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ENVIRONMENTAL ASSESSMENT FOR PIER COMPLEX REPLACEMENT NWS EARLE NJ
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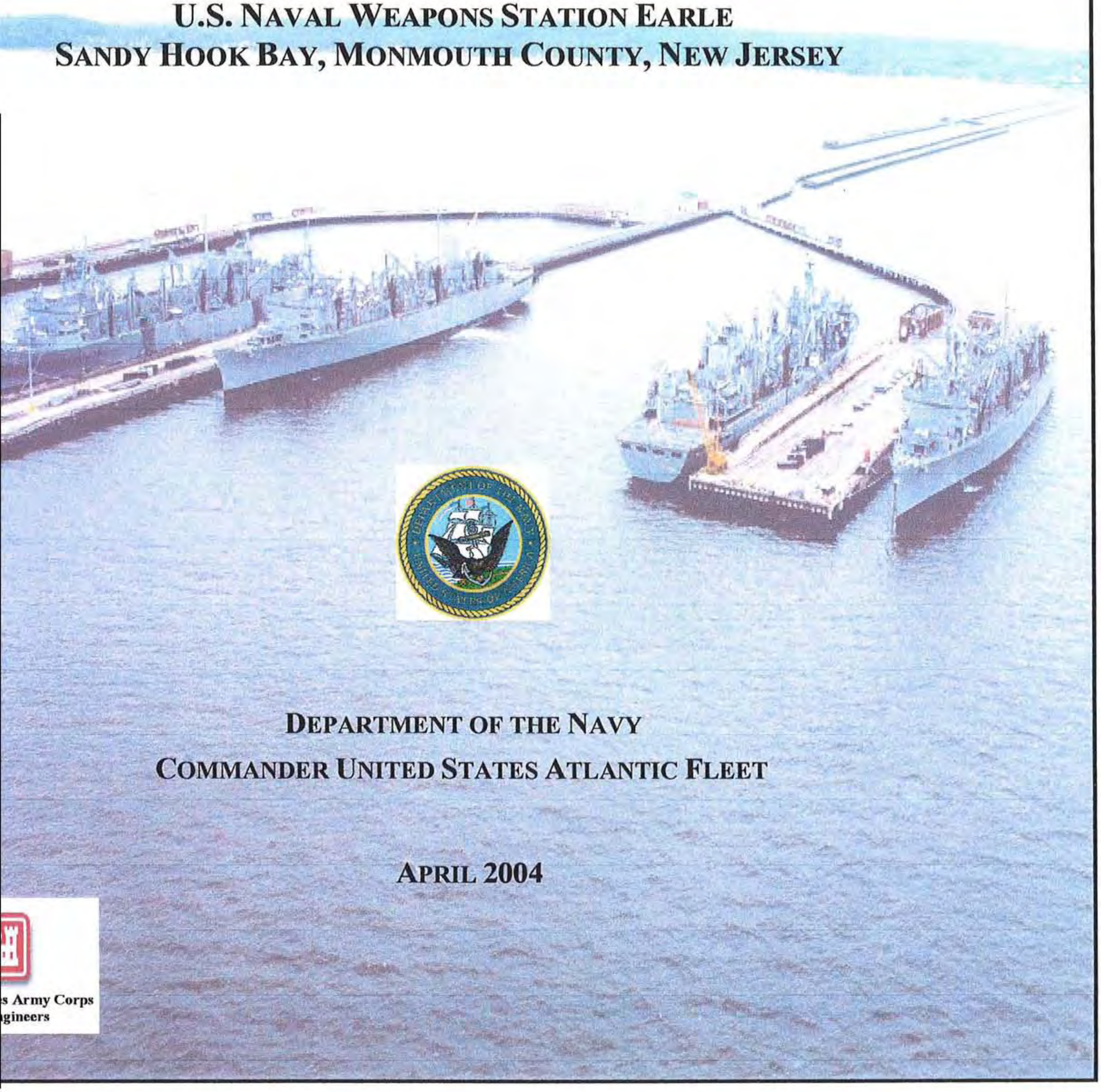
U S ARMY CORPS OF ENGINEERS

ENVIRONMENTAL ASSESSMENT

PIER COMPLEX REPLACEMENT
AT
U.S. NAVAL WEAPONS STATION EARLE
SANDY HOOK BAY, MONMOUTH COUNTY, NEW JERSEY



DEPARTMENT OF THE NAVY

COMMANDER UNITED STATES ATLANTIC FLEET

APRIL 2004

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AT
U.S. NAVAL WEAPONS STATION EARLE
SANDY HOOK BAY, MONMOUTH COUNTY, NEW JERSEY

Department of the Navy

April 2004

Prepared for:
Commander
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District Engineer, New York District
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New York, NY *

In accordance with:
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Pursuant to:
National Environmental Policy Act
Section 102(2)(C)

ENVIRONMENTAL ASSESSMENT

PIER COMPLEX REPLACEMENT
AT
U.S. NAVAL WEAPONS STATION EARLE
PIER COMPLEX
SANDY HOOK BAY, MONMOUTH COUNTY, NEW JERSEY

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Contacts:
Navy

A. Nancy Kuntzleman
Engineering Field Activity Northeast
10 Industrial Highway, Mail Stop 82
Lester, PA 19113-2090
Phone: (610) 595-0567
Fax: (610) 595-0555
Email: anne.kuntzleman@navy.mil

US Army Corps of Engineers

Richard Tomer
Chief, Regulatory Branch
US Army Corps of Engineers
New York District
26 Federal Plaza
New York, NY 10278
(212) 264 3996

* The US Army Corps of Engineers was a cooperating agency in the preparation of this document in accordance with 40 CFR 1501.6

Executive Summary

ES.0 EXECUTIVE SUMMARY

ES.1. Description of the Proposed Action

The Department of Navy has determined that future Auxiliary-Oil-Explosives (AOE) ship homeporting and ordnance handling requirements at the Naval Weapons Station (NWS) Earle Pier Complex in Sandy Hook Bay, New Jersey (Figure ES-1) will require a total of four operational berths (two piers). This requirement, combined with the high cost of maintaining the current three-pier complex, has resulted in the proposed action to replace Pier 3 with a modern pier facility and the subsequent removal of Pier 2 at the Station (Figure ES-2).

The new pier would be approximately 25 % shorter than the existing Pier 3 measuring about 288 meters (m) or 945 feet (ft) long by 49.1 m (161 ft) wide. Dredging the existing berthing area alongside Pier 3 would be necessary to deepen the berths to - 13.7 m (- 45 ft) mean low water (MLW). Dredging requirements for the new pier are approximately 405,000 cubic meters (m^3) (approximately 530,000 cubic yards [yd^3]) of which approximately 236,000 m^3 (308,000 yd^3) is unsuitable for in-water disposal at the Historic Area Remediation Site (HARS) and must be transported to an approved upland location. Upon completion of construction, existing Pier 2 would be demolished thus reducing future maintenance dredging requirements.

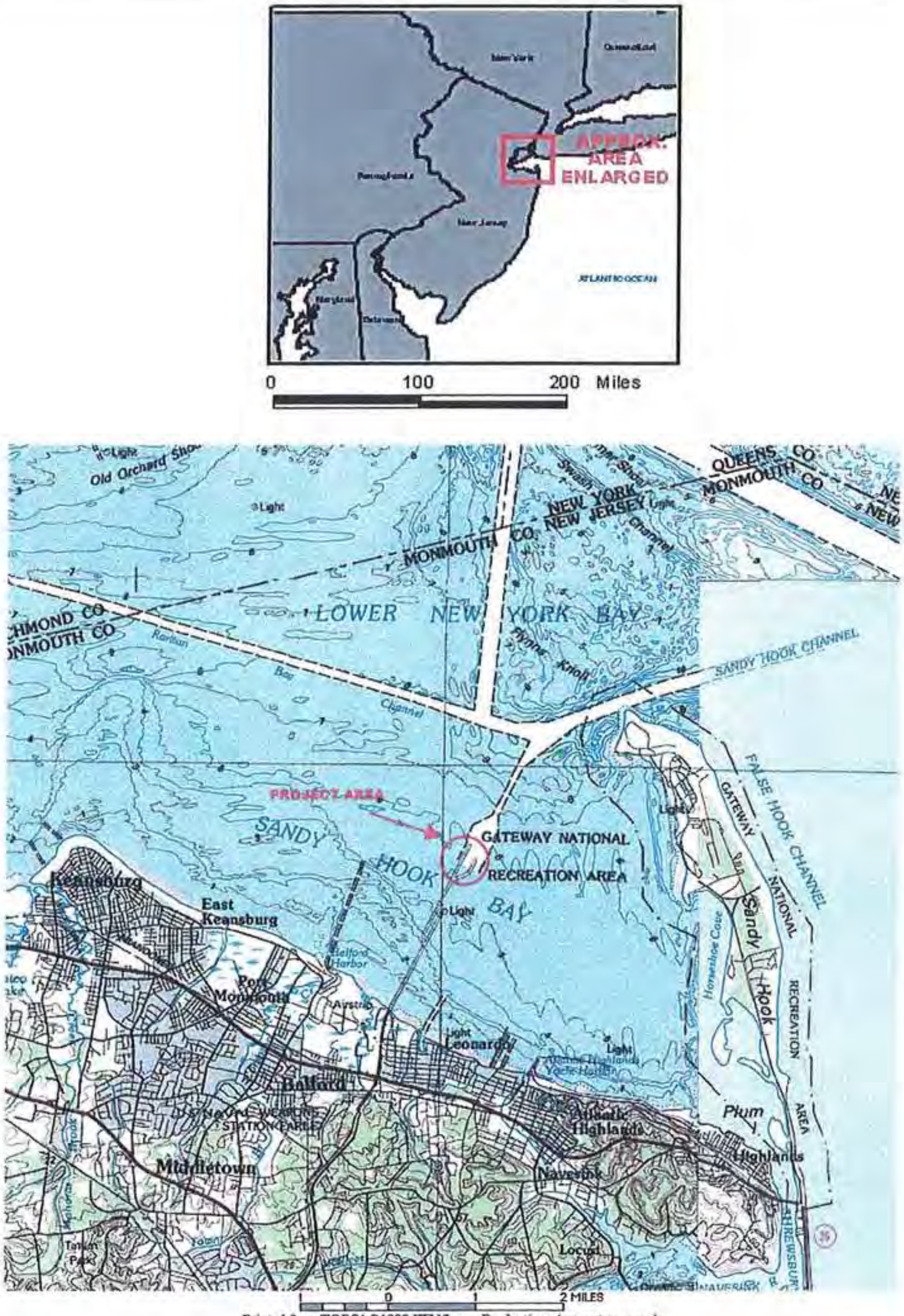
Based on the preliminary design concept for the replacement pier, the demolition of the existing pier and the subsequent construction of the new pier would likely occur as follows:

- *Provide temporary, upgraded utility services at Pier 2*
- *Initiate dismantling/demolition of Pier 3*
- *Initiate first phase of dredging*
- *Construct a new modern pier, connecting trestle and utility support services in the "footprint" of the existing Pier 3*
- *Initiate second phase of dredging*
- *Discontinue ship berthing at Pier 2*
- *Demolish Pier 2 and Trestle 2*

This project will be constructed in three phases, as funding will be provided in three fiscal years (FY) commencing within FY 04 and ending in FY07. Phase I will upgrade and repair existing Pier 2 and Trestle 2. Phase II will demolish the existing Pier 3 and Trestle 3, initiate first phase of dredging, initiate construction of Pier 3 and Trestle 3. Phase III will complete the construction of Pier 3 and Trestle 3, the second phase of dredging and demolition of Pier 2 and Trestle 2.

ES.2. Purpose and Need

The purpose for the proposed action is to provide an adequate and efficient facility to satisfy the NWS Earle mission of providing four homeport services berths for AOE class



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PROJECT LOCATION MAP **FIGURE ES-1**

Figure ES-2 - View of NWS Earle Pier Complex

ships. The project will replace Pier 3, along with connecting Trestle 3, with a new structure that is similar in design to Pier 4. While Pier 4 was constructed in 1990, the other existing piers and trestles were constructed 60 years ago and have serious deficiencies that can no longer be economically repaired. Additionally, future homeporting and ordnance loading requirements necessitate the continued use of only four berths capable of accommodating fully-loaded AOE-class vessels. The removal of one pier and the replacement of another will allow the Station to satisfy future mission requirements efficiently and effectively. The removal of Pier 2 will reduce future maintenance dredging requirements resulting in cost savings and reduced environmental impact.

ES.3. Alternatives including the Proposed Action

Various alternatives were considered to provide the requisite present and anticipated future service to Military Sealift Command (MSC) homeported ships and provision of four AOE homeport berths. The alternatives considered were based on a final end-state ship mix of five MSC ships including two new AOE-class ships expected to be built in the next five to ten years.

Each alternative, as well as the no-action alternative, has been evaluated based on the following operational and environmental factors. Operational factors are important design, location, or construction features that may affect the degree to which the proposed action can satisfy the project needs and objectives. Environmental factors are those conditions that must be met to minimize potential impacts to the environment associated with the proposed action. The proposed action would:

- Provide service to and accommodate AOE-class and MSC supply ships;
- Provide a cost-effective alternative and meet available funding levels;
- Minimize effect on marine organisms including threatened, endangered or managed species; and
- Minimize impact on water quality by reducing turbidity, sedimentation, and storm water runoff.

An Alternatives Matrix, comparing the two action alternatives with the No Action Alternative is shown on Table ES-1.

Table ES-1 Alternatives Matrix

Factors Considered	**Alternatives**		
	Alt. A	**Alt. B**	**No Action**
Operational Factors			
New Pier (AOE-Capable)	Yes	Yes	No
AOE Berths Provided (future – all piers)	4	4	2
Environmental Factors			
Area to be Dredged:			
New Area	1.0 acres (ac)	12.5 ac	0
Previously Dredged	20.7 ac	26.4 ac	0
Total Area	21.7 ac	38.9 ac	0
Dredge Volume (000)	405 m^3 (530 yd^3)	1,045 m^3 (1,375 yd^3)	0
Future Dredge Area to Maintain	113.7 ac	131.9 ac (1)	140 ac (2)
Historical Structures Impact	Yes	Yes	No
Other Factors			
Total Berths Avail during Construction	4	5	NA
Security Zone Expansion Required	No	Yes	No
Project Cost	$124,000,000	$177,958,000	0 (3)
Future Pier Maintenance Costs	Low	Low	High

Alternative A – Replacement of Existing Pier 3 (the proposed action)
Alternative B – New Pier constructed East of Pier 2
Notes: (1) – Assumes Pier 3 is demolished
(2) – Assumes all existing piers remain in service
(3) – Does not include costs to maintain minimum level of service

ES.3A. Proposed Action (Alternative A) - Construct New Pier Replacing Existing Trestle and Pier 3.

Replacement of Pier 3 with a modern structure would require deepening of the pier's two berths to -13.7 m (- 45 ft). The new pier would be approximately 288 m (945 ft) long by 49.1 m (161 ft) wide and would be connected to the "wye" area where Trestles 2, 3 and 4 come together by a new 326.5 m (1,071 ft) trestle. Upon completion of construction of the new pier, Pier 2 and its connecting trestle would be removed.

Approximately 405,000 m^3 (530,000 yd^3) of sediments would be removed to provide the required berthing depths. This dredging would deepen the existing dredged berths at the pier that are currently maintained at -10.7 m (-35 ft) MLW. Of this volume, approximately 236,000 m^3 (308,000 yd^3) is unsuitable for in-water disposal and would be disposed of at an approved upland location. The proposed action also includes about 0.4 ha (one ac) of new area dredging - the area under the seaward end of the existing Pier 3 as the new pier would be 104.2 m (342 ft) shorter than the existing pier.

ES.3B. Alternative B - Construct Pier at a New Location

This alternative would construct a new pier at a location east of, and immediately adjacent to, existing Pier 2. The existing west berth of Pier 2 would remain in use during the construction of the new pier. Under this alternative, a new 288 m (945 ft) by 49.1 m (161 ft) pier, a 488 m (1,600 ft) long connecting trestle, and an expansion of the dredged berthing area would be required. Dredging the required berthing area would result in the removal of approximately 1,045,000 m^3 (1,375,000 yd^3) of Bay sediments or more than twice the volume required under the proposed action. Also, construction of the pier at this location would require the dredging of approximately five hectares (ha) (12.5 ac) of previously undisturbed Bay bottom. Following construction of the new pier, Pier 2 and its connecting trestle would be demolished.

This Alternative, like the proposed action, would satisfy the project purpose and need by providing a new AOE-capable pier with two berths but it would result in substantial additional cost (due to the greater volume of dredging and the longer connecting trestle length).

ES.3C - Other Alternatives (Explosive Safety Criteria Siting)

Alternatives were evaluated to determine if the new pier could be sited to comply with the criteria that govern construction within explosive safety quantity (ESQD) arcs as provided in Naval Sea Systems Command Manual, *Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation and Shipping,* (NAVSEA OP – 5, Volume 1, 7th Rev). If a planned action does not satisfy OP-5 explosive safety criteria, the action proponent must obtain a secretarial certification identifying reasons why OP-5 compliance is not possible. In accordance with OP-5, piers where ordnance loading is to occur are to be separated from other piers, wharfs, inhabited buildings, and public transit routes by a separation distance determined by the amount of ordnance expected to be handled on the pier (or onboard ship(s) at the pier) at any one time.

An analysis evaluating these potential pier locations concluded that locating the new pier at the required separation distances would not be economically feasible, would result in significant ecological impact as a result of major new dredging, would significantly expand the pier complex navigation prohibited zone, and would increase the security requirements at the pier complex. Based on the analysis, these alternatives were determined to be infeasible.

ES.3D. - No Action Alternative

Under the No Action Alternative, pier replacement under either action alternative would not occur and the Navy would continue to use the existing pier/trestle system with reduced operations and high repair and maintenance costs. The shallow water depths available at Pier 3 prevent the full loading of AOE vessels as an AOE fully loaded with cargo fuel cannot access the pier to receive ordnance load-out. AOEs must first be loaded with ordnance at the Station and then receive its cargo fuel at the Craney Island fuel depot in Virginia. This loading sequence is not in compliance with Navy ordnance handling regulations.

Selection of the No Action Alternative would endanger the military mission, compromise the support services of the Atlantic Fleet and impact the vitality of the Station by losing a source of income generated by serving MSC ships. The No Action Alternative does not satisfy the project's purpose and need and therefore, is an unacceptable alternative.

ES.4. Environmental Effects of the Proposed Action (Alternative A)

ES.4A Natural Environment

No long-term irreversible impact to the biological resources of the Bay associated with the proposed action was identified. Short term impact to benthic invertebrate infauna would occur through sediment removal and subsequent burial during disposal. Extensive data available through numerous monitoring programs of dredge and disposal sites suggest that recolonization of the sediment within disturbance areas by pioneer benthic infaunal species would occur soon after cessation of the disturbance and continue until the benthic infaunal community reached equilibrium with the surrounding undisturbed areas within a few years of the cessation of disturbance.

The use of an environmental window to regulate seasonal in-water activity at the project site would result in impact avoidance or minimization to the major fisheries resources within the Bay. Spawning adult winter flounder, their eggs, larvae and juveniles were identified as especially susceptible to dredging activity within Sandy Hook Bay. The Bay was also identified as an important shellfish and blue crab winter ground. A closed dredging window from 15 November through 31 May was suggested for the Pier 3 berthing areas to avoid impact to important fisheries resources.

No impact to marine vegetation, habitats of particular concern, herpetofauna, avifauna, marine mammals, or rare species due to the proposed action was identified or anticipated. Likewise, no impact to existing natural marine hydrodynamic processes (tides, currents, flows) or sediment geomorphologic processes (erosion, deposition, shoaling, sediment re-suspension) as a result of the proposed action was identified or anticipated. However the bathymetry of the existing Pier 3 pier berths would change from –10.7 m (-35 ft) MLW to –13.7 m (-45 ft) MLW.

Sampling of the sediment and water media at the pier complex to determine bulk sediment, site water, and elutriate quality was conducted. Elevated concentrations of PCBs and PAHs were detected in unconsolidated recently deposited sediments below the Pier (Reach 2). Elevated concentrations of PCBs were detected in unconsolidated recently deposited sediments within the berth areas (Reach 3). Biological testing was conducted on this material to determine the potential for acute and chronic toxicity. The materials from these reaches were determined to have concentrations of PCBs sufficient to bioaccumulate in test organisms. Therefore, the sediments to be removed from Reaches 2 and 3 under the proposed action were determined to be unsuitable for open ocean disposal and would be disposed of at an approved upland site.

Sediments from lower elevations throughout the dredge footprint, representing parent material, were determined to be suitable for open ocean disposal, as they demonstrated no bioaccumulative concentrations of chemical constituents. It is anticipated that this material would be sent to the HARS for use as capping material in support of on-going remediation activities.

A dredging event modeling and hydrodynamic analysis was conducted to determine the extent of temporary impact of dredging on the water column during sediment removal of both suitable and unsuitable material. Results of this analysis predict that dredging activity would result in increased concentrations of total suspended solids. These excess concentrations will dissipate upon cessation of dredging and other in-water activity associated with the proposed action. Contaminants in the sediment will not contribute to existing site water pollutant concentrations during dredging activity since the concentrations of these contaminants within the two media are at equilibrium. Sediment impacted by various chemical constituents would be removed from the existing pier berths and under the seaward end of Pier 3, thereby removing potential sources of these regulated materials from the environment, thus, resulting in an improvement over existing conditions.

Implementation of the proposed action would allow a significant reduction in future maintenance dredging requirements. The removal of Pier 2 would reduce the AOE ship berthing and maneuvering areas that would be maintained by periodic dredging by about 10.6 ha (26.3 ac). Over time, these areas would return to depths more typical of the Bay environment. Additionally, the removal of Pier 2 would eliminate almost 1.6 ha (four ac) of shading over the water surface caused by the pier decking. The proposed action includes about 0.4 ha (one acre) of new area dredging under the seaward end of the existing Pier 3, as the new pier would be 104.2 m (342 ft) shorter than the existing pier.

This will also eliminate shading of the water surface at this end of the pier. The demolition debris, including concrete from the pier deck surface, could be used to create new or add to existing artificial reefs under the New Jersey Artificial Reef Program.

No significant impact to air quality would occur as a result of the proposed action. Construction activities would cause added air emissions of the ozone precursors nitrogen oxide (NO_x) and volatile organic compounds (VOCs). However, these emissions would be temporary and would be eliminated after cessation of construction, as confirmed by the results of an applicability determination analysis conducted in compliance with the General Conformity Rule of the Clean Air Act. Results from the analysis show that all additive emissions from the construction and operation phases of the proposed action would not exceed the *de minimis* limit of ozone precursors set for severe non-attainment areas. Therefore, there would be no long-term adverse affect on air quality as a result of the proposed action.

No permanent changes to mobile or stationary noise emitting sources would occur as a result of the proposed action. However a temporary increase in noise would result due to the construction activities associated with the proposed action until completion of the project. The restricted area that surrounds the pier complex prevents unauthorized entry into the pier area and has the secondary effect of preventing Bay users from exposure to any elevated construction noises generated by the proposed action.

ES.4B Built Environment

The proposed action would have a minimal effect on the existing land use on-base, and in the surrounding community. The use of the marine lands within and adjacent to the pier complex would remain as military maritime supply service.

No impacts to population, employment, income or housing conditions on base or in the surrounding community, as a result of the proposed action, were identified or anticipated. No impacts to schools or health care facilities were identified or anticipated.

The proposed action would result in a temporary increase in barge traffic in the Sandy Hook and Raritan Bay East Reach Channels during the construction and demolition activities associated with the proposed action.

To mitigate the impact to historic resources at the pier complex (the loss of Piers 2 and 3 and their associated outbuildings), the Navy and the New Jersey State Historic Preservation Office (SHPO) have entered into a memorandum of agreement whereby the Navy will complete the following: provide recordation (documentation to be included in the Historic American Engineering Record) of the pier complex, prepare an oral history provided by former personnel employed at the Station's pier complex during the early years of operation, and provide an enhancement of existing digital mapping system at the Station to include a layer of historic buildings/structures/railways and a related database of the Station's cultural resource survey data forms ("Form Ks"). No archeological resources would be affected by the proposed action as all work would occur within the existing pier complex footprint.

The proposed action would have no visual impact on the current vistas of the Bay that are available to the general public from the shoreline areas surrounding Sandy Hook Bay.

The proposed action would be an improvement to the existing utility systems that provide service to the pier complex. Upgraded or new steam systems, wastewater collection systems, telecommunications, and improved security measures servicing Pier 3 would occur as a result of the proposed action. These improvements and the wider deck space associated with the new Pier 3 would also improve emergency services at the pier.

The demolition of the existing Piers 2 and 3 would result in the removal of existing contaminant sources used in the initial construction of the piers (i.e., asbestos and lead containing materials, creosoted-timber pilings) and other contaminants such as bird waste that has accumulated on the piers.

The proposed action would not require an irretrievable commitment of resources and would not conflict with existing state and federal policies, plans, or procedures.

ES.5. Environmental Effects of Alternative B (New Pier at New Location)

ES.5A Natural Environment

Under Alternative B, a new pier would be constructed adjacent to existing Pier 2 versus replacing Pier 3 in its same footprint as under the proposed action. Upon completion of the new pier, Pier 2 would be removed. The effect of this action is that the two remaining piers -- the new pier and existing Pier 4 - would be separated by a greater distance than under the proposed action and result in a marginally improved explosive safety environment. This location for the new pier would require significant new dredging as well as an increase in future maintenance dredging to maintain operating depths at the pier berths. Under Alternative B, initial dredging would increase to over 988,000 m^3 (1,300,000 yd^3) or more than 2.5 times greater than the proposed action. In addition to this significant (additional) volume, this Alternative would require 5 ha (12.5 ac) of new dredging. Also, the dredged area to be maintained by future maintenance dredging would expand to encompass approximately 53.4 ha (131.9 ac) compared to the dredged area [46 ha (113.7 ac)] that would be maintained under the proposed action. Finally, this Alternative would require the upland disposal of an estimated 623,000 m^3 (820,000 yd^3) of dredged material that is unsuitable for disposal at the HARS. Upland disposal of this unsuitable dredged material would significantly increase the cost of this Alternative.

While Alternative B has a substantially larger dredging requirement than the proposed action, no long-term irreversible impact to the biological resources of the Bay would be expected. Short-term impacts to benthic invertebrate infauna would occur through sediment removal and subsequent burial during disposal of suitable dredged material at the HARS. However, re-colonization of the sediment in the dredge disturbance areas by pioneer benthic infaunal species would occur soon after cessation of the disturbance and continue until the benthic infaunal community reached equilibrium with the surrounding undisturbed areas within a few years of the cessation of disturbance.

While this Alternative would require substantially more dredging than the proposed action, it is expected that the required dredging would be completed during the dredging window established to avoid or minimize impacts to the major fisheries resources in the Bay. A closed dredging window from 15 November through 31 May was suggested to avoid impact to important fisheries resources.

As with the proposed action, no impacts to marine vegetation, habitats of particular concern, herpetofauna, avifauna, marine mammals, or rare species, due to this Alternative, are anticipated. Also, impacts to the natural marine hydrodynamic processes or sediment geomorphologic processes are not expected under this Alternative. However, as under the proposed action, the bathymetry of the dredged berthing areas would change from –10.7 m (-35 ft) MLW to –13.7 m (-45 ft) MLW.

Elevated amounts of PCBs and PAHs, in concentrations sufficient to bioaccumulate in test organisms, are expected in approximately 623,000 m^3 (820,000 yd^3) of the total dredge volume required under Alternative B. This dredged material would not be suitable for open ocean disposal and would be disposed of at an approved upland site.

The remaining sediments, typically from the lower elevations throughout the dredge footprint, represent parent material and would be suitable for open ocean disposal. It is anticipated that this material would be sent to the HARS for use as capping material in support of on-going remediation activities.

Implementation of this Alternative would expand future maintenance dredging requirement as the required dredging footprint would increase by 16 % over the proposed action. Like the proposed action, this Alternative includes the removal of existing Piers 2 and 3 and the construction of a new pier resulting in a net reduction of the shading effect over the water surface caused by the pier decking. However, the net shading reduction as a result of Alternative B would be less than the proposed action as the pier location under this Alternative requires a longer connecting trestle.

The demolition debris from the piers' deck surfaces could be used to create new or add to existing artificial reefs under the New Jersey Artificial Reef Program.

Though construction of the new pier under Alternative B would require additional dredging resulting in a longer construction period, no significant air quality impacts would be expected. Construction activities would cause added air emissions of the ozone precursors NO_x and VOCs. However, these emissions would be temporary and would be eliminated after cessation of construction. The additive emissions from the construction and operation phases of Alternative B would not exceed the *de minimis* limit of ozone set for severe non-attainment areas. Therefore, there would be no long-term adverse affect on air quality as a result of this Alternative.

No permanent changes to mobile or stationary noise emitting sources would occur as a result of Alternative B. However a temporary increase in noise, and longer in duration due to the additional dredging, would result due to the construction activities associated with Alternative B until completion of the project. The restricted area that surrounds the pier complex prevents unauthorized entry into the pier area and has the secondary effect of preventing Bay users from exposure to any elevated construction noises generated by the proposed action.

ES.5B Built Environment

Similar to the proposed action, Alternative B would have a minimal effect on existing, on-base land uses and in the surrounding community. All actions associated with this alternative would occur within the restricted area that currently exists around the pier complex and the use of this area would remain as military maritime supply service.

Also, no change in on-base population, employment, income or housing occupancy or in the surrounding community would result under Alternative B. No impact to schools or health care facilities as a result of Alternative B were identified or anticipated.

Like the proposed action, Alternative B would result in a temporary increase in barge traffic in the Sandy Hook and Raritan Bay East Reach Channels during construction and demolition activities. Such barge traffic is not expected to affect recreational and /or commercial use of the Bay.

Under Alternative B, and similar to the proposed action, the existing pier complex, which is eligible for listing on the National Register, would be replaced/altered. The mitigation requirements for this loss would be the same as under the proposed action.

Alternative B would also have no visual impacts to the current vistas of the Bay available to the general public from the shoreline areas surrounding Sandy Hook Bay. Utilities services to the pier complex under this Alternative would not be significantly different from the proposed action.

The restricted area that surrounds the pier complex would be expanded under Alternative B. The eastern limit of the restricted area would be moved approximately 61 m (200 ft) to the east. This expansion would require that an additional 25.4 ha (62.7 ac) of the Bay waters to be excluded from recreational and commercial use.

Demolition activities under Alternative B would be similar to the proposed action and would result in the removal of existing contaminant sources (i.e., asbestos and lead containing materials, creosoted-timber pilings) and other contaminants such as bird waste that has accumulated on the piers.

Like the proposed action, Alternative B would not require an irretrievable commitment of resources and would not conflict with existing state and federal policies, plans, or procedures.

ES.6. Environmental Effects of the No Action Alternative

Under the No Action Alternative, the pier replacement project would not be implemented thereby avoiding the temporary environmental impacts that would be expected through implementation of either of the action alternatives. The Navy would continue to maintain the existing pier complex including the dredged berthing areas at each pier. However, under the No Action Alternative, the dredged area that would be maintained, is larger than either the proposed action or Alternative B.

The No Action Alternative would avoid the loss of National Register-eligible historic resources as the existing piers and trestles would not be demolished.

ES.7. Cumulative Impacts

Cumulative impacts are defined by the Council on Environmental Quality (CEQ) in the Code of Federal Regulations (40 CFR 1508.7) as *...the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions...* There are several planned, underway or recently completed actions at the Station that have been taken into consideration in this Environmental Assessment.

In 2002, maintenance dredging was conducted in the Pier 4 berthing areas, turning basin and the terminal channel that connects the pier complex to the Sandy Hook Channel. Dredge depth throughout the dredge footprint was -13.7 m (-45 ft) MLW plus 0.6 m (2 ft) of allowable overdepth. Approximately 200,500 m^3 (262,500 yd^3) of sediment was removed and disposed at the HARS located off the New Jersey coast and managed by the United States Army Corps of Engineers (ACOE).

Maintenance dredging of the berthing areas around Piers 2 and 3 was completed during the 2003 dredging season, which ended on November 15th in accordance with New Jersey Department of Environmental Protection (NJDEP) regulations. The berthing areas were maintained to –10.7 m (-35 ft) MLW, plus 0.6m (2 ft) of allowable overdepth. The sediment had a moderately elevated concentration of PCBs and, therefore, disposal of this material at the HARS was not allowed. Approximately 43,000 m^3 (56,200 yd^3) of this maintenance dredged sediment was removed by barge to an upland location for dewatering. Following dewatering, trucks were used to transport the sediment to its end use as either land fill cover, construction fill or other acceptable uses. Given the volume of sediment transported on the highway system, as many as 7,000 round-trip truck-trips (15 tons per truck) were likely required to move the sediments. Temporary noise and air emissions, as well as additional traffic congestion, were likely impacts of this disposal action.

A concrete floating platform (dock) was recently constructed at the pier complex to provide mooring for three small crafts (33-ft. maximum length) assigned as security patrol boats. The float units are pre-fabricated and consist of a 3-inch thick reinforced concrete exterior with a solid 0.76 m (2.5 ft) foam center. The concrete float units are attached to six steel pipe guide piles via a steel pile bracket. The bracket moves up and down the steel pipe guide along with the tide. Free standing wave screens, were installed on the north and west sides to protect the platform. The floating dock is accessible from the existing trestle by an aluminum gangway.

In conjunction with the floating dock for small craft, an electric jib crane capable of lifting, rotating and lowering the small craft has been installed. The crane is mounted on a reinforced concrete pedestal. The existing deck where the crane has been installed was removed and replaced with a reinforced, cast-in-place concrete deck capable of supporting the crane's weight and lifting capacity in wind conditions up to 25 mph. Quartz lights have been installed to illuminate the crane.

The proposed action includes the disposal of sediment unsuitable for disposal at the in-water disposal site (HARS). Similar to the recent unsuitable maintenance dredged sediment, once on land, this material will be transported to an approved upland location. In order to move the sediment, the sediment must be de-watered sufficiently to allow further movement by truck and/or rail. If all the material to be disposed of at an upland location under the proposed action were transported by truck to an end user (such as a landfill) following dewatering, approximately 15,000 round-trip truck-trips may be necessary. However, it is assumed that additional noise and air emissions and traffic congestion resulting from such material handling are possible cumulative impacts of the proposed action.

Following the completion of the proposed action, dredge depth at all berths (Piers 3 and 4), the turning basin, and the terminal channel will be maintained at –13.7 m (-45 ft) MLW. Given the frequency that maintenance dredging has been conducted at the Station, it is anticipated that future maintenance dredging would occur in about five to seven years.

Any cumulative impact of these past, present and future actions would largely be the result of the continuing need to dredge the piers' berths, turning basin and entrance channel to maintain the required operating depth for homeported and other ordnance vessels. These periodic maintenance dredging cycles would result in direct impacts to the benthic community within the dredged area and at the HARS if this site was used for the disposal of dredged material. However, these periodic events are expected to cause only temporary and reversible impacts to the benthic communities.

Sediments not suitable for disposal at the HARS would be transported to an approved upland facility.

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LIST OF ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this EA:

ac	Acre
ACOE	Army Corps of Engineers
ACOE/NYD	Army Corps of Engineers/New York District
ACM	Asbestos-containing material
AOE	Auxiliary-Oil-Explosive (ship)
AOEC	Area of environmental concern
AST	Above ground storage tank
AUD	Acceptable use determination
bhp	Boiler Horsepower
BMPs	Best management practices
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CAFRA	Coastal Area Facilities Review Act
CD	Consistency Determination
CEDTI	Clean Earth Dredging Technologies, Inc
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Act Information System
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	Centimeters
CO	Carbon monoxide
CZMA	Coastal Zone Management Act

CWA	Clean Water Act
dB	Decibel
dBA	Decibel, A-weighted
DOD	Department of Defense
DON	Department of the Navy
EA	Environmental Assessment
EFANE	Engineering Field Activity Northeast
EFH	Essential Fish Habitat
EPA	US Environmental Protection Agency
EPIC	Environmental Photographic Interpretive Center
ESA	Endangered Species Act
ESQD	Explosive safety quantity distance
ft	Feet
FY	Fiscal Year
gal	Gallon
GCR	General Conformity Rule
ha	Hectare
HAER	Historic American Engineering Record
HAP	Hazardous Air Pollutant
HARS	Historic Area Remediation Site
hp	Horsepower
HUD	US Department of Housing and Urban Development
HVAC	Heating, ventilation and air conditioning
in	Inches
INRMP	Integrated Natural Resources Management Plan
IR	Installation Restoration
km	Kilometer
kV	Kilovolt
LBP	Lead-based paint
l	Liter
m	Meter
m^2	Square meters
m^3	Cubic meters
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
mi	Miles
mi^2	Square miles
MMBTU/HR	Million British Thermal Units per Hour
MOA	Memorandum of Agreement
MSC	Military Sealift Command
NAAQS	National Ambient Air Quality Standards
NAD	Naval Ammunition Depot
NAVFACENGCOM	Naval Facilities Engineering Command
NEPA	National Environmental Policy Act

NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJSA	New Jersey State Act
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPL	National Priorities List
NPS	National Park Service
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWS	Naval Weapons Station
NYD	New York District
O_3	Ozone
OPNAVINST	Office of the Chief of Naval Operations Instruction
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAH	Polycyclic aromatic hydrocarbon
Pb	Lead
pbb	Parts per billion
PCBs	Polychlorinated biphenyls
PEL	Permissible exposure limit
PM_{10}	Particulate matter with a diameter less than or equal to10 microns
PORTS	Physical Oceanographic Real Time System
lb/h	Pound per hour
ppb	Parts per billion
ppm	Parts per million
psig	Pounds per square inch – gauge
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SAIA	Sikes Act Improvement Amendments
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SSFATE	Suspended Sediment FATE
TOC	Total organic carbon
TOMSA	Township of Middletown Sewage Authority
TSS	Total suspended solids
UDM	Unsuitable Dredged Material
USC	United States Code
USCG	United States Coast Guard
USFWS	US Fish and Wildlife Service

UST	Underground storage tank
VOC	Volatile organic compound
yd^3	Cubic yards

Section 1.0

1.0 INTRODUCTION

1.1 Background

Naval Weapons Station (NWS) Earle is an ordnance storage and handling facility of the United States Atlantic Fleet. Ammunition and military supply ships are homeported or re-supplied, at the NWS Earle pier complex located in Sandy Hook Bay, New Jersey (Figure 1-1).

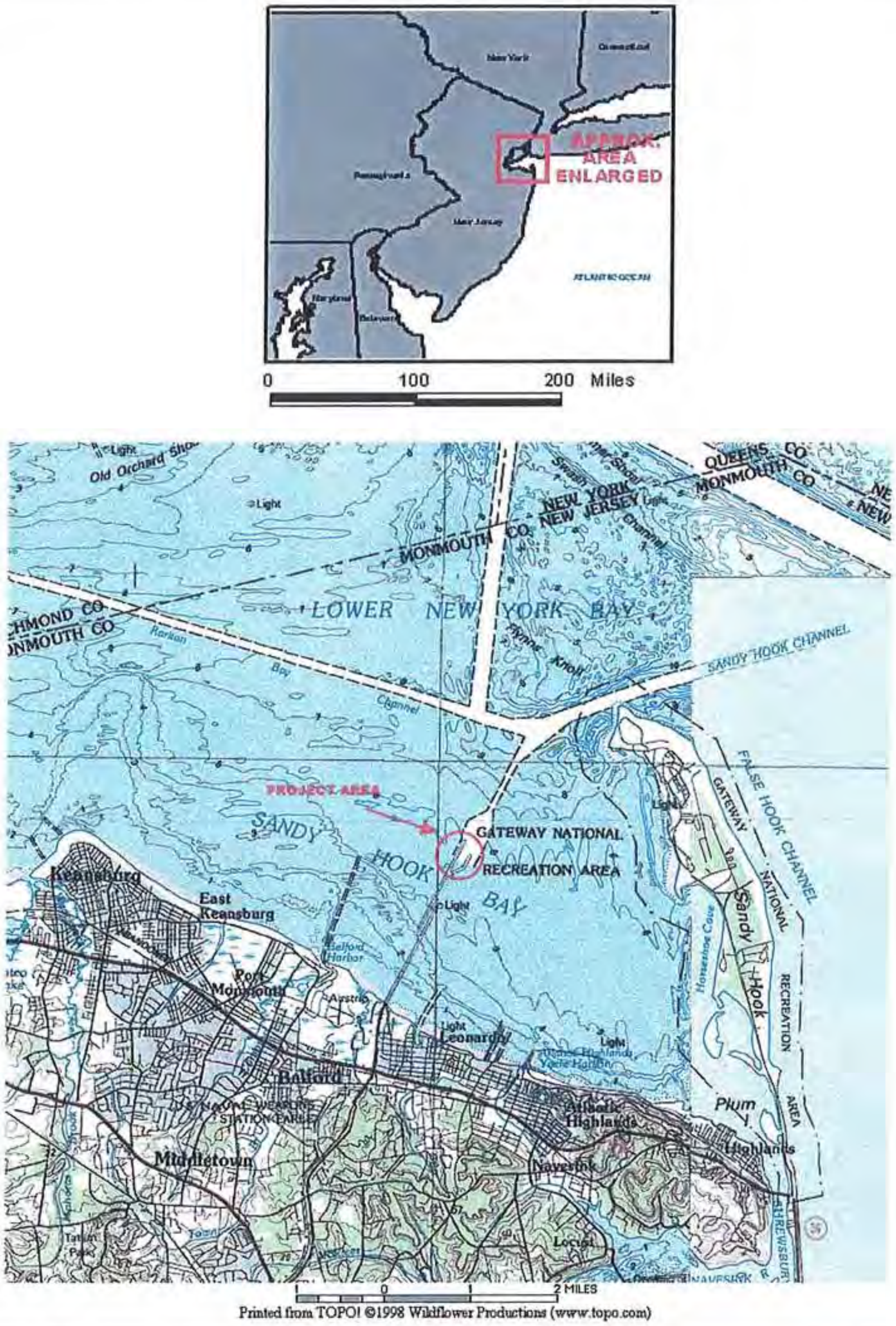
NWS Earle, originally commissioned in 1943 as the Naval Ammunition Depot (NAD) Earle, began as a transshipment depot for the movement of ammunition from East Coast production facilities to the military forces then engaged in the European theater of World War II (LBA, 1999). The Station is one of three Naval weapons stations on the East Coast; the others are NWS Yorktown, VA and NWS Charleston, SC.

