a schedule specified for the dredging content.

243

244 It will be the responsibility of the dredging contractor to ensure that these criteria are satisfied.  
245 Verification of compliance with critical operating criteria by a designated representative or agent  
246 of the contracting officer through use of an electronic "silent" inspector will ensure that the  
247 project will proceed in a responsible manner. Results of these compliance reports will be  
248 documented in site operation reports.

249

250 Interim surveys of the work sites should be performed frequently by the USACE. These surveys  
251 would indicate the disposition of the placed material. Survey data will provide vital information  
252 to the contracting officer, will allow the opportunity for plan revisions, and will provide for the  
253 proper planning of future placement operations.

254

255 **4.2.3.b Operational Controls.** The principal objective of defining and implementing operational  
256 controls on the placement activities is to minimize the opportunity for sediment resuspension and  
257 dispersion during the placement process, while maximizing operational efficiency and safety.  
258 The specific control methods that are employed will depend on the dredging and placement  
259 techniques that are implemented. Control techniques specific to Site 104 may include: (1)

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260 contractually requiring that the placement operations meet specific minimum environmental  
261 performance standards and environmental windows; (2) including, as part of the contract  
262 documents, the requirement for submittal and implementation of project specific plans: *Accident*  
263 *Prevention and Site Emergency Plan, Environmental Protection and Turbidity Control Plan,*  
264 *Dredging Equipment Plan & Schedule, Quality Control Plan, and Diving Plan;* (3) placing of  
265 marker buoys to identify routes or designated material placement locations, and (4) use of a  
266 Differential Global Positioning System (DGPS) with capability to identify and document  
267 location of material placement, (5) inspectors to verify placement location; (6) requiring the  
268 dredging contractor(s) to meet specific minimum competency and experience requirements; and  
269 (7) supplying notifications to U.S. Coast Guard, navigation, fishing, and boating interests of  
270 dredge and scow locations and movements.

271  
272 Contract documents are used to clearly and equitably define the operational expectations and  
273 requirements as they pertain to the contractor. The contract documents will define the quantities,  
274 locations, types of materials to be dredged, and the water quality standards and other  
275 environmental requirements that must be met. The required location and elevations for the  
276 dredged material for placement at Site 104 will be clearly defined. Proper location, materials,  
277 and acceptable tolerances will be clearly defined in the specifications for this project.

278  
279 The dredging contractor, under the terms of a performance-based contract, will execute the  
280 project. This means that the operation must satisfy specific performance standards during all  
281 operations. Dredged material placement must be performed to the specified lines and must be  
282 performed in such a manner as to control turbidity levels. If these criteria or standards are not  
283 achieved, the contracting officer will be obligated by contract to require the contractor to alter the  
284 method of operation or cease operations until the required standards are met.

285  
286 **4.2.3.c Monitoring Requirements.** Monitoring will be undertaken to confirm predicted potential  
287 impacts to the surrounding environment and to assist in managing the site. Section 9 of this  
288 document presents details of the Monitoring Framework. It will be the responsibility of the  
289 contracting officer to implement and execute monitoring. The monitoring program will identify  
290 specific minimum performance criteria that must be satisfied to safely, effectively, and  
291 responsibly complete the required dredging and associated activities. Monitoring results will be  
292 compared with modeling predictions to more effectively plan for future placement at the site.

293  
294 During dredged material placement operations and associated activities, the contractor will be  
295 observed by the contracting officer or his representative.

296  
297 **4.2.3.d Project Review and Oversight.** As part of site management, regular meetings among the  
298 contracting officer, the contractor, monitoring groups, and designated review authorities will be  
299 held to review data collected, discuss project operations, and assess the general project progress.  
300 If warranted, adjustments will be made at this time to provide for improved site management and  
301 operations.

302  
303 A Site 104 Working Group, composed of representatives of Federal and state resource and  
304 regulatory agencies and other pertinent parties, will be maintained during the operational life of  
305 the project. The group will promote the exchange of information between managers of the site

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306 and the disciplines and interests represented in the working group. Meetings will be held on an  
307 as-needed basis and are anticipated to be more frequent during the first year of placement than  
308 during the latter years of operations. Participants in the MPA-sponsored DNPOP program  
309 Executive, Management, and Citizen Committees will be informed about project performance at  
310 scheduled meetings. CENAB will schedule other public involvement activities as necessary and  
311 appropriate.

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## Section 5

### Affected Environment/Existing Conditions

#### 5.1 EXISTING RESOURCES

8 This section describes the existing conditions within and around Site 104 with respect to  
9 environmental, cultural, archaeological, socio-economic, aesthetics, and recreational resources.  
10 This information is necessary for NEPA compliance. The existing environmental resources are  
11 an important focus because, in this region of the Bay, these resources are an integral part of  
12 socio-economics and most recreational activities. The description provides a basis for measuring  
13 potential impacts associated with the placement of clean dredged material at Site 104. This  
14 material would be dredged from the Federally maintained navigation channels in the main stem  
15 of the Bay, including the Craighill Entrance, Craighill Channel, Craighill Angle, Craighill Upper  
16 Range, Cutoff Angle, Brewerton Channel Eastern Extension, Swan Point Channel, Tolchester  
17 Channel, and the southern approach channels to the C&D Canal. NEPA documentation has been  
18 prepared for the Federally maintained mainstem channels and will be updated as needed prior to  
19 dredging. Additionally, the Baltimore District characterizes sediment quality in all Federal channels  
20 scheduled for maintenance every ~~three~~ 3 years. New work projects will have sediment quality  
21 characterizations conducted prior to dredging operations.

##### 5.1.1 Setting

23  
24  
25 Site 104 is a proposed open-water dredged material placement site located in the main stem of  
26 the Chesapeake Bay of Maryland. The site is a previously used 1,800-acre open-water  
27 placement site located approximately 0.61 kilometer (km) (2,000 ft) north of the Chesapeake  
28 Bay Bridge and 1.6 km (1 mile) west of Kent Island on the eastern shore, and approximately 3.2  
29 km (2 miles) due east from Sandy Point on the western shore. The almost rectangular shape is  
30 approximately 6.8 km (4.2 miles) long and 1.1 km (0.65 miles) wide (Figure 2-1).

31  
32 Site 104 was previously used as a placement area for dredged material from approximately 1924  
33 to 1975. Prior to 1924, there are no records of placement at the site, though it is believed to have  
34 been used as a placement area (MDNR 1976). An estimated 70 mcy (55.5 mcm) of material was  
35 placed at the site between 1945 and 1975, although records are incomplete.

36  
37 The boundaries of the area are as follows:

- 38
- 39 • Beginning at the western-most point at 38 59 43.19 N, 076 21 56.33 W
- 40 • Running thence to 39 00 44.37 N, 076 21 32.11 W
- 41 • Running thence to 39 00 42.40 N, 076 21 21.84 W
- 42 • Running thence to the northernmost point at 39 03 05.42 N, 076 20 24.65 W
- 43 • Running thence to 39 03 09.24 N, 076 19 44.72 W
- 44 • Running thence to the southernmost point at 38 59 33.13 N, 076 21 10.37 W
- 45 • Running thence to the point of the beginning
- 46

1 **5.1.2 Physiography, Geology, and Hydrology**  
2

3 **5.1.2.a Physiography.** The topography within Site 104 is very flat, with slopes ranging from 100  
4 horizontal feet to 1 vertical foot (100:1), to essentially flat (see Section 5.1.3.a). Prior to 1924,  
5 water depths at Site 104 ranged from 20 to 22 m (70 to 73 ft) in the northern three-fourths of the  
6 site to 26 to 28 m (86 to 95 ft) in the southern one-fourth of the site (MDNR 1976). The long  
7 dimension of the site (approximately north-northeast to south-southwest, oriented at about 17°  
8 relative to true north) is located along the Susquehanna River Paleochannel (Halka 1997—a or  
9 b?). This Paleochannel is the prehistoric channel of the Susquehanna River at the time when the  
10 sea level was lower; the Chesapeake Bay Estuary was created as sea level rose with the melting  
11 of the glaciers that began about 18,000 years ago (MES 1997—a, b, or c?). The site is located in  
12 a relatively narrow portion of the Bay, where the distance between the western shore at Sandy  
13 Point and Kent Island is about 6,000 m (20,000 ft). The site is in the deeper portions of this area.  
14 Outside of the site boundaries, the bottom rises to the east at a relatively steep 50:1 slope to the  
15 shoal area west of Kent Island; to the west, the bottom remains fairly flat for more than 2,500 m  
16 (8,000 ft) until it reaches the shoal areas east of Sandy Point.  
17  
18

1 **5.1.2.b Geology.** Site 104 lies within the Chesapeake Bay approximately 25 km (15 miles) to  
2 the east of the Fall Zone, in the Atlantic Coastal Plain Physiographic Province (USDA 1973).  
3 The Coastal Plain sediments form an east-southeastward thickening wedge consisting of sand,  
4 gravel, clay and sandy clay, of early Cretaceous to Holocene Age (MGS 1968).

5  
6 The surficial materials of Site 104 (prior to placement of dredged sediments that began prior to  
7 1924) consisted of fine-grained, unconsolidated sediments deposited in the Susquehanna River  
8 Paleochannel during the Holocene rise in sea level (i.e., during sea level rise over the past 18,000  
9 years). Prior to sea level rise, this channel was incised into the Coastal Plain sediments of the  
10 site, removing portions of the sedimentary sequence in the area. At the current location of the  
11 Chesapeake Bay Bridge crossing, the Paleochannel was eroded to nearly 200 ft below mean sea  
12 level (Ryan 1953). In the process, sediments of the Pleistocene Age Kent Island (Talbot  
13 Formation, and Tertiary Age Calvert, Piney Point, and Nanjemoy Formations were removed  
14 from the area (Colman and Halka 1989; Drummond 1988). As sea level rose and the  
15 Chesapeake Bay formed, fine-grained, organically rich estuarine muds were subsequently  
16 deposited into these eroded channels. An acoustic sub-bottom survey of Site 104 performed by  
17 the Maryland Geological Survey (MGS) in August 1997 indicates that soft, fine-grained,  
18 organically rich sediments occur throughout the site area which include, in part, the dredged  
19 material historically placed at the site as well as sediments naturally deposited at the site due to  
20 shoreline erosion, etc. The thickness of these sediments is a minimum of 10 to 15 m (30 to 45  
21 ft), with mean thickness on the order of 20 to 30 m (60 to 90 ft) (Halka 1997).

22  
23 Coastal Plain deposits in the Site 104 area immediately below the incised Paleochannel consist of  
24 the Aquia Formation, Hornerstown Sand, and Brightseat Formations (all of Paleocene Age)  
25 underlain by the Cretaceous Age Severn, Matawan and Magothy Formations and the Potomac  
26 Group (Drummond 1988). The Aquia Formation and the Hornerstown Sand together form the  
27 Aquia Aquifer, the source of most residential fresh water for residents of Kent Island. These  
28 units are predominantly sandy with abundant glauconite, some clay matrix and some calcite  
29 cementation. The Brightseat, Severn, and Matawan Formations are predominantly sandy clay  
30 with variable amounts of glauconite; they function as a lower confining bed to the Aquia  
31 Aquifer. The Magothy Formation lacks glauconite and is predominantly sandy with some clay-  
32 sized materials. The underlying Potomac Group consists of interbedded sands, silts, and clays.  
33 Below the Potomac Group is an undifferentiated crystalline bedrock, the surface of which dips to  
34 the southeast. Bedrock was reached at a depth of 763 m (2,504 ft) below sea level at the town of  
35 Chester, located on Kent Island (Maek 1983).

36  
37 The U.S. Geological Survey (Halka 1998) reported the presence of a potential geologic fault in  
38 the Site 104 vicinity. The feature was described as a lineation (or linear ground feature  
39 observable on a high altitude, Landsat photo image) that extends from near Rock Hall (located  
40 about 11 km (7 mi) northeast of the northern border of Site 104), across the Chester River at  
41 Comegys Bight, across Spaniard's Neck north of the Corsica River, and continues east toward  
42 Delaware. A ground survey reviewed by the U.S. Geological Society (USGS) revealed that there  
43 was an elevation change across this feature. The USGS interpreted the feature to be the result of  
44 ground movement associated with a geologic fault. However, the MGS believes it is unlikely  
45 that the feature described is related to a surface expression of faulting (Halka 1998). The MGS  
46 notes that from an aerial perspective, numerous ground features can create lineations that may or

47 ~~may not be associated with geologic faulting, and that features having elevation changes across~~  
48 ~~them have been noted in numerous areas around the Chesapeake Bay and have been associated~~  
49 ~~with periods of higher sea levels occurring between glacial periods. The investigations into these~~  
50 ~~features, however, did not extend north of Talbot County in Maryland, and therefore did not~~  
51 ~~include the Site 104 area and the lineation identified to the northeast of Site 104 (Annex C,~~  
52 ~~Attachment E).~~

53  
54 ~~5.1.2.c Hydrology. The MGS completed a ground water study on Kent Island in the late 1980s~~  
55 ~~(Drummond 1988). This study indicated that the Aquia Formation suberops beneath the~~  
56 ~~Chesapeake Bay and is at present hydraulically connected to the waters of the Bay. In locations~~  
57 ~~where fine grained sediments accumulate on the Bay bottom where the Aquia is present, they~~  
58 ~~serve as a leaky confining bed for the aquifer. The density difference between the more saline~~  
59 ~~Bay water and the fresh water of the aquifer probably results in the movement of Bay water into~~  
60 ~~the lower portions of the Aquia matched by a corresponding outward movement of the overlying~~  
61 ~~fresh water under normal conditions.~~

62  
63 5.1.2.b Geology. The sediments that make up the Coastal Plain physiographic province in  
64 Maryland consist of unconsolidated clay, silt, sand and gravel beds, which dip gently to the  
65 southeast. These sediments crop out in a concentric band that lies parallel to the Fall Line. The  
66 Fall Line marks the western boundary of the Coastal Plain. The Coastal Plain sediments are  
67 underlain by Precambrian and Paleozoic gneiss, schist, and gabbroic rocks, which are usually  
68 referred to as "basement" rocks. The surface of the basement rocks underlying Southern  
69 Maryland has been downwarped into a structure termed the "Salisbury Embayment" (Chapelle  
70 and Drummond 1983).

71  
72 The wedge of sediments that make up the Coastal Plain of Maryland consists of beds ranging  
73 from Cretaceous to Holocene in age. The location of a geologic cross section (A-B) near Site  
74 104 is shown in Figure 5-1. The stratigraphic sequence is shown in Figure 5-2 and consists of  
75 the Severn Formation, overlain by the Aquia Formation, which is overlain by Pleistocene  
76 organic-rich mud, gravel, and sand. The "Aquia Aquifer" as used in this report is defined as the  
77 sandy hydrogeologic unit above the lower confining bed and below the upper confining bed.  
78 This designation assigns three stratigraphic units to the Aquia Aquifer (in ascending order): The  
79 Homerstown Sand, the Aquia Formation, and the Lower Eocene Sand. Although these sands  
80 have different ages, they are assumed to act as a single hydraulic unit, at least on a regional scale,  
81 and are thus designated as a single aquifer.

82  
83 The Homerstown Sand is the sandy layer directly overlying the lower confining bed, which is  
84 distinguishable throughout the study area. The Aquia Formation consists of medium to coarse-  
85 grained glauconitic quartz sand, silt, and clay. Although the Aquia is predominantly sand, some  
86 zones occur which contain significant quantities of clay and silt-sized particles. These low  
87 permeability zones are not considered to be an aquifer. The sediments designated as Lower  
88 Eocene Sand directly overlie the Aquia Formation and were previously thought to be a part of  
89 the Aquia Formation due to lithologic similarity. However, core analysis for foraminifera  
90 assemblages (simple plant species) yielded an Early Eocene age for these sands; therefore, they  
91 are commonly referred to as the Lower Eocene Sands when distinguishing it from other sands in  
92 the Aquia Aquifer.

93

94 The Aquia Aquifer described above generally subcrops (is exposed below the water surface)  
95 beneath a thin veneer of Pleistocene sediments, but actually crops out as bluffs along the banks  
96 of rivers and creeks. It also subcrops beneath the Chesapeake Bay and the mouth of the Chester  
97 River where a paleochannel truncates the Aquia either partially or completely (Figure 5-2). The  
98 subcrop area trends southward down the Bay along the entire extent of Kent Island.

99

100 The Aquia Aquifer unconformably overlies the Severn Formation (lower confining bed), which  
101 is a sandy clay layer and functions as an impervious confining bed in the study area near Kent  
102 Island. The Aquia Aquifer is overlain by the upper confining bed which is defined by Drummond  
103 (1988) as a clayey layer which hydraulically separates the Aquia Aquifer from the overlying  
104 (usually) unconfined aquifer (Piney Point aquifer) or from the Chesapeake Bay, as in the study  
105 area. The upper confining bed includes the Nanjemoy and Calvert Formations, which generally  
106 separate the Aquia from the overlying unconfined aquifer and, in places, separate the Aquia from  
107 the Piney Point aquifer. The upper confining bed does not occur where the Aquia Aquifer  
108 subareally crops out or subcrops and there is direct contact between the Aquia and the  
109 unconfined aquifer. According to Drummond, the upper confining bed also includes the fine-  
110 grained, lower permeability bay-bottom sediments, which in places separate the Aquia from the  
111 Chesapeake Bay. In the paleochannel at Site 104, the Aquia is in contact with highly permeable  
112 channel deposits, which are then overlain by bay-bottom ooze as shown in Figure 5-2.

113

114 During Pleistocene time (about ten thousand to two million years before present), there were  
115 several periods of worldwide glaciation during which much of the water in the world was frozen  
116 in vast ice sheets. This caused a cyclic worldwide fluctuation of sea level. During periods of  
117 low sealevel stand, rivers cut deep channels into the existing Coastal Plain sediments. A river  
118 system developed which approached a sea level, which was 300 to 400 ft below the present sea  
119 level. During the periods between glaciations, the ice melted, sea level rose, and the channels  
120 were filled with sediments. At the end of Pleistocene time, the rising sea submerged much of this  
121 river system and the channels they had formed, creating the Chesapeake Bay estuary (Figure 5-  
122 3). The figure shows the distribution of paleochannels in the Kent Island area and identifies a  
123 major paleochannel near the shore, approximately following the present course of the  
124 Chesapeake Bay. The depth of the channel is reported to be up to 200 ft below sea level with  
125 sediment thickness between 66 and 126 ft. These paleochannels influence the hydrogeology of  
126 the Coastal Plain aquifer systems such as the Aquia Aquifer in the area of Site 104.

127

128 Because of the fluvial depositional environment of the Pleistocene channel-fill deposits, their  
129 lithology is highly variable. A generalized sequence consists of a fining-upward series of fluvial  
130 and estuarine deposits. Coarse fluvial lag gravel occurs at the base of this channel, grading  
131 upward into sand, silt, clay, and bay-bottom ooze at the top. The hydraulic properties of the  
132 channel-fill sediments are not well known because no laboratory or field hydraulic test results are  
133 available. Permeability of these sediments can be estimated from lithologic descriptions to  
134 within possibly several orders of magnitude. The extremely variable nature of channel-fill  
135 sediments makes it difficult to estimate hydraulic properties beyond the locations of sediment  
136 samples.

137

138 5.1.2.c Hydrogeology. The Kent Island area has undergone considerable residential and  
139 commercial development in the last few decades, which is expected to continue into the future.  
140 This development is accompanied by an increasing demand for freshwater. Virtually all of the  
141 freshwater is obtained from ground water, and most of that has been supplied by the Aquia  
142 Aquifer. Although not the sole ground-water source on Kent Island, the Aquia is relatively  
143 shallow, dependable, and produces water of drinking water quality throughout most of its extent.  
144 However, because it is shallow in the vicinity of the Chesapeake Bay and its tidal tributaries, and  
145 due to the presence of paleochannels incised into the Aquia Aquifer, the water supply is  
146 vulnerable to brackish-water intrusion. Water levels in the Aquia dropped from several feet  
147 above sea level in the mid-1950s to several feet below sea level in 1984. In addition, numerous  
148 wells screened in the Aquia near the Chesapeake Bay were reported to produce water of high  
149 chloride concentrations. These factors led to concern by State and county officials that brackish  
150 water was entering the Aquia Aquifer and that it was in danger of becoming irrevocably  
151 contaminated. A study was then undertaken by the Maryland Geological Survey to provide a  
152 better understanding of the hydrogeologic system (Drummond 1988). Much of the information  
153 in this report was obtained from that study.

154  
155 Water level changes over time show the response of an aquifer system to various stresses (e.g.,  
156 pumpage from wells, droughts, and rainfall) on the system. Seasonal water level changes in  
157 wells screened on Kent Island indicate that the seasonal trend is probably caused by seasonal  
158 fluctuations in evapotranspiration and precipitation. The correlation of water levels with  
159 evapotranspiration and precipitation suggests that the Aquia Aquifer is recharged locally, at least  
160 in part, and that there is a hydraulic connection with the unconfined aquifer.

161  
162 The potentiometric surface of the Aquia Aquifer was measured in October 1984 and is shown in  
163 Figure 5-4. Ground-water elevations (heads) in the study area range from about 1 ft above sea  
164 level on the northern Kent Island to about 8 ft below sea level on the mainland Eastern Shore.  
165 The low heads are a result of heavy pumpage from the Easton area southeast of the study area,  
166 and of domestic pumpage throughout Kent Island. The direction of ground-water flow is  
167 perpendicular to the potentiometric contours, generally inland from northwest to southeast.

168  
169 The Aquia Aquifer forms a flow system in which it gains water at its recharge zones, transmits  
170 water throughout its extent, and loses water at its discharge zones (Figure 5-5). Potential  
171 recharge and discharge zones include the subareal outcrop/subcrop area, leakage through the  
172 upper and lower confining beds, and the subcrop area beneath the Chesapeake Bay. Whether  
173 one of these sites acts as a recharge or discharge zone depends on the relative water pressures in  
174 the Aquia and the zone at that point. If the water pressure is greater in the zone than in the  
175 Aquia, the site will act as a recharge zone, and vice versa.

176  
177 The Aquia Aquifer probably receives some recharge through the subaerial outcrop/subcrop area.  
178 Water can enter the Aquia directly where its sands are exposed, or through the overlying  
179 sediments where the Aquia is overlain by the unconfined aquifer. The subcrop of the Aquia  
180 Aquifer beneath the Chesapeake Bay, such as at Site 104, is an important zone for recharge and  
181 discharge to/from the aquifer. In Bay subcrop areas, where the freshwater head in the Aquia  
182 exceeds the head of brackish Bay water, freshwater will discharge into the Bay. In Bay subcrop  
183 areas where the freshwater head in the Aquia is less than the head of the bay water, brackish

184 water will enter the Aquia as recharge. Before substantial pumpage from the Aquia began, water  
185 pressures in the Aquia probably exceeded those in the Bay everywhere, and the entire Aquia  
186 subcrop beneath the Bay was a discharge zone. However, since major Aquia pumpage began,  
187 Aquia heads have dropped below the head of the Bay water, and these areas have become  
188 recharge zones for brackish water.

189  
190 Kent Island is experiencing a salt-water intrusion problem in the Aquia Aquifer due to brackish  
191 recharge from the Chesapeake Bay. This recharge from the bay is caused by pumping from the  
192 Aquia Aquifer in excess of the natural recharge from precipitation. Chloride distributions in  
193 1983-1984 are shown in Figure 5-6. Brackish water is present in the Aquia along the  
194 Chesapeake Bay shore from the northernmost tip of the island (Love Point) to at least as far  
195 south as Prices Creek. In the northern part of the brackish-water zone, the entire vertical section  
196 contains brackish water. In the southern part of the brackish-water zone, the bottom of the Aquia  
197 contains brackish water, but the top contains freshwater. The northern and middle portions of  
198 the brackish water zone have increased in concentration over the last 20 years (Cooper 1999).  
199 The southern portions of the island, toward Kent Point, have remained relatively constant. As  
200 development and pumping quantities increase, this will probably change.

201  
202 Based on ground-water flow and transport modeling (Drummond 1988), the brackish-  
203 water/freshwater interface has been calculated to move inland at approximately 21 ft per year.  
204 This calculation was based upon expected increases in pumping rates due to development. If all  
205 pumping from the Aquia were terminated, the brackish-water/freshwater interface would actually  
206 reverse direction and move towards the bay at a velocity of approximately 2 ft per year.

207  
208 **[NOTE: FIGURES 5-1 THRU 5-6 REQUESTED FROM MCKEE 9/22/99]**  
209

1 **5.1.3 Hydrodynamics** ~~[THERE IS NEW DATA FOR THIS SECTION]~~

2  
3 ~~This section summarizes the following site conditions: germane to the~~  
4 ~~hydrology/hydrodynamics of Site 104 include average water depths, water levels, astronomical~~  
5 ~~tides, storm surge, water levels, wind conditions, wave conditions, tidal currents, and~~  
6 ~~sedimentation, and wave conditions for the part of the Chesapeake Bay near Site 104. A more~~  
7 ~~in-depth discussion is presented in Annex F.~~

8  
9 **5.1.3.a Average Water Depths.** Bathymetric data in the vicinity of Site 104 were obtained from  
10 National Oceanic Atmospheric Administration (NOAA) charts 12263, 12273, 12273, and  
11 12278. Hydrographic data within Site 104 were obtained from the CENAB survey data  
12 collected in September 1997. Vertical data are referenced to MLLW based upon the 1960 to  
13 1978 tidal epoch, and horizontal data are referenced to the Maryland State Plane, North  
14 American Datum (NAD) 1983.

15  
16 The bathymetry of the site is presented in Figure 2-1. Water depths at Site 104 range from -12.8  
17 m  
18 (-42.0 ft) MLLW to -23.8 m (-78.0 ft) MLLW. As stated in Section 5.1.2.a, the slopes at Site  
19 104 are very flat, with a range of 100:1 to flat. The typical slope where placement would occur  
20 in the site is about 100:1 to 400:1, in areas within Site 104 that are below -13.7 m (-45.0 ft)  
21 MLLW.

22  
23 Over the northern portion of Site 104, the bottom depths range from -12.8 m (-42.0 ft) to -14.0 m  
24 (-46.0 ft) MLLW. From the northern end of the site, the bottom gently slopes downward  
25 towards the south. In the mid-section of the site, the downward slope increases, reaching a  
26 maximum depth of -23.8 m (-78.0 ft) MLLW at the southern boundary of the site.

27  
28 The site slopes are steeper along the eastern edge, extending upward from -14.0 m (-46.0 ft)  
29 MLLW in the northern end and -23.8 m (-78.0 ft) MLLW in the southern end, to approximately  
30 -11.0 m (-36.0 ft) MLLW just east of the site. The bottom then continues to slope upwards  
31 towards the western shoreline of Kent Island.

32  
33 **5.1.3.b Astronomical Tides.** An astronomical tide is one that is caused by the attractive forces  
34 of the sun and moon. In the Chesapeake Bay, astronomical tides occur semi-diurnally, or twice a  
35 day. For Site 104, the mean tide level is between 0.22 and 0.26 m (0.73 and 0.84 ft) above  
36 MLLW; the mean tidal range is between 0.30 and 0.37 m (0.99 and 1.16 ft); and the spring tidal  
37 range is between 0.45 and 0.52 m (1.49 and 1.72 ft) (NOS 1996). Tidal datum characteristics for  
38 two locations in the upper Bay near Site 104 reported from National Ocean Service (NOS) are  
39 presented in Table 5-1 (76° 20.9' W). These data were used to generate tidal current velocity  
40 characteristics for modeling of the fate and transport of placed dredged material (Section 6.1.3).

41  
42  
43  
44 **5.1.3.cb Water Levels.** Normal water level variations in the upper Bay are generally dominated  
45 by astronomical tides, although wind effects and freshwater discharge can be important  
46 influences. Depending on direction and duration, wind can force water into or out of rivers and

**Table 5-1**  
**Astronomical Tidal Datum Characteristics for Selected Chesapeake Bay Locations**

<b>Tidal Datum</b>	<b>Matapeake<sup>1</sup> [ms (ft)]</b>	<b>Love Point<sup>2</sup> [ms (ft)]</b>
Mean Higher High Water (MHHW)	0.45 (1.49)	0.52 (1.72)
Mean High Water (MHW)	0.37 (1.22)	0.43 (1.42)
Mean Tide Level (MTL)	0.22 (0.73)	0.26 (0.84)
National Geodetic Vertical Datum (NGVD)	0.11 (0.35)	0.11 (0.35)
Mean Low Water (MLW)	0.07 (0.23)	0.08 (0.26)
Mean Lower Low Water (MLLW)	0.00 (0.00)	0.00 (0.00)

<sup>1</sup> Located on the western shore of Kent Island at latitude 38°57.4 ft north and longitude 76°21.3 ft west, 3 km (2 mi) south of Site 104.

<sup>2</sup> Located on the northeastern shore of Kent Island at 39°1.9 ft north and 76°18.1 ft west, 3 km (2 mi) east of the site.

1 embayments, subsequently causing a localized increase or decrease, respectively, of water level  
2 within the affected body of water. Relatively high occurrences of freshwater discharges from a  
3 river or stream can also locally raise water levels where it flows into the Bay. Extremely high  
4 water levels, on the other hand, are dictated by storm tides. A storm tide is a temporary rise in  
5 water level generated either by large-scale extra-tropical storms (nor'easters) or by hurricanes.  
6 The rise in water level results from wind action, the low pressure of the storm disturbance, and  
7 the Coriolis effect.

8  
9  
10 ~~Long-term rise in sea level began about 18,000 years ago to create the Chesapeake Bay. In 1984,~~  
11 ~~USACE reported that the rise in sea level was continuing at an average rate of about 0.001 to~~  
12 ~~0.002 m/yr (0.003 to 0.007 ft/yr) (USACE 1984). In 1987, the National Research Council~~  
13 ~~(NRC) reported that sea level rise resulting from melting of the polar ice caps for the past~~  
14 ~~century has been about 0.12 m (0.4 ft), resulting in a rise of approximately 0.0012 m/yr (0.004~~  
15 ~~ft/yr) (NRC 1987).~~

16  
17 ~~A recent hydrodynamics modeling study performed by Waterways Experiment Station (WES);~~  
18 ~~for the proposed Delaware Bay deepening work project, showed that an assumed sea level rise of~~  
19 ~~0.305 m (1.0 ft) at the mouth of the Chesapeake Bay would result in an increase in water depth~~  
20 ~~of about 0.274 m (0.9 ft) at the Chesapeake Bay Bridge. Therefore, a rate of sea level rise in the~~  
21 ~~oceans of 0.0012 m/yr (0.004 ft/yr) would equate to a potential water level rise at Site 104 of~~  
22 ~~approximately 0.0011 m/yr (0.0036 ft/yr). At the time the model was run for the Delaware Bay~~  
23 ~~deepening work, it had not yet been developed to include the C&D Canal and therefore may not~~  
24 ~~adequately represent a predicted change in sea level rise in the area of Site 104. A model of both~~  
25 ~~the Chesapeake Bay and Delaware Bay that includes the C&D Canal and extends out onto the~~  
26 ~~Atlantic continental shelf would have to be developed to be required to adequately address sea~~  
27 ~~level rise in these areas (WES 1998).~~

28  
29 5.1.3.c Astronomical Tides ~~An Astronomical tides is one that is caused by the attractive forces~~  
30 ~~of the sun and moon. In the Chesapeake Bay, astronomical tides are occur semi-diurnally, or~~  
31 ~~twice a day. For Site 104, the mean tide level is between 0.22 and 0.26 m (0.73 and 0.84 ft)~~  
32 ~~above MLLW; the mean tidal range is between 0.30 and 0.37 m (0.99 and 1.16 ft); and the spring~~  
33 ~~tidal range is between 0.45 and 0.52 m (1.49 and 1.72 ft) (NOS 1996). Tidal datum~~  
34 ~~characteristics for two locations in the upper Bay near Site 104 reported from National Ocean~~  
35 ~~Service (NOS) are presented in Table 5-1. Matapeake is located on the western shore of Kent~~  
36 ~~Island at latitude 38° 57.4' N and longitude 76° 21.3' W, approximately 3 km (2 miles) south of~~  
37 ~~the site. Love Point is located on the northeastern shore of Kent Island at latitude 39° 1.9' N and~~  
38 ~~longitude 76° 18.1' W, approximately 3 k (2 miles) east of the site. The difference in elevation~~  
39 ~~between MLLW and the national geodetic vertical datum (NGVD), or mean sea level, is~~  
40 ~~approximately 0.35 ft. MLLW will serve as the datum for this project since it is the standard~~  
41 ~~datum for nautical charts.~~

42  
43 ~~Tide and current data were also obtained from an extensive survey conducted by the NOS in the~~  
44 ~~1970s and 1980s (NOS 1988). The 1970s data were collected in a cooperative effort with~~  
45 ~~USACE for use in the design of the physical model of the Bay. Two survey locations were in the~~  
46 ~~vicinity of Site 104. The first was at Matapeake, and the tidal harmonic constants for tidal~~

1 amplitude and phase were developed for this location. The second location was located within  
2 the boundaries of Site 104 (Station No. 175 in the survey at latitude 39° 0.2' N and longitude 76°  
3 20.9' W); tidal harmonic constants for tidal currents (speed, direction, and phase) were  
4 developed for this station. Table 5-2 presents the tidal harmonic constants from these two  
5 locations. These data were used to generate tidal current velocity characteristics for modeling  
6 of the fate and transport of placed dredged material (Section 6.1.3). Figures 5-1 and 5-2 present  
7 the predicted tidal heights for 1 year and 30 days, respectively, based upon the harmonic  
8 constants shown in Table 5-2. These figures show that maximum amplitude above and below  
9 mean tide level is almost 0.3 m (1.0 ft), compared to the spring tidal range of about 0.5 m (1.6  
10 ft).

11  
12 **5.1.3.d Storm Surge.** Extreme water levels are dominated by storm effects (i.e., storm surge and  
13 wave setup) in combination with astronomical tide. Wave setup describes the rise in water level  
14 due to wave breaking. Specifically, it refers to change in momentum that attends the breaking of  
15 waves propagating towards shore resulting in a surf zone force, which raises water levels at the  
16 shoreline.

17  
18 A comprehensive evaluation of storm-induced water levels for several Chesapeake Bay locations  
19 has been conducted by the Virginia Institute of Marine Science (1978) as part of the Federal  
20 Flood Insurance Program. Results of this study are summarized in Table 5-32 and shown as  
21 water level versus frequency curves presented in Figure 5-37. The table provides water levels in  
22 meters above MLLW (NGVD) for various return periods. A return period is a statistical  
23 probability of occurrence for a given event (e.g., a 5-year return period has a 20 percent chance  
24 of occurring, a 50-year return period has a 2 percent chance of occurring, and a 100-year return  
25 period has a 1 percent chance of occurring at any given time). Data in Table 5-32 and Figure 5-  
26 37, for stations closest to Site 104, indicate that the storm tide elevation for a 10-year return  
27 period is 1.2 m (4.1 ft) MLLW and the 100-year water level for the project area is 2.3 m (7.7 ft)  
28 MLLW.

29  
30 **5.1.3.e Wind Conditions.** Wind data from the National Oceanic and Atmospheric  
31 Administration (NOAA), National Climatic Data Center (NOS 1982) for Baltimore-Washington  
32 International (BWI) Airport, were used to estimate wind conditions at the project site (Table 5-  
33 43). Data are presented as fastest mile winds, that which are defined as the highest recorded wind  
34 speeds that last long enough to travel 1 mile, during a 24-hour recording period (NOS 1982).  
35 These winds were used to develop wind speed--return period relationships based upon a Type I  
36 (Gumbel) statistical distribution.  
37 The specific return periods examined were 5, 10, 15, 20, 25, 30, 35, 40, 50 and 100 years.

38  
39 Table 5-53 shows that the wind speeds for a 5-year return period storm range from 14 m/s (32  
40 mph) for winds from the east direction to 24 m/s (54 mph) for winds from the northwest  
41 direction. The wind speeds for a 100-year return period storm range from 29 m/s (65 mph) for  
42 winds from the east direction to 43 m/s (97 mph) for winds from the southwest direction. These  
43 wind speeds were used to estimate storm wave conditions for Site 104 (Section 5.1.3.fh).  
44

**Table 5-23**  
**Water Level Elevation per Return Period**

<b>Return Period (years)</b>	<b>Water Level [m (ft) MLLW]</b>
5	1.2 (4.0)
10	1.2 (4.1)
15	1.3 (4.2)
20	1.4 (4.5)
25	1.5 (5.0)
30	1.6 (5.3)
35	1.7 (5.6)
40	1.9 (6.1)
50	2.0 (6.7)
100	2.3 (7.7)

**Table 5-35**  
**Fastest Mile Wind Speeds per Direction and Return Period (RP)**

RP	N		NE		E		SE		S		SW		W		NW	
Year	North		Northeast				East				Southeast					
Year	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph
5	18	40	17	37	14	32	17	37	16	36	21	47	22	50	24	54
10	21	48	20	44	17	38	20	45	19	43	25	56	24	54	26	59
15	23	52	21	48	18	41	22	50	21	47	27	61	25	56	28	62
20	25	56	23	52	20	45	25	55	23	51	30	67	26	59	29	65
25	26	59	25	55	21	47	26	58	24	54	31	70	27	60	30	67
30	28	62	25	57	22	49	27	61	25	56	33	73	27	61	30	68
35	29	64	27	60	23	51	28	63	26	58	34	76	28	62	31	70
40	30	66	28	62	24	53	29	65	27	60	35	78	28	63	32	71
50	31	69	30	66	25	55	31	69	28	63	37	82	29	64	33	73
100	36	81	34	76	29	65	37	82	33	74	43	97	31	69	36	81

1 **5.1.3.f Wave Conditions.**

2  
3 **Average Wave Conditions**

4  
5 One year of hourly-averaged wind speed and directional data were obtained from the NOS for C-  
6 MAN station TPLM2, located at latitude 38° 58.5' N and longitude 76° 24' W, less than 1 mile  
7 southwest of Site 104. These data were used to generate an average wave height and period for  
8 the year using methods presented in the Shore Protection Manual (USACE 1984). The mean  
9 wave height was computed to be about 0.15 m (0.5 ft) and the mean wave period was computed  
10 to be about 1.5 seconds.

11  
12 **Extreme Wave Conditions**

13  
14 Site 104 is exposed to wind-generated waves approaching primarily from the north and south  
15 directions. The longest fetch distances (i.e., the area of the water over which a wind of constant  
16 direction and speed blows to generate waves) to which the site is exposed correspond to these  
17 two directions. In accordance with procedures recommended by the U.S. Army Shore Protection  
18 Manual (USACE 1984), wave conditions were hindcast for each fetch direction for the  
19 winds adjusted appropriately for duration, water levels, and mean water depths along the fetch  
20 directions. The results are shown in Tables 5-54 and 5-65.

21  
22 **5.1.3.gf Tidal Currents.** Vertical water movement associated with the rise and fall of the tide  
23 creates horizontal water movement called tidal currents. Tidal currents in the upper Chesapeake  
24 Bay are moderate to weak with an average maximum velocity of about 0.6 meters (m/s)-per  
25 second (m/s) ([2 ft per second (ft/s)], NOS 1996). The Horn Point Environmental Laboratory  
26 (HPEL) of the University of Maryland, Center for Environmental Sciences (UMCES) conducted  
27 current velocity measurements for Site 104 using an Acoustic Doppler Current Profiler (ADCP),  
28 which was surveyed for one complete tidal cycle (about 13 hours) on 28 July 28, 1997 [UMCES  
29 1997 (see Appendix F)]. Maximum ebb velocities were measured on the order of 0.45 to 0.6 m/s  
30 (1.5 to 2 ft/s), while maximum flood velocities were measured to be on the order of 0.3 to 0.45  
31 m/s (1 to 1.5 ft/s).

32 ~~Velocity vector plots for peak ebb and peak flood are shown in Figures 5-48 and 5-59;~~  
33 ~~respectively (Moffatt and Nichol Engineers [M&N], 1998). This figure shows the peak ebb~~  
34 ~~velocity distribution in and adjacent to the project area. These velocity measurements are similar~~  
35 ~~to those reported in NOS (1996) for historic average conditions.~~

36  
37 ~~The tidal harmonic constants shown in Table 5-2 were used to generate predicted tidal current~~  
38 ~~velocities for Site 104. Figures 5-6 and 5-7 present tidal current velocities over time for 1 year~~  
39 ~~and 30 days, respectively. Maximum velocities are about 0.6 m/s (2 ft/s).~~

40  
41 **5.1.3.hg Sedimentation.** The upper Chesapeake Bay is a region where a relatively large quantity  
42 of fine-grained sediment is deposited (MES 1995). The two primary sources of these fine-  
43 grained sediments are discharge from the Susquehanna River and adjacent shoreline erosion  
44 from within the upper Bay.

45  
46 **Susquehanna River Discharge**

**Table 5-46**  
**Wave Height per Return Period**

Fetch Direction	Return Period (years)									
	1	2	5	10	20	25	30	40	50	100
	m	m	m	m	m	m	m	m	m	m
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
North	0.9	1.2	1.5	1.7	2.0	2.1	2.2	2.3	2.4	2.8
	(3.0)	(3.9)	(4.8)	(5.7)	(6.6)	(6.9)	(7.2)	(7.7)	(8.0)	(9.3)
South	0.9	1.3	1.7	2.0	2.3	2.5	2.5	2.7	2.8	3.3
	(3.0)	(4.2)	(5.5)	(6.5)	(7.7)	(8.1)	(8.3)	(8.9)	(9.3)	(10.7)

**Table 5-57**  
**Wave Period (seconds) per Return Period**

<b>Fetch Direction</b>	<b>Return Period (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>20</b>	<b>25</b>	<b>30</b>	<b>40</b>	<b>50</b>	<b>100</b>
North	3.7	4.1	4.5	4.8	5.1	5.2	5.3	5.5	5.6	5.9
South	3.9	4.4	5	5.4	5.8	5.9	6	6.1	6.3	6.7

1  
2  
3 The primary input of suspended sediment into the upper Chesapeake Bay is due to discharge  
4 from the Susquehanna River. The Susquehanna River supplies more than 50 percent of the fresh  
5 water to the Bay and more than 90 percent of the fresh water to the upper Bay north of Baltimore  
6 (Magnien *et al.* 1993—“a” or “b”?). According to Biggs (1970) the Susquehanna River accounts  
7 for 96 percent of the total fresh water discharge to “Station VI,” which is located at the northern  
8 limit of Site 104. Mean annual average discharge from the Susquehanna River (measured at the  
9 Conowingo Dam) between 1928 and 1975 was about 1,000 m<sup>3</sup>/sec (36,000 ft<sup>3</sup>/sec). The long-  
10 term mean discharge is approximately 1,099 m<sup>3</sup>/sec (38,800 ft<sup>3</sup>/sec); however, freshwater inflow  
11 to the upper Bay varies daily, weekly, monthly, and yearly, with relatively high discharge in the  
12 spring and low to moderate discharge in the summer and fall (Schubel and Pritchard 1987).  
13 Average flows in March and April exceeded 2,200 m<sup>3</sup>/sec (78,000 ft<sup>3</sup>/sec) between 1929 and  
14 1984 (Schubel and Pritchard 1987); flows from 1984 through 1991 for February through April  
15 ranged from 1,100 to 2,100 m<sup>3</sup>/sec [40,000 to 75,000 ft<sup>3</sup>/sec (MES 1997—“a,” “b,” or “c”)].

16  
17 Previously, MDNR estimated that from 1928 through 1975, the discharge from the Susquehanna  
18 River provided an average of about 540,000 metric tons (600,000 tons) of sediment each year to  
19 the Bay (MDNR 1976). This estimate was based upon suspended sediment concentrations  
20 measured from the discharge of water through the Conowingo Dam. More recent data  
21 (1978–1993) indicate that the sediment load from the Susquehanna River (measured at  
22 Conowingo Dam) is approximately 1.3 million metric tons per year [1.4 million tons (MES  
23 1995) and Panageotou *et al.* 1996]. During 1978–1993, the estimated annual total suspended  
24 load from the Susquehanna River varied from about 400,000 metric tons (440,000 tons) to 2.7  
25 million metric tons (3 million tons). It is believed that a relatively small fraction of this sediment  
26 load actually reached the Site 104 area (Halka, personal communication), although occurrences  
27 of high-suspended sediment caused increased turbidity in the area (MDNR 1976). Biggs (1969)  
28 stated that more than 90 percent of the suspended sediment contributed by the Susquehanna  
29 River was deposited north of Station VI (north of Site 104).

30  
31 Sediment input to the Bay due to extreme weather events can be significant. In January 1996,  
32 record snowfall followed by a heavy rainfall and warm temperatures caused major flooding in  
33 the Chesapeake Bay watershed. During the January 1996 flood, the Susquehanna River  
34 discharged a total of about 9 billion m<sup>3</sup> (320 billion ft<sup>3</sup>) of sediments at an average of 3,400  
35 m<sup>3</sup>/sec (120,000 ft<sup>3</sup>/sec). This equates to approximately 1.8 million metric tons (2 million tons)  
36 of sediment carried into the Bay by the Susquehanna River during this single event which is;  
37 more than the average yearly input between the years 1978 and 1993 (USGS 1996).

### 38 Shoreline Erosion

39  
40 Suspended sediment resulting from erosion of the shoreline from within the upper Bay is an  
41 additional significant source of material. Estimates of the quantity of material due to shoreline  
42 erosion in the upper Bay range from 300,000 metric tons (330,000 tons) (Biggs 1970) to 390,000  
43 metric tons per year (430,000 tons [Kerhin *et al.* 1988]). The fine-grained fraction of this  
44 material is estimated to range from 110,000 metric tons (120,000 tons [Biggs 1970]) to 180,000  
45 metric tons (200,000 tons [Kerhin *et al.* 1988]) per year.

## 1 Total Sedimentation

2 Based upon a review of the data presented above, the total quantity of sediment supplied to the  
3 upper Bay averages from approximately 1.6 to 1.7 million metric tons (1.8 to 1.9 million tons),  
4 per year. In addition, according to using suspended sediments concentration data collected at  
5 various locations throughout the upper Bay, Biggs (1969) estimated that about 4 percent of the  
6 annual supply of material to the upper Bay is transported south of Station VI (the northern limit  
7 of Site 104). Based upon this estimate, a mean of approximately 60,000 to 70,000 metric tons  
8 (66,000 to 77,000 tons) is supplied annually to the Site 104 area and south. This sediment is  
9 deposited over a large area of the Bay, including an estimated small percentage at Site 104.

10 Most of this

11 remaining material is deposited north of the mouth of the Potomac River (Officer *et al.* 1984;  
12 Donoghue 1990; Colman *et al.* 1992; Hobbs *et al.* 1992).

## 14 Sedimentation at Site 104

15 Sedimentation at Site 104 corresponds primarily to sediment particle size and classification and  
16 is influenced by particle settling velocity, density throughout the water column, and current  
17 velocity. Typical fine-grained, naturally-occurring sediment suspended in the waters of the  
18 upper Bay are approximately 0.010 to 0.015 mm (0.0004 to 0.0006 in.) in diameter, with settling  
19 (falling) velocities in the range of 0.004 cm/sec ( $1.5 \times 10^{-4}$  ft/sec; MDNR 1976). Samples  
20 collected by E2Si (1997) and MGS (1997) add MGS 1997 to ref. list in Site 104 contained  
21 material with particle sizes ranging from 0.005 to 0.1 mm (0.0002 to 0.004 in.), with a mean of  
22 0.02 mm (0.0008 in.). Settling velocity for a 0.02 mm (0.0008 in.) particle is approximately 0.06  
23 cm/sec (0.002 ft/sec). Due to these relatively slow settling velocities, this suspended material  
24 can be transported over large distances by tidal currents, and some material may never settle to  
25 the bottom. In addition, wave-forced resuspension of deposited material is an important factor  
26 influencing the transport of material (Sanford 1994).

28 Biggs (1970) estimated that sedimentation in the area around Site 104 is approximately 1.1  
29 mm/yr (0.04 in./yr). This estimate assumes a uniform distribution of 303,000 metric tons  
30 (334,016 U.S. tons) of particulate matter spread evenly over the bottom of this region. The  
31 amount of material being deposited is based upon the difference in suspended matter measured at  
32 the designated upstream and downstream stations from 1 February 1996, through 31 January  
33 1997. Eskin *et al.* (1996) estimates that the sedimentation rate in the area is about 1.2 to 10  
34 mm/yr (0.05 to 0.4 in./yr) as a result of lead-210 analyses of core samples collected at stations in  
35 and around Site 104.

37 Sedimentation rates in the deeper portions of the Chesapeake Bay are generally higher than in  
38 the surrounding shallower waters, due in part to lower current velocities and lessened effects  
39 from wave action. The deeper channels are relict features incised during times of lower sea level  
40 by the Susquehanna River and its tributaries, and are now filling relatively rapidly with  
41 sediments (Colman *et al.* 1992). It is estimated that over more than a 10,000-year period, the  
42 long-term average rate of sediment accumulation in the vicinity of Site 104 has been  
43 approximately 0.003 m/yr (0.12 in./yr) (Colman and Halka 1990). Pollen dating techniques  
44 applied to three recent sediment cores collected in the vicinity of Site 104 indicate that a rate of  
45 sediment accumulation since the time of European occupation has averaged approximately 0.004  
46 m/yr (0.156 in./yr; Brush 1990; Brush *et al.* 1997). Although these cores were not located within

1 the Site 104 boundaries, and extrapolation of sedimentation rates from specific core locations is  
2 questionable, the results corroborate the long-term average (Halka 1998). Higher sedimentation  
3 rates [0.01 to 0.03 m/yr (0.396 to 1.176 in./yr)] have been calculated from radionuclide dating of  
4 two cores collected from the deep water areas to the south of Kent Island (Goldberg *et al.* 1978).  
5 Assuming a surface sediment bulk density of 1.25 grams per cubic centimeter (g/cc) in Site 104,  
6 Halka (1998) calculated the sedimentation rate of 0.004 m/yr (0.156 in./yr), which would result  
7 in a sediment mass accumulation rate of 1,600 g/m<sup>2</sup>/yr.  
8 Table 5-56 shows estimated sedimentation rates at or near Site 104 as determined by a variety of  
9 methods. The estimates range from 1 mm/yr to 4 mm/yr. These estimates are much lower than  
10 Goldberg's estimated of 10-30 mm/yr for deeper waters south of Kent Island. Sedimentation  
11 rates in deeper portions of the Chesapeake Bay are generally higher due to lower current  
12 velocities and lessened effects from wave action.

### 14 5.1.3.h Wave Conditions:

#### 16 Average Wave Conditions

17  
18 One year of hourly averaged wind speed and directional data were obtained from the NOS for C-  
19 MAN station TPLM2, located at latitude 38° 58.5' N and longitude 76° 24' W, less than 1 mile  
20 southwest of Site 104. These data were used to generate an average wave height and period for  
21 the year using methods presented in the Shore Protection Manual (USACE 1984). Figures 5-810  
22 and 5-911 present the hourly averaged wave heights and periods for 1 year, respectively, using  
23 the TPLM2 data. The figures show the variability of the wave heights and periods for the year.  
24 The mean wave height and period for the year were computed from the above analysis output.  
25 The mean wave height was computed to be about 0.15 m (0.5 ft) and the mean wave period was  
26 computed to be about 1.5 seconds.

#### 28 Extreme Wave Conditions

29  
30 Site 104 is exposed to wind-generated waves approaching primarily from the north and south  
31 directions. The longest fetch distances (i.e. the area of the water over which a wind of constant  
32 direction and speed blows to generate waves) to which the site is exposed correspond to these  
33 two directions. In accordance with procedures recommended by the U.S. Army Shore Protection  
34 Manual (USACE 1984), a radially averaged fetch distance was computed for the two directions.  
35 The radially averaged fetch distances for the north and south directions are shown in Figures 5-  
36 1012 and 5-1113, respectively. Wave conditions were hindcast for each fetch direction for the  
37 winds (Table 5-54) adjusted appropriately for duration, water levels (Table 5-32), and mean  
38 water depths along the fetch directions (Figure 5-37). The results are shown in Tables 5-65 and  
39 5-76.

40  
41 A sea state is normally composed of a spectrum of waves with varying heights and periods that  
42 may range from relatively long waves to short ripples. In order to summarize the spectral  
43 characteristics of a sea state, it is customary to represent that wave spectrum in terms of a  
44 distribution of wave energy over a range of wave periods. Having made this distribution, known  
45 as a wave spectrum, it is convenient to represent the wave spectrum for Site 104 by a single  
46 representative wave height and period. The wave conditions reported in Tables 5-6 and 5-7 are

**Table 5-6**  
**Estimated Sedimentation Rates in the Vicinity of Site 104**

Source	Location	Estimated Rate	Method of Estimation
Goldberg et al 1978	Deep water areas south of Kent Island	10 to 30 mm/yr	Radionuclide dating of cores
Biggs 1970	Site 104 vicinity	1.1mm/yr	Based upon difference in suspended matter measure upstream and downstream
Eskin 1996	Site 104 vicinity	1.2-10 mm/yr	Lead 210 core analyses
Colman and Halka 1990	Site 104	3mm/yr	10,000year long term average
Brush 1990; Brush etal 1997	Site 104 vicinity	4mm/yr	Pollen dating post European occupation

1 the significant wave height,  $H_s$ , and the peak spectral wave period,  $T_p$ . The significant wave  
2 height,  $H_s$ , is defined as the average of the highest one-third of the waves in the spectrum.  
3 Depending on the duration of the storm condition represented by the wave spectrum, maximum  
4 wave heights may be as high as 1.8 to 2 times the significant wave height computed above. The  
5 peak spectral period,  $T_p$ , is the wave period that corresponds to the maximum wave energy level  
6 in the wave spectrum. Higher return periods for both wave height and periods lead to a greater  
7 potential for storm-induced resuspension of sediments from the bottom.  
8

## 5.1.4 Water Quality

### Summary-Introduction

Existing water quality conditions at Site 104 are described in the context of this region of the Bay ecosystem. The findings from several data collection efforts are summarized to characterize the water quality ~~in~~ at Site 104. The data collection efforts undertaken for this document included water column studies that sampled and analyzed water quality at three depths within the water column; sediment studies that characterized nutrient levels in the sediments and the sediment characteristics of the sediments that could influence water quality; and nutrient-related and sediment nutrient flux studies that measured fluxes of nutrients and oxygen to and from the sediments now existing in at Site 104.

The results of these studies were within expected ranges and were similar to other studies of waters of similar depth and salinity in the Bay. The area of the Bay in which Site 104 is located has a ~~mesohaline~~ mesohaline salinity, generally from 5 to 13 ppt (Lippson 1973). These salinity changes with depth, with bottom water being more saline. The water column generally shows less salinity stratification in the autumn through early spring, and shows greater stratification in the May to October period (MDE 1998a; Lippson 1973).

Salinity, water depths, and nutrient-rich sediments in Site 104 combine to ~~result in~~ cause seasonal deep water hypoxia (low dissolved oxygen) or anoxia (no dissolved oxygen) ~~resulting from~~ due to enhanced microbial growth in the sediments as the water temperatures warm up in the spring. This anoxia and resulting anaerobic microbial metabolism in turn cause increased rates of nitrogen and phosphorus release to the water column overlying the sediments. Studies performed by UMCES indicate that increased phosphorus and ammonium fluxes resulted in higher concentrations of these nutrients in the near-bottom waters of Site 104 in the warmer months of 1996, but this did not appear to result in more frequent or larger algal blooms (Boynton *et al.* 1998). This could be due to the large volume of water in this area, relative to the ~~loadings~~ loading from the sediment. In addition, when salinity stratification exists, the waters with higher nutrient concentrations would remain in the deeper waters of Site 104, below the photic zone where increased phytoplankton production would occur. At some point, these higher concentrations of nutrients are thought to become mixed with waters above the pycnocline and to result in increased phytoplankton productivity. Details of this mixing in the Chesapeake Bay system are not well understood at this time (Boynton *et al.* 1998).

Pore water and sediment water interactions were also studied in the navigation channels in order to compare channel sediment conditions to those in Site 104 (Cornwell and Boynton 1998). While water quality conditions and grain size distributions in the deep channels were similar to those ~~of~~ in at Site 104, the sediments in the channels were less likely to flux phosphorus to the water column than were Site 104 sediments. This is thought to be due to the because of the higher levels of easily decomposed, phytoplankton-based organic material associated with the Site 104 sediments versus a more terrestrial nature of the nutrients associated with the channel sediments. Ammonium fluxes were lower in the more southerly CENAB channels than in the northern C&D Canal approach channels, perhaps because of higher rates of organic matter

46 deposition in the northern channels. These observations are discussed in further detail in later  
47 sections.

#### 48 49 **5.1.4.a** Water Column Studies.

##### 50 51 **Introduction**

52  
53 Estuaries, such as the Bay, have been experiencing water quality problems related to the  
54 worldwide growth of the human population, specifically in coastal areas (Dennison *et al.* 1994).  
55 Water quality is a significant contributor to the health of an aquatic ecosystem and can affect the  
56 distribution and abundance of living organisms within the ecosystem. Significant research on  
57 water quality has been conducted in the Bay in an effort to restore and protect the Bay ecosystem  
58 and resources. These initiatives were formalized by Federal, state, and local agencies in the  
59 1980's (Magnien *et al.* 1993).

60  
61 Water quality is influenced by a variety of factors including natural precipitation, point and non-  
62 point sources of runoff, physical mixing, natural seasonal processes, tidal cycles, and  
63 temperatures (Magnien *et al.* 1993b). Water quality in the Bay is also influenced by the  
64 magnitude and timing of freshwater flow events (Boicourt 1992). In the upper Bay near Site  
65 104, freshwater flows originate almost exclusively from the Susquehanna River. Water quality  
66 in the relatively broad, shallow estuary of the upper Bay is also strongly influenced by sediment  
67 oxygen consumption and sediment nutrient exchange rates, which are related to and regulated by  
68 external nutrient supplies, (including freshwater flows, and water temperature (Boynton *et al.*  
69 1990; Boynton *et al.* 1998).

70  
71 Water quality is typically monitored by gathering a variety of chemical and physical data and by  
72 evaluating abundance and diversity of resident critical species (Dennison *et al.* 1993). Water  
73 quality data typically monitored includes: spatial location, depth, temperature, salinity,  
74 conductivity, turbidity, total suspended solids (TSS), secchi depth, pH, dissolved oxygen (DO),  
75 chlorophyll-a and nutrients such as nitrogen, phosphorus, carbon and silica species, and other  
76 components that are important to ecosystem function (Magnien *et al.* 1993).

77  
78  
79 There are significant studies on-going in the Bay, including water quality, physiochemical  
80 processes monitoring, and biological and living resources monitoring (Heasley *et al.* 1989). These  
81 studies are part of the Chesapeake Bay Basin Monitoring Program, which is funded and  
82 supported by the Federal and state governments. The monitoring subcommittee, which oversees  
83 the monitoring program, includes representatives from the EPA, USFWS, USGS, NOAA,  
84 USACE, and representatives from Maryland, Virginia, Delaware, Pennsylvania, and the District  
85 of Columbia. The water quality monitoring portion of this program, which monitors chemical  
86 and physical components, has been ongoing in Maryland since 1984.

87  
88 Data from ~~this~~ a comprehensive water quality study (Heasley *et al.* 1989) and other studies  
89 undertaken in the upper Bay region for specific dredged material placement projects (Austin *et*  
90 *al.* 1991; Boynton *et al.* 1992; Boynton *et al.* 1993; Boynton *et al.* 1994; Boynton *et al.* 1995;

91 Boynton *et al.* 1996a and b; Boynton *et al.* 1997; Boynton *et al.* 1998; MDE 1996e; MDE 1997;  
92 MDE 1998a, and b; Michael *et al.* 1991) have indicated that water quality in the Bay varies  
93 spatially, temporally, and seasonally, and that year-to-year variability is often significant.

94  
95 MDE conducted seasonal water quality studies for this project, including a data collection effort  
96 beginning in October 1996 at stations located within and outside of Site 104, as well as an  
97 evaluation of data from two Chesapeake Bay Water Quality Monitoring Stations, MCB3.3C and  
98 MCB3.3E, which are located in the southern and eastern vicinity of Site 104, respectively (Figure  
99 5-142). The MDE provided seasonal means-average data from the two aforementioned  
100 monitoring stations from 1985 to 1995, and compared these data to data collected beginning in  
101 October 1996 in the vicinity of Site 104. The Chesapeake Biological Laboratory (CBL) also  
102 performed a study of bottom-water quality in the Site 104 area (Figure 5-153) over the period of  
103 May-September 1996 (Boynton *et al.* 1998).

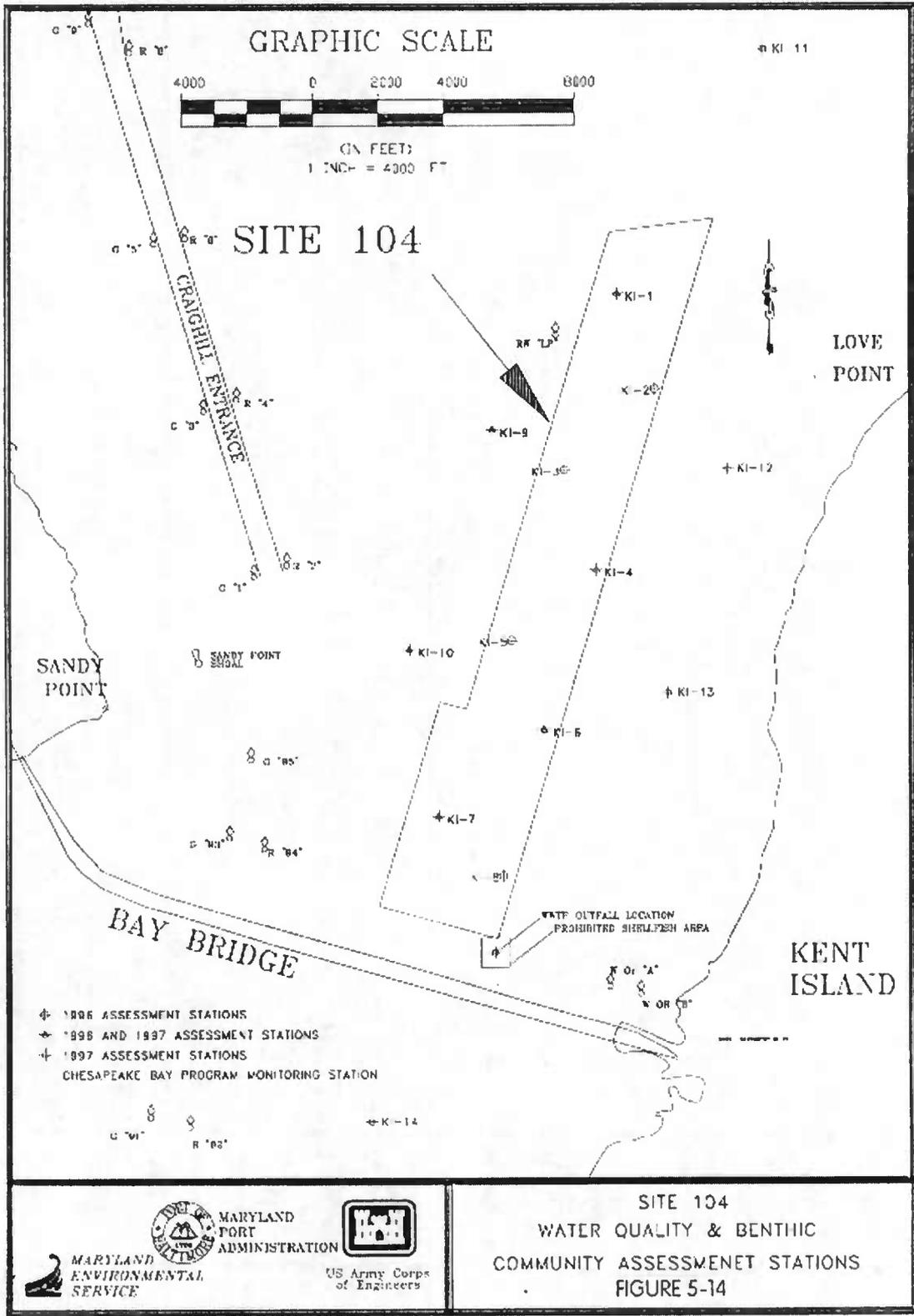
104  
105 -Data from the MDE and CBL studies are discussed in the following sections. Both All reports  
106 can be found in Appendix C.

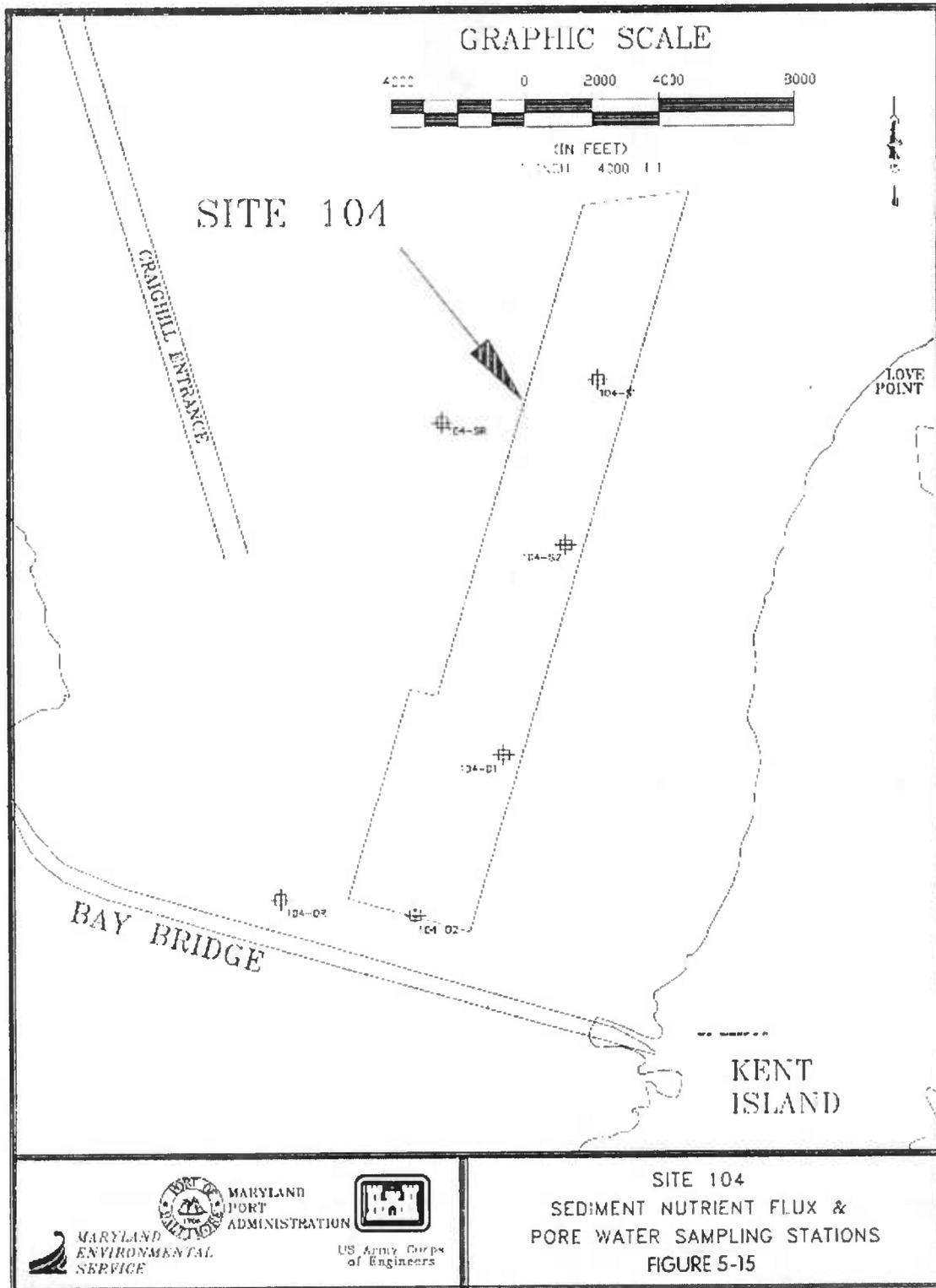
#### 107 108 **Seasonal Trends**

109  
110 Data results indicate that water quality was influenced by seasonally varying levels of  
111 precipitation in the watershed and freshwater entering the upper Bay. A wetter than average fall  
112 in 1996 resulted in low salinities in the vicinity of Site 104 during October 1996, followed by a  
113 gradual increase through October 1997 and a slight decline in December 1997 (MDE 1998a).  
114 Surface waters were well oxygenated throughout the year, but low DO was observed in summer  
115 1996 at depth (Boynton *et al.* 1998) and in the summer of 1997 (MDE 1998a). Water quality  
116 sampling was conducted at 10 stations in October and December 1996 (KI-1 to 10) and in April,  
117 July, October, and December 1997 (KI-1, KI-4, KI-6, KI-7, and KI-9 to KI-14) by MDE (1998a)  
118 (Figure 5-142). Four new stations were added for the 1997 work (KI-11 to 14) in order to make  
119 the sampling stations more representative of Site 104 as a whole, and in exchange, four of the  
120 stations sampled in 1996 were not included in the 1997 sampling regime- (KI-2, KI-3, KI-5 and  
121 KI-8). - Water depths sampled ranged from -13 m (-42 ft) to -24.5 m (-80 ft) MLLW. Typically,  
122 three water quality samples were collected per station (surface, mid, and bottom) per sampling  
123 event. Mid-layer samples were collected at a site-specific calculated mid-depth. Exceptions to  
124 the three-layer sampling occurred at KI-1, KI-3, and KI-4, where mid-layer sampling was omitted  
125 because the depths were slightly shallower than at the other stations. Furthermore, at KI-12 and  
126 KI-13, where sampling depths ranged from 1.5 m (4.9 ft) to 4.1 m (13.5 ft), every sample was  
127 collected at mid-depth (MDE 1998a).

128  
129 *In-situ* sampling was performed by MDE and analytical analysis was performed by CBL utilizing  
130 standard EPA/CBP techniques (MDE 1998a) for parameters listed in Table 5-78.

131  
132  
133  
134 Table 5-89 provides a summary of the means and ranges of salinity, temperature, pH, TSS,  
135 turbidity and DO for Site 104, by sample depth and by season. A summary of the means and





 <p>MARYLAND ENVIRONMENTAL SERVICE</p>	 <p>MARYLAND PORT ADMINISTRATION</p>	 <p>US Army Corps of Engineers</p>
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**SITE 104**  
**SEDIMENT NUTRIENT FLUX &**  
**PORE WATER SAMPLING STATIONS**  
**FIGURE 5-15**

Table 5-78G-1

**Water Quality Parameters Measured, Units, Analysis Location, and Field Equipment or Analytical Method Utilized**

Parameter	Unit	Type of Sample	Equipment/Method Utilized
Temperature	C	<i>in-situ</i>	Linear thermistor network, Hydrolab
Dissolved Oxygen (DO)	mg/L	<i>in-situ</i>	Au/Ag polarographic cell, Hydrolab
Conductivity	mmhos/cm	<i>in-situ</i>	Temperature compensated six electrode cell, Hydrolab
pH	pH units	<i>in-situ</i>	Glass Electrode, Hydrolab
Secchi Depth	M	<i>in-situ</i>	20-cm diameter disk
Depth	M	<i>in-situ</i>	Hydrolab
Turbidity	NTU	<i>in-situ</i>	Hach 2000P Turbidimeter
Total Organic Carbon	mg/L as C	analytical	EPA 1979, Method 415.2 (Infrared)
Dissolved Organic Carbon, filtered	mg/L as C	analytical	EPA 1979, Method 415.1 and 415.2 (Infrared)
Particulate Carbon	mg/L as C	analytical	Perkin Elmer Corp.
Total Suspended Solids	mg/L	analytical	Standard Methods, sect. 209D, p. 94 (Gravimetric)
Total Persulfate Nitrogen, filtered	mg/L as N	analytical	D'Elia <i>et al.</i> 1977, Valderma 1981, EPA 1979, Method 353.2
Particulate Nitrogen, filtered	mg/L as N	analytical	Perkin Elmer Corp.
Ammonia	mg/L as N	analytical	EPA 1979, Method 350.1
Nitrate & Nitrite, filtered	mg/L as N	analytical	EPA 1979, Method 353.2
Nitrite, filtered	mg/L as N	analytical	EPA 1979, Method 353.2
Total Phosphorus	mg/L as P	analytical	EPA 1979, Method 365.1
Dissolved Phosphorus	mg/L as P	analytical	EPA 1979, Method 365.1
Orthophosphate	mg/L as P	analytical	EPA 1979, Method 365.1
Particulate Phosphorus	mg/L as P	analytical	Aspila <i>et al.</i> 1976, EPA Method 160.2-1
Chlorophyll-a	µg/L	analytical	Standard Methods, sect. 1002G, pp. g50-g54
Pheophytin-a	µg/L	analytical	Standard Methods, sect. 1002G, pp. g50-g54

Source: MDE 1998a

Table 5-89G-2

## Means and Ranges of Physical Parameters, by Sample Depth and Sampling Event for Site 104

Sampling Event		Salinity (ppt)	Temp (C)	pH (units)	Turbidity (NTU)	TSS (mg/L)	DO (mg/L)
Oct. 1996	Surface	7.7 (7.1-8.0)	17.4 (16.9-18.4)	8.3 (8.2-8.4)	NA	4.7 (3.0-7.3)	10.4 (9.5-11.0)
	Mid	9.9 (9.1-10.6)	17.8 (17.5-18.0)	7.7 (7.7-7.8)	NA	4.0 (2.8-5.2)	6.7 (6.2-7.2)
	Bottom	10.7 (9.8-11.6)	18.1 (17.8-18.4)	7.6 (7.6-7.7)	NA	8.3 (5.0-12.7)	6.3 (5.4-8.6)
Oct 1996 Average	Mean Range	9.4 (7.1-11.6)	17.8 (16.9-18.4)	7.9 (7.6-8.4)	NA	5.7 (2.8-12.7)	7.8 (5.4-11.0)
Dec. 1996	Surface	3.0 (2.4-3.2)	4.3 (4.2-4.4)	7.6 (7.5-7.6)	NA	12.0 (10.0-14.3)	11.9 (11.6-12.1)
	Mid	4.0 (0.0-6.4)	4.7 (0.0-5.1)	7.5 (0.0-7.6)	NA	10.7 (0.0-12.2)	NA
	Bottom	7.6 (5.3-9.5)	6.5 (5.7-7.0)	7.3 (7.0-7.4)	NA	21.1 (12.2-29.8)	9.2 (6.2-9.9)
Dec 1996 Average	Mean Range	4.9 (0.0-9.5)	5.2 (0.0-7.0)	7.5 (0.0-7.6)	NA	14.6 (0.0-29.8)	10.6 (6.2-12.1)
April 1997	Surface	5.3 (4.8-5.9)	11.1 (10.8-11.5)	8.0 (7.8-8.3)	18.1 (15.5-26.0)	6.3 (5.3-7.4)	10.9 (10.2-11.8)
	Mid	8.2 (6.0-10.1)	10.4 (10.2-10.6)	7.6 (7.5-7.7)	18.1 (16.0-22.0)	5.7 (3.4-8.6)	8.3 (7.0-9.9)
	Bottom	14.4 (13.1-16.1)	10.0 (10.0-10.0)	7.3 (7.3-7.3)	20.7 (14.8-34.0)	27.8 (11.0-65.7)	4.1 (3.0-4.8)
April 1997 Average	Mean Range	9.3 (4.8-16.1)	10.5 (10.0-11.5)	7.6 (7.3-8.3)	19.0 (14.8-34.0)	13.3 (3.4-65.7)	7.8 (3.0-11.8)
July 1997	Surface	9.0 (8.5-9.2)	26.8 (26.6-27.0)	8.2 (8.1-8.3)	2.9 (2.5-3.3)	4.6 (2.8-5.8)	7.7 (6.9-8.4)
	Mid	10.7 (9.0-12.6)	24.8 (22.5-26.6)	7.5 (7.1-8.1)	2.4 (1.9-2.8)	3.6 (2.2-6.0)	3.7 (0.4-7.0)
	Bottom	16.6 (15.3-18.0)	20.0 (19.0-21.0)	7.3 (7.2-7.3)	4.7 (2.5-7.6)	7.5 (4.0-14.2)	0.13 (0.1-0.15)
July 1997 Average	Mean Range	12.1 (8.5-18.0)	23.9 (19.0-27.0)	7.7 (7.1-8.3)	3.3 (1.9-7.6)	5.2 (2.2-14.2)	3.8 (0.1-8.4)
Oct. 1997	Surface	14.6 (13.6-15.0)	17.3 (16.9-17.6)	7.6 (7.5-7.7)	2.2 (2.0-2.4)	1.9 (1.5-2.8)	7.7 (7.5-8.0)
	Mid	15.6 (14.1-16.9)	17.7 (16.8-18.5)	7.6 (7.6-7.7)	2.3 (1.6-2.8)	6.3 (1.5-40)	7.0 (5.9-8.1)
	Bottom	17.8 (16.9-18.8)	19.2 (18.6-19.8)	7.5 (7.2-7.6)	7.2 (2.5-11.0)	9.3 (3.2-15.4)	4.9 (3.8-6.1)
Oct 1997 Average	Mean Range	16.0 (13.6-18.8)	18.1 (16.6-19.8)	7.6 (7.2-7.7)	3.9 (1.6-11.0)	5.8 (1.5-40)	6.5 (3.8-8.1)
Dec. 1997	Surface	9.9 (9.7-10.1)	5.6 (5.4-5.8)	7.8 (7.6-8.0)	2.1 (2.0-2.4)	2.0 (1.5-3.2)	10.2 (10.0-10.4)
	Mid	15.1 (9.8-17.3)	7.7 (5.4-8.5)	7.7 (7.5-7.8)	2.5 (2.0-3.2)	3.6 (1.5-6.0)	7.6 (6.6-10.7)
	Bottom	17.0 (16.7-17.5)	8.6 (8.5-8.6)	7.6 (7.3-7.7)	6.3 (3.5-10.9)	10.0 (5.3-16.0)	6.4 (6.2-6.6)
Dec. 1997 Average	Mean Range	14.0 (9.7-17.5)	7.3 (5.4-8.6)	7.7 (7.3-8.0)	3.6 (2.0-10.9)	5.2 (1.5-16.0)	8.1 (6.2-10.7)

Source: MDE 1998a

Note: NA - data not available for that parameter or depth for that sampling period. Turbidity measurements were not made prior to the April 1997 collection.

Surface, mid and bottom samples were not collected for all stations at each sampling event. Therefore, the mean for each parameter and each event is determined based upon a varying sample size.

136 ranges of chlorophyll-a (chl a) and nitrogen species, including total dissolved nitrogen (TDN),  
137 total nitrogen (TN), ammonia (NH<sub>4</sub>), nitrite (NO<sub>2</sub>), nitrite+nitrate (NO<sub>2+3</sub>), particulate nitrogen  
138 (PN), and dissolved inorganic nitrogen (DIN) for Site 104 is provided for the period October  
139 1996 through December 1997 in Table 5-9+0. Table 5-10+1 includes a summary of the means  
140 and ranges of phosphorus species.  
141  
142

143 Above-normal precipitation in fall 1996 resulted in slightly lower salinity readings in the vicinity  
144 of Site 104 during October 1996. Salinities were also relatively low in December 1996 and  
145 increased to substantially higher levels in April, July, and October 1997 before decreasing  
146 slightly again in December 1997 (Figure 5-16+4). Water temperature (Table 5-89) and dissolved  
147 oxygen concentrations (Figure 5-17+5) followed seasonal weather patterns. TSS and pH values  
148 were within the normal range for this area of the Bay (Table 5-89).  
149

150 The CBL study indicated that DO concentrations in the bottom layer were below 2.0 mg/L at  
151 deep water Site 104 sampling stations in June, July, and August 1996, and at shallow water Site  
152 104 sampling stations (Figure 5-15+3) in July and August 1996 (Boynton *et al.* 1998) (Table 5-  
153 11+2). Shallow water and deep water reference stations near Site 104 had DO concentrations  
154 below 2.0 mg/L in July, August, and September 1996. DO levels (Table 5-89) in October 1996  
155 (MDE 1998a) reflected a rebound from summer hypoxic conditions observed earlier in 1996  
156 (Table 5-11+2, Boynton *et al.* 1998)]. In December 1996, the water column was well mixed and  
157 typical to the region and the season. Mean DO in the bottom layers was as high as 9 mg/L during  
158 December 1996, but then dropped to anoxic conditions (<2 mg/L) at deeper stations in July 1997  
159 (MDE 1998a); these anoxic conditions are typical of the area during the summer (Boynton *et al.*  
160 1997, 1998). By October 1997, mean DO concentrations in the bottom layers had reached a  
161 mean of 4.9 mg/L, and continued to increase in December 1997, reaching a mean of 6.4 mg/L  
162 (MDE 1998a). Physical parameters in spring 1997 reflected a relatively dry period prior to the  
163 April 1997 sampling event (MDE 1998a). Strong vertical stratification was observed in July  
164 1997 and some parameters (ammonia nitrogen, orthophosphate, and salinity) were slightly  
165 elevated in bottom waters due to a protracted dry period in early 1997, and reflected sediment-to-  
166 water nutrient flux (MDE 1998a). The deeper sampling stations in Site 104 exhibited anoxia in  
167 bottom waters during July 1997 (MDE 1998a). Surface water samples were well oxygenated  
168 throughout the year; mid-depth samples showed a decline in DO in the summer, remaining on  
169 average above 3.5 mg/L (although mid-depth DO concentrations at two individual sampling  
170 locations dropped below 2.0 mg/L during July 1997) (MDE 1998a). Similar patterns were  
171 observed yearly at the background stations (MDE 1998a), and represent a natural water quality  
172 phenomenon in the deeper waters of the Maryland mainstream Chesapeake Bay (Maryland Sea  
173 Grant 1992).  
174  
175

### 176 **Spatial Trends**

177

178 Spatial variations in water quality parameters between stations inside Site 104 compared to  
179 outside Site 104 were minimal and followed no clear pattern during the period from May 1996

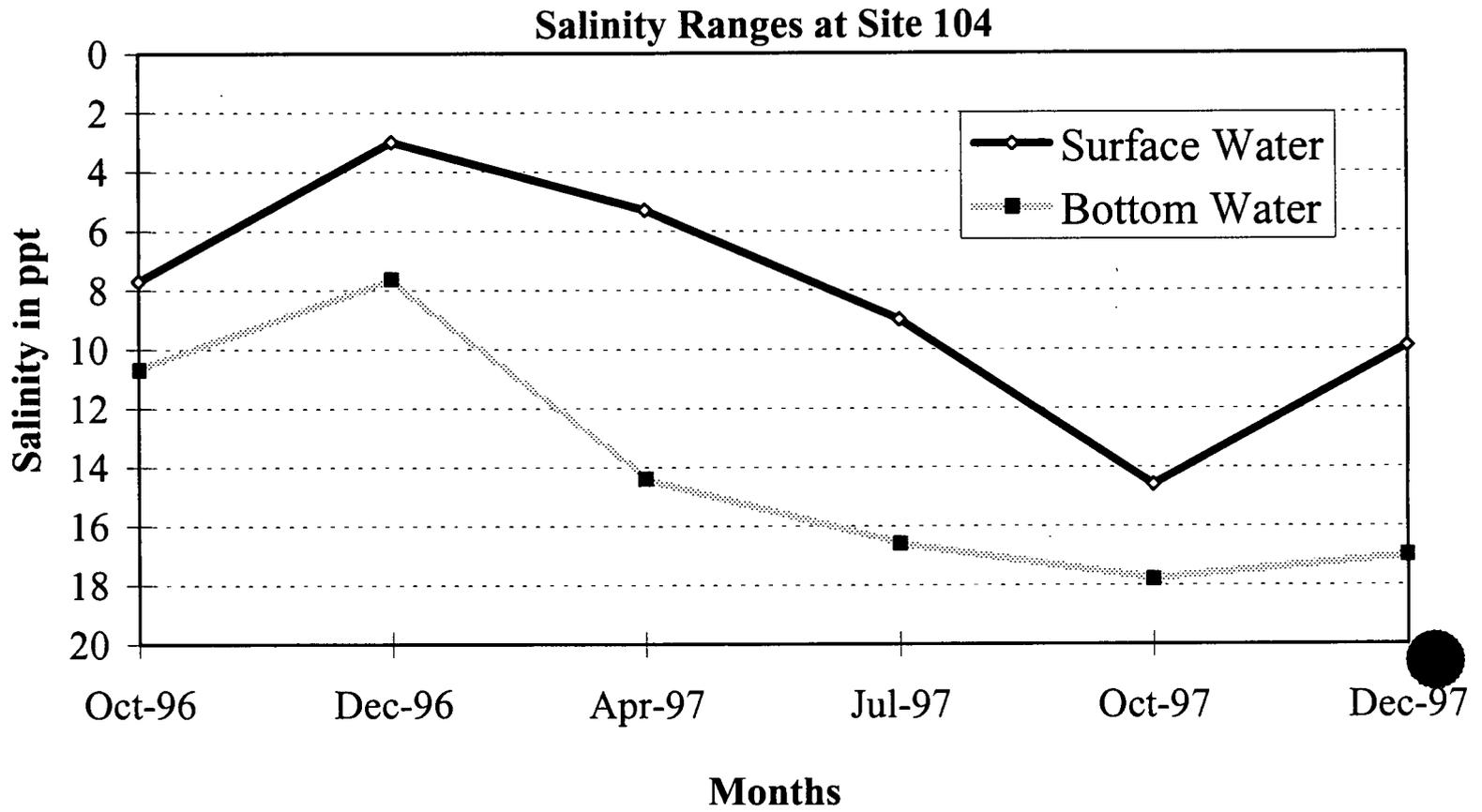


Figure 5-1644. Salinity Ranges at Site 104 (Source: MDE 1998a).

### Dissolved Oxygen for Site 104

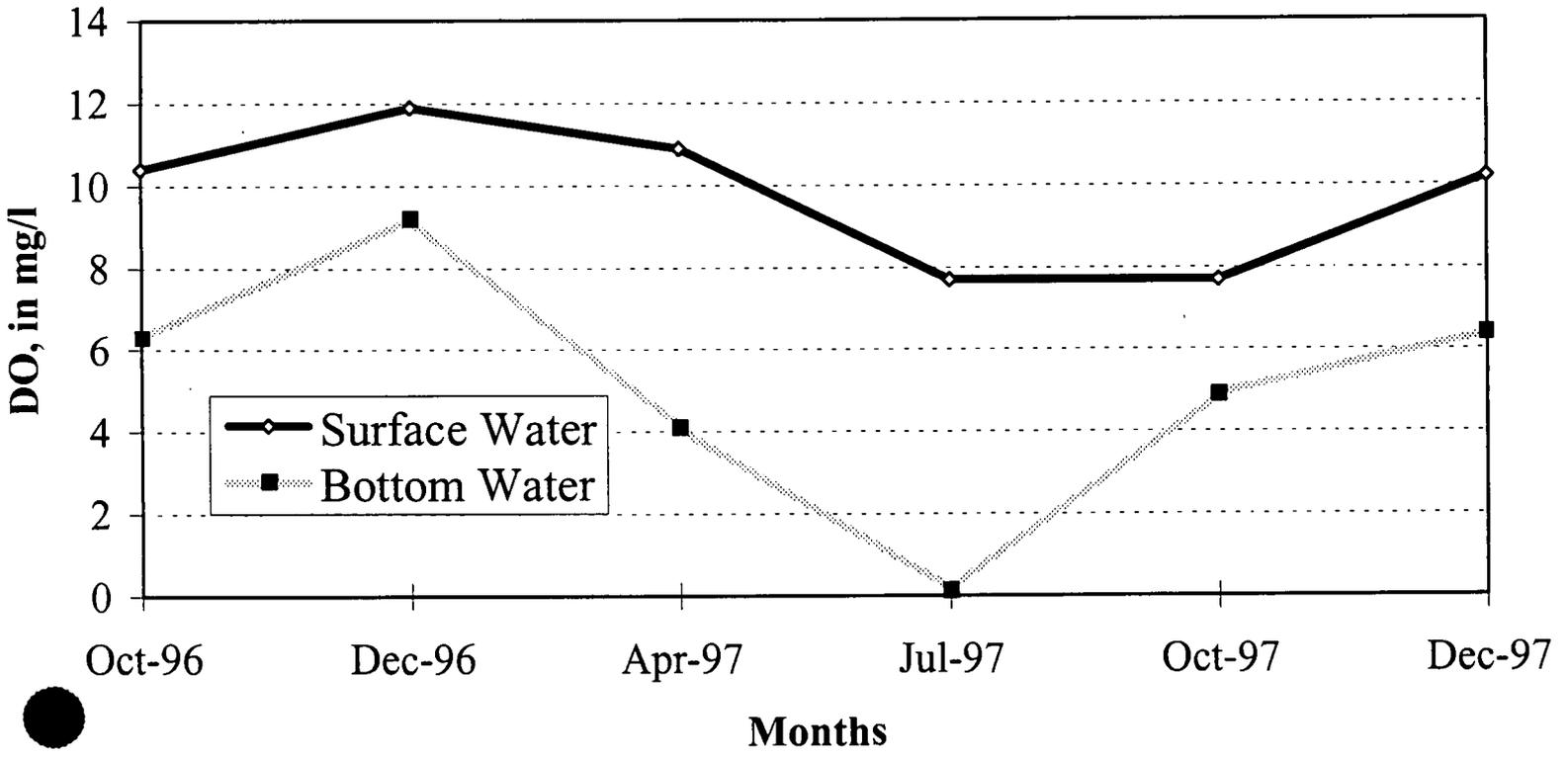


Figure 5-1715G-4. Dissolved Oxygen for Site 104 (Source: MDE 1998a).

Table 5-910G-3

Means and Ranges of Chlorophyll-a and Nitrogen Species, by Sample Depth and Sampling Event (October 1996 - December 1997) for Site 104

Sampling Event		Chl_a (ug/L)	TDN (mg/L)	TN (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>2</sub> (mg/L)	NO <sub>2+3</sub> (mg/L)	PN (mg/L)	DIN (mg/L)
Oct. 1996	Surface	19.1 (11.7-31.7)	0.57 (0.51-0.62)	0.87 (0.76-0.96)	0.003 (0.003)	NA	0.23 (0.18-0.27)	0.30 (0.22-0.42)	0.23 (0.18-0.27)
	Mid	7.6 (5.4-9.0)	0.60 (0.56-0.69)	0.75 (0.70-0.82)	0.034 (0.028-0.042)	NA	0.23 (0.22-0.24)	0.15 (0.11-0.18)	0.27 (0.25-0.28)
	Bottom	4.7 (2.4-7.8)	0.63 (0.58-0.65)	0.78 (0.71-0.84)	0.048 (0.044-0.057)	NA	0.24 (0.22-0.25)	0.16 (0.11-0.19)	0.28 (0.27-0.29)
Oct 1996 Average	Mean Range	10.5 (2.4-31.7)	0.60 (0.51-0.69)	0.80 (0.70-0.96)	0.028 (0.003-0.057)	NA	0.23 (0.18-0.27)	0.20 (0.11-0.42)	0.26 (0.18-0.29)
Dec. 1996	Surface	9.1 (4.5-16.2)	1.28 (1.20-1.36)	1.43 (1.37-1.52)	0.071 (0.062-0.078)	NA	1.02 (0.87-1.03)	0.16 (0.10-0.25)	1.09 (0.94-1.11)
	Mid	3.4 (0.0-10.5)	1.26 (0.00-1.32)	1.36 (0.00-1.53)	0.084 (0.000-0.097)	NA	0.99 (0.00-1.03)	0.10 (0.00-0.21)	1.08 (0.00-1.11)
	Bottom	2.2 (1.8-3.0)	1.01 (0.66-1.15)	1.13 (0.91-1.23)	0.108 (0.100-0.115)	NA	0.68 (0.18-0.86)	0.13 (0.08-0.17)	0.79 (0.33-0.97)
Dec 1996 Average	Mean Range	4.9 (0.0-16.2)	1.18 (0.00-1.36)	1.31 (0.00-1.53)	0.088 (0.000-0.115)	NA	0.90 (0.00-1.03)	0.13 (0.00-0.25)	0.99 (0.00-1.11)
April 1997	Surface	NA	1.06 (1.00-1.12)	NA	0.042 (0.009-0.066)	0.010 (0.009-0.011)	0.83 (0.81-0.84)	0.17 (0.11-0.28)	NA
	Mid	NA	0.97 (0.93-1.04)	NA	0.108 (0.054-0.147)	0.011 (0.010-0.011)	0.68 (0.55-0.79)	0.14 (0.10-0.24)	NA
	Bottom	NA	0.85 (0.79-0.92)	NA	0.260 (0.200-0.299)	0.014 (0.013-0.015)	0.37 (0.30-0.41)	0.21 (0.13-0.42)	NA
April 1997 Average	Mean Range	NA	0.96 (0.79-1.12)	NA	0.137 (0.009-0.299)	0.012 (0.009-0.015)	0.63 (0.30-0.84)	0.17 (0.10-0.42)	NA

Source: MDE 1998a

Note:

1. NA - data not available for that parameter or depth for that sampling period.
2. Surface, mid and bottom samples were not collected for all stations at each sampling event. Therefore, the mean for each parameter and each event is determined based upon a varying sample size.

Table 5-940G-3 (continued)

Sampling Event		Chl a (ug/L)	TDN (mg/L)	TN (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>2</sub> (mg/L)	NO <sub>2+3</sub> (mg/L)	PN (mg/L)	DIN (mg/L)
July 1997	Surface	9.1 (5.7-11.1)	0.31 (0.27-0.34)	0.58 (0.53-0.65)	0.013 (0.003-0.031)	0.001 (0.001-0.002)	0.008 (0.003-0.014)	0.28 (0.22-0.33)	NA
	Mid	5.0 (3.0-8.7)	0.35 (0.24-0.42)	0.52 (0.43-0.60)	0.089 (0.011-0.156)	0.002 (0.001-0.003)	0.009 (0.003-0.012)	0.17 (0.12-0.27)	NA
	Bottom	4.1 (2.7-5.1)	0.66 (0.61-0.71)	0.80 (0.74-0.85)	0.400 (0.335-0.427)	0.001 (0.001-0.002)	0.004 (0.002-0.008)	0.14 (0.10-0.19)	NA
July 1997 Average	Mean Range	6.1 (2.7-11.1)	0.44 (0.24-0.71)	0.63 (0.43-0.85)	0.167 (0.003-0.427)	0.001 (0.001-0.003)	0.007 (0.002-0.014)	0.20 (0.10-0.33)	NA
Oct. 1997	Surface	5.8 (4.5-7.5)	0.46 (0.43-0.53)	0.58 (0.54-0.64)	0.039 (0.034-0.046)	0.008 (0.008-0.009)	0.15 (0.014-0.18)	0.11 (0.09-0.13)	NA
	Mid	3.6 (2.1-6.6)	0.41 (0.38-0.44)	0.51 (0.46-0.55)	0.040 (0.031-0.051)	0.009 (0.007-0.012)	0.12 (0.09-0.15)	0.09 (0.06-0.12)	NA
	Bottom	1.8 (1.2-3.0)	0.45 (0.4-0.54)	0.54 (0.48-0.61)	0.073 (0.051-0.094)	0.019 (0.013-0.024)	0.09 (0.07-0.10)	0.10 (0.07-0.15)	NA
Oct 1997 Average	Mean Range	3.7 (1.2-7.5)	0.44 (0.38-0.54)	0.54 (0.46-0.61)	0.051 (0.031-0.094)	0.012 (0.007-0.024)	0.12 (0.07-0.18)	0.10 (0.06-0.15)	NA
Dec. 1997	Surface	3.6 (3.0-3.9)	0.94 (0.87-0.98)	1.05 (0.96-1.12)	0.107 (0.090-0.121)	0.007 (0.006-0.007)	0.58 (0.55-0.59)	0.11 (0.09-0.12)	NA
	Mid	6.8 (2.7-9.9)	0.61 (0.42-0.95)	0.74 (0.60-1.04)	0.096 (0.088-0.107)	0.006 (0.005-0.007)	0.20 (0.05-0.057)	0.14 (0.09-0.19)	NA
	Bottom	10.2 (7.8-15.0)	0.51 (0.46-0.58)	0.71 (0.65-0.76)	0.104 (0.094-0.114)	0.006 (0.005-0.006)	0.07 (0.05-0.09)	0.20 (0.16-0.26)	NA
Dec. 1997 Average	Mean Range	6.9 (2.7-15.0)	0.69 (0.42-0.98)	0.84 (0.61-1.09)	0.102 (0.088-0.121)	0.006 (0.005-0.007)	0.28 (.05-0.59)	0.15 (0.09-0.26)	NA

Source: MDE 1998a

Note:

1. NA - data not available for that parameter or depth for that sampling period.
2. Surface, mid and bottom samples were not collected for all stations at each sampling event. Therefore, the mean for each parameter and each event is determined based upon a varying sample size.

TDP = Total Dissolved Phosphorus

TP = Total Phosphorus

PP = Particulate Phosphorus

Table 5-1011G-4

## Means and Ranges of Phosphorus Species, by Sample Depth and Sampling Event for Site 104

Sampling Event		PO <sub>4</sub> (mg/L)	TDP (mg/L)	TP (mg/L)	PP (mg/L)
Oct. 1996	Surface	0.004 (0.001-0.006)	0.017 (0.014-0.022)	0.043 (0.034-0.059)	0.026 (0.019-0.038)
	Mid	0.011 (0.008-0.014)	0.022 (0.017-0.026)	0.038 (0.035-0.043)	0.016 (0.013-0.019)
	Bottom	0.017 (0.015-0.019)	0.026 (0.023-0.029)	0.047 (0.039-0.056)	0.021 (0.015-0.030)
Oct 1996 Average	Mean Range	0.011 (0.001-0.019)	0.022 (0.014-0.029)	0.043 (0.034-0.059)	0.021 (0.013-0.038)
Dec. 1996	Surface	0.017 (0.015-0.021)	0.024 (0.022-0.026)	0.049 (0.044-0.052)	0.024 (0.022-0.026)
	Mid	0.018 (0.000-0.019)	0.025 (0.000-0.026)	0.050 (0.000-0.052)	0.025 (0.000-0.026)
	Bottom	0.017 (0.013-0.019)	0.023 (0.019-0.024)	0.046 (0.043-0.049)	0.023 (0.022-0.024)
Dec 1996 Average	Mean Range	0.017 (0.000-0.021)	0.024 (0.000-0.026)	0.048 (0.000-0.052)	0.024 (0.000-0.026)
April 1997	Surface	0.002 (0.001-0.003)	0.008 (0.007-0.010)	0.043 (0.020-0.148)	NA
	Mid	0.004 (0.001-0.006)	0.010 (0.008-0.013)	0.024 (0.018-0.032)	NA
	Bottom	0.014 (0.012-0.016)	0.020 (0.017-0.022)	0.057 (0.034-0.103)	NA
April 1997 Average	Mean Range	0.007 (0.001-0.016)	0.013 (0.007-0.022)	0.041 (0.018-0.148)	NA
July 1997	Surface	0.006 (0.004-0.010)	0.015 (0.013-0.017)	0.039 (0.034-0.043)	0.024 (0.020-0.026)
	Mid	0.004 (0.003-0.005)	0.013 (0.011-0.016)	0.031 (0.027-0.037)	0.019 (0.016-0.022)
	Bottom	0.044 (0.030-0.054)	0.055 (0.039-0.069)	0.086 (0.064-0.101)	0.031 (0.023-0.041)
July 1997 Average	Mean Range	0.018 (0.003-0.054)	0.028 (0.011-0.069)	0.052 (0.027-0.101)	0.025 (0.016-0.041)
Oct. 1997	Surface	0.025 (0.023-0.027)	0.034 (0.030-0.037)	0.042 (0.038-0.045)	0.008 (0.008-0.009)
	Mid	0.020 (0.015-0.024)	0.029 (0.023-0.033)	0.035 (0.030-0.042)	0.007 (0.005-0.011)
	Bottom	0.018 (0.016-0.022)	0.026 (0.021-0.031)	0.038 (0.031-0.050)	0.014 (0.007-0.023)
Oct 1997 Average	Mean Range	0.021 (0.015-0.027)	0.030 (0.021-0.037)	0.038 (0.030-0.050)	0.010 (0.005-0.023)
Dec. 1997	Surface	0.007 (0.005-0.009)	0.014 (0.012-0.019)	0.016 (0.013-0.020)	0.001 (0.001-0.001)
	Mid	0.004 (0.003-0.006)	0.012 (0.011-0.013)	0.014 (0.013-0.015)	0.001 (0.001-0.002)
	Bottom	0.004 (0.003-0.005)	0.013 (0.011-0.016)	0.016 (0.013-0.019)	0.002 (0.002-0.003)
Dec. 1997 Average	Mean Range	0.005 (0.003-0.009)	0.013 (0.011-0.019)	0.015 (0.013-0.020)	0.002 (0.001-0.003)

Source: MDE 1998a

## Note:

1. NA - data not available for that parameter or depth for that sampling period.
2. Surface, mid and bottom samples were not collected for all stations at each sampling event. Therefore, the mean for each parameter and each event is determined based upon a varying sample size.

TDP = Total Dissolved Phosphorus

TP = Total Phosphorus

PP = Particulate Phosphorus

Table 5-1142G-5

## Physical Parameters Measured in Bottom Water Layers in the Vicinity of Site 104 During Summer 1996

Station	Date	Time	Total Depth (m)	Sample Depth (m)	Bottom Water Measurements			
					Temp. (C)	Salinity (ppt)	DO (mg/L)	DO Sat (%)
<b>Shallow Water Stations: 12 - 15 Ms</b>								
<b>Shallow Water Reference Station: Average Depth 13.5 Ms</b>								
104-SR	14-May-96	1708	14.5	14.0	13.8	10.6	3.07	31.6
104-SR	10-Jun-96	1620	14.5	14.0	18.2	12.0	2.07	23.6
104-SR	17-Jul-96	801	14.0	13.5	21.8	14.5	0.09	1.1
104-SR	15-Aug-96	745	14.3	14.0	24.5	16.8	0.16	2.1
104-SR	11-Sep-96	820	12.0	12.0	25.1	NA	1.96	24.4
<b>Shallow Water Sampling Station #1: Average Depth 13.3 Ms</b>								
104-S1	14-May-96	1145	14.5	13.5	14.0	9.9	3.27	33.7
104-S1	10-Jun-96	1100	14.5	14.0	19.4	8.4	4.09	46.6
104-S1	16-Jul-96	1415	13.5	13.0	24.0	8.8	3.53	44.1
104-S1	12-Aug-96	1440	13.5	13.0	24.3	15.6	0.15	2.0
104-S1	9-Sep-96	1355	14.0	13.0	25.6	11.7	3.32	43.4
<b>Shallow Water Sampling Station #2: Average Depth 15.7 Ms</b>								
104-S2	14-May-96	1400	17.0	16.0	13.9	10.2	3.15	32.4
104-S2	10-Jun-96	1335	16.5	15.5	17.2	14.6	0.47	5.3
104-S2	16-Jul-96	1618	15.5	15.0	23.0	10.4	1.64	20.3
104-S2	12-Aug-96	1735	17.0	16.0	24.3	16.4	0.14	1.8
104-S2	9-Sep-96	1600	17.0	16.0	25.5	12.3	2.95	38.6
<b>Deep Water Stations: 16 - 25 Ms</b>								
<b>Deep Water Reference Station: Average Depth 17.6 Ms</b>								
104-DR	15-May-96	1302	18.0	17.5	14.1	9.1	3.56	36.5
104-DR	11-Jun-96	1145	18.0	17.0	19.5	9.9	3.63	41.9
104-DR	22-Jul-96	1118	18.0	17.5	22.1	15.1	0.20	2.5
104-DR	14-Aug-96	1420	18.5	18.0	24.5	17.6	0.21	2.8
104-DR	10-Sep-96	800	18.0	18.0	25.1	14.9	0.49	6.5
<b>Deep Water Sampling Station #1: Average Depth 18.3 Ms</b>								
104-D1	15-May-96	815	20.0	19.5	13.3	11.3	2.51	25.7
104-D1	11-Jun-96	835	19.5	19.0	18.0	12.7	1.66	18.9
104-D1	22-Jul-96	830	18.5	18.0	22.2	14.9	0.18	2.3
104-D1	14-Aug-96	815	18.5	18.0	24.4	18.0	0.16	2.1
104-D1	10-Sep-96	1025	18.5	17.0	25.5	13.0	1.98	26.0
<b>Deep Water Sampling Station #2: Average Depth 24.1 Ms</b>								
104-D2	15-May-96	1102	25.0	24.5	13.9	10.1	3.24	33.3
104-D2	11-Jun-96	1445	25.0	23.5	16.9	16.4	0.08	0.9
104-D2	22-Jul-96	1504	25.0	24.0	22.0	15.4	0.20	2.5
104-D2	14-Aug-96	1035	25.0	24.5	24.4	18.1	0.15	2.0
104-D2	10-Sep-96	1400	27.0	24.0	25.4	14.9	0.13	1.7

Source: Boynton *et al.* 1998

Note: NA indicates data were not available.

180 through December 1997. Spatial variations were less apparent than the seasonal trends  
181 previously discussed.

182  
183 In order to compare physical and chemical water quality parameters inside the previously used  
184 placement area (Site 104) to parameters outside the site, the stations were grouped by location  
185 and depth. -This enabled comparison of stations at similar locations and depths. The major  
186 categories were deep inside stations, consisting of stations KI-1 through KI-8 (Figure 5-14+2), all  
187 inside Site 104 and all in water ranging from 12.5 m (41 ft) to 19.5 m (64.3 ft) deep; deep outside  
188 stations, including stations KI-9, KI-10, and KI-11, all outside Site 104; and shallow outside  
189 stations, that included stations KI-12 and KI-13, outside Site 104 and in waters less than 4.1 m  
190 (13.5 ft) deep. Station KI-14, outside Site 104 to the south of the Bay Bridge, was not included  
191 because its depth is >25m (82 ft). No shallow stations [less than 4.6 m (15 ft)] exist inside Site  
192 104.

193  
194 For each water quality parameter, the occurrence, direction, and magnitude of statistical  
195 significance with respect to background data from EPA's Chesapeake Bay Program monitoring  
196 stations (MCB3.3C and MCB3.3E) were calculated (Appendix C). Water quality conditions at  
197 Site 104 were within typical ranges for this region of the Bay and conditions in Site 104 were  
198 similar to the nearby CBP monitoring stations from October 1996 to July 1997 (MDE 1998a).

199  
200 Minimal spatial variations were observed between the water quality assessment stations inside  
201 and outside the boundaries of Site 104 in summer 1996 (Table 5-12+3) (Boynton *et al.* 1998) and  
202 during the October 1996 through December 1997 sampling period (MDE 1998a). During  
203 summer 1996, no clear spatial trends emerged in physical parameters in surface or bottom water  
204 layers, either when comparing shallow stations inside Site 104 and shallow reference stations  
205 outside the site (Figure 5-15+3), or comparing deep stations inside and outside Site 104 (Table 5-  
206 12+3). DO levels declined below 2.0 mg/L in June 1996 at the deep stations inside Site 104,  
207 while the deep reference station remained above hypoxic levels (Boynton *et al.* 1998). However,  
208 the stations inside Site 104 were deeper than the corresponding reference stations. In July and  
209 August 1996 nutrient concentrations in bottom waters in the vicinity of Site 104 -(Table 5-13+4)  
210 followed no discernible spatial trends among the deep and shallow Site 104 stations and  
211 reference stations, although clear seasonal trends were evident for nitrate and nitrite.  
212 Nitrite+nitrate concentrations in the bottom layers were somewhat lower at the deep stations at  
213 Site 104 than at the corresponding reference station or the shallow stations in June 1996;  
214 nitrite+nitrate concentrations continued to be lower at all deep stations than at shallow stations in  
215 July 1996.

216  
217 Differences in bottom water nutrient concentrations among the stations were less apparent than  
218 seasonal trends (Boynton *et al.* 1998). Deviations in the observed patterns among chemical and  
219 nutrient parameters from those seen in the background data could be attributed to heavy  
220 precipitation and runoff in fall and early winter of 1996, followed by an extended dry spell during  
221 spring and summer of 1997 (MDE 1998a).

222  
223  
224 **Kent Island Waste Water Treatment Plant Outfall**

Table 5-1213G-6

Physical Parameters in the Vicinity of Site 104 in Summer 1996, by Sampling Date, Depth, and Location

		May 1996				June 1996			
Level	Station	Depth (m)	Salinity (ppt)	Temp (C)	DO (mg/L)	Depth (m)	Salinity (ppt)	Temp (C)	DO (mg/L)
Surface	Mean of S1, S2	0.5,0.5	2.2	16.2	10.36	0.5,0.5	5.7	22.2	7.83
	SR	0.5	1.8	17.5	10.65	0.5	6	22.5	8.34
	Mean of D1, D2	0.5,0.5	3.2	15.4	9.2	0.5,0.5	6	22.2	7.2
	DR	0.5	3	15.7	9.27	0.5	5.8	22.3	7.7
Middle	Mean of S1, S2	6,6	6.3	14.7	5.81	6,6	6.1	21.3	6.78
	SR	6	7.2	14.5	5.7	6	6.4	21.4	6.95
	Mean of D1, D2	6,6	4.7	15.2	7.67	6,6	6.5	22.1	7.51
	DR	6	3.2	15.4	8.68	6	5.8	22.2	7.42
Bottom	Mean of S1, S2	13.5, 16	10.1	14	3.21	14,15.5	11.5	18.3	2.28
	SR	14	10.6	13.8	3.07	14	12	18.2	2.07
	Mean of D1, D2	19.5,24.5	10.7	13.6	2.88	19,23.5	14.6	17.5	0.87
	DR	17.5	9.1	14.1	3.56	17	9.9	19.5	3.63

Source: Boynton *et al.* 1998

Note: S1, S2: shallow stations inside Site 104.  
 SR: shallow reference station.  
 D1, D2: deep stations inside Site 104.  
 DR: deep reference station.

Table 5-1213G-6 (continued)

Physical Parameters in the Vicinity of Site 104 in Summer 1996, by Sampling Date, Depth, and Location

Level	Station	July 1996				August 1996				September 1996			
		Depth (m)	Salinity (ppt)	Temp (C)	DO (mg/L)	Depth (m)	Salinity (ppt)	Temp (C)	DO (mg/L)	Depth (m)	Salinity (ppt)	Temp (C)	DO (mg/L)
Surface	Mean of S1, S2	0.5,0.5	6.1	27.3	11.2	0.5,0.5	7.2	25.3	6.68	0.5,0.5	9.5	26.9	11.87
	SR	0.5	6.9	25.4	7.1	0.5	5.6	24.3	7.66	0.5	8.6	26.3	9.22
	Mean of D1, D2	0.5,0.5	5.6	25.2	9.5	0.5,0.5	6.2	23.9	6.87	0.5,0.5	8.7	27.0	12.54
	DR	0.5	6	25.1	9.2	0.5	6.2	24.9	7.28	0.5	8.6	25.9	8.41
Middle	Mean of S1, S2	6,6	7.2	25.1	5.9	6,6	8.1	25.4	5.14	6,6	10.6	25.8	5.17
	SR	6	7.5	24.8	5.6	6	9.2	24.4	4.03	6	10.6	25.6	4.02
	Mean of D1, D2	6,6	9	24.3	3.1	6,6	11.3	24.3	2.71	6,6	10.1	25.8	5.08
	DR	6	7.9	24.6	4.8	6	11.1	24.5	2.66	6	10.1	25.9	6.23
Bottom	Mean of S1, S2	13,15	9.6	23.5	2.6	13,16	16	24.3	0.15	13,16	12.0	25.6	3.14
	SR	13.5	14.5	12.8	0.1	14	16.8	24.5	0.16	12	NA	25.1	1.96
	Mean of D1, D2	18,24	15.2	22.1	0.2	18, 24.5	18.1	24.4	0.16	17,24	8.7	25.5	1.06
	DR	17.5	15.1	22.1	0.2	18	17.6	24.5	0.21	18	14.9	25.1	0.49

Source: Boynton *et al.* 1998

Note: S1, S2: shallow stations inside Site 104.  
 SR: shallow reference station.  
 D1, D2: deep stations inside Site 104.  
 DR: deep reference station.

Note: NA indicates data were not available. 1996, differences in bottom DO levels between deep reference and deep Site 104 stations were negligible (Boynton *et al.* 1998)

Table 5-1314G-7

Nutrients in Bottom Water Layers in the Vicinity of Site 104 in Summer 1996, by Sampling Date and Location

Station	Depth (m)	NH <sub>4</sub> (uM)	NO <sub>2</sub> (uM)	NO <sub>2+3</sub> (uM)	DIP (uM)
<b>May 1996</b>					
Mean of S1, S2	13.5, 16	24.2	2.45	41.4	0.53
SR		23	2.41	40	0.5
Mean of D1, D2	19.5, 24.5	22.9	2.45	38.45	0.47
DR		24.6	2.46	43.3	0.64
<b>June 1996</b>					
Mean of S1, S2	14, 15.5	15.1	0.97	16.87	0.1
SR	14	16.1	0.8	12.7	0.1
Mean of D1, D2	19, 23.5	19.8	0.49	5.71	0.34
DR	17	11.6	0.98	21.4	0.11
<b>July 1996</b>					
Mean of S1, S2	13, 15	25.9	0.5	6.32	0.7
SR	13.5	33.4	0.24	0.75	1.54
Mean of D1, D2	18, 24	38	0.07	0.15	3.05
DR	17.5	35.7	0.08	0.15	2.52
<b>August 1996</b>					
Mean of S1, S2	13, 16	29.5	0.05	0.16	2.78
SR	14	23.8	0.05	0.12	2.69
Mean of D1, D2	18, 24.5	20.8	0.05	0.13	4.1
DR	18	22.1	0.08	0.14	2.28
<b>September 1996</b>					
Mean of S1, S2	13, 16	20.4	0.23	0.8	1.75
SR	12	21.1	0.18	0.59	1.88
Mean of D1, D2	17, 24	23.4	0.15	0.42	2.08
DR	18	25.8	0.04	0.2	2.55

Source: Boynton *et al.* 1998

Note: S1, S2: shallow stations inside Site 104.  
 SR: shallow reference station.  
 D1, D2: deep stations inside Site 104.  
 DR: deep reference station.

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The outfall for the Kent Island Waste Water Treatment Plant (WWTP) extends from the Kent Island shoreline to a point approximately adjacent to the southeastern corner of Site 104 (Figure 5-14). A diffuser is located on the Bay bottom at the end of a submerged pipe that releases effluent at consistent points, not just at the end. Physical and chemical water quality of the treatment plant effluent is monitored periodically by plant personnel at a sampling point on the WWTP property upstream of the submerged discharge pipe. Effluent water quality records for the period 1990 through February 1997 were obtained and compared to nutrient levels at Site 104. Nutrient levels in the treatment plant effluent at the plant prior to discharge were generally similar to or higher than those observed in surface waters at Site 104; no discernable increase in nutrient levels at Site 104 sampling locations closest to the outfall were noted (MDE 1998a).

It is likely that ambient Chesapeake Bay waters in the mixing zone adjacent to the plant outfall dilute any elevated nutrient concentrations in the treatment plant effluent.

### Conclusions —Water Quality Data Collection

Site 104 lies in the mesohaline portion of the middle Chesapeake Bay. Physical and chemical water quality parameters observed throughout this assessment study were largely within expected ranges observed in this area of the Bay. The time frame encompassing the assessment study included extended periods of unusual meteorological conditions. The year 1996 was wetter than average in the Bay region, while an extended dry spell occurred during the spring and summer of 1997. The signatures of these events are evident in data collected during the assessment study. Salinity data from Site 104, when compared with background data from 1985-1996, highlights these episodic events (MDE 1998a).

Hypoxic to anoxic conditions were observed in summer 1997 at the bottom layers of all but the shallowest stations in the vicinity of Site 104. Site 104 lies within the portion of the Bay routinely subjected to oxygen depletion in deeper water during the summer months. The background data collected by the ~~Chesapeake Bay Program~~ CBP at station MCB3.3C and MCB3.3E also exhibited similar trends (MDE 1998a).

Dissolved nutrient regimes at Site 104 generally followed seasonally-expected patterns, with minor perturbations probably owing due to meteorologic al variations variability. A prominent feature was the relatively high concentration of both ammonia and orthophosphate in bottom waters during summer 1997. These concentrations were similar to those seen in the background data set, and indicate nutrient flux from sediments to the overlying water column during periods of low oxygen concentrations (MDE 1998a).

Particulate nutrient fractions, as well as measures of water clarity, appear to have been more immediately influenced by precipitation and runoff. A sharp spike in these parameters in the bottom water layer at Station KI-6 in April 1997 may be the result of localized disturbance of the Bbay floor. (MDE 1998a).

269 Water quality at sampling stations outside and inside the boundaries of the proposed site  
270 generally did not exhibit significant spatial variation (Boynton *et al.* 1998; MDE 1998a). Where  
271 such variation did occur, it usually was attributable to differing sampling depths. Stations KI-12  
272 and KI-13, for example, exhibited apparent differences from other mid-layer samples. However,  
273 the mid-layer at these two stations was only 1 to 1.5 m (3 to 5 ft) deep, and when compared with  
274 water samples from that depth, differences in most parameters were no longer evident (MDE  
275 1998a).

276  
277 The most serious degradation of water quality in this area of the Bay occurred during the summer  
278 months when DO levels approach zero at bottom depths; and the concentrations of  
279 orthophosphate and ammonia nitrogen exhibited sharp increases indicative of nutrient fluxes  
280 (MDE 1998a).

#### 281 282 **5.1.4.b Sediment Nutrient Interactions in Site 104.**

##### 283 284 **Summary**

285  
286 The sediments in the middle and upper Bay can serve as the predominant source of nutrients,  
287 which can fluxes to the overlying water column (Boynton *et al.* 1998) under certain conditions.  
288 Sediment water interactions at Site 104 were studied to characterize the existing relationship of  
289 water quality and sediment ~~interactions~~. Sediments within Site 104 are rich in organic material  
290 and nutrients (Boynton *et al.* 1998). Annual deposition of organic materials in Site 104 fuels the  
291 ~~seasonal~~-summer anoxia and high rates of ammonium and phosphorus release to the bottom  
292 waters in the area. At least temporarily, the ~~seasonal~~-summer pycnocline that develops as a result  
293 of freshwater runoff and solar warming of the surface keeps waters with higher nutrient  
294 concentrations at the bottom. Over a period of time, these nutrients move upward through the  
295 pycnocline into the waters of the photic zone. This process likely occurs by the time the  
296 pycnocline decreases in strength with winter cooling of the surface layers, but the mechanism is  
297 ~~n<sup>o</sup>t~~ fully described or understood as of yet (Boynton *et al.* 1998). The results of  
298 sediment/nutrient flux studies at Site 104 were similar to other deep mesohaline waters of the  
299 Chesapeake Bay.

##### 300 301 **Introduction to Sediment Nutrient Interactions**

302  
303 The Chesapeake Bay is a relatively shallow ecosystem with limited flushing. Because of this, the  
304 sediments act as the dominant storage site for nutrients and organic matter. Sediments have a  
305 significant influence on water quality conditions, due to the following: (1) microbes in the  
306 sediments utilize DO from the overlying water column, resulting in hypoxic or anoxic conditions  
307 in deep water; and (2) sediments release essential nutrients that support phytoplankton growth;  
308 this phytoplankton growth is followed by deposition and decay on the sediment surface that fuels  
309 the depletion of DO in deep water and the resulting hypoxia and anoxia (Boynton *et al.* 1998). A  
310 considerable portion of the total primary production (10-50 percent) and organic matter are  
311 deposited in the sediments. At depths greater than 20.1 m (66 ft), the percentage of primary  
312 production deposition often exceeds 40 percent of total primary production (Roden *et al.* 1995).  
313 This high rate of organic matter deposition typically leads to a predominance of anaerobic

314 pathways for sediment metabolism (Roden *et al.* 1995) associated with hypoxic or anoxic  
315 conditions.

316  
317 In order to evaluate the Bay's overall health and to facilitate changes that would improve the  
318 ecosystem, it is necessary to monitor nutrient levels in the water column and sediments, as well  
319 as the exchange between the two components, referred to as sediment nutrient flux, in addition to  
320 the phytoplankton production in the estuary. As discussed above, these components, as well as  
321 others, are interdependent, and a significant, far-field change in one factor could result in  
322 significant changes throughout the ecosystem.

323  
324 In support of the Chesapeake Bay Agreement, which was signed by parties from the Bay  
325 jurisdictions, ~~the Chesapeake Bay Program~~ CBP has established a goal of achieving a 40  
326 percent reduction of nutrients entering the Bay by the year 2000 (MDE *et al.* 1995). As part of  
327 this strategy, there has been a movement to address the nutrient inputs to the Bay at their source,  
328 referred to as the Tributary Strategies Program (MDE *et al.* 1995). The majority of nutrient  
329 loading to the Bay is from external sources at the head of the estuary, typically riverine sources  
330 and major wastewater treatment plants (Magnien *et al.* 1992). In addition, within the mainstem  
331 Bay, the oligohaline and upper mesohaline portions are sites of considerable internal recycling of  
332 nutrients to surface waters, and the sedimentation load (containing significant nutrients) from the  
333 upper reaches of the Bay is considered the major source of these recycled nutrients (Magnien *et*  
334 *al.* 1992).

335  
336 As part of the Maryland Chesapeake Bay Water Quality Monitoring Program (Heasley *et al.* 1989)  
337 the Sediment Oxygen and Nutrient Exchanges (SONE) monitoring program has been initiated by  
338 UMCES. This program monitors the nutrient levels in the water column and sediments, and  
339 studies sediment nutrient flux. Results from this program are discussed below.

#### 340 341 **Sediment Nutrients—Study Description and Related Studies**

342  
343 In order to evaluate the existing sediment nutrient flux conditions at Site 104, the UMCES, CBL,  
344 and Horn Point Environmental Laboratory (HPEL) conducted sediment carbon, oxygen and  
345 nutrient flux analysis (Boynton *et al.* 1998) and pore water/solid phase analysis (Cornwell and  
346 Owens 1998) for the Site 104 area. Included in the data collection effort were stations located  
347 within and adjacent to the project area. For the sediment carbon, oxygen, and nutrient flux study,  
348 CBL also evaluated available data from the Deep Trough study (Boynton and Garber 1989), from  
349 other nearby stations which are part of the SONE program, and from studies completed in the  
350 Pooles Island area (Boynton *et al.* 1992, 1993, 1994, 1995, 1996, 1997) to provide a comparison  
351 base to determine whether the data for Site 104 is similar to or unique from other areas of the  
352 upper Bay.

353  
354  
355 Findings from sediment nutrient flux studies at two stations from the SONE program and four  
356 stations within the Deep Trough were evaluated and compared to the findings from the Site 104  
357 data collection. Site 104 ~~conditions~~ nutrient flux relationships were similar to those found in the  
358 Deep Trough study conducted in 1989, and in 10 years of data collection at two SONE stations in

359 relatively deep waters. The Deep Trough study (Boynton and Garber 1989) conducted in 1989  
360 revealed higher rates of ammonium fluxes and dissolved inorganic phosphate fluxes from the  
361 sediments to the water column than those observed at Site 104, but the ranges were similar.

362

### 363 **Sediment, Carbon, Oxygen, and Nutrient Flux Analysis**

364

365 Sediment carbon, oxygen, and nutrient flux sampling occurred at six stations, three in shallow  
366 water (104-SR, 104-S1, and 104-S2) and three in deep waters (104-DR, 104-D1, and 104-D2)  
367 (Figure 5-15+3). Sampling was conducted by CBL during May, June, July, August, and  
368 September 1996 (Boynton *et al.* 1998). A total of five sets of measurements were made per  
369 station (vertical water column profiles of temperature, salinity, and DO; water column samples;  
370 and sediment core samples). The sampling was scheduled for the period of the year when water  
371 temperatures are above 15°C (59°F). This temperature was selected because previous  
372 investigations have revealed that sediment-water carbon, oxygen, and nutrient exchanges are  
373 most active during the warmer months, and sediment-water fluxes (particularly phosphorus) are  
374 greatest during hypoxic or anoxic periods in the warmer months (Boynton *et al.* 1998). This  
375 phenomenon is attributed to microbial mediation. Microorganisms in the sediments, which are  
376 most active during the warm months, decompose organic matter to obtain energy. This  
377 decomposition process results in a release of dissolved inorganic forms of the nutrients to the  
378 water column (Day *et al.* 1989).

379

380 The water column samples were analyzed for ammonium, nitrite, nitrite+nitrate, dissolved  
381 inorganic phosphorus (DIP) corrected for salinity, and silicic acid (Table 5-14+5).  
382 The sediment cores were used to measure oxidation-reduction potential (Eh) of the sediments at  
383 1 cm (0.4 in.) intervals for the top 10 cm (4 in.), particulate carbon, particulate nitrogen,  
384 particulate phosphorus total and active chlorophyll-a (Table 5-15+6), and net exchanges of  
385 carbon, oxygen and dissolved nutrients between sediments and overlying waters (Table 5-16+7).  
386 In addition, water samples from the overlying waters of the cores that were used for the net  
387 exchange analysis were analyzed for ammonium, nitrite, nitrite+nitrate, dissolved inorganic  
388 phosphorus, silicic acid, and total carbon dioxide.

389

390 As outlined in the sediment oxygen and nutrient exchange report for Site 104 (Boynton *et al.*  
391 1998), a characterization of average input (river flow) from the Susquehanna River into the upper  
392 Bay is required to calculate sediment oxygen, carbon, and nutrient flux rates. In the study, 1993,  
393 1994, and 1996 were considered high-flow years and 1992 and 1995 were considered low-flow  
394 years. The high flows in 1996 are attributed to high winter and spring flows whereas the high-  
395 spiked flows of 1993 and 1994 occurred only in spring.

396

397 Research in the Bay has shown that the intra-annual and inter-annual time scales are important in  
398 governing relationships between nutrient loading rates and sediment-water carbon, nutrient, and  
399 oxygen exchange rates in the Bay. The Susquehanna River is a significant source of nutrients to  
400 the upper Bay due to runoff within the upper Bay drainage basin. Depending on the amount of  
401 riverine input, the quantity of nutrients and fresh water coming into the upper Bay will vary,  
402 resulting in these inter-annual and seasonal differences.

403

Table 5-1415G-8

Summary of Site Assessment Study Sediment Nutrient Parameters: Ammonium (NH<sub>4</sub><sup>+</sup>), Nitrite (NO<sub>2</sub><sup>-</sup>), Nitrite+nitrate (NO<sub>2</sub><sup>-</sup> + NO<sub>3</sub><sup>-</sup>), Dissolved Inorganic Phosphorus (DIP), and Silicate [Si(OH)<sub>4</sub>] at Site 104 Open Water Placement Area.

Station	Date	TOTAL DEPTH (m)	SAMPLE DEPTH (m)	DISSOLVED NUTRIENTS				
				NH <sub>4</sub> (μM)	NO <sub>2</sub> (μM)	NO <sub>2+3</sub> (μM)	CORR DIP (μM)	SILICATE (μM)
<b>Shallow Water Stations: 12 - 15 Ms</b>								
<b>Shallow Water Reference Station: Average Depth 13.5 Ms</b>								
104-SR	14-May-96	14.5	14.0	23.00	2.41	40.00	0.50	13.40
104-SR	10-Jun-96	14.5	14.0	16.10	0.80	12.70	0.10	26.50
104-SR	17-Jul-96	14.0	13.5	33.40	0.24	0.75	1.54	43.90
104-SR	15-Aug-96	14.3	14.0	23.80	0.05	0.12	2.69	37.90
104-SR	11-Sep-96	12.0	12.0	21.10	0.18	0.59	1.88	45.50
<b>Shallow Water Sampling Station #1: Average Depth 13.3 Ms</b>								
104-S1	14-May-96	14.5	13.5	24.10	2.31	41.80	0.52	14.00
104-S1	10-Jun-96	14.5	14.0	11.10	1.26	24.10	0.07	26.00
104-S1	16-Jul-96	13.5	13.0	22.50	0.52	7.27	0.56	33.50
104-S1	12-Aug-96	13.5	13.0	30.20	0.05	0.20	2.94	47.20
104-S1	9-Sep-96	14.0	13.0	20.70	0.18	0.73	1.83	45.70
<b>Shallow Water Sampling Station #2: Average Depth 15.7 Ms</b>								
104-S2	14-May-96	17.0	16.0	24.30	2.59	41.00	0.54	13.20
104-S2	10-Jun-96	16.5	15.5	19.10	0.68	9.63	0.12	26.10
104-S2	16-Jul-96	15.5	15.0	29.20	0.48	5.36	0.83	36.50
104-S2	12-Aug-96	17.0	16.0	28.80	0.04	0.12	2.61	46.90
104-S2	9-Sep-96	17.0	16.0	20.00	0.28	0.86	1.66	46.10
<b>Deep Water Stations: 16 - 25 Ms</b>								
<b>Deep Water Reference Station: Average Depth 17.6 Ms</b>								
104-DR	15-May-96	18.0	17.5	24.70	2.46	43.30	0.64	18.40
104-DR	11-Jun-96	18.0	17.0	11.60	0.98	21.40	0.11	28.10
104-DR	22-Jul-96	18.0	17.5	35.70	0.08	0.15	2.52	48.40
104-DR	14-Aug-96	18.5	18.0	22.10	0.08	0.14	2.28	37.70
104-DR	10-Sep-96	18.0	18.0	25.80	0.04	0.20	2.55	48.40
<b>Deep Water Sampling Station #1: Average Depth 18.3 Ms</b>								
104-D1	15-May-96	20.0	19.5	22.60	2.50	36.50	0.45	13.90
104-D1	11-Jun-96	19.5	19.0	18.40	0.60	9.02	0.10	26.40
104-D1	22-Jul-96	18.5	18.0	36.90	0.06	0.17	2.81	48.60
104-D1	14-Aug-96	18.5	18.0	21.50	0.06	0.14	2.08	38.30
104-D1	10-Sep-96	18.5	17.0	22.80	0.21	0.61	1.88	46.80
<b>Deep Water Sampling Station #2: Average Depth 24.1 Ms</b>								
104-D2	15-May-96	25.0	24.5	23.20	2.40	40.40	0.49	14.40
104-D2	11-Jun-96	25.0	23.5	21.10	0.38	2.39	0.58	26.10
104-D2	22-Jul-96	25.0	24.0	39.10	0.07	0.12	3.29	51.00
104-D2	14-Aug-96	25.0	24.5	20.10	0.04	0.11	2.02	34.90
104-D2	10-Sep-96	27.0	24.0	23.90	0.09	0.22	2.27	47.60

Source: Boynton *et al.* 1998.

Note: NA indicates data were not available.

Table 5-1516G-9

Summary of Site Assessment Study Sediment Particulate Parameters: Eh, Particulate Carbon (SED PC), Particulate Nitrogen (SED PN), Particulate Phosphorus (SED PP), and Total and Active Chlorophyll-a (SED CHLa), at Site 104 Open Water Placement Area.

STATION	DATE	TIME	EH CORE DEPTH (cm)	Eh CORR (mV)	CORE DEPTH (cm)	SURFICIAL SEDIMENT PARTICULATES				
						SED PC (%wt)	SED PN (%wt)	SED PP (%wt)	SED CHLa TOTAL (mg m <sup>-3</sup> )	SED CHLa ACTIVE (mg m <sup>-2</sup> )
<b>Shallow Water Stations: 12 - 15 Ms</b>										
<b>Shallow Water Reference Station: Average Depth 13.5 Ms</b>										
104-SR	14-May-96	1641	0.0	359	-1.0	4.13	0.280	0.099	304.8	154.4
104-SR	10-Jun-96	1700	0.0	110	-1.0	4.43	0.550	0.131	540.9	440.8
104-SR	17-Jul-96	726	0.0	227	-1.0	3.57	0.400	0.132	459.5	334.6
104-SR	15-Aug-96	703	0.0	331	-1.0	3.28	0.400	0.080	359.8	285.0
104-SR	11-Sep-96	748	0.0	336	-1.0	3.42	0.410	0.070	196.0	146.0
<b>Shallow Water Sampling Station #1: Average Depth 13.3 Ms</b>										
104-S1	14-May-96	1118	0.0	326	-1.0	4.80	0.250	0.074	189.2	79.7
104-S1	10-Jun-96	1045	0.0	333	-1.0	4.16	0.510	0.142	287.2	162.7
104-S1	16-Jul-96	1238	0.0	209	-1.0	3.85	0.510	0.154	243.7	153.5
104-S1	12-Aug-96	1308	0.0	299	-1.0	3.03	0.350	0.090	143.1	100.8
104-S1	9-Sep-96	1252	0.0	-50	-1.0	4.04	0.560	0.150	209.2	147.7
<b>Shallow Water Sampling Station #2: Average Depth 15.7 Ms</b>										
104-S2	14-May-96	1320	0.0	361	-1.0	4.13	0.280	0.099	273.7	124.1
104-S2	10-Jun-96	1512	0.0	249	-1.0	4.73	0.620	0.150	535.4	428.4
104-S2	16-Jul-96	1535	0.0	329	-1.0	3.84	0.530	0.097	372.7	279.8
104-S2	12-Aug-96	1602	0.0	215	-1.0	3.36	0.330	0.070	205.8	176.9
104-S2	9-Sep-96	1521	0.0	351	-1.0	3.09	0.390	0.110	171.1	135.5
<b>Deep Water Stations: 16 - 25 Ms</b>										
<b>Deep Water Reference Station: Average Depth 17.6 Ms</b>										
104-DR	15-May-96	1242	0.0	341	-1.0	4.80	0.250	0.074	339.6	201.8
104-DR	11-Jun-96	1121	0.0	80	-1.0	4.32	0.590	0.141	368.6	261.0
104-DR	22-Jul-96	1022	0.0	255	-1.0	1.92	0.240	0.053	115.7	63.3
104-DR	14-Aug-96	1332	0.0	180	-1.0	1.76	0.220	0.040	100.1	53.1
104-DR	10-Sep-96	730	0.0	351	-1.0	3.11	0.360	0.070	240.6	171.3
<b>Deep Water Sampling Station #1: Average Depth 18.3 Ms</b>										
104-D1	15-May-96	752	0.0	355	-1.0	4.13	0.280	0.099	322.9	214.0
104-D1	11-Jun-96	849	0.0	298	-1.0	4.54	0.620	0.141	364.9	226.5
104-D1	22-Jul-96	730	0.0	332	-1.0	3.59	0.470	0.085	308.2	219.2
104-D1	14-Aug-96	653	0.0	68	-1.0	2.94	0.360	0.070	123.5	75.2
104-D1	10-Sep-96	1045	0.0	351	-1.0	2.94	0.330	0.060	178.8	112.0
<b>Deep Water Sampling Station #2: Average Depth 24.1 Ms</b>										
104-D2	15-May-96	1035	0.0	349	-1.0	4.80	0.250	0.074	138.9	47.2
104-D2	11-Jun-96	1510	0.0	334	-1.0	3.48	0.440	0.091	237.7	99.2
104-D2	22-Jul-96	1409	0.0	-8	-1.0	3.30	0.400	0.080	227.6	128.4
104-D2	14-Aug-96	944	0.0	170	-1.0	2.99	0.380	0.050	116.4	72.4
104-D2	10-Sep-96	1332	0.0	348	-1.0	4.01	0.550	0.080	249.1	178.8

Source: Boynton *et al.* 1998.

Note: NA indicates data were not available.

Table 5-1617G-10

Summary of Site Assessment Study Flux Measurements: Ammonium (NH<sub>4</sub><sup>+</sup>), Nitrite (NO<sub>2</sub><sup>-</sup>), Nitrite + Nitrate (NO<sub>2</sub><sup>-</sup> + NO<sub>3</sub><sup>-</sup>), Phosphate (DIP), Silicate [Si(OH)<sub>4</sub>] and Total Inorganic Carbon (TCO<sub>2</sub>), at Site 104 Open Water Placement Area.

Station	Date	MEAN FLUX						
		SOC (gO <sub>2</sub> /m <sup>2</sup> day)	NH <sub>4</sub> (μM N/(m <sup>2</sup> hr))	NO <sub>2</sub> (μM N/(m <sup>2</sup> hr))	NO <sub>2+3</sub> (μM N/(m <sup>2</sup> hr))	DIP (μM P/(m <sup>2</sup> .hr))	SILICATE (μM Si/(m <sup>2</sup> .hr))	TCO <sub>2</sub> (μM C/(m <sup>2</sup> .hr))
<b>Shallow Water Stations: 12 - 15 Ms</b>								
<b>Shallow Water Reference Station: Average Depth 13.5 Ms</b>								
104-SR	14-May-96	-0.78	206.05	3.82	-136.01	-0.50	223.89	2137.27
104-SR	10-Jun-96	-0.61	229.84	-6.53	-154.26	0.63	399.50	2740.71
104-SR	17-Jul-96	-0.18	256.32	-2.84	-4.72	16.04	212.67	2922.18
104-SR	15-Aug-96	-0.01	209.72	0.00	0.00	49.34	240.46	1944.03
104-SR	11-Sep-96	-0.54	102.9	5.17	4.47	0.47	189.95	0.00
<b>Shallow Water Sampling Station #1: Average Depth 13.3 Ms</b>								
104-S1	14-May-96	-0.92	439.10	8.16	-207.05	7.98	262.97	3316.75
104-S1	10-Jun-96	-0.94	214.47	0.00	-148.25	4.09	195.69	2288.13
104-S1	16-Jul-96	-0.77	496.59	3.34	-35.96	8.24	298.23	4401.98
104-S1	12-Aug-96	0.00	185.62	0.00	0.00	34.37	154.10	1530.32
104-S1	9-Sep-96	-0.79	198.00	4.92	4.47	2.94	205.84	0.00
<b>Shallow Water Sampling Station #2: Average Depth 15.7 Ms</b>								
104-S2	14-May-96	-0.53	149.10	4.57	-121.86	1.69	253.51	966.40
104-S2	10-Jun-96	-0.25	262.57	-5.54	-79.73	1.82	351.66	1677.28
104-S2	16-Jul-96	-0.50	255.11	-1.34	-34.00	-4.10	202.61	1510.73
104-S2	12-Aug-96	0.00	194.67	0.00	0.00	36.65	264.82	1151.46
104-S2	9-Sep-96	-0.68	188.90	4.39	5.92	-0.50	230.33	0.00
<b>Deep Water Stations: 16 - 25 Ms</b>								
<b>Deep Water Reference Station: Average Depth 17.6 Ms</b>								
104-DR	15-May-96	-0.91	192.26	2.17	-169.49	-4.95	189.76	1753.93
104-DR	11-Jun-96	-0.92	161.58	-2.76	-151.62	0.17	230.10	1855.40
104-DR	22-Jul-96	0.00	122.87	0.00	0.00	8.87	198.30	1549.51
104-DR	14-Aug-96	0.00	133.37	0.36	0.00	17.99	319.68	1280.67
104-DR	10-Sep-96	-0.18	53.30	0.00	0.00	8.76	146.67	0.00
<b>Deep Water Sampling Station #1: Average Depth 18.3 Ms</b>								
104-D1	15-May-96	-0.47	216.20	2.75	-92.80	5.72	388.71	1980.28
104-D1	11-Jun-96	-0.40	272.50	-2.50	-93.37	33.49	385.66	2711.15
104-D1	22-Jul-96	-0.02	203.35	-0.43	0.00	51.58	281.87	2793.05
104-D1	14-Aug-96	-0.02	134.32	-0.24	5.48	32.48	218.81	1951.42
104-D1	10-Sep-96	-0.80	362.70	-1.44	-1.55	42.30	323.06	0.00
<b>Deep Water Sampling Station #2: Average Depth 24.1 Ms</b>								
104-D2	15-May-96	-0.66	812.80	9.70	-104.79	49.70	186.95	3779.50
104-D2	11-Jun-96	-0.11	395.59	-0.74	-24.68	54.77	273.59	3770.14
104-D2	22-Jul-96	0.00	311.80	3.08	0.00	47.76	186.62	2052.70
104-D2	14-Aug-96	-0.01	264.53	0.00	0.00	35.14	186.55	2275.73
104-D2	10-Sep-96	-0.23	352.10	0.00	2.15	50.61	219.23	0.00

Source: Boynton *et al.* 1998.

Note: NA indicates data were not available.

404 Bottom water temperature at Site 104 was within expected ranges for summer: 13.78-C (56.8-F)  
405 to 25.57-C (78-F) in shallow water (depth range: 12-17 m) and 13.33-C (56-F) to 25.48-C (77.8-F)  
406 in deep water (depth range: 18-27 m) and the vertical temperature difference was less than 2-C  
407 (Table 5-11+2) (Boynton *et. al* 1998). Data from the nearby SONE station R-64 shows a  
408 historical trend during low-flow years (1992 and 1995) of increasing temperature from spring to  
409 summer and decreasing temperature from summer to fall/winter. SONE station R-64 is located  
410 at 38°33.517'N, 76°25.583'W, in the mainstem Chesapeake Bay near the mouth of the Little  
411 Choptank River.

412  
413 Similarly, long-term (1984-1997~~8~~) bottom water temperature observations at the Chesapeake Bay  
414 Program (CBP) Station MCB3.3C show gradually increasing temperatures from late March  
415 through late June (Figure 5-18+6) with relatively little year-to-year variations in the rate of  
416 increase, and peak bottom water temperatures in mid- to late-August (Figure 5-19+7), followed  
417 by a steady decline in temperature into December.

418  
419 Bottom water salinity generally increased from May to August 1996 due to decreasing river  
420 flows and decreased from August to September 1996 due to increased river flows. Salinity  
421 ranged from 8.4 ppt to 16.8 ppt in the shallow water sites and from 9.1 ppt to 18.1 ppt in the deep  
422 water sites. Data from the nearby SONE station R-64 shows a historical trend of decreasing  
423 salinity from spring to summer and increasing salinity from summer to fall/winter during 1992  
424 and 1995 (low flow years). During high-flow years (1993, 1994, and 1996), there was an  
425 increase in salinity from spring to summer and a decrease from summer to fall/winter at the  
426 nearby SONE station R-64.

427  
428 Bottom water DO at the shallow water sites in the vicinity of Site 104 ranged from 0.1 mg/L to  
429 4.1 mg/L and at the deep water sites it ranged from 0.1 mg/L to 3.6 mg/L. At Site 104, hypoxic  
430 conditions were generally present in near-bottom waters from June to September 1996. Over the  
431 period 1984-1997, bottom water DO concentrations at CBP station MCB3.3C generally fell  
432 below 2.0 mg/L in the mid-April to mid-May period, although the onset of less than 2.0 mg/L  
433 DO concentrations occurred as soon as early April and as late as early June (Figure 5-20+8).  
434 Bottom water DO generally remained below 2.0 mg/L at MCB3.3C until early September to mid-  
435 October (Figure 5-21+9).

436  
437 Information from the nearby SONE station R-64 shows that historically there are similar trends  
438 in both low- and high-flow years to those found at Site 104 in 1996. Data from the SONE station  
439 R-64 also indicated that in October, from 1985 to 1994, there was an average DO concentration  
440 of 5.4 mg/L and a range of 4.0 to 7.3 mg/L. During 1992, a low-flow year, DO concentrations in  
441 October were measured at 5.4 mg/L and during high-flow years such as 1993 and 1994, DO  
442 concentrations in October were measured at 4.7 and 6.8 mg/L, respectively.

443  
444 Therefore, there appears to be a historical trend of an increase in DO levels that generally begins  
445 during the September to October period in the Site 104 area. However, there is significant inter-  
446 annual variability of the duration of hypoxic conditions, which is directly related to the  
447 magnitude of winter-spring river flows.

448



Figure 5-19: Bottom Water Temperature (C) at CBP Station MCB3.3C  
July - December (1984 - 1998)

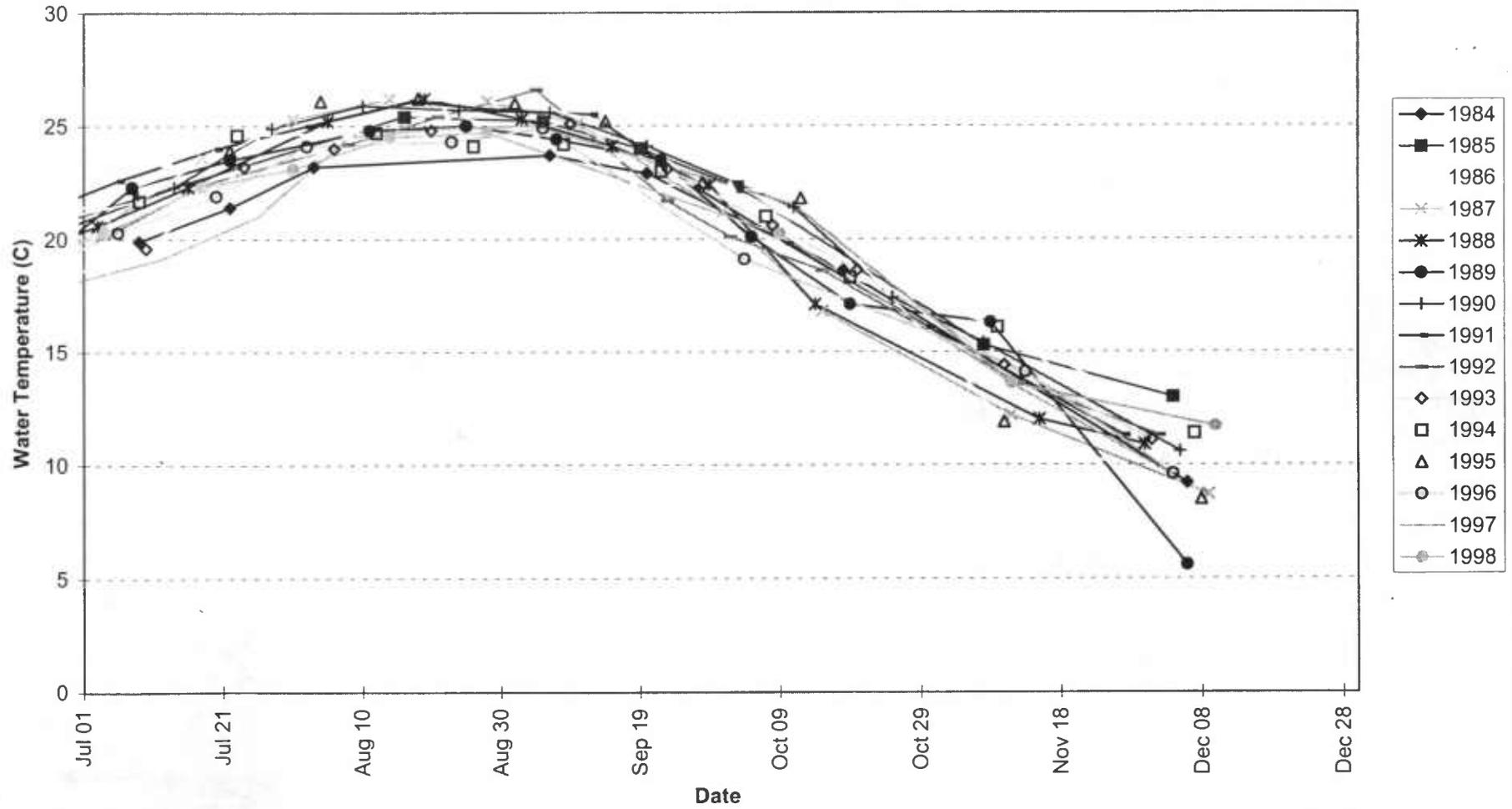
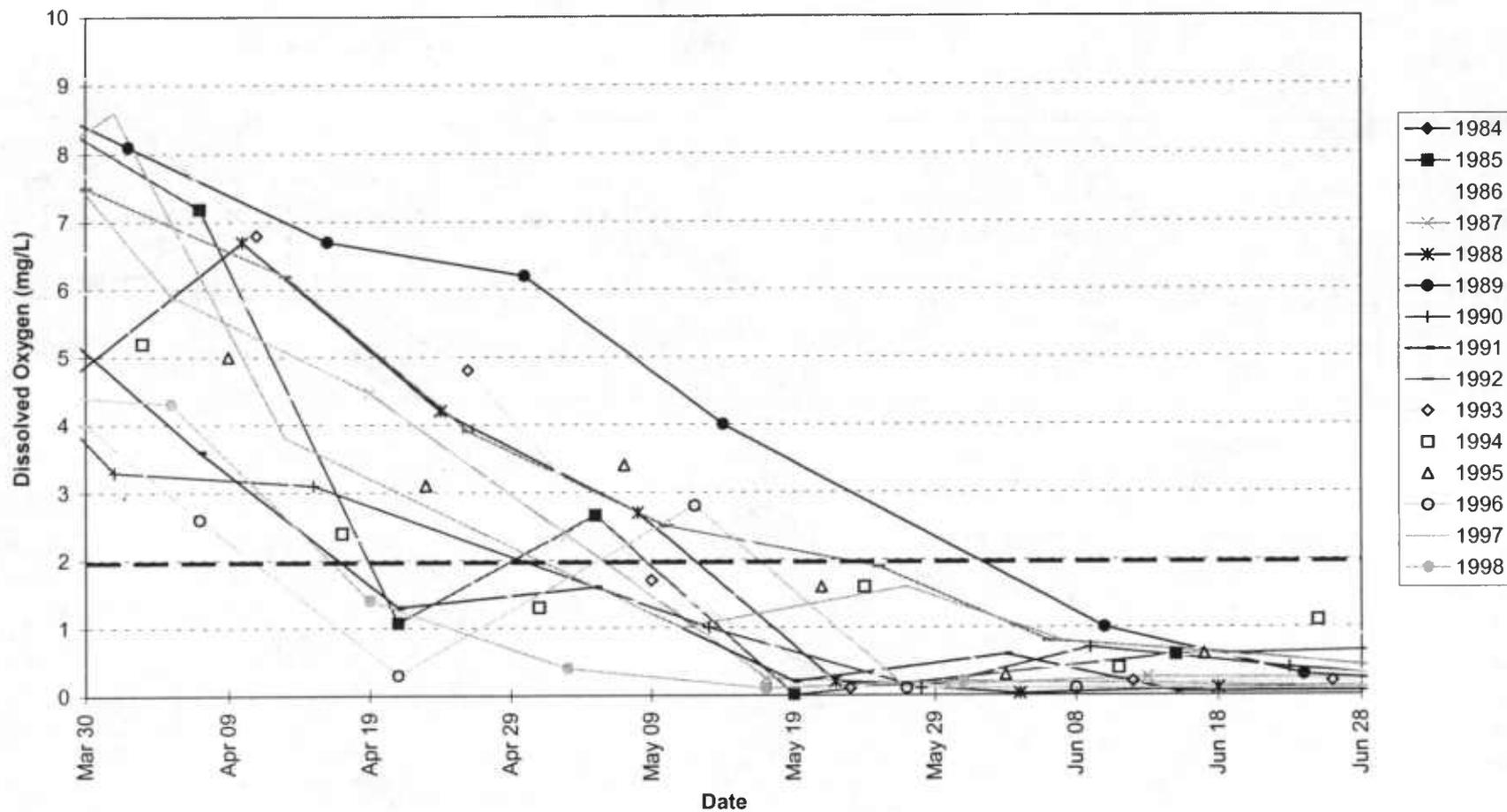


Figure 5-20: Bottom Water Dissolved Oxygen Concentration (mg/L) at CBP Station MCB3.3C March - June (1984 - 1998)





449 **Sediment Fluxes**

450  
451 Sediments in Site 104 were rich in organic matter and nitrogen that resulted from phytoplankton  
452 deposition. Phosphorus was relatively abundant in the sediments but most of it ~~is~~ was bound to  
453 sediment particles and would not, therefore, be available to the biological community until  
454 hypoxic (low oxygen) sediment conditions ~~exist~~ occur. The sediment oxygen consumption  
455 (SOC) rates were modest during the spring, increased during early summer due to increased  
456 temperatures, and were followed by a decline due to a lack of oxygen in the overlying water in  
457 mid to late summer.

458  
459 Ammonium fluxes in Site 104 and at deep water reference sites were high ( $>200 \mu\text{mol N m}^{-2} \text{ hr}^{-1}$ )  
460 relative to other, shallower regions of the Bay. This is, probably from thought to be due to the  
461 high rate of organic matter being deposited, followed by the decomposition of the organic matter  
462 and release of ammonium from the organic matter. This was also reflected in the sediment  
463 organic carbon and nitrogen concentrations. Nitrate fluxes were high and generally directed into  
464 the sediments from the water column. This is typical of deep water areas of the Bay that  
465 experience oxygen depletion (hypoxia) during the summer. Nitrate fluxes from the sediments to  
466 the water column in areas such as this throughout the Bay are rare. Phosphate fluxes were also  
467 generally large in Site 104 and adjacent deep water sites ( $30\text{--}60 \mu\text{mol N m}^{-2} \text{ hr}^{-1}$ ) during the  
468 summer hypoxic period. Smaller fluxes are associated with well-oxygenated areas of the Bay  
469 that do not experience hypoxic conditions.

470  
471 Although Site 104 experiences hypoxia, existing sediments at the site are still considered active  
472 sites for organic matter consumption and nutrient release. This ongoing metabolism during the  
473 summer months is expected to continue to be elevated as long as the rate of organic matter  
474 deposition is elevated.

475  
476 In summation, nutrient levels in the Site 104 area were subject to intra-annual and inter-annual  
477 variability due to Susquehanna River input to the upper Bay. Hypoxia occurred during the  
478 summer months (July to September in 1996) in bottom waters, organic matter deposition was  
479 high, and nutrient and sediment nutrient flux levels were within expected ranges for a deep water  
480 area that experiences summer hypoxia.

481  
482 **Pore Water and Solid Phase Analysis**

483  
484 These analyses were conducted by ~~Horn Point Environmental Laboratory (HPEL)~~ in 1996 to  
485 ~~determine study and describe~~ the mechanism of nitrogen and phosphorus release from sediments  
486 in and adjacent to Site 104. The sediment carbon, oxygen, and nutrient flux study (previously  
487 discussed) analyzed conditions just above the sediment surface, while the pore water and solid  
488 phase study analyzed conditions in the upper layers (0.8--3 in.) of the sediments. Pore water and  
489 solid phase sampling occurred at the same six sites that were used for the sediment carbon,  
490 oxygen, and nutrient flux study (Figure 5-15-3). Vertical cores were collected in June and  
491 August 1996 for surficial solid phase and pore water analyses, and in July 1996 for surficial solid  
492 phase analysis. The top 8 cm (3 in.) of each core was used for analysis in June 1996 and the top  
493 2 cm (0.8 in.) in July and August 1996.

494  
495  
496 The study found considerable spatial and temporal variability in the pore water (water between  
497 individual sediment particles) and solid phase data. The variability noted at Site 104 is similar to  
498 other seasonally anoxic areas of the Bay that experience summer anoxia. This variability  
499 suggests high rates of nutrient remineralization (or recycling) of nutrients to the water column as  
500 a result of organic matter decomposition ~~offrom organic matter~~.

501  
502 Overall, data from the pore water and solid phase study supported the findings of the sediment  
503 carbon, oxygen, and nutrient flux study. The site receives a significant load of organic matter  
504 and has high rates of nitrogen and phosphorus remineralization. In summation, this site is similar  
505 to other deep water sites that experience summer anoxia.

506  
507 **5.1.4.c Pore Water/Solid Phase Analysis and Sediment Nutrient Interactions in the Channels**  
508 Summary. [JEFF C'S DATA TO BE ADDED]

509  
510 **Introduction**

511  
512 Pore water and solid phase nutrient analyses were performed on sediment core samples taken  
513 from both in-navigation channels and in-Site 104 in September 1999. The reason for performing  
514 these analyses was to gain an understanding of the chemical and probable biological conditions  
515 existing in sediments at the time of measurement. Measuring these conditions helps us to  
516 improves the understanding of the potential types and flux rates of fluxes of nutrients and other  
517 elements from sediments, and improves the ability to estimate the storage or "bank account" of  
518 nutrients and other materials in sediments. This information can also be used to compare  
519 sediments in one area to another. A detailed discussion of these analyses is presented in Annex  
520 G and summarized below.