NWS Earle's history began in 1940 when both the Army and Navy Departments perceived a need for an ammunition transshipment depot in the New York area. Both Departments formed committees to investigate location opportunities focusing their searches on the New Jersey shoreline south of New York. The requirements for a transshipment depot were a large storage area located away from densely populated areas but near New York City, access to major railroad lines, and access to deepwater berths and ocean access (LBA, 1999). Sandy Hook Bay met the deepwater criterion but its likely high cost to develop a coastal depot gave the Army Department reason to abandon this location. Further investigation by the Navy's Bureau of Ordnance revealed the presence of a large woody, swampy tract of land about 19.2 km (12 mi) southwest of the Bay – the site that would ultimately become NAD Earle.

Named for Rear Admiral Ralph Earle, Chief of the Bureau of Ordnance during World War I, construction of NAD Earle began in the summer of 1943. Construction of the waterfront facilities began in February 1944 with the contract for a 3.2 km (2-mi) long trestle and a two-berth pier (Pier 2) for Navy vessels. The shorter and closer to shore Pier 1 was constructed as a Navy barge pier. Through an agreement between the Department of War and the Department of the Navy, the establishment of NAD Earle became a joint venture with the Army Department contributing more than $19.5 million for the expansion of the Depot in 1944. A third pier (Pier 3) was built for Army ordnance transshipments and the Army Department paid for the 52 barricaded railroad sidings on a 688 ha (1,700-acre) tract of land adjacent to the main station (LBA, 1999).

Based on a projection of future homeport (ship) berth needs, the Navy is planning to replace Pier 3 and demolish Piers/Trestles 2 and 3 to continue service of the military weapons and supply vessels that visit the pier complex. Due to the age of the pier and adjoining trestle structures, the Navy has concluded that renovation of Pier 3 (Figure 1-2) is not economically feasible. Therefore, the Navy proposes to demolish Piers 2 and 3 and their connecting trestles, dredge the ship berthing areas adjacent to Pier 3 to project depth, and rebuild Pier 3 and Trestle 3 in place with modern utilities to service homeported and berthed ships.

The NWS Earle pier complex (i.e., the project area) is located in Sandy Hook Bay, Monmouth County, NJ. Sandy Hook Bay is located on the north shore of the New Jersey coast west of the



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N

NWS EARLE
ENVIRONMENTAL ASSESSMENT
PIER COMPLEX REPLACEMENT

PROJECT LOCATION MAP **FIGURE 1-1**

Figure 1-2. View of NWS Earle Pier Complex, Looking Southeast into Sandy Hook Bay.

Sandy Hook peninsula. It borders the communities of Leonardo and Atlantic Highlands to the east and Belford to the west. The project area lies approximately 24 kilometers (km) (15 miles (mi)) north of Colts Neck, NJ where the main portion of NWS Earle is located. The Sandy Hook Bay shoreline is characterized by intermittent smaller embayments of Sandy Hook to the east, separated by beach, back beach, and primary dune uplands, or headlands. To the south, the Bay shoreline is characterized by marinas and other developed areas within intermittent salt marsh systems at the mouth of various drainages.

The mission of NWS Earle is to provide fleet operational services and infrastructure management to support Combat Logistics Force homeporting, ordnance functions and tenant activities in execution of the National Military Strategy. NWS Earle is the primary east coast Fleet Support Activity providing ammunition logistics to Navy, Marine Corps, and Coast Guard units and shore activities in the northeastern United States. NWS Earle is the only ammunition depot serving fleet units on the east coast north of Virginia; the others are located in Yorktown, Virginia, and Charleston, South Carolina.

Some existing, and all future, Navy ammunition ships, known as Auxiliary-Oil-Explosives ships, or AOEs, will be manned and operated by civilian personnel of the Military Sealift Command (MSC). Currently, some existing ships homeported at NWS Earle are manned by MSC crews, though a small contingent of US Navy officers and sailors will continue to be aboard these ships.

In the future, all homeported AOEs at NWS Earle will be manned by a mix of MSC personnel and US Navy sailors. This will ultimately reduce the number of Navy sailors and their families stationed at NWS Earle.

For this Environmental Assessment (EA), reference to NWS Earle refers to all the military property at the Station. There are four distinct regions of the base. The main base area "the Mainside" is located in Colts Neck, approximately 24 km (15 mi) inland. The Chapel Hill Area and the waterfront complex are both located in Middletown Township, and the pier complex is located approximately 3.2 km (two mi) off-shore in Sandy Hook Bay. Where the terms "base", "on-base", "facility" or "station" are used in this EA, they are synonymous with NWS Earle.

1.2 Description of the Proposed Action

The Department of the Navy (DON) has determined that future AOE ship homeporting and ordnance handling requirements at NWS Earle will require a total of four operational berths (two piers). This requirement, combined with the high cost of maintaining the current three-pier complex, has resulted in the proposed action to replace Pier 3 with a modern pier facility (Referred to as Pier 3A in Figure 1-3) and the subsequent removal of Pier 2. Based on the preliminary design concept for the replacement pier, the demolition of the existing pier and the subsequent construction of the new pier would likely occur as follows:

- *Provide temporary, upgraded utility services at Pier 2*

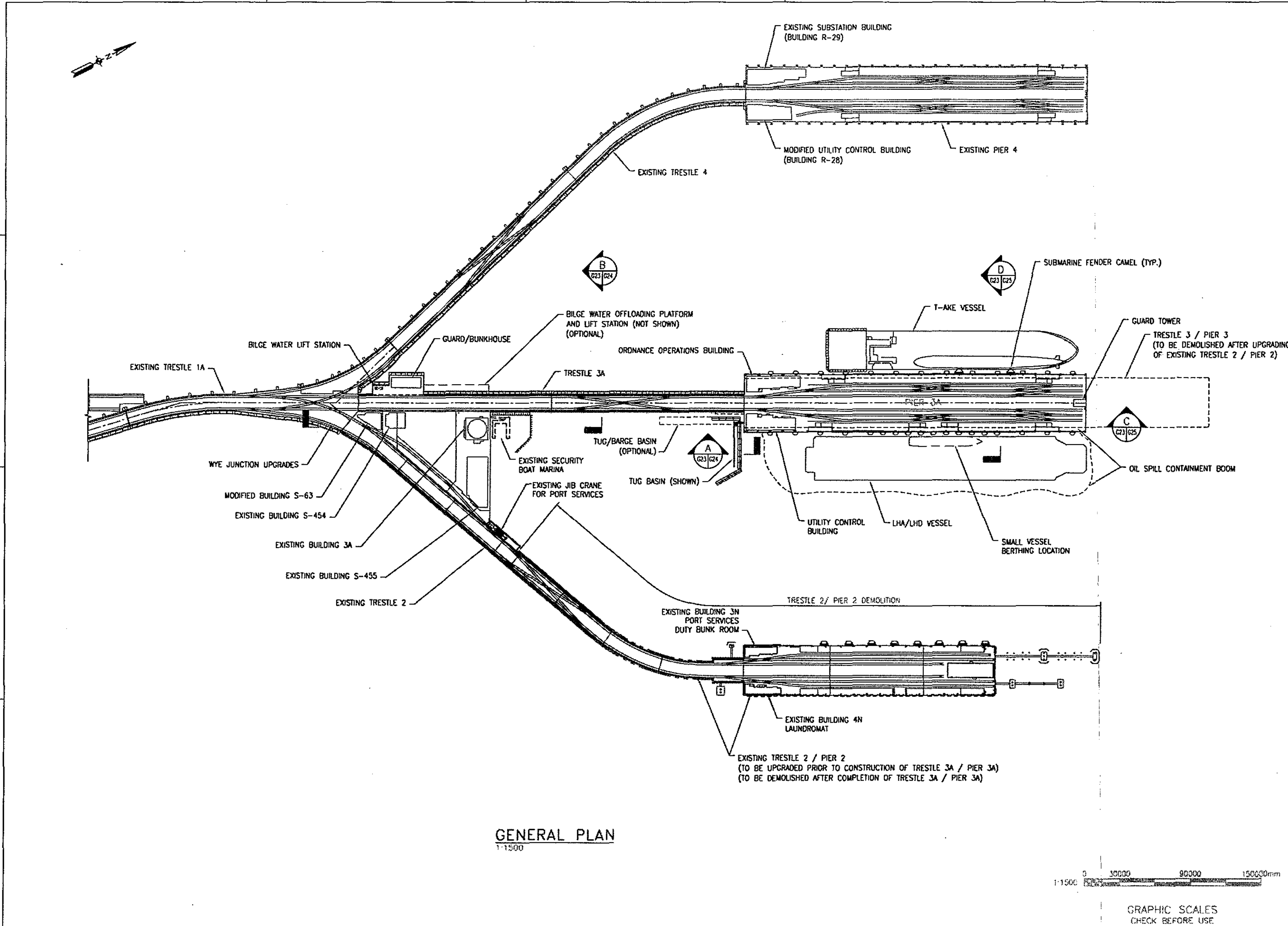
  During the construction period for the new pier, ship berthing and ordnance offloading operations will be shifted to Pier 2. Some utilities upgrading and minor structural repairs will be made to Pier 2 to support berthing and ordnance handling operations until the new pier is completed.

- *Initiate dismantling/demolition of Pier 3*

  Once ship berth upgrades have been completed at Pier 2, work would begin to dismantle Pier 3 including the removal of support buildings, utilities and rail tracks. Removal of the concrete deck would then commence, working from the seaward end of the pier. As sections of the deck are removed, wood support piles would be removed as they are exposed. At the same time, steel support piles for the new pier would be driven at appropriate locations. Using this technique, the existing concrete deck and wood piles can be removed, and new steel piles installed by equipment working from the existing pier. The approximately 15,300 cubic meters (m^3) (20,000 cubic yards [yd^3]) of concrete from the Pier 3 deck will be salvaged and may be used to create artificial reefs off the NJ coast. The creosoted-wood piles that support the deck will be disposed at a state-approved and permitted upland disposal/reuse/recycling facility.

- *Initiate first phase of dredging*

  After the existing pier deck and support piles have been removed, the first of two dredging operations would commence. Sediment testing has determined that two of the three reaches or layers of sediment that must be dredged for this project consist of contaminated sediments while the remaining reach consists of "clean" sediments. Clean



HPA
HAN-PADRON ASSOCIATES ENGINEERS

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY NORTHEAST
LESTER, PENNSYLVANIA
NAVAL WEAPONS STATION EARLE, COLTS NECK, NJ

PIER COMPLEX REPLACEMENT

PIER COMPLEX PLAN

SCALE: 1:1500

N62472-02-C-0018

Fig. 1-3

sediment will be disposed at the in-water disposal site known as the Historic Area Remediation Site (HARS) while all contaminated sediments will be transported to an approved upland disposal location. The first phase of the dredging program would remove 51,000 m^3 (67,000 yd^3) of contaminated sediment from under the existing pier.

- *Construct a new modern pier, connecting trestle and utility support services in the approximate "footprint" of the existing Pier 3*

  Following the dredging contaminated sediments from under the pier, construction of the new pier and connecting trestle would commence. The new pier will be located in the footprint of the existing pier but it will be approximately 104.3 m (342 ft) shorter in length. The new pier will have complete utility services to provide "cold iron" utility service to homeported ships. ("Cold iron" refers to a ship's boilers that are shut down, or cold, when the ship is provided with shore-side utilities.) The new pier will be 288 m (945 ft) long and 49.1 m (161 ft) wide and will be configured with a partial double deck system providing below deck utility galleys, loading platforms and access ramps. The new pier will have six railroad tracks, two vehicle traffic lanes, complete cold iron services, lightning protection, an oil boom retention system, waterfront operations building, and a utility control building. The new connecting trestle will be approximately 326. m (1,071 ft) long and 18.9 m (62 ft) wide, with two railroad tracks and two traffic lanes.

- *Initiate second phase of dredging*

  Following construction of the new pier, the second phase of dredging to establish the required depths in the pier berths would commence. Both contaminated and clean sediments (176,000 m^3 (232,000 yd^3)) and 170,000 m^3 (222,000 yd^3)), respectively) would be removed from the berthing areas and the seaward end of existing Pier 3, providing a final dredge depth of -13.7 m (-45 ft) MLW.

- *Discontinue ship berthing at Pier 2*

  Upon completion of construction, ship berthing and ordnance operations will return to Pier 3 and Pier 2 will be abandoned.

- *Demolish Pier 2 and Trestle 2*

  Following completion of the new Pier 3, Pier 2 will be demolished.

This project will be implemented in three phases as project funding will be provided in three fiscal years; construction is expected to begin in the summer of 2004. Phase I will upgrade and repair existing Pier 2 and Trestle 2. Phase II will demolish the existing Pier 3 and Trestle 3, initiate first phase of dredging, initiate construction of Pier 3 and Trestle 3. Phase III will complete the construction of Pier 3 and Trestle 3, the second phase of dredging, and demolition of Pier 2 and Trestle 2.

1.3 Purpose and Need

The purpose for the proposed action is to provide an efficient facility able to satisfy the NWS Earle mission of providing four homeport services berths for AOE class ships. The project will replace Pier 3, along with connecting Trestle 3, with a new structure that is similar in design to existing Pier 4. The existing piers (Piers 1, 2 and 3) and their trestles were constructed almost 60 years ago and have serious deficiencies that can no longer be economically repaired. Additionally, future homeporting and ordnance loading requirements only necessitate the continued use of four berths capable of berthing fully loaded AOE-class vessels. The removal of one pier and the replacement of another will allow the Station to satisfy future mission requirements efficiently and effectively. The removal of Pier 2 will reduce future maintenance dredging requirements, resulting in defense budget savings and reduced environmental impact.

Section 2.0

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Replacement Alternatives

Various alternatives were considered to provide the requisite present and anticipated future service to MSC homeported ships and provision of four AOE homeport berths. The alternatives considered were based on a final in-state ship mix of five MSC ships including two new AOE ships expected to be built in the next five to ten years. NWS Earle provides support services to the MSC based on the needs of the MSC ships. The visiting ships' needs were determined based on typical MSC operation. A total of three MSC ships would be berthed at NWS Earle at any one time.

Any alternative considered must have full range of security services. These services are currently accommodated at Pier 2 and include duty berthing, first response, and security personnel accommodations. Other accommodations include the need for a boat launch and duress alarms. Possible accommodations for a gantry crane for containerized out-loading and future cargo loading were also considered. The target date for completion of construction of this proposed action is before the end of fiscal year 2007.

Each alternative, as well as the No Action Alternative, has been evaluated based on the following operational and environmental factors. Operational factors are important design, location, or construction features that may affect the degree to which the proposed action can satisfy the project needs and objectives. Environmental factors are those conditions that must be met to minimize potential impacts to the environment associated with the proposed action. The proposed action would:

- Provide service to and accommodate AOE-class and MSC supply ships;
- Provide a cost-effective alternative that meets available funding levels;
- Minimize effect on marine organisms including threatened, endangered or managed species; and
- Minimize impact on water quality by reducing turbidity, sedimentation, and storm water runoff by a reduction in net pier deck area that currently collects storm water.

The two action alternatives and the No Action Alternative are described below and summarized in an alternatives matrix shown in Table 2.1.

2.1.1 Alternative A – (Proposed Action) Construct New Pier Replacing Existing Trestle and Pier 3.

This alternative, the proposed action, would involve the following activities:

- Provide/upgrade temporary utility service to Pier 2;
- Provide structural improvements to Pier 2 and construct mooring dolphin on the east side;
- Demolish Pier 3;

- Replace Trestle 3 and Pier 3 at their current location with modern structures (Figures 2-1 and 2-2); and
- Demolish Pier 2 without replacement.

Replacement of Pier 3 with a modern structure would require deepening of the pier's two berths to -13.7 m (-45 ft) MLW. The new pier would be approximately 288 m (945 ft) long by 49.1 m (161 ft) wide and would be connected to the "wye" area (i.e., where Trestles 2, 3 and 4 come together) by a new 326.5 m (1,071 ft) trestle.

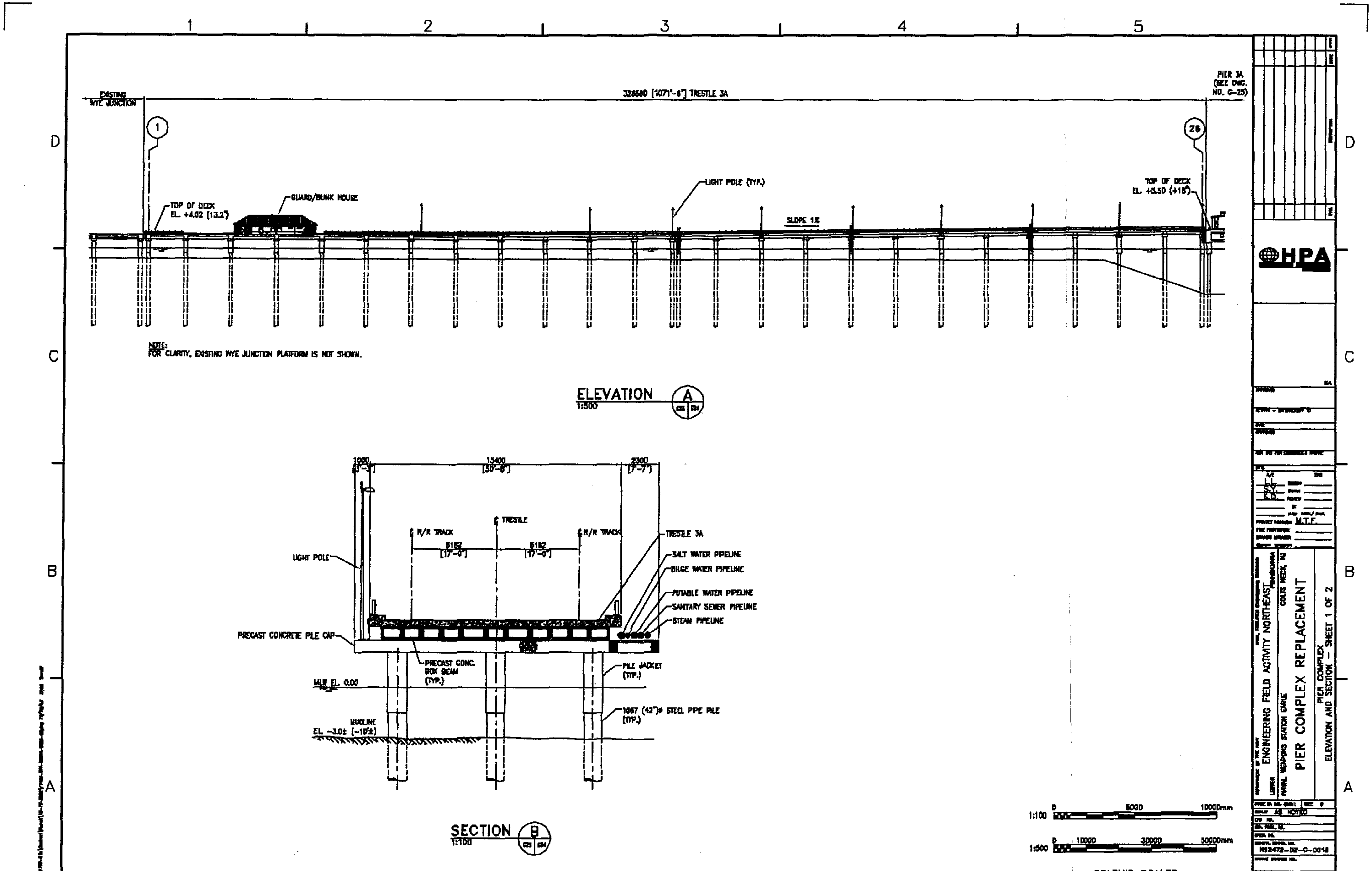
Approximately 405,000 m^3 (approximately 530,000 yd^3) of sediments would be removed to provide the required berthing depths. This dredging would deepen the existing dredged berths at the pier that are currently maintained at -10.7 m (-35 ft) MLW. Of this volume, approximately 236,000 m^3 (308,000 yd^3) is unsuitable for in-water disposal and would be disposed of at an approved upland location. Alternative A includes about 0.4 ha (one acre) of new area dredging under the seaward end of the existing Pier 3, as the new pier would be 104.2 m (342 ft) shorter than the existing pier.

Upon completion of the new pier construction and subsequent demolition and removal of Pier 2, the AOE ship berthing/maneuvering area that would require periodic maintenance dredging would be reduced by about 10.6 ha (26.3 ac). Over time, this area would return to depths more typical of the surrounding Sandy Hook Bay environment.

2.1.2 Alternative B - Construct Pier at a New Location

This alternative would construct a new pier at a location east of, and immediately adjacent to, existing Pier 2. The existing west berth of Pier 2 would remain in use during construction of the new pier. Under this alternative, a new 288 m (945 ft) by 49.1 m (161 ft) pier, a 488 m (1,600 ft) long connecting trestle, and an expansion of the dredged berthing area would be required. Dredging the berthing area would require removal of approximately 1,045,000 m^3 (1,375,000 yd^3) of Bay sediments, or more than twice the volume required under Alternative A. Also, construction of the pier at this location would require dredging approximately five ha (12.5 ac) of previously undisturbed Bay bottom. Following construction of the new pier, Pier 2 and its connecting trestle would be demolished. This alternative would require an expansion of the Station's restricted area that surrounds the pier complex, resulting in an additional area of open water lost to multi-use purposes.

This alternative, like Alternative A, would satisfy the project's purpose and need by providing a new AOE-capable pier with two berths but it would result in substantial additional cost (given the greater dredge volume required). The location of this pier would also require dredging a substantial area of the Bay that has not previously been dredged resulting in a significantly greater impact to the environment than Alternative A.



EXISTING WYE JUNCTION
328580 [1071'-8"] TRESTLE 3A
PIER 3A (SEE DWG. NO. C-25)
TOP OF DECK EL. +4.02 (13.2')
GUARD/BUNK HOUSE
LIGHT POLE (TYP.)
SLOPE 1%
TOP OF DECK EL. +5.50 (+18')
NOTE:
FOR CLARITY, EXISTING WYE JUNCTION PLATFORM IS NOT SHOWN.
ELEVATION
1:500
1000 [3'-3"]
15400 [50'-6"]
2300 [7'-7"]
℄ TRESTLE
℄ R/R TRACK
5182 [17'-0"]
LIGHT POLE
TRESTLE 3A
SALT WATER PIPELINE
BILGE WATER PIPELINE
POTABLE WATER PIPELINE
SANITARY SEWER PIPELINE
STEAM PIPELINE
PRECAST CONCRETE PILE CAP
PRECAST CONC. BOX BEAM (TYP.)
PILE JACKET (TYP.)
MLW EL. 0.00
MUDLINE EL. -3.0± (-10'±)
1067 (42")ø STEEL PIPE PILE (TYP.)
SECTION
1:100
GRAPHIC SCALES
CHECK BEFORE USE
1:100
1:500
HPA
ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
PIER COMPLEX
ELEVATION AND SECTION - SHEET 1 OF 2
M.T.F.
AS NOTED
N62472-92-C-0018

Fig. 2-1

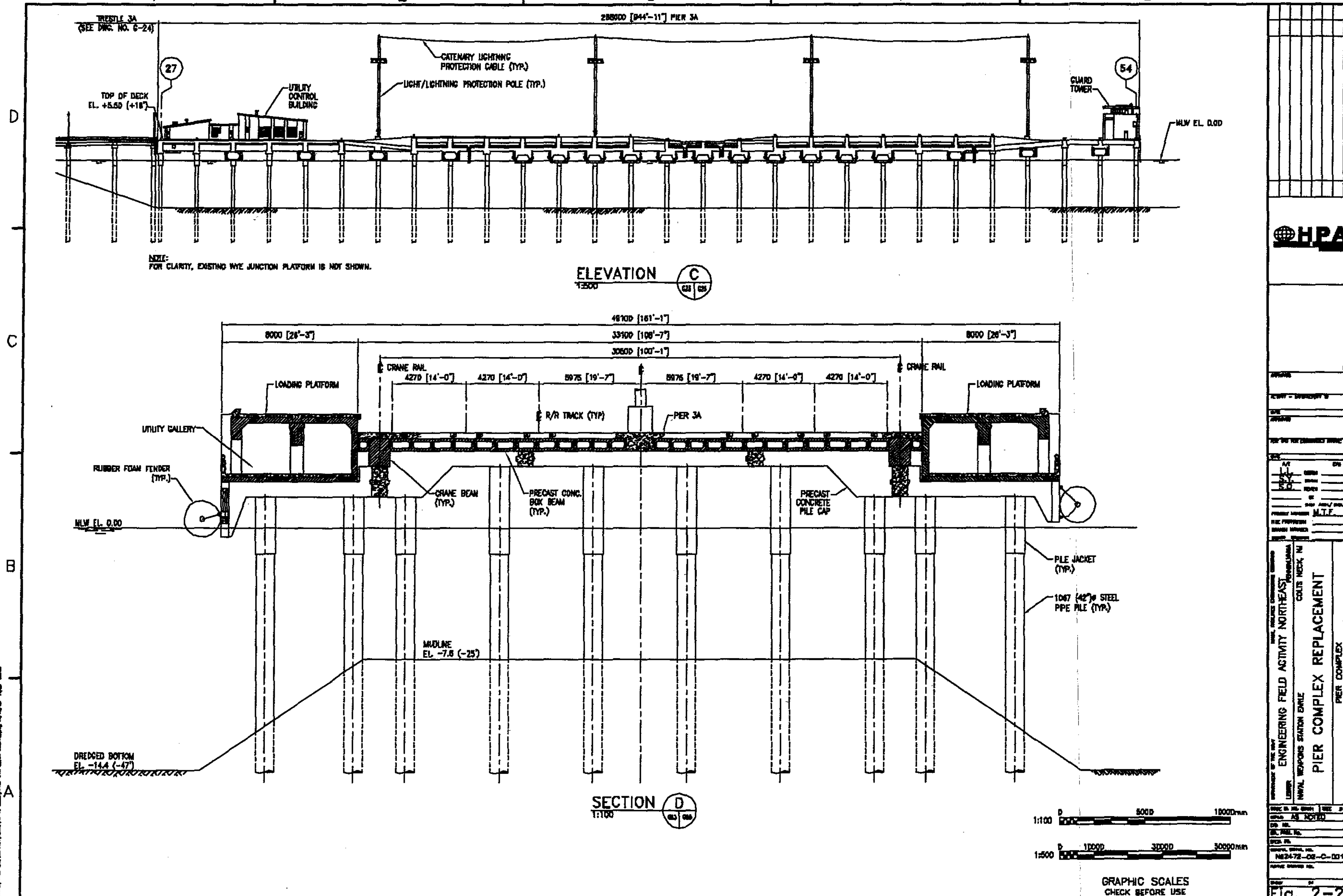

TRESTLE 3A (SEE DWG. NO. C-24)
288600 [944'-11"] PIER 3A
CATENARY LIGHTNING PROTECTION CABLE (TYP.)
LIGHT/LIGHTNING PROTECTION POLE (TYP.)
TOP OF DECK EL. +5.60 (+18')
UTILITY CONTROL BUILDING
GUARD TOWER
MLW EL. 0.00
27
54
NOTE:
FOR CLARITY, EXISTING WYE JUNCTION PLATFORM IS NOT SHOWN.
ELEVATION C
1:500
49100 [161'-1"]
8000 [26'-3"]
33100 [108'-7"]
8000 [26'-3"]
30500 [100'-1"]
CRANE RAIL
4270 [14'-0"]
5975 [19'-7"]
LOADING PLATFORM
R/R TRACK (TYP)
PIER 3A
UTILITY GALLERY
RUBBER FOAM FENDER (TYP.)
CRANE BEAM (TYP.)
PRECAST CONC. BOX BEAM (TYP.)
PRECAST CONCRETE PILE CAP
MLW EL. 0.00
PILE JACKET (TYP.)
1067 (42")ø STEEL PIPE PILE (TYP.)
MUDLINE EL. -7.6 (-25')
DREDGED BOTTOM EL. -14.4 (-47')
SECTION D
1:100
1:100 0 5000 10000mm
1:500 0 10000 30000 50000mm
GRAPHIC SCALES
CHECK BEFORE USE
HPA
ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
PIER COMPLEX ELEVATION AND SECTION - SHEET 2 OF 2
AS NOTED
N62472-02-C-0018
M.T.F.

Fig. 2-2

2.1.3 Other Alternatives (Explosive Safety Criteria Siting)

Alternatives were evaluated to determine if the new pier could be sited to comply with the criteria that govern construction within explosive safety quantity (ESQD) arcs as provided in Naval Sea Systems Command Manual, *Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation and Shipping,* (NAVSEA OP – 5, Volume 1, 7th Rev). If a planned action does not satisfy OP-5 explosive safety criteria, the action proponent must obtain a secretarial certification identifying reasons why OP-5 compliance is not possible. In accordance with OP-5, piers where ordnance loading is to occur are to be separated from other piers, wharfs, inhabited buildings, and public transit routes by a separation distance determined by the amount of ordnance expected to be handled on the pier (or onboard ship(s) at the pier) at any one time.

OP-5 criteria establish minimum separation distances (based on expected ordnance handling requirements) to prevent accident/explosion at one pier causing a "sympathetic" detonation at an adjacent pier. An alternatives analysis prepared by the Navy investigated siting requirements for the proposed pier (Pier 3 replacement) that would comply with OP-5 criteria. Based on the ordnance operations conducted at the piers, a minimum separation distance (from existing Pier 4) of 792 m (2,596 ft) would be required though a greater separation distance of 998 m (3,271 ft) would be the preferred separation distance to retain ordnance-handling flexibility at the piers. The analysis evaluating these potential pier locations concluded that locating the new pier at either of these separation distances would not be economically feasible, would result in significant ecological impact as a result of major new dredging, would significantly expand the pier complex restricted area, and would increase the security requirements at the pier complex. Based on the analysis, these alternatives were determined to be infeasible and the Navy has requested a secretarial certification for the proposed action of replacing existing Pier 3 with a new pier in the existing pier "footprint". Under this scenario, existing Pier 4 and the new Pier 3 would be considered as a "single pier" or pier complex. The Navy has acknowledged that a major accident/explosion at one pier could result in damage and possible injury to ship(s), personnel and facilities at the adjacent pier. Receipt of the secretarial certification approving the proposed action is anticipated.

2.1.4 No Action Alternative

Under the No Action Alternative, pier replacement under either Alternative A or B would not occur and the Navy would continue to use the existing pier/trestle system with reduced operations and high maintenance and repair costs. The shallow water depth available at Pier 3 prevents the full loading of AOE vessels. An AOE fully loaded with cargo fuel cannot access the pier to receive ordnance load-out. AOEs must first be loaded with ordnance at the Station and then receive its cargo fuel at the Craney Island fuel depot in Virginia. This loading sequence is not in compliance with Navy ordnance handling regulations (OP–5) that require ordnance to be loaded last and just before ship deployment.

Selection of the No Action Alternative would endanger the military mission, compromise the support services of the Atlantic Fleet and impact the vitality of the Station by losing a source of income generated by serving MSC ships. The No Action Alternative does not satisfy the project's purpose and need, therefore is not an acceptable alternative.

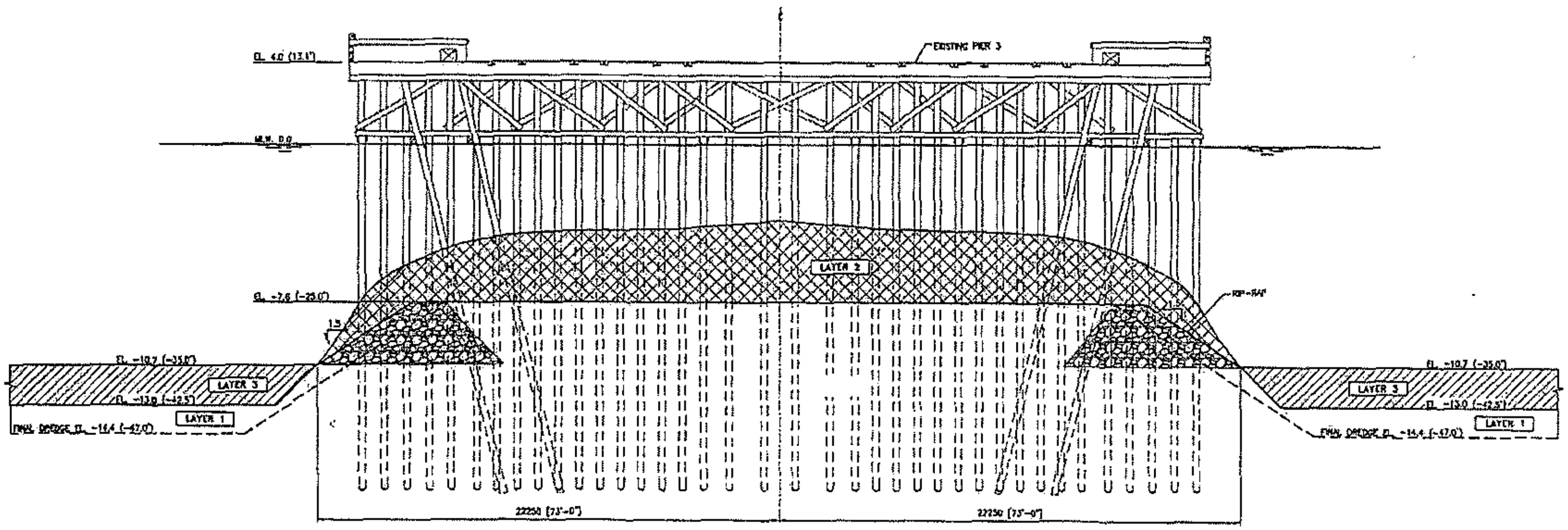
Table 2.1 Alternatives Matrix

Factors Considered	Alternatives		
	Alt. A	Alt. B	No Action
Operational Factors			
New Pier (AOE-Capable)	Yes	Yes	No
AOE Berths Provided (future – all piers)	4	4	2
Environmental Factors			
Area to be Dredged:			
New Area	1.0 ac	12.5 ac	0
Previously Dredged	20.7 ac	26.4 ac	0
Total Area	21.7 ac	38.9 ac	0
Dredge Volume	405,000 m^3 (530,000 yd^3)	1,045,000 m^3 (1,375,000yd^3)	0
Future Dredge Area to Maintain	113.7 ac	131.9 ac (1)	140 ac (2)
Historical Structures Impact	Yes	Yes	No
Other Factors			
Total Berths Avail during Construction	4	5	NA
Restricted Area Expansion Required	No	Yes	No
Project Cost	$124,000,000	$177,958,000	0 (3)
Future Pier Maintenance Costs	Low	Low	High

Alternative A – Replacement of Existing Pier 3 (Proposed Action)
Alternative B – New Pier constructed East of Pier 2
Notes: (1) – Assumes Pier 3 is demolished
(2) – Assumes all existing piers remain in service
(3) – Does not include costs to maintain minimum level of service

2.2 Dredged Sediment Disposal Alternatives

Sediment sampling and testing conducted in June 2002, as part of the required US Army Corps of Engineers (ACOE) permit process, resulted in the identification of three vertical reaches or layers as shown in Fig. 2-3. Two of these reaches – Layers 2 and 3 - are unsuitable for in-water disposal due to elevated levels of PCBs. Layer 2, located under existing Pier 3, consists of about 51,000 m^3 (67,000 yd^3). Layer 3, located in the berth areas of the new pier, consists of about 176,000 m^3 (232,000 yd^3). Sampling results suggested that clean sediments were present in Layer 1, which is comprised of the deeper sediment layer under the pier and in the berth areas. Only the clean



EXISTING SEABED MATERIALS
1:200

HPA
HAN-PADRON ASSOCIATES
ENGINEERS

1:200 0 2500 5000 10000mm

NAVAL WEAPONS STATION EARLE
PIER COMPLEX REPLACEMENT
PIER 3A–EXISTING SEABED MATERIALS
AND PIER 3 CONFIGURATION

Figure 2-3

sediments from the deeper layer would be suitable for ocean disposal.

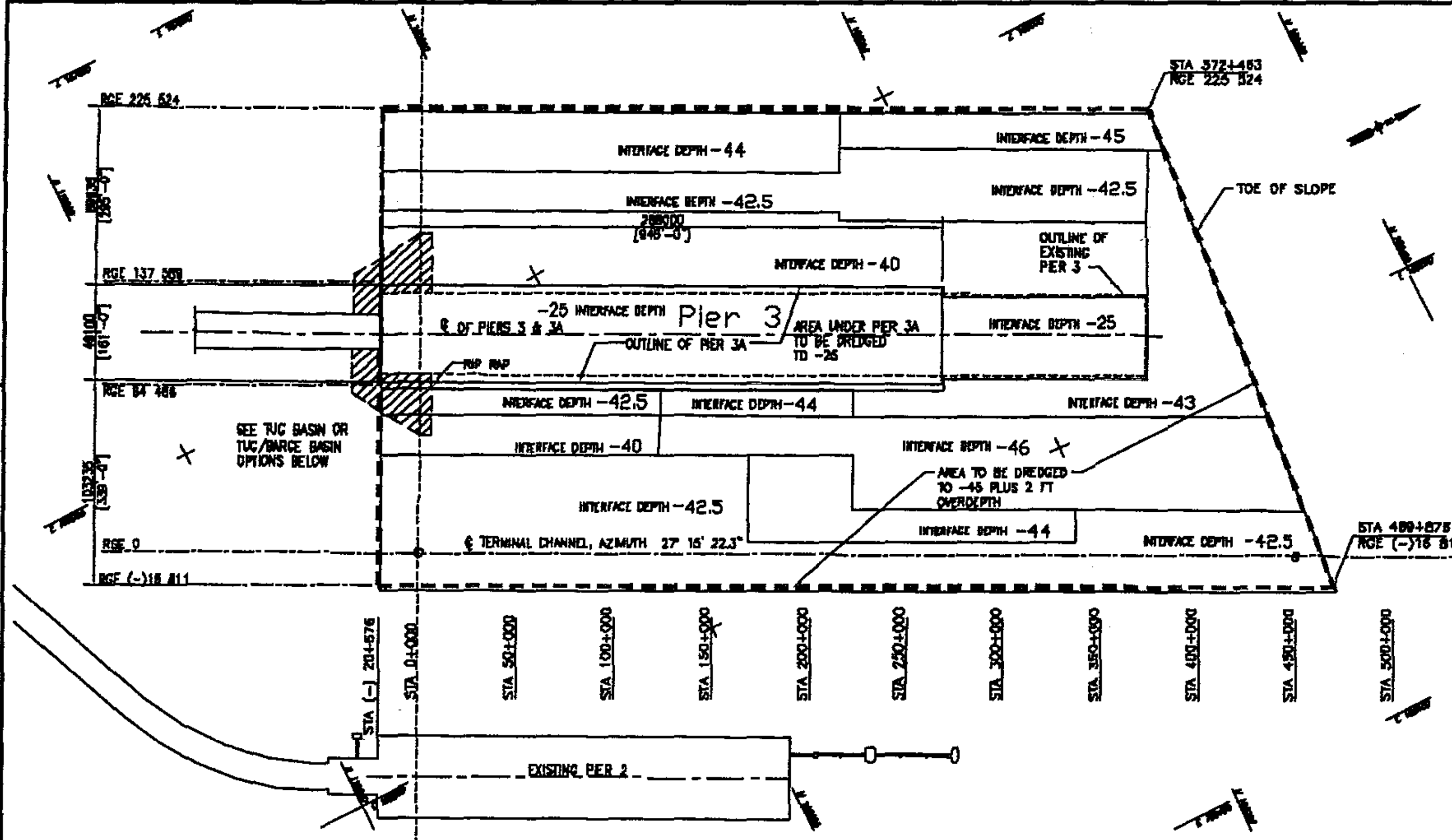
After initial testing identified Layer 1 sediments as clean, an additional testing program was conducted in July 2003. This additional sediment testing program was established based on a dredging plan that would remove all of the sediment in the berthing areas and under the seaward end of pier to a depth of –13.7 m (-45 ft MLW). As the project entered the design phase, the Navy determined that much of the layer of clean sediment under the pier could remain in place resulting in a reduction of the volume of dredged material to be removed. Therefore, the dredging footprint for Layer 1 was reconfigured to include the deep layer from the berthing areas and the deep layer from under the seaward end of existing Pier 3, but not the clean deep layer that would remain under the footprint of the new Pier 3A. The decision to alter the original dredging plan (eliminating some of the dredging volume that would remain under the new Pier 3A), necessitated a change in the sediment testing program. As a result, additional samples were collected and analyzed from the reconfigured Layer 1 in July 2003 and re-analyzed. The additional sampling conducted in July 2003 for the reconfigured Reach 1 confirmed that approximately 170,000 m^3 (222,000 yd^3), would be suitable for in-water disposal.

Overall, the dredging plan would result in the removal of 236,000 m^3 (308,000 yd^3) of contaminated sediment that would be disposed at an approved upland facility and approximately 170,000 m^3 (222,000 yd^3) of clean sediment that would be disposed at the HARS in the Atlantic Ocean. The total estimated volume of contaminated sediment also includes dredge sediment from a proposed tug or tug/barge berth as depicted in Figure 2-4 as optional items.

The majority of the required dredging (i.e., the berthing areas) would be conducted during the dredging season, as specified by the New Jersey Department of Environmental Protection (NJDEP) and ACOE, which begins on/about May 31st and ends on/about November 15th each year. No environmental window is anticipated for dredging under the existing Pier 3. It is expected that the dredging would be accomplished using clamshell and backhoe dredges. An environmental clamshell bucket would be used for the removal of the unsuitable sediments in Layers 2 and 3, down to the interface depth with Layer 1. The interface depth varies with location within the dredge envelope (Figure 2-4). Following removal of Layers 2 and 3, either a clamshell or a backhoe dredge would be used to remove Layer 1 material down to project depth.

2.2.1 Dredged Material Suitable for Ocean Disposal

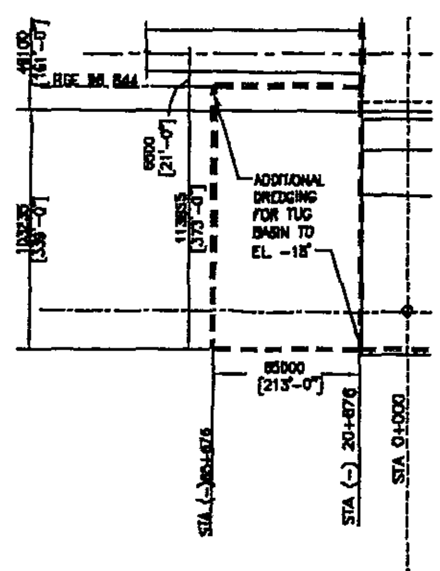
Under Alternative A, dredging would be necessary to provide the required water depth for AOE berthing and would require the removal of approximately 405,000 m^3 (530,000 yd^3) of Bay sediments. Of this amount, 236,000 m^3 (308,000 yd^3) has been determined to be unsuitable for in-water disposal at the ACOE designated HARS. Disposal of the clean (uncontaminated) sediments (170,000 m^3 [220,000 yd^3]) at the HARS, under either pier



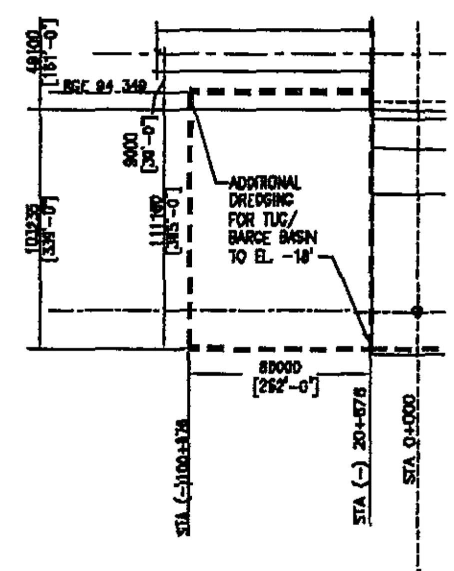
ESTIMATED MATERIAL QUANTITIES

	Dredging Depths (FT)		Estimated Quantities (CY)		
	Required Grade	Allowable Overdepth	Required Grade	Allowable Overdepth	Total CY
Contaminated Material					
Layer 2 (Under Pier 3)	Existing Grade to -25	None	18,500	0	18,500
Layer 2 (Under Pier 3A)	Existing Grade to -25	None	48,500	0	48,500
Layer 3 (Berth Areas)	Existing Grade to Interface	None	231,500	0	231,500
Total Pay Cubic Yards	Existing Grade to Interface	None	298,500	0	298,500
Clean Material					
Layer 1 (Under Pier 3)	Interface to -45	-45 to -47	35,500	4,000	39,500
Layer 1 (Berth Areas)	Interface to -45	-45 to -47	104,500	78,500	183,000
Total Pay Cubic Yards	Interface to -45	to -47	140,000	82,500	222,500
Combined Total Pay CY	Existing Grade to -45	to -47	438,500	82,500	521,000
Optional Dredging:					
Contaminated:					
Tug Berth	Existing Grade to -18	None	6,100	0	6,100
Tug & Barge Berth	Existing Grade to -18	None	9,200	0	9,200

Notes: "Under Pier 3" denotes materials within the footprint of the Pier 3 area to the north of Pier 3A



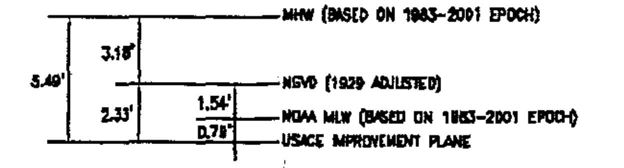
TUG BASIN OPTION
1:1500



TUG/BARGE BASIN OPTION
1:1500

GENERAL NOTES

1. ELEVATIONS AND SOUNDINGS ARE SHOWN IN FEET AND ARE REFERRED TO MEAN LOW WATER (MLW).
2. THE PLANE OF MLW IS REFERENCED AT 2.5 FT BELOW NGVD 1929
3. "NGVD", NATIONAL GEODETIC VERTICAL DATUM, IS THE DATUM OF GEODETIC LEVEL NET OF THE UNITED STATES.



4. THE COORDINATE GRID IS THE STATE OF NEW JERSEY MERCATOR (NAD 1983 METERS).
5. HYDROGRAPHIC SURVEYS WERE PERFORMED BY GAHAGAN & BRYANT ASSOCIATES, INC. ON DECEMBER 4, 2002. SURVEY DATA WAS OBTAINED WITH THE SURVEY VESSEL "SEA FIX" UTILIZING A TSS POS/MV GPS AND ODOM ECHOSCAN MULTIBEAM SYSTEM.
6. DIFFERENTIAL CORRECTIONS PROVIDED BY U.S.C.G. NAVBEACON SYSTEM
7. THE TEMPORARY REMOVAL OF AIDS TO NAVIGATION, IF REQUIRED, SHALL BE CARRIED OUT IN ACCORDANCE WITH THE SPECIFICATIONS.
8. BERTHING AREAS AND A PORTION OF PIER 3 FOOTPRINT TO BE DREDGE TO ELEVATION -45' + 2' OVERDEPTH (AS INDICATED). PIER 3A FOOTPRINT TO BE DREDGED TO 25' ELEV. (AS INDICATED)
9. PIER AND DOLPHIN DECK ELEVATIONS SHOWN ARE FROM NAVFAC FILE DRAWINGS AND HAVE NOT BEEN VERIFIED.
10. ALL DIMENSIONS ARE IN MILLIMETERS.
11. ALL ELEVATIONS ARE IN FEET.
12. MATERIALS TO BE DREDGED ARE CLASSIFIED AS CONTAMINATED (UNSUITABLE FOR OCEAN DISPOSAL) OR CLEAN (SUITABLE FOR OCEAN DISPOSAL) AND HAVE BEEN SEGREGATED INTO THREE VERTICAL LAYERS DEPENDING ON THEIR PHYSICAL LOCATION AS NOTED BELOW:
    - LAYER 1 – UNCONTAMINATED MATERIALS LYING BELOW THE INTERFACE TEMPLATE BENEATH THE EXISTING PIER 3 AND UNCONTAMINATED MATERIALS LYING BELOW THE INTERFACE TEMPLATE IN THE AREA ADJACENT TO PIER 3.
    - LAYER 2 – MATERIALS CONSIDERED CONTAMINATED (NOT SUITABLE FOR OCEAN DISPOSAL) LYING BENEATH THE EXISTING PIER 3 AND ABOVE OUTER SLOPES OF THE ROCK DYKES.
    - LAYER 3 – MATERIALS CONSIDERED CONTAMINATED (NOT SUITABLE FOR OCEAN DISPOSAL) LYING ABOVE THE INTERFACE TEMPLATE IN THE AREAS ADJACENT TO PIER 3.

LEGEND

— — — — LIMITS OF DREDGING (TOE OF SLOPE)

1:1500 0 25 50 100 150m

GRAPHIC SCALES
CHECK BEFORE USE

GBA

HPA

ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
DREDGING GENERAL PLAN AND NOTES
1:1500
N62472-02-C-0015
M.T.F.

Fig. 2-4

construction alternative, is the preferred suitable sediment disposal alternative as the cost of such disposal is substantially less than an upland disposal alternative.

The HARS is located off the New Jersey coast where dredged sediments from the New York Harbor area had been historically placed. Since its re-designation in September 1997, the HARS has been under remediation in order to isolate contaminated dredged material dumped prior to modern environmental regulations. According to the HARS Site Management and Monitoring Plan, "the HARS will be remediated with uncontaminated dredged material (i.e. dredged material that meets current Category I standards and will not cause undesirable toxicological effects including through bioaccumulation)". This site no longer accepts unsuitable (contaminated) dredge sediments. Sediments that do not pass the criteria for HARS disposal must be placed at an upland location.

2.2.2 Dredged Material Unsuitable for Ocean Disposal

Several ocean, nearshore and upland disposal/reuse alternatives were considered for the disposal of sediments determined to be unsuitable for HARS placement and open ocean disposal (i.e., unsuitable dredged material). The ocean and nearshore disposal alternatives investigated, such as a confined disposal facility, are typically intended to isolate unsuitable sediments from the surrounding environment and have considerable associated construction and engineering costs. As a result, these alternatives were not cost-effective for the disposal of the unsuitable sediment from NWS Earle.

The upland disposal/reuse alternatives investigated (Appendix A) are located both on and off of NWS Earle property and include several New Jersey dredged material management areas. Some of these alternatives were determined not to be feasible due to the inadequate physical properties (such as grain size) of the sediment for the intended reuse, and the high costs associated with the transport and disposal of this material.

Upland disposal of dredged sediments at NWS Earle, at either the main station (Mainside) in Colts Neck or the Waterfront Area, was determined to be impracticable because of Station operational and/or security conflicts or site conditions such as the presence of wetlands. Within the New York-New Jersey area, there are a number of facilities that can accept unsuitable dredged sediments. The principal issue associated with the upland disposal of dredged sediments is cost. Upland disposal costs are generally about ten times (or more) higher than disposal of sediments at the HARS.

It is anticipated that an ACOE permit will be issued for the disposal of clean sediments at the HARS based on the sediment testing results. However, in the event that such approval is not received, all sediments from all reaches (layers) would be taken to an approved upland site for disposal. NJDEP principally regulates the disposal of dredged sediment at approved upland disposal sites. A discussion of available upland locations that are capable of accepting unsuitable dredged sediments is provided in Appendix A.

2.2.3 Preferred Dredged Sediment Disposal Alternative

Based on sediment testing results, approximately 170,000 m^3 (222,000 yd^3) of sediment has been determined suitable for in-water disposal; these sediments would go to the HARS as capping material. The remaining dredged sediment volume [236,000 m^3 (308,000 yd^3)], which is unsuitable for HARS disposal, will be transported to an approved and permitted upland disposal/reuse/treatment facility with available capacity to accept this volume.

2.3 Disposal of Demolition Debris

The Pier Complex Replacement project is expected to generate large quantities of bulky waste as a result of demolition activities. This waste is to be loaded on barges for transport to a disposal area or shoreside facility for treatment, transport, and/or disposal. Three major separate waste streams would be generated including concrete and rock, asphalt, and creosote-treated wood. Several alternatives exist for the disposal of each waste stream and are discussed herein.

2.3.1 Alternatives Considered for Timber Pile Disposal

An estimated 14,000 creosoted-timber piles comprise the pier support structure for Piers 2 and 3. These piles have an estimated weight of 13,600 metric tons (15,000 tons) (HPA, 2003a). The piles were treated with coal tar creosote in order to preserve and waterproof the wood, as well as to prevent or minimize animal and vegetative growth on the wood (ATSDR 2002).

The disposal of creosote is governed by both federal and state law. The 1992 Toxic Release Inventory produced by the United States Environmental Protection Agency (EPA) identified coal tar creosote as a carcinogen (HPA, 2003a). However creosote-treated wood is not a hazardous waste according to the EPA Toxicity Characteristic Leaching Procedure regulation (AWPI, 2000). Landau Associates, Inc. tested creosote-treated marine timber and pilings from Puget Sound and found that "creosote-treated marine timbers and pilings are not a federal hazardous waste under 40 CFR. Part 261." (AWPI, 2000). Therefore, according to federal regulations, they may be disposed of as solid waste (AWPI, 2000). Likewise, NJDEP classifies creosoted-timber piles as solid waste. The disposal of creosote-treated wood in the state of New Jersey must be in accordance with state regulations for solid waste. Preliminary estimates indicate that disposal costs of the timber piles could range from \$56 to \$97 per ton. Options for disposal of creosote-treated wood include incineration, recycling/reuse and landfill disposal.

Incineration

According to federal regulations that classify creosote-treated wood as solid waste, creosoted wood that has been used for industrial purposes may be disposed of in industrial incinerators or boilers (ATSDR, 2002). Incineration would require the timber piles to be shipped to an incinerator outside of the state of New Jersey. Several out of state waste-to-energy facilities have expressed interest in accepting the material; these are discussed below. The majority of these facilities prefer the material to be chipped prior to transport. If chipping is not feasible, some may be able to accept the material if it is cut into smaller fragments or will chip the material on-site at an additional cost. Options for out-of-state waste-to-energy incineration include:

- **Envirowaste Management (EWM):** EWM is a division of Specialty Waste Services Group, Inc. It is located in Westford, MA and has a branch office in Plaistow, New Hampshire. The facility can accept the pier piles whole but prefers to receive them chipped. EWM does not operate shorefront incinerators; therefore, transportation would be via truck or railroad. Estimated cost for the disposal of chipped piles is $53-$55 per ton. Truck transport was estimated to be $30-$40 per ton. Total cost for truck transport and disposal of the chipped piles would therefore be $83-$95 per ton. Non-chipped piles would increase the disposal cost. EWM has access to a rail yard in New Haven, CT. Barges could transport the piles to New Haven, CT where they could be transferred to rail cars for transport to the EWM facility. Cost estimates under this scenario would need to be negotiated with EWM.

- **Covanta Energy Solutions (Covanta):** Covanta has 27 facilities and is the world's leading operator of large-scale waste-to-energy facilities that use municipal solid waste as a fuel to generate renewable energy. Covanta can accept creosote treated wood, however, disposal prices would be project dependent and are negotiated on a case-by-case basis.

- **American Ref-Fuel (ARF):** ARF is the largest waste-to-energy company in the Northeast and is indirectly owned by Duke Energy Corporation and United American Energy Corp. Non-hazardous waste can be accepted by ARF only after receipt of the appropriate approvals from AFR's Special Waste Services team and, in some circumstances, from applicable regulatory agencies. ARF can only accept truck-transported material. ARF prefers the piles to be chipped prior to transport, however, it may be feasible for the facility to accept the piles if they are cut into smaller segments. Disposal costs could not be offered prior to waste characterization by the company's special waste service team; however, the company has expressed interest in accepting this material.

Incineration costs at all facilities would be reduced if the piles were chipped prior to transport. Chipping would also reduce transport costs because the reduction of interstitial space allows a greater volume of material to be transported in each load.

Recycling

Recycling is generally not a consideration for disposal of creosote-treated wood due to the many potentially contaminating substances that could be included with creosote wastes (ATSDR, 2002). In recycling operations, the processing of the wood poses health concerns for workers who might be exposed to air emissions including particulate matter and fumes (Felton and DeGroot 1996).

Reuse

Treated wood may be reused in ways that are consistent with its original purpose (AWPI 2000). Treated wood, in general, may be used for poles, fence posts, retaining walls, and landscape timbers (AWPI, 2000). However, creosote-treated woods present health threats that may limit its ability to be reused in these manners. Environmental regulations limit the use of creosote-treated wood to building materials that would be in ground contact and thus would be subject to decay and insect infestation (Felton and DeGroot 1996).

The State of New Jersey categorizes creosote-treated wood as solid waste; therefore it can be reused in the state, provided there is a demand and all applicable state regulations are met. One example of creosoted-timber reuse occurred in West Virginia when the Naval Security Group Activity at Sugar Grove, West Virginia dismantled an antenna array. The Navy saved over $650,000 by arranging for reuse of 17,500 linear feet of creosote-coated poles. The West Virginia Department of Transportation bought the poles for use as bridge supports and for shoring up riverbanks for flood protection. The Navy avoided transportation costs and the high labor expense of cutting the poles into smaller sizes prior to landfilling (Seldman and Jackson, 2000).

A similar disposal scenario could be achieved provided there is an identifiable demand for the material. Since the 2001 NJDOT Standard Specifications do not permit the use of creosote in marine environments, in-state reuse applications would most likely be land based. Creosote-treated wood is commonly used in landscape applications, however, environmental and health concerns associated with treated wood may reduce the demand for this material. Many wood processors will not cut treated wood because of the associated health risks. Therefore, reuse options may be limited to applications that can utilize whole piles.

Landfill Disposal

Treated and untreated wood scrap is classified as a type 13C solid waste (construction and demolition waste) in the state of New Jersey. Therefore, in-state disposal must be at a landfill permitted to this type of waste. While there are many landfills in the state permitted to accept type 13C waste, the volume of waste being generated at NWS Earle may substantially limit disposal options within the state. Tipping fees for instate landfills range from $56-$97 per ton. Landfill disposal in another state is likely to be more expensive due to the additional transport and handling costs.

2.3.2 Alternatives Considered for Pier Decking Disposal

The Pier 3 decking contains a substantial volume of asphalt and concrete. Pier 3 demolition is expected to generate approximately 7,600 m^3 to 9,600 m^3 (10,000 yd^3 to

12,500 yd^3) of concrete debris from the pier and trestle decks. To date, projected asphalt volumes have not been determined. Two options exist for the disposal of this material, landfill disposal and beneficial use/reuse. These options are discussed in the following section.

Artificial Reef

Disposal of the concrete rubble may be accomplished through participation in the New Jersey Artificial Reef Program. In order for the material to be acceptable for reef building activities, all hazardous and potentially polluting components must be removed. Acceptable materials include concrete and steel rubble, structural steel, rock, vessels, military vehicles, railroad cars, and other "materials of opportunity" that are evaluated on a case-by-case basis by the NJDEP, such as the Pier 3 railroad rails. Items prohibited from disposal under the Artificial Reef Program include asphalt, wood, ferro-cement vessels, fiberglass vessels or hull molds, railroad boxcars, concrete-ballasted tire units, automobile and truck bodies, airplanes, and white goods (refrigerators, stoves, etc.).

In order to dispose of the Pier 3 concrete through the NJ reef-building program, the material must be free of floatables, toxic residues and large volumes of dirt. Therefore, the bituminous overlay and any surface staining on the concrete must be removed prior to disposal. Bituminous material cannot be used for reef building and, therefore, would be disposed of in accordance with all applicable regulations for construction and demolition debris. Any remaining stains on the underlying concrete should be cleaned or otherwise removed from the concrete prior to disposal under the direction of the NJDEP. If the creosote treated piles are imbedded into the concrete decking they must be cut off flush with the decking if the decking is to be used in reef building activities. To ensure that the material meets the above-mentioned criteria, each proposed source must be inspected by the NJDEP prior to its transport to sea. An observation vessel must also be provided so that the placement of the material can be monitored by the NJDEP.

Landfill

It is feasible to dispose of the Pier 3 demolition debris in a landfill permitted to accept construction and demolition debris. However, because the material is to be transported from the project area via barge, the transport and handling costs associated with bringing the material upland would substantially increase the disposal costs. Therefore, landfill disposal is most suitable for any portion of the material that is not suitable for disposal by other means, such as the asphalt overlay material.

Section 3.0

3.0 RELATIONSHIP OF THE PROPOSED ACTION TO FEDERAL, STATE AND LOCAL PLANS, POLICIES AND CONTROLS

The following federal, state and local regulations, plans, policies and controls have been considered in the preparation of this EA.

3.1 Federal Plans, Policies and Controls

3.1.1 National Environmental Policy Act

National Environmental Policy Act (NEPA) regulations have been developed by the Council on Environmental Quality (CEQ) that oversees the NEPA process for federal agencies. The NEPA regulations, codified at 40 Code of Federal Regulations (CFR) Parts 1500-1508, set forth the general requirements that federal agencies must follow to ensure compliance with NEPA. These regulations include procedural requirements for the preparation of environmental impact statements, environmental assessments and categorical exclusions. The Navy's procedures for implementing NEPA are identified in Chief of Naval Operations Instruction (OPNAVINST) 5090.1B).

3.1.2 National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966, requires, under Section 106 of the Act, federal agencies to allow the Advisory Council on Historic Preservation an opportunity to comment whenever their undertakings may affect National Register resources or resources that are eligible for listing on the National Register of Historic Places (NRHP). Also, Section 110 of the Act requires federal agencies to identify, evaluate, inventory, and protect National Register resources (or resources that are eligible for listing on the NRHP) on properties that they control.

3.1.3 Federal Water Pollution Control Act (Clean Water Act)

The Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), regulates the discharge of pollutants into waters of the United States. Under Section 404 of the CWA, permits are required for the discharge of dredged or fill material into waters of the United States (including wetlands). These permits are issued by the ACOE. Section 401 of the CWA requires that activities that may affect water quality receive state water quality certification. State certification is granted following a finding that the proposed activity would not violate established state water quality standards.

3.1.4 Clean Air Act

The Clean Air Act of 1970 (CAA), and its amendments, regulate stationary air emission sources nationwide and establish permit requirements and standards for new air emission sources through permitting programs administered by the EPA. The National Ambient Air Quality Standards (NAAQS), established by EPA, set forth the emission standards for individual pollutants contributing to air pollution. The NAAQS criteria pollutants include ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), lead (Pb), and inhalable particles with a diameter less than or equal to a nominal ten micrometers (PM_{10}). The primary responsibility for air pollution prevention and control falls to state and local governments. The region and the state must develop an air quality plan indicating how it will attain and maintain air quality standards for each of the criteria pollutants.

3.1.5 Endangered Species Act

The Endangered Species Act (ESA) of 1973, as amended (16 United States Code [USC] §§1531 et. seq.) empowers the Secretary of the Interior to establish a list of threatened or endangered species and critical habitats designated for protection. The listing process is carried out in cooperation with the appropriate state regulatory agency. Section 7 of the ESA establishes agency coordination responsibilities, and sets forth directives for preparation of a biological assessment if a federally- listed endangered species or critical habitat is found within the area.

3.1.6 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund")

In 1980 CERCLA (42 USC Part 9601 et seq.: 26 USC Parts 4611, 4612, 4661, 4662, 4671, 4672) was passed to provide a "Superfund" for the cleanup of sites with uncontrolled releases of hazardous substances. This program was continued in the Superfund Amendments and Reauthorization Act (SARA) of 1986 (42 USC Part 11001 et seq.). Section 211 of SARA provides continued authorization for the Department of Defense (DOD) Environmental Restoration Program and the Defense Environmental Restoration Account. Major responsibilities for monitoring compliance with these acts rests with EPA.

3.1.7 Coastal Zone Management Act

The federal Coastal Zone Management Act (CZMA) enables states to develop and implement regulatory guidelines to ensure appropriate protection and compatibility of uses of their coastal zones. As part of the federal CZMA, states may develop their own coastal zone management programs.

NJDEP has enacted legislation to regulate development within the state's coastal areas. The New Jersey Coastal Permit Program Rules, New Jersey Administrative Code (NJAC) 7:7, and the Coastal Zone Management Rules, NJAC 7:7E, determine what development project may be allowed under the auspices of three state laws, the Waterfront Development Law (New Jersey State Act [NJSA] 12: 5-3), the Coastal Area Facility Review Act or "CAFRA" (NJSA 13:19), and the Wetlands Act of 1970 (NJSA 13:9A) described below. New Jersey's Coastal Zone Management plan was approved by the US Department of Commerce in 1980 under the federal CZMA of 1972.

3.1.8 Sikes Act Improvement Act Amendments

The Sikes Act Improvement Act (SAIA) Amendments of 1997, 16 USC 670a et seq., requires that military installations prepare and implement an Integrated Natural Resource Management Plan (INRMP). The goal of the INRMP is to provide for the conservation and rehabilitation of natural resources, sustainable multipurpose uses of resources, and public access for use of natural resources subject to safety and military security considerations.

3.1.9 Executive Order 11990

Executive Order 11990 mandates that federal agencies ensure preservation and enhancement of wetland resources and take appropriate action to minimize destruction, loss or degradation of wetlands in undertaking a proposed action.

3.1.10 Executive Order 11988

Under Executive Order 11988, federal agencies are directed to take appropriate action to minimize flood hazards and impacts resulting from modifications to floodplains. Both long-term and short-term effects are to be evaluated and appropriate mitigative measures specified, as necessary.

3.1.11 Executive Order 12898

Executive Order 12898 requires federal agencies to evaluate their programs, policies, and activities to ensure that proposed actions do not disproportionately affect minority and low-income populations. The agency must determine whether a proposed action or alternatives have the potential to cause disproportionately high or adverse human health or environmental effects on minority or low-income populations.

3.1.12 Executive Order 13045

Executive Order 13045 requires federal agencies to evaluate their programs, policies, and activities to ensure that they do not pose a disproportionate health and safety risk to children. The agency must determine whether a proposed action or alternatives have the potential to cause children to come in contact with, or ingest, products or substances that may adversely affect their health and safety.

3.1.13 Occupational Safety and Health Act

The Occupational Safety and Health Administration (OSHA), established pursuant to the Occupational Safety and Health Act, is charged with ensuring that work place conditions are safe and hazard free. OSHA mandates a set of standards and practices, including, for example, the use and handling of hazardous materials and toxic chemicals and the operation of machinery.

3.2 State Plans, Policies and Controls

3.2.1 Coastal Area Facility Review Act

The Coastal Area Facility Review Act (CAFRA) (NJSA 13:19) is applicable to projects proximal to coastal waters from the New Jersey north shore at Cheesequake Creek south and around Cape May, then northerly again along the Delaware Bay to the Kilcohook National

Wildlife Refuge in Salem County. Different types of development are regulated within the various zones established within the regulated area. The pier complex lies within the Coastal Metropolitan Area zone. CAFRA regulates the construction, relocation, and enlargement of buildings and/or structures, and all related work, such as excavation, grading, shore protection structures, and site preparation. Compliance with CAFRA for the proposed action is addressed through the CZMA Consistency Determination process.

3.2.2 Waterfront Development Law (NJSA 12:5-3)

This law was enacted in 1914 to regulate new development in order to prevent impact to navigation channels, marinas, moorings and other existing waterways uses. This law is applicable to any development in a tidally flowed waterway anywhere in New Jersey. Examples of development projects that require a waterfront development permit include the construction of new docks, piers, pilings, bulkheads, marinas, bridges, pipelines, cables and dredging activities.

3.2.3 Wetlands Act of 1970 (NJSA 13:9A)

NJSA 13:9A requires that NJDEP regulate development in coastal wetlands.

3.3 Local Plans, Policies and Controls

Local development policies are set forth in the Monmouth County Comprehensive Plan.

Section 4.0

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The natural and built environments of NWS Earle are addressed in this section with emphasis on the natural resources surrounding the existing pier complex in Sandy Hook Bay. Since the proposed action is to site the new Pier 3 in place of the existing Pier 3, the information provided in this section is applicable to both the existing Pier 3 and the proposed Pier 3 sites (herein collectively referred to as the Pier 3 site, unless otherwise noted). Information regarding finfish resources is supplemented by an Essential Fish Habitat Assessment provided in Appendix B. Information provided in this section was obtained from published documents, NWS Earle personnel, grey literature, and consultation with state and federal agencies. Copies of all correspondence obtained from state and federal agencies are provided in Appendix C.

4.1 Natural Environment

4.1.1 Meteorology and Climate

NWS Earle lies within the coastal climate zone. Within this zone, both continental and oceanic influences converge. Each influence may alter the climate on a daily to weekly basis. In autumn and early winter, when the ocean is warmer than the land surface, the coastal climate zone experiences warmer average temperatures in contrast to interior regions of the state. In the spring months, this condition is reversed as steady ocean breezes create an average lower temperature along the coast. Due to the moderating effects of the adjacent Atlantic Ocean, (which has a high heat capacity compared to land), seasonal temperature fluctuations tend to be more gradual and less prone to extremes.

Onshore and offshore currents, created when the land and ocean heat and cool at different rates, create sea breezes that play a major role in the coastal climate. The influence of the penetrating sea breezes is often 8–16 km (5-10 mi) inland, but under more favorable conditions, can affect locations as far as 40-64 km (25-40 mi) inland. Moderating sea breezes are most common during the spring and summer months.

Coastal storms, typically nor'easters, are most frequent between October and April. These storms tend to extend from over the coastal plain to upwards of several hundred miles offshore, bringing strong winds and heavy rains along their path. At least one significant coastal storm occurs during most winters; however some winters bring as many as ten. The New Jersey coast is also prone to tropical storms and hurricanes, which are a concern, given the low-lying topography of the coastal plain. In some years, tropical storms contribute a significant amount to the precipitation totals of the region. Damage during times of high tide can be severe when tropical storms or "nor'easters" affect the region. Values for average daily minimum and maximum temperatures and average precipitation during each month of the year are provided in Table 4-1 (http://climate.rutgers.edu/stateclim/njclimoverview.html).

4.1.2 Terrestrial Ecology

The NWS Earle pier complex lies in Sandy Hook Bay approximately 3.2 km (2 mi) from shore. Due to its location in the Bay, the pier complex is removed from the terrestrial environment, and therefore not dominated by terrestrial ecosystem processes.

Table 4-1
Weather Data Recorded at Sandy Hook New Jersey for the Period 1971-2000.

Record		Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Ave. Daily Minimum	(°C)	-3.5	-2.8	1.1	5.7	11.3	16.4	19.8	19.3	15.8	9.4	4.7	-.2
	(°F)	25.7	27.0	33.9	42.3	52.4	61.6	67.7	66.8	60.5	48.9	40.5	31.6
Ave. Daily Maximum	(°C)	3.5	4.4	9.1	14.6	20.2	25.5	28.4	27.7	24.3	17.8	11.9	6.7
	(°F)	38.3	40.0	48.3	58.3	68.4	77.9	83.1	81.9	75.7	64.0	53.5	44.1
Mean Temp.	(°C)	0.0	0.8	5.1	10.2	15.8	21.0	24.1	23.6	20.1	13.6	8.3	3.3
	(°F)	32.0	33.5	41.1	50.3	60.4	69.8	75.4	74.4	68.1	56.5	47.0	37.9
Precipitation	(cm)	10.1	7.3	9.1	9.4	10.2	9.0	10.4	10.2	8.7	8.5	8.7	9.1
	(in.)	4.0	2.9	3.6	3.7	4.0	3.5	4.1	4.0	3.4	3.4	3.4	3.6

http://climate.rutgers.edu/stateclim/norms/max.html

4.1.3 Marine Ecology

The NWS Earle pier complex lies in the open water area of the Raritan Bay - Sandy Hook Bay complex (Complex #17), recognized by the US Fish and Wildlife Service (USFWS) as a significant water habitat complex. The project area lies within the region of Sandy Hook Bay recognized as a regionally significant estuarine habitat for shellfish and marine, estuarine, and anadromous fish, as well as for its significant migratory and wintering waterfowl concentrations (USFWS, n.d.). Information regarding the occurrence of protected species within Sandy Hook Bay was obtained through site observations, correspondence with appropriate state and federal agencies (refer to Appendix C), and other sources as noted in the subsequent sections.

Vegetation

Aquatic vegetation beds in New Jersey's estuarine environments are typically made up of various algae and two common vascular plants. Common algal species include red algae, such as *Gracilaria* spp.; green algae, such as sea lettuce (*Ulva lactuca*) and green fleece (*Codium fragile*); and the two vascular plants eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*) (Tiner Jr., 1985). However, various abiotic and biotic factors prevent the formation of these beds around the pier complex. The most influential abiotic factor is light. Light intensity decreases with depth and is blocked by the pier decking at Piers 2 and 3. Therefore, the light intensity at the benthic substrate is not sufficient to sustain the growth of these vegetation species. Disturbance from maintenance dredging and shipping traffic also helps to deter the formation of aquatic vegetation beds below and proximal to the pier.

Invertebrate Resources

Benthic Infaunal Community: Past marine investigations have been conducted in association with construction activities at the NWS Earle pier complex. Results of the most recent investigations are summarized in Table 4-2.

The benthic invertebrate community composition in Sandy Hook Bay varies with hydrodynamic conditions and substrate types. The sediment beneath and under Pier 3 is composed primarily of silt at the surface, and therefore is most likely colonized by species of lower invertebrate taxa that favor fine textured sediments. Amphipods were frequently encountered during sediment cores collected in support of the ACOE dredging permit sampling plan. Other species of benthic invertebrate taxa expected to be numerically abundant within the finer textured sediments of the project area include the clam *Mulina lateralis*, and the marine polychaete *Nephtys incisa*.

Table 4-2
Results of Benthic Invertebrate Sampling Associated with past Pier Projects at NWS Earle

Project and Date	No. of Samples and Sampling Locations	Dominant Species
EIS Documentation for Trestle Replacement (1989)	Ten sampling locations west of current trestle location	Molluscs (*Gemma gemma*) and annelids (Polychaeta: *Sabellaria vulgaris*) numerically dominant
Pier 4 Construction and Channel Deepening (1985)	22 sampling locations around Pier 4, pier complex turning basin, and entrance channel	Amphipods numerically dominant, capitellid and spionid polychaete annelids, tellin clams and dog whelks were also common

Piling Community: The older creosote piles exhibit a denser colonization of sessile marine invertebrates, than do the newer pressure-treated piles. The pressure-treated piles are also resistant to boring marine organisms such as common shipworms (*Teredo navalis*). Exterior piles and fenders along the piers are subject to higher light intensity and therefore, support denser more robust colonies of seaweeds and other marine algae species (e.g., red weeds in the sub-littoral zone). From the splash zone (i.e., above highest high tide), down to the mud line, the piles bisect the various biotic zones of inshore waters, including the littoral fringe, mid-littoral, and sub-littoral zones.

The littoral fringe is defined as that portion of the inter-tidal zone that is subject to wetting by wave spray or splashing. It is usually the biome with the least diversity of marine animals as it is subject to extreme variations in temperature and desiccation. The mid-littoral zone lies between the average high and low tide elevations and is subject to the daily tidal fluctuations under normal cyclic conditions. The sub-littoral zone is rarely exposed to the air, lying below the average low water elevation (Gosner, 1978).

Within the New York Bight eco-region, blue-green algae dominate the littoral fringe. The lower extent of their coverage marks the depth of the littoral fringe. Northern rock barnacles (*Balanus balanoides*) begin to colonize the pilings at the littoral fringe and mid-littoral zone interface. Their colonies form the demarcation of the upper limits of the mid-littoral zone, and extend downward well into the mid-littoral zone. Beneath the rock barnacles, anemones and sea squirts often colonize marine pilings within the New York Bight eco-region, followed by a zone of co-occurring tubicolous amphipods and blue mussels (*Mytilus edulis*). The limit of the blue mussel colonies typically defines the lower limit of the mid-littoral zone and the upper limit of the sub-littoral zone. At the upper limit of the sub-littoral zone, red seaweeds, hydroids and sponges quickly dominate coverage of the pilings. Since they require near constant coverage of water, their appearance on the pilings with depth demarcates the upper limit of the sub-littoral zone. The pilings beneath the piers typically bisect approximately 4.6 m (15 ft) of water between the MLW elevation above and the sediment surface elevation below.

Shellfish: Various gastropod and bivalve mollusks are abundant shellfish in Sandy Hook Bay. In addition to the numerically dominant species identified within the benthic infaunal invertebrate communities above, many larger shellfish species are significant members of the benthic invertebrate community in the region based on their biomass contributions. In the sub-tidal sediments of Sandy Hook Bay, these species include the soft shell clam (*Mya arenaria*) and the hard shell clam (*Mercenaria mercenaria*). In addition, the blue mussel (*Mytilus edulis*) is commonly found attached to mid-littoral structures in the Bay, including the pilings of Pier 3.

The area surrounding the pier and adjacent areas of Sandy Hook Bay have high densities of hard shell clams (McCloy and Joseph 1985, NJDEP 2000) and has historically been recognized as having high commercial value for this species (DOI, 1963). This same area is recognized as a production area for soft clams. The commercial harvesting of shellfish proximal to the project area (i.e., outside of but adjacent to the restricted area) is allowed under special permit by the NJDEP, providing the shellfish are further processed either through depuration or relay (NJDEP, 2003).

Megainvertebrates: Other larger invertebrate species comprising significant biomass contributions to the invertebrate communities of the Bay include the lady crab (*Ovalipes ocellatus*), the rock crab (*Cancer irroratus*), and the American lobster (*Homarus americanus*). With the onset of colder water temperatures during winter months, lobsters move offshore to warmer waters, or become inactive within the deeper waters of the Bay. Blue crabs (*Callinectes sapidus*) are often found within the Bay and hibernate during winter months within the Bay's soft mud sediment (USN, 1992).

Fisheries Resources

Finfish: Sandy Hook Bay lies in a larger, distinct faunal region in which the fish community is composed of both cold-temperate and warm-temperate contingents (Robins and Ray, 1986). This faunal region extends from Cape Cod to the entrance of Chesapeake Bay. The finfish community of Sandy Hook Bay is composed of species that represent numerous taxonomic families and various feeding guilds. Among the most abundant fish within the harbor include Atlantic silverside (*Menidia menidia*), winter flounder (*Pseudopleuronectes americanas*), striped killifish (*Fundulus majalis*), and Atlantic menhaden (*Brevoortia tyrannus*). Also common are bay anchovy (*Anchoa mitchilli*), mummichog (*Fundulus heteroclitus*), scup (porgy) (*Stenotomus chrysops*), weakfish (*Cynoscion regalis*), summer flounder (*Paralichthys dentatus*), and windowpane (*Scopthalmus aquaosus*). Blueback herring (*Alosa aestivalis*), spotted hake

(*Urophycis regia*), bluefish (*Pomatomus saltatrix*), striped searobin (*Prionotus evolans*), and northern pipefish (*Syngnathus fuscus*) are also found with regularity. Within the adjacent estuarine waters of the Navesink River, mummichog, white perch (*Morone americanus*) and hogchockers (*Trinectes maculatus*) are abundant.

The abundance of many of these species can change in response to the varying seasons. For instance, scup, bluefish, and Atlantic silversides reach their peak abundances in the summer months, while species such as winter flounder reach their peak abundance from late winter to early spring. Still others, such as the windowpane are caught in trawl nets during every month of the year. Sandy Hook Bay has been the site of numerous finfish sampling studies over the years. A summary of these studies is presented in Table 4-3.

Recreational Fisheries: The marine resources of Sandy Hook Bay support both recreational and commercial fisheries in the area and therefore, are important economic resources. The Sandy Hook Bay – Raritan Bay complex supports the following recreational fisheries: weakfish, bluefish, winter flounder, summer flounder, striped bass (*Morone saxitilus*), black sea bass (*Centropristus striata*), tautog (*Tautoga onitis*), scup, and spot (*Leiostomus xanthurus*) (Bennett, personal communication; MacKenzie, 1992; Steimle, personal communication).

Table 4-3
Results of Fish Sampling Efforts Within Sandy Hook Bay

Study	Wilk and Silverman	Wilk	ACOE
Date	1976	1983	1984
Location	Sandy Hook Bay	Raritan Bay (including Sandy Hook Bay)	Raritan Bay (including Sandy Hook Bay)
Sampling Interval	Summer	30-month period	1982-1983
Species Richness	35 species	59 species	56 species
Most Abundant Species	red hake, butterfish, bluefish, summer and winter flounder, scup, and weakfish	sea robin, winter flounder, spotted hake, red hake, windowpane	winter flounder, bay anchovy, butterfish, red hake
Other Findings	Abundant fish reported are summer residents	99% of total catch represented by 20 species; 99% of total catch weight represented by 27 species. Principal species represented both permanent residents and seasonally abundant species	Most abundant species collected from stations closest to NWS Earle were bay anchovy, winter flounder, red hake, scup, windowpane, and weakfish

The Bay and adjacent waters support a robust sport fishing industry as evidenced by the many six-pack and head boat charters berthed within the Atlantic Highland Marina. Six-pack charters or "six packers" is a colloquial term used to refer to the smallest scale charter operations in the Bay. They typically involve boats 18 to 24 ft in length with "six" referring to the maximum number of passengers. It is primarily a catch and release fishery that focuses on sport rather than subsistence fishing. Striped bass and bluefish are typically the key species targeted by six packers.

Some charter operations may target "summer exotic species" including bonito, false albacore, and Spanish mackerel. These groups of fishermen are light tackle sport fishing specialists that use fly rods or light tackle. In order to permit room for flycasting, there are usually only one or two passengers and the charter operator on these boats. For these fishermen, the size of the fish and the quality of the fight involved in landing these species defines a successful trip. The target area for light tackle specialists is most likely in the vicinity of Sandy Hook. This specialized fishery has a narrow window of activity when exotics appear in the Bay, usually from July to September. From May to June, they may also target striped bass.

Larger-scale charter operations are known as "head boats or party boats". Both boat size and client capacity are significantly greater than for six packers. The average head or charter boat size is 60 ft but range anywhere from 31 to 100 ft. The client capacity ranges from 25 to 100 persons per trip depending on boat size. The charter season lasts about six months with the height of activity occurring during the warmer summer months.

Head boat charters tend to primarily target abundant bay species, since the sport for these day-trippers is in the quantity caught. Many patrons view their catch as an important source of food for their households. In Sandy Hook Bay, the target species for head boat charters are likely to be for scup, black sea bass, tautog, and summer flounder. Although head boats cater to recreational fishermen, the focus of their operation is similar to commercial fishermen with the emphasis likely to be on profit rather than the sheer sport of fishing unlike six packers and private boat fishermen. Head boat operators are likely to pursue licensed commercial fishing activities within, but not excluded to, the Bay outside of the charter season. The charter season typically occurs between May and September, however there may be lighter activity from March to May and October to December depending on the target species.

Commercial Fisheries: The Raritan Bay complex supports a commercial fishing industry based on both shellfishing and finfishing. Commercial finfish fisheries in the Bay include American shad (*Alosa sapidissima*) and American eel (*Anguilla rostrata*). Shellfishing employs an estimated 200 full time people annually in the Bay. American lobster (*Homarus americanus*) is taken commercially from within the Bay (USFWS, 2001) as well. There is a commercial crab fishery for blue crabs (*Callinectes sapidus*), a species that winters in the soft sediments of the Bay. This species supports a winter dredge fishery within and proximal to the NWS Earle entrance channel (Steimle, personal communication), while adjacent rivers and harbors support recreational crabbing (Bennett, personal communication).