521  
522 [Sections to be written after Jeff Cornwell data becomes available.]

523  
524 Pore water and solid phase testing of sediments from Site 104 were conducted by Horn Point  
525 Environmental Laboratories in Cambridge, Maryland. Solid phase testing refers to  
526 measurements of various constituents in the actual solids or particulates that comprise the  
527 sediments near the surface of the bottom. Pore water is the interstitial water that surrounds  
528 sediment particles (i.e. water between the sediment grains). Pore water is separated from the  
529 solid phase (particles) with a centrifuge. Nutrient concentrations were determined for both pore  
530 water and solid phase elements of the sediment. This information is used to determine whether  
531 nutrients are bound to particulates (solids) or whether they are released into the interstitial waters.  
532 The solid phase and pore water studies are integral to determining the sediment-nutrient  
533 interactions and the potential availability of nutrients to the water column.

534  
535 Remineralization refers to the rate of change of particulate and dissolved organic forms of  
536 nitrogen and phosphorus into ammonium, nitrite, nitrate and phosphate, which are available for  
537 reuse in the aquatic system by phytoplankton and microbes. Also important is the fate of  
538 nutrients, in particular phosphorus, which is sorbed to sediment particles. This linkage of

539 phosphorus to sediment particles is important because such bound phosphorus is generally  
540 unavailable for biological uptake unless low oxygen conditions in the water occur. Under these  
541 conditions phosphorus can be rapidly (days to weeks) released from sediment particles and is  
542 then available for reuse in the aquatic system by phytoplankton and other microorganisms.  
543

544 Pore water/solid phase analysis and an analysis of sediment/water nutrient interactions in several  
545 Chesapeake Bay Federal navigation channels and adjacent shoal areas were conducted in August  
546 of 1997 by HPEL and CBL (Cornwell and Boynton 1998). The Fort McHenry, Brewerton,  
547 Brewerton Channel Eastern Extension, Craighill, and Northern C&D Canal approach channel  
548 were studied (Figure 1-2), along with adjacent shoal areas for comparison. The Fort McHenry  
549 Channel and Brewerton Channel results are included here, but these sediments will not be placed  
550 at Site 104 as they are from the Inner Harbor. These studies showed that the waters and  
551 sediments in the channels are subject to conditions similar to those at Site 104. The waters in the  
552 channels are of higher salinity, lower temperature, and lower DO concentrations than waters in  
553 shoal areas near the channels.  
554

555 Ammonium and dissolved inorganic phosphorus concentrations are higher in the deep waters of  
556 the channels than in shallow waters adjacent to the channels. Ammonium fluxes in the channel,  
557 however, were similar to shoal sediments nearby, with the exception of the northern Bay channel,  
558 where ammonium fluxes were higher than nearby shoal sediments. Ammonium fluxes were  
559 similar in the channels to those observed in Site 104, although considerable variability exists in  
560 the channels. Ammonium fluxes would generally be expected to be higher in the channels, which  
561 are generally characterized by DO levels lower than in adjacent shoals, and which are  
562 depositional areas where fresh supplies of organic material would tend to enhance flux rates.  
563 Ammonium fluxes were smallest in the Craighill Channel, which is the most southern channel,  
564 and highest at the northern C&D Canal approach channel, which is the most northern channel.  
565

566 Fluxes of dissolved inorganic phosphorus were directed into the sediments in the Brewerton  
567 Eastern Extension and in the Craighill Channels. Small positive fluxes from the sediment to the  
568 water column were measured in the Brewerton and in the Fort McHenry channels. A larger flux  
569 to the water column was present in the northern C&D Canal approach channel. All dissolved  
570 inorganic phosphorus fluxes in the channels in August of 1997 were smaller than those measured  
571 in Site 104 in August of 1996. In particular, the deeper stations at Site 104 showed much higher  
572 dissolved inorganic phosphorus fluxes than those observed in the channels. Based upon these  
573 findings, it would appear that conditions in the sediments of the channels are very somewhat  
574 different from those at Site 104, even though water quality conditions are similar in the two  
575 environments. Additional studies are planned in complete to more fully characterize the  
576 differences, but it has been speculated that the source of the channel sediments may result from  
577 abe more land-based in characteristic, versus the phytoplankton-based organic matter in areas  
578 such as Site 104 and the Deep Trough. This terrestrial -based sediment appears to contain higher  
579 percentages of inorganic and more complex or non-refractory organic matter inputs of which are  
580 newer than those deposited in Site 104, and thus result in lower phosphorus fluxes.  
581

## 582 583 **Conclusions**

584  
585 Hypoxic to anoxic conditions were observed in summer of 1996 and 1997 in the bottom layers of  
586 the deeper stations in the vicinity of Site 104. Relatively high concentrations of ammonia and  
587 orthophosphate were observed in water column samples during the summer months. The  
588 ~~seasonal~~summer anoxic conditions enhanced release of nitrogen and phosphorus from the  
589 sediments into the water column. Depositional rates of organic matter in the vicinity of Site 104  
590 were high and associated with deposition of phytoplankton. Sediments at Site 104 are rich in  
591 organic carbon and nitrogen; phosphorus is also relatively abundant, but the majority is bound to  
592 sediment particles and unavailable for biological uptake until hypoxic sediment conditions exist.  
593 Remineralization rates in the sediments are also high, resulting in the observed flux rates of  
594 nitrogen and phosphorus.

595  
596

### 5.1.5 Sediment

Sources of sediments in the central portions of the Chesapeake Bay include Susquehanna River flows, erosion of bay banks and shorelines, and resuspension of existing bay sediments. Another source of sediments in the vicinity of Site 104 is historic dredged material placement that occurred at the site from prior to 1924 until 1975 (MDNR 1976). Much of this deposited material would be expected to have remained substantially in place because Site 104 is located in the main stem of the Chesapeake Bay, which is generally considered to be a depositional area with deposition rates ranging from 0.0012 to 0.01 m/yr (0.047 to 0.393 in./yr) (Eskin *et al.* 1996). Once deposited in the bay in the vicinity of Site 104, sediments can act as a source or sink for chemical constituents that have been introduced into the aquatic system from natural or anthropogenic (man-made) sources.

**5.1.5.a Sediment Composition** A geotechnical field and laboratory investigation was conducted by Earth Engineering and Sciences, Inc. (E2Si 1997) and the Maryland Geological Survey (MGS 1997) to evaluate sediment characteristics within the Site 104 project area (see Appendix D). E2Si collected sediment samples from six borings that were drilled using a hollow stem auger. Each boring was approximately 12.2 m (40 ft) in depth. MGS obtained nine piston core samples having lengths ranging from approximately 2.4 to 4.3 m (8 to 14 ft). Boring and piston core locations are shown in Figure 5-20.

Data obtained from the investigation indicate that the Site 104 area consists primarily of very soft to soft gray silty clay containing localized pockets of silty sand and red brown silty clay. The Standard Penetration Test (SPT) resistance of the sediment at Site 104 is typically the "weight of the rod" (WOR), i.e., the coring device moves through the sediment under its own weight because the sediment has a low bearing capacity. The liquid limit ranges from 38 to 139 percent, and the plastic limit has a mean of 36.6 percent. The data show that several samples collected from the borings and analyzed in the laboratory contain water contents greater than the liquid limit, indicating that the soil-water system is in a suspension. The water contents ranged from 25 to 377.5 percent.

Grain size distribution measured from eight samples indicated that sediment composition was 0.6 percent gravel, 15.3 percent sand, 50.5 percent silt, and 33.6 percent clay. Organic content is approximately 9.0 percent. Unit weight of the material ranged from 1300 to 1800 kg/m<sup>3</sup> (82 to 115 pcf). Specific gravity ranges from 2.63 to 2.77, with a mean of 2.69. Shear stress is low, ranging from 0 kg/m<sup>2</sup> (0 psf) at the mudline, 600 kg/m<sup>2</sup> (120 psf) at 3 m (10 ft) below the mudline, 900 kg/m<sup>2</sup> (180 psf) at 6 m (20 ft) below the mudline, 1100 kg/m<sup>2</sup> (220 psf) at 9 m (30 ft) below the mudline, 1750 kg/m<sup>2</sup> (350 psf) at 12 m (40 ft) below the mudline, and 2500 kg/m<sup>2</sup> (500 psf) at 15 m (50 ft) below the mudline. The angle of internal friction ( $\phi$ ) is zero.

**5.1.5.b Sediment Quality** The sediment quality study prepared by EA Engineering, Science, and Technology in November 1997 (EA 1997) was performed to provide information on the chemical and physical characteristics of sediments at Site 104. An earlier study (EA 1996) included sediment elutriate samples from several main stem Chesapeake Bay approach channels, and was intended to characterize the sediments in the approach channels, as well as in certain reference areas and potential placement sites. The results of these studies can be used to fulfill

## NOT UPDATED

1 the requirements of Tier I and Tier II evaluations as described by the EPA and USACE manual  
2 "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. Testing  
3 Manual" (EPA/USACE 1998), commonly referred to as the Inland Testing Manual, for  
4 placement of sediments from approach channels at Site 104. Tier I is a literature review of  
5 existing reference documents detailing sediment chemistry studies in the project area, and Tier II  
6 consists of sediment sampling and analysis in the projected dredging area.

7  
8 The Tier I literature review included a review of previous dredged material placement at the site  
9 (MDNR 1976), and a review of sediment characteristics from nearby locations in the upper  
10 Chesapeake Bay (E2Si *et al.* 1997, MES 1997), and from mainstem Chesapeake Bay locations  
11 (Eskin *et al.* 1996). Available data for sediment metal concentrations in those areas to be  
12 dredged for disposal at Site 104 (e.g., main stem Chesapeake Bay approach channels) were  
13 compared to sediment quality guidelines implemented by NOAA and EPA. Finally, existing  
14 sediment elutriate data collected in late 1995 at several main stem Chesapeake Bay approach  
15 channels (EA 1996) were compared to Maryland water quality standards for estuarine and salt  
16 water.

17  
18 The Tier II evaluation compared the results of sediment testing at Site 104 (EA 1997) to  
19 available criteria, standards or regulations governing sediment quality, and described whether or  
20 not the sediments collected in the sample area would meet the objectives for the area. Inasmuch  
21 as standardized numerical sediment quality criteria are not available, this Tier II analysis  
22 compared bulk sediment quality at Site 104 with sediment quality guidelines implemented by  
23 NOAA and EPA to protect environmental health, and with EPA Region III's Risk-Based  
24 Concentrations (RBCs) for chemical screening of soils to protect human health. The details of  
25 this Tier II evaluation are included in the sections which follow.

26  
27 Sediment quality in the vicinity of Site 104 is influenced by the nature of the source materials  
28 and by the hydrodynamic processes that control sediment transport and deposition. A site-  
29 specific sediment sampling report prepared by EA Engineering, Science, and Technology in  
30 January 1998 (EA 1998) is included as an appendix. This report contains information on  
31 sampling methodology and analytical tests.

32  
33 Studies indicate that sediment priority pollutant organic compound concentrations in existing  
34 sediments sampled at Site 104 are generally below detection limits (EA 1997) or are near or  
35 below sediment quality guidelines (Eskin *et al.* 1996, EPA 1998). Organic compounds found at  
36 concentrations above sediment quality guidelines include anthracene and phenanthrene at KI-7  
37 (higher than the No Observable Effect Level [NOEL] but less than the Probable Effects Level  
38 [PEL]), and naphthalene at KI-3 (slightly higher than the NOEL but less than the PEL) (Figure  
39 5-21). Further details of sediment organic compound distributions at Site 104 are discussed in  
40 the following Organic Analysis section. Sediment metal concentrations at Site 104 are generally  
41 similar to concentrations measured at other nearby locations, including Site 3 of the upper Bay  
42 Island Placement Sites study, northwest of the Swan Point Channel (E2Si *et al.* 1997), and  
43 mainstem Chesapeake Bay locations (Eskin *et al.* 1996). Further details of sediment metal  
44 concentrations at Site 104 are discussed in the Metals Analysis section. Sediment metals  
45 concentrations at Station KI-7 at Site 104, however, are higher than at nearby locations.  
46 Sediment metal concentrations at Site 104 (exclusive of KI-7) are generally higher than (but  
47 within an order of magnitude of) concentrations at a reference station near Pooles Island (MES

1 1997). Environmental effects, including effects on fish and wildlife, associated with existing  
2 sediments at Site 104, exclusive of KI-7, would therefore be expected to be higher than but  
3 within the range of those observed at an upper Chesapeake Bay reference station. Human health  
4 effects are unlikely both because sediment concentrations are generally below human health-  
5 based guidelines (EPA 1998) and because extended exposure is unlikely.  
6  
7

### 8 **Water Column Effects**

9

10 The Tier I evaluation of existing data included an analysis of sediment elutriate data collected  
11 during October and November 1995 in several approach channels to Baltimore Harbor in the  
12 main stem of the Chesapeake Bay (EA 1996). Sediments for the elutriate tests were collected  
13 using a Van Veen grab sampler to collect surface sediments. At two locations (Tolchester  
14 Channel and Brewerton Channel Eastern Extension), additional sediments were collected using a  
15 gravity corer to sample the consolidated sediments beneath the sediment surface. The sediment  
16 elutriate test data were compared to Maryland water quality standards for estuarine and salt water  
17 to determine if potential water column effects might result from open water placement of the  
18 dredged material from these approach channels (Table 5-18).  
19

### 20 Human Health

21

22 The potential for the general public health risk associated with contaminant levels in sediments at  
23 Site 104 can be evaluated on a screening level by comparing ambient sediment concentrations  
24 with U.S. EPA Region III Risk Based Concentrations (RBCs [U.S. EPA 1998]). RBCs are  
25 screening level tools that are set at levels low enough that humans exposed to these  
26 concentrations in industrial or residential soils will not experience unacceptable risk levels  
27 related to increased incidence of cancer or other non-carcinogenic human health endpoints. In  
28 the case of the residential soil RBC, the assumption is that exposure will occur over a longer  
29 period of time than for exposure to soil in an industrial scenario.  
30

31 It is unlikely that humans will come in direct contact with the sediments at Site 104 or in the  
32 channels to be dredged and placed at Site 104. Dredging contractors may be more likely than the  
33 general public to come in direct contact with the sediments dredged from channels to be placed  
34 at Site 104, but their exposure would be sporadic. Dredging contractors are unlikely to come in  
35 contact with existing sediments at Site 104. Environmental sampling personnel contracted to  
36 collect samples in the channels to be dredged or at Site 104 have the potential for exposure to  
37 sediments during the sample collection procedure, but standard protocol requires that sampling  
38 personnel utilize personal protective equipment (PPE) which prevents direct dermal contact with  
39 the sediments. If ambient concentrations in these sediments are less than RBCs, it is reasonable  
40 to assume that human health risks from other exposure pathways (e.g., ingestion of fish or  
41 shellfish which were exposed to sediments) should be even lower, and should also result in  
42 acceptable risk levels.  
43

### 44 **Field Sampling**

45

46 Sediment sampling was conducted on 23 September 1997 in the vicinity of Site 104 by EA  
47 Engineering, Science, and Technology, Inc. under contract to CENAB. Analyses of the sediment

## NOT UPDATED

1 samples were performed by EA (organics and inorganics), the University of Maryland's HPEL  
2 (nutrients), and E2Si (grain size and Atterberg limit tests) (EA 1997). The results of this final  
3 data report are summarized in this section, and the entire report is included in Appendix D.1.

4  
5 Sediment samples were collected at eight locations: four inside the boundaries of Site 104 and  
6 four outside (Figure 5-21). Most of these sediment sampling locations corresponded with  
7 stations monitored for water quality (MDE 1998a Section 5.1.4) and benthic community analyses  
8 (MDE 1998b) (Section 5.1.6.c) (Figure 5-21). Two sediment sampling locations (KI-15 and KI-  
9 16) were newly established for this September 1997 sediment collection. Depths at the sampling  
10 locations inside Site 104 ranged from -12.5 m (-41 ft) to -18 m (-61 ft); depths at the four  
11 reference locations ranged from -12 m (-40 ft) to -24 m (-80 ft).

### 12 13 Physical Conditions

14  
15 Sediments in the vicinity of Site 104 were predominantly silts and clays, with trace amounts of  
16 sand, although up to 24 percent sand was present at two locations (KI-5 and KI-7). Sediments  
17 collected at location KI-7 were visibly different from the sediment collected at the other seven  
18 stations. Field sampling personnel noted that only the sediments from KI-7 were characterized  
19 by an oily smell. The sediments at KI-7 were described as a "dark gray tacky substance at  
20 approximately 8 in. depth (20 cm), surface layer very black, tar-like consistency, oil sheen" (EA  
21 1997). Sediments at KI-7 were 23.5 percent sand and 1 percent gravel, the highest sand and  
22 gravel content for this group of samples (EA 1997).

23  
24 Piston core samples collected by MGS in September 1997 at nearby stations in the southern,  
25 deeper part of Site 104 were also characterized by "a variety of fairly firm, stiff light grey and  
26 pink clays," with admixtures of sands and small gravel-sized sediments in a mud matrix (Halka  
27 1997). Sediments with physical characteristics similar to those observed at these stations nearby  
28 KI-7 are not normally encountered in deeper waters of the Chesapeake Bay, and are likely the  
29 result of sediments originally dredged in the Baltimore Harbor area (Halka 1997) and deposited  
30 at Site 104 during its active period, 1924-1975 (Halka 1998). These former Harbor sediments  
31 might be buried by sediments ranging in depth from 22 to 73 cm, assuming an approximate  
32 deposition rate of 1 cm/yr (Eskin *et al.* 1996; Halka 1998), and a possible placement date  
33 between 1924 and 1975.

### 34 35 Organic Analysis

36  
37 Organic analyses included volatile organic compounds, semi-volatile organic compounds, semi-  
38 volatile polycyclic aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls  
39 (PCBs). Volatile organic compounds were below detection limits at all sediment sampling  
40 locations. Detection limits were established by the analytical laboratory for each sample and  
41 analysis, based upon the sample quantitation limit, corrected for sample dilution (if any) and  
42 percent moisture. As shown in the tables in Appendix D.1, 49 semi-volatile organic compounds  
43 were tested at each of the 8 sample sites. With only 4 exceptions out of 392 sampled analytes,  
44 semi-volatile organic compounds (other than PAHs) were also below detection limits at all  
45 locations. Two semi-volatile organic compounds, bis(2-ethylhexyl)phthalate and 2-  
46 methylphenol, were detected at concentrations equal to their detection limits at locations KI-1

## NOT UPDATED

1 and KI-11, respectively. A semi-volatile organic compound, 3+4-methylphenol, was detected at  
2 locations KI-7 and KI-15. The majority of the sixteen typically detected PAHs were found at the  
3 sediment sampling locations; details of ambient concentrations and implications are discussed in  
4 the next two sections.

5  
6 Most pesticides and PCBs were below detection limits at the sediment sampling stations, with  
7 limited exceptions. Exceptions included location KI-7, at which five pesticides (1,1-dichloro-  
8 2,2-bis(p-chlorophenyl)ethylene (DDE), aldrin, endosulfan-I, endrin aldehyde, and heptachlor  
9 epoxide) and two aroclors (1254 and 1260) were detected. Heptachlor epoxide was detected at  
10 three of the eight sampling locations, but was also detected in the field blank, suggesting the  
11 possibility of contamination in the field. Three pesticides (endrin, endrin aldehyde, and  
12 methoxychlor) were detected at the reference location KI-14. Details of ambient concentrations  
13 of pesticides and PCBs, and implications of these concentrations are discussed in the next two  
14 sections.

### 15 16 Environmental Health Effects

17  
18 All sediment PAH concentrations were less than the PELs (Table 5-19). With the exception of  
19 naphthalene at KI-3 and anthracene and phenanthrene at KI-7, none of the PAH concentrations  
20 exceeded the NOELs. Because PAH concentrations were less than PELs in all cases, and less  
21 than NOELs in most cases, adverse biological effects to aquatic organisms at Site 104 due to  
22 sediment concentrations of PAHs would not be likely. PAHs are widely found throughout the  
23 Bay.

24  
25 The pesticide DDE concentration at KI-7 was well below the PEL, and only slightly higher than  
26 the NOEL; NOELs and PELs were not available for the other pesticides detected at KI-7. PELs  
27 are not also available for the three pesticides detected at reference location KI-14. Because most  
28 pesticides and PCBs were either below detection limits or below available PELs and only  
29 slightly higher than NOEL, adverse biological effects to aquatic organisms are not expected.

### 30 31 Human Health Effects

32  
33 Concentrations of PAHs at Site 104 were less than residential soil RBCs for all PAHs except  
34 benzo[a]pyrene (BAP), for which the sediment concentration at KI-7 exceeded the RBC by less  
35 than 7 percent. BAP concentrations at KI-7 were substantially lower than the industrial soil  
36 RBC. The BAP RBC is based upon increased incidence of cancer upon exposure to soils. Based  
37 upon the relatively small degree of exceedence of the residential soil RBC, and the fact that the  
38 sediments did not exceed the industrial soil RBC, little incremental human health risk is  
39 anticipated, given the unlikelihood of human exposure extended (greater than 8 hours/day) to  
40 BAP in sediments present at Site 104.

41  
42 Concentrations of pesticides and PCBs at Site 104 were substantially lower than the RBCs for  
43 residential and industrial soil exposure. Therefore, there is little likelihood of increased risk to  
44 human health due to potential exposure to pesticides and PCBs in Site 104 sediments.

1 **Metals Analysis**

2  
3 With the exception of metals at location KI-7, sediment concentrations of most metals (arsenic,  
4 chromium, copper, lead, mercury, nickel and zinc) at Site 104 (Table 5-20), were similar to  
5 concentrations reported in clean sediments from the navigation channels in the main stem of the  
6 Chesapeake Bay (EA 1996) (Table 5-21). Cadmium concentrations in Site 104 sediments,  
7 however, were higher than the maximum cadmium concentrations reported in these clean  
8 sediments (Table 5-21). Sediment metal concentrations (arsenic, cadmium, copper, lead,  
9 mercury, nickel, and zinc) at location KI-7 (Table 5-21) were higher than the maximum reported  
10 in clean sediments, except for nickel. Nickel concentrations at KI-7 were similar to those found  
11 in the channel and at other Site 104 locations. Details of sediment metals concentrations at Site  
12 104 compared to quality guidelines and other Chesapeake Bay sediments are discussed in the  
13 following two sections:

14  
15 Environmental Health Effects

16  
17 With the exception of chromium, sediment metal concentrations were generally higher than  
18 NOELs at most sediment sampling locations (both in-site and reference) in the vicinity of Site  
19 104 (Table 5-21). Chromium was detected at concentrations below the NOEL at three of the  
20 eight sampling locations (two within the site and one reference station). Sediment metal  
21 concentrations were generally less than the PELs at most stations; however, metal concentrations  
22 at KI-7 exceeded PELs for all metals for which PELs were available, except chromium.  
23 Cadmium concentrations exceeded the PEL at all locations at Site 104 (both in-site and  
24 reference).

25  
26 The Tier I evaluation of available data on sediment metal concentrations compared to sediment  
27 guidelines indicated that maximum sediment metal concentrations at areas to be dredged for  
28 disposal at Site 104 (main stem Chesapeake Bay channels) were higher than NOELs but were  
29 less than PELs, except for zinc, for which the maximum zinc concentration was higher than the  
30 PELs. Mean concentrations of sediment metals in the main channels were all less than PELs.

31  
32 Sediment metal concentrations greater than NOELs but less than PELs would imply that adverse  
33 effects, such as increased mortality rates in benthic organisms may be possible but are not  
34 probable. Effects of the exceedences of these sediment quality guidelines at KI-7 were reflected  
35 in benthic species diversity indices at KI-7 in September 1997 which was lower than all other  
36 locations except the deep location KI-14 (MDE 1998b Section 5.1.6.c). However, overall  
37 abundance of benthic organisms at KI-7 ranked fourth highest of the 10 locations sampled in  
38 September 1997. The benthic index of biotic integrity at KI-7 in September 1997 also ranked  
39 fourth of 10 locations (MDE 1998b Section 5.1.6.c). These mixed results probably reflect the  
40 conservative derivation of the NOEL and PEL thresholds and demonstrate how exceedences of  
41 the PEL do not always infer effects.

42  
43 Human Health Effects

44  
45 Sediment metal concentrations in the vicinity of Site 104 were less than the residential soil RBCs  
46 for all metals except arsenic. Arsenic concentrations at all eight sediment quality stations in the

## NOT UPDATED

1 vicinity of Site 104 exceeded the RBCs (both residential and industrial soil) for arsenic. The  
2 arsenic RBC is based upon increased cancer incidence upon exposure to soils.

3  
4 Maximum metal concentrations in the clean sediments of the navigational channels in the main  
5 stem of the Chesapeake Bay near Baltimore (Table 5-21) were substantially lower than the  
6 industrial soil RBCs for all metals except arsenic (no RBC is available for lead). Mean and  
7 maximum sediment arsenic concentrations in the navigational channels are substantially lower  
8 than arsenic concentrations inside Site 104 (especially KI-7), but still exceeded both the  
9 residential and industrial soil RBCs. However, because humans are not expected to be directly  
10 exposed to sediments in the navigational channels or in the vicinity of Site 104, little additional  
11 human health risk associated with exposure to these sediments is expected. Burial of existing  
12 sediments inside Site 104 with sediments from the navigational channels would lower the mean  
13 arsenic concentrations in surficial sediments at Site 104.

### 14 15 **Summary**

16  
17 In summary, sediment concentrations of most organic and inorganic constituents in the vicinity  
18 of Site 104 were well below levels that would likely cause adverse biological effects to aquatic  
19 organisms or, if found in residential soils, might result in unacceptable human health risks.  
20 Sediment metal concentrations at KI-7 were higher than at nearby locations, and exceeded PELs,  
21 but these exceedences were not necessarily reflected in lower benthic abundances. BAP and  
22 arsenic concentrations in the sediments in the vicinity of Site 104 were higher than residential  
23 RBCs, suggesting that unacceptable human health risks could result if humans were exposed to  
24 these sediments to the same extent that they would be exposed to soils around their homes.  
25 Arsenic in clean sediments from the navigational channels of the main stem Chesapeake Bay  
26 near Baltimore, on average, were substantially lower than those at Site 104, but also exceeded  
27 the residential arsenic RBC. Because sustained human exposure to these sediments is unlikely,  
28 unacceptable human health risks from exposure to metals in the sediments are not expected.

29  
30

1 **5.1.5- Sediment**

2  
3 **5.1.5.1a- General Overview of Physical Behavior of Dredged Material at Aquatic Sites.**

4  
5 Aquatic placement in conjunction with site selection and management techniques and dredged  
6 material testing procedures to ensure environmentally sound placement is the most widely used  
7 management option for uncontaminated dredged material in the United States and around the  
8 world. To properly use these management tools, it is important to recognize the behavior of  
9 dredged material at aquatic placement sites and how that behavior affects the potential for  
10 environmental consequences.

11  
12 This summary, taken from a much more detailed discussion in MES (1999), describes the typical  
13 distribution of deposited dredged material around the release point, and the  
14 distance-time-concentration relationships typical of suspended sediments around aquatic dredged  
15 material placement sites.

16  
17 When dredged material is released from a vessel, the vast majority of the material falls quickly to  
18 the bottom. The size and configuration of the deposit are determined by many factors. Both  
19 suspended and deposited sediments have potential ecological ramifications. Deposited  
20 sediments inevitably bury the existing seafloor and any benthic (bottom-dwelling) organisms  
21 living in or on it. Sediment that remains in suspension after the moment of discharge will settle  
22 out of the water column or become so diffused that the concentration cannot be distinguished  
23 from background levels.

24  
25 This summary should not be construed as predictive of conditions likely to result from any  
26 specific dredged material placement operation, but indicate the limits within which most  
27 operations would typically be expected to fall.

28  
29 Sediment deposits tend to be thickest at the point of release, and become thinner with distance  
30 from the release point. Dredged material that is clumped in the barge tends to form thick  
31 deposits with less lateral spread, while slurried material tends to form thinner deposits with more  
32 lateral spread. Deposits of slurried dredged material may be several feet thick at the center, and  
33 may spread laterally over hundreds of feet. Deposits of slurried material tend to be very low  
34 relief, with side slopes on the order of 1/100 or 2/100. Barge position at the time of release can  
35 be controlled to influence the thickness and lateral spread of the overall deposit resulting from  
36 the complete project. Sediment is shifted and redeposited by natural processes like storms, but to  
37 a lesser degree than by dredged material placement.

38  
39 Suspended sediment concentrations tend to be highest at the point and time of release, and  
40 decrease with distance and time from the release. Suspended sediment concentrations tend to be  
41 lower in the upper water column, and higher closer to the bottom. Suspended sediment  
42 concentrations in the upper water column may have a maximum value on the order of a few  
43 hundred mg/l (parts per million – ppm) near the release point at aquatic placement sites.  
44 Suspended sediment concentrations near the bottom at aquatic placement operations may have a  
45 maximum value on the order of several hundreds of mg/l. Suspended sediment concentrations  
46 tend to dissipate to approximately background conditions within distances on the order of 800 to  
47 1400 meters from the release point. Suspended sediment concentrations near aquatic placement

48 operations tend to dissipate to approximately background conditions within less than an hour  
49 after release in many cases. Dissolved constituents in the discharge tend to follow time and  
50 space patterns of distribution roughly similar to suspended sediments.

51  
52 Sediment is suspended by dredged material placement and by natural processes like wind, waves  
53 and currents. Suspended sediment concentrations from dredging operations tend to be on the  
54 same general order as natural maximum suspended sediment concentrations. Naturally elevated  
55 suspended sediment concentrations tend to cover large areas and persist continuously for perhaps  
56 a few days. Suspended sediment (and dissolved constituents) from aquatic placement of  
57 mechanically dredged material tend to cover relatively small areas and persist for perhaps a few  
58 hours, but to be repeated several times a day for periods of weeks or months.

59  
60 The potential ecological implications of dredged material distribution can be accurately assessed  
61 only in the context of the major factors that control the overall effect of any environmental stress.  
62 Important among these are:

- 63  
64 • **Concentration:** Other things being equal, the farther any parameter is from normal  
65 values the more stressful it becomes to organisms that experience it.
- 66  
67 • **Time:** Other things being equal, the longer any parameter deviates from normal values  
68 the more stressful it becomes to organisms that experience it.
- 69  
70 • **Area:** Other things being equal, the larger an area in which any parameter deviates from  
71 normal values the more organisms will experience it, and the greater the potential for the  
72 population as a whole to be affected.

73  
74 **5.1.5.2-b Tiered Evaluation.**— Discussion of tiered approach, what is evaluated in which tier.

75  
76 The U. S. Environmental Protection Agency's (EPA) Guidelines for Specification of Disposal  
77 Sites for Dredged or Fill Material implementing Section 404(b)(1) of the Clean Water Act are  
78 published in the Code of Federal Regulations at 40 CFR Part 230. The technical evaluation of  
79 potential effects of contaminants that may be associated with dredged material is to be conducted  
80 in accordance with 40 CFR 230.60 and 230.61. The EPA and U. S. Army Corps of Engineers  
81 (USACE) have jointly published a Testing Manual (U.S. EPA 1998c) describing testing and  
82 evaluation in accordance with 40 CFR 230.60 and 230.61 of dredged material proposed for  
83 placement in waters of the United States.

84  
85 The testing manual (U.S. EPA 1998c) uses a tiered approach to testing. The initial tier (Tier I)  
86 uses readily available existing information, and if this is inadequate to support a decision, testing  
87 proceeds through subsequent tiers of successively more extensive and specific testing until  
88 sufficient information to support a decision is generated. It is necessary to proceed through the  
89 tiers only until information on each topic sufficient to make the required factual determinations  
90 has been obtained. If the existing information compiled in Tier I is complete and comparable to  
91 that which would be sufficient to make a decision in higher tiers, factual determinations can be  
92 made without more testing in the higher tiers (U.S. EPA 1998c). In such cases, the existing (Tier

93 I) information for each type of data is evaluated in relation to the guidance for that type of data  
94 presented in Tier II or III in the manual (U.S. EPA 1998c).

95  
96 The manual (U.S. EPA 1998c) specifies that potential effects both in the water column and from  
97 deposited dredged material be evaluated, as summarized below. An action may be disapproved  
98 if there are unacceptable adverse effects to either the water column or from deposited dredged  
99 material; it may be approved only if both water column and deposited dredged material effects  
100 are acceptable.

- 101
- 102 • **Water column effects** address the chemical quality of the water, and thus potential  
103 effects on water-column organisms. Water column effects are evaluated by comparison of  
104 elutriate test results to water quality criteria and standards, considering the mixing that  
105 will occur at the site.
  - 106
  - 107 • **Deposited dredged material effects** are the emphasis of the evaluation because  
108 organisms can be exposed to deposited dredged material for extended periods. Two  
109 aspects of deposited dredged material are evaluated:  
110
    - 111 ▪ **Bioaccumulation** or the accumulation of chemical constituents from the dredged  
112 material in the tissues of organisms. If biologically adverse constituents were  
113 accumulated to sufficiently high levels both the organisms themselves and their  
114 predators, including humans, could potentially be affected. Bioaccumulation is  
115 evaluated by comparing dredged material test results to (1) bioaccumulation from a  
116 reference sediment, and (2) potentially adverse levels documented in the scientific  
117 literature. (I ASSUME THE REFERENCE SEDIMENT CONCEPT HAS BEEN  
118 EXPLAINED ELSEWHERE)
    - 119
    - 120 ▪ **Toxicity** is evaluated by comparing toxicity of dredged material to toxicity of  
121 reference sediment.
- 122

123 Spatial considerations are important in evaluating test data. Sedentary organisms (e.g., clams)  
124 may spend their entire life at the dredged material placement site, resulting in elevated body  
125 burdens (bioaccumulation) of some constituents from the dredged material in individuals on the  
126 site. This same site may constitute only a small proportion of the feeding range of a mobile  
127 predator (e.g., fish). Such a site typically provides only a small proportion of the prey of such a  
128 predator, unless something about the site is peculiarly attractive to the predator. Therefore, the  
129 site may contribute only a small proportion of the total diet, and the predator may receive a  
130 relatively small dose of the constituent bioaccumulated by the prey from the site. The net result  
131 may be that the site is of relatively little consequence to the predator.

132  
133 Potential human health evaluations focus on determination of potential effects on individuals. In  
134 contrast, ecological evaluations focus more on effects that might threaten stable, self-  
135 perpetuating local populations and communities than about risks to individual organisms. This  
136 generalization does not apply when endangered species are of potential concern.

138 **5.1.5.2b.1. Tier I**

139  
140 Tier I consists of compiling the readily available existing information and evaluating that  
141 information to determine whether it provides a sufficient basis for making the factual  
142 determinations required by 40 CFR 230.

143  
144 **5.1.5.2b.1.1. Presentation of existing information**

145 **[EXISTING SITE 104 AND CHANNEL DATA TO BE UPDATED]**

146  
147  
148  
149 **5.1.5.2b.1.2. Tier I conclusions**

150 According to the manual (U.S. EPA 1998c), after consideration of all available Tier I  
151 information, one of the following conclusions is reached.

- 152  
153  
154 1. Existing information does not provide a sufficient basis for making factual  
155 determinations. In this case, further evaluation in higher tiers is appropriate.  
156  
157 2. Existing information provides a sufficient basis for making factual determinations. In  
158 this case, one of the following decisions is reached:

159  
160 (a)a. The material meets the criteria for exclusion from testing

161  
162 (b)b. The material does not meet the criteria for exclusion from testing, but information  
163 concerning the potential impact of the material is sufficient to make factual  
164 determinations.  
165

166 The existing Site 104 information presented in Section 5.1.5.2.1.1 leads to conclusion 2(b),  
167 because it provides a sufficient basis for making factual determinations and indicates that the  
168 dredged material does not meet the criteria for exclusion from testing. The existing information  
169 includes data on potential water column and deposited sediment effects, and addresses both  
170 toxicity and bioaccumulation. It is complete and comparable to that which would be sufficient to  
171 make a decision in higher tiers (i.e., Tier II for water quality and bioaccumulation data and Tier  
172 III for toxicity data). Therefore, the existing data will be evaluated according to the guidance  
173 (U.S. EPA1998c) in the appropriate tier for each type of data.

174  
175 **5.1.5.2b.2. Tier II**

176  
177 **5.1.5.2b.2.1. Water quality evaluation**

178  
179 Analytical chemistry data for the elutriate samples collected in 1995 and 1998 were evaluated for  
180 a large group of analytes collected from six sample locations: Swan Point Channel, Craighill  
181 Entrance / Craighill, Craighill Angle, Craighill Upper Range/Cutoff Angle, Tolchester, and  
182 Brewerton Eastern Extension. The following chemical suites were analyzed: volatile organics,  
183 semi-volatile organics, pesticides and PCBs, metals and general water chemistry parameters.

184  
185 Tables 1-1 and 1-2 summarize the results of the analytical characterizations and present all of the  
186 analytes with values which were equal to or greater than the reported analytical detection limit.  
187 The table does not present the data qualifiers, which may be important to the interpretation of the  
188 analytical results (e.g., J= estimated value; B= chemical measured in blank; E- estimated  
189 concentration). These qualifiers are discussed in the text below if they are important for a  
190 particular analyte.

191  
192 For those analytes which were detected, Tables 1-1 and 1-2 present the range of the reported  
193 elutriate sample concentrations. These undiluted elutriate concentration values are then  
194 compared to specific regulatory criteria which are applicable to estuarine / saltwater conditions:

- 195
- 196 ■ The saltwater acute and chronic aquatic life criteria from U.S. EPA's (1998c) National  
197 Recommended Water Quality Criteria [63 Federal Register 68354 - 68364], and  
198 Maryland Department of the Environment's ambient water quality criteria [COMAR  
199 26.08.02.03-2G]; and
  - 200
  - 201 ■ U.S. EPA's and MDE's criteria for the protection of human health from the consumption  
202 of contaminated aquatic organisms [63 Federal Register 68354 - 68364; and COMAR  
203 26.08.02.03-2G].

204  
205 Few of the more than 145 analytes analyzed in the samples were detected in the elutriate  
206 samples. For each of the detected analytes where a measured concentration exceeded a criterion,  
207 the required maximum dilution factor is calculated (maximum elutriate concentration / most  
208 restrictive criterion). Dilution modeling using the U.S. Army Corps of Engineers' STFATE  
209 model was conducted for both peak ebb and slack water tidal conditions by Moffatt and Nichol  
210 Engineers (30 September 1999- Draft). Each elutriate analyte with an undiluted concentration  
211 which exceeded a numerical criterion is discussed below.

212  
213 1. 1.1-Evaluation of the 1995 Elutriate Dataset

214  
215 Of the 145 analytes evaluated in 1995, only six had elutriate concentrations which  
216 exceeded any applicable numeric water quality criteria for saltwater. Each is presented in  
217 Table 1-1 and discussed below.

218  
219 a. 1.1.1-Copper

220  
221 Copper was detected in elutriates from each of the six stations at concentrations  
222 ranging from 1.7-3.5 µg/L. As shown in Table 1-1, the concentration measured in  
223 elutriates from three of the stations are slightly higher than U.S. EPA's (1998c)  
224 saltwater chronic aquatic life criterion, which is 3.1 µg/L (dissolved). However, the  
225 criterion would not be exceeded because the U.S. EPA's chronic criterion is a 4-day  
226 average concentration (U.S. EPA 1993), and modeling has shown that the elutriate  
227 concentration would be diluted to a concentration below the 4-day chronic criterion in  
228 less than five minutes under absolute worst case (slack water) conditions. Note also  
229 that the highest measured elutriate concentration (3.5 µg/L) is below MDE's estuarine

230 criterion of 6.1 µg/L. Thus, because of the transient nature of the dredged material  
231 release and the rapid dilution, ambient water quality criteria for copper should not be  
232 exceeded at the site.

233  
234 b. 4.1.2-Manganese

235 Manganese was measured in elutriates from each of the six stations at concentrations  
236 ranging from 589 - 9,960 µg/L. U.S. EPA's ambient water quality criterion for the  
237 protection of human health is 100 µg/L, was published in the Agency's (1976) Red  
238 Book, and was intended "to protect against a possible health hazard to humans by  
239 manganese accumulation in shellfish" (U.S. EPA 1993, p. 158).

240  
241 The assumptions upon which U.S. EPA's manganese criterion is based are not  
242 consistent with the water column exposure that will occur at the proposed dredged  
243 material disposal site. Specifically:

- 244  
245
- 246 ■ The transient and short duration in the water column will not allow mollusks to  
247 achieve a steady-state bioaccumulation factor, and therefore not accumulate  
248 manganese to high concentrations in their edible tissues. STFATE modeling for  
249 the site has shown that manganese concentrations are diluted by more than 100-  
250 fold under peak ebb flow within 60 minutes, and by approximately 80-fold under  
251 slack water conditions. Within hours, therefore, manganese concentrations are  
252 expected to be below U.S. EPA's 100 µg/L human health criterion.
  - 253  
254 ■ The manganese human health criterion is based on humans consuming the  
255 contaminated aquatic life on a regular basis for a **long duration (e.g., 6.5 grams**  
256 **per day for a 70 year lifetime)???** Because the proposed site will be closed to  
257 commercial fishing, it is highly unlikely that anyone could consume aquatic  
258 species collected from the site on a daily basis throughout their lifetime.
  - 259  
260 ■ EPA's criteria document states that "*very large doses of manganese can cause*  
261 *some diseases and liver damage, but these are not known to occur in the United*  
262 *States. Only a few manganese toxicity problems have been found throughout the*  
263 *world, and these have occurred under unique circumstances (i.e., a well in Japan*  
264 *near a deposit of buried batteries)*" (U.S. EPA 1993, p. 157).

265  
266 Therefore, based on the environmental fate and exposure that would occur at the  
267 proposed site, environmental concerns based on exposure to manganese are very  
268 unlikely.

269  
270 c. 4.1.3-Mercury

271  
272 Total mercury was "detected" in 5 of the 6 undiluted elutriate samples in the 1995  
273 dataset. Of these, 4 of the 5 were reported to be at concentrations ≤ 0.18 µg/L. The  
274 remaining value was 1.8 µg/L total mercury (Swan Point Channel), had an N-  
275 qualifier (MS outside of control limits). Comparisons of these concentrations with

276 aquatic life and human health criteria are presented in Table 1-1, and discussed  
277 below.

278  
279 Acute Criteria Comparisons

280  
281 The highest elutriate concentration measured (1.8 µg/L) is numerically equivalent to  
282 U.S. EPA's (1998c) acute aquatic life criterion of 1.8 µg/L (dissolved). However,  
283 U.S. EPA's acute criterion is a 1-hour average exposure concentration, and the  
284 STFATE modeling has demonstrated that the highest measured elutriate  
285 concentration will be below the acute criterion in less than 5 minutes under worst-  
286 case slack water conditions.

287  
288 Chronic Aquatic Life Comparisons

289  
290 As shown in Table 1-1, U.S. EPA's (1998c) and MDE's chronic criteria differ  
291 substantially (0.94 µg/L versus 0.025 µg/L, respectively) because MDE's value is  
292 based upon U.S. EPA's (1986) Gold Book value which was substantially revised  
293 during U.S. EPA's promulgation of revised water quality standards for the state of  
294 California [62 Federal Register 42194 (5 Aug 97); and 63 Federal Register 68357 (10  
295 Dec 98)]. As a result, U.S. EPA's revised value (0.94 µg/L- dissolved) is considered  
296 to be the most scientifically valid chronic criterion for the protection of saltwater  
297 aquatic life. Based on this updated criterion, only the highest elutriate value (1.8  
298 µg/L) exceeds EPA's 4-day average chronic criterion (0.94 µg/L) by a factor of two.  
299 STFATE modeling has demonstrated that the highest measured elutriate  
300 concentration will be below EPA's chronic criterion in less than 5 minutes under  
301 worst-case slack water conditions. Thus, U.S. EPA's chronic criterion would not be  
302 exceeded at the proposed site. Similarly, STFATE modeling shows that MDE's 4-day  
303 average chronic criterion of 0.025 µg/L would be met within several hours under  
304 slack water conditions, and in less than 1 hour under peak ebb conditions.

305  
306 Human Health Criteria Comparisons

307  
308 Concentrations measured in undiluted elutriates from the four stations exceed U.S.  
309 EPA's and MDE's human health criteria by factors of 35 and 12, respectively. As  
310 discussed above, MDE's value is based upon U.S. EPA's (1986) Gold Book value  
311 which was substantially revised during U.S. EPA's promulgation of revised water  
312 quality standards for the state of California [62 Federal Register 42194 (5 Aug 97);  
313 and 63 Federal Register 68357 (10 Dec 98)]. As a result, U.S. EPA's (1998c) more  
314 stringent value (0.051 µg/L) is considered to be the most scientifically valid criterion  
315 for the protection of human health from the consumption of contaminated organisms.  
316 The transient and short duration in the water column will not allow aquatic species to  
317 achieve a steady-state bioaccumulation factor, and therefore not accumulate mercury  
318 to high concentrations in their edible tissues. STFATE modeling for the site has  
319 shown that mercury concentrations are diluted by more than 100-fold during peak ebb  
320 flow within 60 minutes, and by approximately 80-fold under slack water conditions.  
321 In less than one hour, therefore, mercury concentrations are expected to be below

322 U.S. EPA's human health criterion. As stated by U.S. EPA (1980) the mercury  
323 criterion should be interpreted "*as a time-weighted average concentration covering a*  
324 *period of 2 months or so. In other words it should not be regarded as an*  
325 *instantaneous value that should never be exceeded even for brief periods of time*" (p.  
326 C-106). Finally, because the proposed site will be closed to commercial fishing, it is  
327 highly unlikely that consumers could obtain and eat aquatic species collected from the  
328 site on a daily basis throughout their lifetime, **which is an assumption of the**  
329 **criterion.**  
330

331 d. 4.1.4-Nickel

332  
333 Nickel was detected in elutriates from each of the six stations at concentrations  
334 ranging from 3.3-41.3 µg/L. The concentration measured in elutriates from four of  
335 the stations are higher than U.S. EPA's (1998c) and MDE's saltwater chronic aquatic  
336 life criterion (8.2 µg/L-dissolved). However, the criterion would not be exceeded  
337 because the nickel chronic criterion is a 4-day average concentration (U.S. EPA  
338 1993), and STFATE modeling has shown that the highest elutriate concentration  
339 (41.3 µg/L) would be diluted to a concentration below the 4-day chronic criterion in  
340 less than 15 minutes under absolute worst case (slack water) conditions. Thus,  
341 because of the transient nature of the release, ambient water quality criteria for nickel  
342 should not be exceeded at the site.  
343

344 e. 4.1.5-Silver

345  
346 Silver was detected in elutriates from two of the stations sampled in 1995 at  
347 concentrations of 4 and 5 µg/L (data qualified as between the IDL and CRDL). As  
348 shown in Table 1-1, these concentrations exceed the values in U.S. EPA's (1998c)  
349 and MDE's saltwater acute criteria for the protection of aquatic life. However, the  
350 criteria are 1-hour average concentrations (U.S. EPA 1993), and the STFATE  
351 modeling has demonstrated that the highest measured elutriate concentration will be  
352 diluted to below the EPA and MDE acute criteria in less than 5 minutes under worst-  
353 case slack water conditions, and quicker under ebb tide conditions. Thus, ambient  
354 water quality criteria for silver should not be exceeded at the site.  
355

356 f. 4.1.6-Ammonia

357  
358 Ammonia was detected in elutriate samples from each of the six sites in  
359 concentrations ranging from 1.4 to 10.8 mg/L total ammonia (as nitrogen). U.S.  
360 EPA's (1993) total ammonia criteria vary with pH, temperature and salinity (which  
361 were assumed for this analysis to be 7.4, 20° and 10 g/kg, respectively). As shown in  
362 Table 1-1, elutriate samples from five of the six stations exceeded U.S. EPA's (1993)  
363 saltwater criterion of 3.0 mg/L total ammonia (as nitrogen). The highest elutriate  
364 value (10.8 mg/L) is 3.6 times higher than the 4-day average chronic criterion. Based  
365 on STFATE modeling, however, the highest elutriate concentration would be diluted  
366 to below U.S. EPA's 4-day average criterion in less than 15 minutes under worst case

367 slack water conditions, and less than 5 minutes under ebb flow. Therefore, ambient  
368 ammonia criteria will not be exceeded.

369  
370

371 4.2.2. Evaluation of the 1998 Elutriate Dataset

372  
373

Of the 162 analytes evaluated in the 1998 sampling program, only six had elutriate  
374 concentrations which exceeded any applicable numeric criteria for saltwater. Each is  
375 presented in Table 1-2 and discussed below.

376  
377

a. 4.2.1 Heptachlor

378  
379

Heptachlor was detected at very low concentrations in elutriates from each of the six  
380 stations in 1998. The six samples ranged from 0.009 to 0.022 µg/L, which are near  
381 the reported instrument detection limit of 0.006 µg/L. U.S. EPA's (1998c) ambient  
382 criterion for the protection of human health from the consumption of contaminated  
383 aquatic life is 0.00021 µg/L, 29 times lower than the instrument detection limit. As  
384 discussed in U.S. EPA water quality criteria documents (e.g., EPA 1993, Appendix  
385 C) the Agency's criterion is based upon the following *assumptions*:

386  
387

- The criterion is the exposure concentration that is estimated to cause a lifetime  
388 carcinogenic risk of  $10^{-6}$  (i.e., causing one additional cancer out of one million  
389 exposed persons),
- "*Continuous exposure to the compound*" throughout a 70 year human lifespan,  
391 which would require daily consumption of contaminated organisms from the site  
392 for 70 years,
- The consumed organisms are exposed to the chemical for a sufficient duration  
393 that they reach a maximum steady state tissue concentration, and
- A continuously exposed population of edible contaminated organisms from the  
394 site that is sufficient to feed a population on a daily basis for 70 years.

395  
396  
397

The assumptions upon which U.S. EPA's heptachlor criterion is based are not  
398 consistent with the water column exposure that will occur at the proposed dredged  
399 material disposal site. Further, a dilution factor of 105 would reduce the highest of  
400 the heptachlor concentrations below EPA's ambient water quality criterion. STFATE  
401 modeling has demonstrated that this amount of dilution would occur within a few  
402 hours under slack or ebb tide conditions. Therefore, measured elutriate  
403 concentrations of heptachlor would not have adverse effects to human health.

404  
405  
406

b. 4.2.2 Heptachlor epoxide

407  
408

Heptachlor epoxide was detected at very low concentrations in elutriates from each of  
409 the six stations in 1998. The six samples ranged from 0.0027 to 0.0076 µg/L, and  
410 each value has important laboratory qualifiers (i.e., five of the six reported heptachlor  
411 epoxide in the blank, and the remaining sample was "estimated"). U.S. EPA's  
412 (1998c) ambient criterion for the protection of human health from the consumption of

413 contaminated aquatic life is 0.00011 µg/L, 9 times lower than the instrument  
414 detection limit (0.001 µg/L). The discussion immediately above for heptachlor also  
415 applies for heptachlor epoxide; except the required dilution factor of 69 (see Table 1-  
416 2) would be achieved slightly quicker.

417  
418 c. 1.2.3-Manganese

419  
420 Manganese was measured in elutriates from each of the five stations at concentrations  
421 ranging from 746 - 11,200 µg/L. U.S. EPA's ambient water quality criterion for the  
422 protection of human health is 100 µg/L, was published in the Agency's (1976) Red  
423 Book, and was intended "*to protect against a possible health hazard to humans by*  
424 *manganese accumulation in shellfish*" (U.S. EPA 1993, p. 158).

425  
426 As discussed for the 1995 manganese dataset (above), the assumptions upon which  
427 U.S. EPA's manganese criterion are based are not consistent with the water column  
428 exposure which will occur at the proposed dredged material disposal site.  
429 Specifically, the transient and short duration in the water column will not allow  
430 resident mollusks to achieve a steady-state bioaccumulation factor, and therefore not  
431 accumulate manganese to high concentrations in their edible tissues for long-term  
432 human consumption. STFATE modeling for the site has shown that manganese  
433 concentrations are diluted by more than 100-fold under peak ebb flow within 60  
434 minutes, and by approximately 80-fold under slack water conditions. With a  
435 maximum required dilution factor of 112 (see Table 1-2), manganese concentrations  
436 are expected to be below U.S. EPA's 100 µg/L human health criterion within several  
437 hours. Therefore, based on the environmental fate and exposure that would occur at  
438 the proposed site, environmental concerns based on exposure to manganese are very  
439 unlikely.

440  
441 d. 1.2.4-Mercury

442  
443 Total mercury was "detected" in 3 of the 5 undiluted elutriate samples in the 1998  
444 dataset at concentrations ranging from 0.12 to 0.97 µg/L. Each of the three had a data  
445 qualifier noting the concentration reported was greater than the Instrument Detection  
446 Limit (IDL) but less than the Reporting Limit (RL). Comparisons of these  
447 concentrations with aquatic life and human health criteria are presented in Table 1-2,  
448 and discussed below.

449  
450 Chronic Aquatic Life Comparisons

451  
452 As shown in Table 1-2, U.S. EPA's (1998c) and MDE's chronic criteria differ  
453 substantially (0.94 µg/L versus 0.025 µg/L, respectively) because MDE's value is  
454 based upon U.S. EPA's (1986) Gold Book value which was substantially revised  
455 during U.S. EPA's promulgation of revised water quality standards for the state of  
456 California [62 Federal Register 42194 (5 Aug 97); and 63 Federal Register 68357 (10  
457 Dec 98)]. As a result, U.S. EPA's revised value (0.94 µg/L- dissolved) is considered  
458 to be the most scientifically valid chronic criterion for the protection of saltwater

459 aquatic life. Based on this updated criterion, the highest elutriate value (0.97 µg/L)  
460 exceeds EPA's 4-day average chronic criterion (0.94 µg/L) by only 3 percent.  
461 STFATE modeling has demonstrated that the highest measured elutriate  
462 concentration will be below EPA's chronic criterion in less than 5 minutes under  
463 worst-case slack water conditions. Thus, U.S. EPA's chronic criterion would not be  
464 exceeded at the proposed site. Similarly, STFATE modeling shows that MDE's 4-day  
465 average chronic criterion of 0.025 µg/L would be met within several hours under  
466 slack water conditions, and in less than 30 minutes under peak ebb conditions.

#### 467 Human Health Criteria Comparisons

468 Concentrations measured in undiluted elutriates from the three stations exceed U.S.  
469 EPA's and MDE's human health criteria by factors of 19 and 6.6, respectively. As  
470 discussed above, MDE's value is based upon U.S. EPA's (1986) Gold Book value  
471 which was substantially revised during U.S. EPA's promulgation of revised water  
472 quality standards for the state of California [62 Federal Register 42194 (5 Aug 97);  
473 and 63 Federal Register 68357 (10 Dec 98)]. As a result, U.S. EPA's (1998c) more  
474 stringent value (0.051 µg/L) is considered to be the most scientifically valid criterion  
475 for the protection of human health from the consumption of contaminated organisms.  
476 The transient and short duration in the water column will not allow aquatic species to  
477 achieve a steady-state bioaccumulation factor, and therefore not accumulate mercury  
478 to high concentrations in their edible tissues. STFATE modeling for the site has  
479 shown that mercury concentrations are diluted by more than 100-fold during peak ebb  
480 flow within 60 minutes, and by approximately 80-fold under slack water conditions.  
481 In less than one hour, therefore, mercury concentrations are expected to be below  
482 U.S. EPA's human health criterion. As stated by U.S. EPA (1980) the mercury  
483 criterion should be interpreted "*as a time-weighted average concentration covering a*  
484 *period of 2 months or so. In other words it should not be regarded as an*  
485 *instantaneous value that should never be exceeded even for brief periods of time*" (p.  
486 C-106). Finally, because the proposed site will be closed to commercial fishing, it is  
487 highly unlikely that consumers could obtain and eat aquatic species collected from the  
488 site on a daily basis throughout their lifetime, **which is an assumption of the**  
489 **criterion.**

490 Silver was detected in elutriates from three of the five stations samples in 1998 at  
491 concentrations ranging from 1.6 to 2.1 µg/L (data qualified as between the IDL and  
492 RL). As shown in Table 1-2, the highest concentration exceed U.S. EPA's (1998c)  
493 saltwater acute aquatic life criterion (1.9 µg/L-dissolved) by 10 percent. However,  
494 the criteria are 1-hour average concentrations (U.S. EPA 1993), and the STFATE  
495 modeling has demonstrated that the highest measured elutriate concentration will be  
496 diluted to below the EPA acute criterion in less than 5 minutes under worst-case slack  
497 water conditions, and quicker under ebb tide conditions. Thus, because of the  
498 transient nature of the release, ambient water quality criteria for silver should not be  
499 exceeded at the site.

504 e. 4.2.5 Ammonia  
505

506 Ammonia was detected in elutriate samples from each of the six sites in  
507 concentrations ranging from 1.7 to 8.8 mg/L total ammonia (as nitrogen). U.S. EPA's  
508 (1993) total ammonia criteria vary with pH, temperature and salinity (which were  
509 assumed for this analysis to be 7.4, 20° and 10 g/kg, respectively). As shown in  
510 Table 1-2, elutriate samples from five of the six stations exceeded U.S. EPA's (1993)  
511 saltwater criterion of 3.0 mg/L total ammonia (as nitrogen). The highest elutriate  
512 value (8.8 mg/L) is 2.9 times higher than the 4-day average chronic criterion. Based  
513 on STFATE modeling, however, the highest elutriate concentration would be diluted  
514 to below U.S. EPA's 4-day average criterion in less than 15 minutes under worst case  
515 slack water conditions, and less than 5 minutes under ebb flow. Therefore, given the  
516 transient nature of the release, ambient ammonia criteria will not be exceeded.  
517

518 **5.1.5.2b.2.2. Water quality conclusions**  
519

520 According to the manual (U.S. EPA 1998c), after consideration of the Tier II water quality data,  
521 one of two possible conclusions is reached regarding the potential water column impact of the  
522 proposed dredged material:  
523

- 524 1. The available water quality requirements are met. Further information on water column  
525 toxicity must be evaluated in Tier III when there are contaminants of concern for which  
526 applicable water quality criteria or standards are not available or where interactive effects  
527 are of concern.  
528
- 529 2. Concentrations of one or more of the dissolved contaminants of concern, after allowance  
530 for mixing, exceeds applicable water quality criteria or standards beyond the boundaries  
531 of the mixing zone. In this case, the proposed discharge of dredged material does not  
532 comply with the water quality criteria or standards.  
533

534 The preceding discussion of the data demonstrates that the available water quality requirements  
535 are met. Most dissolved contaminants of concern in the discharge are predicted to be below the  
536 applicable water quality criteria or standards. Those that exceed the applicable water quality  
537 criteria or standards do so by relatively small margins. Mixing and dispersion at Site 104 will  
538 bring them into compliance with the applicable criteria or standards within a matter of minutes  
539 and hundreds of yards of the discharge point, which will be at least 1000 yards inside the site  
540 boundary.  
541

542 **5.1.5.2b.2.3. Bioaccumulation** (TBP for each COC in relation to reference, Corps'  
543 Environmental Residue-Effects Database (ERED), and human exposure via consumption.  
544

545 **5.1.5.b.2.3.1 Basis for evaluation**  
546

547 **Environmental Residue-Effects Database.** The Environmental Residue-Effects Database  
548 (ERED) is a compilation of data relating bioaccumulation of individual chemicals to specific  
549 biological changes in particular species. ERED is maintained by the EPA and USACE and is

550 updated regularly. The biological changes or endpoints in ERED include any endpoints reported  
551 in the peer-reviewed scientific literature in conjunction with appropriate bioaccumulation data.  
552 Some of these studies involve important physiological processes, but measure specific biological  
553 endpoints whose consequences, if any, at the organism or ecosystem level are not at all clear  
554 (e.g., reduced glucose content of the coelomic fluid). Other endpoints are of clear importance at  
555 the level of the organism (e.g., survival, growth) or ecosystem (e.g., various measures of  
556 reproduction). Because of the diversity of species and chemical constituents reported in the  
557 literature, ERED may contain relatively few data for the exact species and chemical tested for  
558 any particular project. However, data for related species and chemicals are useful in evaluating  
559 bioaccumulation. For evaluation of this project, if ERED data were not available for *Neanthes*  
560 species, data for any annelid were considered potentially useful substitutes. If ERED data were  
561 not available for *Macoma* species, data for any bivalve mollusk were considered potentially  
562 useful substitutes. If ERED data were not available for individual pesticides or polychlorinated  
563 biphenyls (PCB), data for any chlorinated hydrocarbon were considered potentially useful for  
564 evaluating bioaccumulation. No substitutions were made for metals. PAH were evaluated by the  
565 critical body residue approach discussed below. The measurement in the ERED considered most  
566 useful for this evaluation was "no observed effect dose" (NOED), since this indicates the effects  
567 under study were not observed at a bioaccumulation level at least that high, and therefore the  
568 NOED is presumably a "safe" level in terms of those effects. If NOED data were not available,  
569 "lowest observed effects dose" (LOED) data were used. This is the lowest bioaccumulation  
570 level studied at which the effects under study were observed, and implies that the effects may  
571 occur at a level lower by some unknown margin.

572  
573

574 **[TABLES NEED TO BE ADDED]**

575  
576

577 The complete ERED information for all relevant constituents is presented in **Table 5.1.5.2.2.3.1-**  
578 **N** for *Neanthes virens*, and in **Table 5.1.5.2.2.3.1-M** for *Macoma nasuta*. All data in the ERED  
579 are presented in mg/kg wet weight, and this reporting basis is used in **Tables 5 and 6**. Because  
580 the Site 104 TBP bioaccumulation data (**Table ? from Section 5.1.5.2.1.1**) are presented in units  
581 of mg/kg, ug/kg and ng/kg wet weight for various compounds, the data from ERED summarized  
582 in **Table 5.1.5.2.2.3.2-ERED** have been converted to the same units as the Site 104 data for ease  
583 of comparison.

584

585 **Critical Body Residue.** The critical body residue (CBR) approach is based upon PAH primary  
586 mode of lethality, which is narcosis (causing unconsciousness, immobility, or death). Studies  
587 have shown that narcosis occurs when the concentration of total PAH in tissues exceeds a critical  
588 threshold (McCarty and Mackay 1993). The CBR is the sum of the tissue concentrations of PAH  
589 on a umol/g wet weight basis. The CBR threshold for chronic narcosis is in the range of 0.2 to  
590 0.8 umol/g wet weight for aquatic invertebrates (McCarty and Mackay 1993). That is, if the  
591 CBR is less than the threshold of 0.2 to 0.8 umol/g wet weight, chronic narcosis is not expected  
592 from the total PAH body burden in the organism. The CBR threshold for acute narcosis is much  
593 higher, in the range of 2 to 8 umol/g wet weight for aquatic invertebrates (McCarty and Mackay  
594 1993), and is not considered in this evaluation.

595

596 **5.1.5.b.2.3.2 Evaluation of data**

597  
598 For every analyte Table 5.1.5.2.2.3.2-ERED presents the maximum TBP calculated for any  
599 sediment sample representing dredged material potentially proposed for placement at Site 104.  
600 The table also presents the TBP for the reference sediment for each analyte, and the ERED data  
601 on body burdens associated with biological responses. The critical body residue (CBR) based on  
602 TBP of PAH for each sediment sample representing dredged material potentially proposed for  
603 placement at Site 104 is shown in Table 5.1.5.2.2.3.2-CBR. This table also shows the CBR as a  
604 percent of the threshold for chronic effects (0.2 umol/g wet weight). The following discussion of  
605 each analyte is based on the information summarized in these two tables.  
606

607 **4,4'-DDD.** (a discussion like the following will be inserted for every pesticide/PCB)

608  
609 **1-methylnaphthalene and 2-methylnaphthalene.** The TBP of these compounds was not  
610 calculated for the reference sediment. The maximum TBP of these compounds from any of the  
611 samples was 210.91 ug/kg dry weight. There are no relevant ERED data for these compounds in  
612 *Macoma* or *Neanthes*, nor in any other bivalve mollusk or annelid. The maximum CBR of all  
613 PAH for any sediment sample representing dredged material potentially proposed for placement  
614 at Site 104 was 0.006055 umol/g wet weight from sample CR3 (Table 5.1.5.2.2.3.2-CBR). This  
615 value is only 3.03 percent of the CBR threshold for chronic effects (Table 5.1.5.2.2.3.2-CBR).  
616 In other words, the critical body residue of all PAH, of which 1-methylnaphthalene and 2-  
617 methylnaphthalene are components, would have to have been 33 times higher before chronic  
618 effects might have been a concern in the sample with the highest TBP values for PAH. Because  
619 of this, the low TBP values, and the lack of evidence in ERED of potential effects,  
620 bioaccumulation of 1-methylnaphthalene and 2-methylnaphthalene to an environmentally  
621 important level by *Macoma* and *Neanthes* from any sediment sample representing dredged  
622 material potentially proposed for placement at Site 104 does not appear likely.  
623

624 **Acenaphthene.** The TBP of acenaphthene from the reference sediment was 25.60 ug/kg dry  
625 weight. The maximum TBP of this compound from any of the sediment samples representing  
626 dredged material potentially proposed for placement at Site 104 was 143.82 ug/kg dry weight.  
627 The TBP from the highest sample was 118.22 ug/kg (parts per billion – ppb) wet weight (5.6  
628 times) higher than from the reference sediment. There are no relevant ERED data for  
629 acenaphthene in *Macoma* or *Neanthes*, nor in any other bivalve mollusk or annelid. The  
630 maximum CBR of all PAH for any sediment sample representing dredged material potentially  
631 proposed for placement at Site 104 was 0.006055 umol/g wet weight from sample CR3 (Table  
632 5.1.5.2.2.3.2-CBR). This value is only 3.03 percent of the CBR threshold for chronic effects  
633 (Table 5.1.5.2.2.3.2-CBR). In other words, the critical body residue of all PAH, of which  
634 acenaphthene is a component, would have to have been 33 times higher before chronic effects  
635 might have been a concern in the sample with the highest TBP values for PAH. Because of this,  
636 the low TBP value, the small increase in the sample compared to the reference, and the lack of  
637 evidence in ERED of potential effects, bioaccumulation of acenaphthene to an environmentally  
638 important level by *Macoma* and *Neanthes* from any sediment sample representing dredged  
639 material potentially proposed for placement at Site 104 does not appear likely.  
640

641 Other PAH. (a discussion like the preceding will be inserted for every PAH)

642

643

644 **5.1.5.2b.2.4. Bioaccumulation conclusions**

645

646 According to the manual (U.S. EPA 1998c), after consideration of the Tier II bioaccumulation  
647 data, one of the following conclusions is reached based upon comparison between the theoretical  
648 bioaccumulation potential (TBP) for the dredged material and for the same contaminants in the  
649 reference sediment:

650

651 1. The TBP for the non-polar organic contaminants of concern in the dredged material does  
652 not exceed the TBP for the reference sediment, and therefore, the dredged material is  
653 predicted not to result in benthic bioaccumulation of the measured non-polar organic  
654 compounds.

655

656 2. The TBP for the non-polar organic contaminants of concern in the dredged material  
657 exceeds the TBP for the reference sediment. In this case, the information is not sufficient  
658 to predict whether the dredged material will result in benthic bioaccumulation of the  
659 measured non-polar organic compounds, and further evaluation of bioaccumulation in  
660 Tier III is necessary to furnish information to make determinations under the guidelines.

661

662

663

664 **5.1.5.2b.3. Tier III**

665

666 **5.1.5.2b.3.1. Benthic toxicity evaluation** (Old Versar data & space-holder for data now being  
667 generated.)

668

669 **5.1.5.2b.3.2. Benthic toxicity conclusions**

670

671 According to the manual (U.S. EPA 1998c), benthic toxicity testing of contaminants in the  
672 dredged material in Tier III will result in one of the following possible conclusions:

673

674 1. Mortality in the dredged material is not statistically greater than in the reference  
675 sediment, or does not exceed mortality in the reference sediment by at least 10  
676 percentage points (or 20 percentage points for amphipods). Therefore, the dredged  
677 material is predicted not to be acutely toxic to benthic organisms.

678

679 2. Mortality in the dredged material is statistically greater than in the reference sediment  
680 and exceeds mortality in the reference sediment by at least 10 percentage points (or 20  
681 percentage points for amphipods). In this case, the dredged material is predicted to be  
682 acutely toxic to benthic organisms.

683

684

685  
686  
687  
688

5.1.5.3c: Summary and ~~econclusions~~ conclusions.

|  
|

1  
2 **5.1.6 Aquatic Resources**  
3

4 **5.1.6.a Plankton.** Phytoplankton are microscopic plants found throughout aquatic systems  
5 ~~and that~~ generally form the basis of aquatic system food webs. Phytoplankton production,  
6 accumulation, and subsequent decomposition, govern the productivity at higher trophic levels, as  
7 well as nutrient and dissolved oxygen concentrations in the Bay and its tributaries (Sellner 1993).  
8 Zooplankton, which are microscopic animals that feed directly upon phytoplankton, are also an  
9 essential link in the food web and provide the bulk of the forage prey for most larval and juvenile  
10 fish as well as many other estuarine organisms (Birdsong and Buchanan 1993).  
11

12 **Phytoplankton**  
13

14 Phytoplankton serve as an integral link in the aquatic food chain, produce life-sustaining oxygen  
15 for aquatic organisms, and assimilate nutrients (nitrogen, phosphorus, and silicon) that flow into  
16 the Bay. Light, temperature, nutrients, and zooplankton abundance regulate the distribution and  
17 abundance of phytoplankton in any estuarine ecosystem (Lippson 1973). Maximum  
18 phytoplankton productivity generally occurs in the mainstem of the Chesapeake Bay between the  
19 Chesapeake Bay Bridge and the Potomac River, where water clarity, nutrient concentrations, and  
20 mixing in the water column create optimal conditions (Tuttle *et. al.* 1985 and Sellner 1987). Site  
21 104 is located in the maximum phytoplankton production area of the Bay.  
22

23 The annual cycle of phytoplankton production in the Chesapeake Bay is characterized in by two  
24 phases. There is a spring biomass maximum in April-May supported by increased light  
25 penetration and high riverine nutrient inputs. ~~And~~ This is followed by a summer productivity  
26 maximum supported by benthic nutrient regeneration/lease from bottom sediment organic matter  
27 decomposition (Conley and Malone 1992). Recent work by Fisher, *et. al.* (1992, 1999); and  
28 Malone, *et. al. et al.* (1996) and Fisher, *et. al.* (1992) have more fully described the nature of these  
29 phytoplankton productivity cycles and the seasonal factors ~~which~~ that limit phytoplankton  
30 productivity. These findings have led to a better understanding of the nature of nutrient  
31 limitations and the seasonal changes in water quality conditions which then control  
32 phytoplankton growth.  
33

34 The factors ~~which~~ that control phytoplankton growth include temperature, light, salinity, and  
35 nutrients. Nutrients that control phytoplankton growth include nitrogen and phosphorus and in  
36 some cases, silica. Prior to recent studies in the Chesapeake Bay, the Bay was thought to be  
37 nitrogen-limited for phytoplankton growth. That is, the phytoplankton would only grow to the  
38 extent that nitrogen was available as a nutrient; when nitrogen was no longer available,  
39 phytoplankton growth would stop. The studies by Fisher, *et. al.* (1992 and 1999) and Malone, *et*  
40 *al.*, (1996) have further refined that theory. ~~What~~ These studies have found ~~is~~ that nitrogen in  
41 fact limits phytoplankton growth in the summer, but in the spring, phosphorus is the limiting  
42 factor (for diatoms, a kind of phytoplankton with a silicate skeleton, silica becomes limiting in  
43 the spring).  
44

45 The reasoning behind this change in limiting factors is due to the changing environmental  
46 conditions in the estuary. The late winter to spring period in the Chesapeake Bay is characterized  
47 by large freshwater runoff, with higher ratios of nitrogen loadings compared to phosphorus in the  
48 runoff. During this time period, as sunlight is also increasing, there is more nitrogen available  
49 than can be utilized by the phytoplankton, when compared to phosphorus. Under these  
50 conditions, phosphorus then becomes the limiting nutrient – the phytoplankton only grow to the  
51 extent that phosphorus is available as a nutrient. During the summer this dynamic changes.  
52 With a decrease in nitrogen loading as freshwater runoff declines and plants in the watershed  
53 begin to grow and tie up the nutrients, the source of nutrients to the water column switches to the  
54 nutrients being recycled from organic matter decomposition in the sediment. The increasing  
55 water temperatures in the bottom waters begin a process of microbial activity. These microbes  
56 break down the organic matter that has fallen to the bottom of the Bay, and in the process,  
57 nutrients are “remineralized,” or recycled to the water column. When this happens, the  
58 sediments become the main source of nutrients to fuel phytoplankton growth. Under these  
59 conditions, the Bay is now producing higher ratios of phosphorus, and phytoplankton only grow  
60 to the extent that nitrogen is available as a nutrient.

61  
62 The Chesapeake Bay Water Quality Program (CBWQP) determines the standing crop (biomass)  
63 of phytoplankton by indirectly measuring concentrations of chlorophyll-a (the primary  
64 photosynthetic pigment in all plants). Chlorophyll-a has been measured seasonally from 1984 to  
65 1996 by the CBWQP at MCB3.3C, a fixed sampling station located in the southern portion of  
66 Site 104 north of the Chesapeake Bay Bridge, and various other fixed stations within the Bay  
67 (Figure 5-1412). Chlorophyll-a concentrations were found to have generally increased in the  
68 mainstem of the Bay from 1985 to 1996. This increased trend was largely attributed to  
69 productivity during the summer months (Lacouture *et al.* 1993). In the context of water quality,  
70 increased chlorophyll-a concentrations would be an indicator of deteriorating conditions.  
71 However, in the context of nutrient and suspended sediments trends, increases in chlorophyll-a  
72 are actually a positive sign that the ecosystem is becoming more balanced. Lacouture *et al.*  
73 (1997/1998) postulated that the chlorophyll-a concentrations would have to increase, then  
74 stabilize, and finally decrease to be in the necessary range for a balanced ecosystem.

75  
76 Diatoms, dinoflagellates, golden brown algae, green algae, and blue-green algae represent  
77 dominant major phytoplankton taxonomic groups found within the Chesapeake Bay estuary.  
78 Studies performed by the CBWQP have found that diatoms generally dominate the spring  
79 phytoplankton biomass initially, followed by a large contribution of dinoflagellates. These  
80 dinoflagellates continue to dominate the productivity maximum in the summer (Lacouture *et al.*  
81 1993). Studies have also shown that dinoflagellates have a higher light optima, shorter  
82 generation times, and are motile [EXPLAIN SO PUBLIC CAN UNDERSTAND], whereas  
83 diatoms have a lower light optima, longer generation times, and a greater capacity for energy  
84 storage, but require mixing to remain suspended (Lacouture *et al.* 1993). Generally,  
85 phytoplankton in the Bay are considered to be extremely productive when compared to the open  
86 ocean flora (EA 1997). Phytoplankton densities, pigment levels, and productivity decrease in the  
87 open ocean due to limited nutrient availability and higher salinity levels.

89 **Zooplankton**

90

91 Zooplankton, the animal component of the planktonic community, provide an important pathway  
92 by which phytoplankton and bacterial biomass moves up through the food chain to higher trophic  
93 levels. Grazing by zooplankton regulates phytoplankton and bacteria populations, and excretion  
94 by zooplankton transports nutrients to the benthos (Brownlee and Jacobs 1987). Zooplankton  
95 includes crustaceans such as copepods, fishes in egg and larval stages (ichthyoplankton), and  
96 other pelagic microscopic animals that are at the mercy of water currents. These free swimming  
97 selective feeders are capable of consuming large quantities of phytoplankton and detritus and the  
98 enormous abundance of zooplankton constitute a primary source of food for larval stages of  
99 fishes and other planktonic feeders. Zooplankton have been monitored Bay-wide at a network  
100 of stations in the Chesapeake Bay since 1984 by the CBWQP. Station MCB3.3C is located north  
101 of the Chesapeake Bay Bridge and is located in the southern portion of the site (Figure 5-14+2).

102

103 Calanoid copepods have dominated mesozooplankton collections in the Maryland and Virginia  
104 portions of the Chesapeake Bay since 1984 (Brownlee and Jacobs 1987). Species distributions  
105 tend to vary seasonally and by salinity. In mesohaline salinities (5-18 ppt), such as the Site 104  
106 area, *Acartia spp.* dominate mesozooplankton communities in the summer and fall; and  
107 *Eurytemora affinis* predominate in the winter months (Brownlee and Jacobs 1987). It has been  
108 indicated that *E. affinis*, when fed to striped bass larvae, produces optimum growth and survival  
109 (Jacobs 1995). Brownlee and Jacobs noted that mesohaline stations in the mainstem of the Bay  
110 (including MCB3.3C) generally yielded fewer copepod species overall than freshwater and  
111 oligohaline zones in the Bay. In addition to calanoid copepods, polychaete larvae and barnacle  
112 nauplii were also collected in the mesohaline region of the Bay. Polychaete larvae were collected  
113 in winter and summer in pulses while the barnacle nauplii were collected in spring in highest  
114 densities. During the summer months, comb jellies (ctenophores), such as the sea walnut  
115 (*Mnemeopsis leidyi*) were found to be abundant in the mesozooplankton samples in mesohaline  
116 and polyhaline waters (Brownlee and Jacobs 1987).

117

118 Rotifers, largely *Synchaeta spp.*, dominated microzooplankton collections at mesohaline stations  
119 (including MCB3.3C) within the Chesapeake Bay (Brownlee and Jacobs 1987). Major  
120 abundance and biomass peaks (1984 to 1996) occurred in late summer-early fall, with minor  
121 peaks in winter and spring. Other species collected were *Copepod nauplii* and *Tintinnines*. The  
122 overall status of microzooplankton in the Bay is considered fair (Lacouture *et al.* 1997, 1998).

123

124 Hypotrich ciliates [EXPLAIN] have been identified as microaerophiles (species who tolerate low  
125 oxygen conditions) and are frequently found in hypoxic or anoxic waters (Sellner and Brownlee  
126 1995). These populations have been proposed as excellent indicators of recurring summer  
127 hypoxia and anoxia in the deep bottom waters of the Chesapeake Bay. Hypotrich ciliates, such  
128 as *Euplotes spp.*, have been shown to grow most rapidly at oxygen concentrations from 6-8%  
129 saturation. For the period 1984-1994 hypotrich ciliate abundances were compared to bottom DO  
130 concentrations for six CBPWQ stations including MCB3.3C. Densities of hypotrich ciliates  
131 were found to be strongly associated with bottom DO levels (Sellner and Brownlee 1995).  
132 Station MCB3.3C was found to support a summer maximum for stress tolerant organisms that  
133 have been shown to survive long periods of low dissolved oxygen concentrations.

1  
2 **5.1.6.b Fisheries.**  
3

4 **Introduction**  
5

6 Historically, the Chesapeake Bay has been among the most productive estuaries in the world for  
7 fish and shellfish, supporting commercial and recreational fisheries for as many as 50  
8 commercial species throughout Maryland and Virginia (Rothschild *et al.* 1981). In the past two  
9 decades, populations of some fish species (e.g., American shad [*Alosa sapidissim*] and river  
10 herring [*Alosa* spp.]) have declined significantly (Richkus *et al.* 1992), whereas other species  
11 such as striped bass (*Morone saxatilis*-rockfish) are showing signs of recovery after years of  
12 record low abundances (CBP 1995b).  
13

14 The habitat requirements of individual fish species are numerous and complex. They include  
15 abiotic and biotic environmental conditions. The two major determining abiotic conditions are  
16 salinity and depth. Biotic conditions are governed by variables such as vegetative cover, quality  
17 and quantity of prey species, predation, and competition. Habitat types in the Bay range from  
18 deep open-water habitats in the mainstem to expansive saltwater marshes in the southeastern  
19 areas. Salinity zones in the Bay can be classified as tidal fresh, oligohaline, mesohaline, or  
20 polyhaline. Water depths within Site 104 vary from deep (-23.8 m [-78 ft] MLLW) to shallow (-  
21 12.8 m [-42 ft] MLLW) habitat types. It is common for the deeper water habitats of Site 104 to  
22 go hypoxic (dissolved oxygen less than 4 to 5 mg/L) to anoxic (dissolved oxygen 0 mg/L) in the  
23 bottom layers during the summer (Section 5.1.4). Dissolved oxygen concentrations associated  
24 with hypoxic to anoxic conditions are potentially harmful to aquatic life. [MES will provide  
25 temperature data here to answer the thermal refuge question in the UMCES white paper].  
26

27 Murdy *et al.* (1997) cataloged 267 species of fish that inhabited the Chesapeake Bay during a  
28 portion of their life history. However, only 32 species are classified as year-round residents. Of  
29 the 267 species present in the Bay, a significant number require high salinities and are, therefore,  
30 restricted to the lower portion of the Bay. The upper Bay supports a maximum diversity of 100  
31 species of fish, for at least a portion of their lifecycle, and these species are distributed primarily  
32 based upon their tolerance to salinity, available habitat, and annual migratory cycles (Lippson *et*  
33 *al.* 1979; Lippson and Lippson 1984). Site 104 is located in the mesohaline portion of the upper  
34 Bay. Species present in this region of the Bay must be able to tolerate salinity concentrations that  
35 vary from 5 to 13 ppt (Lippson 1973).  
36

37 Fish species that occur in the upper Bay mainstem (which includes Site 104) of the Chesapeake  
38 Bay can be divided into two dominant groups based upon utilization of the area: permanent  
39 residents and migratory species. The permanent residents consist of species that spend their  
40 entire life cycle in the upper Bay (CBP 1995b). The bay anchovy (*Anchoa mitchilli*) is an  
41 example of a resident species. This species has a life expectancy of 1 year and is an important  
42 link in the Bay's food web (Miller 1998). Migratory fish are categorized based upon their  
43 utilization of the Bay. Migratory fish include both species that regularly (seasonally) utilize the  
44 area for some period of their life cycles as well as many that are only occasional transients of the  
45 fish community (Setzler-Hamilton 1987). Migratory fish can be further divided on the basis of

46 spawning behavior: anadromous fish, which migrate from the ocean to spawn in the Bay or its  
47 tributaries, and catadromous fish, which migrate from Bay waters to spawn in the ocean (CBP  
48 1995b). True anadromous fish include alewife (*Alosa pseudoharengus*) and blueback herring  
49 (*Alosa aestivalis*), American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), striped  
50 bass (*Morone saxatilis*), shortnose sturgeon (*Acipenser brevistrum*), and Atlantic sturgeon  
51 (*Acipenser oxyrinchus*). Semi-anadromous fish, which migrate from the lower estuary to upper  
52 estuary freshwaters to spawn, include white perch (*Morone americanus*), gizzard shad  
53 (*Dorosoma cepedianum*), yellow perch (*Perca flavescens*), and estuarine populations of threadfin  
54 shad (*Dorosoma petenense*). Eels (*Anguilla rostrata*) are the only true catadromous species in  
55 the Chesapeake Bay (CBP 1995b). Although eels live in the Chesapeake for long periods, they  
56 eventually migrate to open waters in the Sargasso Sea to spawn.

57  
58 Other fish, mostly marine species, utilize the Bay not for spawning purposes but for successful  
59 completion of a portion of their life cycle (e.g., as larvae or juvenile life stages) (Setzler-  
60 Hamilton 1987). Examples of marine fish that spend some portion of their life cycle in the Bay  
61 include Atlantic menhaden (*Brevoortia tyrannus*) and bluefish (*Pomotomus saltatrix*) [May want  
62 to include EFH discussion here]. Some marine fishes that utilize the Bay, if given the  
63 opportunity, may survive equally as well in coastal or oceanic waters during these life stages  
64 (e.g., Tautog and harvestfish) (Setzler-Hamilton 1987).

65  
66 An inventory of fishes commonly known to occur in the mesohaline portion of the upper Bay  
67 from the Chesapeake Bay Bridge to the Pooles Island area was derived from a variety of  
68 literature sources and is included in Table 5-21 (Miller 1998). Table 5-22 provides a synopsis of  
69 general distribution and life history information for these upper Bay species (Miller 1998;  
70 Setzler-Hamilton 1987; Jordan *et al.* 1991).

## 71 72 **Commercially Important Species**

73  
74 Two species of fish, striped bass and white perch, support an extensive fishery in the NOAA025  
75 region (Chesapeake Bay Bridge to Pooles Island) of the Bay (Section 5.3.5.e). Site 104 is  
76 included in this region.

77  
78 The striped bass is an anadromous fish that occurs from Canada to the Florida peninsula (Murdy  
79 *et al.* 1997). However, the majority of spawning occurs in a few areas, with the Hudson River  
80 and the Chesapeake Bay accounting for nearly all stocks (Setzler-Hamilton and Hall 1991). In  
81 the Chesapeake Bay, spawning occurs from early April to late May in the tidal freshwater areas,  
82 and during times of peak abundance, fish spawned in the Bay may contribute as much as 90  
83 percent of the coastal migratory stocks (Miller 1998; Setzler-Hamilton and Hall 1991). During  
84 summer and fall (June-November), commercial fishermen take striped bass in pound nets  
85 (MDNR 1999d). These fixed nets are set typically in <6.1 m (<20 ft) of water along shorelines to  
86 intercept fish as they move. Miller (1998) documented that because of the offshore location of  
87 Site 104, pound netting was not commonly practiced within its boundaries. Commercial  
88 fishermen use drift gill nets during the winter (December-February). Commercial fisherman  
89 from Rock Hall that were interviewed by Miller (1998) indicated that most drift nets are

**Table 5-21**  
**Scientific and Common Names of Fishes that are Known to Occur in the Mesohaline Portion of the Upper Bay.**

Common Name	Scientific Name
Family Species	Family <i>Species</i>
Freshwater Eels American eel	Anguillidae <i>Anguilla rostrata</i>
Herrings Blueback herring Hickory shad Alewife American shad Atlantic menhaden Gizzard shad Threadfin shad	Clupeidae <i>Alosa aestivalis</i> <i>Alosa mediocris</i> <i>Alosa pseudoharengus</i> <i>Alosa sapidissima</i> <i>Brevoortia tyrannus</i> <i>Dorosoma cepedianum</i> <i>Dorosoma petenense</i>
Anchovies Bay anchovy	Engraulidae <i>Anchoa mitchelli</i>
Minnnows Common carp	Cyprinidae <i>Cyprinus carpio</i>
North American Catfish Channel catfish Brown bullhead Yellow bullhead	Ictaluridae <i>Ictalurus punctatus</i> <i>Ictalurus nebulosus</i> <i>Ictalurus natalis</i>
Toadfish Oyster toadfish	Batrachoididae <i>Opsanus tau</i>
Killifishes Mummichog	Cyprinodontidae <i>Fundulus heteroclitus</i>
Silverside Atlantic silverside	Atherinidae <i>Menidia menidia</i>
Temperate Basses White perch Striped bass	Percichthyidae <i>Morone americanus</i> <i>Morone saxatilis</i>
Perch Yellow perch	Percidae <i>Perca flavescens</i>
Bluefishes Bluefish	Pomotomidae <i>Pomotomus saltatrix</i>
Drums Weakfish Spot Atlantic croaker	Sciaenidae <i>Cynoscion regalis</i> <i>Leiostomus xanthurus</i> <i>Micropogonias undulatus</i>
Gobies Naked goby	Gobiidae <i>Gobiosoma boscii</i>
Right Eye Flounders Winter flounder	Plueronectidae <i>Pleuronectes americanus</i>
Soles Hogchoker	Soleidae <i>Trinectes maculatus</i>

Source: Miller 1998

Table 5-22

General Distribution and Life History Information for Fishes Found in the Mesohaline Portion of the Upper Bay

Species	Spawning Season and Locations	Eggs	Habitat Larvae	Juveniles	Occurrences of Larvae/Juveniles
<b>Herrings</b>					
<b>Blueback herring</b> <i>Alosa aestivalis</i>	Fresh and brackish waters not far above tidewater; April-June	Essentially pelagic	Fresh. O.	Leave nursery grounds ~ 50 mm mid Sept.-Oct; O, M, P	Larvae, April-June. Juveniles May-Nov; James R., downstream migration almost complete by Nov. Some overwintering in Del. and Chesapeake Bay
<b>Hickory shad</b> <i>Alosa mediocris</i>	Tidal freshwater late April early June	Demersal or pelagic	Fresh. O.	Leave nursery areas early summer. O, M, P	Juveniles of age group I found sporadically throughout most of year, Chesapeake Bay and tributaries
<b>Alewife</b> <i>Alosa pseudoharengus</i>	Ascend freshwater streams further than blueback herring; late March-mid May	Essentially pelagic	Freshwater; form schools at <10 mm	Pass slowly down Ches. Drainage system. O, M, P	Juveniles main seaward migration, fall.
<b>American shad</b> <i>Alosa sapidissima</i>	Tidal freshwater April-July	Demersal or pelagic; absent at <5 ppm DO	Fresh. O. Most abundant at surface	Form schools 20-20 mm. O, M, P	Juveniles gradually move downstream; some remain in Chesapeake Bay for first year
<b>Atlantic menhaden</b> <i>Brevoortia tyrannus</i>	During northward spring and southern fall migration	Pelagic, mostly offshore; P (July-Aug.)	Pelagic, enter estuary ~10 mm P, M, few O	O, tidal freshwater	Larvae lower Bay, Feb., April-May, Aug.; upper Bay May-June, Nov. Juveniles, spring-summer; migrate south in fall, some overwinter
<b>Gizzard shad</b> <i>Dorosoma cepedianum</i>	Freshwater, near surface; April-June	Demersal, adhesive	Smallest larvae most abundant at surface; freshwater. Largest larvae surface day; midwater night	Greatest abundance well upstream from brackish water	Juveniles < 70 mm only in freshwater
<b>Threadfin shad</b> <i>Dorosoma petenense</i>	Freshwater or O; April-July	Demersal, attached	Freshwater; diel migration inshore	Prefer < 15 ppt.; most common <5 ppt. O, M	no information

Note: O = Oligohaline (0.5 - 5.0 ppt.) M = Mesohaline (5.1—20.0 ppt.) P = Polyhaline (> 20.00 ppt.)

Sources: Setzler-Hamilton 1982 and Jordan *et al.* 1991

Table 5-22 (Continued)

Species	Spawning Season and Locations	Eggs	Habitat Larvae	Juveniles	Occurrences of Larvae/Juveniles
<b>Anchovies</b> <b>Bay anchovy</b> <i>Anchoa mitchelli</i>	Late April-late Sept. (peak July) throughout mid and lower Ches. Bay O, M, P; most > 9 ppt.; peak 13-15 ppt. (though eggs most abundant in most saline portion of lower Bay)	Pelagic, congregate at surface. M, P	O, M, P surface waters	O, M, P, euryhaline, ascend rivers to freshwater	Larvae early May-mid Oct; greatest abundance 3-7 ppt. Juveniles most abundant brackish water near salt-fresh interface June-Sept.; deeper waters Oct-March
<b>Minnows</b> <b>Common Carp</b> <i>Cyprinus carpio</i>	Shallow marshes and flats, tidal freshwater, May-June	Demersal, attached	Freshwater O; in vegetation	In vegetation	Tidal tributaries of Chesapeake Bay
<b>North American Catfish</b> <b>Channel catfish</b> <i>Ictalurus punctatus</i>	May-June; tidal freshwater, in nests, depressions or other protected areas	Demersal, adhesive	Guarded by male 2-5 days after hatching Freshwater. O	Freshwater, O, M	Larvae upper salinity tolerance ~ 8 ppt; Juveniles grow at salinities < 11 ppt. at 5-6 mo.
<b>Brown bullhead</b> <i>Ictalurus nebulosus</i>	May-June; tidal freshwater	Demersal, adhesive, aerated by parents		School throughout summer. O	Early juveniles herded about in schools by one or more parents
<b>Toadfish</b> <b>Oyster toadfishes</b> <i>Opsanus tau</i>	April-July or Aug.; cavities among shells or rocks, tin cans, broken bottles, etc. in nests. M, P and coastal waters	Demersal, attached; guarded by male	Yolk-sac larvae remain attached to substrate of nest site until yolk absorbed; cared for by male. M, P	Demersal; become free swimming between 16-18 mm	Juveniles, summer
<b>Killifishes</b> <b>Mummichog</b> <i>Fundulus heteroclitus</i> ;	Chesapeake Bay, April-Aug; Delaware Bay, May-mid Aug. Several peaks at or near new moon high tide; shallow areas with sparse to dense vegetation. Upper tidal marsh among <i>Spartina</i> roots; freshwater O, M, P	Demersal; filamented eggs attached; eggs with reduced filaments, inside vertically oriented ribbed mussel shells	Remain off bottom; attracted to light; O	Among eelgrass, shallow pools and ditches; O, M, P	no information

Note: O = Oligohaline (0.5 - 5.0 ppt.) M = Mesohaline (5.1—20.0 ppt.) P = Polyhaline (> 20.00 ppt.)

Sources: Setzler-Hamilton 1982 and Jordan *et al.* 1991

Table 5-22 (Continued)

Species	Spawning Season and Locations	Eggs	Habitat Larvae	Juveniles	Occurrences of Larvae/Juveniles
<b>Silverside</b> <b>Atlantic silverside</b> <i>Menidia menidia</i>	March-July, Chesapeake region; May-Nov, Chesapeake Bay; intertidal zone or shallows waters; estuarine areas O, M, P (mostly M and P)	Demersal, attached	Shallow water near shore; school at 8-10 mm TL; O, M, P	Chesapeake Bay, O, M; 1-14 ppt; mode = 7 ppt. Also P	Larvae and Juveniles schools at surface, follow incoming and outgoing tides
<b>Temperate Basses</b> <b>White perch</b> <i>Morone americana</i>	Freshwater or O; late March-early June	Demersal, attached	Freshwater O; downstream movement with development	Estuarine populations move toward more brackish water, Aug-Nov. O (most), M	Larvae freshwater to at least 8 ppt.; greatest abundances at mid depths in water column (day). Juveniles ~ 20-25 mm, move inshore shoal areas
<b>Striped Bass</b> <i>Morone saxatilis</i>	Tidal freshwater April-early June; peak Chesapeake Bay last half April-first week May	Pelagic	Freshwater O, move inshore to shoal area ~ 17 mm	Schools, more abundant areas with pronounced current. O, M	Larvae April-early June; concentrate at bottom; Juveniles general downstream movement late May
<b>Perch</b> <b>Yellow perch</b> <i>Perca flavescens</i>	March-April; tidal freshwater; O (max. salinity 2.5 ppt.)	Attached; long flat demersal, semibuoyant or rarely floating band or ribbons	Pelagic, phototrophic, O	Large schools initially pelagic, then demersal; O, M	Larvae, end of March-mid May; Potomac and Patuxent estuaries Juvenile salinity range to 9.5 ppt.
<b>Bluefishes</b> <b>Bluefish</b> <i>Pomatomus saltatrix</i>	June-Aug. (possibly May)	Pelagic, offshore; few mouth of Bay	Pelagic, offshore; few mouth of Bay	Coastal waters. P, M, O, tidal freshwater	Juveniles, summer and fall
<b>Drums</b> <b>Weakfish</b> <i>Cynoscion regalis</i>	Late spring and summer; two peaks, June and July, Delaware Bay	Initially buoyant, M, P	Sink to bottom by 8-10 mm. M, P	Soft, muddy bottoms, low salinity areas, O, M, P	Larvae, May-Aug., Chesapeake Bay. Juveniles, Mar-Oct; may remain Nov-Dec; most seek warmer offshore waters; upper York R. most abundant July; migrating downstream Sept-Nov.

Note: O = Oligohaline (0.5 - 5.0 ppt.) M = Mesohaline (5.1—20.0 ppt.) P = Polyhaline (> 20.00 ppt.)

Sources: Setzler-Hamilton 1982 and Jordan *et al.* 1991

Table 5-22 (Continued)

Species	Spawning Season and Locations	Eggs	Habitat Larvae	Juveniles	Occurrences of Larvae/Juveniles
<b>Drums Cont'd</b>					
<b>Spot</b> <i>Leiostomus xanthurus</i>	Late fall, winter	Pelagic, well offshore	Most frequently at bottom coastal waters	Enter Bay ~ 4 mo. P, M, O (smaller juv)	no information
<b>Atlantic croaker</b> <i>Micropogonias undulatus</i>	Offshore over wide area; extends some distance offshore, Aug-Dec; peak Aug-Sept; VA may occur in all months. spring-fall peaks	no information	O, M	Conc. At ~ 18 ppt; bottom waters of relatively deep channels. M, P	Larvae taken during winter; Juveniles, spring and summer. Croaker larvae and juveniles upper Bay 0-21 ppt; 0-24°C
<b>Gobies</b>					
<b>Naked goby</b> <i>Gobiosoma boscii</i>	May-mid Nov; upper Chesapeake Bay, clam and oyster shells; M, P, 10-30 ppt.	Demersal, attached, guarded by male	Day, mid-depth and near bottom; nearer surface at night. O, M	Benthic, O, M	Larvae, upriver or in waters <18.5 ppt; appear in Patuxent first week of May, and in Potomac mid-May; York River, May-Oct.
<b>Right Eye Flounders</b>					
<b>Winter flounder</b> <i>Pleuronectes americanus</i>	Mid Dec-May; peak March estuaries, sandy bottoms, 1.8-3.6 m; 11.4-33 ppt. M, P. 1-10°C; peak 2-5°C	Demersal	Pelagic, strongly bottom oriented before metamorphosis; O, M, P	Benthic - remain in estuaries 2 + yrs; inshore except for temperature extremes	Larvae 3.5-27.7 ppt; peak abundance 6-15 ppt. Juveniles 4-30 ppt; normal growth at 20 but not 30 ppt; 0-25°C, normal growth 12-16°C
<b>Soles</b>					
<b>Hogchoker</b> <i>Trinectes maculatus</i>	May-Sept. primarily in estuaries; 0-24 ppt. peak 10-16 ppt. O, M, P	Near surface, higher salinities; near bottom, lower salinities	Move into low salinity waters. O	Shore zone, move upstream to 240 km inland; over-winter in bays. O, M	Larvae concentrate near salt-freshwater

**Note:** O = Oligohaline (0.5 - 5.0 ppt.) M = Mesohaline (5.1—20.0 ppt.) P = Polyhaline (> 20.00 ppt.)

**Sources:** Setzler-Hamilton 1982 and Jordan *et al.* 1991

90 deployed north of the "RWLP" [NEED MAP SHOWING WHERE THIS IS] buoy (Figure2-1)  
91 within and around Site 104. This is north of the area planned for dredged material placement.

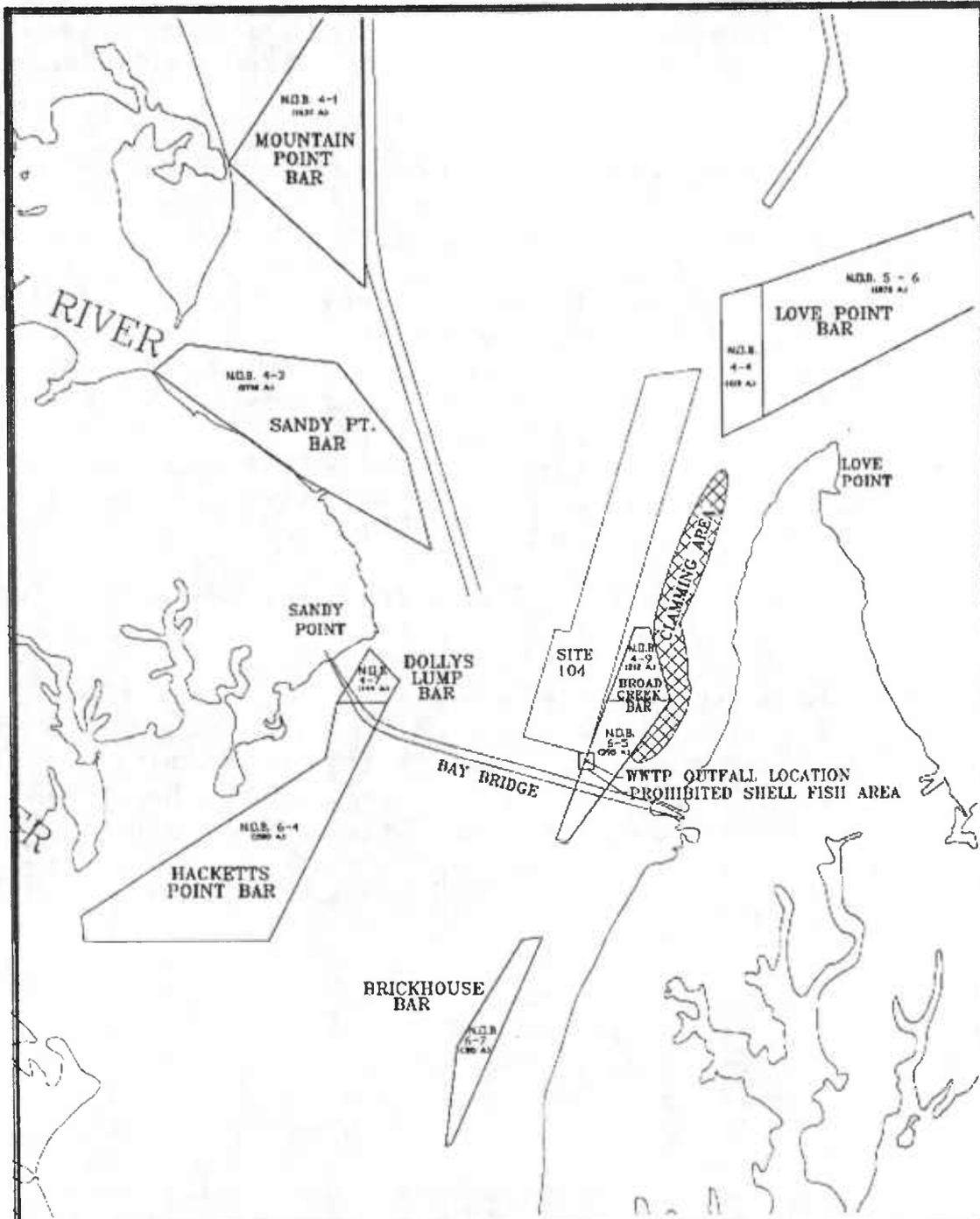
92  
93 White perch is one of the most abundant fish in the Bay (Miller 1998). Within the Bay, white  
94 perch migrate in the spring from regions of polyhaline to freshwater to spawn. Spawning  
95 migrations begin in March. Following spawning, adults move back downstream to higher  
96 salinity regions. Drift gill nets and pound nets are the two principal fishing gears deployed in the  
97 NOAA025 region for this species (Miller and McCracken 1997). During summer and fall  
98 (August-November), white perch are taken in pound nets set close to shore. No pound nets are  
99 set within the boundaries of Site 104 (Miller 1998). Drift gill nets are used by commercial  
100 fishermen during the winter (December-April) above the "RWLP" buoy within and around Site  
101 104 (Miller 1998).

102  
103 Three invertebrate species of commercial importance occur near to Site 104: soft shell clam (*Mya*  
104 *arenaria*), oyster (*Crassostrea virginica*), and blue crab (*Callinectes sapidus*). Of these, only  
105 blue crab inhabits Site 104. Peak densities of soft shell clams along the Eastern Shore of the Bay  
106 are found from the Eastern Bay to Pocomoke Sound, particularly at depths of less than 5.2 m (17  
107 ft) along the shoreline (Baker and Mann 1991). The shallowest depth at Site 104 is -12.8 m (-42  
108 ft).

109  
110 For hundreds of years, eastern oysters were among the most abundant bivalves and the most  
111 commercially important fishery resource in the Bay (Richkus *et al.* 1992). Harvests throughout  
112 the Bay have been declining for decades for a variety of reasons, leading to a near collapse of the  
113 industry in recent years (CPB 1995b). Oysters provide the only available hard substrate in many  
114 areas of the Bay, and oyster bars provide physical habitat for a wide variety of Bay species  
115 (Kennedy 1991). Most oysters in the Bay occur in waters between 2.4 and 7.6 m (8 and 25 ft)  
116 deep (Lippson 1973). Seasonal deficiencies in dissolved oxygen prevent their establishment in  
117 most waters over 10.7 m (35 ft) deep (Lippson 1973).

118  
119 There are seven oyster bars (Broad Creek, Love Point, Mountain Point, Sandy Point, Dolly's  
120 Lump, Hacketts Point, and Brickhouse Bar) that are known to exist in the vicinity of Site 104  
121 (Figure 5-24). The boundaries of the oyster bars depicted in this figure are of historic nature and  
122 do not necessarily reflect the areas currently considered viable [BY WHOM]. The Love Point  
123 oyster bar is located approximately 1.1 km (0.7 miles) northeast of the northern edge of Site 104.  
124 Mountain and Sandy Point bars are both located approximately 5.1 km (3.2 miles) northwest and  
125 west, respectively, of Site 104. Hacketts Point Bar and Dolly's Lump are located south-southeast  
126 of Sandy Point State Park and are approximately 2.4 km (1.5 miles) from the southwest boundary  
127 of Site 104. Brickhouse Bar is located approximately 3.2 km (2.1 miles) south of Site 104.  
128 Broad Creek is the closest oyster bar to Site 104 (just southeast of the southern end of Site 104).  
129 However, a portion of the Broad Creek oyster bar is prohibited to shellfish harvesting due to the  
130 presence of the Kent Island Waste Water Treatment Plant outfall (Figure 5-24).

131  
132 MDNR's Oyster Propagation Program (1999f) reported that 1998 was a low year (four spat per  
133 bushel) for average oyster spat sets on both natural bars and on State designated seed areas in the  
134 Bay. According to MDNR (1999f), Sandy Point, Dolly's Lump, and Hacketts Point are the most



 <p>MARYLAND ENVIRONMENTAL SERVICE</p>	 <p>MARYLAND PORT ADMINISTRATION</p>	 <p>US Army Corps of Engineers</p>	<p><b>HISTORIC OYSTER BAR LOCATION MAP</b></p> <p>FIGURE 5-24</p>
---	---	---	---

135 heavily commercially harvested oyster bars in the vicinity of Site 104. Broad Creek is actively  
136 harvested, although it is not naturally reproducing (i.e., 0 spat per bushel), and requires annual  
137 seeding by MDNR. MDNR reported that most of the harvesting takes place in 16 to 22 ft (4.9 to  
138 6.7 m) of water at this bar (MDNR 1999g).

139  
140 The blue crab is widely distributed along the Atlantic and Gulf coasts, but is most abundant and  
141 perhaps best known from the Chesapeake Bay. Blue crabs utilize nearly every habitat type in the  
142 Bay during some stage of their lifecycles. Mating occurs from June to October generally in  
143 shallow water (<3 m, <9.8 ft) in the middle and upper Bay and its tributaries (Lippson 1973).  
144 The peak mating period is usually during July and August. After mating, most of the females  
145 migrate toward the lower Bay to the higher-salinity areas, not to return until the following spring,  
146 while the majority of males remain in the fresher waters, most overwintering at depths >9 m  
147 (>29.5 ft) in the muddy bottom of deeper channel waters. Blue crab density is widely distributed  
148 (i.e., at a variety of depths); however, concentrations of blue crabs are higher in shallow water  
149 areas. Shallow water areas, particularly those with SAV or other suitable cover, are important  
150 refuges for older juveniles and soft crabs (Van Heukelem 1991). Crabs are taken commercially  
151 by pots, trotlines, dip nets, and in limited areas by crab traps (Section 5.3.5.f).

152  
153 The Winter Dredge Survey conducted by MDNR annually monitors random stations within the  
154 Bay for blue crab densities during the winter months (Volstad et al. 1994; Rothschild and Sharov  
155 1997). Data collection during December to February of 1995 to 1997 found that Site 104 is  
156 mostly utilized by adult males who are overwintering during the winter months (MDNR 1998b).  
157 While in fewer numbers, females were also captured at Site 104 during these sampling periods.  
158 The Chesapeake Bay Winter Dredge Survey results indicate that hibernating blue crab densities  
159 are lower in waters deeper than -12.2 m (40 ft) than in shallower areas of the Bay ( MDNR  
160 1998a). [Estimates of crab densities at the site indicate that Site 104 has low crab densities  
161 (59.9/1000 m<sup>2</sup>) relative to other areas of the upper Bay (88.95/1000 m<sup>2</sup>) and the average for  
162 Maryland portions of the Bay (101.10/1000 m<sup>2</sup>)]-Waiting for Information from Glen Davis of  
163 MDNR-].

164  
165 The commercial crab pot fishery is used as an indicator to track female blue crab migration to the  
166 lower Bay. From 1990 to 1998, total combined yields were highest in September and October  
167 (approximately 3 to 8 million). These were the highest pot catches of female blue crabs in  
168 Maryland waters. By November, total combined pot catches of female blue crabs in Maryland  
169 waters had decreased significantly to approximately 1 to 2 million (MDNR 1999e).

170  
171 Commercial harvesting of blue crabs occurs throughout the upper Bay, including Site 104.  
172 However, crab pots are usually set in the shallower areas (less than 12 m [<40 ft]) because of  
173 potential gear conflict with water traffic (MDNR 1998b). All of Site 104 is deeper than 12 m  
174 (40 ft).

175

176 **Site 104 Finfish Survey**

177  
178 Introduction

179  
180 Fish abundances and distributions in the upper Bay are highly dynamic and can vary seasonally,  
181 dielly, interannually, and in response to changes in temperature, salinity, and oxygen conditions  
182 in the water column (Brandt *et al.* 1994). To account for these fluctuations and to identify the  
183 fish species specifically using the Site 104 area, a four-season sampling program was conducted  
184 by University of Maryland Chesapeake Biological Laboratory and Buffalo State College Great  
185 Lakes Center during the day and night at varying depths from July 1996 to April 1997. Nearby  
186 reference areas A and B were established as controls and sampled to help separate natural  
187 seasonal and interannual variability in fish abundances (Weimer *et al.* 1996) (Figure 5-25). In  
188 addition to the use of gill nets, fish density, size, and species composition were evaluated using  
189 underwater fish acoustics, mid-water trawls, and bottom trawls within Site 104 and the two  
190 reference areas.

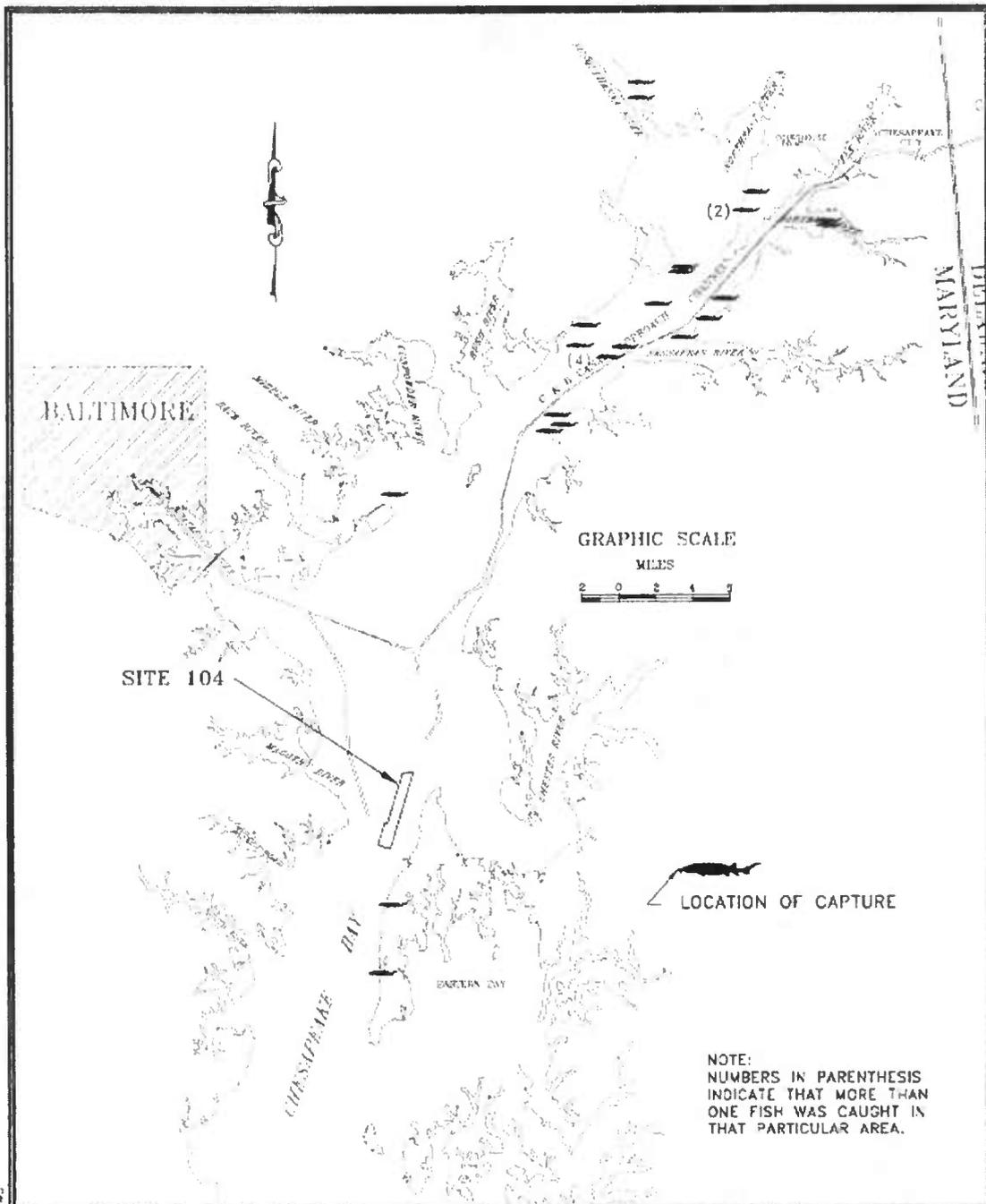
191  
192 The fisheries cruises were conducted during the months of June/July, October, and December  
193 1996 and April 1997. A total of 28 deployments of multi-panel anchor-set gill nets, 96 acoustic  
194 transects, 128 bottom trawls, and 24 mid-water trawls were performed to determine the  
195 composition of the fish community within and around Site 104. Summaries of the gillnet,  
196 acoustic, and trawl studies are discussed below. Additional information can be found in  
197 Appendix B.

198  
199 Fish community structure during 1996-1997 varied among sampling periods and sampling areas.  
200 Fish collection methods yielded a total of 21 species representing 14 families. Of these 21  
201 species, none are listed as rare, threatened, or endangered species. All together, white perch  
202 dominated gill net and acoustic/trawl sampling in all seasons sampled. However, mid-water and  
203 bottom trawl sampling in October revealed a peak in catch of bay anchovy and Atlantic croaker.  
204 Species diversity was lowest in June irrespective of gear type. All estimates of total fish  
205 abundance were lowest in October.

206  
207 **Bottom and Mid-Water Trawl and Fish Acoustic Results (Reference Areas A & B and Site**  
208 **104)**

209  
210 **Seasonal Comparison of Bottom Trawls**

211  
212 In all areas sampled, species diversity in bottom trawls (day and night combined) varied from a  
213 low of 4 in June (Area A and B) to a maximum of 12 during April (Area A). In Site 104, species  
214 diversity was greatest during April 1997 (10), and lowest during June 1996 (5). In Area A, 10 to  
215 12 fish species were collected during each sampling period except in June 1996 when only 4  
216 species were caught. In Area B, the number of fish species almost doubled from 4 in June 1996  
217 to 7 during October and December 1996. White perch were caught in all sampling areas during  
218 each sampling period. Atlantic croaker and gizzard shad were not captured during June 1996.  
219 Striped bass were not caught during October 1996 and bay anchovy were not captured during  
220 December 1996. Hogchoker were captured in Area A during October and December 1996 and



NOTE:  
 NUMBERS IN PARENTHESIS  
 INDICATE THAT MORE THAN  
 ONE FISH WAS CAUGHT IN  
 THAT PARTICULAR AREA.

4:\SITE\DATA\MP\STURGE3.CORC

 MARYLAND PORT ADMINISTRATION	 US Army Corps of Engineers
 MARYLAND ENVIRONMENTAL SERVICE	

**SHORTNOSE STURGEON LANDINGS  
 IN CHESAPEAKE BAY AND TRIBUTARIES  
 4/96 TO 7/98  
 FIGURE 3-25**

221 April 1997 (Weimer et al. 1996). Mean catch per unit effort (CPUE=#fish/trawl) also varied  
222 across all seasons in all areas during day and night. During the day, CPUE was highest for all  
223 species in all areas during December. At night, mean total catch was highest during October and  
224 December in Site 104, during October in Area A, and during December in Area B. Mean total  
225 catch was lowest during June in all areas during the day and night.

226  
227 Among individual species, CPUE of white perch varied across seasons in all areas during both  
228 day and night. During the day, the largest catches of white perch occurred during December for  
229 all three areas. White perch were also relatively abundant during April in Site 104 and Area B.  
230 Mean CPUE of white perch during the day was lowest during June and October for all areas. At  
231 night, CPUE of white perch was also highest during December for all areas.

232  
233 Striped bass catches were small in all sampling areas. During the day, mean CPUE of striped  
234 bass peaked during December and April in all three areas. At night, CPUE of striped bass was  
235 highest during April in Site 104 and Area A, but did not differ among seasons in Area B.

236  
237 Mean CPUE of bay anchovy was variable among seasons and time of day in all areas. During  
238 the day, bay anchovy were most abundant during April in Site 104 and Area A, and during  
239 October and April in Area B. At night, highest catches of bay anchovy occurred during October  
240 in all areas. Bay anchovy were also relatively common at night during April in Site 104 and Area  
241 B. Few bay anchovy were collected during June and December in any area.

242  
243 Mean CPUE of Atlantic croaker varied among seasons during the day and night in all areas.  
244 Atlantic croaker numbers were low during June, increased during October (night) and December  
245 (day), and decreased during April (day and night).

#### 246 247 Seasonal Comparison of Mid-Water Trawls

248  
249 The species diversity in midwater trawls ranged from a minimum of 1 (Site 104 and Area B in  
250 December, Area A in April) to a maximum of 6 (Area A in June). Species diversity in each area  
251 was greatest during June 1996, and lowest (1 or 2 species) during December 1996 and April  
252 1997.

253  
254 Total midwater trawl catches were greatest during June, decreased through October and  
255 December, and increased during April. Mean CPUE peaked during June at Site 104 due to some  
256 very large catches. During June, midwater trawl catches were dominated by white perch, with  
257 some bay anchovy and some herring species present. In contrast, bay anchovy accounted for the  
258 majority of the mid-water catch during October, with some herring species present. White perch  
259 were not caught in mid-water trawls during October, December, or April.

#### 260 261 Seasonal Comparison of Acoustic Data

262  
263 During the day, acoustic estimates of numeric fish densities generally ranged between 0.04 and  
264 0.6 fish·m<sup>-3</sup>. During the day, peak densities (approximately 0.5 fish·m<sup>-3</sup>) occurred at different  
265 seasons among areas: during June in Site 104, during April in Area A, and during October in

266 Area B. At night, fish numeric density peaked during December ( $0.7$  to  $2$  fish·m<sup>-3</sup>) and was  
267 lowest during June ( $<0.1$  fish·m<sup>-3</sup>) in all three areas. In Site 104 and Area A, numeric densities  
268 were similar at night during October and April; however, biomass density was higher in October  
269 compared to April in Area B. Based upon trawl data, the high numeric densities of fish during  
270 December at night were related to large numbers of white perch and Atlantic croaker in the area.

271  
272 Fish biomass density during the day was greatest during October in all areas ( $>40$  g·m<sup>-3</sup>). This  
273 high density was attributed to the presence of larger size class fish, including weakfish, white  
274 perch, and gizzard shad. Fish biomass densities were also relatively high during the day in June  
275 in Site 104 and Area B (about  $9$  g·m<sup>-3</sup>). At night, fish biomass density peaked during October  
276 and December in Site 104 (about  $11$  to  $13$  g·m<sup>-3</sup>), and during December in Areas A and B (about  
277  $3$  to  $6$  g·m<sup>-3</sup>).

278  
279 Mean total length of fish during the day was highest during June and October in all areas ( $>40$   
280 mm). At night in Site 104, fish length was similar during June, October, and December (about  
281  $100$  to  $130$  mm), but lower during April (about  $50$  mm). In Areas A and B at night, fish length  
282 peaked during June (about  $106$  to  $115$  mm), and was lowest in April (about  $45$  to  $57$  mm).

### 283 284 **Summary of Gill Net Sampling Results**

285  
286 Species diversity and abundance differed greatly between seasons. A total of 610 fish from 6  
287 species were collected from 28 anchored gillnet deployments in Site 104 and 2 reference areas.  
288 Of this total, 36 fish were caught in July, October, and December combined as compared to 574  
289 fish caught in April 1997. Miller (1998) attributed this peak primarily to white perch and other  
290 anadromous fish that were present because of annual spawning migrations through the area.  
291 Species diversity varied from a low of 1 species (Site 104 during July and October and Area A  
292 during July and December) to 5 species during April (Areas A and B). The low sample sizes in  
293 July, October, and December 1996 precluded a detailed description of community composition  
294 during these periods.

#### 295 296 July 1996

297  
298 A total of 7 fish ( 6 striped bass and 1 white perch) were captured in July 1996 from the 7  
299 anchored gillnet deployments. Of these, two striped bass were caught at Site 104. All the  
300 remaining fish came from the two reference areas. All fish were caught in 3 or 4 inch panels.

#### 301 302 October 1996

303  
304 A total of 15 fish (5 Atlantic menhaden, 7 gizzard shad, 1 striped bass, and 2 weakfish) were  
305 captured in October 1996 from the 7 anchored gillnet deployments. Of this total, only one fish, a  
306 weakfish, came from Site 104. The majority of fish captured came from Area B.

#### 307 308 December 1996

309

310 No sampling was possible in Area B in December 1996 because of commercial drift nets in the  
311 area (Miller 1998). The survey gill nets could not be deployed because of the risk of destroying  
312 the commercial fishermen nets. From the 6 deployments performed at Site 104 and Area A, 14  
313 fish (3 gizzard shad, 3 striped bass, and 8 white perch) were captured. Two of the three striped  
314 bass came from Site 104.

315

316 April 1997

317

318 A total of 574 fish from 5 species (98 Atlantic menhaden, 2 gizzard shad, 14 striped bass, 457  
319 white perch, and 1 shad *sp.*) were collected in all areas combined from the 8 anchored gillnet  
320 deployments. Of this total, 402 fish were collected at Site 104, 116 fish were collected in Area A  
321 and 56 fish were collected in Area B. Estimated CPUE was highest at Site 104 and declined for  
322 both reference areas A and B, respectively. The most abundant species captured was white  
323 perch. Striped bass, Atlantic menhaden, gizzard shad, and other shads (both blueback herring  
324 and hickory shad) were also collected. The majority of striped bass were caught in reference  
325 areas A and B.

326

1 **5.1.6.c Benthic Community.**

2  
3 **Community Composition**

4  
5 Benthic macroinvertebrates are ~~organisms~~ animals that live on or in the bottom substrates of  
6 water bodies for all or part of their lives (Versar 1992). Benthos are an important link in the  
7 ecology of the Chesapeake Bay because they are secondary consumers of detritus and bacteria  
8 from the bottom and are in turn an important food source for fish, crustaceans, and waterfowl.  
9 Conditions which control benthic macroinvertebrate species diversity and distribution include  
10 salinity, sediment type, dissolved oxygen levels, water temperature, and hydrodynamics.

11 Benthic macroinvertebrate species diversity and distribution are lower in the upper Bay than in  
12 areas further south due to salinity and temperature fluctuations (Rogers and Rogers 1986; Diaz  
13 and Schaffner 1990; Ruddy 1990). In addition, diversity of benthic communities (number of  
14 species present) is theoretically lowest in environments with salinities of approximately 7 ppt,  
15 and increases progressively in more and less salty waters (Gosner 1971). Studies in the upper  
16 Bay have shown that benthic species diversity is typically highest in spring and fall (MDE  
17 1996ab).

18  
19 The substrate in the upper Bay is predominantly silty clay, to clayey silt (mud) (MDE 1996ba;  
20 MDE 1996bc; MDNR 1996). Because of this, the upper Bay is dominated by macroinvertebrates  
21 that prefer mud substrates and that can survive in a low-mesohaline to oligohaline environment  
22 with wide fluctuations in salinity and temperature. Studies conducted by Diaz and Schaffner  
23 (1990) have shown that habitats dominated by mud substrate exhibit the lowest productivity,  
24 compared to mixed mud and sand substrate habitats, although the highest productivity for mud  
25 substrate habitats occurs in the low-mesohaline to oligohaline zones. The bottom substrate at  
26 Site 104 is comprised of predominantly silty clay substrate (Table 5-2324) and the site is located  
27 in a predominantly mesohaline region (Table 5-98; Section 5.1.4).

28  
29 Environmental factors such as substrate type, temperature, salinity, and dissolved oxygen dictate  
30 that the Site 104 region be dominated by stress-tolerant, opportunistic species that are less  
31 sensitive to environmental fluctuations and stresses and that can re-colonize rapidly. It is  
32 generally accepted that the upper Bay is a naturally unstable environment that precludes the  
33 establishment of a benthic community dominated by equilibrium species. Equilibrium species  
34 are those benthic taxa that require a setting characterized by relatively constant, rather than  
35 variable, physical environmental  
36 ~~Variables~~ conditions; and This equates to a reduced level of environmental stressors such as  
37 extremes of temperature, salinity, dissolved oxygen, or ambient water or sediment concentrations  
38 of chemical contaminants (Cronin *et al.* 1970; MDE 1996ab; MDE 1996cb).

39  
40  
41 **Seasonal Trends**

42  
43 The MDE performed sampling at Site 104 and at nearby locations selected as reference stations  
44 on six dates during the period October 1996 through December 1997. Benthic samples were  
45 collected at locations KI-1 through KI-10 in October 1996 (Figure 5-1412). Subsequent to the

Table 5-2324

## Percent Composition of Substrate and Depth of Stations in the Vicinity of Site 104 by Station and Sampling Event

Stations	Station Number	October 1996		March 1997		May 1997		July 1997		September 1997		December 1997	
		Depth	Composition	Depth	Composition	Depth	Composition	Depth	Composition	Depth	Composition	Depth	Composition
		Site 104	KI-1	13.0 m (42.6 ft)	1% detritus 1% shell 98% silty clay	13.5 m (44.3 ft)	100% silty clay	13.3 m (43.6 ft)	100% silty clay	12.5 m (41.0 ft)	100% silty clay	12.7 m (41.7 ft)	99% silty clay 1% shell
	KI-2	14.6 m (47.9 ft)	2% detritus 1% shell 97% silty clay										
	KI-3	13.8 m (45.3 ft)	1% detritus 99% silty clay										
	KI-4	14.2 m (46.6 ft)	2% detritus 1% shell 97% silty clay	14.7 m (48.2 ft)	100% silty clay	15.3 m (50.2 ft)	100% silty clay	14.5 m (47.6 ft)	100% silty clay	14.8 m (48.5 ft)	99% silty clay 1% shell	14.8 m (48.5 ft.)	100% silty clay
	KI-5	15.3 m (50.1 ft)	10% detritus 10% sand 5% shell 75% silty clay										
	KI-6	17.1 m (56.1 ft)	1% detritus 99% silty clay	17.9 m (58.7 ft)	5% sand 95% silty clay	17.3 m (56.7 ft)	75% sand 25% silty clay	17.0 m (55.8 ft)	100% silty clay	17.7 m (58.1 ft)	100% silty clay	17.7 m (58.1 ft.)	100% silty clay
	KI-7	18.6 m (61.0 ft)	50% detritus 50% silty clay	19.3 m (63.3 ft)	95% sand 5% silty clay	19.5 m (64.3 ft)	25% sand 5% shell 70% silty clay	19.0 m (62.3 ft)	100% silty clay	19.2 m (63.0 ft)	65% gravel, 35% silty clay	19.2 m (63.0 ft.)	60% silty clay 40% gravel
	KI-8	18.0 m (59.0 ft)	1% detritus 1% shell 98% silty clay	18.0 m (59.0 ft)									
Ref.	KI-9	14.0 m (45.9 ft)	1% detritus 25% shell 74% silty clay	14.9 m (48.9 ft)	15% gravel 85% silty clay	13.8 m (45.3 ft)	20% gravel 40% sand 20% silty clay	17.0 m (55.8 ft)	10% gravel 10% sand 80% silty clay	13.5 m (44.3 ft)	10% gravel 35% sand, 55% silty clay	13.5 m (44.3 ft.)	86% silty clay 10% sand 4% shell
	KI-10	17.2 m (56.4 ft)	10% detritus 10% gravel 20% sand 10% shell 50% silty clay	18.3 m (60.0 ft)		17.5 m (57.4 ft)	20% gravel 80% sand	14.0 m (45.9 ft)	100% silty clay	17.0 m (55.8 ft)	100% silty clay	17.0 m (55.8 ft.)	95% silty clay 5% sand
	KI-11			13.8 m (45.3 ft)	100% silty clay	13.2 m (43.3 ft)	100% silty clay	12.5 m (41.0 ft)	100% silty clay	12.6 m (41.3 ft)	100% silty clay	12.6 m (41.3 ft.)	90% silty clay 10% sand
	KI-12			4.1 m (13.5 ft)	100% sand	2.6 m (8.50 ft)	100% sand	1.5 m (4.90 ft)	100% sand	2.0 m (6.60 ft)	100% sand	2.0 m (6.6 ft.)	100% sand
	KI-13			3.4 m (11.2 ft)	100% sand	3.6 m (11.8 ft)	100% sand	2.5 m (8.20 ft)	100% sand	2.9 m (9.50 ft)	100% sand	2.9 m (9.5 ft.)	100% sand
	KI-14			25.3 m (83.0 ft)	100% silty clay	25.8 m (84.6 ft)	100% silty clay	25.0 m (82.0 ft)	100% silty clay	25.0 m (82.0 ft)	100% silty clay	25.0 m (82.0 ft.)	100% silty clay

Source: MDE 1998b

46 October 1996 sampling period, certain benthic (and water quality) sampling stations were revised  
47 to better represent the benthic community at Site 104 (Figure 5-1442, Table 5-2324).

48  
49 Benthic organism collection at Site 104 from October 1996 to December 1997 has shown that the  
50 area is generally dominated by mollusk, annelid, and arthropod species typical of much of the  
51 Bay (Table 5-2425). This table also provides a listing of all species found during the benthic  
52 community assessment at Site 104 and at the reference locations, for each of the sampling events.  
53 Dominant species found at Site 104 included: the mollusks *Macoma balthica* and *Mulina*  
54 *lateralis*; the polychaetes *Marenzelleria viridis*, *Streblospio benedicti*, and *Neanthes succinea*;  
55 the oligochaete *Tubificoides* sp.; and the arthropod *Leptocheirus plumulosus*.

56  
57 Data gathered for the benthic community assessment at all sampling locations both inside and  
58 outside Site 104 were used to determine a number of variables that together were used to  
59 calculate the Benthic Index of Biotic Integrity (B-IBI) for the Site 104 vicinity as a whole.  
60 Benthic invertebrates are used extensively as indicators of estuarine environmental stress and  
61 trends; the B-IBI provides a uniform scale for comparing the quality of benthic assemblages  
62 across varying  
63 habitats (Weisberg *et al.* 1997). The B-IBI assigns a score to each of several attributes (overall  
64 abundance, abundance of opportunistic and equilibrium species, Shannon Diversity Index,  
65 abundance of carnivores and omnivores) that describe benthic communities (MDE 1998b).

66  
67 The first of several attributes used in the calculation of B-IBI scores was total abundance. Total  
68 abundance was calculated as total number of organisms per square meter ( $\#/m^2$ ). Other benthic  
69 community attributes, including abundance of equilibrium and opportunistic taxa, and abundance  
70 of carnivores and omnivores, were calculated as the percentages of total abundance, and were  
71 also used in calculating the B-IBI.

72  
73 Equilibrium taxa are generally large, relatively long-lived organisms that often dominate  
74 community biomass in undisturbed or unstressed habitats (Warwick 1986). In contrast, the  
75 relatively short-lived, opportunistic taxa have a relatively high reproductive and recruitment  
76 potential. Opportunistic taxa typically dominate disturbed or stressed habitats (Boesch 1973;  
77 Rhoades *et al.* 1978). Consequently, high percentages of opportunistic species and low  
78 percentages of equilibrium species could be expected in a degraded habitat.

79  
80 The Shannon Diversity Index (H) is related primarily to species richness EXPLAIN TO  
81 PUBLIC and distribution of individuals among the species (Weber 1973). The index was used  
82 to show hierarchical species diversity and to calculate the B-IBI. Higher diversity index values  
83 suggest greater numbers of species and a more even representation of the taxa present.

84  
85 From October 1996 to March 1997 based upon the mean of all stations sampled during the study  
86 at all study stations, there was an increase in the B-IBI, number of taxa, overall abundance (Table  
87 5-2526), and percent of equilibrium species present (Table 5-26) ~~based upon the mean of all~~  
88 ~~stations sampled during the study~~. Similarly, there was a decrease in the carnivore/omnivore  
89 abundance and the percent of opportunistic species present, and a slight decrease in the Shannon  
90 -Diversity Index.

Table 5-2425  
 Species of Benthic Invertebrates Collected in the Vicinity of Site 104, October 1996 through  
 December 1997.

	October	March	May	July	September	December
<b>CNIDARIA</b>						
Actinaria					X	X
<b>NEMERTINEA</b>	X	X	X	X		
<b>MOLLUSCA</b>						
<i>Macoma balthica</i>	X	X	X	X	X	
<i>Macoma mitchelli</i>		X	X	X	X	X
<i>Mulina lateralis</i>	X	X	X	X	X	X
<i>Mya arenaria</i>		X	X			X
<i>Opisthobranchia</i>	X	X	X			
<i>Rangia cuneata</i>		X		X		X
<b>ANNELIDA</b>						
<b>POLYCHAETA</b>						
<i>Boccardiella ligERICA</i>	X			X		
Capitellidae			X			X
<i>Capitella</i> sp.		X	X	X	X	X
<i>Glycera</i> sp.			X	X		X
<i>Hypereteone heteropoda</i>	X	X	X	X	X	X
<i>Leitoscoloplos fragilis</i>	X	X				
<i>Marenzelleria viridis</i>	X	X	X	X	X	X
<i>Neanthes succinea</i>	X	X	X	X	X	X
<i>Pectinaria gouldii</i>		X	X	X		X
<i>Polydora cornuta</i>	X	X	X			X
Sabellariidae						X
<i>Sabellaria vulgaris</i>						X
<i>Streblospio benedicti</i>	X	X	X	X	X	X
<b>OLIGOCHAETA</b>						
Tubificidae			X			
<i>Tubificoides</i> sp.	X	X	X	X	X	X
<b>ARTHROPODA</b>						
<i>Americoludes</i> sp.		X	X	X	X	
<i>Chiridotea almyra</i>	X	X	X	X	X	X
<i>Chiridotea caeca</i>			X			
<i>Corophium lacustre</i>	X	X	X			X
<i>Cyathura polita</i>	X		X	X	X	
<i>Cyclaspis varians</i>			X			
<i>Gammarus</i> sp.			X			
<i>Gammarus daiberi</i>	X	X	X			
<i>Gammarus palustris</i>		X	X			
<i>Gammarus tigrinus</i>		X	X			
Haustoriidae		X	X	X	X	X
<i>Leptocheirus plumulosus</i>	X	X	X	X		X
<i>Neomysis americana</i>					X	X
<b>INSECTA</b>						
<i>Chironomus</i> sp.	X	X				
<i>Coelotanytus</i> sp.		X				
<i>Cricotopus/Orthocladius</i>	X					
<i>Eukeiffieriella</i> sp.	X		X			
Orthocladinae			X			
<i>Procladius</i> sp.	X					
<i>Rheotanytarsus</i> sp.	X		X			

Source: MDE 1998b

Table 5-2526

Benthic Community Assessment Summary of B-IBI, Shannon Diversity Index and Abundance Parameters by Sampling Event for Locations in the Vicinity of Site 104

Sampling Event	B-IBI Mean	Number of Taxa		Shannon Diversity Index		Carnivore /Omnivore Abundance Percent	Overall Abundance Mean (#/m <sup>2</sup> )
		Mean (Range)	Std. Dev.	Mean (Range)	Std. Dev.		
Oct. 1996	1.85	5.5 (3-7)	1.43	1.63 (1.39-1.85)	1.43	26.5	1766.6
March 1997	2.7	10.1 (7-16)	3.14	1.62 (0.45-2.38)	3.14	9.8	6422.6
May 1997	2.56	10.1 (6-15)	2.69	2.19 (0.82-3.07)	2.69	12.2	3325.9
July 1997	2.05	9.1 (7-11)	1.20	1.50 (0.76-2.15)	0.33	3.70	6310.6
Sept. 1997	1.51	4.1 (1-8)	2.08	1.24 (0-2.57)	0.72	4.32	1733.3
Dec. 1997	2.16	5.3 (3-9)	1.9	1.37 (0.61-1.92)	0.46	11.8	2537.3
Net change - Oct. 1996 to March 1997	+0.85	+4.6		-0.01		-16.7	+4656
Net change - March 1997 to May 1997	-0.14	0		+0.57		+2.4	-3097
Net change - May 1997 to July 1997	-0.51	-1		-0.69		-8.5	+2985
Net change - July 1997 to Sept. 1997	-0.54	-5		-0.26		+0.62	-4577
Net change - Sept. 1997 to Dec. 1997	+0.65	+1.2		+0.13		+7.48	+804

Source: MDE 1998b

Table 5-2627

**Benthic Community Assessment: Percent Opportunistic Species Abundance and Percent Equilibrium Species Abundance by Sampling Event for Locations in the Vicinity of Site 104**

Sampling Event	% Opportunistic Species Abundance		% Equilibrium Species Abundance	
	Mean (Range)	Std. Dev.	Mean (Range)	Std. Dev.
Oct. 1996	49.9 (27.2-73.3)	15.5	0.8 (0.0-2.9)	1.0
March 1997	18.5 (0.3-64.2)	19.5	63.4 (26.7-96.7)	25.0
May 1997	40.3 (0.8-96.6)	28.8	32.9 (1.2-81.1)	25.1
July 1997	63.7 (2.2-91.1)	33.2	12.0 (2.9-64.2)	18.5
Sept. 1997	56.2 (2.1-96.9)	34.8	6.4 (0-22.3)	9.6
Dec. 1997	53.6 (2.8-92.4)	32.8	9.5 (0.03-42.3)	13.5
Net change - Oct. 1996 to March 1997	-31.4		+62.6	
Net change - March 1997 to May 1997	+21.8		-30.5	
Net change - May 1997 to July 1997	+23.4		-20.9	
Net change - July 1997 to Sept. 1997	-7.5		-5.6	
Net change - Sept. 1997 to Dec. 1997	-2.6		+3.1	

Source: MDE 1998b

91  
92 From March 1997 to May 1997, there was a decrease in the B-IBI (Table 5-2625), and decrease  
93 in the overall abundance and the percent of equilibrium species present, based upon the mean of  
94 all stations (Table 5-2726). At the same group of stations, there was an increase in the Shannon  
95 Diversity Index, carnivore/omnivore abundance, and the percent of opportunistic species present.  
96 The number of taxa present remained steady from March to May 1997.

97  
98 From May 1997 to July 1997, there was a decrease in the mean B-IBI, number of taxa, the  
99 Shannon Diversity Index, the carnivore/omnivore abundance, and the percent of equilibrium  
100 species present. Overall abundance and the percent of opportunistic species present increased  
101 during the same period.

102  
103 From July 1997 to September 1997, based upon the mean of all stations sampled, all calculated  
104 indices decreased, with the exception of the carnivore/omnivore abundance index, which  
105 increased slightly. In contrast, from September to December 1997, all calculated indices  
106 increased, except the percentage of opportunistic species, which decreased slightly.

107  
108 The general trends in the benthic community appeared to follow the bottom dissolved oxygen  
109 concentrations in the overlying water column (Table 5-2827). As the dissolved oxygen increased  
110 from October 1996 to March 1997, the benthic community improved (Tables 5-2625 and 5-  
111 2726), but as the dissolved oxygen levels decreased in May and July (Table 5-2827), there was a  
112 decline in the benthic community. This decline was further  
113 evident during September 1997. The increase in dissolved oxygen concentrations in December  
114 1997 compared to the previous collection was reflected in the generally improving trend in  
115 benthic population indices in December 1997 compared to September 1997.

## 116 **Spatial Trends**

117  
118  
119 For comparison purposes, sampling locations were grouped into categories based upon their  
120 location (inside or outside of Site 104) and depth. Stations categorized as deep-water locations  
121 inside Site 104 included KI-1 through KI-8 during October 1996, and KI-1, KI-4, KI-6, and KI-7  
122 thereafter (Figure 5-1214). ~~Deep-water~~ Deep-water locations outside Station 104 (reference  
123 stations) included KI-9 and KI-10 during October 1996, and KI-9, KI-10, and KI-11 thereafter.  
124 Locations KI-12 and KI-13 (sampled ~~only~~ after October 1996) were classified as shallow stations  
125 outside Site 104. Location KI-14 (also sampled ~~only~~ subsequent to October 1996) was a very  
126 deep station outside Site 104. ~~Be-~~ because the water depth at KI-14 was substantially greater  
127 than the depth of the other reference stations outside Site 104, KI-14 was not grouped with the  
128 other deep outer stations, but rather was categorized as its own group of one station.

129  
130 The mean B-IBI (Table 5-2928) and the mean number of taxa at locations inside the previously  
131 used dredged material placement area at Site 104 were equal to or higher than locations outside  
132 Site 104 in four of the six sampling periods; The ratios of inside to outside station B-IBI indices  
133 during these four periods ranged from 1 to 1.29. The Shannon Diversity Index was higher at  
134 deep outside stations compared to deep inside stations on five of the six sampling dates; ratios of  
135 outside to inside stations on these five dates ranged from 1.056 to 1.50. Overall abundance was

Table 5-2728

Water Quality Parameters at the MDE Benthic Sampling Stations in the Vicinity of Site 104

Month	Station	Temp (C)	pH	DO (mg/L)	Salinity (ppt)	Conductivity (mS/cm)		
October 1996	Deep Inner	KI-1	16.8	7.3	5.3	18600		
		KI-2	16.9	7.4	5.2	19400		
		KI-3	17	7.3	5	19900		
		KI-4	17	7.4	5	19900		
	Deep Outer	KI-5	17.2	7.3	5.2	19900		
		KI-6	17.1	7.3	5.2	19000		
		KI-7	17.2	7.3	4.6	20700		
		KI-8	17.1	7.3	4.9	19800		
		KI-9	17	7.3	5.1	19500		
		KI-10	17.1	7.3	4.9	20100		
March 1997	Deep Inner	KI-1	6.1	7.4	8.6	17900		
		KI-4	6	7.4	8.6	18600		
		KI-6	6	7.3	8.1	18700		
		KI-7	6	7.3	8.1	19900		
	Deep Outer	KI-9	6.2	7.4	8.1	18700		
		KI-10	6.1	7.3	8.6	19800		
		KI-11	6.1	7.4	8.3	18200		
		KI-12	6.5	7.7	11.8	8670		
		KI-13	6.5	7.7	11.6	9080		
		KI-14	6.1	7.3	7.8	21200		
May 1997	Deep Inner	KI-1	12	7.3	3.9	21100		
		KI-4	11.7	7.2	3.2	22100		
		KI-6	11.8	7.2	3.3	21800		
		KI-7	11.7	7.2	3.2	23300		
	Deep Outer	KI-9	12.3	7.4	4.4	19600		
		KI-10	12	7.4	3.5	21200		
		KI-11	12.2	7.4	4.1	20100		
		KI-12	14.1	7.9	9.3	12410		
		KI-13	13.7	7.7	8.4	13840		
		KI-14	11.5	7.1	2.9	24500		
July 1997	Deep Inner	KI-1	20.8	7.6	1.4	22400		
		KI-4	19.2	7.5	2.1	26000		
		KI-6	18.8	7.5	0.31	27300		
		KI-7	18.9	7.5	0.36	27400		
		KI-9	19.3	7.6	0.3	26400		
		KI-10	20	7.8	0.3	24500		
		KI-11	21.3	7.6	0.8	21100		
	Shallow Outer	KI-12	25.7	8.1	14	13890		
		KI-13	24.9	7.9	9.1	15100		
		KI-14	18.2	7.4	0.21	29400		
		September 1997	Deep Inner	KI-1	24.1	7.19	2.14	26500
				KI-4	24.2	7.21	1.88	27600
				KI-6	24.2	7.21	1.81	27600
				KI-7	24.3	7.21	1.5	28800
KI-9	23.9			7.18	2.9	25100		
KI-10	24.1			7.2	2.49	26400		
KI-11	23.9			7.2	1.82	24500		
Shallow Outer	KI-12		23.9	7.68	6.92	20500		
	KI-13		23.9	7.65	6.27	22100		
	KI-14		24.4	7.16	1.4	27300		
	December 1997		Deep Inner	KI-1	8.8	7.6	6.4	27200
				KI-4	8.8	7.6	6.3	27300
				KI-6	9.0	7.8	6.0	27800
				KI-7	9.3	7.7	5.5	28700
KI-9		8.8		7.6	6.3	27100		
KI-10		9.0		7.8	6.0	27600		
KI-11		8.7		7.6	6.4	26900		
Shallow Outer		KI-12	6.1	7.7	10.3	19500		
		KI-13	6.9	7.9	9.1	21400		
		KI-14	9.3	7.8	5.6	28800		

Source: MDE 1998b

**Table 5-2928**  
**Benthic Community Indices by Sampling Date and Stations Categorized by Depth, Location, and**  
**Ratio of**  
**B-IBI Indices**

<b>Overall Abundance (No./m2)</b>	<b>Deep Inner</b>	<b>Deep Outer</b>	<b>Ratio Out/In</b>	<b>Ratio In/Out</b>	<b>Shallow Outer</b>	<b>KI-14</b>
October 1996	1480	2910	1.97	0.51	NA	NA
March 1997	9520	5750	0.60	1.66	3310	2300
May 1997	3980	1790	0.45	2.22	1630	8700
July 1997	7270	8180	1.13	0.89	2580	4340
September 1997	1360	3640	2.68	0.37	474	10
December 1997	4312	2064	0.48	2.09	222	1490
Max.			2.68	2.22		
Min.			0.45	0.37		
<b>Number of Taxa</b>						
October 1996	5.25	6.5	1.24	0.81	NA	NA
March 1997	11	11	1.00	1.00	8.5	7
May 1997	12.5	9.67	0.77	1.29	6.5	9
July 1997	9	9	1.00	1.00	9	10
September 1997	3.75	3.66	0.98	1.02	7	1
December 1997	5.5	6.7	1.22	0.82	3	5
<b>Shannon Diversity Index</b>						
October 1996	1.61	1.7	1.06	0.95	NA	NA
March 1997	1.49	2.24	1.50	0.67	0.68	2.11
May 1997	2.7	2.56	0.95	1.05	1.32	0.82
July 1997	1.04	1.44	1.38	0.72	1.71	0.76
September 1997	0.813	1.1	1.35	0.74	2.09	0
December 1997	1.37	1.57	1.15	0.87	1.46	0.61
Max.			1.50	1.05		
Min.			0.95	0.67		
<b>B-IBI</b>						
October 1996	1.94	1.5	0.77	1.29	NA	NA
March 1997	2.5	2.33	0.93	1.07	3.75	2.5
May 1997	2.6	2.6	1.00	1.00	3.2	1
July 1997	1.2	2.6	2.17	0.46	3.25	1.4
September 1997	1.3	1.13	0.87	1.15	2.75	1
December 1997	2.0	2.3	1.15	0.87	2.5	1.7
Max.			2.17	1.29		
Min.			0.77	0.46		
<b>Opportunistic Taxa Abundance (%)</b>						
October 1996	54.2	32.8	0.61	1.65	NA	NA
March 1997	12.0	23.8	1.98	0.50	0.75	64.2
May 1997	45.0	41.4	0.92	1.09	0.91	96.6
July 1997	78.8	72.2	0.92	1.09	5.8	93.8
September 1997	68.0	59.4	0.87	1.14	5.8	100
December 1997	66.7	56.5	0.85	1.18	3.3	92.4
<b>Equilibrium Taxa Abundance (%)</b>						
October 1996	0.74	1.05	1.42	0.70	NA	NA
March 1997	69.0	48.5	0.70	1.42	93.0	26.7
May 1997	29.4	19.1	0.65	1.54	76.3	1.19
July 1997	5.74	6.49	1.13	0.88	37.1	3.23
September 1997	1.4	0.03	0.02	46.67	20.0	0
December 1997	4.82	2.5	0.52	1.93	33.3	2.01

Source: MDE 1998b

Note: NA – Locations in this category were not sampled during this month

136 higher at deep stations outside Site 104 compared to deep stations inside Site 104 on three of the  
137 six sampling dates; ratios of outside to inside overall abundance ranged from 1.132 to 2.678 on  
138 these three dates.

139  
140 Opportunistic taxa abundance was higher at stations inside Site 104 on five of the six sampling  
141 trips, but the differences were minimal in most cases. Equilibrium taxa abundance was similar at  
142 stations inside Site 104 compared to outside Site 104 on three of the six sampling dates. On two  
143 dates (March and May 1997) equilibrium taxa abundance appeared to be slightly higher at deep  
144 stations inside Site 104 than at similar depths outside Site 104.

## 145 146 **Summary**

147  
148 Overall, the benthic community was within expected ranges for this area and there were few  
149 substantial differences between areas of similar depth outside Site 104 and areas within the  
150 boundaries of Site 104. Spatial comparisons revealed no generalized pattern in the relationship  
151 between stations inside and outside Site 104 at similar depths. Spatial location appeared to have  
152 minimal affect on the benthic community; differences were much more apparent when  
153 comparing locations of different depth. Site 104 is located in a section of the Chesapeake Bay  
154 that is prone to summer hypoxia below the pycnocline. The depth of the water column  
155 exacerbates this condition. Hypoxic/anoxic conditions during the summer months resulted in  
156 reduced number of benthic taxa, low B-IBI scores, and low diversity indices relative to other  
157 times of the year (MDE 1998b).

158  
159 The Chesapeake Restoration Goals Index (RGI) is an evaluation criteria which has been  
160 developed as a target for benthic community restoration. To achieve a "restored" or healthy  
161 condition, a score of 4.0- 3.0 or more on the B-IBI must be achieved.

162  
163 ~~Only one deep station sampled inside or outside of Site 104 achieved this goal during the study.~~  
164 ~~This was Station K1-1, which is at 42.6 feet of water in the northern end of Site 104, it achieved a~~  
165 ~~B-IBI of 4 in October, 1996. Otherwise, all deep water stations in all seasons had B-IBI's of less~~  
166 ~~than 4, indicating a generally poor quality benthic environment.~~

167  
168 Within the Site 104 stations sampled (deep inner stations; depths ranging from approximately 42  
169 to 63 ft.), the mean B-IBI never achieved the RGI of 3.0. The highest mean B-IBI for the Site  
170 104 stations sampled was 2.5 in May 1997. The only individual stations to achieve or exceed the  
171 RGI of 3.0 were stations K1-1 and K1-4 (Figure 5-1412). Station K1-1 is the northernmost  
172 station in the site with depths approximating 42 ft. Station K1-4 is located on the eastern edge at  
173 approximately the middle of the site. Depths at this site are approximately 48 ft. The RGI of 3.0  
174 was only achieved or surpassed at station K1-1 in October 1996 (4.0) and May 1997 (3.0) and at  
175 station K1-4 in March (3.0) and May 1997 (3.0).

176  
177 During the study, the deep outer-stations outside of Site 104 (K1-9, 10 and 11; depths ranging  
178 from approximately 41 to 60 ft.) and the deep outlier station, K1-14 (depth approximately 83 ft.),  
179 never achieved the RGI of 3.0. The highest B-IBI at the deep outer-stations outside of Site 104  
180 was 2.6 in May and July 1997. The highest B-IBI at station K1-14 was 2.5 in March 1997.

181 However, the mean B-IBI at the shallow ~~outer~~ stations outside of Site 104 (K-12 and 13; depths  
182 ranging from approximately 8 to 10 ft.) achieved the RGI during the March, May and July 1997  
183 sampling event. The mean B-IBI at these stations ranged from 3.3 to 3.8 over this period.

184  
185 The low mean B-IBI scores within Site 104 (deep inner), the deep ~~outer~~ stations outside of Site  
186 104 and the deepest outlier station, isare an indication of the poor quality benthic habitat in  
187 deeper areas of theis region of the Bay. The mean B-IBI scores at the shallow ~~outer~~ stations  
188 outside of Site 104 indicate the generally better habitat available to the benthic community in the  
189 shallow waters in the vicinity of Site 104.

190 This is probably due to a combination of better, sandy substrate, as well as better oxygenation of  
191 the bottom environment in the spring, summer, and fall in the more shallow waters.

192

1  
2 **5.1.6.d Submerged Aquatic Vegetation (SAV).** SAV (~~submerged aquatic vegetation~~) is an  
3 important component of the Chesapeake Bay ecosystem. SAV communities can contribute much  
4 to the primary and secondary productivity of an estuary. They provide food and nursery habitat  
5 for many species and help to consolidate sediment and reduce turbidity by decreasing wave  
6 energy. They also absorb nutrients and produce oxygen (Batiuk *et al.* 1992;<sup>;</sup> Hurley 1990;<sup>;</sup>  
7 Hurley 1991). Because SAV have specific habitat requirements, their presence can be used to  
8 help evaluate the water quality of a given area (Dennison *et al.* 1994). These habitat  
9 requirements can be profoundly affected by land use since agricultural, residential, and urban  
10 ~~land-use practices~~ influence loadings of nutrients and sediment (Hurley 1990). Increases in  
11 nutrients stimulate algae growth in the water column and on the SAV. This limits the ability of  
12 SAV to utilize available sunlight. Also, increased sedimentation from shoreline erosion, etc.  
13 reduces available sunlight and covers the plants with sediments.  
14

15 Historically, expansive communities of SAV contributed significantly to the high productivity of  
16 the Bay, and were indicative of good water quality. ~~But~~ However, dramatic SAV declines in the  
17 late 1960s and the 1970s ~~have resulted from degradation of the Bay's water quality at that time.~~  
18 Baywide SAV coverage and density has, however, increased in recent years (Orth *et al.* 1995;<sup>;</sup>  
19 Blankenship 1997). However, the rates of recovery are not constant throughout the Bay. Certain  
20 tributaries and areas of the Bay have not attained sufficient water quality to support SAV growth  
21 (Orth *et al.* 1994).  
22

23 Because of light availability requirements, SAV in the Chesapeake Bay is limited to shallow  
24 waters, generally less than 2 m (6.6 ft) in depth (Batiuk *et al.* 1992). No SAV have been found in  
25 Site 104 because the area is too deep to support them due to insufficient light. Three ephemeral  
26 or short-term beds have been documented within 2.5 nautical miles of Site 104 in the past few  
27 years. In 1996, an ephemeral bed was documented approximately 2.5 nautical miles to the  
28 southwest of Site 104 in Goose Pond, just north of Hackett Point (Orth *et al.* 1996). In 1997, two  
29 ephemeral beds were documented in coves located approximately 1 nautical mile southeast of  
30 Site 104, just to the north and south of the Bay Bridge (Orth *et al.* 1997). None of the three  
31 ephemeral beds were observed before or after their respective sightings in 1996 or 1997. In  
32 the vicinity of Site 104, it is very common to have ephemeral beds occur due to the recruitment  
33 of seed sprouts. Most of the ephemeral beds in the area are composed of widgeon grass (Orth  
34 1999).  
35

36 The nearest significant SAV beds to Site 104 (documented in 1997) are ~~over~~ more than 4 nautical  
37 miles away along the southern shoreline of the Magothy River and along the northern shoreline  
38 of the Chester River mouth. The Magothy River bed, which consists primarily of           , is  
39 located approximately 5 nautical miles away, along the western shoreline of the mouth of Deep  
40 Creek. The bed along the northern shore of the Chester River mouth is located approximately 4  
41 nautical miles from Site 104 in the area between Eastern Neck and Eastern Neck Island. This  
42 SAV bed is rather large, covering an area approximately 5,000 meters long and 2,250 meters  
43 wide and consisting of           . Additional beds are also located intermittently along the eastern  
44 shore of Eastern Neck Island approximately 6 nautical miles from Site 104 (Orth *et al.* 1997).  
45

46 The closest documented SAV is approximately 4.0 km (2.5 miles) southeast of Site 104, in  
47 Goose Pond (north of Hackett Point)(Orth *et al.* 1996), but it is isolated from the site by Kent  
48 Island. The nearest beds that are along the mainstem are 4 miles away (mouth of the Magothy  
49 River) and 5 miles away (north shore of the Chester River mouth). One ephemeral SAV bed was  
50 found on the Eastern Shore adjacent to the Bay Bridge in 1997 but was not found prior or since.