Mackenzie (1992) provides a historical overview of the commercial and recreational fisheries of Raritan Bay. Other commercial shellfish fisheries in the Bay include hardshell clam or northern quahog (*Mercenaria mercenaria*) and soft-shell clam (*Mya arenaria*). Harvest of these shellfish for commercial market requires prior transfer to depuration or relay areas. Other commercial and recreational fisheries wax and wane in the harbor with the abundance or demand for certain baitfish, foodfish or sport fish. An example is the horseshoe crab (*Limulus polyphemus*) fishery (Bennett, personal communication).

Essential Fish Habitat: The project area lies in waters designated as an Essential Fish Habitat (EFH) for one or more life stages of 15 federally managed fish species. A complete description of the EFH-designated area and the federally managed fish species inhabiting this area is located in Appendix B.

Herpetofauna

Herpetofaunal species known or expected to occur in the vicinity of the pier complex include six species of turtles, including five marine sea turtles and one estuarine species. Typically, sea turtles can be found in the New York Bight from June through November (Gorski, personal communication). The species, status, and expected occurrence in Sandy Hook Bay are shown in Table 4-4.

Avifauna

The NWS Earle pier complex lies in the Atlantic migration corridor (Bellrose, 1976). Approximately 300 species of birds have been recorded in and around Sandy Hook, NJ. Some of these species, mostly waterfowl and seabirds, can be observed proximal to the NWS Earle pier complex. Various species of birds typically visit the pier complex with relative frequency (i.e., on a daily basis). Common year-round residents visiting the piers include seabirds such as the Herring Gull (*Larus argentatus*), Ring-billed Gull (*Larus delawarensis*) and Great Black-backed Gull (*Larus marinus*), the Double-crested Cormorant (*Phalacrocorax auritus*), and those generalist species attracted to human structures such as Rock Dove (*Columba livia*), European Starling (*Sturnus vulgaris*), and House Sparrow (*Passer domesticus*). The Fish Crow (*Corvus ossifragus*) also frequents the piers, scavenging dead gulls and pigeons, and eating scraps of sea life left over by feeding gulls.

During spring and summer, Barn Swallows (*Hirundo rustica*) commonly nest under the piers. In winter, large concentrations of waterfowl congregate along the leeward (southeast) side of the pier. These mixed species congregations include loons, grebes, brant, scoters, scaups, mergansers, and other waterfowl.

Five avian species that are listed on the New Jersey Division of Fish and Wildlife Endangered and Non-game Species Program, list of Endangered and Threatened Wildlife of New Jersey (NJDEP, 2002a) may be sighted from the pier complex on occasion, but are unlikely to find the pier complex suitable for nesting. These five species and their status as endangered or threatened are indicated in Table 4-5. The Peregrine Falcon (state endangered) has frequented the pier complex during winter months to prey on concentrations of Rock Doves, waterfowl and gulls. Osprey (state threatened), Black Skimmer (state endangered) and Least Tern (state endangered) nest at nearby Sandy Hook and can often be found searching for prey in Sandy Hook Bay, many times in view of the pier complex. The Black-Crowned Night-Heron (*Nycticorax nycticorax*) has been observed roosting during the day beneath the pier on occasion during summer months. Beans and Niles (2003) indicate that some non-breeding individuals may occur in New Jersey during the summer months. The Black-Crowned Night-Heron observed under Pier 3 is most likely a non-breeding summer resident, as man-made structures are not mentioned by Beans and Niles (2003) in their description of suitable breeding habitats for this species.

Table 4-4
Marine Herpetofaunal Species Known to Occur in Sandy Hook Bay

Species Name	Habitat Preferences[1]	Range[1]	Occurrence in Sandy Hook Bay[2]	Federal Status[3]	NJ Status[4]
Leatherback Turtle *Dermochelys coriacea*	Warm tropical and subtropical pelagic waters; sandy beaches for nesting; occasionally enters bays, sounds, and estuaries	Western Atlantic, from Newfoundland to Argentina. Nests on Atlantic coasts as far north as North Carolina	Regularly occurs in area in summer months	Endangered	Endangered
Loggerhead Turtle *Caretta caretta*	Warm Atlantic pelagic waters; sandy beaches for nesting	In the western Atlantic, from the Canadian Maritime Provinces to Argentina	Occasionally enters bays and sounds in the eco-region during summer months	Threatened	Endangered
Atlantic Ridley Turtle *Lepidochelys kempii*	Warm subtropical to tropical waters; sandy beaches for nesting	Chiefly Gulf of Mexico	Immatures occasionally enter bays and sounds in the eco-region during summer and fall months	Endangered	Endangered
Green Turtle *Chelonia mydas*	Warmer Atlantic waters, rare in estuarine waters	In the Western Atlantic, from Massachusetts to northern Argentina	Immatures occasionally enter bays and sounds in the eco-region during summer and fall months	Threatened	Threatened
Atlantic Hawksbill *Eretmochelys i. imbricata*	Subtropical and tropical waters; sandy beaches for nesting	In the Western Atlantic, from southern New England to southern Brazil	Rare visitor to eco-region where it is found far offshore.	Endangered	Endangered
Northern Diamondback Terrapin *Malaclemys t. terrapin*	Salt and brackish water coastal marshes, tidal flats, coves and estuaries	Coast from Cape Cod to Cape Hatteras	Breeder, regular visitor	Not listed	Not Listed

Sources: [1] (Conant and Collins, 1991) [2] (Weiss, 1995) [3] http://endangered.fws.gov/ [4] http://njfishandwildlife.com/tandespp.htm

Mammals

Given the piers' location in Sandy Hook Bay, few terrestrial mammal species would be expected to frequent the pier complex. Mammals that may be found on the piers include non-native generalist rodents such as the Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*).

Six whale species are listed by Beans and Niles (2003) as known to occur in New Jersey territorial waters either formerly or currently. They are: the sperm whale (*Physeter macrocephalus*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera physalusborealis*), blue whale (*Balaenoptera musculus*), humpback whale (*Megaptera novaeangliae*) and the North Atlantic northern right whale (*Eubalena glacialis*). These six species are listed as federally endangered. As a result of their federal listing, these species were automatically added to the New Jersey endangered species list following enactment of the New Jersey Endangered and Non-game Species Act in 1973 (Beans and Niles, 2003).

The sperm, sei, and blue whales are rarely found near the coast and therefore would rarely, if ever, be found within Sandy Hook Bay unless sick or injured. The fin, humpback, and right whales, however may be seen in proximity of the Atlantic shore from time to time. The endangered right whales and humpback whales are present in the mid-Atlantic waters off the coast of New Jersey in late winter through early spring, whereas fin whales are present throughout the year (Gorski, personal communication). The occurrence of these species in Sandy Hook Bay in recent times is extremely rare. Pinnipeds rarely occur in Sandy Hook Bay. Those that do occur are usually harbor seals that have reached the southern limit of their winter range.

Table 4-5
Avifaunal Species Listed as Endangered or Threatened by the NJDEP Observed or Expected to Occur in Proximity of NWS Earle Pier Complex

Common Name (*Scientific name*)	Habitat[1]	NJ Status[2]	Federal Status[3]
Peregrine Falcon *Falco peregrinus*	At coastal locations, habitat includes oceans and bays wherever there is an abundance of birds such as gulls, waterfowl, large nesting colonies of seabirds, small to medium songbirds, and rock doves	E	De-listed from federal Endangered and Threatened species list in August 1999. Species status currently being monitored (first five years).
Osprey *Pandion haliaetus*	Seacoast, bays, large unfrozen rivers and lakes	T	Not listed
Black Skimmer *Rhychops niger*	Shallow bays estuaries and creeks, nests on sandy islands, beaches and shoals	E	Not listed
Least Tern *Sterna antillarum*	Flat, open, sandy, coastal beaches and associated bays, estuaries, and ocean	E	Regional populations not listed
Black-crowned Night-Heron *Nycticorax nycticorax*	Freshwater swamps and tidal marshes; nests in hardwood or conifer groves near coastal marshes, marine islands, wooded swamps, also sometimes apple orchards and city parks.	T	Not listed

[1] (Terres, 1980) [2] (NJDEP, 2002a) [3] (USFWS, 2003) E= Endangered T= Threatened

4.1.4 Water Resources

Surface Water

Circulation: Sandy Hook Bay is an embayment of the Hudson-Raritan Estuary system. It is bounded by Lower New York Bay to the north and the New Jersey shoreline to the southwest (Pt. Comfort to the base of the Sandy Hook peninsula) and east (the Sandy Hook peninsula). Depths in the bay are typically less than 9 m (~30 ft), with the exception of the channels. The Sandy Hook Channel (-13.7 m [-45 ft] MLW) runs slightly north of east through the bay, exiting north of the Sandy Hook peninsula. It provides access to Sandy Hook Bay and Lower New York Bay from offshore. The Terminal Channel (-13.7 m [45 ft] MLW) extends southeast from the Sandy Hook Channel to the turning basin at the NWS Earle pier complex (Figure 4-1).

The primary source of direct freshwater input to Sandy Hook Bay is the Shrewsbury River, which empties into Sandy Hook Bay at the base of the Sandy Hook peninsula (USN, 1992). Additional freshwater flow into the Bay comes from numerous small streams, such as Pews Creek, Compton's Creek and Ware Creek, the last of which drains areas including portions of NWS Earle's waterfront.

Figure 4-1. Map of Study Area and Surrounding Waters.

Tides in Sandy Hook Bay are semi-diurnal, their amplitudes varying as a function of location within the bay. Mean tidal ranges have been reported as 1.5 m (4.9 ft) at Keansburg (USN, 1992), 1.4 m (4.7 ft) at Sandy Hook (USN, 1992), and 1.2 m (3.8 ft) at the mouth of the Shrewsbury River (USN, 1992). NOAA maintains a water level station at Sandy Hook (40° 28.0'N, 74° 0.6'W) as part of its Physical Oceanographic Real-Time System (PORTS). A series of tidal datums developed from data collected at this station over the 19-year period from January 1983 through December 2001 can be used to calculate a mean tidal range (MHW – MLW) of 1.434 m (4.705 ft). Likewise, a mean spring tide range can be calculated as Mean Higher High Water (MHHW) – Mean Lower Low Water (MLLW), which yields a value of 1.592 m (5.223 ft). The highest observed water level during this period occurred on 12 September 1960, when a height of 3.074 m (10.09 ft) above MLLW was observed.

A number of hydrodynamic studies have been conducted to investigate the details of estuarine circulation within the Hudson-Raritan Estuary (e.g., Oey et al., 1985a,b; Scheffener et al., 1994; Blumberg et al., 1999; Swanson et al., 2001; Sankaranarayanan and McCay, 2003). Studies show that tidal currents are strong within the Hudson-Raritan Estuary, with resultant velocities in excess of 1.0 meter per second (m/s) (knots per second (1.94 kts)) in some locations (Sankaranarayanan and McCay, 2003).

Sandy Hook Bay currents are greatest near the tip of the Sandy Hook peninsula, decreasing in magnitude toward the New Jersey mainland shoreline. Flows in the vicinity of the NWS Earle Pier complex are generally less than 0.2 m/s (0.3 kts) (USN, 1992).

Water Quality

The waters of Sandy Hook Bay are generally well mixed, showing little difference in temperature and salinity between surface and bottom waters (USN, 1992). Sandy Hook Bay is classified as SE1 waters by the NJDEP 2002b. Designated uses for class SE1 waters are 1) shellfish harvesting in accordance with NJAC 7:12; 2) maintenance, migration and propagation of the natural and established biota; 3) primary and secondary contact recreation; and 4) any other reasonable uses (NJDEP, 2002b).

Concentrations of metals and selected pesticides and industrial chemicals in site water from the NWS Earle pier complex are shown in Table 4-6. Relevant New Jersey and federal ambient water quality criteria for class SE1 waters are shown for comparison. In site water samples collected during initial sampling of all sediment reaches (20 June 2002) concentrations of all contaminants except total polychlorinated biphenyls (PCBs) were well below both New Jersey and federal acute and chronic exposure criteria. Total PCB concentrations [0.06998 parts per billion (ppb) (Reach 1), 0.0772 ppb (Reach 2) and 0.0718 ppb (Reach 3)] exceeded both the New Jersey and federal chronic exposure criteria of 0.03 ppb at all locations. In the site water sample collected during sampling of the reconfigured Reach 1 (10 July 2003) concentrations of all contaminants including PCBs were well below both New Jersey and federal acute and chronic exposure criteria (Appendix D).

Wetlands

According to the classification hierarchy of wetlands and deep-water habitats (Cowardin, et al. 1979), the open water habitat surrounding the pier complex is described as marine sub-tidal, unconsolidated bottom. Although the Hudson-Raritan Bay Complex, (which includes Sandy Hook Bay) is often referred to as an estuary, the water column surrounding Pier 3 exhibits seawater salinities (i.e. >25 parts per thousand). Therefore, the habitat is more comparable to that of the marine environment than that of the estuarine environment.

Other wetland systems proximal to the pier complex lie along the shores of Middletown, Belford and Leonardo at the landward end of the pier complex access trestle, approximately 3.2 km (2 mi) southwest of Pier 3. At this location, the following wetland and deepwater habitat classifications have been delineated in the undeveloped areas of the shore: marine inter-tidal rocky shore, marine inter-tidal unconsolidated bottom, estuarine sub-tidal unconsolidated bottom, estuarine inter-tidal emergent wetland, estuarine inter-tidal scrub-shrub wetland, and riverine tidal.

Floodplains

No floodplains are in the project area.

Watercourses

No watercourses are in the project area. Pier 3 lies in the center of three piers that are accessed via a marine navigational channel in Sandy Hook Bay known as Terminal Channel. This channel lies in a southwest to northeast orientation from the pier complex to the intersection of the Raritan Bay and Sandy Hook federal navigation channels.

The closest perennial watercourse to the pier complex site is Ware Creek, a riverine tidal watercourse located approximately 3.2 km (2 mi) southwest of the pier complex between Belford and Middletown.

Table 4-6
Summary of site water analyses and relevant water quality criteria.

Concentrations shown in bold italics exceed chronic exposure levels as established by either the New Jersey Department of Environment Protection (NJDEP, 2002b) or the US Environmental Protection Agency (EPA, 2002), as listed.

	Site Water Concentrations (ppb)			NJ Criteria (ppb)			EPA Criteria (ppb)	
Substance	**Reach 1**	**Reach 2**	**Reach 3**	**Acute**	**Chronic**	**Human Health**	**Acute**	**Chronic**
Ag	0.010	0.013	0.01			164*	1.9	
Cd	0.224	0.554	0.043			10*	40	8.8
Cr	0.271	0.392	0.364			3230*	1100	50
Cu	1.43	1.50	1.51	7.9	5.6		4.8	3.1
Hg	0.003	0.003	0.003			0.146*	1.8	0.94
Ni	0.83	0.85	0.85			3900*	74	8.2
Pb	1.06	0.877	0.299	210	24		210	8.1
Zn	4.76	4.56	4.07				90	81
Chlordane	0.0005	0.0005	0.00028	0.09	0.0040		0.09	0.004
Total DDT	0.0046	0.0047	0.00452					
Total PCB	***0.0698***	***0.0772***	***0.0718***		0.03	0.00017(hc)		0.03

* Concentration criteria refers to total recoverable substance.
(hc) Carcinogenic effect-based human health criterion as a 70-year average.

4.1.5 Bathymetry/Geology/Sediments

Bathymetry

The NWS Earle pier complex lies approximately at elevation 4.5 m (15 ft) MLW. Water depths in Sandy Hook Bay vary with location. To the east and just outside the berthing areas of the piers and the turning basin, depths range from -4.9 to -5.5 m (-16 to -18 ft). East of the entrance channel to the project area, depths range from -6.4 to -8.5 m (-21 to -28 ft). To the west and outside the berthing areas of the piers and the turning basin within the project area, depths range from -4.9 to -6.1 m (-16 to -20 ft), while west of the entrance channel to the project area, depths average -7.9 m (-26 ft) (NOAA, 2001).

Bathymetric surveys conducted over a 120-year period indicate little natural change in the bottom configuration of the estuary. Therefore, most disturbance events altering the bathymetry are man-made (i.e. dredging of shipping lanes) (MacKenzie, 1992).

Geology

The surficial geology underlying Pier 3 is composed of the following formation, from sediment surface to bedrock: recently deposited marine sediment; artificial fill; and beach and nearshore marine sand of Holocene origin. This same generalized profile exists in the berthing areas of Pier 3, however in the berthing areas the fill layer is absent.

The recently deposited marine sediment includes unconsolidated gray to black, fine sand and silt interspersed with bivalve shell fragments. Fine textured material is transported to the pier complex via prevailing currents in Sandy Hook Bay, which predominantly flow in a counterclockwise direction. Sediments transported to the vicinity of the pier complex originate to the west and are deposited in the vicinity of the piers where water currents are slowed by the numerous pilings beneath the pier complex.

The layer of fill beneath Pier 3 is composed of dredged sediment from the pier berths and piles of stone rip rap at the base of various support piers. This material was deposited during construction of the piers in 1944. The fill layer is underlain by native surficial geologic materials, mapped for Sandy Hook Bay as the Beach and Nearshore Marine Sand Unit (Stanford, 2000). This unit is described as sand, very pale brown to light gray; and pebble gravel. It includes a silt and clay layer that appears dark gray to black and is as much as three meters (10 ft) thick below the sediment surface. This silt and clay layer overlies a deeper sand and gravel layer. The formation was deposited during a Holocene era sea level rise and is underlain by estuarine deposits.

Estuarine deposits, also of Holocene origin, and defined by Stanford (2000) consist of dark brown to black salt-marsh peat, organic silt and clay; sand and minor pebble gravel in varying colors of very pale brown, white, or gray. These deposits are commonly underlain by lower terrace deposits.

Lower terrace deposits, in the vicinity of Sandy Hook Bay are of late Pleistocene origin and are composed of yellow, yellowish brown, or reddish yellow sand and minor silt; and also pebble gravel. Sand is comprised primarily of quartz with some glauconite and mica. Gravel is composed of quartz and quartzite, with minor ironstones fractions (Stanford, 2000).

Sediments

The sediments found in Raritan Bay vary with regions from north to south. Sands predominate in the lower Bay area, while a muddy-bottom region lies east to west at mid-Bay, likely a result of river-transported sediment from the Raritan River. The south shore sediments are derived from Keansburg sands (MacKenzie, 1992) overlain in many areas adjacent to the project area by more recent deposits of finer sand, silt, clay and some organic debris. The finer sediments in the project area (silts, clay, and organic detritus) occur adjacent to the project area, since wave energy is greatly reduced in this location by the numerous pier pilings. Larger-grained sediment (fine to medium sand) occurs in the entrance channel proximal to the main navigation channel of Raritan Bay. The faster currents entering the estuary around the northern tip of Sandy Hook, especially during storm events, most likely transport these coarser-grained sediments into the Bay from off-site sources. Once in the Bay, they are deposited in the relatively protected waters of the Bay where current energy dissipates. These sediment movement patterns in Sandy Hook Bay appear to conform to the predominant circulation patterns and littoral processes.

The sediment texture and composition below the piers vary with location along the piers. This regional variation is a combination of recently deposited unconsolidated silt; various fill materials; native, silty clay; and native fine to medium sand, which occur from sediment surface to project depth.

Eleven core samples were collected in September 2002 in the area of the proposed dredging at NWS Earle Pier 3 to assess sediment quality and suitability for ocean disposal. Sediment samples from the pier berth areas were collected using a Vibracore sampling unit pursuant to the approved ACOE New York District (NYD) sampling plan for the project. The sampling plan and the location of these coring sites in relation to Pier 3 are depicted in Appendix D - Sediment Sampling and Testing. A combination of Vibracore and conventional split-spoon sampling techniques was used to collect sediment beneath Pier 3 (known to be underlain by a fill layer). Cores were advanced to project depth -13.7 m (-45 ft) below MLW, divided by elevation interval to represent the respective reaches (layers) as specified in the ACOE, NYD sampling plan, and then composited by reach (layer). Reach 1 was represented by the appropriate elevation interval sub-sampled from the 11 sampling locations (Nos. 1-11), Reach 2 by the appropriate elevation interval sub-sampled from the three sampling locations beneath the pier (Nos. 1-3), and Reach 3 by the appropriate elevation interval sub-sampled from eight sampling locations (Nos. 4-11).

The recovered sediment samples were then subjected to physical, chemical, and biological testing. All sampling and testing was performed in accordance with EPA and ACOE guidelines pursuant to the 1991 Green Book, Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual, EPA-503/8-91/001, Guidance for Performing Tests on Dredged Material Proposed for Ocean Disposal, Revision 1: June 1994, ACOE, NYD and the Management and Regulation of Dredging Activities and Dredged Material in New Jersey Tidal Waters, October 1997, along with a revised memorandum dated 20 June 2002 from Ms. Oksana Yaremko of the ACOE, NYD.

Samples were subjected to physical analysis for the following parameters:

- Grain size
- Percent moisture
- Total Organic Carbon (TOC)
- Bulk Density
- Specific Gravity, and
- Atterberg Limits

Bulk sediment, site water, elutriate and the tissue of bioassay test organisms were subjected to chemical analysis for PCBs, Polycyclic Aromatic Hydrocarbons (PAHs), the semi-volatile compound 1,4-Dichlorobenzene, pesticides, heavy metals (silver, arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc) and dioxins/furans.

Biological testing consisted of the following:

- Whole sediment toxicity testing assessed through ten-day exposures with an opossum (mysid) shrimp *Mysidopsis bahia*, and the amphipod *Ampelisca abdita* in solid phase bioassays.
- The toxicity of elutriate was assessed through 96-hour suspended particulate phase toxicity bioassays with the Inland Silverside (*Menidia beryllina*) and *Mysidopsis bahia.*
- A 48-hour embryo development test was performed using the blue mussel (*Mytilus edulis*); and
- The bioaccumulation of PCB congeners, 1,4-Dichlorobenzene, pesticides, heavy metals, and dioxins/furans were assessed using a 28-day exposure of the clam *Macoma nasuta* and the sandworm *Nereis virens.*

Results of sediment testing are presented in the Technical Report for Sampling and Testing of Material Proposed for Dredging and Ocean Disposal from the Naval Weapons Station Earle, Pier 3 Replacement, New Jersey (ASI, 2003). Summary tables of the analytical results are provided in Appendix D. The results of additional testing of sediment that commenced in July 2003 in the deeper layer in the berth areas and under the seaward end only of existing Pier 3 are also presented in Appendix D.

4.1.6 Air Quality

Regional and Local Air Quality

The EPA, in accordance with the requirements of the 1970 Clean Air Act (CAA) as amended in 1977 and 1990, established National Ambient Air Quality Standards (NAAQS) for six contaminants, referred to as criteria pollutants (40 CFR 50) in this country. These pollutants are ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM_{10}), and Lead (Pb). The NAAQS include primary standards (established at levels sufficient to protect public health with an adequate margin of safety) and secondary standards (established to protect the public welfare from the adverse effects associated with pollutants in ambient air).

Geographical areas that meet the NAAQS standard for a criteria pollutant are designated as being in attainment whereas areas where a criteria pollutant level exceeds the NAAQS are designated as being in non-attainment. If an area was formerly designated as non-attainment, but currently attains the standard for each pollutant, and has an EPA approved plan to maintain the standard, that area is considered a maintenance area.

O_3 non-attainment areas are categorized, based on their severity (i.e., duration of O_3 at elevated concentrations), as marginal, moderate, serious, severe-I, severe-II, or extreme. Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) contribute to the formation of O_3, CO and PM_{10}. Where insufficient data exist to determine the attainment status of a particular area, the area is assumed to be in attainment or may be designated as unclassifiable.

The NWS Earle pier complex is located in Monmouth County, New Jersey, an area with the following air quality status (EPA, 2003):

- O_3: non-attainment, classification: severe.
- PM_{10}: attainment
- SO_2: attainment
- CO: attainment
- NO_2: attainment
- Pb: attainment

The closest air quality monitoring station to the proposed action is at Monmouth University, approximately 16 km (10 mi) from NWS Earle. O_3 exceedances in Monmouth County from 1989 to 2002 are depicted in Table 4-7. The ozone exceedances presented are based on the one-hour ozone standard of 0.12 parts per million (ppm). For concentrations to be considered exceedances, they must be 0.125 ppm or above (NJDEP, 2002c). The data in Table 4-7 show that both the number of one-hour exceedances and the peak levels (the maximum one-hour concentrations) have been declining over time.

Baseline emissions for ambient air quality pollutants at NWS Earle are based on 1994 emissions as required for Title V of the Clean Air Act Amendment (CAAA). These annual pollutant emissions are as follows:

- CO 5.23 metric tons/year (5.77 tons/year)
- NO_x 13.00 metric tons/year (14.34 tons/year)
- VOCs 8.94 metric tons/year (9.86 tons/year)

The estimates of air emissions for the 1999 calendar year are as follows:

- CO 6.44 metric tons/year (7.10 tons/year)
- NO_x 10.12 metric tons/year (11.16 tons/year)
- VOCs 10.08 metric tons/year (11.12 tons/year)

Clean Air Act Conformity

The CAAA of 1990 expanded the scope and content of the Act's conformity provisions in terms of their relationship to a state implementation plan (SIP). Under section 176(c) of the CAAA, a proposed action or construction project or facility is in accordance with the purpose of the SIP to eliminate or reduce the severity and number of violations of the NAAQS and achieve expeditious attainment of such standards. Conformity further requires that such activities would not:

- Cause or contribute to any new violations of any standards in any area;
- Increase the frequency or severity of any existing violation of any standards in any area; or,
- Delay the timely attainment of any standard or any required interim emission reductions or other milestones in any area.

The EPA published final rules on general conformity (40 CFR Parts 51 and 93 in the Federal Register on November 30, 1993) that apply to federal actions in areas designated as being in non-attainment for any of the criteria pollutants under the CAAA. The proposed rules specify *de minimis* emission levels by pollutant to determine the applicability of conformity requirements for a project. Since NWS Earle lies in an area designated as a severe non-attainment area for O_3, air emissions produced by the proposed action must comply with the *de minimis* concentration criteria of 23 metric tons/year (25 tons/year) of VOCs and 23 metric tons/year (25 tons/year) of NO_x.

Table 4-7
New Jersey Air Quality Monitoring Results for O_3 1989-2002 Exceedances of 0.12 ppm (one hour average) EPA Air Quality Standard

Location	Year	No. of One-hr Exceedances Observed	Exceedance Value Range (ppm)
Monmouth County (Monmouth University)	1989	10	0.126 - 0.139
	1990	6	0.126 - 0.197
	1991	6	0.132 - 0.166
	1992	2	0.137 - 0.147
	1993	5	0.126 - 0.162
	1994	0	
	1995	5	0.129 - 0.163
	1996	1	0.126
	1997	2	0.132 - 0.147
	1998	2	0.129 - 0.132
	1999	0	
	2000	2	0.129 - 0.130
	2001	1	0.127
	2002	2	0.126 - 0.142

Source: (NJDEP. 2002c)

Air Emission Sources at NWS Earle

Mobile sources of air pollution that occur at NWS Earle include, but are not limited to, ships utilizing the piers, ordnance vans (trucks) and locomotives for ordnance operations and other NWS Earle support vehicles. Stationary sources at NWS Earle include, but are not limited to the following: boilers, emergency generators, ship refueling operations, and ship maintenance activities such as painting, engine testing, and parts cleaning, etc. These sources emit the following NAAQS criteria pollutants: CO, SO_2, and PM_{10} and the O_3 precursors VOCs and NO_x. The ships are the single most significant mobile sources of air emissions at the pier complex.

Since ordnance operations and ship deployments would not significantly change under the proposed action, changes in the amount of mobile source-related emissions would similarly not change. Based on the type of pollutants emitted (criteria pollutants or hazardous air pollutants [HAPs]), the CAAA sets forth permit rules and emission standards for sources of certain sizes. New Source Performance Standards (NSPS) are applicable to sources emitting criteria pollutants, while the National Emission Standards for Hazardous Air Pollutants (NESHAPs) apply to sources that emit or have the potential to emit certain hazardous compounds. The EPA oversees programs for issuing permits for the operation of stationary sources (Title V) and for new or modified major stationary source construction (New Source Review).

Noise

Noise levels in the project area would be typical of background levels for low-density commercial land usage. Noise levels are typically higher during peak traffic hours and lower during off-peak hours. On occasion, aircraft, ferries, or recreational motor craft contribute noise to the ambient environment in the vicinity of the pier complex, however these occurrences are infrequent and mitigated by distance as these sources must stay outside of the piers' navigation prohibited zone.

Based on information provided in the *Noise Control Reference Handbook* (IAC, 1989), a comparison of typical ambient noise levels, in decibels (dB), at certain locations and/or under specified land use conditions is provided in Table 4-8.

The project area is typical of suburban residential or low-density commercial land usage, which shows a typical ambient noise level of approximately 60 dBA (decibels – A-weighted scale [dBA]). On-base noise is caused by mobile (i.e. vehicular) and stationary sources. Some noise is produced as a result of activities essential to the health, safety, and welfare of the Station population such as that produced by emergency vehicle sirens, and routine construction and maintenance equipment operations. Traffic noise in Monmouth County is produced from the movement of people and goods (activities that sustain the economic vitality of the region) and from base operations at NWS Earle. Mobile and stationary sources of noise resulting from on-base operations are identified below.

Table 4-8 Typical Noise Levels (dB) Associated with Specific Land Use Conditions	
Land Use Condition	**Typical Expected dB**
Wilderness ambient	35
Rural residential	40
Agricultural crop land	44
Rural residential	51
Suburban residential or low density commercial	60
Urban row housing on major avenue	68
Urban high density apartment	78
Downtown area with some construction activity	79
Touchdown at major airport at ¾-mile distance	86
Apartment next to freeway	88

Source: (IAC, 1989)

NWS Earle Mobile Noise Sources

Mobile sources of noise at NWS Earle include: the ships utilizing the piers; general support equipment such as vans, trucks and locomotives used for ordnance operations and handling; pier complex maintenance support equipment associated with base operations; and emergency response vehicles such as fire engines, police and ambulance vehicles. In the summertime, ambient noise levels near the piers may be increased as the traffic of recreational motorboats increases on the water.

NWS Earle Stationary Noise Sources

Stationary, on-base noise sources include heating, ventilation and air conditioning (HVAC) systems of larger buildings, broadcast and emergency siren systems, emergency power generators, and the various mechanical units and facilities for NWS Earle maintenance and support operations. The human response to noise varies, depending on the type, intensity and source, the receptor, the distance between the source and receptor, and the receptor setting. Time of day is also important and whether or not the human receptor is indoors or outdoors.

4.2 Built Environment

4.2.1 Land Use

Predominant land use at the NWS Earle Waterfront Area is related to support services for the pier and waterfront facilities. Emergency services, public works, officers & enlisted club, recreational facilities, pass and decal office, and base store are located at the Waterfront Area. The pier complex contains support buildings for pier operations.

Other land area at the Waterfront Area is developed with railroad sidings, vehicular parking and storage, etc. The remaining, undeveloped areas are protected natural resources such as beach, dune, and wetland habitat.

Land use adjacent to the Waterfront Area is characterized by a progressive urban sprawl originating from the rapidly growing metropolitan areas to the west and northwest of Monmouth County. Land uses to the south and east of the Station include a mixture of limited agricultural, residential, commercial, and industrial uses, with most parcels being zoned for these uses. Land uses to the west include a mixture of residential, commercial, and industrial uses. Future land use patterns are expected to continue as the urban sprawl proceeds to the south and east of the waterfront area of the Station.

Restricted Area– Pier Complex: The Station maintains a restricted area surrounding the pier complex in Sandy Hook Bay. Originally established by US Coast Guard (USCG) as a security zone, then later expanded by the ACOE, the restricted area is, in essence, a large rectangular area that encompasses the piers and trestles from the shoreline to a point approximately 686 m (750 yd) from the seaward end of the piers. Buoys are located to identify this restricted area and this zone is marked on nautical charts. The area of the restricted zone is approximately 623 ha (1,540 ac). NWS Earle security personnel enforce the following restrictions:

- No unauthorized vessels shall enter the restricted area at any time;
- Vessels are authorized to cross the Terminal Channel (channel to NWS Earle pier complex) provided that there are no Naval vessels transiting the Channel;
- No person may swim in the restricted area.

4.2.2 Socioeconomics

Population

While some counties in New Jersey have experienced a recent downward trend in population, the population of Monmouth County has grown since 1990. Large tracts of undeveloped or agricultural land, zoned as low density residential, lie south of NWS Earle waterfront. Therefore, the population increase can be expected to continue.

The town of Colts Neck has a population of approximately 6,500. The Waterfront Area of NWS Earle, abutting Sandy Hook Bay, is located in the Leonardo section of the town of Middletown, which has a population of approximately 68,000 people. Approximately 1,600 people either work or live at NWS Earle. Population in Monmouth County from the 1990 census was 553,124 (USBOC 1990) and in 2000 reached 615,301 (USBOC, 2000). An increase of 62,177 occurred between the 1990 and 2000 census.

The personnel loading at NWS Earle fluctuates on a periodic basis, due to use of the base by reservists on weekends, and the level of base military activity. The on-base population, as of September 2003 included 16 officers, 220 enlisted personnel, 632 civilian employees and 155 contractors attached to 26 commands or tenant activities. These figures do not include fleet personnel assigned to homeported ships.

Income

Local income data, obtained from 2000 Census data provided by the Monmouth County Planning Board, is provided in Table 4-9 for Atlantic Highlands and Middletown, the two municipalities that are located proximal to NWS Earle waterfront. Income is defined as the money income received (as reported by the 2000 Census) by persons 15 years of age and older. It includes wage or salary income (before taxes and pension deduction); non-farm self-employment income (calculated as the gross receipts minus operating expenses); farm self-employment income; interest, dividend, or net rental income; social security income; public assistance income; retirement or disability income; and all other sources of income.

Table 4-9
Local Income Data for Atlantic Highlands and Middletown – 2000

Statistic	Political Subdivision	
	Atlantic Highlands	Middletown
Total Population	4,705	66,327
Median Household Income[1]	$64,955	$75,566
Medium Family Income[1]	$79,044	$86,124
Per Capita Income[1]	$34,798	$34, 196

Source: Monmouth County Planning Board: http://www.monmouthplanning.com/Census2000Index.htm

The median household income, and family income, in Middletown was higher than that of Atlantic Highlands, whereas Atlantic Highlands per capita income was slightly higher than Middletown, based on 2000 census data (USBOC 2000).

Employment

As of September 2003, NWS Earle employed 787 civilians, which comprised approximately 77% of all base personnel. In addition, local and regional businesses, employing numerous civilians, provide goods and services to support on-base operations. Approximately 64% of the working population (16 years and older) in the town of Middletown is employed with an unemployment rate of 2.2%. The borough of Atlantic Highlands also employs approximately 64% of its working population, and has an unemployment rate of 4%.

Housing

Housing at NWS Earle consists of 554 housing units. The total number of military personnel housed at NWS Earle is 263. In addition, NWS Earle houses 674 military dependents (McCaffy, 2003).

The 2000 census provides housing data for Middletown, Atlantic Highlands, and Monmouth County. The town of Middletown has a total of 23,841 housing units, 605 of which are vacant (2.5% vacancy), with an average number of persons per household of 2.84. The borough of Atlantic Highlands has a total of 2,056 housing units, 87 of which are vacant (4.2%). The average household size is 2.39. Monmouth County contains 240,884 housing units, 16,648 of which are vacant. The average number of persons per household is 2.7.

4.2.3 Traffic

Access to the waterfront area of NWS Earle is via controlled gates at two locations. One gate is located on NJ Route 36, a four-lane highway that is adjacent to the south side of the Waterfront Area. This gate provides primary direct access to the Waterfront Area and the pier complex. State Route 36 interchanges with the Garden State Parkway at Exit 117. The other gate is located at the northern terminus of Normandy Road. Normandy Road is a US Government-owned highway that connects the waterfront area with the Mainside area of the base in Colts Neck. Local streets intersect with Normandy Road at seven signalized intersections and one un-signalized intersection. Access/use of Normandy Road is limited to military and civilian personnel on official NWS business. The road provides direct access to the Waterfront Area of the Station.

Several state and local highways serve the communities surrounding the NWS Earle Waterfront Area. Academy Bus provides seven–day/week service along Route 36 past the waterfront complex with stops in Middletown, Leonardo, and Atlantic Highlands. Rail (non-passenger) service is also provided to the Waterfront Area via the Navy's railroad line that runs along Normandy Road.

Five major airports service the local demographic region: Philadelphia International Airport, Philadelphia, PA; Mercer County Airport, Trenton, NJ; Newark International Airport, Newark NJ; LaGuardia Airport, Queens, NY; and John F. Kennedy International Airport, Queens, NY. Military air facilities in the region include McGuire Air Force Base, Wrightstown, NJ; Naval Air Station Joint Reserve Base, Willow Grove, PA; and the Naval Air Engineering Center, Lakehurst, NJ. Air space above NWS Earle is also used by municipal aircraft arriving and departing regional airports.

4.2.4 Cultural Resources

NWS Earle, originally commissioned in 1943 as the Naval Ammunition Depot (NAD) Earle, began as a transshipment depot for the movement of ammunition from East Coast production facilities to the military forces then engaged in the European theater of World War II (LBA, 1999). The Station is one of three Naval weapons stations on the East Coast; the others are NWS Yorktown, VA and NWS Charleston, SC.

NWS Earle's history began in 1940 when both the Army and Navy Departments perceived a need for an ammunition transshipment depot in the New York area. Both Departments formed committees to investigate location opportunities focusing their searches on the New Jersey shoreline south of New York. The requirements for a transshipment depot were a large storage area located away from densely populated areas but near New York City, access to major railroad lines, and access to deepwater berths and ocean access (LBA, 1999). Sandy Hook Bay met the deepwater criterion but its likely high cost to develop a coastal depot gave the Army Department reason to abandon this location. Further investigation by the Navy's Bureau of Ordnance revealed the presence of a large woody, swampy tract of land about 19.2 km (12 mi) southwest of the Bay – the site that would ultimately become NAD Earle.

Named for Rear Admiral Ralph Earle, Chief of the Bureau of Ordnance during World War I, construction of NAD Earle began in the summer of 1943. Construction of the waterfront facilities began in February 1944 with the contract for a 3.2 km (2-mi) long trestle and a two-berth pier (Pier 2) for Navy vessels. The shorter and closer to shore Pier 1 was constructed as a Navy barge pier. Through an agreement between the Department of War and the Department of the Navy, the establishment of NAD Earle became a joint venture with the Army Department contributing more than $19.5 million for the expansion of the Depot in 1944. A third pier (Pier 3) was built for Army ordnance transshipments and the Army Department paid for the 52 barricaded railroad sidings on a 688 ha (1,700-acre) tract of land adjacent to the main station (LBA, 1999).

Architectural Resources

NWS Earle, one of nine ammunition depots constructed by the Navy during the period from 1941 to 1944, was the only one on the East Coast from which rapid transshipment of ordnance from manufacturer and/or storage to the ongoing war effort in Europe – the overriding wartime mission. Most specifically and importantly, it was through NWS Earle that the greater part of the ordnance used by both Army and Navy forces in the European theater following the Normandy invasion in June 1944 was shipped. It is this part of NWS Earle's history that gives the Station its identity and historical significance (LBA, 1999).

With regard to this historical significance, Station resources that are most directly associated with its contribution to the US war effort are those closely linked to the Station's principal wartime mission as a transshipment facility. Among the Station's resources directly associated with that mission and possessing the requisite integrity to meet the National Register Criterion A, Association with Significant Events, is a historic district encompassing Piers 1, 2 and 3, the connecting trestles and associated buildings on the piers. According to the 1999 architecture survey the "piers constituted the point of embarkation for most of the Navy and Army ordnance destined for Europe from just after the Normandy landing to through V-E Day" (LBA, 1999). Included in the district are the buildings located on the piers including buildings 4A, 5A, 6A, 3N, 4N, S-62, and S-63. Non-contributing resources, by reason of age, are Pier 4 and its buildings that were constructed after World War II. The NJ SHPO has agreed with this finding of eligibility for the pier complex.

Piers 2 & 3 Description

Pier 2, constructed in 1944, consists of a reinforced concrete deck and two loading platforms supported by timber piles. It is 211 m (693 ft) long by 41.5 m (136 ft) wide and carries six railroad sidings – three on each side of a double vehicular traffic lane in the middle of the pier. The raised loading platforms on each side of the pier are 5.5 m (18 ft) wide. Two buildings, 3N and 4N, are located on the southwestern and southeastern corners of the pier, respectively. Both have changed little since their construction in 1944. At the northern end of the pier is a newer building, R-20, which was expanded in 1976. Pier 2 provides two berths with complete utility support to homeported vessels.

Pier 3 was constructed in 1944 with four ship berths for use as an ordnance transshipment pier for the Army. With ship berthing reduced to two berths due to the length of the current ordnance vessel, Pier 3 remains as the principal ordnance-loading pier at the Station. It is 392.5 m (1,287 ft) long and 41.5 m (136 ft) wide. It also has a reinforced concrete deck supported by timber piles and has same railroad sidings and vehicular traffic lanes as Pier 2. Buildings 3A, 4A, 5A and 6A, at each of the corners of the pier, were constructed in 1944. Building 3A has been removed and Building 4A was replaced in 2000. Building 531 was added in 1963 at north end of the pier. Pier 3 provides limited utilities services to its two berths.

Trestles 2 & 3 Description

Trestles 2 and 3 were constructed like the piers with a reinforced concrete deck supported by creosoted-timber piles. Each trestle carries two railroad lines – one on each side - and a dual vehicular traffic lane in the middle of the trestle. Trestle 2 measures approximately 410 m (1,344 ft) long and its width ranges from 14 m to 18.6 m (46 ft to 61 ft).

Trestle 3 is approximately 326 m (1,070 ft) long and also ranges in width from 14 m to 18.6 m (46 ft to 61 ft). In the early 1980s, utility lines – potable water and wastewater – were added on the side of the trestles to provide utility service from shore to ships at the piers.

Submerged Historic Resources

One known National Register-listed submerged resource, located within the pier complex is the *Alexander Hamilton* that sunk while moored at Pier 1 in 1985. This vessel, a privately-owned, side-paddle, excursion sight-seeing tour boat, was temporarily moored at Pier 1 to allow a USCG inspection of the vessel prior to it being transported to a permanent mooring in the Hudson River. The vessel was damaged during a storm and before it could be moved, it sunk and subsequently deteriorated. Remnants of the ship are still located in the waters adjacent to Pier 1 that is well removed from the project area.

Archeological Resources

The pier complex includes the piers and trestles, the dredged berthing areas, the ship turning basin and the Terminal Channel that connects the pier complex to Sandy Hook Channel. The 1990 Cultural Resources Survey prepared for the Station determined that the pier complex area, including the dredged areas do not possess archeological resources.

4.2.5 Aesthetics

The municipalities surrounding the NWS Earle pier complex are a mix of residential, commercial and industrial land users. Large tracts of wetlands, forests or open space are located northeast of the Waterfront Area at Sandy Hook which is part of the Gateway National Recreational Area. The aesthetic quality of the area is considered high, though it is important to note that aesthetic quality is subjective; what is visually pleasing to one person may not be pleasing to another. For example, someone who has an interest in shipping (as a hobby or profession) may find the pier complex at NWS Earle to be aesthetically pleasing, while others who do not have a passion for ships and associated maritime operations may not. The existing pier complex is visible from the various shore-side municipalities along New Jersey's north coast.

4.2.6 Utilities

Electricity

Electricity is supplied to the majority of the waterfront area and pier complex via a single overhead pole line of 34.5 kilovolts (kV) (HPA, 2003b). This pole line is connected to a Jersey Central Power and Light loop at Route 36 and continues approximately one mile north to the main substation. At the main substation, the line ends at two overhead towers with overhead buswork leading to the various components. The substation serves the entire waterfront complex. It distributes power to marine facilities at 13.2 kV via underground feeders. There are four groups of transformers and switchgear at the substation that have a total of four 13.2 kV feeders, one 4,160-volt feeder and one connector feeder. The Station has the capability to distribute power at 4.16 kV for onshore and certain offshore facilities but is not currently connected to do so. The second service to the Waterfront Area and pier complex is 5 kV and serves onshore facilities, including all buildings and certain offshore facilities such as the heat tracing of pipes on the trestles. Electricity at Pier 2 is supplied by a 5 kV submarine cable from Pier 1 and two 15 kV submarine cables. These terminate at two substations at the pier head. These substations are the source of power for the ship's shoreline receptacles. Pier 3 is supplied by one 5 kV submarine cable that runs directly to a substation and serves only the buildings and pier lighting.

Heating System

Heating requirements for Piers 2 and 4 are supplied by their own boiler houses and steam distribution piping systems. Pier 3 does not have steam generation or a steam distribution system.

The boiler house on Pier 2 houses three boilers: two operate at a capacity of 14.58 million British thermal units per hour (MMBTU/HR) (350 boiler horsepower [bhp]); the third operates at 19.18 MMBTU/HR (500 bhp). These boilers have the capacity to supply steam to two berths (HPA, 2003b) for AOE-4 class vessels. Boiler house equipment also includes two de-aerators.

Pier 4 has two 14.58 MMBTU/HR (500 bhp) boilers and a 1.316 MMBTU/HR industrial "donkey" boiler that provides heat circulation for Pier 4's independent fire suppression system during the winter. The industrial boiler can also be used as a secondary heat source for the building when the 14.58 MMBTU/HR (500 bhp) boilers are out of operation.

The boiler units deliver steam to a 25.4-cm (10-in) header that transmits to two 15-centimeter (cm) 6-inch (in) pipes that delivers steam to the pier berths. The steam is discharged overboard after its heat has been extracted. There is no separate condensate receiver vessel.

The boilers are supplied with fuel oil from 37,854 l (10,000 gallon [gal]) tank cars. The tank cars and the fuel oil supply/return manifold are interconnected to allow for fueling from either without remaking connections.

Water Supply

The potable water requirements of the pier complex are provided by a 15-cm (6-in) diameter water pipeline that runs along the east side of the Trestle 3 (HPA, 2003b). At Trestle 2, the pipeline runs on the west side from trestle junction to Pier 2. The potable water pipeline traverses beneath the decks of Trestles 2 and 3 and is insulated in a weatherproof jacket with heat tracing system that covers the piping and valves. At Piers 2 and 3, the main utility pipelines enter and vertically penetrate the deck. The pipelines then split into two main branches to the west and east side underneath the loading platforms to connect to several utility pits which contain the valve and fitting connections. The main branches for potable water are 10.1-cm (4-in) diameter and the backflow preventers are 6.4-cm (2.5-in). Located on the surface of loading platforms are potable water outlets, which are 6.4-cm (2.5-in) diameter.

The trestle junction fire pumphouse consists of a diesel-driven vertical fire pump to provide seawater to Trestles 2, 3 and 4 and Pier 3. The pipelines are drained before the winter season so no insulation is necessary. The 25.4-cm (10-in) diameter fire protection water piping is located parallel to the other utility pipelines along the east side of Trestle 2 and to the west of Trestle 3 in a lower level. Trestle 3 connects to the fire main and to fire hydrants on its deck while Trestle 2 only connects to fire hydrants. The main fire protection water pipeline for Pier 3 comes from the fire pump house located at the trestle junction. The fire protection water pipeline enters Pier 3 from below and splits into two 24.5-cm (10-in) diameter main branches and runs along the west and east side underneath loading platforms parallel to the other utility lines. On the loading platform surface there are 6.4-cm (2.5-in) diameter fire water supply outlets. There are fire hydrants and manifolds located at the end of the each pier deck. Pier 2 also has two main branches of 25.4-cm (10-in) diameter fire protection piping which run parallel to the other utility lines to the east and west of the pier and form a closed loop. On the loading platform surface there are 6.4-cm (2.5-in) diameter fire water outlets and fittings. Inside the utility room at Pier 2 there is an electric-driven fire pump, diesel driven pump and jockey pump.

Pier 4 has its own salt water pumping station for fire protection is independent from the pumping state at the trestle junction.

Sanitary Sewer

Sanitary requirements of the pier complex are supplied by a 20-cm (8-in) diameter sanitary sewer line that runs parallel to the potable water line on the east side of Trestle 3 and under the deck to the west side below the pier deck (HPA, 2003b). A weatherproof jacket, insulation and a heating system insulate the pipe. At Trestle 2, the 20-cm (8-in) diameter pipeline runs on the west side, parallel and outward to the potable water pipeline from Trestle Junction toward Pier 2. A weatherproof jacket, insulation, and heat tracing system cover the piping and valves. Along with the other main utility pipelines, the sanitary sewer pipes at Piers 2 and 3 enter below the pier decks and vertically penetrate the decks. Each pipe splits into two main branches on the west and east side which run underneath the loading platforms. At the piers, two 10.2-cm (4-in) diameter main branch collectors run from the pump stations to each loading platform.

Storm Water

Storm water at the piers is managed via a system of seams, manholes, and other drain holes in the pier decking, necessary to keep standing water from accumulating.

4.2.7 Community Services

Schools

Children in the communities that encompass NWS Earle attend schools in three separate school districts – the Colts Neck, Eatontown, and Tinton Falls school districts. Tinton Falls currently has an agreement with the Navy to accept Navy children from NWS Earle. The Tinton Falls school district consists of the Mahala F. Atchison Elementary School, the Swimming River Elementary School, and the Tinton Falls Middle School. The school district currently employs 120 full-time teachers and the current enrollment is 1,800 students, 204 (11%) of which are Navy children. In addition, 49 Navy children attend high school at Monmouth Regional High School. The number of Navy students enrolled in the district has decreased due to the recent re-assignment of Navy personnel from NWS Earle.

The cost per year to educate a student in the Tinton Falls school district is $8,600 per year (2002). The US Department of Education provides "impact aid" to the school district in the amount of $1,300 per Navy child per year. The enrollment for the 2003 school year was approximately 1,800 students (Sidney-Gens, 2003).

The Station has a child care center for infants through five years and a youth center which provides before-school and after-school care for children in kindergarten through age 12. Both centers are open Monday – Friday and are located at the Mainside Area of the Station.

Emergency Services

NWS Earle has on-base emergency services. These services include police, fire and ambulance emergency response. Specially trained units respond to oil and hazardous materials spills or releases. The base police and contractor security guards provide security at the Mainside and Waterfront Gates and regularly patrol the Station boundaries. A fire/emergency response station is located at the Waterfront Area.

Health Care and Other Facilities

NWS Earle provides medical and dental clinics at the Waterfront Area. At Mainside, a family services center, community center, development center, religious services, a career counselor, medical clinic, personnel office, credit union, and Navy/Marine Corps relief society are located. There are also two full service hospitals, Bayshore Community Hospital in Holmdel and Riverview Medical Center in Redbank, located within 16 km (10 mi) of the Waterfront Area.

Recreation

Recreation services on-base include gym/fitness center, an auto hobby shop, an enlisted men's club, and retail exchange store. The Waterfront Area personnel support assets mirror the Mainside assets in many ways. A gym and fitness center, a pier recreation facility, an enlisted men's club, and mini-exchange store enhance quality of life for the sailors. The closest off-base recreational facilities to the Waterfront Area are Hartshorne Woods Park and the Sandy Hook National Recreational Area located east of the Waterfront Area.

4.2.8 Hazardous and Other Regulated Substances/Materials

Information regarding the potential presence of hazardous and other regulated substances on-base and specific Areas of Environmental Concern (AOECs) was obtained via DataMap Technology Corporation's computerized database search FirstSearch™, studies performed as part of the ongoing design effort for the new pier, discussions with knowledgeable base personnel, and Navy documents. The database provided information regarding the presence of known hazardous and other regulated substances/materials sources and releases on-base and on properties adjacent to or near the base.

CERCLA Navy IR Sites

In August 1990, NWS Earle was placed on the National Priorities List (NPL) after several areas of contamination were discovered. These sites, collectively referred to as Installation Restoration (IR) Program sites, vary in size and status of remedial efforts conducted to date. Remediation activities are ongoing and are expected to continue through fiscal year 2008. Twenty-three sites have been completed; five sites are currently in long-term monitoring and natural attenuation status; fourteen sites are under investigation or undergoing active field remediation; and one site remains active for mission requirements. Presently, there are no remediation activities being conducted at the NWS Earle pier complex.

Hazardous Chemical Survey – Pier Complex

A hazardous chemical survey was conducted for the pier complex as part of the design effort for the new pier (HPA, 2003c). As a result of this survey, no hazardous chemicals were identified on Pier 3 or in the buildings on the pier. Also, there was no evidence of major spills on the decking. On Pier 2, the survey did indicate the presence of hazardous chemicals in the boiler house building, Bldg R-20. All chemicals were found properly containerized. Four mercury switches were identified in Bldg R-20 and more than 800 linear feet of fluorescent lighting was found on both piers. The fluorescent lighting was identified as post-1980 and therefore the ballasts should not contain PCBs.

Storage Tanks

One above ground storage tank located adjacent to Building 4N on Pier 2, used for the storage of fuel oil (945 liters [l] (250 gallons [gal]), was determined to be in poor condition during a recent hazardous chemical survey conducted at the pier (HPA, 2003c). One 1040 l (275 gal) steel aboveground storage tank (AST) is actively in use at Pier 3 to supply heating oil to the personnel building.

Railroad tank cars are used to transport oily wastewater (bilge water) from ships to an on-shore treatment facility. All tank cars will be removed from the pier area prior to the start of the pier replacement project.

Asbestos-containing Materials

An asbestos survey was conducted for Pier 2 and Pier 3 in 2002 (HPA, 2003d). Asbestos containing material (ACM) was found on both piers, in buildings on the piers, and on utility line insulation. Analytical testing confirmed the presence of asbestos, and removal and proper disposal of the ACM waste will be required. An abatement and disposal plan would be developed prior to disturbance of the material.

Lead-based Paint

All areas on Piers 2 and 3 (as well as Pier 4) were surveyed for the presence of lead-based paint (LBP) in 2002 (HPA, 2003e). The Navy's definition (standard) of LBP is paint containing 0.01 % lead while the US Department of Housing and Urban Development (HUD) standard is 0.5 %. A total of 47 paint samples from a variety of painted surfaces on all piers were tested using both standards. Of the samples tested, 30 samples had LBP in concentrations ranging from 0.01 % to 16 %. Eight samples had concentrations exceeding the HUD standard of 0.5 %.

Bird Waste

A "pigeon and seagull waste survey" (HPA, 2003f) was conducted for the pier complex (Piers 2, 3 & 4) in 2002 to determine the presence of *Histoplasma capsulatum* – a fungus associated with bird feces that causes infectious disease of the lungs. Disturbance of bird droppings can release spores of *H. capsulatum* into the air, creating a health risk particularly to demolition and construction workers. Pier 4 was relatively free of bird wastes though significant quantities were found on Piers 2 and 3. Droppings covered approximately 427 m^2 (4,600 sf) on Pier 2 (about 32 m^3 (42 yd^3) of waste) and 242 m^2 (2,600 sf) on Pier 3 (about 18 m^3 [24 yd^3] of waste). A significant amount of bird droppings were also found on the catwalk that extends the length of Pier 2.

Section 5.0

5.0 ENVIRONMENTAL EFFECTS

The planned schedule of existing Pier 3 demolition, dredging, and replacement Pier 3 construction will have a bearing on the temporal and spatial aspects of impact. Based on an operational scenario likely to occur for this demolition and construction project, it is envisioned that dredging of the berthing areas and the Pier 3 removal will occur during the open dredging seasons within a three-year period. The dredging window, as specified by the National Marine Fisheries Service (NMFS) and NJDEP, is usually from May or June to November and is designed to avoid the sensitive life stages of important fish and shellfish species. Therefore, excavation of the berthing areas, which includes removal of unsuitable dredged material for upland disposal, and placement of suitable dredged materials at the HARS, would likely be limited to a period of less than six months for each year during the life of the project. However no time-of –year restriction is anticipated to be imposed on pier demolition, construction, or dredging activity conducted underneath the existing Pier 3 (refer to Appendix B – Essential Fish Habitat).

The three-year period of time during which the proposed action would occur would be the maximum amount of time when *temporary* impacts could occur. Once the new Pier 3A is constructed and final in-water construction and dredging operations have ceased, any potential remaining impacts would be considered *long term*. The expected impacts of the project were evaluated based upon the following: site-specific information gathered during the NEPA process; previous studies of the Bay region; studies done at nearby New England sites (e.g. Boston, Salem, Gloucester, New Bedford, and Buzzards Bay, MA; Providence River, RI; Thames River, and Long Island Sound, CT) and Mid-Atlantic sites (New York Harbor, etc.). Information was also obtained from existing scientific literature reporting on laboratory studies of the effects of dredging and related activities.

5.1 Natural Environment

The following site-specific efforts were undertaken in support of the NEPA process to address potential impacts to the natural environment:

- Sampling of the sediment and water media at the pier complex to determine bulk sediment, site water, and elutriate quality.
- Biological testing to determine the potential for the sediments acute toxicity and bioaccumulation potential; and
- Dredging event modeling and hydrodynamic analysis to determine the extent of temporary impact of dredging on the water column.

5.1.1 Meteorology and Climate

Alternative A (Proposed Action) and Alternative B (New Pier in New Location)

Neither Alternative A nor Alternative B would impact the meteorology and/or climate of the pier complex and/or adjacent environs.

No Action Alternative

The No Action Alternative would not impact the meteorology and/or climate of the pier complex and/or adjacent environs.

5.1.2 Marine Ecology

Vegetation

Alternative A (Proposed Action) and Alternative B (New Pier in New Location)

Since there are no known stands of vascular vegetation in the project area and adjacent waters in the vicinity of the pier complex, neither Alternative A nor Alternative B would impact vegetation in the project area, or in the nearby ecosystems associated with the coastal, inter-tidal, and sub-tidal habitats of the Bay. The pier pilings beneath Piers 2 & 3 may be vegetated with marine algae around the exterior piles. The interior piles are shaded by the pier decking and would not be expected to support extensive algal growth. Removal of the pier piling associated with demolition of the piers represents a limited loss of algal vegetation colonizing the upper reaches of the sub-tidal zone on the perimeter pilings.

No Action Alternative

There are no known stands of vascular vegetation in the project area and adjacent waters in the vicinity of the pier complex.

Benthos

Alternative A (Proposed Action)

Information used to predict the environmental consequences to benthic organisms, is based on classic studies of how disturbances impact benthic invertebrate biota in the northeastern United States (Kaplan et al., 1975; McCall, 1977; Pearson and Rosenberg, 1978; Rhoads and Germano, 1982; Rhoads and Germano, 1986). Direct impact to the benthic habitats and their organisms would occur as a result of the excavation of the pier berths to the anticipated project depth, excavation of the existing sediment below the pier, and disposal of suitable dredged material at the HARS for use as capping material. All these events are expected to result in temporary and reversible impacts to the benthos at their respective locations. Excavation of sediment at the pier berths and beneath the pier would result in mortality for many of the smaller benthic infaunal organisms residing on the bottom. Many of the larger, more mobile benthic megainvertebrates, such as crabs, would be able to flee the disturbed area. Following dredging activities, colonization of the substrate within the pier berths and beneath the piers is expected via larval recruitment and emigration of benthic organisms from the surrounding area (Santos and Simon, 1980). However, the rate of re-colonization and the type and abundance of benthic invertebrates re-colonizing the bottom would depend on both abiotic and biotic factors as discussed by Gallagher and Keay (1998). Abiotic factors include physical substrate conditions, water temperature, dissolved oxygen content, and salinity. Biotic factors include succession, recruitment, competition, and biogeography.

At the HARS, as suitable dredged material is placed in the designated remediation areas, direct impact to the benthos would likely occur. Most, if not all sessile marine invertebrates are not expected to survive burial. Some motile marine organisms would be buried and unable to survive, while others such as burrowing specialists, may survive. Vertical migration of motile benthic invertebrates (particularly crustaceans, polychaetes and molluscs) following burial has been demonstrated by Maurer et al. (1982a,b) and Nichols et al. (1978). These studies showed that burrowing organisms could survive repeated burial events by vertically migrating to the sediment surface. Survival rates depended primarily on burial depth. For example, in the Nichols et al. (1978) study, organisms were able to burrow upwards through 28 cm (11 in). However, it is reasonable to assume that repeated burial would weaken most benthic, motile organisms, resulting in direct or indirect mortality (e.g., greater susceptibility to predation) since most disposal events would result in greater than 28 cm (11 in) deposition of suitable dredged material. In fact, the target thickness of capping materials at the HARS is one m (3.3 ft).

Both the excavation and disposal events are likely to result in direct localized adverse impacts to pioneering benthic invertebrates during the dredge and disposal operation. This is due to constant perturbation of the substrate by continuous grabs of the sediment by the dredge bucket at the dredging sites and perturbation caused by repeated disposal discharges at the HARS. However, as discussed below, these impacts would be temporary. The clean material cap covering the remediation cells at the HARS would provide new substrate for re-colonization by benthic invertebrate organisms and would prevent exposure of the benthos to the existing contaminated sediments that have yet to be capped at the HARS, resulting in a long-term benefit. There would be a change in substrate texture and conditions as a result of the placement of the clean material atop the existing unsuitable dredge material (UDM) at the HARS. The capping material would consist of primarily sand; however, some silt fractions may be present. Typically, the surface of the cap would lie at an elevation at or above the surrounding area depending on the location of disposal and the extent of remedial activities at the HARS. Beneath the pier and in the berthing areas, the texture would change from unconsolidated silt (existing conditions) to the natural parent material at elevations ranging from to –12.2 m (–40 ft) to –13.7 m (–45 ft) MLW consisting of native sands of Holocene origin. Over time, natural sedimentation would occur within the recess of the berthing areas, thereby replicating the sediment texture surrounding the pier complex to the east, west, and south.

The re-colonization of the disturbed areas would likely progress in successive stages, with dominant species varying over time. Although exact community assemblages are hard to predict to species level, the life history attributes and functional organism-sediment relationships are typically predictable. A typical re-colonization scenario is discussed below based largely on re-colonization studies described by Pearson and Rosenberg (1978), Rhoads et al. (1978), and Rhoads and Germano (1982).

The specific nature of the benthic recovery process would largely depend on the timing of the disposal operation, local habitat characteristics, and which species exist in the surrounding areas to form source populations for re-colonization. Typically, the first colonizing species to arrive to a recently disturbed area are "opportunistic" (Stage I) tubiculous polychaetes or oligochaetes. Various meiofauna may also dominate (especially free-living nematodes) because they may be extremely abundant in the sediments of the region (Weiss, 1995). During the initial stages of re-colonization, macrobenthic densities would likely be high and species diversity low (Grassle and Grassle, 1974; Kaplan et al., 1975; McCall, 1977; Zajac and Whitlatch, 1982; Jones, 1986). This situation may act to enhance the food supply of bottom feeding finfish species such as winter flounder (Rhoads et al., 1978).

The pioneer species occupy the sediment-water interface. Since colonization begins at the sediment surface, the feeding and bioturbation zone is shallow. However, the colonization of an azoic soft bottom habitat by Stage I pioneers, often facilitates succession by colonization of additional organisms (Gallagher, et al., 1983). Eventually, the Stage I pioneering benthic invertebrate community is succeeded by a transitional (Stage II) community, which may include deeper burrowing organisms employing additional feeding strategies. The predicted Stage II community is typically characterized by an apparently diverse assemblage of tubicolous amphipods, molluscs, and polychaetes, with most species feeding at or near the surface (Rhoads and Germano, 1986). Some late Stage II communities may also be inhabited by "conveyor-belt species" (species that feed head-down in the sediment surface) although they do not dominate at this stage. The Stage II organisms within nearby undisturbed areas will likely provide a source population for colonization of both the pier areas and the HARS site.

Eventually over time, a Stage III equilibrium community is reached. In a Stage III equilibrium community, all benthic invertebrate functional groups are represented. That is, the species partition their niche by varying feeding depth, employing different feeding techniques, and represent various feeding guilds (e.g., planktivores, predators, detritivores). Rhoads and Germano (1986) reported that various maldanid, pectinariid, and orbinid polychaetes; caudate holothuroideans; protobranch bivalves; and some infaunal ophiuroids typically dominate the Stage III community. Some Stage I organisms may persist in the Stage III communities.

At this stage of succession, bioturbation and bioirrigation of a deeper sediment layer and higher rates of organic carbon consumption typically prevent anoxic and hypoxic conditions from occurring at the sediment-water interface, down to a 20-cm (8-in) or deeper depth. As the benthic invertebrate community succeeds to Stage III equilibrium, the prey availability to finfish may decrease as a greater percentage of the benthic infauna reside deeper within the sediment. Stage III benthic invertebrate organisms typically do not exhibit significant seasonal changes in abundance or biomass.

The species that colonize the newly dredged areas and the clean cap at the HARS would most likely be the same as those from the surrounding benthic invertebrate community. At the Central Long Island Sound Disposal Site (CLISDS), Rhoads et al. (undated) observed that a sand cap, with trace silt, was colonized by the same organisms (polychaetes and bivalves primarily) as a nearby site that consisted of a silt cap. This suggests that larval recruitment and emigration from surrounding areas was the major factor in re-colonization. This implies that the colonization of the disturbance areas would initially consist of organisms that live in the surrounding area. However, since the material to be disposed of at the HARS consists primarily of sand, and since the dominant texture of the dredged areas may also initially be sand, successive colonizing species may be typical of those known to prefer the sandier habitats of the Bay since there is evidence that supports the notion that benthic invertebrate community assemblages are a function of particle size (Kaplan, et al., 1975; Etter and Grassle, 1992). Species preferring sandier substrates may dominate until natural sedimentation of the recessed berth areas restores the sediment surface to that of the more shallow soft bottom sediment to the east, west, and south of the pier complex. Additional information would be needed to better predict the benthic impacts on a species level at the disturbance areas; however, the exact species composition of the community is not as important as the functionality of the organism-sediment relationships that form during the successional stages (Rhoads and Germano, 1986).

Macroinvertebrate sampling data obtained in support of the NWS Earle trestle replacement EIS (BCM, 1990) found the spionid polychaete *Spiophanes bombyx* to be the most abundant species of benthic infauna within soft bottom areas adjacent to the trestle. In sandier areas (i.e., proximal to the shoreline), the numerically dominant invertebrate benthic infaunal species was the subellariid polychaete *Sabellaria vulgaris.*

Dredging within the existing berthing basin during the winter months has the potential to harm blue crabs (*Callinectes sapidus*) which enter the channel and slough areas of Raritan Bay in November, and burrow into surficial sediments as water temperatures decline. Blue crabs remain in this dormant state of torpor until sediments warm again in the spring (Gorski, personal communication). In their dormant winter state, they are unable to escape dredging and entrainment during disposal. Blue crabs are an important food source for several state and federally managed fish species including winter flounder, little skate, winter skate, scup, and summer flounder (Steimle et al., 2000). To avoid the destruction of overwintering blue crabs dredging during their overwintering period from approximately November 15 to April 15 will be avoided.

Despite the changes in the benthic invertebrate community, potential impact within the disturbance areas around the pier would not be significant for the Bay. Likewise potential impact within the disturbance areas at the HARS would not be significant for the New York Bight eco-region as a whole.

<u>Alternative B (New Pier at New Location)</u>

The types of impact to the benthic invertebrate community that would be anticipated in the vicinity of this alternative location would be similar to that of Alternative A. However, within the location of this alternative, the existing benthic community is more likely to exhibit a later successional stage of development since the area receives less ship-generated disturbance on a routine basis (i.e., no AOE class ships routinely disturb the benthos at this location). Despite the potential for the benthic community to exist at a more developed stage at this location, the anticipated impact within this location would not be substantial in comparison to the overall area of the benthos within the Bay.

The area surrounding the pier complex and adjacent areas of Sandy Hook Bay have high densities of hard shell clams (*Mercenaria mercenaria*) (McCloy and Joseph 1985, NJDEP 2000) and has historically been recognized as having high commercial value for this species (DOI, 1963). This same area is recognized as a production area for soft clams (*Mya arenaria*). The commercial harvesting of shellfish proximal to the project area (i.e., outside of but adjacent to the restricted area) is allowed under special permit by the NJDEP, providing the shellfish are further processed either through depuration or relay (NJDEP, 2003).

In addition to their commercial value, shellfish have an important ecological role in the Raritan and Sandy Hook Bay area. As filter feeders, they play an important role in improving water quality in the bay. They also serve as a food source for a variety of fish that feed on the siphons of shellfish. In a study of the diets of winter flounder in the Hudson-Raritan Estuary (Steimle et al., 2000) found that the siphons of hard clams were an important part of the diet of winter flounder (*Pseudopleuronectes americanus*) in the estuary. The construction of a new pier in a new location would result in the loss of this commercially and ecologically important fishery from an additional 12.5 acres of existing shellfish beds. Further, the creation of a deep basin surrounded by shallow waters by dredging the berthing areas to a depth of -45 ft mlw would allow the accumulation of fine-grained organic sediments with the basin. These fine-grained organic sediments are more likely than the existing sandy sediments to contain contaminants that could adversely affect the benthic community. Also, the expansion of the pier area eastward and outside of its existing boundaries would prohibit access of area commercial and recreational shellfisherman to these beds via an expansion of the requisite restricted area and condemnation of the beds as required under the State's National Shellfish Sanitation Program. This program prohibits shellfishing within the footprints of a dock because of the concerns with disease causing pathogens (Gorski, personal communication).

No Action Alternative

Under the No Action Alternative, sediments will remain in their present condition. The nature (e.g., texture and composition) of the benthos would not be expected to change from current conditions in any predictable way. In the vicinity of Pier 3, chemical constituents in the sediment of the berth areas and under the pier may continue to impact the benthic invertebrate community, particularly in the sediments beneath the pier. The benthic invertebrate fauna inhabiting the un-remediated disposal cells of the HARS would continue to be subject to exposure of contaminants from the existing un-remediated (i.e., uncapped) material until suitable capping material becomes available from other dredging projects in the region.

Finfish

Alternative A (Proposed Action)

The fishery resources within Raritan Bay (inclusive of Sandy Hook Bay and the project area) have been described by various studies (Wilk and Silverman, 1976; Wilk, 1983; ACOE, 1984; Mackenzie, 1992) while the finfish community within the New York Bight (inclusive of the HARS) has been described by Wilk et al. (1992). (Refer to Section 4.1.3). Dredging and dredged material disposal will have the greatest impact on fishes that are dependent on the bottom. Both disturbance areas have benthic species within their ichthyofaunal communities. Little to no impact is anticipated for pelagic fishes, since they are very mobile and can readily avoid the temporary areas of turbidity in the water column that may occur as a result of dredging and dredged material disposal. Also, many fish popular with sport fishermen, such as black sea bass, striped bass, and tautog are found mainly near shoal, rocky areas and ledges, rather than the muddy berthing areas proposed for dredging and the muddy or silty substrates areas of the HARS.

Short-term impacts to fish in the upper to mid-water column at the disturbance areas would occur during excavation of the pier berths, removal of material from beneath the pier, and disposal of suitable dredged material at the HARS. Most short-term impacts are associated with suspended sediment or turbidity plumes created during excavation and disposal of sediment. However, some turbidity may be generated during the removal of wood piles first from the existing Pier 3, then later with the removal of Pier 2. Increased barge activity can also have short-term impacts to fisheries by invoking avoidance response. Various behavioral effects and some sub-lethal effects (physical stresses) can be considered short-term impacts, since fish behavior should return to normal and the sub-lethal effects could be reversed or eliminated following disturbance (Newcombe and Jensen, 1996). Some fish, especially highly mobile, migratory or pelagic species, are capable of fleeing the area while these activities occur. Although these impacts are unavoidable, they are short term in nature and would cease upon completion of activities in the disturbance areas.

Moderate to severe sub-lethal, lethal, or para-lethal effects may be irreversible and long lasting. They may be associated with habitat degradation, reduced growth rate, delayed hatching, increased predation, and various levels of mortality (Newcombe and Jensen, 1996). These effects may be incurred via direct burial by sediment, exposure to suspended sediment, or via major alterations of their habitat that results in substantial changes to food source, water quality, flow regime, or biotic interactions (Karr, 1991). The severity of the effect of the suspended sediment on fish is a function of sediment concentration, duration of exposure, concentration of contaminants in the sediment, particle size, and particle morphology (Newcombe and Jensen, 1996). The susceptibility of various fish species to these potential ill effects is a function of one or more of the following: their taxonomic group, natural history, life history phase, and health status prior to exposure. Generation of suspended sediment plumes is harder to avoid in an environment such as a tidally influenced estuary. However, the project area is not considered high quality fish habitat in contrast to the spawning shoals, rock reefs, eel grass beds and other marine habitats that occur in the region. Impact to finfish may also occur indirectly via alteration of habitat. Both the benthic habitat and vertical pier piling structure would be altered as a result of Alternative A. Impact to winter flounder illustrates the potential impact to a typical benthic species while black sea bass is an example of a species dependent upon vertical structure to provide suitable habitat.

Winter flounder, one of the most important fishery species in the area, are bottom spawners with demersal eggs that stick to bottom substrate. Although they have pelagic larvae, winter flounder live on the bottom for most of their life cycle. They begin spawning once water temperatures drop below 10° C (50 ° F), which can be anticipated to occur by January – February in Sandy Hook Bay. Eggs are found in bottom habitats with sand, mud, and gravel substrates where water temperatures are less than 10° C (50° F), salinities range between 10 and 30 ‰ and water depths are less than 5 m (16 ft). Their eggs hatch in about 15 to 18 days (Bigelow and Schroeder, 1953). Larvae typically inhabit open water and benthic habitats in areas where the sea surface water temperatures are less than 15° C (59 ° F) and the salinity ranges from 4 to 30 ‰. Juveniles are also found in bottom habitats with a substrate of mud or fine-grained sand. They typically occupy waters from 0.1 to 10 m (0.3 to 33 ft) deep, and areas where the water temperature is below 28° C (82° F) and where the salinity is between 5 and 33 ‰. Adults have similar benthic habitat substrate requirements. They are typically found in water 6 m (20 ft) deep, at temperatures below 15° C (59° F), and in waters with a salinity between 5.5 and 36 ‰ (Pereira et al., 1999). Being demersal fish with demersal eggs and larvae, the egg, embryonic, and larval stages of winter flounder (and most other fish) are most susceptible to mortality and injury (Blaxter, 1969, 1974; McGurk, 1986; Black et al., 1988; Chambers et al., 1988).

Black seas bass exploit the cover offered by man-made structure and therefore may be seasonally abundant in and around Pier 3. Black sea bass juveniles enter estuarine waters upon development from larval stages. They can be found at varying depths from the surface down to 38 m (125 ft) and represent a typical important water column finfish resource in the Bay. Black sea bass are typically found around the edges of salt marshes and channels, preferring a rough bottom substrate such as shellfish, sponge or eelgrass beds, and nearshore patches of man-made objects. Adults tend to congregate around rock jetties, rocky bottom substrate areas, and areas underlain by sand and shell fragments (Steimle et al., 1999). Due to their propensity for congregating around structures, they tend to be abundant around piers. Removal of the piers may represent a loss of habitat. However, the results of a growth study of caged fish beneath a large urban pier have shown that the captive fish exhibited reduced growth rates in comparison to caged fish at the pier edge or away from the pier in open water (Duffy-Anderson and Able, 1999). This study suggests that the habitat beneath such piers may be considered sub-optimal fisheries habitat.

Flounder and other demersal fish species may benefit shortly after dredging at the pier and cessation of disposal at the HARS. Bigelow and Schroeder (1953) report that winter flounder are most often caught on muddy sand, but may be found on a variety of bottom types. Flounder typically spawn on a sandy bottom substrate. Since the uncapped sediment at the HARS lacks sandy areas, the area may become more attractive for these fish if the site is capped with sand or sand with some silt. In addition, the formerly unsuitable sediments from Reaches 2 and 3 at the pier would be removed, exposing the clean sediments below in Reach 1. The newer, cleaner, and sandier sediments may encourage settlement and formation of more robust benthic invertebrate communities in an area where they were formerly impacted by degraded sediment. The abundance of early colonizing invertebrates at the sediment surface is readily available to demersal predators and may benefit the various groundfish, including winter flounder that inhabit the Bay. Given the geographic range and distribution of finfish within the Bay, the temporal and spatial scale of disturbance and resultant potential impact to finfish associated with dredging at the pier and disposal of suitable dredged material at the HARS is insignificant.

The potential impact to other fish species and their habitat is discussed in detail in Appendix B – Essential Fish Habitat Assessment. In an effort to avoid or minimize the potential adverse impact on spawning, egg and larval development, and juvenile survivorship, which could be incurred as a result of dredging and dredge disposal activities, all sediment disturbance activities in the berth areas would be restricted during sensitive seasonal periods of species development. This restricted time period is referred to as a "closed dredging and disposal window" and is discussed in further detail in Appendix B.

Sport and commercial fishing are not permitted in the restricted area that surrounds the pier complex. Therefore, sport and commercial fishing in the vicinity of the pier would not be impacted by in-water activities associated with Pier 3 replacement and subsequent operations.

Alternative B (New Pier at New Location)

The types of impact to the finfish resources that would be anticipated in the vicinity of this alternative location would be similar to that of Alternative A. However, within the location of this alternative the benthic community may be more established since it receives less ship-generated disturbance on a routine basis (i.e., no AOE class ships routinely disturb the benthos at this location), and therefore offer a more robust source of food to benthic feeding finfish. However, the potential impact to this finfish food source would not be substantial in comparison to that of the overall Bay area.

No Action Alternative

Under No Action Alternative, the unconsolidated sediments of Reaches 2 and 3 would remain in place and continue to be a source of chemical constituents in the Bay environment.

Avifauna

Alternative A (Proposed Action)

Tidal flats are important shorebird feeding habitat. Since no tidal flats are located in close proximity to the project area, impacts to shorebird habitat from suspended sediments or covering of feeding areas via siltation would not occur. No loss of shorebird breeding habitat (e.g., salt marsh, sand or cobble beach) will occur from either dredging or disposal of suitable material at the HARS.

Depending on the species, seabirds such as gulls and terns forage in a variety of marine habitats including the open water surface, along beaches, on tidal flats, in salt marshes, or a combination of these habitats. Various species of these seabirds forage in the vicinity of the pier complex as well. Many of these are well adapted to human activity and may forage in and around the pier even during dredging, demolition, and construction activities. No loss of seabird foraging or breeding habitat will occur as a result of this project. However, dredging of marine sediments may cause temporary suspension of benthic invertebrate macrofauna in the upper water column. Here the invertebrates may be eaten by gulls or terns. Benthic invertebrate macrofauna may also be gleaned by gulls from excavated sediment temporarily stored on barges.

The various species of waterfowl (loons, grebes, ducks, etc.) that frequent Sandy Hook Bay reach their greatest concentrations during migration and in the winter. Waterfowl and seabirds in the Bay tend to congregate in areas of abundant food supply proximal to shellfish beds, and areas where marine fish congregate such as rocks, ledges and reefs. The dredging and disposal of marine sediment will result in the loss of some shellfish habitat but would have no impact to reefs and other submerged structures outside of the project area. Fish concentrations will avoid the temporary disturbances to the water columns during dredging and disposal of marine sediments. Therefore, temporary impact to piscivorous waterfowl foraging habitat is expected, but would be negligible in comparison to the areal extent of the eco-region. With completion of the project, the site would return to pre-disturbance conditions. No loss of waterfowl breeding habitat will occur since both the dredging and disposal sites occur in open water areas.

Alternative B (New Pier at New Location)

The types of impact to the avifaunal community that would be anticipated in the vicinity of this alternative location would be similar to that of Alternative A. However, within the location of this alternative the benthic community may be more established since it receives less ship-generated disturbance on a routine basis (i.e., no AOE class ship has routinely disturbed the benthos at this location), and therefore offers a more robust source of food to diving waterfowl. However, the potential impact to this food source would not be substantial in comparison to that offered by the overall Bay area.

No Action Alternative

The existing status, distribution, and welfare of the avifaunal resources within the vicinity of the pier would be unaffected under the No Action Alternative.

Mammals

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

There would be no loss of wildlife habitat as a result of either of the action alternatives. Therefore, Alternative A would have no impact (either positive or negative) to mammals of the region. As discussed in Section 4.1.3.6, marine mammals of the region are unlikely to be found in the vicinity of the project area and therefore, are unlikely to be affected by dredging and disposal activities.

No Action Alternative

The No Action Alternative would have no impact on marine mammals in the region.

5.1.3 Water Resources

Wetlands and Floodplains

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Neither Alternative A nor Alternative B would impact freshwater or marine wetlands and floodplains associated with the Sandy Hook Bay and the adjacent regions. The use of best management practices (BMPs) for turbidity control will ensure that the open water marine environment is protected from excessive re-suspension of dredged sediment.

No Action Alternative

The No Action Alternative would have no impact upon the open water marine environment.

Water Quality

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Water quality impacts from dredging and dredge material disposal include physical, chemical and biological impacts. Temporary changes to the water turbidity, pH, and DO are expected both during the actual dredging activity at the NWS Earle pier complex, and during disposal of suitable material at the HARS.

Physical Impacts

Physical impairment of the water column, resulting from dredging and dredge material disposal, occurs from changes in DO, salinity, pH, and turbidity with a resultant decrease in light penetration. The degree of change or alteration of the water column's physical components depends on various physical and chemical parameters of the sediment (e.g., pH, oxidation-reduction potential, sediment size, organic matter content, concentration of reactive iron and manganese, etc.). The water column proximal to the proposed action would experience temporary physical impairment due to an increase in Total Suspended Solids (TSS) during dredging and pile removal. Likewise, the water column proximal to the disposal area at the HARS would also be impacted by an increase in turbidity during disposal. Disturbance of the sediment may also result in the release of dissolved hydrogen sulfides into the water column resulting in a concurrent decrease in DO.

The temporary increase in TSS is expected to be of comparable magnitude to that of naturally occurring events in the Hudson-Raritan Bay Estuarine Complex, such as peak seasonal river discharges and storm events. The temporary impacts to the water column associated with turbidity will cease following completion of in-water activities associated with the construction of the new Pier 3. Tidal forcing, the grain size fractions of the material being dredged, and the method of dredging (e.g., clamshell vs. backhoe dredge) all affect the horizontal and vertical extent of elevated TSS concentrations that may occur within Sandy Hook Bay as a result of the proposed action. Various scenarios addressing these factors were considered when evaluating characteristic increases in TSS in the water column as a result of dredging at Pier 3. Results of these evaluations are provided in Appendix E – Hydrodynamic Modeling Report.

In addition, the proposed action would temporarily generate dredge water at the pier complex during dewatering of the dredged sediment unsuitable for ocean disposal (material generated from Layers 2 and 3). This material would be dewatered through decanting on the disposal scow or via some other method at the pier complex, prior to shipment via barges to a shoreside transport locality for final upland disposal/treatment/recycling. Dredged sediment suitable for ocean disposal (Layer 1 material) would be dewatered via barge overflow during transport to the HARS in compliance with policies and procedures identified under the HARS Site Management and Monitoring Plan (SMMP) (ACOE/EPA, 1997), and any applicable project-specific permit conditions.

Chemical Impacts

Results of bioaccumulation testing on composite sediments collected from the berthing areas around Pier 3, and from sediments beneath the pier, show that the material in the surficial layers (i.e., Layers 2 and 3) is unsuitable for ocean disposal due to the presence of PCBs concentrations that have been shown to bioaccumulate in marine indicator test organisms in excess of federal guidelines established in the National Ocean Disposal Testing Manual (the "Green Book") jointly developed by the EPA Region 2 and the ACOE - NYD (EPA/ACOE-NYD, 1994). Sediments from the deeper undisturbed parent material (i.e., Layer 1) were determined to be suitable for ocean disposal using these same guidelines and biological testing regime.

Model simulations were conducted to illustrate potential water quality impact from pollutants released by disturbance of the contaminated Layers 2 and 3. A representative pollutant (PCBs) with a source concentration of 1 microgram per liter (μg/L) under three different tidal forcings (neap, mean and spring) was used in the model. The details and results of pollutant modeling are provided in Appendix E – Hydrodynamic Modeling. Results of the modeling depict the horizontal and vertical extent of excess pollutant concentrations (i.e., concentrations above ambient). Spring tide forcing results in the largest plume of pollutant, but also the greatest overall dilution (and therefore the lowest concentrations). Neap tide forcing leads to a relatively small pollutant plume but also relatively little dilution (and therefore high concentrations).