51

52

1  
2 **5.1.7 Avian/Terrestrial Resources**  
3

4 **5.1.7.a Terrestrial Resources.** Site 104 is an open-water placement area located 1.6 km (1 mile)  
5 from the Kent Island shoreline; therefore, there are no terrestrial resources within the project  
6 area.  
7

8 **5.1.7.b Avian Resources.** There are three categories of avian resources that could potentially  
9 occur within the Site 104 open-water placement area; these are (1) raptor species, (2) waterfowl,  
10 and (3) sea birds including gulls, terns, etc. The USFWS stated that because colonial wading  
11 birds prefer areas less than 1 m (3.3 ft) in depth, they would not be present at Site 104, which  
12 ranges from -12.8 to -23.8 m (-42 to -78 ft) MLLW in depth (Doug Forsell 1997). The USFWS  
13 performed limited aerial surveys that estimated the numbers of all waterbirds in the area of  
14 ~~proposed~~ Site 104. Consultation with USFWS indicated that except for the occasional transient,  
15 no Federally listed, or proposed for listing, endangered avian species are known to exist at Site  
16 104 (Forsell 1997; Annex C). The Wildlife and Heritage Division (W&HD) of DNR stated in a  
17 letter dated 9 May 9, 1997, that they have no records for Federal or state rare, threatened, or  
18 endangered plants or animals within Site 104 (Slattery 1997; Annex C). However, the W&HD  
19 and Environmental Review Division (ERD) of MDNR indicated that the Department has  
20 designated a site on the shoreline on the western side of Kent Island immediately north of the  
21 Bay Bridge as a is adjacent to a Historic wWaterfowl Ceoncentration aAreas. This area extends  
22 westward from the Kent Island shoreline approximately 5,000 feet and northward from the  
23 westbound span of the Bay Bridge approximately 6,000 feet, and includes a buffer area. This  
24 area is designated by the Department as being outside the Site 104 boundaries (MDNR 1999a;  
25 Annex C).  
26

27 Raptor species common to the Bay region include bald eagle (*Haliaeetus leucocephalus*) and  
28 osprey (*Pandion haliaetus*). Bald eagles prefer large trees for nesting, roosting, and perching, in  
29 areas with limited human activity. They feed on a variety of prey species and are considered an  
30 opportunistic predator-scavenger. Ospreys prefer to nest over or near water (within 150 m [(492  
31 ft)]) or on man-made structures isolated from animal predation and away from human activity.  
32 They feed on fish caught from the nearby waterway (Funderburk *et al.* 1991). There are no  
33 structures within the proposed placement area to provide nesting habitat for the osprey, and the  
34 site is located 1.6 km (1 mile) from the Kent Island shoreline.  
35

36 According to MDNR, there are no raptor species inhabiting Site 104. There are peregrine falcons  
37 (*Falco peregrinus*), a raptor species that is not considered common to the Bay region, that nest  
38 on the mainspan of the Bay Bridge; however, they do not utilize Site 104 as a primary feeding  
39 area and their use of the area for feeding habitat is characterized as intermittent (Glenn Therres  
40 1997). The peregrine falcon ~~is~~ has been removed from the Federal Endangered Species List  
41 ~~presently designated as~~ but is still considered ~~endangered~~ by the Federal and State entities;  
42 while the bald eagle is considered threatened by Federal entities and endangered by state  
43 entities. Although the peregrine falcon and the bald eagle are presently designated endangered  
44 and/or threatened, consultation with Federal and state agencies has determined that the proposed  
45 project will not have an adverse impact on either species.

46  
47 There are numerous waterfowl species common to the Chesapeake Bay region including wood  
48 duck (*Aix sponsa*), American black duck (*Anas rubripes*), canvasback (*Aythya valisineria*), lesser  
49 scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala*  
50 *clangula*), and redhead (*Aythya americana*). Wood ducks remain in the Bay region in all but the  
51 coldest months. They are considered omnivores, prefer a variety of freshwater wetland habitats,  
52 typically nest in tree cavities, and are unlikely to be at Site 104. Black ducks typically remain in  
53 inland and emergent wetlands throughout the Bay region. They are also considered omnivores.  
54 Canvasbacks, scaup, goldeneye, and buffleheads are diving ducks that prefer inland and coastal  
55 habitats. They prefer shoal-water habitats with extensive submerged aquatic vegetation (SAV)  
56 beds and small bivalves. They are considered predominantly herbivores and feed primarily on  
57 sago pondweed and wild celery. The Bay provides an important overwintering habitat for  
58 canvasbacks. Redheads are also diving ducks that are considered sporadic fall and spring  
59 migrants to the Bay region. They are almost exclusively herbivores and feed mainly on SAV.  
60 Waterfowl concentration studies conducted in the Bay region by USFWS were used to determine  
61 whether a significant waterfowl population was present at Site 104 (USFWS 1994). USFWS  
62 studies included limited surveys of Site 104, and the majority of the waterfowl sightings were to  
63 the north and west of Site 104. Species of ducks that were observed by the USFWS in the  
64 vicinity of Site 104 include lesser scaup, bufflehead, and goldeneye. Based upon these studies  
65 and the fact that water depths are too great to support SAV (see Section 5.1.7.d), it was  
66 determined that Site 104 does not support a significant waterfowl population.

67  
68 Sea birds that are common to the Chesapeake Bay region include various species of terns, gulls,  
69 and sea ducks. Sea ducks are grouped separately from other ducks because of their preference  
70 for open bay and inshore coastal water habitation. Sea ducks observed by the USFWS in the Site  
71 104 vicinity include oldsquaw (*Clangula hyemalis*) and white-winged scoter (*Melanitta fusca*).  
72 Gulls that were observed by USFWS in the vicinity of Site 104 include the herring gull (*Larus*  
73 *argentatus*), ring-billed gull (*Larus delawarensis*), black-backed gull (*Larus marinus*), and  
74 bonaparte's gull (*Larus philadelphia*). No terns were observed in the vicinity of Site 104. In  
75 addition, through discussion with the MDNR and USFWS, it was determined that seabirds such  
76 as terns, gulls, and sea ducks used the area only for occasional foraging. Consultation with Mr.  
77 Forsell (USFWS) on ~~10~~ April 10, 1997 determined that Site 104 does not appear to support a  
78 significant seabird population.

79

1 **5.1.8 Rare, Threatened, and Endangered (RTE) Species**

2  
3 **5.1.8.a Introduction.** Certain species of plants and animals are protected by Federal and state  
4 State regulations under the Endangered Species Act (ESA) of 1973 and the Maryland Nongame  
5 and Endangered Species Conservation Act of 1975. Under (Section 7[a]) of the ESA, Federal  
6 agencies are required to consult with the USFWS and NMFS (where appropriate) if a prospective  
7 permit or license applicant or the implementing agency of Federal actions or Federal projects has  
8 reason to believe that rare, threatened, or endangered species (RTE) may be affected by a  
9 proposed project. The Maryland Nongame and Endangered Species Conservation Act has a  
10 similar consultation requirement regarding protected species that may be potentially affected.  
11

12 **5.1.8.b Coordination.** In fulfillment of Federal and state-State requirements, consultation was  
13 conducted with the USFWS Ecological Services Office in Annapolis, Maryland; the Habitat and  
14 Protected Resources Division of the NMFS in Oxford, Maryland; and MDNR's Fish, Heritage,  
15 and Wildlife Administration located in Annapolis, Maryland. Information requested from these  
16 agencies included Federal and state-State listed rare, threatened, and endangered RTE species,  
17 designated or proposed critical habitat, and candidate taxa occurring in the project area.  
18

19 The State of Maryland RTE response letter (Slattery 1997; Attachment E) received from MDNR  
20 stated that their agency has no records of state listed rare, threatened or endangered RTE plants or  
21 animals within the project site.  
22

23 The response letter from the USFWS (Wolfen 1997; Attachment E) stated that shortnose sturgeon  
24 (*Acipenser brevirostrum*), a Federally listed endangered species, had been documented off  
25 western Kent Island in May 1996 by USFWS. USFWS also cited wild Atlantic sturgeon  
26 (*Acipenser oxyrinchus*), which has been recorded in the area as a species of concern.  
27

28 The Atlantic sturgeon is not currently listed Federally for purposes of the ESA. However, its  
29 future listing status is uncertain at this time. The summary statement provided by USFWS  
30 indicates that, except for occasional transient individuals, no other Federally listed or proposed  
31 for listing endangered or threatened species are known to exist in the project impact area, and  
32 therefore, no further Section 7 Consultation was required with the USFWS. However, USFWS  
33 recommended contacting NMFS because they are the lead Federal agency for formal Section 7  
34 requirements for the shortnose sturgeon.  
35

36 The Federal response letter from the NMFS (Rosenberg 1997a; Attachment E) stated that while  
37 their agency is responsible for a number of endangered and threatened species, including sea  
38 turtles and several marine mammals, in the upper Chesapeake Bay, NMFS believes it unlikely  
39 that the proposed action would adversely affect these species. Nevertheless, the NMFS stated  
40 that their agency could not accurately determine the current status of the shortnose sturgeon  
41 (SNS).  
42

43 Beginning in the fall of 1997, SNS catches in the Chesapeake Bay have been under review by  
44 NMFS due to the results of a bounty program administered by the USFWS since 1996. This

45 program has resulted in the reporting and documentation of SNS as incidental bycatch in the  
46 pound nets, hoop nets, and gill nets of watermen in the Chesapeake Bay. With the documented  
47 incidence of more than an occasional transient, NMFS has requested an Informal Section 7  
48 Consultation under the ESA of 1973 and Biological Assessments of proposed actions by the  
49 Baltimore and Philadelphia Corps Districts in open-water in the Chesapeake Bay (Rosenberg  
50 1997b and 1997c; Annex A). This consultation is underway, with both Baltimore and  
51 Philadelphia Districts participating.

52  
53 An interim Biological Assessment is being prepared by the Baltimore District and will be  
54 distributed to NMFS at the time of the public release of this draft EIS [MCKEE-CURRENT  
55 STATUS?]. This interim Biological Assessment (BA) will include all field data available at this  
56 time. Although a final BA will not be completed until 2000, after 2 years of field data have been  
57 collected, the District will request a biological opinion from NMFS on this action based upon the  
58 data contained in the interim BA. Preliminary assessment of SNS have indicated that most  
59 specimens were genetically similar to the Delaware Bay population which is currently stable.

60  
61 The NMFS encouraged collection of information to determine whether or not SNS in the  
62 Chesapeake Bay constitute a geographically and genetically distinct population from the  
63 Delaware Bay. If a distinct shortnose population exists in the Chesapeake Bay, then more  
64 stringent protection requirements could be required by NMFS because of the unique nature of the  
65 population.

#### 66 67 5.1.8.c Shortnose Sturgeon (SNS) History, Biology, and Current Status.

##### 68 69 **History and Current Status of SNS in the Chesapeake Bay**

70  
71 Shortnose sturgeon (SNS) has been documented in the Chesapeake Bay since the 1600s, when  
72 settlers first colonized America. Historical records indicate that SNS wereas commonly found to  
73 inhabit the Potomac River in Maryland in the 1800s (Uhler and Lugger 1876). Few sturgeon  
74 have been reported in the Chesapeake Bay since the last known resident populations were  
75 thought to have been extirpated in the 1970s (Dadswell *et al.* 1984). There is, however, a  
76 documented resident population in the Delaware River (Hastings *et al.* 1987).

77  
78 When shortnose sturgeon were found in the Bay over the last 20 years, it was generally believed  
79 that they were infrequent transient, non-resident adults thatwhieh had traveled through the Inland  
80 Waterway, or C&D Canal, from the Delaware Bay into the Chesapeake Bay. Prior to 1997, No  
81 juveniles or spawning activity havees been observed in the Chesapeake Bay for decades, leading  
82 to the assumption that a distinct population segment, or resident population, did not exist in the  
83 Chesapeake Bay.

84  
85 Speculation has been that overfishing, losses of habitat, and spawning impediments such as the  
86 Conowingo Dam have contributed to their decline. At present, the continued existence of SNS  
87 as a distinct genetic population in the Chesapeake Bay remains uncertain. However, preliminary  
88 assessment of SNS have indicated that most specimens were genetically similar to the Delaware  
89 Bay population which is currently stable (NMFS 1999).

90

## 91 **Biology of the Shortnose Sturgeon (SNS)**

92

93 The life history of SNS is not fully understood to date. ~~SNShortnose sturgeon~~ populations have  
94 been documented by Dadswell *et al.* (1984) to occur in rivers, estuaries, and nearshore marine  
95 waters. ~~Shortnose sturgeons~~SNS are anadromous, migrating to fresh water to spawn. Movement  
96 of SNS is usually restricted within their natal river or estuary. Most of the year SNS are found at  
97 or below the fresh-saline water interface until the spawning migration begins, at which time they  
98 move into freshwater reaches of the Bay.

99

100 Freshets, substrate character, and flows are all documented factors influencing SNS spawning  
101 (Gilbert, 1989). ~~Shortnose sturgeon~~SNS spawn mostly once a year between February and May  
102 depending on latitude and longitude (Dadswell *et al.*; 1979).

103

104 Temperature is also a major factor in determining spring migration. Spawning generally occurs  
105 between 9°C and 12°C in freshwater areas. After spawning, the adults move to deep  
106 overwintering sites that are sometimes adjacent to the spawning grounds (Dadswell *et al.*; 1979).

107

108 Fertilized eggs of SNS stick to the bottom (Baine 1997). SNS eggs and hatch in 8 days at  
109 approximately 17°C. After 2 days, the yolk-sac fry seek concealment and avoid light. ~~Beginning~~  
110 ~~†~~Twelve days after hatching, the yolk sac is completely absorbed and the fry start feeding on  
111 zooplankton (Buckley and Kynard 1981). ~~Washburn and Gillis Associates (1981)~~ found that  
112 ~~†~~fertilized eggs strongly adhere to rough-surfaced substrata within 1 minute ~~after of~~ fertilization  
113 ~~occurs~~ (Washburn and Gillis Assoc. 1981). SNS~~sturgeon~~ eggs begin hatching 12 days after  
114 fertilization with some individuals still emerging on the 16<sup>th</sup> day.

115

116 Early growth of SNS is rapid. Young SNS begin to resemble adults by the time they are 20-30  
117 mm in length, ~~approximately 1 year of age~~ [(Dadswell *et al.* 1984)], ~~but~~ they remain juveniles  
118 until they are 45-55 cm Fork Length (FL) (~~approximately 3 years of age for males and up to 6~~  
119 ~~years of age for females~~), depending on the latitude. Males may mature in 2-3 years in the  
120 southern part of the range (Georgia) and up to 10-11 years in the northernmost part of their range.

121

122 Females require longer to mature, as their range moves northward, ~~from~~ 6 years in the  
123 southernmost parts of the range to 13 years in the northernmost (Gilbert 1989).

124

125 Suitable and/or critical habitat for the SNS in the Chesapeake Bay is currently unknown, due to  
126 their infrequent detection in the Chesapeake Bay. Spawning habitat has not been identified in the  
127 Chesapeake Bay. ~~but~~ If this habitat is consistent with the preferred substrate and water quality  
128 conditions in other East Coast populations, spawning habitat would consist of relatively fresh  
129 water high up in a river system that has a ~~with~~ relatively high velocity and gravelly to gravelly-  
130 sand and sandy mud substrates (MES 1998a).

131

132 **5.1.8.d Atlantic Sturgeon History, Biology, and Current Status.**

133

134 **History and Current Status of the Atlantic Sturgeon in the Chesapeake Bay**

135

136 An abundant and economically important population of Atlantic sturgeon (*Acipenser oxyrinchus*)  
137 once inhabited the Chesapeake Bay. During the late 19<sup>th</sup> century, the Chesapeake Bay supported  
138 the third greatest caviar fishery in the Eastern United States (Secor and Houde 1997). An 1876  
139 Maryland fisheries manual (Uhler and Lugger 1876) describes the Atlantic sturgeon as  
140 populating the Susquehanna and Potomac Rivers.

141

142 In the early 1900<sup>s</sup>, the Atlantic sturgeon population collapsed. In Maryland, fishery landings  
143 declined from 74,500 kg in 1904 to 320 kg in 1920 (Hildebrand and Schroeder 1928). Atlantic  
144 sturgeon has not recovered from this decline in the Chesapeake Bay. No spawning activity has  
145 been observed in the Chesapeake Bay for two decades, leading to the assumption that any  
146 remnant population of Atlantic sturgeon in the Bay may be incapable of a resurgence. The last  
147 fish legally harvested in the Chesapeake Bay, a mature female, was captured in 1970 from the  
148 Potomac River. Secor and Houde (1997) reported that the spawning population of Atlantic  
149 sturgeon may have been extirpated. Speculation has been that overfishing, losses of habitat,  
150 hypoxia, and spawning impediments such as the Conowingo Dam have contributed to their  
151 decline or extirpation in the Bay (Secor and Houde 1997). At present, the continued existence of  
152 Atlantic sturgeon in the Chesapeake Bay remains uncertain.

153

154 **Biology of the Atlantic Sturgeon**

155

156 The life history of Atlantic sturgeon, like the shortnose sturgeon, is not fully understood to date.  
157 Atlantic sturgeon populations have been documented by Bain (1997) to occur in rivers to river  
158 mouths, estuaries, and marine waters.

159

160 Atlantic sturgeon are anadromous and spawn generally once a year between April and May  
161 depending on latitude and longitude (Gilbert 1989). Little is known about temperature, salinity,  
162 or dissolved oxygen requirements for spawning. Borodin (1925) reported that Atlantic sturgeon  
163 spawning occurred in the Delaware River at depths of 11 to 13 m (36-42 ft.) over a hard clay  
164 bottom at water temperatures of 13.3-17.8 °C (55.9-64 F).

165

166 Fertilized eggs of Atlantic sturgeon are adhesive and remain on the bottom in deep channel  
167 habitats. Sturgeon embryos and larvae have a limited salt tolerance, so their habitat must be well  
168 upstream of the salt front. No additional information is available on egg and larval development  
169 of the Atlantic sturgeon. Baine (1997) reported the transition from larva to juveniles occurs at  
170 about 30 mm total length based upon Hudson River specimens.

171

172 After spawning, the adults move to marine waters (either all year or seasonally) for feeding and  
173 further development. Little is known about their behavior in marine waters. Available  
174 information suggests that juvenile Atlantic sturgeon may make oceanic excursions. Despite their  
175 extensive oceanic migrations, these fish are believed to be highly site-site-specific and apparently  
176 return to the same river and even the same general hatching area to spawn (Gilbert 1989).

177 Suitable and/or critical habitat for the Atlantic sturgeon in the Chesapeake Bay is currently  
178 unknown. Spawning habitat also has not been identified in the Chesapeake Bay.

179  
180 **5.1.8.e Shortnose and Atlantic Sturgeon Studies.** Due to their believed extirpation from the  
181 Chesapeake Bay, few studies have been conducted of the shortnose and Atlantic sturgeon in the  
182 area until very recently. The following paragraphs list and discuss aquatic sampling in and  
183 around dredged material placement sites conducted in the Chesapeake Bay.

184  
185 **Previous Aquatic Studies in and around Dredged Material Placement Sites in the Upper**  
186 **Bay**

187  
188 Fish Population Characterizations Conducted Before, During, and After Open-water-Water  
189 Dredged Material Placement in the Upper Bay.

190  
191 Eight fish characterization studies have been performed in the Pooles Island area on proposed  
192 and existing dredged material placement sites and reference areas to collect baseline data for  
193 planned actions and to monitor placement actions. The studies conducted since 1992 have  
194 included midwater and bottom trawls along with acoustic surveys in four quarters each year  
195 (MES 1997c). In addition to Along with the above-mentioned annual studies, anchor set gill nets  
196 were used in several sites in four quarters from July of 1996 to April of 1997. The nets were  
197 generally set in the daytime tide, and consisted of 150 ft length with a 3-4-5-6-7-and 8-inch  
198 mesh.

199  
200 A charter boat angling survey was also conducted in the summer and fall of 1996. The objectives  
201 of the angling and the fish characterization studies were to characterize the abundances, diversity,  
202 and changing community structure and seasonal abundances of the fish populations in planned  
203 and actual placement sites and nearby reference areas. Data collected was used to calculate  
204 catch per unit effort, length frequency distributions, diel changes in use of sites and depths of  
205 water at the sites, as well as changes in these parameters over time if placement was implemented  
206 at the study sites.

207  
208 No SShortnose sturgeon were captured during the eight studies (166 hours of gill netting, 79  
209 hours of bottom trawl and 38 hours of mid-water trawl sampling) conducted to characterize the  
210 upper Bay reference areas and proposed and actual placement sites since 1992. One Atlantic  
211 sturgeon was captured during the 1996/1997 gill netting study. This wild Atlantic sturgeon was  
212 captured in the July 1996 gill net setting in a reference area between Pooles Island and Fairlee  
213 Creek. It was 870 mm long and weighed 4,173 grams (9.2 lb). According to Bain (1997), the  
214 corresponding age range would be from 6- to 11 years and the individual would be considered a  
215 late juvenile. This individual was considered At the time of capture, a late juvenile of this size  
216 class according to Bain (1997) and would not be of spawning age,  
217 at the time of capture.

218  
219 Fish Population Characterization Conducted in In and around Around Site 104.

221 Fish abundances and distributions were evaluated at Site 104 and two reference areas during a  
222 four-season sampling program conducted during the day and night, during different seasons of  
223 the year (July 1996 to April 1997) and at varying depths [Finfish Survey in Section 5.1.6.b]. The  
224 fisheries cruises were conducted during the months of June/July, October, December 1996 and  
225 April 1997. A total of 28 deployments of multi-panel anchor-set gill nets, 24 midwater trawls,  
226 and 128 bottom trawls were performed to determine the composition of the fish community  
227 within and around Site 104 (Figure 5-~~23~~25). The gill nets were generally set during the daytime  
228 tide, and consisted of 150 ft length with a 3-4-5-6-7- and 8-inch mesh. Bottom trawls consisted  
229 of a 7.9-m headrope, 3.8-cm stretch mesh netting, and a ~~13~~13-mm stretch mesh liner to retain  
230 small samples.

231  
232 -No shortnose or Atlantic sturgeon were captured during the study by either method in Site 104  
233 or in reference areas A and B during July 1996 to April 1997. ~~No sturgeon were collected during~~  
234 ~~the Poplar Island fish studies in 1995.~~

235  
236

### 237 **Current Shortnose and Atlantic Sturgeon Studies**

238

#### 239 Aberdeen Proving Ground Study.

240

241 The USFWS is currently conducting a field study with the U. S Army Aberdeen Proving Ground  
242 (APG). ~~No sturgeon have been collected as of January 1999.~~ Data collection has been underway  
243 since early summer of 1997. While no published data are available yet, studies have used gill  
244 nets set in 3.7-6.1 m (12-20 ft) of water in the mainstem of the Bay around Pooles Island and in  
245 the Gunpowder River. The nets have generally been set asin daytime slack tide and overnight  
246 sets year round, and consist of 300-ft (91.4-m) and 400-ft (122-m)~~182.9 m 300 and 600 ft~~  
247 lengths with 4, 5, -6- and 8-inch mesh. ~~A few data collections have occurred using nets that have~~  
248 ~~been set overnight. Nets have been set every 2-3 weeks for 4-12 hours each time.~~ No shortnose  
249 sturgeon have been collected in approximately 593 hours of gillnetting to date (USFWS 1999a) 1.  
250 The APG is performing this study to fulfill their responsibility to document and manage any rare,  
251 threatened, or endangered species that exist within their boundaries.

252

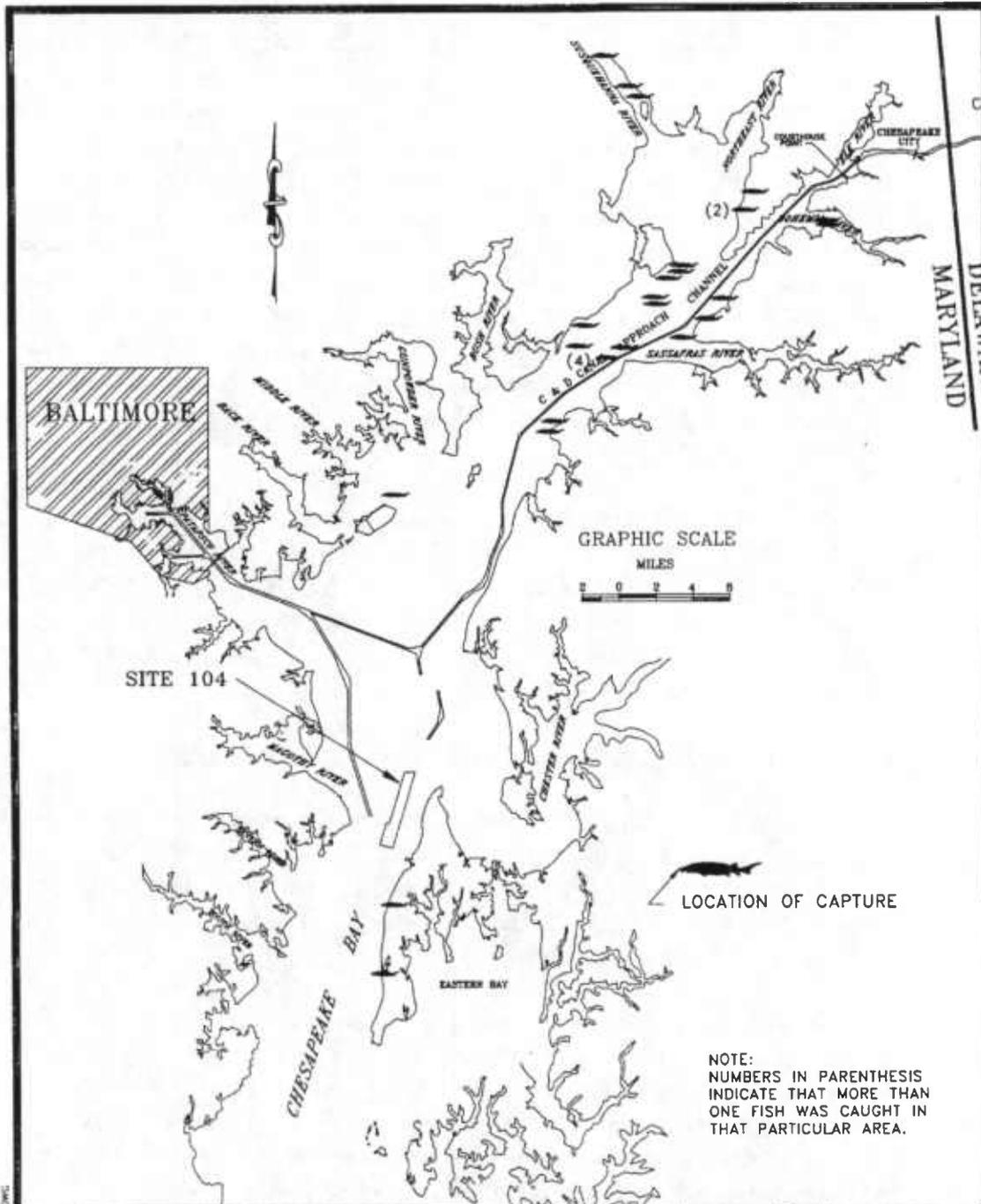
#### 253 USFWS Atlantic and Shortnose Sturgeon Bounty Program.

254

255 The USFWS is currently conducting a field study of Atlantic and shortnose sturgeon populations  
256 in the Chesapeake Bay through a bounty program. This program is offering a reward of \$25 for  
257 each live Atlantic sturgeon and \$100 for each live ~~SNS~~Shortnose sturgeon reported and  
258 documented as incidental bycatch by commercial or recreational watermen.

259

260 The study has documented ~~29~~32 shortnose caught between 4 April 4, 1996, and 24 September  
261 July 124, 1998~~9~~ (Figure 5-~~24~~26). Most of the fish were caught in relatively shallow water, using  
262 pound nets (11~~0~~ fish), gill nets (13~~4~~ fish), fyke nets (4 fish), eatfish traps (2 fish), a hoop net (1  
263 fish); and an eel pot (1 fish) and a catfish trap (2 fish). Of the 32~~29~~ fish captured, 127 were  
264 captured ight in the winter 1996 (December-February April, May, and June), 180 in the  
265 Spring were caught in 1997 (March-May January, April, and December), 2 in the Summer and 12



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**MARYLAND PORT ADMINISTRATION**  

**MARYLAND ENVIRONMENTAL SERVICE**  

**US Army Corps of Engineers**

**SHORTNOSE STURGEON LANDINGS**  
**IN CHESAPEAKE BAY AND TRIBUTARIES**  
 4/96 TO 10/99  
 Figure 5-26

266 were caught in 1998 (June- AugustJanuary- April) and none in the Fall (September-October).  
267 None have been captured since the original bounty program ended July 1, 1998. The bounty  
268 program started up again on 11 December 1998 and no new captures have been made. Of the  
269 fish caught to date, 24 Twenty-three of the fish were caught in the far upper Chesapeake Bay,  
270 20 from near the between the Sassafras River and into the Susquehanna Rivers. The other nine  
271 SNS four were captured in various other locations such as the Potomac River, Nanticoke River,  
272 Barren Island, and Hart-Miller Island. between Hart Miller Island and Worton Point. To date no  
273 SNS have been found within Site 104. The remaining 5 were caught elsewhere in the Bay: 2  
274 south of the Bay Bridge, 1 off Barren Island, and 2 in the Potomac River. Compared to the  
275 overall capture mean of 762- 914 mm (2.5- 3 ft), 7 of the 29 fish were considered small in size.  
276 These small fish were captured in the far upper Bay in the Bohemia River, off Worton Point, and  
277 off Aberdeen during February, March and April of 1998. Their sizes ranged from 381 mm (1.3  
278 ft) to 527 mm (1.7 ft) However, 2Two SNS were captured along the Kent Island shoreline south  
279 of the Chesapeake Bay Bridge in May 1996.

280  
281 As with the SNSshortnose sturgeon, most of the wild Atlantic sturgeon were also caught in  
282 relatively shallow water, using pound nets (23 fish), gill nets (27 fish), crab pot (1) and trawls  
283 (1). Of the 395244 captured, 953 percent were captured below the Chesapeake Bay Bridge. in  
284 the lower Bay below the Choptank River). No wild Atlantic sturgeon were captured within Site  
285 104 boundaries. However, although 2 fish were located [OR CAPTURED? REVISE] along the  
286 shoreline of Kent Island, east of Site 104 in May 1997 (Figure 5-2527).

#### 287 288 Hatchery Raised Atlantic Sturgeon Population Studies in the Chesapeake Bay.

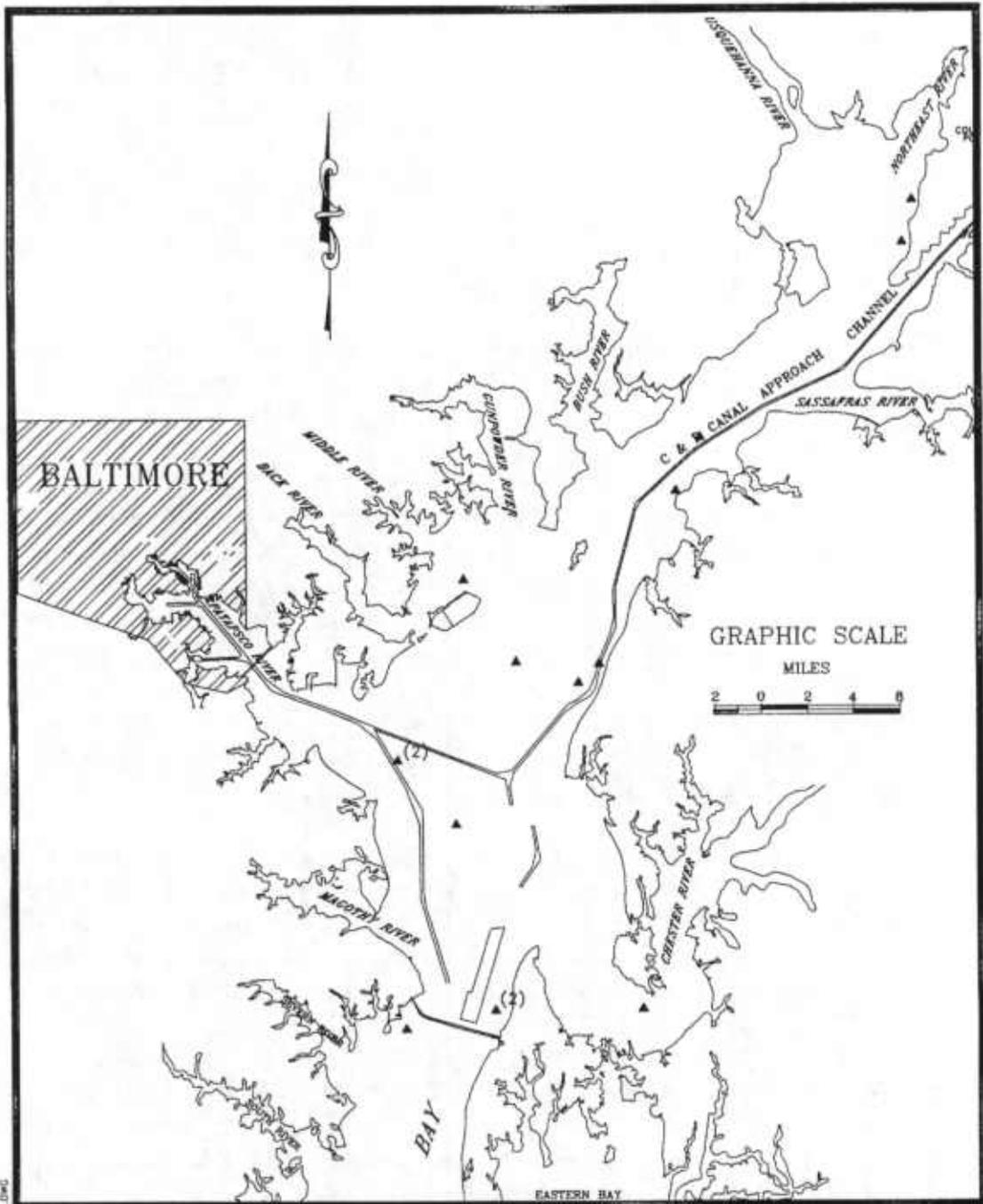
289  
290 In order to assess the potential for reestablishing spawning populations of Atlantic sturgeon in  
291 the Chesapeake Bay, a team, comprised of scientists from USFWS, University of Maryland, and  
292 the Chesapeake Bay Program, released more than 3,000 hatchery-raised (Hudson River brood  
293 stock) and tagged juvenile Atlantic sturgeon in the Nanticoke River in July 1996 to address the  
294 feasibility of sturgeon restoration (Miller 1998).

295  
296 Of the total number stocked, 46049 non-multiple were re-captured occurred as a result of the  
297 USFWS Bounty Program Bay-wide between October 1996 and 294 September 24, 1999  
298 December 1998. Of the 449 hatchery Atlantic sturgeon recaptured, 93 percent were found in the  
299 Bay south of the Chesapeake Bay Bridge. Of the 449 Atlantic Sturgeon recaptured only 1  
300 percent were recaptured within or around Site 104. The methods used to evaluate the objectives  
301 outlined above include use of anchored gill nets, telemetry, genetic testing, and water quality  
302 assessments. The majority of these fish were landed below the Chesapeake Bay Bridge).

#### 303 304 Determining the Status of SNS in the Chesapeake Bay

305  
306 As part of the Section 7 Consultation process to determine the status of the shortnose and  
307 Atlantic sturgeon within the Chesapeake Bay, a two<sup>2</sup>-year sampling program was developed by  
308 the USFWS in consultation with the NMFS and funded by the Baltimore and Philadelphia Corps  
309 Districts.

310



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Wild Atlantic Sturgeon In Chesapeake Bay and Tributaries  
4/96 - 10/99  
Figure 5-27

311 The main objectives of the two-year study are to:

- 312
- 313 • Determine whether the Chesapeake Bay supports a resident SNS population, or if the
  - 314 SNS found in the Chesapeake Bay are transients from the Delaware River via the
  - 315 C&D Canal;
  - 316 • Assess the genetic composition of the Chesapeake Bay SNS with the Delaware River
  - 317 and Hudson River stock; and
  - 318 • Determine the Atlantic and SNS use of the shipping channels and the proposed and
  - 319 existing dredged material placement sites.
- 320

321 The methods used to evaluate the objectives outlined above include anchored gill nets, telemetry,

322 genetic testing, and water quality assessments. Field sampling for this study was initiated in

323 March of 1998 in the Chesapeake Bay and the Delaware River, using anchored experimental gill

324 nets (4, 5, and 6-inch mesh) set during daytime and overnight

325 in 19 sample locations. The 19 sample locations were determined by the NMFS based on

326 proposed dredged material placement sites and shipping channels. Proposed dredged material

327 placement sites are sampled on a rotating schedule biweekly with four nets at a

328 time during the fall, winter, and spring for both shortnose and Atlantic sturgeon. [Summer

329 sampling is performed in areas that do not become hypoxic/anoxic during the summer months.

330 The larger sites, such as Site 104, are subdivided based upon their size and other ecological

331 features. Shipping channels are also divided into sampling sections and sampled similarly to the

332 above-mentioned proposed placement sites. Waiting for call from Mike Mangold to

333 determine if and when they stopped sampling within the proposed placement sites. Also want to

334 include a total number of gill netting hours in Site 104 and overall].

335

336 Sonic tags will be fitted on up to 30 shortnose sturgeon captured from the Delaware River and

337 the Chesapeake Bay. Once fitted, the sonic tags will allow USFWS personnel to track SNS

338 movements in the Chesapeake Bay biweekly using a portable hydrophone. In addition,

339 movement of SNS between the Chesapeake Bay and the Delaware River via the C&D Canal is

340 monitored by stationary continuous automatic sonic tag loggers located at Chesapeake City and

341 Reedy Point.

342

343 In order to determine whether a distinct population of SNS exists within the Chesapeake Bay, a

344 small tissue sample is clipped from the caudal fin of each tagged shortnose sturgeon upon

345 capture. DNA analysis will be performed on these tissue samples and will be compared to

346 Hudson, Delaware, and Savannah River tissue samples.

347

#### 348 Preliminary Results

349

350

351 Data collected from this 2-year study will be used to prepare an interim biological assessment

352 and will be distributed to NMFS at the time of the public release of this draft EIS. This interim

353 biological assessment will include all field data available at this time. A final biological

354 assessment will not be completed until 2000, after 2-years of field data have been collected.

355 Preliminary genetic analysis indicates that of the 17 Chesapeake Bay SNS sampled so far there  
356 were 7 different haplotypes of which 6 were found in the Delaware Bay indicating a similarity  
357 among the populations.

358  
359 On 26 January 26, 1999, NMFS issued a Biological Opinion (BO) concerning impacts to  
360 shortnose sturgeon from maintenance dredging of the C&D Canal and Northern Approach  
361 Channel to the C&D Canal in Maryland and Delaware.

362  
363 Based on their review of available data and the CENAP Break Out Biological Assessment,  
364 NMFS concluded that the project was not likely to jeopardize the continued existence of  
365 shortnose sturgeon that inhabit the project area in the Upper Chesapeake Bay. The NMFS  
366 authorized an incidental take allowance of three shortnose sturgeon for this project.

367  
368 Since the initiation of the sampling program, some preliminary conclusions about the seasonal  
369 distribution of the SNS in the Upper Chesapeake Bay due to investigations and results of the  
370 USFWS reward program have been made by USFWS (1999b) and NMFS (1999). NMFS (1999)  
371 reported in the BO that it is likely that SNS spawn in the Potomac River and, possibly, below the  
372 Conowingo Dam in the Susquehanna River. NMFS drew this conclusion based on the  
373 occurrence of SNS within freshwater reaches of the Potomac River, the capture of adult SNS  
374 below the Conowingo Dam in mid to late April, and the capture of six juvenile shortnose  
375 sturgeon in the Upper Bay.

376  
377 Eight SNS were captured during the winter (1997/1998) in relatively deep regions of the Upper  
378 Bay near Howell and Grove Points. SNS are known to overwinter in deep, channel sections of  
379 Rivers. Thus, it is probable that the Howell to Grove Point section of the Upper Bay provides  
380 overwintering habitat for SNS. The extent to which SNS use the shipping channel in this region  
381 is unknown. Additional data in the area may provide additional information on the use of this  
382 region.

383  
384 Telemetry information from five sturgeon tracked in the Upper Bay from the early feeding  
385 season; indicates SNS use of the Worton Point to Howell Point section of the Upper Bay. Four  
386 fish were tracked south and southeast of Pooles Island in water depths of approximately 20 feet.  
387 Based on foraging patterns exhibited by SNS in other northeast river systems, SNS in this system  
388 are likely to be widely dispersed and actively feeding during the summer. Productive reaches of  
389 the Upper Bay (e.g., near the saltwater/freshwater interface and channel areas bordering mud flats  
390 or emergent macrophytes) are potential feeding areas (NMFS 1999).

391  
392 The USFWS tracked one SNS in the C&D Canal in July (1998), indicating that the sturgeon may  
393 move between the Delaware River and Chesapeake Bay, possibly to access productive feeding  
394 areas in either the Chesapeake or Delaware Bay.

395  
396 Preliminary genetic analysis performed by Dr. Ike Wirgn of the New York Medical School under  
397 contract to USFWS indicates that of the 18 Chesapeake Bay SNS genetically sampled to date,  
398 there were 7 different haplotypes of which 6 were found in the Delaware Bay. Several reasons  
399 may account for why all 7 haplotypes in the species sampled did not occur in the Delaware Bay.

400 First, the individual sampled may be of a rare genotype found in either the Delaware or  
401 Chesapeake Bays and so rare that it does not match the other genotypes in the sample set.  
402 Secondly, the fish could represent a Chesapeake Bay stock prior to the opening of the C&D  
403 canal. Lastly, the fish could have been from somewhere else.

404  
405 Continued Coordination

406  
407 Data collected from this 2-year study will be used to prepare an interim Biological Assessment  
408 and will be distributed to NMFS at the time of the public release of this draft EIS.

409  
410  
411  
412 This interim Biological Assessment will include all field data available ~~at this time~~. A final  
413 Biological Assessment will ~~not~~ be completed ~~until~~ in 2000, after 2 years of field data have been  
414 collected.

415  
416

1 **5.1.9 Air Quality**

2  
3 As required by the Federal Clean Air Act, the State of Maryland monitors six air pollutant  
4 criteria: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter.  
5 The Environmental Protection Agency has established the National Ambient Air Quality  
6 Standards (NAAQS), which sets acceptable limits for the six parameters listed above. These  
7 national standards provide a benchmark to which air pollutant levels can be compared. Areas are  
8 classified as either in attainment of the NAAQS; or, if they do not meet the standards, they are  
9 classified as nonattainment areas.

10  
11 In Maryland, the MDE, Air and Radiation Management -Administration is responsible for  
12 monitoring the state's air quality. In the most recent Maryland Air Quality Data Report (MDE  
13 1995), it was reported that the State of Maryland is meeting all of the air quality standards with  
14 the exception of ozone. Maryland as a whole is classified as a nonattainment area for the  
15 National Ozone Sstandard. Also, Maryland is part of the Northeast Ozone Transport Region.  
16 This region includes 12 states concerned with the transport of ozone between states. Individual  
17 states, as well as regional efforts, are concluding that ozone nonattainment areas cannot  
18 demonstrate attainment simply through the implementation of control measures within a  
19 nonattainment area. ~~;~~ ~~s~~Significant ozone and precursor concentration reductions at the boundary  
20 of a nonattainment area will be necessary, together with volatile organic compounds (VOC)  
21 and/or nitrogen oxides (NOx) reductions within the nonattainment areas, in order to demonstrate  
22 modeled attainment.

23  
24 No air quality monitoring was conducted at the Site 104 project area, ~~since~~ and there are no  
25 monitoring stations in the vicinity. Consequently, the information is regional in nature. Site 104  
26 is adjacent to Kent Island, the Bay Bridge, and Sandy Point State Park. The northern end of Kent  
27 Island (the closest landmass to the proposed placement site) has little industry and its land use is  
28 ~~primarily consists of~~ mainly residential and agricultural ~~land use~~. Sandy Point State Park is  
29 located to the west and is surrounded by ~~mostly~~ ~~predominately~~ residential and agricultural areas.  
30 The most significant determinant of air quality in the vicinity of Site 104 is the vehicular traffic  
31 on the Bay Bridge. Air quality in the channels and at Site 104 is typical of adjacent Bbay areas.  
32 Because Site 104 is an open water area, it does not adversely contribute to air quality in the  
33 immediate vicinity other than through commercial and recreational boating activity.

1 **5.1.10 Noise**

2  
3 Open water areas generally have very few natural noise sources; ~~most noise is generated by~~  
4 ~~natural occurrences.~~ Noise levels at Site 104 have not been measured, but background noise can  
5 be attributed to natural processes such as wave action, wind, and any wildlife that may frequent  
6 the areas. In addition to natural noise sources, Site 104 experiences man-caused noise pollution  
7 as well. Vehicular traffic on the Bay Bridge (approximately 0.61 km ([2,000 ft]) south),  
8 commercial, and recreational boat traffic in and around the site, and noise from small planes  
9 using the small Bay Bridge airport on Kent Island are the primary contributors to the noise levels  
10 in the area.  
11

1 **5.1.11 Hazardous, Toxic, and Radioactive Substances**

2  
3 Site 104 is not designated as a Superfund site on the National Priorities List (NPL) under the  
4 Comprehensive Environmental Response, Compensation, and Liability Act (40 CFR 300, Annex  
5 A: NPL List). ~~Site 104~~ and is not listed for further action under the Comprehensive  
6 Environmental Response, Compensation, and Liability Information System (CERLIS). ~~and~~  
7 ~~There are no known hazardous materials in the proposed placement area.~~

8  
9 USACE regulations require documentation of the existence of CERCLIS and NPL sites within  
10 the boundaries of a proposed project that could impact, or be impacted by, the presence of  
11 Hazardous, Toxic, or Radioactive Substances (HTRS) contamination. USACE regulation ER  
12 1162-2-132 provides that dredged material and sediments beneath navigable waters proposed for  
13 dredging qualify as HTRS only if they are within the boundaries of a site designated by the EPA  
14 or a state for a response action, such as removal or remediation under CERCLA. Site 104 is not  
15 a designated CERCLA site.

16  
17 The Resource Conservation and Recovery Act of 1976 (RCRA) established the Federal program  
18 regulating solid and hazardous waste management. RCRA is a comprehensive amendment of  
19 earlier legislation, the Solid Waste Disposal Act of 1965. Subtitle C of RCRA created the  
20 hazardous waste management program. RCRA specifically excludes materials covered under  
21 certain other legislation, including the Clean Water Act, covering discharges to navigable waters,  
22 and the Marine Protection, Research, and Sanctuaries Act, which applies to ocean placement.  
23 Dredged material placement is regulated by the Corps of Engineers under one or more of these  
24 acts, and is not regulated by RCRA.

25  
26 Site 104 (previously known as the Kent Island Deep placement site) was used for placement of  
27 approximately 70 million cubic yards of dredged material between 1924 and 1975. Records for  
28 the period are incomplete, and although the approximate quantities of dredged sediments are  
29 known, there are no records of the sediment characteristics, nor are there records of where the  
30 material came from. It appears that some quantity of dredged maintenance material from  
31 Baltimore Harbor was placed at the site in the early 1960s. This was the last time that Site 104  
32 received material from the Baltimore Harbor.

33  
34 In 1975, the final year of placement, the origin and quantities of dredged material were recorded.  
35 In addition, environmental monitoring was performed in 1975 before, during, and after  
36 placement. No adverse impacts were noted on oysters, clams, and other benthic organisms. The  
37 approximately 860,000 cubic yards of sediments that were placed originated from the Baltimore  
38 Harbor approach channels including the Craighill Channel and the Brewerton Extension. The  
39 material placed was clean, uncontaminated sediment.

40  
41 Some new work and maintenance material dredged from Baltimore Harbor was placed in Kent  
42 Island Deep (Site 104) during the period from 1924 to the early 1960's. Sediments which may  
43 have been originally dredged from the Baltimore Harbor area were noted during surficial  
44 sediment and subsurface sediment sampling at Site 104 in 1997, as discussed in the Physical  
45 Conditions section under Section 5.1.5.b. These sediments were ~~dissimilar~~ different in  
46 appearance and chemical composition from other surficial sediment samples collected

1 ~~concurrently~~ at the same time, and may have been buried under a layer of sediment deposited  
2 since placement at Site 104 ceased in 1975. It is clear, however, that the material placed at Kent  
3 Island from the mid 1960s to 1970s did not originate from Baltimore Harbor. Environmental  
4 monitoring which was performed before, during, and after the final placement in 1975, addressed  
5 a wide array of environmental parameters. The monitoring results disclosed no significant  
6 impacts. These findings support the conclusion that Site 104 (Kent Island Deep) is not a source  
7 of hazardous, toxic, or radioactive wastes.  
8

1 **5.2 CULTURAL AND ARCHAEOLOGICAL RESOURCES**

2  
3 The Maryland Historical Trust (MHT) was consulted to identify and evaluate any potential  
4 historic, cultural, or archaeological resources in the Site 104 area, as per the National Historic  
5 Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR Part 800.  
6

7 **5.2.1 Historical Use of Site 104 Dredged Material Placement Area**

8  
9 Site 104 is a previously used 1,800-acre open-water placement site located approximately 0.61  
10 km (2,000 ft) north of the Chesapeake Bay Bridge and 1.6 km (1 mile) west of Kent Island. The  
11 site is approximately 7.2 km (4.5 miles) long and 0.8 km (0.5 mile) wide. Beginning in 1924, the  
12 site was used for dredged material placement, though records are incomplete (MDNR 1976). It  
13 is estimated that a total of 70 mcy (53.5 mcm) of sediment were placed at the site during the  
14 period 1924 to 1975 (CENAB 1997—"a" or "b"?). In the early 1960s it was reported that some  
15 operations and maintenance material from the Baltimore Harbor was also placed in the site.  
16 Subsequent placement of sediments from the Federal approach channels and from new work  
17 dredging of the Federal channels in the 1960's and 1970's occurred in Site 104. New work  
18 dredging usually produces coarser grained material because the area has not been dredged  
19 before, as compared to maintenance dredging of existing channels that have been previously  
20 shoaled. The last placement of sediment occurred in 1975 and totaled approximately 850,000  
21 cubic yards of material.  
22

23 **5.2.2 Existing Archaeological, Cultural, and Historic Resources**

24  
25 Coordination with the MHT was initiated in June 1997. The MHT has stated that the site is  
26 considered disturbed due to historical placement in the area, which would have buried any  
27 potential resources under several meters of material. The MHT stated that there are no  
28 archaeological, historical, or cultural issues related to the Site 104 area (see Attachment E).  
29 Therefore, marine surveys for archaeological or historic resources in the Site 104 area were not  
30 considered necessary.  
31

1  
2 **5.3 SOCIOECONOMIC RESOURCES**  
3

4 Site 104 and the surrounding area form an integral part of the socioeconomic framework of  
5 Queen Anne's, Anne Arundel, and Kent Counties. The socio-economics of the Site 104 region  
6 are tied to commercial and recreational activities associated with the Chesapeake Bay and the  
7 Port of Baltimore. Demographics, land and water use, fishing activity, employment, and industry  
8 are discussed in the following sections.  
9

10 **5.3.1 Identification of Socioeconomic Resources**  
11

12 Socioeconomic resources were identified through coordination with the MPA-DNPOP Site 104  
13 Working Group; the Site 104 Public Outreach Committee; county representatives, and  
14 representatives of commercial and recreational fishing interests; review of information gathered  
15 at public scoping meetings; and literature search and review.  
16

17 **5.3.2 Water Use**  
18

19 Commercial use of waters around Site 104 is mainly centered around transportation and  
20 commercial fishing. The waters of Site 104 are part of an active ~~fairway~~-corridor between the  
21 Bay Bridge and the Swan Point Channel. Commercial vessels, tugs, and barges with drafts of  
22 10.7 m or less (35 ft or less) use this route (~~35 ft or less~~) when transiting directly to and from the  
23 C&D Canal and ports south of Baltimore. Vessels calling on the Port of Baltimore through the C  
24 &-D Canal occasionally use this route if they can-not use the Brewerton Channel Eastern  
25 Extension. Vessels with drafts to 12.2 m (40 ft) can be expected to use this route if the C&D  
26 Canal and its approach channels are deepened to 12.2 m (40 ft). This navigation network is a  
27 critical component of the regional economy in the mid-Atlantic area. Recreational use of the  
28 waters of Site 104 include sailing and power boating, wind surfing, personal water craft, and  
29 recreational fishing.  
30

31 During most of the year, Site 104 provides a suitable natural environment for commercial  
32 crabbing and fishing. In the summer months, the distribution of aquatic life may be limited due  
33 to anoxic conditions within the deeper waters of Site 104. Nonetheless, commercial crabbing  
34 and fishing resources contributes significantly to the economic well-being of the region. As a  
35 result of the seasonal nature of these species, waters in the northern portion of the site are utilized  
36 virtually year round. Commercial fishermen concentrate gillnetting efforts north of the RWLP  
37 buoy in areas shallower than 13.7 m (45 ft) (Figure 2-1). Recreational fishermen and charter boat  
38 captains fish the shallower edges [ $< 12.2$  m ( $< 40$  ft)] east of the site. [May want to update this  
39 line after the meeting with the Recreational Fishers] Commercial fishing activities within  
40 Site 104 and the surrounding areas are discussed further in Section 5.3.5.d.  
41

42 **5.3.3 Land Use**  
43

44 There are no land masses within the Site 104 boundaries. The nearest land mass to the east  
45 (approximately 1.6 km [1 mile] away) is Kent Island in Queen Anne's County. The nearest land

46 mass to the west is the Anne Arundel County mainland (4.0 km [(2.5 miles)] to the west). Land  
47 use in sensitive coastal areas, also known as the Chesapeake Bay Critical Area, is heavily  
48 regulated by Queen Anne's County (QAC) Ordinances (a 1,000-ft buffer is required) to protect  
49 water quality and crucial habitat areas (QAC 1996).

50  
51 The western side of Kent Island north of the Bay Bridge is largely rural, except at the northern  
52 extremity (Love Point), which is suburban with non-public facilities. The western shoreline  
53 north of the Chesapeake Bay Bridge is lightly populated. Single-family residences are widely  
54 dispersed. The Route 50 corridor across Kent Island is heavily commercialized. The  
55 Stevensville area also hosts light manufacturing facilities. The eastern shoreline area south  
56 (approximately 3.2 km [(2 miles)])) of the Bay Bridge is mostly suburban with some public  
57 facilities. There is a marina immediately southeast of the bridge. Further south, the shoreline is  
58 interspersed with rural areas and suburban areas with non-public facilities, except for a small  
59 suburban area with public facilities about 9.7 km (6 miles) south of the bridge (QAC 1993).

60  
61 The Anne Arundel County shoreline, immediately north and northwest of the Bay Bridge for  
62 approximately 4.8 km (3 miles), consists of Sandy Point State Park. Sandy Point State Park is  
63 heavily used seasonally as a land and water recreation site. The facility includes a small boat  
64 harbor, the entrance to which is immediately north of and adjacent to the Bay Bridge. The  
65 shoreline northwest of the State Park consists of suburban residential areas. The shoreline at  
66 Sandy Point breaks towards the northwest until the mouth of the Magothy River is reached  
67 immediately south of Gibson Island. The southern shoreline at the river mouth is approximately  
68 the same latitude as the northernmost boundary of Site 104.

69  
70 The Anne Arundel County shoreline immediately south of the Chesapeake Bay Bridge is  
71 categorized as light industrial. South of this small industrial area, is the entrance to Whitehead  
72 Bay, which is dominated by Holly Neck Farm. This farm is privately owned and is zoned for  
73 agricultural use. The U.S. Naval Ship Research and Development Center is located on the  
74 shoreline between the southwest side of the entrance to Whitehead Bay and the Severn River.  
75 The largest urban center in the proximity of Site 104 is Annapolis.

#### 76 77 **5.3.4 Demographics**

78  
79 The counties surrounding Site 104 are mostly rural in nature with low density population. The  
80 closest county to the east of Site 104 is Queen Anne's County. Most of the development in  
81 Queen Anne's County is associated with Route 50, the main artery to and from the Eastern  
82 Shore. The most recent census data revealed that in 1990, approximately 33,953 individuals  
83 resided in Queen Anne's County (U.S. Bureau of Census 1990). Projections of population  
84 growth indicate the 1995 population to be 37,350 (U.S. Bureau of Census 1990). This shows a  
85 projected absolute growth of 8.6 percent over the 5-year period. The projected population for  
86 2005 is 44,900. This shows an absolute growth of 32.2 percent over the 15-year period. The  
87 minority population in Queen Anne's County in 1990 was 3,993 individuals. The number of  
88 individuals with income below the poverty level in 1989 totaled 2,235 individuals (U.S. Bureau  
89 of Census 1990). Minority individuals with incomes below the poverty level in 1989 were as  
90 approximately 2 percent of the total county population while the percent of white individuals

91 with incomes below the poverty level in 1989 was approximately 4 percent of the total county  
92 population. Kent Island is the closest community located in proximity to Site 104 with a 1990  
93 population of 12,829 (Maryland Department of Economic and Employment Development  
94 [MDEED] 1996b). Recreational activities associated with tourism as well as sailing and power  
95 boating contribute significantly to the local economy in the southern portion of Kent Island. For  
96 instance, the Bay Bridge brings more than 20 million visitors through Queen Anne's County each  
97 year (MDEED 1996a).

98  
99 The closest county to the west of Site 104 is Anne Arundel County. According to the U. S.  
100 Bureau of Census, approximately 427,239 individuals resided in Anne Arundel County in 1990.  
101 Projections of population growth indicate the 1995 population to be 459,700. This ~~shows~~  
102 indicates an absolute growth of 7.5 percent over the 5-year period. Projections of population  
103 growth indicate the 2005 population to be 501,000. This indicates an absolute growth of 17.3  
104 percent over the 15-year period. The minority population in Anne Arundel County in 1990 was  
105 61,634 individuals. The number of individuals with income below the poverty level in 1989  
106 totaled 18,391 individuals (U.S. Bureau of Census 1990). Minority individuals with incomes  
107 below the poverty level in 1989 ~~was~~ were approximately 2 percent of the total county population  
108 while the percent of white individuals with incomes below the poverty level in 1989 was  
109 approximately 3 percent of the total county population. The largest urban center relative to Site  
110 104 is Annapolis, with a 1990 population of 33,187. It is important to note that the Sandy Point  
111 State Park to the west and Annapolis Harbor and Severn River to the southwest all experience  
112 significant seasonal increases in visitor populations during the spring through fall. Recreational  
113 activities associated with tourism as well as sailing and power boating contribute significantly to  
114 the local economy in these areas.

115  
116 Kent County is located to the northeast of Site 104, north of Queen Anne's County. In 1990,  
117 approximately 17,842 individuals resided in Kent County. Projections of population growth  
118 indicate the 1995 population to be 18,300. This ~~shows~~ indicates an absolute growth of 2.5  
119 percent over the 5-year period. Projections of population growth indicate the 2005 population to  
120 be 19,800 (U.S. Bureau of Census 1990). This ~~shows~~ indicates an absolute growth of 11.0  
121 percent over the 15-year period. The minority population in Kent County in 1990 was 3,649  
122 individuals. The number of individuals with income below the poverty level in 1989 totaled  
123 1,943 individuals (U.S. Bureau of Census 1990). Minority individuals with incomes below the  
124 poverty level in 1989 ~~was~~ were approximately 4 percent of the total county population while the  
125 percent of white individuals with incomes below the poverty level in 1989 was approximately 7  
126 percent of the total county population. Recreational activities associated with tourism as well as  
127 sailing and power boating contribute significantly to the local economy of Kent County.

128  
129 It is assumed that low income or minority populations use the Site 104 area to some extent,  
130 ~~although~~ The exact number of users is unknown but is expected to be small. Published  
131 information on the use of the Site 104 water area by specific populations was not found. There is  
132 potential that some area commercial and recreational fishermen are members of low income or  
133 minority populations.

135 **5.3.5 Employment and Industry**

136  
137 **5.3.5.a Queen Anne's County.** The median income per household in Queen Anne's County in  
138 1990 was \$42,800 (U.S. Bureau of Census). The majority of individuals in Queen Anne's  
139 County (31 percent) were reported in the 1990 Census ~~to be~~ employed in technical, sales, or  
140 administrative support occupations. Another 29 percent were reported ~~to be~~ employed in  
141 service occupations. A further breakdown of the employment statistics reveal that approximately  
142 861 individuals, or 5 percent of the work force, were reported ~~to be~~ employed in trades  
143 associated  
144 with fisheries, agriculture, or forestry. The exact number of individuals actively engaging in  
145 fishing activities is not published for Queen Anne's County.

146  
147 Kent Island is located on the western edge of Queen Anne's County and is the closest body of  
148 land relative to Site 104. The principal employment on Kent Island is service industries for  
149 tourism and recreation. Traditionally, Kent Island has been a residential retreat from more  
150 populated and developed areas on the western shore of the Chesapeake Bay.

151  
152 **5.3.5.b Anne Arundel County.** The median household income for Anne Arundel County in 1990  
153 was \$55,342. The majority of individuals in Anne Arundel County (35 percent) were reported in  
154 the 1990 Census ~~to be~~ employed in technical, sales, or administrative support occupations.  
155 Another 32 percent were reported ~~to be~~ employed in the managerial and professional specialty  
156 occupations. A further breakdown of the employment statistics reveal that approximately 2,097  
157 individuals, or 1 percent of the work force, were employed in trades associated with fisheries,  
158 agriculture, or forestry. The exact number of individuals actively engaging in fishing activities is  
159 unknown for Anne Arundel County.

160  
161 **5.3.5.c Kent County.** The median income per household for Kent County in 1990 was \$35,231.  
162 The majority of individuals in Kent County (46 percent) were reported in the 1990 Census ~~to~~  
163 ~~be~~ employed in managerial, professional, technical, sales, or administrative support  
164 occupations. Another 45 percent were reported ~~to be~~ employed in the service, operators,  
165 fabricators, precision production, or laborer industries. A further breakdown of the employment  
166 statistics reveal that approximately 881 individuals, or 10 percent of the work force, were  
167 reported ~~to be~~ employed in trades associated with fisheries, agriculture, or forestry. The exact  
168 number of individuals actively engaging in fishing activities is not published for Kent County.  
169 Traditionally, Kent County has been a residential retreat from more populated and developed  
170 areas on the western shore of the Chesapeake Bay.

171  
172 **5.3.5.d Fishing Activity.** Commercial fishing in the Chesapeake Bay primarily involves small-  
173 scale operators. In the entire Chesapeake Bay in 1998~~6~~, approximately 833~~78~~ commercial  
174 fisherman reported actively fishing for crabs in crab-pots, 552~~656~~ reported actively fishing for  
175 finfish with gill nets, and 1,707~~620~~ oyster harvesters reported oyster catches using a variety of  
176 techniques (Lewis 1999).

177  
178 Gill nets and pound nets are the two principal fishing gears deployed in the Site 104 region.  
179 Commercial fishermen ~~revealed~~ indicated that gill-netting effort is concentrated to the upper half

180 of Site 104 north of the RWLP buoy. Commercial fishermen also reported that the area below  
181 the RWLP buoy is avoided during non-slack tidal periods because of reported snags and other  
182 bottom obstructions that foul gill nets. Pound nets are typically set in less than 6.1 m (20 ft) of  
183 water along shorelines to intercept fish as they move. Due to the depth of Site 104, no pound  
184 nets are set within the boundaries of the site (Miller 1998).

185  
186 **5.3.5.e Finfish Fishery.** The economic value of aquatic resources obtained by commercial  
187 fishing from within the site and immediate surrounding waters are difficult to estimate because of  
188 the way landings are tracked by the Maryland Department of Natural Resources. Landings are  
189 grouped and reported yearly as sales from specific sub-regions based upon commercially  
190 important harvestable fish. The sub-region containing Site 104, termed the NOAA025 area, is  
191 considered to contain waters from the Bay Bridge north to Pooles Island. Table 5-3029 presents  
192 weight and dollar value of selected commercial fisheries landings for the NOAA025 portion of  
193 the Chesapeake Bay, by year, from 1980 to 19986 (MDNR 1999b8). The portion of income  
194 derived specifically from Site 104 and the immediate surrounding area cannot be extracted from  
195 these data.

196  
197 ~~Of finfish, s~~Striped bass were caught in the greatest quantity (~~240,352~~~~179,752~~ lbs. average yearly  
198 catch between 1990 and 19986) and they have also been the most monetarily important finfish  
199 species

200 (~~\$531,691,863~~~~698~~ in 19986). More recent data for striped bass ~~was~~~~were~~ unavailable  
201 [REVISE?]; however, an increase in both landings and dollar value would be expected because  
202 of the easing of restrictions associated with a 5-year moratorium (lifted in 1996) that limited or  
203 completely restricted harvest of striped bass in an effort to replenish reproductive stocks. Other  
204 important commercial fish species caught within this region of the Chesapeake Bay include white  
205 perch, Atlantic menhaden, summer flounder, and bluefish. The total monetary contribution  
206 (\$82,492 in 1998) for ~~of each of these finfish species and others listed in Table 5-2930~~, however,  
207 is significantly less than striped bass. It is important to note that seasonal abundances and market  
208 conditions can affect the monetary value of any species on a seasonal or yearly basis.

209  
210 **5.3.5.f Blue Crab Fishery.** Blue crabs provide the most significant income-producing resource  
211 for most Chesapeake Bay regions. Landings and the monetary value associated with those  
212 landings exceed every other harvestable resource within the Chesapeake Bay waters  
213 (~~2,867,936~~~~4,745,500~~ lbs. worth ~~\$3,161,229,995~~~~107~~ in 19986). In addition, total crab catches  
214 exceed catches of every other commercially important species combined (Table 5-3029). In  
215 19968, ~~7985~~ percent of the total landings of selected commercial species in the NOAA025 area  
216 consisted of blue crabs.

217  
218 In recent years, increasing pressure has been placed on the blue crab fishery as catches increase  
219 with the introduction of more efficient gear and an increasing demand. Stricter regulations on  
220 commercial and recreational crabbing were instituted in 1997. For example, commercial  
221 crabbers must obey area closures, time restrictions, and undetermined waiting periods for  
222 licenses. Recreational crabbers may not harvest on Wednesdays and commercial crabbers may  
223 not harvest on either Sunday or Monday. In addition, the 19986 season was closed on 30  
224 November ~~30~~, compared to the normal season closing (31 December). Commercial harvesting

Table 5-2930

Weight and Dollar Value of Selected Commercial Fisheries Landings for the NOAA025 Portion of the Chesapeake Bay From 1980 - 1996.

Year	Species									
	Blue Crab (sum of hard and soft)		Blue Fish		Menhaden		Oyster		River Herring	
	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value
1980	2,185,807	549,669	116,041	9,503	530,335	28,884	112,820	158,429	10,133	828
1981	8,374,838	2,242,133	140,781	15,443	688,890	40,990	105,870	154,181	2,856	287
1982	5,359,292	1,777,819	99,871	15,003	1,694,327	101,567	110,726	175,393	5,786	1,377
1983	4,316,630	1,502,329	20,673	3,283	459,751	22,988	115,439	227,286	2,807	685
1984	5,663,072	2,056,469	5,010	578	173,752	10,765	24,665	58,301	1,337	168
1985	12,358,778	4,690,066	75,918	12,927	422,346	25,749	28,457	52,858	35,719	4,674
1986	6,215,196	2,694,662	120,122	25,531	358,587	25,733	148,731	454,654	3,622	409
1987	5,207,240	2,556,782	9,128	1,807	248,859	16,364	132,558	475,529	56	6
1988	4,092,420	1,878,396	5,935	818	37,084	2,228	117,750	396,647	2,616	247
1989	4,088,320	2,039,609	11,349	1,968	153,250	11,680	88,120	298,246	135	18
1990	4,284,279	18,234,253	16,554	3,947	132,240	12,014	130,749	482,386	96	16
1991	5,065,860	2,128,023	1,608	414	210,065	20,667	121,442	374,300	2,109	195
1992	3,279,221	1,800,777	10,358	3,834	241,117	23,153	129,831	443,734	2,875	639
1993	6,024,740	3,477,756	138	83	4,000	415	62,266	180,493	800	95
1994	4,945,510	4,206,405	971	274	34,320	5,299	49,988	159,075	770	42
1995	5,185,213	4,783,633	192	120	84,390	9,035	118,264	318,338	150	8
1996	4,745,500	3,229,107	50	36	42,550	4,294	20,882	68,583	-0-	-0-
1997	3,573,187	3,169,550	136	43	6,080	595	101,704	338,047	222	44
1998	2,867,936	3,161,995	471	125	20,252	1,850	91,861	305,686	90	10

Table 5-2930 (Continued)

Year	Species									
	Soft Clam		Striped Bass (sum of large, med., and small)		Summ Flounder		Weakfish		White Perch	
	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value	Pounds	\$ Value
1980	280,440	634,797	1,076,244	897,541	45	21	1,658	502	282,747	101,913
1981	316,392	644,018	780,100	767,715	1,003	548	13,812	6,400	125,146	52,146
1982	392,322	827,987	219,645	361,107	-0-	-0-	7,724	4,360	119,090	65,995
1983	579,952	1,313,912	87,019	163,154	278	155	186	120	49,398	29,575
1984	226,818	578,311	114,218	192,700	106	112	48	22	52,397	24,468
1985	136,734	374,799	-0-	-0-	31,121	42,797	81,506	45,728	35,215	13,441
1986	109,242	311,846	-0-	-0-	370	576	38,385	39,810	51,171	22,887
1987	845,916	1,544,498	-0-	-0-	320	364	1,029	808	18,895	10,675
1988	1,665,324	3,427,094	-0-	-0-	136	254	360	386	53,665	28,162
1989	1,754,862	4,244,568	-0-	-0-	1,374	3,208	9,902	9,142	55,013	34,920
1990	701,085	2,941,801	4,148	8,393	78	137	150	169	58,060	31,011
1991	366,387	1,238,288	15,135	29,921	-0-	-0-	422	361	19,063	12,279
1992	157,437	906,308	130,973	194,117	615	920	337	532	80,126	148,040
1993	395,148	1,814,640	156,558	288,858	-0-	-0-	-0-	-0-	107,169	78,192
1994	211,581	1,427,891	225,374	374,368	56	79	1,298	943	165,302	133,630
1995	188,898	1,024,183	288,438	434,860	631	1,031	9,531	10,61	211,926	169,028
1996	116,820	605,550	437,642	691,699	15	35	12	12	232,049	136,914
1997	<u>106,320</u>	<u>751,481</u>	<u>481,672</u>	<u>694,137</u>	<u>8</u>	<u>16</u>	<u>1,055</u>	<u>440</u>	<u>246,404</u>	<u>98,720</u>
1998	<u>81,820</u>	<u>547,407</u>	<u>423,227</u>	<u>531,863</u>	<u>20</u>	<u>42</u>	<u>600</u>	<u>344</u>	<u>140,740</u>	<u>80,121</u>

Source: MDNR 19998

225 within Site 104 is concentrated on the eastern edge of ~~the s~~Site 104 and is limited to the  
226 shallower areas less than 12.2 m (<40 ft) because of potential gear conflict with water traffic  
227 (Site 104 Open-Water Placement Area Commercial and Recreational Fishermen Meeting  
228 Summary July, 28 1997).

229  
230 **5.3.5.g Oyster Fishery.** The average yearly catch of oysters harvested in the NOAA025 area  
231 from 1980 to 1998~~6~~ was ~~95,375,209~~ lbs with an approximate monetary value of ~~\$2693,588437~~  
232 (Table 5-~~3029~~). It is not possible to determine from the available data which portion of the total  
233 catch came from waters adjacent to Site 104 (there are no oyster bars in Site 104). In years past,  
234 oysters were dredged from the deeper waters of the Bay by sailboats, but most beds now are  
235 found in the shallows along the shore and in Bay tributaries where sediments are firmer and  
236 where the supply of dissolved oxygen is more reliable (Kennedy 1991).

237  
238 There are ~~six~~ seven oyster bars (Broad Creek, Love Point, Mountain Point, Sandy Point, Dolly's  
239 Lump, Hacketts Point, and Brickhouse Bar ~~and Broad Creek~~) that are known to exist in the  
240 vicinity of the Site 104 (Figure 5-~~2224~~). The boundaries of the oyster bars depicted in this figure  
241 are of historic nature and do not necessarily reflect the areas currently considered viable. The  
242 Love Point oyster bar is located approximately 1.1 km (0.7 miles) northeast of the northern edge  
243 of Site 104. Mountain and Sandy Point bars are both located approximately 5.1 km (3.2 miles)  
244 northwest and west, respectively, of Site 104. Hacketts Point Bar and Dolly's Lump are located  
245 south-southeast of Sandy Point State Park and are approximately 2.4 km (1.5 miles) from the  
246 southwest boundary of Site 104. Broad Creek is the closest oyster bar to Site 104 (just southeast  
247 of the southern end of Site 104). However, a portion of the Broad Creek oyster bar is prohibited  
248 to shellfish harvesting due to the presence of the Kent Island Waste Water Treatment Plant  
249 outfall (Figure 5-~~242218~~). According to MDNR (1999), Sandy Point, Dolly's Lump, and  
250 Hacketts Point are the most heavily commercially worked oyster bars in the vicinity of Site 104.

251  
252 The Maryland Department of Transportation and MDNR have established a program to provide  
253 supplemental funding for MDNR's Oyster Recovery Program to account for transportation-  
254 related introduction and re-circulation of potentially harmful nutrients and/or pollutants in the  
255 Bay. This topic is further discussed in Section 6.3.2.b.

256  
257 **5.3.5.h Soft Clam Fishery.** The distribution of soft shell clams in the Chesapeake Bay is  
258 restricted by several variables, particularly salinity, sediment type, anoxia, and predation.  
259 Populations persist mainly in shallow areas of the Bay, particularly in areas of less than 5.2 m  
260 (17 ft) (Baker and Mann 1991). Optimal areas for soft shell clams are found on the Eastern  
261 Shore of the Pocomoke Sound to Eastern Bay and on the western side from the Rappahanock  
262 River to the Severn River.

263  
264 Over the last ~~197~~ years, soft clam landings in the NOAA025 area have fluctuated widely. A ~~197~~  
265 year (1980-1998~~6~~) mean of ~~45496,395785~~ lb. with an approximate average annual monetary  
266 value of ~~\$1,324403,178558~~ for the region from the Bay Bridge to Pooles Island was determined  
267 by MDNR (Table 5-~~3019~~). Soft clam populations fluctuate on a yearly basis, depending on  
268 reproductive success. It is difficult to determine what percentage of the soft clam harvest came  
269 from ~~the vicinity of~~ near Site 104 specifically. MDNR (1999) reported that most of the soft

270 clamming commercial activity occurs in shallower depths north of the Broad Creek Oyster Bar.  
271 ~~Soft clamming activity was documented to occur near the boundaries of Site 104.~~ However,  
272 clamming in parts of Site 104 is prohibited because it is near a closure zone around the Kent  
273 Island Waste Water Treatment Plant ~~WWTP~~ outfall. No soft clams are harvested within the Site  
274 104 boundaries because most of the site is too deep to support the resource.

275

276

1  
2 **5.4 AESTHETICS AND RECREATIONAL RESOURCES**  
3

4 The upper Chesapeake Bay, which encompasses Site 104, is a recreational and aesthetic resource  
5 enjoyed by many different individuals in a variety of pursuits. The upper Bay region, in its  
6 entirety, offers a number of seasonal recreational activities including water sports such as  
7 boating, sail boating, and fishing. An aesthetically pleasing environment is an integral part of  
8 these seasonal recreational activities.  
9

10 **5.4.1 Aesthetics**  
11

12 Over 20 million people, whether commuting or vacationing, enjoy a panoramic view of the  
13 upper-Bay while traveling across the Chesapeake Bay Bridge each year (Maryland Department of  
14 Business & Economic Development 1997). Most of this traffic occurs in times of warmer  
15 weather rather than during the winter months when placement would occur. Sandy Point State  
16 Park, which is 4.0 km (2.5 miles) west of the proposed placement site, consists of several public  
17 beaches and many natural protected areas that provide scenic vistas to both the shoreline observer  
18 and the boater. To the east of the proposed placement site are the rural shorelines of Kent Island.  
19

20 **5.4.1.a Odors.** Because Site 104 is an open water placement site approximately 1.6 km (1 mile)  
21 from the nearest shoreline, it is generally not subject to anthropogenic (manmade) sources of  
22 odor. Brief odors could be experienced which are associated with automobile traffic on the Bay  
23 Bridge and marine traffic. Distances from industrial sources of odor are generally great enough  
24 to prevent odors from reaching the area. Baseline odors at Site 104 have not been measured;  
25 however, there are no permanent sources of odor at the site, and only natural odors common to  
26 open water areas of the Bay should be detectable.  
27

28 **5.4.2 Recreation**  
29

30 A variety of recreational activities occur around Site 104 depending on the season and on  
31 weather conditions. The most popular recreational activities in the area are fishing activity and  
32 boating. Marina and boat launching facilities are available on Kent Island. Sandy Point State  
33 Park on the western shore provides many recreational opportunities such as beaches, boat docks,  
34 boat launching facilities, and picnic pavilions.  
35

36 **5.4.2.a Fishing.** Fishing is likely the most common recreational activity that occurs in the waters  
37 surrounding Site 104. Fishing for several species, including striped bass and white perch, is  
38 especially popular during spring migration periods. There is a "trophy" striped bass season in the  
39 spring (~~23 April 234-31 May June 3114~~ in 19998) with a minimum size of 28 in. and a  
40 subsequent summer/fall season with a smaller size ~~limit which limit, which~~ extends from 14 June  
41 ~~14mid-August to 30 November 30late-November~~ (MDNR 1999c). The white perch fishing  
42 season is typically open year round with no minimum size restrictions.  
43

44 Representatives from the Maryland Waterman's Association (MWA), Maryland Charter Boat  
45 Association (MCBA), Upper Bay Charter Boat Captains Association (UBCBCA), Maryland

46 Saltwater Sportfishermen's Association (MSSA), and Kent, Anne Arundel, and Queen Anne's  
47 Counties were contacted to discuss the current use of Site 104 by recreational and commercial  
48 fishermen. [CENAB to Update after latest meeting with recreational fishers]. Two meetings  
49 were also held in February and July 1997. ~~In July~~At the July meeting, the recreational fishermen  
50 stated that they fish on the northern edge of the site in shallow areas (~~Site 104 Open Water~~  
51 ~~Placement Area Commercial and Recreational Fishermen Meeting Summary July, 28 1997~~MES  
52 1997d). Personal communication with Russell Green, President of the MCBA, on 18 November  
53 18, 1997 verified that recreational fishermen and charter boat captains fish the shallower edges (<  
54 12.2 m [ $<40$  ft]) east of the Site 104. A Kent County representative and the Charter Boat  
55 Captains stated that the RW "LP" buoy, which is located 0.4 km (0.4 mile) west of the northern  
56 portion of the proposed site, is the southern cut-off point for recreational fishing activities (~~Site~~  
57 ~~104 Open Water Placement Area Commercial and Recreational Fishermen Meeting Summary~~  
58 ~~July, 28 1997~~MES 1997d).

59  
60 **5.4.2.b Boating.** Boating is central to many Bay activities, including recreational pursuits. In  
61 the Chesapeake Bay, power boaters, water-skiers, and sailboaters all utilize portions of the Bay  
62 waters. Commonly, boats passing through Site 104 are in transit to and from either Baltimore  
63 Harbor, Sandy Point State Park, Chester River, other northern areas along the eastern shore,  
64 marinas on the western shore of Kent Island, or points south of the Bay Bridge. There are four  
65 major access points for boats entering or exiting the Bay just south of the Bay Bridge on the  
66 eastern edge of Kent Island. Traveler Marine, Chesapeake Bay Bridge, and Pier 1 Marinas are  
67 located just south of the Bay Bridge and north of Broad Creek in Stevensville. The Traveler  
68 Marine, Chesapeake Bay Bridge, and Pier 1 Marinas are full service yards offering a wide array  
69 of services and facilities for recreational boaters. The Matapeake Terminal and State Park,  
70 located south of the Bay Bridge, is not a full service yard, but does offer a launching ramp for  
71 recreational boaters. Adjacent to the west side of Site 104 is the Craighill Entrance, which is the  
72 principal access to the Port of Baltimore for shipping.

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Section 6

**Potential Environmental Impacts of the Proposed Action**

**6.1 IMPACTS OF THE PROPOSED ACTION**

The NEPA process requires the evaluation of potential impacts of the proposed project to area resources at Site 104. The following section analyzes the impacts of the placement of dredged material on various resources identified in Section 5. The specific issues associated with Site 104, as well as Bay-wide concerns, and the analysis of these parameters relative to the use of Site 104 for dredged material placement are discussed. The impacts of the alternatives presented in Section 2 are discussed in Section 7.

Short-term impacts are defined as impacts that occur during dredged material placement activities and subside and return to normal shortly after placement ends. Long-term impacts are defined as impacts that occur as a direct result of placement activities, and remain and do not diminish after placement ceases. Both short-term and long-term impacts can be minimized by time-of-year restrictions on site use and by modification of placement strategies. A summary of impacts for the proposed action is provided in Table 6-1. Potential negative impacts that are expected to be minimized by the implementation of time-of-year restrictions and/or by the modification of placement strategies are also designated within Table 6-1.

The dredging of the channels has been addressed in other NEPA documentation. This documentation will be updated as appropriate prior to the dredging of individual channels. The channels are dredged based upon shoaling surveys performed by the USACE. In general, the Federal channels are dredged every year. The dredging frequency of the various channel reaches varies from every other year to every few years depending upon shoaling rates. Prior to dredging, a public notice is distributed and a water quality certification is applied for from MDE.

**6.1.1 Setting**

Site 104 is a previously used 1,800-acre open-water placement site. The proposed dredged material placement activities would occur inside the existing site boundaries as defined in Section 5.1.1. Therefore, use of the site for dredged material placement will not alter the physical boundaries or the existing setting of the site. Other than temporary visual impacts during placement activities, there will be no visible change within the project area other than the anticipated changes in underwater relief.

**6.1.2 Physiography, Geology, and Hydrology**

**6.1.2.a Physiography.** The use of Site 104 as an open-water dredged material placement area is not anticipated to significantly change the current physiography of the area. The site was previously used for dredged material placement from 1924 through 1975; consequently, the area is relatively flat with slopes on the order of 100 horizontal to 1 vertical (100H:1V) or flatter, and

**Table 6-1.  
Summary of Impacts for the Proposed Action**

Resource	No Impact	Positive Impact		Negative Impact		
		Short-term	Long-term	Short-term	Long-term	Minimize <sup>(a)</sup>
<b>Environmental Resources</b>						
Setting	✓					
Physiography, Geology, Hydrology	✓					
Groundwater	✓					
Hydrodynamics <sup>(b)</sup>				✓		✓
Water Quality			✓	✓		✓
Sediment Quality			✓			
<b>Aquatic Resources</b>						
Plankton Communities				✓		✓
Finfish Communities			✓	✓		✓
Shellfish Communities				✓		✓
Benthic Communities			✓	✓		✓
Submerged Aquatic Vegetation (SAV)	✓					
Terrestrial / Avian Resources	✓					
Rare, Threatened & Endangered Species	✓ <sup>(c)</sup>					
Air Quality				✓		✓
Noise				✓		✓
Hazardous, Toxic, & Radioactive Substances	✓					
<b>Cultural and Archaeological Resources</b>						
Cultural Resources	✓					
Archaeological Resources	✓					
<b>Socioeconomic Resources</b>						
Aquatic Resources			✓	✓		✓
Commercial Fisheries			✓	✓		✓
Regional Economics			✓			
<b>Aesthetic Resources</b>						
Aesthetics				✓		✓
Odors				✓		✓
<b>Recreational Resources</b>						
Fishing			✓	✓		✓
Boating				✓		✓

(a) Material placement and site management practices were chosen to minimize impacts to resources of concern.

(b) See Table 6-3 for detailed summary of hydrodynamics impacts

(c) Assumed. Shortnose sturgeon study not finalized. Current results show no impact. Pending biological determination from NMFS.

1 contains soft, fine-grained material (MDNR 1976; CENAB 1996—ADD TO REF. LIST; Halka  
2 1997—a or b?; and E2Si 1997). Future use of the site for dredged material placement will  
3 maintain these flat slopes and soft sediment composition. Placement of dredged material could  
4 potentially cover up and eliminate fishing net snags in the bottom areas where material is placed.  
5

6 **6.1.2.b Geology.** The use of Site 104 as an open-water dredged material placement area will not  
7 change the underlying geology of the area. The presence of the lineation (or linear ground  
8 feature observable on a high altitude, Landsat photo image) identified in the vicinity of Site 104  
9 and described in Section 5.1.2.b of this document is insignificant to the proposed action.  
10 Maryland is ranked in the lowest category of potential for ground acceleration (FEMA 1994—  
11 ADD TO REF. LIST), and is ranked in the second lowest risk category based on the USGS  
12 National Seismic Hazard Mapping project. The possibility of a major earthquake occurring in  
13 Maryland is relatively low, and even a large scale event would likely have little effect on the soft  
14 sediments in the bottom of the Chesapeake Bay, including those deposited within the Site 104  
15 area (Halka 1998). The soft sediments, both naturally deposited in the Bay and placed dredged  
16 material, would effectively absorb and dissipate any relatively minor motion of the underlying  
17 earth such that no impact would be expected to occur.  
18

19 **6.1.2.c Hydrology.** Placement of sediment in Site 104 will likely have little effect on the overall  
20 movement of water from the Bay into the lower portions of the Aquia Aquifer in the Kent Island  
21 area, or the corresponding outward movement of the overlying fresh water. Using calculated  
22 velocities for current inland movement (21 feet per year), the advective travel time of water from  
23 Site 104 would require over 400 years to reach the closest wells on Kent Island. Since any  
24 alleged solute from the dredged material would be subject to retardation, this estimated travel  
25 time would actually be larger, based on the respective retardation of the alleged contaminant. In  
26 addition, the hydraulic conductivity of the dredge material is considerably lower than both the  
27 paleochannel and Aquia Aquifer (Section 5.1.2e). This would have the effect of thickening the  
28 clay seal at the bottom of the current channel, thus decreasing the velocity at which water will  
29 enter the aquifer. In other words, disposing of dredge material at Site 104 may actually decrease  
30 the current rate of salt-water intrusion (Halka 1997). Placement of dredged material at Site 104  
31 will result in a greater thickness of fine-grained sediments between the Bay waters and the  
32 sediments of the Aquia. The movement of Bay water from the Bay to the aquifer will tend to be  
33 inhibited by placement of additional sediments (Halka 1997). The fine-grained material is not  
34 expected to move beyond the placement area into the aquifer.  
35

### 36 **6.1.3 Hydrodynamics** [NEED UPDATED INFO. FROM SAIC/WES]

37  
38 **6.1.3.a Introduction.** Computer models were run by Moffatt & Nichol Engineers (M&N) and  
39 the U.S. Army Corps of Engineers Waterways Experiment Station (WES) to simulate potential  
40 hydrodynamic changes due to placement of dredged material at Site 104. Models simulated the  
41 motion of the water (hydrodynamics) flowing through Site 104 and the resulting potential for  
42 erosion and movement of placed dredged material using both controlled hydraulic bottom  
43 pipeline placement and bottom-release scow placement methods. The erosion models also  
44 provided information on potential annual changes in water depths. Laboratory testing was  
45 conducted by WES to characterize the erodability of the dredged materials proposed for  
46 placement at Site 104. The information gained from the laboratory testing was ultimately used in

**Table 6-2**  
**Five Year Placement Plan for Site 104**

<b>Year</b>	<b>Volume (m<sup>3</sup>) / (cy)</b>	<b>Modeled Placement Days</b>
1	1,913,265 / 2,500,000	140
2	3,443,878 / 4,500,000	140
3	2,295,918 / 3,000,000	168
4	4,591,837 / 6,000,000	168
5	1,530,612 / 2,000,000	140
<b>Total</b>	<b>13,775,510 / 18,000,000</b>	

Table 6-3

Summary of impacts to hydrodynamic processes in the vicinity of Site 104

Hydrodynamics	No Impact	No Significant Impact	Impact
Average Depth			✓
Water Level	✓		
Astronomical Tides	✓		
Extreme Water Levels	✓		
Wind Conditions	✓		
Tidal Currents		✓	
Sedimentation Rates		✓	
Sediment Erodability			✓
Material Spreading			✓
Potential Sediment Transport			✓
Wave Conditions		✓	

1 the modeling of the potential erosion and movement of placed dredged material. The annual  
2 placement plans were developed using the MDFATE model in accordance with the following  
3 criteria: minimize loss of material during placement; minimize loss of material following  
4 placement due to erosion; minimize mounding of the material at each placement location (which  
5 subsequently serves to minimize erosion); prevent material from mounding above elevation –  
6 13.7 meters (-45 feet); place material in the deeper portions of the site to achieve as uniform a  
7 depth as possible throughout the site; and maximize capacity. The quantities of material to be  
8 placed originated from the State of Maryland's Strategic Plan for Dredged Material Management  
9 (Table 6-2). In the model, 2,755 m<sup>3</sup> (3,600 cy) of material (holding capacity of one barge) was  
10 placed during each placement event. The number of placement events in any one day or  
11 placement season depended upon the total amount of dredged material to be placed in that year.  
12 A placement window from 1 November into March was utilized.

13  
14 **6.1.3.b Summary.** A summary of potential impacts to hydrodynamic processes is provided in  
15 Table 6-3. Water levels, astronomical tides, extreme water levels, and wind conditions will not  
16 be impacted by the proposed action. The changes in the depth-averaged currents due to a  
17 decrease in the water depths at Site 104 from dredged material placement were determined to be  
18 small (less than 2%). Changes in the resulting bottom forces that could move the bottom  
19 sediments varied by ±15% depending upon where and in what order material was placed. Based  
20 on the assumptions and the material placement plan used for the erosion model studies, the  
21 modeled results indicated a worst-case potential for 16.9% of the material placed by bottom-  
22 release scow to leave the site boundary and a potential for 6.2% of the material placed by  
23 controlled hydraulic pipeline bottom placement to leave the site boundary. Available models of  
24 the Chesapeake Bay are not able to predict sediment transport. It is, therefore, unknown exactly  
25 where material potentially leaving the site boundaries will end up, although smaller particles will  
26 tend to travel farther than larger ones. The hydraulic placement modeling simulated the  
27 hydraulic unloading of individual barges by pump-out through a pipeline and diffuser, to  
28 locations within about 2 meters (6.0 feet) of the Site 104 bottom. Most of the predicted erosion  
29 is anticipated to take place during the material placement period (WES 1998). These predicted  
30 sediment losses are thought to be higher than what actually would be expected to occur, since the  
31 model doesn't take into account any material that leaves the site and is then carried back into the  
32 site by tidal action. The losses could vary for either of the placement methodologies under actual  
33 conditions (WES 1998).

34  
35 Sedimentation rates are controlled by the physical characteristics of the sediments and  
36 surrounding water and the hydrodynamics of the area. Since the hydrodynamics models revealed  
37 that the variations in tidal currents through the site area would not change significantly (WES  
38 1998), it is anticipated that natural sedimentation rates within Site 104 will not be significantly  
39 impacted by the proposed action. Physical analysis of sediments proposed for placement at Site  
40 104; indicated that the particle sizes of material to be placed at the site are similar to the  
41 sediments that currently exist at the site. The majority of sediment proposed for placement  
42 consists of silt and clay particles. Analysis of sediments from the Craighill Angle, the Cutoff  
43 Angle, the Brewerton Channel Eastern Extension, the Tolchester Channel, and the Swan Point  
44 Channel indicated that the mean sediment particle size was 10.88x10<sup>-6</sup> meters (3.57x10<sup>-5</sup> feet).  
45 Existing sediments in the Site 104 area consist primarily of very soft to soft gray silty clay with

1 localized pockets of silty sand and red-brown silty clay (E2Si 1997; MGS 1997—ADD TO  
2 REF. LIST; EA 1998).

3  
4 The water quality model developed by WES and described below in Annex F was run using a  
5 tracer concentration that indicated the long-term movement of water over the Site 104 bottom to  
6 be to the north, indicating that sediments remaining in suspension over multiple tidal cycles  
7 would ultimately move in a northerly direction. However, it should be noted that the suspended  
8 sediments that will remain in the water column over tidal cycles will be low.

9  
10 This northward movement is not expected to interfere with the turbidity maximum zone in the  
11 upper Bay or with planktonic transport associated with the movement of the turbidity maximum  
12 zone. Impacts to recreational and commercial fishing, due to the northerly movement of the  
13 suspended sediment, will be minimal due to the time-of-year that placement will occur and the  
14 small amount that will likely be transported. In addition, northerly movement is not expected to  
15 impact clam beds adjacent to the site because the movement will be restricted to the deeper areas  
16 that are located west of the clam beds.

17  
18 **6.1.3.c Model Descriptions**. Preliminary investigations into the hydrodynamics of Site 104 and  
19 the development of dredged material placement plans to minimize the potential for erosion were  
20 performed by M&N using the following models: FASTTABS, STFATE, SURGE, MDFATE,  
21 LTFATE. More detailed investigations of the Site 104 hydrodynamics, potential sediment  
22 erosion and transport, and placement plan development were performed by WES using the  
23 following models: CH3D-WES, STFATE, SURGE, MDFATE, LTFATE, CEQUAL-ICM. Each  
24 of these models is state-of-the-art, is utilized both nationwide and internationally, and is the best  
25 tool available for making respective predictions for areas within the Chesapeake Bay. A joint  
26 effort by M&N and WES was made to compute the initial footprint generated by hydraulically  
27 placed material based on work by Thevenot *et al.* 1992. Reports on both modeling studies are  
28 located in Appendix F. Validation and calibration of the models and a discussion of the  
29 assumptions for each model are also included in these reports. Brief descriptions of each model  
30 utilized are provided in the following sections Annex F.

31  
32 ~~FASTTABS is the personal computer version of the main frame based TABS 2 model (Thomas~~  
33 ~~and McAnally 1985) developed by the USACE. It was used to simulate existing depth averaged~~  
34 ~~tidal current velocities in and around Site 104. Predicted depth averaged current velocities were~~  
35 ~~used as inputs to the MD FATE model that was used for development of a dredged material~~  
36 ~~placement plan to be utilized in the WES modeling studies. The FASTTABS model~~  
37 ~~encompasses an area of the Chesapeake Bay from the Susquehanna River and C&D Canal to~~  
38 ~~near the southern tip of Calvert County in the south and was refined in the area of Site 104 to~~  
39 ~~provide greater detail. The model requires that the estuarial system be represented by a network~~  
40 ~~of nodal points (i.e. points defined by coordinates in the horizontal plane and water depth) and~~  
41 ~~elements (i.e. areas made up by connecting adjacent nodal points). The nodes were connected to~~  
42 ~~form quadrilateral and triangular two dimensional elements. The resulting nodal/element~~  
43 ~~network is commonly called a finite element mesh and provides a computerized representation of~~  
44 ~~the estuarial geometry and bathymetry. The site bathymetry modeled was provided by CENAB~~  
45 ~~from a survey conducted in September 1997 (Appendix F.3, M&N 1998).~~

1 The CH3D-WES (Curvilinear Hydrodynamics in Three Dimensions) model was developed  
2 jointly through funding by the USACE, EPA, and the State of Maryland, with oversight provided  
3 by the Chesapeake Bay Program. This model simulates the hydrodynamics, salinity, and  
4 temperature of the entire Chesapeake Bay system in three dimensions (WES 1998). The  
5 principal model extends from the mouth of the Chesapeake Bay in the south to the Susquehanna  
6 River and C&D Canal in the north. A version of this model was developed for simulations  
7 within the upper Bay to provide more detailed predictions within the upper Bay, including Site  
8 104, with relatively short model run times. The boundary conditions of the upper Bay model  
9 were initially driven by the full Bay model, but were then changed to utilize data. Both models  
10 contain layers of cells that are five feet thick, with the exception of the top layer, which varies  
11 with the tides.

12  
13 The modeling study conducted for the proposed action used data collected during the year 1993  
14 for specifying conditions at the model boundaries. 1993 was a high fresh water flow year into  
15 the Bay and it was deemed that modeling with these flows would provide a worst case for the  
16 project area hydrodynamics resulting in a higher estimate of potential sediment losses, since  
17 higher flow rates generate higher forces that are able to dislodge more sediments from the  
18 estuary bottom than the forces produced by average flow conditions. During the period of time  
19 being simulated, the CH3D-WES model generated depth averaged current velocities and bottom  
20 shear stresses. The bottom shear stresses result in forces along the bottom of the study area  
21 resulting from the varying movement of water over the sediments and control whether or not the  
22 sediments will move off of the bottom. These depth averaged current velocities and the bottom  
23 shear stresses computed by CH3D-WES were applied in the MDFATE modeling. The CH3D  
24 model was rerun at the end of each simulated placement year to produce the new depth averaged  
25 current velocities and bottom shear stresses based on the changed bathymetry produced by  
26 MDFATE from dredged material placement. Therefore, the results account for any changes in  
27 the area currents caused by decreased depths from dredged material placement in the previous  
28 model year (Appendix F.2, WES 1998).

29  
30 The earliest version of the STFATE (Short Term FATE) model was developed by the U.S.  
31 Environmental Protection Agency (Koh and Chang, 1973) to predict the behavior of dredged  
32 material placement in open water. This model was later modified and refined by WES to predict  
33 the behavior of discrete discharges of dredged material from hoppers or barges. The model  
34 computes the fate of the placed material during its descent through the water column, its spread  
35 over the bottom, and finally the transport and diffusion of material remaining in suspension.

36  
37 The STFATE model grid for Site 104 covered most of the site with the exception of the shallow  
38 water areas to the north that are planned to receive very little dredged material. The model  
39 utilizes input data describing characteristics of the planned placement vessel (i.e. bottom release  
40 scow or hopper dredge), dredged material being placed, and the placement site (Site 104).  
41 STFATE modeling for Site 104 computed the fate of dredged material placed with a bottom-  
42 release scow as the material falls through the water column and then impacts with the bottom. It  
43 also computed the movement of the suspended sediments stripped from the main mass during  
44 material descent until this stripped material reaches the site boundary; therefore, predicting the  
45 quantity of material potentially leaving the site during this phase of placement.

1 The model output provided the following information: 1) the amount of placed dredged material  
2 that is stripped; 2) the potential horizontal movement of the material until it reaches the edge of  
3 the site boundary while in suspension; 3) the footprint on the Bay floor resulting from the  
4 material placed within the site; and 4) the dynamics when the material encounters the site  
5 bottom. This output was used in determining material placement set backs within the site  
6 boundaries in order to minimize the potential for material movement outside of the site. A  
7 limitation in the application of STFATE and in the model used to evaluate the spreading of  
8 hydraulically placed material is that both models assume that the bottom being impacted by the  
9 dredged material is essentially flat. To compensate for this limitation, the extent of material  
10 spreading on bottom slopes was evaluated using the SURGE model (Appendix F.3 & F.2, M&N  
11 1998 and WES 1998).

12  
13 SURGE modeling provided a basic analysis of the extent of material mass movement from the  
14 moment it impacts the site bottom until it comes to rest. The model was run for various slopes  
15 expected to be found at Site 104. SURGE uses output from the STFATE model including the  
16 velocity and diameter of the material cloud just before impact and a description of the bottom  
17 slopes expected to be encountered during placement. The energy stored (potential energy) in the  
18 falling cloud is converted to active energy (kinetic energy) by the SURGE model to establish the  
19 extent of potential material mass movement along the bottom slope (Appendix F.3 & F.2, M&N  
20 1998 and WES 1998). These results can also be used for determining set backs from the site  
21 boundaries for material placement that will minimize the amount of placed material leaving Site  
22 104.

23  
24 The MDFATE (Multiple Dump FATE) and LTFATE (Long Term FATE) models were used to  
25 evaluate the extent of long term movement of dredged material that has been placed on the  
26 bottom when subjected to the forces produced by the CH3D model described earlier. A version  
27 of STFATE is a component of MDFATE which models the descent and spreading of each  
28 placement load. The MDFATE/LTFATE evaluation considers potential erosion of material after  
29 it has settled to the bottom and remained in place for a relatively long period of time which is  
30 specific to the simulation being performed and can range from hours to years after the initial  
31 placement of material. For the Site 104 study, a period of one calendar year from 1 November  
32 to 31 October was used for each material placement year evaluated, since at the time the  
33 modeling was being performed, it was thought that the placement window would begin with 1  
34 November. Multiple placement plans were assessed to devise an optimal placement location and  
35 timing sequence to minimize material losses during the simulated placement of dredged  
36 materials at Site 104 over a five year period. This optimal placement plan was then input to the  
37 model. Physical characteristics of the dredged material proposed for placement at Site 104 were  
38 determined through laboratory analyses and were also used as input in the model. During the  
39 model runs, only the material that was being placed for the year was evaluated. Thus, the model  
40 scenario was set up so that existing sediment as well as the previous year's material could not  
41 erode since material that remains at the site longer than one year would be minimally susceptible  
42 to erosion compared to the year being evaluated. The object of the modeling was to determine  
43 the lost quantities of the material placed during the modeled year. This was done by assessing  
44 the model output of the mass remaining on the site bottom following the model run and  
45 comparing it with the mass of dredged material placed at the beginning of that modeled year  
46 (Appendices F.4 & F.3, M&N 1998 and WES 1998).

1  
2 CEQUAL-ICM (Corps of Engineers Quality-Integrated Compartment Model) is a three  
3 dimensional model of the entire Bay developed (Cereo and Cole 1994) to be used in conjunction  
4 with the CH3D-WES hydrodynamics model to evaluate water quality and compute the fate of  
5 water quality constituents. CH3D-WES provides 3-D velocities and diffusion coefficients to  
6 CEQUAL-ICM that contains a database of sediment characteristics measured throughout the  
7 Bay. Since no model has been developed to track sediment transport throughout the Chesapeake  
8 Bay, CEQUAL-ICM was used to track a tracer concentration released in the bottom model cell  
9 which covers Site 104 and to provide an indication of where in the Bay the fraction of suspended  
10 sediment leaving Site 104 that remains in the water column over multiple tide cycles may end  
11 up. It must be noted, however, that this model does not simulate the true physical behavior of  
12 sediments and cannot therefore provide information on the final destination of the sediments that  
13 might leave Site 104. These computations primarily provided insight into the effect of bottom  
14 residual currents near Site 104 (Appendix F.2, WES 1998).

15  
16 The formation of a footprint of material resulting from hydraulic placement of dredged material  
17 at Site 104 was computed based upon the USACE & USEPA (1992) approach. For the  
18 simulations run for the Site 104 study, it was assumed that the estuary bottom was horizontal, the  
19 viscosity (or thickness of the slurried material) was constant, the overlying flow exerted  
20 negligible shear stress on the underflow, and the spreading of the placed material was radially-  
21 outward around the discharge end of the pipe. The assumptions chosen were those that fit the  
22 conditions most likely to be encountered during this type of placement at Site 104. The model  
23 assumptions simulated the hydraulic unloading of an individual barge holding  $2,755 \text{ m}^3$  (3,600  
24 ey) of dredged material that was pumped out through a pipeline and diffuser and placed within 2  
25 meters (6.6 feet) of the site bottom. These assumptions were used because they minimized water  
26 column losses (Appendix F.3 and F.2, M&N 1998 and WES 1998). Hydraulic placement, with  
27 the discharge pipe positioned just under the water surface, would maximize material exposure to  
28 the currents in the 14 to 24 meter (45 to 78 feet) water column, and would result in a larger  
29 bottom footprint, with more erosion than mechanical placement. The characteristics of the  
30 dredged material being placed were based on laboratory analyses of the channel sediments  
31 proposed for placement. The output of the computation is a footprint of placed material  
32 providing its predicted radius and thickness. The resulting material footprint data were input into  
33 a modified version of the MDFATE model by WES to determine the potential for erosion. The  
34 results of the models are discussed in the following subsections.

35  
36 **6.1.3.d Average Depths.** Average depths at Site 104 will be directly impacted by the proposed  
37 action since placement of dredged materials would cause the depths to become shallower.  
38 Existing water depths at Site 104 range from -12.8 to -23.8 meters (-42.0 to -78.0 feet).  
39 Proposed placement of dredged material at Site 104 would reduce the water depths from a  
40 maximum of -23.8 meters (-78.0 feet) MLLW to a current design depth of -13.7 meters (-45.0  
41 feet). Areas where water depths are currently at or shallower than -13.7 meters (-45.0 ft) are not  
42 targeted for material placement. A minimum depth of -12.2 meters (-40.0 feet) MLLW should  
43 be maintained throughout the Site 104 area to promote navigational access to the Swan Point  
44 Channel. Average depths are discussed further in Annex F.

1 The most recent bathymetric surveys performed by CENAB in 1997 indicate that the bottom  
2 depths at the proposed placement Site 104 range between 12.8 meters (42 feet) MLLW and  
3 23.8 meters (78 feet) MLLW. Although dredged material was placed at the site for over 50  
4 years, the material was not consistently placed to a particular depth at all locations to achieve a  
5 consistent bottom contour. The proposed action would raise the deeper areas within the site to  
6 13.7 meters (45 feet) MLLW and will not affect the areas that are shallower than 13.7 meters  
7 (45 feet) MLLW. Bathymetric studies would be required before, during, and after placement to  
8 ensure that the placement is limited to approved depths. The proposed action at Site 104 is not  
9 expected to significantly affect the surrounding bathymetry outside of the site.

10  
11 The modeling of hydraulic placement (hydraulic unloading of individual barges by pump out  
12 through a pipeline and diffuser to locations within 2 meters (6.6 feet) of the site bottom) of 3,600  
13 ey of dredged material from one barge resulted in a footprint with a thickness of 7.8 cm (3.1 in)  
14 and a radius of 129 meters (423 feet). This footprint was used in the MDFATE modeling for  
15 each hydraulic placement event and resulted in changes in bathymetry similar to the stacking of  
16 disks or pancakes. Although this does not accurately represent what is expected to occur under  
17 actual conditions, it was the closest representation that could be modeled. The modeled footprint  
18 of material placed by bottom release scow varies with each placement and depends on the depth  
19 of the water column through which the material is placed and the ambient current at the time of  
20 placement. In both placement scenarios, the cumulative height of mounded material above the  
21 surrounding bathymetry was attempted to be kept below 3.1 to 4.6 m (10 to 15 ft) and the  
22 exposed surface area of newly placed material minimized. This was done in an attempt to  
23 minimize material exposure to erosive forces and thus minimize material erosion.

24  
25 Changes to water depths within the site would vary from year to year. The water depth changes  
26 will depend upon the quantities and locations of material placed in any one year, and the  
27 equipment and methods used for placement (i.e. bottom hydraulic placement vs. bottom release  
28 scow or hopper dredge placement). The proposed action would raise the deeper areas within the  
29 site to 13.7 meters (45 feet) MLLW and will not affect the areas that are shallower than 13.7  
30 meters (45 feet) MLLW. Figures 6-1 through 6-5 and Figures 6-6 through 6-10 show predicted  
31 cumulative changes to the bathymetry following each year of placement resulting from the  
32 MDFATE modeling for both bottom release scow and hydraulic bottom placement, respectively.  
33 At the end of the fifth year, slopes range from basically flat throughout the majority of the site  
34 with steep slopes between 20:1 and 35:1 at the southern portion of the western boundary and at  
35 the southern boundary where material accumulation above the existing depths is greatest. The  
36 steeper slopes would be formed in an attempt to maximize the capacity of the site. The same  
37 placement plan was used for each of the modeled placement scenarios discussed above and  
38 allowed for a 152.4 meters (500 feet) buffer along the site perimeter. The placement plan for the  
39 modeling was developed to place an estimated 13.8 million m<sup>3</sup> (18 mecy) of dredged material at  
40 Site 104. The bathymetry at the end of the fifth year of placement is shown in Figures 6-5 and 6-  
41 10. However, these average water depths will increase over time due to consolidation of the  
42 placed material. This consolidation will occur due to the overlying weight of the newly placed  
43 dredged material. It is anticipated that areas where 9.1 meters (30.0 feet) of dredged material are  
44 placed will consolidate by up to 1.1 meters (3.5 feet). In areas with less placed material, less  
45 consolidation should be seen. Fifty percent of the consolidation has been calculated to occur

1 within the first eight years following placement. The remaining consolidation should occur more  
2 gradually over the next three to four decades (E2Si 1998).

3  
4 **6.1.3.e Water Levels**. Placement of dredged material at Site 104 would not affect extreme high  
5 water levels resulting from storm tides that are predominantly driven by wind forces and  
6 atmospheric pressure forces. Long-term sea level rise will cause higher average water levels.  
7 However, long-term sea level rise is a small percentage (less than one percent) of the existing  
8 normal water level variations as discussed in Section 5.1.3.c, and it is not anticipated to be  
9 affected by the proposed action.

10  
11 **6.1.3.f Astronomical Tides**. Astronomical tides in the Chesapeake Bay and the Site 104 area  
12 would also not be impacted by the proposed action. Astronomical tides result from gravitational  
13 forces of the moon and the sun on the earth and from the earth's rotation and are influenced, in  
14 part, by the three-dimensional shape of the estuary. Decreasing the water depth at Site 104  
15 would not affect the magnitude of tidal height at Site 104.

16  
17 **6.1.3.g Extreme Water Levels (Storm Surge and Wave Setup)**. Extreme water levels would not  
18 be impacted by the proposed action as they are dominated by storm effects (i.e., storm surge and  
19 wave setup) in combination with astronomical tide. Storm surge is a temporary rise in water  
20 level from wind stress generated either by large-scale extra-tropical storms known as  
21 north\_easters, or by hurricanes. The rise in water level results from wind action, the low pressure  
22 of the storm disturbance, and the Coriolis force. Wave setup is a term used to describe the rise in  
23 water level due to wave breaking. Specifically, change in momentum that attends the breaking  
24 of waves propagating toward shore results in a surf zone force that raises water levels at the  
25 shoreline. Decreasing the water depth at Site 104 has no effect on these forces, and the area of  
26 Site 104 where the estuary bottom will be raised is a small percentage of the entire upper Bay.  
27 The storm surge at the site itself will not be higher due to the decrease in water depth.

28  
29 Storm surge would indirectly affect the changed conditions at Site 104 as a factor in the  
30 development of extreme wave conditions: higher storm surge would allow for higher waves,  
31 longer wave periods and longer wavelengths. For a given water depth, the longer the  
32 wavelength, the greater the erosional effect of the wave energy on the bottom. Based on the  
33 LTFATE modeling conducted, a 25-year storm event would not effect the bottom below -13.7  
34 meters (-45.0 feet) which is the current design elevation to which dredged material is proposed to  
35 be placed at Site 104. Storms greater than 25-year events would increasingly affect the bottom.  
36 For storms greater than a 25-year event, significant erosion and turbidity will occur in shallow  
37 waters east and north of the site, before Site 104 is affected. The 100-year storm event modeled  
38 using LTFATE predicts about 0.3 meters (1.0 feet) erosion for a bottom at elevation -13.7  
39 meters (-45.0 feet) (Moffatt & Nichol 1998—ADD TO REF. LIST). Similar erosion rates for  
40 these storm events would be expected for the same type of sediments found at depths of -13.7  
41 meters (-45.0 feet) in the areas of the Bay in the vicinity of Site 104. Due to placement  
42 activities, the Site 104 area would be more susceptible to erosion from storm events occurring  
43 less frequently than the 25-year storm.

44  
45 **6.1.3.h Wind Conditions**. Wind conditions on the earth are ultimately caused by energy from  
46 the sun and rotation of the planet. Subsurface placement of dredged material at Site 104 would

1 have no effect on wind conditions. Wind would have an effect only on the surface of the water  
2 where waves would be generated. Section 6.1.3.k (Wave Conditions) discusses the potential  
3 impacts on wave conditions caused by wind, whereas Section 6.1.3.g (Extreme Water Levels)  
4 discussed the effects of extreme wind/wave conditions.

5  
6 **6.1.3.i Tidal Currents.** Placement of dredged material at Site 104 and subsequent decrease in  
7 water depth would theoretically cause a slight increase in tidal current velocity directly  
8 proportional to the decrease in water depth. Hydrodynamic model results indicated a slight  
9 increase for some depth-averaged velocity points as material was placed at the site; however, the  
10 magnitude of this change from year to year was negligible (see Figures 6-11 through 6-15).  
11 Changes measured in the model are practically imperceptible (from zero to a maximum of two  
12 percent increase in velocity from year to year) for the three observation points within the Site  
13 104 project area (i.e., different elevations in the water column; one near the southern end of the  
14 site, one near the center of the site, and one further to the north of the site) (Appendix F.3). Tidal  
15 currents are discussed further in Annex F.

16  
17 ~~Note that although the boundary forcings from the 1993 data remain the same for each simulated~~  
18 ~~year, the CH3D WES model was rerun after each year of proposed placement using the changed~~  
19 ~~bathymetry from the previous placement year (See Figures 6-1 to 6-10). The reruns resulted in~~  
20 ~~changes to bottom shear stresses that were input to the subsequent years of MDFATE modeling.~~  
21 ~~Therefore, any minor changes in currents that were predicted to occur due to the decreased~~  
22 ~~depths associated with dredged material placement, were taken into consideration during the~~  
23 ~~erosion modeling.~~

24  
25 ~~Residual currents in the upper Bay would not be appreciably impacted with placement of~~  
26 ~~material at the site. Existing residual current flow is toward the north. The tracer concentration~~  
27 ~~studies show that the long-term movement of water over the site bottom is to the north due to~~  
28 ~~gravitational circulation (WES 1998). Therefore, if material or nutrients remain in suspension~~  
29 ~~for long periods of time, it is likely that some of the material or nutrients carried through the~~  
30 ~~southern boundary of the site during an ebb flow could be carried back into the site during the~~  
31 ~~subsequent flood cycle, with the net drift being to the north.~~

32  
33 **6.1.3.j Sedimentation.** Sedimentation rates are controlled by the physical characteristics of the  
34 sediments and the hydrodynamics of the area. The hydrodynamic modeling revealed that  
35 variations in depth-averaged current velocities through the site area would change as little as zero  
36 to two percent and would not change significantly (WES 1998). Based on these results, it is  
37 anticipated that natural sedimentation rates within the Site 104 area will not be significantly  
38 impacted by the proposed action. Sedimentation is discussed further in Annex F.

39  
40 ~~Sedimentation and the potential for material movement at Site 104 due to placement of dredged~~  
41 ~~material is dependent on: 1) the physical sediment characteristics of the placed material; 2) the~~  
42 ~~physical characteristics of the water through which the material is being placed (i.e., temperature,~~  
43 ~~salinity, and density which are not anticipated to significantly change following the proposed~~  
44 ~~action); 3) the created and existing bottom geometry; and 4) the hydrodynamics on the~~  
45 ~~surrounding area. Based on grain size analyses, the majority of the dredged material proposed to~~  
46 ~~be placed at Site 104 ( $\pm 95\%$ ) is made up of fine-grained silts and clays that typically would take~~

1 a long period of time to settle as individual particles. Placement using bottom release seows or  
2 hoppers causes the material to settle *en masse*, allowing it to reach the bottom faster than if  
3 individual particles were released. This is particularly true of cohesive sediments such as those  
4 proposed for placement at Site 104. A portion of the mass, however, does become removed (or  
5 stripped) from the cloud of placed material as it descends and remains in the water column. The  
6 duration of time that this material remains in the water column depends on factors such as grain  
7 size and surrounding hydrodynamics. The STFATE model run for Site 104 indicated that < 1%  
8 of material placed using bottom release seows was stripped during descent and dispersed  
9 throughout the water column. This loss is not seen in bottom hydraulic placement since the  
10 material being placed is contained within the pipeline during descent and the discharge end of  
11 the pipeline is normally located within a few feet of the estuary bottom.

12  
13 ~~When a load of mechanically placed dredged material (either placed with a bottom release seow  
14 or a hopper dredge) reaches the site bottom and collapses, a portion of the material's clay  
15 fraction remains in suspension in the water column above the bottom surface. Modeling  
16 conducted for Site 104 using this placement technique indicated that loss of this suspended clay  
17 material would account for another 3.3% of the total of the mechanically placed material. It was  
18 assumed during the modeling that all of the hydraulically placed material settles to the bottom  
19 before erosive forces act on it. No portion of the hydraulically placed material will experience  
20 the collapse phase to which mechanically placed material is subjected because the material will  
21 be pumped to the bottom through a pipeline. A combination of both mechanical (bottom release  
22 seow) and controlled hydraulic pipeline bottom placement will likely be used for dredged  
23 material placement at Site 104.~~

### 24 25 **6.1.3.j.1 Sediment Erodability**

26  
27 To characterize the erodability of both in-place and dredged maintenance material currently  
28 proposed for placement at Site 104, sediment samples were obtained by Maryland Geological  
29 Survey (MGS) and provided to WES for laboratory erosion experiments described below. One  
30 sediment core was collected from each of the following channels with the exception of the  
31 Brewerton Channel Eastern Extension from which two samples were collected (one was  
32 collected at each end of the channel): Craighill Angle, Cutoff Angle, Tolchester, and Swan  
33 Point. The cores were collected in shoaling areas and are representative of the material proposed  
34 for placement at Site 104. Other channels proposed for maintenance dredging were not sampled  
35 because the channels had already been dredged for the season at the time of sampling. Previous  
36 sediment characterization studies in these channels (EA 1996) indicate that the physical  
37 characteristics of sediments in the non-sampled channels are similar to those of the cores  
38 collected for the erosion experiments. Generally, the sediments proposed for maintenance  
39 dredging are primarily comprised of silt/clay particles. Section 6.1.5.a provides a description of  
40 the core samples' physical characteristics. Annex F provides a detailed discussion of sediment  
41 erodability.

42  
43 ~~Results from the erosion tests were used to provide erosion parameters such as critical shear  
44 stresses for the modeling of material placement and potential erosion of the material placed both  
45 hydraulically and by bottom release seow. This modeling was subsequently performed using  
46 MDFATE. The experiments tested both original channel sediments and sediments mixed with~~

**Table 6-4**  
**Dredged Material Erosion from the Bottom Surface by Placement Year**

Year	Mechanical (bottom-release scow)	Hydraulic (controlled bottom pipeline placement)
1	16.0%	6.3%
2	9.5%	4.0%
3	18.9%	10.4%
4	9.5%	4.7%
5	15.6%	9.2%
Weighted 5-Year Average	12.6%	6.2%

Source: WES 1998

**Table 6-5**  
**Total Dredged Material Erosion as a Five Year Average**

Erosion	Mechanical (bottom-release scow)	Hydraulic (controlled bottom pipeline placement)
Water Column	4.3%	0.0%
Bottom	12.6%	6.2%
Total	16.9%	6.2%

Source: WES 1998

1 water from Site 104 (which had a constant and uniform density which is representative of the  
2 waters 12.0 meters (39.4 feet) below the surface, within 3.0 meters (9.8 feet) of the sediments at  
3 Site 104). The sediment samples were placed in the 11.75 cm (4.63 in) diameter test cylinder,  
4 covered with 12.7 cm (5.0 in) of additional water from Site 104, and allowed to settle over  
5 specified increments of time between one and eight days prior to testing. The original sediments  
6 were representative of the material as it exists in the channels. The sediments mixed with water  
7 and allowed to settle were representative of material dredged and placed. A mechanical  
8 oscillating disk moved water over the surface of the sediments in the test cylinder at various rates  
9 equivalent to shear stresses of 0.1, 0.2, 0.3, 0.4, and 0.5 Pascals (allowing 30 minutes at each  
10 step) to simulate movement of water over sediments in Site 104 at various velocities. The mass  
11 of sediments eroded from the test bed at each rate was measured to determine erosion rates and  
12 critical shear stresses to be used in the FATE modeling along with the shear stresses generated  
13 by the CH3D modeling for each year of placement. The effects of water pressure and  
14 gravitational forces were not simulated directly since these experiments simulated the impact on  
15 material erosion of a range of shear stresses acting on the bottom sediments. How those shear  
16 stresses are created in the real world is not considered by the model, (e.g., the total shear stress at  
17 Site 104 is influenced by tidal circulation). However, it is not each individual component of the  
18 shear stress that is important, but the total stress acting on the bottom which could potentially  
19 dislodge the sediments (Appendix F.2, WES 1998).

#### 20 21 **Potential Erosion of Placed Dredged Material**

22  
23 The MDFATE model was run as explained in the beginning of Section 6.1.3 under "Model  
24 Descriptions" and in the study report located in Appendix F.3 for both bottom-release scow and  
25 bottom hydraulic placement scenarios to predict the percentages of material potentially lost from  
26 the site during placement. Long-term erosion losses as a five-year, weighted average were  
27 predicted to be 12.6% for placement with a bottom-release scow and 6.2% for hydraulic pump-  
28 out of individual barges. The weighted averages were determined by multiplying the annual  
29 predicted percent losses by the placement quantity for that year and then adding the resulting  
30 quantities and dividing them by the total quantity to be placed over the five-year time period.  
31 Predicted percent losses for bottom-release scow and hydraulic pump-out of individual barges by  
32 placement year and the five-year averages are provided below in Tables 6-4 and 6-5,  
33 respectively. Percentages vary from year to year based primarily on the total quantities of  
34 material placed and the placement locations. The greater the exposed surface area of new  
35 material and closer the placement location is to the site boundaries, the more likely it is that  
36 placed material will erode and move outside of those boundaries.

37  
38 As discussed earlier in Section 6.1.3.j, the bottom-release scow methodology was predicted to  
39 lose an additional 4.3% into the water column between the time the material left the barge and  
40 settled on the site bottom. It was assumed that all of the hydraulically placed material settles to  
41 the bottom before erosional forces act on it, since no portion of this material experiences water  
42 column stripping or the collapse phase to which mechanically-placed material is subjected.  
43 Therefore, the total predicted worst-case losses were 16.9% for bottom-release scow and 6.2%  
44 for hydraulic placement (Table 6-5). However, these predicted losses are thought to be higher  
45 than will be experienced under actual conditions because the model could not predict the return  
46 of sediments back into the site effectively (WES 1998). As previously discussed, some sediment

1 may leave the site during ebb tide and be transported back to the site during flood tide. The  
2 model can only predict the portion of material that has the potential to leave the site, not the  
3 portion that would be expected to return.

4  
5 For each placement method scenario, a representative year-long run was made for each year of  
6 proposed placement. The major impacts on the model results are the erosion parameters  
7 discussed above, the size of the material footprint from each placement event, and the bottom  
8 shear stresses generated from the CH3D-WES model for each simulated year of placement.  
9 Since the erosion parameters and the bottom shear stresses were the same for both placement  
10 scenarios, the controlling factor for material losses due to erosion was the footprint. As  
11 ~~discussed in Section 6.1.3.d,~~ the footprint generated from the hydraulic placement modeling  
12 was smaller than the footprints generated from the bottom-release scow modeling. Reasons why  
13 a single barge pump-out results in a smaller footprint size and less erosion than a bottom-release  
14 scow include:

- 15
- 16 • Hydraulic pump-out will result in material reaching the bottom at a higher  
17 concentration and thus with a lower total volume than a barge release
- 18
- 19 • Hydraulic pump-out results in a spreading layer that is of more limited height, is  
20 thicker, and has a smooth flow over a short distance from the discharge point,  
21 whereas, bottom release is turbulent and continues to pick up water as it spreads over  
22 the bottom
- 23
- 24 • Hydraulically placed material spreads closer to the bottom surface and is, therefore,  
25 less affected by currents
- 26
- 27 • Hydraulic pump-out will result in a spreading layer which will get denser more  
28 rapidly than a barge release and, due to the limited volume being pumped, will not  
29 spread as far from the release point as a barge release does (WES 1998).
- 30

31 Therefore, as shown in Table 6-4, the bottom erosion for mechanical placement is predicted to be  
32 greater than hydraulic placement for each placement year. However, results would be different if  
33 hydraulic placement were conducted with a continuous flow instead of pump-out of individual  
34 barges. In this case, the hydraulic placement footprint would be larger and thus subject to greater  
35 erosion.

### 36 37 **6.1.3.j.2 Material Spreading**

38  
39 One aspect of dredged material placement that is not considered by STFATE, MDFATE, and  
40 hydraulic footprint modeling is the spread of material on a slope. SURGE modeling was  
41 performed to evaluate distances that placed material could travel along the bottom from the  
42 location at which the material reaches the site bottom. The modeling was performed using data  
43 from the STFATE modeling of bottom-release dredged material placement at the deepest part of  
44 the site (i.e., near the southern boundary since bottom slopes are greater there). Although not  
45 specifically modeled (since no model exists that can do so), hydraulically placed material should  
46 also be expected to spread further on slopes versus a flat bottom. Typical slopes anticipated to

1 be encountered at Site 104 were between 0.0% and 1.5%. Typical slopes were measured from  
2 existing bathymetry and modeling calculations determined the post-shearing angles that result  
3 from "slumping" of placed material, as described in the study report in Appendix F.3. Predicted  
4 dredged material spreading over the slopes ranged from approximately 220 meters (720 feet) to  
5 920 meters (3,020 feet). The model assumes that the slopes are continuous, whereas in reality,  
6 opposing slopes could be encountered, therefore reducing the amount of material spreading. A  
7 SURGE model run was made on a 1.5% slope with a created 6 meters (20 feet) high opposing  
8 slope of approximately 7H:1V placed approximately 305 meters (1,000 feet) away. The results  
9 of the model run indicated that the surge produced from placement on the 1.5% slope would not  
10 have enough energy to overtop the opposing slope. The results of the SURGE model should be  
11 viewed with caution, since actual surge data for placement operations at Site 104 do not exist to  
12 verify the model. Also, some input parameters for the Site 104 modeling had to be obtained  
13 from what were thought to be similar projects for which these data were available (WES 1998).

### 14 15 **6.1.3.j.3 Potential Sediment Transport**

16  
17 It should be noted that a portion of the predicted losses is comprised of material that leaves the  
18 boundaries of the MDFATE model to the south during an ebb tide or to the north during a flood  
19 tide and could potentially re-enter the site boundaries during a flood tide or ebb tide,  
20 respectively. The model does not track sediments once they leave the model boundaries. The  
21 site boundaries are rectangular and were established to include the bottom two-thirds of the Site  
22 104 project area, and extend approximately ~~915~~ an additional 915 meters (3,000 feet) to the  
23 south and 610 meters (2,000 feet) on both the east and west sides of the southern portion of the  
24 site. In reality, material in suspension is influenced by the tidal cycles and, therefore, material  
25 that moves from the site due to tidal fluctuations could be brought back into the site boundaries  
26 on the next opposing tide (i.e., what leaves with the ebb tide could return with the flood tide). In  
27 addition, material that left the northern model boundary could still be in the northern third of Site  
28 104. These "losses", therefore, would not truly be lost from the site. This dynamic process will  
29 continue over a period of time. Sediment will consolidate and movement will eventually  
30 approach or equal the normal sediment redistribution patterns in the upper Bay.

31  
32 The tracer studies conducted using the CEQUAL-ICM model to evaluate net long-term  
33 movement of suspended material within the Site 104 area indicated that the net residual current  
34 is directed northward. Material that remains in suspension would thus have a tendency to be  
35 transported northwards. Material placement at Site 104 is proposed for the southern deeper  
36 portions of the site where depths are currently greater than -13.7 meters (-45 feet) MLLW.  
37 This equates to approximately the lower two-thirds of the site. Material would not be placed in  
38 the northern portion of the site in depths shallower than -13.7 meters (-45 feet) MLLW  
39 (approximately the northern one-third of the site). No model of the Chesapeake Bay exists that  
40 can quantifiably track potential sediment movement throughout the Bay. Therefore, the final  
41 destination of the material that was predicted to leave the site remains unknown. Based on  
42 typical settling rates, however, it is believed that any material placed at Site 104 that is  
43 suspended in the bottom currents will settle out over a short distance and depending on the  
44 location of the placement will most-likely stay within the site boundaries unless further erosion  
45 takes place.  
46

1 **6.1.3.k Wave Conditions.** Average and extreme wave conditions for Site 104 are dependent on  
2 wind conditions within the Chesapeake Bay region. As stated in Section 6.1.3.g above, wind  
3 conditions would not be affected by the proposed action and, subsequently, placement of  
4 dredged material at Site 104 would not affect wave conditions at the site. Average depths at the  
5 site will not change to the extent that normal wave conditions would have an effect on the  
6 increased bottom elevations. Effects from extreme wave conditions due to storms were  
7 discussed earlier in Section 6.1.3.e. The proposed action is not expected to change the  
8 characteristics of surficial waves at the site. For storm events greater than or equal to a 25-year  
9 storm event, however, sub-surface waves will impact the bottom.

#### 10 **6.1.3.l Effects of a Berm on Flow Field and Dredged Material Placement**

11  
12  
13 If a berm is built at the southern boundary of Site 104, there could be two impacts relative to the  
14 proposed placement of dredged material at the site. The first impact (probably the most  
15 significant) is related to the possibility of the berm stopping bottom density surges containing  
16 suspended sediment. These surges result from the encounter of the placement material striking  
17 the bottom. The second is the impact on erosion of deposited placement material.

18  
19 When the placement material descends through the water column as a cloud or jet it entrains  
20 ambient water and grows. At the moment of bottom encounter, the jet or cloud of material  
21 possesses a certain amount of energy which is the sum of its potential and kinetic energy. An  
22 outward flow of the suspended sediment and water mixture then occurs along the sea floor. This  
23 is referred to as the bottom surge. This outward movement of suspended sediment and water  
24 mixture continues until the energy possessed by the surge is dissipated. Dissipation of its kinetic  
25 energy occurs due to frictional effects. Potential energy is converted to kinetic energy and is also  
26 lost due to the fact that as the surge loses energy and slows down suspended material is  
27 deposited on the bottom, resulting in a decrease of the surge's density.

28  
29 Whether placement occurs on a flat bottom, a down slope or an up slope all of the processes  
30 described above occur. However, if a down slope is encountered, the surge also gains energy  
31 due to the gravitational force accelerating the surge down the slope. Likewise, when the surge  
32 attempts to move up a slope, the kinetic energy of the surge decreases due to the resisting  
33 gravitational force.

34  
35 The behavior described above has been incorporated into the model called SURGE. A  
36 simulation of the placement by bottom scow release in a water depth of 21.3 meters (70 ft) at  
37 Site 104 that occurs 304.8 meters (1,000 ft) in front of a 6.0 meters (20 ft) high berm with an  
38 angle of repose of 8 degrees has been made with SURGE. The model predicted that the energy  
39 of the bottom surge would be dissipated before the surge over topped the berm. Of course, these  
40 results should be viewed with caution since results are dependent on parameters such as the rate  
41 of dissipation and the rate of conversion of potential energy to kinetic energy. However,  
42 depending on the characteristics of the placement material, the placement process, and the  
43 placement bathymetry, berms can obviously be used to control the spreading of placement  
44 material contained in bottom surges.

1 The second impact of constructing a berm at the southern boundary of Site 104 relates to changes  
2 in erosion of deposited material that might occur due to changes in the flow field caused by the  
3 berm. These impacts will be very localized and relatively insignificant. The impact on the flow  
4 field will be determined by the magnitude of the ambient flow and the height of the berm. In any  
5 case, the impact away from the berm should not extend more than ~~2-3~~two to three times the  
6 height of the berm. Thus, changes in erosion rates will only be seen within perhaps 50-100 ft of  
7 the location of the berm.

8  
9

1 6.1.4 6.1.4 Water Quality

2  
3 Projected water quality effects are described here by type of impact and by time scale of impact.  
4 The types of water quality impacts which that have been investigated include turbidity, salinity,  
5 contaminant and nutrient releases which could be associated with dredged material placement at  
6 Site 104. The time scale for potential impacts is divided into the following: those which are  
7 expected in short-term time scales, essentially during and just after placement events; those  
8 water quality impacts which could be expected within a year of placement; and longer term  
9 impacts which could endure longer than one year after placement.

10  
11 6.1.4.a Impacts During Placement.

12  
13 ~~Summary. Both placement methods are expected to cause short term nutrient water quality~~  
14 ~~impacts during placement activities. However, the~~ A primary water quality impact expected  
15 during placement is turbidity. The extent and behavior of turbidity plumes for both controlled  
16 pipeline placement and bottom-release scow have been studied by the MGS, MDE, and WES.  
17 For water quality impact prediction at Site 104 ~~In this study, two types of placement actions are~~  
18 ~~considered. Water column turbidity was modeled for placement by a bottom-release scow,~~  
19 ~~while but it was assumed that water column turbidity would be non-existent (other than near~~  
20 ~~the bottom) for the pump-out method of placement. Some increase in~~ The release of the  
21 ~~nutrient nitrogen, in the form of ammonia was exhibited during modeled~~  
22 ~~placement predicted found during placement using studies of channel sediment nutrients~~  
23 ~~conditions, as well as projections of and likely releases during lab studies and modeling~~  
24 ~~activities which simulated dredging and placement. Water quality M modeling and studies of~~  
25 sediment/water nutrient interactions have not predicted significant negative ~~impacts effects~~ at Site  
26 104 or either upstream or downstream of Site 104 due to changes in nutrient concentrations in  
27 the waters of Site 104 resulting from placement by either method (Ccrco-WES, 1999). To  
28 minimize impacts, placement of dredged material at Site 104 is scheduled for the fall and winter  
29 quarters. During these periods, water temperature, salinity, and dissolved oxygen conditions are  
30 not conducive to negative water quality impacts from phytoplankton blooms ~~in the event~~  
31 ~~resulting from enhanced nutrient concentrations are enhanced during placement. In addition,~~  
32 biological resources are less prevalent and less active at the site during these periods. ~~No~~  
33 ~~significant turbidity associated impacts are expected at the time of placement.~~

34  
35 Short-term near-field water quality impacts from turbidity are expected at the time of placement.  
36 These impacts are expected to be of relatively short duration, lasting less than an hour after  
37 material is released to the site. In the event of near-bottom hydraulic placement, turbidity is  
38 expected to impact near-bottom waters only. In the event of bottom release scow placement,  
39 turbidity plumes are expected to last less than 20-40 minutes after each release.

40  
41  
42 Short-term near-field increases in nitrogen concentrations in the water column and near-bottom  
43 waters are expected at the time of placement. These increases were not found to have negative  
44 water quality outcomes, using the water quality module of the CH3D Chesapeake Bay  
45 Hydrodynamic model.

1 Salinity changes due to placement of dredged material at Site 104 are not expected.

2  
3 Contaminant concentrations in the water column were modeled using the sediment quality of  
4 material from the channels, and modeling the concentrations of contaminants in the water  
5 column after release. Toxic effects levels are not expected to be exceeded based on the model  
6 results. [Leave room for a more full description of Tier II and III]

## 7 8 **Turbidity Impacts During Placement**

### 9 10 Hydraulic Placement

11 The assumption in the hydrodynamic modeling conducted by WES was that no water column  
12 turbidity would result from hydraulic placement, if non-continuous pumping is performed, with  
13 pipeline placement directed to near the bottom (WES 1998). Some near-bottom turbidity  
14 releases are expected, but were not modeled.

### 15 16 Bottom-Release Scow Placement

17 For bottom-release scow placement, approximately <1% of the material was predicted to be lost  
18 to the water column before the material reached the bottom. An additional maximum 3.3% is  
19 predicted to re-enter ~~be lost to~~ the water column when the material actually strikes the bottom.  
20 Some of this material is expected to settle back to the bottom over a relatively short time frame  
21 of minutes to hours, but the existing model capabilities do not allow a calculation. -

### 22 23 Discussion

24 Studies performed on other open-water placement actions in the Chesapeake Bay have ~~all~~ been  
25 conducted under ~~different~~ varying conditions. In the upper Bay, in relatively shallow water (<25 ft),  
26 monitoring of continuous hydraulic placement has shown the placed sediments typically descend  
27 to the bottom as a slurry (Panageotou and Halka 1990). The MGS study of Pooles Island Area D  
28 found a small portion of material dispersed as a turbidity plume extended no farther than 0.5  
29 kilometers (1,641 feet) down current during periods of strong current velocities (Panageotou and  
30 Halka 1990).

31  
32 Acoustic monitoring studies performed by Versar (1994) of hydraulic placement in 1991 and  
33 1992, again in shallower waters in the upper Bay, found that turbidity plumes, from continuous  
34 hydraulic placement with the pipeline located approximately 2 meters below the surface of the  
35 water, were larger than from bottom-release scow placement. (Bottom-release scows operate by  
36 moving over a placement area, with the assistance of a tug. The bottom doors of the scow then  
37 open, allowing the dredged material to fall out of the scow and through the water column to the  
38 bottom). Specifically, hydraulic plumes extended ~~to~~ for greater than 3 kilometers (9,843 feet)  
39 and controlled bottom- release plumes extended less than 0.7 kilometers (2,297 feet). The  
40 turbidity plume from bottom-release scow placement was nearly 2.5 times shorter in length than  
41 the continuous hydraulic placement turbidity plume, though they were similar in width. Though  
42 no measurements were made of the hydraulic placement area, the total suspended solids  
43 concentrations in the bottom-release scow area returned to ambient levels within 20 to 40  
44 minutes.

1 In addition, in the bottom-release scow area, the total suspended solids concentrations of the  
2 plumes represented approximately 1 to 5% of the total sediment deposited. The Versar (1994)  
3 studies confirmed that hydraulic placement had a near-field, short-term impact to water quality  
4 from increased suspended sediment concentrations. Hydraulic pump-out of single barges at a  
5 time is expected to significantly reduce the water column turbidity compared to continuous  
6 hydraulic dredging and placement -just below the water surface. During placement activities  
7 proposed for Site 104, the pipeline will be approximately 2 meters (6.0 feet) from the bottom.  
8 Barge pump-out will entrain less water in the dredged material, and placement targeted close to  
9 the bottom will reduce the area of the water column which experiences increased turbidity. It is  
10 expected that any turbidity impacts resulting from placement at Site 104 would be transitory,  
11 localized, and not environmentally significant.

### 12 13 **Nutrient Impacts During Placement**

14  
15 The potential for nutrient-related water quality effects during placement were investigated in  
16 several ways. Nutrient-related water quality effects could occur from enhanced concentrations  
17 of nutrients in the water column. The source of these nutrients would be the nutrients existing as  
18 part of organic or inorganic matter in the dredged sediments. Adding nutrients to the water  
19 column could theoretically increase the fuel for phytoplankton blooms, which could result in  
20 increased organic matter production, leading to increased organic matter decomposition when the  
21 algae die. This leads to decreased dissolved oxygen as the organic matter decomposes. Low  
22 dissolved oxygen concentrations in the water column cause fish mortality, and low dissolved  
23 oxygen in bottom waters kills the benthic animals living in the sediments. Low dissolved  
24 oxygen in the sediments results in even greater nutrient releases when it results in the process of  
25 anaerobic decomposition; (from a change in the type of microbes which live in the sediments  
26 when there is no oxygen), and this in turn releases large amounts of dissolved inorganic  
27 phosphorus and nitrogen from the sediments.

28  
29 These potential effects were investigated using laboratory studies of channel sediments, using the  
30 recommended tiered testing protocol in the Inland Testing Manual, and using three-dimensional  
31 hydrodynamic and water quality modeling.

32  
33 Laboratory testing of the channel sediments and Site 104 sediments was performed to  
34 characterize the sediments and to enable predictions of changes if channel sediments were  
35 moved to Site 104. The laboratory testing was also used to provide data to perform the three-  
36 dimensional and Tiered testing modeling.

37  
38 The water quality model of Chesapeake Bay (CEQUAL-ICM) was run to assist in the prediction  
39 of potential impacts to water quality from the placement of dredged material at Site 104 (Cerro  
40 1999; WES 1998, WES, 1999). Insignificant impacts to water quality are expected from  
41 interaction of the Kent Island Waste Water Treatment Plant (WWTP) discharges and any  
42 nutrients released during or after placement of dredged material. Water quality sampling within  
43 Site 104 did not find any increased nutrient discharges at the sampling point closest to the Kent  
44 Island WWTP discharge point. The large volume of water in the Bay, combined with the minor  
45 change in water quality modeled from placement, are not expected to cause detectable changes in

1 ~~water quality or contribute to negative water quality impacts such as enhanced algal blooms or~~  
2 ~~increased anoxia.~~

3  
4 ~~Three~~Originally, ~~Two~~ potential cases were modeled, in an attempt to cover a range of  
5 environmental conditions which could result from placement of dredged material at Site 104  
6 according to the proposed plan. ~~One~~ case was ~~when the~~for surface channel sediment to be ~~was~~  
7 completely mixed with water, with all dissolved and bound nutrients released completely to the  
8 water column at the time of placement. ~~For, and on~~the second case, ~~with~~ modeling was  
9 performed allowing ~~no~~ mixing of surface sediments with water, and all nutrients remaining in  
10 deposited in the sediments deposited on the bottom at Site 104. This could make the nutrients  
11 subject to release during the first season of anoxia after placement. Water quality impacts were  
12 ~~first then~~ reviewed under these two "worst case" sets of scenarios. A third scenario was modeled  
13 after the completion of Dr. Jeff Cornwell's findings of pore water ammonium releases and  
14 higher ammonium concentrations at depth from dredged material channel sediments placement.  
15 This third scenario used Dr. Cornwell's values of 0.13 lb of N (nitrogen) per cubic yard of  
16 dredged material placed, with no additional P (phosphorus) release at the time of placement. No  
17 additional P (phosphorus) release was assumed for this scenario due to Dr. Cornwell's finding  
18 that the oxidized condition of the sediment and water, combined with the exposure of multiple  
19 binding sites for phosphate during movement of the dredged material would essentially lock up  
20 all available P (phosphorus) during the dredging and placement process.

21  
22 In the first, complete mixing and release scenario, increased ~~releases~~concentrations of  
23 phosphorus were noted at the bottom during placement seasons, but not at other times. The  
24 increased phosphorus had no detectable impact to chlorophyll levels or dissolved oxygen (DO)  
25 concentrations during the fall and winter seasons of placement, ~~or thereafter,~~ but a slight  
26 stimulatory effect on the spring algal blooms was observed. There ~~is~~was no apparent effect on  
27 summer chlorophyll levels. It is thought the effect ~~does~~would not last until the summer because  
28 the phosphorus released iswould be dispersed before the summer algal blooms begin. The  
29 releases from elutriation of ammonium, nitrate or Chemical Oxygen Demand (COD) are minor  
30 and no influence on water column nitrogen or oxygen were predicted by the model.

31  
32 Nutrient releases from mixing of higher concentrations of nutrients from dredged sediment pore  
33 water have been studied during previous open water placement events in the Chesapeake Bay.  
34 Water quality studies performed during and after the open water placement of dredged materials  
35 in the upper Chesapeake Bay have included multi-year 12-month data collection efforts, with  
36 analysis of water samples at the surface, mid-depth and bottom for nutrients, chlorophyll,  
37 turbidity and total suspended solids. These studies have not detected increased nutrient  
38 concentrations or increased phytoplankton productivity in the water column during placement  
39 (MES 1997, 1997b). This is thought to be due to a combination of factors. The actual volume  
40 of water associated with the transport of dredged material only results in a very small increase in  
41 nutrient concentrations in the total water column. The receiving water volume is huge  
42 (thousands of gallons of water associated with the dredged material vs. billions of gallons in the  
43 Bay in the mainstem). In addition, losses at the point of dredging could result in smaller pore  
44 water contributions at the placement site.

1 Under ~~the~~ the second no elutriation scenario (no mixing, all nutrients deposited ~~in~~with the  
2 sediment), water quality impacts from increased nutrient concentrations would not be observed  
3 during placement, according to the scenario used WES model. A slight stimulatory effect on the  
4 spring algal blooms was observed. There was no apparent effect on summer chlorophyll levels.  
5 It is thought that the enhanced phytoplankton growth effect is not found to last until the summer  
6 because the released phosphorus would be dispersed before the summer algal blooms begin. The  
7 modeled releases from elutriation of ammonium, nitrate, or Chemical Oxygen Demand (COD)  
8 are minor and no influence on water column nitrogen or oxygen were predicted by the model.

9  
10 Under the third scenario, with 0.13 lb of nitrogen per cubic yard of dredged material released as  
11 ammonium at the time of placement, no water quality impacts were observed at the time of  
12 placement. This is probably due to the cold water temperatures and lack of sunlight during the  
13 recommended placement window of 15 October to 15 April.

14  
15 Nutrient releases from mixing of higher concentrations of nutrients from dredged sediment pore  
16 water have been studied during previous open--water placement events in the Chesapeake Bay.  
17 Water quality studies performed during and after the open--water placement of dredged materials  
18 in the upper Chesapeake Bay have included multi-year 12--month data collection efforts, with  
19 analysis of water samples at the surface, mid-depth, and bottom for nutrients, chlorophyll,  
20 turbidity, and total suspended solids. These studies have not detected increased nutrient  
21 concentrations or increased phytoplankton productivity in the water column during placement  
22 (MES 1997c, 1997b). This is thought to be due to a combination of factors. The actual volume  
23 of water associated with the transport of dredged material only results in a very small increase in  
24 nutrient concentrations in the total water column. The receiving water volume is huge  
25 (thousands of gallons of water associated with the dredged material vs. billions of gallons in the  
26 Bay in the mainstem). In addition, losses at the point of dredging could result in smaller pore  
27 water contributions at the placement site. The timing of placement during winter months also  
28 contributes to less likelihood of increased phytoplankton production.

29  
30  
31 Nutrient concentrations were also modeled for the Tiered Testing protocol in the Inland Testing  
32 Manual (EPA/USACE 1998). Concentrations of nutrients in the water column were found to be  
33 [put in M&N information]

34  
35  
36 In order to minimize water quality impacts from possible releases in nutrient concentrations at  
37 the time of placement, Site 104 is scheduled for placement 15 October to 15 April, when water  
38 temperature, salinity, and dissolved oxygen conditions are not conducive to negative water  
39 quality impacts from phytoplankton blooms. According to Dr. Cornwell's studies, This should  
40 limit the immediate release of phosphorus, in particular, which would strip from the sediment  
41 particles as if they entered anoxic waters.

42 ~~Nutrient releases from newly placed sediments are predicted when anoxic conditions occur in the~~  
43 ~~no mixing scenario. These releases are predicted to be higher than that of the background~~  
44 ~~sediments, but should be limited to the top 10 cm of the placed sediment, and would only occur~~  
45 ~~for the first season of anoxia after each year's placement. Section 6.1.4.b describes potential~~  
46 ~~long term impacts likely to result from purposed dredged material placement.~~

1  
2 ~~There were differences in the background water quality and sediment nutrient flux data collected~~  
3 ~~during field studies and the background values used by the model. This is thought to be due to~~  
4 ~~the differences in the years when data was collected for the model (1985-1987) and the depth-~~  
5 ~~averaging of the cell in which Site 104 is found in the model. The model results were verified~~  
6 ~~and found to be correct for the conditions under which the model ran the water quality impact~~  
7 ~~module. Due to the differences, however, additional sampling will be performed as part of the~~  
8 ~~Site 104 monitoring to ascertain and verify the projected impacts.~~  
9

10 It must be noted that the ~~complete mixing and no mixing~~ scenarios modeled for Site 104 ~~are~~ were  
11 ~~both~~ worst-case scenarios, ~~which were used to bound and define the extent of negative impacts to~~  
12 ~~water quality from nutrient releases from the sediments. No negative water quality effects were~~  
13 ~~predicted by the model during or just after placement using these scenarios. These scenarios are~~  
14 ~~considered worst case because neither case is expected to exclusively occur~~ The third scenario is  
15 the expected scenario for conditions of nutrient release, albeit it is conservative in that it  
16 ~~probably over-estimates nitrogen release, and no short-term water quality impacts were~~  
17 ~~detected under this scenario, but rather some combination of the two is expected. In either case,~~  
18 ~~impacts were found to be limited in duration and aerial extent. Mitigation efforts, such as~~  
19 ~~limiting the timing of placement to avoid anoxia, should further limit negative impacts.~~  
20

21 Insignificant impacts to water quality are expected from interaction of the Kent Island Waste  
22 Water Treatment Plant (WWTP) discharges and any nutrients released during or after placement  
23 of dredged material. Water quality sampling within Site 104 did not find any increased nutrient  
24 discharges at the sampling point closest to the Kent Island WWTP discharge point. The large  
25 volume of water in the Bay, combined with the minor change in water quality modeled from  
26 placement, are not expected to cause detectable changes in water quality or contribute to  
27 negative water quality impacts such as enhanced algal blooms or increased anoxia.  
28  
29

### 30 **Contaminant Impacts at the Time of Placement**

31  
32 No contaminant-related water quality ~~impacts~~ effects are expected at the time of placement, ~~are~~  
33 expected. Sediment analysis ~~of~~ found sediment quality in the channel sediments was performed  
34 according to the new tiered testing protocol in the Inland Testing Manual. ~~to be generally good,~~  
35 and similar to sediments in Site 104. Sediment quality in the channels was generally similar to  
36 that expected in most of the Chesapeake Bay. No water quality effects at the time of placement  
37 are expected from placement of these sediments at Site 104. [Needs a greater discussion of  
38 Tiered protocol]  
39

40 One area of Site 104 was found to have ~~Some~~ contaminants ~~were found to be~~ present in higher  
41 levels than in most of the other sediments ~~the sediments~~ existing at the placement site. There is a  
42 potential that these sediments could be disturbed during placement, creating short-term increases  
43 in concentrations of these contaminants in near-bottom waters. These contaminated sediments  
44 are expected to ~~will be~~ covered by the placed sediments and are not predicted to result in  
45 significant water quality impacts. Placement is planned to be designed to minimize disturbance

1 of these sediments and to cover them with channel sediments, which are cleaner. Placement  
2 techniques to achieve this will be developed.

3  
4 A Tiered ~~I-Testing~~ evaluation (using guidelines provided in EPA/USACE 1998) of sediment  
5 elutriate data from the channels proposed for dredging indicated that trace metal -and organic  
6 compounds in the elutriates were all less than the Maryland acute water quality criteria (see  
7 Section 5.1.5). Therefore, it is not anticipated that trace metals or organic compounds suspended  
8 in the water column from placement of sediment will adversely impact aquatic organisms. This  
9 statement is valid for all metals and organic compounds for which state water quality criteria  
10 exist. [must be modified with M&N data and Peddicord evaluation]

11  
12 Both placement scenarios, bottom-release scow and hydraulic pump-out with controlled pipeline  
13 placement, have been designed to minimize turbidity and sediment movement. Placement  
14 methods will be controlled to reduce the potential for disturbances of sediment from Site 104  
15 into the water column during placement. Additional care may need to be taken under the  
16 hydraulic pump-out scenarios to avoid scouring the bottom during placement, with the potential  
17 re-suspension of sediments from the bottom. -Overall, the existing contaminated sediments will  
18 be covered (capped) with clean material and ~~no~~ re-suspension of contaminated material is not  
19 expected to cause significant impacts.[Must be updated with EA, M&N and Peddicord data]

#### 20 21 **Salinity Impacts at the Time of Placement**

22  
23 There are no salinity impacts predicted at the time of placement. The location (or origin) of the  
24 source material is in the upper Bay in the same region and salinity regime as Site 104.  
25 Therefore, there will be no significant difference between the salt content in the dredged material  
26 and the water column.

#### 27 28 **6.1.4.b Impacts Within 1 Year After Placement.**

29  
30 ~~Summary.~~ Impacts occurring up to ~~one~~ 1 year after placement were modeled using the WES  
31 CH3D Chesapeake Bay Model, with the Water Quality Module (CEQUAL-ICM). Impacts were  
32 found to be limited in nature. Under a worst-case scenario of complete mixing and release of all  
33 nitrogen and phosphorus nutrients, a slight stimulatory effect on the spring algal concentrations  
34 was observed, but this effect did not continue into the summer. In the expected scenario of  
35 nitrogen release at the time of placement, and summer nitrogen and phosphorus release  
36 continuing at pre-placement levels, no water quality effects were detected using the modeled. In  
37 addition, no impacts within one 1 year from ~~resulting from~~ elevated turbidity are expected, as  
38 turbidity impacts are expected to be very short term in nature.

1 **Turbidity Impacts Within 1 Year of Placement**

2  
3 Modeling of the short- and long-term fate of dredged material placed at Site 104 by either  
4 bottom-release scow or pipeline placement found that no long-term environmentally significant  
5 turbidity impacts are predicted after placement. Modeling was conducted with a combination of  
6 the WES CH3D model, which is a three-dimensional model of the Chesapeake Bay, along with  
7 MDFATE, STFATE and SURGE, which are WES models ~~which~~ that track the short- and long-  
8 term fate of material deposited. These models were run, as appropriate, to mimic conditions  
9 occurring after bottom-release scow placement and after directed pipeline hydraulic placement to  
10 the bottom at Site 104. [Needs a review after SAIC report is done]

11  
12 Monitoring of open water placement at Pooles Island areas G-South and G-North (see Figure 1-  
13 2) revealed the greatest local (affecting the water column in and near the placement site) short-  
14 term impacts from the bottom-release scow placement to be increases in phosphorus and  
15 turbidity concentrations in the immediate vicinity (Austin *et al.* 1991; MES 1997). MGS also  
16 studied placement in G-South (Halka *et al.* 1994) and found that post-placement, the elevated  
17 (bottom) suspended sediment concentrations were localized in time (<7 months) and space, and  
18 there was no evidence of elevated background concentrations.

19  
20 Water column turbidity levels would be elevated during placement, for approximately 20-30  
21 minutes during and after each placement event. This effect would be more distributed in the  
22 water column for controlled bottom-release scow placement than for a pump-out barge, which  
23 would confine the material within a pipeline directed to the bottom, and place the material just  
24 above the bottom. These intermittent increases in turbidity would last each year for the duration  
25 of the placement activities. The total duration would depend upon how long each placement  
26 action took. The recommended placement duration each year is ~~six~~ 6 months. Therefore,  
27 intermittent periods of localized turbidity could occur during a ~~six~~ 6-month placement period,  
28 but localized turbidity would not be continuously elevated at the site for a ~~six~~ 6-month duration.

29  
30 Monitoring of dredged material placement in the Pooles Island Open Water Placement Area G-  
31 West by MGS has shown significant turbidity associated with placement activities. The turbidity  
32 values, however, returns to ambient levels within 40 to 45 minutes after a placement event, and  
33 turbidity concentrations outside the plume never exceed levels that naturally occur in the Bay  
34 (Halka *et al.* 1995).

35  
36 Based on these studies, dredged material placement at Site 104 is expected to result in elevated  
37 total suspended solids concentrations and turbidity plumes during placement events, but the  
38 turbidity plumes are expected to dissipate in a short time-frame, and settle out within a short  
39 distance of the placement locations. ~~and~~ †The elevated total suspended solids concentrations  
40 would be localized, intermittent, and short-term in nature.

1 **Nutrient Impacts Within 1 Year of Placement**

2  
3 Water quality impacts from placement of dredged material at Site 104 were modeled over a  
4 ~~five~~- year placement period. Using the complete mixing scenario, all water quality impacts  
5 would be short-term, lasting only for the duration of each placement action. These impacts were  
6 discussed in the previous section.

7  
8 For the no mixing scenario, ~~increased~~ sediment releases of all bound and unbound nitrogen and  
9 phosphorus compounds contained in the dredged material over background rates were  
10 modeled predicted for during the first season of anoxia after each placement event. This impact  
11 was predicted using values for ambient and channel sediment nutrient concentrations which  
12 existed in the model. Under the no elutriation scenario (no mixing, all nutrients deposited in the  
13 sediment), a slight stimulatory effect on the spring algal blooms was observed. There was no  
14 apparent effect on summer chlorophyll levels. It is thought that the enhanced phytoplankton  
15 growth effect is not found to last until the summer because the released phosphorus would be  
16 dispersed before the summer algal blooms begin.

17  
18 Studies performed in the field at Site 104 found different sediment nutrient release rates  
19 than compared to those used in the model as background conditions. This is thought to be due to  
20 the size of the cells used in the water quality model, and an inability to distinguish between  
21 relatively small-scale changes in bottom conditions, as well as inter-annual variations which are  
22 observed in the Chesapeake Bay. Additional sediment-nutrient flux studies are recommended  
23 during and after- placement to verify and further calibrate the model.

24  
25 For the expected nitrogen release at the time of placement scenario, using Dr. Cornwell's  
26 findings of immediate large-scale ammonium releases and no phosphorus releases at the time of  
27 placement, -no long-term water quality impacts were observed in the model. Water quality  
28 impacts were not observed at Site 104 or in any other parts of the Chesapeake Bay during any  
29 time scale. This model assumed that sediment nutrient flux rates were unchanged over  
30 background rates in Site 104 after placement of dredged sediments. It has been speculated that  
31 the terrestrial nature of the channel sediments, and higher bound phosphorus concentrations,  
32 could result in larger sediment nutrient fluxes after organic matter deposition in the spring and  
33 the onset of hypoxia and anoxia in Site 104. This is a potential outcome, but is not predicted.  
34 This is not predicted based on further studies performed by Dr. Cornwell under anoxic  
35 conditions, where organic matter was added to simulate conditions after placement in Site 104.  
36 Organic matter additions had no impact on the flux rates. [Verify after Dr. Cornwell completes  
37 studies].

38  
39 Discussion

40 Sediment-nutrient flux studies conducted by Dr. Walter Boynton of Chesapeake Biological  
41 Laboratory (Boynton *et al.* 1998) found that elevated nitrogen and phosphorus nutrient releases  
42 occur from the top 10 cm of the sediments during May to September in the Site 104 area of the  
43 Bay. This time period is dependent upon water temperature in the spring and available organic  
44 matter carbon in the fall. For this reason, the time period proposed for placement at Site 104  
45 does not include the May to September time period when anoxic conditions and enhanced  
46 sediment-nutrient fluxes occur. Phosphorus within the sediment would can be released into the

1 water column during periods of anoxia. Nutrient releases outside the May to September time  
2 period are expected to be small due to the relatively low water temperatures and available  
3 dissolved oxygen.

4  
5 The no mixing scenario found nutrient impacts in the spring were restricted to bottom waters  
6 immediately over the sediments. The only noticeable change was an increase in dissolved  
7 inorganic phosphorus in the near bottom waters. At the time of year and at the water depths  
8 where this will occur, this enhanced phosphorus should not contribute to phytoplankton blooms  
9 because it is outside of the normal mid-April to mid-October bloom period, and is below the  
10 photic zone. The photic zone is the depth to which light sufficiently penetrates the water column  
11 where photosynthetic activity can take place.

12  
13 Anoxic conditions; that occur during the summer months; stimulate phosphorus releases from the  
14 sediments. After placement of dredged material, these bottom releases are not expected to  
15 increase beyond the normal summer anoxic periods that currently exist at the site. Sediment-  
16 nutrient flux studies conducted on sediments within the channels proposed for dredging indicated  
17 that the release of phosphorus from the channel sediments is actually lower than the release from  
18 existing sediments at Site 104. This may be due, in part, to the origin of the actual sediment  
19 particles. Sediments from land-based erosion are the primary source of sediments deposited in  
20 the channels. Sediments deposited in mainstem areas of the Bay (such as in Site 104) are  
21 typically organic-rich depositional materials.

22  
23 Nutrients have not been identified as causing direct effects to fish or crabs in "Habitat  
24 Requirements of Chesapeake Bay Living Resources" (Funderburk *et al.* 1991). Ammonia is a  
25 known toxin, but was not shown to have detectable enhanced concentrations in the no elutriation  
26 or complete elutriation results. Elutriation is the process of mixing, settling, and decanting. In  
27 this case, sediment and water are mixed and settled, and the decanted water is tested for  
28 dissolved nutrients.

29  
30 The model also found vertical stratification which tended to trap the additional phosphorus in  
31 bottom waters below the photic zone so little or no stimulation of algae in surface waters was  
32 expected in the summer (WES 1998). Some speculation has occurred that there will be some  
33 northward movement of the bottom waters from Site 104, with eventual mixing with surface  
34 waters at some point(s) remote from Site 104. The water quality model did find some northward  
35 migration of a dissolved tracer placed in the bottom waters of Site 104. The model showed  
36 gradual dispersion of this tracer, with some movement northeast, but more movement in the  
37 northwest direction, indicating a potential tendency to follow the channels and on into the  
38 Patapsco River. Overall, increased concentrations appeared negligible. Monitoring at the time  
39 of placement is recommended to verify the model predictions.

40  
41 The no complete mixing scenario found the spring algal bloom was slightly enhanced due to  
42 enhanced phosphorus remaining in the water column. This effect did not last until the summer  
43 phytoplankton blooms. No effect was predicted from elutriation of ammonium, nitrates, or  
44 COD.

1 ~~As was stated before, the complete mixing and no mixing scenarios modeled for Site 104 are~~  
2 ~~both worst case scenarios, which were used to bound and define the extent of negative impacts to~~  
3 ~~water quality from nutrient releases from the sediments. Neither case is expected to occur,~~  
4 ~~rather, some combination of the two is expected, dependent upon the selected placement type~~  
5 ~~and conditions that occur at the time of placement. In eiall modeledther easescenarios,~~ impacts  
6 were found to be limited in duration and aerial extent. Mitigation efforts, such as limiting the  
7 timing of placement to avoid anoxia, should further limit negative impacts.

8  
9 Water quality impacts from increased nutrient concentrations resulting from placement of  
10 dredged material have also been found to be temporary in nature in the open water placement  
11 sites in the upper Bay. Monitoring of placement in Pooles Island Area G-West for ~~four~~ 4 years  
12 has shown no long-term or regional water quality impacts in the surface or bottom waters  
13 associated with placement (MES 1997c). The open water placement sites in the Pooles Island  
14 area do not experience seasonal anoxia, have lower salinities, and are shallower than Site 104;  
15 therefore, these sites were not used as a model for Site 104. The long-term information gained  
16 from the monitoring of these sites, however, was used to create the data collection effort for Site  
17 104 and will be used to define the monitoring requirements for this site.

18  
19 In addition, some of the findings in the upper Bay studies support some of the findings in these  
20 studies. For example, measured phosphorus fluxes in the placed sediments in Pooles Island were  
21 negative, with phosphorus moving from the water to be bound by the sediments. -This supports  
22 the finding that under oxidized conditions, phosphorus releases will not be enhanced when  
23 sediments are dredged. It also supports the theory that dredging of the sediment will tie up any  
24 pore water phosphorus by exposing it to more iron oxide binding sites on the sediment particles.

25  
26 In the upper Bay, as is expected for Site 104, significant seasonal and annual fluctuations in  
27 water quality associated with the Susquehanna River flow and shoreline erosion were found to  
28 impact sediment conditions and fluxes.

29  
30 The use of Site 104 for placement is expected to have short-term and localized impacts on water  
31 quality, primarily through increased turbidity at the time of placement, total suspended solids,  
32 and nutrient concentrations. These short-term impacts are expected to last only until the summer  
33 season after the last placement event. After these short-term impacts cease, ~~the site will likely~~  
34 ~~experience~~ there is a potential for ~~a longer-term positive impacts eoffrom~~ shorter hypoxia and  
35 anoxia events. Decreasing the depth ~~will~~ could limit the intrusion of low oxygen bottom water  
36 during the summer months. Hypoxia and anoxia are typical in deep water areas of the Bay,  
37 including Site 104, during the summer months.

### 38 39 **Salinity Impacts Within 1 Year of Placement**

40  
41 There are no ~~short-term~~ salinity impacts predicted ~~within one~~ 1 year of ~~during or immediately~~  
42 ~~after~~ placement. The location (or origin) of the source material is in the upper Bay in the same  
43 region and salinity regime as Site 104. Therefore, there will be no significant difference between  
44 the salt content in the dredged material and the water column.

1 **6.1.4.c Sediment-Nutrient Flux Changes.** As discussed in Section 5.1.5, sediments have a  
2 significant influence on overlying water quality, specifically in utilization of dissolved oxygen  
3 from the overlying water column and recycling of nutrients in the ecosystem. Deep areas in the  
4 Chesapeake Bay, such as Site 104, experience very different cycles when compared to shallower  
5 areas of the Bay, due, in part, to anoxic or hypoxic conditions during the summer months.  
6

7 As with other areas of the upper Bay, Site 104 is subject to inter-annual and intra-annual  
8 variability due to input from the Susquehanna River. Bottom waters in the area were hypoxic  
9 during the summer (July to September 1996) and organic matter deposition rates were generally  
10 high. Sediment-nutrient fluxes in the Site 104 area were found to be within expected ranges for  
11 an area experiencing summer hypoxia (Boynton *et al.* 1998).  
12

13 The impact of dredged material open-water placement on sediment-nutrient fluxes has been  
14 studied extensively in the Pooles Island open-water placement areas. This area has typical  
15 depths between -5 and -7 meters (16 to 23 feet) and does not experience seasonal hypoxia or  
16 anoxia due to the shallower depths and well-mixed water column (MES 1997a). Studies on the  
17 effects of dredged material placement on sediment-nutrient fluxes in deep water sites  
18 experiencing seasonal hypoxia or anoxia are limited or non-existent. The on-going monitoring at  
19 the Pooles Island open-water placement areas is the first extensive monitoring of an open-water  
20 placement sites in the Maryland portion of the Bay including sediment-nutrient flux  
21 measurements. The monitoring at the Pooles Island sites was used to design the NEPA data  
22 collection effort at Site 104 and will also be used to design the monitoring of placement at this  
23 site.  
24

25 Historically, Site 104 was the only open-water placement site in deep water in Maryland with  
26 any monitoring records until recent years, when extensive monitoring has been performed at the  
27 Pooles Island sites. The last placement action in Site 104, which occurred in 1975, was  
28 monitored, including: the accumulation and dispersal of the placed material; the biological  
29 effects of placement on clams and oyster; and the impacts to the commercial shellfish stocks and  
30 predominant benthic organisms (MDNR 1976).  
31

32 As presented in the most recent monitoring report (MES 1997b,c), pre-placement monitoring at  
33 the Pooles Island G-West area has shown that natural sediments in the G-West area represent a  
34 modest internal source of nitrogen and an important internal source of phosphorus to the  
35 overlying water column. For one year after placement, the sediments represented an important  
36 source of nitrogen and a loss of phosphorus. The studies could not fully explain why the results  
37 were different for nitrogen and phosphorus fluxes. It could be due to a loss of phosphorus from  
38 pore water during placement, whereupon the silt and clay particles tend to strip phosphorus from  
39 the water column until a similar equilibrium is achieved. These conditions are controlled by the  
40 fluxes from the newly placed sediments, and it has been estimated that these fluxes occur in the  
41 top 10 cm of the sediment only. By the third year post-placement, the sediment-nutrient flux  
42 rates had returned to baseline conditions. The changes in flux rates from the second to third year  
43 post-placement was attributed to consolidation of the placed sediments.  
44

45 In addition to studying the effects of open-water placement, the G-West monitoring effort  
46 studied the effect of placement technique on sediment-nutrient flux rates (bottom-release scow

1 versus continuous hydraulic placement). These studies were performed by collecting and  
2 incubating sediment samples from areas of controlled bottom-release scow placement and from  
3 continuous hydraulic placement areas each year, measuring the flux rates to the overlying water  
4 column, and comparing these concentrations to background sediments which were incubated in  
5 the same way. Samples were collected from June to August, which is the period for enhanced  
6 fluxes in the upper Bay near Pooles Island. The enhanced ammonium fluxes observed from the  
7 sediments lasted less than ~~one~~ 1 year for the hydraulic placement areas and did not exceed ~~one~~ 1  
8 year for the bottom-release scow areas.

9  
10 In summary, nutrient loading observed at G-West over the monitoring period (from 1993 to  
11 1996) was found to be a locally important, short-term impact (<1 year) and to represent a modest  
12 source of nutrients when compared to external sources, predominantly Susquehanna River input  
13 (Boynton *et al.* 1997). The impacts were found to be locally important, versus regionally  
14 important due to the magnitude of the source compared to the magnitude of other sources, and  
15 due to the fact that enhanced water column concentrations of nutrients or chlorophyll were not  
16 observed in areas remote from the placement areas.

17  
18 Based on studies conducted at other open-water placement sites (Pooles Island), it has been  
19 speculated that several sources cumulatively contribute to localized nutrient concentrations at a  
20 placement area: (1) water column concentrations occurring at the point of dredging; (2) the  
21 short-term concentrations released at the time of placement; and (3) longer term releases or  
22 fluxes from the sediment during the first season after placement. Ongoing Further studies of  
23 placement are being would be planned to ~~conducted to attempt to~~ better quantify these amounts.  
24 No studies performed to date have detected increased anoxia or hypoxia, or enhanced  
25 phytoplankton blooms at the placement sites (G-West near Pooles Island) as a result of  
26 placement.

27  
28 When comparing sediment-nutrient flux rates from Pooles Island (G-West) to Site 104 it is  
29 apparent that the greater depth at Site 104 and the seasonal hypoxia have a significant effect on  
30 the magnitude of the fluxes. The studies conducted at Site 104 in 1996 found the region to have  
31 high rates of organic matter deposition, and sediment-nutrient fluxes in this area are significant  
32 contributors to the poor water quality conditions and high primary production. This is typical of  
33 deep areas, such as Site 104, which undergo seasonal hypoxia or anoxia.

34  
35 When compared to external nutrient loadings (primarily the Susquehanna River), the existing  
36 conditions at Site 104 ~~area~~ contribute a modest amount of ammonium but a large amount of  
37 phosphorus in the upper Bay region, due to the effect of hypoxic conditions on phosphorus  
38 fluxes (Boynton *et al.* 1998). This large phosphorus input contributes significantly to the high  
39 primary productivity and resultant algal blooms that further deplete dissolved oxygen from the  
40 water column. The timing, degree, and extent of phytoplankton blooms are dependent upon the  
41 ratio of nitrogen and phosphorus in the water column and the time of year that these releases are  
42 observed. Both nutrients are required for primary production (phytoplankton growth). Nitrogen-  
43 phosphorus (N:P) ratios have been studied; ~~and~~ southern areas of the Bay have been found to be  
44 generally nitrogen-limited, and northern areas phosphorus-limited for phytoplankton blooms.

1 The annual cycle of phytoplankton production in the Chesapeake Bay is characterized by two  
2 phases. There is a spring biomass maximum in April-May supported by increased light  
3 penetration and high riverine nutrient inputs. This is followed by a summer productivity  
4 maximum supported by benthic nutrient regeneration from bottom sediment organic matter  
5 decomposition (Conley and Malone 1992). Recent work by Fisher, *et al.* (1992, 1999), and  
6 Malone, *et al.* (1996) and Fisher, *et al.* (1992) have more fully described the nature of these  
7 phytoplankton productivity cycles and the seasonal factors which limit phytoplankton  
8 productivity. These findings have led to a better understanding of the nature of nutrient  
9 limitations and the seasonal changes in water quality conditions which then control  
10 phytoplankton growth. What these studies have found is that nitrogen in fact limits  
11 phytoplankton growth in the summer, but in the spring, phosphorus is the limiting factor.

12  
13 The reasoning behind this change in limiting factors is due to the changing environmental  
14 conditions in the estuary. The late winter to spring period in the Chesapeake Bay is  
15 characterized by large freshwater runoff, with higher ratios of nitrogen loadings compared to  
16 phosphorus in the runoff. During this time period, as sunlight is also increasing, there is more  
17 nitrogen available than can be utilized by the phytoplankton, when compared to phosphorus.  
18 Under these conditions, phosphorus then becomes the limiting nutrient -- the phytoplankton only  
19 grow to the extent that phosphorus is available as a nutrient. During the summer this dynamic  
20 changes. With a decrease in nitrogen loading as freshwater runoff declines and plants in the  
21 watershed begin to grow and tie up the nutrients, the source of nutrients to the water column  
22 switches to the nutrients being recycled from organic matter decomposition in the sediment. The  
23 increasing water temperatures in the bottom waters begin a process of microbial activity. These  
24 microbes break down the organic matter that has fallen to the bottom of the Bay, and in the  
25 process, nutrients are "remineralized," or recycled to the water column. When this happens, the  
26 sediments become the main source of nutrients to fuel phytoplankton growth. Under these  
27 conditions, the Bay is now producing higher ratios of phosphorus, and phytoplankton only grow  
28 to the extent that nitrogen is available as a nutrient.

29  
30 From the above studies, it has been determined that Primary productivity at Site 104 would be  
31 primarily phosphorus-limited in the spring and nitrogen-limited in the summer. Water quality  
32 modeling of the complete elutriation or no elutriation scenarios found slightly enhanced  
33 dissolved phosphorus concentrations at Site 104 after placement. This was found to have a slight  
34 stimulatory effect on the spring algal bloom under the no mixing scenario, but no impact on  
35 phytoplankton blooms in the complete mixing scenario. found no impacts on chlorophyll-a  
36 production (which is a measure of phytoplankton growth) under the expected-case scenario.  
37 Under the scenario which released all of the available phosphorus during seasonal anoxia, a  
38 slight stimulatory effect was observed on phytoplankton growth, but this did not last into the  
39 summer.

40  
41 The monitoring of the effects of dredged material placement on sediment-nutrient flux at the G-  
42 West area near Pooles Island have shown placement to have a short-term local impact on the flux  
43 rates. A similar ~~The same~~ magnitude and duration of impacts would be ~~are~~ expected in the Site  
44 104 area. Additional studies are currently being conducted on nutrient fluxes from the sediments  
45 in the deep water (50-foot) channels that would be dredged and placed in Site 104. Studies  
46 performed in 1997-7 by Horn Point Environmental Laboratories found nutrient fluxes and water

1 quality conditions in the channels to be similar to those in Site 104, leading to the conclusion that  
2 overall net changes should be small when sediments are moved from the channels to Site 104.

3  
4 Further study was performed as part of the water quality modeling aspect of this EIS. Using the  
5 complete mixing scenario, all water quality impacts would be short-term, lasting only for the  
6 duration of each placement action. For the no mixing scenario, increased releases of nitrogen  
7 and phosphorus compounds from the sediment were predicted for the first spring season of  
8 anoxia after each placement event. This impact was predicted using values for ambient and  
9 channel sediment nutrient concentrations which exist in the model. These values were entered  
10 into the model after field sampling from 1985-1987, and were verified as accurate after the  
11 model runs for Site 104. These values differed from the results of the field study of Site 104 in  
12 1996, but these differences are thought to result from the different time periods when sampling  
13 occurred, and from the depth-averaged nature of the model's conditions for the Site 104 cell.  
14 The expected--case scenario found no changes to water quality conditions after placement of  
15 dredged sediment with large ammonium releases as the time of placement.

16  
17 It is projected that after placement has ended, natural annual sediment deposition would become  
18 the source of sediment-nutrient fluxes and conditions would be expected to return to ambient  
19 levels. This is projected based on the knowledge of sediment depositional processes in the Bay,  
20 on the multi-year study of nutrient fluxes which occur from these sediments, and from the  
21 findings of monitoring at the Pooles Island sites in the upper Bay.

22  
23 As stated before, the ~~complete mixing and no mixing~~ scenarios modeled for Site 104 are both  
24 worst-case scenarios, used to bound and define the extent of negative impacts to water quality  
25 from nutrient releases from the sediments. ~~Neither case is expected to occur, rather, some~~  
26 ~~combination of the two is expected, dependent upon the selected placement type and conditions~~  
27 ~~that occur at the time of placement. In either all~~ cases, nutrient impacts were found to be limited  
28 in duration and aerial extent. Mitigation efforts, such as limiting the timing of placement to  
29 avoid anoxia, should further minimize negative impacts.

30  
31 Overall, the impacts to sediment-nutrient flux at Site 104 from dredged material placement are  
32 expected to be short-term and local in nature, as has also been observed at the Pooles Island  
33 open-water placement areas (MES 1997b<sub>c</sub>). Monitoring of placement activities at Site 104 will  
34 include sediment-nutrient flux studies and water quality studies to verify this.

35  
36 **6.1.4.d Long-term Impacts to Water Quality.** In the long-term, water quality in the bottom  
37 waters at Site 104 is expected to be unchanged, or to possibly ~~could~~ improve. Decreasing the  
38 depth at the site (by placement of dredged material) ~~sh~~ould minimize the extent and distribution  
39 of hypoxic and anoxic bottom waters in the site. The saltier, hypoxic and anoxic waters will be  
40 restricted to deeper water areas adjacent to the site. Therefore, post-placement, water quality in  
41 the filled area could be better for supporting aquatic communities.

42  
43 There are no predicted long-term adverse impacts to water quality from placing dredged material  
44 at Site 104. Nutrient releases from the sediments under worst case conditions of either complete  
45 mixing or no mixing of nutrients with the water column during placement are predicted to result  
46 in a return to ambient conditions within ~~six~~ 6 months of placement. It is important to note that

1 because placement will occur during the 15 October to 15 April placement window, by the time  
2 nutrient levels are expected to return to ambient conditions (~~six~~ 6 months post-placement), a new  
3 placement event may or will have likely occurred. Thus, nutrients in bottom waters at the site in  
4 the winter will be slightly to moderately elevated throughout the ~~1 to 9 year~~ placement period.  
5 Nutrient impacts to water quality are not expected ~~will be localized and seasonal~~, and food-chain-  
6 effects, although not modeled, are not expected to be significant.

7  
8 Changes to salinity conditions upstream of Site 104 were modeled by the CH3D model in  
9 response to concerns related to the impacts of reduced water depths on the ability of the salt  
10 wedge to move up the Bay. These conditions were modeled as long-term impacts only,  
11 assuming near-complete filling of Site 104 to the -45 feet MLLW contour. The study performed  
12 by WES (1998) found a mean decrease in salinity of < 0.1 ppt to pre-placement conditions at  
13 the Chesapeake Bay Program MCB3.2 station (due east of the Patapsco River, north of Site 104)  
14 after ~~four~~ 4 of ~~five~~ 5 years of placement at Site 104.

15  
16 Smaller net changes in salinity were observed, when compared to background at the other MCB  
17 stations that extend up the Bay to Pooles Island and beyond. Mean changes in the more northern  
18 station appeared to be less than 0.05 ppt. In some cases, salinities increased, for unknown  
19 reasons. Changes were concentrated in the time periods before and after calendar days 100 to  
20 150, during that period, and essentially no change was predicted by the model. These days  
21 would correspond to the spring freshet, when it is assumed that fresh water from the  
22 Susquehanna pushes higher salinity waters further down the Bay and results in essentially fresh  
23 water for most of the upper Bay. This timing would indicate no impacts from enhanced salinities  
24 to anadromous fish spawning concentrations. Natural inter-annual variability in salinity from  
25 one year to the next is generally much greater than the 0.05 to 0.1 change predicted at the times  
26 before and after calendar days 100 to 150, -so limited impacts are expected from this potential  
27 change. The ecosystem of the Chesapeake Bay is adapted to respond to widely varying  
28 fluctuations in salinity due to impacts from drought and excessive rainfall. These fluctuations  
29 can span a changes of 10 ppt from the surface to the bottom of deep water in the Bay, and can  
30 change the salinity by 5 to 10 ppt over a period of days of heavy rainfall. -For these reasons, the  
31 small changes in salinity which have been modeled for this proposed action are not projected to  
32 result in negative impacts.

33  
34 There will be no long-term turbidity impacts. Elevated levels of water column turbidity will be  
35 short-term and localized during placement. Bottom turbidity will remain slightly elevated while  
36 the material consolidates and settles. While depth and water quality conditions are different at  
37 Site 104, when compared to the extensively studied Pooles Island sites, these impacts are similar  
38 to impacts observed at other open-water placement areas in the upper Bay.

1 **6.1.5 Sediment**

2  
3 **6.1.5.a Sediment Composition.** Maintenance sediments from the following channels were  
4 collected through piston cores taken by MGS in January 1998 and analyzed by WES for use in  
5 the modeling studies (WES 1998): Craighill Angle, Cutoff Angle, Brewerton Channel Eastern  
6 Extension, Tolchester, and Swan Point. These samples represent approximately 85% of the  
7 maintenance material targeted for placement at Site 104 and are typical of the majority of  
8 maintenance material likely to be placed. The other 15% of material will originate from  
9 approaches to the C&D Canal and the upper Tolchester Channel and is likely to be similar in  
10 composition to the sediments used in the modeling studies. Results from an analysis of a  
11 composite made from the core samples revealed a water content of 67.44% and an organic  
12 content of 10.1%. The sediment particle size was follows: mean of  $10.88 \times 10^{-6}$  meters ( $3.57 \times 10^{-5}$   
13 feet), median of  $6.02 \times 10^{-6}$  meters ( $1.98 \times 10^{-5}$  feet), and standard deviation of  $14.2 \times 10^{-6}$  meters  
14 ( $4.66 \times 10^{-5}$  feet). Silt and clay are defined as particle sizes  $< 50 \times 10^{-6}$  meters ( $15.10 \times 10^{-5}$  feet).  
15 The majority of sediment proposed for dredging is primarily comprised of silt and clay particles.  
16 All sediments to be placed at Site 104 have been tested or will be tested prior to placement at the  
17 site.  
18

19 Based on data obtained from Site 104 (see Section 5.1.5.a), sediments in the Site 104 area consist  
20 primarily of very soft to soft gray silty clay with localized pockets of silty sand and red-brown  
21 silty clay (E2Si 1997, MGS 1997, EA 1998). The proposed action will not change the physical  
22 characteristics of the sediment in the area because the sediments proposed for placement are  
23 primarily silt and clay particles.  
24

25 **6.1.5.b Sediment Quality Impacts.** Based on chemical analysis of the existing sediments at Site  
26 104 and Tier II evaluations (EPA/USACE 1998), the sediment quality at Site 104 is expected to  
27 improve as the result of placement activities. A review of the relative priority pollutant  
28 concentrations in existing Site 104 sediments was compared to channel sediments proposed for  
29 placement. Metals concentrations for this comparison are presented in Table 5-2016, along with  
30 the NOEL and PEL values for each metal. This table shows that mean metals concentrations in  
31 existing Site 104 sediments, excluding sample site KI-7, are similar but somewhat higher than  
32 the metals concentrations in the channel sediments which are proposed for placement at Site 104.  
33 Sample KI-7 in Site 104 had metals concentrations at least 10 times higher for almost all metals  
34 than those in the channels proposed for placement in Site 104, and when this sample is added to  
35 the mean sediment quality at Site 104, all values except nickel exceeded the channel means. As  
36 was discussed in Section 5, the finding of some unclean sediments within Site 104 could be due  
37 to the placement of unclean inner harbor sediments in Site 104 from actions starting in 1924 and  
38 continuing to the 1970s.  
39

40 While both the channel sediments and Site 104 sediments had a majority of mean metals  
41 concentrations which exceeded the NOEL values, all channel sediments had mean values less  
42 than the PELs. Most of the mean channel sediment concentrations of heavy metals were less  
43 than that of Site 104, indicating a potential improvement in sediment quality for benthic  
44 organisms if channel sediments cover or "cap" the in-place sediments at Site 104. This improved  
45 sediment quality for benthic organisms could help the benthic populations, although the anoxia  
46 which occurs annually only allows limited repopulation in the fall and spring. The risk of

**NOT UPDATED**

1 potential human health impacts due to exposure to arsenic that exceeds the soil RBCs will be  
2 reduced if channel sediments cover existing sediments at Site 104.  
3

4 The physical composition of sediment at Site 104 will not be impacted by placement activities.  
5 A review of the sediment composition from samples in the channels and samples collected in  
6 Site 104 shows very similar particle sizes, with sediments in both Site 104 and in the channels  
7 consisting of predominantly silty clays to clayey silts. Therefore, the physical composition (i.e.  
8 particle size) of the sediments is not expected to change.  
9

10 Overall, no negative impacts related to sediment quality are predicted, and a potential positive  
11 long-term impact would result from capping the contaminated sediments that exist at KI-7 within  
12 Site 104 with cleaner channel sediments.  
13

1 **6.1.6 Aquatic Resources**

2  
3 **6.1.6.a Plankton.** In the short-term, increases in turbidity associated with dredged material  
4 placement by controlled bottom-release scow could suppress light penetration into the water  
5 column and, therefore, locally depress the phytoplankton community. The proposed placement  
6 schedule (mid-October through mid-April) should minimize potential effects on the  
7 phytoplankton population because the primary phytoplankton productivity is already depressed  
8 due to the decreased daylight and temperatures. Turbidity associated with dredged material  
9 placement by hydraulic pump-out placement is not expected to have short-term or long-term  
10 effects on the phytoplankton population because there would be no turbidity occurring in the  
11 photic zone.

12  
13 For mechanical placement by bottom-release scow, there will be some direct mortality to  
14 phytoplankton and zooplankton as the result of entrainment in the turbidity plume during  
15 placement events. This mortality is not expected to significantly impact or be detrimental to  
16 local phytoplankton or zooplankton populations.

17  
18 Effects from enhanced nutrient release were modeled. Under a worst-case scenario of complete  
19 mixing and release of nutrients at the time of placement, a slight stimulatory effect on spring  
20 algal concentrations was observed, but this effect did not continue into the summer. Under a  
21 scenario of no mixing with releases in the next summer after placement, no impacts on  
22 phytoplankton populations were projected.

23  
24 Overall, the short-term effects on the phytoplankton are; expected to be negligible. As a result,  
25 zooplankton communities that are dependent on phytoplankton densities are not expected to be  
26 limited by food availability. Effects on photosensitive zooplankton species due to localized light  
27 penetration are expected to be short lived due to current exchanges and rapid settling of most of  
28 the materials. Short-term impacts to zooplankton would be temporarily significant; however, no  
29 medium or long-term impacts are expected. Temporary significant impacts would include  
30 inability to forage and potential loss of organisms in the water column that are entrained in the  
31 turbidity plume. It is important to note that Site 104 is within the southern portion of the  
32 turbidity maximum area and therefore already experiences significant turbidity events from  
33 discharge from the Susquehanna and other nearby river systems. Long-term impacts to  
34 phytoplankton productivity due to nutrient releases are also expected to be negligible. Although  
35 nutrient concentrations at the site will be slightly elevated throughout the 1- to 9-year placement  
36 period, effects to phytoplankton communities, although not modeled, are not expected to be  
37 significant. Seasonal placement is also expected to be planned for seasons of the year when  
38 phytoplankton activity -and zooplankton populations are depressed, thus; minimizing any impact  
39 to larger populations that would occur during the -warmer months.

40  
41 ~~6.1.6.b Fisheries.~~

42  
43 ~~Potential Impacts to Finfish~~

44  
45 ~~Adverse impacts to the resident finfish communities will be short term and minimal. Due to~~  
46 ~~their mobility, finfish are affected by placement operations much less than benthic~~

47 macroinvertebrates. However, larval and juvenile life stages are less mobile than adults are. As  
48 such, placement operations should be avoided during peak reproductive periods. Table 6-6  
49 shows critical life stages of target species and harvest seasons overlaid with the placement  
50 operations window. Critical life stages of target species were chosen based on spawning, larval  
51 and juvenile development intervals. Habitat requirements of these target species were outlined  
52 and discussed in Section 5.1.6.b. The dredged material placement window shown in Table 6-6  
53 avoids significant impacts to commercially and recreationally valuable fish species during their  
54 critical life stages. In addition, most commercial and recreational fishing effort takes place north  
55 of the "RWLP" buoy (Figure 2-1) and along the shallows east of Site 104. The hatched bars in  
56 Table 6-6 indicate that the habitat necessary for the critical life stages development takes place  
57 outside of Site 104. Table 6-6 also shows recreational and commercial fishery seasons overlaid  
58 with the recommended dredging operations window for Site 104.

59  
60 More mobile members of the pelagic (e.g., menhaden, striped bass) and demersal fish  
61 community (e.g., flounders, oyster toadfish) are expected to move out of or generally avoid the  
62 area during placement. The fishes most affected would be the smaller, less mobile resident  
63 species and young fish that may utilize the area for staging between nursery areas and  
64 overwintering areas. Increased turbidity may cause migrating fish to alter their course to avoid  
65 the plume.

66  
67 Two species of fish, striped bass and white perch, support an extensive fishery in Maryland and  
68 are known to inhabit the waters of Site 104 (Section 5.1.6.b). The proposed placement is not  
69 expected to significantly impact the striped bass population because Site 104 does not support  
70 conditions necessary for critical life stages. The proposed placement is also not expected to  
71 negatively impact the white perch population because spawning takes place in tributaries and  
72 along shorelines. In addition, the existing abiotic water quality conditions (e.g., salinity ranges)  
73 at Site 104 are not suitable for the development of eggs and larvae. Overall, placement is not  
74 expected to negatively effect the striped bass and white perch commercial and recreational  
75 fishing industry because most fishing effort takes place north of the "RWLP" buoy.

76  
77 No impact is anticipated for alewife, American shad, weakfish, hickory shad, white perch and  
78 yellow perch because spawning and early life stages occur outside of the Site 104 area in  
79 tributaries of the Bay. The critical life stages of winter flounder are also not anticipated to be  
80 impacted because spawning takes place in shallow water during the winter. Known winter  
81 flounder spawning areas include the Patapsco, Sassafras and Chester Rivers.

82  
83 Potential impacts to shortnose sturgeon, a federally endangered species, are not known at this  
84 time. However, use of Site 104 should not impact spawning activities since spawning would  
85 occur in the tributaries. An interim Biological Assessment will integrate information collected  
86 from the two-year sturgeon monitoring program and will assess potential placement impacts.  
87 The proposed project cannot proceed unless NMFS decides that the interim Biological  
88 Assessment provides sufficient data to issue an opinion on the potential impacts of open water  
89 placement on shortnose sturgeon, prior to the completion of the 2-year study being conducted by  
90 the Baltimore and Philadelphia Districts (Section 5.1.8).

92 The burial of benthic macroinvertebrates (further discussed in Section 6.1.6.e Impacts to  
93 Benthics) temporarily reduces the size of the benthic population available for consumption by  
94 finfish. (See Section 6.1.6.e for more information on Benthics). This may impact benthic-  
95 feeding finfish populations that use these areas as feeding grounds in the winter. Atlantic croaker  
96 was the most abundant bottom feeding fish that was observed in the winter months at Site 104.  
97

98 While most fish experience reduced metabolism and reduced need for food in the winter, the loss of  
99 benthic organisms during placement years could result in fish moving to nearby unimpacted areas to  
100 feed and possible increased competition for benthic food resources in other areas. Placement is not  
101 projected to result in a long term change in the benthic community which currently exists at Site  
102 104, as the site is expected to be re-colonized within 18 months after cessation of all placement  
103 activities based on studies conducted by the MDE (1998b). The temporary reduction in benthic  
104 populations will last for the 1 to 9 year placement duration. These studies generally indicated  
105 rapid re-colonization by pioneer species and the eventual re-colonization by a climax benthic  
106 community. Some studies have indicated that the re-colonization by long-lived species takes  
107 much longer. This is not a factor in Site 104 because of the annual die-off of benthic organisms  
108 due to low oxygen conditions in the late spring and summer which limits long-lived benthics at  
109 the site (Section 6.1.6.e).  
110

111 Fish habitat is anticipated to change from waters of a maximum depth of 23.8 meters (78 feet)  
112 MLLW to waters of 13.7 meters (45 feet) MLLW in Site 104. The impact of these changes is  
113 not anticipated to be significant, because the existing bathymetry in Site 104 does not provide a  
114 substantial amount of features considered important for fish habitat. Important habitats include:  
115 rocks or shell reefs that provide protection from predators and feeding areas; overwintering  
116 areas; shallow water areas that are used as nursery grounds for newly hatched fish (generally,  
117 depths less than 1.8 meters (6 feet); and hard bottom substrates (used by some species for  
118 spawning). No fish habitat structures have been located by bathymetry surveys and side-scan  
119 sonar studies within Site 104. No fish habitat structures are expected to be impacted by the  
120 placement activities.  
121

122 Finfish and sensitive spawning periods are not expected to be affected by elevated turbidity in  
123 the water column or by nutrient releases from the bottom sediments. Finfish in the Bay are  
124 generally used to and tolerant of turbid water quality. It is expected that finfish in the vicinity of  
125 Site 104 will leave the site during placement events. In addition, no placement will occur during  
126 spawning season. Turbidity levels at the site are expected to be elevated for approximately 20-  
127 30 minutes during and after each placement event. This effect would be more distributed in the  
128 water column for controlled bottom release scow placement than for a pump-out barge, which  
129 would confine the material within a pipeline directed to the bottom, and place the material just  
130 above the bottom. These intermittent increases in turbidity would last each year for the duration  
131 of the placement events. The total duration would depend upon how long each placement action  
132 took. The recommended placement duration each year is six months. Therefore, intermittent  
133 periods of localized turbidity could occur during a six-month placement period, but localized  
134 turbidity would not be continuously elevated at the site for a six-month period. It is expected that  
135 demersal (bottom-dwelling) species would potentially be more impacted by placement activities  
136 than pelagic (water column) species.  
137

138 Nutrient releases that could potentially occur post placement are not expected to impact sensitive  
139 lifestages or spawning activities because nutrient releases during spawning periods are expected  
140 to be very small due to low water temperatures.

141  
142 In the long term, finfish communities in the Site 104 area may be positively impacted as a result  
143 of placement activities. The depth change at the site will improve water quality and change the  
144 water column dynamics from a deep water area to a mid-depth water area. As a result, although  
145 not modeled, primary productivity in the immediate vicinity could increase, thus fueling the  
146 bottom of the food chain (at a localized level). Generally, shallow water areas are considered to  
147 be more valuable and productive habitat for aquatic organisms. Directly after placement there  
148 may be a lack of benthic food resources for finfish. After the benthic communities begin to re-  
149 establish, however, the communities may actually be more prolific and provide more abundant  
150 food resources for bottom feeding fish than pre placement, if the duration and extent of anoxia is  
151 reduced. Thus, in the long term, it is possible that placement activities at Site 104 will actually  
152 enhance the fish habitat and food resources in the immediate vicinity of the Site.

### 153 **Potential Impacts to Shellfish**

154  
155  
156 Oysters are not known to occur within Site 104. The closest oyster bar that has been harvested in  
157 recent years is the Broad Creek Bar which is located at the southeastern side of Site 104 (Scott  
158 1998). Broad Creek is adjacent to the proposed placement area. No impacts are anticipated for  
159 this bar because it is outside of the placement area, and models have predicted that sediment  
160 transport will be predominantly to the north (Section 6.1.3.g).

161  
162 Peak densities of softshell clams along the eastern shore of the Chesapeake are found from the  
163 Eastern Bay to Pocomoke Sound, particularly at depths of less than 5.2 meters (17 feet) along the  
164 shoreline (Baker and Mann 1991). The proposed placement activity is not expected to adversely  
165 effect softshell clam densities because the minimum depth at Site 104 is 12.8 meters (42 feet).

166  
167 Blue crabs utilize nearly every habitat type in the Bay during some stage of their lifecycle.  
168 During the fall, female crabs begin their migration to the lower Bay and adult males migrate to  
169 deeper waters from the Bay tributaries to overwinter. Although the Chesapeake Bay Winter  
170 Dredge Surveys performed by MDNR have found overwintering males in Site 104 boundaries  
171 during the proposed placement window, the survey indicates that hibernating blue crab densities  
172 are generally lower in areas greater than 12.2 meters (40 feet) (Alexi Sharov MDNR 1998).  
173 The blue crabs present in water greater than 12.8 meters (45 feet) MLLW within the portion of  
174 Site 104 where placement would occur, would likely be covered by material. The impact to crab  
175 densities should be minimal since the densities are lower at these greater depths and it is  
176 primarily the male crab that would be impacted. Also, estimates of crab densities at the site  
177 indicate that Site 104 has low crab densities ( $59.9/1000\text{ m}^2$ ) relative to other areas of the upper  
178 Bay ( $88.95/1000\text{ m}^2$ ) and the average for Maryland portions of the Bay ( $101.10/1000\text{ m}^2$ ).  
179 Impact to populations and migratory patterns of the blue crab, therefore, is not anticipated  
180 because female migration to the lower Bay will be completed before the placement activities  
181 begin each year, and females will migrate north to lower salinities after placement activities  
182 cease each year.

184 In summary, it is expected that the proposed dredged material placement at Site 104 would have  
185 a short term negative effect on the shellfish community and a long term positive effect. These  
186 results would be consistent with observations made in conjunction with the placement of dredged  
187 material in the Pooles Island open water placement sites.  
188

189 **6.1.6.e Benthic Community.** The upper Bay is considered a naturally unstable environment with  
190 a benthic community dominated by opportunistic species (refer to Section 5.1.6.e). This  
191 environment is considered unstable due to the fluctuating salinity, seasonal anoxia in deep water  
192 areas, and periods of high turbidity during high inflows from the Susquehanna. Proposed  
193 dredged material placement would permanently raise the bottom in this area to 13.7 meters (45  
194 feet) from the current elevations, which range from 12.8 meters (42 feet) to 23.8 meters (78  
195 feet). This is not projected to result in a long term change in the benthic community that  
196 currently exists at Site 104. Mortality due to placement is considered a significant, but  
197 temporary short term impact in an already unstable environment. The site is expected to be  
198 recolonized within 18 months after cessation of all placement events, based on studies conducted  
199 by MDE and others (e.g., Cronin 1970, Gross *et al.* 1976). Recolonization occurs both through  
200 in-place survival of a portion of the populations, and by an influx of individuals from adjacent  
201 unaffected areas. A key component of the temporary nature of the projected impacts is that the  
202 dredged material composition is similar to the existing substrate composition allowing for rapid  
203 recolonization of similar species (Cronin *et al.* 1970). The substrate in Site 104 is predominantly  
204 a silty clay composition similar to the upper Bay. The material dredged from the channels would  
205 have a similar composition because it is from shoaling of sediment that is flushed into the upper  
206 Bay from the Susquehanna River and shoreline erosion.  
207

208 Research has shown that benthic communities in dredged material placement areas are  
209 completely disrupted during and immediately after placement, but that they are recolonized  
210 within twelve to eighteen months after the end of placement (Ruddy 1990; Cronin *et al.* 1970;  
211 MDE *et al.* 1996). Research by Cronin *et al.* (1970) indicated that immediately after placement  
212 there was a 71% decrease in the average number of individuals per sample within a dredged  
213 material placement area and an 11% increase in stations outside the placement area. The  
214 increase in stations outside the placement area was partially attributed to hydrologic pushing or  
215 migration of individuals out of the placement area during or after placement. The increase in the  
216 number of individuals outside of the area may have also contributed to the rapid recolonization  
217 of the area as the opportunistic benthic macroinvertebrates typical to the upper Bay rapidly  
218 reproduced or relocated in response to the decrease in abundance. Long-lived species such as  
219 bivalves are slower to recolonize. In addition to this research, Cronin *et al.* (1970) recommended  
220 that placement occur from late fall to early spring to avoid the period of high species diversity  
221 and organism distribution and thereby, cause the least amount of impact to the benthic  
222 community. The proposed dredged material placement window for Site 104 would be from 15  
223 October and 15 April each dredging year.  
224

225 Overall, the benthic communities at the site will return to pre-placement conditions after all  
226 placement activities cease. Some partial recolonization is expected to occur after each placement  
227 event. However, these communities are expected to die off by naturally occurring summer  
228 anoxia events that are likely to occur between yearly placement windows. Thus, benthic  
229 production will be repressed in the area throughout the 1 to 9 year placement period.

230  
231 As discussed in Section 5.1.6.c, the low mesohaline mud substrate portions of the Bay are  
232 considered areas that have high macroinvertebrate productivity when compared to areas further  
233 south. Therefore, temporary impacts to the benthic community from placement during a period  
234 of low species diversity and organism distribution would not have a long term impact on an area  
235 that already has high macroinvertebrate productivity. In support of this concept, Cronin *et al.*  
236 (1970) observed no gross effect of dredged material placement on phytoplankton primary  
237 productivity, zooplankton, fish eggs and larvae, and fish immediately after placement, all of  
238 which are populations that would have been directly affected by changes in the benthic  
239 community.

240  
241 Benthic assemblage studies in Pooles Island areas G Central, D, E and F (see Figure 1-2), after  
242 dredged material placement of similar volumes and types proposed for Site 104, indicated that  
243 the benthic assemblages recover from localized placement effects within nine to eleven months  
244 after placement (Ranasinghe and Riechkus 1993). Versar (1994) found a more rapid recovery in  
245 the aforementioned areas as well as in G South than in Areas G West, A and B. The lack of  
246 immediate recovery in G West has been attributed to the continuous placement of dredged  
247 material annually and the lack of sufficient time (twelve to eighteen months post placement)  
248 without placement activities occurring for the area to recover (MES 1997). Some repopulation  
249 of the benthic population at Site 104 would be expected to occur from areas inside the site not  
250 utilized for placement operations during a given year, even under the projected placement  
251 schedule at Site 104 which calls for placement on an annual basis. Versar (1994) also found that  
252 areas of bottom release seow placement of dredged material had lower species diversity and  
253 lower total abundance in the first eight months post placement than hydraulic placement areas.  
254 While exact reasons for this are unknown, it has been speculated that the increased density of  
255 bottom release seow material results in longer periods before recolonization, compared to the  
256 less dense hydraulically placed material. Hydraulically placed material can also be placed in  
257 thinner lifts. These thinner lifts may allow some benthic organisms an opportunity to move up  
258 and out of the dredged material, rather than experiencing mortality through burial.

259  
260 MDE (1996) conducted a study at G South prior to 1996/1997 placement activities to verify the  
261 recovery of the resident benthic community subsequent to earlier placement of dredged material  
262 in 1993. The results of the study suggested that the benthic community at the G South site was  
263 healthy and met the Chesapeake Bay Benthic Restoration Goals and the Chesapeake Bay Benthic  
264 Index of Biotic Integrity. Scores of three or greater were considered as meeting the Chesapeake  
265 Bay restoration goal. The benthic community in G South met or exceeded RGI and B-IBI goals  
266 for the upper Chesapeake Bay within approximately 3 years post placement and there was no  
267 notable difference between the sampling stations and reference station.

268  
269 Although there will be short term, localized adverse impacts to the benthic communities at Site  
270 104, in the long term, benthic communities in the site may be positively impacted as a result of  
271 placement activities. The depth change at the site will improve water quality and change the  
272 water column dynamics from a deep water area to a mid depth water area. Generally, shallower  
273 water areas are considered to be more valuable and productive habitat for aquatic organisms. In  
274 addition, the extent and duration of seasonal hypoxia and anoxia is expected to be reduced in the  
275 area after placement occurs. This will provide the benthic communities a longer growing season.

276 The improved sediment quality, created by covering the existing contaminated sediment, will  
277 also enhance the benthic environment. The changes in depth, water quality, and sediment  
278 quality will provide a long term positive effect on the local benthic communities.

279  
280 In summation, it is expected that, as has been seen in other dredged material placement areas,  
281 placement in Site 104 would have a short term, near field effect on the benthic community. This  
282 is not expected to significantly impact the benthic community or their predators due to the  
283 existing annual benthic die off during the seasonal anoxia in the bottom waters. The benthic  
284 community is expected to remain of poor quality when compared to Chesapeake Bay restoration  
285 goals, but would be expected to recover to pre placement conditions within twelve to eighteen  
286 months after all placement was completed. In addition, the improved water quality and sediment  
287 quality at the site post placement will provide a more favorable environment for benthic  
288 productivity.  
289

1  
2  
3 **6.1.6.b Fisheries.**  
4

5 **Potential Impacts to Finfish**  
6

7 Adverse impacts to the resident finfish communities will be short-term and minimal. Due to  
8 their mobility, finfish are affected by placement operations much less than benthic  
9 macroinvertebrates. However, larval and juvenile life stages are less mobile than adults are. As  
10 such, placement operations should be avoided during peak reproductive periods. Table 6-6  
11 shows critical life stages of target species and harvest seasons overlaid with the placement  
12 operations window. Critical life stages of target species were chosen based on spawning, larval  
13 and juvenile development intervals. Habitat requirements of these target species were outlined  
14 and discussed in Section 5.1.6.b. Note that critical habitat for shortnose sturgeon and Atlantic  
15 sturgeon have yet to be determined in the Chesapeake Bay. Potential impacts to these species are  
16 discussed in detail in Section 6.1.8. The dredged material placement window [If it is decided to  
17 shorten this window from March to April because of the White Paper we should reduce the  
18 window in Table 6-6 to reflect this change] shown in Table 6-6 avoids significant impacts to  
19 commercially and recreationally valuable fish species during their critical life stages. In  
20 addition, most commercial and recreational fishing effort takes place north

21 **Table 6-6 Critical Life Stages and Fishing Seasons Overlaid with the Recommended Dredging Operations Window for Site 104.**

22

ENVIRONMENTAL FACTOR	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE
<b>CRITICAL LIFE STAGE</b>												
<u>SHORTNOSE STURGEON</u>								Diagonal Hatching				
<u>ATLANTIC STURGEON</u>										Cross-hatching		
<u>ALEWIFE</u>	Black	Black	Black							Cross-hatching		
<u>AMERICAN SHAD, HICKORY SHAD</u>	Black	Black	Black							Cross-hatching		
<u>ATLANTIC MENHADEN</u>	Black	Black	Black							Cross-hatching		
<u>BAY ANCHOVY</u>	Black	Black	Black								Black	
<u>BLUEBACK HERRING</u>	Black	Black	Black							Cross-hatching		
<u>SUMMER FLOUNDER</u>	Black	Black	Black							Cross-hatching		
<u>BLUEFISH</u>	Black	Black	Black							Cross-hatching		
<u>OYSTER TOADFISH</u>	Black	Black	Black							Cross-hatching		
<u>STRIPED BASS</u>	Black	Black	Black							Cross-hatching		
<u>WHITE PERCH</u>	Black	Black	Black							Cross-hatching		
<u>WINTER FLOUNDER</u>	Black	Black	Black							Cross-hatching		
<u>YELLOW PERCH</u>	Black	Black	Black							Cross-hatching		
<u>WLAKFISH</u>	Black	Black	Black							Cross-hatching		
<u>BLUE CRAB</u>	Black	Black	Black							Cross-hatching		
<u>EASTERN OYSTER</u>	Black	Black	Black							Cross-hatching		
<u>SOFT-SHELL CLAM</u>	Black	Black	Black							Cross-hatching		
<b>RECREATIONAL FISHERY</b>												
<u>STRIPED BASS SEASON*</u>	Black		Black	Black	Black						Black	
<u>BLUE CRAB SEASON*</u>	Black	Black	Black	Black	Black						Black	
<b>COMMERCIAL FISHERY</b>												
<u>STRIPED BASS DRIFT GILL NET SEASON*</u>	Black	Black	Black	Black	Black						Black	
<u>STRIPED BASS HOOK AND LINE*</u>	Black	Black	Black	Black	Black						Black	
<u>STRIPED BASS POUND NET*</u>	Black	Black	Black	Black	Black						Black	
<u>BLUE CRAB SEASON*</u>	Black	Black	Black	Black	Black						Black	

23 \* = Seasons fluctuate annually based on Management Effort and Total Harvest.

24 **Note:** Critical life stages of other species are not presented in this table because their critical life stages do not overlap with the typical dredging window.

25  Cross-hatching indicates that Site 104 does not support habitat crucial to critical life stages.  Critical Habitat for this species has yet to be determined by NMFS.

26 **Sources:** Critical life stages adapted from information presented in the Chesapeake Bay Program's *Habitat Requirements for Chesapeake Bay Living Resources* and Setzler-Hamilton 1987.

27 of the "RWLP" buoy (Figure 2-1) and along the shallows east of Site 104 [Update with  
28 information from Recreational Fish meeting]. The hatched bars in Table 6-6 indicate that the  
29 habitat necessary for the critical life stages development takes place outside of Site 104. Table 6-  
30 6 also shows recreational and commercial fishery seasons overlaid with the recommended  
31 dredging operations window for Site 104.

32  
33 More mobile members of the pelagic (e.g., menhaden, striped bass) and demersal fish  
34 community (e.g., flounders, oyster toadfish) are expected to move out of or generally avoid the  
35 area during placement. The fishes most affected would be the smaller, less mobile resident  
36 species and young fish that may utilize the area for staging between nursery areas and  
37 overwintering areas. Increased turbidity may cause migrating fish to alter their course to avoid  
38 the plume.

39  
40 Two species of fish, striped bass and white perch, support an extensive fishery in Maryland and  
41 are known to inhabit the waters of Site 104 (Section 5.1.6.b). The proposed placement is not  
42 expected to significantly impact the striped bass population because Site 104 does not support  
43 conditions necessary for critical life stages. The proposed placement is also not expected to  
44 negatively impact the white perch population because spawning takes place in tributaries and  
45 along shorelines. In addition, the existing abiotic water quality conditions (e.g., salinity ranges)  
46 at Site 104 are not suitable for the development of eggs and larvae. Overall, placement is not  
47 expected to negatively effect the striped bass and white perch commercial and recreational  
48 fishing industry because most fishing effort takes place north of the "RWLP" buoy [Update with  
49 findings from Recreational Fishers Meeting].

50  
51 No impact is anticipated for alewife, American shad, weakfish, hickory shad, ~~white perch~~ and  
52 yellow perch because spawning and early life stages occur outside of the Site 104 area in  
53 tributaries of the Bay. Potential impacts to shortnose sturgeon, a federally endangered species,  
54 are discussed in Section 6.1.8.

55  
56 The Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) (16 USC  
57 1801) requires that federal agencies consult with NMFS regarding any action or proposed action  
58 authorized, under, or undertaken by the agency that may adversely affect Essential Fish Habitat  
59 (EFH) identified under the Act. EFH that could potentially be impacted by placement activities  
60 at Site 104 are bluefish, winter flounder and summer flounder habitats. An analysis of impacts  
61 on each species follows. [PLEASE NOTE: the following paragraphs were generated from text  
62 written by Mark Mendelsohn for the EFH consultation; we NEED CITES and verification for the  
63 information presented in the THE FOLLOWING PARAGRAPHS]

64  
65 No impacts to spawning, egg or larvae habitat of the bluefish are projected because spawning  
66 does not occur in the Chesapeake Bay and the eggs and larvae do not occur in the Site 104 area.  
67 There are no impacts expected for adult and juvenile bluefish because the proposed placement  
68 window occurs during a time in their lifecycle when they are overwintering off of the  
69 southeastern coast of Florida. According to the proposed dredged material placement window  
70 placement activities would be ending before bluefish begin their migration into the Chesapeake  
71 Bay. Adults are not typically bottom feeders and are strong swimmers that can easily avoid  
72 turbid conditions. Juveniles prefer shallower waters [Need a definition of shallow water habitat

73 in this case from Mark Mendelsohn] than that found in Site 104. Therefore, no significant  
74 impacts are expected to adults or juveniles during the proposed placement activities. [THIS  
75 PARAGRAPH NEED CITES FROM MARK MENDELSON]

76  
77 Adult summer flounder would not likely be in the project area during the proposed placement  
78 window because they overwinter in the Ocean. Juveniles prefer shallower waters [NEED A  
79 DEFINITION OF SHALLOW WATER HABITAT IN THIS CASE FROM MARK  
80 MENDELSON'S RESEARCH] than what is presently found at Site 104. Therefore, no  
81 significant impacts are expected to adults or juveniles during the proposed placement activities.  
82 No impacts to spawning or summer flounder eggs are projected because spawning occurs during  
83 the offshore ocean migration which is not located in the Chesapeake Bay and the eggs do not  
84 occur in the Site 104 area. Larvae could be present in the project area because they begin to  
85 migrate into the Bay in October. However, because of the timing of the placement window the  
86 larvae that could potentially use the shallow water areas near Site 104 would not be in great  
87 enough numbers to cause a significant impact. [THIS PARAGRAPH NEED CITES FROM  
88 MARK MENDELSON]

89  
90 Winter flounder adults and juveniles are in the bay during the time of the year (winter) when Site  
91 104 contains enough dissolved oxygen to support a benthic community. Some food sources  
92 (benthics) may be lost during material placement. Site 104 is not considered to be a significant  
93 resource for the winter flounder because of the annual depression of benthic species in the area  
94 due to yearly severe anoxic events. Some food sources for the juveniles may be lost, however,  
95 juveniles are expected to occur more frequently in more shallow water. [THIS PARAGRAPH  
96 NEED CITES FROM MARK MENDELSON]

97  
98 The critical life stages of winter flounder are not anticipated to be impacted because spawning  
99 takes place from mid-February to mid-March in shallow waters [NEED A DEFINITION OF  
100 SHALLOW WATER HABITAT IN THIS CASE FROM MARK MENDELSON'S  
101 RESEARCH] during the winter. Known winter flounder spawning areas include the Patapsco,  
102 Sassafras and Chester Rivers. Winter flounder eggs stick to the bottom and are not transported  
103 out of the shallows. The winter flounder larvae is strongly attracted to the bottom (demersal) so  
104 its is unlikely that it would reach Site 104 during placement window. If larvae are transported to  
105 the site by currents it is unlikely likely that larvae would survive. However, the amount of larvae  
106 that could be in the site is considered very small and would not contribute significantly to the  
107 decline of the overall population if lost. [THIS PARAGRAPH NEED CITES FROM MARK  
108 MENDELSON]

109  
110 The critical life stages of winter flounder are also not anticipated to be impacted because  
111 spawning takes place in shallow water during the winter. Known winter flounder spawning areas  
112 include the Patapsco, Sassafras and Chester Rivers.

113  
114 Potential impacts to shortnose sturgeon, a federally endangered species, are not known at this  
115 time. However, use of Site 104 should not impact spawning activities since spawning would  
116 occur in the tributaries. An interim Biological Assessment will integrate information collected  
117 from the two year sturgeon monitoring program and will assess potential placement impacts.  
118 The proposed project cannot proceed unless NMFS decides that the interim Biological

119 Assessment provides sufficient data to issue an opinion on the potential impacts of open water  
120 placement on shortnose sturgeon, prior to the completion of the 2-year study being conducted by  
121 the Baltimore and Philadelphia Districts (Section 5.1.8).  
122

123 The burial of benthic macroinvertebrates (further discussed in Section 6.1.6.c Impacts to  
124 Benthics) temporarily reduces the size of the benthic population available for consumption by  
125 finfish. (See Section 6.1.6.c for more information on Benthics). This may impact benthic-  
126 feeding finfish populations such as winter flounder that use these areas as feeding grounds in the  
127 winter. However during the seasonal fisheries study at Site 104, Miller (1998) documented no  
128 winter flounder in or around Site 104 as a result of his sampling program. Atlantic croaker was the  
129 most abundant bottom feeding fish that was observed in the winter months at Site 104.

130  
131 While most fish experience reduced metabolism and reduced need for food in the winter, the loss of  
132 benthic organisms during placement years could result in fish moving to nearby unimpacted areas  
133 to feed and possible increased competition for benthic food resources in other areas. Placement is  
134 not projected to result in a long-term change [may want to adjust this sentence if the placement  
135 timeframe is 9 years] in the benthic community which currently exists at Site 104, as the site is  
136 expected to be re-colonized within 18 months after cessation of all placement activities based on  
137 studies conducted by the MDE (1998b). The temporary reduction in benthic populations will last  
138 for the [1- to 9-year placement duration]. These studies generally indicated rapid re-colonization  
139 by pioneer species and the eventual re-colonization by a climax benthic community. Some  
140 studies have indicated that the re-colonization by long-lived species takes much longer. This is  
141 not a factor in Site 104 because of the annual die-off of benthic organisms due to low oxygen  
142 conditions in the late spring and summer which limits long lived benthics at the site (Section  
143 6.1.6.c).  
144

145 Blue fish are voracious predators. They are sight feeders throughout the water column, with  
146 smaller individuals feeding on a wide variety of fishes and invertebrates and with large bluefish  
147 feeding almost exclusively on fishes, particularly menhaden, bay anchovies and Atlantic  
148 silversides. Impacts to bluefish prey are not anticipated because species such as bay anchovy,  
149 menhaden and Atlantic silversides are not found in depths that are characteristic of Site 104.  
150 They are more likely to occur in shallower waters in depths below 25 meters. ;MARK  
151 MENDELSON VERIFY THIS WITH CITE] Since these species are found in shallower waters  
152 their critical life stages are believed to be supported by habitat found within Site 104. In  
153 addition, Site 104 is not considered a unique or important source of plankton on which these  
154 species feed. [THIS PARAGRAPH NEED CITES FROM MARK MENDELSON]  
155

156 Fish habitat is anticipated to change from waters of a maximum depth of -23.8 meters (-78 feet)  
157 MLLW to waters of -13.7 meters (-45 feet) MLLW in Site 104. The impact of these changes is  
158 not anticipated to be significant, because the existing bathymetry in Site 104 does not provide a  
159 substantial amount of features considered important for fish habitat. Important habitats include:  
160 rocks or shell reefs that provide protection from predators and feeding areas; overwintering areas;  
161 shallow water areas that are used as nursery grounds for newly-hatched fish (generally, depths  
162 less than 1.8 meters (6 feet); and hard bottom substrates (used by some species for spawning). No  
163 fish habitat structures have been located by bathymetry surveys and side-scan sonar studies

164 [NEED TO VERIFY WITH MOST RECENT CORPS SURVEY] within Site 104. No fish  
165 habitat structures are expected to be impacted by the placement activities.

166  
167 Site 104 contains deep water habitat in the lower portion of the site. Deep water habitat is  
168 considered unique if it provides a warmer water habitat when compared to shallower surrounding  
169 waters. These warm habitats are considered important to fish because they provide a thermal  
170 refuge during the winter months (overwintering habitat). To evaluate the potential that the deep  
171 waters at Site 104 provide unique warm water habitat, two long term Chesapeake Bay  
172 Monitoring Program (CBMP) stations, MCB3.1 and MCB3.3C, were analyzed [(Figure 6-?, 6-  
173 ?)]. Station MCB3.1 is 41 feet deep and is located off of Fairlee Creek in the Upper Bay.  
174 Station MCB3.3C is 77 feet deep and is located in the southern end of Site 104. From 1990 to  
175 1998, winter surface water temperatures at the deeper CBMP station, MCB3.3C, ranged from 0.7  
176 to 6.2 °C and the bottom water temperatures ranged from 0.5 to 7.6 °C. The difference in  
177 temperatures in any given year ranged from +0.2 to +5 °C between the surface and bottom water  
178 at this deep-water station. In comparison, from 1990 to 1998, winter temperatures in the  
179 shallower CBMP station, MCB3.1, ranged from 0.7 to 5 °C and the bottom water temperatures  
180 ranged from 0.7 to 7.3 °C. The temperatures in any given year ranged from no difference in  
181 temperature to a difference of + 4.3 °C between the surface and bottom water at this shallow  
182 station. The long-term temperature differences observed between these sites in addition to the  
183 water quality monitoring performed by MDE does not indicate that the deep water in Site 104  
184 provides a unique thermal refuge for fish when compared to other surrounding waters in the Bay.  
185 It also doesn't indicate a unique thermal refuge in Site 104 when compared to the depths of  
186 waters expected in Site 104 after the proposed placement. [PLEASE NOTE THESE ARE  
187 PRELIMINARY FINDINGS. MES NEEDS TO QC & VERIFY THIS DATA AND RESULTS  
188 THEN DISCUSS WITH TOM MILLER (UMCES)].

189  
190 Finfish and sensitive spawning periods are not expected to be affected by elevated turbidity in  
191 the water column or by nutrient releases from the bottom sediments. Finfish in the Bay are  
192 generally used to and tolerant of turbid water quality. It is expected that finfish in the vicinity of  
193 Site 104 will leave the site during placement events. In addition, no placement will occur during  
194 spawning season. Turbidity levels at the site are expected to be elevated for approximately 20-30  
195 minutes during and after each placement event. [This effect would be more distributed in the  
196 water column for controlled bottom-release scow placement than for a pump-out barge, which  
197 would confine the material within a pipeline directed to the bottom, and place the material just  
198 above the bottom CENAB NEEDS TO DETERMINE PLACEMENT METHOD]. These  
199 intermittent increases in turbidity would last each year for the duration of the placement events.  
200 [The total duration would depend upon how long each placement action took. The recommended  
201 placement duration each year is six months. Therefore, intermittent periods of localized turbidity  
202 could occur during a six month placement period, but localized turbidity would not be  
203 continuously elevated at the site for a six month period CENAB NEEDS TO DETERMINE  
204 LENGTH OF PLACEMENT WINDOW]. It is expected that demersal (bottom dwelling)  
205 species would potentially be more impacted by placement activities than pelagic (water column)  
206 species.

207  
208 After April, we expect negligible ~~N~~nutrient concentrations when compared to background  
209 conditions. ~~R~~Nutrient releases that could potentially occur ~~post-placement~~during this period are

210 not expected to impact sensitive lifestages or spawning activities because nutrient releases during  
211 spawning periods (after April) are expected to be very small ~~due because of~~ low water  
212 temperatures.

213  
214 In the long-term, finfish communities in the Site 104 area may be positively impacted as a result  
215 of placement activities. The depth change at the site ~~will~~ may slightly improve water quality and  
216 change the water column dynamics from a deep water area (78 feet) to a mid-depth water area  
217 (approximately 45 feet in the southern portion of the site). ~~As a result, although not modeled,~~  
218 ~~primary productivity in the immediate vicinity could increase, thus fueling the bottom of the food~~  
219 ~~chain (at a localized level).~~ Generally, shallow water areas are considered to be more valuable  
220 and productive habitat for aquatic organisms. Directly after placement there may be a lack of  
221 benthic food resources for finfish. After the benthic communities begin to re-establish and could  
222 be subject to more intermittent and less severe seasonal hypoxia, ~~however,~~ the communities may  
223 actually be more prolific and provide more abundant food resources for bottom-feeding fish than  
224 pre-placement, ~~if the duration and extent of anoxia is reduced.~~ Thus, in the long-term, there is a  
225 potential it is possible that placement activities at Site 104 will could actually contribute to  
226 enhanced the fish habitat and food resources in the immediate vicinity of the Site.

### 227 228 **Potential Impacts to Shellfish**

229  
230 Oysters are not known to occur within Site 104. The closest oyster bar that has been harvested in  
231 recent years is the Broad Creek Bar which is located at the southeastern side of Site 104 (Scott  
232 1998). Broad Creek is adjacent to the proposed placement area. No impacts are anticipated for  
233 this bar because it is outside of the placement area in shallower depths (between 8 and 25 feet),  
234 and models have predicted that sediment transport will be predominantly to the north and along  
235 the bottom in deeper water (Section 6.1.3.gi). Using monitoring from open water placement  
236 areas including monitoring of Site 104 and the Pooles Island Area (MES 1991-1997, MDNR  
237 197) it is also expected that any sediment transport would be restricted to areas close to the  
238 placement area and impacts to the Broad Creek and the Love Point bar (north of Site 104) are not  
239 expected.

240  
241 Peak densities of softshell clams along the eastern shore of the Chesapeake are found from the  
242 Eastern Bay to Pocomoke Sound, particularly at depths of less than 5.2 meters (17 feet) along the  
243 shoreline (Baker and Mann 1991). The proposed placement activity is not expected to adversely  
244 effect softshell clam densities because the minimum depth at Site 104 is -12.8 meters (-42 feet)  
245 and any potential sediment transport would be restricted to areas close to the placement area.

246  
247 Blue crabs utilize nearly every habitat type in the Bay during some stage of their lifecycle.  
248 During the fall, female crabs begin their migration to the lower Bay and adult males migrate to  
249 deeper waters from the Bay tributaries to overwinter. Although the Chesapeake Bay Winter  
250 Dredge Surveys performed by MDNR have found overwintering males in Site 104 boundaries  
251 during the proposed placement window, the survey indicates that hibernating blue crab densities  
252 are generally lower in areas greater than -12.2 meters (-40 feet) ~~(Alexi Sharov MDNR 1998).~~  
253 The blue crabs present in water greater than -12.8 meters (-45 feet) MLLW within the portion of  
254 Site 104 where placement would occur, would likely be covered by material. The impact to crab  
255 densities should be minimal since the densities are lower at these greater depths and it is

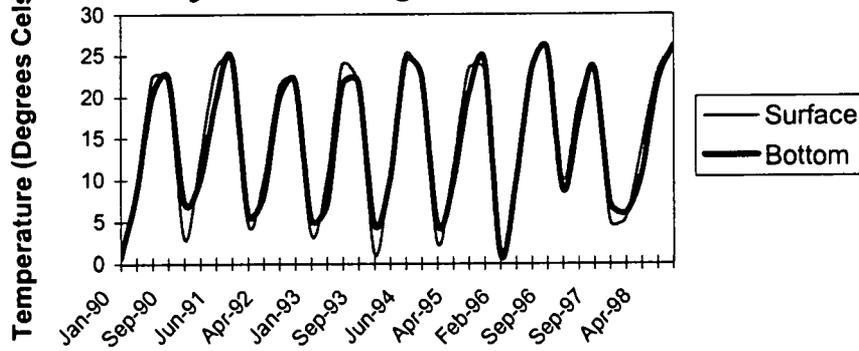
256 primarily the male crab that would be impacted. Also, estimates of crab densities at the site  
257 indicate that Site 104 has low crab densities ( $59.9/1000\text{-m}^2$ ) relative to other areas of the upper  
258 Bay ( $88.95/1000\text{-m}^2$ ) and the average for Maryland portions of the Bay ( $101.10/1000\text{-m}^2$ ) [MES  
259 will need to update this with information from Glen Davis]. Impact to populations and migratory  
260 patterns of the blue crab, therefore, is not anticipated because female migration to the lower Bay  
261 will be completed before the placement activities begin each year, and females will migrate north  
262 to lower salinities after placement activities cease each year.

263  
264 In summary, it is expected that the proposed dredged material placement at Site 104 would have  
265 a short-term negative effect on the ~~shellfish~~ benthic community. There is a potential for and a  
266 long term positive effect on the quality of habitat as a result of placement if the benthic habitat is  
267 subject to more intermittent and less severe seasonal hypoxia duration. There is no impact  
268 expected to shellfish. Overall, ~~These~~ results would be consistent with observations made in  
269 conjunction with the placement of dredged material in the Pooles Island open-water placement  
270 sites and past monitoring at Site 104.

271  
272

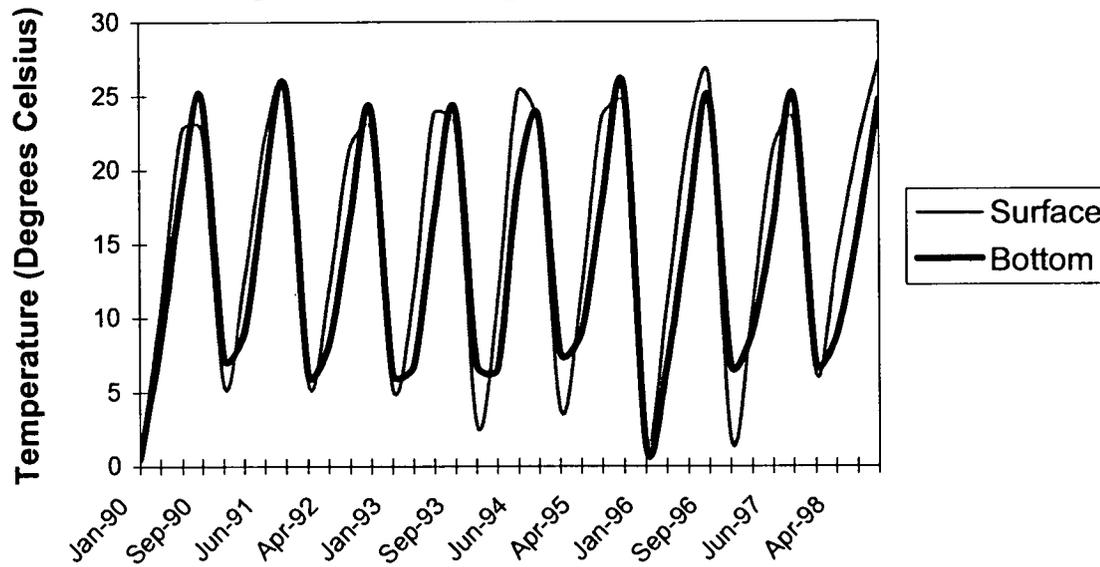
Temp Chart

Figure 6-?. Temperature from Water Quality Monitoring Station MCB3.1



Temp Chart

**Figure 6-?. Temperature from Water Quality Monitoring Station MCB3.3C**



1 **6.1.6 Aquatic Resources**

2  
3 **6.1.6.a Plankton.** In the short term, increases in turbidity associated with dredged material  
4 placement by controlled bottom release scow could suppress light penetration into the water  
5 column and, therefore, locally depress the phytoplankton community. The proposed placement  
6 schedule (mid-October through mid-April) should minimize potential effects on the  
7 phytoplankton population because the primary phytoplankton productivity is already depressed  
8 due to the decreased daylight and temperatures. Turbidity associated with dredged material  
9 placement by hydraulic pump-out placement is not expected to have short term or long term  
10 effects on the phytoplankton population because there would be no turbidity occurring in the  
11 photic zone. —

12  
13 For mechanical placement by bottom release scow, there will be some direct mortality to  
14 phytoplankton and zooplankton as the result of entrainment in the turbidity plume during  
15 placement events. This mortality is not expected to significantly impact or be detrimental to  
16 local phytoplankton or zooplankton populations.

17  
18 Effects from enhanced nutrient release were modeled. Under a worst case scenario of complete  
19 mixing and release of nutrients at the time of placement, a slight stimulatory effect on spring  
20 algal concentrations was observed, but this effect did not continue into the summer. Under a  
21 scenario of no mixing with releases in the next summer after placement, no impacts on  
22 phytoplankton populations were projected.

23  
24 Overall, the short term effects on the phytoplankton are, expected to be negligible. As a result,  
25 zooplankton communities that are dependent on phytoplankton densities are not expected to be  
26 limited by food availability. Effects on photosensitive zooplankton species due to localized light  
27 penetration are expected to be short lived due to current exchanges and rapid settling of most of  
28 the materials. Short term impacts to zooplankton would be temporarily significant; however, no  
29 medium or long term impacts are expected. Temporary significant impacts would include  
30 inability to forage and potential loss of organisms in the water column that are entrained in the  
31 turbidity plume. It is important to note that Site 104 is within the southern portion of the  
32 turbidity maximum area and therefore already experiences significant turbidity events from  
33 discharge from the Susquehanna and other nearby river systems. Long term impacts to  
34 phytoplankton productivity due to nutrient releases are also expected to be negligible. Although  
35 nutrient concentrations at the site will be slightly elevated throughout the 1- to 9 year placement  
36 period, effects to phytoplankton communities, although not modeled, are not expected to be  
37 significant. Seasonal placement is also expected to be planned for seasons of the year when  
38 phytoplankton activity and zooplankton populations are depressed, thus, minimizing any impact  
39 to larger populations that would occur during the warmer months.

40  
41 **6.1.6.b Fisheries:**

42  
43 **Potential Impacts to Finfish**

44  
45 Adverse impacts to the resident finfish communities will be short term and minimal. Due to  
46 their mobility, finfish are affected by placement operations much less than benthic

47 macroinvertebrates. However, larval and juvenile life stages are less mobile than adults are. As  
48 such, placement operations should be avoided during peak reproductive periods. Table 6-6  
49 shows critical life stages of target species and harvest seasons overlaid with the placement  
50 operations window. Critical life stages of target species were chosen based on spawning, larval  
51 and juvenile development intervals. Habitat requirements of these target species were outlined  
52 and discussed in Section 5.1.6.b. The dredged material placement window shown in Table 6-6  
53 avoids significant impacts to commercially and recreationally valuable fish species during their  
54 critical life stages. In addition, most commercial and recreational fishing effort takes place north  
55 of the "RWLP" buoy (Figure 2-1) and along the shallows east of Site 104. The hatched bars in  
56 Table 6-6 indicate that the habitat necessary for the critical life stages development takes place  
57 outside of Site 104. Table 6-6 also shows recreational and commercial fishery seasons overlaid  
58 with the recommended dredging operations window for Site 104.

59  
60 More mobile members of the pelagic (e.g., menhaden, striped bass) and demersal fish  
61 community (e.g., flounders, oyster toadfish) are expected to move out of or generally avoid the  
62 area during placement. The fishes most affected would be the smaller, less mobile resident  
63 species and young fish that may utilize the area for staging between nursery areas and  
64 overwintering areas. Increased turbidity may cause migrating fish to alter their course to avoid  
65 the plume.

66  
67 Two species of fish, striped bass and white perch, support an extensive fishery in Maryland and  
68 are known to inhabit the waters of Site 104 (Section 5.1.6.b). The proposed placement is not  
69 expected to significantly impact the striped bass population because Site 104 does not support  
70 conditions necessary for critical life stages. The proposed placement is also not expected to  
71 negatively impact the white perch population because spawning takes place in tributaries and  
72 along shorelines. In addition, the existing abiotic water quality conditions (e.g., salinity ranges)  
73 at Site 104 are not suitable for the development of eggs and larvae. Overall, placement is not  
74 expected to negatively effect the striped bass and white perch commercial and recreational  
75 fishing industry because most fishing effort takes place north of the "RWLP" buoy.

76  
77 No impact is anticipated for alewife, American shad, weakfish, hickory shad, white perch and  
78 yellow perch because spawning and early life stages occur outside of the Site 104 area in  
79 tributaries of the Bay. The critical life stages of winter flounder are also not anticipated to be  
80 impacted because spawning takes place in shallow water during the winter. Known winter  
81 flounder spawning areas include the Patuxent, Sassafus and Chester Rivers.

82  
83 Potential impacts to shortnose sturgeon, a federally endangered species, are not known at this  
84 time. However, use of Site 104 should not impact spawning activities since spawning would  
85 occur in the tributaries. An interim Biological Assessment will integrate information collected  
86 from the two year sturgeon monitoring program and will assess potential placement impacts.  
87 The proposed project cannot proceed unless NMFS decides that the interim Biological  
88 Assessment provides sufficient data to issue an opinion on the potential impacts of open water  
89 placement on shortnose sturgeon, prior to the completion of the 2 year study being conducted by  
90 the Baltimore and Philadelphia Districts (Section 5.1.8).

91

92 The burial of benthic macroinvertebrates (further discussed in Section 6.1.6.e Impacts to  
93 Benthics) temporarily reduces the size of the benthic population available for consumption by  
94 finfish. (See Section 6.1.6.e for more information on Benthics). This may impact benthic-  
95 feeding finfish populations that use these areas as feeding grounds in the winter. Atlantic croaker  
96 was the most abundant bottom feeding fish that was observed in the winter months at Site 104.

97  
98 While most fish experience reduced metabolism and reduced need for food in the winter, the loss of  
99 benthic organisms during placement years could result in fish moving to nearby unimpacted areas to  
100 feed and possible increased competition for benthic food resources in other areas. Placement is not  
101 projected to result in a long-term change in the benthic community which currently exists at Site  
102 104, as the site is expected to be re-colonized within 18 months after cessation of all placement  
103 activities based on studies conducted by the MDE (1998b). The temporary reduction in benthic  
104 populations will last for the 1 to 9 year placement duration. These studies generally indicated  
105 rapid re-colonization by pioneer species and the eventual re-colonization by a climax benthic  
106 community. Some studies have indicated that the re-colonization by long-lived species takes  
107 much longer. This is not a factor in Site 104 because of the annual die-off of benthic organisms  
108 due to low oxygen conditions in the late spring and summer which limits long-lived benthics at  
109 the site (Section 6.1.6.e).

110  
111 Fish habitat is anticipated to change from waters of a maximum depth of 23.8 meters (78 feet)  
112 MLLW to waters of 13.7 meters (45 feet) MLLW in Site 104. The impact of these changes is  
113 not anticipated to be significant, because the existing bathymetry in Site 104 does not provide a  
114 substantial amount of features considered important for fish habitat. Important habitats include:  
115 rocks or shell reefs that provide protection from predators and feeding areas; overwintering  
116 areas; shallow water areas that are used as nursery grounds for newly hatched fish (generally,  
117 depths less than 1.8 meters (6 feet); and hard bottom substrates (used by some species for  
118 spawning). No fish habitat structures have been located by bathymetry surveys and side scan  
119 sonar studies within Site 104. No fish habitat structures are expected to be impacted by the  
120 placement activities.

121  
122 Finfish and sensitive spawning periods are not expected to be affected by elevated turbidity in  
123 the water column or by nutrient releases from the bottom sediments. Finfish in the Bay are  
124 generally used to and tolerant of turbid water quality. It is expected that finfish in the vicinity of  
125 Site 104 will leave the site during placement events. In addition, no placement will occur during  
126 spawning season. Turbidity levels at the site are expected to be elevated for approximately 20-  
127 30 minutes during and after each placement event. This effect would be more distributed in the  
128 water column for controlled bottom release scow placement than for a pump-out barge, which  
129 would confine the material within a pipeline directed to the bottom, and place the material just  
130 above the bottom. These intermittent increases in turbidity would last each year for the duration  
131 of the placement events. The total duration would depend upon how long each placement action  
132 took. The recommended placement duration each year is six months. Therefore, intermittent  
133 periods of localized turbidity could occur during a six-month placement period, but localized  
134 turbidity would not be continuously elevated at the site for a six-month period. It is expected that  
135 demersal (bottom dwelling) species would potentially be more impacted by placement activities  
136 than pelagic (water column) species.

138 Nutrient releases that could potentially occur post-placement are not expected to impact sensitive  
139 lifestages or spawning activities because nutrient releases during spawning periods are expected  
140 to be very small due to low water temperatures.

141  
142 In the long term, finfish communities in the Site 104 area may be positively impacted as a result  
143 of placement activities. The depth change at the site will improve water quality and change the  
144 water column dynamics from a deep water area to a mid-depth water area. As a result, although  
145 not modeled, primary productivity in the immediate vicinity could increase, thus fueling the  
146 bottom of the food chain (at a localized level). Generally, shallow water areas are considered to  
147 be more valuable and productive habitat for aquatic organisms. Directly after placement there  
148 may be a lack of benthic food resources for finfish. After the benthic communities begin to re-  
149 establish, however, the communities may actually be more prolific and provide more abundant  
150 food resources for bottom-feeding fish than pre-placement, if the duration and extent of anoxia is  
151 reduced. Thus, in the long term, it is possible that placement activities at Site 104 will actually  
152 enhance the fish habitat and food resources in the immediate vicinity of the Site.

### 153 154 **Potential Impacts to Shellfish**

155  
156 Oysters are not known to occur within Site 104. The closest oyster bar that has been harvested in  
157 recent years is the Broad Creek Bar which is located at the southeastern side of Site 104 (Scott  
158 1998). Broad Creek is adjacent to the proposed placement area. No impacts are anticipated for  
159 this bar because it is outside of the placement area, and models have predicted that sediment  
160 transport will be predominantly to the north (Section 6.1.3.g).

161  
162 Peak densities of softshell clams along the eastern shore of the Chesapeake are found from the  
163 Eastern Bay to Pocomoke Sound, particularly at depths of less than 5.2 meters (17 feet) along the  
164 shoreline (Baker and Mann 1991). The proposed placement activity is not expected to adversely  
165 effect softshell clam densities because the minimum depth at Site 104 is 12.8 meters (42 feet).

166  
167 Blue crabs utilize nearly every habitat type in the Bay during some stage of their lifecycle.  
168 During the fall, female crabs begin their migration to the lower Bay and adult males migrate to  
169 deeper waters from the Bay tributaries to overwinter. Although the Chesapeake Bay Winter  
170 Dredge Surveys performed by MDNR have found overwintering males in Site 104 boundaries  
171 during the proposed placement window, the survey indicates that hibernating blue crab densities  
172 are generally lower in areas greater than 12.2 meters (40 feet) (Alexi Sharov MDNR 1998).  
173 The blue crabs present in water greater than 12.8 meters (45 feet) MLLW within the portion of  
174 Site 104 where placement would occur, would likely be covered by material. The impact to crab  
175 densities should be minimal since the densities are lower at these greater depths and it is  
176 primarily the male crab that would be impacted. Also, estimates of crab densities at the site  
177 indicate that Site 104 has low crab densities ( $59.9/1000\text{ m}^2$ ) relative to other areas of the upper  
178 Bay ( $88.95/1000\text{ m}^2$ ) and the average for Maryland portions of the Bay ( $101.10/1000\text{ m}^2$ ).  
179 Impact to populations and migratory patterns of the blue crab, therefore, is not anticipated  
180 because female migration to the lower Bay will be completed before the placement activities  
181 begin each year, and females will migrate north to lower salinities after placement activities  
182 cease each year.

183

184 In summary, it is expected that the proposed dredged material placement at Site 104 would have  
185 a short-term negative effect on the shellfish community and a long-term positive effect. These  
186 results would be consistent with observations made in conjunction with the placement of dredged  
187 material in the Pooles Island open-water placement sites.  
188

189 **6.1.6.c Benthic Community.** The upper Bay is considered a naturally unstable environment with  
190 a benthic community dominated by opportunistic species (refer to Section 5.1.6.c). This  
191 environment is considered unstable due to the fluctuating salinity, seasonal anoxia in deep-water  
192 areas, and periods of high turbidity during high inflows from the Susquehanna. Proposed  
193 dredged material placement would permanently raise the bottom in this area to -13.7 meters (-45  
194 feet) from the current elevations, which range from -12.8 meters (-42 feet) to 23.8 meters (-78  
195 feet). This is not projected to result in a long-term change in the benthic community that  
196 currently exists at Site 104. Mortality due to placement is considered a significant, but  
197 temporary short-term impact in an already unstable environment. The site is expected to be  
198 recolonized within 18 months after cessation of all placement events, based on studies conducted  
199 by MDE and others (e.g., Cronin 1970; Gross *et al.* 1976). Recolonization occurs both through  
200 in-place survival of a portion of the populations, and by an influx of individuals from adjacent  
201 unaffected areas. A key component of the temporary nature of the projected impacts is that the  
202 dredged material composition is similar to the existing substrate composition allowing for rapid  
203 recolonization of similar species (Cronin *et al.* 1970). The substrate in Site 104 is predominantly  
204 a silty clay composition similar to the upper Bay. The material dredged from the channels would  
205 have a similar composition because it is from shoaling of sediment that is flushed into the upper  
206 Bay from the Susquehanna River and shoreline erosion.  
207

208 Research has shown that benthic communities in dredged material placement areas are  
209 completely disrupted during and immediately after placement, but that they are recolonized  
210 within ~~twelve~~ 12 to ~~eighteen~~ 18 months after the end of placement (Ruddy 1990; Cronin *et al.*  
211 1970; MDE *et al.* 1996). Research by Cronin *et al.* (1970) indicated that immediately after  
212 placement, there was a 71% decrease in the average number of individuals per sample within a  
213 dredged material placement area and an 11% increase in stations outside the placement area.  
214 The increase in stations outside the placement area was partially attributed to hydrologic pushing  
215 or migration of individuals out of the placement area during or after placement. The increase in  
216 the number of individuals outside of the area may have also contributed to the rapid  
217 recolonization of the area as the opportunistic benthic macroinvertebrates typical to the upper  
218 Bay rapidly reproduced or relocated in response to the decrease in abundance. Long-lived  
219 species such as bivalves are slower to recolonize. In addition to this research, Cronin *et al.*  
220 (1970) recommended that placement occur from late fall to early spring to avoid the period of  
221 high species diversity and organism distribution and, thereby, cause the least amount of impact to  
222 the benthic community. The proposed dredged material placement window for Site 104 would  
223 be from 15 October and 15 April each dredging year.  
224.

225 Overall, the benthic communities at the site will return to pre-placement conditions after all  
226 placement activities cease. Some partial recolonization is expected to occur after each placement  
227 event. However, these communities are expected to die off by naturally-occurring summer  
228 anoxia events that are likely to occur between yearly placement windows. Thus, benthic  
229 production will be repressed in the area throughout the 1- to 9-year placement period.

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As discussed in Section 5.1.6.c, the low mesohaline mud substrate portions of the Bay are considered areas that have high macroinvertebrate productivity when compared to areas further south. Therefore, temporary impacts to the benthic community from placement during a period of low species diversity and organism distribution would not have a long-term impact on an area that already has high macroinvertebrate productivity. In support of this concept, Cronin *et al.* (1970) observed no gross effect of dredged material placement on phytoplankton primary productivity, zooplankton, fish eggs and larvae, and fish immediately after placement, all of which are populations that would have been directly affected by changes in the benthic community.

Benthic assemblage studies in Pooles Island areas G-Central, D, E and F (see Figure 1-2), after dredged material placement of similar volumes and types proposed for Site 104, indicated that the benthic assemblages recover from localized placement effects within ~~nine-9~~ to ~~eleven-11~~ months after placement (Ranasinghe and Richkus 1993). Versar (1994) found a more rapid recovery in the aforementioned areas as well as in G-South than in Areas G-West, A and B. The lack of immediate recovery in G-West has been attributed to the continuous placement of dredged material annually and the lack of sufficient time (~~twelve-12~~ to ~~eighteen-18~~ months post-placement) without placement activities occurring for the area to recover (MES 1997—a, b, or c?). Some repopulation of the benthic population at Site 104 would be expected to occur from areas inside the site not utilized for placement operations during a given year, even under the projected placement schedule at Site 104 which calls for placement on an annual basis. Versar (1994) also found that areas of bottom-release scow placement of dredged material had lower species diversity and lower total abundance in the first ~~eight-8~~ months post-placement than hydraulic placement areas. While exact reasons for this are unknown, it has been speculated that the increased density of bottom-release scow material results in longer periods before recolonization, compared to the less dense hydraulically placed material. Hydraulically placed material can also be placed in thinner lifts. These thinner lifts may allow some benthic organisms an opportunity to move up and out of the dredged material, rather than experiencing mortality through burial.

MDE (1996d) conducted a study at G-South prior to 1996/1997 placement activities to verify the recovery of the resident benthic community subsequent to earlier placement of dredged material in 1993. The results of the study suggested that the benthic community at the G-South site was healthy and met the Chesapeake Bay Benthic Restoration Goals and the Chesapeake Bay Benthic Index of Biotic Integrity. Scores of three or greater were considered as meeting the Chesapeake Bay restoration goal. The benthic community in G-South met or exceeded RGI and B-IBI goals for the upper Chesapeake Bay within approximately 3-years post-placement and there was no notable difference between the sampling stations and reference station.

Although there will be short-term, localized adverse impacts to the benthic communities at Site 104, in the long-term, benthic communities in the site may be positively impacted as a result of placement activities. The depth change at the site will improve water quality and change the water column dynamics from a deep-water area to a mid-depth-water area. Generally, shallower water areas are considered to be more valuable and productive habitat for aquatic organisms. In addition, the extent and duration of seasonal hypoxia and anoxia is expected to be

276 reduced in the area after placement occurs. This will provide the benthic communities a longer  
277 growing season. The improved sediment quality, created by covering the existing contaminated  
278 sediment, will also enhance the benthic environment. -The changes in depth, water quality, and  
279 sediment quality will provide a long-term positive effect on the local benthic communities.  
280

281 In summation, it is expected that, as has been seen in other dredged material placement areas,  
282 placement in Site 104 would have a short-term, near-field effect on the benthic community. This  
283 is not expected to significantly impact the benthic community or their predators due to the  
284 existing annual benthic die off during the seasonal anoxia in the bottom waters. The benthic  
285 community is expected to remain of poor quality when compared to Chesapeake Bay restoration  
286 goals, but would be expected to recover to pre-placement conditions within ~~twelve-12~~ to ~~eighteen~~  
287 18 months after all placement was completed. In addition, the improved water quality and  
288 sediment quality at the site post-placement will provide a more favorable environment for  
289 benthic productivity.  
290

1  
2  
3 **6.1.6.d Submerged Aquatic Vegetation (SAV).** SAV is not generally viable in the Chesapeake  
4 Bay at depths greater than 2 meters (6.6 feet) due to natural light limitations (Hurley 1990;  
5 Batiuk *et al.* 1992). The existing depths at Site 104 range between -12.8 meters (-42 feet) and -  
6 23.2 meters (-78 feet) MLLW and therefore, do not support SAV. It is proposed that placement  
7 occur in the site up to -13.7 meters (-45 feet) MLLW. At this proposed elevation the site would  
8 still not support SAV, due to lack of light.  
9

10 Although there are no SAV beds in Site 104, the following SAV issues were considered: (1)  
11 proximity of the proposed placement action to historically documented SAV beds, (2) resulting  
12 turbidity plumes from placement activities that may adversely effect SAV in the area, and (3)  
13 timing of the placement action in relation to SAV critical life stages. Potential impacts  
14 associated with the proposed placement of dredged material at Site 104 have been considered  
15 according to the *Guidance for Protecting Submerged Aquatic Vegetation in Chesapeake Bay*  
16 *from Physical Disruption* (CBP 1995), and are discussed below.  
17

18 The Chesapeake Bay Program's (CBP's) suggested undisturbed buffer width around SAV beds  
19 is 500 yards (CBP 1995). There are no documented SAV beds within the 500 yard buffer (Orth  
20 1996). The closest potential SAV habitat is the shallow water on the western shore of Kent  
21 Island. Although most of these potential habitat areas are greater than 500 yards away from Site  
22 104, ~~there are some~~ are some potential habitats ~~potential habitat areas~~ within this suggested  
23 buffer area. However, the shallow waters west of Kent Island are quite exposed and unsuitable  
24 for SAV growth (Orth 1994). In addition, there is no historical documentation of SAV growth  
25 on the shoals of the western shore of Kent Island (field surveys - Orth 1994).  
26

27 Three One ephemeral SAV beds ~~were~~ was identified within 2.5 miles of Site 104 in the past few  
28 years. This includes 1 bed in Goose Pond (2.5 nautical miles southwest of Site 104 in 1996) and  
29 two beds approximately 1 mile southeast of Site 104 (just above and below the Bay Bridge in  
30 1997). None of the three ephemeral beds were observed before or after their respective siting in  
31 1996 or 1997 (Orth 1996, 1997), near the Bay Bridge in 1997 but was not found before or since.  
32 ~~The proposed action is not anticipated to impact the potential SAV habitat areas along the~~  
33 ~~western shoreline of Kent Island. The nearest significant SAV beds to Site 104 are over 4 miles~~  
34 away along the southern shoreline of the Magothy River (Deep Creek mouth) and along the  
35 northern shoreline of the Chester River mouth (between Eastern Neck and Eastern Neck Island)  
36 (Orth 1997).  
37

38 The proposed action is not anticipated to impact the potential SAV habitat areas or existing beds.  
39 ~~closest SAV habitat on the western shore of the Bay is located near the mouth of the Little~~  
40 ~~Magothy River approximately four miles west of the site (VIMS and USGS 1998). The closest~~  
41 ~~SAV is southeast of the site in Goose Pond (north Hackett Point). This area is enclosed and~~  
42 ~~isolated from the site of the proposed action. Measurements and modeling of the currents~~  
43 ~~flowing through Site 104 (See sSections 5.1.3 and 6.1.3) indicate that the currents run in a~~  
44 ~~predominately north-south pattern with a net movement to the north. Therefore, if a turbidity~~  
45 ~~plume was created during placement activities, it is expected to dissipate very quickly and it~~  
46 ~~should not effect potential SAV habitat to the east, the ephemeral beds to the southeast or~~

47 southwest, or the existing beds in the Magothy and Chester River areas. located to the east of the  
48 site. Any sediment transport is also expected to occur near the bottom of the placement area in  
49 deeper waters, not in the shallow, near-shore waters where SAV are located. Several small SAV  
50 beds exist in shallow waters near the mouth of the Chester River (VIMS and USGS 1998)  
51 (approximately 5 miles away). These beds, however, are not expected to be impacted by  
52 placement activities because they are in shallow, near shore waters. In addition, dredging  
53 activities will take place during typical dormant periods for SAV.  
54  
55

1 **6.1.7 Avian/Terrestrial Resources**

2  
3 **6.1.7.a Terrestrial Resources.** Site 104 is an open-water placement area located 1.6 km (1 mile)  
4 from the Kent Island shoreline. There are no terrestrial resources within the project area;  
5 therefore there are no impacts to terrestrial resources within the project area.

6  
7 **6.1.7.b Avian Resources.** There are three categories of avian resources that could potentially  
8 occur within the Site 104 open-water placement area; these are raptor species, waterfowl and  
9 seabirds.

10  
11 Raptor species common to the Bay region include bald eagle (*Haliaeetus leucocephalus*) and  
12 osprey (*Pandion haliaetus*). Coordination with MDNR was conducted regarding potential raptor  
13 species within the vicinity of Site 104. MDNR stated that no raptor species are known to utilize  
14 Site 104 (Glenn-Therres 1997). Both Bald eagle and Peregrine falcons (*Falco peregrinus*)  
15 have been identified in the upper Bay region. Peregrine falcons, raptors that are not common to  
16 the Bay region, nest on the mainspan of the Bay Bridge. These birds do not, however, utilize Site  
17 104 as a primary feeding area, and their use of the area for feeding habitat is characterized as  
18 intermittent (Glenn-Therres 1997). In addition, there is abundant comparable habitat within the  
19 region. There are no expected impacts to the peregrine falcons residing on the Chesapeake Bay  
20 Bridge or to other raptor species common to the Chesapeake Bay region.

21  
22 There are numerous waterfowl species common to the Chesapeake Bay region including wood  
23 duck (*Aix sponsa*), American black duck (*Anas rubripes*), canvasback (*Aythya valisineria*), lesser  
24 scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala*  
25 *clangula*) and redhead (*Aythya americana*). Waterfowl concentration studies that had been  
26 conducted in the Bay region by USFWS were used to determine if a significant waterfowl  
27 population was present in Site 104. The USFWS studies included limited surveys of the Site 104  
28 vicinity and indicated that majority of the waterfowl sightings were to the north and west of Site  
29 104 (Doug-Forsell 1997). Some waterfowl species such as canvasback and redhead feed on  
30 SAV. Based on the above studies and the fact that water depths are greater than those required to  
31 support SAV (see Sections 5.1.6.d and 6.1.6.d), it was determined that Site 104 does not appear  
32 to support a significant waterfowl population (Doug-Forsell 1997). Coordination was also  
33 completed with the Environmental Review Division of MDNR concerning the Historic  
34 Waterfowl Concentration Area in the vicinity of Site 104 [(MDNR, 1999; Annex C)]. This area  
35 extends westward from the Kent Island shoreline approximately 5,000 feet and northward from  
36 the westbound span of the Bay Bridge approximately 6,000 feet and included a buffer area.  
37 MDNR indicated that because the Concentration Area was outside the designated boundaries of  
38 Site 104, they did not anticipate any disturbance impacts from the proposed use of Site 104 to  
39 wintering waterfowl within the designated Concentration Area. Therefore, there are no expected  
40 impacts to waterfowl from the proposed project.

41  
42 Sea birds that are common to the Chesapeake Bay region include various species of terns, gulls,  
43 and sea ducks. Sea ducks are grouped separately from other ducks because of their preference  
44 for open bay and inshore coastal water habitation. Sea ducks observed by the USFWS in the Site  
45 104 vicinity include oldsquaw (*Clangula hyemalis*) and white-winged scoter (*Melanitta fusca*).  
46 Gulls that were observed by USFWS in the vicinity of Site 104 include the herring gull (*Larus*

47 *argentatus*), ring-billed gull (*Larus delawarensis*), black-backed gull (*Larus marinus*) and  
48 bonaparte's gull (*Larus philadelphia*). There were no terns observed by USFWS surveys in the  
49 vicinity of Site 104. Consultation with Mr. Forsell on 10 April ~~10~~, 1998 determined that Site  
50 104 does not appear to support a significant seabird population. Therefore there are no expected  
51 impacts to seabirds from the proposed project. The placement of dredged material is expected to  
52 attract scavengers such as herring gulls to the water surface as material is introduced into the  
53 water column. Thus the placement may provide a slight increase in feeding opportunities for  
54 gulls, but it is not expected to be significant.

55  
56

1 **6.1.8 Rare, Threatened, and Endangered (RTE) Species**

2  
3 Coordination with USFWS and MDNR has verified that, other shortnose sturgeon (SNS) and  
4 transient individuals, no threatened or endangered species under their jurisdiction are  
5 documented as occurring in the proposed placement areas or relying on them for habitat needs  
6 (Rosenberg 1997a and b; Wolfin 1997; Slattery 1997; Attachment E).

7  
8 Few studies have been conducted on dredging and placement related impacts to SNS. However,  
9 potential impacts that could occur from dredging and placement include: (1) physical injury or  
10 death to sturgeon due to entrainment by a hydraulic pipeline or hopper dredges, (2) burial from  
11 dredged material placement, (3) injury to larvae or juveniles from dredging operations, (4) the  
12 disruption of migrations due to physical disturbances and noise, (5) the settling of suspended  
13 material on the spawning ground or foraging locations, and (6) if the material is contaminated,  
14 toxin uptake by sturgeon. It has been suggested by Hastings (1983) that dredging in some river  
15 systems produces a residual beneficial impact on sturgeon by creating or maintaining deeper  
16 channel regions which both juveniles and adults seem to prefer.

17  
18 Maintenance dredging of Federal navigation channels can adversely affect or jeopardize SNS  
19 populations. In particular, hydraulic dredges (e.g., hopper) can lethally harm sturgeon by  
20 sucking fish up through dredge dragarms and impeller pumps. In addition to the direct effects of  
21 dredging operations, SNS may potentially be impacted by the destruction of benthic feeding  
22 areas, disruption of spawning migrations, and deposition of resuspended fine sediments in  
23 spawning habitat as a result of dredge operations. Potential impacts from hydraulic dredge  
24 operations may be avoided by imposing work restrictions during sensitive time periods (i.e.,  
25 spawning, migration, feeding) when sturgeon are most vulnerable to mortalities from dredging  
26 activity. To avoid jeopardy to the critical life stages in other river systems from projects in the  
27 past, the NMFS has recommended that the USACE use alternative dredge types (i.e., clamshell,  
28 and hydraulic pipeline) and/or reschedule the project after sturgeon were likely to have moved  
29 away from the project area (USACE 1997).

30  
31 On January 26, 1999 a Biological Opinion (BO) was issued to the USACE by the NMFS  
32 concerning impacts to endangered shortnose sturgeon from maintenance dredging (Hopper  
33 Dredge) of the C&D Canal and the Northern Approach Channel to the C&D Canal in Maryland  
34 and Delaware. NMFS based their BO on the review of the available data from the USFWS  
35 sturgeon study in addition to the CENAP Break Out Biological Assessment. In this BO, the  
36 NMFS concluded that the project was not likely to jeopardize the continued existence of  
37 shortnose sturgeon that inhabit the project area in the Upper Chesapeake Bay. The NMFS  
38 authorized an incidental take allowance of three shortnose sturgeon for this project.

39  
40 Sturgeon eggs and larvae could potentially be subject to burial during bottom release scow or  
41 hydraulic placement actions. Since no sturgeon eggs or larvae have been found in the  
42 Chesapeake Bay including Site 104 in at least 20 years, impacts to sturgeon eggs and larvae from  
43 the placement of material at Site 104 is unlikely. [Larval data possibly inserted from UMCES].

44  
45 Spawning habitat could potentially be subject to burial during the settling of dredged material  
46 from placement actions. However, the time period for dredging and placement of material at Site  
47 104 and the salinity levels do not correlate with reported water temperatures (9-12 °C) and other

48 water quality parameters required for sturgeon spawning and larval development (Kynard 1997).  
49 The fine-grained sediment currently found at Site 104 in addition to what is proposed for  
50 placement from the Federal channels are not the type of sediments typically found used by  
51 sturgeon eggs or larvae historically. In addition, the NMFS (1999) stated that based on the  
52 distribution and timing of eapture data from the USFWS survey, it is likely that SNS spawn in  
53 the Potomac River and possibly, below the Conowingo Dam in the Susquehanna River. Based  
54 on these observations, impacts of siltation on spawning areas are unlikely because SNS spawning  
55 areas would be found much further upstream in freshwater areas.

56  
57 Another potential impact is burial of SNS under deposited material or displacement from  
58 overwintering habitats. However, according to the NMFS (1999), review of the most current  
59 information on SNS, overwintering habitat of SNS is likely to be between Howell and Grove  
60 Points. This overwintering habitat is approximately 25 nautical miles away from Site 104.  
61 Therefore, no impact from burial or displacement from overwintering habitat to the SNS is  
62 projected from proposed placement at Site 104.

63  
64 [Toxin uptake from SNS is not considered a potential impact because contaminant levels in  
65 channel sediments were not found to be present in levels that are expected to affect state water  
66 quality eriteria during the proposed action-EA TO VERIFY]. In addition, sediment quality  
67 investigations within Site 104 found one area of contaminated scdiments which could produce  
68 toxic effects to benthics organisms, this area would be covered during the proposed action. [EA  
69 may want to add a blurb from the most recent data analysis here].

70  
71 ~~Coordination with USFWS and MDNR has verified that, other than transient individuals, no~~  
72 ~~threatened or endangered species under their jurisdiction are documented as occurring in the~~  
73 ~~proposed placement areas or relying on them for habitat needs (Rosenberg 1997a and b, Wolfin~~  
74 ~~1997, Slattery 1997; Attachment E). Therefore, there will be no impact to threatened or~~  
75 ~~endangered species from the proposed dredged material placement in Site 104.~~

76 From review of the USFWS study results to date it is anticipated that the short and temporary  
77 nature of the placement operations would not have any impacts to larval, young-of-the year or  
78 juvenile sturgeon due to the location of Site 104 with respect to NMFS observation of habitat  
79 location.

80 ~~However, the USFWS and NMFS have stated that further coordination is necessary on the~~  
81 ~~shortnose sturgeon. Pper the request of NMFS (Rosenberg 1997; Attachment E), formal~~  
82 ~~consultation under Section 7 (e ) of the Endangered Species Act of 1973, as amended, has been~~  
83 ~~initiated by the Baltimore and Philadelphia Districts of the COE with the NMFS. Studies~~  
84 ~~conducted by USFWS for the Baltimore and Philadelphia Districts began in 1997. No shortnose~~  
85 ~~sturgeon have been reported in Site 104. To further ensure that the placement action will not~~  
86 ~~jeopardize or alter designated critical habitat for the shortnose sturgeon, Aa Biological~~  
87 ~~Assessment (BA) is currently underway, to address issues raised by NMFS such as ensuring that~~  
88 ~~the proposed placement action does not jeopardize or alter designated critical habitat for the~~  
89 ~~shortnose sturgeon. This BA will include the full results of the two year study currently being~~  
90 ~~conducted by the USFWS for the Baltimore and Philadelphia Districts. study is expected to be~~  
91 ~~completed by the year 2000. An-In the mcantime an interim BA will be submitted to NMFS at~~  
92 ~~the time of distribution of this DEIS. Preliminary assessment of SNS have indicated that most~~  
93 ~~specimens were genetically similar to the Delaware Bay population which is currently stable.~~

1 **6.1.9 Air Quality Impacts**  
2

3 The increase in air pollution emissions from proposed dredged material placement activities at  
4 Site 104 are expected to be small and temporary in nature and should not adversely effect air  
5 quality in the surrounding area. The increase would be from tugboats ~~boats~~ transporting scows  
6 to and from the site. The use of controlled hydraulic pipeline placement would increase air  
7 quality impacts further because hydraulic pump-out equipment would be stationed at Site 104  
8 during the entire dredging period. Dredged material placement activities will take place during  
9 the late fall and winter and, therefore, equipment emissions are not likely to contribute to high  
10 levels of ozone. Consultation with ~~the~~ MDE has confirmed that the proposed dredged material  
11 placement activities at Site 104 will be in compliance with the Maryland State Implementation  
12 Plan of the Clean Air Act (~~Diane~~ Franks 1997).  
13

14 **6.1.10 Noise**  
15

16 Sources of noise from the proposed action would include tugboats transporting scows to and  
17 from the site and hydraulic pumps if controlled bottom pipeline placement is used. The  
18 hydraulic pumping would likely cause the largest increase in local noise levels. Noise impacts  
19 associated with the placement of dredged material in Site 104 are expected to be insignificant  
20 due to the distance of the site from the surrounding shoreline (approximately 1.6 km ([1 mile])).  
21 Placement will occur during the winter months of the year. The lower temperatures generally  
22 make it necessary for residential doors and windows to be shut, further precluding any noise  
23 detection. Also, there are fewer recreational boaters at this time of year that will experience the  
24 increased noise levels associated with dredged material placement operations. Placement at Site  
25 104 will not increase vehicular traffic on the Bay Bridge, which is considered one of the primary  
26 contributors to the noise levels in the area. Communication with MDE verified that no noise  
27 related impacts are expected in the surrounding communities (~~Dave~~ Jarinko 1997). Furthermore,  
28 there are no known noise ordinances for which compliance is necessary that are applicable to the  
29 proposed placement activities (~~John~~ Nickerson 1997).  
30

31 **6.1.11 Hazardous, Toxic, and Radioactive Substances**  
32

33 The proposed project will not involve the use, storage, or transport of hazardous, toxic, or  
34 radioactive materials during or after placement. None of the originating locations for the  
35 material to be placed at Site 104 are listed as CERCLIS or NPL sites and therefore are not  
36 considered to be a potential source of hazardous, toxic, or radioactive substances. Placement of  
37 uncontaminated sediment at Site 104 would tend to further bury or cap any existing sediment  
38 which remains from the previous dredged material placement activities. Dredged material  
39 placement is specifically excluded from regulation under RCRA, because dredged material  
40 management regulations are authorized under the Clean Water Act and under the Marine  
41 Protection, Research, and Sanctuaries Act.  
42

43 **6.2 CULTURAL AND ARCHAEOLOGICAL RESOURCES**  
44

45 Dredged material placement at Site 104 is not expected to impact cultural or historic resources in  
46 the area. Coordination with the MHT was initiated in June 1997 (Banta 1997; Attachment E).

47 MHT stated that the site is considered to be a disturbed area as a result of previous dredged  
48 material placement. Therefore, it is "unlikely that placement of dredged material will affect  
49 historic properties" (Langley 1997; Attachment E). If any "unanticipated cultural resources" are  
50 discovered during the course of the proposed action or if there is any disturbance of the bottom,  
51 such as dredging, further coordination with the MHT will be conducted.  
52

1 **6.3 IMPACTS TO SOCIOECONOMIC RESOURCES**

2  
3 Impacts on the socioeconomic resources directly associated with use of Site 104 for the open-  
4 water placement of dredged material will depend, in part, on the ~~manner~~ placement method and  
5 timing of placement. Impacts ~~are~~ would also be related to the employment of commercial users  
6 of Site 104 resources, accessibility of the site for placement, effects on income-producing aquatic  
7 organisms in and near the project area, and public perception of the health and safety of  
8 harvestable resources within and in proximity to the affected environment.

9  
10 Under the proposed project design, water depths in Site 104 would be reduced and the bottom  
11 leveled. [VERIFY AFTER FINAL DECISION ON SMOOTHING AND RELIEF.] The extent  
12 to which the change in bottom elevation and placement activities would affect socioeconomic  
13 resources is evaluated in the following paragraphs.

14  
15 The potential for employment of area residents and commercial fishermen is unlikely to change  
16 significantly, because the scope of dredging and placement activity associated with use of Site  
17 104 will be confined to the portion of the site which is not currently used by commercial  
18 fishermen. The contour of 13.7 meters (45 feet) was also deliberately chosen so as not to have  
19 an impact to ~~commercial~~ shipping vessels in transit to and from the C&D Canal approach  
20 channels which require a 45-ft depth for navigation. In addition, placement operations are not  
21 anticipated to impede the navigation of ~~commercial~~ fishing vessels because they currently utilize  
22 the northern portion of the site where placement will not occur. [VERIFY AFTER CORPS  
23 COORD W/ REC FISHERS] Use of Site 104 for placement activities will have no significant  
24 impact on minority or low income populations. If minority or low income watermen find fewer  
25 commercial fishing gear conflicts after the completion of bottom conditioning at the site, gear  
26 maintenance cost will decrease, producing a net increase in income. However, it is not known at  
27 this time the extent of contouring that will occur and if snags can be eliminated. [VERIFY  
28 AFTER FINAL DEICISION ON SMOTHING AND RELIEF]

29  
30 The schedule of use for Site 104 is an important consideration in determining socioeconomic  
31 impacts to the project area and the region. Barge traffic, dredging activities, and operational  
32 access would potentially have an impact on watermen fishing in and in proximity to Site 104 and  
33 recreational boaters transiting the site. In particular, representatives of the Maryland Watermen's  
34 Association (MWA) and members of the Site 104 Public Outreach Committee have identified a  
35 potential for gear conflicts because of tugs and barges transiting to and from the placement site  
36 and have requested appropriate routing and monitoring arrangements if the site is used. In order  
37 to minimize impacts, ~~T~~ugboat routes will be designated, marked as necessary, and monitored to  
38 ensure dredged material placement vessel access to the site through designated routes only.

39  
40 Charter boat and sportfishing activities in proximity to the site could potentially be affected by  
41 placement activities. Barge traffic and vessels associated with placement activities could  
42 interfere with normal fishing boat transit and operations. In addition, fish are likely to avoid  
43 areas of high activity and turbidity. Fishing effort in the general area, however, is has been  
44 reported as most intense during the summer months when the weather is suitable for smaller  
45 vessels ~~and when fish abundance is generally higher~~. Therefore, placement activities at Site 104  
46 will be designed and timed to avoid potentially negative impacts to living resources, shipping.

47 commercial and recreational fishing activity, and recreational boating. These potential impacts  
48 are described in the following sections.

### 49 6.3.1 Scope of the Project

50 The project placement schedule is an important determinant when considering socioeconomic  
51 impacts to the project area and region. Barge traffic and placement activities could potentially  
52 affect commercial and recreational activities in the project area, even with coordination and  
53 appropriate routing and monitoring arrangements. Under the proposed project design, all  
54 placement of dredged material will be within the existing Site 104 boundaries. The water depth  
55 ~~in the lower two-thirds of Site 104 in Site 104~~ would be reduced to -13.7 meters (-45 feet)  
56 MLLW. The reduction in depth and leveling of the bottom within site boundaries would change  
57 the physical character of this deep-water area. Although there is some indication of sediment  
58 contamination at the site from earlier placements of sediments from within the Baltimore Harbor,  
59 the proposed placements ~~would~~ provide a cap of clean material from the approach channels  
60 over the Baltimore Harbor materials at Site 104. [CAPPING AND RELIEF NEED FINAL  
61 DETERMINATION AFTER DECISIONS ON PLACEMENT TYPE, SMOOTHING AND  
62 RELIEF]

63 Best management practices (i.e., placement during time-of-year when aquatic species would be  
64 least impacted, limiting barge traffic to marked channels, compliance with placement protocols,  
65 and quickly and efficiently completing placement activities) will be utilized during placement  
66 operations to avoid or minimize impacts to aquatic resources, marine traffic, and, consequently,  
67 impacts to socioeconomic resources.

### 68 6.3.2 Economic Impact to Aquatic Resources

69 The current project alignment, which is within the charted boundaries of this previously used  
70 placement area, would impact approximately 1,200 acres of Bay bottom (approximately the  
71 southern ~~2/3~~ two-thirds of the site). Presently, this charted area contributes a portion of the total  
72 landings for finfish and blue crab fisheries in the Chesapeake Bay, which in turn, contributes to  
73 the economic well-being of Queen Anne's, Kent, and Anne Arundel Counties and surrounding  
74 communities. Sportfishing areas along the western shore of Kent Island and northwest of the site  
75 (the Belvedere Shoal) contribute to the sportfishing catch of the region.

76 Under the proposed project design, deep-water areas would be increased in elevation from  
77 depths of -23.8 meters (-78 feet) MLLW to approximately -13.7 meters (-45 feet) MLLW. Upon  
78 completion of placement activities, the affected bottom would be graded or leveled using  
79 appropriate techniques (Section 4.2) [VERIFY]. The decrease in depth would change the  
80 physical character of this deep-water area by covering existing snags or other low-lying  
81 obstructions on the bottom.

82 -Historically, placement of sediments at Site 104 included some material that originated from  
83 inside the Baltimore Harbor. Because of this, there is an ~~preliminary~~ indication of contamination  
84 at one location sampled in the site (Sections 5.1.5 and 6.1.5). The proposed placement of ~~clean~~  
85 suitable dredged material from the outer channels ~~would~~ provide additional capping of

93 previously placed sediments. ~~It has been proposed that~~ There is a potential outcome that the  
94 decrease in depth may reduce the duration of hypoxic and anoxic conditions that occur in the site  
95 during summer months (Section 6.1.4). ~~This sh~~ould produce a benefit to the ecosystem by  
96 providing a longer growing season for benthic organisms, ~~which will~~could also provide  
97 additional food resources for fish and crabs.

98  
99 **6.3.2.a Economic Value of Aquatic Resources.** Studies have been conducted to determine the  
100 monetary value of the early life stages of aquatic resources that are killed as the result of power  
101 plant projects throughout the East Coast. However, these studies involve estimates of  
102 impingement and entrainment that can be more directly correlated. Methods are not available to  
103 calculation ~~E~~economic losses resulting from dredging and open-water placement ~~have never~~  
104 ~~been calculated or correlated~~ ion withto impacts to sensitive life stages of economically important  
105 resources. Because of this, it is difficult to assign a monetary value to impacts to non-  
106 harvestable life stages of aquatic resources that contribute to overall recruitment in a much larger  
107 area ~~are difficult to assign a monetary value~~. Unlike power plant operations, dredging and  
108 associated open-water placement operations can be controlled and impacts minimized by timing  
109 events to coincide with periods when sensitive life stages are not present or present in minimal  
110 numbers.

111  
112 Harvestable resources in the Chesapeake Bay region are reported annually by commercial  
113 watermen to the Maryland Department of Natural Resources (MDNR). Prices for harvestable  
114 resources fluctuate on a yearly and seasonal basis. Assigning a standard value to any one  
115 resource is difficult, because of the many factors that affect market prices. Information on the  
116 monetary value of harvestable resources collected from the NOAA 025 region (Bay Bridge north  
117 to Pooles Island) is discussed below. It should be noted that past prices often have no correlation  
118 with future market prices for any harvestable resources. Furthermore, the fishing productivity of  
119 specific sub-locations within an MDNR sub-region can vary significantly annually and between  
120 seasons. For these reasons, predicting the socioeconomic value of future harvestable resources  
121 in and around Site 104 cannot be calculated with any precision and could be significantly  
122 different in any given year.

#### 123 124 **Finfish Fishery** [FINFISH USAGE IN WINTER?]

125  
126 Site 104 is not known to be a nursery or spawning area for any commercially important fish  
127 species, including striped bass. Therefore, long-term adverse impacts from project-related  
128 activities on local finfish landings are not anticipated. Impacts to critical lifestages are discussed  
129 in detail in Section 6.1.6.b. It is difficult to determine direct impacts from habitat loss caused by  
130 dredged material placement. Survey results of existing conditions indicate that fish utilization of  
131 Site 104 is greatest in the spring and summer [VERIFY] (Miller 1998). Some impacts on  
132 harvestable fish could be minimized by timing placement activities during periods of lower fish  
133 activity (Sections 5.1.6.b and 6.1.6.b). Generally, finfish will avoid localized areas with elevated  
134 turbidity concentrations. Elevated turbidity will be short-term and will not affect critical finfish  
135 lifestages. It is also assumed that most fish would avoid the bottom waters of Site 104 during the  
136 seasonal anoxia/hypoxia which occurs in the late spring and summer to early fall [BUT WE ARE  
137 NOT PLACING THEN].

139 Commercial and recreational watermen that actively use the Site 104 area have indicated that  
140 fishing is concentrated on the northeastern edge of the site in the shallower waters. [VERIFY  
141 THROUGH CORPS COORDINATION] Although placement would not occur in these more  
142 productive areas, there may be some temporary impacts, due to elevated levels of bottom  
143 turbidity that may result in a reduction in catch and income during placement and consolidation  
144 of dredged material. Turbidity impacts are expected to be short-term. No significant long-term  
145 adverse impacts to the finfish fishery are expected as the result of temporary increases in water  
146 column turbidity, increases in bottom turbidity, or as the result of slightly elevated nutrient  
147 concentrations. A minimization of short-term impacts by timing placement activities to occur  
148 within winter months during periods of low utilization by commercially important species and  
149 commercial and recreational fishermen would limit disruption to the aquatic environment and the  
150 socioeconomic well-being of the region.

151  
152 Decreasing the depth at Site 104 from a maximum of -23.8 meters (-78 feet) to approximately  
153 13.7 meters (-45 feet) MLLW ~~will~~ could potentially improve some water quality conditions and  
154 finfish utilization and enhance commercial and recreational fishing in the area. Shallower  
155 habitat, combined with more abundant benthic food resources and shorter duration of hypoxia or  
156 anoxia, could potentially improve finfish habitat at Site 104 over the long-term. Both outcomes  
157 are uncertain. Currently, the majority of commercial fishing activity, primarily gill netting, is  
158 reported to occurs in the northern portion of the site in shallower, ~~more productive~~ habitats where  
159 material placement will not occur. Improving finfish habitat and foraging areas at Site 104 ~~will~~  
160 could potentially improve the commercial fishing efforts in the region. ~~In addition,~~ †The  
161 shallower depths and smoothed bottom after placement ~~will~~ would facilitate use of gill netting in  
162 the area. [VERIFY AFTER DECISIONS ON SMOOTHING AND RELIEF]

163  
164 Impacts of the project on the socioeconomic resources associated with the crabbing industry are  
165 expected to be minimal. Due to the depth, the area is not highly utilized by commercial crabbers.  
166 In addition, the commercial crabbing season usually runs from April through November  
167 [CHECK THIS], closing earlier in some years as directed by MDNR. The proposed placement  
168 window is from mid-October to mid-April, the primary period during which the fishery is closed.  
169 The blue crabs present in water greater than -12.8 meters (-45 feet) MLLW within the portion of  
170 Site 104 where placement would occur would likely be covered by material. The crabs residing  
171 in this area are overwintering males. [MES NEEDS TO GET #S FOR THIS] The quantity of  
172 crabs that would be directly smothered by material placement would be insignificant to the  
173 health and prosperity of the overall fishery because crab densities at the site were low relative to  
174 both upper-Bay and Bay-wide densities. In addition, this impact to crab densities should be  
175 minimal as the densities are lower at these greater depths. Impact to migratory patterns and  
176 populations ~~of the~~ is not anticipated because female migration to the lower Bay is completed  
177 before the placement activities are planned to begin and return after placement activities cease.

178  
179 [NEED TO ADD A BLUE CRAB SECTION]

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**Soft Clam Fishery**

Peak densities of softshell clams along the Eastern Shore of the Chesapeake are found from the Eastern Bay to Pocomoke Sound, particularly at depths of less than 5.2 meters (17 feet) along the shoreline (Baker and Mann 1991). A soft shell clam bed is located east of Site 104 in shallow water (     m [     ft]). Placement in Site 104 is not expected to effect the clam bed, which at its closest point is located     miles from the placement area. Because the minimum depth at Site 104 is -12.8 meters (-42 feet), and it does not contain unique habitat for the softshell clam, the proposed placement activity is not expected to adversely effect softshell clam densities. [DNR 76 REPORT SHOWED NO IMPACTS TO BAR—SEE DNR 1976 REPORT FOR APPROPRIATE TEXT]

**Oyster Fishery**

Live harvests of oysters have not been found within Site 104, and the closest oyster bar, that has been harvested in recent years, is the Broad Creek Bar, which is located on the southeastern side of Site 104 (Scott, R MDNR 1998). The Broad Creek Bar is not currently a self-sustaining oyster bar. It is seeded yearly by DNR. Minimal socioeconomic impacts are anticipated for this bar because it is outside of the placement area and therefore would not be directly impacted. Any short-term impacts from turbidity plumes would be expected to be minimal because net movement is to the north, not to the south. Precautions, such as time-of-year restrictions and modifications to placement strategies as appropriate, will be implemented to minimize impacts to the Broad Creek Bar and to ensure survival for future growth and expansion of the viable beds on the bar. The 1975 placement monitoring at Site 104 detected no impacts to this bar.

There are no known oyster bars within Site 104. Placement during the winter avoids impact to the critical life stage of the Eastern Oyster. There would be no spawning during placement; therefore, no larval or egg stages could be impacted. There is a time-of-year restriction for hydraulic dredging within 500 yards of an oyster bar from 1 June 4 to 30 September 30. Placement would not be ongoing on during that period, and dredging in this area is not being performed.

Placement of dredged material at Site 104 could provide a direct, positive long-term impact to the oyster fishery of the Bay through MDNR's Oyster Recovery Program. The program benefits are discussed in the following section.

**6.3.2.b MDOT and MDNR Chesapeake Bay Enhancement Program (Oyster Recovery).** The proposed use of Site 104 for the placement of clean dredged material is not anticipated to directly impact oyster beds and the oyster fishery. However, placement of dredged material at Site 104 could indirectly provide a positive long-term impact to the Bay's oyster fishery. On 1 September 4, 1996, MDOT and MDNR executed a cooperative agreement with the Maryland Watermen's Association (MWA) to devise programs that would enhance the Bay and concurrently sustain economic growth opportunities associated with Bay resources.

225 The purpose of MDNR's Oyster Recovery Program is "... restore the oyster population of the  
226 Chesapeake Bay to a sustainable economic foundation for the oyster industry as well as to a  
227 viable ecological foundation for the Bay ecosystem" (MDOT and MDNR, 1996). Recognizing  
228 that a healthy and prosperous oyster population improves water quality by the filtration of excess  
229 nutrients, and that there was a need to expand MDNR's oyster recovery program, MDOT agreed  
230 to provide supplemental funding with a net value of \$17.7 million over the life of the agreement.  
231 This funding is directly related to the quantity of dredged sediments placed in open water sites.  
232 The agreement is in effect for ~~six~~ 6 years beginning in State Fiscal Year 1997 and ending at the  
233 close of State Fiscal Year 2002, and is subject to the availability of appropriated funds and the  
234 actual placement of dredged material in open water, among its various provisions. The  
235 agreement automatically terminates "... if after any two consecutive years, no dredged material  
236 has been placed in open water sites ... ." (MDOT and MDNR, 1996).

237  
238 If dredged material is placed at Site 104, it could provide an ancillary environmental benefit  
239 accounting for up to 70 percent (\$12.4 million) of the prospective MDOT supplemental funding  
240 to the Oyster Recovery Program. The agreement between MDOT and MDNR is based on the  
241 first use of a new open water site in State Fiscal Year 1999 (MDOT and MDNR, 1997).  
242 [CHECK W/MPA ON WHAT HAPPENS WHEN FY99 WASN'T MET] The target capacity of  
243 Site 104 is 18 mcy (13.8 mcm) under the State of Maryland's Strategy for Dredged Material  
244 Management. Site 104 appears to be the only open-water site with sufficient capacity under  
245 investigation or able to be authorized for placement within the next 1 to 4 years by the pertinent  
246 state and Federal regulatory agencies. As is reviewed in Section 7, other open-water sites with  
247 sufficient placement capacity are not currently under active investigation due to various  
248 impediments to implementation. If Site 104 is used for dredged material placement, it could  
249 provide an ancillary positive economic impact to the Oyster Recovery Program, and thus a  
250 positive impact to the oyster fishery.

### 251 252 6.3.3 Impacts to Commercial Fishing

253  
254 Site 104 is currently used only to a limited extent by commercial fishermen in the southern  
255 portion of the site where placement is planned. The presence of snags or other obstructions on  
256 the bottom in this area severely limits the opportunity for commercial fishing with drift nets; the  
257 only authorized open-water commercial fishing technique for finfish. Representatives of the  
258 MWA have stated that, although they object to open-water placement generally, they would not  
259 oppose placement in Site 104 if bottom conditions could be improved (Site 104 Open-Water  
260 Placement Area Commercial and Recreational Fishers Meeting Summary July, 28 1997 --  
261 Attachment C). ~~Some material drift is expected near the bottom at the northern site boundary~~  
262 ~~which could impact commercial netting during the period when the site is actively being used (1-~~  
263 ~~9 years).~~ Consultation with MWA representatives resulted in a determination that the placement  
264 of dredged material could be managed to minimize or avoid impacts with fishing activity in any  
265 given fishing season (Sections 5.1.6.b and 6.1.6.b). This would involve sequencing and timing  
266 placements in coordination with the MWA, the Upper Bay Charter Captains Association  
267 (UBCCA), and the Maryland Charter Boat Association (MCBA), as well as the establishment of  
268 strict transportation routing requirements for tugs and barges to avoid vessel conflicts with  
269 fishing gear. ~~In the long term, commercial fishing activities are expected to be positively~~

270 impacted by placement activities. Covering of snags and raising the bottom elevation will  
271 facilitate gillnetting in the area. [CONSULTATIONS ONGOING]

272

### 273 **6.3.4 Socioeconomic Impacts to the Site 104 Region**

274

275 The potential for additional employment related to dredging activity is limited. Dredging and  
276 placement activity associated with use of Site 104 is generally within the scope and scale of  
277 existing annual maintenance dredging and is not anticipated to result in any appreciable changes  
278 in employment opportunities. New work dredging, which is the deepening or widening of  
279 channels rather than maintaining existing channels at their current authorized dimensions, would  
280 increase the level of dredging activity above that which is associated with maintenance dredging.  
281 The possibility for an economic benefit within the local region by using the local workforce  
282 would depend upon the dredging contractors and the sources they use for employees and  
283 subcontracted services.

284

285 Dredging of the approach channels to the Port of Baltimore will ensure future economic growth  
286 and success of port-related industry. -Maintenance of the channels is necessary for the viability  
287 of the Port. Placement of dredged material at Site 104 will provide long-term benefits to the  
288 regional economy through continued viability of the Port of Baltimore.

289

290 In summary, regional socioeconomic impacts resulting from the project are closely related to  
291 impacts on commercially important species that are harvested from the area. Some short-term  
292 adverse impacts can be expected within the project area as a result of the placement activities.  
293 Long-term adverse socioeconomic impacts are not anticipated. Short-term impacts will be  
294 minimized by timing disruptive activities to occur within periods of low utilization by  
295 commercially important species. Placement during a period of low utilization will limit  
296 disruption to the aquatic environment and the socioeconomic well-being of the region. In the  
297 long-term, placement of material at Site 104 will provide benefits ~~to~~ through the Oyster  
298 Recovery Program and to the regional economy through the viability and success of port-related  
299 business and industry.

300

## 301 **6.4 AESTHETICS AND RECREATIONAL RESOURCES**

302

303 Impacts to aesthetics and recreational resources as a result of the proposed placement at Site 104  
304 will be short-term in nature and primarily associated with the placement phase of the project.  
305 Upon completion of placement, both aesthetic values and recreational utilization are expected to  
306 return to pre-placement conditions.

307

### 308 **6.4.1 Aesthetics**

309

310 The proposed placement of dredged material is not expected to have a long-term effect on the  
311 aesthetics of Site 104. Aesthetically, Site 104 would experience a short-term impact due to the  
312 presence of dredged material placement equipment, such as barges and tugboats during the  
313 placement phase of the proposed project. If bottom-dump scow placement is used, tugs and  
314 scows would periodically travel to the site, spend a few minutes depositing material, and then  
315 leave. If controlled bottom placement with hydraulic pipeline is used, a hydraulic unloader

316 would be stationed at the site for the entire dredging period, and tugs and scows would spend  
317 approximately 1 hour at the site while the scows are pumped out. The equipment would be  
318 visible to individuals commuting across the Bay Bridge and to commercial fishermen and to  
319 recreational fishermen and boaters ~~that~~ who transit the area. However, dredging is not expected  
320 to occur during the summer season, when the bridge is used heavily and when recreational  
321 boating and fishing activities are at a peak. Sandy Point State Park is approximately 2 miles west  
322 of Site 104. Consequently, it is not expected that placement activities will be noticeable from the  
323 park. No sedimentation impacts to the park are expected based on hydrodynamic modeling  
324 (Section 6.1.3). The water clarity at the placement sites is expected to be temporarily reduced by  
325 sediment plumes during placement operations. This aesthetic impact is expected to be short-term  
326 in nature.

327  
328 **6.4.1.a Odors.** Historically, there have been no complaints about odors produced by open water  
329 dredged material placement operations. The material will be transported to the site by barge and  
330 since it will be placed underwater, potential odors from the dredged material would be quickly  
331 contained. Also, odor impacts associated with the placement of dredged material at Site 104 are  
332 expected to be insignificant due to the distance of the site from the surrounding shoreline  
333 ~~{(approximately 1.6 km (1 mile))}~~. This distance is generally sufficient to make most odors  
334 undetectable (Mike-Caughlin 1997). It is possible that recreational boaters or recreational  
335 fishermen ~~that~~ who transit the area during placement activities could detect an odor from material  
336 exposed to air on the barges before or during the pump-out or bottom-release events. There will  
337 be no odor from the material after it is placed underwater, however. In addition, the filled barges  
338 will not remain stationary on the site for an extended period of time. Any odors that are created  
339 by the placement of dredged material ~~is~~ are expected to be short-lived and will not be chronic in  
340 nature. Also, the variability of weather patterns and prevailing winds will decrease the potential  
341 of odors adversely impacting any one area persistently.

342  
343 Odor issues related to the placement of dredged material at Site 104 fall under the Code of  
344 Maryland Regulation (COMAR) 26.11.06, Sections .08 and .09 (Mike-Caughlin 1997). If odors  
345 are determined to be offensive and persistent, then compliance with COMAR would become an  
346 issue. COMAR 26.11.06.08 states: "*Nuisance. An Installation or Premise may not be operated*  
347 *or maintained in such a manner that a nuisance or air pollution is created. Nothing in this*  
348 *regulation relating to the control of emissions may in any manner be construed as authorizing or*  
349 *permitting the creation of, or maintenance of, nuisance or air pollution.*" COMAR 26.11.06.09  
350 states: "*Odors. A person may not cause or permit the discharge into the atmosphere of gases,*  
351 *vapors, or odors beyond the property line in such a manner that a nuisance or air pollution is*  
352 *created.*" Odors resulting from the placement of dredged material at Site 104 are not expected to  
353 create a nuisance to surrounding communities. In the unlikely event odors are detected, they are  
354 not expected to be persistent in nature.

355

356 **6.4.2 Recreation**  
357

358 The proposed placement of dredged material is not expected to have a long-term effect on the  
359 recreational activities at Site 104. Recreational activities, such as boating and fishing, are  
360 expected to be minimally impacted during the proposed placement of dredged material within  
361 Site 104. These impacts will primarily be associated with increased vessel traffic (barges and  
362 tugboats) during placement operations and a moored hydraulic pump-out facility if controlled  
363 hydraulic bottom placement is used. Channels will be established and marked in the area to  
364 minimize potential navigational hazards to recreational boaters or commercial fishermen caused  
365 by an increased volume of vessel traffic associated with placement activities. Placement will be  
366 timed to occur during the late fall and winter seasons when recreational boating activities are  
367 minimal.  
368

369 **6.4.2.a Fishing.** [NEED TO UPDATE WITH COE/FISHERMEN CONSULTATION DATA]

370 Recreational fishing activities within Site 104 are concentrated in shallow areas (-12.2 meters (-  
371 40 feet)) north of the RW "LP" buoy and along the eastern edge of Site 104 (Site 104 Open-  
372 Water Placement Area Commercial and Recreational Fishers Meeting Summary July, 28 1997--  
373 Appendix E). Therefore, recreational impacts will be minimal, since the proposed placement  
374 action will occur in areas below the -13 meter (-45 feet) contour interval. The proposed action  
375 will raise the contours of the remainder of the site up to -13.7 meters (-45 feet). Decreasing the  
376 depth may improve recreational fishing in the area, and may decrease the extent, distribution,  
377 and duration of hypoxic or anoxic conditions allowing a longer growing season for benthic  
378 organisms. Thus, in the long-term recreational fishing success in the area may be enhanced as  
379 the result of placement activities.  
380

381 **6.4.2.b Boating.** Existing levels of boating activity are usually confined to boats passing  
382 through the Site 104 area in transition to or from either the Baltimore Harbor, Sandy Point State  
383 Park, Matapeake State Park, or points further south of the Bay Bridge during the spring, summer,  
384 and fall months of the year. Use of the Bay waters and the Site 104 area diminishes in the winter  
385 due to inclement weather. Proposed placement of dredged material at Site 104 is expected to  
386 have a minimal impact on boating activities as the placement window is slated for the 15 October  
387 to 15 April time period. During the placement activity, recreational boaters can avoid  
388 inconveniences due to the tugboats and barges in the area by modifying their direction to avoid  
389 the boats. This will not require an extensive change in course or require considerable additional  
390 time and expense. As stated previously, tugs will be required to follow a marked course to  
391 minimize effects on recreation and commercial boaters.  
392

393 **6.5 IRRETRIEVABLE COMMITMENT OF RESOURCES**  
394

395 During construction of a project, resources may be expended or impacted. If the resource is not  
396 renewable, it may be considered irretrievable. Resources can come from on-site or off-site  
397 sources.  
398

399 Currently, the only off-site resources to be utilized for "construction" would be the fuel used for  
400 the dredged material placement equipment and the sediment dredged from the channels.

401 Currently, fuel is not considered an irretrievable resource and placement at Site 104 is not  
402 expected to use enough of this resource to significantly deplete available sources of the fuel.  
403

404 Dredging of the channels is necessary to maintain navigation throughout the Bay. The sediment  
405 that shoals in the channels and results in the need for the dredging is from external sources,  
406 predominantly the Susquehanna River and shoreline erosion, and is a consistent input to the  
407 upper Bay (Kerhin *et al.* 1988; Panageotou *et al.* 1996). In addition, the sediment is just being  
408 relocated within the upper Bay and is not being lost. Therefore, the sediment dredged from the  
409 channels is not considered an irretrievable resource.  
410

411 The most significant on-site irretrievable resource to be affected by the proposed project is the  
412 change in depth of the deep-water (>-45 feet MLLW) habitat and the burial of potential snags  
413 that may provide deep-water fish habitat. These losses are considered among the impacts. The  
414 depths would be reduced to -13.7 meters (-45 feet) MLLW in the portion of Site 104 that is  
415 currently greater than -13.7 meters (-45 feet) deep (Figure 2-1). Generally, shallower areas are  
416 more highly utilized by aquatic organisms and are considered to be more valuable habitat areas  
417 than are deep-water areas (greater than -13.7 meters [-45 feet]). Primary productivity is higher  
418 in shallow water areas, and this productivity fuels the food chain. The loss of deep-water habitat  
419 at Site 104 is offset by the potential increase in value and usability of the site for the commercial  
420 and recreational fishermen. The "smoothing" of the bottom and covering of the snags by placing  
421 material will facilitate gill netting in the area. The depth change could also potentially reduce the  
422 duration and extent of hypoxic or anoxic conditions, leading to an localized increase in benthic  
423 abundance and thus to an increase in the food sources for bottom foraging fish species.  
424

425 [NEED TO ADD BENTHICS/BLUE CRAB INFO. WHEN AVAILABLE]  
426

## 427 **6.6 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE** 428 **ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-** 429 **TERM PRODUCTIVITY** 430

431 The use of Placement Site 104 will be short-term. Placement of up to 18 mcy of dredged  
432 material is expected to occur over a projected 1- to 9-year period. When the capacity of the site  
433 is filled, placement activities will cease. The short-term use of the site will result in long-term  
434 overall benefits to the local environment and natural resources associated with the site.  
435 Placement of clean dredged material will cap the existing contaminated sediment that originated  
436 from placement activities that occurred at the site decades ago. This capping will provide long-  
437 term environmental benefits by creating a more favorable habitat for aquatic organisms that may  
438 potentially support more diverse aquatic communities. In addition, placement of material will  
439 decrease the depth at the site. This decrease will essentially change the existing deep-water  
440 habitat to more productive mid-depth-water habitat. In the long-term, the post-placement  
441 habitat at the site will support enhanced primary productivity, food resources, and aquatic  
442 communities.  
443

1  
2  
3  
4  
**Section 7**

**Alternatives Impacts**

5 Section 404(b)(1) guidelines require that no discharge of dredged material into waters of the U.S.  
6 will be permitted if another practicable alternative exists with fewer impacts to the aquatic  
7 ecosystem unless the alternative itself has other significant environmental impacts. Consequently,  
8 less environmentally damaging practicable alternatives are required to be evaluated that do not  
9 include placement of material in waters of the U.S. The alternatives analysis must demonstrate that  
10 an open water alternative is the least damaging practicable alternative, based upon economics,  
11 technology, logistics, and environmental considerations. The impacts of dredged material  
12 placement alternatives are analyzed in this section. Impacts from other placement options, which  
13 have been considered as part of several Corps and Port of Baltimore initiatives, are described.  
14

15 The site screening process (detailed in Section 2 and Annex E) reduced the numbers of potentially  
16 viable sites by identifying significant environmental impacts, access problems, or costs/institutional  
17 constraints that would preclude the site from being developed, particularly in the near term (1-9  
18 years). Details on non-viable alternatives are addressed in Annex E and only potentially viable  
19 alternatives are considered in this section. Based upon the site screening process (Annex E) and the  
20 Alternatives analysis (Section 2), the following alternatives were identified which could potentially  
21 meet the Port's short-term placement needs either individually or in combination. In accordance  
22 with NEPA, the "No Action Alternative" (assuming that no project is developed) is also analyzed.  
23

24 [This is the list as it currently stands in Chapter 2; I have added text to some and annotated  
25 thoughts to others]

- 26 • No action  
27 • Open-water sites:  
28 • Site 104  
29 • Site 171 open water,  
30 • Worton Point open water  
31 • Shad Battery Shoal  
32 • Ocean Placement  
33 • Deep Trough  
34 • Existing site:  
35 • South Cell Of Hart & Miller Island  
36 • C&D Canal Sites  
37 • New containment options  
38 • Hart-Miller Island new cell)  
39 • Beneficial use  
40 • Poplar Island wetland cell conversion to upland  
41 • Poplar Island footprint expansion  
42 • Holland Island  
43 • Sparrow's Point  
44 • Island placement site:  
45 • Pooles Island area

DRAFT: To be completed after decision regarding final alternatives is made.

- 46 • Tolchester West
- 47 • Site 168
- 48 • Site 171
- 49 • Site 171
- 50 • Combination of smaller options
- 51 (Holland Island, Bodkin Island, Artificial Reefs, Parson's Island, Cox Creek)

52  
53 **7.1 No action**

54  
55 Without sites to accept dredged sediment, dredging of the federally-maintained navigation channels  
56 to authorized project depths would have to be severely curtailed or delayed until sufficient  
57 placement capacity is identified, delineated, assessed and permitted. Annually, 4 mcy of capacity is  
58 needed for maintenance dredging with additional capacity for new work projects. If this annual  
59 capacity is not met, then channel currently scheduled for maintenance or upgrades may not be  
60 maintained. This would then inhibit access by deep-draft vessels that currently use these routes and  
61 would increase risk to navigation safety unless there is a corresponding reduction in cargo-carrying  
62 capacity in order to reduce vessel draft. In the extreme, some deep draft vessels that currently use  
63 the Baltimore Harbor and C&D Canal might not be able to access the Harbor or Canal at all, due to  
64 inadequate draft or difficult handling in shallow water associated with minimum under-keel  
65 clearance requirements coordinated by the U.S. Coast Guard and Association of Maryland Pilots.

66  
67 A No Action Alternative is comparable with not maintaining authorized depths in the Federal  
68 channels. Furthermore, the Port of Baltimore directly and indirectly contributes in excess of \$2  
69 billion per year to the State of Maryland's economy and contributes a significant amount to the  
70 Eastern Seaboard regional economy (MPA 1996). It is likely that some of this shipping and  
71 associated business activity would be lost to the Port of Baltimore and would be shifted to other  
72 ports. It is in the national interest to maintain the navigation infrastructures necessary for a  
73 productive Port of Baltimore. Therefore, the No Action Alternative is unacceptable.

74  
75 **7.2 Open-water sites:**

76  
77 Open-water placement sites were included the Port and USACE planning process because they can  
78 provide a large amount of capacity that can be made available relatively quickly. Most open-water  
79 options are more cost effective than comparably-sized containment islands or upland options both  
80 in terms of development costs and placement costs. There are trade-offs with any placement  
81 option. Any option that involves placement within a waterbody invariably includes the potential  
82 for some impacts to the aquatic ecosystem. Open-water sites have predominantly short-term  
83 impacts but the placement areas generally recover over time and remain productive components of  
84 the aquatic environment. In some cases, dredged material placement can improve the conditions of  
85 a placement site by decreasing depths in an area that experiences anoxia or by improving the  
86 composition or quality of the sediments in the area.

87  
88 **7.2.1 Site 104**

89  
90 Site 104 (also known as "Kent Island Deep") is the preferred alternative for the open-water  
91 placement of 18 mcy (13.8 mcm) of clean sediment beginning in 2000. Placement would occur

*Sullivan*

DRAFT: To be completed after decision regarding final alternatives is made.

92 over a period of 1 to 9 years (2000 to 2008), depending upon the dredging sequence, dredging need  
93 and other factors (Figure 1-2). Clean sediment would be dredged from the Federally maintained  
94 navigation channels in the main stem of the Bay. These include the Craighill Entrance, Craighill  
95 Channel, Craighill Angle, Craighill Upper Range, Cutoff Angle, Brewerton Channel Eastern  
96 Extension, Swan Point Channel, Tolchester Channel and the southern approach channel to the  
97 C&D Canal. This site is not proposed for placement of sediment from the Baltimore Harbor  
98 Channels (those channels that lie to the west of the line between North Point in Baltimore County  
99 and Rock Point in Anne Arundel County).

100  
101 Placement would be limited to areas deeper than the -13.7 m (-45 ft) MLLW contour interval to  
102 achieve a final site elevation of -45 ft MLLW. Based on existing contours within the proposed site,  
103 placement would occur in the area south of the lighted, red and white buoy for Love Point (RW  
104 "LP" buoy) (Figure 2-1).

105  
106 The impacts and cumulative impacts of the preferred alternative are detailed in Sections 6 and 8  
107 (consecutively) and are only abstracted here. No impacts are predicted for the following resources:  
108 setting; physiography, geology, and hydrology; groundwater; submerged aquatic vegetation;  
109 terrestrial/avian resources; rare, threatened and endangered species (pending biological  
110 determination from NMFS); hazardous, toxic, and radioactive substances; cultural resources, and  
111 archaeological resources. Several resources are expected to be impacted only during placement and,  
112 thus would be very short-term. These include impacts: air quality, noise, aesthetics, odors, and  
113 recreational boating.

114  
115 Negative impacts to water quality and the benthic community are expected to be short-term in  
116 nature. Capping of poorer quality bottom sediments and decreases in water depth (after placement)  
117 are expected to have long-term positive impacts on benthics and site water quality. The short-term  
118 water quality impacts are projected to include turbidity impacts during placement, and some  
119 impacts related to the release of nutrients from the dredged material at the time of placement and  
120 possibly into the spring after placement. The extent and duration of turbidity impacts are dependent  
121 upon placement type, with bottom release scow likely to result in water column release of 4 % or  
122 less. [WE NEED A DECISION OF WHETHER THIS IS STILL THE PARTY LINE: Controlled  
123 bottom pipeline placement to just above the bottom should result in minimal release other than  
124 limited flow of sediments along the bottom of Site 104]. [NEED TO CONFIRM THIS WHEN  
125 ANALYSES ARE COMPLETE: Release of nutrients during mixing at the time of placement was  
126 also modeled and was found to result in few impacts over either the short or long term when  
127 analyzed with hydrodynamic modeling. The estimated nitrogen releases at Site 104 would be 2.3  
128 pounds. The measured phosphorus releases were negligible and resulted in predicted loading of  
129 zero. If no mixing occurs, nutrient release from placed sediments was modeled to result in a slight  
130 enhancement of the spring phytoplankton bloom due to higher phosphorus concentrations, but this  
131 effect did not extend into the summer bloom period due to rapid dissipation. This effect was also  
132 limited to the area directly over Site 104. Dissipation occurred relatively rapidly after material  
133 placement, so that no far field impacts were projected to occur. Under the complete mixing  
134 scenario, no impacts to phytoplankton blooms were predicted due to rapid dissipation in the colder  
135 months of placement, when blooms do not occur].

136  
137 Placement would be limited to the cold weather months, beginning after October 15 when vertical

*Corps decision  
here  
bottom place  
is  
hydrodynamic  
controlled  
placement*

DRAFT: To be completed after decision regarding final alternatives is made.

*should be March 15  
VMCEES*

→ 138 mixing of the water column has begun in response to cooler air temperatures. The placement  
139 window would continue until before or on April 15, when increasing water temperatures begin to  
140 cause the development of hypoxia in the bottom waters of Site 104. Limiting placement to these  
141 colder temperatures and to conditions when the bottom waters are relatively well oxygenated will  
142 reduce the potential for short-term impacts from the release of phosphorus, which would otherwise  
143 be stripped from the sediments as they entered anoxic or hypoxic waters.

144 *A change → VMCEES*

145 Changes to salinity conditions upstream of Site 104 were modeled to address concerns related to  
146 the impacts of reduced water depths on the ability of the salt wedge to move up the Bay. Limited  
147 study of changes to salinities after four years of placement at Site 104 found some evidence of a  
148 mean decrease in salinity of less than 0.1 ppt. This was modeled at the Chesapeake Bay Program  
149 monitoring station MCB3.2 due north of Site 104 and due east of the Patapsco River. Smaller  
150 changes were identified by modeling as the stations extended up the Bay to Pooles Island and  
151 beyond. Mean changes in the more northern station were modeled to be less than 0.05 ppt.  
152 Changes were predicted by the model during the periods before and after model calendar days 100  
153 and 150. Within this interval, however, no changes were predicted. The timing of these reduced  
154 salinities (before and after the spring freshet, but not during) should avoid impacts to anadromous  
155 fish spawning. Natural interannual, spatial and temporal salinity variations in the bay are generally  
156 much greater than this, and the bay ecosystem is adapted to this, so limited impacts are expected.  
157 Modeling indicated small, almost subtle changes in mean salinity. These changes would be  
158 significantly smaller than natural daily or seasonal variations in Bay water salinity. With sea level  
159 continually rising (and pushing more saline waters farther into the Bay), these slight decreases in  
160 salinity will be negligible.

161  
162 Impacts to the benthic community from placement of clean dredged sediments in Site 104 would  
163 occur. The benthic community naturally dies off each spring and summer in Site 104, with some  
164 recruitment occurring in the late fall and winter. Placement of dredged material in the winter would  
165 reduce the potential for recruitment in the placement areas. This effect would be expected to  
166 continue in the areas of Site 104 where dredged material is placed until placement has ended. This  
167 effect should be limited each year to the area impacted by dredged material placement. Benthic  
168 monitoring at other sites in the Chesapeake Bay and the U.S. have shown benthic community  
169 recovery within 18 months after all placement has ended. These other sites, however, did not  
170 experience the seasonal anoxia that has been observed at Site 104 to cause seasonal benthic die-off.  
171 These conditions have been observed at sites in the Bay with different conditions, but similar  
172 results are expected due to the stress-tolerant nature of the benthic community in this portion of the  
173 estuary.

174  
175 The potential annual burial of the benthic community at Site 104 during dredged material  
176 placement in the fall and winter when the benthic community is normally reestablishing itself could  
177 negatively impact benthic feeding fish populations which may use these areas as feeding grounds in  
178 the winter. While most fish show reduced metabolism and reduced need for food in the winter, the  
179 loss of benthics in this area could result in fish moving to nearby unimpacted areas to feed,  
180 resulting in possible increased competition for benthic food resources in other areas. Potential  
181 negative impacts to fisheries resources are, therefore, expected to be very short-term. It is predicted  
182 that the improved quality of the benthic community and site water quality over time will have a net  
183 positive impact on fisheries resources of on the site. Recreational and commercial fishing is,

184 therefore, expected to improve over time. The potential covering of snags on the site will make the  
185 site more accessible to commercial netters which is expected to have a positive impact on area  
186 commercial fishing and economics.

187  
188 Some short-term shellfish impacts are predicted. Because a small portion of the Bay blue crab  
189 population overwinters in deeper areas of the Bay (like Site 104), burial of some crabs is expected  
190 during placement. The small loss of blue crabs that is predicted is not expected to substantially  
191 impact the Bay blue crab population or productivity and will only occur in the years during  
192 placement. Other shellfish resources should be unaffected by placement activities. The oyster bar  
193 immediately east-southeast of Site 104 is in shallow water and any material drift from the site is  
194 predicted to be in a northerly direction. No soft-clam resources occur on or immediately adjacent to  
195 the site.

196  
197 Hydrologic modeling was conducted to identify potential effects of sediment losses during and after  
198 the placement operations at Site 104. A worst-case potential for 16.9% of the placed material to  
199 move out of the site boundaries was determined from the modeling of controlled bottom release  
200 scow placement. A worst-case potential for 6.2% of the placed material to move out of the site  
201 boundaries after hydraulic placement near the bottom was also determined from the modeling  
202 exercise. Available models of the Chesapeake Bay are not able to predict sediment transport.  
203 Conservative tracer studies found that the net movement from the site was northward, following the  
204 higher salinity tidal flow. While movement of sediment could not be fully modeled, when settling  
205 velocities were assigned to particles at Site 104, settling was found to occur very quickly. It is  
206 assumed that some of the material that was defined by the model as leaving the site would re-  
207 deposit during the next ebb tide, but the model could not accurately depict this. All modeling was  
208 performed using conservative factors, such as the use of 1993 hydrodynamic forcings in the CH3D-  
209 WES model. These factors included using the highest freshwater inflows to the Bay in the years  
210 that are available to model.

211

#### 212 **7.2.2 Site 171 open water**

- 213 -Higher nutrient releases is all capacity is used
- 214 -Comparable aquatic resource conditions, perhaps a little better fishing
- 215 -a target islanddevelopment site

216

#### 217 **7.2.3 Worton Point open water**

- 218 -smaller capacity.
- 219 -lower nutrient releases
- 220 -significant finfish nursery area; commercial fishing area
- 221 -significant waterfowl area

222

#### 223 **7.2.4 Shad Battery Shoal**

224 [No datasheet yet]

- 225 -smaller capacity
- 226 -lower nutrient releases

227

#### 228 **7.2.5 Ocean Placement**

- 229 -Higher transportation costs

DRAFT: To be completed after decision regarding final alternatives is made.

230 -No nutrient releases within Bay

231

### 232 7.2.6 Deep Trough

233 -Institutional constraints

234 -Higher nutrient releases than Site 104

235 -Poorer overall ecological value (due to depths and nearby resources) than Site 104

236

### 237 7.3 Existing sites

238

#### 239 7.3.1 South Cell Of Hart & Miller Island

*This North Cell update met South Cell*

240 [THIS IS THE OLD HMI TEXT.]...Hart-Miller Island Dredged Material Management Facility is  
241 the only major placement facility that is currently receiving dredged material. The facility has an  
242 optimum annual efficient operating capacity of 2.5 mcy for dewatering and crust management.

243 Placement beyond the 2.5 mcy efficient operating capacity would not allow for effective use of site  
244 as greater lifts (layers) of material would greatly inhibit evaporative drying potential. Placement  
245 beyond the efficient operating capacity would also not effectively use the site's capacity which has  
246 been designated for other maintenance and improvements dredging projects and should be retained  
247 for unclean Harbor sediments (particularly since CSX/Cox Creek has a small capacity). Hart Miller  
248 Island alone cannot meet the current annual maintenance dredging needs (approximately 4 mcy),  
249 and the site would not be able to provide the 18 mcy of capacity provided by the Site 104 option.  
250 For these reasons, Hart Miller Island was rejected as an alternative to Site 104.

251

252 Jane's thought: I don't think HMI belongs here. The only thing that I see as viable would be to use  
253 some of the currently annual capacity as part of a combination of smaller sites.

254

#### 255 7.3.2 C&D Canal Sites

256 -No nutrient releases to Bay

257 -Far from channels

258 -Already designated sites

259 [Have not had opportunity to read datasheets]

260

### 261 7.4 New containment options

262 -Point out that any new containment option is going to involve significant time delays.