However, while results show significant dilution of PCBs introduced to the water column by the dredging process, it is important to keep in mind that these concentrations represent concentrations in excess of the pollutant concentrations in the ambient water. A chemical analysis of site water samples collected during the June 2002 sampling program at the NWS Earle Pier 3 shows that ambient concentrations of total PCBs exceed the chronic water quality concentrations for all three sediment reaches. The impact of the addition of PCBs to the water column from sediments during the dredging process would, therefore, be negligible.

Results of the July 2003 testing of the reconfigured Reach 1 sediment revealed that the PCB concentration in site water was below the chronic water quality concentration and that the sediment elutriate PCB concentration results revealed a ten-fold decrease (Refer to Appendix D).

Overall, the physical and chemical impacts to water quality that are expected during dredging and dredged material disposal associated with this project would be temporary and diminish with the cessation of in-water activities (e.g., dredging, pier pile removal, disposal). Using proper controls, the impacts would be minimized and the anticipated changes to the water quality of the marine system would return to pre-project conditions once the project is completed.

<u>Alternative B (New Pier at New Location)</u>

Similar impacts would be expected for Alternative B, however Alternative B involves a greater volume of the upper (i.e., unsuitable) sediment layers since the area within the Alternative B pier footprint has not been maintained to 10.7 m (–35 ft) MLW. Therefore the duration of impact would be longer as it would take a longer time to dredge and dewater the unsuitable material from this location.

No Action Alternative

The No Action Alternative would have no impact upon watercourses or waterbodies.

5.1.4 Bathymetry/Surficial Geology/Sediments

Bathymetry

Alternative A (Proposed Action)

Alternative A would result in a change in the topographic elevation of the sediment surface within the pier berths on the east and west side of existing Pier 3. This area would be deepened from –10.7 m (-35 ft) MLW to a project depth of -13.7 m (-45 ft) MLW plus a 0.8 m (2 ft) overdredge. The proposed dredging would have an adverse, albeit minor, temporary impact on the area due to regular maintenance dredging cycles within the berthing areas. Maintenance dredging typically occurs every 4 to 7 years at NWS Earle. Therefore, the bathymetry would change from the existing elevation to the project depth of -13.7 m (-45 ft) MLW, then become shallower during the subsequent five-year period until maintenance dredging restored the berthing areas to the -13.7 m (-45 ft) MLW project depth. These period changes to the bathymetry could render the berthing areas unsuitable habitat for some managed species (Refer to Appendix B – Essential Fish Habitat Assessment).

Alternative B (New Pier at New Location)

Construction of the new pier at this location would result in a greater topographic change to the sediment surface (than under Alternative A) since dredging of a large, undisturbed area would be required. The area of the Bay that would be dredged to –13.7 m (–45 ft) MLW under this alternative is 15.7 ha (38.9 ac). Of this area, 5 ha (12.5 ac) would be new dredging – i.e. an area that previously has not been dredged. Water depths in this area are approximately 5.5 to 6.1 m (18 to 20 ft) and under this alternative, dredging would deepen this area to –13.7 m (–45 ft) MLW.

No Action Alternative

Under current conditions, the existing benthoscape frequently changes due to disturbance caused by loaded supply ships that have little clearance of the existing sediment surface. Localized changes occur when the ships are underway and their propellers are engaged under load to depart the pier. The turbulence caused by engaging the propellers disturbs the sediment surface and re-suspends recent deposited sediment. The pier berths are subjected to a five-year maintenance dredging program to maintain the existing berths at –10.7 m (-35 ft) MLW plus a 0.8 m (2 ft) overdredge. Under the No Action Alternative this maintenance schedule would continue.

Native Surficial Geology (Parent Material)

Alternative A (Proposed Action)

Alternative A would remove approximately 170,000 m^3 (222,000 yd^3) of native parent geologic materials (Holocene deposited marine greensands and other deposits described by Stanford, 2000) throughout the project area, from an area of approximately 8.8 ha (21.7 ac). This material, comprising the material found in Reach (Layer) 1, has been determined to be suitable for open ocean disposal. This material would be removed from the project area for use as capping/remediation material at the HARS. Analytical results of this material (bulk sediment chemistry, elutriate, physical analysis, and biological testing) is provided in Appendix D and is represented by the data labeled Reach 1.

Alternative B (New Pier at New Location)

Alternative B would require dredging 988,000 m^3 (1,300,000 yd^3) in the pier berths, plus an additional 57,000 m^3 (75,000 yd^3) of sediment from beneath the existing pier, for a total of 1,045,000 m^3 (1,375,000 yd^3) of dredged material. Some of this material is expected to be native parent geologic material (Holocene deposited marine greensands and other deposits described by Stanford, 2000), while the remaining portion would consist of recently deposited unconsolidated sediment. Assuming that, as in Alternative A, 40% of the material would be considered native uncontaminated parent material, this alternative would then require the removal of approximately 418,000 m^3 (550,000 yd^3) of clean parent material from the vicinity of the pier complex.

No Action Alternative

Selection of the No Action Alternative would not impact the native parent geologic materials underlying the project area.

Sediment (Recently Deposited Unconsolidated Material)

Alternative A (Proposed Action)

Alternative A would result in the removal of about 236,000 m^3 (308,000 yd^3) of dredged sediment material determined to be unsuitable for open ocean disposal. Approximately 177,000 m^3 (231,500 yd^3) of material would be removed from the area of the pier berths (Layer 3) and approximately 51,000 m^3 (67,000 yd^3) underneath Pier 3 (Layer 2). An additional 9,200 yd^3 would also be removed for a possible tug/barge berth option. This material would be disposed at a permitted and approved upland disposal/reuse/recycling facility. The removal of the recently deposited unconsolidated material represents an improvement over existing conditions since this material has already been impacted by anthropogenic chemical constituents. The removal of this material would not contribute to existing PCB concentrations within the water column since site water and elutriate data show that PCB concentrations within the two media are at equilibrium. Analytical results of this material (bulk sediment chemistry, elutriate, physical analysis, and biological testing) is provided in Appendix D and is represented by the data labeled as Reach 2 (sediment underlying Pier 3) and Reach 3 (surficial sediment from the Pier 3 berth areas).

Alternative B (New Pier at New Location)

Alternative B would require dredging 988,000 m^3 (1,300,000 yd^3) in the pier berths, plus an additional 57,000 m^3 (75,000 yd^3) of sediment from beneath existing Pier No. 2, for a total of 1,045,000 m^3 (1,375,000 yd^3) of dredged material. Some of this material is expected to be native parent geologic material while the remaining portion would consist of recently deposited unconsolidated sediment, with elevated concentrations of various contaminants. Assuming that, as in Alternative A, 60% of the total dredged material volume would be considered "contaminated", this alternative would require the removal of approximately 627,000 m^3 (825,000 yd^3) of contaminated sediment from the vicinity of the pier complex.

No Action Alternative

Under the No Action Alternative, the unsuitable material would be left in place and would continue to be a source of anthropogenic and bioaccumulative chemical constituents within the marine environment around the pier.

5.1.5 Air Quality

Alternative A (Proposed Action)

Alternative A would cause added temporary air emissions of the ozone precursors NO_x and VOCs. These emissions would come from the construction equipment, hot asphalt pavement at the time of paving, and from private and government owned automobiles reporting to the site during this time. These emissions would be temporary and would cease after cessation of construction. Ongoing operation of the reconstructed piers would not increase the overall population of the Station or increase the trip frequency of ships, or the number of fossil fuel burning automobiles. Therefore, there would be no long-term adverse affect on air quality as a result of Alternative A.

An analysis of the emission of ozone precursors associated with Alternative A was conducted under the General Conformity Rule (GCR) of the CAA. Results from the analysis show that all additive emissions from the construction and operation phases of Alternative A would not exceed the *de minimis* limit for ozone set for severe non-attainment areas. Therefore, air emissions generated by the Alternative A would not have a negative impact on air quality at NWS Earle or in the region. Details of the analysis (i.e., methodology and calculations) are provided in the Applicability Analysis for the GCR under the CAA included in Appendix F. The replacement of Pier 3 would not result in increased emissions to the region as all actions and equipment that are required in the day-to-day activities of the pier are already in operation.

Alternative B (New Pier at New Location)

Alternative B would also cause temporary air emissions of ozone precursors from construction equipment and from private and government owned automobiles reporting to the site during this time. These emissions would be temporary and would be eliminated after cessation of construction.

In comparison to the GCR analysis performed under Alternative A, identical construction equipment would be required on site under Alternative B. However, as this alternative requires a larger dredging volume, barges, cranes, tugs, and transport vehicles would either operate in greater frequency or for a longer duration during construction. Accordingly, the resulting air emissions, although not anticipated to exceed *de minimis* levels, would be higher than those provided under the GCR analysis provided under Alternative A.

No Action Alternative

Under the No Action Alternative, air quality in the Bay environment would be unchanged.

5.1.6 Noise

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Construction of a new berthing pier under Alternative A or Alternative B would not alter the current ship homeporting or ordnance operations at NWS Earle. Therefore, no permanent changes to mobile or stationary noise emitting sources would result. However a temporary increase in noise would result due to the construction activities associated with either action alternative. This temporary increase in noise would occur during the eight-hour workday for a five-day workweek until completion of the pier/trestle construction and dredging operations. The approximate range of noise levels that would occur during this multi-year construction period is indicated in Table 5-1.

To illustrate a typical construction noise scenario, noise from a jackhammer may be used as a gauge. Fifty feet away from a jackhammer, the expected noise level would be about 88 dB (IAC, 1989). Similar noise levels would be expected from other construction equipment. Noise levels decrease dramatically with distance from the noise source. In general, as distance from the source doubles, the noise level decreases by about six dB. Therefore, at 31 m (100 ft) from the source, the noise level from a jackhammer would be about 82 dB (88 minus six).

Demolition and construction activities would be limited to the deepwater piers (Piers 2 & 3) that are located approximately 3.2 km (2 mi) from shore and therefore would not create adverse noise impacts to the residential communities on-shore. Construction-related noise would be heard by recreational users of the Bay waters in the vicinity of the pier complex. However, the restricted area that surrounds the pier complex prevents unauthorized entry into the pier area and has the secondary effect of preventing Bay users from exposure to the high construction noises that would be generated by the pier replacement project.

Table 5-1. Typical Noise Levels (dBA) of anticipated Construction Equipment needed for the Pier Replacement

Equipment Required	Approximate Range of Noise (dBA)[1]
Trucks	82 – 94
Concrete Mixers	75 – 87
Skidders	81 – 83
Cranes (Movable)	76 – 87
Cranes (Derrick)	86 – 88
Pumps	69 – 71
Generators	71 – 82
Compressors	74 – 86
Tug	83 – 88
Jack Hammers and Rock Drills	81 – 97
Pile Drivers	95 – 105
Welder	69 – 81
Concrete Saws	72 – 81

Sources:
[1] Bolt, Beranek, and Newman (1971)
[2] IAC (1989)

Finally, some construction material and some demolition debris would be transported to and from the Waterfront Area of the Station by trucks entering from NJ State Route 36. This materials delivery and debris removal would occur throughout the construction timeframe that is expected to last up to four years. No significant traffic noise impacts associated with this operation are expected.

No Action Alternative

The No Action Alternative would not impact the noise environment at NWS Earle or the surrounding community. Noise levels would remain near background levels for suburban residential or low-density commercial land usage (approximately 60 dBA).

5.2 Built Environment

5.2.1 Land Use

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Either action alternative would have minimal effect on the existing land use on-base, and on the surrounding community. The nearest developed areas along the shoreline adjacent to NWS Earle include the Monmouth County (Belford) Ferry Terminal, residential housing, The Bayshore Commercial Fishing Co-op, and the Township of Middletown Sewage Authority (TOMSA). The proposed marina project (Spy House Marina) is planned to be located along the shoreline adjacent to the recently constructed residential housing development. The Navy project to replace Pier and Trestle 3 will have no impact on the proposed marina or existing developed areas along the shoreline. Therefore, there would be no impact to adjacent land uses and/or land ownership by the replacement of Trestle and Pier 3.

Some construction materials may be staged on portions of the Waterfront Area resulting in a temporary change in land use. The use of the marine lands adjacent to the pier complex would remain as military maritime supply service. An assessment of Alternative A with regard to the policies of the NJ CZMA plan is provided in Appendix G.

No Action Alternative

The No Action Alternative would not affect existing land uses on-base or in the surrounding community. However the ability of the pier complex to meet current demand for military maritime supply service would be compromised.

Pier Complex Restricted Area

Alternative A (Proposed Action)

The pier complex Restricted Area provides a 686 m (750 yd) security area measured from the edge of the outward piers (Piers 2 & 4) and the resulting zone forms a large rectangle that encompasses the piers and the connecting trestle to the shore. Based on the distance criteria of 686 m (750 yd), the width of the restricted area could be reduced on the eastern side when Pier 2 is removed if the restricted area was measured from the new pier. This would reduce the width of the zone by about 213 m (700 ft) – the distance between Piers 2 and 3. However, given the heighten security imposed by the threat of terrorist attack, the existing Restricted Area will remain as established and the buoys that mark the boundary of the zone will not be relocated.

Alternative B (New Pier at New Location)

Under this alternative, the new pier would be constructed on the east side of existing Pier 2 requiring that the restricted area be expanded to maintain the 686 m (750 yd) separation distance. Thus the eastern limit of the restricted area would be moved approximately 61 m (200 ft) to the east. This expansion of the restricted area would require an additional 25.4 ha (62.7 ac) of the Bay waters to be excluded from recreational and commercial use. The buoys that denote the restricted area limits would be relocated to mark the expanded zone.

No Action Alternative

Under the No Action Alternative, the established restricted area around the pier complex will remain in place.

5.2.2 Socioeconomics

Alternative A (Proposed Action)

Alternative A would not have a long-term effect on population, employment, income or housing condition on base or in the surrounding community. However, the significant cost of Alternative A – more than $132,000,000 – could result in temporary construction employment and/or construction material purchasing in the region thereby providing a short-term boost to the local economy. Construction worker purchases for food, lodging and other services would also create a short-term, minor impact to the local economy.

Alternative B (New Pier at New Location)

The higher construction costs associated with Alternative B – approximately $45 million more than Alternative A – may result in a slightly higher economic benefit to the region as construction worker purchases would occur over a slightly longer construction period. Cost of construction material for Alternative B would not be significantly higher than Alternative A as the majority of the cost difference between the two alternatives is in the significantly greater dredging requirement of Alternative B.

No Action Alternative

The No Action Alternative would not affect existing socioeconomic conditions on-base or in the surrounding communities.

5.2.3 Traffic & Transportation

Alternative A (Proposed Action)

The pier complex is located approximately 3,050 m (10,000 ft) from shore and is accessed by vehicles via the trestle roadway system from the waterfront portion of the base. Most of the removal of demolition material and dredged sediment resulting from the implementation of Alternative A would be conducted via barge to either an off-site upland disposal/reuse/recycling or an off-site in-water disposal site based on the materials composition and suitability for ocean disposal (Refer to Section 5.1.3). Similarly, much of the construction material for the new pier would also be transported to the pier complex by barge. Local roadways and highways would not be used for the majority of the major construction and demolition activities and these activities would occur over the expected three to four-year construction time period. Construction workers would commute to the Waterfront Area by personal vehicles but this workforce of up to 200 workers is not expected to adversely affect traffic conditions in the region. Construction worker vehicle parking would be on the Waterfront Area and off-base impacts are not expected. Therefore, Alternative A would have only a minor and temporary impact to vehicular traffic at NWS Earle and in the surrounding region.

Alternative A would result in a temporary increase in barge traffic in the Sandy Hook and Raritan Bay East Reach Channels during the major construction and demolition activities associated with Alternative A. This increase in vessel traffic would be due to the removal of demolition debris and dredge sediment and the delivery of construction materials such as the steel support piles for the pier and the pre-fabricated concrete (pier) deck sections. All barge movement activities would be coordinated with the USCG and Station security and port services. These actions would occur throughout the construction period that is expected to take three to four years and would cease after construction activities are completed.

Alternative B (New Pier at New Location)

The traffic impacts of Alternative B associated with the delivery of construction materials and the removal of demolition debris are expected to be similar to those impacts anticipated for Alternative A. Additionally, on-shore traffic impacts as a result of construction workers commuting to and from the Waterfront Area of the Station would be similar to the minor and temporary impacts expected under Alternative A. The primary difference in these two alternatives is the amount of dredged material required under Alternative B – compared to Alternative A. This larger volume – approximately twice as much – will require additional barge traffic entering and exiting the Bay area. Barge movements would be coordinated with the USCG and are not expected to affect recreation and/or commercial use of the Bay waters.

No Action Alternative

The No Action Alternative would have no effect upon existing roadway or waterway traffic in the region.

5.2.4 Cultural Resources

Historic Resources

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Under either Alternative A or Alternative B, Piers 2 and 3 and their connecting trestles would be removed and a new replacement pier and trestle would be constructed replacing Pier 3. The Navy has determined that the piers, trestles and the associated buildings on the piers are eligible for listing on the National Register of Historic Places and their removal would constitute an adverse effect with regard to these eligible resources. To mitigate this adverse effect, the Navy and the NJ SHPO have entered into a memorandum of agreement (MOA) that provides the following stipulations (refer to correspondence in Appendix C):

- *Recordation of Historic Properties*
  The Department of Navy (Navy) will prepare *Historic American Engineering Record (HAER)* recordation documentation of Piers 2 and 3 and Trestles 2 and 3 in accordance with a Schedule of Documentation to be obtained from the National Park Service (NPS). Navy will submit this documentation to the NPS for their acceptance and retention.

- *Oral History*
  Navy will prepare an oral history of the Pier Complex at the Naval Weapons Station Earle. A minimum of three individuals will be interviewed, as available. Navy will distribute copies of the oral history to appropriate local, state and federal agencies, schools, museums, historical societies and repositories.

- *Digital Mapping*
  Navy will enhance the existing digital mapping system at the Naval Weapons Station to include a layer of historic buildings/structures/railways and a related database of the Station's cultural resource survey data forms (Form Ks).

Navy has initiated the contractual effort necessary to complete the above stipulations.

No Action Alternative

The No Action Alternative would not impact historic resources at NWS Earle.

Archeological Resources

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

No archeological resources would be affected by either Alternative A or Alternative B as all work would occur within the existing pier complex.

No Action Alternative

The No Action Alternative would not impact archaeological resources at NWS Earle

Submerged Historical Resources

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

The known submerged historic resource, the *Alexander Hamilton*, that sunk while moored at Pier 1, would not be affected by Alternative A or Alternative B. No work is planned at this pier under either alternative that would affect the site of this submerged vessel.

No Action Alternative

The No Action Alternative would not impact submerged historical resources at NWS Earle.

5.2.5 Aesthetics

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Neither Alternative A nor Alternative B would have a positive or negative visual impact. The replacement of the either Pier 3 or Pier 2 with a newer modern structure would not change the current vistas of the Bay available to the general public from the shoreline areas surrounding Sandy Hook Bay.

No Action Alternative

There would be no aesthetic impact as a result of the No Action Alternative.

5.2.6 Utilities

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Neither Alternative A nor Alternative B would have a negative effect on the electricity, heating, water supply, sanitary sewer or storm water systems that service NWS Earle, but would in fact be an improvement of the utility services currently offered by the pier infrastructure.

No Action Alternative

The No Action Alternative would maintain the status quo at NWS Earle and therefore Pier 3 would continue to have inadequate telecommunications and waste management services for homeported and visiting ships and would continue to lack adequate steam power for berthed ships.

5.2.7 Community Services

Schools

Ongoing changes to ships complement will ultimately result in a reduction of assigned Navy personnel (and their families) at the Station. Homeported ships are being converted to civilian crews of the MSC and as a result, the number of Navy children attending schools in Tinton Falls, under the current agreement between the Station and the Tinton Falls School District, will significantly reduce as all ships crews are converted. US Department of Education funds will continue to be provided to the Tinton Fall School District for each Navy dependent enrolled in the local schools, but as the Navy families are reassigned, these funds will be reduced. This change in homeported ships complement is an ongoing action and is not associated with Alternative A. Personnel (crew) changes will continue regardless of whether a new pier is constructed.

Emergency Services

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Neither Alternative A nor Alternative B would have an effect on existing emergency services in the surrounding community. However implementation of either alternative would help to improve the effectiveness of current and existing emergency services at NWS Earle pier complex. The proposed replacement pier would be wider allowing for greater access for emergency vehicles on the pier deck and would include improved security warning and monitoring systems, lighting, and berthing or anchorage areas for escort watercraft (i.e., a tug and security patrol boats).

No Action Alternative

The No Action Alternative would have no effect on existing emergency services at NWS Earle or in the surrounding community.

Health Care Facilities

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Implementation of the either Alternative A or Alternative B would have no effect on health care facilities at NWS Earle or in the surrounding municipalities.

No Action Alternative

The No Action Alternative would have no effect on health care facilities at NWS Earle or in the surrounding municipalities.

Recreation

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Implementation of Alternative A or Alternative B would not impact recreational facilities at NWS Earle or the surrounding municipalities.

No Action Alternative

The No Action Alternative would have no effect on recreation facilities at NWS Earle or in the surrounding municipalities.

5.2.8 Hazardous and Other Regulated Substances

Alternative A (Proposed Action) and Alternative B (New Pier at New Location)

Neither Alternative A nor Alternative B would impact any known areas of environmental concern (AOEC) identified under the IR program at NWS Earle since the neither alternative would occur within known IR sites on base. Under either alternative, Piers 2 and 3 would be demolished. A health and safety plan will be prepared prior to commencement of work to identify known hazards and safety concerns at these piers and to determine the proper personal protective equipment required for conducting pre-demolition work at the piers. The health and safety plan will include a contingency plan should additional previously unknown contamination conditions be encountered at the pier complex.

The dismantling and demolition of the piers would require the abatement of all identified hazardous materials present or suspected to be present on the piers. Based on the age of the piers (1943) the occurrence of various hazardous materials was suspected and the presence of these materials was confirmed through inspection during the design phase of the Pier 3 replacement project. Typical hazardous or other regulated material that have been found during the design inspections of the pier facilities include asbestos-containing materials, lead-based paint and other lead-containing materials, mercury switches, creosote pilings and bird waste. All hazardous waste materials would be removed and disposed of in accordance with all applicable federal, state and local regulations regarding removal, collection (and/or temporary storage), transport, and disposal of such materials.

No Action Alternative

Since demolition and removal of piers and trestles would not occur under the No Action Alternative, much of the identified hazardous materials associated with the piers' structure and appurtenances would remain in place. These materials represent a potential source of hazardous contaminants to the environment.

5.3 Cumulative Impacts

Cumulative impacts are defined by the CEQ in 40 CFR 1508.7 as *...the impact on the environment which results from the incremental impact of the action when added to other past present and reasonably foreseeable future actions...* The following planned, underway or recently completed actions at the Station have been taken into consideration in this EA:

Maintenance Dredging – Phase I

Maintenance dredging in the Pier 4 berthing areas, turning basin, and terminal channel at the waterfront area was conducted in 2002. This dredging is part of a maintenance cycle that ensures safe navigation to the Station's pier complex. Since the pier complex was constructed in the 1940s, maintenance dredging has been conducted at the Station on a four to seven year cycle to maintain operating depths for homeported and other ordnance vessels.

The dredging was conducted in the Pier 4 berthing areas, turning basin and the terminal channel that connects the pier complex to the Sandy Hook Channel. Dredge depth throughout the dredge footprint was -13.7 m (-45 ft) MLW plus 0.6 m (2 ft) of allowable overdepth. Approximately 200,500 m^3 (262,500 yd^3) of sediment was removed and disposed at the HARS located off the New Jersey coast and managed by the ACOE.

Maintenance Dredging – Phase II

Maintenance dredging of the berthing areas around Piers 2 and 3 was completed in accordance with NJDEP regulations during the 2003 dredge window (1 June through 14 November). The berthing areas were restored to a depth of –10.7 m (-35 ft) MLW plus 0.6m (2ft) of allowable overdepth. The sediment had elevated concentrations of PCBs and, therefore, was not suitable for disposal at the HARS. Approximately 42,950 m^3 (56,200 yd^3) of sediment was dredged via a closed clamshell bucket and placed in dredge scows for transport to the Clean Earth Dredging Technologies, Inc. (CEDTI) dredged material processing facility in Jersey City, NJ. After processing, CEDTI transported the material via truck to either the FDP Enterprises Intermodal Container Site or the Westwood Borough Landfill Site for beneficial use. The NJDEP has issued an Acceptable Use Determination (AUD) to CEDTI for use of the NWS Earle dredged material at both locations. More than 7,000 round–trip truck-trips were necessary to transport the processed dredged material to the placement sites. Temporary noise and air emissions, as well as additional traffic congestion, were the cumulative impacts of this disposal action.

Security Boat Floating Platform

A concrete floating platform (dock) was recently constructed at the pier complex to provide mooring for three small crafts (33-ft. maximum length) assigned as security patrol boats. The float units are pre-fabricated and consist of a 3-inch thick reinforced concrete exterior with a solid 2-1/2 ft. foam center. The concrete float units are attached to six 12-3/4 inch diameter steel pipe guide piles via a steel pile bracket. The bracket moves up and down the steel pipe guide along with the tide. Free standing wave screens, composed of PZ27 steel sheet piling, are installed on the north and west sides to protect the platform. The wave screens extend 2.4 m (8 ft.) above mean low water and are connected to steel wales supported by H-piles. The floating dock is accessible from the existing trestle by an aluminum gangway.

Jib Crane

In conjunction with the floating dock for small craft, a 7-ton, base mounted, electric jib crane capable of lifting, rotating and lowering the small craft has been installed. The crane is mounted on a reinforced concrete pedestal. The existing deck where the crane has been installed was removed and replaced with a reinforced, cast-in-place concrete deck capable of supporting the crane's weight plus the 7-ton carrying load in wind conditions up to 25 mph. Three 1500-watt quartz lights have been installed to illuminate the crane.

Unsuitable Sediment Disposal – Alternative A

Alternative A of the proposed Pier 3 replacement includes the disposal of sediment unsuitable for disposal at the in-water disposal site (HARS) and this material would be transported to an approved upland location. In order to move the sediments once they have been transported to an upland (shoreside) location, the sediment must be de-watered sufficiently to allow further movement via truck and/or rail. It is anticipated that the initial movement of this material – from the dredging site – to an upland facility would be by barges but following dewatering, it is expected that the sediments would be transported to their end use to via truck and/or rail. If all the material to be disposed of at an upland location under Alternative A, were to be transported by truck to an end user (such as a landfill) following dewatering, approximately 15,000 round-trip truck-trips would be necessary. However, it is assumed that additional noise and air emissions and traffic congestion resulting from such material handling are possible cumulative impacts of Alternative A.

Future Maintenance Dredging

Following the construction of the Alternative A, dredge depth at all berths (Piers 3 and 4), the turning basin, and the terminal channel will be maintained at –13.7 m (-45 ft) MLW. Given the frequency of maintenance dredging conducted at the Station, it is anticipated that future maintenance dredging would occur in about five to seven years. After the removal of Pier 2, future maintenance dredging area will be reduced as approximately 10.6 ha (26.3 ac) of Bay bottom around Pier 2 would be allowed to return to depths more typical of the Bay environment.

Any cumulative impact of these past, present and future actions would largely be a result of the continuing need to dredge the pier berths, turning basin and entrance channel to maintain the required operating depth for homeported and other ordnance vessels. These periodic maintenance cycles would result in direct impacts to the benthic community within the dredged area and at the HARS if this site was used for the disposal of dredged material. However, these periodic events are expected to cause only temporary and reversible impacts to the benthic communities.

Sediments not suitable for disposal at the HARS would be transported to an approved upland facility using barges and trucks/rail as appropriate. Impacts associated with the ultimate disposal of this dredged material are considered cumulative impacts of Alternative A.

Section 6.0

6.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS AND CONSIDERATIONS THAT OFFSET ADVERSE EFFECTS

The primary short-term unavoidable, adverse effects on the environment resulting from implementation of the proposed action are the effects of the removal and disposal of approximately 405,000 m^3 (530,000 yd^3) of dredged material. Dredging would cause increased levels of suspended solids and turbidity in the vicinity of dredging (at the pier complex and in the Bay) and the HARS disposal area off the New Jersey coast (for the disposal of clean sediments). Dredging would also disrupt the benthic communities at the dredging site and the disposal area. These impacts would be temporary and the effects should disappear rapidly following completion of dredging activities.

Removal of contaminated sediments from the Bay environment would offset these impacts. Approximately 236,000 m^3 (308,000 yd^3) of sediments containing PCBs would be dredged and disposed of at an approved upland disposal site. Also, the proposed action would ultimately remove Pier 2, thereby reducing the area to be maintained for ship access by about 10.6 ha (26.3 ac). Water depths in this formerly dredged area would be allowed to return to depths more typical of the Bay environment. Removal of Pier 2 and Trestle 2 would also remove the shading effect of the pier decking from approximately 1.6 ha (4 ac) of Bay water.

The removal of the existing piers and trestles would also include the removal of the 14,000 creosoted-timber piles that would be disposed of at an approved facility. The new pier and trestle would be constructed using steel piles. The concrete decking from the piers and trestles would be used to create artificial reefs off the New Jersey shore under the state's artificial reef program.

The removal of Piers 2 and 3, which are eligible for listing on the NRHP, would constitute an adverse and unavoidable effect to these historic properties. The Navy and the SHPO have entered into a MOA identifying the appropriate mitigation for this action.

Section 7.0

7.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The replacement of Pier 3 and Trestle 3 and the subsequent removal of Pier 2 and Trestle 2, will reduce operations and maintenance costs by reducing the number of piers and the berthing areas to be maintained, thereby providing NWS Earle with a modern ship berthing and ordnance handling facility that would produce long-term gains in operational readiness. Construction activities would result in economic benefit to the region through increased, although temporary, construction employment.

Construction activities would create short-term, minor impacts to the local environment. Future productivity of the benthic communities may be slightly reduced due to the deepening of the berthing areas, although as the berthing areas are regularly maintained (dredged), benthic communities in these dredged areas may be limited. With the removal of Pier 2, future maintenance dredging will be substantially reduced. Other impacts would include increased noise levels due to the operation of construction equipment; increased air emissions due to the operation of construction equipment; and a potential increase in particulate emissions due to fugitive dust.

The expected increase in noise levels from the operation of construction equipment would be small and temporary in nature because of the distant locations of sensitive noise receptors in relation to the project activities that will be undertaken.

The expected temporary increase in vehicle air emissions resulting from the operation of construction equipment would be negligible. Emissions associated with construction are well below the *de minimus* levels set under the GCR. The potential increase in particulate emissions due to fugitive dust would be mitigated or avoided with the use of BMPs for dust control.

Section 8.0

8.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The proposed replacement of Pier 3 and Trestle 3, the demolition of Pier 2 and Trestle 2, the required dredging and the subsequent operation and maintenance activities of the pier complex, would require a commitment of various resources. Nonrenewable resources include the commitment of labor, capitol, energy, construction materials and biological resources. Since the reuse of these resources is generally not possible, these resources would be considered irreversible and irretrievably committed to the development of the proposed action.

Commitment of these resources to the proposed action would preclude their use for other actions/uses. The length of the commitment for the use of that portion of Sandy Hook Bay dedicated to the proposed action is dependent on the life of the facility, but more importantly, the needs of the Department of the Navy to operate and maintain the ship berth facility. While the pier complex could ultimately be removed, the permanent nature of the proposed action would indicate that this commitment is long-term.

Section 9.0

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Section 10.0

10.0 LIST OF PREPARERS

This document was prepared under the direction of:

A. Nancy Kuntzleman
Project Manager
Department of the Navy
Engineering Field Activity Northeast
Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113-2090

The following personnel employed at NWS Earle aided in the preparation of this EA:

John Mahoney	Director Public Works Engineering
James Santry	Public Works Engineer

LOCATION INFORMATION

The prime contractor for the management and preparation of this EA is:

Maguire Group Inc.
One Court Street
New Britain, CT 06051

The following individuals are the principal preparers of this EA:

Name	Professional Background
Robert H. Wardwell, AICP	Project Director Vice President, 29 years experience in NEPA documentation
Anthony J. Zemba	Senior Environmental Scientist 16 years experience in habitat assessment, wetlands, wildlife, site contamination, environmental impact assessment, essential fish habitat
Neil Pade	Senior Environmental Planner 9 years experience in environmental impact evaluation, water resources engineering, air and noise studies

Erika Fuery	Environmental Scientist 5 years experience in hazardous and solid waste management, GIS
Nancy Shea, AICP	Technical Editor 21 years experience in environmental documents and regulatory compliance
Kathleen E. Hall	Environmental Planner 6 years experience in environmental documents, regulatory compliance, community issues and socioeconomics
Gregg Rotundo	Environmental Technician 3 years experience in GIS design, GPS, and advanced graphic techniques
Melissa Maxwell	Intern Internet Data Retrieval

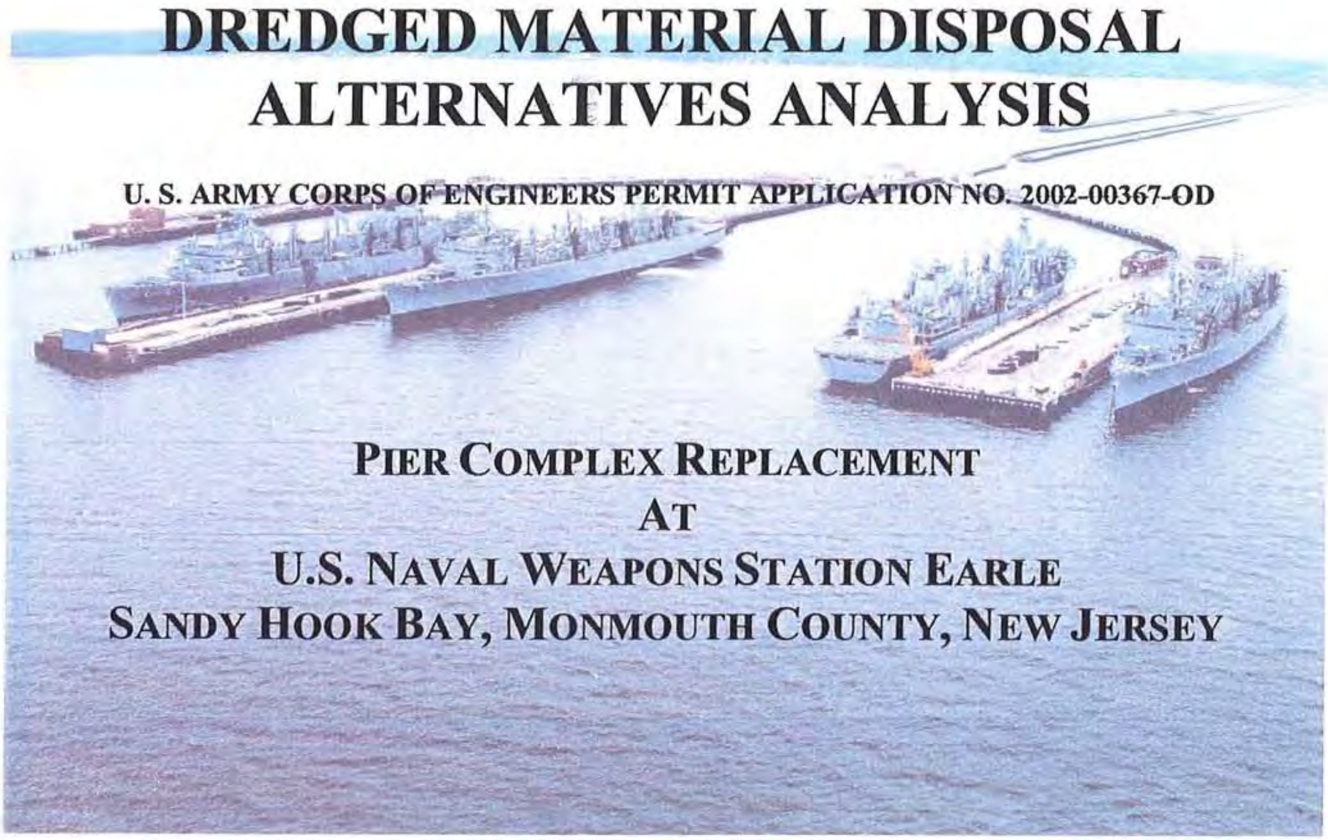
Sub-consultants:

Applied Science Associates, Inc.
70 Dean Knuass Drive
Narragansett, RI 02882-1143

Aqua Survey, Inc.
499 Point Breeze Rd.
Flemington, NJ 08822

Battelle
397 Washington Street
Duxbury, MA 02332

Appendix “A”



DREDGED MATERIAL DISPOSAL ALTERNATIVES ANALYSIS

U. S. ARMY CORPS OF ENGINEERS PERMIT APPLICATION NO. 2002-00367-OD

PIER COMPLEX REPLACEMENT AT U.S. NAVAL WEAPONS STATION EARLE SANDY HOOK BAY, MONMOUTH COUNTY, NEW JERSEY

DEPARTMENT OF THE NAVY
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DEPARTMENT OF THE NAVY
Commander US Atlantic Fleet

APRIL 2004

PREPARED BY:

MAGUIRE GROUP

EXECUTIVE SUMMARY

This Dredged Material Disposal Alternatives Analysis has been prepared for the United States Navy (Navy) pursuant to the 1972 Marine Protection, Research and Sanctuaries Act (MPRSA) for dredging activities associated with the proposed replacement of Pier 3 at the Naval Weapons Station (NWS) Earle pier complex (Figure 1-2). NWS Earle is a weapons storage and handling facility of the United States Atlantic Fleet. It has provided ammunition supplies to almost every class of vessel operated by the Navy and Coast Guard as well as commercially owned vessels from a multitude of nations since World War II. The purpose for the proposed action is to provide an adequate and efficient facility to satisfy the NWS Earle mission of providing four homeport services berths for Auxiliary-Oil-Explosive (AOE) class ships. The project will replace Pier 3, along with Trestle 3, with new structures similar to existing Pier 4. The proposed action will also upgrade Pier 2 for temporary use during the demolition and re-construction of Pier 3. Also included in the proposed action is the deepening of the Pier 3 berthing area to -13.7 meters (m) (-45 feet [ft]) mean low water (MLW) plus .6 m (2 ft) overdredge. The project area is located in Sandy Hook Bay, NJ (Figure 1-1). Historically, dredged material generated from NWS Earle has been disposed of at the former Mud Dump (MD). The dredging associated with the replacement of Pier 3 would generate an estimated 432,000 cubic meters (m^3) (565,000 cubic yards [yd^3]) of sediment and is proposed to begin in 2004. The majority of the dredged material generated from this project is unsuitable for ocean disposal and therefore must be disposed of in the upland environment. Dredged sediment suitable for ocean disposal will be placed at the Historic Area Remediation Site (HARS) located in the New York Bight Apex (the Bight) approximately 9.6 kilometers (km) (6 miles [mi]) east of Sandy Hook, NJ and 17.7 km (11 mi) south of Rockaway, NY.

Alternatives Considered

Several disposal alternatives were investigated during the preparation of this Dredged Material Disposal Alternatives Analysis. These disposal alternatives included ocean, nearshore and upland disposal options. The majority of the ocean and nearshore disposal alternatives had considerable associated construction and engineering costs and were not economically feasible when compared to other disposal options. Treatment technologies were also evaluated and deemed not to be economically feasible based on associated transport dewatering and handling costs.

Preferred Alternative

The preferred disposal alternative for the fraction of dredged material from NWS Earle that is not suitable for ocean disposal would be to use it in upland remediation projects provided the material meets all the criteria necessary for the upland application. It should be noted that substantial augmentation may be required in order for the material to meet the criteria necessary for upland application in a fill/remediation project. Augmentation may result in volumetric increases and would require increased material handling. These factors have the potential to increase the disposal costs to the point where they are no longer economically feasible. Should the material be deemed unsuitable for upland remediation projects and require substantial augmentation, it may be more cost effective to deliver the material to an upland processing facility for disposal. Any fraction of the material deemed suitable for ocean disposal would be disposed of at the HARS.