#### 263 7.4.1 Hart-Miller Island (new cell)

264 -Moderate nutrient releases

265 -Would have to be permitted; may not happen

266 -finfish area

267 -recreational area

268 -waterfowl area

269

### 270 7.5 Beneficial use

271 -Point out that beneficial uses may have short-term impacts but are ultimately beneficial to the  
272 region

273 -Some are very small scale

274 -Can take a long time to permit and implement

275

DRAFT: To be completed after decision regarding final alternatives is made.

276 **7.5.1 Poplar Island**

277  
278 Poplar Island is currently under construction and will be ready to receive material during the 1999-  
279 2000 dredging season. The designed maximum annual capacity for the site is 2-3 mcy. Placement  
280 beyond designed capacity could result in discharge of poorer quality water relative to design  
281 specifications (if dewatering must be done too quickly); poorer quality releases of water could  
282 impact natural resources by adding elevated nutrients and metals concentrations to the local waters.  
283 Exceeding maximum design capacity could also impact the designed wetland creation at the site.  
284

285 The capacity that will become available by 2000 has already been designated for other maintenance  
286 and improvement projects and would not be available to offset the short-term need for 18 mcy of  
287 placement capacity. One option considered for Poplar Island is to convert one or more of the  
288 wetland cells to uplands. Another possibility considered was to raise the upland dikes to provide  
289 more capacity. The final possibility would be to expand the footprint to include more placement  
290 capacity. Potential impacts of these alternatives are detailed below.  
291

292 **7.5.1.a. Poplar Island: wetland cell conversion to upland**

293 - Loss of some wetland habitat which is a significant benefit of the current project.  
294 *Reduction*

295 **7.5.1.b. Poplar Island: raising upland dikes**

- 296 - Adds capacity without impacting more shallow water habitat  
297 - Minimal incremental nutrient releases  
298 - Change of the original design that may have aesthetic impacts  
299

300 **7.5.1.c Poplar Island: footprint expansion**

- 301 -Would covert more shallow open water to uplands  
302 -low nutrient releases  
303 -High value living resource area  
304 -Not available immediately  
305

306 **7.5.2 Holland Island**

- 307 -Very low capacity  
308 -low nutrient releases  
309 -significant terrestrial and avian resources  
310 -soft clam and oyster bars  
311

312 **7.5.3 Sparrow's Point**

- 313 -Within 5 mile of HMI  
314 -Some avian resources  
315 -Within spawning area of some anandromous fish species  
316 -[Need nutrient informtion]  
317

318 **7.6 Island placement site**

319 [I think that this should include a generic discussion of the impacts of Island placement sites versus  
320 open water and upland with some detail about the range of implementation costs and nutrient  
321 releases. I have left the discussion of 171 in and added the nutrient information. My concern is

DRAFT: To be completed after decision regarding final alternatives is made.

322 that the environmental trade-offs and nutrient release information is fairly redundant. This goes  
323 back to the idea that we should be elevating the Upper Bay island as a concept and not as viable  
324 individual alternatives.]

325

326 **7.6.1 Pooles Island area**

327

328 **7.6.2 Tolchester West**

329

330 **7.6.3 Site 168**

331

332 **7.6.4 Site 170**

333

334 **7.6.5 Site 171**

335

336 Site 171 is under investigation as the possible location for a new containment island (Figure 2-2).  
337 As part of that investigation, the possible construction of a submerged island is also being  
338 considered. Potential environmental impacts at the site would include short term impacts  
339 investigated at other open water placement sites, including turbidity in the water column during  
340 placement, hydrodynamic impacts, benthic community impacts and fisheries impacts. Nutrient  
341 releases may also be of concern as this area is in relatively deeper water and would experience  
342 anoxia during some of the warmer months. Modeling of the nutrient releases of this option  
343 indicated that up to 10 pounds of nitrogen would be released as a result of placement (as a  
344 submerged option). This is nearly 5 times the release projected for Site 104 (2.3 pounds of  
345 nitrogen). As a containment (emergent island), the nitrogen releases would be slightly higher than  
346 those projected for site 104 (3.6 pounds of N), but would also include some release of Phosphorus  
347 (0.09 pounds).

348

349 If developed as an island, this site would not be available for approximately 10 to 14 years (which  
350 is an estimate of the time needed for feasibility studies, design work, permitting, and construction  
351 based upon the HMI experience). This option would, therefore, not meet the immediate need short  
352 term (1-9 year) placement need in the State of Maryland's Strategic Plan. Prefeasibility  
353 investigations for the Upper Bay Island Placement Sites (EA 1998) indicated that commercial  
354 fishermen utilize parts of the site, particularly in winter. Site 171 does appear to be utilized more  
355 than Site 104 for commercial fishing based upon interviews with area watermen. For these reasons,  
356 Site 171 was eliminated from consideration as an alternative to Site 104 at this time.

357

358 **7.7 Combination of smaller options**

359 **(Holland Island, Bodkin Island, Artificial Reefs, Parson's Island, Cox Creek)**

360

361 Multiple limited capacity options were considered as alternatives to the Proposed Action. Within  
362 the multiple limited capacity alternatives, several sites would be selected which could be used in  
363 combination to match the required 18 million cubic yards of capacity identified at Site 104. In  
364 addition to the alternatives listed in Section 7.0, a combination of smaller capacity sites was  
365 considered as an alternative to Site 104 (Section 2.4.7). [Old text that needs to be updated when  
366 the alternatives analysis for this option is completed....It was concluded from the analysis that a  
367 combination of suitable smaller sites into a multi-site alternative offers limited potential and

DRAFT: To be completed after decision regarding final alternatives is made.

368 insufficient capacity (between approximately XX and XX MCY). Concerns were also raised as to  
369 whether or not all of the capacity projected for these sites would actually become available or could  
370 be effectively utilized is uncertain. Use of some or all of the viable small-scale sites would result in  
371 a significant increase in dredging costs.]

372  
373 To completely evaluate this alternative, partial use of Site 104 would be needed to accommodate  
374 the full 18 MCY capacity requirement and/or sites with known or expected environmental, cost,  
375 development time or institutional constraints would have to be considered in combination. There  
376 is, however, an economy of scale related to dredging and placement. It is far more economical to  
377 use one large site because this reduces the cost for mobilization and demobilization of equipment as  
378 well as additional costs related to logistics, design and environmental studies. Additionally, travel  
379 distances from dredged channels to a site can significantly increase costs. Table 7-1 summarizes  
380 the distances from various proposed placement sites to the channels scheduled for maintenance or  
381 improvement over the next several years. Many of the smaller capacity sites (for example, Holland  
382 Island, Bodkin Island, Parson's Island) are 2 to 10 times further from the approach channels than  
383 the preferred alternative. Longer travel distances would translate into significantly higher  
384 placement costs per cubic yard of material because the average transportation cost is approximately  
385 \$0.10 per cubic yard per mile.

386  
387 In conclusion, although it is conceivable that many small sites could be combined to accommodate  
388 the 18 MCY of material that is proposed for placement in Site 104 over the next 5 years, it would  
389 be difficult because of increased costs, logistical problems, and increased environmental impacts.  
390 It would be less desirable to use a combination of many of the smaller sites because of the  
391 significant potential for environmental impacts to valuable habitat at some of the sites and because  
392 of the significantly higher cost per cubic yard of placement. This alternative is, therefore, rejected.

393  
394 **[Old Text: Cox**  
395 CSX/Cox Creek is an existing site that has been evaluated and rejected as an alternative to Site 104.  
396 This site is within Baltimore Harbor and as such is designated for contaminated sediments  
397 originating from within the harbor. Therefore, if CSX/Cox Creek were used for clean materials, it  
398 would not be available for the anticipated contaminated materials placement needs over the next 10  
399 to 15 years. The annual maximum capacity at CSX/Cox Creek is also very low (approximately 0.5  
400 mcy/year) and it would, therefore, not be a viable alternative for the placement need that  
401 necessitated consideration of Site 104 at this time].

402  
403  
404  
405  
406

407 Think this should be retained:

408

410 ?????? **Man-O-War Shoals**

411

412 Potential environmental impacts at the Man-O-War Shoals (Figure 2-2) would include short term  
413 impacts investigated at other open water placement sites, including turbidity in the water column  
414 during placement, hydrodynamics impacts, benthic community impacts and fisheries impacts.

DRAFT: To be completed after decision regarding final alternatives is made.

415 Because of its location within the striped bass spawning area and a relatively narrowed part of the  
416 Bay, it is believed that the potential for hydrodynamic and fisheries impacts would be greater than  
417 those at Site 104. Man-O-War Shoals was rejected due to concerns related to striped bass habitat  
418 and potential impediments to navigation. Prefeasibility investigations for the Upper Bay Island  
419 Placement Sites (EA 1998) indicated that commercial fishermen utilize parts of the site, particularly  
420 in winter. These resource issues would indicate a higher potential for impacts from placement at  
421 this site relative to Site 104.

422  
423

**Table 7-1  
Distance Measured from Designated Channels to Site 104 and Alternatives**

Sites	Channels																	
	Craighill Entrance		Craighill Channel		Craighill Angle		Craighill Upper Range		Cutoff Angle		Brewerton Eastern Extension		Swan Point		Tolchester		C&D Canal Approach	
	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi	Km	N Mi
Davis Tract Marsh	78	42	73	39	69	38	66	36	65	35	61	33	59	32	45	24	12	7
Grove Neck	64	34	58	31	55	30	52	28	51	27	46	25	45	24	30	16	1	0
Aberdeen Proving	47	25	41	22	38	21	34	19	34	18	29	16	27	15	13	7	5	2
Shad Battery Shoal	46	25	41	22	38	20	34	18	33	18	29	16	27	15	13	7	<1	<1
Rocky Point	52	28	46	25	43	23	39	21	38	21	34	18	32	17	18	10	2	1
Worton Point	42	23	37	20	34	18	30	16	29	16	25	14	23	13	9	5	0	0
Pooles Island	42	23	37	20	34	18	30	16	29	16	25	14	23	13	9	5	2	1
Hart-Miller Island	22	12	16	9	14	7	10	5	9	5	9	5	15	8	9	5	9	5
Masonville	29	15	23	13	20	11	17	9	15	8	16	9	30	16	26	14	39	21
Sparrows Point	20	11	15	8	12	7	9	5	7	4	8	4	22	12	18	10	31	17
Tolchester S-Turn	28	15	23	12	20	11	16	9	15	8	6	3	9	5	<1	<1	3	2
CSX/Cox Creek	22	12	16	9	13	7	10	5	8	4	9	5	23	12	19	10	32	17
Man-O-War Shoals	13	7	8	4	5	3	1	1	<1	<1	<1	<1	4	2	0	0	12	6
Site 168	26	14	21	11	17	9	14	7	13	7	4	2	7	4	1	0	12	6
Site 170	12	6	7	4	4	2	16	8	<1	<1	1	0	14	8	11	6	24	13
Swan Point	26	14	21	11	18	10	14	8	13	7	5	2	3	2	2	1	11	6
Site 171	6	3	5	3	6	3	9	5	11	6	5	3	2	1	6	3	19	10
Site 104	1	0	5	3	10	5	13	7	16	9	12	7	3	2	12	7	26	14
Queenstown	18	10	19	10	24	13	27	14	30	16	24	13	14	8	23	13	36	20
Deep Trough	3	2	9	5	14	8	17	9	21	11	20	11	11	6	20	11	33	18
Holly Neck Farm	4	2	10	6	16	8	18	10	22	12	22	12	12	7	21	12	34	18
Parsons Island	34	18	40	21	45	24	48	26	51	28	51	27	41	22	50	27	63	34
Bodkin Island	30	16	37	20	42	23	45	24	48	26	48	26	38	21	47	26	60	32
Poplar Island	27	15	34	18	39	21	41	22	45	24	45	24	35	19	44	24	57	31
Artificial Reefs	18	10	24	13	30	16	32	17	36	19	35	19	26	14	35	19	48	26
Bay Bridge Airport	0	2	8	4	13	7	16	9	20	11	16	8	6	3	15	8	29	15
Eastern Neck	2	12	24	13	29	16	32	17	36	19	29	16	20	11	29	16	42	23
Smith Island	119	64	125	68	130	70	133	72	137	74	136	74	127	68	136	73	149	80
Holland Island	108	58	114	62	120	65	122	66	126	68	125	68	116	63	125	68	138	74
Barren Island	79	42	85	46	90	49	93	50	96	52	96	52	86	47	95	52	108	58

\* Distance measured from closest point in channel to closest point in site following relevant channels.

**Section 8****Cumulative Impacts**

Cumulative impacts are impacts that are additive and/or synergistic in nature. Cumulative impacts may result from a single project or from multiple projects that occur concurrently or successively within a defined area or region. Although impacts caused by a single project may not be environmentally significant, the combined impacts of multiple, concurrent, or successive projects could result in significant cumulative environmental impacts.

The Region of Influence (ROI) for the proposed action is the mainstem of the Chesapeake Bay extending from Pooles Island south to Kent Point (the southernmost portion of Kent Island). This region encompasses an area of the mainstem Bay that is approximately 56 kilometers (35 miles) in length.

Open water placement of dredged material at Site 104 by itself has both negative and positive environmental impacts. The majority of cumulative negative effects are short-term, temporary and of minimal environmental significance. Future projects in the upper Bay could compound the hydrodynamic effects in the region, and additional studies prior to future construction or placement projects would be required to determine the potential impacts. The cumulative positive effects and overall benefits of the project are long-term. The long-term net environmental and socioeconomic benefits outweigh the short-term adverse environmental impacts. The project could not adversely impact setting, physiography, geology, hydrology, groundwater, sediment quality, SAV, terrestrial or avian resources, cultural resources or archaeological resources in the region. In addition, the proposed project will not involve the use, storage or transport of hazardous, toxic or radioactive materials during or after placement. Pending a biological determination from NMFS, the project is not expected to impact shortnose sturgeon. In the long-term, the project could positively impact water quality, sediment quality, and socioeconomics associated with the Oyster Recovery Program, commercial and recreational fisheries, and port-related industry. The long-term cumulative impacts related to hydrodynamics have not been studied. Open water placement at Site 104 provides a short-term solution to the existing placement deficit for dredged material, while causing minimal site-specific or cumulative regional adverse environmental impacts and providing long-term benefits to aquatic and socioeconomic resources.

**8.1 PAST, PRESENT, AND FUTURE DREDGING-RELATED ACTIVITIES IN THE UPPER-BAY AND BAY-WIDE**

Approximately 4 mcy of material must be dredged annually from the upper Bay shipping channels to the Port of Baltimore in order to keep the port viable. There is a possibility that additional shipping lines will move to Baltimore. This will require more dredging of inner harbor material that would need to be placed at HMI. Past, present, and future placement areas for dredged material from these channels are geographically concentrated in the upper Chesapeake Bay region (north of the Bay Bridge) to minimize costs associated with transporting the material to placement facilities/areas. Past and present placement activities for the navigational channels include (but are not limited to): historic placement at Site 104 (1924

47 through 1975), at Man O'War Shoal (1900s-1950s), and at Shad Battery Shoal (prior to 1968);  
48 contained upland placement at Cox Creek (1960s -1970s); open water placement north and east  
49 of Pooles Island (1940-1960 and 1977-present); and placement of contaminated sediments at  
50 Masonville (1970s to early 1990s) and Hart-Miller Island (1984 to present). On a more Bay-  
51 wide basis, future long-term placement activities include beneficial use of clean material to  
52 restore Poplar Island and the proposed construction of an upper Bay containment island to  
53 accommodate the future demand for placement of dredged sediments.

54  
55 Existing dredged material placement areas for the navigational channels in the upper Bay region  
56 encompass more than 10,000 acres of enclosed, open water, or shoreline area. In addition, there  
57 are 17 upland placement areas and numerous other county placement areas have been used for  
58 smaller projects. On a Bay-wide scale, there are few other regions in the Bay that have such a  
59 dense concentration of dredging-related activities that impact Bay bottom. The concentration of  
60 open water placement and dredging activities in the upper Bay could potentially contribute to  
61 cumulative environmental impacts associated with the proposed open water placement at Site  
62 104.

## 63 64 **8.2 CUMULATIVE NEGATIVE IMPACTS**

65  
66 Potential negative short-term impacts to hydrodynamics, water quality, aquatic communities, air  
67 quality, noise, socioeconomic resources, aesthetics, and recreational resources have been  
68 identified and are discussed in detail in Chapter 6. Potential cumulative impacts to each resource  
69 component are described in the following sections. Under each section, an overview of Site 104  
70 specific impacts is provided followed by a description and discussion of the anticipated  
71 cumulative effects that may result from other activities in the region.

### 72 73 **8.2.1 Hydrodynamics**

74  
75 **8.2.1.a Salinity.** Site-specific alterations in hydrodynamics of the area, caused by decreasing  
76 the depth, could potentially impact salinity in the immediate region. A slight average decrease in  
77 salinity north of the site (0.05 to 0.1 ppt) could occur due to less up-estuary movement of the salt  
78 wedge. This decrease would most likely be observed during the summer months, but not during  
79 springtime migration and spawning periods for anadromous fish. The slight decrease in salinity  
80 should be insignificant to resident aquatic organisms that are adapted to much wider salinity  
81 ranges. Estuarine organisms, especially those in the upper Bay, are resilient to annual variability  
82 in physical parameters caused by natural events (i.e. drought, floods, etc.). Greater salinity  
83 fluctuations are observed annually, than those that will be observed or created by placement of  
84 material at Site 104.

85  
86 Within the ROI, cumulative impacts of other future dredging-related projects in the upper Bay  
87 could compound hydrodynamic changes associated with movement of the salt wedge. The  
88 proposed deepening of the C&D Canal is expected to create a slight increase in salinity in the  
89 northern Bay (CENAP 1996). In addition, the construction of an upper Bay containment island  
90 could change regional hydrodynamic properties and could potentially affect the northward  
91 movement of the salt wedge (EA 1997). The net change in salinity distribution to the upper Bay  
92 as a cumulative impact of the present and future projects has not been studied, and additional

93 future studies would be required to determine the environmental significance of impacts of future  
94 proposed projects.  
95

96 **8.2.1.b Material Loss and Erosion.** In addition to potential changes in regional salinity, site-  
97 specific hydrodynamic processes will influence the movement of dredged material from the  
98 placement site. Hydrodynamic modeling conducted to date indicates that depth-averaged tidal  
99 currents in the region of Site 104 will increase proportionally to the decrease in water depth. This  
100 increase (approximately 0-2% year to year) is relatively minor, will be gradual, is not expected to  
101 affect natural sedimentation rates, and is not expected to adversely affect aquatic organisms or  
102 boat navigation in the area. Site specific changes in bottom shear stress ( $\pm 15\%$  depending upon  
103 where and in what order material is placed) will influence movement of bottom sediment at the  
104 site. Erosion modeling has indicated a worst-case potential loss of 16.9% and 6.2% of material  
105 placed by bottom-release scow and controlled hydraulic pipeline methods, respectively (5-year  
106 average). The majority of erosion will be short-term and take place during the placement period  
107 (WES 1998). Current models cannot predict the destination and cumulative impact of material  
108 that moves off of the site. Following completion of all placement activities, losses are expected  
109 to stabilize and the additive effects related to other planned dredged material management  
110 activities are expected to be minimal.  
111

112 Based on modeling studies, it is also anticipated that water column losses of fine-grained  
113 suspended clay will amount to 4.3% of the total mechanically placed (bottom-release scow)  
114 material. A portion of the fine-grained material may be transported in the bottom waters and  
115 could potentially be deposited on adjacent Bay bottom. This transport and deposition is not  
116 expected to be environmentally significant. Shallow water areas along the Kent Island shoreline  
117 are not expected to be impacted. Studies conducted by WES indicate that the net long-term  
118 movement of water over the site bottom is to the north due to gravitational circulation (WES  
119 1998). Nutrients or particulates suspended in bottom waters will be transported south of the site  
120 during ebb flows and back-into the site and north of the site during flood flows, with a net  
121 movement to the north. It is not anticipated that northward bottom movement of suspended  
122 sediment or nutrients will impact waters of the Chester River, as natural shoals will prohibit the  
123 movement of bottom waters into the river mouth.  
124

125 Cumulative impacts related to other dredging-related projects proposed for the upper Bay could  
126 result in further changes or disruptions to hydrodynamic properties and influence erosional and  
127 depositional processes at or near Site 104. Construction of an upper Bay containment island (EA  
128 1997) north of Site 104 and the proposed deepening of the C&D Canal (CENAP 1996) could  
129 result in some potential additional changes in hydrodynamic processes in the area. The  
130 cumulative changes to hydrodynamics in the region as a result of multiple projects could  
131 potentially influence erosion and sedimentation or create navigational hazards. Directional or  
132 velocity changes to tidal currents could cause changes in erosion and sedimentation rates in  
133 nearby shoreline areas. In addition, changes in tidal currents and velocity could potentially  
134 impact normal navigation patterns and maneuverability of large cargo vessels approaching to and  
135 departing from the Port of Baltimore. Additional studies and modeling would be required to  
136 quantify and predict the cumulative changes associated with future projects. Preliminary  
137 hydrodynamic modeling on the potential navigation effects is being performed by the USACE-  
138 WES under sponsorship of the MPA.

139

140 **8.2.2 Water Quality**

141

142 Minor site-specific water quality impacts are expected to occur during placement activities at  
143 Site 104. These include localized increases in turbidity and total suspended solids (TSS) during  
144 placement periods but these will be short-term, temporary and not environmentally significant.  
145 Studies conducted during open water placement at Pooles Island revealed that turbidity and TSS  
146 values subside and return to background levels within 20-40 minutes after scow releases (Versar  
147 1994). Similar turbidity and TSS values and short-term changes are expected during open water  
148 placement at Site 104. The localized turbidity impacts will occur every dredging season over a  
149 projected 1- to 9-year period but will not be additive in nature. Cumulative effects of other  
150 activities in the upper Bay that could potentially create temporary localized increases in turbidity  
151 include placement activities at Pooles Island, maintenance dredging activities in the approach  
152 channels to Baltimore Harbor and new work dredging projects. Because turbidity associated  
153 with the majority of these activities is short-term and localized in nature, it is not expected that  
154 water quality impacts from successive or concurrent dredging-related projects will be cumulative  
155 or exceed the normal range of values for the upper Bay region.

156

157 In addition to localized turbidity increases, it is anticipated that nutrients (phosphorus and  
158 nitrogen) in the project area are expected to be slightly elevated throughout the 1- to 9-year  
159 placement period. These slightly elevated nutrient concentrations will be localized and seasonal  
160 and will be primarily associated with bottom waters at the site. These nutrients are expected to  
161 dissipate quickly after all placement activities cease and are not expected to enhance algal  
162 blooms or anoxic conditions on a Bay-wide scale. In order to minimize the potential for  
163 localized nutrient impacts, placement at Site 104 will only occur during the fall, winter, and early  
164 spring months, when algal populations are naturally significantly depressed. Based upon studies  
165 conducted after open water placement at Pooles Island, the nutrient loadings originating from  
166 dredged material placement will be locally important, but short-term. Water quality modeling  
167 indicated a worst-case potential for slight, localized increases in phytoplankton production fueled  
168 by phosphorus releases from the recently deposited sediments during the spring following winter  
169 placement. Although not modeled, if placement occurs every 15 October to 15 April over a  
170 projected 1- to 9-year period, the worst-case result could be a slight localized increase in  
171 phytoplankton production for each consecutive spring period. Typically, maximum  
172 phytoplankton productivity in the Chesapeake Bay occurs in the Bay Bridge region. In this  
173 region, water clarity, nutrient concentrations, and water column mixing can create optimal  
174 conditions for phytoplankton production (Sellner 1987). In comparison to the annual loadings  
175 from external sources (predominantly the Susquehanna River), the quantity of nutrients released  
176 by placement, however, is modest (Boynton et al. 1997). After placement activities cease,  
177 springtime phytoplankton production in the local region of the placement site are expected to  
178 return to within normal ranges.

179

180 The slight increase in springtime phytoplankton production is not expected to result in significant  
181 phytoplankton blooms or increased severity/duration of anoxia in the local region or Bay-wide.  
182 At the local level, increased phytoplankton growth could arise from nutrients released at the  
183 point of dredging, nutrients released during placement, and nutrients released during the first  
184 season post-placement. Studies to quantify the additive impact of these activities are not

185 feasible. Cumulative impacts, however, are expected to be short-lived. No studies have  
186 quantified the additive impact potential of these activities, but they are expected to be short-lived.  
187 It is not expected that the localized nutrient releases or increases in phytoplankton production at  
188 Site 104 will combine with similar effects from other placement projects to produce an additive  
189 or synergistic effect on the Bay system.

### 191 8.2.3 Aquatic Organisms

192  
193 **8.2.3.a Phytoplankton and Zooplankton.** Site specific phytoplankton and zooplankton  
194 communities may be impacted by placement activities. Both controlled hydraulic pipeline  
195 placement (directed to the bottom) or bottom-release scow placement could displace or bury  
196 phytoplankton and zooplankton in the water column. Because the controlled hydraulic pipeline  
197 placement will be directed to within 2 m (6.0 ft) of the bottom, the impact to organisms in the  
198 water column will be minimal. Material placed by bottom-release scow will be released at  
199 approximately 20 feet or descend through the water column and create a more significant impact.  
200 These losses will be short-term, temporary, and environmentally insignificant on a Bay-wide  
201 scale. Mortality impacts to zooplankton will be minimal during the 15 October to 15 April  
202 placement events when densities are typically depressed by temperature and food resources.  
203 Localized increases in turbidity and total suspended solids may suppress light penetration in the  
204 water column resulting in repressed phytoplankton densities and may inhibit zooplankton  
205 foraging ability. These impacts will be short-term, temporary in nature (lasting as long as the  
206 turbidity events), and environmentally insignificant. Nutrients are expected to be slightly  
207 elevated throughout the placement period, but will be localized and seasonal, and food-chain  
208 effects, although not modeled, are not expected to be significant. Nutrient releases during or  
209 after placement may result in phytoplankton potentiation in the springtime, but long-term adverse  
210 cumulative effects are not expected. Impacts to phytoplankton and zooplankton communities as  
211 a result of maintenance dredging, placement activities at Pooles Island, and other new dredging  
212 projects are not expected to be cumulative. Additive impacts from upper Bay dredging activities  
213 and placement projects will also be short-term and localized in nature and will not result in  
214 significant cumulative environmental impacts on a regional or Bay-wide scale.

215  
216 **8.2.3.b Finfish Communities.** While finfish are an important commercial and recreational  
217 resource in the Chesapeake Bay, they are much less directly affected by dredged material  
218 placement activities than benthic macroinvertebrates because they are mobile. Studies indicate  
219 that the area in the vicinity of Site 104 is utilized by a variety of fish species, including  
220 commercial species such as striped bass and white perch. Placement activities at Site 104 will  
221 occur during the period of 15 October through 15 April to avoid peak spawning and migration  
222 periods for commercially important species. In addition, the fish will likely avoid the region  
223 during the short-term periods of elevated turbidity. The commercial and recreational fishery for  
224 striped bass and white perch is not expected to be impacted by placement, because the majority  
225 of fishing effort takes place north of the site, in shallower water. Scow and tug traffic may create  
226 short-term congestion in the fishing areas via transit to and from the site, but the impact to the  
227 fishery will be negligible. Burial of the existing benthic communities at Site 104 will  
228 temporarily reduce local food resources for demersal fish species in the area. Sufficient food  
229 resources should be available in areas adjacent to the site. Due to the depth at the site and annual  
230 summer hypoxia/anoxia events, it is not likely that the site is actively used for summer foraging  
231 or serves as an important foraging area or critical habitat for Bay species. Cumulative impacts to

232 the finfish fishery in the upper Bay from maintenance dredging, open water placement at Pooles  
233 Island, and other upper Bay projects are expected to be minor due to the availability of  
234 comparable habitat in the region.

235  
236 **8.2.3.c Shellfish.** Commercial shellfish that are important to the upper Bay region include  
237 oysters, softshell clams, and blue crabs. Oysters and softshell clams are not expected to be  
238 directly impacted by placement at Site 104 because oyster and softshell clam habitats do not exist  
239 within the Site 104 boundaries. The closest viable oyster bar is the Broad Creek Bar located at  
240 the southeastern end of Site 104 (Scott 1998). Although not directly impacted by placement of  
241 dredged material at Site 104, the bar could potentially be affected by residual turbidity plumes  
242 and sediment deposition. Impacts from turbidity plumes are expected to be minimal (although  
243 deposition outside of the site has not been modeled) and environmentally insignificant. Time of  
244 year restrictions will minimize potential impacts to larval or juvenile lifestages. Few viable  
245 oyster bars remain in the Bay today, so that adverse impacts to any viable bar are considered  
246 significant on both a regional and Bay-wide scale. Historical overharvesting, disease, and habitat  
247 destruction have cumulatively impacted the Chesapeake Bay oyster fishery. Any potential  
248 adverse impact to viable oyster bars would add to the existing pressure on this resource and  
249 would be environmentally significant.

250  
251 Overwintering male blue crabs within the site boundary will be directly impacted by placement  
252 activities. Both controlled hydraulic pipeline placement to the bottom and bottom-release scow  
253 placement will bury overwintering male crabs within the project area. These males only  
254 represent a sub-set of the total overwintering population in the upper Bay. Based on Winter  
255 Dredge Surveys conducted by MDNR (Sharov 1998), the density of male crabs overwintering in  
256 water deeper than -13.7 meters (-45 feet) is reduced compared to shallower locations of the site.  
257 Blue crab densities within the site were low compared both to the upper-Bay and Bay-wide  
258 densities. Placement impacts to blue crabs would, therefore, be locally significant (at the site),  
259 but short-term and temporary. The direct mortality may minimally impact recruitment on a year-  
260 to-year basis but is not expected to have impacts on the Bay-wide population. The site specific  
261 placement activities will not impact female blue crabs because they overwinter in higher salinity  
262 areas near the mouth of the Bay.

263  
264 On a Bay-wide scale, the impact to the blue crab fishery is expected to be insignificant due to the  
265 availability of comparable overwintering habitat in the upper Bay. Little significant cumulative  
266 impact to the blue crab fishery is expected on a regional or Bay-wide scale, because, on a  
267 regional level, few other planned dredging or placement activities will occur concurrently with  
268 dredged material placement at Site 104.

269  
270 **8.2.3.d Benthic Communities.** Benthic communities in the Site 104 boundary will be  
271 significantly impacted by the direct placement of dredged material on Bay bottom. The existing  
272 communities in the immediate area are dominated by opportunistic species that re-colonize each  
273 successive year after summer anoxia events. Based on benthic community studies conducted at  
274 other open water placement sites similar to Site 104, the communities are expected to re-establish  
275 to pre-placement conditions within 18 months following cessation of all placement activities.  
276 This scenario will be valid for locations within the site that are annually used during all nine  
277 potential placement years. Placement, however, is expected to occur at various locations

278 throughout the site, with only a few areas being used continuously throughout the life of the  
279 project. Overall, impacts to the community will be short-term (approximately 1 to 9 years in  
280 duration), and environmentally insignificant on a Bay-wide scale.

281  
282 Other dredging-related activities in the upper Bay that could disrupt regional benthic  
283 communities include placement at Pooles Island, maintenance dredging, and new dredging  
284 projects. Overall, the net cumulative impacts to benthic communities in the upper Bay will be  
285 short-term, temporary, and environmentally insignificant. In addition, the majority of  
286 communities that will be impacted by dredging or placement activities are not diverse  
287 equilibrium communities, already exhibit signs of stress from naturally occurring hypoxia events,  
288 or have been disturbed by previous placement activities. These areas are already stressed by  
289 naturally occurring conditions or by previous dredging or placement events, and are not  
290 undisturbed pristine communities. It is possible that a more diverse benthic community may  
291 eventually become established due to shallower depths and shorter duration of summer hypoxia  
292 events after placement at the site ceases.

#### 293 294 **8.2.4 Air Quality**

295  
296 Localized increases in air pollutant emissions from placement equipment and vessels will be  
297 short-term and environmentally insignificant. The emissions generated at the placement site are  
298 not expected to cumulatively impact air quality or contribute to high ozone levels in the region.

#### 299 300 **8.2.5 Noise**

301  
302 Noise generated by placement equipment and marine vessels will be short-term, localized, and  
303 non-disruptive to residents of the adjacent shorelines. The noise generated by several different  
304 on-site sources will not be cumulative. Because no other noise-generating activities or noise  
305 sources are anticipated in the immediate area, no adverse cumulative noise impacts are expected.

#### 306 307 **8.2.6 Socioeconomics**

308  
309 Adverse impacts to socioeconomics associated with aquatic resources and fisheries of the region  
310 will be short-term and temporary. Finfish, blue crabs, and oysters are not expected to be  
311 significantly impacted by placement activities. Commercial and recreational finfish catches from  
312 the vicinity of the site may potentially be depressed during placement activities, but are expected  
313 to return to normal levels after placement ceases. Mortality of overwintering blue crabs in the  
314 site is not expected to significantly impact blue crab recruitment or the blue crab fishery on a  
315 Bay-wide scale. On a regional level, the site is not highly utilized by commercial crabbers, and  
316 the majority of placement activities will take place outside of the commercial crabbing season.  
317 There are no oyster beds within the site, and placement activities are not expected to adversely  
318 impact oyster beds adjacent to the site. Economics associated with recreational use in the region  
319 are not expected to be impacted by placement activities (see Section 8.2.8). Overall, short-term  
320 economic impacts to fisheries and commercial watermen will be minor on a regional level, and  
321 will be insignificant on a Bay-wide scale. If multiple dredging-related projects are implemented  
322 concurrently in the upper Bay, there could be a net adverse impact to the overall fishery landings  
323 and recreational use for the region. Additional socioeconomic evaluations would be necessary to

324 determine the potential cumulative impacts to fisheries of the region prior to implementation of  
325 future projects. Each individual new dredging project in the upper Bay region will be evaluated  
326 for potential impacts to commercial fisheries prior to implementation.

327

### 328 **8.2.7 Aesthetics**

329

330 There will be no long-term adverse impacts to the aesthetic quality of the region. Placement  
331 equipment, such as scows and tugboats, will disrupt the visual aesthetics of the area only during  
332 placement activities, as will turbidity plumes. These impacts will be short-term and temporary,  
333 lasting only as long as the placement activities continue. No physical changes above the water  
334 will occur at the site as the result of placement activities. Therefore, there will be no cumulative  
335 impact to the aesthetics of the area.

336

### 337 **8.2.8 Recreational Resources**

338

339 Recreational fishing and boating in the site-specific area will be temporarily impacted during  
340 placement events. Increased scow and tugboat traffic will potentially disrupt recreational boating  
341 and fishing activities, and localized, short-term increases in water column turbidity could  
342 potentially disrupt recreational fishing success in the vicinity of the placement site. Because  
343 placement has been planned for periods when recreational activities are minimal, these impacts  
344 should be insignificant. Vessel traffic in the area of Site 104 should return to normal levels after  
345 placement ceases, and turbidity levels are expected to subside to background values within a  
346 short period of time after each placement event. Therefore, no cumulative adverse impacts to the  
347 recreational resources of the area are expected from the project.

348

349 Other dredging-related activities proposed for the upper Bay, could adversely impact  
350 recreational resources in the region. The majority of currently proposed projects should,  
351 however, only create temporary disruptions to the recreational resources of the upper Bay.  
352 Cumulative impacts to the recreational resources in the upper Bay from maintenance dredging,  
353 open water placement at Pooles Island, and other upper Bay projects are expected to be minor  
354 due to the availability of comparable recreational boating and fishing areas in the region.

355

## 356 **8.3 CUMULATIVE POSITIVE IMPACTS**

357

358 Positive effects of the project are long-term and are discussed in detail in Chapter 6. Major long-  
359 term benefits of the project include improvement to water quality, sediment quality, and aquatic  
360 resource habitat, and increased economic prosperity to the local commercial fisheries and to the  
361 Port of Baltimore.

362

### 363 **8.3.1 Water Quality**

364

365 Despite site-specific short-term, localized increases in turbidity, total suspended solids, and  
366 nutrient concentrations, placing dredged material at Site 104 could have a long-term positive  
367 impact on water quality in the region. Water column stratification, hypoxia, and anoxia  
368 commonly occur in the deep central portions of the Bay during the summer months. Typically,  
369 these areas support little aquatic life or are limited to communities composed of organisms  
370 adapted to low dissolved oxygen conditions. Decreasing the depth from a maximum of -23.8

371 meters (-78 feet) to approximately -13.7 meters (-45 feet) MLLW could reduce the duration and  
372 severity of regional hypoxic and anoxic conditions during the summer months in the vicinity of  
373 Site 104. Shorter duration of hypoxia and anoxia would allow a longer annual recovery period  
374 for benthic communities and a longer foraging period for finfish that inhabit the area.  
375 Improvement to the available habitat would be reflected in healthier benthic and finfish  
376 communities. Combined with other water quality restoration efforts in the upper Bay watershed,  
377 changes in the distribution and duration of anoxic conditions would provide a net benefit to the  
378 area on a regional level.

### 379 380 **8.3.2 Sediment Quality**

381  
382 The quality of surficial sediments at Site 104 will improve by placing dredged material at the  
383 site. The sediment to be placed at Site 104 will be non-contaminated material dredged from the  
384 Chesapeake Bay approach channels to the Port of Baltimore Harbor. Sediment studies (EA  
385 1998) for the approach channels indicate that quality of these materials is good. Physical  
386 characteristics of the sediments currently at Site 104 are comparable to the physical  
387 characteristics of sediments proposed for placement at the site. Chemical characterizations,  
388 however, revealed that concentrations of trace metals in existing sediments at Site 104 were up to  
389 ten times greater than sediments from the channels proposed for dredging. It is suspected that  
390 the high concentrations of trace metals at Site 104 are the result of historic placement of  
391 contaminated sediment from Baltimore Harbor. Future placement of clean dredged material at  
392 Site 104 will provide a capping effect and will improve site specific surficial sediment quality for  
393 the resident benthic communities. Sediment quality improvement could be manifested by  
394 enhanced benthic and finfish production on a regional level.

395  
396 Proposed future dredged material placement activities will further ensure that no contaminated  
397 sediments will be placed in open water sites.

### 398 399 **8.3.3 Aquatic Resource Habitat and Commercial Fisheries**

400  
401 **8.3.3.a Finfish.** Decreasing the depth at Site 104 from a maximum of -23.8 meters (-78 feet) to  
402 approximately -13.7 meters (-45 feet) MLLW will potentially improve finfish utilization and  
403 enhance commercial and recreational fishing in the area. Shallower habitat, combined with more  
404 abundant benthic food resources and shorter duration of hypoxia or anoxia will improve finfish  
405 habitat at Site 104 over the long-term. Currently, the majority of commercial fishing activity,  
406 primarily gill netting, occurs in the northern portion of the site in shallower, more productive  
407 habitats where material placement will not occur. Improving finfish habitat and foraging areas at  
408 Site 104 will potentially improve the commercial fishing efforts in the region. Representatives  
409 from MWA have stated that, although they object to open-water placement in general, they  
410 would not oppose placement in Site 104 if bottom conditions could be improved. The shallower  
411 depths and smoothed bottom after placement will facilitate use of gill netting in the area by  
412 commercial fishermen.

413  
414 **8.3.3.b Shellfish.** In addition to potential long-term improvement to the regional finfish fishery,  
415 open water placement activities at Site 104 could provide an ancillary benefit to MDNR's Oyster  
416 Recovery Program and watermen. MDOT and MDNR have executed a cooperative agreement  
417 with the MWA to develop and fund programs that will enhance Bay resources and sustain

418 economic growth. In a six-year funding agreement (1997-2002), MDOT has agreed to provide a  
419 maximum of \$17.7 million to DNR's Oyster Recovery Program. The program is designed to  
420 "...restore the oyster population of the Chesapeake Bay to a sustainable economic foundation for  
421 the oyster industry as well as to a viable ecological foundation for the Bay ecosystem" (MDOT  
422 and MDNR 1996). Funding is directly proportional to the quantity of dredged material that is  
423 placed in open water sites. If dredged material is placed at Site 104, it would provide a secondary  
424 environmental benefit to the oyster fishery of the Bay. Open water placement of 18 mcy of  
425 dredged material at Site 104 could fund up to \$12.4 million for the Oyster Recovery Program.  
426 When combined with open water placement at Pooles Island, the cumulative benefit to the  
427 Oyster Recovery Program is substantial.

428

#### 429 **8.3.4 Regional Socioeconomics**

430

431 Placement of dredged material at Site 104 will provide long-term economic benefits to the state,  
432 the Port of Baltimore, and to industries that depend upon the viability of the Port. Regional  
433 economic benefits of the project could include employment by local dredging companies and  
434 increased value of the local commercial fisheries landings as a result of improved habitat quality.  
435 Because the project will provide funding to the Oyster Recovery Program, the oyster fishery will  
436 be enhanced both ecologically and economically.

437

438 Maintenance dredging and placement activities must take place in order to assure safe  
439 navigational access to and from the Port. The potential capacity at Site 104 (18 mcy) will  
440 accommodate placement needs for clean material for approximately one to nine years. This  
441 short-term solution will allow time for completion of the Poplar Island facility and will allow for  
442 continued evaluation of future placement options. Open water placement at Pooles Island and  
443 Site 104, maintenance dredging, and new work dredging projects throughout the upper Bay will  
444 cumulatively contribute to a net economic benefit for local watermen, the Port, and the upper  
445 Bay region.

446

#### 447 **8.4 CUMULATIVE IMPACTS SUMMARY**

448

449 Open water placement of dredged material at Site 104 will not adversely impact the regional  
450 setting, physiography, geology, hydrology, groundwater, sediment quality, SAV, terrestrial or  
451 avian resources, cultural resources or archaeological resources in the region. In addition, the  
452 proposed project will not involve the use, storage or transport of hazardous, toxic or radioactive  
453 materials during or after placement. Pending a biological determination from NMFS, the project  
454 is not expected to impact the endangered shortnose sturgeon. Although some short-term adverse  
455 impacts are anticipated for air quality, noise, socioeconomics, aesthetics, and recreational  
456 resources, adverse cumulative impacts to these resources are not expected.

457

458 Overall, cumulative negative effects of open water placement at Site 104 are of minimal  
459 environmental significance. Increases in turbidity, TSS, and nutrient concentrations will be site  
460 specific, short-term, and localized. Potential cumulative effects upon regional salinity will be  
461 negligible and will not adversely impact resident organisms. Due to the abundance of  
462 comparable habitat in the region, the project will have little adverse impact on a Bay-wide scale.  
463 The majority of hydrodynamic impacts will be short-term and temporary. Depths at the site will

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464 be permanently changed, and some sediment erosion, sediment transport, and material spreading.  
465 will occur. The potential cumulative impacts to regional hydrodynamics as the result of multiple  
466 upper Bay projects have not been studied. Additional studies and modeling of regional  
467 hydrodynamics would be required to determine the potential adverse cumulative impacts.  
468

469 Overall, the cumulative positive effects of the project outweigh the short-term negative impacts.  
470 Improvements to water quality, sediment quality, and fishery habitat are environmentally  
471 significant at a local level. In addition, representatives of the MWA have stated that, although  
472 they object to open-water placement generally, they would not oppose placement in Site 104 if  
473 bottom conditions could be improved (Site 104 Open-Water Placement Area Commercial and  
474 Recreational Fishers Meeting Summary July, 28 1997-Attachment C). In addition, the potential  
475 reduction in anoxia in the area and the contributions to the Oyster Recovery Program may be  
476 environmentally significant at a regional level. Combined with other on-going restoration  
477 projects in the Bay, the positive impacts contribute to cumulative improvements to the Bay  
478 resources and ecosystem. Dredged material placement at Site 104 is an economically significant  
479 project for the Port of Baltimore. As an ancillary benefit any enhancement or improvement of  
480 the Bay's oyster fishery will provide improvements in the health of the Bay and help support  
481 future economic prosperity of the Bay's watermen.  
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Section 9

**SITE 104 MONITORING FRAMEWORK**

**9.1 PURPOSE**

Monitoring for the Site 104 placement operations will be performed as part of regulatory compliance, to ensure that performance criteria are met, to confirm and to limit the predicted potential impacts, and to provide information to further assist in the management of the site. Results of the Site 104 monitoring framework can be used to verify assumptions and predictions or to provide a basis for modifying the site management process. This monitoring framework was developed with the objective of providing the information needed by regulatory and resource agencies to meet their operational requirements and data needs, and serves as a template for developing the monitoring plan. The monitoring framework will be submitted by CENAB to MDE for approval as part of the Water Quality Certification requirements for this project should a favorable Record of Decision be issued for use of Site 104 for placement of dredged material.

**9.2 INTRODUCTION**

This monitoring framework, like the study process and project design, is the result of a collaborative effort. It has been developed to provide a multi-disciplinary monitoring program that meets the regulatory and resource agencies requirements for the Site 104 open-water placement project. Monitoring needs have been identified in a collaborative manner by a multi-disciplinary group of state and Federal regulatory and resource agencies for similar sites throughout the upper Bay (e.g., Hart-Miller Island, Pooles Island sites, and Poplar Island).

~~Agencies providing expertise and information on Region III and CBP monitoring elements will include NMFS, USFWS, MDNR, MGS, MPA, MDE, MES, EPA, USACE, UMCES HPEL and CBL. A collaborative, multi-disciplinary team will participate in the development of the monitoring framework in order to contain costs, to ensure comprehensive monitoring, and to provide concurrent peer review of the monitoring effort.~~

The development of the monitoring approach is a dynamic process, and monitoring elements will evolve to fit changing conditions and findings. The specifics of each monitoring element will be controlled by the final project details. Changes will continue to be presented to the agency team for their review and comment. Monitoring is intended to be flexible in order to meet the needs of the project and the requirements of the resource and regulatory agencies over time. Each element will be evaluated at the end of each monitoring year, and the monitoring team will decide upon appropriate changes as necessary.

These monitoring needs require that data be collected before, during, and after placement at Site 104. The baseline data include information previously collected for the NEPA process to document existing conditions in or around Site 104. Data collected would be used to compare and assess future conditions both during and after placement occurs. Baseline data collection was initiated in the spring of 1996.

47  
48 The use of fish (demersal and pelagic) and crustaceans such as crabs to directly monitor the  
49 impacts of the placement operations is not appropriate. They move into and out of the Site 104  
50 area, which makes it impossible to determine how representative they would be in assessing the  
51 impacts of placement operations in Site 104. Also, the direct effects of dredged material  
52 placement in open waters on the behavior and long-term physiological response of fish and crabs  
53 is poorly understood. There are no indices or coefficients (such as toxicity tests) that allow the  
54 direct exposure effects on predators to be quantified.

55  
56 Although not included in this framework, a ~~two~~<sup>2</sup>-year monitoring program for the shortnose and  
57 Atlantic sturgeon was developed by the NMFS, USFWS, and USACE and implemented by the  
58 USFWS and funded by CENAB and CENAP. An interim Biological Assessment (BA) is being  
59 prepared by the Baltimore District and will be provided to NMFS at the time of the public release  
60 of this draft EIS. This interim BA will include all sturgeon-related field data available at that  
61 time. In addition to the data collected during this sturgeon monitoring program, the interim BA  
62 will include data collected during the USFWS Bounty Program.

### 63 64 **9.3 MONITORING ELEMENTS**

#### 65 66 **9.3.1 Site Management**

67  
68 ~~The objectives of this monitoring element are as follows:~~

- 69  
70 ~~1. To provide guidelines for placement of material at Site 104;~~  
71  
72 ~~2. To specify operational criteria where controls are necessary;~~  
73  
74 ~~3. To provide detailed plans for meeting restrictions imposed by certification; and~~  
75  
76 ~~4. To provide monitoring of site performance.~~

77  
78 ~~The following methodologies will be used to achieve the above objectives:~~

79  
80 Guidelines for material placement would be designed to minimize resuspension and dispersion of  
81 sediment, and to ensure that material is placed in accordance with pre-designated locations and  
82 depths within the placement site. Placement plans will be developed prior to each year's dredging  
83 and will be developed based on pre-placement surveys performed to verify the capacity of the Site  
84 104 area. The specific minimum performance criteria may include, but are not necessarily limited  
85 to: (1) verification of dredging and placement depth by bathymetric surveys, (2) use of specified  
86 routes for travel between the dredging and placement sites, and (3) verification of dredging and  
87 placement locations using data from electronic navigation systems.

88  
89 ~~Implementing operational controls on the placement activities would minimize the opportunity for~~  
90 ~~sediment resuspension and dispersion during the placement process while maximizing operational~~  
91 ~~efficiency and safety. Control techniques may include, but are not limited to: (1) contractually~~  
92 ~~requiring that the placement operations meet specific minimum environmental performance~~

standards and environmental windows; (2) contractually requiring submittal and implementation of project specific plans; (3) placement of marker buoys to identify routes or the designated material placement locations; (4) use of a Global Positioning System with onboard recording capability to identify and document the location of material placement and/or requirements for inspectors to verify placement locations; (5) requiring the dredging contractor(s) to meet specific minimum competency and experience standards; and (6) notifications to fishing and boating interests of dredge and scow movements and schedules.

CENAB will submit a finalized Site Management Plan to MDE to ensure coordination of all parties involved and will obtain approval for use of Site 104 prior to commencement of any placement activity. The Site Management Plan will include estimates of placement capacity and coordinates of the designated grid area in which all placement will occur. This will include the placement sequence of material and the designated locations and volumes. The operations plan to be used by the contractor for dredged material placement will also be appended to the Site Management Plan.

#### Study Endpoint:

The study endpoint of this monitoring element will be determined within a window to be defined following the last placement action. This window will be clarified based upon information collected following the completion of all placement activities.

### 9.3.2 Consolidation and Erosion

The objectives of this monitoring element are as follows:

1. To determine the initial capacity of the Site 104 area before and the remaining capacity after each placement season;
2. To measure and evaluate changes in the material placed within and around the Site 104 area due to erosion and consolidation of sediments;
3. To evaluate the monitoring data and suggest modifications as necessary in the monitoring program design and in-site management.

The hypothesis being evaluated is as follows:

Dredged sediment is subject to predictable forces after placement which result in relatively standard rates of consolidation and erosion, based on the type of material, the method of placement and the placement location. Placement of dredged material will not materially deviate from these expected conditions.

Observations of consolidation and erosion in the Site 104 area would be determined through sample collection, laboratory analysis, and data processing and synthesis. Existing sediments in the Site 104 location would be collected and analyzed before dredging and placement operations begin. Bathymetric surveys of the placement area would also be performed prior to placement to evaluate changes in capacity of the placement area over time. At the conclusion of the proposed

139 placement activities and at the end of the monitoring period, core samples would be collected  
140 from the placement area to provide a baseline for evaluating changes in the deposited sediments  
141 over time. Selected samples would be subjected to grain size and bulk property analyses. These  
142 data would be analyzed to determine volumetric changes due to consolidation of the foundation  
143 sediments.

144  
145 ~~Study Endpoint:~~

146  
147 Monitoring would be performed each year that placement occurs within the Site 104 area, and up  
148 to ~~one~~ 1 year after placement is completed to document consolidation and erosion.

### 149 150 **9.3.3 Shellfish Bed Sedimentation**

151  
152 The objective of this monitoring element would be to provide information on the change in  
153 sedimentation rates on nearby charted oyster bars (State of Maryland Natural Oyster Bars  
154 [N.O.B.] 6-5 and 4-8), otherwise known as Broad Creek and the Bear Creek Bar, respectively)  
155 and at adjacent reference sites.

156  
157 ~~The hypothesis being evaluated is:~~

158  
159 ~~There is no discernable increase in sedimentation rates on the charted oyster bars during~~  
160 ~~placement when compared to sedimentation rates prior to placement activities, adjusted to reflect~~  
161 ~~seasonal and annual variations in sedimentation.~~

162  
163 ~~To test this hypothesis, t~~The baseline sedimentation rate within the oyster bar ~~must~~would first be  
164 determined and then compared to rates obtained during placement operations. This will be  
165 accomplished using bathymetric surveying combined with a side-sonar survey and acoustic  
166 bottom classification. The baseline accumulation rates will be determined by measurements  
167 made at predefined locations within the oyster bar for a specified period prior to initiation of  
168 placement operations. The rates will be adjusted to reflect seasonal and ~~annual~~ variations to  
169 enable an appropriate comparison. The specific approach will be developed prior to submission  
170 of the monitoring framework.

171  
172 If it is determined that sedimentation within the oyster bar has increased due to placement of the  
173 dredged materials, operations will be discontinued until the placement methods can be re-  
174 evaluated and refined.

175  
176 ~~Study Endpoint:~~

177  
178 Evaluations would continue annually to determine whether monitoring should continue.

### 179 180 **9.3.4 Sediment Quality Monitoring**

181  
182 The objectives of this monitoring element are as follows:

183

- 184 ~~1. To characterize the chemical composition of the sediments in the channels to be placed~~  
185 ~~at Site 104;~~  
186  
187 ~~2. To track the quality of sediments placed at Site 104; and~~  
188  
189 ~~3. To distinguish the anticipated improvement of the sediment quality at station KI-7~~  
190 ~~(which had the highest levels of contaminants).~~

191  
192 The hypotheses being evaluated are as follows:

- 193  
194 ~~1. The priority pollutant organic compound concentrations in sediments taken from the~~  
195 ~~channels and placed at Site 104 will be below detection limits or below the~~  
196 ~~appropriate criteria for these constituents.~~  
197  
198 ~~2. The metal concentrations in sediments placed at Site 104 will be below appropriate~~  
199 ~~criteria for these constituents; and~~  
200  
201 ~~3. After one year of placement at KI-7, the concentrations of metals and organics will be~~  
202 ~~below the appropriate sediment criteria for these constituents.~~

203  
204 Sediment samples would be collected both inside and outside the boundaries of Site 104 every  
205 ~~three~~ 3 years -at the same locations as in the baseline sampling (Figure 5-13). Sediment samples  
206 would be analyzed for organics, inorganics, nutrients, and grain size (including the Atterberg  
207 limit tests).

208  
209 Samples would be collected from the Chesapeake Bay approach channels and analyzed using  
210 field and laboratory methods as defined by the Chesapeake Bay Program to support the Inland  
211 Testing Manual guidelines (EPA and USACE, 1998). The results of these samples are used to  
212 define the materials dredged during channel maintenance operations.

213  
214 After ~~one~~ 1 year of placement, sediments at station KI-7 would be analyzed to verify equal or  
215 improved sediment quality over baseline conditions.

216  
217 ~~Study Endpoint:~~

218  
219 The study endpoint of this monitoring element will be the final monitoring following the last  
220 proposed placement action at Site 104.

### 221 222 **9.3.5 Sediment Nutrient Flux**

223  
224 The objectives of this monitoring element are as follows:

- 225  
226 ~~1. To characterize nutrient loading in and around Site 104; and~~  
227  
228 ~~2. To verify that placement at Site 104 will have no long term impact on nutrient flux rates~~  
229 ~~and, therefore, water quality (short term impacts are expected).~~

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The hypothesis being evaluated is as follows:

~~Sediment nutrient flux rates will remain within the expected ranges for a similar area that experiences summer hypoxia.~~

~~In order to evaluate this hypothesis,~~ Stations in and around Site 104 would be monitored each year during hypoxic/anoxic periods (May--September) at a time when microbial activities and potential nutrient releases are highest. Sediment carbon, oxygen, and nutrient flux sampling would take place during May, June, July, August, and September following placement each season. A total of five sets of measurements would be made at each station (vertical water column profiles of temperature, salinity and DO, water column samples, and sediment core samples). The water column samples would be analyzed for ammonium, nitrite, nitrite+nitrate, dissolved inorganic phosphorus (DIP) corrected for salinity, and silicious acid. The sediment cores would be used to measure oxidation-reduction potential (Eh) of the sediments at 1-cm intervals for the top 10 cm, particulate carbon, particulate nitrogen, particulate phosphorus, total and active chlorophyll-a, and net exchanges of carbon, oxygen, and dissolved nutrients between sediments and overlying waters.

~~Study Endpoint:~~

~~When sediment nutrient flux rates return to within expected ranges for the area, or are predictable in nature based upon data collected over a minimum of ~~three~~ 3 years, the study team will determine whether monitoring should continue.~~

### 9.3.6 Water Quality Monitoring

~~The objectives of this monitoring element are as follows:~~

- ~~1. To characterize water quality in and around Site 104 to evaluate whether long term water quality changes have resulted from the proposed action (short term water quality impacts are expected);~~
- ~~2. To monitor turbidity resulting from placement activities at the edge of the mixing zone; and~~
- ~~3. To comply with the Water Quality Certificate requirements during placement.~~

~~The hypotheses being evaluated are as follows:~~

- ~~1. There will be no significant long term change in water quality conditions at Site 104 (a slight short term change in turbidity is expected immediately after placement operations within the boundaries of Site 104); and~~
- ~~2. Turbidity levels outside the defined mixing zone will remain in compliance with the Water Quality Certification limitations during and after placement activities.~~

276  
277 ~~In order to evaluate these hypotheses,~~ Stations within and outside of Site 104, including the  
278 Chesapeake Bay Program Water Quality Monitoring (CBP) stations, would be monitored  
279 seasonally during placement. Typically three water quality samples would be taken per station  
280 (surface, mid, and bottom). The same parameters would be used for water quality testing as are  
281 evaluated in the Chesapeake Bay Program (spatial location, depth, temperature, salinity,  
282 conductivity, turbidity, total suspended solids [TSS], secchi depth, pH, dissolved oxygen,  
283 chlorophyll-a, and nutrients such as nitrogen, phosphorus, carbon, and silica species). The CBP  
284 approach is specific to the Bay and will function as the tool to satisfy the ITM guidelines. In  
285 addition, data from CBP stations would be evaluated for use as a historical comparison for  
286 baseline data sets.

287  
288 TSS and nutrient samples would be collected upstream, in and downstream of the turbidity  
289 plume. Samples would be collected at three depths in the water column including surface, mid,  
290 and bottom layers. This would be repeated during each placement year.

291  
292 Compliance turbidity monitoring is not defined as yet. It would depend upon the mixing zone,  
293 which has yet to be developed. Turbidity monitoring would be required during placement since  
294 compliance limits would be set in the Water Quality Certification issued by the Maryland  
295 Department of the Environment.

296  
297 ~~Study Endpoint:~~

298  
299 Evaluations would be made by the monitoring team annually on whether the monitoring should  
300 be continued.

### 301 302 **9.3.7 3-D Water Quality Modeling of Sediment Nutrient Flux Impacts on Water Quality**

303  
304 ~~The objective of this monitoring element is as follows:~~

305  
306 ~~To provide data to evaluate potential water quality impacts from sediment nutrient fluxes~~  
307 ~~and to substantiate the model predictions under actual placement conditions at Site 104.~~

308  
309 ~~The hypothesis being evaluated is as follows:~~

- 310  
311 ~~1. The use of Site 104 for placement is expected to have a short term and localized impact~~  
312 ~~on water quality, primarily through increased turbidity, total suspended solids and~~  
313 ~~nutrient concentrations at the time of placement;~~
- 314  
315 ~~2. Placement of dredged material at Site 104 will provide a moderate increase in dissolved~~  
316 ~~oxygen concentrations in bottom waters due to decreasing water depth;~~
- 317  
318 ~~3. Salinity concentrations in the upper Bay will not change more than 0.1 ppt; and~~
- 319  
320 ~~4. No long term impacts to water quality are expected.~~

21

322 ~~In order to evaluate these hypotheses, w~~Water quality data from Site 104 during the first, second,  
323 and third year of placement would be collected. These data would be used to re-run the water  
324 quality module of the WES CH3D Chesapeake Bay Model to assist in the verification of  
325 predicted impacts to water quality from the placement of dredged material at Site 104.

326  
327 ~~Study Endpoint:~~

328  
329 Evaluations would continue annually by the study team to determine whether monitoring should  
330 continue.

### 331 332 **9.3.8 Benthics Monitoring**

333  
334 ~~The objectives of this monitoring element are as follows:~~

335  
336 ~~To verify re-establishment of the benthic community and to compare the results of~~  
337 ~~sampling with established Chesapeake Bay benchmarks, including the B-IBI, to evaluate~~  
338 ~~benthic community conditions at Site 104;~~

339  
340 ~~The hypotheses being evaluated are as follows:~~

341  
342 ~~1. The benthos at Site 104 will show no long term loss in terms of the multi-metric~~  
343 ~~Benthic Index of Biotic Integrity (B-IBI) within a specified time period after all~~  
344 ~~placement has ceased; and~~

345  
346 ~~2. The elevation of the site depths may potentially embellish benthic colony establishment~~  
347 ~~(due to reductions in low oxygen events) and may promote non-opportunistic species~~  
348 ~~colonization.~~

349  
350 ~~In order to evaluate these hypotheses, b~~Benthic stations would be monitored once in the summer,  
351 fall, winter, and spring beginning ~~one~~1 year after placement of material has ceased. Three  
352 replicate samples per station would be collected. Reference stations would be established outside  
353 the area of impact for comparison purposes. The Chesapeake Bay Program's Benthic  
354 Monitoring Program and baseline data would provide useful data for comparison. The ~~Benthic~~  
355 ~~Index of Biotic Integrity (B-IBI)~~ would be used to compare the benthos at the active placement  
356 site to the benthos at the reference sites. Appropriate depth stations would be compared. At least  
357 one of the reference stations would be a Chesapeake Bay Program Benthic Monitoring Program  
358 Site.

359  
360 ~~Study Endpoint:~~

361  
362 The study endpoint of this monitoring element is ~~eighteen~~18 months after the last placement  
363 action at Site 104.

364

Section 10

Compliance with Applicable Laws, Regulations and Executive Orders

As part of the NEPA process, the applicable environmental laws and statutes were reviewed relative to the proposed placement plan. For a placement site to be environmentally acceptable, the location, plan, and operation must be in compliance with a suite of environmental protection statutes and executive orders. The placement plan is expected to comply with all pertinent regulations, as summarized in Table 10-1. Table 10-1 outlines the statutes and executive orders that are potentially applicable to the project, including the level of compliance. The multiple organizations involved in the project, the ongoing and open communication surrounding the placement site, the identification process, and site evaluation and decisions have helped assure complete compliance with potentially applicable statutes and regulations.

The plan is expected to be in compliance with the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The plan is in compliance with the National Historic Preservation Act.

The technical impact assessment documented in this report demonstrates that the project complies with applicable components of the Anadromous Fish Conservation Act; Clean Air Act, Coastal Zone Management Act, Estuary Protection Act, Marine Mammal Protection Act, Archaeological and Historic Preservation Act, National Historical Preservation Act, and the Rivers and Harbors Act. The proposed action would be in full compliance with the Clean Water Act if the State of Maryland issues a Water Quality Certification (WQC). The proposed action would also be in full compliance with the Endangered Species Act when the NMFS issues a Biological Opinion for shortnose sturgeon based upon activities associated with this project.

The project complies with all components of NEPA. Through the coordination process, the project complies with the Fish and Wildlife Coordination Act.

A number of executive orders are applicable to the project. The impact evaluation process demonstrates that the project complies with Executive Orders number 11593 Protection and Enhancement of Cultural Environment, number 11990 Protection of Wetlands and number 12962 Protection of Recreational Fisheries.

The project will have no disproportionate impact on minority or low-income communities, and complies with Executive Order number 12893, Environmental Justice. Through USACE public involvement and Outreach Committee meetings and public scoping meetings, the residents of Queen Annes, Anne Arundel, and Kent Counties have been involved in the decision making process.



## Section 11

## Relative Costs of Placement Site Alternatives

The costs related to the use of any placement alternative must be balanced against the benefits inherent in its use. As part of the NEPA process, the economic considerations of the preferred alternative (i.e., the Proposed Action) must be analyzed and balanced against the environmental impacts. The NEPA process also requires that the economics of any viable options be considered and weighed against the economics of the Proposed Action. This section summarizes the relative costs of the various viable placement alternatives considered in Sections 2 and 7.

**11.1 PLACEMENT ALTERNATIVES**

The placement alternatives considered for the 18 mcy short-term placement need were screened from hundreds of potential candidate sites (Section 2). The screening process considered sites with several different placement strategies. The placement strategies and sites that were considered viable after the screening process are detailed below.

**11.1.1 Types of Placement Alternatives**

Dredged material placement sites are generally categorized by the type of containment that is provided. The costs to develop and operate a site are directly dependent upon the type of placement involved. Generally speaking, placement sites are either on uplands or within/along bodies of water (shoreline stabilization/marsh reconstruction). Upland sites are generally contained and include some type of berm or retaining wall to help to keep materials in place. Shoreline stabilization sites or marsh/island reconstruction sites (along water bodies) are generally "semi-contained," a berm, breakwater, or bulkhead may be constructed to help stabilize material initially, but it may be designed to be temporary in low physical energy settings. Materials used for shoreline stabilization or marsh construction (i.e., beneficial use options) are generally expected to interact with the adjacent water body. Sites that lie completely within a waterbody tend to be one of two basic types: (1) island creation (usually completely or mostly diked/contained); or (2) open water (either with or without a berm).

Because all of these operations differ in the type and degree of materials contained and the necessary construction, the costs for development and operation will vary considerably.

**11.1.2 Alternatives Considered**

The screening process to identify the most appropriate type of placement and placement site for the 18 mcy short-term dredging need is detailed in Section 2. The analysis yielded the following list of viable alternatives:

- Site 104
- Hart Miller Island
- CSX/COX Creek
- Pooles Island Open Water

## NOT UPDATED

- 47 • Poplar Island (Phase I&II)
- 48 • Site 171 (as open-water site)
- 49 • Man-O-War Shoals
- 50 • Combination of Potentially Implementable Small Scale Projects
- 51 • No Action Alternative

52

53 Sections 2 and 7 detail the site-specific reasons that these sites remained as viable alternatives for  
54 the short-term placement need, relative to the hundreds of sites initially considered throughout  
55 the Bay region. Details on the economic and environmental considerations that resulted in Site  
56 104 becoming the preferred alternative (and Proposed Action) are also found in Sections 2 and 7.  
57 The remainder of this section is meant to clarify some of the economic considerations for the  
58 selection of Site 104.

59

### 60 **11.1.3 No Action Alternative**

61

62 The no action alternative is not the lowest cost alternative. If a placement option or site is not  
63 used, dredging cannot proceed. The cost to the Port would be potential loss of bulk and  
64 container carriers due to the inability to navigate the channels, increased costs to lighter ships  
65 calling on the Port, and increased transportation costs resulting from light loading of vessels.  
66 This would result in irretrievable losses of revenue as well as jobs. The ultimate cost would be  
67 the demise of Baltimore as a viable Port for modern seagoing ships. Since this would not be a  
68 realistic situation, the No Action Alternative would not be acceptable.

69

### 70 **11.2 PLACEMENT COSTS**

71

72 The type of placement facility and area where materials are placed will dictate the costs of  
73 placement. Costs can vary greatly from site to site, even within one type of placement. The  
74 main reasons for this variability includes: distance from dredging project to placement  
75 site/facility, accessibility of facility to barges/scows, land acquisition constraints and costs,  
76 monitoring costs, and site-specific engineering constraints. There are, however, some  
77 generalizations that can be made within and between placement types. These are outlined in the  
78 following sections with site-specific examples, as available.

79

#### 80 **11.2.1 Costs of Dredging and Transportation of Dredged Materials**

81

82 One of the significant factors that is utilized to make comparisons among alternatives is the  
83 estimation of the cost for dredging and transportation of the dredged material to any specific  
84 alternative location. While the least expensive alternative is not always preferred, the difference  
85 in cost provides a useful tool with which to judge the merits of each alternative. As a general  
86 rule, the costs of the actual dredging of the channels will not vary much among the placement  
87 alternatives.

88

89 The most significant cost factor in the actual dredging operation is the distance over which the  
90 dredged material must be transported. Current estimates of transportation costs for this region  
91 are \$0.10/cubic yard per mile of distance. Section 7 includes an analysis of distances from the  
92 channels scheduled for maintenance/improvement relative to all of the sites considered to

93 accommodate the short-term placement need (Table 7-1). Sites 171, Man-O-War Shoals, and  
94 Site 104 have the lowest transportation distances of any of the currently viable placement  
95 alternatives. Although increased transportation costs will not, of themselves, preclude a site from  
96 being economically viable, it remains as one of the key considerations in assessing placement  
97 costs in this region.  
98

### 99 11.2.2 Dredged Material Placement Costs

100  
101 Dredged material placement costs are a function of several factors: (1) the type of dredging  
102 necessary for the project; (2) the type of transportation necessary for the type of dredging used;  
103 and (3) the type of placement implied by the type of dredging and placement facility type. In the  
104 Bay, materials are generally dredged either mechanically (with a large bucket that scoops  
105 material onto a barge/scow) or hydraulically (where material is either cut or suctioned into/onto a  
106 scow or pumped directly to a placement site).  
107

108 Upon arrival at a site, the way the material is placed is dependent upon the type of site. For  
109 upland or contained sites, material must either be mechanically placed (i.e., scooped) onto the  
110 site or pumped onto the site. Mechanical placement is more time consuming and, therefore,  
111 costly. For open water sites, the placement occurs either by hydraulically pumping sediments  
112 directly onto the site from nearby channels, pumping materials from a scow (controlled pipeline),  
113 or allowing the materials to drop from the bottom of a scow (bottom release scow) or hopper  
114 dredge. In this instance, the mechanical placement (bottom release scow) is the least costly  
115 alternative for open-water and the least costly of any placement type. Although the process of  
116 hydraulic placement is similar for both open-water and contained/semi-contained sites, vessel  
117 access to open-water sites is generally easier, making this process slightly less costly at open-  
118 water sites. Placement in open water sites (such as Site 104, Man-O-War Shoals, and Site 171)  
119 tend to be the least costly placement processes.  
120

### 121 11.2.3 Real Estate Costs

122  
123 The relative costs of real estate required for each of the placement site types are dependent upon  
124 whether the alternative is an upland vs. in-water (open water, shoreline) site. In-water placement  
125 sites will not require purchase of real estate unless a connection to shore is required. The State of  
126 Maryland, as the owner of the Bay bottom, already owns the placement sites for all open-water  
127 sites. All upland sites and shoreline sites must be acquired or leased, or an easement must be  
128 obtained from the current owners prior to use if not already under State or Federal ownership.  
129 This generally results in significant cost and can take a very long time in negotiation. For  
130 example, the land required for the CSX/Cox Creek Site took more than 6 years to acquire.  
131 Because most upland and shoreline sites are of moderate or low capacity, development of  
132 multiple sites would be required to meet the 18-mcy short-term need. Multiple sites will cost  
133 significantly more per acre to negotiate and acquire than a single site large enough to handle the  
134 required 18 MCY.  
135

136 Sites that are already owned or acquired, and are either permitted (HMI, Pooles Island) or in the  
137 process of construction or permitting (Poplar Island, CSX/Cox Creek) would not involve any  
138 new real estate costs. Therefore, these would be comparable to open water sites in terms of real

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139 estate costs (at the present time). However, all of the aforementioned sites have maximum  
140 annual capacity constraints and are currently scheduled for materials other than the 18 mcy that  
141 are necessitating the consideration of Site 104 at this time.

142

### 143 11.2.4 Site Development Costs

144

145 Site development costs are a function of the amount of construction needed. Confined sites (that  
146 require dike construction) are the most costly to develop. Upland or shoreline sites that require  
147 some kind of stabilizing structure (bulkhead, retaining wall, berm) would be less costly than a  
148 completely contained facility, but certainly more costly to develop than an open water site. The  
149 costs are incurred not only from the need to construct containment structures, but also from the  
150 need to construct infrastructure (e.g., developing access roads, dredging service channels,  
151 development of docking/mooring facilities). For example, CSX/COX Creek will require  
152 significant renovation and improvements prior to full-scale operation.

153

154 All of the new confined or upland alternatives would, therefore, require significant site  
155 development. There would be planning, design, and construction costs associated with each of  
156 these alternatives that are much greater than at either of the existing sites or open water options.  
157 Open water sites require little, if any, containment construction or infrastructure development.  
158 Some open water alternatives may require construction of underwater berms to adequately  
159 confine the dredged material; underwater berms would be an additional cost at an open-water  
160 site, and would be comparable in costs to similar containment structures on land. None of the  
161 development cost would be incurred at Site 104.

162

163 Beneficial use sites with habitat components, such as Poplar Island, would have the added cost of  
164 habitat reconstruction. Although this is not strictly a construction cost, it must be acknowledged  
165 as a cost of site development.

166

### 167 11.2.5 Site Operation Costs

168

169 Site operation costs are a direct function of the type of placement and facility. Engineered  
170 (contained) facilities require a certain amount of continual maintenance to ensure that dikes and  
171 spillways are properly maintained and that material de-watering and consolidation proceed as  
172 planned. Therefore, site operation costs for a facility like CSX/COX Creek are expected to be  
173 somewhat more expensive than the current operating costs at HMI. Upland and shoreline sites  
174 may require less maintenance than containment sites, although some grading and spreading  
175 generally is required. Of course, site operation costs for multiple upland/shoreline sites would be  
176 expected to be significantly higher than for any single site with capacity for 18 mcy, and  
177 significantly higher than open water sites. Open water sites require little to no site operation  
178 other than monitoring (see below). Grading is required for some open water sites, and grading  
179 may be required for Site 104.

180

### 181 11.2.6 Site Monitoring Costs

182

183 Site monitoring costs will vary both among and within placement types, due primarily to the  
184 resources of concern in the area and the nature of the placement activity. All contained sites are

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185 required to monitor the quality of the water that is released from the site as well as the condition  
186 of the aquatic resources in the vicinity of the site. The use of HMI would not result in additional  
187 monitoring costs since monitoring is already an integral part of site operations and will occur  
188 regardless of the source of the material. The other confined site, CSX\COX Creek, is expected to  
189 have similar monitoring requirements to HMI. In the case of Poplar Island, monitoring of  
190 aquatic resources may be required because the area has significant fisheries resources and  
191 monitoring of wetlands development will be required. This would be in addition to the water  
192 quality monitoring required by the NPDES discharge permit.

193  
194 Upland sites would not necessarily have any aquatic monitoring requirements but would have  
195 effluent monitoring requirements. Monitoring of the health and recovery of plant communities  
196 within, and adjacent to, the placement area may require monitoring. Shoreline stabilization and  
197 marsh reconstruction sites would likely have to monitor water quality and the condition of the  
198 aquatic biota in proximity to the site. In beneficial use cases such as Poplar Island (where habitat  
199 reconstruction is an integral part of the site development and operation) additional costs of  
200 monitoring the success of the habitat reconstruction will occur.

201  
202 Open water sites generally require more monitoring than most other options and would,  
203 therefore, incur additional expense. In addition to the water quality and natural resource  
204 monitoring, open water sites require bathymetric surveys to verify that placement occurred  
205 correctly. Site 104 will require significant monitoring which will cost approximately the same as  
206 other open water options (e.g., Site 171, Man-O-War Shoals). Monitoring at confined sites will  
207 generally not require the more extensive bottom monitoring and phosphorous flux evaluations  
208 that would be necessary at deeper sites, such as Site 104. A combination of small scale projects  
209 will be significantly more costly since each site will require effluent monitoring and perhaps  
210 some other natural resource monitoring.

### 211 212 **11.2.7 Permitting Costs and Considerations**

213  
214 All placement alternatives require a certain amount of investigation prior to site  
215 development/utilization. In most cases, environmental assessments and/or environmental impact  
216 statements must be prepared. The costs associated with this required documentation are a  
217 function of: (1) the size of the site; (2) the natural resources within the potential influence of the  
218 alternative; and (3) the type of material to be placed at the site. In general, the more  
219 environmental documentation and negotiations that are necessary, the more costly the alternative  
220 will be.

221  
222 In-water options (open water, shoreline stabilization, island construction sites) have special  
223 permits and certifications that are required. In addition to the water quality certification, projects  
224 that involve shallow water, wetlands, and other shoreline areas require additional approvals and  
225 permits under state and Federal law. The more permits and approvals required, the more  
226 complex and costly the process. Existing sites that have already been through the process would  
227 not require additional permitting/documentation costs. Open water sites tend to be of moderate  
228 cost to permit. Although they generally do not involve wetlands, they do require water quality  
229 certifications, and documentation tends to involve more costly (boat-based) field studies. Upland  
230 sites tend to be the least costly to study and permit.

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**11.3 CONCLUSIONS**

Placement costs are a direct function of the placement type for most cost factors, with the exception of transportation costs. Containment (confined) facilities tend to be the most costly to build and operate, although monitoring costs are lower. Upland sites and shoreline stabilization sites are relatively inexpensive to develop and maintain, but many tend to be low capacity. When the costs of developing several low-capacity sites are factored together, the option can be cost prohibitive. Open water sites are the least costly to develop and maintain. Even though the initial environmental documentation, permitting, and monitoring may be among the most costly of any placement type, these costs are relatively low compared to site development and operation costs. Open water sites, such as Site 104, are the most cost-effective placement options currently available in the Bay region.

Section 12

List of Preparers

Carol Anderson-Austra	Landscape Architect USACE, Baltimore District
Tammy Rose Banta	Senior Environmental Specialist Maryland Environmental Service
Jane Boraczek	Aquatic/Fisheries Scientist EA Engineering, Science, and Technology
Mark Cohoon	CADD Technician Maryland Environmental Service
Robert M. Corletta	Environmental Specialist Maryland Environmental Service
Peggy Derrick	Aquatic Scientist EA Engineering, Science, and Technology
Cecelia L. Donovan	Senior Environmental Scientist Maryland Environmental Service
Jennifer L. S. Duff	Environmental Specialist Maryland Environmental Service
Cherry Janiczewski	Water Resources Assistant
Vanessa Jones	Civil Engineer Maryland Environmental Service
Suzanne M. Kelly	Environmental Specialist Maryland Environmental Service
Stacey Kemper	Marketing Services Supervisor EA Engineering, Science, and Technology
Anwar Khan	Water Quality Specialist EA Engineering, Science, and Technology
Alex Knab	Administrative Support Maryland Environmental Service

**NOT UPDATED**

Pete Kotulak	Professional Engineer Moffatt & Nichols Engineers
Charles Leasure	Project Scientist EA Engineering, Science, and Technology
Jia Liu	Administrative Support Maryland Environmental Service
Jeffrey A. McKee	Ecologist USACE, Baltimore District
Matthew T. McKnight	Environmental Specialist Maryland Environmental Service
Mark Mendelsohn	Biologist USACE, Baltimore District
Christopher E. Norris	Graphics Specialist Maryland Environmental Service
Frank Pine, Ph.D.	Senior Project Manager/Senior Scientist EA Engineering, Science, and Technology
Stephen Storms, Ph.D.	Environmental Specialist Maryland Environmental Service
Maria De la Torre	USACE, Baltimore District
Brian Walls	Civil Engineer USACE, Baltimore District
Wayne Young	Senior Environmental Planner Maryland Environmental Service

Section 13

Public Involvement and Agency Coordination

13.1 PURPOSE OF THE PUBLIC INVOLVEMENT PROGRAM

The Baltimore District, U.S. Army Corps of Engineers has prepared this Draft Environmental Impact Statement (EIS) for the placement of 18 mcy of dredged material at Site 104 at the request of the Maryland Port Administration (MPA). Corps policy and guidance emphasizes that opportunities for public involvement must be provided during the planning stages of a project. Public involvement and agency coordination were especially important for the Site 104 project because of the high degree of public interest in dredged material placement in the upper Bay area. For these reasons, as well as the need to satisfy National Environmental Policy Act (NEPA) requirements for Federal projects, public involvement and agency coordination were designed to be an integral part of the planning process for this project.

The purposes of the public involvement program for the Site 104 study included the following:

- Introducing the public to the study team and planning process;
- Informing the public and decision makers about the study;
- Gathering information;
- Coordinating with citizens, interest groups, and agencies;
- Assessing support for the project;
- Providing a mechanism for citizen input to the planning process; and
- Explaining the use of tax dollars to the taxpaying public.

13.2 PARTICIPANTS

Many factions of the public were represented in the public involvement and agency coordination process for the Site 104 study. In addition to the MPA and MES, the different groups included natural resource management, regulatory, and planning agencies, the port community, citizen and interest groups, and the general public. A Site 104 DNPOP Working Group, comprised of study team members, representatives of commercial fishing interests, and natural resource management and regulatory agencies, also met on an as needed basis to provide input during the planning process. In addition, on-going public involvement and agency coordination activities conducted by the MPA, such as the DNPOP Executive, Management, and Citizen's Committee meetings and the Public Outreach Committee meeting, provided opportunities to incorporate citizen and agency input into navigation and dredged material placement activities. Coordination activities with natural resources management and regulatory agencies included communicating with the Maryland Department of Natural Resources (MDNR), National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for rare, threatened, and endangered species and with the Maryland Historic Trust for historical and cultural resources.

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45 For public involvement purposes on this study, the term "public" refers to any person, group, or  
46 agency that is not the Corps of Engineers. In addition to individuals, key participants in this  
47 study included the following:

- 48
- 49 • Federal natural resource management and regulatory agencies, such as Environmental  
50 Protection Agency Region III, NOAA/National Marine Fisheries Service, and U.S.  
51 Fish and Wildlife Service;
- 52
- 53 • State agencies, including the Maryland Department of the Environment, Maryland  
54 Geological Survey, Maryland Historical Trust, and Department of Natural Resources;
- 55
- 56 • Local agencies and offices, such as the Commissioners of Kent and Queen Anne's  
57 Counties;
- 58
- 59 • Commercial and recreational fishing groups - Maryland Waterman's Association,  
60 Maryland Charterboat Association, Upper Bay Charter Boat Captains Association,  
61 and the Maryland Saltwater Sportfishermen's Association;
- 62
- 63 • Environmental interest groups, such as the Chesapeake Bay Foundation, Haztrak  
64 Coalition, Alliance for Chesapeake Bay, and Chester River Association.
- 65

66 A number of public involvement activities were accomplished as part of an earlier site selection  
67 process for the State of Maryland's Strategic Plan for Dredged Material Management, prepared  
68 by the Maryland Port Administration (MPA) in 1996. The Citizens Committee for the Dredging  
69 Needs and Placement Options Program is comprised of representatives of county governments,  
70 commercial fishing groups, the Hart Miller Island Citizen's Committee and other pertinent  
71 parties. A Management Committee, which includes representatives from the Chesapeake Bay  
72 Foundation and the Alliance for the Chesapeake Bay, also provides input for navigation dredging  
73 and placement issues. Both of these groups continue to assist in the evaluation of alternative  
74 placement sites in the Bay and contribute to implementation of the State of Maryland's Strategic  
75 Plan. Information from the groups was incorporated into the Site 104 EIS.

### 76

#### 77 **13.2.1 Program Structure and Relationship to Planning Process**

### 78

79 The public involvement program for the Site 104 study was organized into several stages. The  
80 stages were linked to the stages and tasks of other study activities. The public involvement  
81 stages included Project Initiation, Data Gathering, Data Analysis and Development of  
82 Recommended Plan, and Conclusion of Planning Study. Each stage provided different  
83 opportunities for public participation and agency coordination, including formal and informal  
84 meetings, correspondence, newsletters, and conversations, and each stage resulted in specific  
85 products.

#### 86

##### 87 **13.2.1.a Stage 1 - Project Initiation Stage**

### 88

89 The objectives of the Project Initiation Stage of the study were to develop a public involvement  
90 program; identify potential study participants and prepare a mailing list; notify the public and

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91 agencies about the study and the public involvement process; conduct public scoping meetings;  
92 and define data needs. The product of these activities was an extensive list of the citizens,  
93 groups, and agencies that would be involved in the study and the comments, ideas, concerns, and  
94 issues that were identified as important to incorporate into the planning process.

95  
96 In June 1997, a notice was prepared and mailed to approximately 500 individuals, agencies, and  
97 offices announcing the intent of the Corps to prepare a draft Environmental Impact Statement  
98 (DEIS) that would evaluate the proposed placement of dredged material at Site 104. The notice  
99 also announced scoping meetings to be held on July 15, 17, and 22, 1997. The same information  
100 appeared in a Meeting Notice and a Notice of Intent published in the Federal Register and in  
101 advertisements and legal notices published in several newspapers in Queen Anne's, Kent, and  
102 Anne Arundel Counties.

103  
104 The purpose of the scoping meetings was to present preliminary information about the study to  
105 the public and to identify the ideas, values, and concerns of the public. Three scoping meetings  
106 were held at Centreville (Queen Anne's County), Chestertown (Kent County), and Annapolis  
107 (Anne Arundel County) in order to meet with citizens in each of the three counties adjacent to  
108 Site 104. The same agenda and information were presented at each of the three locations. A  
109 fourth meeting was held in Centreville on July 28 to discuss the study with representatives of  
110 commercial fishing interests in the Bay, including the Maryland Watermen's Association and the  
111 Maryland Charter Boat Association. Although attendance was modest in numbers, the product  
112 of the four meetings was an extensive list of the concerns, thoughts, and ideas of the attendees.  
113 Annex A includes attendance lists for the four meetings, as well as a list of questions and  
114 comments from each of the July meetings.

115  
116 In August 1997, a newsletter was distributed to addresses on the mailing list. The newsletter  
117 provided a discussion of the study progress and responded to ideas, questions, and comments  
118 received at the scoping meetings and by phone and mail. The comments and questions fell into  
119 several general categories, including the following: existing conditions at the site; fishing use of  
120 the site; field testing, monitoring, and modeling studies; potential impacts to the site, the upper  
121 Bay area, and the region; the effectiveness/ineffectiveness of public participation in the study and  
122 the credibility/lack of credibility of project proponents; the need for the project and/or other  
123 placement options; and the design, construction and maintenance of the project.

124  
125 **13.2.1.b Stage 2 - Data Gathering Stage.** The objectives of this stage were to collect data on  
126 existing conditions at the site to serve as a baseline for possible impacts, to conduct modeling  
127 studies on different placement, methods, and locations, and to continue agency coordination  
128 activities. The product of this stage was preliminary technical data and continued coordination  
129 with natural resource management and regulatory agencies. Following the scoping meetings,  
130 data gathering needs were finalized and although most of the studies were already underway,  
131 some tests and studies were modified in order to incorporate the concerns identified in the  
132 scoping meeting comments and questions. The studies that were described in the newsletter  
133 included bathymetric surveys; studies on sediment nutrient flux and pore water/solid phase  
134 characteristics; water quality; sediment quality and foundation testing; fishing activity; wildlife,  
135 including the identification of rare, threatened, and endangered species; and studies of the  
136 groundwater, air quality, noise and odors, and hazardous, toxic, and radioactive materials at the

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137 site; a benthic community and fish abundance, size, and composition survey; and a cultural and  
138 archaeological resources survey. Other studies included hydrodynamic modeling for sediment  
139 transport, fate, and erosion as an evaluation tool for the effects of different placement techniques  
140 and to predict water quality impacts of the project. In response to specific questions about the  
141 possible impacts of the project on groundwater in the area, the Maryland Geological Survey  
142 (MGS) provided data on aquifers, as well as possible tectonic faults near the site. Finally, a  
143 comprehensive summary of the impacts of using Site 104 was addressed in a study of the  
144 Cumulative Impacts.

145  
146 A summary of the studies conducted for the project was part of the August 1997 newsletter,  
147 included in Annex A.

148  
149 Following the initiation of studies to characterize site conditions and potential impacts of the  
150 project, coordination with NMFS and USFWS identified new or anticipated studies on  
151 Chesapeake Bay sturgeon populations. A study focusing on the endangered shortnose sturgeon  
152 had been initiated and USFWS reported that Bay populations of Atlantic sturgeon were being  
153 considered for listing, which would require studies on their presence and habits in the Bay. The  
154 result of this coordination was initiation of a study on the Atlantic sturgeon, to be tied to the  
155 study and future dredging and navigation activity in the upper Bay.

156  
157 **13.2.1.c Stage 3 - Data Analysis and Development of Recommended Plan.** Following the Data  
158 Gathering Stage of the public involvement and agency coordination program, analysis was begun  
159 on the preliminary monitoring and study findings. The objectives were to determine a scenario  
160 for use of the site that would result in the least negative environmental impacts of dredged  
161 material placement. Public involvement activities during this stage included a second newsletter,  
162 distributed in March 1998, and a second series of public meetings. The purpose of the newsletter  
163 was to provide information on the project status, report on the preliminary findings, and  
164 announce the March 1998 public information meetings.

165  
166 The second series of public meetings was held following the receipt and preliminary analysis of  
167 draft reports on the monitoring and study results. The meetings were again held at three  
168 locations - in Stevensville, Annapolis, and Chestertown - in order to provide information to  
169 residents of each of the counties adjacent to the project site. A summary of the study findings  
170 was presented at each of the meetings, followed by a question and comment period. A number  
171 of the questions asked and comments made addressed topics similar to those received at the July  
172 1997 meetings, however, a new topic - sturgeon populations in the Bay - was also addressed.  
173 The first March meeting, held in Stevensville on March 24, had the largest attendance  
174 (approximately 100 people) and the liveliest discussion. About 20 people attended each of the  
175 meetings in Annapolis and Chestertown. A list of the questions and comments received at the  
176 March 1997 series of meetings are in Annex A of this report.

177 **13.2.1.d Stage 4 - Conclusion of Planning Study.** Following the analysis of study findings, the  
178 impacts of placing dredged material at Site 104 are being evaluated and a decision will be made  
179 on whether to recommend the proposed action. The draft EIS being submitted for public and  
180 agency review includes information from these studies. Copies of the DEIS will be available for  
181 public review at several public libraries in Queen Anne's, Kent, and Anne Arundel Counties, as

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182 well as at local government offices. In addition, copies will be available electronically and by  
183 mail if requested.

184  
185 A series of public hearings is scheduled to follow distribution of the draft EIS. The hearings will  
186 be held in the three counties adjacent to the project site. The purpose of the public hearing will  
187 be to receive comments on the DEIS an during the official 45-day public review and comment  
188 period. A summary and copies of official letters, questions and comments made about the study,  
189 and records of other communications are included in Annex A.

190  
191 The formats of each of the meetings will be identical; however, prior to the Kent Island public  
192 hearing, a workshop will be held to review the project with interested citizens and representatives  
193 of agencies, offices, and organizations. The workshop will provide an opportunity for attendees  
194 to ask questions to technical investigators and to make written or taped comments on the EIS.

195  
196 **13.2.2 Public Meetings and Newsletters**

197  
198 The following table shows the dates and locations of public meetings held as part of the study.  
199 Notices announcing the meetings were sent to addresses on the study mailing list and placed as  
200 paid advertisements in local newspapers several weeks prior to the meeting dates.

201

DATE	LOCATION	COUNTY	PURPOSE	# ATTENDEES
15 July 1997	Chestertown, MD	Kent	Scoping	
17 July 1997	Centreville, MD	Queen Anne's	Scoping	
22 July 1997	Annapolis, MD	Anne Arundel	Scoping	
28 July 1997	Centreville, MD	Queen Anne's	Scoping	
24 March 1998	Stevensville, MD	Queen Anne's	Information	
25 March 1998	Annapolis, MD	Anne Arundel	Information	
26 March 1998	Chestertown, MD	Kent	Information	
<i>March 1999</i>	<i>Stevensville, MD</i>	<i>Queen Anne's</i>	<i>Info. Workshop</i>	To be determined
<i>March 1999</i>	<i>Stevensville, MD</i>	<i>Queen Anne's</i>	<i>Public Hearing</i>	To be determined
<i>March 1999</i>	<i>Chestertown, MD</i>	<i>Kent</i>	<i>Public Hearing</i>	To be determined
<i>March 1999</i>	<i>Annapolis, MD</i>	<i>Anne Arundel</i>	<i>Public Hearing</i>	To be determined

202  
203 Two editions of a study newsletter were also mailed to approximately 500 individuals and  
204 offices. The first newsletter was sent in August 1997. The August newsletter reviewed the July  
205 public scoping meetings and included a project overview and information on the questions and  
206 comments received at the scoping meetings. The second newsletter was sent in March 1998,  
207 prior to the second set of public meetings. The March newsletter announced the second set of  
208 public meetings and reported on the technical studies and modeling being conducted for the EIS.

209

210 **13.2.3 Evaluation of Program**

211

212 The public involvement program developed for the Site 104 study included a number of  
213 communication techniques. The public scoping and information meetings provided an

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214 opportunity for citizens to interact with the study team, to discuss their ideas and concerns, to ask  
215 questions, and to make comments. At each of the meetings, numerous comments were made and  
216 questions asked. Project newsletters mailed to approximately 500 agencies, organizations,  
217 businesses, interest groups, and citizens provided a way to report on the study status and to  
218 answer questions that were asked several times. Comment cards were distributed at meetings  
219 and in the newsletters. Most of the cards returned included requests for inclusion on the mailing  
220 list, rather than comments. Extensive comments were included in several letters, however.



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Section 15

Terms and Acronyms

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<u>°C</u>	<u>Degrees Celsius</u>
<u>°F</u>	<u>Degrees Fahrenheit</u>
<u>μM</u>	See μmol.
<u>μMOL</u>	Micromole. A solution that contains 1 gram molecular weight (1 gram mole) of a solute, dissolved in 1 liter of solution, is known as a 1 molar solution. A micromolar solution contains 1 gram mole of a solute dissolved in 1,000,000 liters of solution. Concentrations can be expressed on a mole-volume basis because all chemical reactions occur according to a fixed ratio of the gram molecular weights of the reactants (Quagliano 1964).
<u>ABIOTIC</u>	Non-biological; factors independent of living organisms.
<u>ADCP</u>	Acoustic Doppler Current Profiler
<u>AEROBIC</u>	<u>Requires atmospheric oxygen to survive.</u>
<u>ALGAE</u>	<u>Aquatic organisms that contain chlorophyll and other pigments and can photosynthesize; includes microscopic single-celled organisms as well as large multi-cellular structures, including seaweed.</u>
<u>ALGAE BLOOM</u>	<u>An unusually large concentration of algae in or on a body of water.</u>
<u>AMBIENT</u>	<u>Of or relating to an environmental condition, such as temperature or pressure.</u>
<u>AMPLITUDE</u>	<u>The size, range, or extent of something.</u>
<u>ANADROMOUS</u>	<u>Fish that live most of their lives in the ocean, but migrate to freshwater streams to spawn.</u>
<u>ANAEROBIC</u>	<u>Occurring with little or no oxygen.</u>
<u>ANNELID</u>	<u>A class of animals including earthworms and leeches.</u>
<u>ANOXIA/ANOXIC</u>	Without dissolved oxygen or in oxygen deficit. Dissolved oxygen concentrations of 0 mg/l (MDE 1994).

41	APG	Aberdeen Proving Ground-
42	<u>AQUIFER</u>	<u>Rock that has sufficient permeability to allow</u>
43		<u>ground water to flow through it, and which can</u>
44		<u>provide significant amounts of water to wells</u>
45		<u>and springs.</u>
46	<u>ASTRONOMICAL TIDE</u>	<u>A tide caused by the attractive forces of the sun</u>
47		<u>and moon, as opposed to a meteorological tide</u>
48		<u>caused mainly by wind and atmospheric</u>
49		<u>pressure.</u>
50		
51	<u>BA</u>	<u>Biological Assessment</u>
52	<u>BASEMENT ROCK</u>	<u>Rocks that underlie the rocks of interest in an</u>
53		<u>area; often sedimentary (i.e., rocks that pertain</u>
54		<u>to or contain sediment, or were formed by its</u>
55		<u>deposition).</u>
56	<u>BATHYMETRY</u>	<u>Information gathered by measuring the depths</u>
57		<u>of bodies of water.</u>
58	BAY BRIDGE	William Preston Lane Jr. Memorial Bridge,-
59		located between Kent Island and Cape St.
60		Clair Maryland.
61	<u>BENCHMARK</u>	<u>A measurement or standard against which</u>
62		<u>similar units can be compared.</u>
63	BENTHIC	Living in, on, or in close association with the
64		bottom of a body of water.
65	BEP II	Bay Enhancement Phase II. A working group of
66		the DNPOP.
67	<u>BERM</u>	<u>A bench-like earthen structure used for</u>
68		<u>stabilization.</u>
69	B-IBI	Benthic Index of Biotic Integrity. A technique
70		to assess the health of a benthic community.
71		Scores are assigned based upon a number of
72		variables. Generally in the Chesapeake Bay, a
73		B-IBI score of 3 or greater is considered equal
74		to or above restoration goals and a score of less
75		than three is below the restoration goals.
76	<u>BIOMASS</u>	<u>Refers to the entire population of living</u>
77		<u>organisms, both plant and animal, of a given</u>
78		<u>habitat.</u>
79	BIOTIC	Ecological factors due to the interactions of
80		living organisms.
81	<u>BIVALVE</u>	<u>An organism that has a two-part shell.</u>
82	<u>BO</u>	<u>Biological Opinion</u>

83	<u>BRACKISH</u>	<u>Water with a salt content between that of sea water and fresh water.</u>
84		
85	BWI	Baltimore--Washington International
86		
87	C&D	Chesapeake and Delaware
88	CALANOID	One of the major suborders of the Order Copejocoda, which are microscopic planktonic crustaceans, relatives of the crabs.
89		
90		
91	<u>CARBON MONOXIDE</u>	<u>A colorless, almost odorless, highly poisonous, and flammable gas that is an exhaust product from automobile engines, and occurs when a carbon-containing fuel is burned with an insufficient amount of oxygen.</u>
92		
93		
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95		
96	<u>CATADROMOUS</u>	<u>Fish that live in fresh water but migrate downriver and spawn at sea.</u>
97		
98	CBL	Chesapeake Biological Laboratory. Part of the University of Maryland, Center for Environmental Science.
99		
100		
101	CBP	U.S. Environmental Protection Agency Chesapeake Bay Program-
102		
103	CBWQP	The Chesapeake Water Quality Program
104	<u>cc</u>	<u>Cubic centimeters</u>
105	CENAB	U.S. Army Corps of Engineers, Baltimore District-
106		
107	CENAP	U.S. Army Corps of Engineers, Philadelphia District-
108		
109	<u>CEQUAL-ICM</u>	<u>Corps of Engineers Quality-Integrated Compartment model</u>
110		
111	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This act regulates the release, threat of release, investigations, remedial action and removal of any hazardous substance, pollutant or contaminant (as defined in the Federal Water Pollution Control Act, the Solid Waste Disposal Act, the Toxic Substances Control Act, CERCLA and the Clean Air Act) which is considered detrimental to the environment or is an imminent or substantial danger to public health or welfare. Amended by the Superfund Amendments and Reauthorization Act of 1986. Sites designated under CERCLA/Superfund are
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125		considered contaminated areas under the
126		aforementioned guidelines.
127	CERCLIS	Comprehensive Environmental Response,
128		Compensation, and Liability Information
129		System-
130	CFR	Code of Federal Regulations
131	<u>CH3D-WES</u>	<u>Curvilinear Hydrodynamics in Three</u>
132		<u>Dimensions model</u>
133	CHLOROPHYLL-A (Chl a)	A photosynthetic pigment found in plants,
134		including phytoplankton. Frequently utilized as
135		an estimate of plant or phytoplankton standing
136		crop.
137	<u>CLAY</u>	<u>An extremely small fragment of rock or mineral</u>
138		<u>with a diameter less than 0.0039 millimeter.</u>
139	<u>cm</u>	<u>Centimeter(s)</u>
140	<u>COASTAL PLAIN</u>	<u>A low, broad plain that has its margin on the</u>
141		<u>ocean shore, and which gently slopes towards</u>
142		<u>the water.</u>
143	<u>COD</u>	<u>Chemical Oxygen Demand</u>
144	COMAR	Code of Maryland Regulations
145	<u>CONFINING BED</u>	<u>Material that is impermeable or distinctly less</u>
146		<u>permeable located adjacent to an aquifer(s).</u>
147	<u>COPEPOD</u>	<u>A microscopic crustacean.</u>
148	<u>CORE SAMPLE</u>	<u>A piece of rock or soil that is extracted by</u>
149		<u>drilling and used for analysis.</u>
150	CORIOLIS EFFECT	The deflection of air or water as a result of the
151		earth's eastward rotation. In the northern
152		hemisphere, this results in a deflection to the
153		right.
154	<u>CPUE</u>	<u>Catch Per Unit Effort</u>
155	<u>CRUSTACEAN</u>	<u>A class of animals including crabs, lobsters,</u>
156		<u>shrimps, crayfish, and barnacles, among others.</u>
157	CWA	Clean Water Act-
158	CY or cy	Cubic Yards. A common measure for dredged
159		material.
160		
161	DDE	Dichlorodiphenyltrichloroethylene or 1,1-
162		dichloro-2,2-bis(p-chlorophenyl)ethylene, a
163		degradation product of the pesticide DDT.

163	DDT	Dichlorodiphenyltrichloroethane, or 1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, a pesticide.
164		
165		
166	DEIS	Draft Environmental Impact Statement-
167	<u>DEMOGRAPHICS</u>	<u>The characteristics of a population, such as average age, life expectancy, etc.</u>
168		
169	<u>DENSITY</u>	<u>The concentration of items in a given area; measured as the ratio of mass to volume.</u>
170		
171	<u>DETRITUS</u>	<u>Loose rock or organic material produced by decay of a substance or tissue.</u>
172		
173	<u>DIATOM</u>	<u>A type of microscopic algae.</u>
174	<u>DIFFUSER</u>	<u>A duct used to convert a fast-moving stream of fluid to a slow-moving stream of fluid.</u>
175		
176	<u>DIKE</u>	<u>A ridge of earth used to hold water in place or protect against flooding.</u>
177		
178	DIN	Dissolved inorganic nitrogen-
179	<u>DINOFLAGELLATE</u>	<u>A type of zooplankton.</u>
180	DIP	<del>Disorganized</del> <u>Dissolved inorganic phosphorus-</u>
181	DIVERSITY	A measure of the number of species coexisting in a community.
182		
183	DMCF	Dredged Material e <u>Containment</u> f <u>Facility-</u>
184	DMMP	Dredged Material Management Plans-
185	DNPOP	Dredging Needs and Placement Options Program; sponsored by MPA and facilitated by MES; established to address channel placement needs of the Port of Baltimore and associated channel systems in Maryland.
186		
187		
188		
189		
190	DNR	(Maryland) Department of Natural Resources-
191	DO	Dissolved oxygen-
192	<u>DRAFT</u>	<u>The vertical distance from the waterline to the bottom of a vessel's keel (i.e., the main beam running the length of a vessel's bottom.</u>
193		
194		
195		
196	E2Si	Earth Engineering Sciences Inc.
197	EA	<del>Environmental Assessment. A brief document required by NEPA which provides sufficient information to the District Commander on potential environmental effects of the proposed</del>
198		
199		
200		

201		<del>action and its alternatives to determine if an EIS</del>
202		<del>or FONSI is required.</del>
203	EA	EA Engineering, Science, and Technology, Inc.
204	EAI	Ecological Analysts, Inc.
205	<u>EBB</u>	<u>The flowing back of the tide as water returns to</u>
206		<u>the sea.</u>
207	Eh	Oxidation-reduction potential. A measure of the
208		chemical environment (oxidizing or reducing) at
209		a specific depth in the sediment column
210		measured relative to a calomel electrode.
211	EIS	Environmental Impact Statement. Required by
212		NEPA for actions that could result in significant
213		environmental impacts or for projects that are
214		not eligible for an <u>Environmental Assessment</u>
215		and FONSI. Results in a Record of Decision
216		from the District Commander.
217	ELUTRIATION	Process for separating into sized fractions finely
218		divided particles in accordance with their rate of
219		gravitation relative to a rising stream of fluid.
220	<u>ENVIRONMENTAL ASSESSMENT</u>	<u>A brief document required by NEPA which</u>
221		<u>provides sufficient information to the District</u>
222		<u>Commander on potential environmental effects</u>
223		<u>of the proposed action and its alternatives to</u>
224		<u>determine if an EIS or FONSI is required.</u>
225	<u>EOCENE</u>	<u>Includes geologic time and rocks after the</u>
226		<u>Paleozoic time period and before the Oligocene</u>
227		<u>time period; part of the early Tertiary (i.e.,</u>
228		<u>between 65 million and 2million years ago) time</u>
229		<u>period.</u>
230	EPA	Environmental Protection Agency-
231	EQUILIBRIUM SPECIES	Generally large organisms that are long-lived
232		and dominate communities in undisturbed or
233		unstressed habitats.
234	<u>ERD</u>	<u>Environmental Review Division</u>
235	ER-L	Effects Range – Low-
236	ER-M	Effects Range – Medium-
237	<u>EROSION</u>	<u>Processes such as wind and water which cause</u>
238		<u>materials on the earth's surface to loosen,</u>
239		<u>dissolve, or wear away, and be transported from</u>
240		<u>one place to another.</u>

241	<u>ESA</u>	<u>Endangered Species Act of 1973.</u>
242	<u>ESTUARY</u>	<u>An area of the sea at the mouth of, or the</u>
243		<u>drowned mouth of, a river, where the tide meets</u>
244		<u>the river current.</u>
245	<u>EURYHALINE</u>	<u>Organisms capable of withstanding widely</u>
246		<u>varying saltwater concentrations in the</u>
247		<u>environment.</u>
248	<u>EVAPOTRANSPIRTATION</u>	<u>The portion of precipitation that is returned to</u>
249		<u>the atmosphere by evaporation (i.e., the</u>
250		<u>conversion of liquid to vapor by heating) and</u>
251		<u>transpiration (i.e., evaporation from a plant's</u>
252		<u>surface of water absorbed by the plant's roots).</u>
253	<u>EXTIRPATE</u>	<u>To make extinct.</u>
254		
255	<u>FALL LINE</u>	<u>An imaginary line that connects the waterfalls of</u>
256		<u>nearly parallel rivers. More specifically, the</u>
257		<u>Fall Line marking the boundary between the</u>
258		<u>Piedmont Plateau and the Atlantic Coastal Plain.</u>
259	<u>FETCH</u>	<u>An area of water over which a wind of constant</u>
260		<u>direction and speed blows to generate waves.</u>
261	<u>FL</u>	<u>Fork Length</u>
262	<u>FLORA</u>	<u>Plant life that is present in a particular habitat.</u>
263	<u>FLUVIAL</u>	<u>Of or pertaining to a stream or river.</u>
264	<u>FONSI</u>	<u>Finding of No Significant Impact-</u>
265		<u>Authorization to initiate a project once an</u>
266		<u>Environmental Assessment has been completed</u>
267		<u>and an EIS was determined <del>to</del> not to be</u>
268		<u>necessary to fulfill the requirements of the</u>
269		<u>NEPA.</u>
270	<u>FOOTPRINT</u>	<u>The outline and surface area.</u>
271	<u>FORAMINIFER</u>	<u>A protozoan (i.e., a single-celled organism),</u>
272		<u>usually marine.</u>
273	<u>FRESHET</u>	<u>Discharge of a large volume of fresh water</u>
274		<u>resulting from ice melts and spring rains.</u>
275	<u>Fft-</u>	<u>Foot/feet-</u>
276		
277	<u>g</u>	<u>Grams</u>
278	<u>GABBROIC</u>	<u>Basaltic (Basalt is an igneous rock [i.e.,</u>
279		<u>solidified from molten or partially molten</u>
280		<u>material (magma)]).</u>

281	<u>GILL NET</u>	<u>A mesh net that is suspended from a fishing boat; catches fish by snaring their gill covers.</u>
282		
283	<u>GNEISS</u>	<u>A metamorphic (i.e., derived from pre-existing rocks by changes in temperature, pressure, shearing stress, and chemical environment) rock.</u>
284		
285		
286		
287	GPS	Global Positioning System-
288		
289	<u>HEAD</u>	<u>The elevation that water rises to at a given point due to reservoir pressure.</u>
290		
291	<u>HERBIVORE</u>	<u>An organism that eats plants.</u>
292	HMI	Hart-Miller Island-
293	<u>HOPPER</u>	<u>A vessel with sloping sides that discharges material through a valve-like opening in the bottom.</u>
294		
295		
296	HP or hp	Horsepower-
297	HPEL	Horn Point Environmental Laboratory. Part of the University of Maryland, Center for Environmental Science.
298		
299		
300	hr	Hour(s)
301	HTRS	Hazardous, Toxic, or Radioactive Substances
302	<u>HYDROGEOLOGIC UNIT</u>	<u>An area with similar subsurface waters and related geologic aspects of surface water.</u>
303		
304	<u>HYDROLOGY</u>	<u>The science of water (liquid and solid), its properties, circulation, and distribution, both on and below the earth's surface and in the atmosphere.</u>
305		
306		
307		
308	HYPOTRICH CILIATES	Benthic ciliated protozoa (microzooplankton) that have been shown to survive long periods of low dissolved oxygen concentrations in aquatic systems.
309		
310		
311		
312	HYPOXIA/ANOXIA	Deficiencies in the concentration of dissolved oxygen in aquatic systems.
313		
314	HYPOXIC/HYPOXIA	Having dissolved oxygen concentrations less than 4 to 5 mg/l (MDE 1994).
315		
316		
317	IBI	Index of Biological Integrity
318	in.	Inches
319	<i>IN-SITU</i>	Latin term meaning 'in place,' especially in natural or original position. In research, this
320		

321		typically refers to data collection or analysis that
322		occurs at the location where sampling occurs,
323		versus taking samples then shipping them
324		elsewhere for data collection or analysis.
325	IRP	Installation Restoration Program-
326		
327	<u>K</u> km	Kilometers-
328		
329	<u>L</u>	Liter(s)
330	<u>LAG GRAVEL</u>	<u>Coarse rock fragments that accumulate on a</u>
331		<u>surface after the finer material has been blown</u>
332		<u>away by wind.</u>
333	<u>lb</u>	Pound(s)
334	<u>LITHOLOGIC</u>	<u>Of lithology, the description of rocks based on</u>
335		<u>characteristics such as color, mineral</u>
336		<u>composition, and grain (i.e., particle) size.</u>
337	<u>LTFATE</u>	<u>Long Term FATE model</u>
338		
339	<u>M</u> m	Meters-
340	<u>M&amp;N</u>	<u>Moffatt and Nichol Engineers</u>
341	MACROINVERTEBRATE	Organisms greater than 0.5 mm, possessing no
342		internal skeleton.
343	MAINTENANCE	Dredging process that involves maintaining a
344		channel at an existing depth, rather than
345		dredging to greater depths.
346	MAINTENANCE DREDGING	Dredging necessary to keep the channels serving
347		the Port of Baltimore and the C&D Canal at
348		their nominal authorized depth and width.
349	MCBA	Maryland Charter Boat Association
350	<u>MCM or mcm</u>	<u>Million cubic meters.</u>
351	MCY or mcy	Million cubic yards-
352	MDE	Maryland Department of the Environment-
353	<u>MDEED</u>	<u>Maryland Department of Economic and</u>
354		<u>Employment Development</u>
355	<u>MDFATE</u>	<u>Multiple Dump FATE model</u>
356	MDNR	Maryland Department of Natural Resources
357	MDOT	Maryland Department of Transportation-
358	<u>MEAN</u>	<u>Average; the sum of all data values divided by</u>

359		<u>the total number of values.</u>
360	<u>MEAN TIDE LEVEL</u>	<u>The reference plane halfway between mean high</u>
361		<u>water and mean low water.</u>
362	MES	Maryland Environmental Service-
363	MESOHALINE	Salinity of 5.0 to 18.0 parts per thousand (ppt).
364		Waters containing from 3.0 to 16.5 ppt-
365		dissolved salts.
366	MESOOPLANKTON	An assemblage of zooplankton organisms
367		greater than 200 $\mu$ m.
368	<u>METABOLISM</u>	<u>The chemical and physical processes occurring</u>
369		<u>within a living organism.</u>
370	<u>MI</u>	<u>Mile</u>
371	<u>mg</u>	<u>Milligram(s)</u>
372	MGS	Maryland Geological Survey
373	<u>MHW</u>	<u>Mean High Water. The average height of all</u>
374		<u>high waters at a given place, usually over a</u>
375		<u>period of 19 years.</u>
376	<u>MHHW</u>	<u>Mean Higher High Water. The average height</u>
377		<u>of all the daily higher high waters at a given</u>
378		<u>place, usually over a period of 19 years.</u>
379	<u>MHT</u>	<u>Maryland Historical Trust</u>
380	<u>MI</u>	<u>Mile</u>
381	MICROAEROPHILES	Organisms that are specialized in the use of
382		gases.
383	<u>MICROBE</u>	<u>A microorganism, such as bacteria, protozoa,</u>
384		<u>and fungi.</u>
385	MICROZOOPLANKTON	An assemblage of zooplankton organisms less
386		than 200 $\mu$ m.
387	<u>MLW</u>	<u>Mean Low Water. The average height of all low</u>
388		<u>waters at a given place, usually over a period of</u>
389		<u>19 years.</u>
390	<u>MLLW</u>	<u>Mean Lower Low Water. The average height of</u>
391		<u>all the daily lower low waters at a given place,</u>
392		<u>usually over a period of 19 years.</u>
393	<u>MLLW</u>	<u>Mean lower low water.</u>
394	<u>mm</u>	<u>Millimeters</u>
395	<u>MOTILE</u>	<u>Capable of spontaneous movement.</u>
396	<u>MOUTH</u>	<u>The outfall of a river, stream, or bay into</u>
397		<u>another body of water.</u>

398	MPA	Maryland Port Administration.
399	<u>mph</u>	<u>Miles per hour</u>
400	MSSA	Maryland Saltwater Sportfishermen's
401		Association-
402	MWA	Maryland Waterman's Association-
403		
404	<u>NAAQS</u>	<u>National Ambient Air Quality Standards</u>
405	<u>NAD</u>	<u>North American Datum. A surface to which</u>
406		<u>horizontal positions in the United States,</u>
407		<u>Canada, Mexico, and Central America are</u>
408		<u>accurately surveyed and referenced.</u>
409	<u>NAUPLII</u>	<u>Free-swimming larvae of most marine</u>
410		<u>crustaceans, having a single eye, two pairs of</u>
411		<u>antennae, and one pair of mandibles.</u>
412	NEPA	National Environmental Policy Act. Refers to
413		<u>the Act of 1969 and all Amendments.</u>
414	NEW WORK DREDGING	Dredging needed to widen and deepen channels
415		below existing conditions. Virgin material
416		would be dredged to allow larger ships to safely
417		gain access to Baltimore and the C&D Canal.
418	NGVD	National Geodetic Vertical Datum-, or mean sea
419		<u>level. Derived from the average sea level over a</u>
420		<u>period of many years at 26 tide stations along</u>
421		<u>the Atlantic, Gulf of Mexico, and Pacific Coast.</u>
422		<u>Does not necessarily represent local mean sea</u>
423		<u>level at a particular place.</u>
424	NH <sub>4</sub>	Ammonia-
425	<u>NITROGEN DIOXIDE</u>	<u>A brown gas or yellow liquid used as a catalyst</u>
426		<u>in the production of nitric acid and as an</u>
427		<u>oxidizer for rocket fuels.</u>
428	NMFS	National Marine Fisheries Service-
429	<u>NO<sub>2</sub></u>	<u>Nitrite</u>
430	<u>NO<sub>2+3</sub></u>	<u>Nitrite + nitrate</u>
431	NOAA	National Oceanic and Atmospheric
432		Administration-
433	<u>N.O.B.</u>	<u>Natural Oyster Bed</u>
434	NOEL	No Observable Effect Level-
435	<u>NO<sub>2</sub></u>	<u>Nitrite.</u>
436	<u>NO<sub>2+3</sub></u>	<u>Nitrite + nitrate.</u>

437	NOI	Notice of Intent-
438	<u>NON-POINT SOURCE</u>	<u>A non-specific source, such as runoff from a</u>
439		<u>large field.</u>
440	NOS	National Ocean Survey
441	NO <sub>x</sub>	Nitrogen oxides-
442	NPL	National Priorities List-
443	NRC	National Resource Research Council
444	<u>NUTRIENT</u>	<u>A substance that provides nourishment.</u>
445		
446	OLIGOHALINE	Salinity of 0.5 to 5.0 ppt-
447		<u>Waters containing from 0.5 to 3.0 ppt-</u>
448		<u>dissolved salts.</u>
449	<u>OMNIVORE</u>	<u>An organism that eats both plants and animals.</u>
450	OPPORTUNISTIC SPECIES	Generally small organisms that are short-lived
451		and reproduce rapidly. They generally dominate
452		communities in disturbed or stressed habitats.
453	<u>OUTCROP</u>	<u>The part of a geologic formation appearing</u>
454		<u>exposed and visible at the earth's surface.</u>
455	<u>OVERWINTER</u>	<u>To remain alive through the winter.</u>
456	<u>OZONE</u>	<u>A form of oxygen that is an ingredient of smog</u>
457		<u>in the lower atmosphere.</u>
458		
459	PAH	Polycyclic Aromatic Hydrocarbon-
460	<u>PALEOCHANNEL</u>	<u>The remains of a river or stream channel carved</u>
461		<u>in older rocks, which has filled with or been</u>
462		<u>buried by sediments of younger rocks.</u>
463	<u>PALEOZOIC</u>	<u>Includes geologic time and rocks from the end</u>
464		<u>of the Precambrian time period to the beginning</u>
465		<u>of the Mesozoic time period; from about 570 to</u>
466		<u>225 million years ago.</u>
467	<u>PALUSTRINE</u>	<u>Of or relating to a marshy habitat.</u>
468	<u>PARAMETER</u>	<u>A variable quantity or value.</u>
469	<u>PARTICULATE MATTER</u>	<u>Matter composed of particles that are not bound</u>
470		<u>together (e.g., sand or dust).</u>
471	<u>PASCALS</u>	<u>A unit of measure equal to the pressure of a</u>
472		<u>force of one newton (i.e., the amount of force</u>
473		<u>needed to produce an acceleration of one meter</u>
474		<u>per second per second in a mass of one</u>
475		<u>kilogram) per square meter.</u>

476	PCB	Polychlorinated biphenyl-
477	PEL	Probable Effects Level-
478	PELAGIC	Pertaining to the open ocean.
479	<u>PERMEABILITY</u>	<u>The ability of a porous rock, sediment, or soil to</u>
480		<u>transmit fluid.</u>
481	<u>PHASE</u>	<u>A particular stage or aspect of something.</u>
482	PHOTIC ZONE	The upper water layer down to the depth of
483		effective light penetration where photosynthesis
484		balances respiration.
485	<u>PHYSIOGRAPHIC PROVINCE</u>	<u>A region whose parts have similar geology and</u>
486		<u>climate.</u>
487	<u>PHYSIOGRAPHY</u>	<u>The description and origin of landforms.</u>
488	PHYTOPLANKTON	Microscopic plants (primary producers) found
489		throughout aquatic systems.
490	PLANKTON	Small floating or feebly swimming plants and
491		animals.
492	PN	Particulate nitrogen-
493	<u>POINT SOURCE</u>	<u>A specific source, such as an outfall pipe.</u>
494	POLYHALINE	Waters containing from 16.5 to 30.0 ppt.
495		dissolved salts.
496	<u>POLYCHAETE</u>	<u>A class of marine worms.</u>
497	PORE WATER STUDY	Study of the interstitial water. Pore water
498		chemistry studies provides information on (1)
499		the predominant chemical redox regime within
500		the sediment (i.e., whether the system is anoxic,
501		sulfidic, etc.); and (2) the upward gradients and
502		upward fluxes of solutes within sediments,
503		providing an indication of rates of organic
504		matter oxidation.
505	<u>ppm</u>	<u>Parts per million</u>
506	<u>ppt</u>	<u>Parts per thousand</u>
507	<u>PRECAMBRIAN</u>	<u>Includes geologic time and rocks before the</u>
508		<u>beginning of the Paleozoic time period;</u>
509		<u>approximately 90% of geologic time.</u>
510	<u>PRIMARY PRODUCTION</u>	<u>The rate at which organisms such as plants store</u>
511		<u>of energy as carbohydrates to be consumed by</u>
512		<u>other organisms.</u>
513	PRP	<u>Partially Potentially Responsible Party-</u>
514	<u>PPT</u>	<u>Parts Per Thousand-</u>

515	<u>PYCNOCLINE</u>	<u>A water layer that shows a marked change in density with increasing depth.</u>
516		
517		
518	<u>QAC</u>	<u>Queen Anne's County</u>
519		
520	RCRA	Resource Conservation and Recovery Act-
521	REMINERALIZATION	A portion of a cyclic process in which organic materials are decomposed, releasing mineral elements (i.e., nitrogen, phosphorus) as inorganic ions.
522		
523		
524		
525	<u>RGI</u>	<u>Restoration Goals Index</u>
526	<u>RIVERINE</u>	<u>Found in or near a river.</u>
527	ROD	Record of Decision-
528	ROI	Region of Influence-
529	ROTIFERS	Microscopic members of the Phylum Rotifera, many of which are planktonic.
530		
531	RTE	Rare, Threatened, or Endangered Species-
532	<u>RUNOFF</u>	<u>Precipitation that flows over land (i.e., runs off) and into a body of water.</u>
533		
534	RW "LP"	Red and white buoy.
535		
536	<u>s</u>	<u>Second</u>
537	<u>SALINITY</u>	<u>The ratio of dissolved salts to water.</u>
538	<u>SARGASSO SEA</u>	<u>Located in the North Atlantic Ocean, northeast of the West Indies; has unusually calm waters and large areas of free-floating marine plants.</u>
539		
540		
541	SAV	Submerged Aquatic Vegetation
542	<u>SCHIST</u>	<u>A crystalline metamorphic (i.e., derived from pre-existing rocks by changes in temperature, pressure, shearing stress, and chemical environment) rock.</u>
543		
544		
545		
546	<u>SCOW</u>	<u>A large, flat-bottomed boat with square ends, usually pulled by a tug boat.</u>
547		
548	<u>SECCHI DISK</u>	<u>A white disk used to measure clarity of water; the disk is lowered into the water until it can no longer be seen, and the depth to the disk is measured.</u>
549		
550		
551		
552	<u>SET-BACK</u>	<u>A recessed area.</u>

553	<u>SEDIMENT</u>	<u>Material that is transported by, suspended in, or deposited by wind, water, or ice, and then accumulates in layers.</u>
554		
555		
556	SHANNON DIVERSITY INDEX	Typically used to show the hierarchical species diversity and one of the parameters used to calculate the B-IBI. Formula is: $H' = \sum (n_i/N) \log(n_i/N)$ where $n_i$ = number of individuals of a given species and $N$ = total number of individuals in each sample (Brower and Zar 1984).
557		
558		
559		
560		
561		
562		
563	<u>SHOAL</u>	<u>A area of submerged accumulation of sediments in shallow water.</u>
564		
565	<u>SHOALING AREA</u>	<u>An area of initial decrease in wave height, followed by a rapid increase in wave height before the wave breaks.</u>
566		
567		
568	<u>SILICEOUS</u>	<u>Consisting of, containing, or resembling silica (a mineral).</u>
569		
570	<u>SILT</u>	<u>Sediment that is suspended in water; smaller than a very fine grain of sand and larger than coarse clay, ranging in diameter from 0.002 to 0.06 millimeter.</u>
571		
572		
573		
574	<u>SNS</u>	<u>Shortnose Sturgeon</u>
575	<u>SOC</u>	<u>Sediment oxygen consumption-</u>
576	SOLID PHASE PROFILES	Study of the sediments. Solid phase profiles of biogeochemical redox components provide information on the chemical forms of phosphorus, carbon, sulfur and iron in sediments.
577		
578		
579		
580		
581	SONE	Sediment Oxygen Nutrient Exchange Program. An element under the Maryland Chesapeake Bay Water Quality Monitoring Program that has been conducted since 1984. Stations are located throughout the mainstem Bay and in each major tributary.
582		
583		
584		
585		
586		
587	<u>STFATE</u>	<u>Short Term FATE model</u>
588	<u>STORM SURGE</u>	<u>An exceptionally high water caused by high winds on the convergence of wind-driven currents; may also include the effect of a drop in atmospheric pressure caused by hurricane winds.</u>
589		
590		
591		
592		
593	<u>STRATIFICATION</u>	<u>A process by which sediment is formed, accumulates, or is deposited in layers.</u>
594		

595	<u>SUBAERIAL</u>	<u>Formed, situated, or occurring in contact with the open air, directly adjacent to or on the land surface.</u>
596		
597		
598	<u>SUBCROP</u>	<u>Subsurface layers of rock that are in contact with the underneath of a younger layer of rock, marked by an obvious overstep (i.e., an overlap).</u>
599		
600		
601		
602	<u>SUBSTRATE</u>	<u>Material that underlies cover material.</u>
603	<u>SULFUR DIOXIDE</u>	<u>A toxic, colorless gas that is an oxidizing and reducing agent and a dangerous constituent of smog.</u>
604		
605		
606	SUMMER MAXIMUM	Refers to highest taxa abundance.
607		
608	TDN	Total dissolved oxygen-nitrogen-
609	<u>TIDAL</u>	<u>Of or relating to tides; a tidal marsh is an area of land along a coast that is usually flooded at high tide.</u>
610		
611		
612	TIDAL HARMONIC CONSTANTS	The observed tide is the sum of a number of components, each of whose periods corresponds to one of the relative astronomical motions between the earth, sun, and moon. The tidal harmonic constants are the period-, amplitude, and phase angle (epoch) for each of the tidal components.
613		
614		
615		
616		
617		
618		
619	TN	Total nitrogen-
620	<u>TOPOGRAPHY</u>	<u>The configuration of a land surface; includes relief (i.e., elevation) and position of both natural and man-made features.</u>
621		
622		
623	<u>TRAWL</u>	<u>A baglike net that is towed beneath a vessel to catch marine life.</u>
624		
625	<u>TROPHIC</u>	<u>Having to do with nutrition.</u>
626	TSS	Total suspended solids-
627	<u>TURBIDITY</u>	<u>A cloudy or hazy appearance in a naturally clear liquid caused by the suspension of fine solids in the liquid.</u>
628		
629		
630		
631	UBCBCA	Upper Bay Charter Boat Captains Association-
632	UMCES	University of Maryland, Center for Environmental Science-
633		
634	<u>UNCONFORMABLY</u>	<u>Layers of rock that do not succeed underlying rocks in order of age or parallel position; not part of a continuous whole.</u>
635		
636		

637	USACE	U.S. Army Corps of Engineers-
638	USFWS	U.S. Fish and Wildlife Service-
639	USGS	U.S. Geological Survey-
640	UXO	Unexploded ordnance; ammunition that has
641		been fired and has contacted ground without
642		detonating. In the Chesapeake Bay region, this
643		ordnance is typically buried and is therefore not
644		an explosive danger until it is disturbed by
645		activities such as dredging or placement.
646		
647	<u>VOC</u>	<u>Volatile organic compound</u>
648	<u>VISCOSITY</u>	<u>The internal friction of a fluid; i.e., a fluid's</u>
649		<u>resistance to flow.</u>
650		
651	<u>W&amp;HD</u>	<u>Wildlife and Heritage Division</u>
652	<u>WAVE PERIOD</u>	<u>The time between the passage of adjacent points</u>
653		<u>of equal phase through a fixed point in space.</u>
654	<u>WAVE SETUP</u>	<u>An increase in mean water level between the</u>
655		<u>zone of wave break and shore, caused by the</u>
656		<u>momentum of the waves.</u>
657	WES	Waterways Experiment Station-
658	<u>WETLANDS</u>	<u>Low-lying areas that are periodically submerged</u>
659		<u>or whose soil contains a lot of moisture.</u>
660	WWTP	Waste Water Treatment Plant-
661		
662	<u>yr</u>	<u>Year</u>
663		
664	ZOOPLANKTON	Microscopic animals that live suspended in the
665		water column and move passively in relation to
666		water currents.

ADDITION TO  
ANNEX B  
ATTACHMENT C

**Site 104 Open-Water Placement Area  
Commercial and Recreational Fishers Meeting Summary**

**July 28, 1997**

**Attendees:**

Mark Mendelsohn	CENAB	Tammy Banta	MES
Jeff McKee	CENAB	Jennifer Duff	MES
Carol Anderson-Austra	CENAB	Emory Edwards	MWA
George Crosby	MCBA	Joey Sadler	MWA
Russell Green	MCBA	Larry Simns	MWA
Greg Jetton	MCBA	Del. Baker	QA Cty
Roland Limpert	MDNR	Commissioner O'Donnell	QA Cty
Richard Schaefer	MDNR	Commissioner Fithian	Kent Cty
Wayne Young	MES		

**Date and Location:**

Monday, July 28, 1997, 7pm at Queen Anne's County Office Building, Centreville.

**1. Opening Remarks**

Ms. Anderson-Austra presented the opening remarks. She stated that the meeting was being held to discuss with the commercial and recreational fishers their concerns regarding placement in Site 104, and the locations of snags and important fishing spots within the site.

**2. Study Update**

Mr. McKee presented an update on the status of the project. He stated that the current schedule was for completion of a draft Environmental Impact Statement (EIS) by January, 1998. The proposed action would be to place 18 mcy of clean dredged material up to the -45-foot MLLW contour. CENAB is currently evaluating environmental concerns as well as fishing seasons to determine the most appropriate placement schedule.

**3. Open Discussion**

Mr. Simns opened the discussion by addressing the commercial fishers' concerns regarding placement at Site 104. He stated that the commercial fishers want the areas where placement will occur to be clearly marked and for placement to start at the southern end and move north. Mr. McKee verified that "southern end" actually

equates to approximately midway down the site at roughly the -45-foot contour. Mr. Simns also stated that the fishers' want the barge/construction equipment traffic to stay within the marked channels to prevent destruction of fishing gear outside the channels.

Mr. Simns stated that the southern end of the site is useless due to the snags throughout the area. The fishers' want the site "smoothed" out to enable use of the area for drift netting.

Mr. Fithian stated that the LP buoy is the southern cut-off point for gillnet fishing. He agreed with Mr. Simns, that placement should begin below the LP buoy. Mr. McKee stated again that placement would be in the areas below the -45-foot contour; therefore, placement would not occur north of the LP buoy.

Mr. Simns inquired into the distance between the southern end of the site and the Bay Bridge. It was determined through open discussion that the area between the southern end of the site and the Bridge was not used for commercial fishing but that drift netting did occur below the bridge and sometimes began just north of the bridge, but south of the site, and drift through the bridge pilings.

Mr. Fithian inquired into what was meant by filling to the -45-foot contour with 18 mcy of material. Mr. McKee explained that placement would slope back from the edges to maintain placement within the area and would meet the -45-foot contour in the north. It has been estimated that this would total 18 mcy of placement. This does not mean that the entire site will be filled to -45 feet MLLW. Mr. McKee also stated that the site could be dragged after placement to help "flatten" it out. Mr. McKee then explained what "dragging" the bottom meant and how it was done.

Mr. Simns explained that the some of the snags may only be a foot or two out of the bottom but what happens is that the snags catch the bottom of the net and then drag the top down. The fishers want something flatter than 1 foot contours. The nets will catch on mounds as well as actual protrusions from the bottom.

Mr. Simns stated that he was concerned because they cannot smooth out clay materials. Mr. McKee stated that dredging operations could be scheduled so that clays could be placed first and then capped with fine-textured materials to facilitate smoothing the surface. Mr. Simns then stated that it was OK if some snags were missed because the fishers know that it would be impossible to flatten the entire site. He just wants everyone to do what they say they will do at the site.

Commissioner O'Donnell expressed concern that they will not be able to smooth the site but stated that if they could they would gain significant public trust. Mr. McKee stated that hydraulic placement would create a smoother area but that the unloader would have to remain on location for several months, which would create additional noise in the area, and may make it more difficult to retain material in the site. The fishers stated that they could work around the unloaders if they knew where they were.

Mr. Fithian inquired into the impacts associated with dredged material placement. Recreational fishers stated that they fish on the northern side of Site 104 above the LP buoy. They also stated that they are concerned with the shallower edges of the site and bad oxygen levels in the water chasing fish away. They are also concerned with the plume, turbidity and phosphorus levels. He stated that the fishers use the site north of LP buoy from May to November. Mr. McKee stated that it would be unlikely placement would occur from June 1 to October 15 because of anoxic conditions at the site. He stated again that material would be placed below the -45-foot contour.

Commissioner O'Donnell raised concerns about the Aquia Aquifer located below Kent Island and Site 104. Bay City has problems with saltwater intrusion and Commissioner O'Donnell is concerned that by filling Site 104, the opening to the Aquia Aquifer that could be in the deeper portions of the site could be blocked with material. He stated that Kent Island has to draw water from the Magothy Aquifer. Mr. McKee stated that they are coordinating with MGS regarding groundwater issues.

Mr. Simns stated that the commercial fishers want the barges to remain within the shipping channels until they are close to the site then run straight to the site and place the material. The channels should be clearly marked. He offered to assist CENAB with laying out the routes for the barges. Mr. McKee stated that CENAB could designate in the specs. that the barges stay within the channels and there be GPS tracking of the barges. Mr. Simns also stated that he would recommend that CENAB have contractors put up a bond to repair and replace fishing equipment damaged during placement.

Delegate Baker stated that he wants a representative from Queen Anne's County to review the trackings weekly or monthly to verify that the contractors stayed within the channels. Ms. Austra stated that they could set up monthly meetings with a citizen's committee to discuss project issues. It was also suggested that some of the money from the \$18 million for the Oyster Recovery Program might be used to fund citizen monitoring of the contractor. The fishers agreed that they would set up reviewers and work on a possible stipend.

Mr. Fithian stated that he is frustrated with how the money is being distributed from the Oyster Recovery Program.

Commissioner O'Donnell stated that they should place material in Aberdeen Proving Ground (APG) and that if he was on the committee he would get access to APG within two weeks.

Mr. Simns stated that he was concerned that they want to straighten the Tolchester Channel and fill in the old channel. He is concerned that they are going to use up the sites they have. Mr. McKee stated that they are no longer discussing placing the material into the old channel.

Mr. Fithian wanted to know how long the Corps was going to spend money to maintain the channels, how long the Port of Baltimore would be viable, and if the Port of Baltimore would eventually be a tug boat port only. Mr. McKee stated that there is a \$12 to \$13 million budget for Baltimore Corps to maintain the approach channels to the Port and a comparable budget for the Philadelphia Corps to maintain the C&D Canal and the southern approach channels. The C&D Canal Deepening would be a 75% Corps and 25% State cost-share. Delegate Baker inquired as to where the Port of Baltimore ranked nationwide for maintenance costs. Mr. McKee stated due to the distance from the ocean, it cost more to maintain channels. Mr. McKee stated that placement at Site 104 would be approximately \$2.25 to \$2.50 per cubic yard.

Mr. Simns wanted to know if small harbors could place material in Site 104. He stated that Broad Creek Marina would be dredging soon and that it was a private job. Mr. Young stated that Hart-Miller Island is required by COMAR to accept county jobs and some private owners based upon dredging. Mr. O'Donnell stated that he would recommend investigating this if Site 104 is used. Mr. McKee stated that they would address this issue in the cumulative impacts section of the document. They would specify a generic yardage and specify criteria to be met. Mr. Simns questioned how they would address the issue if a county such as Dorchester wanted to place in Site 104 and could afford to get it to the site; would they be permitted to place? It was agreed that it would be reasonable to allow the counties closest to and potentially most affected by dredged material placement at Site 104 to use the site for material placement.

At this time, the meeting was adjourned.

ADDITION TO  
ANNEX B  
ATTACHMENT D ?



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Chesapeake Bay Field Office  
177 Admiral Cochrane Drive  
Annapolis, MD 21401

April 1, 1997

Mr. Robert Smith  
Maryland Environmental Service  
2011 Commerce Park Drive  
Annapolis, MD 21401

Re: Site 104 Dredged Placement Area Near Kent  
Island, Queen Anne's County, MD

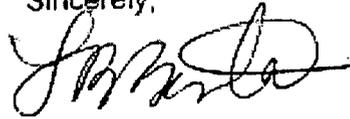
Dear Mr. Smith:

This responds to your March 12, 1997, request for information on the presence of species which are Federally listed or proposed for listing as endangered or threatened in the project area. We have reviewed the information you enclosed and are providing comments in accordance with Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

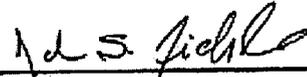
One Federally listed species, the Shortnose sturgeon (*Acipenser brevirostrum*) occurs in the proposed spoil placement area. Shortnose sturgeon were documented off western Kent Island in May 1996, by the U.S. Fish and Wildlife Service's Maryland Fisheries Resources office. A second species of concern (not Federally listed), the Atlantic sturgeon (*Acipenser oxyrinchus*) is also found in the project area in significant numbers. You may wish to contact the Maryland Fisheries Resources office at (410) 573-4506 for additional information and survey recommendations for these species. Because National Marine Fisheries Service had lead for the endangered Shortnose sturgeon, they should be contacted for formal Section 7 requirements.

Except for occasional transient individuals, no other Federally listed or proposed endangered or threatened species are known to exist in the project impact area. Therefore, no further Section 7 Consultation with the U.S. Fish and Wildlife Service is required. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered. This response relates only to endangered species under our jurisdiction. For information on other rare species, you should contact Ms. Lynn Davidson of the Maryland Natural Heritage Program at (410) 974-3195.

Sincerely,



Ms. Tammy Banta  
Project Manager  
Environmental Dredging



Mr. John S. Nichols  
Fishery Biologist  
National Marine Fisheries Service

TRB:smk

c: Mr. David Bibo, MPA  
Mr. Mark Mendelsohn, CENAB  
Mr. Brian Walls, CENAB  
Mr. Jeff McKee, CENAB  
Dr. Thomas Miller, UMCES  
Ms. Sue Kelly, MES



MARYLAND  
ENVIRONMENTAL  
SERVICE

Parris N. Glendening  
Governor

James W. Peck  
Director

January 16, 1998

Mr. John S. Nichols  
Fishery Biologist  
US Department of Commerce  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Habitat and Protected Resources Division  
Oxford, Maryland 21654

Reference: Site 104 Open-Water Placement Area  
Sturgeon Coordination

Dear Mr. Nichols:

The Maryland Environmental Service (MES) is writing, on behalf of the Maryland Port Administration, regarding the National Marine Fisheries Services' response to a request by Dr. Thomas Miller, University of Maryland Center of Environmental Science, for literature on the fish community and fisheries occurring at and in the vicinity of the proposed Site 104 dredged disposal site in the Chesapeake Bay, west of the northern tip of Kent Island.

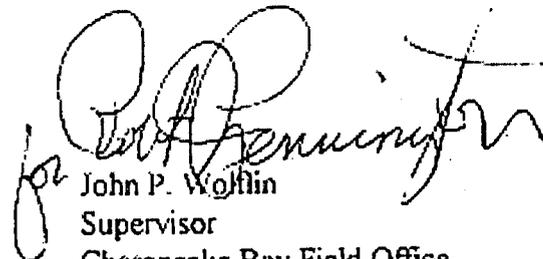
In a letter dated July 31, 1997, NMFS stated that "2 shortnose sturgeon have been taken within the proposed site during 1996 and 1997." As per your conversation with Ms. Sue Kelly, a member of our staff, on January 16, 1998 you verified that the 2 shortnose sturgeon landings were not found within Site 104, but were south of the Bay Bridge off the western shore of Kent Island. Further examination of information available from USF&WS shows that no recorded shortnose sturgeon landings have been documented to date within Site 104 boundaries.

If you concur with the information presented above please sign below and return this letter as soon as possible to MES. Thank you for your timely response to this request.

Service comments on this project under the Fish and Wildlife Coordination Act and the National Environmental Policy Act (NEPA) will be provided through future comments during the NEPA process.

Thank you for your interest in fish and wildlife issues. If you have any questions or need further assistance, please contact Andy Moser at (410) 573-4537.

Sincerely,



John P. Wolfen  
Supervisor  
Chesapeake Bay Field Office

cc: Jorgen Skjeveland, MD FRO  
Laurie Silva, NMFS, Gloucester, MA  
MD Heritage

ADDITION TO  
ANNEX C



Parris N. Glendening  
Governor

**Maryland Department of Natural Resources**  
**ENVIRONMENTAL REVIEW**

Tawes State Office Building  
Annapolis, Maryland 21401

March 16, 1999

John R. Griffin  
Secretary

Carolyn D. Davis  
Deputy Secretary

Wayne Young  
Maryland Environmental Service  
2001 Commerce Drive  
Annapolis, MD 21401



Dear Mr. Young:

We writing in response to your question regarding potential impacts from the proposed use of Site 104 as an open water disposal site on wintering waterfowl. The Department has designated a site on the western side of Kent Island immediately north of the Bay Bridge as a Historic Waterfowl Concentration Area. This area extends westward from the Kent Island shoreline approximately 5,000 feet and northward from the westbound span of the Bay Bridge approximately 6,000 feet and includes a buffer area. Based on the dimensions for Site 104 presented in the Draft Environmental Impact Statement (Figure 2-1); the area designated by the Department as a Historic Waterfowl Concentration Area is outside of the boundaries for Site 104. We do not anticipate any disturbance impacts from the proposed use of Site 104 to wintering waterfowl within the area designated as a Historic Waterfowl Concentration Area.

If you have any questions regarding these comments, please feel free to contact Roland Limpert of my staff at (410) 260-8330.

Sincerely,

A handwritten signature in cursive script that reads "Ray C. Dintaman, Jr." with a stylized flourish at the end.

Ray C. Dintaman, Jr.  
Director

Telephone: \_\_\_\_\_  
DNR TTY for the Deaf: (410) 974-3683

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## Annex E

### Selection of Alternatives with Supporting Data and Analysis

This annex applies screening criteria from Section 2 to a wide range of placement options that were identified through dredged material management planning activities specific to development of the DEIS which this annex supports as well as through prior and ongoing planning through the State-sponsored Dredging Needs and Placement Options Program. The screening criteria are described. The criteria are then applied to placement options that are organized by categories of placement types. A supporting analysis and data sheets are provided for each option.

#### 1.0 Screening Criteria

The following criteria were developed by the Baltimore District, U.S. Army Corps of Engineers (CENAB) to provide a rationale for determining which of the various placement options were practical for consideration as alternatives by this DEIS, consistent with the requirements of the National Environmental Policy Act (NEPA) and NEPA regulations promulgated by the Council on Environmental Quality. In some cases, applicable Federal requirements necessitated the consideration as alternatives of placement options that are institutionally constrained by State statutes, as discussed in pertinent sections of this Annex. The rationale for these criteria are presented in Section 2 and are not repeated here.

##### Primary Screening Criteria:

*Screening Criteria Number 1:* The proposed placement option (whether it be a single options or combination of multiple smaller capacity options) has the potential to provide approximately 9 to 18 mcy of placement capacity to meet at least 50 percent of the placement deficit need to which the proposed action is directed.

*Screening Criteria Number 2:* The property owner is willing or has indicated a willingness to accept dredged material.

*Screening Criteria Number 3:* Preliminary evaluations, based upon existing information (outlined in Section 2.1.3), indicated that environmental impacts at the site are probably not significant enough to preclude the site from use.

*Screening Criteria Number 4:* Infrastructure is in place, or expected to be in place, in sufficient time to enable the placement option to receive dredged material when the capacity is needed. Infrastructure includes dikes, docking facilities, access channels, and berms, where applicable. Alternatively, with regard to using a combination of sites, infrastructure for the first site to be used is in place or expected to be in place in sufficient time to meet dredging needs with infrastructure for subsequent sites expected to be in place prior to previously developed site or sites reaching capacity.

##### Secondary Screening Criteria:

49 *Screening Criteria Number 5:* There is a reasonable prospect that any institutional constraint (e.g.  
50 statute preventing site development or placement, CERCLA liability, etc.) that would otherwise  
51 preclude use of a placement alternative could be resolved or removed as an impediment not later  
52 than six months prior to the first planned placement. This planning factor is necessary because of  
53 lead times required for dredging contracting. Alternatively, with regard to using a combination  
54 of sites, the institutional constraint for the first can be resolved or removed no later than six  
55 months prior to the first planned placement and the constraints for each subsequent site can be  
56 removed prior to the previous site reaching capacity.

57  
58 *Screening Criteria Number 6:* The cost for using the placement alternative can be feasibly borne  
59 by the Federal and local project sponsors under existing rules, and regulations, except that no  
60 option would be screened out solely on the basis of cost if screening factors 1 through 5 would  
61 otherwise result in the option being considered an alternative to the proposed action;

62  
63 *Screening Criteria Number 7:* Use of the placement alternative may either potentially provide a  
64 net environmental improvement with respect to existing conditions or avoid or substantially  
65 reduce any of the significant environmental impacts of a potential placement activity.

## 66 67 **1.2 Screening Criteria.**

68  
69 At the minimum, in order to be selected as an alternative for the action under investigation by  
70 this DEIS, an option had to satisfy the primary screening criteria (1 through 4), except as  
71 otherwise noted. The secondary criteria (5 through 7) were applied to determine if there were  
72 any option-specific factors that would make a particular option unreasonable (e.g.,  
73 insurmountable institutional constraint) or might make the option more competitive (e.g., high  
74 cost but high environmental benefit). No options were screened out as possible alternatives solely  
75 on the basis of either legislated prohibitions or cost or both if the primary criteria were satisfied.  
76 The following parameters were used in applying the screening criteria.

### 77 78 **1.2.1 Dredging Need (Screening Criteria Number 1)**

79  
80 A dredged material placement deficit of 18 mcy was identified by CENAB and used as a baseline  
81 in applying Screening Criteria Number 1, as follows:

- 82
- 83 • An option that was capable of providing new or added capacity for at least 50 percent  
84 of the deficit in dredged material placement need was eligible for consideration as an  
85 alternative.
  - 86
  - 87 • Options that did not individually provide new or added capacity for at least 50 percent  
88 of the deficit but which satisfied criteria 2 through 4 were assembled into a combined  
89 options alternative.
  - 90
  - 91 • An option that reprogrammed sediments from one placement option to another  
92 without providing new or added capacity for at least 50 percent of the deficit was not  
93 eligible for selection as an alternative.
  - 94

### 95 **1.2.2 Real Estate (Screening Criteria Number 2)**

96

- If sufficient real estate were available for use with owner concurrence or prospective concurrence, the option was eligible for consideration as an alternative.
- Except as noted in the next bullet, if a property owner objected to use of the real estate or was not capable of authorizing use of the real estate, the option was not eligible for consideration as an alternative.
- If there was a legislated prohibition on the use of property needed to implement the option, then screening criteria number 5 was applied in lieu of screening criteria number 2.

**1.2.3 Preliminary Environmental Suitability (Screening Criteria Number 3)**

- An option which had no specific environmental conditions that would make it unacceptable was eligible for consideration as an alternative.

**1.2.4 Infrastructure Considerations (Screening Criteria Number 4)**

- If the needed infrastructure can reasonably be expected to be available or completed in sufficient time to allow use of the option when needed, the option was eligible for consideration as an alternative.
- For small-scale options satisfying criteria 1 through 3, an option was considered to be eligible for considerations as part of a multi-option alternative if infrastructure could reasonably be expected to be available or completed in approximately 2 years from the time implementation commenced.

**1.2.5 Institutional Constraints (Screening Criteria Number 5)**

- If there is a reasonable prospect that any institutional constraint that would otherwise preclude use of a placement option could be resolved or removed as an impediment not later than six months prior to the first planned placement, then the option was eligible for consideration as an alternative.
- Without prejudice to the legislative process and in compliance with NEPA regulations, if an option satisfied screening criteria 1 through 4 but was legislatively prohibited from use, the site was eligible for consideration as an alternative.
- Without prejudice to the legislative process and in compliance with NEPA regulations, an option was considered eligible for consideration as a component of a multi-option alternative if the prohibition were legislatively imposed and could be resolved or removed as an impediment not later than six months prior to the first use of the option.

**1.2.6 Preliminary Economic Viability (Screening Criteria Number 6)**

- If the unit cost per cubic yard of a proposed option was not more than 200% of the highest unit cost for an actual placement project for the Port of Baltimore, rounded up to the next dollar (\$22 per cubic yard), then the option was considered eligible for consideration as an alternative or as a component of a multi-option alternative.
- If an option that would have been screened out solely on the basis of cost, it was nevertheless eligible for consideration as an alternative or component of a multi-option alternative if screening factors 1 through 4 would otherwise have resulted in its selection as an alternative.

### **1.2.7 Environmental Tradeoffs.**

- If a placement option satisfied Screening Criteria Numbers 1 through 4 but did not satisfy Screening Criteria Number 6, it was nevertheless eligible for consideration as an alternative if it might either potentially provide a net environmental improvement with respect to existing conditions or avoid or substantially reduce any of the significant environmental impacts of a potential placement activity.

## **2.0 Results of Screening Process**

The screening criteria identified in Section 1 of this annex are applied to a variety of placement options in Section 3. The results of the screening process are summarized below.

### **2.1 Overall Results of Screening**

The screening criteria (identified in section 1.2 above) were applied to each placement option and are summarized in Table X-1 [EA ADD TABLE]. Each site was assigned a designation of 0 (meets criteria), X (doesn't meet criteria). In many cases of site availability, the site was designated with a "P" indicating that the state would consider accepting material pending issuance of a water quality certification. The information used to derive the screening designation are summarized in Table X-2 [EA ADD TABLE] and detailed. All sites listed in Table X-1 are addressed in the following sections based upon their viability as an alternative for Site 104. A series of locator maps displaying the site locations by placement type are available for reference in Section 2 (Figures 2-2 through Figure 2-7). Non-selection of an option as an alternative does not necessarily mean that a particular option is not or could not eventually become suitable at some future date.

### **2.2 Options Selected as Alternatives**

The options shown in the following categories survived the screening process that was applied in this annex and were designated by CENAB as alternatives for consideration in this EIS:

- No action (required by NEPA regulations)
- Open-water sites (Deep Trough, Ocean Placement, Shad Battery Shoal. Site 104, Site 170 open water, Site 171 open water, Worton Point open water)
- Existing site: (Hart-Miller Island South Cell)
- New containment options (Hart-Miller Island new cell)
- Beneficial use (Poplar Island wetland cell conversion to upland, Poplar Island Increase in

- 191 Elevation; Poplar Island footprint expansion)  
192 • Island placement site (Pooles Island area, Tolchester West, Site 168, Site 170, Site 171)  
193 • Combination of smaller options (Artificial Reef off Thomas Point, Bodkin Island,  
194 Holland Island, Parsons Island).  
195

196 **3.0 Application of Screening Criteria and Option Characterization.**  
197

198 The following section of this Annex applies the screening criteria described in above and in  
199 Section 2 of the DEIS to a wide range of placement alternatives.  
200

201 **3.1 No Action.**  
202

203 As required by NEPA, the option of taking no action included as an alternative. The option was  
204 screened using the screening criteria for consistency purposes only.  
205

**Box XX-1**  
**Screening of No Action**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: No capacity provided.
2. Site Availability: Not applicable.
3. Environmental Suitability: No primary environmental effects would be caused by taking no action. The ancillary environmental implications are discussed in the DEIS and, as applicable, to individual placement options insofar as they would be affected.
4. Infrastructure Readiness: The no-action option would necessitate reprogramming of sediments to existing placement sites or sites that are being constructed. Each of the existing sites and sites that are under construction or reconstructed are addressed as a separate option and screening accordingly.
5. Institutional Feasibility: No institutional constraints.
6. Prospective Affordability: No direct cost. Secondary economic effects are addressed in Section 2.
7. Potential for Environmental Improvements: None.

**Results of Screening:** Option required by NEPA to be considered as an alternative.

206  
207  
208 **3.1.1a Location.** Not applicable.  
209

210 **3.1.1b Type of Placement Option.** Under the no-action option, dredging would need to be  
211 performed within the capacity available from existing placement sites and sites that are under  
212 construction (Poplar Island) or reconstruction (Cox Creek).

213  
214 **3.1.1c Potential Placement Capacity.** No additional capacity would be provided. Under the no-  
215 action option, dredged sediment would be reprogrammed to existing sites and to sites that are

216 under construction or reconstruction (Poplar Island and Cox Creek). Use of any of these sites  
217 would have the effect of reducing their service life through use of capacity earlier than current  
218 projected and potentially through filling at rates in excess of capabilities to effectively dewater  
219 and/or consolidate the sediment that is placed.

220  
221 **3.1.1d Bathymetry/Topography.** Not applicable.

222  
223 **3.1.1e Environmental Characteristics.** No primary environmental effects are caused by taking  
224 no action. However, there are ancillary environmental implications relative to marine  
225 transportation and other placement options. Future options to compensate for the capacity not  
226 provided would likely have environmental effects. These implications are discussed, as  
227 applicable, for individual placement options addressed in this annex, insofar as they would be  
228 affected.

229  
230 **3.1.1f Implementation Factors.** No action maintains the status quo but would not resolve the  
231 placement deficit. Therefore, it can be anticipated that efforts would continue to implement one  
232 or more placement option. Future options to compensate for the capacity not provided as the  
233 result of no action may have construction requirements and also have variable implementation  
234 time frames.

235  
236 **3.1.1g Institutional Constraints.** None. There are institutional constraints associated with  
237 certain other options either would or could potentially be used that may affect their availability,  
238 which are discussed later in this annex.

239  
240 **3.1.1h Estimated Costs.** No direct costs. Ancillary costs would accrue as a result of a need to  
241 continue action to find placement options. There are economic implications with respect to the  
242 ability to maintain the marine navigation infrastructure and economic effects of potentially  
243 significant proportion that would need to be addressed.

244  
245 **3.1.1i Other Factors.** Selection of the no-action would necessitate future action to provide  
246 capacity matched to dredging needs, would have the effect of delaying decision-making to  
247 resolve the deficit in placement capacity, and would result in the shortening of the service life of  
248 sites used to cover the capacity requirement of the proposed action.

249  
250 **3.1.1j Option Summary.** The no-action option is required to be considered as an alternative by  
251 CEQ's NEPA regulations. Although there would be no direct effects from not taking action,  
252 there would be secondary effects that could be significant that would need to be assessed.

253  
254 **3.1.1k Option Data Sheet.** [ADD DATA SHEET]

255 **3.2 Open-Water Sites**

256

257 The following open-water placement sites are examined in this subsection.

258

259

- Deep Trough

260

- Ocean Placement

261

- Pooles Island open-water

262

- Shad Battery Shoal

263

- Site 104

264

- Site 170 open-water

265

- Site 171 open water

266

- Worton Point open water

267 **3.2.1 Deep Trough**

268  
269 The area known as the Deep Trough was screening (Box XX-2) and determined to be reasonable  
270 for consideration as an alternative to the proposed action.  
271

**Box XX-2**  
**Screening of Deep Trough**

**Screening Summary:** The screening criteria were applied with the following results:

1. **Placement Potential:** Capacity adequate to serve as alternative (>100 mcy).
2. **Site Availability:** Criteria #2 waived; Criteria #5 applies. Local sponsor cannot designate as a placement site because use of the site is prohibited by State law.
3. **Environmental Suitability:** No specific environmental characteristics are known that would preclude consideration of the Deep Trough as an alternative.
4. **Infrastructure Readiness:** Site could be prepared for use when needed.
5. **Institutional Feasibility:** Institutional constraints could be removed by the legislature of the State of Maryland and the Governor of Maryland in sufficient time to enable use of the site when needed.
6. **Prospective Affordability:** Estimated unit cost (\$) is less than maximum screening threshold.
7. **Potential for Environmental Improvements:** Modest potential for segregation of nutrients. Phosphorus deposited at the site would be buried, thereby preventing communication of all but the top \_\_\_ cm with the water column.

**Results of Screening:** Option reasonable for consideration as an alternative.

272  
273 **3.2.1a. Location.** An very deep trench in the center of the Chesapeake Bay has been previously  
274 considered as a placement option. A specific portion of this trench, referred to as the Deep  
275 Trough (located south of the Bay Bridge) (Figure 2-2), has been considered several times as a  
276 potential open-water placement site (DNPOP, 1995a,c; Gucinski and Ecological Associates,  
277 1984; MPA, 1990; Versar, 1990a,b. Although the trench is broadly referred to as the Deep  
278 Trough, only a portion is legally defined using the term "Deep Trough." According to Title 8,  
279 Section 8-1601, subsection (a)(6) of the Annotated Code of Maryland,

*"Deep Trough" means any region that: (i) Is south of the Chesapeake Bay Bridge  
and north of a line extending westerly from Bloody Point; and (ii) Has a depth  
that exceeds 60 ft [18.3 m].*

280  
281  
282  
283  
284  
285 **3.2.1b Type of Placement Option.** Use of the Deep Trough would result in open-water  
286 placement. Controlled bottom placement could be conducted using either hydraulic placement  
287 means or by bottom-release scows.

288  
289 **3.2.1c Potential Placement Capacity.** Placement capacity at the Deep Trough is estimated to  
290 exceed 100 mcy depending upon the depth of placement and the acreage used.

291

292 **3.2.1d. Bathymetry.** The Deep Trough is part of a trench of very deep water, up to 48.8 m (160  
293 ft) in depth, that is generally aligned along a north-south axis in the eastern center of the main  
294 stem of the Chesapeake Bay. This trench is a remnant of the ancient Susquehanna River channel  
295 when this portion of the Bay was a riverine environment. The trench is approximately 32.2 km  
296 long (20 miles) beginning offshore of Kent Island, in the vicinity of the Bay Bridge, and  
297 extending south to the mouth of the Little Choptank River. It is an area encompassed by the -  
298 18.3 m (-60 ft) MLLW depth contour which extends 32.2 km (20 miles) south from the  
299 Chesapeake Bay Bridge to a shallower sill of a depth of -18.3 m to -21.3 m (-60 ft to -70 ft)  
300 MLLW opposite the mouth of the Little Choptank River (Versar 1990).

301  
302 **3.2.1e Environmental Characteristics.** The available studies are dated and inconclusive with  
303 respect to the environmental acceptability of the Deep Trough as a long-term placement option.  
304 The studies that were undertaken did not reveal any insurmountable environmental conditions.  
305 The environmental characteristics of the Deep Trough are presented in the Deep Trough Option  
306 Data Sheet, and generally summarized below.

307  
308 Living Resources. The available data suggest that use of the site would likely result in short-  
309 term, near-field effects. Although there were some uncertainties due to data limitations, the study  
310 results suggested that placement of approximately 20 mcy of sediments with an increase in  
311 bottom elevation of not more than 6 meters would probably result in short-term effects of limited  
312 duration to benthos and other living resources. The potential for long-term effects from  
313 protracted placements was not studied (Gucinski and Ecological Analysts, 1984). A draft  
314 feasibility study and impact assessment are available. They was sponsored by the Maryland  
315 Department of Natural Resources (MDNR) on behalf of the Maryland Port Administration  
316 (MPA). Concerns that were identified related to potential nutrient releases, commercial fisheries,  
317 and benthic community impacts, as well as public concern about the possible environmental  
318 effects (Versar, 1990a,b).

319  
320 Water Quality. [XXXX]

321  
322 Hydrodynamics. [XXXX]

323  
324 Rare, Threatened or Endangered (RTE) Species. [XXXX]

325  
326 Fishing Activity. [XXXX]

327  
328 Recreational Activity. [XXXX]

329  
330 Historical/Archeological. [XXXX]

331  
332 Groundwater: [XXXX]

333  
334 View Shed. Open-water placement would result in an increase in marine operations between the  
335 Chesapeake Bay Bridge on the north and Bloody Point to the south. This increased activity  
336 would involve tug and barge activity and would temporarily affect the view shed during the  
337 placement period.

338  
339 **3.2.1f Implementation Factors.**

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Construction Considerations. Placement of dredged material in the Deep Trough would not be expected to require any construction activities. The previously discussed draft feasibility assessment considered a demonstration placement of sediment from the Craighill Channel. The sediment that would be placed was to have a larger grain size than material that had been naturally deposited at the proposed placement site. The draft assessment reported that use of the Deep Trough for bottom placement of clean material would have the advantages of natural bathymetric features that would form a barrier to sediment migration as well as the lower costs associated with open-water placement (Versar, 1990a).

Implementation Time Frame. Should the State of Maryland remove the restrictions on the use of the Deep Trough, it is estimated that approximately 2 to 3 years of study and environmental documentation would be needed prior to the first placement. In order to prove the feasibility of using the Deep Trough, a phased approach of test placements separated by study periods as well as an extensive environmental monitoring regime was developed through the DNPOP program. The approach consisted of 3 test placement sequences covering about 9 years (CTITATION). Although this approach was not implemented, it presents a practical approach that could be used for validating the results of environmental studies. If this approach were adopted, it would take about 10 to 12 years to move from initial placements to full-scale use of the Deep Trough.

### **3.2.1g Institutional Constraints.**

In 1991, the State legislature amended Title 8, section 8-1602 of the Annotated Code of Maryland to prohibit the placement of dredged material in the Deep Trough. According to Title 8, Section 8-1602 subsection (d):

*Material excavated from Bay. - A person may not dump, deposit, or scatter any earth, rock, soil, waste matter, muck, or other material excavated or dredged from the Chesapeake Bay or its tidal tributaries into or onto the area of the bottomlands or waters of the Chesapeake known as the Deep Trough.*

Use of the Deep Trough was reconsidered under the MPA-sponsored Dredging Needs and Placement Options Program (DNPOP) in 1995 as part of efforts to develop a consensus-based plan to overcome an imminent shortfall in placement capacity. At the request of the DNPOP Management Committee, the technical status of the Deep Trough as a placement option was reviewed and compiled. Representatives of the Federal and State resource and permitting agencies were consulted in order to provide additional information to assist decision makers in determining the technical merits of Deep Trough as an option prior to anticipated coordination with the Maryland General Assembly regarding the legal issues (DNPOP, 1995a). A consensus-based study approach consisting of studies and closely controlled and monitored test placements was developed at the request of the DNPOP Executive Committee by the program's Bay Enhancement Phase II Working Group (DNPOP, 1995c). Subsequently, the Deep Trough was not included in the State of Maryland Strategic Plan for Dredged Material in response to an environmental policy decision by Governor Parris Glendening not to further reconsider use of the site.

The existing institutional constraints could be removed by the legislature of the State of Maryland in sufficient time to enable use when needed.

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**3.2.1h Estimated Cost. [XXXX]**

**3.2.1i Other Factors.** None identified.

**3.2.1j Option Summary.** The Deep Trough has more than ample capacity for 18 mcy. No environmental factors have been identified that would make consideration of the option unreasonable. However, the institutional constraints that apply to the Deep Trough preclude its designation by the State as a placement site and required participation by the local sponsor. In order for the Deep Trough to be designated by the local sponsor, the Legislature of the State of Maryland would have to remove or waive the prohibition on the use of the site and the Governor of Maryland would have to sign the legislation. The institutional constraint notwithstanding, the Deep Trough is reasonable for consideration as an alternative within the scope of the NEPA regulations published by the Council on Environmental Quality.

**3.2.1k Option Data Sheet. [ADD DATA SHEET]**

1 **2.2.3.b.5-Deep Trough**

2  
3 The Deep Trough (located south of the Bay Bridge) was investigated by DNPOP as a potential  
4 site for placement of dredged material from the Baltimore Harbor outer channels (Figure 2-2). It  
5 was specified in the draft environmental assessment (~~EA~~) that use of the Deep Trough for bottom  
6 placement of clean material would have the advantages of containment within this natural  
7 structure and the low costs associated with open-water placement.

8  
9 The ~~EA~~ environmental assessment for the proposed use of the Deep Trough was prepared as a  
10 draft technical report. Concerns related to potential nutrient releases, commercial fisheries, and  
11 benthic community impacts, as well as public nuisance concerns, combined to result in the site  
12 not being investigated further for placement after 1989. Use of the site was reconsidered under  
13 the DNPOP program in 1995, but was not included in the State of Maryland Strategic Plan for  
14 Dredged Material Management due to the ~~s~~State law prohibiting placement in this area (see  
15 below) and an ~~a~~n environmental policy decision by the Governor not to reconsider use of the site.  
16 In order for this to be a viable alternative, public opinion would have to force a change in the  
17 current law. Then, the site investigations would have to be completed, culminating in the  
18 preparation of an environmental impact statement (EIS).

19  
20 The Deep Trough is part of a trench of very deep water, up to 48.8 m (160 ft) in depth, that is  
21 generally aligned along a north-south axis in the eastern center of the main-stem of the  
22 Chesapeake Bay. This trench is a remnant of the ancient Susquehanna River channel when this  
23 portion of the Bay was a riverine environment. The trench is approximately 32.2 km long (20  
24 miles) beginning offshore of Kent Island, in the vicinity of the Bay Bridge, and extending south  
25 to the mouth of the Little Choptank River. It is an area encompassed by the -18.3 m (-60 ft)  
26 MLLW depth contour which extends 32.2 km (20 miles) south from the Chesapeake Bay Bridge  
27 to a shallower sill of a depth of -18.3 ~~m~~ to -21.3 m (-60 ~~ft~~ to -70 ft) MLLW opposite the mouth  
28 of the Little Choptank River (Versar 1990).

29  
30 Although this trench is broadly referred to as the Deep Trough, only a portion is legally defined  
31 using the term "Deep Trough." According to Title 8, Section 8-1601, subsection (a)(6) of the  
32 Annotated Code of Maryland,

33  
34 *"Deep Trough" means any region that: (i) Is south of the Chesapeake Bay Bridge and*  
35 *north of a line extending westerly from Bloody Point; and (ii) Has a depth that exceeds*  
36 *60 ft [18.3 m]."*

37  
38 In 1991, the State legislature amended Title 8, Section 8-1602 of the Annotated Code of  
39 Maryland to prohibit the placement of dredged material in the Deep Trough. According to Title  
40 8, Section 8-1602 subsection (d):

41  
42 *"Material excavated from Bay. - A person may not dump, deposit, or scatter any earth,*  
43 *rock, soil, waste matter, muck, or other material excavated or dredged from the*  
44 *Chesapeake Bay or its tidal tributaries into or onto the area of the bottomlands or waters*  
45 *of the Chesapeake known as the Deep Trough."*

47 Any future proposals to place dredged material in the Deep Trough will be evaluated on a  
48 project-by-project basis in accordance with the Clean Water Act Section 404 (b)(1) Guidelines  
49 and other applicable laws and regulations. Although some previous reports suggest that  
50 placement of material at the Deep Trough is environmentally acceptable and is a cost-effective  
51 dredged material placement alternative, the existing State law essentially prohibits the required  
52 participation by the local sponsor. The legally defined Deep Trough was considered as an  
53 alternative to the use of Site 104. Placement capacity at the Deep Trough is estimated to exceed  
54 100 mcy depending upon the depth of placement.

#### 55 56 1982-1983 Studies

57  
58 The Deep Trough was extensively studied in the early 1980's as part of an assessment related to  
59 a proposal to place up to 25 million yards of dredged material from maintenance and deepening  
60 of the approach channels. Dissolved Oxygen (DO) depletion was found to occur during the  
61 summer months throughout the Deep Trough. At depths between 30 and 60 feet, the waters  
62 would be considered oxygen stressed with concentrations < 5 ppm. The Deep Trough was found  
63 to become completely anoxic during the summer months at depths greater than 60 feet. The  
64 areas proposed for dredged material placement are in waters which are greater than 60 feet in  
65 depth. Material would be placed in an average thickness of 5 feet.

66  
67 Stratification occurs during the summer months and little oxygen is transferred below the  
68 pycnocline (the boundary-[something missing here])

69  
70 Benthic community organisms are significantly affected by the summer low DO concentrations.  
71 During the 1982 studies, DO concentrations in bottom waters remained at 0.0 ppm. This  
72 resulted in near elimination of all benthic organisms during the summer period. -Recolonization  
73 by pioneer species such as polychaete worms was noted by November, followed by a mollusk  
74 (*Mulinia lateralis*) in February. Total recovery to an expected normal diversity or density (when  
75 compared to shallow reference areas) never occurred.

76  
77 Finfish populations were found to be moderately abundant during the winter months when both  
78 dissolved oxygen and availability of food organisms were favorable.- The dominant juvenile  
79 species were Atlantic croaker and menhaden. - The seasonal occurrence in the Deep Trough is is  
80 likely related to the timing of their migrations through the area and possible overwintering.- In  
81 addition, blueback herring, alewife, and American eel use the general area during winter months.  
82 Spawning of Bay Anchovy occurred in the spring, but the Trough is not considered a significant  
83 spawning area for any finfish species. - Utilization of the deepest waters occurred during the  
84 winter months when lower temperatures resulted in DO concentrations >5 ppm.

85  
86 Most fish species, however, use the Trough as a migration route to more northern waters. The  
87 utilization of the Trough was found to be highly seasonal and limited in summer months by  
88 higher temperatures, low to non-existent dissolved oxygen, and lack of food source. Bottom fish  
89 were virtually absent during summer months. Fish abundance and diversity were very low in  
90 summer and significantly higher in winter. Commercial fish such as striped bass and white  
91 perch were present in the area but inconsistently from year to year. In the winter sampling of  
92 1982-1983, virtually no striped bass or white perch were caught.

93  
94 Blue crabs were found to be very low in number during most of the year, but lowest in summer.  
95 The Trough was found not to be a significant habitat for blue crabs.

96  
97 The Deep Trough is not considered a significant habitat for either finfish or blue crabs. While  
98 winter utilization by finfish does occur, the overall ecological value is restricted to fall and  
99 winter and to only a limited number of species. It is also not considered a significant spawning  
100 area.

101  
102  
103 REFERENCES?? NEED MORE CURRENT ONES IF THEY EXIST.

104  
105  
106 Site Impacts

107  
108 The environmental impacts of placement of dredged materials from the approach channels into  
109 the Deep Trough are both physical and chemical. - Toxic effects are not expected due to the  
110 similarity of the channel sediments to those already in the site. Particle sizes and moisture  
111 content of the materials are virtually identical to those currently present in the Deep Trough.  
112 This comparison was made in the early 1980's and would be considered the same today. - The  
113 main difference between the nature of the materials to be dredged today is that they are cleaner.  
114 The nutrient concentrations are expected to be similar. The direct physical effects would be  
115 smothering of existing benthic communities.

116  
117 Winter Placement

118  
119 -If the placement occurred during the winter months, short-term impacts upon finfish and blue  
120 crabs would be expected. - The smothering of that year's benthic community would also occur.  
121 Recovery of the community (to the limited extent that it would recover normally) would not  
122 occur until all placement had ceased. The Trough is not, however, considered a significant  
123 source of food for migrating fish at any time of the year.

124  
125 Nutrient impacts would be expected to be minimal and potentiation of phytoplankton densities  
126 would be minimal because of low temperatures and limited migration of deep waters to the  
127 surface 10 meter depths. - Displacement of anoxic waters would be minimal since the winter DO  
128 concentrations are typically >7.0 ppm. - Placement would decrease the average depth by 5 feet. -  
129 No significant raising of the minimum depth of anoxic waters would be expected, therefore.

130 Summer Placement

131  
132 Summer placement (which is not likely because of general restrictions on time of year placement  
133 throughout the Bay) would have little effect upon the benthic community since it is virtually  
134 eliminated anyway due to natural anoxia below the 60 feet. - Finfish and blue crab populations  
135 would not be significantly affected since they are not found in the deeper portions of the Trough  
136 during summer months.- Short term nutrient effects above the pycnocline (the boundary, usually  
137 at 15-20 feet deep, formed by salinity and temperature gradients) might occur, although this  
138 would be expected to relate to dispersion of nutrients during initial dumping and not from  
139 movement from the bottom after placement. The depths of the Trough are such that there would

140 be significant dispersion of nutrients released from anoxic sediments during the summer months  
141 when phytoplankton effects might be expected to occur. - Some short-term increases in turbidity  
142 at the surface would reduce light penetration slightly and tend to inhibit phytoplankton growth. -  
143 Some minor upwelling of deoxygenated water might occur on a very short-term basis when the  
144 dredged material displaced water at the bottom of the trough.

145  
146  
147 There would not be any environmentally significant long term effects of dredged material  
148 placement at the Deep Trough site.

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Title

Deep Trough

Type:

Open Water

Location:

Located south of the Bay Bridge and approximately 1 mile west of Kent Island. It runs from approximately ½ mile south of the bridge to south of Bloody Point.

Size: Approximately ½ mile wide by 9 miles long. Actual proposed usable area is about 2600 acres filled to an average thickness of 5 feet in waters > 90 feet in depth.

Potential Capacity: Approximately 26 mcy (could be more if a larger area or greater thickness of placement were used).

Availability:

State owned waters.

Nutrients: Some release would be expected. Effects would depend upon the time of year that the placement occurred. Depths are sufficiently great that effects would be minimal for placement near the bottom. Bottom dump from scows would result in somewhat greater effects.

Infrastructure Required to Implement:

None

Institutional Issues:

The site has been restricted from use for dredged material placement by state law.

Costs:

Total Unit Costs Per Cubic Yard: [NEED!] *Approximately \$4 - \$6 per cu. yd.*

Development & Implementation Costs: No development or implementation costs would be required for placement. Monitoring costs would need to be defined

COMMENTS:

Ecological value is restricted to fall through spring.

Benthic community is severely impacted during summer months by low to 0 dissolved oxygen concentrations.

Fisheries are limited. Potential winter use for passage.

Limited drift gill netting in winter and spring

Not an important spawning area.

Possible short term upwelling of deoxygenated water might occur during summer placement.

DRAFT  
TITLE: Deep Trough

DRAFT

DRAFT  
PROJECT TYPE: Open Water

DRAFT

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate		X		
High Relief Area				X
Suspended Particulates, Turbidity		X		
Water Quality		X		
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality		X		
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle				X
<b>Aquatic Organisms</b>				
Benthic Communities		X		
Fisheries		X		
Designated Spawning Area				X
Larval Habitat Area				X
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation			X	
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars-NAB1-1				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality				X
Noise				X
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>		X		

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Living Resources Maps**

**MDNR Historic Oyster Bar Maps**

**MGS Tidal Wetland Maps**

**MGS Non-Tidal Wetland Maps**

**Lee Crockett Living Resource Map of the Upper Bay**

**MDNR Report on the Deep Trough of the Chesapeake Bay: An Assessment of the Fisheries Value and Suitability for Dredged Spoil Disposal. 1984.**

405 **3.2.2 Ocean Placement**

406  
407 Ocean placement was screened (Box XX-3) and determined to be reasonable for consideration as  
408 an alternative to the proposed action.

**Box XX-3**  
**Screening of Ocean Placement**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Capacity adequate to serve as alternative (>100 mcy).
2. Site Availability: An ocean placement site has been designated off of Cape Henry for use in disposing of sediments from channels serving the Port of Hampton Roads. The site is available and could potentially be designated for use for disposing of sediments from approach channels to the Port of Baltimore. The site is considered to be available for planning purposes.
3. Environmental Suitability: No specific environmental characteristics are known that would preclude consideration of ocean placement as an alternative.
4. Infrastructure Readiness: Site could be prepared for use when needed.
5. Institutional Feasibility: The site potentially can be designated for use in support of the Port of Baltimore under existing federal regulations that are applicable to ocean placement.
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) is near and potentially could exceed the maximum screening threshold, depending upon transportation costs. However, the option is otherwise reasonable for consideration as an alternative.
7. Potential for Environmental Improvements: None.

**Results of Screening:** Option reasonable for consideration as an alternative.

409  
410  
411 **3.2.2a Location.** Currently, ocean placement is used for the placement of dredged material by a  
412 number of USACE Districts including the Norfolk District. The Norfolk Placement Site is  
413 located off the Virginia Capes approximately 17 miles from the mouth of the Chesapeake Bay.  
414 The EPA has previously designated and permitted the site for use by tidewater Virginia ports.

415  
416 **3.2.2b Type of Placement Option.** Use of the ocean placement site would result in open-water  
417 placement. Controlled bottom placement would be conducted using bottom-release scows and  
418 tugboats suitable for offshore operations during winter operating conditions.

419  
420 **3.2.2c Potential Placement Capacity.** The ocean disposal site can accommodate large  
421 quantities of dredged material and has more than adequate potential for the proposed action.

422  
423 **3.2.2d Bathymetry/Topography.** [XXXX]

424  
425 **3.2.2e Environmental Characteristics [CENAB PROVIDE DATA FROM NORFOLK**  
426 **DISTRICT EIS]**

427

428 **3.2.2e Environmental Characteristics.** [CENAB PROVIDE DATA FROM NORFOLK  
429 DISTRICT EIS]

430  
431 Living Resources. [XXXX] Ocean substrates near the mouth of the Bay tend to be larger grained  
432 in nature than the northern Chesapeake Bay sediments, which are mostly fine grained and  
433 typically have high organic matter contents and nutrients. The placement of these fine grained  
434 sediments in areas of larger grained sediments could result in benthic community impacts and  
435 water quality impacts due to changes in the benthic substrate.

436  
437 Water Quality. [XXXX]

438  
439 Hydrodynamics. [XXXX]

440  
441 Rare, Threatened or Endangered (RTE) Species. [XXXX]

442  
443 Fishing Activity. [XXXX}

444  
445 Recreational Activity. [XXXX]

446  
447 Historical/Archeological. [XXXX]

448  
449 Groundwater: [XXXX]

450  
451 View Shed. Open-water placement would result in an increase in marine operations between the  
452 channels being dredged and the ocean placement site. This increased activity would involve tug  
453 and barge transit activity that would be similar to existing marine traffic.

454  
455 **3.2.2f Implementation Factors.** [CENAB PROVIDE REQUIREMENTS FROM NORFOLK  
456 DISTRICT EIS]

457  
458 Construction Considerations.???????

459  
460 Implementation Time Frame.

461  
462 **3.2.2g Institutional Constraints**The site is currently not designated for use for the Port of  
463 Baltimore. The site potentially can be designated for use in support of the Port of Baltimore  
464 under existing federal regulations that are applicable to ocean placement. Ocean placement from  
465 Chesapeake Bay channels would require the designation for use by the Port of Baltimore  
466 (including permitting from state and Federal agencies)

467  
468 3.2.2h Estimated Costs. [XXXX]

469  
470 . and transport to the ocean via the southern approach channels through Virginia waters.

471  
472 The average distance from the centroid of the Harbor approach channels to the ocean is  
473 approximately 162 nautical miles. The added distance from the Preferred Actions (Site 104) is  
474 154 nautical miles. Estimated costs for transport are \$0.10/cy per mile resulting in costs of  
475 approximately \$16.20 per cubic yard for this option. Typically transportation costs range from \$1

476 to \$4 per yard for sites within 10 to 40 nautical miles of the channels. This alternative is not  
477 practicable due to transportation costs.

478  
479 **3.2.2i Other Factors. [XXXX]**

480  
481 **3.2.2j Option Summary. [XXXX]**

482  
483 **3.2.2k Option Data Sheet. [ADD DATA SHEET]**

484 **3.2.3 Pooles Island Open-Water**

485  
486 Use of the existing open-water placement sites in the vicinity of Pooles Island was screened (Box  
487 XX-4) and determined to be unsuitable as an alternative to the proposed action as indicated by  
488 the analysis.  
489

**Box XX-4**  
**Screening of Pooles Island Open-Water Placement Sites**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Insufficient capacity to serve as either an alternative or as a component of a multi-option alternative. The remaining capacity as of October 1999 ( $\cong$  4.9 mcy). All of this capacity is already programmed for dredging needs other than the deficit addressed in this annex.
2. Availability: Sites are already in use and would be available if there were reserve capacity.
3. Environmental Suitability: Existing sites are environmental acceptable for placement.
4. Infrastructure Readiness: Sites could be ready for use when needed.
5. Institutional Feasibility: There are no institutional constraints that would restrict use of the sites.
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) would be comparable with current costs of open-water placement at the sites and would be well below the maximum screening threshold.
7. Potential for Environmental Improvements: None.

**Results of Screening:** Use of the Pooles Island open-water placement sites is not suitable for consideration as an alternative because all remaining capacity is already allocated for placement needs other than the deficit addressed by this annex.

490  
491 **3.2.3a Location.** The area immediately east of Pooles Island is a natural depression that has  
492 been used for many years for open-water placement of dredged sediments . There are eleven  
493 existing and two newly designated open-water placement sites in the Pooles Island area (Figure  
494 1-2). These sites are close to the C&D approach channels between the Sassafra River and the  
495 north end of the Tolchester S-Turn that are managed by the Philadelphia District, U.S. Army  
496 Corps of Engineers (CENAP).

497  
498 **3.2.3b Type of Placement Option.** Placement at the Pooles Island open-water placement sites  
499 has involved controlled bottom placement using bottom release scows or hydraulic placement, or  
500 both.

501  
502 **3.2.3c Potential Placement Capacity.** Although historical placement records are incomplete, an  
503 estimated 50-55 mcy of material has been dredged from the C&D Canal approach channels in the  
504 upper Bay since the approach channels were deepened to 27 feet in the mid-1930s (CITATION).  
505 The areas have also been used for maintenance and new work dredging of the approach channels  
506 to Baltimore Harbor. Records prior to 1965 indicate open-water placement was within about

507 1500 feet of the channels. All of the presently designated sites are further from the channel than  
508 1500 feet, and are not known to have received dredged material prior to 1965. During deepening  
509 of the approach channels in 1965-1968, much of the material was placed within open-water sites  
510 encompassed by currently designated sites. All open-water placement of maintenance dredging  
511 material from 1977 until 1998 occurred within designated Areas D, E, F, G and H. Two new  
512 sites, one in area G (site G-East) and Site 92 (per its designation in the MPA Master Plan), have  
513 been designated for open-water placement for the purpose of implementing the Pooles Island  
514 open-water component of the State's Strategy for Dredged Material Management (MDOT,  
515 1996).

516  
517 An estimated combined capacity of approximately 4.9 mcy was initially projected for G-East  
518 and Site 92 with limited residual capacity in some of the other sites (G-West and G-South)  
519 following the 1997-1998 dredging cycle (MES 1997a). The NEPA documentation and the  
520 Environmental Assessment for this placement option was completed with a "finding of no  
521 significant impact" and released to the public (MES, 1997). The bathymetry for Site 92 was  
522 subsequently reassessed using more recent survey data. This resulted in a revised total estimated  
523 capacity of 6.0 mcy was available prior to first use of the site, which occurred during the 1998-  
524 1999 dredging cycle. The placement capacity for the unfilled remaining Pooles Island open-  
525 water sites prior to the commencement of the 1999-2000 dredging cycle (G-West, G-East, G-  
526 South, and Site 92) is estimated at 4.9 mcy.

527  
528 **3.2.3d Bathymetry/Topography.** High relief bottom exists in the vicinity that is used for  
529 foraging by striped bass and other fish species. The placement sites currently available for use  
530 have been configured to take advantage of existing modest depressions that are lower in  
531 elevation than nearly high relief areas. The placement sites have been further designed to avoid  
532 the high relief areas.

### 533 534 **3.2.3e Environmental Characteristics.**

535  
536 Living Resources. There is no submerged aquatic vegetation (SAV) in or near the Pooles Island  
537 placement sites. Previous environmental assessments of the Pooles Island sites have predicted  
538 short-term near field impacts from disturbance to the benthic community and turbidity in the  
539 water column during placement. These predictions have been confirmed through environmental  
540 monitoring. Various fisheries studies have been performed to determine species diversity and  
541 density in the Pooles Island area. Striped bass and other fishes use the Pooles Island high relief  
542 areas for foraging. Finfish transit the waters above the depressions east and southeast of Pooles  
543 Island while enroute to other areas (CITATIONS). Placement activities have been designed to  
544 avoid high relief areas and have been timed to minimize the effect on finfish (CITATIONS).

545  
546 Water Quality. [XXXX]

547  
548 Hydrodynamics. [XXXX]

549  
550 Rare, Threatened or Endangered (RTE) Species. [XXXX]

551  
552 Fishing Activity. A fishing study were previously conducted to ascertain productivity of  
553 placement areas G-East and Site 92 and control sites in response to concerns expressed by  
554 charter boat captains who fished the Pooles Island area (CITATION). The findings of the study

555 resulted in a reconfiguration of Site G-East in order to avoid an impacting bottom area used for  
556 foraging by finfish (CITATION).

557  
558 Recreational Activity. The high relief shoal areas east, northeast and southeast of Pooles Island is  
559 used seasonally for recreational and charter boat fishing activity. The depressions between Pooles  
560 Island and these shoals are rarely fished because they are not productive (CITATION).

561  
562 Historical/Archeological. [XXXX]

563  
564 Groundwater: [XXXX]

565  
566 View Shed. If dredged material were reprogrammed from other locations to the Pooles Island  
567 open-water sites, it would result in a substitution of one dredging need for another. There would  
568 be virtually no change in the level of dredged material placement operations that is already  
569 associated with use of the sites.

570  
571 **3.2.3f Implementation Factors**. The sites are already in use. Water quality certification is  
572 required prior to use. No factors were identified that would inhibit water quality certification.

573  
574 **3.2.3g Institutional Constraints**. No institutional constraints were identified.

575  
576 **3.2.3h Estimated Costs**. [XXXX]

577  
578 **3.2.3i Other Factors**.

579  
580 Sedimentation Rates. Over the past several dredging cycles, relatively low flow conditions from  
581 the Susquehanna River watershed and less severe winter conditions have resulted in a lower than  
582 average dredging need for the upper Bay approach channels to the C&D Canal. Consequently,  
583 the availability of the Pooles Island open-water placement sites may be extended for a year or so  
584 beyond initial projections if average conditions prevail over the next several years. Any such  
585 extension would help compensate to a small extent for delays experienced in implementing the  
586 placement deficit that is addressed by this annex and the delay experienced in the construction of  
587 Phase I of the Poplar Island restoration project.

588  
589 Flood events would likely result in abnormal shoaling and an associated increase in dredging  
590 need. With respect to placement planning, flood events that result in massive delivery of  
591 sediment to the Bay cannot be predicted beyond statistical analysis of return periods. Floods  
592 which resulted in such exceptional conditions occurred in 1972, 1975 and 1996 (CITATION).  
593 The average dredging need used in planning was based on typical low through high flow  
594 conditions and did not take into consideration extreme events. Whether another flood will occur  
595 during the remaining estimated service life of the Pooles Island sites open-water cannot be  
596 predicted. Therefore, it is not possible to precisely estimate actual placement needs. Should  
597 such conditions develop, they would most likely result in the available capacity being used  
598 quicker than projections that are based on average conditions. Variables of this type are normally  
599 accounted for by a contingency to accommodate uncertainty. However, a contingency to cover  
600 an extreme event would have to be very large relative to the remaining capacity and projected  
601 service, and would not be representative of prospective near-term needs. At the same time, the  
602 potential for flood-related shoaling cannot be ignored. Given the limited remaining service life,

603 best management of the existing capacity is accomplished through operational adjustments to  
604 projected needs based on actual conditions that are experienced.

605  
606 Site Management. Use of the Pooles Island open-water sites had been accomplished without  
607 incident until the 1997-1998 winter dredging cycle for approach channels to the C&D Canal.  
608 During that period, procedural errors resulted in placement of some of the material too close to  
609 the perimeter of site G-West for prevailing conditions. About 26 percent of the material migrated  
610 just outside of the site boundary. The situation was identified during environmental monitoring  
611 of the site by the Maryland Geological Survey. The finding was reported to the Maryland  
612 Department of the Environment, CENAP, and the MPA (as local sponsor) as required under the  
613 environmental monitoring regime for the site. Lessons learned from this experience were  
614 subsequently incorporated into an enhanced regulatory oversight and monitoring requirement for  
615 use of the site. Subsequent placement during the 1998-1999 dredging cycle was accomplished  
616 according to plan (CITATION).

617  
618 **3.2.3j Option Summary.** All capacity remaining in the Pooles Island open-water placement  
619 sites has been allocated to placement needs other than the placement deficit addressed in this  
620 annex. In view of the variable shoaling rates and associated dredging need over the past several  
621 years for the C&D approach channels, it cannot be assumed with confidence that any potential  
622 capacity at the Pooles Island sites in excess of the aforementioned capacity estimates could be  
623 substituted for a corresponding portion of the placement deficit addressed by this annex. The  
624 additional capacity estimated by updated surveys may or may not be needed to respond to an  
625 increase in shoaling during the site's projected remaining service life. If so, the USACE could  
626 reprogram this capacity to the extent available to compensate for delays in implementing the  
627 appropriate action to provide for the dredging need addressed in this annex or to satisfy a portion  
628 of the placement deficit if not fully covered by the proposed action.

629  
630 **3.2.3k Option Data Sheet.** [ADD DATA SHEET]  
631

632 **3.2.4 Shad Battery Shoal**

633  
634 Use of the area in the vicinity of Shad battery Shoal for open-water placement was screened (Box  
635 XX-5) and determined to be suitable as an alternative to the proposed action as indicated by the  
636 analysis.  
637

**Box XX-5**  
**Screening of Shad Battery Shoal**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Less than 50% of the dredging need. However, the site could potential serve in conjunction with other open-water sites to provide the needed capacity.
2. Availability: Some of the area is within the boundary of APG. Although APG has opposed use of the site on the basis of military missions and environmental effects, it is anticipated that use of the site for open-water placement could not be reasonably withheld if determined to be in the best interests of the federal government and the State of Maryland.
3. Environmental Suitability: Use of the site could result in environmental impacts to fisheries habitat that could potentially impact high relief areas. The site is also within the legally designated spawning area for striped bass.
4. Infrastructure Readiness: Sites could be ready for use when needed.
5. Institutional Feasibility: Use of the site could potentially involve the covering of unexploded ordnance (UXO) at APG. The extent of UXO contamination would need to be assessed to determine if this posed an institutional barrier to use of the site.
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) would be comparable with current costs of open-water placement at the sites and would be well below the maximum screening threshold, provided that removal of UXO were not required.
7. Potential for Environmental Improvements: None identified.

**Results of Screening:** Use of the Shad Battery Shoal area for open-water placement sites is not suitable for consideration as a standalone alternative due to insufficient capacity. There is also a potential for significant environmental effects and for institutional constraints (military missions and UXO). However, the site potentially could be used in combination with other open-water sites to provide the target capacity. For this reason, Shad Battery Shoal was included as an alternative.

638 **3.2.4a Location.**

639  
640 **3.2.4b Type of Placement Option.**

641  
642 **3.2.4c Potential Placement Capacity.**

643  
644 **3.2.4d Bathymetry/Topography.**

645  
646 **3.2.4e Environmental Characteristics**

647	
648	<b>3.2.4e Environmental Characteristics.</b>
649	
650	<u>Living Resources.</u>
651	
652	<u>Water Quality.</u>
653	
654	<u>Hydrodynamics.</u>
655	
656	<u>Rare, Threatened or Endangered (RTE) Species.</u>
657	
658	<u>Fishing Activity.</u>
659	
660	<u>Recreational Activity.</u>
661	
662	<u>Historical/Archeological.</u>
663	
664	<u>Groundwater:</u>
665	
666	<u>View Shed.</u>
667	
668	<b>3.2.4f Implementation Factors.</b>
669	
670	<u>Construction Considerations.</u>
671	
672	<u>Implementation Time Frame.</u>
673	
674	<b>3.2.4g Institutional Constraints.</b>
675	
676	<b>3.2.4h Estimated Costs.</b>
677	
678	<b>3.2.4i Other Factors.</b>
679	
680	<b>3.2.4j Option Summary.</b>
681	
682	<b>3.2.4k Option Data Sheet. [ADD DATA SHEET]</b>

683 **3.2.5 Site 104**

684  
685 Site 104 was designated by the Maryland Port Administration as the placement site to resolve a  
686 placement deficit of 18 mcy. Use of the site for open-water placement was screened (Box XX-6)  
687 and determined to be suitable as an alternative as indicated by the analysis.  
688

**Box XX-6**  
**Screening of Site 104**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide 14 to 18 mcy.
2. Availability: The site consists of State-owned bottom that has been made available for open-water placement.
3. Environmental Suitability:
4. Infrastructure Readiness: Sites could be ready for use when needed.
5. Institutional Feasibility: There are no institutional constraints to using the site.
6. Prospective Affordability: The estimated unit cost (\$     ) would be comparable with current costs of open-water placement, well below the maximum screening threshold.
7. Potential for Environmental Improvements:

**Results of Screening:** Use of Site 104 for open-water placement sites is suitable for consideration as an alternative.

689 **3.2.5a Location.**

690

691 **3.2.5b Type of Placement Option.**

692

693 **3.2.5c Potential Placement Capacity.**

694

695 **3.2.5d Bathymetry/Topography.**

696

697 **3.2.5e Environmental Characteristics**

698

699 **3.2.5e Environmental Characteristics.**

700

701 Living Resources.

702

703 Rare, Threatened or Endangered (RTE) Species.

704

705 Fishing Activity.

706

707 Recreational Activity.

708

709 Historical/Archeological.

710

711 Groundwater:

712	
713	<u>View Shed.</u>
714	
715	<b>3.2.5f Construction Factors.</b>
716	
717	<b>3.2.5g Institutional Constraints.</b>
718	
719	<b>3.2.5h Estimated Costs.</b>
720	
721	<b>3.2.5i Other Factors.</b>
722	
723	<b>3.2.5j Option Summary.</b>
724	
725	<b>3.2.5k Option Data Sheet. [ADD DATA SHEET]</b>
726	

727 **3.2.6 Site 170B/Patapsco River Mouth (Open Water)**  
728

729 Site 170 is located at the mouth of the Patapsco River. The western portion of Site 170 was  
730 previously considered during the MPA Master Plan Initiative (as Site 97) for estuarine overboard  
731 placement. It was not short-listed for further consideration at that time (MPA, 1990). The area,  
732 redesignated at Site 170, was included as Option #1 of 55 in the Bay Enhancement Phase II  
733 component of the MPA's Dredging Needs and Placement Options Program (DNPOP). The  
734 DNPOP Program documentation uses Site 170A as the option designation for a constructed  
735 island and Site 170B as the option designation for open-water placement. The DNPOP option  
736 designations are used in this annex to refer to specific options whereas the term "Site 170"  
737 applies to the area in general. Site is irregularly shaped (Figure X-\_\_\_\_). It is approximately 1  
738 mile wide and 2.5 miles long, comprising approximately 1,600 acres. This size is consistent with  
739 the approximate acreage that would be needed for a large-scale constructed island placement site.

740  
741 Use of the site for open-water placement was screened (Box XX-6) and determined to be  
742 unsuitable as an alternative to the proposed action as indicated by the analysis.  
743

**Box XX-7**

**Screening of Site 170B/Patapsco River Mouth (Open Water)**

**Screening Summary:** The screening criteria were applied with the following results:

1. **Placement Potential:** Site could potentially provide XX mcy, or over 50 percent of the target placement need.
2. **Availability:** The site consists of State-owned bottom that could be made available for open-water placement.
3. **Environmental Suitability:** Migration of sediment from the site was reported during the most recent placement (1983). Further use of the site for open-water placement is expected to result in environmental impacts due to a significant potential for disturbance of bottom sediments during storm events with waves from the northeast. It is expected that significant quantities of sediment would be dispersed from the site to nearby shallow water areas, tributaries and beaches. Some material could potentially also migrate back into the channels.
4. **Infrastructure Readiness:** Sites could be ready for use when needed.
5. **Institutional Feasibility:** There are no institutional constraints to using the site. Prior use of the site resulted in material migrating to nearby beaches and associated public concern.
6. **Prospective Affordability:** The estimated unit cost (\$\_\_\_) would be comparable with current costs of open-water placement at the sites and would be well below the maximum screening threshold.
7. **Potential for Environmental Improvements:** None identified.

**Results of Screening:** Use of the Patapsco River Mouth for open-water placement sites is not suitable for consideration as an alternative due to the significant potential for migration of material from the site and associated environmental impacts to nearby shorelines and tributaries.

744 **3.2.6a Location.**

745  
746 Site 170 is located at the mouth of the Patapsco River between the shipping channels and the  
747 north shore of Anne Arundel County. The northeastern edge is adjacent to and immediately south  
748 of the Brewerton angle and is configured to generally parallel the channels. The northwestern  
749 side of the site is immediately east of a line between Rock Point in Anne Arundel County and  
750 North Point in Baltimore County (referred to as the Rock Point - North Point line). The  
751 southeastern side is north of the Frankie Point at the mouth of Bodkin Creek. The reconfigured  
752 site approaches to about ½ mile of the northeastern Anne Arundel County shoreline at its closest  
753 point.

754  
755 Immediately west of the western end of Site 170 is a discontinued disposal area. The eastern end  
756 of the old disposal area is due north of Rock Point. This area is west of the Rock Point - North  
757 Point line. It was included and short-listed as Site 123 for island creation in the MPA Master  
758 Plan (MPA, 1990). The shallow-water disposal areas that were used by the Baltimore District for  
759 open-water placement consisted of Sites 123 and 97.

760  
761 **3.2.6b Type of Placement Option.** Open water placement.

762  
763 **3.2.6c Potential Placement Capacity.** XX mcy.

764  
765 **3.2.6d Bathymetry/Topography.**

766  
767 **3.2.6e Environmental Characteristics**

768  
769 **3.2.6e Environmental Characteristics.**

770  
771 Living Resources.

772  
773 Water Quality/Hydrodynamics.

774  
775 Between 1975 and 1983, almost 6 mcy of material dredged during the maintenance of approach  
776 channels to Baltimore Harbor were placed in Sites 123 and 97. Changes to the Code of Maryland  
777 Regulations (COMAR Subsection 8-1602.a) enacted in 1976 prohibited the placement of  
778 dredged material from channels west of the Rock Point - North Point line into waters of the  
779 Chesapeake Bay (Figure 1-2). Consequently, no further dredged material from the Baltimore  
780 Harbor has been placed at Site 97. Subsequently, all material placed at Site 97 was dredged from  
781 the Craighill Channel and the Brewerton Channel east of the North Point - Rock Point line.

782  
783 Site 97 was used for open-water placement between 1975 and 1983. About one third of the  
784 sediment placed at the site was dredged hydraulically and discharged at the site as a slurry.  
785 Material placed hydraulically was down-shunted to the bottom and was placed closer to the  
786 center of the site in order to minimize loss of material from the site. However, some of the  
787 sediment may have been lost to the water column during placement or may have been re-  
788 suspended and carried from the site by wind-driven currents and wave action such as occur  
789 during winter storms. Although not proven, it has been suggested by some resource managers  
790 that the think relatively clean surficial layer of sediments in the lower reaches of the Patapsco  
791 River near the Francis Scott Key Memorial Bridge may have originated from the Site 97

792 placement area. Further, it is possible that the reported temporary deposition of fine grained  
793 sediment in nearshore areas in northern Anne Arundel County may have resulted from placement  
794 of dredged material at Site 97.

795  
796 Use of Site 97 for placement of dredged material ended in 1983. A study performed on Site 97  
797 after it was used in 1983 found that, because of the relatively exposed position of the site and the  
798 shallow depths before and after placement, some material could be lost from the site under  
799 certain wind and current conditions (Halka and Panageotou, 1986). Due to the relatively shallow  
800 depths at the site, the material had the potential to impact adjacent shorelines, shellfish bends,  
801 and shallow water habitats.

802  
803 Site 97/170B was found to be a poor location for overboard placement option as discussed above.  
804 This evaluation was reaffirmed in both the Master Plan and DNPOP planning processes. Use of  
805 Site 170B for open-water placement was estimated to result in an approximately capacity of 9 to  
806 10 mcy. Existing water depths are -14 to -17 feet MLLW. The proposed elevation after  
807 placement would be approximately -10 feet MLLW. The interorganizational, interdisciplinary  
808 Bay Enhancement Phase II Working Group of the DNPOP program, drawing on technical advice  
809 from the Maryland Geological Survey, found that the site is exposed to winter storm conditions,  
810 especially Nor'easters, which would result in the resuspension of sediments because of wave  
811 turbulence and shallow depths of about 15 to 17 feet. The site was considered by as unsuitable  
812 for overboard placement without construction of a protective breakwater, which would be similar  
813 to a perimeter dike for a constructed island (CITATION).

814

815 Rare, Threatened or Endangered (RTE) Species.

816

817 Fishing Activity.

818

819 Recreational Activity.

820

821 Historical/Archeological.

822

823 Groundwater:

824

825 View Shed.

826

827 **3.2.6f Implementation Factors.**

828

829 Implementation Time Frame.

830

831 **3.2.6g Institutional Constraints.**

832

833 **3.2.6h Estimated Costs.**

834

835 **3.2.6i Other Factors.**

836

837 **3.2.6j Option Summary.** Because of the potential for some fine-grained material to move off  
838 the site and the associated potential for environmental effects, Site 170B is not considered  
839 suitable for open-water placement of fine-grained sediments.

840

841 **3.2.6k Option Data Sheet. [ADD DATA SHEET]**

Box XX-8  
Screening of XXX

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ ) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

844 3.2.7a Location.

845  
846 3.2.7b Type of Placement Option.

847  
848 3.2.7c Potential Placement Capacity.

849  
850 3.2.7d Bathymetry/Topography.

851  
852 3.2.7e Environmental Characteristics

853  
854 3.2.7e Environmental Characteristics.

855  
856 Living Resources.

857  
858 Rare, Threatened or Endangered (RTE) Species.

859  
860 Fishing Activity.

861  
862 Recreational Activity.

863  
864 Historical/Archeological.

865

866 Groundwater:

867

868 View Shed.

869

870 **3.2.7f Construction Factors.**

871

872 **3.2.7g Institutional Constraints.**

873

874 **3.2.7h Estimated Costs.**

875

876 **3.2.7i Other Factors.**

877

878 **3.2.7j Option Summary.**

879

880 **3.2.7k Option Data Sheet. [ADD DATA SHEET]**

**Box XX-9  
Screening of XXX**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ \_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

883 3.2.8a Location.

884

885 3.2.8b Type of Placement Option.

886

887 3.2.8c Potential Placement Capacity.

888

889 3.2.8d Bathymetry/Topography.

890

891 3.2.8e Environmental Characteristics

892

893 3.2.8e Environmental Characteristics.

894

895 Living Resources.

896

897 Rare, Threatened or Endangered (RTE) Species.

898

899 Fishing Activity.

900

901 Recreational Activity.

902

903 Historical/Archeological.

904

905 Groundwater:

906

907 View Shed.  
908  
909 **3.2.8f Construction Factors.**  
910  
911 **3.2.8g Institutional Constraints.**  
912  
913 **3.2.8h Estimated Costs.**  
914  
915 **3.2.8i Other Factors.**  
916  
917 **3.2.8j Option Summary.**  
918  
919 **3.2.8k Option Data Sheet. [ADD DATA SHEET]**

**Title:**

Worton Point

**Type:**

Open Water

**Location:**

Located in the Chesapeake Bay, southwest of Worton Point and to the east of the C&D Canal Approach Channel.

**Size:**

700 to 1150 acres

**Potential Capacity:**

Approximately 6 mcy

**Availability:**

State owned

**Nutrients:** [NEED INFO!]

**Infrastructure Required to Implement:**

Site may require a berm to minimize material erosion because of strong currents on eastern side of Bay. Depending on berm needs would require additional time and costs for material other than dredged material.

**Institutional Issues:**

Permitting required for construction in shallow water habitat.  
Permitting required for open water placement.

**Costs:**

**Total Unit Costs Per Cubic Yard:**

[NEED!]

**Development & Implementation Costs:**

[NEED!]

**COMMENTS:**

Site lies within finfish nursery area of the upper Bay  
Near significant waterfowl use, waterfowl use the area during typical dredging window  
Supports a small recreational finfish fishery area  
Some year's conditions may support striped bass spawning areas, in the area of striped bass spawning rivers.  
Waters off shore is used for commercial fishing

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area	X			
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations		X		
Salinity Gradients -Low salinity Regime	X			
Sediment Quality		X		
HTRS			X	
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area	X			
Larval Habitat Area	X			
Crabs	X			
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area		X		
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars-NOB1-1	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality				X
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources			X	
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**Title**

Worton Point

**Type:**

Open Water

**Location:**

Located in the Chesapeake Bay, southwest of Worton Point and to the west of the C&D Canal Approach Channel.

**Size:**

700 to 1150 acres

**Potential Capacity:**

Approximately 6 mcy

**Availability:**

State owned

**Infrastructure Required to Implement:**

Site may require a berm to minimize material erosion because of strong currents on eastern side of Bay, placement of berm would require additional time and costs.

**Institutional Issues:**

Permitting required for construction in shallow water habitat.

Permitting required for open water placement.

**Costs:**

**Total Unit Costs Per Cubic Yard:**

[NEED!]

**Development & Implementation Costs:**

[NEED!]

**COMMENTS:**

Site lies within finfish nursery area of the upper Bay

Near significant waterfowl use, waterfowl use the area during typical dredging window

Supports a small recreational finfish fishery area

Some year's conditions may support striped bass spawning areas, in the area of striped bass spawning rivers.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area	X			
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations		X		
Salinity Gradients –Low salinity Regime	X			
Sediment Quality		X		
HTRS			X	
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area	X			
Larval Habitat Area	X			
Crabs	X			
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area		X		
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars-NAB1-1	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality				X
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources			X	
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

DRAFT

DRAFT

DRAFT

DRAFT

**Resources Used**

**Living Resources Maps**

**MDNR Historic Oyster Bar Maps**

**MGS Tidal Wetland Maps**

**MGS Non-Tidal Wetland Maps**

**Lee Crockett Living Resource Map of the Upper Bay**

920 3.3 Existing Placement Options (Less Open Water)

921  
922 3.3.1 C&D Canal Upland Sites [CENAB TO REVISE AND UPDATE THIS SECTION. A  
923 DECISION IS NEEDED REGARDING WHETHER THERE SHOULD BE A  
924 BLANKET SCREEING OR WHETHER OR NOT INDIVIDUAL SITES NEED  
925 TO BE SCREENED. A SCREENING OF SELECTED SITES IS SUGGESTED  
926 FOR CONSISTENCY WITH THE REST OF THIS ANNEX.]

**Box XX-10**  
**Screening of C&D Canal Upland Sites**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ \_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

927  
928 3.3.1a **Location.** There are currently 17 Federal upland sites designated along the C&D Canal  
929 for dredged material placement (Figure 2-6). The C&D Canal upland placement sites are  
930 strategically located to accommodate certain channel reaches within the C&D Canal and the  
931 northern portion of the approach channels.

932  
933 3.3.1b **Type of Placement Option.** Upland placement in confined disposal facilities.

934  
935 3.3.1c **Potential Placement Capacity.** Periodic expansion of the C&D upland confined  
936 disposal sites has been necessary to accommodate maintenance needs of those channel reaches.  
937 Placement site capacity expansion is presently needed to accommodate dredging needs for the  
938 existing C&D Canal channels and approach channels. The sites have limited capacity at present,  
939 and are in the process of being investigated for jurisdictional wetland delineation by CENAP.  
940 After this evaluation is complete, it would take approximately 4 to 6 years to redevelop the sites  
941 to extend their service life. Use of these sites for placement from the CENAB-maintained  
942 channels or CENAP-maintained southern reaches to the C&D Canal would reduce the long-term  
943 potential of these sites for the channel reaches they now serve. It would be virtually impossible to  
944 replace this diverted capacity without acquiring private or public lands with riparian access. The  
945 redirection of sediment from the channels south of the Sassafras River would substitute a long-

946 term deficit for a near-term deficit, transfer the burden of the long-term deficit to a different  
947 geographic area, and impose the burden of the unresolved placement deficit upon the  
948 constituencies interested in dredged material management for the C&D Canal.

949 **3.3.1d Bathymetry/Topography.**

951

952 **3.3.1e Environmental Characteristics**

953

954 **3.3.1e Environmental Characteristics.**

955

956 Living Resources.

957

958 Water Quality.

959

960 Hydrodynamics.

961

962 Rare, Threatened or Endangered (RTE) Species.

963

964 Fishing Activity.

965

966 Recreational Activity.

967

968 Historical/Archeological.

969

970 Groundwater:

971

972 View Shed.

973

974 **3.3.1f Implementation Factors.**

975

976 Construction Considerations.

977

978 Implementation Time Frame.

979

980 **3.3.1g Institutional Constraints.**

981

982 **3.2.1h Estimated Costs.** [The required pumping distances and elevations make use of these sites  
983 for reception of materials from the southern CENAB and CENAP reaches uneconomical and  
984 inefficient from both fiscal and engineering standpoints (MDOT 1996; MPA 1996).]

985

986 **3.3.1i Other Factors.**

987

988 **3.3.1j Option Summary.**

989

990 **3.3.1k Option Data Sheet. [ADD DATA SHEET]**

991  
992

### 3.3.2 Cox Creek Dredged Material Containment Facility

#### Box XX-11

#### Screening of Cox Creek Containment Cell

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

993  
994

#### 3.3.2a Location.

995 The Cox Creek Dredged Material Containment Facility (DMCF) is located approximately 1 mile  
996 south of the Francis Scott Key Bridge, on the west bank of the Patapsco River, near Foreman's  
997 Corner in Anne Arundel County, Maryland (Figure 2-6). The two cells were originally  
998 constructed under contract to CENAB in the 1960's for the containment of dredged material  
999 from the deepening of the Baltimore Harbor Federal channels from -11.9 m (-39.0 ft) to -12.8 m  
1000 (-42.0 ft). The MPA has acquired the cells and plans to renovate the facility for the placement of  
1001 an additional 6 mcy of maintenance dredged material from the Inner Harbor channels.

1002

#### 3.3.2b Type of Placement Option.

1003

#### 3.3.2c Potential Placement Capacity.

1004

1005 Maintenance dredged material targeted for placement in open water will originate from the upper  
1006 Bay channels located outside (east) of the North Point to Rock Point line. The combined capacity  
1007 of the two existing containment cells at Cox Creek and Hart-Miller (which also receives  
1008 sediments from outside of the harbor for which other placement capacity is not available and  
1009 which is prohibited by State law from receiving material after 2009) is not sufficient to  
1010 accommodate all of the dredged material from the harbor during the next 20 years. Site  
1011 configuration will limit placement to a maximum of 500,000 cy per year to optimize cell  
1012 capacity over a planned 12-year service life. Also, placement at Cox Creek of dredged material  
1013 that is suitable for open-water placement would limit the facility's utilization for the placement  
1014 of contaminated dredged material from Inner Harbor channels. Consequently, the capacity at Cox  
1015  
1016

1017 Creek must be reserved for harbor sediments.

1018

1019 **3.3.2d Bathymetry/Topography.** [XXXX]

1020

1021 **3.3.2e Environmental Characteristics.**

1022

1023 Living Resources. [XXXX]

1024

1025 Water Quality.[XXXX]

1026

1027 Hydrodynamics. Not applicable.

1028

1029 Rare, Threatened or Endangered (RTE) Species. None have been observed at the facility.

1030

1031 Fishing Activity. Reconstruction of the facility will involve impacts to shallow water habitat.  
1032 This issue is being addressed through a separate environmental regulatory process.

1033

1034 Recreational Activity. None.

1035

1036 Historical/Archeological. None.

1037

1038 Groundwater: No impacts (CITATION).

1039

1040 View Shed. The dike system is scheduled for an increase in elevation. View shed impacts would  
1041 be minimal.

1042

1043 **3.3.2f Implementation Factors.**

1044

1045 Construction Considerations.

1046

1047 The Cox Creek containment cell, as it was formally known, is bordered on the west by the  
1048 former Cox Creek Refining Company upland property (now owned by the MPA) and on the east  
1049 by the Patapsco River. The cell is surrounded by dikes that are presently at a height of +4.9 m  
1050 (+16.0 ft) MLLW. The site was originally developed in the mid-1960's. Although the cell has  
1051 not been actively used as a placement site since that time, it has been part of the MPA's long-  
1052 term planning for dredged material management since 1979. Roughly 15 acres of the Cox Creek  
1053 containment cell is occupied by an existing pond that was determined not to be jurisdictional  
1054 wetlands under Federal rules and regulations. The pond receives water in the form of  
1055 precipitation and stormwater runoff from the Cox Creek upland adjacent to the pond property.  
1056 The pond is not open to tidal interaction; it is served by a spillway that is passively discharging  
1057 into the Patapsco River. The stormwater system that discharged into the cell has been rerouted  
1058 so that it no longer discharges into the pond.

1059

1060 The CSX containment cell was constructed in the early 1960s, and has been used periodically  
1061 by non-Federal interests for dredged material placement throughout the 1970s. The site was  
1062 purchased by the State of Maryland in July 1993. The cell was previously permitted for  
1063 placement of material obtained from dredging operations in the Patapsco River and Baltimore  
1064 Harbor areas. The area of the dredged material placement cell is 72 acres. Its dikes have been

1065 raised periodically throughout its use and presently have a height of +6.1 m (+20.0 ft) MLLW.  
1066 The last reported use of the site for the placement of dredged material was in 1984; it has been  
1067 part of the MPA's long-term planning for dredged material management since 1979.  
1068

1069 The two existing cells are planned for conversion in a single cell. There will be a phased dike  
1070 construction program in order to progressively surcharge and increase the strength of underlying  
1071 sediments. [ADD HERE WHETHER IT MIGHT BE POSSIBLE TO RAISE THE DIKES  
1072 HIGHER THAN CURRENTLY PLANNED AND THE PROSPECTIVE FINAL HEIGHT.]  
1073 (CITATION).  
1074

1075 Implementation Time Frame. [XXXX]  
1076

1077 **3.3.2g Institutional Constraints.**  
1078

1079 Harbor sediments may not be placed in open water, but may be placed in containment facilities.  
1080 Currently, the Hart-Miller Island DMCF is the only facility that is able to receive contaminated  
1081 sediments. This site is not suitable as an alternative to Site 104 due to the relatively low capacity  
1082 and the need to dedicate the available capacity for Inner Harbor sediments.  
1083

1084 **3.3.2h Estimated Costs.** [XXXX]  
1085

1086 **3.3.2i Other Factors.** [XXXX]  
1087

1088 **3.3.2j Option Summary.** [XXXX]  
1089

1090 **3.3.2k Option Data Sheet.** [ADD DATA SHEET]

**Title:** Cox Creek Dredged Material Containment Facility (DMCF)

**Type:** Upland Placement. Concept is to use site for Inner Harbor channel material

**Location:**

Site located approximately 1 mile south of the Francis Scott Key Bridge, on the west bank of the Patapsco River in Anne Arundel County.

**Size:** 133 Acres

**Potential Capacity:** Approximately 6 mcy. Site configuration will limit placement to a maximum of .5 mcy per year over a 12 year period.

**Availability:** State owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Already developed

**Institutional Issues:**

State Law requires dredged material from the Baltimore Harbor's Patapsco River west of the North Point-Rock Point Line to be placed within the line or in a containment facility. This site is currently being renovated for placement of Inner Harbor dredged materials.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$1.93/cy

**Development & Implementation Costs:**

**COMMENTS:**

Waterfowl in the area from November to April, thus a restriction on water side construction may be imposed.

Wetlands to the north and south of the site. South cell contains 59.3 acres of non-tidal and open water wetlands. North cell contains 50.6 acres of non-tidal and open water wetlands.

Site previously used for contaminated dredged material placement.

Avian wildlife includes herring gulls, song sparrows, red-winged blackbirds, great blue herons, green herons, Carolina wren, American crow, starling, common grackle, house sparrow, slate colored junco, and white throated sparrow.

East of site is a historic waterfowl staging area.

Terrestrial wildlife includes muskrat, raccoon, eastern cottontail, gray squirrel, deer mouse, red fox, meadow vole, white tailed deer, green frog, southern pickerel frog, black rat snake, American toad and fowlers toad.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS	X			
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries				X
Designated Spawning Area-anadromous fish		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Woodward-Clyde 1992. Environmental and Geotechnical Characterization Study. Prepared for CSX Realty. December 23, 1992.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**Vogel, J. K. 1998. Value Engineering Study: Dredged Material Containment Facility, CSX/Cox Creek Maryland. Prepared for USACE, Baltimore District by Project Management Services, Inc. October 1998.**

1091 **3.3.3 Hart-Miller Island Dredged Material Containment Facility**

1092

1093 HMI is an existing state-owned and operated confined placement facility (Figure 2-6) Hart-  
1094 Miller Island is located in the Upper Chesapeake Bay. The site is approximately 14 miles due  
1095 east of Baltimore City, near the mouth of Back River in Baltimore County. Initial construction  
1096 of the placement site began in 1981 and was concluded in December of 1983. HMI covers 1140  
1097 acres and has approximately 6 miles of dike. It is oval shaped and is approximately 2 miles long  
1098 by 1 mile wide.

1099

1100 The facility has received maintenance sediments dredged annually from Baltimore Harbor and  
1101 the approach channels since 1984. Sediments from the Inner Harbor area are considered to be  
1102 contaminated and are required by the Code of Maryland Regulations (COMAR) to be placed in a  
1103 containment facility, or within the Inner Harbor. The facility has also received sediments from  
1104 the 50-foot channel deepening project, as well as smaller volumes of dredged sediments from  
1105 state, local, and private channel maintenance projects.

1106

1107 The sand dikes were originally constructed to an elevation of +5.5 m (+18 ft) above MLW, a  
1108 width of 164 ft at MLLW, with 3 horizontal (H) to 1 vertical (V) outer slopes, and 5H:1V inner  
1109 slopes. The dike has a 20-foot-wide roadbed on top. The side slopes are protected by a  
1110 revetment consisting of filter cloth on the sand dike, covered by a layer of gravel, which is in turn  
1111 covered by a layer of riprap weighing up to 8,500 pounds per stone along the sides exposed to  
1112 the Chesapeake Bay. The original +18 ft MLW high dikes were raised an additional 3.1 m (10  
1113 ft) to a height of +8.5 m (+28 ft) above MLW during the summer and fall of 1988 to provide  
1114 additional capacity for the expedited completion of the 50-foot deepening project. The 1140-acre  
1115 oval placement site holds approximately 62 mcy of dredged material to an elevation of 7.6 m (25  
1116 ft). The +8.5 m (+28 ft) raised portion of the dike has 2H:1V outer slopes, 3H:1V inner slopes,  
1117 with a 10-ft-wide road bed on top. The site is divided into two cells, a North Cell (approximately  
1118 800 acres) and a South Cell (approximately 300 acres).

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### 3.3.4 Hart-Miller Island South Cell Reconstruction and Reactivation

Use of the South Cell was discontinued in 1990 after it was filled to near capacity. The south cell is currently being developed for environmental restoration and passive recreation under a provision of Section 1135, Water Resources Development Act of 199X. To facilitate habitat development in the 300-acre South Cell, the last 3.1 m (10 ft) of dredged material was suitable channel material from outside of the harbor. The south cell is under the day-to-day management of the Maryland Environmental Service, which is providing these services under the terms of an Interagency Agreement with the MPA in support of an intergovernmental agreement between the MPA and the Maryland Department of Natural Resources (MDNR). MDNR is ultimately responsible for the habitat and recreational development of both cells.

CENAB subsequently examined the south cell to determine if it could serve as an alternative to open-water placement.

**Box XX-12**

**Screening of hart-Miller South Cell Reconstruction and Reactivation**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX.

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#### 3.3.4a Location.

See paragraph 3.3.3.

#### 3.3.4b Type of Placement Option.

The State requested that CENAB conduct a Section 1135. CENAB performed the study with the MPA as the local sponsor. The study has identified several approaches for providing ponds, wetlands and uplands that would provide important habitat for migratory birds (CITATIONS).

#### 3.3.4c Potential Placement Capacity.

1146 The South Cell crust management and grading program has been underway since October 1990  
1147 to prepare a foundation for habitat and passive recreational development. Other actions taken to  
1148 prepare the cell include management and discharge of rainwater to facilitate consolidation of the  
1149 crust, phragmites eradication and control measures including controlled burns, and vegetative  
1150 test plots. The 300-acre south cell is currently at +22 ft MLW average elevation.  
1151

1152 The south cell dike system could be reconstructed in stages to a final elevation of approximately  
1153 XX feet. With optimal lifts of approximately XX mcy per annual dredging cycle and aggressive  
1154 crust management, the cell could hold approximately XX mcy of dredged material. Inasmuch as  
1155 the south cell is less than half the acreage of the north cell, it would not be possible to place as  
1156 much material annually as in the north cell without trapping water in the sediments. The annual  
1157 optimal placement potential is approximately XX mcy. Therefore, even if reconstructed and  
1158 reactivated, the south cell would not be capable of providing all of the capacity needed within the  
1159 required time frame. Thus, it would be necessary to use the south cell in conjunction with another  
1160 placement option in order to accommodate the near term need.  
1161

#### 1162 **3.3.4d Bathymetry/Topography.**

1163  
1164 Most of the South Cell's upland tier dike was excavated for use in the north cell dike raising.  
1165 Sand that had previously been placed within the South Cell and stockpiled was mined as a  
1166 resource for reconstructing the North Cell dike to an elevation of +44 feet MLLW.  
1167

#### 1168 **3.3.4e Environmental Characteristics.**

1169  
1170 Living Resources. Inasmuch as the facility already exists, there would be no conversion of Bay  
1171 bottom. The existing vegetation in the cell, which has begun a natural transition from phragmites  
1172 domination to various indigenous species, would be covered if the cell is returned to active  
1173 placement operations. The State and Federal investments in initial preparation of the cell for  
1174 conversion would be lost.  
1175

1176 Water Quality. Use of the south cell would result in nutrient releases at approximately the same  
1177 rate as for an equivalent amount of sediment in the north cell (see Section X.X.X).  
1178

1179 Hydrodynamics. No effects.  
1180

1181 Rare, Threatened or Endangered (RTE) Species. None.  
1182

1183 Fishing Activity. No effects.  
1184

1185 Recreational Activity. Conversion of the south cell for passive recreation would be delayed by  
1186 approximately 12 to 15 years of longer, assuming that the closure plan for the cell continued to  
1187 call for a combination of conversion for habitat and passive recreation.  
1188

1189 Historical/Archeological. No effects.  
1190

1191 Groundwater: No effects.  
1192

1193 View Shed. The second tier dike was removed as a borrow source for construction of the +44

1194 foot north cell dike system. The lowering of the south cell dike system was viewed by residents  
1195 in nearby communities as part of a long-awaited lowering of the dike system that was required by  
1196 the State Wetlands License which authorized the construction of the second tier (+28 foot) dike.  
1197 Reconstruction of the south cell dike system would significantly alter the view shed as seen from  
1198 the Millers Island community by increasing the dike elevation from +18 feet MLLW up to +44  
1199 feet MLLW.

1200  
1201 **3.3.4f Implementation Factors.**

1202  
1203 Construction Considerations. [CENAB ADD HERE GEOTECHNICAL FACTORS, DIKE  
1204 QUALITY MATERIAL REQUIREMENTS AND SOURCES, QUANTITY OF  
1205 MATERIAL REQUIRED FOR DIKE CONSTRUCTION, AND OTHER  
1206 CONSTRUCTION CONSIDERATIONS.]

1207  
1208 Implementation Time Frame.

1209  
1210 **3.3.4g Institutional Constraints.**

1211  
1212 The North Cell dike raising motivated legislation by the Maryland General Assembly that  
1213 required substantial development of the south cell for recreation and habitat within 5 years. The  
1214 law also prohibited the south cell from receiving any more dredged material. The same  
1215 legislation mandated that the dike system could not be raised higher than +44 feet, that  
1216 placement into the North Cell must be completed by the end of calendar year 2009, and that the  
1217 cell was to be substantially developed for recreation and habitat within 5 years of closure  
1218 (Annotated code of the Public General Laws of Maryland, Environmental Article, § 16-202  
1219 (e)(1)(ii)).

1220  
1221 The MPA is constrained from making the cell available for reconstruction because of a  
1222 commitment made to the public by the Maryland Department of Transportation to accelerate the  
1223 development of the south cell for habitat and recreation. Furthermore, it would be illegal for a  
1224 State agency to reactivate the cell for placement because of the aforementioned State law. The  
1225 Maryland General Assembly, having only recently established this law, is unlikely to reverse  
1226 itself.

1227  
1228 **3.3.4h Estimated Costs.**

1229  
1230 The cost of reconstructing the south cell and the cost of operating the south cell for placement of  
1231 18 mcy of sediments would be approximately \$XXXX million, or about \$X.XX per cubic yard.  
1232 Inasmuch as Hart-Miller Island is a state facility, all reconstruction and operations costs would  
1233 be the responsibility of the state. Inasmuch as the south cell could not accommodate all of the  
1234 placement need within the required time frame, it use could potentially increase dredging costs if  
1235 multiple mobilizations are required to enable placement at other locations, if not required for  
1236 other placement needs.

1237  
1238 **3.3.4i Other Factors.** [XXXX]

1239  
1240 **3.3.4j Option Summary.**

1242 Reconstruction and reactivation of the south cell could provide sufficient capacity within the  
1243 time frame needed with minimal environmental effects. Although the State's investment to date in  
1244 a 10-year effort to prepare the south cell for permanent conversion to habitat and passive  
1245 recreational use would be lost, there would be an environmental benefit in the form of increased  
1246 "interim" habitat for migratory waterfowl. There would be an increase in the release of nutrients  
1247 by returning the cell to active operation, however, this release would be somewhat less than for  
1248 open-water placement. Reconstruction and reactivation of the south cell is prohibited by State  
1249 law. State law also requires expedited conversion of the south cell for habitat and passive  
1250 recreation. The cost of reactivation is within the cost screening criteria. But for the State law,  
1251 reactivation of the south cell would be an environmentally acceptable alternative. Therefore, in  
1252 accordance with the NEPA regulations, use of the south cell is considered an alternative to open-  
1253 water placement.

1254

1255 **3.3.4k Option Data Sheet. [ADD DATA SHEET]**

**Title:**

Hart-Miller Island: South Cell Dike Raising

**Type:**

Dredged Material Containment Facility

**Location:**

Chesapeake Bay in Baltimore County, east of the mouth of Back River.

**Size:**

The south cell is 300 acres and at an elevation of +22 feet MLW. This project would raise the dikes at the south cell to +44 feet, consistent with the 800-acre north cell.

**Potential Capacity:**

Approximately 14.0 mcy

**Availability:**

Currently owned by the State of Maryland.

**Nutrients:**

[Need info]

**Infrastructure Required to Implement:**

Infrastructure will be on site for the existing project.

**Institutional Issues:**

The south cell is prohibited from receiving any more dredged material by the Annotated Code of the Public General Laws of Maryland, Environmental Article, § 16-202 (e)(1)(ii).

**Costs:** [Still working on costs]

**Total Unit Costs Per Cubic Yard:** [Need]

**Development & Implementation Costs:** [Not sure what this is]

**COMMENTS:**

This is a very viable option save for the institutional constraint.

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TITLE: Hart-Miller Island: South Cell Dike Raising

PROJECT TYPE: Dredged Material Containment Facility

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality	X			
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area				X
Larval Habitat Area				X
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands		X		
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for

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impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Title:**

Hart-Miller Island: South Cell Dike Raising

**Type:**

Dredged Material Containment Facility

**Location:**

Chesapeake Bay in Baltimore County, east of the mouth of Back River.

**Size:**

The south cell is 300 acres and at an elevation of +22 feet MLW. This project would raise the dikes at the south cell to +44 feet, consistent with the 800-acre north cell.

**Potential Capacity:**      Approximately 8.1 mcy

**Availability:**

Currently owned by the State of Maryland.

**Nutrients:**              [Need info]

**Infrastructure Required to Implement:**

Infrastructure will be on site for the existing project.

**Institutional Issues:**

The south cell is prohibited from receiving any more dredged material by the Annotated Code of the Public General Laws of Maryland, Environmental Article, § 16-202 (e)(1)(ii).

**Costs:** [Still working on costs]

**Total Unit Costs Per Cubic Yard:** [Need]

**Development & Implementation Costs:** [Not sure what this is]

**COMMENTS:**

This is a very viable option save for the institutional constraint.

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TITLE: Hart-Miller Island: South Cell Dike Raising

PROJECT TYPE: Dredged Material Containment Facility

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality	X			
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area				X
Larval Habitat Area				X
Crabs				X
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas			X	
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence)

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of feature and therefore potential impacts are unknown), N/A (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

1259 **3.3.5 Use of Existing North Cell Capacity.**

1260

1261 CENAB examined the north cell of the Hart-Miller Island DMCF to determine if it could serve  
1262 as an alternative to open-water placement.

1263

**Box XX-13**  
**Screening of Use of Hart-Miller Island North Cell**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1264 **3.3.5a Location.**

1265

1266 **3.3.5b Type of Placement Option.**

1267

1268 **3.3.5c Potential Placement Capacity.**

1269

1270 The approximately 800-acre north cell was increased in elevation to 14.6 meters (+44 ft) MLW  
1271 by the MPA in 1997. With optimal crust management and consolidation, an estimated 24 mcy of  
1272 capacity will remain following inflow operations during the 1998-1999 dredging cycle.

1273 Eventually, the entire site will be converted to habitat and passive recreation in compliance with  
1274 State law after dredged material placement ceases in the year 2009. The 21 mcy of capacity that  
1275 is still available in the north cell has been programmed to receive various maintenance and new  
1276 work dredging projects over the remaining service life of the project. The potential capacity will  
1277 be decreased during placement of up to 3.2 mcy during the October 1999-March 2000 dredging  
1278 cycle. The potential remaining capacity following crust management during Summer 2000  
1279 would be approximately 19.5 mcy, depending upon environmental conditions.

1280

1281 The north cell can only receive an annual maximum of 2.5 mcy without overburdening. The  
1282 available capacity is being programmed for Harbor sediments that are unsuitable for open-water  
1283 placement, insofar as practicable, consistent with other placement needs which have been  
1284 programmed to HMI to correspond with dredging needs. CENAB's analysis of dredging needs  
1285 indicates that there is no excess capacity available in the north cell. Diversion of material

1286 planned for open-water placement would not only be substituted for other existing needs, but  
1287 would also result in a reduction in the north cell's ability to receive dredged material, as  
1288 described below.  
1289

1290 Operational records for the HMI facility document the ability to dewater and consolidate  
1291 sediments in order to reduce sediment volume and regain a portion of used placement capacity.  
1292 The operating history indicates that placement of quantities in excess 2.5 mcy would result in  
1293 water being trapped between the crust prior to placement and the crust that forms following  
1294 placement. This would have the effect of reducing the facility's overall capacity, because the  
1295 state law that mandates a closure date does not allow time for a hiatus in placement operations to  
1296 enable extended crust management operations to offset any overburdening. The prospective  
1297 potential outcomes of overburdening the site would therefore be a shortened service life because  
1298 the site would be filled more quickly, inadequate time available between placements for optimal  
1299 dewatering and consolidation, and a reduction in the north cell's overall capacity. The resulting  
1300 reduction in the north cell's optimal capacity would exacerbate the placement deficit that the  
1301 proposed action under investigation by the DEIS is intended to relieve.  
1302

### 1303 **3.3.5d Bathymetry/Topography.** 1304

1305 The Hart-Miller Island DMCF has a maximum permitted dike elevation of +44 feet MLLW. The  
1306 crust within the cell has a very gradual downward slope with highest elevations at the cross dike  
1307 and lowest elevations at the southern end of the facility.  
1308

### 1309 **3.3.5e Environmental Characteristics.** 1310

1311 Living Resources. The north cell provides valuable "interim" habitat for migratory waterfowl  
1312 during the winter flyway period when recently placement dredged material provides a food  
1313 source for foraging. The Cell is also used to a lesser extent during the spring and summer while a  
1314 pond is still present.  
1315

1316 Water Quality. [XXXX]  
1317

1318 Hydrodynamics. Not applicable.  
1319

1320 Rare, Threatened or Endangered (RTE) Species. None.  
1321

1322 Fishing Activity. None.  
1323

1324 Recreational Activity. None at the facility. Utilization of the adjoining State Park would not be  
1325 affected.  
1326

1327 Historical/Archeological. No effect.  
1328

1329 Groundwater: No significant effect.  
1330

1331 View Shed. No significant effect.  
1332

### 1333 **3.3.5f Implementation Factors.**

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Construction Considerations. [XXXX]

Implementation Time Frame. [XXXX]

**3.3.5g Institutional Constraints.**

The north cell dike system was reconstructed and increased in elevation to +44 feet MLLW. State law prohibits the dike from being increased above +44 feet in elevation. Although there is a limited potential to further increase the north cell dike elevation, this is not a viable option under existing state law. The Maryland General Assembly, having only recently established this law, is unlikely to reverse itself. In this regard, recent legislative sessions have seen continuing efforts to continue to impose additional constraints on placement options.

**3.3.5h Estimated Costs.** [XXXX]

**3.3.5i Other Factors.** [XXXX]

**3.3.5j Option Summary.**

The diversion of additional sediments to HMI would therefore result in one or a combination of (1) substituting sediments dredged from one location for another without resolving the underlying placement need, (2) an increase rather than reduce the deficit in placement capacity through overburdening, and (3) deferral of planned dredging due to lack of capacity. In view of the preceding analysis, use of the existing capacity of the north cell is not viable as an alternative to open-water placement.

**3.3.5k Option Data Sheet.** [ADD DATA SHEET]

1362  
1363

### 3.3.6 Masonville

#### Box XX-14 Screening of Masonville

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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#### 3.3.6a Location.

#### 3.3.6b Type of Placement Option.

#### 3.3.6c Potential Placement Capacity.

#### 3.3.6d Bathymetry/Topography.

#### 3.3.6e Environmental Characteristics

#### 3.3.6e Environmental Characteristics.

#### Living Resources.

#### Water Quality.

#### Hydrodynamics. Not applicable.

#### Rare, Threatened or Endangered (RTE) Species.

#### Fishing Activity.

#### Recreational Activity.

#### Historical/Archeological.

1389  
1390 Groundwater:  
1391  
1392 View Shed.  
1393  
1394 **3.3.6f Implementation Factors.**  
1395  
1396 Construction Considerations.  
1397  
1398 Implementation Time Frame.  
1399  
1400 **3.3.6g Institutional Constraints.**  
1401  
1402 **3.3.6h Estimated Costs.**  
1403  
1404 **3.3.6i Other Factors.**  
1405  
1406 **3.3.6j Option Summary.**  
1407  
1408 **3.3.6k Option Data Sheet. [ADD DATA SHEET]**

1 **Masonville**

2  
3 The Masonville site, which is operated by MPA, is located along the southern shore of the  
4 Middle Branch of the Patapsco River off the Ferry Bar Channel. The site consists of  
5 approximately 152 acres of fast land and 175 acres of submerged land. A detailed development  
6 plan and environmental impact analysis were prepared by the MPA in 1982. The site was an  
7 important part of the harbor ~~maintenance-dredging~~maintenance-dredging program for the  
8 placement of dredged material from small private jobs. Currently there are five containment  
9 cells, which are essentially full and could not provide placement capacity for future dredging  
10 needs without construction of a dike [TO BE CONFIRMED BY MPA]. Dike construction in  
11 this area would be restricted due to the statute that restricts dike construction within a ~~5-mile~~  
12 5-mile radius of Hart-Miller Island. In order to raise dikes in this area, supportive public opinion  
13 would need to force a change in the current state law.  
14  
15

16 P:\Federal\DOD\ARMY\projects\6095793\NewDraft\Revised DEIS\Chapter\_02\Masonville.doc

**Title:**  
Masonville

**Type:**  
Fastland Creation

**Location:** Middle Branch of Patapsco River, Baltimore Harbor

**Size:** approximately 175 acres of submerged land and 152 acres of fastland.

**Potential Capacity:** None remaining; site closed

**Availability:** State owned

**Nutrients:** NA

**Infrastructure Required to Implement:**

Site no longer under consideration because it is filled to capacity.

**Institutional Issues:**

Site no longer under consideration because it is filled to capacity.  
Only potential for placement would be to raise dikes above water. This would be constrained by law prohibiting another diked facility within a 5-mile radius of HMI.

**Costs:** NA

**COMMENTS:**

Resource information not updated because site is no longer available for placement.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils	X			
High Relief Area				X
Suspended Particulates, Turbidity		X		
Water Quality		X		
Hydrodynamics			X	
Tidal Fluctuations		X		
Salinity Gradients			X	
Sediment Quality		X		
HTRS			X	
<b>Biological Characteristics</b>				
RTE-			X	
<b>Aquatic Organisms</b>				
Benthic Communities				
Fisheries		X		
Designated Spawning Area-anadromous				X
Larval Habitat Area-anadromous		X		
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds			X	
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries			X	
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>				X
<b>Potential to Minimize Adverse Effects</b>				X

(\* ) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Maryland Port Administration. 1990. Port of Baltimore: Dredged Material Management Master Plan. Report prepared for MPA by Gahagan and Bryant Associates and EA Engineering, Science and Technology, Inc. Unpublished.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**Maryland Tax Records.**

1409 3.4 **New Containment Facilities**

1410 3.4.1 Bay Bridge Airport  
1411

**Box XX-15**  
**Screening of Bay Bridge Airport**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1412 3.4.1a Location.

1413

1414 3.4.1b Type of Placement Option.

1415

1416 3.4.1c Potential Placement Capacity.

1417

1418 3.4.1d Bathymetry/Topography.

1419

1420 3.4.1e Environmental Characteristics

1421

1422 3.4.1e Environmental Characteristics.

1423

1424 Living Resources.

1425

1426 Water Quality.

1427

1428 Hydrodynamics.

1429

1430 Rare, Threatened or Endangered (RTE) Species.

1431

1432 Fishing Activity.

1433

1434 Recreational Activity.

1435

1436 Historical/Archeological.

1437	
1438	<u>Groundwater:</u>
1439	
1440	<u>View Shed.</u>
1441	
1442	<b>3.4.1f Implementation Factors.</b>
1443	
1444	<u>Construction Considerations.</u>
1445	
1446	<u>Implementation Time Frame.</u>
1447	
1448	<b>3.4.1g Institutional Constraints.</b>
1449	
1450	<b>3.4.1h Estimated Costs.</b>
1451	
1452	<b>3.4.1i Other Factors.</b>
1453	
1454	<b>3.4.1j Option Summary.</b>
1455	
1456	<b>3.4.1k Option Data Sheet. [ADD DATA SHEET]</b>

1457 **3.4.2 Hart-Miller Island New Cell**  
1458

**Box XX-16**  
**Screening of Hart-Miller Island New Containment Cell**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

- 1459 **3.4.2a Location.**
- 1460
- 1461 **3.4.2b Type of Placement Option.**
- 1462
- 1463 **3.4.2c Potential Placement Capacity.**
- 1464
- 1465 **3.4.2d Bathymetry/Topography.**
- 1466
- 1467 **3.4.2e Environmental Characteristics**
- 1468
- 1469 **3.4.2e Environmental Characteristics.**
- 1470
- 1471 Living Resources.
- 1472
- 1473 Water Quality.
- 1474
- 1475 Hydrodynamics.
- 1476
- 1477 Rare, Threatened or Endangered (RTE) Species.
- 1478
- 1479 Fishing Activity.
- 1480
- 1481 Recreational Activity.
- 1482
- 1483 Historical/Archeological.

1484	
1485	<u>Groundwater:</u>
1486	
1487	<u>View Shed.</u>
1488	
1489	<b>3.4.2f Implementation Factors.</b>
1490	
1491	<u>Construction Considerations.</u>
1492	
1493	Implementation Time Frame.
1494	
1495	<b>3.4.2g Institutional Constraints.</b>
1496	
1497	<b>3.4.2h Estimated Costs.</b>
1498	
1499	<b>3.4.2i Other Factors.</b>
1500	
1501	<b>3.4.2j Option Summary.</b>
1502	
1503	<b>3.4.2k Option Data Sheet. [ADD DATA SHEET]</b>

1504 3.4.3 Thoms Cove  
1505

**Box XX-17**  
**Screening of Thoms Cove Containment Cell**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1506 3.4.3a Location.

1507

1508 3.4.3b Type of Placement Option.

1509

1510 3.4.3c Potential Placement Capacity.

1511

1512 3.4.3d Bathymetry/Topography.

1513

1514 3.4.3e Environmental Characteristics.

1515

1516 Living Resources.

1517

1518 Water Quality.

1519

1520 Hydrodynamics.

1521

1522 Rare, Threatened or Endangered (RTE) Species.

1523

1524 Fishing Activity.

1525

1526 Recreational Activity.

1527

1528 Historical/Archeological.

1529

1530 Groundwater:

1531

1532 View Shed.

1533

1534 **3.4.3f Implementation Factors.**

1535

1536 Construction Considerations.

1537

1538 Implementation Time Frame.

1539

1540 **3.4.3g Institutional Constraints.**

1541

1542 **3.4.3h Estimated Costs.**

1543

1544 **3.4.3i Other Factors.**

1545

1546 **3.4.3j Option Summary.**

1547

1548 **3.4.3k Option Data Sheet. [ADD DATA SHEET]**

1549 **3.5 BENEFICIAL USE PLACEMENT OPTIONS**

1550  
1551 A concept that has gained considerable popularity is the use of suitable dredged sediment as a  
1552 natural and economic resource rather than as a byproduct of dredging that has traditionally been  
1553 treated as a waste stream, although most dredged material does not classify as contaminated  
1554 sediments (NRC, 1989, 1994, 1997). Expanding from small-scale demonstration projects to  
1555 large-scale application was proposed as a way to resolve the Port of Baltimore's placement needs  
1556 in a manner that would contribute to Chesapeake Bay restoration efforts (MDOT, 1991).

1557  
1558 The concept of using dredged material as a resource has continued to be of interest to the  
1559 USACE, MPA, natural resource agencies, and the public, and has been the subject of intensive  
1560 efforts over the past decade to implement the concept. Moving the beneficial use concept into  
1561 practical application for the navigation infrastructure serving the Port of Baltimore has proven  
1562 very difficult, including the implementation of the Poplar Island restoration project. Over the past  
1563 decade, over 35 beneficial use projects have been proposed for locations in the upper Bay that  
1564 would use dredged material as a natural resource. With the exception of Poplar Island, none of  
1565 these options has been capable of implementation. A variety of factors have inhibited the  
1566 application of the beneficial use concept. Hamons and Young (1999) documented the results of  
1567 the continuing efforts to find beneficial use projects capable of obtaining the support necessary  
1568 for implementation and identified reasons why more beneficial use projects have not been  
1569 implemented.

1570  
1571 A number of beneficial use options are screened in this annex. Most were found to be not  
1572 suitable as either standalone alternatives or as a component of a combined options alternative.  
1573 Some beneficial use options screened successfully as possible components of a multi-option  
1574 alternative to the proposed action, as discussed in later paragraphs.

1575  
1576 Beneficial use projects are, in general, not only more expensive per cubic yard utilized than more  
1577 traditional placement options, but have usually been substantially more expensive. The cost  
1578 factor makes large-scale beneficial use projects extremely difficult to implement, because the  
1579 federal beneficial use authority provided by Section 204 of the XXXXX is directed to small-scale  
1580 projects. The beneficial use options that were screened as possible alternatives ranged in cost  
1581 from tens of millions to hundreds of millions of dollars more than the proposed action, as  
1582 discussed in Appendix XX. Although the beneficial use concept continues to enjoy popular and  
1583 institutional conceptual support, each beneficial use option was considered on its own merits as  
1584 to whether or not it could serve as a practical alternative to the proposed action or as a  
1585 component of a multi-option alternative.

1586 **3.5.1 Aberdeen Proving Ground Beneficial Use Options**  
1587

1588 Aberdeen Proving Ground (APG), a major U.S. military installation with multiple national  
1589 defense missions, controls a large amount of shoreline, shorelands and water areas along the  
1590 western side of the upper Bay. CENAB, CENAP and the MPA have maintained a continuing  
1591 interest in finding opportunities for the placement of dredged material. The possibility of using  
1592 APG-controlled areas for placement has also received considerable attention from the public.  
1593 Accordingly, the APG-controlled area was examined for general suitability. Certain specific  
1594 sites were screened as possible alternatives to the proposed action. The possibility of island  
1595 placement site construction within the APG boundary was examined separately later in this

**Box XX-18**

**Screening of Aberdeen Proving Ground (General Application)**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Varies from small to large scale depending upon location. Most potential sites would have small to modest capacity.
2. Availability: APG has declined to make sites available.
3. Environmental Suitability: Site specific.
4. Infrastructure Readiness: Sites could not be ready for use when needed.
5. Institutional Feasibility: Constrained because of unresolved national-level issues with respect to remediation standards for unexploded ordnance (UXO) and associated liability for remediation.
6. Prospective Affordability: Site specific.
7. Potential for Environmental Improvements: There is potential to encapsulate UXO if aquatic and/or terrestrial encapsulation becomes an accepted long-term remediation technique.

**Results of Screening:** Use of APG-controlled areas is not suitable for consideration as an alternative or as a component of a multi-option alternative because of military missions, UXO liability, and, depending upon site-specific conditions, the potential for significant environmental impacts. Although there is some potential for possible future placement options within the APG-controlled area, these options cannot be effectively considered until such time that UXO remediation standards are promulgated and UXO liability is resolved.

1596 annex.  
1597

1598 **3.5.1a Location.**  
1599

1600 The APG-controlled area totals approximately 72,000 acres located on the northern Chesapeake  
1601 Bay shoreline in Harford and Baltimore Counties. Approximately 40,000 acres consists of Bay  
1602 waters and tributaries. Of the remaining 32,000 acres, a significant percentage is either in use for  
1603 military missions or is wetlands or forested areas. CENAB, CENAP and the MPA have been  
1604 involved in continuing efforts to establish placement sites within the APG area, as discussed in  
1605 the following paragraphs. However, the interest in APG for dredged material management must  
1606 be considered in the context of an active military installation with important national security

1607 missions that are the primary considerations for use of land and water areas controlled by the  
1608 U.S. Army.

1609

### 1610 **3.5.1b Types of Placement Options.**

1611

1612 A variety of placement types have been considered since the mid-1980s for APG-controlled  
1613 areas. CENAB commissioned a major study of the potential for use of APG upland areas for the  
1614 disposal of dredged material. The study began in 1984 and was completed in 1987 (Century  
1615 Engineering, 1987). Three technically feasible sites that would have the least environmental  
1616 impacts were identified after detailed investigation of areas not affected by operating areas or  
1617 critical military missions, areas with endangered species or historical attributes, water and land  
1618 access, and areas with tidal wetlands. Detailed investigation was carried out for the most  
1619 promising upland site which was located at the end of Abbey Point. The site had a potential  
1620 capacity of 2.8 mcy. Deposition of dredged material would cover unexploded ordnance (UXO)  
1621 to a depth of some 5 to 7 feet. It was subsequently determined that this use of the site for  
1622 disposal would severely restrict range and recovery operations. The engineering consultant  
1623 ultimately concluded that “. . . there is no significant acceptable dredged material disposal area  
1624 at Aberdeen Proving Ground” (Century Engineering, 1987).

1625

1626 The MPA Master Plan initiative from 1986 to 1990 considered a number of potential placement  
1627 sites in the APG-controlled water area. Potential sites were identified in the vicinity of Pooles  
1628 Island, Cherry Tree Point, and Shad Battery Shoal. The Master Plan recommended use of the  
1629 then existing open-water sites until their capacity was exhausted, with all dredged sediments  
1630 designated for open-water disposal thereafter being placed in the Deep Trough (MPA, 1990). In  
1631 lieu of implementing the Master Plan recommendations, the Maryland Governor established a  
1632 task force to develop another approach to dredged material management, as previously discussed.

1633

1634 The DNPOP program has, since its inception, continued the active pursuit of placement options  
1635 within the boundaries of APG. Alternatives that have been identified and evaluated have the  
1636 potential to provide material for beneficial use projects at APG such as shoreline stabilization,  
1637 habitat restoration, and encapsulation of hazardous materials and unexploded ordnance (UXO).  
1638 APG representatives are participating in the DNPOP, and continue to discuss the development of  
1639 alternative placement options for APG.

1640

1641 The Maryland Environmental Service, at the request of the MPA, prepared a multi-objective  
1642 screening of the potential of four beneficial use sites for dredged material placement in support of  
1643 the C&D Deepening Study that was being performed by CENAP. Three of the sites – Weir  
1644 Point, Spry Island Shoal, and Pooles Island were largely within the APG controlled area. The  
1645 screening addressed endangered species, waterfowl, fisheries, benthos, wetlands, shallow water  
1646 habitat, colonial waterbirds, submerged aquatic vegetation, ownership and jurisdiction, and  
1647 institutional constraints (MES, 1994). The report served as a technical resource for subsequent  
1648 efforts to find suitable placement options at APG and identified various environmental factors  
1649 and institutional constraints that would require further investigation. The possibility of  
1650 encountering munitions was identified, but was not a factor that was specifically addressed  
1651 during the environmental screening. The presence of UXO as a fatal flaw for projects at APG  
1652 became apparent as the results of subsequent efforts to find placement sites at APG, as discussed  
1653 in the following paragraphs.

1654

1655 A DNPOP working group identified 5 areas (Carroll Island, Spry Island Shoal, Graces Quarters,  
1656 Gunpowder Neck and Pooles Island) with 16 individual concepts for creating or restoring  
1657 intertidal marshes. Most of these sites are within the perimeter of APG. Many areas of APG are  
1658 in Harford County but within the five mile radius of Hart-Miller Island. Use of the sites may  
1659 require a modification of the State law that prohibits establishment of a containment facility  
1660 within 5 miles of the Hart-Miller-Pleasure Island Chain in Baltimore County. APG, Federal and  
1661 state natural resource agencies, and commercial fisherman expressed concerns regarding the  
1662 environmental and economic issues related to each of the sites. Rare, threatened or endangered  
1663 species (RTE) habitat, estuarine and palustrine wetlands, finfish nursery and spawning grounds,  
1664 and CERCLA and UXO liability issues have all been part of the aquatic and terrestrial resources  
1665 and environmental impacts discussed regarding use of APG sites for dredged material placement.  
1666

1667 **3.5.1c Potential Placement Capacity.**

1668  
1669 **3.5.1d Bathymetry/Topography.**

1670  
1671 **3.5.1e Environmental Characteristics**

1672  
1673 **3.5.1e Environmental Characteristics.**

1674  
1675 Living Resources.

1676  
1677 Water Quality.

1678  
1679 Hydrodynamics.

1680  
1681 Rare, Threatened or Endangered (RTE) Species.

1682  
1683 Fishing Activity.

1684  
1685 Recreational Activity.

1686  
1687 Historical/Archeological.

1688  
1689 Groundwater:

1690  
1691 View Shed.

1692  
1693 **3.5.1f Implementation Factors.**

1694  
1695 Construction Considerations.

1696  
1697 Implementation Time Frame.

1698  
1699 **3.5.1g Institutional Constraints.**

1700  
1701 **3.5.1h Estimated Costs.**

1702

1703 **3.5.1i Other Factors.**

1704  
1705 The most significant concerns voiced related to the safety, liability, and cleanup cost for use of a  
1706 site that contains so much UXO and is currently on the National Priority List (NPL) of hazardous  
1707 waste sites. EPA Region III advised the DNPOP program participants who were considering a  
1708 demonstration project a J-Field on Gunpowder Neck that there is no national standard for  
1709 remediation of UXO. EPA and that there are no laws or regulations specifically addressing the  
1710 liability of UXO. In the absence of definitive legal requirements, EPA Region III advised that  
1711 DNPOP planning should use the CERCLA legal requirements and precedents as planning  
1712 factors, including removal of UXO as the worse case remediation requirement Thus, any  
1713 dredged material placement project might have to be removed in order to remediate UXO.  
1714 Furthermore, any party which constructed a project that later required UXO remediation could be  
1715 considered a Potentially Responsible Party by the EPA and, if so designated, would become  
1716 liable for the cost of removing UXO. Neither the Army Corps of Engineers nor the Maryland  
1717 Port Administration can accept the associated risk and liability. Active investigation of all  
1718 potential sites and configurations within the APG boundary has been suspended from further  
1719 evaluation (DNPOP, 1995b).

1720  
1721 **3.5.1j Option Summary.**

1722  
1723 Placement options with the APG area are not suitable as alternatives to the proposed open-water  
1724 placement of dredged material.

1725  
1726 **3.5.1k Option Data Sheet. [ADD DATA SHEET]**

1  
2 **2.2.3.a.5 Aberdeen Proving Ground Beneficial Use Options**  
3

4 The DNPOP program has, since its inception, actively pursued identification and evaluation of  
5 upland placement sites within the boundaries of the U.S. Army, Aberdeen Proving Grounds  
6 (APG). The APG-controlled area totals approximately ~~792,000,000~~ acres located on the  
7 northern upper Chesapeake Bay shoreline in Harford and Baltimore Counties. Approximately  
8 40,000 acres consists of Bay waters and tributaries. Of the remaining 32,000 acres, a significant  
9 percentage is either in use for military missions or is wetlands or forested areas. Alternatives  
10 being evaluated have the potential to provide material for beneficial use projects at APG such as  
11 shoreline stabilization, habitat restoration, and encapsulation of hazardous materials and  
12 unexploded ordnance (UXO). APG representatives are participating in the DNPOP, and  
13 continue to discuss the development of alternative placement options for APG.  
14

15 A DNPOP working group identified 5 areas (Carroll Island, Spry Island Shoal, Graces Quarters,  
16 Gunpowder Neck, and Pooles Island) with 16 individual concepts for creating or restoring  
17 intertidal marshes. [Wayne, please check. Meeting notes I have are a little different]. Most of  
18 these sites are within the perimeter of APG. APG, Federal and state resource agencies, and  
19 commercial fisherman expressed concerns regarding the environmental and economic issues  
20 related to each of the sites. The most significant concerns voiced related to the liability and cost  
21 for use of a site that contains so much UXO and is currently on the National Priorities List  
22 (NPL) of hazardous waste sites. Due to these concerns, active investigation of all potential sites  
23 and configurations has been suspended from further evaluation, although the concepts will be  
24 reconsidered should conditions change.  
25

26 Given the large amount of shoreline controlled by APG on the western side of the upper Bay, the  
27 DNPOP program has maintained a continuing interest in finding opportunities for the placement  
28 of dredged material. Many areas of APG are within the ~~five~~ 5-mile radius of Hart-~~m~~ Miller  
29 Island and are, therefore, unavailable for containment site development under current Maryland  
30 law. However, other smaller-scale concepts such as shoreline stabilization/beneficial use have  
31 been explored. Placement options involving APG have resulted in the inclusion of two APG-  
32 related alternatives to Site 104; Encapsulation of UXO using dredged material at two APG sites  
33 (J-Field [on Gunpowder Neck] and Graces Quarters) was actively pursued during 1994 and 1995  
34 (Figure 2-7). One is a small-scale demonstration project combining waste encapsulation and  
35 shoreline stabilization, known as the J-Field project. This project concept is described below.  
36 The second is the expansion of Pooles Island in conjunction with development of a new island  
37 containment facility with an estimated capacity of 80 ~~million cubic yards (mcy)~~. Rare,  
38 threatened, or endangered species (RTE) habitat, estuarine and palustrine wetlands, finfish  
39 nursery and spawning grounds, and CERCLA and UXO liability issues have all been part of the  
40 aquatic and terrestrial resources and environmental impacts discussed regarding use of APG sites  
41 for dredged material placement. The Pooles Island dredged material island concepts are  
42 described and ~~evaluated~~ incaluated in Section 2.2.3.b.2.  
43

44 Due to the miles of contiguous natural shoreline and relative isolation, there are significant  
45 natural resources associated with APG. The Busch and lower Gunpowder Rivers provide  
46 significant recreational fishing opportunities. Target species include white perch, striped bass,

47 and croaker, channel catfish, and yellow perch. Various parts of the base provide bird nesting  
48 and foraging habitat, particularly for eagles, shorebirds, wading birds, and songbirds. Both rivers  
49 support recreational crabbing in the warmer months. Due to the shallow depths, significant  
50 submerged aquatic vegetation (SAV) beds are present along some areas of the site. The shallow  
51 depths along most of the shorelines also limit dredged material placement concepts due to access  
52 issues.

#### 53 54 J-Field Site

55  
56 A small-scale demonstration project combining encapsulation and beneficial use was considered  
57 for J-Field, which is an APG Superfund site (Figure 2-7). The site also has a unique “floating  
58 marsh” that is in danger of being lost through shoreline erosion. In 1995, APG determined that  
59 incorporating the project into the facility’s installation restoration program (IRP) was potentially  
60 feasible. The demonstration project would have had about 1.5 mcy capacity, and would have  
61 only provided a partial short-term solution for the C&D Canal southern approach channels.  
62 During the course of investigating the concept, it was learned that the shoreline and water  
63 reaches within the restricted area controlled by APG are contaminated by the presence of  
64 between 3 and 30 million rounds of UXO, creating significant concerns for safety. There is also  
65 substantial uncertainty about the degree to which the placement of dredged material would create  
66 exposure to future responsibility or costs if the encapsulated ordnance would need to be  
67 excavated or removed. There is also a technical limitation in locating UXO once buried in  
68 sediments. As a result, the proposed J-Field project to encapsulate UXO and to protect an  
69 eroding shoreline with a protective marsh has been indefinitely delayed and is not likely to be  
70 available to accommodate any of the near-term placement needs for the C&D Canal northern or  
71 southern approach channels.

#### 72 73 Graces Quarters

74  
75 Two beneficial use concepts were investigated for Graces Quarters, which is an APG Superfund  
76 site (Figure 2-7): (1) A 36-acre wetland creation and shore stabilization project with an  
77 approximate capacity of 400,000 cy, and (2) a 36-acre encapsulation for shore protection with an  
78 approximate capacity of 400,000 to 824,000 cy, depending on fill elevation. Consideration of  
79 both concepts was discontinued due to: (1) the low capacity of the site, particularly if it had to be  
80 diked; (2) poor boat/scow access (very shallow water and poor truck access to most of the site;  
81 (3) difficulties in getting the materials to the identified areas even with a hydraulic dredge; (4)  
82 the need for dewatered, consolidated materials to make the concept work; and (5) existence of  
83 prime tiger beetle (endangered species) habitat. The potential presence of UXO at this site (see  
84 above) would also indefinitely delay its use for accommodating any of the near-term placement  
85 needs for the C&D Canal northern or southern approach channels.

86  
87  
88 P:\Federal\DOD\ARMY\projects\6095793\NewDraft\Revised DEIS\Chapter 02\Aberdeen Proving Ground BU Op.doc

**Title:**  
Aberdeen Proving Ground

**Type:**  
Beneficial Use

**Location:** APG is located on the western shore of the Chesapeake Bay in Harford County between the Busch and Gunpowder Rivers. Five areas were considered initially (Carroll Island, Spry Island Shoal, Graces Quarters, Gunpowder Neck and Pooles Island). Two options were advanced for further consideration (J-field, Grace's Quarters).

**Size:** J-Field—????  
Grace's Quarters: (1) 36 acres wetland creation  
(2) 36 acre shoreline encapsuation

**Potential Capacity:** J-Field— 1.5 mcy  
Grace's Quarters: (1) 36 acres wetland creation  
(2) 36 acre shoreline encapsuation

**Availability:** Federally owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facilities, de-watering facilities, and containment structures.

**Institutional Issues:**

Permitting required for construction in shallow water habitat.  
Permitting required for critical area development  
Permitting required for wetland disturbance.  
APG is an NPL (hazardous waste) site  
Significant amounts of UXO known to exist in all water accessible areas of APG

**Costs:** [NEED]

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [NEED!]

**COMMENTS:**

Colonial waterbirds and Eagles occur at APG  
Located in a spawning area for anadromous fish such as herring, white perch and yellow perch.  
Wetlands and Critical Areas  
Some SAV presence  
Poor accessibility for placement.  
UXO and HTRW pose significant risks/liabilities

DRAFT  
**TITLE: APG Beneficial Use**

DRAFT  
**PROJECT TYPE: Beneficial Use**

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils	X			
High Relief Area			X	
Suspended Particulates, Turbidity		X		
Water Quality		X		
Hydrodynamics			X	
Tidal Fluctuations			X	
Salinity Gradients			X	
Sediment Quality		X		
HTRS	X			
<b>Biological Characteristics</b>				
RTE-	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area-anadromous	X			
Larval Habitat Area-anadromous	X			
Crabs	X			
Mollusks				
Soft shell clams			X	
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
Avian Wildlife				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV	X			
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands		X		
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas	X			
Cultural Resources		X		
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

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**Box XX-19**  
**Screening of APG – Graces Quarters**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1729 **3.5.2a Location.**

1730

1731 **3.5.2b Type of Placement Option.**

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1733 **3.5.2c Potential Placement Capacity.**

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1735 **3.5.2d Bathymetry/Topography.**

1736

1737 **3.5.2e Environmental Characteristics**

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1739 **3.5.2e Environmental Characteristics.**

1740

1741 Living Resources.

1742

1743 Water Quality.

1744

1745 Hydrodynamics.

1746

1747 Rare, Threatened or Endangered (RTE) Species.

1748

1749 Fishing Activity.

1750

1751 Recreational Activity.

1752

1753 Historical/Archeological.

1754	
1755	<u>Groundwater:</u>
1756	
1757	<u>View Shed.</u>
1758	
1759	<b>3.5.2f Implementation Factors.</b>
1760	
1761	<u>Construction Considerations.</u>
1762	
1763	<u>Implementation Time Frame.</u>
1764	
1765	<b>3.5.2g Institutional Constraints.</b>
1766	
1767	<b>3.5.2h Estimated Costs.</b>
1768	
1769	<b>3.5.2i Other Factors.</b>
1770	
1771	<b>3.5.2j Option Summary.</b>
1772	
1773	<b>3.5.2k Option Data Sheet. [ADD DATA SHEET]</b>

1774 3.5.2 APG - J-Field  
1775

**Box XX-20**  
**Screening of APG – J-Field**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1776 3.5.3a Location.

1777

1778 3.5.3b Type of Placement Option.

1779

1780 3.5.3c Potential Placement Capacity.

1781

1782 3.5.3d Bathymetry/Topography.

1783

1784 3.5.3e Environmental Characteristics

1785

1786 3.5.3e Environmental Characteristics.

1787

1788 Living Resources.

1789

1790 Water Quality.

1791

1792 Hydrodynamics.

1793

1794 Rare, Threatened or Endangered (RTE) Species.

1795

1796 Fishing Activity.

1797

1798 Recreational Activity.

1799

1800 Historical/Archeological.

1801  
1802 Groundwater:  
1803  
1804 View Shed.  
1805  
1806 **3.5.3f Implementation Factors.**  
1807  
1808 Construction Considerations.  
1809  
1810 Implementation Time Frame.  
1811  
1812 **3.5.3g Institutional Constraints.**  
1813  
1814 **3.5.3h Estimated Costs.**  
1815  
1816 **3.5.3i Other Factors.**  
1817  
1818 **3.5.3j Option Summary.**  
1819  
1820 **3.5.3k Option Data Sheet. [ADD DATA SHEET]**

1821 **3.5.4 Artificial Reefs (small to medium scale)**  
1822

**Box XX-21**  
**Screening of Artificial Reefs (Small to Medium)**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

1823 **3.5.4a Location.**

1824

1825 **3.5.4b Type of Placement Option.**

1826

1827 **3.5.4c Potential Placement Capacity.**

1828

1829 **3.5.4d Bathymetry/Topography.**

1830

1831 **3.5.4e Environmental Characteristics.**

1832

1833 Living Resources.

1834

1835 Water Quality.

1836

1837 Hydrodynamics.

1838

1839 Rare, Threatened or Endangered (RTE) Species.

1840

1841 Fishing Activity.

1842

1843 Recreational Activity.

1844

1845 Historical/Archeological.

1846

1847 Groundwater:

1848  
1849 View Shed.  
1850  
1851 **3.5.4f Implementatioo Factors.**  
1852  
1853 Construction Considerations.  
1854  
1855 Implementation Time Frame.  
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1857 **3.5.4g Institutional Constraints.**  
1858  
1859 **3.5.4h Estimated Costs.**  
1860  
1861 **3.5.4i Other Factors.**  
1862  
1863 **3.5.4j Option Summary.**  
1864  
1865 **3.5.4k Option Data Sheet. [ADD DATA SHEET]**

**Title:**

Artificial Reefs-Thomas Point Strawman Design

**Type:**

Beneficial Use

**Location:**

Thomas Point design is located in the Chesapeake Bay in Anne Arundel County east of the Thomas Point lighthouse. Multiple concepts have been proposed for reef construction in bottom areas below the Chesapeake Bay Bridge in waters 30-50 feet deep in Anne Arundel County and Calvert County westerly and outside of navigation channels and the Deep Trough. Each area would be subject to site specific impacts. This site evaluation is for an area located immediately east of Thomas Point Lighthouse in 30 to 50 feet of water.

**Size:** Thomas Point is 5500 yards long [need acreage].

Overall potential concept area for reef construction is 1 mile wide by 10 to 15 miles long.

**Potential Capacity:** Approximately 5 mcy for the Strawman design

**Availability:** State Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Each site could require a diked area to contain the fine grained material. The location of the berms would depend on results of a hydrodynamic study. Additional time and costs may be needed for material other than dredged material depending on the design of berm. Placement mounds may also need sand or hard substrate capping after dredged material placement.

**Institutional Issues:**

Potential impact to navigation due to an undesignated, yet long standing, area for anchoring ships.

State agency required that a hydrodynamic model study be performed to evaluate the ability of a berm to provide hydrodynamics conducive to fish habitat before moving this option forward.

Consensus needed from commercial and recreational fishermen for site selection and enhancement.

**Costs:**

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [NEED!]

**COMMENTS:**

Hydrodynamic concerns

Potential impact to salt water wedge

Navigational issues associated with area due to long standing area for anchorage of ships

Commercial and recreational fisheries impacts

Potential impact to thermal refuge habitat for fisheries

Potential impact to Oyster bars NOB 8-6, 8-9, 10-1 and 10-2.

DRAFT DRAFT  
 TITLE: Artificial Reefs

DRAFT DRAFT  
 PROJECT TYPE: Beneficial Use

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area	X			
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality			X	
HTRS			X	
<b>Biological Characteristics</b>				
RTE			X	
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area				X
Crabs	X			
<b>Mollusks</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges			X	
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 8-6,-9, 10-1,- 2	X			
Crabs	X			
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality				X
Noise				X
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

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**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

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67

### 3.5.5 Barren Island Restoration

**Box XX-22**  
**Screening of Barren Island Restoration**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.5a Location.**

**3.5.5b Type of Placement Option.**

**3.5.5c Potential Placement Capacity.**

**3.5.5d Bathymetry/Topography.**

**3.5.5e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

1893	
1894	<u>View Shed.</u>
1895	
1896	<b>3.5.5f Implementation Factors.</b>
1897	
1898	<u>Construction Considerations.</u>
1899	
1900	<u>Implementation Time Frame.</u>
1901	
1902	<b>3.5.5g Institutional Constraints.</b>
1903	
1904	<b>3.5.5h Estimated Costs.</b>
1905	
1906	<b>3.5.5i Other Factors.</b>
1907	
1908	<b>3.5.5j Option Summary.</b>
1909	
1910	<b>3.5.5k Option Data Sheet. [ADD DATA SHEET]</b>

1 **Barren Island**  
2

3 Barren Island is a satellite refuge of the Blackwater National Wildlife Refuge. It is an important nesting,  
4 nursery, or wintering area for colonial waterbirds, wading birds, Federally and state-listed endangered  
5 species, and waterfowl. Barren Island supports an active bald eagle nest, several rookeries, and provides  
6 erosion protection to large widgeongrass beds occurring in the lee of the island.  
7

8 The protected shallow waters to the south, east, and northeast of Barren Island exhibit a sand/silt/clay  
9 bottom type, which support expansive widgeon grass beds. The SAV beds and protected shallow waters  
10 are prime nursery habitat for blue crabs, and support a fishery for watermen from nearby Hoopers Island.  
11 Minor amounts of shell and oyster spat have also been found in near-shore waters.  
12

13 The middle portion of Barren Island is configured like an isthmus, comprised of salt marsh, which  
14 connects upland portions of the island to the north and south. This comparatively narrow wetland is  
15 typified by smooth cordgrass, saltmeadow hay, and marsh elder. A comparison of recent aerial  
16 photography shows the width of the wetland to be narrowing. If the wetland is bisected through erosion,  
17 SAV beds will be exposed to erosion wave climates.  
18

19 Since 1848, an estimated 78% of the historical Barren Island acreage has been lost to erosion. Unless  
20 protected, the remaining 175 acres will be lost at an estimated average rate of 16 feet per year along the  
21 western shoreline. The Corps of Engineers has performed some modest-scale marsh restorations at the  
22 site. The DNPOP included wetland and island restoration of Barren Island as a placement option. A  
23 preliminary estimate of potential dredged material capacity for wetland restoration at the Barren Island  
24 site is up to a maximum of 500,000 cubic yards with some containment supplied by geotextile tubes, as  
25 the Corps has done in the past. This option would provide for about 50 acres of wetlands restoration.  
26 Placement costs are expected to be about \$3.5 million, including transportation of the dredged material a  
27 distance of about 50 miles from the channels that are being dredged. Unit cost for this option is about  
28 \$7.00 per cubic yard, making it a suitable project to be used in combination with other small projects in  
29 addressing placement capacity shortfall. However, the Corps has experienced mixed success with the  
30 implementation of geotextile tube structures, and given the potential severe wave climate at Barren Island  
31 and the degree of silts that will be placed there, an armored solution is probably more appropriate.  
32 Replacing the geotextile containment with a low stone sill would likely raise the cost of the restoration an  
33 additional \$5 million, thereby increasing the unit cost to \$17 per cubic yard.  
34

35 The shallow waters proposed for the placement site exhibit a hard clay substrate that is devoid of  
36 submerged aquatic vegetation or commercially important shellfish. The substrate is comparable to the  
37 clays comprising the adjacent eroding bank (southern half of the island), and is probably island parent  
38 material. This proposal would involve a resource trade-off, primarily conversion of shallow water to  
39 estuarine emergent wetland. The great blue heron rookery located on the eastern side and lower portion  
40 of the Island is visually buffered and about ¼ mile away from the proposed placement site. Disturbance  
41 is not expected. Likewise, the bald eagle nest is about a ¼ mile away from the placement site, on the  
42 south facing shoreline and disturbance is not expected.  
43

44 An island restoration project for Barren Island would face similar challenges as the smaller wetland  
45 restoration project. Replicating the 1847 shoreline west of the Island (about 1300 acres), this project  
46 could be constructed in wetland and upland cells, as is Poplar Island to the north. Discounting the size of  
47 the existing islands, the resultant wetland and upland cells would be 550 acres each, just as with Poplar  
48 Island. The expected capacity for the project is about 40 mcy. Construction costs are expected to be  
49 similar to Poplar Island, but the additional 30 miles in transportation adds another \$120 million to the  
50 project cost, bringing its total to about \$578.4 million. The unit cost for this option would be about \$15  
51 per cubic yard.  
52

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1912

**3.5.6 Bodkin Island Restoration**

**Box XX-23**  
**Screening of Bodkin Island Restoration**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ ) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.6a Location.**

**3.5.6b Type of Placement Option.**

**3.5.6c Potential Placement Capacity.**

**3.5.6d Bathymetry/Topography.**

**3.5.6e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

1938	
1939	<u>View Shed.</u>
1940	
1941	<b>3.5.6f Implementation Factors.</b>
1942	
1943	<u>Construction Considerations.</u>
1944	
1945	<u>Implementation Time Frame.</u>
1946	
1947	<b>3.5.6g Institutional Constraints.</b>
1948	
1949	<b>3.5.6h Estimated Costs.</b>
1950	
1951	<b>3.5.6i Other Factors.</b>
1952	
1953	<b>3.5.6j Option Summary.</b>
1954	
1955	<b>3.5.6k Option Data Sheet. [ADD DATA SHEET]</b>

1 **Bodkin Island**

2  
3 Bodkin Island is a small island, just under one-acre in size, in Eastern Bay near the mouth of Crab Alley  
4 Bay. Wooden bulkheads and riprap revetments surround the island. Historically, it was the site of the  
5 highest black duck nesting density known in North America. Loss of quality brood rearing areas on and  
6 near the island as a result of erosion-related losses and increased development has adversely impacted  
7 populations on the island.

8  
9 Wind wave- and storm surge-induced erosion separated Bodkin Island from the mainland in the late 18<sup>th</sup>  
10 and early 19<sup>th</sup> centuries. Bodkin Island has declined in size from approximately 50 acres in 1847, to two  
11 islands totaling 4.5 acres in 1953, and finally, to a single island less than an acre in 1999. A wooden  
12 bulkhead was constructed in 1984 around the perimeter of the island to prevent further loss due to  
13 erosion. More recently, riprap has been placed adjacent to the failing bulkhead on one side of the island  
14 to provide additional protection. The decline in the size of Bodkin Island has resulted in a corresponding  
15 loss of prime black duck habitat.

16  
17 Between 1990 and 1994, the U.S. Army Corps of Engineers and the Maryland Department of Natural  
18 Resources, with assistance from the U.S. Fish and Wildlife Service, investigated the restoration of Bodkin  
19 Island as a beneficial use of sediment dredged from the Federal navigation project for the Chester River.  
20 The project would include a combination of upland nesting habitat, high marsh zones, low marsh zones,  
21 and tidal pools.

22  
23 The location of the restored island was selected to minimize impacts to local razor clam populations,  
24 natural oyster bars, and to take advantage of the shallowest depths in the area. The restored island would  
25 be shaped like a horseshoe, with the opening oriented north. The rounded shape that was proposed would  
26 eliminate sharp corners and minimizes the amount of stone that would be needed for protection. The  
27 northward orientation of the opening shelters the tidal area of the island from the most severe directions  
28 of wave attack. The island would have outer slopes of 1 vertical on 3 horizontal (1V: 3H) and 1V: 6H  
29 interior slopes from the upland crest to the tidal pools. The gentler interior slopes were designed to be  
30 suitable for hens and hatchlings to transverse to reach the water. The island would be planted in lieu of  
31 colonization to insure rapid vegetation cover, to lessen potential impacts to nesting areas, to hasten the  
32 development of brood habitat, to deter the growth of undesirable plant species, and to further stabilize the  
33 placed material. The original cost of the 6.3-acre restoration project was estimated at \$2.03 million, not  
34 including the cost of dredging and transporting the sediment. It was expected that the site would  
35 accommodate about 54,000 cubic yards of dredged material. The cost per cubic yard of dredged material  
36 is about \$39. This unit cost is comparatively high due to the high proportion of marsh and tidal pools to  
37 upland habitat. At its present capacity and unit cost, this option represents a very limited solution as a  
38 placement site for dredged material.

39  
40 It is conceptually possible to enlarge the footprint for the proposed restoration to that of the 1847 footprint  
41 (50 acres). This enlarged option would include 8 acres of upland habitat at +10 MLW, 9.8 acres of crest  
42 and upper slope, 2.8 acres of high marsh, 16 acres of low marsh and tidal pools, and 13.4 acres of inter-  
43 tidal waterways. It is likely that neighboring oyster beds and razor clam beds will be impacted by this  
44 alternative. Capacity for this option would be 568,900 cubic yards. Construction costs are expected to be  
45 about \$16.7 million, or \$39/cyd. Transportation costs to the project, based on \$0.10/cubic yard/mile,  
46 would be about \$1.5 million based on a 30-mile trip from the channels. While unit cost for this enlarged  
47 option is still comparatively high, the increased capacity may make it a suitable project to be used in  
48 combination with other small projects in addressing placement capacity shortfall.

**Title:**  
Bodkin Island

**Type:**  
Beneficial Use, Shoreline Stabilization

**Location:**

Located in Eastern Bay in Talbot County, below the southern approaches to the Kent Island Narrows.

**Size:** 6.3-50 acres, north of island

**Potential Capacity:** Approximately 54,000 to 568,900 cy, depending on concept.

**Availability:**  
Bodkin Island is owned by the State of Maryland.

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facility, containment needed for fine grained material and dewatering equipment.

**Institutional Issues:**

NEPA document from proposed Corps project will have to be updated for smaller project.

Larger projects will require:

- Permitting for construction in shallow water habitat.
- Permitting for critical area development
- Permitting for wetland disturbance.
- Avoidance of impacts to the natural resources in the area.

**Costs:** \$2.1 million (6.3-acre project) - \$16.7 million (50-acre project)

**Total Unit Costs Per Cubic Yard:** \$39 (Poplar Island's ratio of upland to wetland is 1:1. Bodkin Island's is 1:2).

**Development & Implementation Costs:** [not sure what goes here]

**COMMENTS:**

The majority of the island is grassy upland.

Wetlands present are classified as estuarine intertidal unconsolidated shore (cobble-gravel, sand, mud, or organic) wetlands that are irregularly flooded [E2USP].

Water adjacent to the island is mesohaline and ranges in depth from two to five feet.

The bottom is mainly firm laminar mud clay with some mixture of sand on three sides, and mostly sand to the northeast.

Oyster beds around the site. NOB 7-5 mapped on the southeast side of the island. NOB 7-7 (2846 acres) and NOB 7-6 (2006 acres) are within 500 yards. NOB 7-9 (67 acres) is also in the area.

An aquatic species currently found around the island is razor clams.

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Avian wildlife includes green herons, fish crows, ospreys, mallards, and black ducks and songbirds such as cardinals and mourning doves.

The original Corps plan for Bodkin Island was for a horse-shoe shaped island, 6.3 acres in size, which would be armored in stone to protect it from wave action. Subsequent plans called for a replacement of the stone with geotextile tubes to reduce the cost of the project. Due to the unreliability of the geotextile structures, the original plan with stone armor was reconsidered. The enlarged (50-acre) project is based on the historic shoreline in about 3 feet of water. The resulting project would consist of 8 acres of upland habitat, 9.8 acres of crest and upper slope, 2.8 acres of high marsh, 16 acres of low marsh and tidal pools, and 13.4 acres of intertidal waterways.

DRAFT

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TITLE: Bodkin Island

PROJECT TYPE: Beneficial-Use, shoreline stabilization

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients			X	
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE-osprey	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
Mollusks				
Soft shell clams	X			
Hard shell clams				X
Oyster bars NOB 7-5, -6, -7, -8	X			
Terrestrial Wildlife			X	
<b>Avian Wildlife</b>				
Waterfowl concentration area		X		
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 7-6, -7, -8	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries			X	
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas	X			
Forested Areas			X	
Cultural Resources			X	
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Title:**

Bodkin Island

**Type:**

Beneficial Use, Shoreline Stabilization

**Location:**

Located in Eastern Bay in Queen Annes County, to the southeast of Turkey Point. Immediately south of Crab Alley Bay.

**Size:** 0.94 acres

**Potential Capacity:**

Island to be restored to approximately 6 acres, could potentially create up to 10 acres  
Approximately 0.04 to 0.06 mcy

**Availability:** State Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facility, containment needed for fine grained material and de-watering equipment.

**Institutional Issues:**

Permitting required for construction in shallow water habitat.  
Permitting required for critical area development  
Permitting required for wetland disturbance.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

**Costs:**

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:**

**COMMENTS:**

Wetlands present are classified as estuarine intertidal unconsolidated shore (cobble-gravel, sand, mud, or organic) wetlands that are irregularly flooded [E2USP].  
Oyster bars in the area include NOB 7-5 (5269 acres), NOB 7-6 (2006 acres), NOB 7-7 (2846 acres), and NOB 7-9 (67 acres)  
Avian wildlife includes black duck and green-backed heron, songbirds such as cardinals and mourning doves, and osprey.  
An aquatic species currently found around the island is razor clams.

DRAFT  
 TITLE: Bodkin Island

DRAFT  
 PROJECT TYPE: Benny-Use, shoreline stabilization

DRAFT

DRAFT

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients			X	
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE-osprey	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
<b>Mollusks</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars NOB 7-5, -6, -7, -8	X			
Terrestrial Wildlife			X	
<b>Avian Wildlife</b>				
Waterfowl concentration area		X		
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 7-6, -7, -8	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries			X	
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas	X			
Forested Areas			X	
Cultural Resources			X	
Archaeological Resources			X	
Potential for Benefit	X			
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

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**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

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**USACE, Baltimore District. 1994. Chester River Bodkin Island, MD. Section 204 Detailed Project Report and Environmental Assessment. December 1994.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

1956  
57

### 3.5.7 Bodkin Point

#### Box XX-24 Screening of Bodkin Point

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.7a Location.**

**3.5.7b Type of Placement Option.**

**3.5.7c Potential Placement Capacity.**

**3.5.7d Bathymetry/Topography.**

**3.5.7e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

1983	
1984	<u>View Shed.</u>
1985	
1986	<b>3.5.7f Construction Factors.</b>
1987	
1988	<b>3.5.7g Institutional Constraints.</b>
1989	
1990	<b>3.5.7h Estimated Costs.</b>
1991	
1992	<b>3.5.7i Other Factors.</b>
1993	
1994	<b>3.5.7j Option Summary.</b>
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1996	<b>3.5.7k Option Data Sheet. [ADD DATA SHEET]</b>

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### 3.5.8 Eastern Neck Island National Wildlife Refuge

Use of Eastern Neck for beneficial use applications in lieu of the proposed open-water placement has been advocated by a various public officials and private citizens. The potential of Eastern Neck Island for additional beneficial use applications was screened to determine whether it could serve as an alternative to the proposed open-water placement or as a component of a multi-option alternative.

#### Box XX-25

#### Screening of Eastern Neck National Wildlife Refuge

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide between 50,000 and 200,000 cubic yards, depending upon configuration and type of project.
2. Availability: The USFWS would only consider placement of sandy sediments. This would preclude use of the site because the material that would be dredged consists mostly of fine-grained silts and clays and an best, a small sand fraction that could not be practically separated.
3. Environmental Suitability: The west side of Eastern Neck Island is potentially suitable location for a small-scale beneficial use project for shoreline stabilization purposes.
4. Infrastructure Readiness: Sites could be ready for use when needed.
5. Institutional Feasibility: See Screening Criteria #2 above.
6. Prospective Affordability: The estimated unit cost (\$20 to \$85), for practical purposes, exceeds the upper cost threshold. The small scale of a potential beneficial use project relative to construction requirements and a limited placement capacity result in a very high unit cost.
7. Potential for Environmental Improvements: Considerable potential to preserve existing wetland and upland habitat.

**Results of Screening:** Use of the shoreline and shallow water areas along the west side of Eastern Neck Island is not suitable for consideration as an alternative due to insufficient capacity. The site is not suitable as a component of a multi-option alternative because the USFWS is only willing to accept sandy material.

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#### 3.5.8a Location.

Eastern Neck Island National Wildlife Refuge is located on Maryland's Eastern Shore at the mouth of the Chester River. It encompasses all of Eastern Neck Island.

#### 3.5.8b Type of Placement Option.

The refuge is the responsibility of the U.S. Fish and Wildlife Service (USFWS). The refuge was previously the location of a beneficial use project. The possibility of undertaking further beneficial use options at the refuge are listed as an option in the MPA's DNPOP Program.

2016 The earlier beneficial use application was an outgrowth of shore erosion and control measures for  
2017 a portion of the island's western shoreline. The project was necessitated because the island was  
2018 experiencing a significant loss of acreage due to shore erosion. Five stone segmented  
2019 breakwaters were installed in 1992. The USFWS installed several sand-filled geotubes  
2020 immediately southeast of the stone breakwaters, configuring them to extend the segmented  
2021 breakwater system. After the geotubes were installed, CENAB deposited approximately 34,380  
2022 cubic yards of fine-grained sand between the tubes and the shoreline. About 77,000 wetlands  
2023 plants were planted along the shoreline. The habitat value of the shallow water area between the  
2024 breakwater system and the shoreline has subsequently improved significantly (Gill, et. al., 1995;  
2025 Hurt, 1995).

2026  
2027 The BEP II working group considered the potential of Eastern Neck Island in 1995. The working  
2028 group believed that although there was some potential for a small-scale beneficial use project at  
2029 the refuge, large-scale placement options were needed to meet near-term needs. Eastern Neck  
2030 Island was not considered a realistic option for meeting that need due to the limited potential for  
2031 placement capacity. However, supplemental information was subsequently assembled for use in  
2032 DNPOP planning and was available for this DEIS.

2033  
2034 The success of the breakwater system and fill with fine-grained sand suggests that a similar result  
2035 could be obtained from a similar project to the south. A segmented breakwater could be  
2036 designed and installed, subject to suitable foundation conditions. Such a project would preserve  
2037 the general character of the area.

### 2038 **3.5.8c Potential Placement Capacity.**

2039  
2040 An estimated 50,000 cy of dredged sediments could be potentially be placed. Greater placement  
2041 potential on the order of 100,000 to 200,000 cy would necessitate creating a closed dike system  
2042 and constructing marshes or upland, thereby substantially changing the character of the shoreline.  
2043  
2044

### 2045 **3.5.8d Bathymetry/Topography.**

### 2046 **3.5.8e Environmental Characteristics.**

#### 2047 Living Resources.

2048  
2049  
2050 The refuge provides habitat for nesting bald eagles, delmarva fox squirrels (endangered species),  
2051 and migratory birds. There are also tidal wetlands, high value upland forest areas, diverse forage  
2052 for fish, and agricultural fields. Cultural resources are believed to exist within the refuge  
2053 boundaries. The southern portion of the western shoreline of the island is relatively low and  
2054 dominated by fringe marsh. This portion of the shoreline is somewhat exposed, and minimal  
2055 submerged vegetation (SAV) has been reported. Bottom conditions along the southern portion  
2056 and immediately offshore of the western shoreline appear to be similar to conditions that exist in  
2057 the vicinity of the segmented breakwaters. The shallow water areas along the eastern side of the  
2058 island have historically supported the growth of considerable SAV and has considerable tidal  
2059 marshes (Orth, et. al., 1997; 1998).

#### 2060 Water Quality. [XXXX]

2061  
2062  
2063

2064 Hydrodynamics. [XXXX]

2065

2066 Rare, Threatened or Endangered (RTE) Species. [XXXX]

2067

2068 Fishing Activity. [XXXX]

2069

2070 Recreational Activity. [XXXX]

2071

2072 Historical/Archeological. [XXXX]

2073

2074 Groundwater. [XXXX]

2075

2076 View Shed. [XXXX]

2077

2078 **3.5.8f Implementation Factors.**

2079

2080 Site Availability. Informal coordination resulted in a finding that the USFWS is only willing to  
2081 accept material that is mostly sand for a beneficial use project that would maintain the character  
2082 of the area. Therefore, only the smaller-scale sand option would be considered by the agency.

2083

2084 Construction Considerations. [XXXX]

2085

2086 Implementation Time Frame. [XXXX]

2087

2088 **3.5.8g Institutional Constraints.**

2089

2090 **3.5.8h Estimated Costs.**

2091

2092 The southwestern shore of Eastern Neck Island is 11 miles northeast of Site 104 by water. It is  
2093 approximately 4 miles greater in distance from the CENAB channels that would be dredged than  
2094 is Site 104. The increased transportation cost which would be borne by the State would be  
2095 approximately \$0.40 per cubic yard. There would be additional costs for environmental  
2096 documentation, engineering design, site preparation/construction, mobilization and  
2097 demobilization of equipment to Eastern Neck Island, and vegetation following completion of  
2098 placement. The total cost of a beneficial use project to continue the extend the existing  
2099 beneficial use project is estimated between \$20 to \$85 per cubic yard depending upon design,  
2100 construction materials, foundation conditions, and other factors. Total costs could be on the  
2101 order to \$3 to \$10 million. These costs are within the funding limits of Section 204, although  
2102 funds from this source are competed for nationally.

2103

2104 **3.5.8i Other Factors.** [XXXX]

2105

2106 **3.5.8j Option Summary.**

2107

2108 Eastern Neck Island is not suitable as an alternative to open-water placement because the  
2109 USFWS will only accept sandy material, and the sediment from the channels to be dredged  
2110 consists primarily fine silts and clays. There is no practical way to separate out a minor amount  
2111 of sand that may be dredged. It is unlikely that the estimated 50,000 cubic yard capacity could

2112 be used effectively, although this capacity would likely be available within the planned  
2113 placement window.

2114

2115 **3.5.8k Option Data Sheet. [ADD DATA SHEET]**

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2117

**3.5.9 Davis Tract**

**Box XX-26  
Screening of the Davis Tract**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.9a Location.**

**3.5.9b Type of Placement Option.**

**3.5.9c Potential Placement Capacity.**

**3.5.9d Bathymetry/Topography.**

**3.5.9e Environmental Characteristics**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater.

2143	
2144	<u>View Shed.</u>
2145	
2146	<b>3.5.9f Implementation Factors.</b>
2147	
2148	<u>Construction Considerations.</u>
2149	
2150	<u>Implementation Time Frame.</u>
2151	
2152	<b>3.5.9g Institutional Constraints.</b>
2153	
2154	<b>3.5.9h Estimated Costs.</b>
2155	
2156	<b>3.5.9i Other Factors.</b>
2157	
2158	<b>3.5.9j Option Summary.</b>
2159	
2160	<b>3.5.9k Option Data Sheet. [ADD DATA SHEET]</b>

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### 3.5.10 Grove Neck

#### Box XX-27

#### Screening of Grove Neck Upland Containment Facility

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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3.5.10a Location.

3.5.10b Type of Placement Option.

3.5.10c Potential Placement Capacity.

3.5.10d Bathymetry/Topography.

3.5.10e Environmental Characteristics.

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater.

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2189	<u>View Shed.</u>
2190	
2191	<b>3.5.10f Implementation Factors.</b>
2192	
2193	<u>Construction Considerations.</u>
2194	
2195	<u>Implementation Time Frame.</u>
2196	
2197	<b>3.5.11g Institutional Constraints.</b>
2198	
2199	<b>3.5.11h Estimated Costs.</b>
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2201	<b>3.5.11 Other Factors.</b>
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2203	<b>3.5.11j Option Summary.</b>
2204	
2205	<b>3.5.11k Option Data Sheet. [ADD DATA SHEET]</b>

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### 3.5.12 Hawkins Point

#### Box XX-28 Screening of Hawkins Point

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide **XX** mcy, or over **XX** percent of the target placement need.
2. Availability: **XXXX**.
3. Environmental Suitability: **XXXX**
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: **XXXX**
6. Prospective Affordability: The estimated unit cost (\$  ) **XXXX**
7. Potential for Environmental Improvements: **XXXX**

**Results of Screening:** Use of the **XXXX** for **XXXXXX** placement is/isnot suitable for consideration as an alternative due to **XXXX**..

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**3.5.12a Location.**

**3.5.12b Type of Placement Option.**

**3.5.12c Potential Placement Capacity.**

**3.5.12d Bathymetry/Topography.**

**3.5.12e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

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2234	<u>View Shed.</u>
2235	
2236	<b>3.5.12f Implementation Factors.</b>
2237	
2238	<u>Construction Considerations.</u>
2239	
2240	<u>Implementation Time Frame.</u>
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2242	<b>3.5.12g Institutional Constraints.</b>
2243	
2244	<b>3.5.12h Estimated Costs.</b>
2245	
2246	<b>3.5.12i Other Factors.</b>
2247	
2248	<b>3.5.12j Option Summary.</b>
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2250	<b>3.5.12k Option Data Sheet. [ADD DATA SHEET]</b>

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2252

**3.5.13 Holland Island (small-scale)**

**Box XX-29**  
**Screening of Holland Island (small-scale)**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.13a Location.**

**3.5.13b Type of Placement Option.**

**3.5.13c Potential Placement Capacity.**

**3.5.13d Bathymetry/Topography.**

**3.5.13e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

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2279	<u>View Shed.</u>
2280	
2281	<b>3.5.13f Implementation Factors.</b>
2282	
2283	<u>Construction Considerations.</u>
2284	
2285	<u>Implementation Time Frame.</u>
2286	
2287	<b>3.5.13g Institutional Constraints.</b>
2288	
2289	<b>3.5.13h Estimated Costs.</b>
2290	
2291	<b>3.5.13i Other Factors.</b>
2292	
2293	<b>3.5.13j Option Summary.</b>
2294	
2295	<b>3.5.13k Option Data Sheet. [ADD DATA SHEET]</b>

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**3.5.14 Holland Island (large-scale)**

**Box XX-30**  
**Screening of Holland Island (Large Scale)**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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**3.5.14a Location.**

**3.5.14b Type of Placement Option.**

**3.5.14c Potential Placement Capacity.**

**3.5.14d Bathymetry/Topography.**

**3.5.14e Environmental Characteristics**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

2323  
2324 View Shed.  
2325  
2326 **3.5.14f Implementation Factors.**  
2327  
2328 Construction Considerations.  
2329  
2330 Implementation Time Frame.  
2331  
2332 **3.5.14g Institutional Constraints.**  
2333  
2334 **3.5.14h Estimated Costs.**  
2335  
2336 **3.5.14i Other Factors.**  
2337  
2338 **3.5.14j Option Summary.**  
2339  
2340 **3.5.14k Option Data Sheet. [ADD DATA SHEET]**

**Title:**  
Holland Island

**Type:**  
Beneficial Use, Shoreline Stabilization.

**Location:**  
Mid-Bay in Southern Dorchester County on the eastern shore of the Bay, approximately 55 miles south of the Bay Bridge.  
The island is approximately 16 miles northeast of the mouth of the Potomac River.

**Size:**  
Less than 80 acres.

**Potential Capacity:**  
Approximately 0.5 to 2 mcy., depending on elevation of concept.

**Availability:**  
The majority of the island is privately owned. Real estate transactions would have to occur to enable State and Federal involvement.  
Small portion owned by DNR.

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**  
Access channel, unloading facility and de-watering equipment, design of containment for fine-grained material.

**Institutional Issues:**  
Permitting required for construction in shallow water habitat.  
Permitting required for critical area development  
Permitting required for wetland disturbance.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

**Costs:**

**Total Unit Costs Per Cubic Yard:** [Transportation costs estimated at \$5.60/cy.]

**Development & Implementation Costs:**

**COMMENTS:**  
Oyster bars in area (NOB 32-2, 3115 acres)  
High density area for soft shell clam  
High density blue crab  
Avian wildlife includes blue heron, bald eagle, egrets, ducks, geese, swan, gulls, and terns,  
Terrestrial wildlife includes fox, white-tail deer, and terrapins.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE-Bald Eagle, Osprey, Terrapin	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
Mollusks				
Soft shell clams-High Density	X			
Hard shell clams		X		
Oyster bars	X			
Terrestrial Wildlife	X			
Avian Wildlife				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams		X		
Oyster bars-NOB 32-2	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas	X			
Cultural Resources	X			
Archaeological Resources	X			
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

2341 3.5.15 Holly Neck Farm  
2342

**Box XX-31**  
**Screening of Holly Neck Farm**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcg, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

- 2343 3.5.15a Location.  
2344  
2345 3.5.15b Type of Placement Option.  
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2347 3.5.15c Potential Placement Capacity.  
2348  
2349 3.5.15d Bathymetry/Topography.  
2350  
2351 3.5.15e Environmental Characteristics  
2352  
2353 Living Resources.  
2354  
2355 Water Quality.  
2356  
2357 Hydrodynamics.  
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2359 Rare, Threatened or Endangered (RTE) Species.  
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2361 Fishing Activity.  
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2363 Recreational Activity.  
2364  
2365 Historical/Archeological.  
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2367 Groundwater:

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2369	<u>View Shed.</u>
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2371	<b>3.5.15f Construction Factors.</b>
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2373	<b>3.5.15g Institutional Constraints.</b>
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2375	<b>3.5.15h Estimated Costs.</b>
2376	
2377	<b>3.5.15i Other Factors.</b>
2378	
2379	<b>3.5.15j Option Summary.</b>
2380	
2381	<b>3.5.15k Option Data Sheet. [ADD DATA SHEET]</b>

Title

Holly Neck Farm

Type:

Beneficial Use, Shoreline Stabilization

Location:

Located in Anne Arundle County, south of the Chesapeake Bay Bridge. Worton Point

Size: [Need to quantify]

Potential Capacity: Approximately 0.25 mcy

Availability:

Privately owned farm, owner expressed interest in making shoreline available to the State of Maryland for beneficial use project.

Nutrients: [Need info]

Infrastructure Required to Implement:

Access channels, unloading facilities, substrate suitability for stabilization

Institutional Issues:

Permitting required for construction in shallow water habitat.  
Permitting required for critical area development  
Permitting required for wetland disturbance.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

Costs:

Total Unit Costs Per Cubic Yard: [NEED!]

Development & Implementation Costs: [NEED!]

COMMENTS:

Negative impacts to wetlands, shallow-water habitats, SAV, and cultural resources (historic house).  
Large natural oyster bar immediately adjacent to site.  
Site extensively used by waterfowl, Some active Bald Eagle nest and herons exist on site.  
High density area for soft shell clam.  
Adjacent to high density summer habitat for male blue crab.  
Adjacent to low density summer habitat for female blue crab.  
One or more probable wood duck nest in 1982-1989.  
One or more probable American Black Duck nest in 1982-1989.  
Area of Great Blue Heron colony of 16-70 in 1988.  
One or more confirmed Green-Backed Heron nests in 1982-1989.  
Oyster bars= NOB-4-7 (144 acres), NOB 6-4 (1900 acres).

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate		X		
High Relief Area				X
Suspended Particulates, Turbidity		X		
Water Quality		X		
Hydrodynamics		X		
Tidal Fluctuations				X
Salinity Gradients	X			
Sediment Quality		X		
HTRS		X		
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries		X		
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
<b>Mollusks</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges			X	
SAV		X		
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NAB1-1	X			
Crabs		X		
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas	X			
Forested Areas	X			
Cultural Resources	X			
Archaeological Resources		X		
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

DRAFT

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**Resources Used**

**Living Resources Maps**  
**MDNR Historic Oyster Bar Maps**  
**MGS Tidal Wetland Maps**  
**MGS Non-Tidal Wetland Maps**  
**Lee Crockett Living Resource Map of the Upper Bay**

2382 **3.5.16 James Island**

2383  
2384 Although the Poplar Island restoration project is not yet constructed nor filled and vegetated, the  
2385 prospect that the project will ultimately be successful has stimulated interest in the possibility of  
2386 other large-scale island restoration projects. The potential for an island restoration project at  
2387 James Island at the mouth of the Little Choctank River has been informally suggested to the  
2388 MPA for possible inclusion as an option in the DNPOP program, and information is being  
2389 assembled to provide a resource for consideration of the island's restoration potential and  
2390 restoration options by the BEP II Working Group. During the course of the NEPA process for the  
2391 proposed open-water placement action, the possibility of restoring James Island was suggested as  
2392 a possible alternative. The preliminary DNPOP information was made available to CENAB.  
2393 Additional information was developed by CENAB to aid in determining whether or not  
2394 restoration of James Island might effectively serve as an alternate.  
2395

**Box XX-32**  
**Screening of James Island**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide 35 to 50 mcy, depending upon site configuration.
2. Availability: The bottom is owned by the State and is considered to be available. The islands are privately held. Inasmuch as the islands have experienced considerable erosion, it is assumed that the owner's would be interested in a restoration project. For initial planning purposes, it is assumed that suitable real estate arrangements could be made.
3. Environmental Suitability: The area is used for fishing activity. There would be a permanent conversion of bottom habitat. The environmental tradeoffs are estimated to be similar to those at Poplar Island. For planning purposes, the site is considered potentially environmentally acceptable.
4. Infrastructure Readiness: It would take on the order of 10 to 14 years to implement the restoration project. Therefore, placement capacity at James Island could not be ready for use when needed.
5. Institutional Feasibility: No institutional constraints specific to James Island were identified.
6. Prospective Affordability: The estimated unit cost (\$20) approaches the upper screening threshold for cost. This estimate includes contingencies for unforeseen conditions.
7. Potential for Environmental Improvements: Substantial potential for environmental improvements through restoration of habitat that is decreasing in the Bay area and through physical protection for shorelands to the east and southeast.

**Results of Screening:** Use of James Island for placement is not suitable for consideration as an alternative because the site cannot be implemented when needed. However, the option has considerable future potential for consideration on its own merits.

2396 **3.5.16a Location.**

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The existing James Island Archipelago was formed as a result of natural processes of shoreline change that affect the Chesapeake Bay region. James Island is portrayed on 18<sup>th</sup> century maps as being connected to the mainland of Taylors Island by a marsh. By 1847, survey data indicated that connection was nearly breached. At that time, James Island consisted of about 1253 acres of upland and fringe marshes. By 1942, the two remnant island were still connected but the connection to Taylors Island had been breached and consisted of open-water. By 1994, the remaining island was breached into two principal remnants consisting of a total of 106 acres. The islands today are estimate to be less than 100 acres. The southernmost island is separated from Taylors Island by about a mile of shallow open-water (Stevenson and Kearney, 1996). The remaining remnants are privately held by different parties.

**3.5.16b Type of Placement Option.**

Conceptually, James Island could potentially be restored either as an island or as a peninsula reconnected to Taylors Island. In order to be consistent with the historic footprint, the restoration would need to be on the west side of the Archipelago. Inasmuch as an upland island existed at this location, it is assumed that an upland island could be constructed to similar elevations planned for Poplar Island.

**3.5.16c Potential Placement Capacity.**

Potentially, the area could be restored in similar manner to Poplar Island with overall size of perhaps 1,000 to 1,200 acres and capacity also similar to that of the full Poplar Island restoration project (say, 35 to 50 mcy), depending upon the project configuration.

**3.5.16d Bathymetry/Topography.**

[XXXX]

**3.5.16e Environmental Characteristics**

Living Resources.

The shallow waters west and north of the existing remnants provide shallow water habitat for foraging. The area is exposed and does not currently support the growth of SAV (Orth et. al, 1997, 1998). The bathymetric break between the more shallow waters and the deeper waters that form the ancient bed of the Susquehanna River provide an edge that is exploited to some extent by sportsfishermen. There is a designated small natural oyster bar (14-6) of 16 acres size immediately southeast of the southernmost island remnant.

Water Quality. [XXXX]

Restoring the island with a reconnection to Taylors Island could potentially reduce physical energy affecting the east side of the James Island Archipelago and Oyster Cove, thereby improving conditions potentially favorable to colonization and growth of SAV.

Hydrodynamics. [XXXX]

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The progressive erosion of James Island is believed to have contributed to increased erosion of Dorchester County shorelines that were once in the shadow of the island complex. Oyster Cove, located at the northwest tip of Taylors Island, was once enclosed on the west by the peninsula that preceded the current James Island Archipelago. This area is one of the Dorchester County shorelines that has experienced increased erosion that appears to be associated with the progressive loss of the protection that had been provided by James Island.

Rare, Threatened or Endangered (RTE) Species. [XXXX]

Fishing Activity. [XXXX]

Recreational Activity. [XXXX]

Historical/Archeological. [XXXX]

Groundwater. [XXXX]

View Shed. [XXXX]

**3.5.16f Implementation Factors.**

Construction Considerations.

A small-scale restoration would be problematic on the west side of the Archipelago because the location is very exposed. A substantial armored dike system similar to the western dike of the Poplar Island project would be needed for either a large-scale or small-scale restoration.

Implementation Time Frame.

The full developmental time frame for such a project would be at least as long as the Poplar Island restoration project which was fast-tracked, on the order of 10 to 14 years (the actual time frame will vary according to various factors including legislative schedules for consideration of funding authorizations). Based on the experience in building a consensus regarding the appropriateness of a large scale restoration project for Poplar Island, especially the environmental tradeoffs that were involved, it would take approximately 2 to 3 years to establish whether or to what extent a large-scale beneficial use project would be practicable at James Island. Although restoration of James Island is already under consideration as part of long term dredged material management planning, the ability to implement a project at this location is far from certain and would need to be developed on its own merits. The time frame for such development extends beyond the placement need addressed in this annex.

**3.5.16g Institutional Constraints.**

No institutional constraints specific to the restoration of James Island were identified.

**3.5.16h Estimated Costs.**

2492  
2493 Assuming that sufficient sand is available in deposits on site for dike construction, and that there  
2494 would be no mitigation requirements, a planning estimate of the cost (with a standard  
2495 contingency for unanticipated conditions) for a large-scale restoration is \$20 per cubic yard. This  
2496 planning estimate would increase if there were a need to import dike construction materials and  
2497 if mitigation were required for the conversion of shallow water habitat (mitigation was not  
2498 required for Poplar Island because the environmental benefits were assessed as greater than the  
2499 environmental impacts resulting from construction)

2500  
2501 Whether or not a large-scale project can achieve the broad-based support necessary for  
2502 implementation including special funding by the U.S. Congress and funding by the Maryland  
2503 General Assembly of the local sponsor cost share is speculative in view of the legislative history  
2504 of the Poplar Island restoration project. A small-scale restoration project on the order of 0.5 to  
2505 2.0 mcy within the Section 204 discretionary authority could cost on the order of \$50 to \$100 per  
2506 cubic yard, depending upon site configuration, habitat types, and construction requirements.

2507  
2508 **3.5.16i Other Factors.**

2509  
2510 **3.5.16j Option Summary.**

2511  
2512 Restoration of James Island to accommodate the placement deficit used for screening is not  
2513 practical as an alternative to the proposed action because the time frame for implementation and  
2514 first availability extends beyond the placement need period for the deficit. Obtaining funding for  
2515 another large scale restoration project is assessed as problematic, particularly since the  
2516 restoration of Poplar Island is many years from completion. Restoration of James Island may  
2517 prove to be suitable and acceptable as a beneficial use project at a future date.

2518  
2519 **3.5.16k Option Data Sheet. [ADD DATA SHEET]**

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### 3.5.17 Parsons Island

#### Box XX-33 Screening of Parsons Island

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX.

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**3.5.17a Location.**

**3.5.17b Type of Placement Option.**

**3.5.17c Potential Placement Capacity.**

**3.5.17d Bathymetry/Topography.**

**3.5.17e Environmental Characteristics**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

2549	
2550	<u>View Shed.</u>
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2552	<b>3.5.17f Implementation Factors.</b>
2553	
2554	<u>Construction Considerations.</u>
2555	
2556	<u>Implementation Time Frame.</u>
2557	
2558	<b>3.5.17g Institutional Constraints.</b>
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2560	<b>3.5.17h Estimated Costs.</b>
2561	
2562	<b>3.5.17i Other Factors.</b>
2563	
2564	<b>3.5.17j Option Summary.</b>
2565	
2566	<b>3.5.17k Option Data Sheet. [ADD DATA SHEET]</b>

**Title:**  
Parsons Island

**Type:**  
Beneficial Use, Shoreline Stabilization

**Location:**

Located in Eastern Bay in Talbot County, below the southern approaches to the Kent Island Narrows.

**Size:** 85-300 acres, around southern two-thirds of Island

**Potential Capacity:** Approximately 1 –3.5 mcy, depending on concept.

**Availability:**

Privately owned land, owner expressed interest in making shoreline available to the State of Maryland in 1995 for island restoration project. Owners are not interested in selling property.

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facility, containment needed for fine grained material and dewatering equipment.

**Institutional Issues:**

Permitting required for construction in shallow water habitat.  
Permitting required for critical area development  
Permitting required for wetland disturbance.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

**Costs:** [Total cost estimated to exceed \$1 million dollars]

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [Increase transportation costs by \$2.00/cy.]

**COMMENTS:**

Large SAV beds in and around island in footprint of proposed construction.  
Oyster beds around the site (NOB7-7, 2846 acres, NOB 7-6, 2006 acres, NOB 7-8, 1926 acres).  
Estuarine and Palustrine wetlands (approximately 30 and 25 acres respectively).  
Forested acreage includes 30 acres.  
Terrestrial wildlife includes raccoon, possum, bird, deer, black ducks (waterfowl).  
High density soft shell clam area.  
Blue Crab habitat  
Avian wildlife include Geese, American Black Duck, Green-Backed Heron, Bald Eagle.  
The owners manage the property and farming operation so as to enhance the sites habitat value for migratory waterfowl.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients			X	
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
<b>Mollusks</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV	X			
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 7-6, -7, -8	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas	X			
Forested Areas	X			
Cultural Resources	X			
Archaeological Resources				X
Potential for Benefit	X			
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

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### 3.5.18 Poplar Island Restoration Project

Island restoration sites using dredged material are placement areas created by constructing a physical structure to enclose an estuarine or marine area on the site of existing or previously existing islands. Poplar Island, like many islands in the Chesapeake Bay, has been severely eroded. It was determined that island restoration/creation could be an ideal solution to the dredged material management problem facing the Port of Baltimore. The group of islets known as Poplar Island are located in the upper middle Chesapeake Bay, approximately 34 nautical miles southeast of the Port of Baltimore and 2 miles northwest of Tilghman Island, Talbot County, Maryland (Figure 2-7).

Through the cooperative efforts of many state and Federal agencies, as well as private organizations, a project has been developed to reconstruct Poplar Island to its approximate size in 1847. This will be accomplished using suitable dredged material from the approach channels that are part of the Baltimore Harbor and Channels Federal navigation project. Although Poplar Island is farther from some of the areas needing maintenance, the additional costs were offset by the significant beneficial use outputs of the project. The accepted restoration plan, when fully implemented, would create a 1,100-acre dredged material placement area within a 35,000-foot perimeter dike. The area would then be filled with suitable dredged material obtained from periodic maintenance dredging of Federal navigation approach channels that serve the Port of Baltimore. The site can then be developed into low and high marsh wetlands and uplands. The planned placement capacity of this island restoration is 38 mcy.

During the public comment period on the first DEIS for the proposed open-water placement, considerable attention was given in the comments to using the planned capacity of Poplar Island in lieu of the proposed action. In response to these comments, using the planned capacity of Phases I and II are screened as options as are expanding the acreage of the planned restoration, increasing the dike height to increase capacity, and converting one or more wetland cells to upland.

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### 3.5.19 Poplar Island - Phase I

**Box XX-34**  
**Screening of Poplar Island Phase I**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

2599

2600 **3.5.19a Location.**

2601

2602 **3.5.19b Type of Placement Option.**

2603

2604 **3.5.19c Potential Placement Capacity.**

2605

2606 Construction of the Phase I Poplar Island project (670 acres, 19 mcy) began in mid-1998 and the  
2607 dike system will be ready for inflow operations in 2000. The current placement capacity for the  
2608 site has already been designated for uses other than those proposed for Site 104. Annual capacity  
2609 at Poplar Island is limited because of it's environmental restoration, construction, and operation  
2610 schedule. It is currently planned to accept 3 million cubic yards in the Year 2000 and 2 million  
2611 cubic yards in Years 2001 and 2002. After that, it will be limited to 1.5 mcy annually. Because  
2612 Poplar Island has an annual maximum designed placement capacity limit of 2 mcy (beyond  
2613 which the site may not meet its environmental restoration specifications), additional materials  
2614 cannot be placed in this site without adversely affect restoration objectives or reducing the  
2615 potential capacity of the upland component of the project due to trapping of water in successive  
2616 sediment layers. Consequently, Poplar Island can not provide the capacity for the near-term  
2617 shortfall that necessitates considering the Proposed Action.

2618

2619 **3.5.19d Bathymetry/Topography.**

2620

2621 **3.5.19e Environmental Characteristics**

2622

2623 Living Resources.

2624

2625 Water Quality.

2626

2627 Hydrodynamics.

2628

2629 Rare, Threatened or Endangered (RTE) Species.

2630

2631 Fishing Activity.

2632

2633 Recreational Activity.

2634

2635 Historical/Archeological.

2636

2637 Groundwater:

2638

2639 View Shed.

2640

2641 **3.5.19f Construction Factors.**

2642

2643 **3.5.19g Institutional Constraints.**

2644

2645 **3.5.19h Estimated Costs.**

2646

2647 **3.5.19i Other Factors.**

2648

2649 CENAB is considering the application of an innovative technique to prepare the restoration  
2650 project to receive dredged material. The concept being considered is enhanced dewatering of the  
2651 placement cells and drying and consolidation from the existing mud line up. This will involve  
2652 continual pumping of the cell to keep it dry once initially dewatered. In theory, this approach  
2653 could result in a reduction of pore water in the bottom sediments. The associated consolidation  
2654 might nominally lower the bottom elevation, thereby increasing cell volume to a limited extent.  
2655 Any increase in foundation strength that might result could potentially allow an increase in dike  
2656 height. The principal reason for advance dewatering is to allow installation of underdrains in the  
2657 cells to aid in the dewatering of the first several placements of dredged material. The underdrain  
2658 system is anticipated to decrease markedly in capability following the first two placement cycles  
2659 as the fine grained material clogs, and in effect, seals the underdrains. The additional capacity  
2660 that might be gained cannot be effectively predicted. As the cell elevation is below the  
2661 surrounding water level, the ability to keep it dewatered will depend upon environmental  
2662 conditions encountered. Extremely wet conditions would reduce the potential effectiveness of  
2663 this approach. Additionally, there have been additional requests for use of Poplar Island for the  
2664 placement of suitable dredged material, including material from the proposed Wilson Bridge  
2665 reconstruction project. Decisions on these requests are pending. Therefore, it is not clear  
2666 whether any of the additional capacity that might be gained from the innovative approach  
2667 discussed above would actually be available for sediments from the approach channels to the  
2668 Port of Baltimore. For these reasons, the potential for increased capacity through enhanced  
2669 dewatering techniques is not included in capacity estimates for either of Poplar Island Phases I  
2670 and II.