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LIST OF ACRONYMS USED IN TEXT

ac	Acres
ACOE	United States Army Corps of Engineers
AOE	Auxiliary-Oil-Explosive
BCD	Base Catalyzed Decomposition
BLS	Bureau of Labor Statistics
C	Celsius
CAD	Confined Aquatic Disposal
COAST	Clean Ocean and Shore Trust
CDF	Confined Disposal Facility
CET	Clean Earth Technologies
CFR	Code of Federal Regulations
cm	centimeter
CTI	Consolidated Technologies Incorporated
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
DEP	Department of Environmental Protection
DMMA	Dredged Material Management Areas
DMMP	Dredged Material Management Plan
DOD	Department of Defense
DOT	Department of Transportation
DSW	Discharge to Surface Water
EDTA	Edetic Acid
EIC	Excellence In Construction
EIS	Environmental Impact Statement
EIX	Electrochemical Ion Exchange
F	Fahrenheit
FEIS	Final Environmental Impact Statement
ft	feet
h	hour
ha	hectares
HARS	Historic Area Remediation Site
HEP	Harbor Estuary Program
in	inches
IRP	Installation Restoration Program
km	kilometer
LLC	Limited Liability Corporation
m	meter
m^2	square meters
m^3	cubic meters
MBS	Molecular Bonding System
mi	mile

mm	millimeter
MCRC	Monmouth County Reclamation Center
MD	Mud Dump
MLW	Mean Low Water
MPRSA	Marine Protection, Research and Sanctuaries Act
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJMC	New Jersey Meadowlands Commission
NJPDES	New Jersey Pollutant Discharge Elimination System
NPL	National Priorities List
NRPA	Natural Resources Protection Association
NWS	Naval Weapons Station
NY	New York
NYD	New York District
OENJ	Orion-Elizabeth, New Jersey
OMR	Office of Maritime Resources
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
REACH IT	Remediation and Characterization Innovative Technologies
RIRRC	Rhode Island Resource Recovery Corporation
SET	Solvated Electron Technology
SME	Silica Micro Encapsulation
TCLP	Toxicity Characteristics Leachate procedure
TPH	Total Petroleum Hydrocarbons
USDN	United States Department of the Navy
USEPA	United States Environmental Protection Agency
WQC	Water Quality Certificate
yd	yard
yd^3	cubic yard

1.0 INTRODUCTION

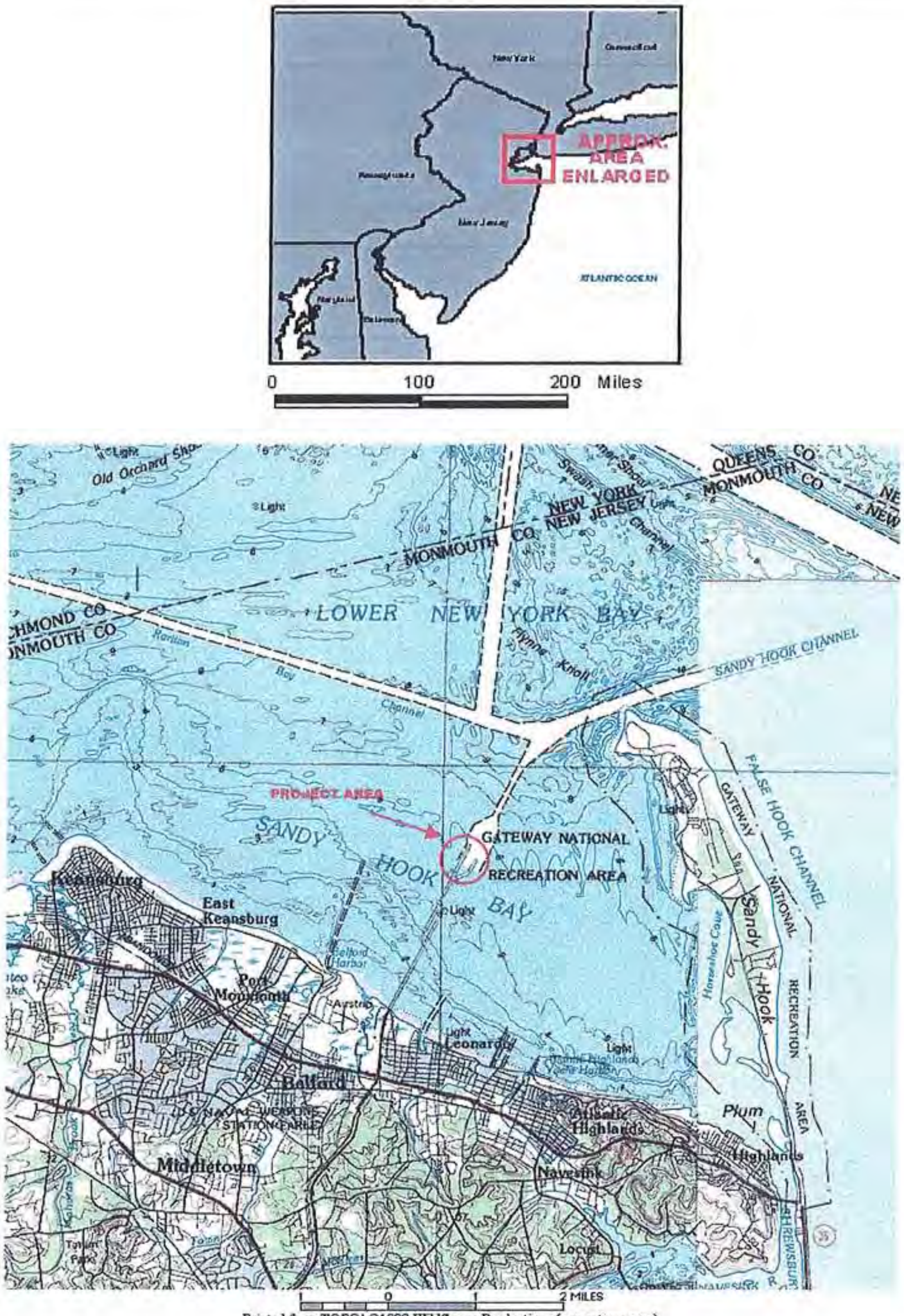
This Dredged Material Disposal Alternatives Analysis has been prepared for the United States Navy (Navy) pursuant to the 1972 Marine Protection, Research and Sanctuaries Act (MPRSA) for the proposed dredging associated with the replacement of Pier 3 to be conducted at the Naval Weapons Station Earle (NWS Earle) pier complex (project area) located in Sandy Hook Bay, NJ (Figures 1-1 and 1-2) The planned dredging at Pier 3 would generate an estimated 432,000 cubic meters (m^3) (565,000 cubic yards [yd^3]) of sediment. The dredged material from this project that is suitable for ocean disposal will be placed at the Historic Area Remediation Site (HARS) located in the New York Bight Apex (the Bight) approximately 9.6 kilometers (km) (6 miles [mi]) east of Sandy Hook, NJ and 17.7 km (11 mi) south of Rockaway, NY. The remainder of the dredged material will be disposed of at an approved upland facility. It is estimated that approximately 159,000 m^3 (208,000 yd^3) may be suitable for ocean disposal. This Dredged Material Disposal Alternatives Analysis presents the alternatives for the disposal or management of the dredged material removed from NWS Earle that is unsuitable for ocean disposal, as well as a comparative assessment of the environmental impacts and costs of each alternative.

1.1 PROJECT DESCRIPTION, PURPOSE AND NEED

NWS Earle is a weapons storage and handling facility of the United States Atlantic Fleet. It has provided ammunition services to almost every class of vessel operated by the Navy and Coast Guard as well as commercially owned vessels from a multitude of nations since World War II. Currently, four Auxiliary-Oil-Explosive (AOE) ships are homeported at NWS Earle and are berthed at the pier complex located in Sandy Hook Bay, NJ.

Pier 3 is one of three pier and trestle facilities at NWS Earle and was built in the early to mid 1940s. The pier consists of a reinforced concrete deck supported by timber piles . The pier is in need of replacement due to its deteriorated structural condition. The wood piles, which provide the structural support for the pier, have been weakened as a result of the activities of marine wood-boring organisms. This degradation has resulted in a safety concern that necessitates the replacement of the pier. In addition, the water depth at Pier 3 limits the loading capacity of the AOE ships docked there. In order to fully load AOE ships, the Pier 3 berths must be deepened from -10.7 m (-35 ft) to -13.7 m (-45 ft) mean low water (MLW).

The purpose of the proposed action is to provide an adequate and efficient facility to satisfy the NWS Earle mission of providing four homeport services berths for AOE class ships. The project is proposed to begin in the summer of 2004.



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NWS EARLE
DREDGED MATERIAL DISPOSAL ALTERNATIVES ANALYSIS
PIER COMPLEX REPLACEMENT

N

Figure 1-1 - Project Location Map

Figure 1-2. View of NWS Earle Pier Complex Looking Southeast into Sandy Hook Bay
Source: NWS Earle Engineering Dept., c.1990.

1.2 AUTHORITY

The United States Army Corps of Engineers (ACOE) has authority over dredging activities conducted in navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Act of 1899. Disposal of dredged material in ocean waters is regulated by the ACOE and the United States Environmental Agency (EPA) pursuant to the MPRSA. Dredged material may be disposed of in ocean waters only at sites designated by the EPA, with permits issued by the ACOE pursuant to Section 103 of the MSRPA. The State of New Jersey has discretionary authority to review disposal activities at ocean disposal sites pursuant to the federal Coastal Zone Management Act (CZMA). The review of proposed disposal operations at currently designated ocean disposal sites is coordinated with the ACOE and the EPA. In inland waters, any dredged material disposal/management/use alternative which results in the placement of dredged material into navigable waters of the United States requires a Clean Water Act (CWA) Section 404 permit from the ACOE.

Authority for the permitting of effluent discharge resulting from dewatering dredged material to surface waters of the state is in Section 401 of the federal CWA. In New Jersey, dredged material dewatering effluent returning to the same water body from which the material was originally dredged requires a water quality certificate (WQC). This WQC will have discharge conditions similar, if not identical, to those that would be found in a New Jersey Pollutant Discharge Elimination System – Discharge to Surface Water (NJPDES-DSW) permit. A NJPDES permit is required for discharges from materials dredged from single or multiple sites located in a different surface water body, or from "unidentified" sites (NJDEP, 1997).

2.0 UPLAND DISPOSAL SYSTEM COSTS

Marine sediment treatment, dewatering and upland disposal are often components of a single logistical system for the handling/disposal of dredged materials. Depending on the characteristics and composition of the sediment, dredged material may be subject to handling, storage, and transport a number of times before its ultimate disposal or use in the upland environment. Note, upland disposal costs addressed in this section assume all dredge sediment is disposed at an upland facility.

2.1 DEWATERING

In order to implement any upland disposal alternative, a site with adequate area to process and dewater the dredged material is required. A dewatering site (or sites) is (are) necessary to provide an area to reduce the moisture content of the dredged material, allowing it to be handled, processed and transferred to an upland site for final disposal or reuse. The dewatering of dredged material involves delivering the material via barge or hydraulic methods to a shoreside staging area. The barge or the shoreside staging area could serve as a dewatering site, or watertight trucks or rail cars could transfer the material to either an inland dewatering area or directly to a confined disposal facility (CDF) or other disposal site (Maguire, 2000).

In order to dewater the sediment at an upland or shoreside location, suitable land area must be available to accommodate the material. Ideally, this area should be: large enough to contain the entire dredge quantity; located adjacent to Raritan/Sandy Hook Bay and accessible by crane-mounted barge and; located outside of inland wetlands. In addition, the land would have to be available for lease or purchase by the Navy for this purpose. Because dredged material contains a high water content, the dewatering process could take months or even years, depending on the stockpiling height and environmental conditions.

2.1.1 Dewatering Process

The process to prepare dredged material for final upland disposal or reuse involves the following primary site functions: off-loading; material screening; lime treatment; soil amendment; and transfer to disposal/reuse site. As illustrated in Figure 2-1 dredged material first leaves the barge for storage, dewatering and/or treatment at a shoreside location.

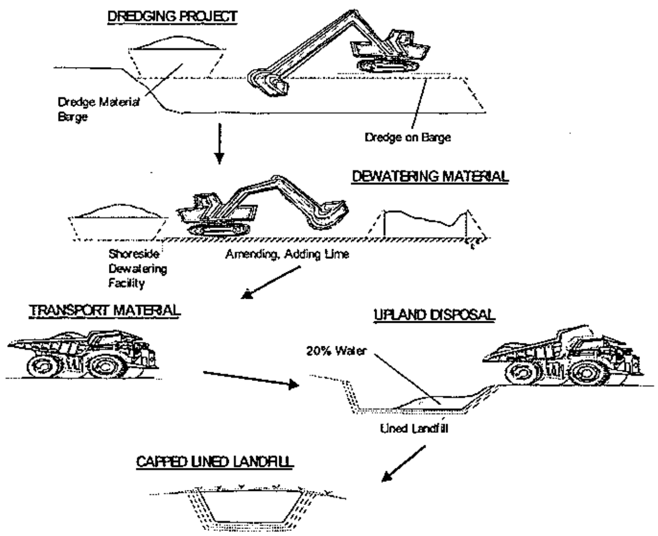


Figure 2-1 - Relationship of Treatment, Dewatering, and Upland Disposal.

Offloading the dredged material requires that the barge be tied to a pier or seawall along the shorefront. Either front-end loaders or cranes are used to unload the dredged material from the barge and place it on the site or in dump trucks or rail cars, which move the material to a specific location on or near the site. If the dredged material has a high water content, watertight crane buckets and dump trucks/rail cars may be required to minimize the uncontrolled discharge of seawater and suspended sediment.

The piers at NWS Earle are unsuitable for the offloading of the dredged material because such an activity would conflict with facility operations and pose a substantial security threat. As a result, the material must be offloaded elsewhere.

Material screening is often required to screen out large pieces of debris, such as piling fragments, fishing gear, and other debris typically encountered in an urban harbor environment. This material must be removed from the dredged material and disposed of separately, and in accordance with state and federal regulations.

Lime treatment is often required to reduce the moisture content of the dredged material and to control odors. Dredged material with a high organic content has often undergone long-term anaerobic decomposition in the marine environment. Anaerobic decomposition results in the production of strong sulfur odor that may be controlled via lime additions to the dredged material. Lime treatment also results in a material that is easier to handle and spread.

Soil amendment of the dredged material is often required to produce a final product that is suitable for various end uses. Dredged material is typically fine-grained, silty material.

Mixing or amending dredged materials with coarser material such as sand improves the workability of the material. Soil amendment is typically done at the dewatering site.

Transport of the dredged material to the final disposal or reuse site is required. Truck transport is the most common method. Water transport via barge or alternative land transport such as rail is also possible but less common. Space must be available within the dewatering site to allow for the loading of transport vehicles. All material must also meet state Department of Transportation (DOT) guidelines for overland transport for each state the material is transported through.

Ideally, the performance of all the above functions is conducted at one dewatering site, minimizing the number of times the material is handled and reducing overall costs (Maguire, 2000).

2.1.2 Dewatering Technologies

Dewatering technologies are used to reduce the amount of water in dredged material and to prepare the dredged material for further treatment or disposal. The need for dewatering is determined by the water requirements or limitations of the treatment or disposal technologies and the solids content of the dredged material following removal and transport.

Mechanically dredged material typically has a solids content comparable to that of the *in situ* sediments (about 50 percent by weight for most fine-grained sediments). To prepare dredged material for most treatment or disposal technologies, water must be removed and/or the solids content of the sediments must be made more uniform. Dewatering is required for most dredged material treatment technologies. The dewatering requirements of mechanically dredged and transported material are typically less than those for hydraulically dredged or transported material (EPA, 1994).

Another function performed by dewatering is the reduction of the volume and weight of the dredged material, which decreases the subsequent costs of its handling, transport, and treatment and/or disposal. Dewatering will reduce the weight of a dredged material load, but the effects of dewatering on the volume of a dredged material load are more complex. When a hydraulically dredged or transported material (slurry) is dewatered, the removal of free water will directly reduce the volume of material remaining in a nearly one-to-one relationship. Sediments that have been partially dewatered or mechanically dredged will lose additional water, but the volume will not always be reduced because the water driven from the voids between sediment particles is replaced by air. Some dewatering processes may even increase the volume of the sediments. In addition, the water removed during dewatering may be contaminated and require further treatment (EPA, 1994).

Three general types of dewatering technologies are discussed in the following sections:

- Passive dewatering technologies
- Mechanical dewatering technologies

- Active evaporative technologies

2.1.2.1 Passive Dewatering Technologies

For this analysis, the term "passive dewatering" refers to those dewatering techniques that rely on natural evaporation and drainage to remove moisture. Drainage may occur by gravity or may be assisted (e.g., using vacuum pumps). Some mechanical movement of the sediments, such as the reworking of the material with heavy machinery, may also take place (EPA, 1994).

Dewatering of dredged material has traditionally been accomplished through the use of temporary holding/re-handling facilities, tanks, and lagoons using design principles similar to those developed for CDFs (Section 3.3.1.3). This method of dewatering relies on primary settling, surface drainage, consolidation, and evaporation. However, the dewatering and consolidation process can be accelerated through the use of drying agents such as Speedi-dry™, subsurface drainage mechanisms and wick (vertical strip) drains. The major advantage of passive dewatering is that the process is less labor intensive than the other dewatering techniques discussed in this section. However passive dewatering also requires substantial amounts of land; is most effective if the dredged material can be spread out in thin layers; and is weather dependent. In addition, the use of drying agents, such as Speedi-dry™, to accelerate the drying process can result in substantial increases in material volume and subsequent disposal costs (EPA, 1994).

Surface Drainage-- Surface drainage dewatering (decanting) is typically accomplished by depositing the dredged material either in scows (in-vessel dewatering) or in temporary settling basins and removing the surface water once the material has settled. Surface water is drained to a discharge point(s), which may include overflow weirs, filter cells, or pump control structures. Another method is to construct the settling basins of concrete construction blocks covered with filter fabric. Water drains through the filter fabric while the suspended sediments become trapped. Drainage water includes both the water in the dredged sediment and rainfall runoff and may require additional treatment before it can be discharged (EPA, 1994).

Evaporative Drying-- This method of dewatering is actually a two-stage process. The first stage involves the use surface drainage dewatering techniques to remove all free-standing water from the surface of the dredged material. The second stage of involves the natural evaporation of water from the dredged material until a crust forms over its surface. After crust formation, the dredged material is typically reworked and the process is repeated until the dredged material achieves the desired consistency for treatment, transport or disposal. The thickness of the crust and rate of evaporative drying and consolidation are dependent on local conditions and sediment properties (EPA, 1994).

Subsurface Drainage--A subsurface drainage system can be used for the dewatering of dredged material and/or leachate collection. One method is to place perforated pipes under or around the perimeter of the dewatering area that drain into a series of sumps from which water is withdrawn. The pipes can be placed in a thin layer or in trenches. Subsurface drainage may not be suitable for dewatering large quantities of fine-grained dredged material because the material may clog the drainage system. Drainage water includes both the water in the dredged sediment and rainfall runoff and may require additional treatment before it can be discharged (EPA, 1994).

Several variations of subsurface drainage systems exist, including the gravity underdrain system described above as well as vacuum-assisted underdrain systems. The gravity underdrain system provides drainage at the base of the dredged material by the gravity-induced downward flow of water. The vacuum-assisted underdrain is the same as the gravity-fed system, but uses an induced partial vacuum in the underdrainage layer. The vacuum induction greatly accelerates the dewatering process but requires considerable maintenance and supervision (EPA, 1994).

Wick Drains--Wick drains or "wicks" are polymeric vertical strips that provide a conduit for upward transport of pore water, which is under pressure from the overlying weight of the material. By placing the vertical strips on 1.5-m (5-ft) centers, both radial and vertical drainage are promoted (EPA, 1994).

2.1.2.2 Mechanical Dewatering Technologies

Mechanical dewatering requires the input of energy to squeeze, press, or draw water from the feed material and is most widely used for conditioning municipal and industrial sludges and slurries, as well as mineral processing applications. Most mechanical dewatering processes increase the solids content of the feed material to a level comparable to that of the *in situ* sediment deposits (about 50 percent solids). Mechanical dewatering processes work best with homogeneous waste streams at a constant flow rate. The features and requirements of six mechanical dewatering processes are summarized in Table 2-1. The performance of a mechanical dewatering system is measured by a number of parameters, including:

- Chemical conditioning dosage, measured as the mass of conditioner (lime) per mass of dry solids
- Solids capture, defined as the dry mass of dewatered solids per dry mass of solids fed into the process
- Solids content of the dewatered material

A high solids capture is desirable, because solids lost from the process (i.e., in the filtrate or centrate) represent a route for contaminant loss. Some particulate loss during mechanical dewatering is inevitable; therefore, the effluent stream may need to be treated (EPA, 1994).

Table 2-1
Mechanical Dewatering Technologies and Requirements

Belt Filter Press	Uses single or double moving belts to dewater material. With double moving belt, upper belt operates as the press belt and the lower belt operates as the filter belt. A flocculant is injected to condition the solids in a mix tank positioned in front of the belt filter. Dewatering occurs in three stages: 1) gravity drainage of free water, 2) low-pressure compression, and 3) high-pressure compression and shear; the dewatered solids are discharges from the high-pressure zone. Important operational variables include: belt speed, feed concentration, conditioner type and dosage, belt characteristics (type, tension), and washwater flow.
Recessed Plate Filter	Uses rigid, individual filtration chambers operated in parallel under high pressure Consists of parallel vertical plates placed in a series and covered on both sides with replaceable fabric filters; slurry is pumped under pressure into the press and passes through feed pores in trays that lie along the length; water flows through the filter media while solids form a cake on the filters surface; when dewatering ceases, the filter press is opened and individual vertical plates are removed sequentially over a gap allowing the caked solids to fall off; after the cake is removed, the plates are pushed back into place and the press is closed for the next dewatering cycle. Important operational variables include: feed pressure, filtration time, conditioner type and dosage, use of precoat, and type of filter cloth.
Diaphragm Plate Filter	Similar to recessed plate filter, except that an inflatable diaphragm is incorporated into the design; at the end of the pumping cycle additional pressure is applied to the diaphragm for improved dewatering. Percent solids usually 5-8% higher that a conventional filter press. Important operational variables include: diaphragm and feed material pressures, conditioner type and dosage, filtration and diaphragm squeezing times, and type of filter cloth.
Vacuum Filter	Continuous process with self-cleaning filter media consists of a rotating cylindrical drum mounted horizontally and partially submerged in a trough containing a slurry; the drum, covered by fabric or wire mesh, allows moist solids to adhere via negative pressure from a vacuum supply; water flows through the filter into the center of the drum and exits the unit for further treatment or disposal; solids are scraped off the drum as it rotates. Important operational variables include: Drum submergence, drum speed/cycle time, solids content in feed material, wash water quantity, conditioners, and filter media used.
Centri-fugation	Uses rapid rotation of a fluid mixture inside a rigid vessel to separate the components based on their mass. Centrifuges are generally used in conjunction with flocculants and can be used to dewater or concentrate dredged material ranging in decreasing size from fine gravel to silt; incorporation of a paper cloth filter in the centrifuge or the injection of flocculants improves the recovery and removal efficiencies. Important operational variables include: rotation speed, pool depth, conditioner dosage and point of addition.
Gravity Thickening	Operates on differences in specific gravity between solids and water to accomplish separation; an effluent with a reduced concentration of suspended solids is produced and removed while a thickened mass of solids remains in a smaller slurry volume. Gravity thickening usually occurs in a circular vessel constructed of concrete or steel designed similarly to a conventional clarifier; slurry is pumped into a feed well and allowed to thicken via gravity settling; clarified liquid overflows an effluent weir and leaves through an effluent pipe, while the concentrated material is raked to the center of the vessel and discharges by gravity or pumping. Important operational parameters include: conditioner dosage and overflow rates.

SOURCE: EPA, 1994)

The major advantage of mechanical dewatering is the substantially accelerated drying rate that results in a much smaller land requirement for the establishment of the dewatering site. However, mechanical dewatering requires increased handling and processing of the dredged material that can be costly. Materials to be placed in a mechanical dewatering device must first be screened more finely to prevent damage to the machine. This option is most feasible when time is limited and there are adequate funds for processing the material. In addition, wastewater may need to be collected and treated before it can be discharged (EPA, 1994).

2.1.2.3 Active Evaporative Technologies

Active evaporative technologies are different from the evaporative drying techniques in that artificial energy sources are used to heat the sediments, as opposed to solar radiation. Evaporation is the most expensive dewatering technology, but has been effectively used to prepare municipal sludge for incineration or for sale as fertilizer (Dick, 1972). Nearly all of the water is removed, resulting in a solids content of about 90 percent. Technologies applied to sludge that may be applicable to fine-grained dredged material include:

- Flash dryers
- Rotary dryers
- Modified multiple hearth furnaces
- Heated auger dryers

Evaporative dewatering technologies have only been demonstrated with dredged material on bench, pilot and field scales and were typically used in conjunction with mechanical dewatering techniques. Additives were also used during the process to promote drying and to stabilize and solidify contaminants in the dredged material. As a result, most of the design and operating experience and guidance on these technologies are from municipal and industrial wastewater applications (EPA, 1994). Since active evaporative technologies have not been proven as an effective method for dewatering large quantities of dredged sediments they are not considered to be a viable dewatering option for NWS Earle.

2.1.3 Dewatering Costs

Dewatering costs are difficult to calculate due to the many variables involved in the process. These variables include but are not limited to; site use costs; engineering requirements of the selected site, size and types of equipment used, size and schedule of work crew; presence, types, concentration and treatment of contaminants; fuel costs and weather. The estimates provided herein should be considered "de minimus" costs for each dewatering scenario presented under each of the described conditions.

Seasonal dredging restrictions imposed to protect fish and shellfish spawning require dredging to be completed within specific time frames or be spread out over multiple years. Based on the preliminary design, dredging would be conducted in two seasons with dredging under the pier occurring early in the construction process and the dredging of the berthing areas occurring toward the end of the pier construction. Historically, the dredge window for NWS Earle is 22 weeks per season. In order to remove 432,000 m^3 (565,000 yd^3) or 273,000 m^3 (357,000 yd^3) of sediment within this timeframe, minimum dredging rates of 246 m^3/hour (h) (322 yd^3/h) and 159 m^3/hour (208 yd^3/h), respectively, must be maintained based on a 5-day/40-hour work week. However, dredging operations would likely continue 24 hr/day, 7-day week with the governing rate factor being the rate at which the upland receiving facility can accept the sediment.

To determine the minimum area required to process dredged material for upland disposal/reuse from a 432,000 m^3 (565,000 yd^3) dredging project, dewatering site logistics and area requirements were investigated. The dewatering site's area requirements include space for: the application of lime to control sulfide reactivity; amendments to improve sediment workability; adequate mixing of materials, lime storage and augmenting material storage, truck scale and wheel wash, effluent capture and storage mechanisms, and; storage capacity for the dewatered material. The following assumption was also made:

2.1.3.1 Passive Dewatering With No Evaporative Drying

Under this scenario, dredged material would be placed in settling basins with either surface or subsurface drainage mechanisms. It is assumed that there will be no mechanical reworking of the dredged material to promote evaporative drying. As a result, the settling basins are designed to accommodate the entire volume of dredged material. It should be noted that expansion of the dredged material may occur during the drying process. Material expansion has the potential to increase the material volume up to 30%.

Passive Dewatering With No Evaporative Drying – Site Area Requirements

A method to calculate a dewatering site area requirement was developed based on a dredging project completed in Rhode Island for Rhode Island Resource Recovery Corporation (RIRRC) (Maguire, 1999). The Rhode Island dewatering site was configured with the following parameters and a similar configuration is assumed for NWS Earle:

- ✓ Settling basins were constructed with 3 m (10 ft) berms with 0.3 m (1 ft) of freeboard (maximum stockpile height = 2.7 m [9 ft])
- ✓ 60 % of the dewatering area was comprised of settling basins
- ✓ 40 % of the dewatering area was used for operations

Using these parameters as constants, a dewatering site area requirement for 432,000 m^3 (565,000 yd^3) project is calculated as follows:

ASSUME: maximum stockpile height = 3 m (9 ft = 3 yards [yd])

Stockpile Area - $\frac{432{,}000 \text{ m}^3}{3 \text{ m}}$ = 144,000 square meters (m^2)

144,000 m^2 =14 hectares (ha) (36 acres [ac])
(60% of dewatering Site)

Site area required* - 14/0.6 = **23 ha (57 ac)**

* Basin dimensions and resulting site area required are calculated to accommodate the entire predicted volume of dredged material and are dependent on the maximum stockpile height. Creating a taller stockpile will reduce the required site area but will increase construction costs.

The total cost for passive dewatering includes the costs associated with constructing and deconstructing the site as well as operational, transport and handling costs. An itemized cost analysis, which includes all of these components under this scenario is presented in Appendix B. The total "de minimus" cost for dewatering 432,000 m^3 (565,000 yd^3) of dredged material under this scenario is calculated to be approximately **$9,100,000** and is dependant on the location of the dewatering/disposal site.

Should 159,000 m^3 (208,000 yd^3) of material be deemed suitable for open water disposal the cost to dewater the remaining 273,000 m^3 (357,000 yd^3) is estimated to be **$5,733,000.**

2.1.3.2 Passive Dewatering With Evaporative Drying

The costs for passive dewatering with evaporative drying were developed from a similar, recently completed dewatering operation at the Tomlinson Bridge in New Haven, Connecticut. For this dewatering operation, 30,582 m^3 (40,000 yd^3) of dredged material was dewatered at a 1 ha (2.25 ac) site. Assuming a direct relationship between material volume and site size, a 14 ha (35 ac) site would be required to dewater 432,000 m^3 (565,000 yd^3) of dredged material and a 9 ha (22 ac) site would be required to dewater the remaining 273,000 m^3 (357,000 yd^3) should 159,000 m^3 (208,000 yd^3) be deemed suitable for ocean disposal.

The site was constructed by installing rip-rap (5-8 centimeters [cm]) (4-6 inches [in]) berms to create a temporary detention basin. The basin was lined with filter fabric and polyethylene sheeting that was then paved over with bituminous material to create a hard and impervious work surface. The dewatering site cost $270,000 to construct in 1994 (Joe Caruso, Site Foreman, personnel communication). According to the U.S. Bureau of Labor Statistics (BLS), this cost translates to $331,033 in today's economy or

\$331,033/ha (\$147,126/acre). Therefore, a similar 14 ha (35 ac) or 9 ha (22 ac) site can be expected to cost \$4,639,000 and \$2,979,000 to construct, respectively.

Watertight, tri-axle dump trucks hauled and deposited the dredged material into the basin where it was constantly worked with heavy machinery to accelerate the drying process. According to site personnel, it took approximately 6-8 weeks to dewater the dredged material in this manner, provided the weather conditions were favorable. No drying or odor control agents were added, however, dust control was necessary. Based on this information, the duration of a dewatering operation for the dredged material from NWS Earle is assumed to continue for a maximum of eight weeks after the last load is delivered each season; a total of 60 weeks. Therefore, assuming a 5-day, 40-hour work-week, the dewatering site would be in operation for a minimum of 300 days.

According to site personnel, the Tomlinson Bridge dewatering site cost \$40,000 to dismantle. Assuming a direct relationship between site size and dismantling costs for a 14 ha (35 ac) or 9 ha (22 ac) site would be expected to cost \$560,000 and \$360,000, respectively, to dismantle.

The total cost for such a dewatering operation is **\$11,673,000** for a 432,000 m^3 (565,000 yd^3) project and **\$8,082,000** for a 273,000 m^3 (357,000 yd^3) project. An itemized cost analysis is contained in Appendix B of this Dredge Material Disposal Analysis.

2.1.3.3 Mechanical Dewatering

It is feasible to dewater dredged material by mechanical means using a pugmill or belt filter press and hydrocyclone. The pugmill dewatering scenario was derived from activities conducted for the Orion Elizabeth New Jersey (OENJ)/Orion project (Jersey Gardens Mall) in Elizabeth, NJ while hydrocyclone/belt filter press scenarios were presented in the Seawolf Submarine Homeporting Final Environmental Impact Statement (FEIS) issued in July of 1995. Mechanical dewatering site area requirements are dependent on the capacity and throughput of the mechanical device(s) being used and the percent solids in the feed material. In addition, the dredged material must be pre-screened/sorted to prevent large pieces of debris from entering the system where they could damage equipment.

Jersey Gardens Mall - For this project, a pugmill was used to process 229 m^3 (300 yd^3) of contaminated dredged material per hour. The pugmill process at the Jersey Garden Mall project was intended to treat and stabilize contaminants in the dredged material, not dewater it (Joe Branco, Excellence In Construction Associates, personal communication). Under most circumstances, using a pugmill to dewater sediments is not economical because of the time and effort involved with setting up a pugmill-processing facility and the associated costs of increased material handling. Pugmill processing facilities can take up to eight months to set up properly and can cost millions of dollars to design, construct and operate, making it cost and time prohibitive for most projects. In addition, because the material entering the pugmill is typically two-thirds water, using the pugmill to augment the material with drying agents will result in an increase in the volume of the material to be disposed, thus increasing overall disposal costs.

Seawolf Submarine Homeporting FEIS - For this project, a hydrocyclone/belt filter press combination was evaluated to dewater contaminated sediments removed from the Thames River. A hydrocyclone separates the coarse grained material (0.01 millimeter [mm] – 2.0mm) from the fines, organics and water. Since contaminants tend to remain with the fine slurry, the coarse grained material would be suitable for upland disposal or reuse. The fine slurry would be dewatered using belt filter presses with the liquid fraction being retained. Both the separated liquid fraction and the dewatered material would then be treated, disposed, or both.

Some advantages of mechanical dewatering over other dewatering techniques is that the contaminated, fine-grained sediments could be separated from the coarse material, potentially reducing the total material volume. In addition, the faster dewatering rate will reduce the area requirements for the dewatering site. Under this scenario, the dredged material would be fed directly from the scow, through a shaker tank, and into the mechanical dewatering machinery. Therefore, the material is only handled once and the only site requirement is the area needed for the dewatering equipment, operating personnel, and storage containers to hold the dried sediment and drained water.

The primary disadvantage of this scenario is the costs associated with procuring all of the necessary equipment and transporting it to the dewatering site. In addition, increased time may be needed to set up and fine-tune the dewatering machinery. Also, if there is no onsite power source, external power sources (gas or diesel powered generators) must be imported to power the machinery leading to increased fuel costs. If stabilizing/solidifying materials such as lime and/or Portland cement are added to promote the drying process and/or control odors, substantial increases in material volume could result. Because of the limited time window in which this work must occur, the dewatering system must also be able to process a minimum of 246 m^3/hour (h) (321 yd^3/h) for a 432,000 m^3 (565,000 yd^3) project or 155 m^3/h (203 yd^3/h) for a 279,000 m^3 (357,000 yd^3) project, inclusive of any delays resulting from mechanical problems or weather.

TRIMAX Residuals, Inc owns a fleet of mobile mechanical dewatering units and was consulted to determine the total costs for mechanical dewatering. TRIMAX systems are unique in that they can dewater directly into trucks, eliminating costs associated with additional handling. It is assumed that a shoreside area with access to electricity will be available to accommodate the mobile mechanical dewatering unit. TRIMAX equipment rentals are per diem, regardless of whether the machinery is in operation, therefore, a 6-day workweek with 24 hour shifts is recommended. According to Greg MacDonald, Director of Business Development, TRIMAX has recently completed a project of similar volume in Dayton, Ohio. The project used 2-3 centrifuges, a screw press and a tri-flow unit to process the material at the required throughput rate of 185 dry tons per day. The cost to mechanically dewater the material was calculated to be $12,500/day. Since the dredging project at NWS Earle is to be completed within two 22-week timeframes, the mechanical dewatering unit would be on site for a total of 308 days plus an additional

$35,000, on average, in mobilization/demobilization costs. As a result the total cost for mechanical dewatering is approximately **$3,880,000-$3,890,000.**

2.1.3.4 In-vessel Dewatering

As previously stated, costs for in-vessel dewatering are associated with procuring additional scows and pushboats. There are two methods of in-vessel dewatering. The first method is to fill the scow with dredged material and let it sit for at least 24-hours or until the sediment settles. The surface water is then decanted off. The second method involves partitioning the rear portion of the scow with concrete blocks covered with filter fabric. The area behind the partition is then filled with gravel and equipped with outflow piping. By filling the ballasts at one end of the scow with water, a permanent pitch can be established. Dredged material is placed in the high end of the scow and the material is allowed to flow against the filter fabric lined partition. The water passes through the fabric while the sediment is retained and excess, filtered water is allowed to drain via the outflow piping. Both methods are designed to reduce the amount of time each scow must be idle and can be used in conjunction with each other.

Minimum daily throughput for this project is 1,964 m^3 (2,568 yd^3) per day for a 432,000 m^3 (565,000 yd^3) project and 1,241 m^3/day (1,623 yd^3/day) for a 273,000 m^3 (357,000 yd^3) project. Therefore, at least six scows and two pushboats would be needed for a 432,000 m^3 (565,000 yd^3) project and at least four scows and two pushboats would be needed for a 273,000 m^3 (357,000 yd^3) project, assuming each scow can hold at least 765 m^3 (1,000 yd^3) and will not sit for more than 24-hours. Additional scows would be necessary during prolonged periods of rain or if a faster throughput is desired. Should the material be brought upland, decanted water may need to be retained pending laboratory analysis. Current labor and equipment rates from a dewatering operation currently operating at the Tomlinson Bridge in New Haven, Connecticut lists 765 m^3 (1,000 yd^3) scows at $200/hr and pushboats at $160/hr. The current rate for pushboat operators is $30/hr. Therefore, the cost of in-vessel dewatering can be calculated as follows:

ASSUME: 5 day; 40 hour work week – no overtime
2 season - 22 week dredge window

432,000 m^3 (565,000 yd^3) project

[($200 x 6)	+ ($160 x 2)	+ ($30 x 2)]	x (1,760)	= **$2,781,000**
hourly rate for 6 scows	hourly rate for 2 pushboats	hourly rate for 2 pushboat operators	work hours in 44 weeks	

273,000 m^3 (357,000 yd^3) project

[($200 x 4)	+ ($160 x 2)	+ ($30 x 2)]	x (1,760)	= **$2,077,000**
hourly rate for 4 scows	hourly rate for 2 pushboats	hourly rate for 2 pushboat operators	work hours in 44 weeks	

It should be noted that equipment prices are specific to each piece of machinery. Actual costs may differ depending on the size, make and model and location of the equipment utilized.

2.1.4 Additional Costs

Additional Barge Transport Costs

Typically, barge transport costs are included with the cost of dredging provided the material is being transported to a nearby shoreside area or ocean dumping site. Since it is feasible to transport this material by barge to ocean dumping sites and treatment facilities outside of the project area (as appropriate), additional transport costs were estimated. Since pushboats are not suitable for transporting barges and scows in open waters and tugboat must be retained for this purpose. According to the 2003 RS Means Guide of Building Construction Cost Data (RS Means, 2003), the estimated cost for a 250 horsepower tugboat and crew is $446/day. Assuming a 5-day/40-hour workweek with no overtime during the two-season, 44-week dredge window, this equipment and crew would need to be retained for 220 days at a cost of approximately **$98,000** per tugboat. It should be noted that cost estimates are equipment specific. Costs will increase if larger or additional machinery is utilized.

3.0 DISPOSAL ALTERNATIVES

The NJDEP manual entitled "The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters" provides an outline of common disposal alternatives for dredged material in New Jersey. Each of the identified alternatives was investigated as a potential option for the disposal of dredged material from NWS Earle and is discussed herein. In addition, during preparation of the Dredged Material Management Plan (DMMP) for the Port of New York (NY) and New Jersey, the New Jersey Office of Maritime Resources (OMR) identified 80 sites (Figure 3-1) that could accept dredged material. Of the listed sites, Sites 1 – 28 were considered as feasible geographic locations because of their close proximity to the proposed project site and as such, were considered further based on capacity and operational status. The remaining sites (Sites 29-80) were considered too distant from the project area to be viable options for disposal due to economic and logistical constraints. Information regarding dredged material processing facilities and additional disposal sites, both currently permitted and pending permitting, was provide by the NJDEP. The results of the disposal alternatives investigation of Sites 1-28 and other additional sites identified by the NJDEP are summarized in Attachment 1 of this Dredge Material Disposal Analysis. Of the 28 sites, those sites determined to have the sufficient capacity to handle the dredged material generated at NWS Earle are discussed further in this section. All disposal alternatives are presented based on the intended disposal environment (upland, aquatic or both).

3.1 UPLAND DISPOSAL

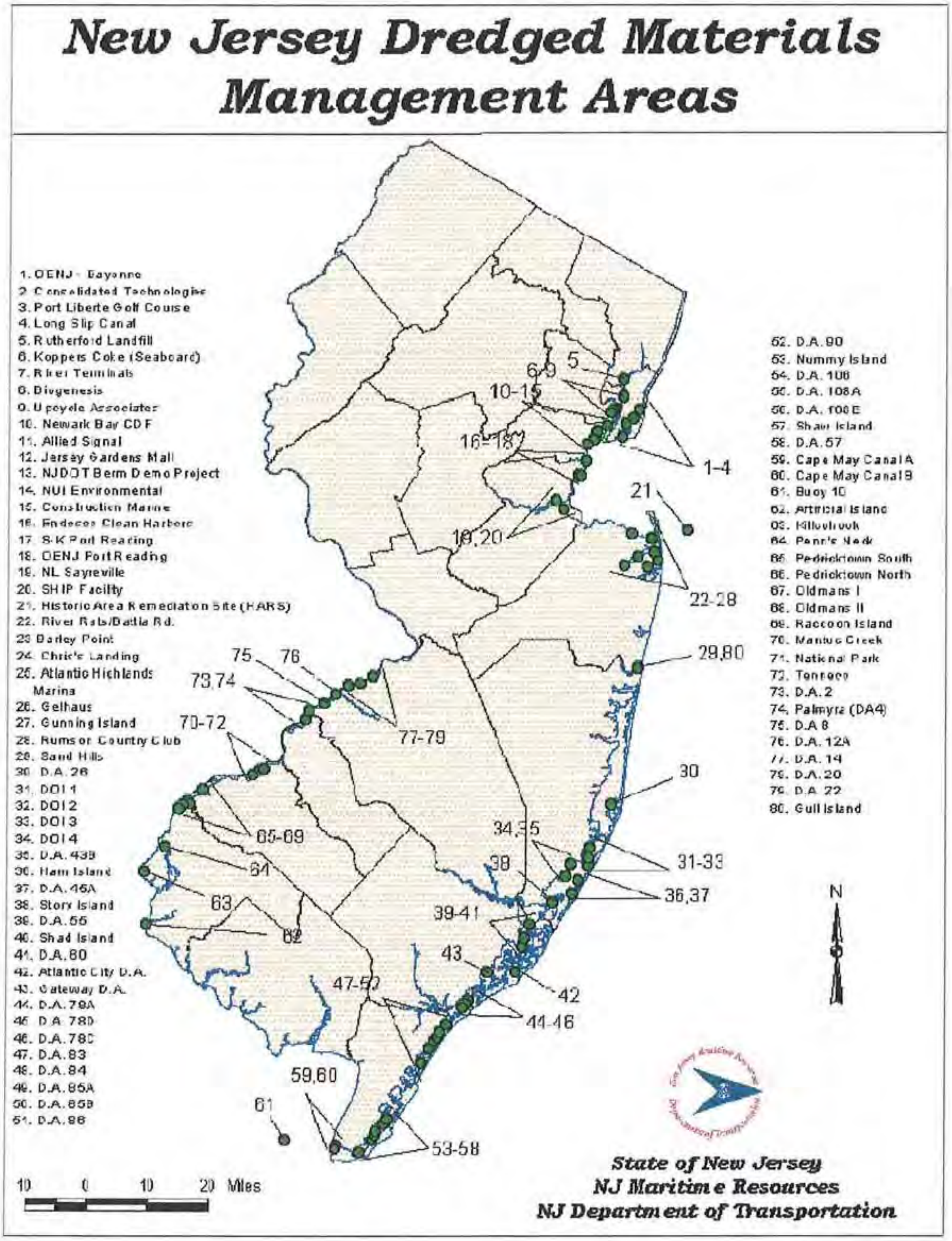
Prior to upland placement, proper characterization of the dredged material is required. Any material of unknown composition must be tested for Resource Conservation and Recovery Act (RCRA) characteristics in accordance with 40 Code of Federal Regulations (CFR) 261. Any material that is determined to be hazardous waste shall be managed and disposed of in accordance with 40 CFR 260-268.