2671

2672

**3.5.19j Option Summary.**

2673

2674

**3.5.19k Option Data Sheet. [ADD DATA SHEET]**

**Box XX-35**  
**Screening of Poplar Island Phase II**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

2677  
2678 3.5.20a Location.

2679  
2680 3.5.20b Type of Placement Option.

2681  
2682 3.5.20c Potential Placement Capacity.

2683  
2684 Construction of Phase II of the Poplar Island restoration project (450 acres, 19 mcy) is projected  
2685 to begin in 19XX. Two additional wetland cells are projected to be ready for inflow operations  
2686 in 19XX. It is anticipated that the Phase II wetland cells would be filled within three year of  
2687 initial availability. The exterior dike for this cell is planned to remain open to the Bay for  
2688 approximately XX years so as to serve as a sheltered harbor and staging area for filling of the  
2689 Phase I and II wetland cells and the Phase I upland cell. The Phase II upland cell would not be  
2690 available for use until the exterior dike is close<sup>d</sup> in approximately 19XX.

2691  
2692 The Phase II upland cell capacity is estimated to be XX mcy. The actual capacity may vary from  
2693 this estimate depending upon how much sand is excavated for dike construction. It is anticipated  
2694 that there would be a more limited opportunity to increase capacity of the Phase II upland cell  
2695 through enhanced dewatering because the depth and configuration of the excavated borrow area  
2696 will likely inhibit the installation of an underdrain system throughout the cell. Once the upland  
2697 cell is available, it would be capable or receiving an average annual inflow into it will be  
2698 approximately X.X mcy. Higher inflow rates are anticipated during the first X to Y years of cell  
2699 filling may be possible because the available volume of the borrow area provides substantially  
2700 more capacity than had the cell not served as a borrow area. Once the sediment placed into the

2701 upland cell rises above the ambient Bay water level, the annual optimum placement potential will  
2702 be reduced to a maximum of X.X mcy.

2703

2704 **3.5.20d Bathymetry/Topography.**

2705

2706 **3.5.20e Environmental Characteristics**

2707

2708 Living Resources.

2709

2710 Water Quality.

2711

2712 Hydrodynamics.

2713

2714 Rare, Threatened or Endangered (RTE) Species.

2715

2716 Fishing Activity.

2717

2718 Recreational Activity.

2719

2720 Historical/Archeological.

2721

2722 Groundwater:

2723

2724 View Shed.

2725

2726 **3.5.20f Implementation Factors.**

2727

2728 Construction Considerations.

2729

2730 Implementation Time Frame.

2731

2732 **3.5.20g Institutional Constraints.**

2733

2734 **3.5.20h Estimated Costs.**

2735

2736 **3.5.20i Other Factors.**

2737

2738 **3.5.20j Option Summary.**

2739

2740 **3.5.20k Option Data Sheet. [ADD DATA SHEET]**

2741	<b>3.5.21</b>	<b>Poplar Island Expanded Footprint</b>
2742		
2743	<b>3.5.21a</b>	<b>Location.</b>
2744		
2745	<b>3.5.21b</b>	<b>Type of Placement Option.</b>
2746		
2747	<b>3.5.21c</b>	<b>Potential Placement Capacity.</b>
2748		
2749	<b>3.5.21d</b>	<b>Bathymetry/Topography.</b>
2750		
2751	<b>3.5.21e</b>	<b>Environmental Characteristics</b>
2752		
2753		<u>Living Resources.</u>
2754		
2755		<u>Water Quality.</u>
2756		
2757		<u>Hydrodynamics.</u>
2758		
2759		<u>Rare, Threatened or Endangered (RTE) Species.</u>
2760		
2761		<u>Fishing Activity.</u>
2762		
2763		<u>Recreational Activity.</u>
2764		
2765		<u>Historical/Archeological.</u>
2766		
2767		<u>Groundwater:</u>
2768		
2769		<u>View Shed.</u>
2770		
2771	<b>3.5.21f</b>	<b>Implementation Factors.</b>
2772		
2773		<u>Construction Considerations.</u>
2774		
2775		<u>Implementation Time Frame.</u>
2776		
2777	<b>3.5.21g</b>	<b>Institutional Constraints.</b>
2778		
2779	<b>3.5.21h</b>	<b>Estimated Costs.</b>
2780		
2781	<b>3.5.21i</b>	<b>Other Factors.</b>
2782		
2783	<b>3.5.21j</b>	<b>Option Summary.</b>
2784		
2785	<b>3.5.21k</b>	<b>Option Data Sheet. [ADD DATA SHEET]</b>

2786  
2787

### 3.5.22 Poplar Island Increase in Elevation

#### Box XX-36

#### Screening of Poplar Island Increase in Elevation

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

2788

3.5.22a Location.

2789

3.5.22b Type of Placement Option.

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2791

3.5.22c Potential Placement Capacity.

2792

2793

2794

3.5.22d Bathymetry/Topography.

2795

2796

3.5.22e Environmental Characteristics

2797

2798

Living Resources.

2799

2800

Water Quality.

2801

2802

Hydrodynamics.

2803

2804

Rare, Threatened or Endangered (RTE) Species.

2805

2806

Fishing Activity.

2807

2808

Recreational Activity.

2809

2810

Historical/Archeological.

2811

2812

Groundwater:

2813  
2814 View Shed.  
2815  
2816 **3.5.22f Implementation Factors.**  
2817  
2818 Construction Considerations.  
2819  
2820 Implementation Time Frame.  
2821  
2822 **3.5.22g Institutional Constraints.**  
2823  
2824 **3.5.22h Estimated Costs.**  
2825  
2826 **3.5.22i Other Factors.**  
2827  
2828 **3.5.22j Option Summary.**  
2829  
2830 **3.5.22k Option Data Sheet. [ADD DATA SHEET]**

2831  
2832

**3.5.23 Poplar Island Wetland Cell Conversion to Upland**

**Box XX-37**  
**Screening of Poplar Island Wetland Cell Conversion to Upland**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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2855  
2856  
2857

**3.5.23a Location.**

**3.5.23b Type of Placement Option.**

**3.5.23c Potential Placement Capacity.**

**3.5.23d Bathymetry/Topography.**

**3.5.23e Environmental Characteristics.**

Living Resources.

Water Quality.

Construction Considerations.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

2858  
2859 View Shed.  
2860  
2861 **3.5.23f Implementation Factors.**  
2862  
2863 Construction Considerations.  
2864  
2865 Implementation Time Frame.  
2866  
2867 **3.5.23g Institutional Constraints.**  
2868  
2869 **3.5.23h Estimated Costs.**  
2870  
2871 **3.5.23i Other Factors.**  
2872  
2873 **3.5.23j Option Summary.**  
2874  
2875 **3.5.23k Option Data Sheet. [ADD DATA SHEET]**

**Title:**

Poplar Island – Lateral Expansion

**Type:**

Beneficial Use, Shoreline Stabilization

**Location:**

Chesapeake Bay in Talbot County, west of Tilghman Island.

**Size:**

Current restoration project is 1100 acres. Proposed modification would laterally expand the project by 230 acres.

**Potential Capacity:**

Approximately 12.7 mcy.

**Availability:**

Currently owned by the State of Maryland.

**Nutrients:**

[Need info]

**Infrastructure Required to Implement:**

Infrastructure will be on site for the existing project.

**Institutional Issues:**

None.

**Costs:** [still working on this]

**Total Unit Costs Per Cubic Yard:** [Need]

**Development & Implementation Costs:**

**COMMENTS:**

Due to the poor foundation condition to the north, a lateral expansion to the south is necessary. This proposal modifies the current plan for Poplar Island, to footprint previously investigated as part of the feasibility study (alternative 2). However, unlike Alternative 2 from the feasibility study, it is assumed that the additional 230 acres will be entirely upland habitat. This alternative basically follows the 8-foot contour to the south of the project.

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TITLE: Poplar Island – Lateral Expansion

PROJECT TYPE: Beneficial-Use, shoreline stabilization

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality	X			
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries				
Designated Spawning Area				X
Larval Habitat Area				X
Crabs		X		
Mollusks				
Soft shell clams	X			
Hard shell clams	X			
Oyster bars	X			
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams	X			
Oyster bars	X			
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas			X	
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for

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impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Title:**

Poplar Island – Upland Expansion

**Type:**

Beneficial Use, Shoreline Stabilization

**Location:**

Chesapeake Bay in Talbot County, west of Tilghman Island.

**Size:**

Current restoration project is 1100 acres, 550 acres of which are upland. Each foot of increase in the elevation of the upland cells adds about 1.2 mcy of additional capacity. As an alternative to Site 104 (18 mcy), raising the dikes on the upland cells from +20 MLLW to +35 MLLW would be necessary.

**Potential Capacity:**

Up to 18 mcy.

**Availability:**

Currently owned by the State of Maryland.

**Nutrients:**

[Need info]

**Infrastructure Required to Implement:**

Infrastructure will be on site for the existing project.

**Institutional Issues:**

None.

**Costs:** [still working on this]

**Total Unit Costs Per Cubic Yard:** [Need]

**Development & Implementation Costs:**

**COMMENTS:**

Adding additional capacity by raising the dikes will extend the life of the project. However, since the surface area of the placement site is not increased for that time period, the annual placement would still need to be equal to or less than \_\_ mcy.

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TITLE: Poplar Island – Upland Expansion

PROJECT TYPE: Beneficial-Use, shoreline stabilization

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality	X			
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area				X
Larval Habitat Area				X
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas			X	
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for

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impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Title:**

Poplar Island – Wetland Modification

**Type:**

Beneficial Use, Shoreline Stabilization

**Location:**

Chesapeake Bay in Talbot County, west of Tiilghman Island.

**Size:**

Current restoration project is 1100 acres. Proposed modification would convert one or more of the current wetland cells (550 acres total) to upland cells.

**Potential Capacity:**

Approximately 3.4 – 21.4 mcy, depending on concept.

**Availability:**

Currently owned by the State of Maryland.

**Nutrients:**

[Need info]

**Infrastructure Required to Implement:**

None.

**Institutional Issues:**

None.

**Costs:** [still working on this]

**Total Unit Costs Per Cubic Yard:** [Need]

**Development & Implementation Costs:**

**COMMENTS:**

Raising the dikes along the wetlands cells will allow an increase in both the annual and total capacity because the surface area of the placement site in the out years increases.

To be a stand alone alternative for the placement of 18 mcy, at least three of the four wetland cells would have to be converted to upland cells. Because such a move would affect the project's environmental restoration value, such a drastic plan is unlikely. However, converting one or two of the wetlands cells may be a viable alternative when combined with other placement sites.

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TITLE: Poplar Island – Wetlands Modification

PROJECT TYPE: Beneficial-Use, shoreline stabilization

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality	X			
HTRS				X
<b>Biological Characteristics</b>				
RTE-Bald Eagle	X			
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area				X
Larval Habitat Area				X
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise		X		
Critical Areas			X	
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for

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impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Box XX-38**  
**Screening of Queenstown**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX.
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

- 2878 3.5.24a Location.
- 2879
- 2880 3.5.24b Type of Placement Option.
- 2881
- 2882 3.5.24c Potential Placement Capacity.
- 2883
- 2884 3.5.24d Bathymetry/Topography.
- 2885
- 2886 3.5.24e Environmental Characteristics
- 2887
- 2888 Living Resources.
- 2889
- 2890 Water Quality.
- 2891
- 2892 Hydrodynamics.
- 2893
- 2894 Rare, Threatened or Endangered (RTE) Species.
- 2895
- 2896 Fishing Activity.
- 2897
- 2898 Recreational Activity.
- 2899
- 2900 Historical/Archeological.
- 2901
- 2902 Groundwater:

2903	
2904	<u>View Shed.</u>
2905	
2906	<b>3.5.24f Implementation Factors.</b>
2907	
2908	<u>Construction Considerations.</u>
2909	
2910	<u>Implementation Time Frame.</u>
2911	
2912	<b>3.5.24g Institutional Constraints.</b>
2913	
2914	<b>3.5.24h Estimated Costs.</b>
2915	
2916	<b>3.5.24i Other Factors.</b>
2917	
2918	<b>3.5.24j Option Summary.</b>
2919	
2920	<b>3.5.24k Option Data Sheet. [ADD DATA SHEET]</b>

1 **Queenstown (Upland Placement, Fastland Creation)**

2  
3 This site was proposed during the MDOT Master Plan process. The proposed site was 520 acres  
4 along the south shore of the Chester River, Queenstown , Queen Anne's County (Figure 2-4).  
5 Estimated capacity is 9 mcy. During the initial site identification process, the site was found to  
6 contain ~~There are~~ tidal and non-tidal wetlands ~~near and on the project, as well as forested and~~  
7 forested areas. Initial estimates of wetlands and forested areas are ~~The exact amount of acreage~~  
8 ~~of wetlands is approximately 9 acres ad 500 acres, respectively. As a worst case assessment,~~  
9 ~~therefore, approximately 500 acres of forested area would be impacted. The site is adjacent to~~  
10 ~~SAV beds. The site was initially chosen due to the~~ There is access from deep water and there  
11 ~~are no known archeological or historical sites on or near the property. The site is far from both~~  
12 ~~CENAB and CENAP channels which would add as much as \$1.70 per cubic yard to the cost of~~  
13 ~~placement (relative to Site 104) (Section 7). For these reasons the site is impracticable at the~~  
14 ~~current time. Since the initial identification of this site, the property has been developed as a~~  
15 golf course and would no longer be available for dredged material placement.

**Title:**  
Queenstown

**Type:**  
Upland Placement; Fastland Creation

**Location:** Southern Shore of Chester River in Queen Anne's County

**Size:** approximately 520 acres

**Potential Capacity:** approximately 9 mcy

**Availability:** Privately Owned; Developed into a golf course since 1990.

**Nutrients:** NA

**Infrastructure Required to Implement:**

Site no longer under consideration due to the current land use.

**Institutional Issues:**

Site no longer under consideration due to the current land use.

**Costs:** NA

**COMMENTS:**

Resource information not updated because site is no longer available for placement.

DRAFT DRAFT  
 TITLE: Queenstown

DRAFT DRAFT  
 PROJECT TYPE: Upland; Fastland Creation

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils			X	
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality			X	
HTRS			X	
<b>Biological Characteristics</b>				
RTE-			X	
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous				X
Larval Habitat Area-anadromous				X
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife			X	
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas				X
Cultural Resources			X	
Archaeological Resources			X	
<b>Potential for Benefit</b>				X
<b>Potential to Minimize Adverse Effects</b>				X

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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### **Resources Used**

**Maryland Port Administration. 1990. Port of Baltimore: Dredged Material Management Master Plan. Report prepared for MPA by Gahagan and Bryant Associates and EA Engineering, Science and Technology, Inc. Unpublished.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**Maryland Tax Records.**

2921 3.5.25 Rocky Point  
2922

**Box XX-39**  
**Screening of Rocky Point Upland Containment Cell**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ ) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

2923 3.5.25a Location.

2924

2925 3.5.25b Type of Placement Option.

2926

2927 3.5.25c Potential Placement Capacity.

2928

2929 3.5.25d Bathymetry/Topography.

2930

2931 3.5.25e Environmental Characteristics

2932

2933 Living Resources.

2934

2935 Water Quality.

2936

2937 Hydrodynamics.

2938

2939 Rare, Threatened or Endangered (RTE) Species.

2940

2941 Fishing Activity.

2942

2943 Recreational Activity.

2944

2945 Historical/Archeological.

2946

2947 Groundwater:

2948

2949 View Shed.

2950

2951 **3.5.25f Implementation Factors.**

2952

2953 Construction Considerations.

2954

2955 Implementation Time Frame.

2956

2957 **3.5.25g Institutional Constraints.**

2958

2959 **3.5.25h Estimated Costs.**

2960

2961 **3.5.25i Other Factors.**

2962

2963 **3.5.25j Option Summary.**

2964

2965 **3.5.25k Option Data Sheet. [ADD DATA SHEET]**

1 **Rocky Point (Upland Placement)**  
2

3 Rocky Point is an upland site on the Eastern shore of the Upper Bay north of Worton Point  
4 (Figure 2-3). This site was evaluated during the MPA Master Plan process (MDOT 1991). Tidal  
5 and non-tidal wetlands and forested areas occur in and near the proposed site. ~~The ability to~~  
6 ~~obtain riparian access for pumping dredged material into the site is unknown.~~ This site has an  
7 approximate size of 360 acres and an estimated placement capacity of 6 mcy. A conservative  
8 estimate would be that 360 acres of wetlands and forest would be lost to placement site  
9 development. The site is closer to CENAP channels than to CENAB channels. The predominant  
10 current use of the site and area surrounding the site is agricultural. The current landowner has no  
11 interest in allowing placement to occur on the property so the option is not viable presently.  
12

13  
14 P:\Federal\DOD\ARMY\projects\6095793\NewDraft\Revised DEIS\Chapter\_02\Rocky Point (Upland Placement).doc

**Title:**  
Rocky Point

**Type:**  
Upland Placement

**Location:** Eastern Side of Rocky Point, Kent County.

**Size:** approximately 360 acres

**Potential Capacity:** approximately 6 mcy

**Availability:** Privately Owned; Landowner not interested in accepting dredged material

**Nutrients:** NA

**Infrastructure Required to Implement:**

Site no longer under consideration due to the current land use/availability

**Institutional Issues:**

Site no longer under consideration due to the current land use/availability.

**Costs:** NA

**COMMENTS:**

Resource information not updated because site is not considered available for placement.  
Currently in private agriculture.

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils				X
High Relief Area				X
Suspended Particulates, Turbidity				X
Water Quality				X
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS				X
<b>Biological Characteristics</b>				
RTE-		X		
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous				X
Larval Habitat Area-anadromous				X
Crabs				X
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife		X		
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds		X		
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs				X
Recreationally important fisheries				X
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas			X	
Forested Areas		X		
Cultural Resources			X	
Archaeological Resources			X	
<b>Potential for Benefit</b>				X
<b>Potential to Minimize Adverse Effects</b>				X

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Maryland Port Administration. 1990. Port of Baltimore: Dredged Material Management Master Plan. Report prepared for MPA by Gahagan and Bryant Associates and EA Engineering, Science and Technology, Inc. Unpublished.**

**Maryland Tax Records.**

2966 3.5.26 Sollers Point  
2967

**Box XX-40**  
**Screening of Sollers Point Beneficial Use**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

2968 3.5.26a Location.

2969  
2970 3.5.26b Type of Placement Option.

2971  
2972 3.5.26c Potential Placement Capacity.

2973  
2974 3.5.26d Bathymetry/Topography.

2975  
2976 3.5.26e Environmental Characteristics

2977  
2978 Living Resources.

2979  
2980 Water Quality.

2981  
2982 Hydrodynamics.

2983  
2984 Rare, Threatened or Endangered (RTE) Species.

2985  
2986 Fishing Activity.

2987  
2988 Recreational Activity.

2989  
2990 Historical/Archeological.

2991  
2992 Groundwater:

2993	
2994	<u>View Shed.</u>
2995	
2996	<b>3.5.26f Implementation Factors.</b>
2997	
2998	<u>Construction Considerations.</u>
2999	
3000	<u>Implementation Time Frame.</u>
3001	
3002	<b>3.5.26g Institutional Constraints.</b>
3003	
3004	<b>3.5.26h Estimated Costs.</b>
3005	
3006	<b>3.5.26i Other Factors.</b>
3007	
3008	<b>3.5.26j Option Summary.</b>
3009	
3010	<b>3.5.26k Option Data Sheet. [ADD DATA SHEET]</b>

1 **2.2.3.a.17 Sollers Point**

2  
3 ~~This proposed site is 90 acres in the Harbor, is located near the Francis Scott Key Bridge, and~~  
4 ~~has a relatively small capacity (4 mcv). The original concept included land creation for~~  
5 ~~industrial use. The area is considered environmentally degraded. Disadvantages of using the site~~  
6 ~~include the need to move large quantities of sediment and debris, loss of wetlands, and bottom~~  
7 ~~material unfavorable for construction of containment dikes. Dike construction in this area would~~  
8 ~~be restricted due to the statute that restricts dike construction within a 5 mile radius of Hart-~~  
9 ~~Miller Island. In order to raise dikes in this area, supportive public opinion would need to force a~~  
10 ~~change in the current state law.~~

11  
12 This proposed site is 90 acres in the Baltimore Harbor, at latitude 39° 14, longitude 76° 31.2',  
13 located just southeast of the Francis Scott Key Bridge. It has a relatively small capacity volume  
14 of 4 mcv. The original concept included land creation for industrial use. The area is considered  
15 environmentally degraded.

16  
17 Disadvantages of using the site include the need to move large quantities of sediment and debris,  
18 loss of wetlands, and bottom material unfavorable for construction of containment dikes. Dike  
19 construction in this area would be restricted due to the statute that restricts dike construction  
20 within a 5 mile radius of Hart-Miller Island. In order to raise dikes in this area, supportive public  
21 opinion would need to force a change in the current State law.

22  
23 Maryland's Chesapeake Bay Water Quality Monitoring Program has monitored water quality  
24 throughout the Bay since 1984. One Chesapeake Bay Program Water Quality Station in the  
25 Inner Harbor is located in the vicinity of the proposed project site. This data set provides the best  
26 representative water quality data for the proposed site. Salinity can be classified as high  
27 mesohaline (10-18 ppt) in the summer and fall and a low mesohaline (5-10 ppt) primarily  
28 occurring in late winter and spring. Surface DO concentrations range from 4.5-12.0 mg/L with  
29 bottom concentration ranges at 1-10 mg/L. Sollers Point is a shallow area and would be expected  
30 to have sufficient DO to sustain aquatic life. Turbidity in the region, measured as total suspended  
31 solids (TSS) is consistent throughout the season ranging from 10 to 30 mg/L. Chlorophyll-a  
32 concentrations are generally low and variable by season. Particulate phosphorous is generally  
33 steady throughout the year with low concentrations at the surface (mean 0.04 mg/L) when  
34 compared with a mean concentration of 0.40 mg/L in deeper regions.

35  
36 There is no record of submerged aquatic vegetation (SAV) for the proposed site. SAV provides  
37 excellent habitat for organisms but due to depth and turbidity does not occur. Benthic  
38 communities provide a major trophic link in the Chesapeake Bay food chain. A biological study  
39 of Baltimore Harbor represents the best data for the proposed site. A total of 27 species were  
40 found in the harbor, which is low in comparison with other areas of the Chesapeake Bay. Most  
41 species were attributed to 3 major phyla, the mollusks (clams and snails), the arthropods  
42 (crustaceans), and the annelids (worms). The bottom sediments of Baltimore Harbor are mostly  
43 soft silts and clays, which generally favor burrowing invertebrates such as worms (Cronin 1971).

44  
45 Finfish and shellfish in the Chesapeake Bay are valuable commercial and recreational fisheries  
46 resources. Finfish concentrations are lower within the proposed site compared to other regions of  
47 the Chesapeake Bay. White perch were the most abundant fish species in terms of numbers

48 caught. No striped bass eggs or early larvae were found due to the lack of water velocities in  
49 freshwater areas normally associated with successful striped bass spawning. The harbor has  
50 lower salinities constituting greater numbers of freshwater species when compared with other  
51 proposed sites. A combination of uninhabitable bottom sediments and low oxygen levels  
52 (especially summer months) combine to exclude many species of bottom fish throughout deeper  
53 areas of the harbor. The proposed area is shallower and fish exclusion does not occur as readily.  
54 Oysters are predominantly harvested in lower reaches of the upper Bay (Chris Judy, MDNR,  
55 August 1997). Eastern oyster habitat distribution is excluded from the proposed area. There is a  
56 low density of female and male blue crabs. The only rare, threatened, or endangered species  
57 (RTE) within the area is the bald eagle. Due to the urbanization of the area, bald eagles are of no  
58 concern for the proposed site.

59  
60  
61

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**Title:**  
Sollers Point

**Type:**  
Fast Land Creation

**Location:** The site is located in the Patapsco River, within Baltimore Harbor, immediately adjacent to the Francis Scott Key Bridge.

**Size:** approximately 90 acres

**Potential Capacity:** approximately 4 mcy

**Availability:** State Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facilities, de-watering facilities, and containment structures.

**Institutional Issues:**

Concept could violate State law of no containment facility within 5 miles of HMI pleasure Island chain.

Permitting required for construction in shallow water habitat.

Permitting required for critical area development

Permitting required for wetland disturbance.

**Costs:** []

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [NEED!]

**COMMENTS:**

Area considered degraded.

Benthic diversity poor.

Wetlands, shallow water habitat, and Chesapeake Bay Critical Area would be involved in concept.

DRAFT DRAFT  
 TITLE: Sparrows Point

DRAFT DRAFT  
 PROJECT TYPE: Habitat Development

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality		X		
Hydrodynamics			X	
Tidal Fluctuations			X	
Salinity Gradients			X	
Sediment Quality		X		
HTRS			X	
<b>Biological Characteristics</b>				
RTE-			X	
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries		X		
Designated Spawning Area-anadromous				X
Larval Habitat Area-anadromous				X
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife			X	
Avian Wildlife				
Waterfowl concentration area			X	
Land and/or Waterbirds		X		
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges			X	
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas			X	
Cultural Resources		X		
Archaeological Resources			X	
Potential for Benefit	X			
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**Harbor Fisheries Report (need References).**

3011 **3.5.27 Sparrows Point Habitat Development**

3012  
3013 The MPA proposed to develop a 300 to 400 acre site into intertidal wetlands and upland habitat.  
3014 The wetlands would provide improved habitat along the shoreline whereas the upland habitat  
3015 would act as a buffer between the Bethlehem Steel facility and the project and would also serve  
3016 as a visual buffer to the industrialized area when viewed from the east (MES and MPA, 1983).  
3017 This proposal was opposed by local citizens whose support was needed to  
3018

**Box XX-41**

**Screening of Sparrows Point Beneficial Use**

**Screening Summary:** The screening criteria were applied with the following results:

1. **Placement Potential:** Site could potentially provide 10.3 mcy, or approximately 60% of the need. Site specific conditions would limit annual inflow to 800,000 cy, once the site were fully available.
2. **Availability:** The shoreline is owned by Bethlehem Steel. For planning purposes, it is assumed that suitable arrangements could be made for use of the shoreline. The bottom is owned by the State and is considered to be available.
3. **Environmental Suitability:** Bottom habitat would be permanent converted to wetlands and upland habitat. It appears that the overall environmental value of the site would be improved. Although the loss of bottom habitat is a locally important issue, it is not sufficient to singularly screen out this option.
4. **Infrastructure Readiness:** Based on existing circumstances, the project would not be ready for use when needed.
5. **Institutional Feasibility:** Use of the site is considered constrained by State law. The institutional constraint could be clarified, removed or waived at the discretion of the Legislature of the State of Maryland.
6. **Prospective Affordability:** The estimated unit cost (\$11-\$15) is below the screening threshold.
7. **Potential for Environmental Improvements:** Replacement of marginally productive bottom habitat with higher value wetlands buffered by upland habitat.

**Results of Screening:** The Sparrows Point beneficial use project is not suitable as either a standalone alternative or as a component of a multi-option alternative because capacity would not be available when needed.

3019 **3.5.27a Location.**

3020  
3021 A 300 to 400 acre habitat development project was proposed for the southern end of Sparrows  
3022 Point in Baltimore County (Figure 2-7).  
3023

3024 **3.5.27b Type of Placement Option.**

3025  
3026 The project was planned to establish a habitat enhancement project contiguous to industrial  
3027 shoreline by converting relatively poor bottom to aquatic and intertidal wetlands, high marsh,  
3028

3029 and upland nesting areas in order to benefit living resources. The habitat that would have been  
3030 created was also envisioned as providing aesthetic relief for the entrance to the harbor.  
3031 A beneficial use project in the form of habitat improvements to an industrial shoreline was  
3032 proposed.

3033  
3034 **3.5.27c Potential Placement Capacity.**

3035  
3036 The Sparrows Point beneficial use project could potentially provide approximately 10.3 mcy of  
3037 placement capacity (MES and MPA, 1993). However, site-specific conditions would necessitate  
3038 a modest annual inflow rate of approximately 800,000 cy, with lower rates during the first and  
3039 last years of placement. The projected filling cycle was 16 years from the time of initial  
3040 availability for placement.

3041  
3042 **3.5.27d Bathymetry/Topography.** Relatively shallow open-water area immediately south of  
3043 and contiguous to the Sparrows Point shoreline.

3044  
3045 **3.5.27e Environmental Characteristics**

3046  
3047 Living Resources. An environmental study determined that the area's biological productivity was  
3048 similar to that of other areas inside the harbor, but less productive than the Bay (MES, 1995a).

3049  
3050 Water Quality. [XXXX]

3051  
3052 Hydrodynamics. [XXXX]

3053  
3054 Rare, Threatened or Endangered (RTE) Species. [XXXX]

3055  
3056 Fishing Activity. No commercial fishing is authorized in the area.

3057  
3058 Recreational Activity. Recreational boating and fishing is reported to occur in the area. The loss  
3059 of recreational water area due to past filling of Bay bottom by Bethlehem Steel was cited by  
3060 many citizens as reason for their opposition to the conversion of bottom habitat that would result  
3061 from the proposed beneficial use project (Hamons and Young, 1999).

3062  
3063 Historical/Archeological. [XXXX]

3064  
3065 Groundwater: [XXXX]

3066  
3067 View Shed. The existing view shed is of an industrialized shoreline. The view shed would be  
3068 modified through the addition of wetlands and uplands.

3069  
3070 **3.5.27f Implementation Factors.**

3071  
3072 Construction Considerations. The MPA investigated use of this site, with preliminary conceptual  
3073 designs and pre-feasibility environmental studies. Preliminary engineering determined that a  
3074 project at the site was feasible. However, poor foundation conditions would necessitate highly  
3075 specialized construction techniques in order to "float" a structure to enclose the site (GBA et al.,  
3076 1992; Hamons and Young, 1999; MES and MPA, 1993).

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**Implementation Time Frame.** In the absence of support for removal of the institutional constraint associated with this project, habitat development has been maintained as a DNPOP option but efforts to implement the project have been suspended indefinitely. Based on the accelerated time frame for the Poplar Island restoration project, it is estimated that it would take 9 or more years to implement the project of this scale from a cold start.

**3.5.27g Institutional Constraints.**

Institutional difficulties exist from the prohibition in current state law for construction of a containment facility within a 5 mile radius of the Hart-Miller-Pleasure Island chain. Although the proposed project was intended to improve habitat, it nevertheless would have required the water area to be fully enclosed because of site-specific conditions. Attempts on behalf of the MPA to secure citizen support for the beneficial use project and for a revision to the law were not successful (Hamons and Young, 1999).

**3.5.27h Estimated Costs.**

Estimated costs to construct the facility were on the order of \$23 to \$29.5 million, depending upon dike construction materials. The estimated unit cost in 1992 dollars was approximately \$10.40 (DNPOP, 1992; GBA et al., 1992). It is estimated that if constructed today, unit costs could be in the \$11 to \$15 range per cubic yard, depending upon construction techniques and materials.

**3.5.27i Other Factors.**

Federal funding for a beneficial use project at Sparrows Points is uncertain. Potentially, a project could be undertaken using Section 204 standing authority. However, the estimated construction cost is approximately double the annual cap on Section 204 funds that are competed for nationally. In view of the cost, a special Congressional funding appropriation may be required to undertake construction as a Section 204 project.

**3.5.27j Option Summary.**

The existing institutional constraint would need to be removed for the Sparrows Point beneficial use project to become practicable as an alternative to the proposed action. However, the time frame for implementing a beneficial use project precludes its selection as an alternative.

**3.25.27k Option Data Sheet. [ADD DATA SHEET]**

**Title:**  
Sparrows Point

**Type:**  
Beneficial Use, Habitat Creation

**Location:** The site is located on the Sparrows Point Plant of the Bethlehem Steel Corporation along the Patapsco River in Baltimore County

**Size:** approximately 300 acres

**Potential Capacity:** approximately 10 mcy

**Availability:** Privately Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Access channel, unloading facilities, de-watering facilities, and containment structures.

**Institutional Issues:**

Concept violates State law of no containment facility within 5 miles of HMI pleasure Island chain.

Permitting required for construction in shallow water habitat.

Permitting required for critical area development

Permitting required for wetland disturbance.

Permitting required for potential disturbance of anadromous fish spawning

**Costs:** [total costs 25 million, GBA 1992]

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [NEED!]

**COMMENTS:**

Black crowned night heron colony size in 1988 greater than 70.

Located in a spawning area for anadromous fish such as herring, white perch and yellow perch.

Mesozooplankton and Microzooplankton abundances found in MES (1995) study to be typical for that area of the Chesapeake Bay. Bear Creek station was rated poor in terms of speculation and abundance of fish and crabs. Bay anchovy, spot and white perch comprised over 90% of trawl catch.

MES 1995 study found that Sparrows Point does not support a biological community unique to other sites sampled in the Baltimore Harbor area. Site met the Restoration Goals index of 3 for benthos.

DRAFT  
TITLE: Sparrows Point

DRAFT DRAFT  
PROJECT TYPE: Habitat Development

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate-very soft soils	X			
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients			X	
Sediment Quality	X			
HTRS		X		
<b>Biological Characteristics</b>				
RTE-			X	
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area-anadromous	X			
Larval Habitat Area-anadromous	X			
Crabs	X			
<b>Mollusks</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife			X	
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV				X
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars				X
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas	X			
Forested Areas	X			
Cultural Resources		X		
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

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17

**3.5.28 Swan Point Peninsula**

**Box XX-42  
Screening of Swan Point Peninsula**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide **XX** mcy, or over **XX** percent of the target placement need.
2. Availability: **XXXX**.
3. Environmental Suitability: **XXXX**.
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: **XXXX**.
6. Prospective Affordability: The estimated unit cost (\$    ) **XXXX**.
7. Potential for Environmental Improvements: **XXXX**.

**Results of Screening:** Use of the **XXXX** for **XXXXX** placement is/isnot suitable for consideration as an alternative due to **XXXX**..

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**3.5.28a Location.**

**3.5.28b Type of Placement Option.**

**3.5.28c Potential Placement Capacity.**

**3.5.28d Bathymetry/Topography.**

**3.5.28e Environmental Characteristics.**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

3143  
3144 View Shed.  
3145  
3146 **3.5.28f Implementation Factors.**  
3147  
3148 Construction Considerations.  
3149  
3150 Implementation Time Frame.  
3151  
3152 **3.5.28g Institutional Constraints.**  
3153  
3154 **3.5.28h Estimated Costs.**  
3155  
3156 **3.5.28i Other Factors.**  
3157  
3158 **3.5.28j Option Summary.**  
3159  
3160 **3.5.28k Option Data Sheet. [ADD DATA SHEET]**

1 **2.2.3.a.3 Swan Point Peninsula Restoration (Beneficial Use, Upland Placement, Fastland**  
2 **Creation)**

3  
4 Swan Point in Kent County has been severely eroded. Projects proposed as DNPOP placement  
5 options on Swan Point have included a beneficial use project or a containment project for clean  
6 dredged material. It is estimated that a beneficial use project would result in approximately 2 to  
7 5 mcy of capacity. It is estimated that a dike system connected to Swan Point for containment  
8 could result in approximately 10 mcy of capacity. This area is known to provide fish nursery  
9 habitat, is a waterfowl use area, and has viable oyster and clam bars in the immediate vicinity.  
10 Eagles, a recently proposed delisted endangered species, had been and listed Rare, Threatened or  
11 Endangered species (eagles) have been preliminarily identified by resource agencies as present  
12 near or in the project area. -Swan Point, like the majority of the Chesapeake Bay shoreline, is  
13 potential habitat for the bald eagle. [ADDITIONAL INFORMATION ON WATERFOWL AND  
14 FISH SPECIES FOR THE SWAN POINT PENINSULA MAY BE PROVIDED BY NICK  
15 CARTER OF MDNR]

16  
17 Water quality characteristics for the area adjacent to Swan Point are expected to be similar to  
18 those reported for station MCB3.2 of the Chesapeake Bay Water Quality Program. Surface  
19 salinities have historically fallen within the oligohaline to mesohaline range (0 ppt to 14 ppt)  
20 (1992-1996 data). Bottom salinities fall in the upper mesohaline (10-18 ppt) range throughout  
21 most of the year, with the exception of years with above normal precipitation. Because MCB3.2  
22 lies in the deeper, central area of the Bay, the water column exhibits vertical salinity  
23 stratification, with a distinct upper fresher layer and lower saltier layer. Bottom waters in these  
24 areas typically exhibit low DO during the summer and early fall (<1 mg/L), and surface waters  
25 average approximately 6 mg/L during mid-summer (CBP 1999). Historical Secchi data indicate  
26 that water clarity in the region is typically reduced during the spring, and is greatest in the late  
27 summer and early fall. Bottom total suspended solids (TSS) concentrations at MCB3.2 have  
28 historically ranged from 3 mg/L to 271 mg/L throughout the year, with a mean of 27 mg/L  
29 (1984-1997 data). Particulate phosphorus levels in the bottom waters during the 1984 through  
30 1997 sampling period ranged from a high of 0.086 to 0.004 mg/L (CBP 1999). Particulate  
31 phosphorus in the surface waters of the area during the same sampling period ranged from 0.14  
32 to 0.015 mg/L. Levels of nitrogen as nitrite + nitrate ranged from 0.99 to approximately 0.0 in  
33 the bottom waters while the level of nitrogen ranged from 1.75 to approximately 0.0 in the  
34 surface waters of the region (CBP 1999). Typically, concentrations of ammonia are elevated in  
35 anoxic bottom waters in the deep central regions of the Bay and peak during the summer  
36 (CBPWQM 1997).

37  
38 A 1998 survey of submerged aquatic vegetation (SAV) in the region detected beds of SAV along  
39 the shoreline of Tavern and Swan creeks (VIMS 1999). No SAV was observed along the Swan  
40 Point shoreline of the Chesapeake Bay although the shallow depths adjacent to the shoreline  
41 would not preclude the potential for the existence of SAV near the Swan Point site. The shallow  
42 depths west and south of Swan Point may also provide shallow water habitat for various species.

43  
44 A large portion of Swan Point is within the State of Maryland's Chesapeake Bay Critical Area  
45 and may contain both palustrine and estuarine wetland areas (MES GIS 1995). The presence of  
46 archeological resources may also be likely over the entire Swan Point area (MES GIS 1995).

47  
48 The area immediately west of Swan Point provides summer habitat for a high density of male  
49 blue crabs, but little to no habitat value during the winter months for both male and female blue  
50 crabs. This same area includes a low density of softshell clams. Eastern oyster habitat is present  
51 within the region but does not extend to the shoreline of Swan Point (Funderburk et al. 1991).  
52

53 Although time of year restrictions on placement may be sufficient to protect fisheries resources,  
54 the other natural resources at the site would still be vulnerable. The extent of wetland and forest  
55 acreage in the area has not yet been determined by studies performed to date. A conservative  
56 estimate would be that 18 acres of wetlands and forest would be lost to placement site  
57 development. ~~Due to these constraints, the alternative was dropped from further consideration.~~  
58

59  
60 P:\Federal\DOID\ARMY\projects\6095793\NewDraft\Revised DEIS\Chapter\_02\Swan Point Peninsular Restoration.doc

**Title:**

Swan Point Peninsula

**Type:**

Beneficial Use; Fastland Creation; Upland Placement

**Location:**

Swan Point Peninsula is in Queen Anne's County immediately east of the mouth of the Patapsco River (Baltimore Harbor). The area considered is near the tip of the peninsula which has been severely eroded.

**Size:** Swan Point is approximately \_\_\_\_\_ yards long.

**Potential Capacity:** Beneficial use options would be provide approximately 2 to 5 mcy of placement. A dike system constructed adjacent to the site could provide as much as 10 mcy of capacity.

**Availability:** State Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

Some diking or a berm would be required to contain the fine grained material.

**Institutional Issues:**

Much of the site would lie within the Chesapeake Bay Critical Area.

**Costs:**

**Total Unit Costs Per Cubic Yard:** [NEED!]

**Development & Implementation Costs:** [NEED!]

**COMMENTS:**

Commercial and recreational fisheries impacts  
Waterfowl Use Area  
Presence of SAV and Shallow Water Habitat  
Swan Point Oyster Bar in vicinity  
Within Chesapeake Bay Critical Area

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate			X	
High Relief Area			X	
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics			X	
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality			X	
HTRS			X	
<b>Biological Characteristics</b>				
RTE	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area		X		
Larval Habitat Area	X			
Crabs	X			
Mollusks				
Soft shell clams	X			
Hard shell clams				X
Oyster bars	X			
Terrestrial Wildlife		X		
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds		X		
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges			X	
SAV	X			
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality				X
Noise				X
Critical Areas	X			
Forested Areas		X		
Cultural Resources				X
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

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3161 3.5.29 Worton Point Beneficial Use  
3162

**Box XX-43**  
**Screening of Worton Point Beneficial Use**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ \_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

3163 3.5.29a Location.  
3164  
3165 3.5.29b Type of Placement Option.  
3166  
3167 3.5.29c Potential Placement Capacity.  
3168  
3169 3.5.29d Bathymetry/Topography.  
3170  
3171 3.5.29e Environmental Characteristics  
3172  
3173 Living Resources.  
3174  
3175 Water Quality.  
3176  
3177 Hydrodynamics.  
3178  
3179 Rare, Threatened or Endangered (RTE) Species.  
3180  
3181 Fishing Activity.  
3182  
3183 Recreational Activity.  
3184  
3185 Historical/Archeological.  
3186  
3187 Groundwater:

3188	
3189	<u>View Shed.</u>
3190	
3191	<b>3.5.29f Implementation Factors.</b>
3192	
3193	<u>Construction Considerations.</u>
3194	
3195	Implementation Time <u>Frame.</u>
3196	
3197	<b>3.5.29g Institutional Constraints.</b>
3198	
3199	<b>3.5.29h Estimated Costs.</b>
3200	
3201	<b>3.5.29i Other Factors.</b>
3202	
3203	<b>3.5.29j Option Summary.</b>
3204	
3205	<b>3.5.29k Option Data Sheet. [ADD DATA SHEET]</b>

3206 **3.5.30 Innovative Use of Dredged Material**

3207

3208 The concept of using dredged material as a non-traditional or economic resource (e.g., turning it  
3209 back into soil products), a form of "beneficial use," has been widely discussed as a constructive  
3210 approach to managing dredged material. For the purpose of this annex, the concept of using  
3211 dredged sediments as an economic or non-traditional resource for the production of products or  
3212 for non-traditional end uses is referred to as "innovative use" to distinguish it from more  
3213 traditional habitat enhancement and restoration applications.

3214

**Box XX-44**

**Screening of Innovative Use of Dredged Material**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Up to 100,000 cy if successful at production scale. Increase in throughput potential in excess of 100,000 cy would need to be progressively established. All production scale throughput is unproven for the Port of Baltimore.
2. Availability: Indefinite.
3. Environmental Suitability: Site, process, product, and end use dependent.
4. Infrastructure Readiness: Indefinite. Depends upon the results of research and development and market availability.
5. Institutional Feasibility: Site, process, product and end use dependent.
6. Prospective Affordability: The estimated unit cost for products and end uses (\$25 to \$100+ cy) exceeds the upper cost screening threshold. Costs for farm applications are anticipated to approximate the costs of upland containment facilities, on the order to \$10-\$15 per cy. Such costs would be below the upper screening threshold but have yet to be demonstrated in practical application for the Port of Baltimore. The majority of costs would likely have to be borne by the local sponsor.
7. Potential for Environmental Improvements: No direct improvement. Potential for indirect improvement through innovative uses of products and for certain end uses such as those which are associated with site remediation.

**Results of Screening:** Innovative use is not suitable for consideration as an alternative or as a component of a multi-option alternative because the approach has not yet been proven capable of providing a continuing capability for utilizing dredged sediments, there is limited potential for annual throughput on the scale needed, and exceptionally high costs for most applications. The potential of innovative use to make a meaningful contribution to dredged material management for the Port of Baltimore cannot be determined at this time.

3215 The innovative use of dredged sediments is not a new issue for the Port of Baltimore nor are the  
3216 many suggestions that dredged material be recycled for the reclamation of mines and sand and  
3217 gravel pits. The innovative use of dredged material for the production of various products  
3218 including natural and synthetic aggregates, shells, bricks, mineral wools and other materials was  
3219 previously studied for the Port of Baltimore. The manufacture of lightweight synthetic  
3220 aggregates was assessed as feasible, but the potential market was not available. All other  
3221 products were found to be unfeasible for a various technical and economic reasons (Weston,

3222 1974). A study was undertaken for the U.S. Department of Transportation and Baltimore City  
3223 between 1984 and 1986 to examine the treatment of contaminated dredged materials (Kidde  
3224 Consultants, 1984, 1986). The facility now referred to as the Cox Creek DMCF was identified as  
3225 the prospective location for a recycling facility. Conceptual designs, an economic analysis, and  
3226 cost estimates were developed. However, the approach was not practical for implementation.  
3227 Neither the containment cells nor a market were available.

3228 Innovative use has more recently been addressed by the Maryland Port Administration in the  
3229 form of conceptual options suggested through the DNPOP Program for which the MPA has  
3230 sponsored research and has announced intentions to request proposals for innovative uses.  
3231 Considering these developments, the use of dredged sediments was screened to determine  
3232 whether or not a specific application or applications of the innovative use concept could serve as  
3233 a practicable alternative for managing up to 18 mcy of dredged sediments for the Port of  
3234 Baltimore.

3235  
3236 **3.5.30a Location.**

3237  
3238 Site dependent.

3239  
3240 **3.5.30b Type of Placement Option.**

3241  
3242 Varies by process, product and end uses.

3243  
3244 **3.5.30c Potential Throughput Quantities.**

3245  
3246 The throughput potential for innovative use is undetermined inasmuch as the concept is still in  
3247 the developmental stage nationwide. Initial throughput capacities planned for production scale  
3248 are about 100,000 cubic yards, depending upon the technology applied and products produced or  
3249 end uses. Present stated long-term objectives are on the order of 500,000 cy annually. However,  
3250 the ability to reach this potential has not been proven. A 100,000 cy annual throughput would be  
3251 less than 5% of the placement deficit addressed in this annex. If a 500,000 cy annual throughput  
3252 could be achieved, this quantity would be less than 25% of the placement deficit. At 500,000 cy  
3253 per year, it would take about 36 years to accommodate 18 mcy of sediments. The current  
3254 development status with respect to capacity is described in the following paragraphs.

3255  
3256 The majority of testing has been performed at bench, pilot and demonstration test scales  
3257 (Amiran, et al., 1999; CTI, 1998; EPA, 1994; Jones, et al., 1999; McLaughlin, et al., 1999;  
3258 Rehmat, et al., 1999). Certain specific innovative use applications involving the products have  
3259 been demonstrated to be capable of pilot scale application on the order of 100 to 500 cubic yards.  
3260 Some processes have been demonstrated to be capable of demonstration or modest scale  
3261 production on the order of 30,000 to 40,000 cubic yards and others are anticipated to go to this  
3262 scale in the next year. For example, about 19,000 cy of contaminated sediments from Perth  
3263 Amboy, New Jersey, were converted to a cementitious product and successfully placed at Bark  
3264 Camp Mine in Pennsylvania as a strip mine remediation demonstration project at a cost of  
3265 approximately \$85 per cubic yard (CTI, 1998). The research program sponsored by the State of  
3266 New Jersey is planning to advance selected processes from pilot scale (up to 30,000 cy) to full-  
3267 scale commercial production of 100,000 cubic yards per year for the management of  
3268 contaminated marine sediments. The goal is to develop a suite of marketable products and end

3269 uses that in combination would result in the annual conversion of up to 500,000 cy of  
3270 contaminated sediments into marketable products or end uses. Implementation of the concept to  
3271 date indicates that sufficient markets exist or could be developed in the New York and northern  
3272 New Jersey metropolitan area (Amiran et al., 1999; McDonough et al., 1999; McLaughlin et al.,  
3273 1999). However, market conditions, particular for soil products, is significantly different in  
3274 Maryland where soil and fill material is readily available to meet existing demand. For this  
3275 reason, the market for innovative products and end uses will need to be expanded or created in  
3276 order for a technology.

3277  
3278 Preliminary unpublished results suggest that up to 500,000 cy per year could be placed in an  
3279 environmentally acceptable manner on farmland. Sediments could be placed in thin layers,  
3280 naturally dried, and amended, with the farm returned to active agricultural production thereafter.  
3281 Although this approach has been successfully accomplished in Maryland on a very small scale  
3282 (Corletta and Duff, 1997), the large-scale approach is still experimental. Whether or not  
3283 sufficient farmland would become available to enable annual placements is highly uncertain.

3284  
3285 The MPA has publicly stated that the agency's goal is to progressively develop a capability for  
3286 innovative use dredged sediments at a meaningful scale. The MPA has set a conceptual goal of  
3287 500,000 cy annual throughput, to the extent that this proves feasible, practicable and cost  
3288 effective. If the concept proves successful, the MPA would like to expand its application  
3289 significantly over the next decade, insofar as practicable and cost-competitive as a component of  
3290 the overall dredged material management program (Hamons and Young, 1999). Assuming that a  
3291 500,000 cy annual throughput potential were realized, it would take 36 years to accommodate 18  
3292 mcy of dredged sediments.

3293  
3294 **3.5.30d Bathymetry/Topography.** Site dependent.

3295  
3296 **3.5.30e Environmental Characteristics**

3297  
3298 Environmental characteristics will depend upon the processing site as well as receiving site (if an  
3299 end use rather than a product is developed). With respect to site-specific conditions, the MPA has  
3300 expressed interest in using the Cox Creek upland property as a processing site for innovative use  
3301 of dredged material. See paragraph XXXX of this annex for details about Cox Creek.

3302  
3303 Living Resources. Site dependent.

3304  
3305 Water Quality. Site and process dependent.

3306  
3307 Hydrodynamics. Not applicable.

3308  
3309 Rare, Threatened or Endangered (RTE) Species. Site dependent.

3310  
3311 Fishing Activity. Not applicable.

3312  
3313 Recreational Activity. Site dependent.

3314  
3315 Historical/Archeological. Site dependent.

3316

3317 Groundwater: Site dependent.

3318  
3319 View Shed. Site and process dependent.

3320  
3321 **3.5.30f Implementation Factors.**

3322  
3323 Capability for Utilization of Products or End Uses

3324  
3325 Assuming that a technology or technique is viable, a fundamental determinant of success is the  
3326 ability to establish adequate markets and end uses in order to complete the transition from  
3327 dredged sediment to viable innovative products or end uses. A successful technology or  
3328 technique would not become a successful application unless products produced from dredged  
3329 material can be effectively utilized (including the development of markets for these products) or  
3330 suitable end uses can be found on a scale that would make a meaningful contribution to dredged  
3331 material management. High-technology applications generally result in specialty products that  
3332 have small markets. Low-technology applications generally combine lesser production costs  
3333 (relative to high-technology approaches) and flexibility for small through large-scale applications  
3334 such as reclamation of sand and gravel pits and strip mines (use of deep mines has not been  
3335 attempted), provided that suitable properties become available. In general, end uses rather than  
3336 products appear to provide the potential for larger scale applications. Uses that require  
3337 deposition at a specific site, such as a gravel pit, would require a site-specific environmental  
3338 evaluation to determine the site's suitability to receive the material, and environmental  
3339 documentation as appropriate. Engineering design would also be required. Pertinent regulatory  
3340 requirements would also have to be met. An economic analysis would also have to be performed  
3341 to determine economic feasibility. Implementation may require the installation of offloading  
3342 facilities. Use of specific sites typically would involve contractual negotiations and proprietary  
3343 information. There are a considerable number of additional implementation issues that would  
3344 also need to be addressed (EPA, 1994). Even if a specific site is offered for use and appears to  
3345 merit consideration, contractual rules and regulations impose requirements on procurements that  
3346 may preclude consideration of such a site in environmental documentation as a possible  
3347 alternative to a proposed action.

3348  
3349 As part of long-term planning for the management of dredged material, MPA has sponsored  
3350 research of potential farm applications and has announced that the agency plans to issue a request  
3351 for proposals for an innovative use system with initial focus on the management of harbor  
3352 sediments. The objective of the MPA's agricultural applications research is to identify which soil  
3353 amendments might be needed and to determine crop suitability. Bench scale testing is currently  
3354 in progress to collect and assess leachate and soil quality changes over time from both untreated  
3355 and amended sediments from approach channels outside of the harbor. The germination and  
3356 production of various crops are also being studied. The results of the bench testing will be  
3357 applied to assess geophysical conditions that would be suitable for the placement of sediments on  
3358 agricultural lands. The results of the bench tests will also be used to guide the planting,  
3359 monitoring and analysis of field test plots. Bench-scale testing is also being performed for  
3360 industrial and agricultural residuals which could potentially be combined with dredged sediments  
3361 to produce value-added agricultural products. If the results of these experiments is favorable, a  
3362 field demonstration project would be undertaken, provided that a suitable location can be  
3363 identified, is made available, and is capable of being permitted under applicable rules and  
3364 regulations. A site-specific evaluation would be required, as would compliance with applicable

3365 rules and regulations. Whether or not a suitable test location can be found is assessed as  
3366 problematic. (A private venture to apply dredged material to two farms in Kent County  
3367 encountered substantial public opposition. The proposal was withdrawn (Hamons and Young,  
3368 1999)).

3369  
3370 In addition to the MPA's farm applications research, the MPA has indicated that the agency  
3371 plans to issue a solicitation that would be intended to progressively develop a capability for the  
3372 innovative use of dredged sediments. The upland property adjoining the Cox Creek Dredged  
3373 Material Containment Facility has been identified as potentially suitable for the siting of an  
3374 innovative use system. The MPA is hopeful that "perpetual" capacity might be achieved for the  
3375 Cox Creek containment cell prior to it being filled to capacity. The Cox Creek site is also  
3376 envisioned as a potential staging area for both contaminated and clean dredged sediments as  
3377 resources for the innovative use system (Hamons and Young, 1999). State procurement rules  
3378 and regulations preclude the MPA from discussing the specific content of its solicitation prior to  
3379 its public release.

3380  
3381 Construction Considerations. Site and process dependent.

3382  
3383 Implementation Time Frame.

3384  
3385 With reference to innovative use initiatives for the Great Lakes (EPA, 1994) and for the New  
3386 York Harbor area, it can be anticipated that it would take several years for initial testing and  
3387 evaluation to determine whether or not, or to what extent, innovative uses might become  
3388 practicable for managing sediment from the Baltimore Harbor and its approach channels. If the  
3389 approach were to be found suitable at pilot and demonstration scale, it would remain necessary to  
3390 ascertain the feasibility of production-scale utilization and the upper limits of throughput  
3391 potential for suitable processes, products and end uses. It is probable that a market would have to  
3392 be expanded or developed inasmuch as the soils market in Maryland is already highly  
3393 competitive.

3394  
3395 **3.5.30g Institutional Constraints.**

3396  
3397 The issue of institutional constraints would need to be assessed for specific processes, products  
3398 and end uses.

3399  
3400 **3.5.30h Estimated Costs/Economic Viability.**

3401  
3402 The costs of treatment for remediation technologies for contaminated sediments range from  
3403 about \$45 per ton to over \$500 per ton (EPA, 1994, 1998; McLaughlin, et al., 1999). Although  
3404 this DEIS addresses suitable sediments, that is, those that can be characterized as clean, the  
3405 technology for contaminated sediments can be applied to uncontaminated sediments as well. The  
3406 high cost of remediation technologies detracts from their economic viability for innovative  
3407 applications on a large scale, even for contaminated sediments. For example, the State of New  
3408 Jersey's program to develop innovative use as an integral part of dredged material management  
3409 has established a maximum of \$35 per cubic yard as the amount the State is willing to pay for  
3410 each cubic yard that is processed and removed from the dredged material management stream.  
3411 Venders will be responsible for covering any costs in excess of this amount (State of New Jersey,  
3412 1998). Research to date has resulted in prospective State costs of from \$28 to \$35 dollars. Gross

3413 costs (including the State's costs) are estimated to be in the \$45 to \$120 dollar range, exclusive  
3414 of dredging costs and the cost of delivery of material to innovative use venders (Jones, et al.,  
3415 1999; McLaughlin, et al. 1999; O'Donnell and Henningson, 1999; Rehmat, et al., 1999). The  
3416 prospective high costs, however, have prompted efforts to find lower cost approaches for  
3417 application to suitable sediments, such as the applied research efforts of the USACE and the  
3418 MPA regarding soil products and farm applications.

3419  
3420 **3.5.30i Other Factors.**

3421  
3422 [MES EXPAND THE DISCUSSION OF INNOVATIVE USE TECHNOLOGY]

3423 Most research and development into the innovative use of dredged material has been directly  
3424 related to initiatives intended to find solutions for the remediation of contaminated sediments.  
3425 Development of pretreatment and treatment technologies have involved both low through high-  
3426 technology solutions. Inasmuch as the national focus has been predominantly on contaminated  
3427 sediments, the applications that have been tested have tended towards higher technologies.  
3428 These have included thermal destruction technologies (incineration, pyrolysis, high-pressure  
3429 oxidation, and vitrification), thermal desorption technologies (high-temperature thermal  
3430 processor, low-temperature thermal treatment system, proprietary thermal desorption systems,  
3431 desorption and vaporization extraction systems, low-temperature thermal aeration systems, and  
3432 anaerobic thermal processor systems), immobilization technologies, extraction technologies  
3433 (including soil washing), chemical treatment technologies (chelation processes, dechlorination  
3434 processes, chemical dehalogenation treatment, base-catalyzed dechlorination, ultrasonically  
3435 assisted detoxification, oxidation processes, and chemical and biological treatment), and  
3436 bioremediation technologies (bioslurry processes, contained land treatment systems, composting,  
3437 and contained treatment facilities). In general, research and testing have found that pyrolysis,  
3438 oxidation, and bioslurry processes have performed within acceptable limits for both silts and  
3439 clays, and soil washing, solvent extraction, composting, and contained treatment facility  
3440 processes have performed within acceptable limits for silts (EPA, 1994).

3441  
3442 Technologically, there have been significant advances in the technological capability to produce  
3443 products and innovative end uses from dredged marine and estuarine sediments. Technologies  
3444 and techniques that are under development include the manufacturing and blending to create soil  
3445 products (Amiran, et al., 1999; Graalum and Randall, 1997; Palazzo, et al., 1997; Sturgis, et al.,  
3446 1997a,b), soil washing (Amiran, et al., 1999; Olin and Bowman, 1997); conversion into  
3447 lightweight construction aggregates (Weston, 1974), use in landfill construction (MES, 1995b),  
3448 production of construction grade cements (Rehmat, et al., 1999), forming cementitious products  
3449 for mine reclamation (CTI, 1998; McDonough, et al., 1999; O'Donnell and Hennington, 1999),  
3450 manufacture of bricks (Cousins, et al., 1997), production of commercial tiles (McLaughlin, et al.,  
3451 1999), and manufactured material using waste products such as automobile shredder byproduct  
3452 and dredged sediments to produce structural and non-structural fill (McDonough, et al., 1999;  
3453 Willix and Graalum, 1999). Most of these applications have been targeted towards contaminated  
3454 sediments, primarily because these are the more difficult of dredged sediments for which to  
3455 secure final deposition. Other applications, such as farm applications, are intended to use  
3456 suitable, uncontaminated dredged material (Corletta and Duff, 1997; Dalrymple, 1997; Landin,  
3457 1997; Price, et al., 1997). Transforming these approaches into practicable applications requires  
3458 that the technology be capable of adaptation to local sediment conditions, a particular need for  
3459 contaminated sediments.

3460  
3461 For example, innovative uses would include the concept of applying dredged sediments to  
3462 farmlands, with or without the subsequent addition of amendments (Dalrymple, 1997; Landin,  
3463 1997; PIANC, 1992; Price. et. al., 1997). Indeed, this concept has been used in small-scale farm  
3464 applications in Maryland and elsewhere. Although reported to be successful, there currently is  
3465 limited data to support general application in agriculture (Duff and Corletta, 1997). Both the  
3466 USACE and MPA are conducting applied research into potential soil applications. Applied  
3467 research and development into the innovative use of dredged sediments is also being pursued  
3468 elsewhere, including applications for New Jersey waters in the New York Harbor area. This  
3469 latter research involves federal funding through the Water Resources Development Acts of 1990,  
3470 1992 and 1996 as well, over \$100 million in funding from the State of New Jersey in an effort to  
3471 advance from concept to practical application (Jones, et al, 1999; McDonough, et al., 1999; Stern  
3472 et al., 1997, 1998a,b).

3473  
3474 **3.5.30j Option Summary.**

3475  
3476 Inasmuch as innovative use for the port is at the initial concept stage and in consideration of the  
3477 uncertainty of the marketability for products or end uses, an estimate of the potential for  
3478 innovative use as a viable component of dredged material management would be speculative.  
3479 Innovative use systems would therefore not constitute an alternative to the proposed open water  
3480 placement. Should a significant annual capability be developed at some future date, the  
3481 capability could be considered on its merits at that time relative to the dredging program.

3482  
3483 Although there appears to be significant potential for farm applications, there is also significant  
3484 potential that institutional issues may inhibit the availability of sufficient farmland. Therefore,  
3485 farm application is not a practicable alternative to the proposed open-water placement as either a  
3486 standalone option or a component of a multi-option alternative at this time. Should the farm  
3487 application concept become viable at some future date, it could be reconsidered on its merits at  
3488 the appropriate time.

3489  
3490 **3.5.30k Option Data Sheet. [ADD DATA SHEET]**

3491 **3.6 Proposed Upper Bay Island Long-Term Placement Site**

3492

3493 The following placement options were screened as possible alternatives:

3494

3495 • Pooles Island upper Bay island placement sites (3 configurations)

3496 • Tolchester West (Gales Lumps)

3497 • Site 168 (2 configurations)

3498 • Site 170A

3499 • Site 171

3500

3501  
3502

### 3.6.1 Pooles Island Upper Bay Island Placement Sites

#### Box XX-45

#### Screening of Pooles Island Upper Bay Island Placement Sites

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ ) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

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3527

**3.6.1a Location.**

**3.6.1b Type of Placement Option.**

**3.6.1c Potential Placement Capacity.**

**3.6.1d Bathymetry/Topography.**

**3.6.1e Environmental Characteristics**

Living Resources.

Water Quality.

Hydrodynamics.

Rare, Threatened or Endangered (RTE) Species.

Fishing Activity.

Recreational Activity.

Historical/Archeological.

Groundwater:

3528

3529 View Shed.

3530

3531 **3.6.1f Implementation Factors.**

3532

3533 Construction Considerations.

3534

3535 Implementation Time Frame.

3536

3537 **3.6.1g Institutional Constraints.**

3538

3539 **3.6.1h Estimated Costs.**

3540

3541 **3.6.1i Other Factors.**

3542

3543 **3.6.1j Option Summary.**

3544

3545 **3.6.1k Option Data Sheet. [ADD DATA SHEET]**

3546 3.6.2 Tolchester West/Gales Lumps  
3547

**Box XX-46**  
**Screening of Tolchester West Upper Bay Island Placement Site**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$ \_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/is not suitable for consideration as an alternative due to XXXX.

3548 3.6.2a Location.

3549  
3550 3.6.2b Type of Placement Option.

3551  
3552 3.6.2c Potential Placement Capacity.

3553  
3554 3.6.2d Bathymetry/Topography.

3555  
3556 3.6.2e Environmental Characteristics

3557  
3558 Living Resources.

3559  
3560 Water Quality.

3561  
3562 Hydrodynamics.

3563  
3564 Rare, Threatened or Endangered (RTE) Species.

3565  
3566 Fishing Activity.

3567  
3568 Recreational Activity.

3569  
3570 Historical/Archeological.

3571  
3572 Groundwater:

3573	
3574	<u>View Shed.</u>
3575	
3576	<b>3.6.2f Implenentation Factors.</b>
3577	
3578	<u>Construction Considerations.</u>
3579	
3580	<u>Implementation Time Frame.</u>
3581	
3582	<b>3.6.2g Institutional Constraints.</b>
3583	
3584	<b>3.6.2h Estimated Costs.</b>
3585	
3586	<b>3.6.2i Other Factors.</b>
3587	
3588	<b>3.6.2j Option Summary.</b>
3589	
3590	<b>3.6.2k Option Data Sheet. [ADD DATA SHEET]</b>

3591 3.6.3 Site 168  
3592

**Box XX-47**  
**Screening of Site 168 Upper Bay Island Placement Sites**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide XX mcy, or over XX percent of the target placement need.
2. Availability: XXXX.
3. Environmental Suitability: XXXX
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: XXXX
6. Prospective Affordability: The estimated unit cost (\$\_\_\_) XXXX
7. Potential for Environmental Improvements: XXXX

**Results of Screening:** Use of the XXXX for XXXXX placement is/isnot suitable for consideration as an alternative due to XXXX..

3593 3.6.3a Location.

3594

3595 3.6.3b Type of Placement Option.

3596

3597 3.6.3c Potential Placement Capacity.

3598

3599 3.6.3d Bathymetry/Topography.

3600

3601 3.6.3e Environmental Characteristics

3602

3603 Living Resources.

3604

3605 Water Quality.

3606

3607 Hydrodynamics.

3608

3609 Rare, Threatened or Endangered (RTE) Species.

3610

3611 Fishing Activity.

3612

3613 Recreational Activity.

3614

3615 Historical/Archeological.

3616

3617 Groundwater:

3618	
3619	<u>View Shed.</u>
3620	
3621	<b>3.6.3f Implementation Factors.</b>
3622	
3623	<u>Construction Considerations.</u>
3624	
3625	<u>Implementation Time Frame.</u>
3626	
3627	<b>3.6.3g Institutional Constraints.</b>
3628	
3629	<b>3.6.3h Estimated Costs.</b>
3630	
3631	<b>3.6.3i Other Factors.</b>
3632	
3633	<b>3.6.3j Option Summary.</b>
3634	
3635	<b>3.6.3k Option Data Sheet. [ADD DATA SHEET]</b>

3636 **3.6.4 Site 170A**

3637

3638 Site 170, previously described in Section XXXX of this annex, was suggested by the Maryland  
3639 Department of Natural Resources as suitable for a constructed island because of historically  
3640 marginal bottom conditions for living resources. The site was considered as a possible location  
3641 for a containment island under the DNPOP program (Figure 2-3). Although Site 170 was not  
3642 carried forward into the prefeasibility study for the Upper Bay Island Placement Site for the  
3643 aforementioned reasons, the site was screened as a possible alternative to the proposed open-  
3644 water placement action.

**Box XX-48**  
**Screening of Site 170A**

**Screening Summary:** The screening criteria were applied with the following results:

1. **Placement Potential:** Site could potentially provide between about 35 to 75 mcy of placement capacity.
2. **Availability:** The bottom is State-owned and could be made available.
3. **Environmental Suitability:** The exchange of water between the Patapsco River and the Bay would be adversely affected. There would be a permanent conversion of marginally productive open-water bottom habitat to an upland island. There would be a permanent change to the view shed.
4. **Infrastructure Readiness:** The environmental, institutional and construction issues associated with this site indicated that implementation of a facility at Site 170 would be protracted and that a facility most likely could not be ready for use when needed.
5. **Institutional Feasibility:** A portion of the site would be within 5 miles of the Hart-Miller-Pleasure Island Chain. A waiver or relief from the State law that prohibits construction of a containment facility within 5 miles of the Chain would be needed or the facility would have to be configured irregularly to avoid the prohibited area with a reduction in placement potential.
6. **Prospective Affordability:** The estimated unit cost (\$\_\_\_) is below the upper screening threshold for cost.
7. **Potential for Environmental Improvements:** There would be a permanent conversion from Bay bottom to upland with possibly a beneficial use component. For the purpose of applying Criteria #7, no potential for environmental improvements is assumed.

**Results of Screening:** Use of the Site 170A for construction of an island placement site is not suitable for consideration as an alternative to the proposed action due to a combination of (1) significant environmental effects particularly with respect to water quality at the mouth of the Patapsco River, institutional and construction issues, and prospective implementation time frame.

3645

3646 **3.6.4a Location/Background.**

3647

3648 Site 170A is located at the mouth of the Patapsco River. Please refer to section XXXX of this  
3649 annex for a more complete description.

3650

3651 The DNPOP Program's Bay Enhancement Phase II Working Group considered Site 170 as a  
3652 possible location for the proposed Upper Bay Island Placement Site component of the State of  
3653 Maryland's Dredged Material Management Plan. The site was configured to result in an  
3654 approximate capacity of 80 mcy for consistency with dredged material placement needs for the  
3655 large-scale placement island component of the State's Dredged Material Management Plan.  
3656

3657 The Bay II working group did not develop a consensus regarding suitability of Site 170. The  
3658 majority view was that a large-scale island at the mouth of the harbor would reduce the cross-  
3659 sectional area and would likely inhibit circulation patterns to the detriment of water quality in the  
3660 harbor and nearby tributaries. The site was suspended from further consideration as a suitable  
3661 location for a containment island due to a combination of hydrodynamic concerns and potential  
3662 affects on navigation near the harbor entrance. Although the majority of Working Group  
3663 participants did not consider Site 170 a practical alternative for construction of a containment  
3664 island, there was strong sentiment among some participants that Site 170 should be considered  
3665 further. DNPOP participants recommended a hydrodynamics screening study. This was referred  
3666 to the MPA for consideration. A preliminary site configuration was developed (GBA, 1999) and  
3667 a preliminary hydrodynamics screening was performed (CITATION), as discussed later in this  
3668 annex.  
3669

3670 **3.6.4b Type of Placement Option.** Containment facility with a beneficial use component.  
3671

3672 **3.6.4c Potential Placement Capacity.**  
3673

3674 In developing Site 170 as a possible alternative, the effects of scale were considered with respect  
3675 to capacity and hydrodynamic affects. Both a large-scale island of approximately 80 mcy total  
3676 capacity and a smaller-scale island of 40 mcy were considered. An average depth of 16 feet was  
3677 assumed across the site. An elevation of approximately 15 feet above MLLW was used to  
3678 provide a dike height sufficient to withstand storm conditions (GBA, 1999). Planning assumed  
3679 that sediments would be placed hydraulically and that there would be a crust management  
3680 program similar to the program utilized at Hart-Miller Island to create upland conditions (Wikar  
3681 and Moore, 1999).  
3682

3683 An island of approximately 820 acres in size (over 1-1/4 square miles) and about 15 feet in  
3684 elevation would be needed to accommodate approximately 40 mcy of dredged material. A 40  
3685 mcy facility would be approximately 5,100 feet wide (approximately 1 mile) and about 9,000  
3686 feet long (about 1-3/4miles). The perimeter would be on the order of 22,000 feet. An island of  
3687 nearly 2½ square miles in size (1,600 acres) and about 15 foot elevation would need to be  
3688 constructed in order to obtain large-scale capacity of approximately 80 mcy. A 80 mcy would be  
3689 about 6,500 feet wide (about 1-1/4 miles) and about 13,400 feet long (about 2½ miles). The  
3690 perimeter would be on the order of 31,600 feet in length. The larger capacity facility is consistent  
3691 with the dredged need identified in the State of Maryland's Strategy for Dredged Material  
3692 Management. To achieve this capacity, the northern side of the constructed island would need to  
3693 be placed near the shipping channels. The southern side would be within about ½ mile of the  
3694 northeastern Anne Arundel County shoreline. Using the aforementioned configurations, an  
3695 approximate doubling of the perimeter results in approximately 4 times greater capacity. The  
3696 relationship between perimeter length and capacity significantly affects construction costs.  
3697

3698 **3.6.4d Bathymetry/Topography.** Site 170 is relative flat as the result of prior placement of  
3699 dredged material throughout much of the site. Average depths are on the order of -16 feet  
3700 MLLW. There are several submerged obstructions recorded in the area on nautical charts.  
3701

3702 **3.6.4e Environmental Characteristics.**  
3703

3704 A constructed island of the type described above would be considered a major federal action for  
3705 the purposes of NEPA compliance. Principal environmental characteristics and potential effects  
3706 are discussed below.  
3707

3708 Living Resources.  
3709

3710 *Biological Productivity.* Use of Site 170 for a placement island was advocated by MDNR  
3711 through the DNPOP program primarily because MDNR considered the area less biologically  
3712 productive than other areas that were being considered as possible sites for a constructed  
3713 placement island. [ADD HERE ANY INFORMATION FROM DNR ON THE AREAS  
3714 PRODUCTIVITY][ADD HERE WHY COMMERCIAL FISHING WAS CLOSED IN THE  
3715 AREA]  
3716

3717 [Biological productivity studies were conducted for the Sparrows Point area about 2 miles  
3718 northwest of the centroid of Site 170 found the former area to be generally productive to  
3719 marginally productive when the Chesapeake Bay Restoration Goals Index and standard fish  
3720 productivity measures were applied to the data. None of the studies that were performed found a  
3721 unique biological community at the location of the proposed Sparrows Point habitat  
3722 enhancement project (MES, 1995). Site 170, being located in the same general area, Site 170  
3723 would be expected to exhibit biological productivity equivalent or greater to that of the harbor.]  
3724

3725 *Shallow Water Habitat.* Construction of a containment island at Site 170 would permanent  
3726 convert between about 820 to 1600 acres of bottom habitat, depending upon the size of the island  
3727 that were constructed (GBA, 1999). The depths of water in the area range from about -9 to about  
3728 -19 feet, MLLW.  
3729

3730 Sediment Quality. An issue is whether or not the sediments at Site 170 are degraded as a result  
3731 of contamination from the harbor. Channel sediments for the Brewerton Channel east of the  
3732 Rock Point - North Point line, Brewerton Extension, Brewerton Angle, and the Craighill  
3733 Channels have been determined to be suitable for general placement inasmuch as their chemical  
3734 properties are below thresholds for contaminated sediments (CITATION). The material that was  
3735 placed the area during open-water placement was dredged from channels east of the line. These  
3736 sediments would, in general, be as clean or cleaner than the sediments that were placed there  
3737 naturally. The sediments that were placed were soft and fine grained. To the extent that the  
3738 bottom at Site 170 may be less productive today than the areas in the main stem of the Bay, such  
3739 a condition could be associated to some degree with the physical character of the sediments (in  
3740 terms of grain size and nature of material) and generally poor circulation at the mouth of the  
3741 Patapsco River rather than chemical  
3742

3743 Water Quality. The evolving regulatory climate with respect to the Clean Water Act holds  
3744 potential to significantly effect the operation of containment facilities in the Patapsco River. The  
3745 Patapsco River has been designated as an impaired water body by the Environmental Protection

3746 Agency and is subject to the development of Total Maximum Daily Loads (TMDL). Whether or  
3747 not or to what extent the TMDL requirement might apply to operation of a containment facility  
3748 at Site 170 is an unresolved issue. Given the location of Site 170 in vicinity of the mouth of the  
3749 Patapsco River, any containment facility constructed there might potentially be subject to more  
3750 stringent regulation of effluent discharge than might be appropriate for containment facilities  
3751 elsewhere in the Bay region.

3752  
3753 Hydrodynamics. The hydrodynamics of the Patapsco River estuary are important to water quality  
3754 and associated water quality management decisions. A principal concern about the suitability of  
3755 Site 170 as a possible location for a large-scale constructed island is the potential effect on  
3756 circulation patterns and water quality in the Patapsco River estuary. Another concern is the  
3757 potential changes to hydrodynamic as well as wind conditions relative to ship maneuverability  
3758 that might result from construction of an island in proximity to the shipping channels. The  
3759 following discussion characterizes the current situation with respect to the understanding of  
3760 harbor hydrodynamics and the potential for impacts that would be associated with construction  
3761 of a containment island at the harbor mouth.

3762  
3763 A 1982 hydrodynamic study of the estuary identified a complex circulation system. The  
3764 existence of a three-layer, density driven circulation was confirmed through direct current  
3765 measurements within the harbor. The study also found that wind-driven circulation often  
3766 dominates other circulation components over the short term (up to 10 days). In particular, the  
3767 wind-driven component is especially prominent near the mouth of the head of the harbor (Middle  
3768 Branch) and the three principle tributaries (Bear Creek, Curtis Creek, and Northwest Branch).  
3769 The study also found that during Patapsco River freshets, conditions can occasionally be  
3770 produced in which the three-layer circulation is over-ridden by two-layered estuarine circulation.  
3771 Residence times vary across these conditions from about 3 days during the strongest wind events  
3772 to as much as 20 days when density and wind forcings are weak. Although the three-layer  
3773 circulation pattern is the most stable feature, the strongest exchanges of water between the  
3774 Patapsco River and the main stem of the Chesapeake Bay occur during the wind-driven events.  
3775 The effects of wind-driven forcings vary significantly with respect to salinity depending on  
3776 whether the winds are blowing upchannel or downchannel. The wind-driven events also have the  
3777 more pronounced effects on reduction of stratification at the harbor head than do the effects of  
3778 the more typical three-layered circulation pattern (Boicourt and Olson, 1982; Olson, et. al.,  
3779 1982.)

3780  
3781 The location of Site 170 is at the mouth of the river where the greatest exchange of water takes  
3782 place between the Bay and the estuary. A constructed island at this location could significantly  
3783 reduce the cross sectional area of the harbor mouth, depending upon the facility's scale, location  
3784 and configuration. Such a containment could also reduce the fetch for both downchannel and  
3785 upchannel wind forcings. Of concern is the potential for a constructed island to reduce fetch,  
3786 reduce cross sectional area, accentuate or dissipate physical energy under various conditions, of  
3787 or a combination of these factors to change the effects of wind driven forcings on hydrodynamics  
3788 to the detriment of circulation patterns and water quality in the estuary. For example, if the island  
3789 were to constrict the mouth of the harbor, downchannel forcings could potentially result in an  
3790 increase in current velocity in the shipping channels with associated effects on harbor salinity.  
3791 An island could also result in considerable dissipation of the effects of upchannel wind forcings  
3792 by reducing the fetch and dissipating physical energy along the perimeter exposed to these  
3793 conditions. A change in current velocity would also effect shiphandling. Placement of a

3794 constructed island close to the shipping channel could also affect maneuvering characteristics  
3795 (LAPH-PIANC, 1997; NRC, 1992, 1994).

3796  
3797 With respect to the earlier discussion of scale, the width of the facility would have significance  
3798 with respect to cross sectional area and potential effects on harbor hydrodynamics. Although the  
3799 smaller site has less of a potential cross sectional area, the smaller site could still result in a  
3800 significant reduction in cross sectional area at the harbor's mouth. The position of a smaller scale  
3801 facility could potentially be adjusted to some extent to reduce hydrodynamic effects whereas the  
3802 larger facility would necessarily have to be placed close to the mouth of the harbor. In either  
3803 case, there is potential for a significant reduction in cross sectional area and for potential adverse  
3804 effects on hydrodynamics, with the effects of wind forcings appear to be the most vulnerable to  
3805 changed conditions.

3806  
3807 The Chesapeake Bay three-dimensional hydrodynamic model (Curvilinear Hydrodynamic Three  
3808 Dimensional Modle – CH3D) was developed by the U.S. Army Engineer Waterways Experiment  
3809 Station (WES) subsequent to the 1982 hydrodynamics study discussed above. Although it  
3810 remains a work in progress, the CH3D model represents a substantial increase in the capability to  
3811 assess hydrodynamic effects of proposed placement options in the Chesapeake Bay and its  
3812 tributaries within the limitations of the model. The MPA, in response to DNPOP proceedings,  
3813 sponsored use of the CH3D model to specifically perform a preliminary assessment of the effects  
3814 of a large containment facility at Site 170. Preliminary results of the modeling, which is being  
3815 performed by WES), indicate that XXXXXXXX (CITATION).

3816  
3817 Rare, Threatened or Endangered (RTE) Species. [XXXX]

3818  
3819 Fishing Activity. [XXXX]

3820  
3821 Recreational Activity. Site 170 is located immediately offshore between the mouths of Rock  
3822 Creek and Bodkin Creek. Both Creeks and Stony Creek immediately west of Rock Creek all  
3823 support recreational boating activities. Fort Smallwood Park is located immediately southwest of  
3824 the site. The water area comprising Site 170 is used for recreational boating and sportsfishing  
3825 activities. There is a measured mile immediately offshore of Hog Neck. Small boats, depending  
3826 upon their routes, could be forced into or in proximity to the shipping channel as a result of  
3827 construction of a placement island at Site 170.

3828  
3829 Historical/Archeological. [XXXX]

3830  
3831 Groundwater: [XXXX]

3832  
3833 View Shed. The construction of a placement island at Site 170 would present a significant  
3834 change to the view shed from the northeastern Anne Arundel County shoreline from Riviera  
3835 Beach to Bodkin Point and from the Sparrows Point, Old Road Bay and North Point State Park  
3836 areas in Baltimore County. The change would be significant because an island did not exist at  
3837 this location previously and because the prospective elevation, closeness to the shoreline and the  
3838 vertical viewing angle would make the island appear relatively more pronounced than if the  
3839 island were located further offshore. The most pronounced effects would be on the view shed as  
3840 seen from the shoreline along Hog Neck which could be within ½ mile of the site and from the  
3841 Rock Point area in Baltimore County which could be slightly over 1 mile from the site.

**Title:** Site 170a

**Type:** Island Creation

**Location:** Concept located in Anne Arundel County at the mouth of Patapsco River in 12-17 feet of water. Near the intersection of Brewerton Eastern Extension, Brewerton and Cutoff Angle Channels.

**Size:** a 818 to 1,600 acre concept

**Potential Capacity:** 40-80 mcy depending on concept

**Availability:** State Owned

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**  
Access issues related to navigation channels.  
Dike containment construction required.

**Institutional Issues:**

Concept violates the State law of no containment site within five miles of the HMI Pleasure Island chain, requiring a change in existing law.

**Costs:**

**Total Unit Costs Per Cubic Yard:** [\$10-\$15 per cubic yard]

**Development & Implementation Costs:**

**COMMENTS:**

Hydrodynamic concerns are an issue for creating an island. One concern is that placement of an island would exacerbate already poor circulation characteristics within this area of the estuary.

Man-made island might hinder flushing and heighten pollution concentration in Harbor, position at intersection of channels could also increase shear stress and create navigation hazards.

DRAFT  
TITLE: Site 170a

DRAFT

DRAFT  
PROJECT TYPE: Island Creation

DRAFT

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations		X		
Salinity Gradients			X	
Sediment Quality		X		
HTRS		X		
<b>Biological Characteristics</b>				
RTE-			X	
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area				X
Crabs	X			
Mollusks				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 2-6, 2-8	X			
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area		X		
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams	X			
Hard shell clams				X
Oyster bars-NOB 2-6, 2- 8	X			
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality			X	
Noise			X	
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources			X	
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Gahagan & Bryant Associates, Inc. 1999. Conceptual dredged and site analysis for Site 170. Prepared for MES. September 21, 1999.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

**Maryland Department of Natural Resources. 1989. Natural Oyster Bar Maps. Prepared by Coast and Geodetic Survey for the Maryland Department of Natural Resources.**

**Maryland Geological Survey. 1971. Maryland Tidal Wetlands and Critical Area Inventory Maps. Based on County maps 1:2,400 scale organized by.**

**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

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**3.6.4f Implementation Factors.**

Construction Considerations.

*Foundation conditions* that exist at Site 170 are marginal for construction of an island placement site. A considerable amount of soft dredged material was placed throughout the area. Geotechnical boring data exist for one station inside of the Site 170 footprint. These data, although dated, are nevertheless considered to be representative of existing foundation conditions inasmuch as only the surface data would potentially have changed. The available data disclose that there is on the order of XX feet of muck from the earlier placement of dredged material (Green and Trident, 1970). Considerable undercutting of material estimated to be on the order of some 3 and 6 mcy would be necessary if the site were developed as a containment facility. This quantity would vary to some extent based on ability of the underlying material to support a constructed enclosure and the size of the facility if the site were to be developed as a placement island. Undercut material would most likely be placed within the enclosure, thereby reducing the potential capacity by an equivalent amount.

Implementation Time Frame. The time frame for constructing such a placement island is at least seven to ten years and perhaps up to 14 years or longer, regardless of scale. A more precise time frame cannot be predicted because of construction of such a facility would depend upon legislative authorizations and appropriations. It cannot be predicted whether or not the Congress would authorize such a facility as a federal project. If not, then the State would be responsible for funding construction. Whether or not the Legislature of the State of Maryland would authorize and fund such a facility cannot also not be predicted. Considering the nature of such a project, the legislative process could be protracted. For this reason, even if Site 170 were ultimately found to be suitable for a constructed island containment facility, it would not be available within the time frame needed to respond effectively to the placement deficit addressed in this annex.

**3.6.4g Institutional Constraints.**

The location of a major portion of the site within 5 miles of the Hart-Miller-Pleasure Island chain and potential aesthetic effects on the view shed were also identified as issues. The COMAR (CITATION) prohibits construction of a containment facility within 5 miles of the Hart-Miller-Pleasure Island chain in Baltimore County. Whether or not this institutional constraint would apply to a facility in Anne Arundel County is uncertain.

**3.6.4h Estimated Costs. [XXXX]**

**3.6.4i Other Factors. [XXXX]**

**3.6.4j Option Summary.**

**3.6.4k Option Data Sheet. [ADD DATA SHEET]**

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### 3.6.5 Site 171

**Box XX-49**  
**Screening of Site 171 Upper Bay Island Placement Site**

**Screening Summary:** The screening criteria were applied with the following results:

1. Placement Potential: Site could potentially provide **XX** mcy, or over **XX** percent of the target placement need.
2. Availability: **XXXX**.
3. Environmental Suitability: **XXXX**.
4. Infrastructure Readiness: Sites could/could not be ready for use when needed.
5. Institutional Feasibility: **XXXX**.
6. Prospective Affordability: The estimated unit cost (\$  ) **XXXX**.
7. Potential for Environmental Improvements: **XXXX**.

**Results of Screening:** Use of the **XXXX** for **XXXXXX** placement is/isnot suitable for consideration as an alternative due to **XXXX**..

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#### 3.6.5a Location.

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#### 3.6.5b Type of Placement Option.

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#### 3.6.5c Potential Placement Capacity.

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#### 3.6.5d Bathymetry/Topography.

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#### 3.6.5e Environmental Characteristics

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##### Living Resources.

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##### Water Quality.

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##### Hydrodynamics.

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##### Rare, Threatened or Endangered (RTE) Species.

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##### Fishing Activity.

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##### Recreational Activity.

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##### Historical/Archeological.

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##### Groundwater:

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3914 View Shed.  
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3916 **3.6.5f Implementation Factors.**  
3917  
3918 Construction Considerations.  
3919  
3920 Implementation Time Frame.  
3921  
3922 **3.6.5g Institutional Constraints.**  
3923  
3924 **3.6.5h Estimated Costs.**  
3925  
3926 **3.6.5i Other Factors.**  
3927  
3928 **3.6.5j Option Summary.**  
3929  
3930 **3.6.5k Option Data Sheet. [ADD DATA SHEET]**

1  
2 2.2.4.i Man-O-War Shoals  
3

4 The area known as Man-O-War Shoals was included as a DNPOP placement option and was  
5 considered as a possible open-water placement site (Figure 2-2). This site is located just north of  
6 the Brewerton Eastern Extension Channel, was previously used from the 1900's to 1950's as an  
7 open-water placement area, and has current depths of approximately 22 feet. This area is  
8 estimated to have a potential placement capacity of 24.6 mcy and encompasses an estimated  
9 1000 acres. During Bay Enhancement Phase II screening for upper Bay Island placement sites,  
10 this site was not included for consideration due to the proximity to a productive natural oyster  
11 bed (N.O.B. 2-6). An adjacent area (Site 168) was considered for island creation (Section  
12 2.2.3.b.2. Investigations found -weak foundation soils and a soft to very soft substrate at Site  
13 168, particularly where dredged material had been placed previously. Because Man-O-War  
14 Shoals was previously used for placement, similar substrate conditions probably exist on the site.  
15 The existing benthic community at Site 168 is stressed due to periodic summer anoxia and poor  
16 substrate. Because the depths, and salinity regime of Sites 168 and Man-O-War are expected to  
17 be the same, the existing benthic condition of Man-O-War is probably poor. Some parts of Site  
18 168 provide significant commercial fishing opportunities in winter, although hypoxia makes it  
19 unsuitable fish/crab habitat during most summers. Man-O-War Shoals is probably also used for  
20 some commercial harvesting. The other major potential concerns are: (1) that additional  
21 materials placed adjacent to the channel could change hydrodynamics relative to the channels  
22 and potentially affect ship maneuverability and thus ship handling, and (2) that the material  
23 could shoal in the Brewerton Channel Eastern Extension and Tolchester Channel due to the close  
24 proximity of the site to the channels and the tidal currents. Preliminary evaluations of  
25 hydrodynamics of Site 168 and Site 171 (for island creation) indicated significant localized  
26 increases in current velocities and turbulence associated with island configurations. Although  
27 the effects would be less significant for a configuration that does not -emerge from the water  
28 surface, some localized effects are expected for Site 171 as a submerged island option. Similar  
29 effects would be expected at Man-O-War Shoals. [Hydrodynamic modeling of the island options  
30 is ongoing and is expected to provide some information that can be use to help assess the  
31 significance of potential turbulence increases as a result of continued use of Man-O-War Shoals.  
32 The concern is that increases in turbulence could cause pPotential adverse effects on  
33 maneuverability and could necessitate modifications to operating procedures such as reduced  
34 speeds, thereby increasing transit times and operating costs. Extreme effects on maneuverability  
35 could increase the risk to marine safety (e.g., groundings), concurrently increasing the potential  
36 of environmental consequences such as pollution from spills.  
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1 **Smith Island**  
2

3 Smith Island is a low-lying complex of islands with an area of almost 8,000 acres. It is part of a string of  
4 marshy islands that separate Tangier Sound from the Chesapeake Bay. The average elevation of the  
5 island is 2 feet above mean sea level (MSL) and the maximum elevation is about 5 feet above mean sea  
6 level. Smith Island has few upland areas. The communities of Ewell, Tylerton, and Rhodes Point, as well  
7 as several isolated hammocks, dunes and former dredged material disposal areas provide the only high  
8 ground. The range of tide is about 1.6 feet. The northern half of the island is owned by the U.S. Fish and  
9 Wildlife Service (USFWS) and managed as the Martin Wildlife Refuge. Big Thorofare Channel  
10 separates the refuge from the settled areas of Smith Island and is the most important water access to  
11 Ewell. Each of the three communities has a work boat basin, dredged or constructed by the Corps of  
12 Engineers, and each harbor is fringed by rows of wooden work buildings or "crab shanties."  
13

14 Smith Island is exposed to a long open-water fetch from the west, southwest, and northwest. The western  
15 shore of the island is 30 miles from the Virginia shoreline. Because of its exposed position, the entire  
16 island is subject to erosion and flooding. Although it once supported wooded areas, agricultural fields,  
17 and pastures, the island is currently a complex of salt marsh islands separated primarily by narrow tidal  
18 creeks and shallow water areas. Vulnerability to the effects of erosion, flooding, and storms constitute an  
19 obvious problem for the three towns on the island, however, important natural resources are also  
20 threatened.  
21

22 Rhodes Point is the most vulnerable to impending damage from wave energy and erosion. The location  
23 of the island's only boat repair facility, at the southern end of Marsh Road, bears the original name of the  
24 community: Rogue's Point. The community has a Methodist Church, post office, and a Community  
25 Building that houses the Senior Citizens Center.  
26

27 Since 1849, there has been a significant amount of perimeter erosion along the western shore and from the  
28 northeast corner of the island, reflecting exposure to the maximum fetch. The continual loss of land on  
29 Smith Island is attributable to current, near-term and eventual damage scenarios on Smith Island. The  
30 towns of Rhodes Point and Tylerton are currently suffering the economic cost of continual erosion. These  
31 islanders face shoaling delays weekly, damages to their boats sporadically, and increased road, sewer,  
32 dock, ramp, and bulkhead maintenance costs annually. If current conditions persist without any relief,  
33 there is an imminent danger that the continual shoreline erosion on portions of Rhodes Point and Tylerton  
34 will result in major infrastructure damages to the roads, sewer pipes, water pipes, docks, ramps, houses,  
35 and marinas in these two towns. It is estimated that these major infrastructure costs could be incurred by  
36 year five in the current analysis. It is also possible that these major infrastructure damages are imminent,  
37 given the particular vulnerability to storm damage that the continual erosion has created. Whenever  
38 these major infrastructure damages do occur, many of the 288 structures on the island, the sewer pump  
39 station, and roads and utilities would be in immediate danger of tidal or storm flooding.  
40

41 A June 1981 report by the Corps of Engineers stated that by the year 2000, the erosion along Hog Neck  
42 would lead to a situation which would "allow waves to pass over or through the barrier islands more  
43 frequently." The report also said that some sort of protection would be provided to Hog Neck and the  
44 shoreline of Rhodes Point. Some protection has indeed been constructed along Hog Neck by the Corps in  
45 the form of geotextile tube placement and backfill. The shoreline of Rhodes Point itself has not yet been  
46 protected with new bulkheading or similar construction.  
47

48 A preliminary estimate of potential dredged material capacity for wetland restoration at the Barren Island  
49 site is up to a maximum of 300,000 cubic yards with some containment supplied by geotextile tubes, as  
50 the Corps has done in the past. This option would provide for about 30 acres of wetlands restoration.  
51 Placement costs are expected to be about \$3.5 million, including transportation of the dredged material a

52 distance of about 80 miles from the channels that are being dredged. Unit cost for this option is about  
53 \$12.00 per cubic yard. However, the Corps has experienced mixed success with the implementation of  
54 geotextile tube structures particularly in their implementation at Smith Island. Given the potential severe  
55 wave climate at Smith Island and the degree of silts that will be placed there, an armored solution is more  
56 appropriate. Replacing the geotextile containment with a low stone sill would likely raise the cost of the  
57 restoration an additional \$3 million, thereby increasing the unit cost to \$22 per cubic yard.

58  
59 Conceptually, a larger-scale project could be developed that would replicate the 1849 shoreline along the  
60 Hog Neck peninsula (about 300 acres). Such a project would likely be constructed entirely at an upland  
61 elevation (+10 ft MLLW) to protect Rhodes Point and the island's wetlands. Such a project would likely  
62 hold in excess of 8 million cubic yards of dredged material. Expected cost would be about \$100 million,  
63 or roughly \$13 per cubic yard.

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## Chesapeake & Delaware Canal Upland Placement Areas

Approximately 8,853 acres adjacent to the Chesapeake and Delaware Canal are Federally owned. Approximately 6,551 acres have been used for dredged material placement, of which 1,125 acres have been filled and 5,426 are still active. There are nineteen upland placement sites that have been actively used by Philadelphia District in the last 28 years for maintenance dredging of the Chesapeake and Delaware Canal and Northern Approach channels between Station 0+000 at the Delaware River and Station 160+000 located at the Sassafras River. As of December 1994 these sites had an existing diked capacity of approximately 28 million cubic yards. It was also estimated that with dike raisings to a height of 50 feet, these sites have a maximum design capacity of approximately 104 million cubic yards. Maximum design capacity is the remaining (dry) capacity (excluding the volume placed before November 1994) up to an ultimate fill elevation of 50 feet. Maximum design capacities are estimated values based on repeated dike raisings; the actual values may be more or less depending on field conditions. Of the nineteen currently utilized upland placement sites, all but Pearce Creek have perimeter dikes that are sparsely to densely vegetated and several areas have prolific vegetation. Areas no longer used for placement purposes are leased to the states of Maryland and Delaware and managed as wildlife refuges, recreational hunting grounds, and baseball fields. Through the use of digested sewage sludge, abandoned and barren placement areas have been revegetated with a dense cover of perennial grasses such as red fescue and Kentucky blue grass. Eventual plant succession and the establishment of shrubs and trees such as white pine, dogwood, and Norway spruce has increased the habitat diversity of these areas and provide cover and food for wildlife. A ten-year monitoring program commenced in 1987 to evaluate the environmental impacts of the planting. Some diked placement areas contain wetlands that are vegetated primarily with pondweed, cattail, Phragmites, and duckweed.

Although these upland sites are reserved by the Federal government for placement, all of the capacity at each site may not be available for use in the future. Constraints exist at some of the sites that would preclude use of all of the maximum design capacity such as construction limitations, environmental conditions, or existing and currently proposed recreational use, and/or impacts from other projects. The real estate instruments as described in the 1974 Master Plan for such use reserve the rights of the Corps to terminate the recreational use if the sites are needed for project purposes. Five million five hundred and sixty thousand cubic yards of capacity at the Reedy Point North and South placement areas have been identified for placement of dredged material from the Delaware River from year 1997 to the year 2005. In addition, approximately 1 million cubic yards of capacity at Reedy Point South was used for placement of dredged material from the Salem River in 1995. All or parts of six placement areas (Penn Central west, Summit East, Upper Summit, Lower Summit, Bethel, Goose Point) were amended with sewage sludge and lime during a study conducted with the States of Maryland and Delaware to produce more vegetation and reduce erosion on these sites.

Once barren landscape was transformed into meadows with a dense cover of grasses such as red fescue, tall fescue, Kentucky blue, and weeping love. A ten-year monitoring program was commenced in 1987 to monitor heavy metal concentrations in the vegetation, surface water, and the groundwater. Soil sampling, groundwater monitoring, and surface water sampling are conducted on a regular basis by the Maryland Department of Natural Resources and the

Delaware Department of Natural Resources and Environmental Control. Monitoring, thus far, has indicated no problems concerning ground water contamination, pH levels, and surface water contamination. If in the future the full capacity of these sites were to be used, the sludge must be scraped off and disposed of or sold as fertilizer.

The Upper Summit and Penn Central West placement areas are currently used or are proposed for use as recreation areas (Dog Pond in Upper Summit and proposed baseball field in Penn Central West). The Long Creek site is heavily forested and is used as wildlife conservation and hunting areas through lease easements with the State of Maryland. This site would be difficult to use unless costly construction preparation measures were taken (heavy grubbing, sluice repairs, recreation relocation or protection, etc.). Because of this "restricted capacity", the total ultimate usable capacity at a 50-foot dike height for the remaining sites is approximately 109 million cubic yards (Table 18).

Based upon the average annual maintenance quantities, there will be adequate capacity at these placement sites along the Chesapeake and Delaware Canal land-cut for maintenance dredging needs for the next 50 years. The Courthouse Point and Pearce Creek placement sites, located along the Northern Approach Channel, will not have adequate capacity to meet maintenance dredging placement needs from that channel for the 50-year period.

Material dredged during maintenance operations in the C&D Canal is placed in existing Federal upland sites along the Canal. Capacity of these sites is adequate and the Federal government anticipates continued use of these sites. However, in recent years there have been some problems obtaining water quality certificates for the Courthouse Point and Pearce Creek placement areas near the Elk River due to groundwater issues. Approval has been granted to continue using Courthouse Point, but the Corps will not be given a water quality certificate for Pearce Creek until the issue is resolved.

Biddles Point. Biddles Point is located in Delaware in along the C&D Canal. This upland site is approximately 273 acres in size and used periodically for the placement of maintenance dredged material from Reach 1. Some dike construction and earthwork would be required before this site is ready to receive material. New dike slopes would be approximately 10 feet high with a 10-foot wide crest and 3 horizontal to 1 vertical side slopes. Baffle dikes would be constructed as necessary to ensure proper slurry residence time in order for the dredged material to settle out of suspension adequately before discharge out of a regulated sluice. The most abundant cover type is phragmites, covering both upland and wetland portions (about 42% of the site). Phragmites, although a native species, is generally considered a pest species due to its invasive growth habit and low wildlife value as food.

Woody vegetation is the second most common cover type (20%) comprised mostly of sapling trees (i.e. box elder, mulberry, red maple, sycamore, and silver maple) and a dense shrub layer (i.e. multiflora rose, Russian olive, tartarian honeysuckle, and blackberry). About 10% of the site is meadow. There are no species of concern reported for this site by the Delaware Natural Heritage Inventory. However, many gray birch saplings were found in the sapling/shrub cover type (21%) and future placement operations should be designed to avoid this area. The remaining cover types (7%) include groundcover species and bare soil. Wildlife observed on the

site were typical of early successional shrubland and pioneer woodland. Wildlife value is considered low for this site.

St. Georges. St. Georges is located in Delaware along the C&D Canal. This upland site is approximately 134 acres in size and is used periodically for the placement of maintenance dredged material from the C&D Canal. Some dike construction and earthwork would be needed to prepare the site to receive material. In addition to perimeter dikes, it would be necessary to construct dikes to separate the dredged slurry from the bridge abutments for the new St. Georges high level bridge, which now crosses the existing placement area. New dikes would be approximately 10 feet high with a 10-foot wide crest and 3 to 1 side slopes. Baffle dikes would be constructed, as necessary, to ensure proper slurry residence time in order for the dredged material to settle out of suspension adequately before discharge out of a regulated sluice.

Although 134 acres are diked, the total possible area is an irregularly shaped 200 acres site with several low-lying woodlands in drainage swales north of the dike. The only wetland areas are found outside the diked area to the north and east. Jewelweed, a smartweed, phragmites, and various grasses and sedges dominate vegetation. The largest single cover type within the dike is cultivated field (mowed grass), about 34% of the site. The most abundant natural cover is pole-sized pioneer woodland dominated by black locust and staghorn sumac (35%). A dense shrub layer of multiflora rose, tartarian honeysuckle, arrowwood, and blackberry provides 80-100% cover. The Delaware Natural Heritage Inventory has not yet evaluated this site and therefore, did not report any species of concern. This site is largely field and early successional forest of low structural complexity. The habitat supports a low diversity of wildlife species and wildlife value of the site is considered low.

Goose Point. Most of the Goose Point site is located in Delaware with about 500 feet of the western end situated across the Maryland border. This diked upland area is approximately 92 acres in size but actually measures 169 acres based on aerial photography. It is used periodically for the placement of maintenance dredged material from the C&D Canal. Some dike construction and earthwork would be necessary in order to prepare the site to receive dredged material. New dikes would be approximately 10 feet high with a 10-foot wide crest and 3 to 1 side slopes. Baffle dikes would be constructed, as necessary, to ensure proper slurry residence time in order for the dredged material to settle out of suspension adequately before discharge out of a regulated sluice.

The site slopes sharply down to the north, east, and west. The lowest portions of the site have standing water. A low berm runs longitudinally through much of the center of the site separating most of the uplands from the wetlands and ponds. Wetlands make up 33% of the site with 3 separate ponds (6% of the site). Mallards, green heron, muskrat, and frogs were observed using the westernmost pond. The pond is surrounded by several acres of marsh containing woolgrass and beggar-ticks, broad-leaved cattail, and common three-square. Shallow (1-3 inches) water areas within the marsh contain square-stem spikerush and small spikerush with soft-stem bulrush and fall panic grass. The vegetation around the eastern pond is more of a wet meadow with a mixture of small stands of phragmites and woolgrass, with tick-seed sunflower, purple loosestrife, smartweeds, and soft rush.

The most extensive wetland cover type is phragmites (13% of the site). The largest stands of this plant occur in the north and western half of the site. Uplands on the site are dominated by grassland (41% of the site). The dominant species are tall fescue and nodding foxtail grass with common ragweed, lespedeza, broomsedge, weeping love grass, small white aster, goosefoot, horseweed, wild lettuce, barnyard grass, smartweed, and pokeweed. The second most abundant upland type is bare ground (14% of the site). There are three large areas of bare ground, plus some small isolated spots. These areas are devoid of vegetation except for an occasional clump of grass. The Delaware Natural Heritage Inventory lists two species of concern for this site: gray birch was reported for the southwestern portion but was not found in any of the site. The other species is weakstalk bulrush, which was reported and located in the wetlands on the eastern side of the site. Increasing the height of the low longitudinal berm and avoiding any impact to hydrological sources should protect the existing wetlands. The large area of freshwater marsh surrounding scattered ponds forms a good interspersion of cover types, plus the extensive area of grassland and meadow give this area a moderate to high potential for wildlife use.

Summit East. Summit East is located in Delaware along the C&D Canal. This upland site is approximately 110 acres in size with approximately 88 acres of mature woodland. Like the previously mentioned sites, dike construction and earthwork would be necessary to prepare this site for dredged material. Dike design would be similar to that described for the previous 3 sites. As this site has not been used for placement for some time, it would be necessary to clear and grub some trees and stumps that exist within the diked area.

There are no wetlands or open water areas on the site. The majority of the site (56%) is woodland dominated by loblolly pine. Other occasional overstory species include red maple, black locust, black cherry, pin oak, Virginia pine, willow oak, and black oak. Meadow, covering 9% of the site, exists as several small, loosely connected stands along the southern edge of the placement area, and opens into a larger stand in the southwest corner. Bare ground covers approximately 1% of the site and occurs primarily in the southern and western edges where vehicle traffic and dumping have kept the area open.

The site is comprised mostly of mature forest. The forest structure forms a 2 to 3 layer habitat which can support a greater diversity of species than the less complex structure of the habitats previously described. The overall potential wildlife use is therefore fairly high. Future use of this site for dredged material placement should minimize the impact to as much of the forest cover as possible.

Bethel. Bethel is approximately 350 acres in size, located in Maryland just east of Chesapeake City. Wetlands occur on 35% of the site and exist as a large block in the south central portion of the site and as a smaller area in the western end. The largest wetland cover and largest cover type on the entire site is a 65 acre stand of phragmites. A large area of permanent water exists in this area but only 3% of the site remains as standing water during the growing season with 32 acres of American lotus (9% of the site). The eastern end of the pond is consecutive narrow stands of floating seedbox, then common three-square, and then phragmites. The south pond edge is vegetated with duck potato, swamp rosemallow, and phragmites. The shallow water of the pond contains Eurasian watermilfoil.

The majority of uplands on the site fall into one of two types: maple-gum-hickory forest (75 acres) and bare ground-lespedeza (65 acres). The maple-gum-hickory forest occurs mostly as one large stand in the southeast corner of the placement area. Smaller stands occur along the northeast fringe of the site where the stand is actually part of a larger adjacent stand of woods, and as a small stand in the center of the site. The western end of the woodland is not as mature and dominated by tulip poplar. This portion showed evidence of past disturbance from off-road motorcycles.

Grassland types totaling 53 acres comprise most of the remaining uplands. Except for one large planted stand dominated almost entirely by tall fescue, switchgrass is the dominant grass species. The fescue stand along the north edge of the site covers approximately 8% of the site. There are no species of concern reported for this site by the Maryland Natural Heritage Program since they have not done any survey work on the area. However, American lotus (*Nelumbo lutea*) is currently listed as a rare and vulnerable species in Maryland. Large blocks of low value habitat such as phragmites and bare ground dominate the area. While habitat interspersion is fairly good with scattered stands of forest cover among the various bare ground/grass types, the overall habitat structure is poor. The large area of permanent water, however, somewhat increases the overall habitat value of the site. The overall wildlife value of the site is considered low.

Pearce Creek. Pearce Creek is located in Maryland along the northern approach channel to the C&D Canal. This upland area is approximately 240 acres in size and is used periodically for the placement of maintenance dredged material from the northern approach channel to the C&D Canal and occasional for material from the southern approach channel to the C&D Canal. Dike construction and earth work required would be similar to that described in the previous sites. The dominant plant species at this site is phragmites, covering nearly 80% of the site with scrub/shrub growth on the slopes of the dike. Some standing water was observed in the center of the site but is most likely seasonal. Pearce Creek has been used for dredged material placement in the recent past and thus, its vegetation is representative of a disturbed habitat with very low value and wildlife usage.

Courthouse Point. Courthouse Point is located in Maryland along the northern approach channels to the C&D Canal. This upland area is 170 acres in size and has been used recently for placement of maintenance dredged material from the northern approach channel to the C&D Canal. Dike construction and earth work would also be required for this site in a manner similar to that described above. The most extensive cover type is monotypic phragmites, covering most of the diked placement area with shrub/sapling growth along the fringes. Like Pearce Creek, habitat value and wildlife usage is low.

The following paragraphs provide discussions of both general and specific potential impacts associated with use of the existing Federal upland sites.

Groundwater. Impacts to groundwater quality can result from the placement of dredged material in confined upland areas if contaminated leachate reaches an underlying aquifer. This is generally more of a concern for new placement sites as the placement of fine-grained material acts as a groundwater protection blanket, effectively sealing the site as it consolidates. As successive lifts of material are placed into a site and dewatered, the ability of water to percolate

through the material and into the underlying aquifer is reduced. All sites being considered have been used in the past.

Surface Water Quality. Surface water quality impacts associated with the use of selected dredged material placement sites are limited to the discharge of effluent during a placement operation. A hydraulic dredge, hydraulic rehandler, or hopper dredging operation pumps a significant amount of water along with dredged material into a confined placement site. This water must be drained from the site so that the dredged material settles and consolidates. An efficiently drained placement site maximizes capacity and insures site stability at higher elevations.

Excess water drained from the selected sites will be released back into the C&D Canal or approach channels. This water typically contains suspended sediments, and has the potential to contain dissolved inorganic and organic constituents previously associated with the dredged sediments. Depending on the nature of this effluent, water quality in the vicinity of the placement site can temporarily be degraded during a placement operation. Potential impacts include elevated levels of turbidity, decreased dissolved oxygen concentrations, and increased concentrations of nutrients and other chemical constituents. These impacts would be similar to those discussed in relation to the water quality impacts from open water placement. The effluent discharged from a containment site is expected to have a much lower impact on water quality than the open water discharge of dredged material since the majority of suspended solids and chemical constituents would be retained in the containment site.

The concentration of suspended sediment in the effluent discharged from a placement site can be controlled through proper operation of the weir structure. The elevation of the weir can be raised to increase the time water remains in the site before being discharged. The water should remain within the placement site a sufficient amount of time to allow suspended sediments to settle out of the water column. Through monitoring of the effluent leaving the site, the weir can be appropriately adjusted to achieve the desired degree of settling. The effluent discharge from existing dredged material placement sites during placement operations is currently monitored and controlled to insure that it contains no more than the allowable suspended sediment limits.

With regard to potential impacts related to the chemical nature of the effluent discharged from placement sites, chemical testing is employed to identify problems prior to their occurrence. The standard elutriate test was developed by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to monitor the soluble release of contaminants into the water column during placement operations. This test provides a suitable analysis of contaminants that would be released into the water column during a dredging operation, and back into the water through discharge of effluent at the placement site.

Habitat. Environmental Resources, Inc. (1994) conducted an on-site assessment of habitat value of 13 existing or previously used upland placement areas. These include: Reedy Point North, Reedy Point South, Biddle's Point, St. Georges, Schoolhouse Road, Summit East, Goose Point, Bethel, Chesapeake City, and Emily Point. A combination of aerial photography and walk-overs were used to determine the types and percent cover of vegetation present, the presence or absence of standing water, the presence and extent of jurisdictional wetlands, general

topography, surface soil type, and wildlife use of the sites. This study was to assess the habitat complexity, determine acreage of cover types and to identify species that may be disturbed by changes likely to occur from placement operations.

The most common cover types were Phragmites (Phragmites australis) and a pioneer scrub tree community dominated by black locust (Robinia pseudoacacia). Phragmites is considered a pest species of low wildlife value and black locust is a short-lived, pioneer tree species of disturbed and low fertility sites. Reedy Point North and Reedy Point South were colonized mostly by Phragmites. Few of the sites contained any mature forest. Summit East and Emily Point were the only sites containing large areas of mature forest. Emily Point's forested area encompasses more than 100 acres in size and is of importance to declining populations of forest interior dwelling birds.

The majority of the wetland acreage was vegetated with dense stands of Phragmites. More than half the sites had permanent standing water. Most of the sites had low juxtaposition of cover types, with many of these cover types in large blocks. The Delaware City site contains large areas of both open water and Phragmites. The long irregular boundary between these two areas with much of the Phragmites ponded year-round and the dense stands of submerged aquatic vegetation (SAV) in the open water make this area of particular value to migratory waterfowl. The Delaware Division of Fish & Wildlife considers this area of highest wildlife value. The Upper and Lower Summit sites were also listed by the Division as areas of special concern due to their dog-training and dog-trial areas.

Wildlife. Common species of wildlife observed at nearly all the sites included white-tail deer (Odocoileus virginianus), Eastern cottontail (Sylvilagus floridanus), gray fox, (Urocyon cinereoargenteus), and raccoon (Procyon lotor). A variety of song bird species were also recorded, although the time of year of the study field work was not optimum for evaluating breeding bird use. Wild turkey (Meleagris gallopavo), a species reintroduced to Delaware and currently expanding its range, was observed at the Summit East and School House Road sites. Pheasant tracks (Pipilo erythrophthalmus) were observed at Reedy Point South. No animal species are listed as threatened or endangered.

Most of the wildlife recorded would, at least temporarily, be displaced from areas redeveloped for placement of dredged material. The adjacent cover types to the sites are either additional placement areas, woodland, or farm fields. Therefore, most of the wildlife would be able to move into adjacent areas as disturbance exceeded their threshold tolerance. Some, however, like the forest interior dwelling birds, would be permanently displaced, as their habitat would take 50-70 years to begin to recover. Also, any break in the contiguous forest would cause additional habitat to be negatively impacted outside the placement area boundaries. Reconfiguring the dike alignments to avoid wetlands, open water, and forests can reduce impacts to wildlife.

Ten of the sites had 1 or more state-listed species present. Some of these species had not been previously recorded for these locations. Grey birch (Betula chinensis), for example, was only listed by Delaware for the Goose Point site. While it was not observed at Goose Point during this study, it was found at 4 other sites: Summit East, School Road, Delaware City, and Biddles Point. Most of the species of concern were localized on a site or were otherwise within an area

that could easily be avoided in dike realignment. These include Diffuse rush (Juncus diffusissimus) at Goose Point. The weak stem bulrush (Scirpus validus) listed for Goose Point but observed at Chesapeake City and Lower Summit only. Curtis' threeon (Aristida dichotoma var. Curtissii) at Chesapeake City and Reedy Point South.

The 13 sites studied were ranked as to their habitat value, potential to minimize impacts, and opportunities for recovery in the following descending order:

- Emily Point
- Summit East
- Delaware City
- Upper Summit
- Goose Point
- School House Road
- Biddles Point
- St. Georges
- Lower Summit
- Bethel
- Chesapeake City
- Reedy Point South
- Reedy Point North

**Title:** Bethel Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the south bank of the C&D Canal, just east of Chesapeake City.

**Size:** 370 Acres diked.

**Existing Capacity:** Approximately 1 mcy.

**Potential Capacity:** Approximately 9.62 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site receives dredged material from dredging of the C&D Canal.

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal – Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Biddles Point Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, just east of the St. Georges Bridge.

**Size:** 300 Acres. 273 Acres diked.

**Existing Capacity:** Approximately 1.4 mcy.

**Potential Capacity:** Approximately 12.24 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Site requires repairs to western containment dikes to achieve existing capacity.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$/cy

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\* ) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Chesapeake City Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the south bank of the C&D Canal, just west of Chesapeake City.

**Size:** 230 acres. 196 Acres diked.

**Existing Capacity:** Approximately 3.3 mcy.

**Potential Capacity:** Approximately 9.16 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:**

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Courthouse Point Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the east side of the northern approach channel to the C&D Canal, in the vicinity of Courthouse Point.

**Size:** 170 Acres

**Existing Capacity:** Approximately 3.8 mcy.

**Potential Capacity:** Approximately 10.9 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 1998. The site is used every year to every other year for maintenance dredging of the northern approach channels to the C&D Canal. The site has recently received dredged material from maintenance dredging of the southern approach channels to the C&D Canal in lieu of the Pearce Creek placement area.

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater	X			
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Delaware City Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware  
The site is located on the north bank of the C&D Canal, southwest of Delaware City.

**Size:** 300 Acres. 364 Acres diked.

**Existing Capacity:** Approximately 4.0 mcy.

**Potential Capacity:** Approximately 21.65 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_ . The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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### **Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Emily Point Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the north bank of the C&D Canal, just west of Chesapeake City.

**Size:** 180 Acres. 60 Acres diked.

**Existing Capacity:** Approximately 0.33 mcy.

**Potential Capacity:** Approximately 2.22 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 1998. The site has been used to receive dredged material from dredging of the C&D Canal. Repairs necessary to the deteriorated spillways.

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Goose Point Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, east of Chesapeake City.

**Size:** 190 Acres. 161 Acres diked.

**Existing Capacity:** Approximately 4.5 mcy.

**Potential Capacity:** Approximately 4.5 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site receives dredged material from dredging of the C&D Canal. Sewage sludge was applied to the site to encourage vegetative growth.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) Presence (Feature present in or adjacent to site; therefore resource could be impacted), Potential (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), Unknown (No data available to predict presence or absence of feature and therefore potential impacts are unknown), N/A

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal – Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Lower Summit Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, just west of the Summit Bridge.

**Size:** 72 Acres diked.

**Existing Capacity:** Approximately 0 mcy.

**Potential Capacity:** Approximately 1.33 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site was closed in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Sewage sludge was applied to the site to encourage vegetative growth.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard: \$**

**Development & Implementation Costs:**

**COMMENTS:**

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 TITLE: Lower Summit DMCF

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 PROJECT TYPE: Upland Containment Facility

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Pearce Creek Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the east bank of the northern approach channel to the C&D Canal, between Arnold and Worton Points.

**Size:** 260 Acres

**Existing Capacity:** Approximately 4.7 mcy.

**Potential Capacity:** Approximately 15.25 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 1991. Local West View Shores community has complained about well water contamination.

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater	X			
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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### **Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal – Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final Feasibility Report and Environmental Impact Statement. August 1996.**

**USACE, Philadelphia District. 1998. Information Paper – Pearce Creek Disposal Area. November 24, 1998.**

**Title:** Penn Central Cutoff Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware  
The site is located on the north bank of the C&D Canal, east of the Conrail Railroad Bridge.

**Size:** 197 Acres diked.

**Existing Capacity:** Approximately 1.5 mcy.

**Potential Capacity:** Approximately 5.92 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

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TITLE: Penn Central Cutoff DMCF PROJECT TYPE: Upland Containment Facility

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands		X		
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Penn Central East Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, east of the Conrail Railroad Bridge.

**Size:** 215 acres. 136 Acres diked.

**Existing Capacity:** Approximately 1.4 mcy.

**Potential Capacity:** Approximately 6.4 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

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TITLE: Penn Central East DMCF PROJECT TYPE: Upland Containment Facility

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands		X		
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) Presence (Feature present in or adjacent to site; therefore resource could be impacted), Potential (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), Unknown (No data available to predict presence or absence of feature and therefore potential impacts are unknown), N/A

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Penn Central West Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, east of the Summit Bridge and west of the Conrail Railroad Bridge.

**Size:** 103 acres. 89 Acres diked.

**Existing Capacity:** Approximately 0.8 mcy.

**Potential Capacity:** Approximately 2.8 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Sewage sludge was applied to the site to encourage vegetative growth.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site. The site is currently used as a baseball recreational area.

**Costs:**

**Total Unit Costs Per Cubic Yard: \$**

**Development & Implementation Costs:**

**COMMENTS:**

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TITLE: Penn Central West DMCF PROJECT TYPE: Upland Containment Facility

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Reedy Point North Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, at the eastern end of the C&D Canal.

**Size:** 122 Acres diked.

**Existing Capacity:** Approximately 0.98 mcy.

**Potential Capacity:** Approximately 2.82 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site. The site is committed to taking material from the Delaware River deepening project.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

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 TITLE: Reedy Point North DMCF  
 Facility

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 PROJECT TYPE: Upland Containment

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to

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predict presence or absence of feature and therefore potential impacts are unknown), N/A  
(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In  
either case, no impacts are projected).

**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Reedy Point South Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the south bank of the C&D Canal, at the eastern end of the C&D Canal.

**Size:** 133 Acres diked.

**Existing Capacity:** Approximately 0.64 mcy.

**Potential Capacity:** Approximately 3.32 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site. The site is committed to taking material from the Delaware River deepening project.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

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**TITLE:** Reedy Point South DMCF  
 Facility

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**PROJECT TYPE:** Upland Containment

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to

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predict presence or absence of feature and therefore potential impacts are unknown), N/A  
(Feature does not exist in or adjacent to the site or the feature is not applicable to site; In  
either case, no impacts are projected).

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**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Schoolhouse Road Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, east of the Conrail Railroad Bridge and east of the St. Georges Bridge.

**Size:** 160 Acres. 132 Acres diked.

**Existing Capacity:** Approximately 0.8 mcy.

**Potential Capacity:** Approximately 3.6 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_ . The site received dredged material from dredging of the C&D Canal.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

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TITLE: Schoolhouse Road DMCF PROJECT TYPE: Upland Containment Facility

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries				X
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** St. Georges Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, just west of the St. Georges Bridge.

**Size:** 155 Acres. 134 Acres diked.

**Existing Capacity:** Approximately 1.0 mcy.

**Potential Capacity:** Approximately 2.82 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Site requires repairs to containment dikes to achieve existing capacity.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard: \$**

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Summit East Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, just east of the Summit Bridge.

**Size:** 195 Acres diked.

**Existing Capacity:** Approximately 0 mcy.

**Potential Capacity:** Approximately 3.31 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site was closed in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Sewage sludge was applied to the site to encourage vegetative growth.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
<b>Potential for Benefit</b>			X	
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**Resources Used**

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**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Upper Summit Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** New Castle County, Delaware

The site is located on the north bank of the C&D Canal, just west of the Summit Bridge.

**Size:** 62 Acres diked.

**Existing Capacity:** Approximately 0.7 mcy.

**Potential Capacity:** Approximately 3.7 mcy.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 19\_\_\_. The site was closed in 19\_\_\_. The site received dredged material from dredging of the C&D Canal. Sewage sludge was applied to the site to encourage vegetative growth.

**Institutional Issues:** The State of Delaware has requested that only dredged material from the State of Delaware be placed in the site.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
<b>Mollusks</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands		X		
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A**

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**Resources Used**

**Brown, Christopher J. 1998. C&D Canal Disposal Area Inspection Report for FY 1998.**

**Environmental Resources, Inc. 1994. December 1994.**

**USACE, Philadelphia District. 1996. Chesapeake and Delaware (C&D) Canal –  
Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Final  
Feasibility Report and Environmental Impact Statement. August 1996.**

**Title:** Welch Point Dredged Material Containment Facility

**Type:** Upland Placement.

**Location:** Cecil County, Maryland

The site is located on the north bank of the C&D Canal, at the western end of the C&D Canal, at Welsh Point, between the C&D Canal and Elk River.

**Size:** 50 Acres

**Existing Capacity:** N/A.

**Potential Capacity:** N/A.

**Availability:** Owned by U.S. Government

**Nutrients:** [Need info]

**Infrastructure Required to Implement:** Last used in 1960s. The site previously received dredged material from new work dredging of the northern approach channels to the C&D Canal. The site was closed in 19\_\_ and is no longer receiving dredged material.

**Institutional Issues:**

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$

**Development & Implementation Costs:**

**COMMENTS:**

Existing Conditions	Presence	Potential	Unknown	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate				X
High Relief Area				X
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics				X
Tidal Fluctuations				X
Salinity Gradients				X
Sediment Quality				X
HTRS			X	
<b>Biological Characteristics</b>				
RTE-				X
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries				X
Designated Spawning Area-anadromous		X		
Larval Habitat Area-anadromous fish		X		
Crabs		X		
Mollusks				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area			X	
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands			X	
Non-tidal Wetlands			X	
<b>Human Use Characteristics</b>				
Groundwater			X	
Water Related Recreation				X
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs		X		
Recreationally important fisheries		X		
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas		X		
Cultural Resources		X		
Archaeological Resources		X		
Potential for Benefit			X	
Potential to Minimize Adverse Effects	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), N/A

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**Resources Used**

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**Title:**  
Tolchester West

**Type:**  
Island Creation

**Location:**  
Upper Bay in the vicinity of Gales Lumps. West of the northern part of the Tolchester Channel, in 10-16 feet of water.

**Size:**  
790-1060 acres

**Potential Capacity:**  
80 mcy

**Availability:**  
State owned

**Nutrients:** Minimum loadings:  
N- 3.6 lbs  
P- 0.08 lbs

**Infrastructure Required to Implement:**  
Dikes and receiving areas would have to be constructed. Some access channel construction may be necessary, depending on final configuration.

**Institutional Issues:**  
Permitting required for construction in open water.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.  
Site lies within the 5-mile radius of HMI

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$6.91 to 7.05

**Development & Implementation Costs:**

Construction: \$62-70 million  
Dredging and Transport: \$464 million

**COMMENTS:**

Moderate depth; good aquatic resource habitat  
Oyster bars in area but not within site  
Low density area for soft shell clam  
High density are for Blue crab in some seasons  
Good benthic diversity; area not considered stressed  
Important finfish harvest and recreational area

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE			X	
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area	X			
Crabs	X			
Mollusks				
Soft shell clams-Low Density		X		
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges	X			
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams		X		
Hard shell clams				X
Oyster bars				X
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>		X		
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

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**MPA. 1997. Prefeasibility Study for Upper Bay Island Placement Sites—Draft Consolidated Report. December.**

**Title:**  
Site 168

**Type:**  
Island Creation

**Location:**

Upper Bay, north of the intersection of Brewerton Chanel and Tolchester Channel.  
Depths range from 16- 28 feet

**Size:**

1075-1195 acres

**Potential Capacity:**

80 mcy

**Availability:**

State owned

**Nutrients:** Minimum loadings:  
N- 3.6 lbs  
P- 0.08 lbs

**Infrastructure Required to Implement:**

Dikes and receiving areas would have to be constructed.

**Institutional Issues:**

Permitting required for construction in open water.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.  
Site lies withi the 5-mile radius of HMI.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$8.37 to 8.54

**Development & Implementation Costs:**

Construction: \$184-199 million  
Dredging and Transport: \$459 million

**COMMENTS:**

Moderate to deep water; experiences summer anoxia  
Oyster bars in area but not within site; N.O.B. 2-9 fairly close.  
High density are for Blue crab in some seasons  
Poor benthic community; considered stressed  
Important finfish harvest area in winter

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE			X	
<b>Aquatic Organisms</b>				
Benthic Communities		X		
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area		X		
Crabs	X			
<b>Mollusks</b>				
Soft shell clams-Low Density				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars		X		
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>		X		
<b>Potential to Minimize Adverse Effects</b>	X			

(\*). **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**MPA. 1997. Prefeasibility Study for Upper Bay Island Placement Sites—Draft Consolidated Report. December.**

**Title:**  
Site 171 (Swan Point West)

**Type:**  
Island Creation

**Location:**  
Upper Bay, northwest of Swan Point Channel. Depths range from 24-32 feet

**Size:**  
975-1065 acres; island option  
3000 acres as a submerged option

**Potential Capacity:**  
80 mcy

**Availability:**  
State owned

**Nutrients:** Minimum loadings:  
Island: N- 3.6 lbs; P- 0.08 lbs  
Submerged: N-10.08; no P

**Infrastructure Required to Implement:**  
Dikes would have to be constructed for either option. Receiving areas would be required for emergent island.

**Institutional Issues:**  
Permitting required for construction in open water.  
Permitting issues related to impacts associated with the natural resources and local ordinances in the area.  
Site lies within the 5 mile radius of HMI (not pertinent for submerged option).

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$10.05 to 10.26 (emergent); \$7.17 submerged

**Development & Implementation Costs:**  
Emergent: Construction: \$307-320 million; Dredging and Transport: \$474 million  
Submerged: Construction: \$89 million; Dredging and Transport: \$272 million

**COMMENTS:**  
Deep water; experiences summer anoxia  
Significant Oyster bars in area; NOB 4-2 and NOB 5-1  
Poor Blue crab habitat  
Poor benthic community; considered stressed  
Important finfish harvest area in winter  
Submerged option has potential for significant beneficial use

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TITLE: Site 171

PROJECT TYPE: Island Creation

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality		X		
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE			X	
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area			X	
Crabs				X
<b>Mollusks</b>				
Soft shell clams-Low Density				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
<b>Avian Wildlife</b>				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars	X			
Crabs				X
Recreationally important fisheries	X			
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>	X			
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

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**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**MPA. 1997. Prefeasibility Study for Upper Bay Island Placement Sites—Draft Consolidated Report. December.**

**Title:**

Site 171 (Swan Point West)

**Type:**

Open Water

**Location:**

Upper Bay, northwest of Swan Point Channel. Depths range from 24-32 feet

**Size:**

3000 acres

**Potential Capacity:**

80

**Availability:**

State owned

**Nutrients:** Minimum loadings:

N-10.08; no P

**Infrastructure Required to Implement:**

None

**Institutional Issues:**

Permitting required for placement in open water.

Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

**Costs:**

**Total Unit Costs Per Cubic Yard:** \$3.41

**Development & Implementation Costs:**

Dredging and Transport: \$272 million

**COMMENTS:**

Deep water; experiences summer anoxia

Significant Oyster bars in area; NOB 4-2 and NOB 5-1

Poor Blue crab habitat

Poor benthic community; considered stressed

Important finfish harvest area in winter

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate	X			
High Relief Area		X		
Suspended Particulates, Turbidity	X			
Water Quality		X		
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS			X	
<b>Biological Characteristics</b>				
RTE			X	
<b>Aquatic Organisms</b>				
Benthic Communities				X
Fisheries	X			
Designated Spawning Area				X
Larval Habitat Area			X	
Crabs				X
Mollusks				
Soft shell clams-Low Density				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife				X
Avian Wildlife				
Waterfowl concentration area				X
Land and/or Waterbirds				X
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges				X
SAV				X
<b>Wetlands</b>				
Tidal Wetlands				X
Non-tidal Wetlands				X
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation		X		
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars	X			
Crabs				X
Recreationally important fisheries	X			
Commercially important fisheries		X		
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas				X
Forested Areas				X
Cultural Resources				X
Archaeological Resources				X
<b>Potential for Benefit</b>		X		
<b>Potential to Minimize Adverse Effects</b>		X		

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

### Resources Used

**Chesapeake Bay Program. 1996. High Value Living Resource Map of the Upper Bay. In a memo prepared for the Bay Enhancement Phase II Working Group.**

**Funderburk, S.L., S.J. Jordan, J.A. Mihursky and D. Riley. 1991. Habitat Requirements for Chesapeake Bay Living Resources. Second Edition. Chesapeake Bay Program**

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**US Fish and Wildlife Service. 1979. National Wetland Inventory Maps. Non-Tidal Wetlands Maps. Prepared by Office of Biological Services. Based on USGS 7.5 minute topographic quadrangle map series.**

**MPA. 1997. Prefeasibility Study for Upper Bay Island Placement Sites—Draft Consolidated Report. December.**

**Title:**

Pooles Island Area

**Type:**

Island Creation

**Location:**

Upper Bay adjacent or attached to Pooles Island.\

**Size:**

4A- 1300-1475 acres

4B- 825-1125 acres

4B-R- 680-780 acres

**Potential Capacity:**

4A, 4B-80 mcy

4B-R- 40 mcy

**Availability:**

Held by US Army; Aberdeen Proving Grounds

**Nutrients:** Minimum loadings:

4A, 4B: N- 3.6 lbs  
P- 0.08 lbs

4B-R: N- 1.8 lbs  
P- 0.04 lbs

**Infrastructure Required to Implement:**

Dikes and receiving areas would have to be constructed. Some access channel construction may be necessary, depending on final configuration.

**Institutional Issues:**

Permitting required for construction in open water.

Permitting issues related to impacts associated with the natural resources and local ordinances in the area.

Site lies within the 5-mile radius of HMI;

One configuration lies within APG restricted area;

UXO potential: NPL Site

**Costs:**

**Total Unit Costs Per Cubic Yard:**

4A: \$9.52 to 9.97

4B: \$8.28 to 8.93

4B-R: \$10.56-10.82

**Development & Implementation Costs:**

4A: Construction: \$283-316 million; Dredging and Transport: \$455 million

4B: Construction: \$165-213 million; Dredging and Transport: \$471 million

4B-R: Construction: \$173-186 million; Dredging and Transport: \$235 million

DRAFT

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COMMENTS:

Shallow water; good aquatic resource habitat

Low potential for soft shell clams; no oyster bars in area

Good benthic diversity; area not considered stressed

Important finfish harvest and recreational area

Important Finfish spawning and rearing area

Cultural and Historical Resource Issues for some configurations

RTE and Terrestrial resource issues for some configurations

Significant Henronry and other avian resources on Island

Waterfowl use area

DRAFT  
 TITLE: Pooles Island

DRAFT

DRAFT  
 PROJECT TYPE: Island Creation

DRAFT

DRAFT

Existing Conditions	Presence*	Potential*	Unknown*	N/A*
<b>Physical and Chemical Characteristics</b>				
Substrate		X		
High Relief Area	X			
Suspended Particulates, Turbidity	X			
Water Quality	X			
Hydrodynamics	X			
Tidal Fluctuations	X			
Salinity Gradients	X			
Sediment Quality	X			
HTRS	X			
<b>Biological Characteristics</b>				
RTE	X			
<b>Aquatic Organisms</b>				
Benthic Communities	X			
Fisheries	X			
Designated Spawning Area		X		
Larval Habitat Area	X			
Crabs	X			
Mollusks				
Soft shell clams-Low Density				X
Hard shell clams				X
Oyster bars				X
Terrestrial Wildlife	X			
<b>Avian Wildlife</b>				
Waterfowl concentration area	X			
Land and/or Waterbirds	X			
<b>Special Aquatic Sites</b>				
Sanctuaries and Refuges		X		
SAV		X		
<b>Wetlands</b>				
Tidal Wetlands	X			
Non-tidal Wetlands	X			
<b>Human Use Characteristics</b>				
Groundwater				X
Water Related Recreation	X			
<b>Recreational and Commercial Fisheries</b>				
Soft shell clams				X
Hard shell clams				X
Oyster bars				X
Crabs	X			
Recreationally important fisheries	X			
Commercially important fisheries	X			
<b>Aesthetics</b>				
Air Quality		X		
Noise		X		
Critical Areas	X			
Forested Areas	X			
Cultural Resources	X			
Archaeological Resources	X			
<b>Potential for Benefit</b>		X		
<b>Potential to Minimize Adverse Effects</b>	X			

(\*) **Presence** (Feature present in or adjacent to site; therefore resource could be impacted), **Potential** (Feature potentially present; complete documentation not available to verify presence therefore, there exists a potential for impacts), **Unknown** (No data available to predict presence or absence of feature and therefore potential impacts are unknown), **N/A** (Feature does not exist in or adjacent to the site or the feature is not applicable to site; In either case, no impacts are projected).

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**MPA. 1997. Prefeasibility Study for Upper Bay Island Placement Sites—Draft Consolidated Report. December.**

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ANNEX F

HYDRODYNAMICS

5.1.3 Hydrodynamics

F.1 EXISTING CONDITIONS

Hydrodynamics is a term used to describe the study of fluid motion and fluid interactions with boundaries. At Site 104, this includes ~~Site conditions germane to the hydrology/hydrodynamics of Site 104 include~~ average water depths, water levels, astronomical tides, storm surge, wind conditions, tidal currents, sedimentation, and wave conditions for the part of the Chesapeake Bay near Site 104. Each of these topics is discussed in the following sections.

F.1.1 Average Depths

~~5.1.3.a Average Depths.~~ Hydrographic data are those data that relate to the physical features of an area of water. ~~In the vicinity of Site 104, hydrographic data were obtained from National Oceanic and Atmospheric Administration (NOAA) charts 12263, 12273, and 12278. Hydrographic data within Site 104 were obtained from the U.S. Army Corps of Engineers, Baltimore District (CENAB) survey data collected in September 1997. Vertical data are referenced to mean lower low water (MLLW) based upon the 1960 to 1978 tidal epoch. Tides occur semi-diurnally in the Chesapeake Bay, which means that there are two high tides (or high waters) and two low tides (or low waters) each day. MLLW is the average height of the lower of the two low tides, and h~~ Horizontal data are referenced to the Maryland State Plane, North American Datum (NAD) 1983.

The bathymetry of the site is presented in Figure 2-1. ~~Water depths at Site 104 range from -12.8 m (-42.0 ft) MLLW to -23.8 m (-78.0 ft) MLLW. As stated in Section 5.1.2.a, t~~The slopes are very flat, with a range of 100:1 to flat. The typical slope where placement would occur in the site is about 100:1 to 400:1, in areas within Site 104 that are below -13.7 m (-45.0 ft) MLLW.

Over the northern portion of Site 104, the bottom depths range from -12.8 m (-42.0 ft) to -14.0 m (-46.0 ft) MLLW. From the northern end of the site, the bottom gently slopes downward towards the south. About halfway through the site, the downward slope increases, reaching a maximum depth of -23.8 m (-78.0 ft) MLLW at the southern boundary of the site.

The site slopes are steeper along the eastern edge, extending upward from -14.0 m (-46.0 ft) MLLW in the northern end and -23.8 m (-78.0 ft) MLLW in the southern end, to approximately -11.0 m (-36.0 ft) MLLW just east of the site. The bottom then continues to slope upwards towards the western shoreline of Kent Island.

F.1.2 Water Levels

~~5.1.3.b Water Levels.~~ Normal water level variations in the upper Bay are generally dominated by astronomical tides, although wind effects and freshwater discharge can be important

1 influences. Depending on direction and duration, wind can force water into or out of rivers and  
2 embayments, ~~subsequently thereby~~ causing a localized increase or decrease, respectively, of  
3 water level within the affected body of water. Relatively high occurrences of freshwater  
4 discharges from a river or stream can also locally raise water levels where it flows into the Bay.  
5 Extremely high water levels, on the other hand, are dictated by storm tides. A storm tide is a  
6 temporary rise in water level generated either by large-scale extra-tropical storms (nor'easters) or  
7 by hurricanes. The rise in water level results from wind action, the low pressure of the storm  
8 disturbance, and the Coriolis effect.

9  
10 Long-term rise in sea level began about 18,000 years ago to create the Chesapeake Bay. In 1984,  
11 the U.S. Army Corps of Engineers (USACE) reported that the rise in sea level was continuing at  
12 an average rate of about 0.001 to 0.002 m/yr (0.003 to 0.007 ft/yr) (USACE 1984). In 1987, the  
13 National Research Council (NRC) reported that sea level rise resulting from melting of the polar  
14 ice caps for the past century has been about 0.12 m (0.4 ft), resulting in a rise of approximately  
15 0.0012 m/yr (0.004 ft/yr) (NRC 1987).

16  
17 A recent hydrodynamics modeling study performed by Waterways Experiment Station (WES),  
18 for the proposed Delaware Bay deepening work, showed that an assumed sea level rise of 0.305  
19 m (1.0 ft) at the mouth of the Chesapeake Bay would result in an increase in water depth of about  
20 0.274 m (0.9 ft) at the Chesapeake Bay Bridge. Therefore, a rate of sea level rise in the oceans  
21 of 0.0012 m/yr (0.004 ft/yr) would equate to a potential water level rise at Site 104 of  
22 approximately 0.0011 m/yr (0.0036 ft/yr). At the time the model was run for the Delaware Bay  
23 deepening work, it had not yet been developed to include the Chesapeake and Delaware (C&D)  
24 Canal and therefore may not adequately represent a predicted change in sea level rise in the area  
25 of Site 104. A model of both the Chesapeake Bay and Delaware Bay that includes the C&D  
26 Canal and extends out onto the Atlantic continental shelf would have to be developed to  
27 adequately address sea level rise in these areas (WES 1998).

### 28 29 F.1.3 Astronomical Tides

30  
31 ~~5.1.3.e Astronomical Tides~~—As stated before, Astronomical tides (i.e., tides caused by the  
32 attractive forces of the sun and moon) in the Chesapeake Bay are semi-diurnal. For Site 104, the  
33 mean tide level is between 0.22 and 0.26 m (0.73 and 0.84 ft) above MLLW; the mean tidal  
34 range is between 0.30 and 0.37 m (0.99 and 1.16 ft); and the spring tidal range is between 0.45  
35 and 0.52 m (1.49 and 1.72 ft) (NOS 1996). Tidal datum characteristics for two locations in the  
36 upper Bay near Site 104 reported from the National Ocean Service (NOS) are presented in Table  
37 F-1. Matapeake is located on the western shore of Kent Island at latitude 38° 57.4' N and  
38 longitude 76° 21.3' W, approximately 3 km (2 miles) south of the site. Love Point is located on  
39 the northeastern shore of Kent Island at latitude 39° 1.9' N and longitude 76° 18.1' W,  
40 approximately 3 km (2 miles) east of the site. The difference in elevation between MLLW and  
41 the national geodetic vertical datum (NGVD) is approximately 0.35 ft. MLLW will serve as the  
42 datum for this project since it is the standard datum for nautical charts.

43  
44 Tide and current data were also obtained from an extensive survey conducted by the NOS in the  
45 1970s and 1980s (NOS 1988). The 1970s data were collected in a cooperative effort with  
46 USACE for use in the design of the physical model of the Bay. Two survey locations were in the

**Table 5F-1**

**Astronomical Tidal Datum Characteristics for Selected Chesapeake Bay Locations**

<b>Tidal Datum</b>	<b>Matapeake [ms (ft)]</b>	<b>Love Point [ms (ft)]</b>
Mean Higher High Water (MHHW)	0.45 (1.49)	0.52 (1.72)
Mean High Water (MHW)	0.37 (1.22)	0.43 (1.42)
Mean Tide Level (MTL)	0.22 (0.73)	0.26 (0.84)
National Geodetic Vertical Datum (NGVD)	0.11 (0.35)	0.11 (0.35)
Mean Low Water (MLW)	0.07 (0.23)	0.08 (0.26)
Mean Lower Low Water (MLLW)	0.00 (0.00)	0.00 (0.00)

1 vicinity of Site 104. The first was at Matapeake; tidal harmonic constants for tidal amplitude and  
2 phase were developed for this location. The second location was within the boundaries of Site  
3 104 (Station No. 175 in the survey at latitude 39° 0.2' N and longitude 76° 20.9' W); tidal  
4 harmonic constants for tidal currents (speed, direction, and phase) were developed for this  
5 station. Table 5F-2 presents the tidal harmonic constants from these two locations. ~~This~~ These  
6 ~~data was~~ were used to generate tidal current velocity characteristics for modeling of the fate and  
7 transport of placed dredged material (~~Section 6.1.3~~). Figures 5F-1 and 5F-2 present the predicted  
8 tidal heights for 1 year and for 30 days, respectively, based upon the harmonic constants shown  
9 in Table 5F-2. These figures show that maximum amplitude above and below mean tide level is  
10 almost 0.3 m (1.0 ft), compared to the spring tidal range of about 0.5 m (1.6 ft).

#### 11 F.1.4 Storm Surge

12 ~~5.1.3.d Storm Surge~~—Extreme water levels are dominated by storm effects (i.e., storm surge and  
13 wave setup) in combination with astronomical tide. Wave setup describes the rise in water level  
14 due to wave breaking. Specifically, it refers to change in momentum that attends the breaking of  
15 waves propagating towards shore resulting in a surf zone force, which raises water levels at the  
16 shoreline.  
17  
18  
19

20 A comprehensive evaluation of storm-induced water levels for several Chesapeake Bay locations  
21 has been conducted by the Virginia Institute of Marine Science (1978) as part of the Federal  
22 Flood Insurance Program. Results of this study are summarized in Table 5F-3 and shown as  
23 water-level versus frequency curves ~~presented~~ in Figure 5F-3. The table provides water levels in  
24 meters above MLLW (NGVD) for various return periods. A return period is a statistical  
25 probability of occurrence for a given event (e.g., a 5-year return period has a 20 percent chance  
26 of occurring, a 50-year return period has a 2 percent chance of occurring, and a 100-year return  
27 period has a 1 percent chance of occurring at any given time). Data in Table 5F-3 and Figure 5F-  
28 3, for stations closest to Site 104, indicate that the storm tide elevation for a 10-year return period  
29 is 1.2 m (4.1 ft) MLLW and the 100-year water level for the project area is 2.3 m (7.7 ft)  
30 MLLW.  
31

#### 32 F.1.5 Wind Conditions

33 ~~5.1.3.e Wind Conditions~~—Wind data from the NOAA, National Climatic Data Center (NOS  
34 1982) for Baltimore-Washington International (BWI) Airport, were used to estimate wind  
35 conditions at the project site (Table 5F-4). Data are presented as fastest mile winds, ~~that~~ which  
36 are defined as the highest recorded wind speeds that last long enough to travel 1 mile, during a  
37 24 hour recording period (NOS 1982). ~~These~~ winds were used to develop wind speed—return  
38 period relationships based upon a Type I (Gumbel) statistical distribution. The specific return  
39 periods examined were 5, 10, 15, 20, 25, 30, 35, 40, 50, and 100 years.  
40  
41

42 Table 5F-5 shows that the wind speeds for a 5-year return period storm range from 14 m/s (32  
43 mph) for winds from the east direction to 24 m/s (54 mph) for winds from the northwest  
44 direction. The wind speeds for a 100-year return period storm range from 29 m/s (65 mph) for  
45 winds from the east direction to 43 m/s (97 mph) for winds from the southwest direction. These  
46 wind speeds were used to estimate storm wave conditions for Site 104 (Section ~~5.1.3.h~~ 8).

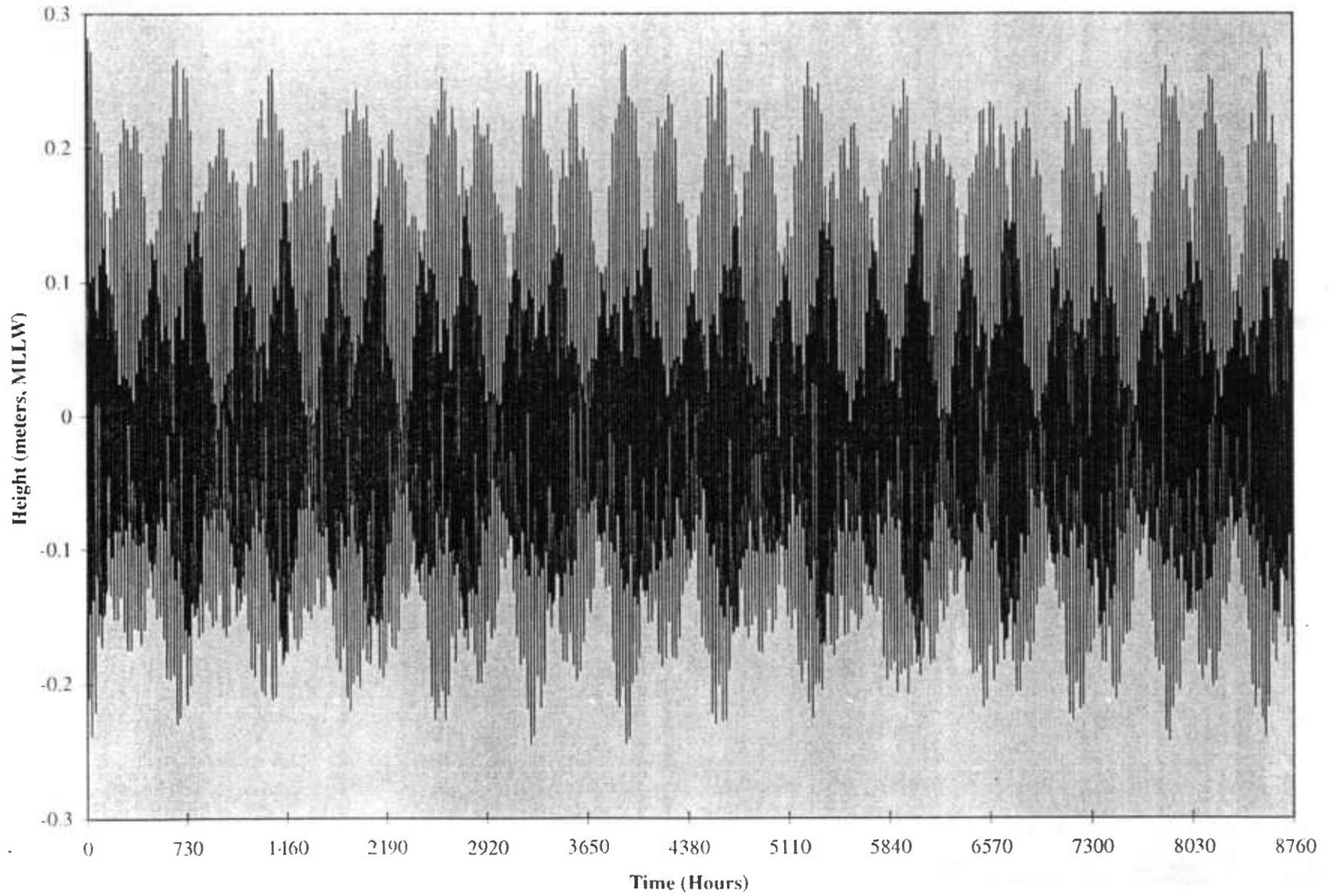
**Table 5F-2**  
**Astronomical Tidal Harmonic Constants**

Constituent	Speed (degrees/ hr)	Amplitude (m)	Epoch (degrees)	Major Direction Speed (cm/s)	Epoch (degrees)	Minor Direction Speed (cm/s)	Epoch (degrees)
<b>M2</b>	28.9841	0.14	146.8	36.8	154	0.7	154
<b>S2</b>	30	0.02	169.1	4.2	184	0.4	184
<b>N2</b>	28.43973	0.03	126.4	5.8	126	1.7	126
<b>K1</b>	15.04107	0.06	276.2	15.9	216	0.3	216
<b>O1</b>	13.94304	0.05	288.8	7.2	230	0.2	230

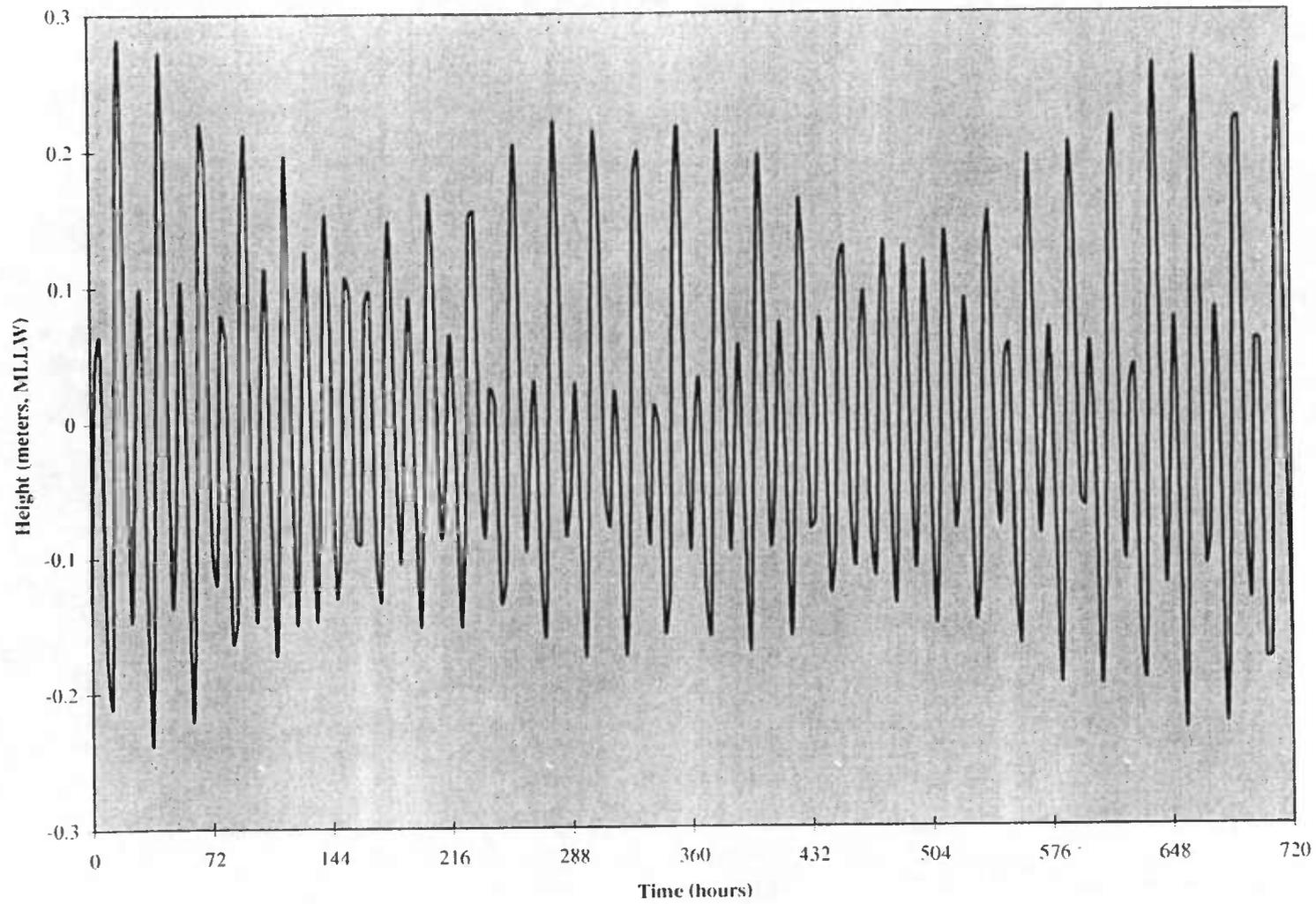
Where: M2 = principal lunar, S2 = principal solar, N2 = larger lunar elliptic, K1 = luni-solar diurnal, and O1 = principal lunar diurnal.

**Table 5F-3**  
**Water Level Elevation per Return Period**

Return Period (years)	Water Level [m (ft) MLLW]
5	1.2 (4.0)
10	1.2 (4.1)
15	1.3 (4.2)
20	1.4 (4.5)
25	1.5 (5.0)
30	1.6 (5.3)
35	1.7 (5.6)
40	1.9 (6.1)
50	2.0 (6.7)
100	2.3 (7.7)



**Figure 5F-1. Predicted Astronomical Tidal Amplitude for One Year.**



**Figure 5F-2. Predicted Astronomical Tidal Amplitude for 30 Days.**

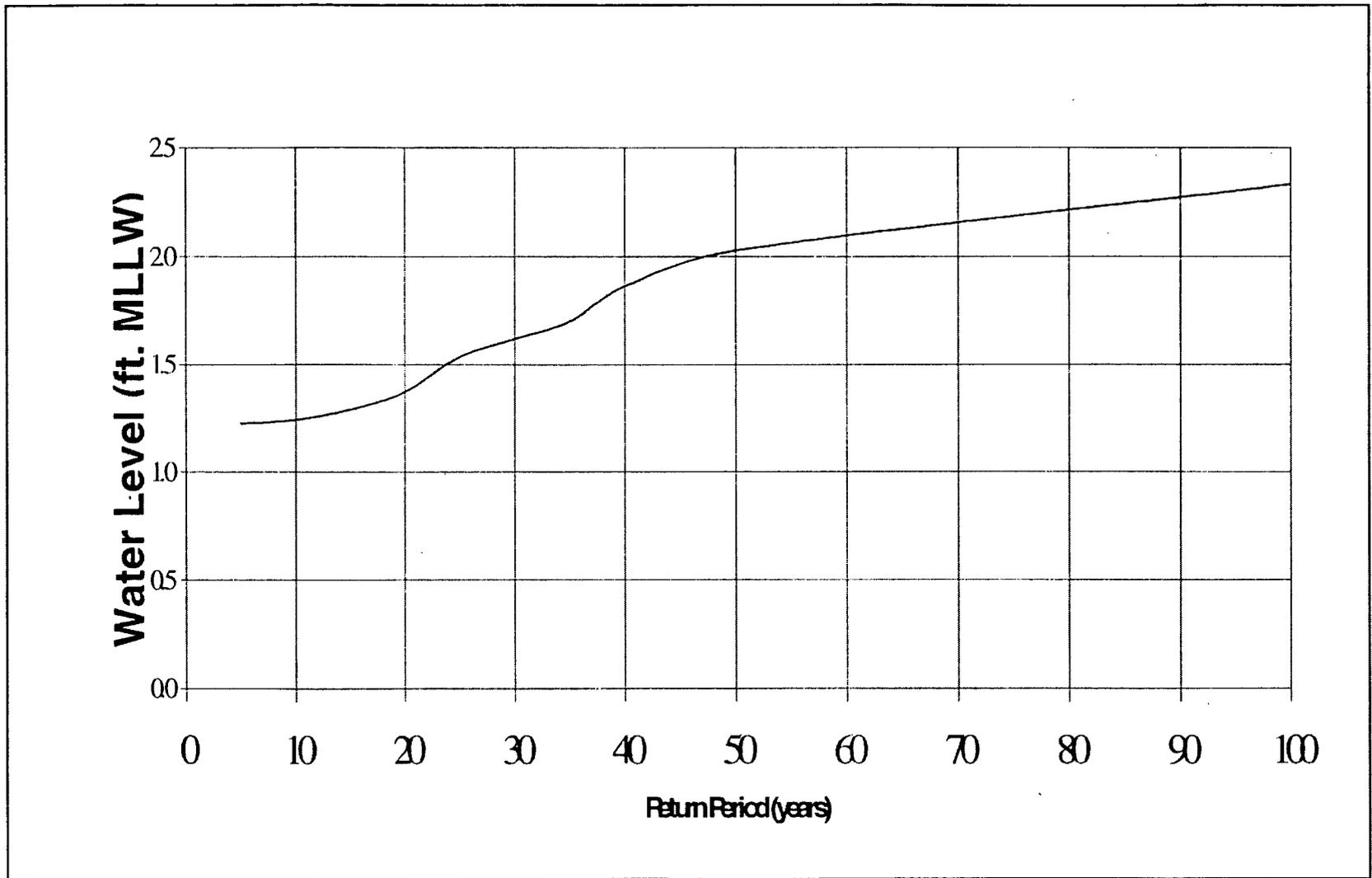


Figure 5F-3. Storm Water Levels (ft, MLLW) for the Site 104 Study Area.

Table 5F-4

Annual Extreme Wind Speed Per Direction for Baltimore-Washington International  
(BWI) Airport, 1951-1982 Fastest Mile Wind Speed

Year	N		NE		E		SE		S		SW		W		NW	
Year	North		Northeast				East				Southeast					
	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph
1951	11	24	18	41	12	27	15	34	17	39	13	29	19	42	21	46
1952	30	66	11	25	21	47	30	66	18	41	30	66	21	46	19	43
1953	9	20	13	28	10	22	12	27	15	34	17	39	21	47	19	43
1954	14	31	12	27	10	22	27	60	13	28	17	39	25	57	20	44
1955	9	21	19	43	13	29	13	28	19	43	24	53	18	40	19	43
1956	13	29	15	34	11	25	11	24	13	28	15	34	25	56	18	40
1957	13	29	24	53	16	35	15	33	15	33	13	30	21	46	21	46
1958	13	30	23	52	11	25	15	33	17	37	19	43	18	40	19	43
1959	13	28	12	26	9	20	12	27	10	23	17	38	21	46	19	43
1960	12	26	17	38	13	28	12	27	11	25	16	35	18	40	24	53
1961	20	45	13	28	13	28	13	29	11	24	31	70	18	41	24	54
1962	25	56	18	41	13	28	8	17	11	25	16	36	19	42	27	61
1963	17	38	14	32	8	18	15	34	11	25	13	28	20	44	27	60
1964	15	34	14	31	10	23	11	24	21	47	10	23	21	48	27	61
1965	16	36	12	26	13	28	15	34	16	36	24	54	20	44	20	44
1966	14	32	11	25	13	29	11	24	21	47	19	43	22	50	21	48
1967	13	30	13	29	11	25	17	39	12	27	21	46	24	53	19	43
1968	20	45	13	30	16	36	12	26	8	19	20	45	21	48	22	50
1969	13	28	9	21	9	20	15	34	12	26	20	45	20	45	24	53
1970	13	28	13	28	8	18	9	21	17	39	15	34	21	48	27	60
1971	14	31	20	45	12	26	8	18	9	21	18	41	17	39	26	58
1972	13	28	11	25	16	35	12	26	9	20	18	41	18	41	18	41
1973	18	40	12	26	12	26	17	38	12	26	16	35	22	49	15	33
1974	14	32	10	23	21	46	13	29	15	33	15	33	20	45	18	41
1975	18	40	12	26	9	21	11	24	11	25	17	38	24	54	20	45
1976	14	31	8	18	9	20	13	28	14	32	13	28	20	45	24	54
1977	14	32	14	31	8	19	13	28	12	26	11	25	22	49	21	48
1978	17	39	13	28	16	36	13	28	8	19	23	52	15	33	20	45
1979	14	32	11	25	12	27	16	36	14	32	14	32	20	45	21	47
1980	15	33	12	27	8	18	14	32	9	20	14	32	20	45	22	50
1981	11	24	11	24	8	19	12	26	10	23	13	28	18	41	19	42
1982	14	31	9	20	10	23	10	23	13	29	15	34	18	40	21	48

Note: Data adjusted to 10 m height as per the methodology in the USACE Shore Protection Manual, 1984.

1  
2 **F.1.6 Tidal Currents**  
3

4 ~~5.1.3.f Tidal Currents~~—Vertical water movement associated with the rise and fall of the tide  
5 creates horizontal water movement called tidal currents. Tidal currents in the upper Chesapeake  
6 Bay are moderate to weak with an average maximum velocity of about 0.6 meters (~~m/s~~) per  
7 second (~~m/s~~) ([2 ft per second (ft/s)], NOS 1996). The Horn Point Environmental Laboratory  
8 (HPEL) of the University of Maryland, Center for Environmental Sciences (UMCES) conducted  
9 current velocity measurements for Site 104 using an Acoustic Doppler Current Profiler (ADCP),  
10 which was surveyed for one complete tidal cycle (about 13 hours) on ~~28 July 28, 1997~~ [UMCES  
11 1997 (see Appendix F)]. Maximum ebb velocities were measured on the order of 0.45 to 0.6 m/s  
12 (1.5 to 2 ft/s), while maximum flood velocities were measured to be on the order of 0.3 to 0.45  
13 m/s (1 to 1.5 ft/s). Velocity vector plots for peak ebb and peak flood are shown in Figures ~~5F-4~~  
14 and ~~5F-5~~, respectively (Moffatt and Nichol Engineers [M&N]; 1998). These velocity  
15 measurements are similar to those reported in NOS (1996) for historic average conditions.  
16

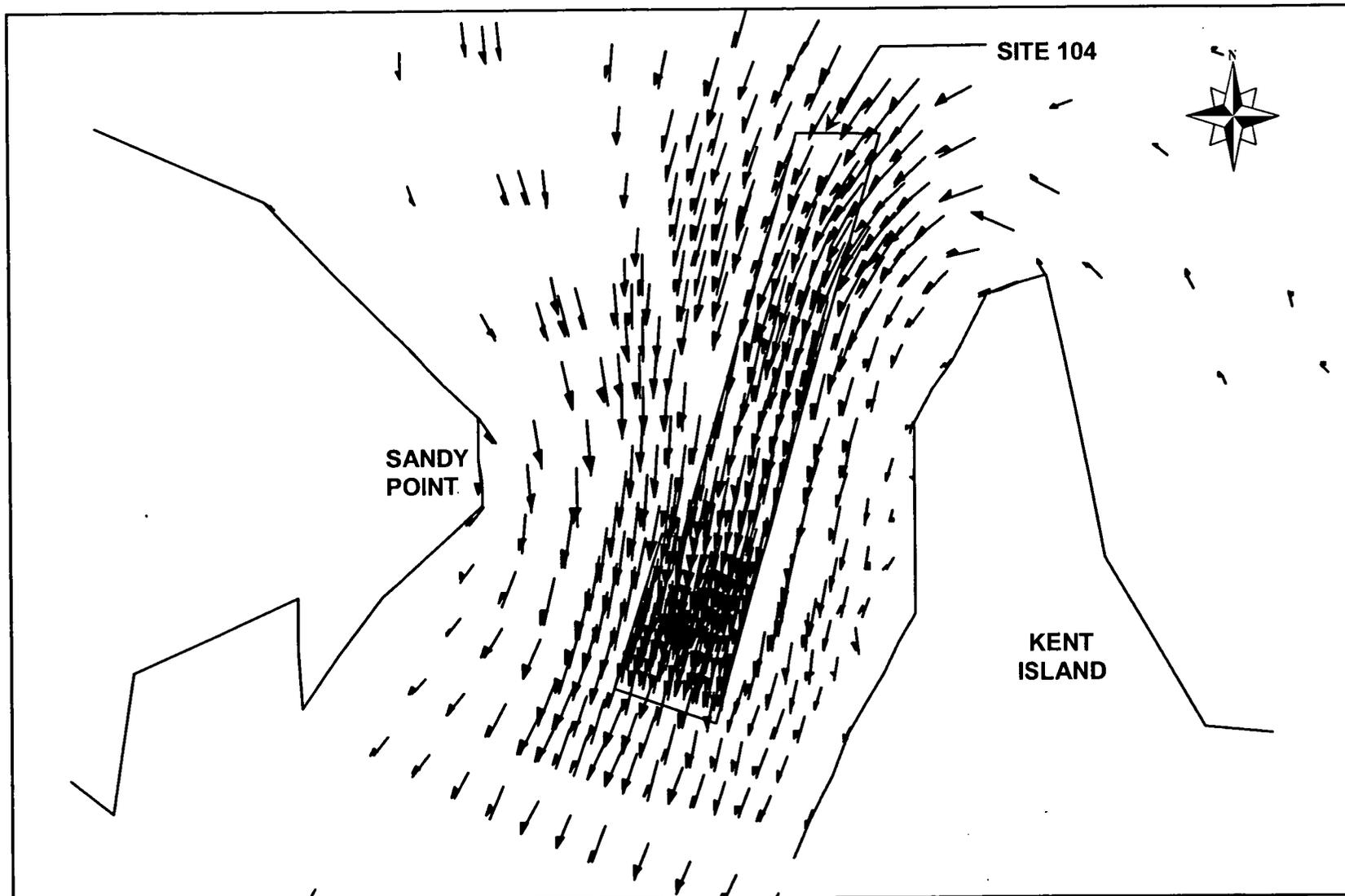
17 The tidal harmonic constants shown in Table ~~5F-2~~ were used to generate predicted tidal current  
18 velocities for Site 104. Figures ~~5F-6~~ and ~~5F-7~~ present tidal current velocities over time for 1  
19 year and for 30 days, respectively. Maximum velocities are about 0.6 m/s (2 ft/s).  
20

21 **F.1.7 Sedimentation**  
22

23 ~~5.1.3.g Sedimentation~~—The upper Chesapeake Bay is a region where a relatively large quantity  
24 of fine-grained sediment is deposited (Maryland Environmental Service [MES] 1995). The two  
25 primary sources of these fine-grained sediments are discharge from the Susquehanna River and  
26 adjacent shoreline erosion from within the upper Bay.  
27

28 The primary input of suspended sediment into the upper Chesapeake Bay is ~~due to discharge~~  
29 from the Susquehanna River. The Susquehanna River supplies more than 50 percent of the fresh  
30 water to the Bay and more than 90 percent of the fresh water to the upper Bay north of Baltimore  
31 (Magnien *et al.* 1993—“a” or “b”?). According to Biggs (1970), the Susquehanna River  
32 accounts for 96 percent of the total fresh-water discharge to “Station VI,” which is located at the  
33 northern limit of Site 104. Mean annual average discharge from the Susquehanna River  
34 (measured at the Conowingo Dam) between 1928 and 1975 was about 1,000 m<sup>3</sup>/sec (36,000  
35 ft<sup>3</sup>/sec). The long- term mean discharge is approximately 1,099 m<sup>3</sup>/sec (38,800 ft<sup>3</sup>/sec);  
36 however, freshwater inflow to the upper Bay varies daily, weekly, monthly, and yearly, with  
37 relatively high discharge in the spring and low to moderate discharge in the summer and fall  
38 (Schubel and Pritchard 1987). Average flows in March and April exceeded 2,200 m<sup>3</sup>/sec  
39 (78,000 ft<sup>3</sup>/sec) between 1929 and 1984 (Schubel and Pritchard 1987); flows from 1984 through  
40 1991 for February through April ranged from 1,100 to 2,100 m<sup>3</sup>/sec [40,000 to 75,000 ft<sup>3</sup>/sec  
41 (MES 1997—“a,” “b,” or “c”?)].  
42

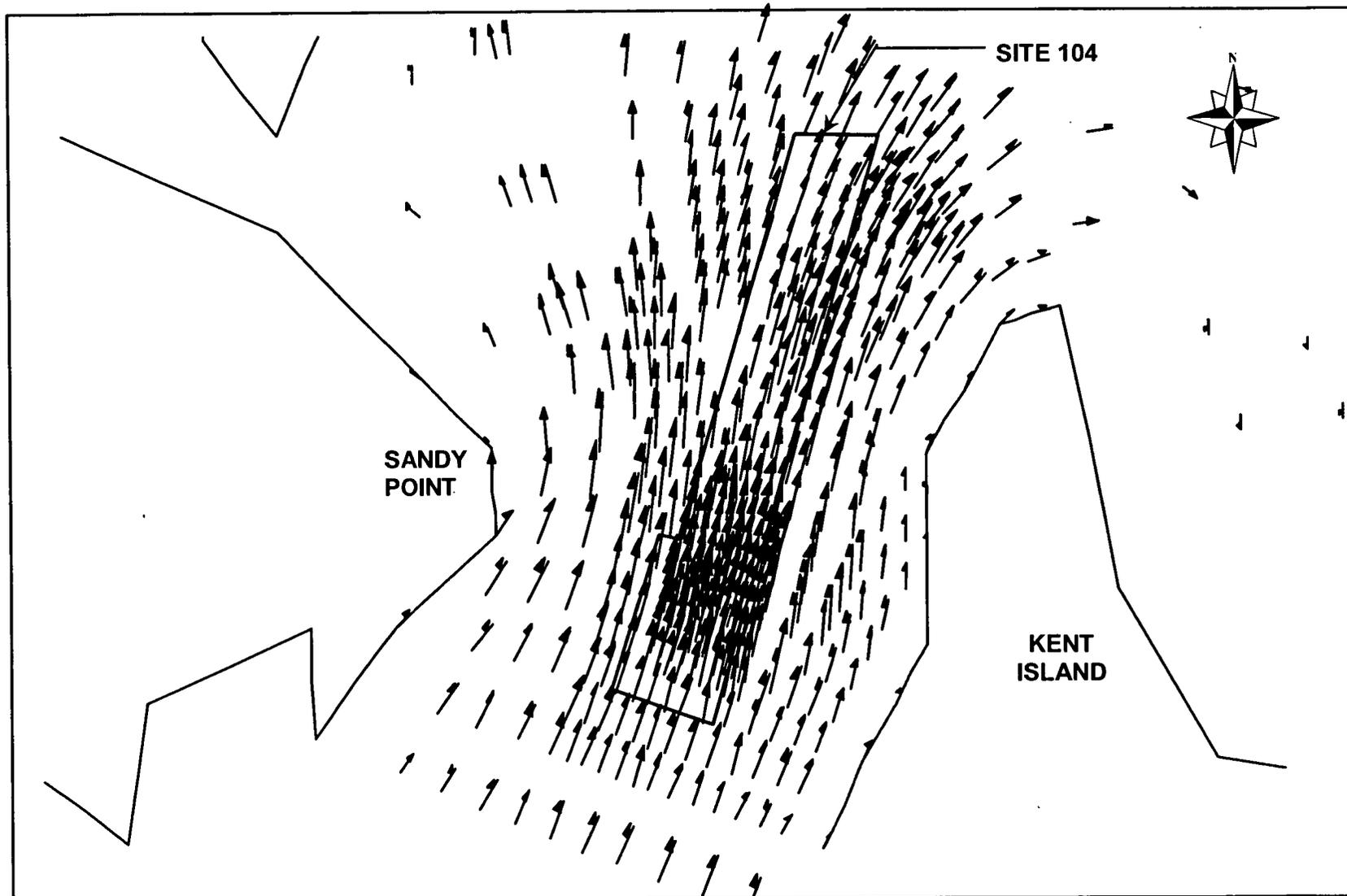
43 Previously, the Maryland Department of Natural Resources (MDNR) estimated that from 1928  
44 through 1975, the discharge from the Susquehanna River provided an average of about 540,000  
45 metric tons (600,000 tons) of sediment each year to the Bay (MDNR 1976). This estimate was  
46 based upon suspended sediment concentrations measured from the discharge of water through



NOTE: VECTORS INDICATE VELOCITY,  
MAGNITUDE & DIRECTION; SPACING  
BETWEEN VECTORS IS BASED ON  
CREATED GRIDS WITHIN THE MODEL.

**SITE 104 OPEN WATER  
PLACEMENT AREA  
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**FIGURE 5F-4  
PEAK EBB VELOCITY VECTORS  
IN VICINITY OF SITE 104**



NOTE: VECTORS INDICATE VELOCITY,  
MAGNITUDE & DIRECTION; SPACING  
BETWEEN VECTORS IS BASED ON  
CREATED GRIDS WITHIN THE MODEL.

**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**FIGURE 5F-5  
PEAK FLOOD VELOCITY VECTORS  
IN VICINITY OF SITE 104**

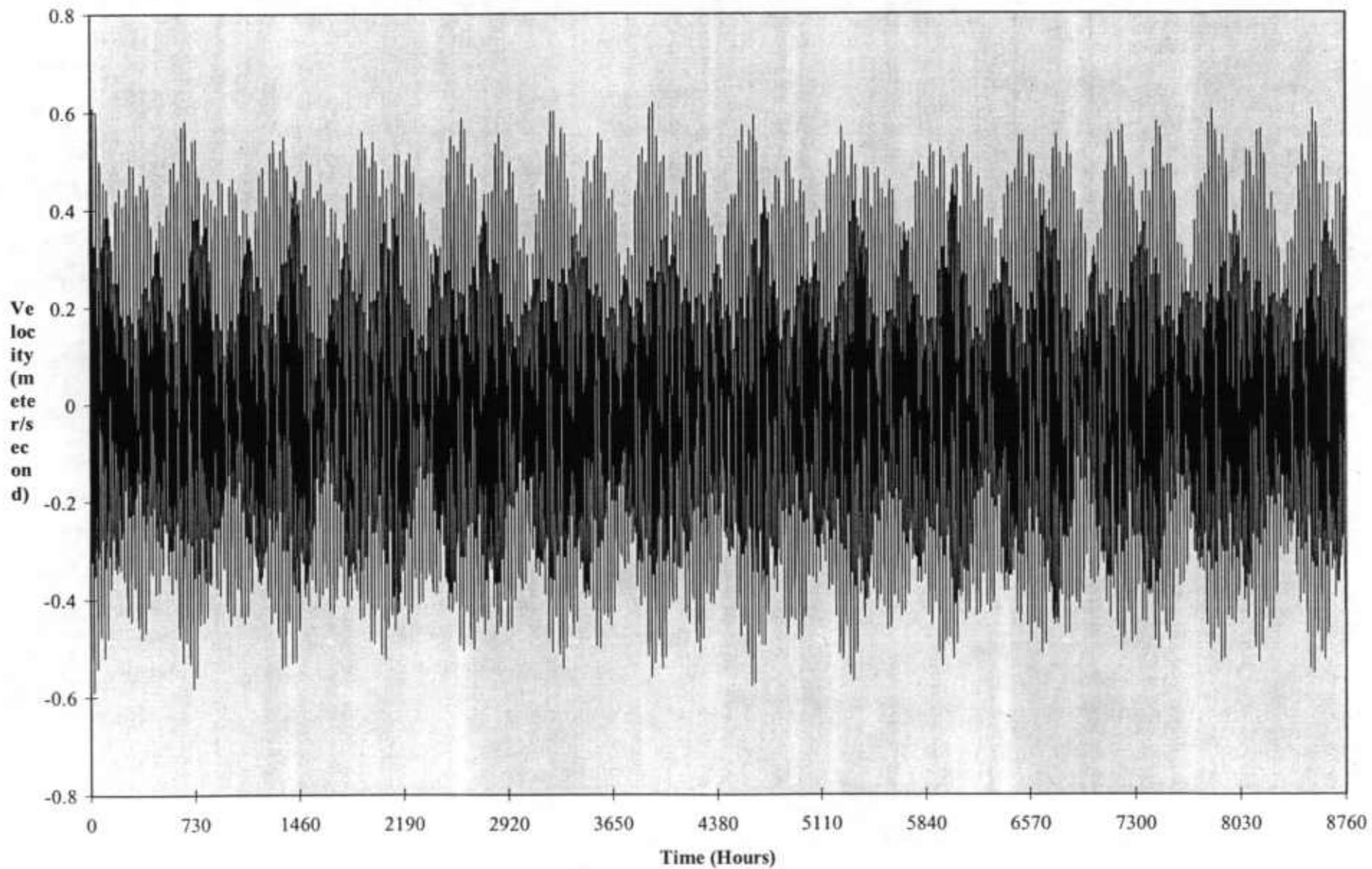


Figure F-6. Predicted Astronomical Tidal Current Velocity for One Year.

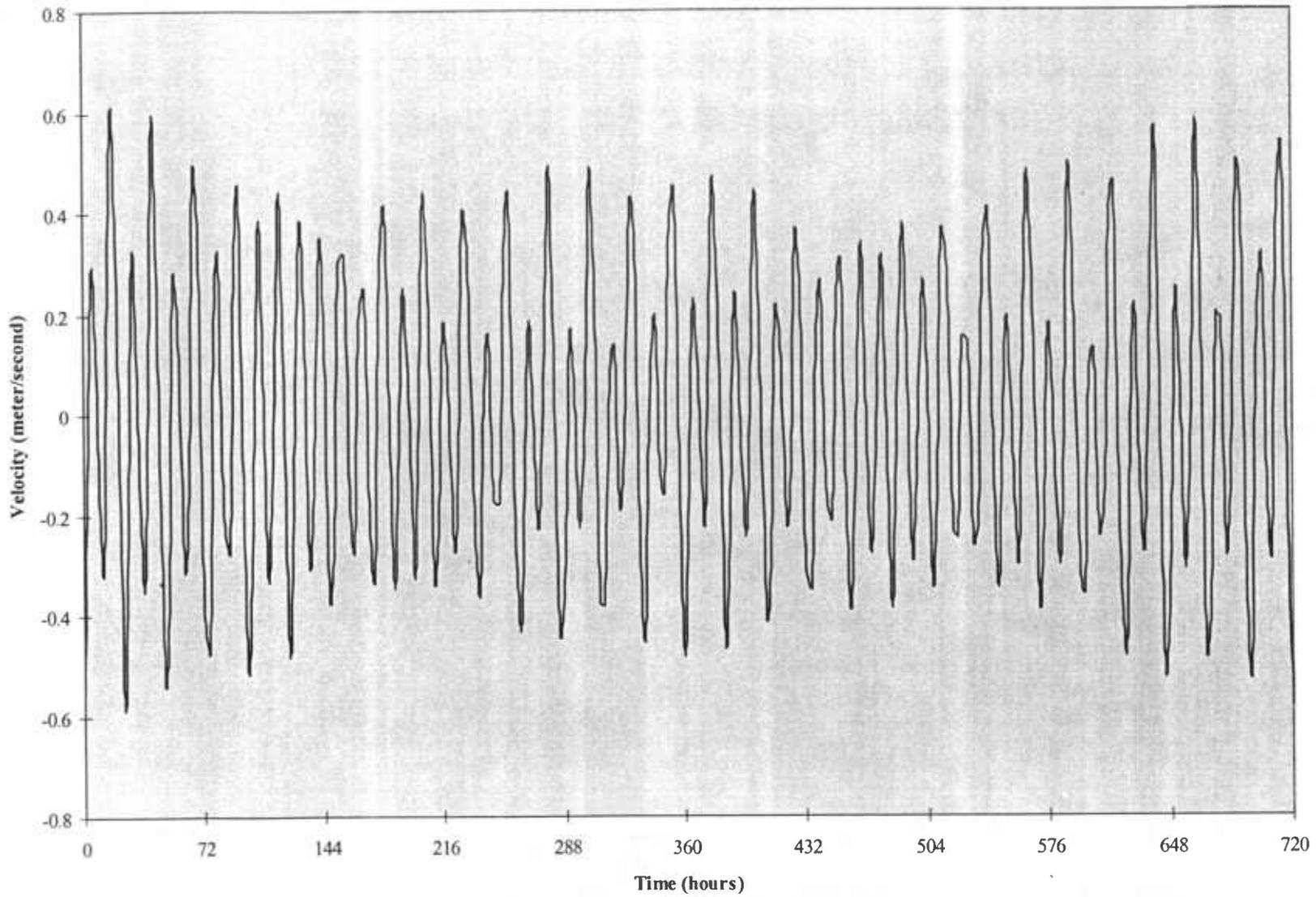


Figure 5F-7. Predicted Astronomical Tidal Current Velocity for 30 Days.

1 the Conowingo Dam. More recent data (1978-1993) indicate that the sediment load from the  
2 Susquehanna River (measured at Conowingo Dam) is approximately 1.3 million metric tons per  
3 year [1.4 million tons (MES 1995); ~~and~~ Panageotou *et al.* 1996]. During 1978-1993, the  
4 estimated annual total suspended load from the Susquehanna River varied from about 400,000  
5 metric tons (440,000 tons) to 2.7 million metric tons (3 million tons). It is believed that a  
6 relatively small fraction of this sediment load actually reached the Site 104 area (Halka, personal  
7 communication), although occurrences of high-suspended sediment caused increased turbidity in  
8 the area (MDNR 1976). Biggs (1969) stated that more than 90 percent of the suspended  
9 sediment contributed by the Susquehanna River was deposited north of Station VI (north of Site  
10 104).

11  
12 Sediment input to the Bay due to extreme weather events can be significant. In January 1996,  
13 record snowfall followed by a heavy rainfall and warm temperatures caused major flooding in  
14 the Chesapeake Bay watershed. During the January 1996 flood, the Susquehanna River  
15 discharged a total of about 9 billion m<sup>3</sup> (320 billion ft<sup>3</sup>) of sediments at an average of 3,400  
16 m<sup>3</sup>/sec (120,000 ft<sup>3</sup>/sec). This equates to approximately 1.8 million metric tons (2 million tons)  
17 of sediment carried into the Bay by the Susquehanna River during this single event, more than  
18 the average yearly input between the years 1978 and 1993 (U.S. Geological Survey [USGS]  
19 1996—Add to ref. list).

20  
21 Suspended sediment resulting from erosion of the shoreline from within the upper Bay is an  
22 additional significant source of material. Estimates of the quantity of material due to shoreline  
23 erosion in the upper Bay range from 300,000 metric tons (330,000 tons) (Biggs 1970) to 390,000  
24 metric tons (430,000 tons [Kerhin *et al.* 1988]). The fine-grained fraction of this material is  
25 estimated to range from 110,000 metric tons (120,000 tons [Biggs 1970]) to 180,000 metric tons  
26 (200,000 tons [Kerhin *et al.* 1988]).

27  
28 Based upon a review of the data presented above, the total quantity of sediment supplied to the  
29 upper Bay averages ~~from~~ approximately 1.6 to 1.7 million metric tons (1.8 to 1.9 million tons):

30  
31 per year. In addition, according to suspended sediments concentration data collected at various  
32 locations throughout the upper Bay, Biggs (1969) estimated that about 4 percent of the annual  
33 supply of material to the upper Bay is transported south of Station VI (the northern limit of Site  
34 104). Based upon this estimate, a mean of approximately 60,000 to 70,000 metric tons (66,000  
35 to 77,000 tons) is supplied annually to the Site 104 area and south. This sediment is deposited  
36 over a large area of the Bay, including an estimated small percentage at Site 104. Most of this  
37 remaining material is deposited north of the mouth of the Potomac River (Officer *et al.*, 1984;  
38 Donoghue 1990; Colman *et al.* 1992; Hobbs *et al.* 1992).

39  
40 Sedimentation at Site 104 corresponds primarily to sediment particle size and classification and  
41 is influenced by particle settling velocity, density throughout the water column, and current  
42 velocity. Typical fine-grained, naturally-occurring sediments suspended in the waters of the  
43 upper Bay are approximately 0.010 to 0.015 mm (0.0004 to 0.0006 in.) in diameter, with settling  
44 (falling) velocities in the range of 0.004 cm/sec (1.5 x 10<sup>-4</sup> ft/sec, MDNR 1976). Samples  
45 collected by Earth Engineering Sciences Inc. (E2Si) (1997) and the Maryland Geological Survey  
46 (MGS) (1997)—Add MGS 1997 to ref. list in Site 104 contained material with particle sizes

1 ranging from 0.005 to 0.1 mm (0.0002 to 0.004 in.), with a mean of 0.02 mm (0.0008 in.).  
2 Settling velocity for a 0.02 mm (0.0008 in.) particle is approximately 0.06 cm/sec (0.002 ft/sec).  
3 Due to these relatively slow-settling velocities, this suspended material can be transported over  
4 large distances by tidal currents, and some material may never settle to the bottom. In addition,  
5 wave-forced resuspension of deposited material is an important factor influencing the transport  
6 of material (Sanford 1994).

7  
8 Biggs (1970) estimated that sedimentation in the area around Site 104 is approximately 1.1  
9 mm/yr (0.04 in./yr). This estimate assumes a uniform distribution of 303,000 metric tons  
10 (334,016 U.S. tons) of particulate matter spread evenly over the bottom of this region. The  
11 amount of material being deposited is based upon the difference in suspended matter measured at  
12 the designated upstream and downstream stations from 1 February 1996 through 31 January  
13 1997. Eskin *et al.* (1996) estimates that the sedimentation rate in the area is about 1.2 to 10  
14 mm/yr (0.05 to 0.4 in./yr) as a result of lead-210 analyses of core samples collected at stations in  
15 and around Site 104.

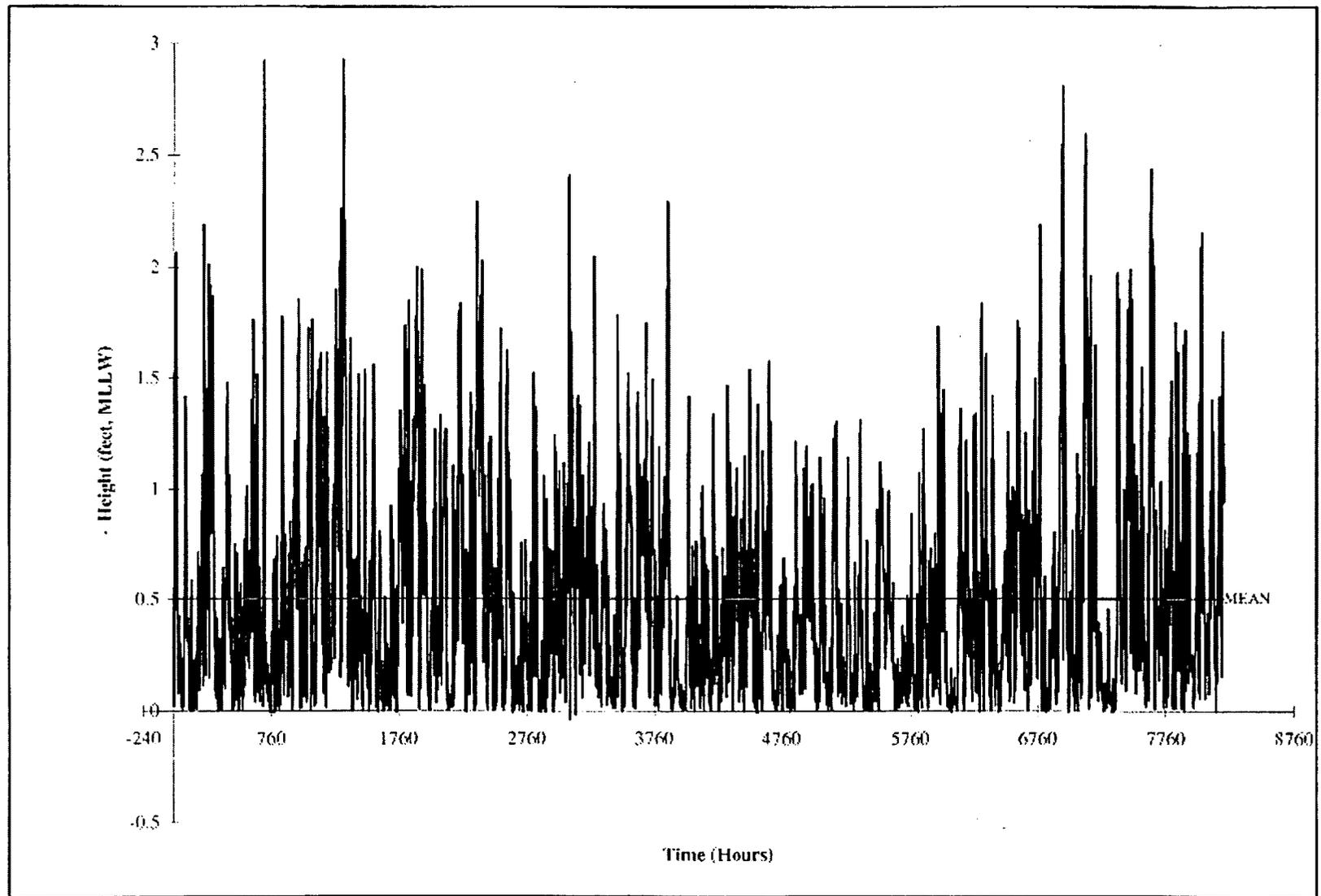
16  
17 Sedimentation rates in the deeper portions of the Chesapeake Bay are generally higher than in  
18 the surrounding shallower waters, due in part to lower current velocities and lessened effects  
19 from wave action. The deeper channels are relict features incised during times of lower sea level  
20 by the Susquehanna River and its tributaries, and are now filling relatively rapidly with  
21 sediments (Colman *et al.* 1992). It is estimated that over more than a 10,000-year period, the  
22 long-term average rate of sediment accumulation in the vicinity of Site 104 has been  
23 approximately 0.003 m/yr (0.12 in./yr) (Colman & Halka 1990). Pollen-dating techniques  
24 applied to three recent sediment cores collected in the vicinity of Site 104 indicate that a rate of  
25 sediment accumulation since the time of European occupation has averaged approximately 0.004  
26 m/yr (0.156 in./yr Brush 1990; Brush *et al.* 1997). Although these cores were not located within  
27 the Site 104 boundaries, and extrapolation of sedimentation rates from specific core locations is  
28 questionable, the results corroborate the long-term average (Halka 1998). Higher sedimentation  
29 rates [0.01 to 0.03 m/yr (0.396 to 1.176 in./yr)] have been calculated from radionuclide dating of  
30 two cores collected from the deep-water areas to the south of Kent Island (Goldberg *et al.* 1978).  
31 Assuming a surface sediment bulk density of 1.25 grams per cubic centimeter (g/cc) in Site 104,  
32 Halka (1998) calculated the sedimentation rate of 0.004 m/yr (0.156 in./yr), which would result  
33 in a sediment mass accumulation rate of 1,600 g/m<sup>2</sup>/yr.

### 34 35 F.1.8 Wave Conditions

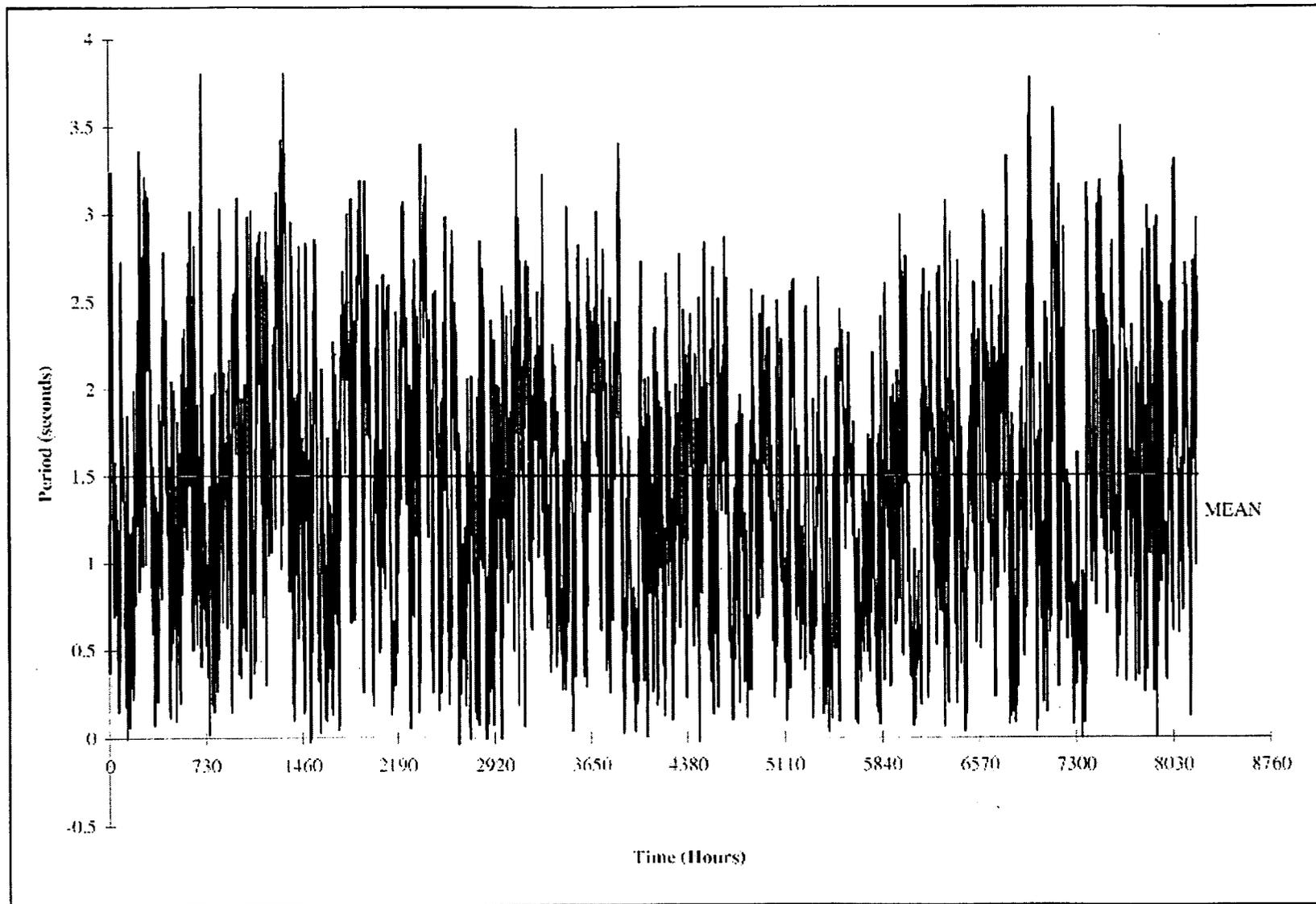
#### 36 37 5.1.3.h Wave Conditions.

#### 38 39 Average Wave Conditions

40  
41 F.1.8.a Average Wave Conditions. One year of hourly-averaged wind speed and directional  
42 data were obtained from the NOS for C-MAN station TPLM2, located at latitude 38° 58.5' N and  
43 longitude 76° 24' W, less than 1 mile southwest of Site 104. These data were used to generate an  
44 average wave height and period for the year using methods presented in the Shore Protection  
45 Manual (USACE 1984). Figures 5F-8 and 5F-9 present the hourly-averaged wave heights and  
46 periods for 1 year, respectively, using the TPLM2 data. The figures show the variability of the



**Figure 5F-8. Hourly-averaged Wave Heights for One Year (based on NOS C-MAN data, 1990).**



**Figure 5F-9. Hourly-averaged Wave Periods for One Year (based on NOS C-MAN data, 1990).**

1 wave heights and periods for the year. The mean wave height and period for the year were  
2 computed from the above analysis output. The mean wave height was computed to be about  
3 0.15 m (0.5 ft) and the mean wave period was computed to be about 1.5 seconds.

#### 4 5 ~~Extreme Wave Conditions~~

6  
7 F.1.8.b Extreme Wave Conditions. Site 104 is exposed to wind-generated waves approaching  
8 primarily from the north and south directions. The longest fetch distances (i.e., the area of the  
9 water over which a wind of constant direction and speed blows to generate waves) to which the  
10 site is exposed correspond to these two directions. In accordance with procedures recommended  
11 by the U.S. Army Shore Protection Manual (USACE 1984), a radially averaged fetch distance  
12 was computed for the two directions. The radially averaged fetch distances for the north and  
13 south directions are shown in Figures 5F-10 and 5F-11, respectively. Wave conditions were  
14 hindcast for each fetch direction for the winds (Table 5F-5) adjusted appropriately for duration,  
15 water levels (Table 5F-3), and mean water depths along the fetch directions (Figure 5F-3). The  
16 results are shown in Tables 5F-6 and 5F-7.

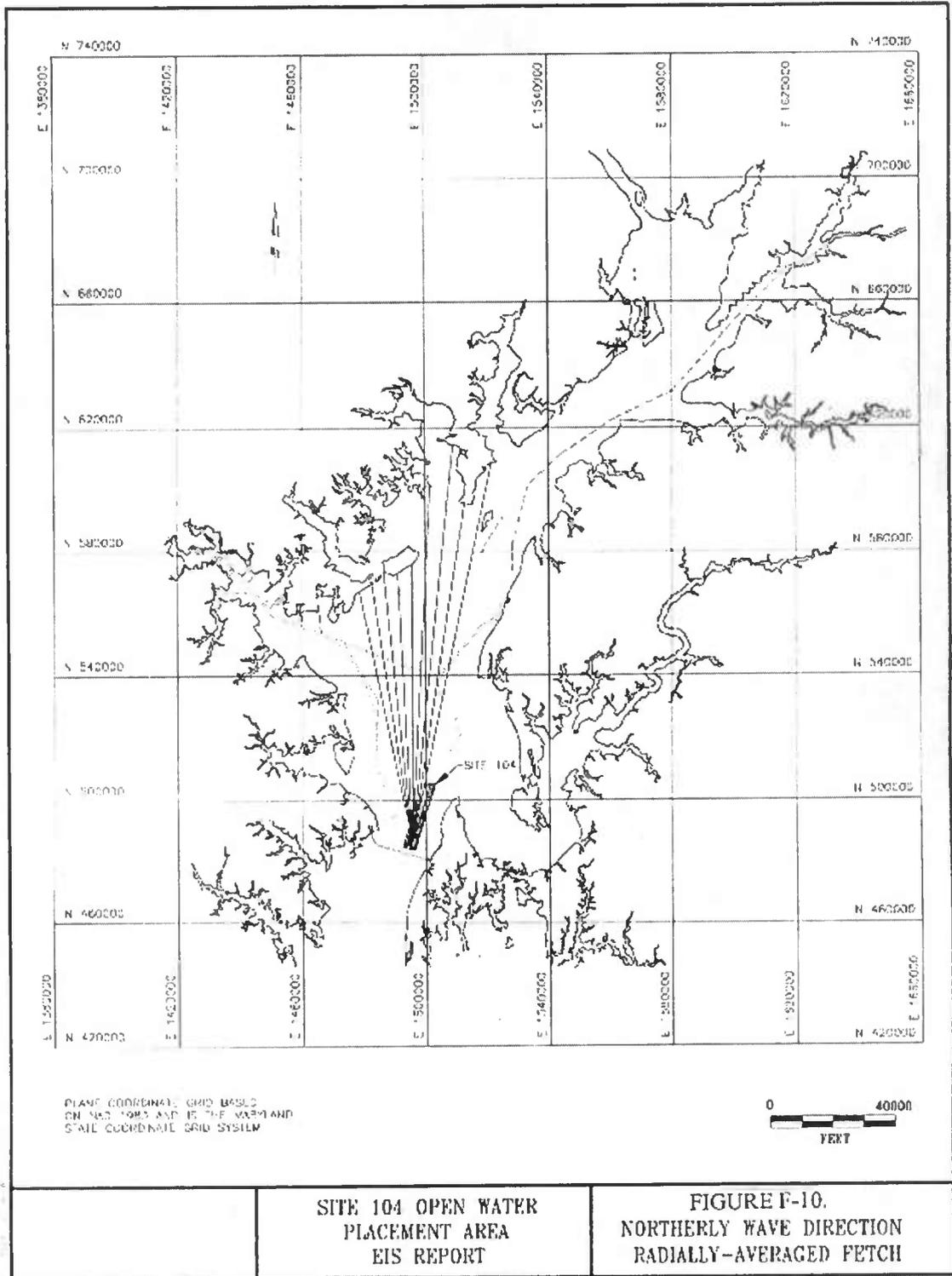
17  
18 A sea state is normally composed of a spectrum of waves with varying heights and periods that  
19 may range from relatively long waves to short ripples. In order to summarize the spectral  
20 characteristics of a sea state, it is customary to represent that wave spectrum in terms of a  
21 distribution of wave energy over a range of wave periods. Having made this distribution, known  
22 as a wave spectrum, it is convenient to represent the wave spectrum for Site 104 by a single  
23 representative wave height and period. The wave conditions reported in Tables 5F-6 and 5F-7  
24 are the significant wave height,  $H_s$ , and the peak spectral wave period,  $T_p$ . The significant wave  
25 height,  $H_s$ , is defined as the average of the highest one-third of the waves in the spectrum.  
26 Depending on the duration of the storm condition represented by the wave spectrum, maximum  
27 wave heights may be as high as 1.8 to 2 times the significant wave height computed above. The  
28 peak spectral period,  $T_p$ , is the wave period that corresponds to the maximum wave energy level  
29 in the wave spectrum. Higher return periods for both wave height and periods lead to a greater  
30 potential for storm-induced resuspension of sediments from the bottom.

## 31 32 F.2 POTENTIAL ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

### 33 34 ~~6.1.3 Hydrodynamics~~

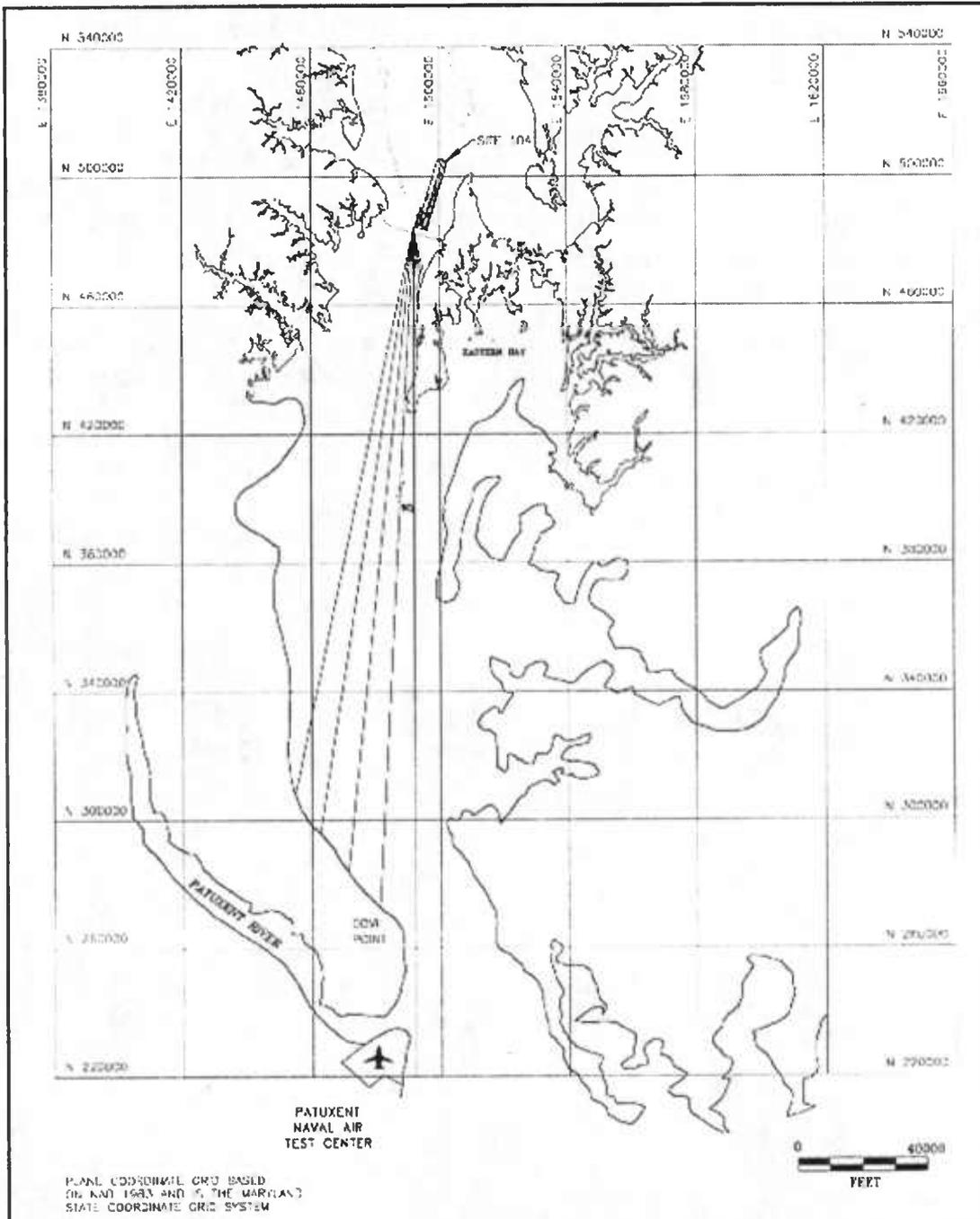
#### 35 36 F.2.1 Introduction

37  
38 ~~6.1.3.a Introduction.~~ Computer models were run by ~~Moffatt & Nichol Engineers (M&N) and~~  
39 ~~the U.S. Army Corps of Engineers Waterways Experiment Station (WES)~~ to simulate potential  
40 hydrodynamic changes due to placement of dredged material at Site 104. Models simulated the  
41 motion of the water (hydrodynamics) flowing through Site 104 and the resulting potential for  
42 erosion and movement of placed dredged material using both controlled hydraulic bottom  
43 pipeline placement and bottom-release scow placement methods. The erosion models also  
44 provided information on potential annual changes in water depths.



PLANE COORDINATE GRID BASED ON NAD 1983 AND IS THE MARYLAND STATE COORDINATE GRID SYSTEM

0 4000  
FEET



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FIGURE F-11.  
 SOUTHERLY WAVE DIRECTION  
 RADIALLY-AVERAGED FETCH

**Table 5F-5**  
**Fastest Mile Wind Speeds per Direction and Return Period (RP)**

RP	N		NE		E		SE		S		SW		W		NW	
Year	North				Northeast				East				Southeast			
Year	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph	m/s	mph
5	18	40	17	37	14	32	17	37	16	36	21	47	22	50	24	54
10	21	48	20	44	17	38	20	45	19	43	25	56	24	54	26	59
15	23	52	21	48	18	41	22	50	21	47	27	61	25	56	28	62
20	25	56	23	52	20	45	25	55	23	51	30	67	26	59	29	65
25	26	59	25	55	21	47	26	58	24	54	31	70	27	60	30	67
30	28	62	25	57	22	49	27	61	25	56	33	73	27	61	30	68
35	29	64	27	60	23	51	28	63	26	58	34	76	28	62	31	70
40	30	66	28	62	24	53	29	65	27	60	35	78	28	63	32	71
50	31	69	30	66	25	55	31	69	28	63	37	82	29	64	33	73
100	36	81	34	76	29	65	37	82	33	74	43	97	31	69	36	81

**Table 5F-6**  
**Wave Height per Return Period**

Fetch Direction	Return Period (years)									
	1	2	5	10	20	25	30	40	50	100
	m	m	m	m	m	m	m	m	m	m
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
North	0.9	1.2	1.5	1.7	2.0	2.1	2.2	2.3	2.4	2.8
	(3.0)	(3.9)	(4.8)	(5.7)	(6.6)	(6.9)	(7.2)	(7.7)	(8.0)	(9.3)
South	0.9	1.3	1.7	2.0	2.3	2.5	2.5	2.7	2.8	3.3
	(3.0)	(4.2)	(5.5)	(6.5)	(7.7)	(8.1)	(8.3)	(8.9)	(9.3)	(10.7)

**Table 5F-7**  
**Wave Period (seconds) per Return Period**

<b>Fetch Direction</b>	<b>Return Period (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>20</b>	<b>25</b>	<b>30</b>	<b>40</b>	<b>50</b>	<b>100</b>
North	3.7	4.1	4.5	4.8	5.1	5.2	5.3	5.5	5.6	5.9
South	3.9	4.4	5	5.4	5.8	5.9	6	6.1	6.3	6.7

1 -Laboratory testing was conducted by WES to characterize the erodability of the dredged  
2 materials proposed for placement at Site 104. The information gained from the laboratory  
3 testing was ultimately used in the modeling of the potential erosion and movement of placed  
4 dredged material. The annual placement plans were developed using the MDFATE model in  
5 accordance with the following criteria: minimize loss of material during placement; minimize  
6 loss of material following placement due to erosion; minimize mounding of the material at each  
7 placement location (which subsequently serves to minimize erosion); prevent material from  
8 mounding above elevation -13.7 meters (-45 feet); place material in the deeper portions of the  
9 site to achieve as uniform a depth as possible throughout the site; and maximize capacity.

10  
11 -The quantities of material to be placed originated from the State of Maryland's Strategic Plan  
12 for Dredged Material Management (Table 6-2F-8). In the model, 2,755 m<sup>3</sup> (3,600 cy) of  
13 material (holding capacity of one barge) was placed during each placement event. The number  
14 of placement events in any one day or placement season depended upon the total amount of  
15 dredged material to be placed in that year. A placement window from 1 November into March  
16 was utilized.

## 17 F.2.2 Summary

18  
19  
20 ~~6.1.3.b Summary~~-A summary of potential impacts to hydrodynamic processes is provided in  
21 Table 6-3F-9. Water levels, astronomical tides, extreme water levels, and wind conditions will  
22 not be impacted by the proposed action. The changes in the depth-averaged currents due to a  
23 decrease in the water depths at Site 104 from dredged material placement were determined to be  
24 small (less than 2%).

25  
26 -Changes in the resulting bottom forces that could move the bottom sediments varied by  $\pm 15\%$   
27 depending upon where and in what order material was placed. Based on the assumptions and the  
28 material placement plan used for the erosion model studies, the modeled results indicated a  
29 worst-case potential for 16.9% of the material placed by bottom-release scow to leave the site  
30 boundary and a potential for 6.2% of the material placed by controlled hydraulic pipeline bottom  
31 placement to leave the site boundary.

32  
33 -Available models of the Chesapeake Bay are not able to predict sediment transport. It is,  
34 therefore, unknown exactly where material potentially leaving the site boundaries will end up,  
35 although smaller particles will tend to travel farther than larger ones. The hydraulic placement  
36 modeling simulated the hydraulic unloading of individual barges by pump-out through a pipeline  
37 and diffuser, to locations within about 2 meters (6.0 feet) of the Site 104 bottom. Most of the  
38 predicted erosion is anticipated to take place during ~~the placement of the material placement~~  
39 ~~period~~ (WES 1998). These predicted sediment losses are thought to be higher than what actually  
40 would be expected to occur, since the model does ~~n~~<sub>o</sub>t take into account any material that leaves  
41 the site and is then carried back into the site by tidal action. The losses could vary for either of  
42 the placement methodologies under actual conditions (WES 1998).

43  
44 Sedimentation rates are controlled by the physical characteristics of the sediments and  
45 surrounding water and the hydrodynamics of the area. Since the hydrodynamics models revealed  
46 that the variations in tidal currents through the site area would not change significantly (WES

**Table F-86-2**  
**Five Year Placement Plan for Site 104**

<b>Year</b>	<b>Volume (m<sup>3</sup>) / (cy)</b>	<b>Modeled Placement Days</b>
1	1,913,265 / 2,500,000	140
2	3,443,878 / 4,500,000	140
3	2,295,918 / 3,000,000	168
4	4,591,837 / 6,000,000	168
5	1,530,612 / 2,000,000	140
<b>Total</b>	<b>13,775,510 / 18,000,000</b>	

Table F-96-3

Summary of impacts to hydrodynamic processes in the vicinity of Site 104

Hydrodynamics	No Impact	No Significant Impact	Impact
Average Depth			✓
Water Level	✓		
Astronomical Tides	✓		
Extreme Water Levels	✓		
Wind Conditions	✓		
Tidal Currents		✓	
Sedimentation Rates		✓	
Sediment Erodability			✓
Material Spreading			✓
Potential Sediment Transport			✓
Wave Conditions		✓	

1 1998), it is anticipated that natural sedimentation rates within Site 104 will not be significantly  
2 impacted by the proposed action. Physical analysis of sediments proposed for placement at Site  
3 104, indicated that the particle sizes of material to be placed at the site are similar to the  
4 sediments that currently exist at the site. The majority of sediment proposed for placement  
5 consists of silt and clay particles. Analysis of sediments from the Craighill Angle, the Cutoff  
6 Angle, the Brewerton Channel Eastern Extension, the Tolchester Channel, and the Swan Point  
7 Channel indicated that the mean sediment particle size was  $10.88 \times 10^{-6}$  meters ( $3.57 \times 10^{-5}$  feet).  
8 Existing sediments in the Site 104 area consist primarily of very soft to soft gray silty clay with  
9 localized pockets of silty sand and red-brown silty clay (E2Si 1997; MGS 1997; EA 1998).

10  
11 The water quality model developed by WES and described below was run using a tracer  
12 concentration that indicated the long-term movement of water over the Site 104 bottom to be to  
13 the north. This indicates, indicating that sediments remaining in suspension over multiple tidal  
14 cycles would ultimately move in a northerly direction. However, it should be noted that the  
15 amount of suspended sediments that will remain in the water column over tidal cycles will be  
16 low.

17  
18 This northward movement is not expected to interfere with the turbidity maximum zone in the  
19 upper Bay or with ~~planktonic~~ transport of plankton associated with the movement of the turbidity  
20 maximum zone. Impacts to recreational and commercial fishing, due to the northerly movement  
21 of the suspended sediment, will be minimal due to the time-of-year that placement will occur and  
22 the small amount that will likely be transported. In addition, northerly movement is not expected  
23 to impact clam beds adjacent to the site because the movement will be restricted to the deeper  
24 areas that are located west of the clam beds.

### 25 26 F.2.3 Model Descriptions

27  
28 ~~6.1.3.e Model Descriptions.~~ Preliminary investigations into the hydrodynamics of Site 104 and  
29 the development of dredged material placement plans to minimize the potential for erosion were  
30 performed by M&N using the following models: FASTTABS, STFATE, SURGE, MDFATE,  
31 and LTFATE. More detailed investigations of the Site 104 hydrodynamics, potential sediment  
32 erosion and transport, and placement plan development were performed by WES using the  
33 following models: CH3D-WES, STFATE, SURGE, MDFATE, LTFATE, and CEQUAL-ICM.  
34 Each of these models is state-of-the-art, is utilized both nationwide and internationally, and is the  
35 best tool available for making respective predictions for areas within the Chesapeake Bay.

36  
37 -A joint effort by M&N and WES was made to compute the initial footprint (i.e., the outline and  
38 surface area) generated by hydraulically placed material based on work by Thevenot *et al.*  
39 1992—add to ref. list. Reports on both modeling studies are located in Appendix F. Validation  
40 and calibration of the models and a discussion of the assumptions for each model are also  
41 included in these reports. Brief descriptions of each model utilized are provided in the following  
42 sections.

43  
44 F.2.3.a FASTTABS. FASTTABS is the personal computer version of the main-frame based  
45 TABS-2 model (Thomas and McAnally 1985—add to ref. list) developed by the USACE. It was  
46 used to simulate existing depth-averaged tidal current velocities in and around Site 104.  
47 Predicted depth-averaged current velocities were used as inputs to the MD-FATE model that was

1 used for development of a dredged material placement plan to be utilized in the WES modeling  
2 studies. The FASTTABS model encompasses an area of the Chesapeake Bay from the  
3 Susquehanna River and C&D Canal to near the southern tip of Calvert County in the south, and  
4 was refined in the area of Site 104 to provide greater detail. The model requires that the estuarial  
5 system be represented by a network of nodal points (i.e., points defined by coordinates in the  
6 horizontal plane and water depth) and elements (i.e., areas made up by connecting adjacent nodal  
7 points). The nodes were connected to form quadrilateral and triangular two-dimensional  
8 elements. The resulting nodal/element network is commonly called a finite element mesh and  
9 provides a computerized representation of the estuarial geometry and bathymetry. The site  
10 bathymetry modeled was provided by CENAB from a survey conducted in September 1997  
11 (Appendix F.3; M&N 1998).

12  
13 F.2.3.b CH3D-WES. The CH3D-WES (Curvilinear Hydrodynamics in Three Dimensions)  
14 model was developed jointly through funding by the USACE, EPA, and the State of Maryland,  
15 with oversight provided by the Chesapeake Bay Program. This model simulates the  
16 hydrodynamics, salinity, and temperature of the entire Chesapeake Bay system in three  
17 dimensions (WES 1998). The principal model extends from the mouth of the Chesapeake Bay in  
18 the south to the Susquehanna River and C&D Canal in the north. A version of this model was  
19 developed for simulations within the upper Bay to provide more detailed predictions within the  
20 upper Bay, including Site 104, with relatively short model run times. The boundary conditions  
21 of the upper Bay model were initially driven by the full-Bay model, but were then changed to  
22 utilize -data. Both models contain layers of cells that are ~~five~~ 5 feet thick, with the exception of  
23 the top layer, which varies with the tides.

24  
25 The modeling study conducted for the proposed action used data collected during the year 1993  
26 for specifying conditions at the model boundaries. The year 1993 was a high fresh-water flow  
27 year into the Bay, and it was deemed that modeling with these flows would provide a worst case  
28 for the project area hydrodynamics, resulting in a higher estimate of potential sediment losses,  
29 since higher flow rates generate higher forces that are able to dislodge more sediments from the  
30 estuary bottom than the forces produced by average flow conditions. During the period of time  
31 being simulated, the CH3D-WES model generated depth-averaged current velocities and bottom  
32 shear stresses. The bottom shear stresses result in are due to forces along the bottom of the study  
33 area, resulting from the varying movement of water over the sediments, and control whether or  
34 not the sediments will move off of the bottom. These depth-averaged current velocities and the  
35 bottom shear stresses computed by CH3D-WES were applied in the MDFATE modeling. The  
36 CH3D model was rerun at the end of each simulated placement year to produce the new depth-  
37 averaged current velocities and bottom shear stresses based on the changed bathymetry produced  
38 by MDFATE from dredged material placement. Therefore, the results account for any changes  
39 in the area currents caused by decreased depths from dredged material placement in the previous  
40 model year (Appendix F.2; WES 1998).

41  
42 F.2.3.c STFATE. The earliest version of the STFATE (Short Term FATE) model was  
43 developed by the ~~U.S. Environmental Protection Agency~~ EPA (Koh and Chang, 1973—add to  
44 ref. list) to predict the behavior of dredged material placement in open water. This model was  
45 later modified and refined by WES to predict the behavior of discrete discharges of dredged  
46 material from hoppers or barges. The model computes the fate of the placed material during its

1 descent through the water column, its spread over the bottom, and finally the transport and  
2 diffusion of material remaining in suspension.

3  
4 The STFATE model grid for Site 104 covered most of the site, with the exception of the shallow  
5 water areas to the north that are planned to receive very little dredged material. The model  
6 utilizes input data describing characteristics of the planned placement vessel (i.e., bottom-release  
7 scow or hopper dredge), dredged material being placed, and the placement site (Site 104).  
8 STFATE modeling for Site 104 computed the fate of dredged material placed with a bottom-  
9 release scow as the material falls through the water column and then impacts with the bottom. It  
10 also computed the movement of the suspended sediments stripped from the main mass during  
11 material descent until this stripped material reaches the site boundary; and, therefore, predicting  
12 the quantity of material potentially leaving the site during this phase of placement.

13  
14 The model output provided the following information: (1) the amount of placed dredged material  
15 that is stripped; (2) the potential horizontal movement of the material until it reaches the edge of  
16 the site boundary while in suspension; (3) the footprint on the Bay floor resulting from the  
17 material placed within the site; and (4) the dynamics when the material encounters the site  
18 bottom. This output was used in determining material placement set-backs (i.e., recesses) within  
19 the site boundaries in order to minimize the potential for material movement outside of the site.  
20 A limitation in the application of STFATE and in the model used to evaluate the spreading of  
21 hydraulically placed material is that both models assume that the bottom being impacted by the  
22 dredged material is essentially flat. To compensate for this limitation, the extent of material  
23 spreading on bottom slopes was evaluated using the SURGE model (Appendixes F.3 &and F.2;  
24 M&N 1998 and WES 1998).

25  
26 F.2.3.d SURGE. SURGE modeling provided a basic analysis of the extent of material mass  
27 movement from the moment it impacts the site bottom until it comes to rest. The model was run  
28 for various slopes expected to be found at Site 104. SURGE uses output from the STFATE  
29 model including the velocity and diameter of the material cloud just before impact and a  
30 description of the bottom slopes expected to be encountered during placement. The energy  
31 stored (potential energy) in the falling cloud is converted to active energy (kinetic energy) by the  
32 SURGE model to establish the extent of potential material mass movement along the bottom  
33 slope (Appendixes F.3 &and F.2; M&N 1998 and WES 1998). These results can also be used  
34 for determining set-backs from the site boundaries for material placement that will minimize the  
35 amount of placed material leaving Site 104.

36  
37 F.2.3.e MDFATE and LTFATE. The MDFATE (Multiple Dump FATE) and LTFATE (Long  
38 Term FATE) models were used to evaluate the extent of long-term movement of dredged  
39 material that has been placed on the bottom when subjected to the forces produced by the CH3D  
40 model described earlier. A version of STFATE is a component of MDFATE which models the  
41 descent and spreading of each placement load. The MDFATE/LTFATE evaluation considers  
42 potential erosion of material after it has settled to the bottom and remained in place for a  
43 relatively long period of time, which is specific to the simulation being performed. This period  
44 of time ~~and~~ can range from hours to years after the initial placement of material. For the Site 104  
45 study, a period of one calendar year from 1 November to 31 October was used for each material  
46 placement year evaluated, since at the time the modeling was being performed, it was thought

1 that the placement window would begin with 1 November. Multiple placement plans were  
2 assessed to devise an optimal placement location and timing sequence to minimize material  
3 losses during the simulated placement of dredged materials at Site 104 over a five~~5~~-year period.  
4 This optimal placement plan was then input to the model. Physical characteristics of the dredged  
5 material proposed for placement at Site 104 were determined through laboratory analyses and  
6 were also used as input in the model. During the model runs, only the material that was being  
7 placed for the year was evaluated. Thus, the model scenario was set up so that existing sediment  
8 as well as the previous year's material could not erode, since material that remains at the site  
9 longer than one year would be minimally susceptible to erosion compared to the year being  
10 evaluated. The object of the modeling was to determine the lost quantities of the material placed  
11 during the modeled year. This was done by assessing the model output of the mass remaining on  
12 the site bottom following the model run and comparing it with the mass of dredged material  
13 placed at the beginning of that modeled year (Appendices F.4 ~~&and~~ F.3; M&N 1998 and WES  
14 1998).

15  
16 F.2.3.f CEQUAL-ICM. CEQUAL-ICM (Corps of Engineers Quality--Integrated Compartment  
17 Model) is a three-dimensional model of the entire Bay developed (Cerco and Cole 1994—add to  
18 ref. list) to be used in conjunction with the CH3D-WES hydrodynamics model to evaluate water  
19 quality and compute the fate of water quality constituents. CH3D-WES provides 3-D velocities  
20 and diffusion coefficients to CEQUAL-ICM that contains a database of sediment characteristics  
21 measured throughout the Bay. Since no model has been developed to track sediment transport  
22 throughout the Chesapeake Bay, CEQUAL-ICM was used to track a tracer concentration  
23 released in the bottom model cell which covers Site 104 and to provide an indication of where in  
24 the Bay the fraction of suspended sediment leaving Site 104 that remains in the water column  
25 over multiple tide cycles may end up. It must be noted, however, that this model does not  
26 simulate the true physical behavior of sediments and cannot therefore provide information on the  
27 final destination of the sediments that might leave Site 104. These computations primarily  
28 provided insight into the effect of bottom residual currents near Site 104 (Appendix F.2; WES  
29 1998).

30  
31 The formation of a footprint of material resulting from hydraulic placement of dredged material  
32 at Site 104 was computed based upon the USACE ~~&and~~ U.S. EPA (1992) approach. For the  
33 simulations run for the Site 104 study, it was assumed that the estuary bottom was horizontal, the  
34 viscosity (or thickness of the slurried material) was constant, the overlying flow exerted  
35 negligible shear stress on the underflow, and the spreading of the placed material was radially-  
36 outward around the discharge end of the pipe. The assumptions chosen were those that fit the  
37 conditions most likely to be encountered during this type of placement at Site 104. The model  
38 assumptions simulated the hydraulic unloading of an individual barge holding 2,755 m<sup>3</sup> (3,600  
39 cy) of dredged material that was pumped out through a pipeline and diffuser and placed within 2  
40 meters (6.6 feet) of the site bottom. These assumptions were used because they minimized water  
41 column losses (Appendices F.3 and F.2; M&N 1998 and WES 1998). Hydraulic placement,  
42 with the discharge pipe positioned just under the water surface, would maximize material  
43 exposure to the currents in the -14 to -24 meter (-45 to -78 feet) water column, and would result  
44 in a larger bottom footprint, with more erosion than mechanical placement. The characteristics  
45 of the dredged material being placed were based on laboratory analyses of the channel sediments  
46 proposed for placement. The output of the computation is a footprint of placed material

1 providing its predicted radius and thickness. The resulting material footprint data were input into  
2 a modified version of the MDFATE model by WES to determine the potential for erosion. The  
3 results of the models are discussed in the following subsections.

#### 4 5 F.2.4 Model Results

6  
7 ~~6.1.3.d~~ F.2.4.a Average Water Depths. Average water depths at Site 104 will be directly  
8 impacted by the proposed action since placement of dredged materials would cause the depths to  
9 become shallower. Existing water depths at Site 104 range from -12.8 to -23.8 meters (-42.0 to  
10 -78.0 feet) MLLW. Proposed placement of dredged material at Site 104 would reduce the water  
11 depths from a maximum of -23.8 meters (-78.0 feet) MLLW to a current design depth of -13.7  
12 meters (-45.0 feet) MLLW. Areas where water depths are currently at or shallower than -13.7  
13 meters (-45.0 ft) MLLW are not targeted for material placement. A minimum depth of -12.2  
14 meters (-40.0 feet) MLLW should be maintained throughout the Site 104 area to promote  
15 navigational access to the Swan Point Channel.

16  
17 The most recent bathymetric surveys performed by CENAB in 1997 indicate that the bottom  
18 depths at the proposed placement Site 104 range between -12.8 meters (-42 feet) MLLW and -  
19 23.8 meters (-78 feet) MLLW. Although dredged material was placed at the site for ~~over~~more  
20 than 50 years, the material was not consistently placed to a particular depth at all locations to  
21 achieve a consistent bottom contour. The proposed action would raise the deeper areas within  
22 the site to -13.7 meters (-45 feet) MLLW and will not affect the areas that are shallower than -  
23 13.7 meters  
24 (-45 feet) MLLW. Bathymetric studies would be required before, during, and after placement to  
25 ensure that the placement is limited to approved depths. The proposed action at Site 104 is not  
26 expected to significantly affect the surrounding bathymetry outside of the site.

27  
28 The modeling of hydraulic placement (hydraulic unloading of individual barges by pump-out  
29 through a pipeline and diffuser to locations within 2 meters ([6.6 feet]) of the site bottom) of  
30 3,600 cy of dredged material from one barge resulted in a footprint with a thickness of 7.8 cm  
31 (3.1 in.) and a radius of 129 meters (423 feet). This footprint was used in the MDFATE  
32 modeling for each hydraulic placement event and resulted in changes in bathymetry similar to  
33 the stacking of disks or pancakes. Although this does not accurately represent what is expected  
34 to occur under actual conditions, it was the closest representation that could be modeled. The  
35 modeled footprint of material placed by bottom-release scow varies with each placement and  
36 depends on the depth of the water column through which the material is placed and the ambient  
37 current at the time of placement. In both placement scenarios, the cumulative height of  
38 mounded material above the surrounding bathymetry was attempted to be kept below 3.1 to 4.6  
39 m (10 to 15 ft) and the exposed surface area of newly placed material minimized. This was done  
40 in an attempt to minimize material exposure to erosive forces and thus minimize material  
41 erosion.

42  
43 Changes to water depths within the site would vary from year to year. The water depth changes  
44 will depend upon the quantities and locations of material placed in any one year, and the  
45 equipment and methods used for placement (i.e., bottom hydraulic placement vs. bottom-release  
46 scow or hopper dredge placement). The proposed action would raise the deeper areas within the

1 site to -13.7 meters (-45 feet) MLLW and will not affect the areas that are shallower than -13.7  
2 meters (-45 feet) MLLW. Figures ~~6-1F-12~~ through ~~6-5F-16~~ and Figures ~~6-6F-17~~ through ~~6-10F-~~  
3 21 show predicted cumulative changes to the bathymetry following each year of placement  
4 resulting from the MDFATE modeling for both bottom-release scow and hydraulic bottom  
5 placement, respectively. At the end of the fifth year, slopes range from basically flat throughout  
6 the majority of the site with steep slopes between 20:1 and 35:1 at the southern portion of the  
7 western boundary and at the southern boundary, where material accumulation above the existing  
8 depths is greatest. The steeper slopes would be formed in an attempt to maximize the capacity of  
9 the site.

10  
11 -The same placement plan was used for each of the modeled placement scenarios discussed  
12 above and allowed for a 152.4-meters (500-feet) buffer along the site perimeter. The placement  
13 plan for the modeling was developed to place an estimated 13.8 million m<sup>3</sup> (18 mcy) of dredged  
14 material at Site 104. The bathymetry at the end of the fifth year of placement is shown in  
15 Figures ~~6-5F-16~~ and ~~6-10F-21~~. However, these average water depths will increase over time due  
16 to consolidation of the placed material. This consolidation will occur due to the overlying  
17 weight of the newly placed dredged material. It is anticipated that areas where 9.1 meters (30.0  
18 feet) of dredged material are placed will consolidate by up to 1.1 meters (3.5 feet). In areas with  
19 less placed material, less consolidation should be seen. Fifty percent of the consolidation has  
20 been calculated to occur within the first ~~eight~~ 8 years following placement. The remaining  
21 consolidation should occur more gradually over the next three to four decades (E2Si 1998).

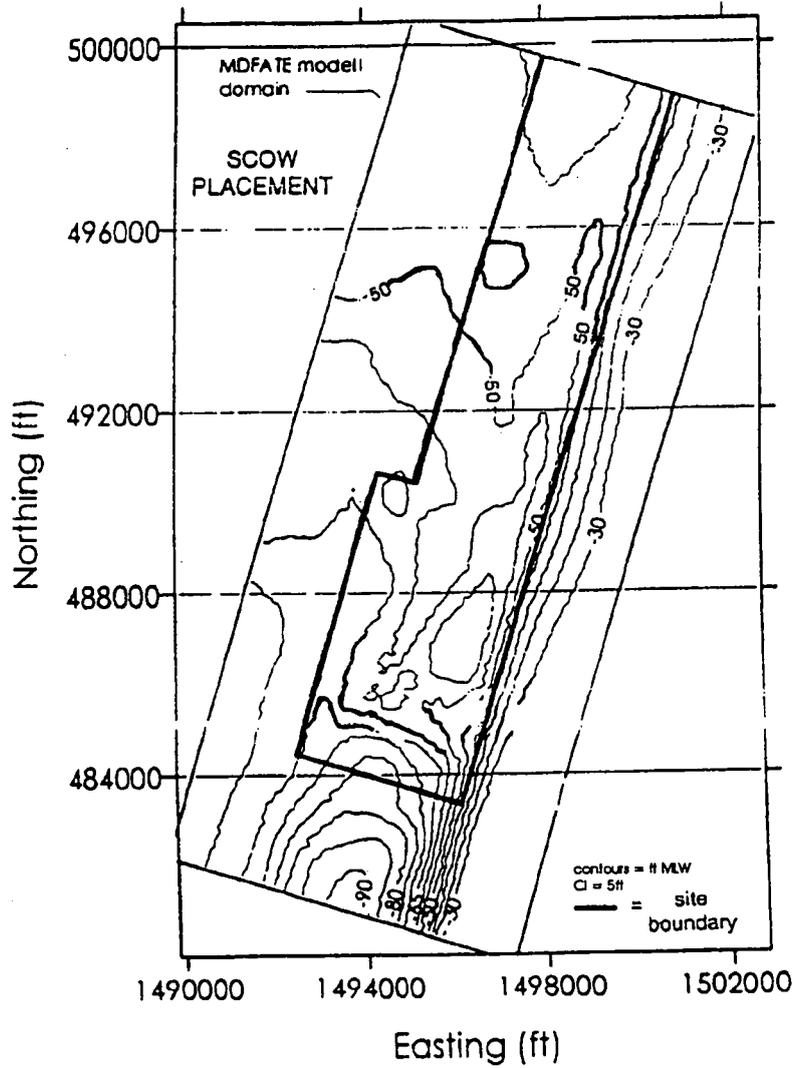
22  
23 6.1.3.eF.2.4.b Water Levels. Placement of dredged material at Site 104 would not affect  
24 extreme high water levels resulting from storm tides that are predominantly driven by wind  
25 forces and atmospheric pressure forces. Long-term sea level rise will cause higher average water  
26 levels. However, long-term sea level rise is a small percentage (less than ~~one percent~~ 1%) of the  
27 existing normal water level variations as discussed in Section ~~5.1.3.eF.1.3~~, and it is not  
28 anticipated to be affected by the proposed action.

29  
30 6.1.3.fF.2.4.c Astronomical Tides. Astronomical tides in the Chesapeake Bay and the Site 104  
31 area also would ~~also~~ not be impacted by the proposed action. Astronomical tides result from  
32 gravitational forces of the moon and the sun on the earth and from the earth's rotation, and are  
33 influenced, in part, by the three-dimensional shape of the estuary. Decreasing the water depth at  
34 Site 104 would not affect the magnitude of tidal height at Site 104.

35  
36 6.1.3.gF.2.4.d Extreme Water Levels (Storm Surge and Wave Setup). Extreme water levels  
37 would not be impacted by the proposed action as they are dominated by storm effects (i.e., storm  
38 surge and wave setup) in combination with astronomical tide. Storm surge is a temporary rise in  
39 water level from wind stress generated either by large-scale extra-tropical storms known as  
40 nor'easters, or by hurricanes. The rise in water level results from wind action, the low pressure  
41 of the storm disturbance, and the Coriolis force. Wave setup is a term used to describe the rise in  
42 water level due to wave breaking. Specifically, change in momentum that attends the breaking  
43 of waves propagating toward shore results in a surf zone force that raises water levels at the  
44 shoreline. Decreasing the water depth at Site 104 has no effect on these forces, and the area of  
45 Site 104 where the estuary bottom will be raised is a small percentage of the entire upper Bay.  
46 The storm surge at the site itself will not be higher due to the decrease in water depth.

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 2,502,000 cy total placement

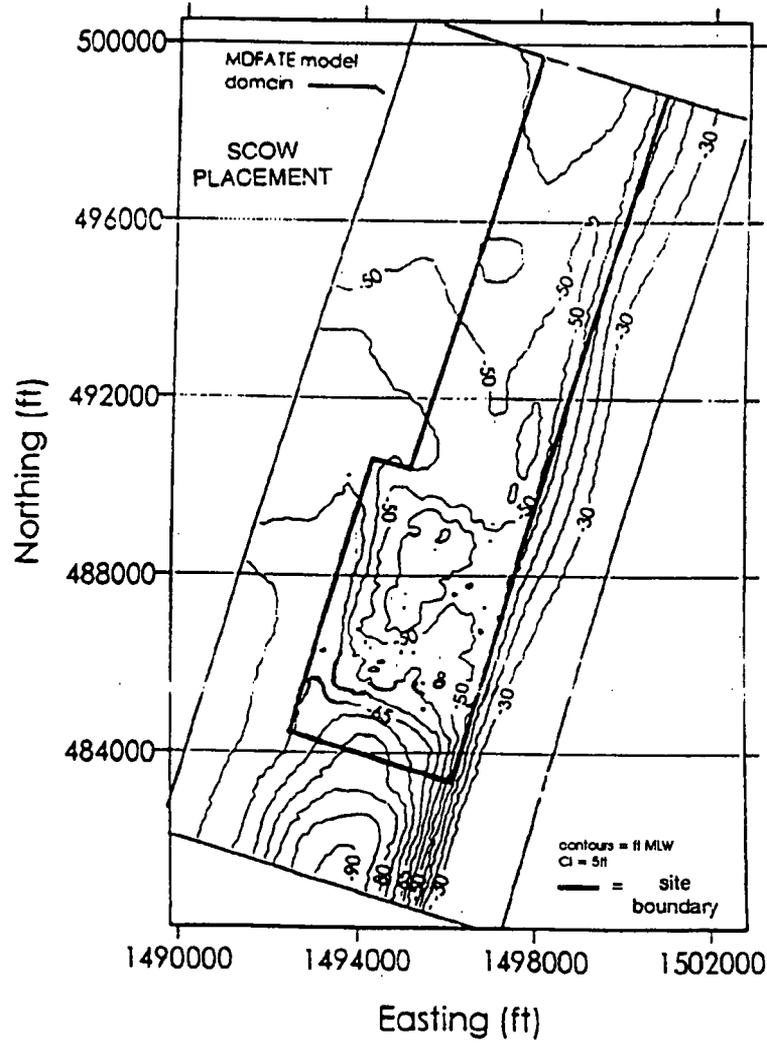


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-12.  
Bathymetry at end  
of first year  
bottom-release scow  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 7,002,000 cy total placement

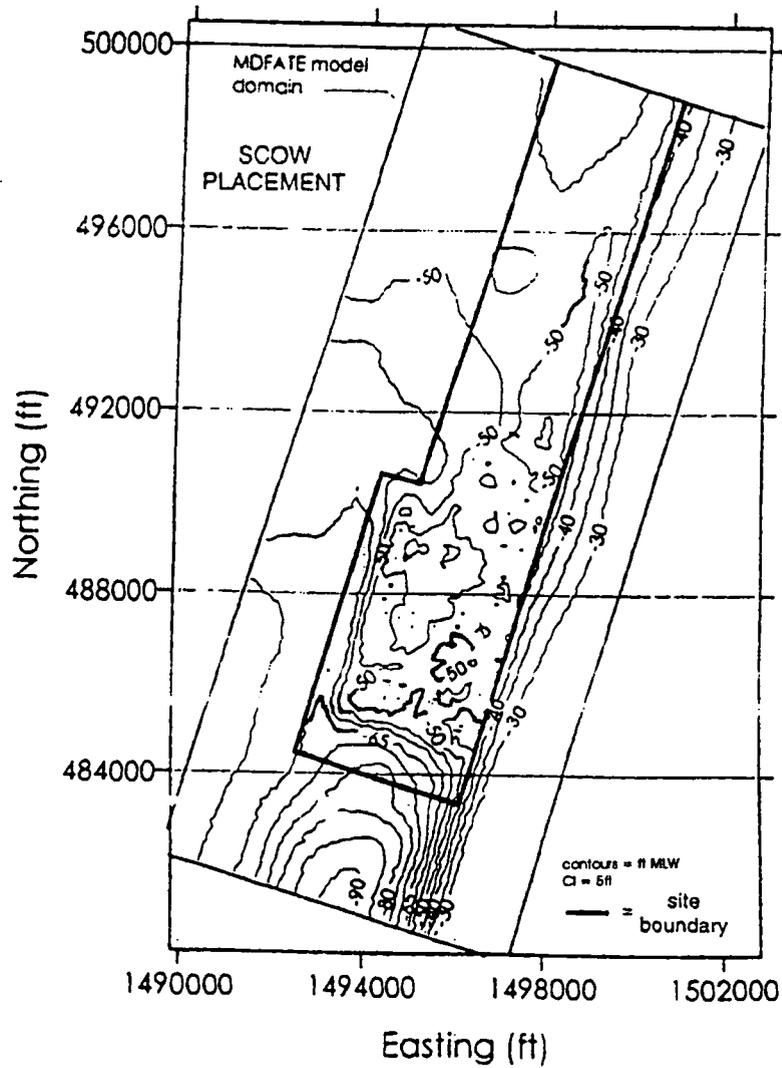


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-13.  
Bathymetry at end  
of second year  
bottom-release scow  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 10,026,000 cy total placement

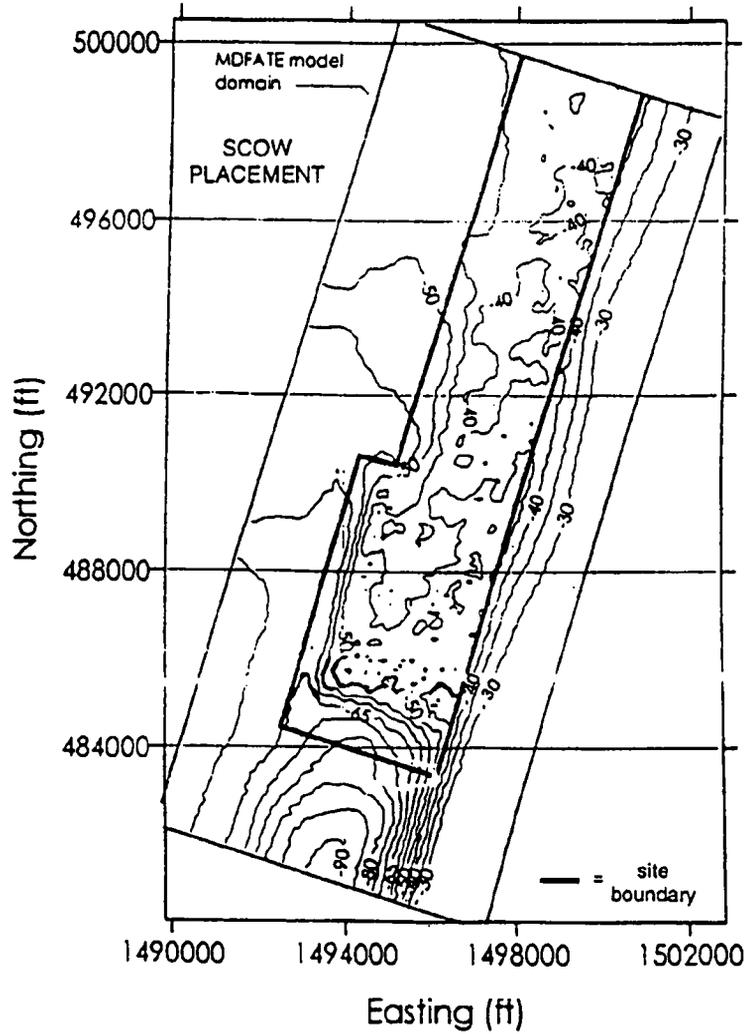


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-14.  
Bathymetry at end  
of third year  
bottom-release scow  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 16,074,000 cy total placement

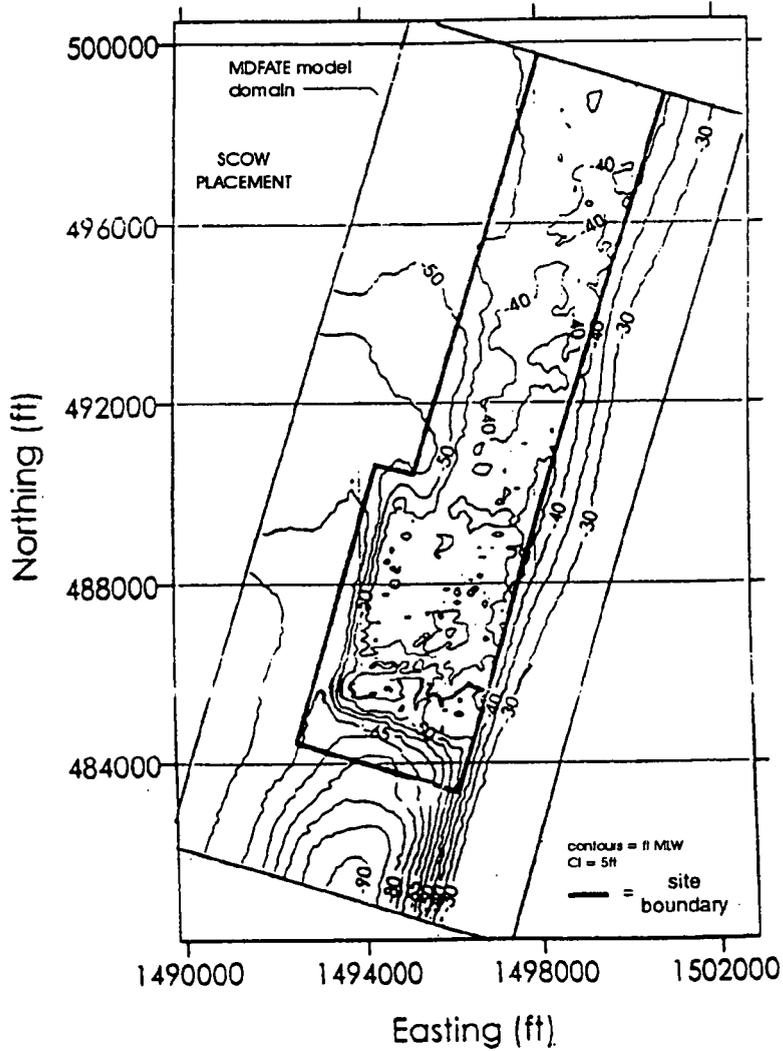


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-15.  
Bathymetry at end  
of fourth year  
bottom-release scow  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 18,090,000 cy total placement

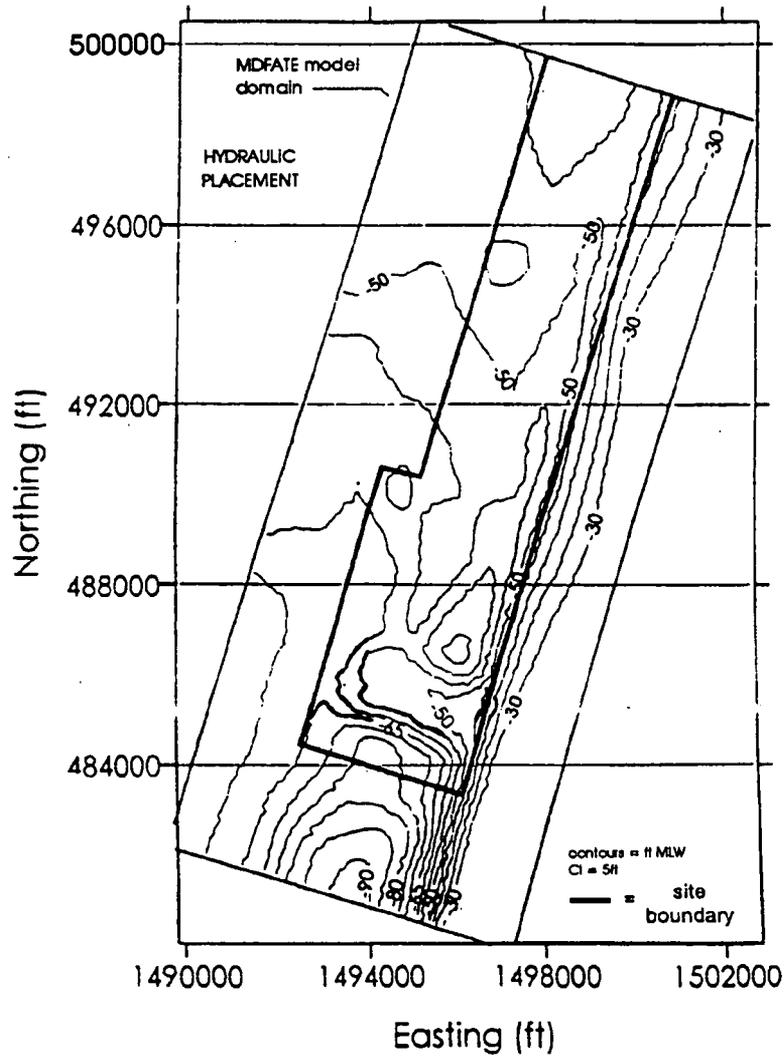


SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT

Figure F-16.  
Bathymetry at end  
of fifth year  
bottom-release scow  
placement

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 2,502,000 cy total placement

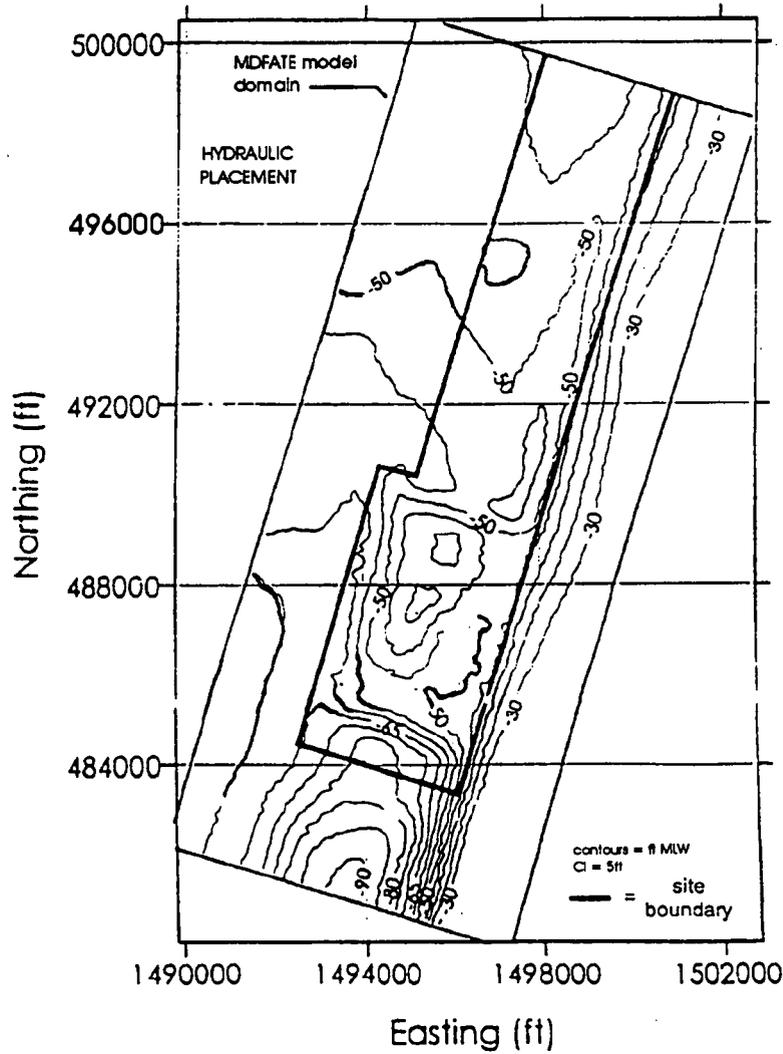


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-17.  
Bathymetry at end  
of first year  
hydraulic  
(controlled bottom pipeline)  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 7,002,000 cy total placement

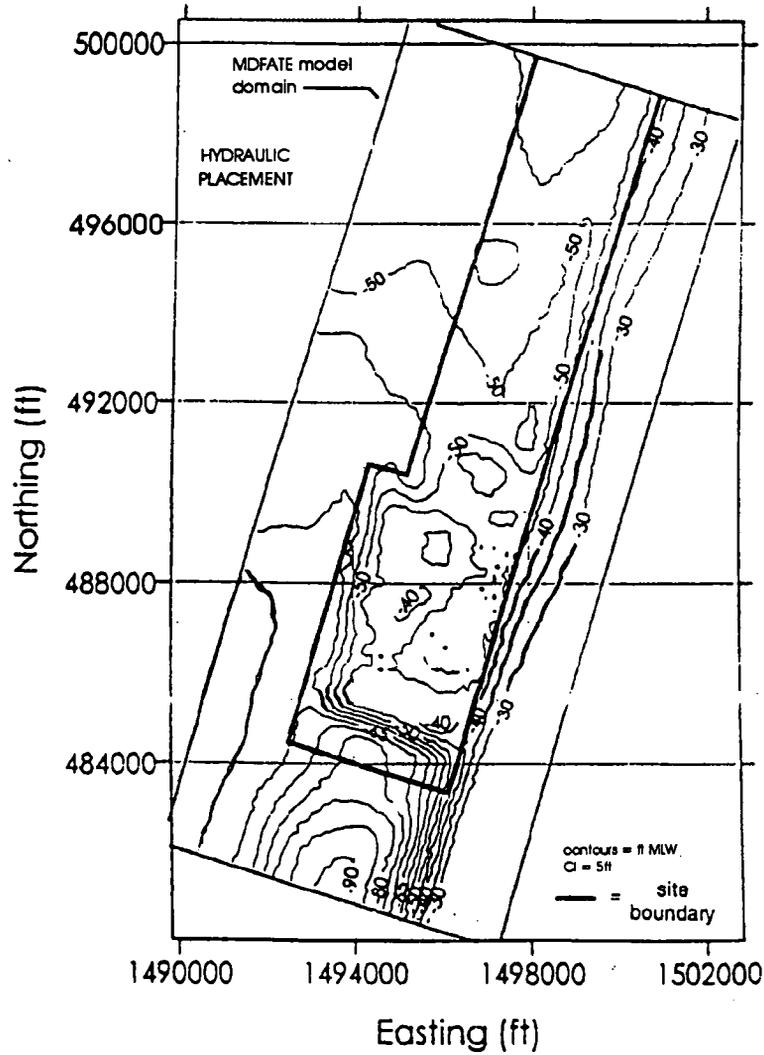


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-18.  
Bathymetry at end  
of second year  
hydraulic  
(controlled bottom pipeline)  
placement**

# Kent Island Dredged Material Placement Site

Year 1 Simulation: After 10,026,000 cy total placement

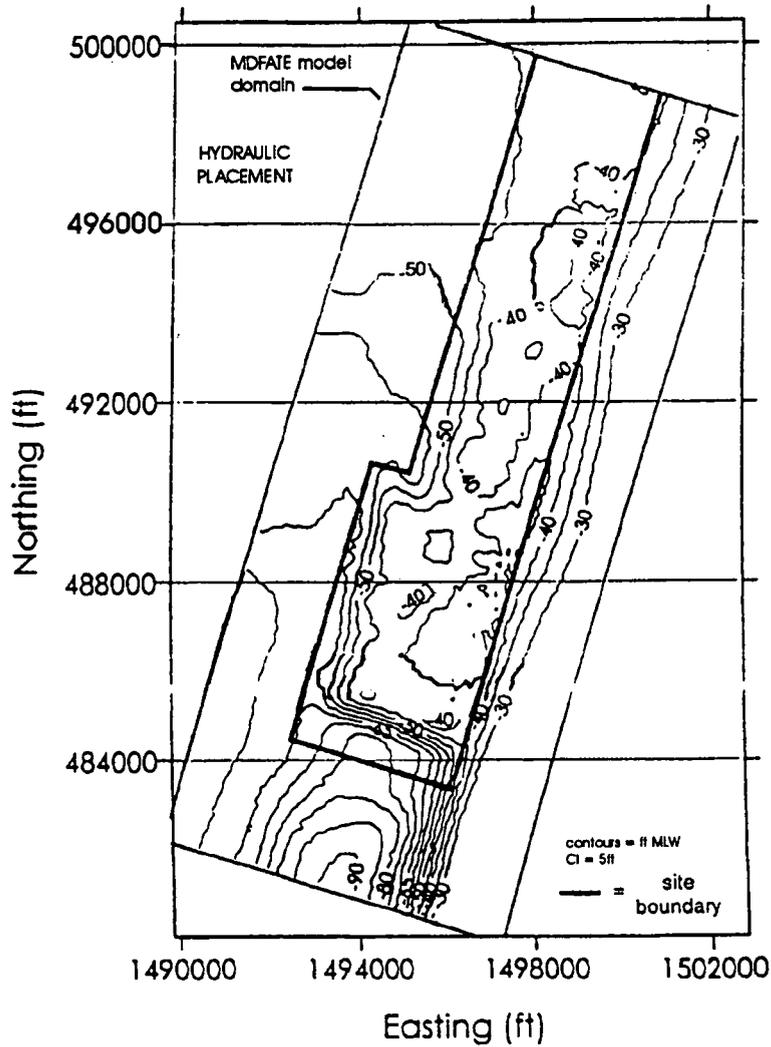


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-19.  
Bathymetry at end  
of third year  
hydraulic  
(controlled bottom pipeline)  
placement**

# Kent Island Dredged Material Placement Site

Year 4 of Simulation: After 16,074,000 cy total placement

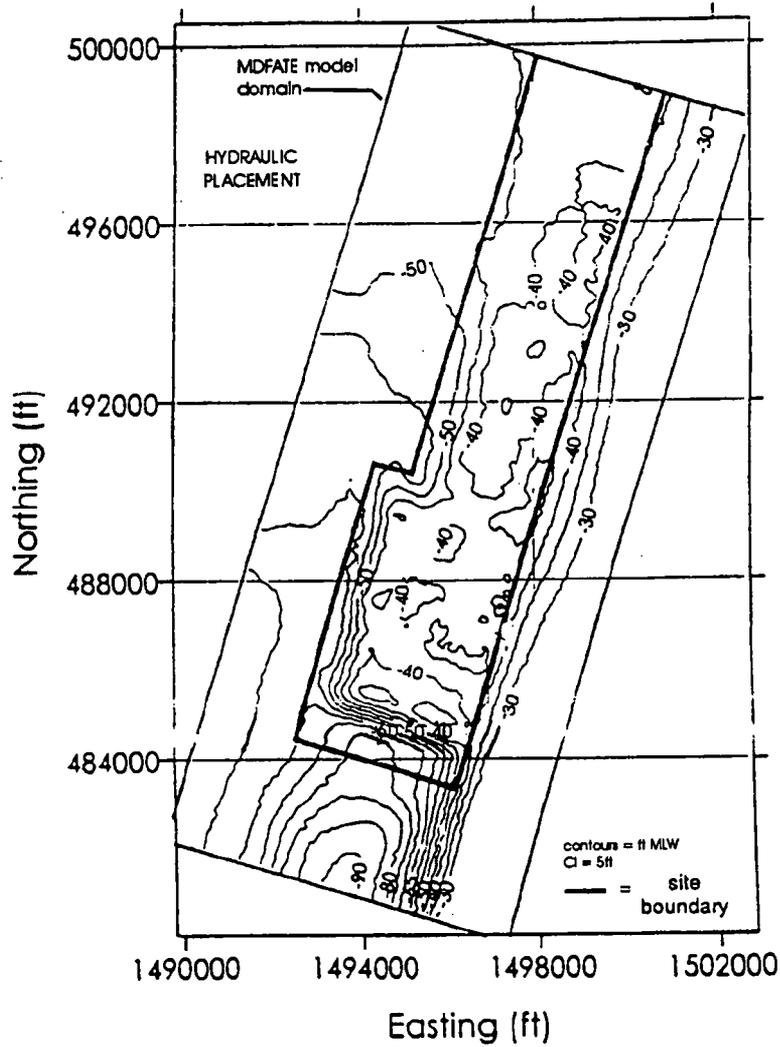


**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-20.  
Bathymetry at end  
of fourth year  
hydraulic  
(controlled bottom pipeline)  
placement**

# Kent Island Dredged Material Placement Site

Year 5 of Simulation: After 18,090,000 cy total placement



**SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT**

**Figure F-21.  
Bathymetry at end  
of fifth year  
hydraulic  
(controlled bottom pipeline)  
placement**

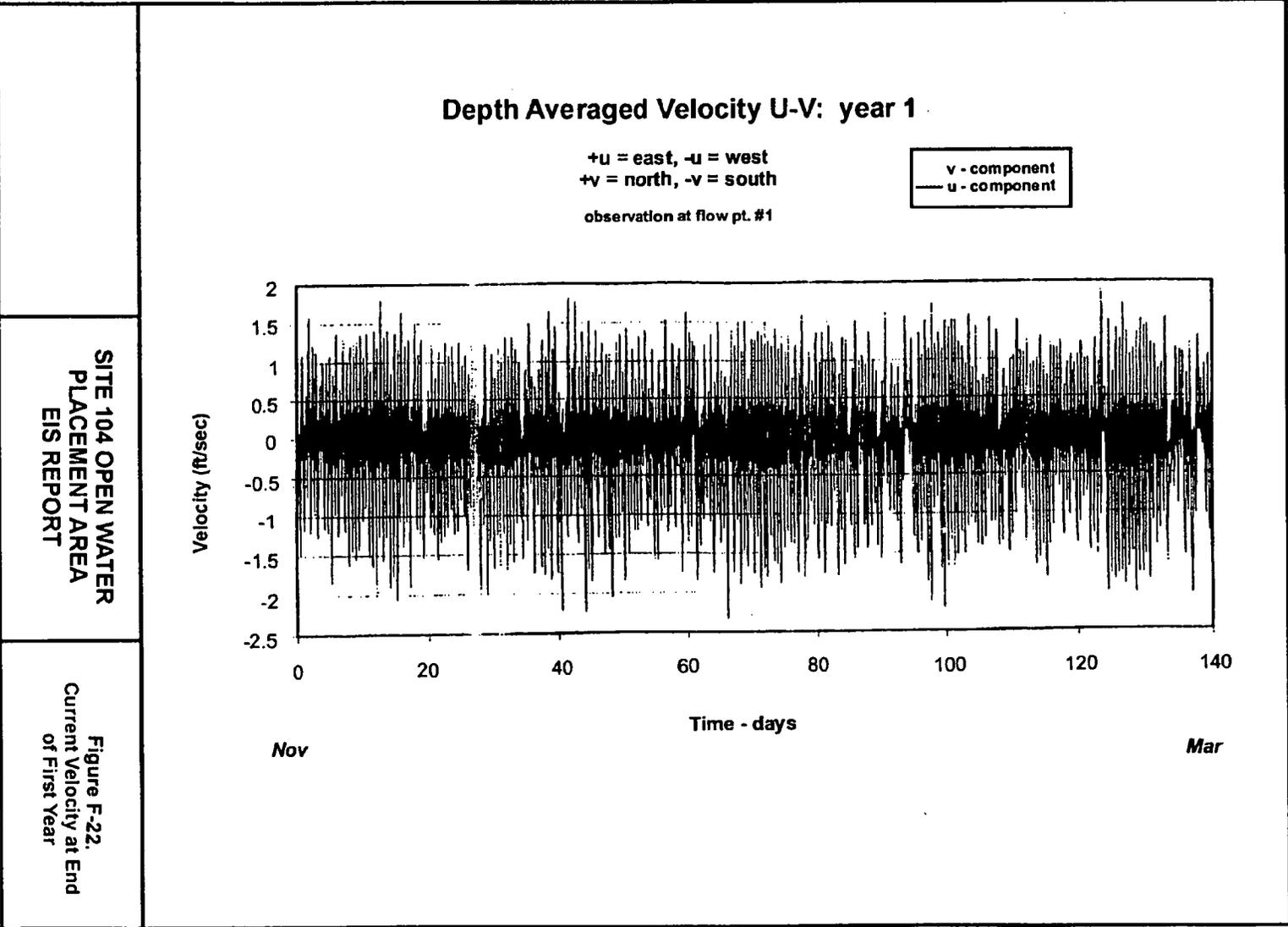
1  
2 Storm surge would indirectly affect the changed conditions at Site 104 as a factor in the  
3 development of extreme wave conditions: higher storm surge would allow for higher waves,  
4 longer wave periods, and longer wavelengths. For a given water depth, the longer the  
5 wavelength, the greater the erosional effect of the wave energy on the bottom. Based on the  
6 LTFATE modeling conducted, a 25-year storm event would not effect the bottom below -13.7  
7 meters (-45.0 feet), which is the current design elevation to which dredged material is proposed  
8 to be placed at Site 104. Storms greater than 25-year events would increasingly affect the  
9 bottom. For storms greater than a 25-year event, significant erosion and turbidity will occur in  
10 shallow waters east and north of the site, before Site 104 is affected. The 100-year storm event  
11 modeled using LTFATE predicts about 0.3 meters (1.0 feet) erosion for a bottom at elevation -  
12 13.7 meters (-45.0 feet) (Moffatt & Nieho 1998). Similar erosion rates for these storm events  
13 would be expected for the same type of sediments found at depths of -13.7 meters (-45.0 feet) in  
14 the areas of the Bay- in the vicinity of Site 104. Due to placement activities, the Site 104 area  
15 would be more susceptible to erosion from storm events occurring less frequently than the 25-  
16 year storm.

17  
18 **6.1.3.h F.2.4.e Wind Conditions.** Wind conditions on the earth are ultimately caused by energy  
19 from the sun and rotation of the planet. Subsurface placement of dredged material at Site 104  
20 would have no effect on wind conditions. Wind would have an effect only on the surface of the  
21 water where waves would be generated. Section ~~6.1.3.k~~ **F.2.4.h** (Wave Conditions) discusses the  
22 potential impacts on wave conditions caused by wind, whereas Section ~~6.1.3.g~~ **F.2.4.d** (Extreme  
23 Water Levels) discussed the effects of extreme wind/wave conditions.

24  
25 **6.1.3.i F.2.4.f Tidal Currents.** Placement of dredged material at Site 104 and subsequent  
26 decrease in water depth would theoretically cause a slight increase in tidal current velocity  
27 directly proportional to the decrease in water depth. Hydrodynamic model results indicated a  
28 slight increase for some depth-averaged velocity points as material was placed at the site;  
29 however, the magnitude of this change from year to year was negligible (see Figures ~~6-11F-22~~  
30 through ~~6-15F-26~~). Changes measured in the model are practically imperceptible (from zero ~~0~~ to  
31 a maximum of ~~two percent~~ **2%** increase in velocity from year to year) for the three observation  
32 points within the Site 104 project area (i.e., different elevations in the water column; one near the  
33 southern end of the site, one near the center of the site, and one further to the north of the site)  
34 (Appendix F.3).

35  
36 Note that although the boundary forcings from the 1993 data remain the same for each simulated  
37 year, the CH3D-WES model was rerun after each year of proposed placement using the changed  
38 bathymetry from the previous placement year (See Figures ~~6-1F-12~~ to ~~6-10F-21~~). The reruns  
39 resulted in changes to bottom shear stresses that were input to the subsequent years of -MDFATE  
40 modeling. Therefore, any minor changes in currents that were predicted to occur due to the  
41 decreased depths associated with dredged material placement; were taken into consideration  
42 during the erosion modeling.

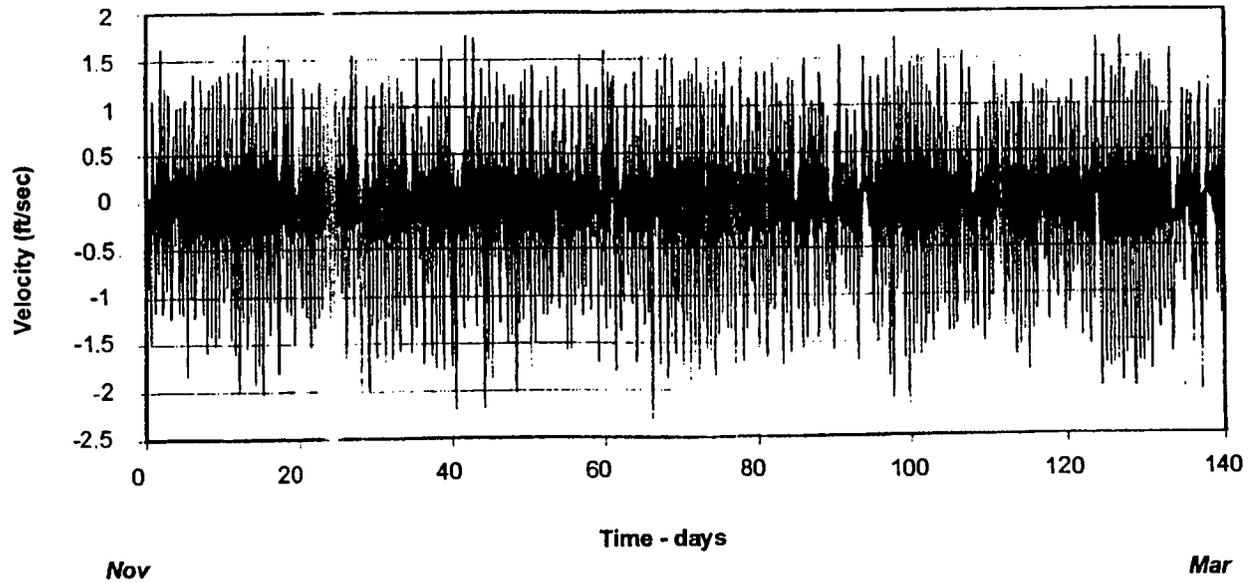
43  
44 Residual currents in the upper Bay would not be appreciably impacted with placement of  
45 material at the site. Existing residual current flow is toward the north. The tracer concentration  
46 studies show that the long-term movement of water over the site bottom is to the north due to



### Depth Averaged Velocity U-V: year 2

+u = east, -u = west  
+v = north, -v = south  
observation at flow pt. #1

v - component  
— u - component



SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT

Figure F-23.  
Current Velocity at End  
of Second Year

SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT

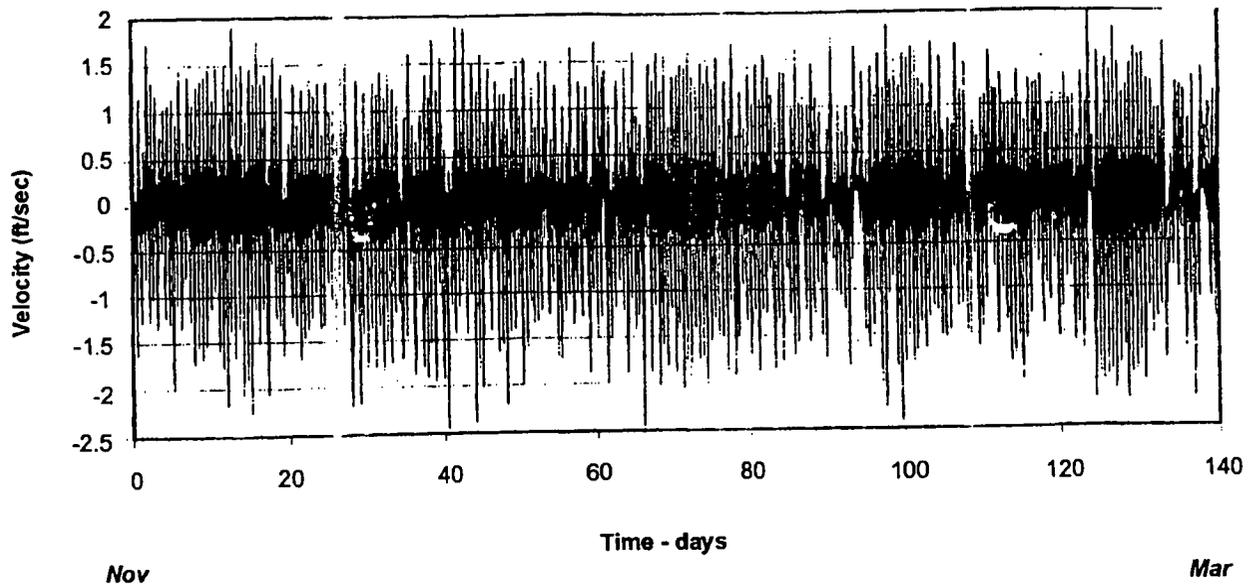
Figure F-24.  
Current Velocity at End  
of Third Year

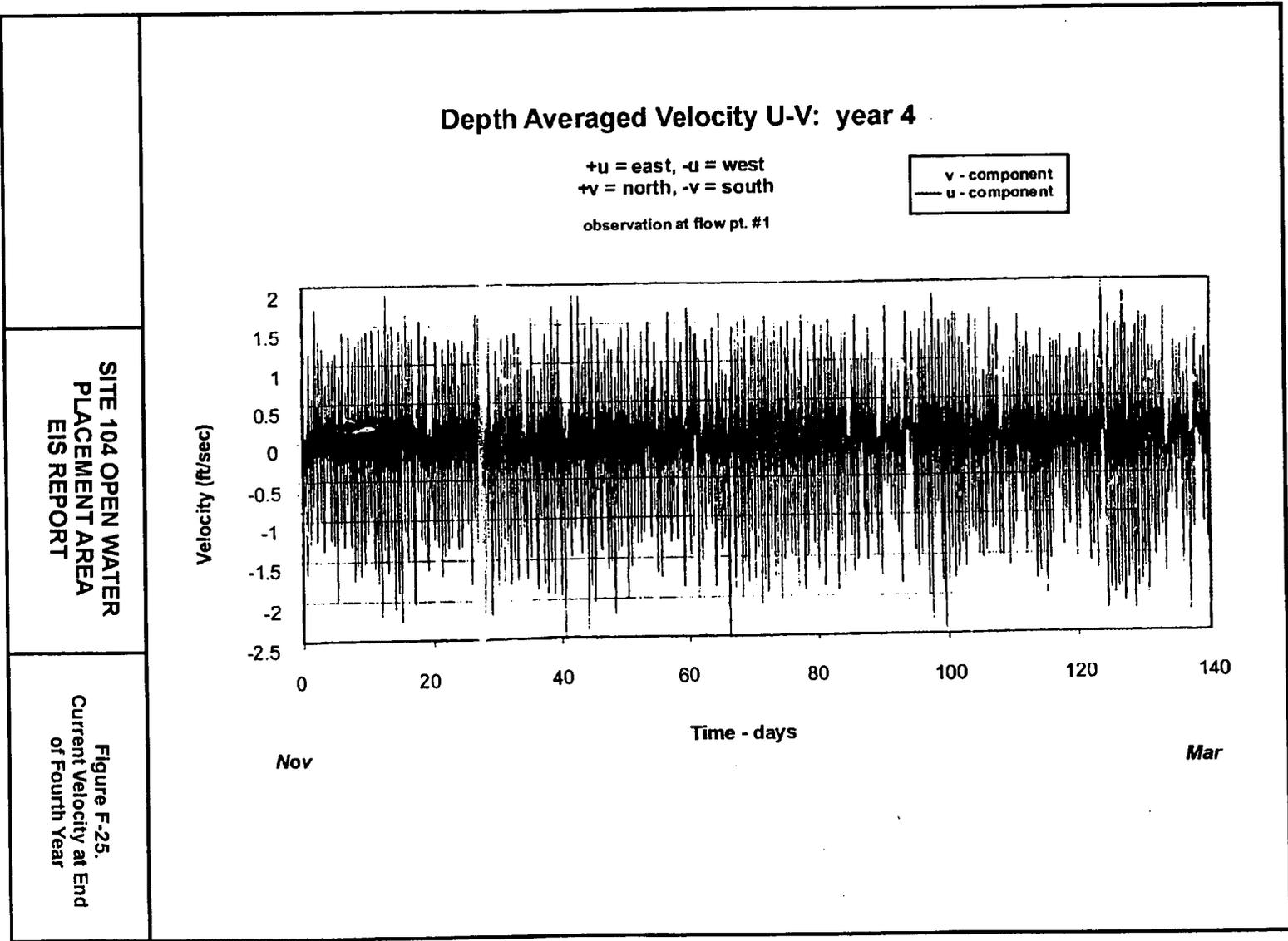
### Depth Averaged Velocity U-V: year 3

+u = east, -u = west  
+v = north, -v = south

observation at flow pt. #1

v - component  
— u - component





SITE 104 OPEN WATER  
PLACEMENT AREA  
EIS REPORT

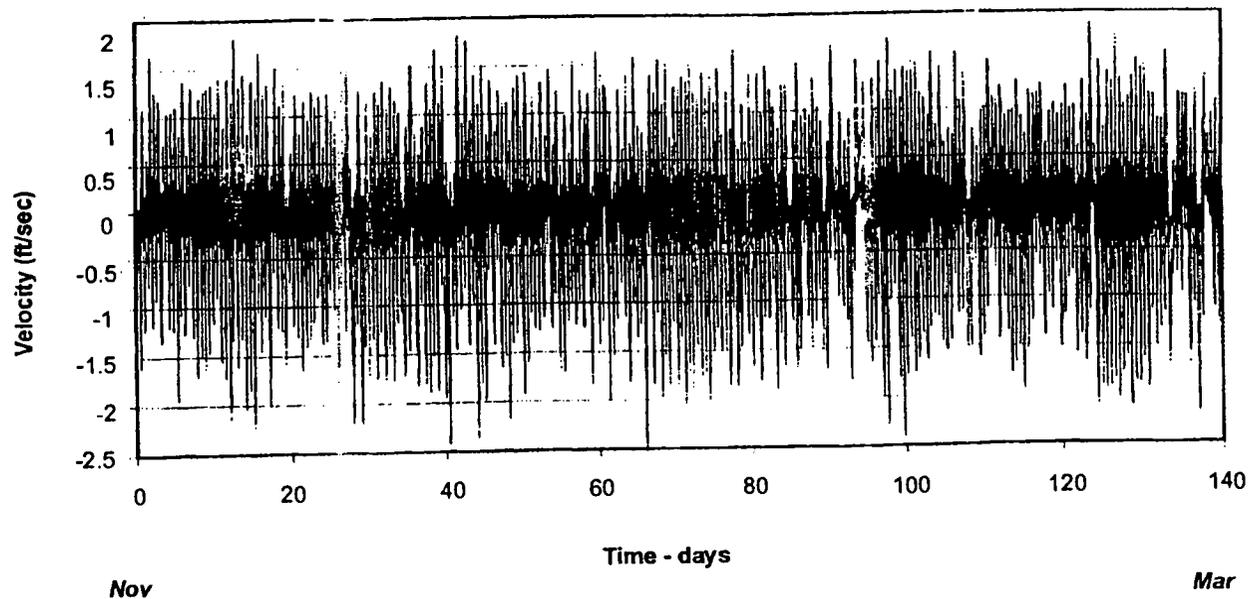
Figure F-26.  
Current Velocity at End  
of Fifth Year

### Depth Averaged Velocity U-V: year 5

+u = east, -u = west  
+v = north, -v = south

observation at flow pt. #1

v - component  
— u - component



1 gravitational circulation (WES 1998). Therefore, if material or nutrients remain in suspension  
2 for long periods of time, it is likely that some of the material or nutrients carried through the  
3 southern boundary of the site during an ebb flow could be carried back into the site during the  
4 subsequent flood cycle, with the net drift being to the north.

5  
6 6.1.3.jF.2.4.g Sedimentation. Sedimentation rates are controlled by the physical characteristics  
7 of the sediments and the hydrodynamics of the area. The hydrodynamic modeling revealed that  
8 variations in depth-averaged current velocities through the site area would change as little as ~~zero~~  
9 0 to two percent 2% and would not change significantly (WES 1998). -Based on these results, it  
10 is anticipated that natural sedimentation rates within the Site 104 area will -not be significantly  
11 impacted by the proposed action.

12  
13 Sedimentation and the potential for material movement at Site 104 due to placement of dredged  
14 material is dependent on: (1) the physical sediment characteristics of the placed material; (2) the  
15 physical characteristics of the water through which the material is being placed (i.e., temperature,  
16 salinity, and density, which are not anticipated to significantly change following the proposed  
17 action); (3) the created and existing bottom geometry; and (4) the hydrodynamics on the  
18 surrounding area.

19  
20 -Based on grain size analyses, the majority of the dredged material proposed to be placed at Site  
21 104 ( $\pm 95\%$ ) is made up of fine-grained silts and clays that typically would take a long period of  
22 time to settle as individual particles. Placement using bottom-release scows or hoppers causes  
23 the material to settle *en masse*, allowing it to reach the bottom faster than if individual particles  
24 were released. This is particularly true of cohesive sediments such as those proposed for  
25 placement at Site 104. A portion of the mass, however, does become removed (or stripped) from  
26 the cloud of placed material as it descends and remains in the water column.

27  
28 -The duration of time that this material remains in the water column depends on factors such as  
29 grain size and surrounding hydrodynamics. The STFATE model run for Site 104 indicated that <  
30 1% of material placed using bottom-release scows was stripped during descent and dispersed  
31 throughout the water column. This loss is not seen in bottom hydraulic placement since the  
32 material being placed is contained within the pipeline during descent and the discharge end of  
33 the pipeline is normally located within a few feet of the estuary bottom.

34  
35 When a load of mechanically placed dredged material (either placed with a bottom-release scow  
36 or a hopper dredge) reaches the site bottom and collapses, a portion of the material's clay  
37 fraction remains in suspension in the water column above the bottom surface. Modeling  
38 conducted for Site 104 using this placement technique indicated that loss of this suspended clay  
39 material would account for another 3.3% of the total of the mechanically placed material. It was  
40 assumed during the modeling that all of the hydraulically placed material settles to the bottom  
41 before erosive forces act on it.

42  
43 -No portion of the hydraulically placed material will experience the collapse phase to which  
44 mechanically placed material is subjected because the material will be pumped to the bottom  
45 through a pipeline. A combination of both mechanical (bottom-release scow) and -controlled

1 hydraulic pipeline—bottom—placement will likely be used for dredged material placement at  
2 Site 104.

### 3 4 **6.1.3.F.2.4.g.1 Sediment Erodability**

5  
6 To characterize the erodability of both in-place and dredged maintenance material currently  
7 proposed for placement at Site 104, sediment samples were obtained by Maryland Geological  
8 Survey (MGS) and provided to WES for laboratory erosion experiments described below. One  
9 sediment core was collected from each of the following channels with the exception of the  
10 Brewerton Channel Eastern Extension from which two samples were collected (one was  
11 collected at each end of the channel): Craighill Angle, Cutoff Angle, Tolchester, and Swan Point.  
12 The cores were collected in shoaling areas and are representative of the material proposed for  
13 placement at Site 104. Other channels proposed for maintenance dredging were not sampled  
14 because the channels had already been dredged for the season at the time of sampling. Previous  
15 sediment characterization studies in these channels (EA 1996) indicate that the physical  
16 characteristics of sediments in the non-sampled channels are similar to those of the cores  
17 collected for the erosion experiments. Generally, the sediments proposed for maintenance  
18 dredging are primarily comprised of silt/clay particles. Section 6.1.5.a provides a description of  
19 the core samples' physical characteristics.

20  
21 Results from the erosion tests were used to provide erosion parameters, such as critical shear  
22 stresses, for the modeling of material placement and potential erosion of the material placed both  
23 hydraulically and by bottom-release scow. This modeling was subsequently performed using  
24 MDFATE. The experiments tested both original channel sediments and sediments mixed with  
25 water from Site 104 (which had a constant and uniform density which is representative of the  
26 waters 12.0 meters (39.4 feet) below the surface, within 3.0 meters (9.8 feet) of the sediments at  
27 Site 104).

28  
29 —The sediment samples were placed in the 11.75—cm (4.63—in.) diameter test cylinder, covered  
30 with 12.7 cm (5.0 in.) of additional water from Site 104, and allowed to settle over specified  
31 increments of time between one\_1 and eight\_8 days prior to testing. The original sediments were  
32 representative of the material as it exists in the channels. The sediments mixed with water and  
33 allowed to settle were representative of material dredged and placed. A mechanical oscillating  
34 disk moved water over the surface of the sediments in the test cylinder at various rates equivalent  
35 to shear stresses of 0.1, 0.2, 0.3, 0.4, and 0.5 Pascals (allowing 30 minutes at each step) to  
36 simulate movement of water over sediments in Site 104 at various velocities.

37  
38 —The mass of sediments eroded from the test bed at each rate was measured to determine erosion  
39 rates and critical shear stresses to be used in the FATE modeling along with the shear stresses  
40 generated by the CH3D modeling for each year of placement. The effects of water pressure and  
41 gravitational forces were not simulated directly since these experiments simulated the impact on  
42 material erosion of a range of shear stresses acting on the bottom sediments. How those shear  
43 stresses are created in the real world is not considered by the model, (e.g., the total shear stress at  
44 Site 104 is influenced by tidal circulation). However, it is not each individual component of the  
45 shear stress that is important, but the total stress acting on the bottom which could potentially  
46 dislodge the sediments (Appendix F.2.; WES 1998).

1  
2 **Potential Erosion of Placed Dredged Material**  
3

4 The MDFATE model was run, as explained in the beginning of Section ~~6.1.3~~F.2.3 under "Model  
5 Descriptions" and in the study report located in Appendix F.3, for both bottom-release scow and  
6 bottom hydraulic placement scenarios to predict the percentages of material potentially lost from  
7 the site during placement. Long-term erosion losses as a ~~five~~5-year, weighted average were  
8 predicted to be 12.6% for placement with a bottom-release scow and 6.2% for hydraulic pump-  
9 out of individual barges. The weighted averages were determined by multiplying the annual  
10 predicted percent losses by the placement quantity for that year and then adding the resulting  
11 quantities and dividing them by the total quantity to be placed over the ~~five~~5-year time period.  
12

13 Predicted percent losses for bottom-release scow and hydraulic pump-out of individual barges by  
14 placement year and the ~~five~~5-year averages are provided below in Tables ~~6-4~~F-10 and ~~6-5~~F-11,  
15 respectively. Percentages vary from year to year based primarily on the total quantities of  
16 material placed and the placement locations. The greater the exposed surface area of new  
17 material and the closer the placement location is to the site boundaries, the more likely it is that  
18 placed material will erode and move outside of those boundaries.  
19

20 As discussed earlier in Section ~~6.1.3~~F.2.4.g, the bottom-release scow methodology was  
21 predicted to lose an additional 4.3% into the water column between the time the material left the  
22 barge and settled on the site bottom. It was assumed that all of the hydraulically placed material  
23 settles to the bottom before erosional forces act on it, since no portion of this material  
24 experiences water column stripping or the collapse phase to which mechanically-placed material  
25 is subjected. Therefore, the total predicted worst-case losses were 16.9% for bottom-release  
26 scow and 6.2% for hydraulic placement (Table ~~6-5~~F-11). However, these predicted losses are  
27 thought to be higher than will be experienced under actual conditions because the model could  
28 not predict the return of sediments back into the site effectively (WES 1998). As previously  
29 discussed, some sediment may leave the site during ebb tide and be transported back to the site  
30 during flood tide. The model can only predict the portion of material that has the potential to  
31 leave the site, not the portion that would be expected to return.  
32

33 For each placement method scenario, a representative year-long run was made for each year of  
34 proposed placement. The major impacts on the model results are the erosion parameters  
35 discussed above, the size of the material footprint from each placement event, and the bottom  
36 shear stresses generated from the CH3D-WES model for each simulated year of placement.  
37 Since the erosion parameters and the bottom shear stresses were the same for both placement  
38 scenarios, the controlling factor for material losses due to erosion was the footprint. As  
39 discussed in Section ~~6.1.3~~F.2.4.a, the footprint generated from the hydraulic placement  
40 modeling was smaller than the footprints generated from the bottom-release scow modeling.  
41 Reasons why a single barge pump-out results in a smaller footprint size and less erosion than a  
42 bottom-release scow include:

- 43 • Hydraulic pump-out will result in material reaching the bottom at a higher  
44 concentration and thus with a lower total volume than a barge release.  
45  
46

**Table F-106-4**  
**Dredged Material Erosion from the Bottom Surface by Placement Year**

Year	Mechanical (bottom-release scow)	Hydraulic (controlled bottom pipeline placement)
1	16.0%	6.3%
2	9.5%	4.0%
3	18.9%	10.4%
4	9.5%	4.7%
5	15.6%	9.2%
Weighted 5-Year Average	12.6%	6.2%

Source: WES 1998

**Table F-116-5**  
**Total Dredged Material Erosion as a Five Year Average**

Erosion	Mechanical (bottom-release scow)	Hydraulic (controlled bottom pipeline placement)
Water Column	4.3%	0.0%
Bottom	12.6%	6.2%
Total	16.9%	6.2%

Source: WES 1998

- 1 • Hydraulic pump-out results in a spreading layer that is of more limited height, is  
2 thicker, and has a smooth flow over a short distance from the discharge point,  
3 whereas, bottom release is turbulent and continues to pick up water as it spreads over  
4 the bottom.  
5
- 6 • Hydraulically placed material spreads closer to the bottom surface and is, therefore,  
7 less affected by currents.  
8
- 9 • Hydraulic pump-out will result in a spreading layer which will get denser more  
10 rapidly than a barge release and, due to the limited volume being pumped, will not  
11 spread as far from the release point as a barge release does (WES 1998).  
12

13 Therefore, as shown in Table ~~6-4~~F-10, the bottom erosion for mechanical placement is predicted  
14 to be greater than hydraulic placement for each placement year. However, results would be  
15 different if hydraulic placement were conducted with a continuous flow instead of pump-out of  
16 individual barges. In this case, the hydraulic placement footprint would be larger and thus  
17 subject to greater erosion.  
18

#### 19 ~~6.1.3.j~~F.2.4.g.2 Material Spreading 20

21 One aspect of dredged material placement that is not considered by STFATE, MDFATE, and  
22 hydraulic footprint modeling is the spread of material on a slope. SURGE modeling was  
23 performed to evaluate distances that placed material could travel along the bottom from the  
24 location at which the material reaches the site bottom. The modeling was performed using data  
25 from the STFATE modeling of bottom-release dredged material placement at the deepest part of  
26 the site (i.e., near the southern boundary since bottom slopes are greater there). Although not  
27 specifically modeled (since no model exists that can do so), hydraulically placed material should  
28 also be expected to spread further on slopes versus a flat bottom.  
29

30 –Typical slopes anticipated to be encountered at Site 104 were between 0.0% and 1.5%. Typical  
31 slopes were measured from existing bathymetry, and modeling calculations determined the post-  
32 shearing angles that result from “slumping” of placed material, as described in the study report in  
33 Appendix F.3. Predicted dredged material spreading over the slopes ranged from approximately  
34 220 meters (720 feet) to 920 meters (3,020 feet). The model assumes that the slopes are  
35 continuous, whereas in reality, opposing slopes could be encountered, therefore reducing the  
36 amount of material spreading.  
37

38 –A SURGE model run was made on a 1.5% slope with a created 6 meters (20 feet) high  
39 opposing slope of approximately 7H:1V placed approximately 305 meters (1,000 feet) away.  
40 The results of the model run indicated that the surge produced from placement on the 1.5% slope  
41 would not have enough energy to overtop the opposing slope. The results of the SURGE model  
42 should be viewed with caution, since actual surge data for placement operations at Site 104 do  
43 not exist to verify the model. Also, some input parameters for the Site 104 modeling had to be  
44 obtained from what were thought to be similar projects for which these data were available  
45 (WES 1998).  
46

1 **6.1.3.jF.2.4.g.3 Potential Sediment Transport**

2  
3 It should be noted that a portion of the predicted losses is comprised of material that leaves the  
4 boundaries of the MDFATE model to the south during an ebb tide or to the north during a flood  
5 tide and could potentially re-enter the site boundaries during a flood tide or ebb tide,  
6 respectively. The model does not track sediments once they leave the model boundaries. The  
7 site boundaries are rectangular and were established to include the bottom two-thirds of the Site  
8 104 project area, and extend approximately an additional 915 additional meters (3,000 feet) to  
9 the south and 610 meters (2,000 feet) on both the east and west sides of the southern portion of  
10 the site.

11  
12 -In reality, material in suspension is influenced by the tidal cycles and, therefore, material that  
13 moves from the site due to tidal fluctuations could be brought back into the site boundaries on  
14 the next opposing tide (i.e., what leaves with the ebb tide could return with the flood tide). In  
15 addition, material that left the northern model boundary could still be in the northern third of Site  
16 104. -These "losses," therefore, would not truly be lost from the site. This dynamic process  
17 will continue over a period of time. Sediment will consolidate and movement will eventually  
18 approach or equal the normal sediment redistribution patterns in the upper Bay.

19  
20 The tracer studies conducted using the CEQUAL-ICM model to evaluate net long-term  
21 movement of suspended material within the Site 104 area indicated that the net residual current  
22 is directed northward. Material that remains in suspension would thus have a tendency to be  
23 transported northwards. Material placement at Site 104 is proposed for the -southern deeper  
24 portions of the site where depths are currently greater than -13.7 meters (-45 feet) MLLW.  
25 This equates to approximately the lower two-thirds of the site. Material would not be placed in  
26 the northern portion of the site in depths shallower than -13.7 meters (-45 feet) MLLW  
27 (approximately the northern one-third of the site).

28  
29 -No model of the Chesapeake Bay exists that can quantifiably track potential sediment  
30 movement throughout the Bay. Therefore, the final destination of the material that was predicted  
31 to leave the site remains unknown. Based on typical settling rates, however, it is believed that  
32 any material placed at Site 104 that is suspended in the bottom currents will settle out over a  
33 short distance and, depending on the location of the -placement, will most-likely stay within the  
34 site boundaries unless further erosion takes place.

35  
36 **6.1.3.kF.2.4.h Wave Conditions.** Average and extreme wave conditions for Site 104 are  
37 dependent on wind conditions within the Chesapeake Bay region. As stated in Section  
38 6.1.3.gF.2.4.d above, wind conditions would not be affected by the proposed action and,  
39 subsequently, placement of dredged material at Site 104 would not affect wave conditions at the  
40 site. Average depths at the site will not change to the extent that normal wave conditions would  
41 have an effect on the increased bottom elevations. Effects from extreme wave conditions due to  
42 storms were discussed earlier in Section 6.1.3.eF.2.4.b. The proposed action is not expected to  
43 change the characteristics of surficial waves at the site. For storm events greater than or equal to  
44 a 25-year storm event, however, sub-surface waves will impact the bottom.

45  
46 **6.1.3.lF.2.4.i Effects of a Berm on Flow Field and Dredged Material Placement**

1  
2 If a berm is built at the southern boundary of Site 104, there could be two impacts relative to the  
3 proposed placement of dredged material at the site. The first impact (probably the most  
4 significant) is related to the possibility of the berm stopping bottom density surges containing  
5 suspended sediment. These surges result from the encounter of the placement material striking  
6 the bottom. The second is the impact on erosion of deposited placement material.  
7

8 When the placement material descends through the water column as a cloud or jet, it entrains  
9 ambient water and grows. At the moment of bottom encounter, the jet or cloud of material  
10 possesses a certain amount of energy, which is the sum of its potential and kinetic energy. An  
11 outward flow of the suspended sediment and water mixture then occurs along the sea floor. This  
12 is referred to as the bottom surge. This outward movement of suspended sediment and water  
13 mixture continues until the energy possessed by the surge is dissipated. Dissipation of its kinetic  
14 energy occurs due to frictional effects. Potential energy is converted to kinetic energy and is also  
15 lost due to the fact that as the surge loses energy and slows down, suspended material is  
16 deposited on the bottom, resulting in a decrease of the surge's density.  
17

18 Whether placement occurs on a flat bottom, a down slope, or an up slope, all of the processes  
19 described above occur. However, if a down slope is encountered, the surge also gains energy  
20 due to the gravitational force accelerating the surge down the slope. Likewise, when the surge  
21 attempts to move up a slope, the kinetic energy of the surge decreases due to the resisting  
22 gravitational force.  
23

24 The behavior described above has been incorporated into the model called SURGE. A  
25 simulation of the placement by bottom scow release in a water depth of 21.3 meters (70 ft) at  
26 Site 104 that occurs 304.8 meters (1,000 ft) in front of a 6.0 meters (20 ft) high berm with an  
27 angle of repose of 8 degrees has been made with SURGE. The model predicted that the energy  
28 of the bottom surge would be dissipated before the surge over topped the berm. Of course, these  
29 results should be viewed with caution since results are dependent on parameters such as the rate  
30 of dissipation and the rate of conversion of potential energy to kinetic energy. However,  
31 depending on the characteristics of the placement material, the placement process, and the  
32 placement bathymetry, berms can obviously be used to control the spreading of placement  
33 material contained in bottom surges.  
34

35 The second impact of constructing a berm at the southern boundary of Site 104 relates to changes  
36 in erosion of deposited material that might occur due to changes in the flow field caused by the  
37 berm. These impacts will be very localized and relatively insignificant. The impact on the flow  
38 field will be determined by the magnitude of the ambient flow and the height of the berm. In any  
39 case, the impact away from the berm should not extend more than ~~2-3~~two to three times the  
40 height of the berm. Thus, changes in erosion rates will only be seen within perhaps 50-100 ft of  
41 the location of the berm.  
42

**SITE 104 MONITORING FRAMEWORK**

**9I.1 PURPOSE**

Monitoring for the Site 104 placement operations will be performed as part of regulatory compliance, to ensure that performance criteria are met, to confirm and to limit the predicted potential impacts, and to provide information to further assist in the management of the site. Results of the Site 104 monitoring framework can be used to verify assumptions and predictions or to provide a basis for modifying the site management process. This monitoring framework was developed with the objective of providing the information needed by regulatory and resource agencies to meet their operational requirements and data needs, and serves as a template for developing the monitoring plan. The monitoring framework will be submitted by CENAB to MDE for approval as part of the Water Quality Certification requirements for this project should a favorable Record of Decision be issued for use of Site 104 for placement of dredged material.

**9I.2 INTRODUCTION**

This monitoring framework, like the study process and project design, is the result of a collaborative effort. It has been developed to provide a multi-disciplinary monitoring program that meets the regulatory and resource agencies requirements for the Site 104 open-water placement project. Monitoring needs have been identified in a collaborative manner by a multi-disciplinary group of state and Federal regulatory and resource agencies for similar sites throughout the upper Bay (e.g., Hart-Miller Island, Pooles Island sites, and Poplar Island).

Agencies providing expertise and information on Region III and CBP monitoring elements will include NMFS, USFWS, MDNR, MGS, MPA, MDE, MES, EPA, USACE, UMCES HPEL, and CBL. A collaborative, multi-disciplinary team will participate in the development of the monitoring framework in order to contain costs, to ensure comprehensive monitoring, and to provide concurrent peer review of the monitoring effort.

The development of the monitoring approach is a dynamic process, and monitoring elements will evolve to fit changing conditions and findings. The specifics of each monitoring element will be controlled by the final project details. Changes will continue to be presented to the agency team for their review and comment. Monitoring is intended to be flexible in order to meet the needs of the project and the requirements of the resource and regulatory agencies over time. Each element will be evaluated at the end of each monitoring year, and the monitoring team will decide upon appropriate changes as necessary.

These monitoring needs require that data be collected before, during, and after placement at Site 104. The baseline data include information previously collected for the NEPA process to document existing conditions in or around Site 104. Data collected would be used to compare and assess future conditions both during and after placement occurs. Baseline data collection was initiated in the spring of 1996.

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The use of fish (demersal and pelagic) and crustaceans such as crabs to directly monitor the impacts of the placement operations is not appropriate. They move into and out of the Site 104 area, which makes it impossible to determine how representative they would be in assessing the impacts of placement operations in Site 104. Also, the direct effects of dredged material placement in open waters on the behavior and long-term physiological response of fish and crabs is poorly understood. There are no indices or coefficients (such as toxicity tests) that allow the direct exposure effects on predators to be quantified.

Although not included in this framework, a ~~two~~-year monitoring program for the shortnose and Atlantic sturgeon was developed by the NMFS, USFWS, and USACE and implemented by the USFWS and funded by CENAB and CENAP. An interim Biological Assessment (BA) is being prepared by the Baltimore District and will be provided to NMFS at the time of the public release of this draft EIS. This interim BA will include all sturgeon-related field data available at that time. In addition to the data collected during this sturgeon monitoring program, the interim BA will include data collected during the USFWS Bounty Program.

### **91.3 MONITORING ELEMENTS**

#### **91.3.1 Site Management**

The objectives of this monitoring element are as follows:

1. To provide guidelines for placement of material at Site 104;
2. To specify operational criteria where controls are necessary;
3. To provide detailed plans for meeting restrictions imposed by certification; and
4. To provide monitoring of site performance.

The following methodologies will be used to achieve the above objectives:

Guidelines for material placement would be designed to minimize resuspension and dispersion of sediment, and to ensure that material is placed in accordance with pre-designated locations and depths within the placement site. Placement plans will be developed prior to each year's dredging and will be developed based on pre-placement surveys performed to verify the capacity of the Site 104 area. The specific minimum performance criteria may include, but are not necessarily limited to: (1) verification of dredging and placement depth by bathymetric surveys, (2) use of specified routes for travel between the dredging and placement sites, and (3) verification of dredging and placement locations using data from electronic navigation systems.

Implementing operational controls on the placement activities would minimize the opportunity for sediment resuspension and dispersion during the placement process while maximizing operational efficiency and safety. Control techniques may include, but are not limited to: (1) contractually requiring that the placement operations meet specific minimum environmental performance

standards and environmental windows; (2) contractually requiring submittal and implementation of project-specific plans; (3) placement of marker buoys to identify routes or -the designated material placement locations; (4) use of a Global Positioning System with onboard recording capability to identify and document the location of material placement and/or requirements for inspectors to verify placement locations; (5) requiring the dredging contractor(s) to meet specific minimum competency and experience standards; and (6) notifications to fishing and boating interests of dredge and scow movements and schedules.

CENAB will submit a finalized Site Management Plan to MDE to ensure coordination of all parties involved and will obtain approval for use of Site 104 prior to commencement of any placement activity. The Site Management Plan will include estimates of placement capacity and coordinates of the designated grid area in which all placement will occur. This will include the placement sequence of material and the designated locations and volumes. The operations plan to be used by the contractor for dredged material placement will also be appended to the Site Management Plan.

#### Study Endpoint:

The study endpoint of this monitoring element will be determined within a window to be defined following the last placement action. This window will be clarified based upon information collected following the completion of all placement activities.

### 91.3.2 Consolidation and Erosion

The objectives of this monitoring element are as follows:

1. To determine the initial capacity of the Site 104 area before and the remaining capacity after each placement season;
2. To measure and evaluate changes in the material placed within and around the Site 104 area due to erosion and consolidation of sediments;
3. To evaluate the monitoring data and suggest modifications as necessary in the monitoring program design and in site management.

The hypothesis being evaluated is as follows:

Dredged sediment is subject to predictable forces after placement which result in relatively standard rates of consolidation and erosion, based on the type of material, the method of placement, and the placement location. Placement of dredged material will not materially deviate from these expected conditions.

Observations of consolidation and erosion in the Site 104 area would be determined through sample collection, laboratory analysis, and data processing and synthesis. Existing sediments in the Site 104 location would be collected and analyzed before dredging and placement operations begin. Bathymetric surveys of the placement area would also be performed prior to placement to evaluate changes in capacity of the placement area over time. At the conclusion of the proposed

139 placement activities and at the end of the monitoring period, core samples would be collected  
140 from the placement area to provide a baseline for evaluating changes in the deposited sediments  
141 over time. Selected samples would be subjected to grain size and bulk property analyses. These  
142 data would be analyzed to determine volumetric changes due to consolidation of the foundation  
143 sediments.

144  
145 Study Endpoint:

146  
147 Monitoring would be performed each year that placement occurs within the Site 104 area, and up  
148 to ~~one~~ one year after placement is completed to document consolidation and erosion.

### 149 **91.3.3 Shellfish Bed Sedimentation**

150  
151 The objective of this monitoring element would be to provide information on the change in  
152 sedimentation rates on nearby charted oyster bars (State of Maryland Natural Oyster Bars  
153 [N.O.B.] 6-5 and 4-8), otherwise known as Broad Creek and the Bear Creek Bar, respectively)  
154 and at adjacent reference sites.

155  
156 The hypothesis being evaluated is:

157  
158 There is no discernable increase in sedimentation rates on the charted oyster bars during  
159 placement when compared to sedimentation rates prior to placement activities, adjusted to reflect  
160 seasonal and annual variations in sedimentation.

161  
162 To test this hypothesis, the baseline sedimentation rate within the oyster bar must first be  
163 determined and then compared to rates obtained during placement operations. This will be  
164 accomplished using bathymetric surveying combined with a side-sonar survey and acoustic  
165 bottom classification. The baseline accumulation rates will be determined by measurements  
166 made at predefined locations within the oyster bar for a specified period prior to initiation of  
167 placement operations. The rates will be adjusted to reflect seasonal and annual variations to  
168 enable an appropriate comparison. The specific approach will be developed prior to submission  
169 of the monitoring framework.

170  
171 If it is determined that sedimentation within the oyster bar has increased due to placement of the  
172 dredged materials, operations will be discontinued until the placement methods can be re-  
173 evaluated and refined.

174  
175 Study Endpoint:

176  
177 Evaluations would continue annually to determine whether monitoring should continue.

### 178 **91.3.4 Sediment Quality Monitoring**

179  
180 The objectives of this monitoring element are as follows:

181  
182  
183

- 184 1. To characterize the chemical composition of the sediments in the channels to be  
185 placed at Site 104;  
186  
187 2. To track the quality of sediments placed at Site 104; and  
188  
189 3. To distinguish the anticipated improvement of the sediment quality at station KI-7  
190 (which had the highest levels of contaminants).  
191

192 The hypotheses being evaluated are as follows:  
193

- 194 1. The priority pollutant organic compound concentrations in sediments taken from the  
195 channels and placed at Site 104 will be below detection limits or below the  
196 appropriate criteria for these constituents.  
197  
198 2. The metal concentrations in sediments placed at Site 104 will be below appropriate  
199 criteria for these constituents; and  
200  
201 3. After ~~one~~ 1 year of placement at KI-7, the concentrations of metals and organics will  
202 be below the appropriate sediment criteria for these constituents.  
203

204 Sediment samples would be collected both inside and outside the boundaries of Site 104 every  
205 ~~three~~ 3 years -at the same locations as in the baseline sampling (Figure 5-13). Sediment samples  
206 would be analyzed for organics, inorganics, nutrients, and grain size (including the Atterberg  
207 limit tests).  
208

209 Samples would be collected from the Chesapeake Bay approach channels and analyzed using  
210 field and laboratory methods as defined by the Chesapeake Bay Program to support the Inland  
211 Testing Manual guidelines (EPA and USACE,1998). The results of these samples are used to  
212 define the materials dredged during channel maintenance operations.  
213

214 After ~~one~~ 1 year of placement, sediments at station KI-7 would be analyzed to verify equal or  
215 improved sediment quality over baseline conditions.  
216

217 Study Endpoint:  
218

219 The study endpoint of this monitoring element will be the final monitoring following the last  
220 proposed placement action at Site 104.  
221

### 222 **91.3.5 Sediment Nutrient Flux** 223

224 The objectives of this monitoring element are as follows:  
225

- 226 1. To characterize nutrient loading in and around Site 104; and  
227  
228 2. To verify that placement at Site 104 will have no long-term impact on nutrient flux  
229 rates and, therefore, water quality (short-term impacts are expected).

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The hypothesis being evaluated is as follows:

Sediment nutrient flux rates will remain within the expected ranges for a similar area that experiences summer hypoxia.

In order to evaluate this hypothesis, stations in and around Site 104 would be monitored each year during hypoxic/anoxic periods (May--September) at a time when microbial activities and potential nutrient releases are highest. Sediment carbon, oxygen, and nutrient flux sampling would take place during May, June, July, August, and September following placement each season. A total of five sets of measurements would be made at each station (vertical water column profiles of temperature, salinity and DO, water column samples, and sediment core samples). The water column samples would be analyzed for ammonium, nitrite, nitrite+nitrate, dissolved inorganic phosphorus (DIP) corrected for salinity, and silicic acid. The sediment cores would be used to measure oxidation-reduction potential (Eh) of the sediments at 1-cm intervals for the top 10 cm, particulate carbon, particulate nitrogen, particulate phosphorus, total and active chlorophyll-a, and net exchanges of carbon, oxygen, and dissolved nutrients between sediments and overlying waters.

Study Endpoint:

When sediment nutrient flux rates return to within expected ranges for the area, or are predictable in nature based upon data collected over a minimum of ~~three~~ 3 years, the study team will determine whether monitoring should continue.

**91.3.6 Water Quality Monitoring**

The objectives of this monitoring element are as follows:

1. To characterize water quality in and around Site 104 to evaluate whether long-term water quality changes have resulted from the proposed action (short-term water quality impacts are expected);
2. To monitor turbidity resulting from placement activities at the edge of the mixing zone; and
3. To comply with the Water Quality Certificate requirements during placement.

The hypotheses being evaluated are as follows:

1. There will be no significant long-term change in water quality conditions at Site 104 (a slight short-term change in turbidity is expected immediately after placement operations within the boundaries of Site 104); and
2. Turbidity levels outside the defined mixing zone will remain in compliance with the Water Quality Certification limitations during and after placement activities.

276  
277 In order to evaluate these hypotheses, stations within and outside of Site 104, including the  
278 Chesapeake Bay Program Water Quality Monitoring (CBP) stations, would be monitored  
279 seasonally during placement. Typically three water quality samples would be taken per station  
280 (surface, mid, and bottom). The same parameters would be used for water quality testing as are  
281 evaluated in the Chesapeake Bay Program (spatial location, depth, temperature, salinity,  
282 conductivity, turbidity, total suspended solids [TSS], secchi depth, pH, dissolved oxygen,  
283 chlorophyll-a, and nutrients such as nitrogen, phosphorus, carbon, and silica species). The CBP  
284 approach is specific to the Bay and will function as the tool to satisfy the ITM guidelines. In  
285 addition, data from CBP stations would be evaluated for use as a historical comparison for  
286 baseline data sets.

287  
288 TSS and nutrient samples would be collected upstream, in and downstream of the turbidity  
289 plume. Samples would be collected at three depths in the water column including surface, mid,  
290 and bottom layers. This would be repeated during each placement year.

291  
292 Compliance turbidity monitoring is not defined as yet. It would depend upon the mixing zone,  
293 which has yet to be developed. Turbidity monitoring would be required during placement since  
294 compliance limits would be set in the Water Quality Certification issued by the Maryland  
295 Department of the Environment.

296  
297 Study Endpoint:

298  
299 Evaluations would be made by the monitoring team annually on whether the monitoring should  
300 be continued.

### 301 302 **91.3.7 3-D Water Quality Modeling of Sediment Nutrient Flux Impacts on Water Quality**

303  
304 The objective of this monitoring element is as follows:

305  
306 To provide data to evaluate potential water quality impacts from sediment nutrient fluxes  
307 and to substantiate the model predictions under actual placement conditions at Site 104.

308  
309 The hypothesis being evaluated is as follows:

- 310
- 311 1. The use of Site 104 for placement is expected to have a short-term and localized  
312 impact on water quality, primarily through increased turbidity, total suspended solids,  
313 and nutrient concentrations at the time of placement;
  - 314
  - 315 2. Placement of dredged material at Site 104 will provide a moderate increase in  
316 dissolved oxygen concentrations in bottom waters due to decreasing water depth;
  - 317
  - 318 3. Salinity concentrations in the upper Bay will not change more than 0.1 ppt; and
  - 319
  - 320 4. No long-term impacts to water quality are expected.

322 In order to evaluate these hypotheses, water quality data from Site 104 during the first, second,  
323 and third year of placement would be collected. These data would be used to re-run the water  
324 quality module of the WES CH3D Chesapeake Bay Model to assist in the verification of  
325 predicted impacts to water quality from the placement of dredged material at Site 104.

326  
327 Study Endpoint:

328  
329 Evaluations would continue annually by the study team to determine whether monitoring should  
330 continue.

### 331 332 **91.3.8 Benthics Monitoring**

333  
334 The objectives of this monitoring element are as follows:

335  
336 To verify re-establishment of the benthic community and to compare the results of  
337 sampling with established Chesapeake Bay benchmarks, including the B-IBI, to evaluate  
338 benthic community conditions at Site 104;

339  
340 The hypotheses being evaluated are as follows:

- 341
- 342 1. The benthos at Site 104 will show no long-term loss in terms of the multi-metric  
343 Benthic Index of Biotic Integrity (B-IBI) within a specified time period after all  
344 placement has ceased; and
  - 345  
346 2. The elevation of the site depths may potentially embellish benthic colony  
347 establishment (due to reductions in low oxygen events) and may promote non-  
348 opportunistic species colonization.

349  
350 In order to evaluate these hypotheses, benthic stations would be monitored once in the summer,  
351 fall, winter, and spring beginning ~~one~~ 1 year after placement of material has ceased. Three  
352 replicate samples per station would be collected. Reference stations would be established outside  
353 the area of impact for comparison purposes. The Chesapeake Bay Program's Benthic  
354 Monitoring Program and baseline data would provide useful data for comparison. The ~~Benthic~~  
355 ~~Index of Biotic Integrity (B-IBI)~~ would be used to compare the benthos at the active placement  
356 site to the benthos at the reference sites. Appropriate depth stations would be compared. At least  
357 one of the reference stations would be a Chesapeake Bay Program Benthic Monitoring Program  
358 Site.

359  
360 Study Endpoint:

361  
362 The study endpoint of this monitoring element is ~~eighteen~~ 18 months after the last placement  
363 action at Site 104.

364