3.1.1 Upland Disposal Site Factors

Upland disposal alternatives involve the placement of the dredged material on land. The land site can be an existing active or inactive landfill, or a raw parcel of land. Siting guidance criteria are outlined in "The Management and Regulation of Dredging Activities and Dredged Materials in New Jersey's Tidal Waters (the Technical Guidance Manual [NJDEP, 1997]). These criteria, which are generally applicable to all upland activities involving dredged material, including beneficial use applications, are summarized as follows:

- The selected site should be in an area of minimal environmental impact;
- The selected site should avoid wetlands, parklands, aquifer recharge/water supply areas, floodplain, coastal erosion areas, threatened/endangered species habitats, and other areas of ecological, recreational, cultural/historic or agricultural significance;

Figure 3-1. New Jersey Dredged Materials Management Areas



- The site should be located on an impermeable substrate, or where soil and groundwater conditions are otherwise amenable to upland facilities;
- The site should be located in a previously developed, non-residential area;
- If the site is contaminated, it should not be contaminated at levels that would preclude disturbance in order to construct and operate upland facilities;
- The site should be selected to ensure ease of implementation, including considerations of site ownership, local zoning, public acceptance, and other socio-economic factors; and,
- The site should be located near potential dredging areas and configured to provide suitable access to a navigable waterway.

The guidance document also provides the following list of site screening criteria:

Site Size. Depending upon potential for redevelopment and the cost of transporting, processing, and utilizing dredged material on-site, minimum size may be as little as 16.2 ha (40 ac). Optimal size is 40.5 ha (100 ac) or more. A golf course, for example, generally requires upwards of 60.7 ha (150 ac). A commercial or industrial facility may require substantially less.

Site Conditions. The site should be free of steep slopes, floodplains, wetlands or other environmental constraints to facilitate the placement of dredged material.

Site Location. Obviously, a site isolated from human activity offers the greatest potential for development without local objection. However, such sites in New Jersey are rare. Thus, the general rule should be that the site is not "environmentally sensitive", is located in a commercial/industrial area, and is substantially removed from residential and recreational activities. Moreover, the site should be relatively close to the source of the dredged material both for economic and public acceptance reasons. Local residents in the vicinity of a site distant from the port areas may not appreciate the significance of port activities and the economic benefit from dredging and disposal activities.

Site Access. The preferred site should be located adjacent to navigable waters. Further enhancements include immediate access to major roads, turnpikes, and interstates, as well as availability of nearby rail facilities. These latter enhancements are particularly important if the site is to be utilized not only for development purposes but also for the re-handling of dredged material for further transport.

Existing Land Use. Obviously, developed land does not lend itself to beneficial use of dredged material unless redevelopment for commercial/industrial uses is planned. Use of developed land will also add to the costs to prepare the site for use and thus may make the project uneconomical. Additionally, land which has been set aside and designated for parkland, recreational area and wildlife management is generally unsuitable. Barren land, abandoned landfills, orphan landfills, and sites requiring remediation are among the most feasible.

Site Configuration. Sites that are narrow, irregularly configured, or do not provide sufficient buffer area between adjacent activities, are generally not feasible and depending on adjacent activities, could result in local opposition.

Zoning. Sites that are currently zoned for commercial and industrial activity are generally the most suitable for beneficial use applications. Preference should be given to sites located in urban enterprise zones and sites subject to the Urban Redevelopment Act.

Landowner Participation. Where a landowner or potentially responsible parties are identified, available and willing, partnerships are feasible and may alter the economics of redevelopment and beneficial use of dredged materials.

Governmental Participation. The support of local, municipal, state government and non-governmental organizations such as improvement authorities, economic development authorities, and others may be key to the funding and local acceptance of a proposed redevelopment/reclamation project utilizing dredged materials (NJ OMR, no date).

3.1.2 Off-Site Upland Disposal Alternatives

3.1.2.1 Landfills

Landfill Disposal

Dredged material may be deposited in a landfill as fill material, however, given the large volume of material to be dredged and the increasing need for landfill space for domestic waste streams, this option is not considered to be a practicable alternative. Dredged material placed on a raw parcel of land could be managed as a landfill and subject to state regulations. However, siting of a new landfill off-base from NWS Earle would be expected to be met with strong opposition in Monmouth County. Furthermore, a site survey of NWS Earle revealed no suitable on-base land space to implement this type of disposal alternative without considerable impacts to the environment and base operations (Section 3.1.3).

Landfill Cover

Dredged material can be used as daily cover or final cover (defined below) for landfills, provided the material meets the physical and chemical specifications for such use. Since landfill operators would otherwise have to purchase soil for daily cover, the acceptance of dredged material for approved applications has been considered an exempt activity pursuant to New Jersey Administrative Code (N.J.A.C). 7:26-1.1 (NJDEP, 1997).

In general, there are three different classifications of cover – daily, intermediate and final. All exposed surfaces of solid waste must be covered at the close of each operating day with a minimum of 15.2 cm (six in) of *daily cover.* Areas outside the immediate landfill working face, which will be exposed for any period exceeding 24 hours, must contain at least 30.5 cm (12 in) of *intermediate cover.* Finally, in compliance with 1993 RCRA amendments, an infiltration layer of at least 45.7 cm (18 in) of earthen material, with a permeability less than or equal to the bottom liner, and an erosion layer of at least 15.2 cm (6 in) of earthen material capable of sustaining plant growth must be provided as part of a *final landfill cover system* (NJDEP, 1997).

There is a need for landfill cover in New Jersey as there are several landfills currently in operation. While the majority are large countywide landfills that utilize large amounts of daily and intermediate cover (NJDEP, 1997) county landfills in New Jersey will not accept material from other counties. As a result, disposal options for landfill cover are extremely limited for this project (County of Monmouth, 2001). The only approved commercial landfill in Monmouth County is the Monmouth County Reclamation Center (MCRC). The dredged sediment from NWS Earle would not be suitable for cover at the MCRC because they use a "bale-fill" operation (Chris Murray, MCRC acting superintendent, personal communication). This type of operation involves baling the refuse in polyethylene and stacking the bales. Bales are covered with clean, free-draining sand to allow vehicles to pass over the bales without damaging the polyethylene bale coverings and to allow rainfall to drain cleanly into landfill sumps. Since the material from NWS Earle contains relatively little sand, this disposal alternative is not considered further.

Transport of dredged material from NWS Earle to most landfills outside of New Jersey is not feasible due to the associated transport and handling costs. However, Waste By Rail does accept barge transported dredged material at its Virginia facility. Prices recently quoted for a smaller dredging project in New London, CT were estimated to be $75 per m^3 ($57 per yd^3) for transport and disposal.

3.1.2.2 Beneficial Use/Reuse

New Jersey solid waste regulations define "beneficial use" as the "use or reuse of material, which would otherwise become solid waste, as landfill cover, aggregate substitute, fuel substitute, or fill material or the use or reuse in a manufacturing process to make a product or as an effective substitute for a commercial product. Beneficial use of a material shall not constitute recycling or disposal of that material." Dredged material can be considered a resource, and the NJDEP strongly supports its reuse, wherever possible, as opposed to exclusive reliance on disposal facilities. Depending on its characteristics, especially grain size, dredged material may be suitable for use in beach nourishment projects, as structural or non-structural fill, as grading material, as landfill cover, in habitat development projects, or to cap open water disposal areas (NJDEP, 1997).

<u>Structural and Nonstructural Fill for Construction/Remediation Projects</u>

Given the various physical/geotechnical requirements for structural and non-structural fill applications, dredged material must be dewatered before it can be used (Section 2.0). In addition, if the dredged material contains a high proportion of fine-grained particles, it would have to be blended with coarser-grained material or otherwise processed/stabilized/amended to form a "product" which would then meet the required engineering specifications (NJDEP, 1997). While development projects typically have the capacity to accept large volumes of dredged material, the costs typically associated with the treatment and transport of the material for use at these sites often makes this reuse alternative less cost effective when compared to other disposal options. Since the material generated from NWS Earle is composed primarily of silt and clay, substantial augmentation and/or a lengthy drying period would be required in order to use it as fill material. Augmentation would substantially increase disposal costs. The following construction/remediation projects have the ability to accept the volume of dredged material from NWS Earle:

Projects in New Jersey

Port Liberté Golf Course

This site is currently in need of material for a large landfill capping project (Josh Wuestneck, Applied Companies, personal communication). Because the site is a construction project and not a disposal area, disposal costs are determined on a case-by-case basis and can be as low as \$3-\$4 per m^3 (\$2-\$3 per yd^3) provided the material arrives in a state that is usable for bulk fill and meets the current direct contact remediation standards set forth by the NJDEP (N.J.A.C. 7:26D). The material must be dewatered, transported and treated (if necessary) independently and can be delivered to this site by truck or barge.

Hackensack – Meadowlands Resort Golf Complex

The Brownfield Golf Corporation is in the process of implementing a large site remediation in the Hackensack Meadowlands (not depicted in Figure 3-1). This project, managed by EnCap Golf, Limited Liability Corporation (LLC), involves the capping and closure of seven landfills including NJ Meadowlands Commission Landfill 1-E and the simultaneous development of a golf resort complex in the New Jersey Meadowlands (NJMC, 2003). This project is in need of clean material for landfill capping (Jim Hockensmith, EnCap Golf LLC, personal communication). The site is located just south of Giants Stadium in the New Jersey townships of Lyndhurst, Rutherford, and North Arlington. The use of dredged materials at this site is driving down the cost to properly cap and close the landfills, making redevelopment possible (EnCap, LLC, no date). To date there has been no response to disposal inquiries at this site, however, according to Sue Detricht of the NJDEP, this site will be the "go to" site after September 2003.

Linden Landfill

This landfill closure project is currently permitted to accept dredged material and has the capacity and capability to accept both anticipated volumes of material from NWS Earle via barge. However, to date there has been no response to inquiries regarding disposal costs at this site.

Projects Outside New Jersey

New York GATX Brownfield
This brownfields redevelopment project is not currently permitted to accept dredged material, however, it is expected to be permitted and active by the time the pier replacement dredging is to commence. To date there has been no response to inquiries regarding disposal at this site.

Penn and Fountain Landfills
This dual landfill closure project is currently permitted to accept dredged material, however, to date there has been no response to inquiries regarding disposal at this site.

Pennsylvania Mine Reclamation
See NJDEP Permitted Upland Processors - Clean Earth Technologies (CET)

NJDEP Permitted Upland Processors

Orion Elizabeth New Jersey (OENJ) Processing Group– Woodbridge, NJ Site
OENJ is one of the larger redevelopment companies working in New Jersey. All dredged material accepted by OENJ must be screened to 30 cm (12 in) and allowed to sit for a minimum of 24 hours to allow excess water to decant. Historically, OENJ has required a minimum throughput of 3,823 m^3 (5,000 yd^3) per day, with a disposal cost of $47 per m^3 ($36 per yd^3) and a $250,000 mobilization fee. Dredged material can be transported to this facility by truck or barge.

CET/ was Consolidated Technologies, Inc. (CTI)
CTI currently manages the Bark Camp Mine Reclamation Project and has a permanent dredged material processing facility located in Jersey City, NJ.

Material slated for use in mine reclamation is processed at the Jersey City facility and then transported by rail to the Bark Camp Mine in Pennsylvania. The Bark Camp Mine Reclamation Project is a large-scale pilot project launched by the Pennsylvania DEP and the Clean Ocean and Shore Trust (COAST) to explore innovative uses for dredged material. The project at Bark Camp involves mixing dredged material with incinerator ash and lime to create a cement-like substance that is then poured into abandoned Pennsylvania strip mines. The material alleviates problems with subsidence while simultaneously buffering acid mine drainage. The ultimate goal of the project is to return the hillside to its original contours before the mining took place. Given the extensive mining that has occurred in the Commonwealth of Pennsylvania the amount of dredged material that could be accepted for mine reclamation is potentially unlimited (NY-NJ COAST, no date).

According to Mr. Steve Sands, President of CTI, the cost for transport and disposal at the Jersey City facility is approximately $52-$59 per m^3 ($40-$45 per yd^3). This estimate is based on previous projects and is dependent on transport costs and material characterization. Material can be transported by rail or by barge. Barge transported material must be drained of free water and rail transported material must be amended to the point where the dredged material is stable enough for rail transport. (Steve Sands, personal communication).

Bioearth
Bioearth was the recipient of an EPA award for its reuse technology (Albert Zelin, Bioearth, personal communication). Bioearth uses a cold soil washing technique to produce potting soil, a sellable product, from dredged sediment. As a result of this technique, dredged material does not require the dewatering needed in other upland applications. Bioearth has a waterfront facility located approximately two miles from the proposed project site with all of the necessary permits to accept and treat dredged sediment. Disposal costs are determined on a case-by-case basis and can be competitive with ocean disposal prices depending on the volume and condition of the material generated. General disposal prices offered without preliminary bulk chemistry data is $46 per m^3 ($35 per yd^3).

Beach Nourishment

Beach nourishment operations typically involve the borrowing of sand from inshore or offshore locations and transporting it by truck or hydraulic pipeline to an eroding beach for restoration purposes (NJDEP, 1997). Potential adverse impacts of beach nourishment operations are displacement of the existing substrate, the destruction of sessile benthic species, and changes in the topography of both the placement and borrow areas. Conversely, beach nourishment operations create new habitats that can usually be rapidly colonized by benthic organisms (NJDEP, 1997).

Dredged material must have a high sand content (≥75%) in order to be reused in beach nourishment projects (NJDEP, 1997). Sand particles typically range in size from 2.0mm to 0.02mm (Lundgren, 1999). The State of New Jersey commonly uses sandy dredged materials from its many inlets to preserve state beaches by combating beach erosion. Previous dredging projects at NWS Earle have uncovered deposits of sand suitable for beach nourishment (Great Lakes Dredge and Dock Company, no date), however, initial sediment evaluations for this project indicate that the sand content will not be sufficient to cost effectively provide sand for beach nourishment projects.

3.1.3 On-Site Upland Disposal Alternatives

Areas of NWS Earle were screened as potential disposal, treatment, or reuse sites. These potential areas included sites that were included in the Installation Restoration Program (IRP) and additional areas that had sufficient area to accommodate a disposal, treatment, or reuse facility. NWS Earle is one of three major ammunition depots serving fleet units on the East Coast. The 4,466-ha (11,134-ac) facility is located entirely in Monmouth County, NJ, and is comprised of two major parcels: the Mainside, located primarily in

Colts Neck Township, and the Waterfront/Chapel Hill area, which is located in Middletown Township on the shoreline of Sandy Hook Bay. A 27.5-km (17.1-mi) road and rail corridor connects these parcels. Mainside contains the housing, ordnance storage, and the majority of NWS Earle's administrative departments and facilities while the Waterfront/Chapel Hill area contains the maintenance and support facilities for homeported ships.

On-site areas of NWS Earle were screened to determine suitability for use as an upland disposal, treatment or reuse site. Potential areas included sites in the IRP and locations that had sufficient size, non-conflicting land use and appropriate topography. Sites were excluded based on their potential to impact water quality and wetlands as well as their location in respect to explosive safety arcs, transportation safety criteria and security requirements.

3.1.3.1 IRP Sites

In August 1990, NWS Earle was placed of the National Priorities List (NPL) after several areas of contamination were discovered. These areas, collectively referenced as IRP sites, include landfills, burn areas, and other disposal sites. Remedial actions have been taken to clean up 62% of these sites, while others continue to be evaluated. There are no ongoing or planned remedial actions at NWS Earle for which the dredged material would qualify as suitable fill or capping material (J. Kolicius, remedial project manager, EFANE, personal communication).

3.1.3.2 Additional Sites

Land use at NWS Earle plays a critical role in determining water quality for the surrounding region, since both NWS Earle Mainside and Chapel Hill tracts are situated higher in elevation relative to the surrounding areas.

Both the Mainside and Waterfront/Chapel Hill areas are divided into three watershed basins. There are approximately 2,097 ha (5,181 ac) of wetlands on NWS Earle and nearly all have been protected from urban development. The primary functions and values of these wetlands include maintaining water quality, providing wildlife habitat, and protecting against flooding on-base and the surrounding communities.

Approximately 90% of the land area at NWS Earle is encumbered by explosive safety arcs with administrative areas and family housing occupying the remaining 10%. A dredged material disposal, treatment, or reuse facility within an explosive arc presents an unacceptable human health and safety risk in the event of an accident and therefore, renders these areas unsuitable for dredged material disposal. Also, the road system at NWS Earle was not designed to accommodate both ordnance-handling and dredged material disposal trucks. A combination of such vehicles would create unacceptable transportation safety, human health, and security risks.

In conclusion, there are no upland disposal or treatment sites available at NWS Earle that do not pose a threat to watershed, water quality, and wetland resources as well as satisfy transportation safety, human health, and security concerns.

3.2. AQUATIC DISPOSAL

The following describes several types of aquatic disposal methods considered for the disposal of dredged material. The primary advantages of open water disposal over other disposal alternatives are typically the large disposal capacity, relatively short-term environmental impacts, and lower relative costs. The primary disadvantages of aquatic disposal include potential changes in benthic habitat quality and temporary water quality degradation, as well as complex logistics associated with certain types of aquatic disposal. The complexity of aquatic disposal is due to the interdependence, sequencing and timing of dredging, storage and disposal operations (Maguire, 2000).

3.2.1 Aquatic Disposal Alternatives

3.2.1.1 Open Water Disposal

Disposal at an open water site requires a demonstration that no practicable alternative site exists, federal and state water quality standards will be met, and potential adverse environmental effects will be minimized. Open water disposal is currently acceptable only in designated areas (NJDEP, 1997). There are currently five federally authorized ocean disposal sites in close proximity to New Jersey. These sites are depicted in Figure 3-2. All inlet disposal areas are intended for the disposal of sediments from their respective inlet (NJDEP, 1997). As a result, the HARS is the only open water disposal area that can accept Category I dredged material from NWS Earle and is discussed later in this section.

Dredged material can be placed in nearshore waters through sidecasting, reprofiling, inter-pier disposal or other means (NJDEP, 1997). These disposal options are typically used for small dredging operations due to their limited capacity. Given the large quantity of dredge material for the pier replacement project at NWS Earle, these near shore disposal alternatives are not feasible for this project (ACOE-NYD, 1997).

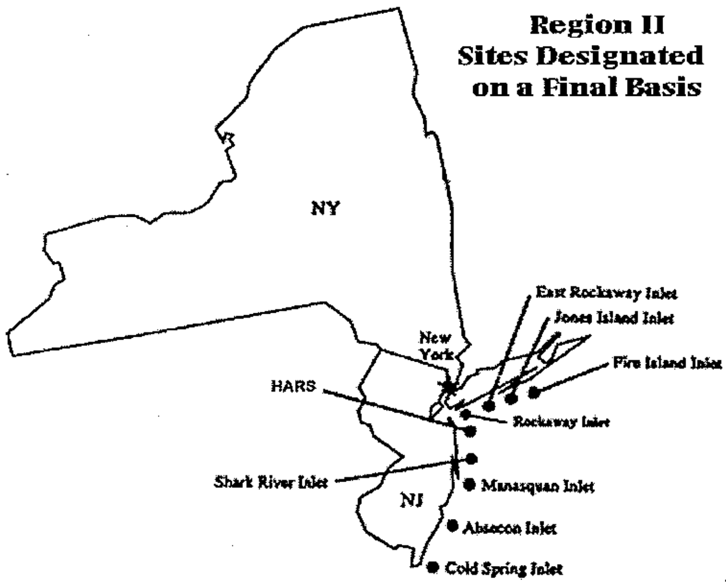


Figure 3-2. Open Water Disposal Sites for Dredged Materials.
(Source: EPA- Region II, 2001)

3.2.1.2 Deep Ocean Disposal

Deep ocean disposal would involve the creation of an ocean disposal site beyond the continental shelf. Major problems associated with this alternative include the economics of transporting dredged material long distances, potential environmental impacts to an undisturbed ocean site, and disposal dispersion considerations associated with a deep water ocean site. Additionally, at least two years are necessary to identify a site, prepare an environmental impact statement, and obtain the necessary permits for the site. This time frame does not meet the requirements of this short-term project and as a result, this alternative does not meet the objective of short-term availability and is dismissed from further consideration.

3.2.1.3 Confined Aquatic Disposal

Confined Aquatic Disposal (CAD) is the process where dredged material that is unsuitable for unconfined open water disposal is deposited into the marine environment within a confined area and then covered with suitable material (Figure 3-3). There are basically two methods of constructing a CAD site. Most commonly, CAD sites are created by placing unsuitable material on the existing sea bed and then covering it with clean dredged material which is considered suitable for open water disposal. The overlying layer is commonly referred to as a cap. It is typically constructed using either dredged silt or sand. This method has been used in open-water disposal sites in New England, New York and elsewhere. It requires that sufficient suitable material be available to provide complete capping of the unsuitable dredged material. In exposed offshore regions, sites with topography conducive to confinement are preferred. Water depths of at least 20 m (65.6 ft) are also recommended to maximize protection against storm driven waves (Maguire, 2000).

The second method of constructing a CAD site is to excavate a confined area, or pit, which is then filled with dredged material and capped. In general these sites can be created in shallower water, but require water depths in excess of 6.1 m (20 ft), so that dredges and barges, which are used to create the pit, can access the area (Maguire, 2000). Historically, proposals to dispose of contaminated dredged material in aquatic pits (borrowed or created) has met with strong opposition from surrounding communities and environmental groups (Natural Resources Protective Association [NRPA], No date). In addition, the additional excavation and materials management required to construct a CAD cell makes this disposal option less economical when compared to other disposal options. Extensive research must also be conducted to determine the physical condition, hydrodynamics and ecological functions of the pit site so that the short and long-tern impacts of the disposal operation on the benthos, water column and biota can be evaluated. Long-term monitoring of the disposal site may also be required to ensure cap integrity is maintained. Precision bathymetry would also be required prior to pit construction, upon completion of pit construction, and may be required prior to and after dredged material disposal in order to provide information on pit capacity and to help ensure the dredged material is contained within the pit (NJDEP, 1997). The costs associated with the additional research and monitoring render this option less economical than other disposal options. As a result, this disposal option is not considered further.

The existing CAD site in New Jersey (i.e., "The Newark Pit") is designated for the disposal of sediments that cannot be disposed of by either means because contaminant concentrations exceed disposal criteria concentrations or because the sediment contains large amounts of debris and cannot be processed for disposal by other means (S. Douglas, NJ OMR, personal communication). Since the dredged material from NWS Earle is not grossly contaminated and can be disposed of by other means, it would not be eligible for disposal at this site. Therefore, this site was not considered further

3.2.1.4 Subaqueous Borrow Pits

Open water sub-aqueous borrow pits have been created in Sandy Hook Bay and Raritan Bay as a result of sand mining for use as fill, construction aggregate, and beach nourishment. The USACOE-NYD requires that these pits be reserved for the disposal of potentially contaminated dredged materials (DON, 1992). However, ACOE investigations into these pits as potential disposal sites for dredged material considered unsuitable for ocean disposal have consistently been met with strong opposition from the surrounding communities and environmental organizations (NRPA, No date). In addition, extensive research must be conducted to determine the physical condition, hydrodynamics and ecological functions of the pit site so that the short and long-tern impacts of the disposal operation on the benthos, water column and biota can be determined. Long-term monitoring of the disposal site would also be required to ensure cap integrity is maintained (NJDEP, 1997). The costs associated with the additional research and monitoring render this option less economical than other disposal options. As a result, this disposal option is not considered further.

3.2.1.5 Containment Areas

Dredged material containment areas are features artificially created in open water or wetlands and include any structure which, upon the completion of its filling with dredged material, would result in an extension of existing upland into open waters, creating what is commonly referred to as "fastland". In addition, a containment area could be constructed to form the substrate on which a wetland could develop (NJDEP, 1997).

Potential adverse environmental impacts of a dredged material containment area depend directly upon the location and existing ecological functions of the site. Potential impacts that require evaluation include:

- Destruction and permanent loss of benthic, open water, or wetlands habitats;
- Temporary physical disruptions during construction of the containment area which may have the potential to interfere with existing benthos, fisheries or anadromous fish migrations; and,
- Potential short-term surface water quality and benthic toxicity impacts related to the dispersal of sediments and associated contaminants (NJDEP 1997).

Filling of natural water areas and wetland areas is prohibited under several state and federal regulations including but not limited to the CWA, Coastal Zone Management Act regulations, and the New Jersey Waterfront Development Act. Such activity requires a demonstration that there is no practicable or feasible land alternative. In addition, minimal interference to special areas (inter-tidal shallows, finfish migratory pathways, and submerged vegetation habitats) must be demonstrated. As with confined disposal facilities, containment areas can be costly to construct and maintain (NJDEP, 1997). Since there are proven alternatives for the upland disposal of the Pier 3 dredged material, this technique was not pursued as a viable disposal option.

3.2.1.6 HARS

This site is in need of clean material to cap the contaminated sediments that have historically been disposed there. This is the only in-water disposal option listed in the NY Harbor and NJ DMMP. Only sediment classified as Category I that passes specific HARS testing is eligible for HARS placement. The use of suitable dredged material for capping purposes involves a number of engineering and design considerations beyond those associated solely with the open water disposal of dredged material. Thus, the NJDEP considers capping to be a potential use of clean dredged material (NJDEP, 1997).

Only clean material of suitable grain size, which would otherwise be accepted for unrestricted ocean disposal, can be used for capping purposes. Both fine-grain and sandy material may be suitable for capping. According to a summary of a pre-application meeting for previous maintenance dredging, if the dredged material is suitable for disposal at the HARS, the ACOE prefers that it go to the HARS (NJDEP, 1997).

When selecting material to be used for capping purposes, its suitability (e.g., chemical composition, grain size) for re-colonization by benthic organisms must be considered. The cap must be thick enough to ensure that re-colonizing organisms cannot penetrate the underlying contaminated dredged material and that bioturbation will not expose the contaminated material. Grain size should also be resistant to erosion and thus be stable over the long term (NJDEP, 1997).

Dredged materials suitable for capping do not need to be dewatered or augmented. Since there is no tipping fee for ocean disposal, the only cost factor for this alternative is transport. Historically, disposal of NWS Earle dredged material as capping material at the HARS has cost \$6.58 per m^3 (\$10 per yd^3), making this alternative the most cost-effective alternative for the disposal of Category I dredged material from NWS Earle.

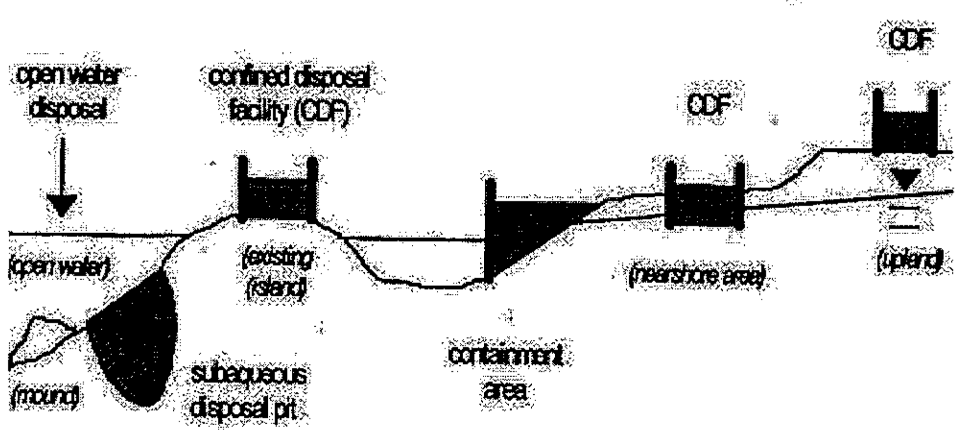


Figure 3-3. Commonly Used Disposal Techniques for Dredged Sediment (Source: EPA- Region II, 2001)

3.3 UPLAND/AQUATIC DISPOSAL

The following describes several types of disposal methods considered for the disposal of dredged material from the pier replacement project at NWS Earle that can be implemented in both upland and aquatic environments.

3.3.1 Upland/Aquatic Disposal Alternatives

3.3.1.1 Habitat Development

A wide range of habitat types can be created, restored or enhanced using dredged material. The New York/ New Jersey Harbor Estuary Program (HEP) has identified several wetland and upland sites, in the vicinity of NWS Earle, that would benefit from enhancement and restoration activities (NJDEP, 1997).

Islands

The construction of islands using dredged material, on which wetland and upland habitat types could develop, is considered to be a special case. NJDEP considers island development on a case-by-case basis (NJDEP, 1997). In the past, proposals to create islands from dredged material unsuitable for ocean disposal have met with strong opposition from local environmental groups (Garden State Environews, 1997).

Aquatic Habitats

Aquatic habitats could be developed as a result of open water disposal of dredged materials and are also considered on a case-by-case basis. In general, dredged material used to create such habitats should be placed so as to maximize habitat value. Such materials are typically large in nature and used in artificial reef building operations. Therefore, the fine-grained, silty (<0.02mm grain size) sediment at NWS Earle would not be suitable for this reuse option (NJDEP, 1997).

Upland Habitats

Habitats will develop on formerly disturbed upland sites regardless of human intervention. However, the use of a variety of management techniques can improve the habitat value upon development or foster the development of specific habitat types. Although the level of effort needed to develop upland habitat could essentially be limited to that necessary to provide erosion control, additional effort and long-term management may be needed to create specific and more productive habitats (NJDEP, 1997).

Dredged material used for upland habitat development must be suitable in terms of physical (e.g., particle grain size) and chemical (e.g., salinity, contaminants and nutrients) characteristics (NJDEP, 1997). When placed in the upland environment, the physical and chemical properties of the material begin to change. Typically, the dredged material will dry, tend to oxidize, and decrease in pH. Thus soil amendments (including lime, manure, sand, and limestone gravel) may be needed to provide a suitable medium for the re-colonization and growth of plants and soil organisms. In addition, the salt content of material dredged from estuarine or marine areas may inhibit the development of upland habitat (NJDEP, 1997). Any chemical contaminant would also need to be treated and/or stabilized which can be costly. The addition of amendments increases the volume of the material and thus increases transport costs because more trips are needed to move the increased volume of material. These added costs make this alternative less cost-effective when compared to other disposal options.

Wetland Habitats

Development of emergent wetland habitats is usually accomplished by the placement of dredged material in shallow open water areas to create substrate elevations conducive to the development of wetlands (NJDEP, 1997). The main concern with the use of dredged materials to create non-open water, emergent wetland habitats is the loss of other habitats coincident with the creation of wetlands. While wetlands are recognized as important and productive components of the aquatic ecosystem, creation of such habitat could result in the loss of existing important open water and benthic habitat (NJDEP, 1997).

3.3.1.2 Containerized Disposal

The ACOE has summarized the potential uses of geotextile containers filled with dredged materials in a variety of projects. These uses include dike construction (including perimeter and subdivision dikes in dredged material disposal areas), underwater stability berms, structural scour protection and beach erosion protection. However, the ACOE has only limited experience with filling geotextile containers with fine-grained dredged materials. Although limited testing with permeable and impermeable liners has shown that fine-grained dredged material can be retained within geotextile containers, additional research is needed before this alternative can be considered further (NJDEP, 1997).

3.3.1.3 Confined Disposal Facility (CDF)

Dredged material can also be disposed of in CDFs. A CDF is, in essence, a cell that is created in order to isolate material from the surrounding environment. These cells require capping once capacity is reached. CDFs can be located offshore as islands, near shore, or upland (Figure 3-2). Creation of a CDF requires construction of confinement walls. Stone reinforcement may be required to protect walls and berms from wave action and tidal scouring (Maguire, 2000). In order to place dredged materials in a CDF, it must be demonstrated that the placement of the dredged material would not result in significant adverse impacts to terrestrial or aquatic ecosystems or pose risks to public health (NJDEP, 1997). CDFs have the advantage of isolating dredged material from the environment while at the same time creating new land which can be put to constructive uses, such as port expansion, development, open space, parkland or wildlife habitat. The CDF can also be left as a subaqueous area, creating additional wetlands. CDFs have the disadvantages of permanently displacing existing tidal and subtidal habitat; being relatively expensive to construct; and, requiring periodic maintenance to ensure the long-term structural integrity of the CDF (Maguire, 2000). CDFs are most commonly implemented as a means to isolate contaminated sediments and therefore are not a cost effective upland disposal alternative for the dredged material from NWS Earle. In addition, past proposals to construct island CDFs in Raritan Bay have met with strong public opposition and, according to former New Jersey Governor, Christine Whitman, have been rejected "based on the environmental sensitivity of the Bay and the many years that the residents along the Bay have devoted to restoring these waters to pristine condition" (Garden State Environews, 1997). The north shore of New Jersey is subject to erosion from long shore currents and the area around Sandy Hook is considered Habitat Area of Particular Concern. Therefore, neither of the two shorelines proximal to the project area offers optimal sites for CDF construction.

4.0 TREATMENT TECHNOLOGIES

Data on available treatment technologies was gathered from the EPA REACH IT (Remediation And Characterization Innovative Technologies) database. This database combines information from technology vendors, the DOD, the Department of Energy, state project managers, and the EPA in order to provide comprehensive, up to date information about proven, alternative treatment technologies. Search criteria were limited to remediation technologies that have been implemented full-scale for treating heavy metals, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), organic pesticides/herbicides and solvents in saturated sediments. Search criteria were limited to the aforementioned contaminants based on the analytical results of past dredging projects at NWS Earle.

The search generated 17 treatment classes under which were listed 54 specific treatment technologies. Treatment classes were identified as follows: acid extraction, bioremediation, chemical reduction/oxidation, chemical treatment, dechlorination, electrical separation, incineration, phytoremediation, soil washing, solidification/stabilization, solvent extraction, thermal desorption, and vitrification. Three additional treatment technologies that were not identified on the EPA REACH IT site but were presented in the DMMP for the City of Gloucester, Massachusetts are also presented. These technologies are: chelation, dehalogenation and fungal remediation. Descriptions of all identified treatment classes are presented herein along with treatment cost ranges and limitations. A summary table is provided at the end of this section to facilitate comparisons (Table 4-1). Costs are strictly for comparative use and should be considered "ballpark" preliminary estimates only. Costs are subject to high variability based on the uncertainties associated with the widely-varying contaminant and sediment types, concentrations, and site-specific conditions. As a result, providing a single figure to represent disposal costs for a specific treatment method is difficult. Therefore, cost ranges presented herein represent the lowest and highest figures offered by all of the vendors of the technologies under a specific treatment class.

4.1 DESCRIPTION OF TREATMENT CLASSES

This section describes existing sediment decontamination technologies. For each technology, distinct categories of the sediment decontamination process including: pretreatment technologies, treatment technologies, sidestream treatment technologies, and residuals management are also considered.

Pretreatment of the sediment typically involves removal of oversized materials and dewatering prior to treating the contaminated sediment. The control of objectionable odors (which are typically emitted when anaerobic sediment is disturbed), may also be required during pretreatment. Odor control may also be required during the treatment stage of dredged sediment management.

Treatment of the sediment involves application of the primary decontamination process (e.g., physical, chemical, biological, and/or thermal) to reduce, destroy, or immobilize the target contaminants present in the sediments. Treatment may include use of a single technology or use of multiple technologies (i.e., treatment "train" or sequence) in order to address the widely-varying contamination and sediment types.

Sidestream treatment is often required for sidestream wastes (e.g., off-gas, particulate emissions, and wastewater) generated during the primary sediment treatment process. These sidestream wastes typically require special handling, treatment, and/or disposal.

Residuals management involves the handling of treated solids from the primary sediment treatment process that may be acceptable for reuse or contain residual contamination that warrants special disposal.

The capabilities and costs of the treatment technology are the main consideration in the selection of a sediment decontamination method. Because sediments often contain a mixture of contaminants, the ability of a treatment technology to handle widely-varying contaminant and sediment types is very important. There are many technologies that will treat a specific contaminant in a relatively inexpensive manner, but require the addition of other technologies in a treatment train to handle a range of contaminants. Because use of a treatment train increases the costs, handling requirements, potential environmental exposure, and complexity of sediment decontamination these technologies are not discussed below and have been dismissed from further consideration. On the other hand, some individual technologies may be more expensive, but can treat a full range of contaminants. These technologies will be further scrutinized for their applicability to treat the NWS Earle dredging project. Although the treatment process normally represents the major portion of the costs of sediment decontamination, the total costs including pretreatment, sidestream treatment, and residuals management must be considered when choosing between treatment alternatives. Public concerns about sidestream discharges, especially air emissions, can preclude the selection of certain treatment technologies.

4.1.1 Acid Extraction

Acid extraction technology involves the use of aqueous leaching solutions to extract heavy metals from contaminated soil, dust, sludge, or sediment. The technology deals with most metal contaminants (e.g., Cd, Cu, Pb, Ni, Zn, Hg) and both common types of lead contamination: pieces of metallic lead of various sizes and finely divided lead oxides/salts. The aqueous leaching solution can be reused to leach more metal from contaminated soil material. If reduction is used as the metal recovery step, the contaminant metals are recovered in solid, metallic form. If an ion exchange agent is used, it is later stripped of the bound metal, under conditions in which the extraction agent is also fully regenerated and recyclable. The cost of acid extraction treatment is approximately \$99-\$261 per m^3 (\$100-\$200 per yd^3).

Limitations include:

- The presence of high levels of surfactants in the soil can disrupt this operation.
- Very high levels of carbonates or oxides will cause excessive leachant consumption.

- Metal levels in excess of 100,000 ppm are generally not cost effective to remove by this particular method, if used for on-site remediation.
- Process only treats metals
- The presence of non-friable porous material, organic compounds, and non-regulated metals are may increase the cost of treatment

4.1.2 Bioremediation

Biological degradation of contaminants is a naturally-occurring process. Bioremediation is the acceleration of the natural biodegradation processes by controlling moisture content, temperature, nutrients, oxygen, and pH to create the optimal environment. Bioremediation can be implemented in a slurry or solid phase either in vessel or at an upland/nearshore location. It is a process in which indigenous or inoculated microorganisms (i.e., fungi, protozoa, bacteria, and other microbes) degrade organic contaminants found in the sediments. In the presence of sufficient oxygen, microorganisms may ultimately convert many organic contaminants to carbon dioxide, water, and microbial cell mass. In the absence of oxygen, the contaminants may be ultimately reduced to methane, carbon dioxide, and trace amounts of hydrogen gas.

In-Situ Bioremediation
In-situ bioremediation involves treating contaminated sediments where they lie without mechanical manipulation. Because this sediment is being removed as part of a pier replacement/berth deepening project, in-situ remediation options are not feasible because the material must be removed.

Solid-Phase Bioremediation
For purposes of this discussion, the varieties of solid-phase biological treatment processes have been divided into three categories based on level of engineering: landfarming, composting, and in-vessel bioremediation. Solid-phase biological treatment technologies are used primarily to treat volatile organic compounds (VOCs) and petroleum hydrocarbons. It is also possible to treat PAHs, PCBs, halogenated organic compounds, explosives and pesticides to some degree, especially in the more highly-engineered in-vessel systems.

Costs for all solid-phase bioremediation technologies range from \$7-\$261 per m^3 (\$5-\$200 per yd^3).

Landfarming
Landfarming is the least engineered of the solid-phase bioremediation treatment processes. Landfarming consists of spreading the contaminated sediments over a large area of land and periodically tilling the sediments for aeration. Environmental conditions are controlled by watering (moisture content), fertilizing (nutrient concentration), tilling (oxygen concentration), and lime addition (pH) to accelerate natural bioremediation. Organic matter is usually added to retain moisture, provide additional nutrients, and as a supplemental food source (bacterial bioremediation). However, the addition of organic matter may increase the volume of the dredged sediment. Temperature cannot be

regulated to a great extent, limiting the applicability of landfarming in cold climates. Since oxygen is added by tilling, the thickness of the spread of the contaminated sediments is limited to the tilling depth; therefore, a large area of land is required for landfarming. Landfarming may also incorporate the use of polyethylene liners to control leaching of contaminants.

Limitations of landfarming include:

- Open landfarming may not be practical in regions of heavy annual rainfall precipitation and/or cold climate;
- Does not remediate inorganic contaminants;
- Inorganic contaminants may leach from contaminated sediments into ground;
- Ineffective for treatment of high molecular weight PAHs and highly chlorinated PCBs;
- Anaerobic bioremediation processes can generate odors;
- Of the solid-phase bioremediation treatment processes, landfarming offers the least control over environmental conditions;
- Of the solid-phase bioremediation treatment processes, landfarming offers the least control over collection of off-gas;
- Of the solid-phase bioremediation treatment processes, landfarming requires the largest space; and,
- Of the solid-phase bioremediation treatment processes, landfarming requires the longest cleanup time.

<u>*Composting*</u>

Composting is the middle level of the engineering hierarchy of the solid-phase bioremediation treatment processes. The two major variations of the composting process discussed here are windrow and aerated static pile. The windrow is a pile typically 6-10 ft high, 4.6-6.1 m (15-20 ft) wide and hundreds of feet long. Windrows are mechanically turned twice a week to once a year to aerate the pile, control the temperature, and create a more uniformly mixed material. Turning of the pile releases odors. Composting is completed in one month to a few years depending on the contaminants and the level of maintenance of the windrow. Maintenance typically includes maintaining optimal moisture content, temperature, oxygen and nutrient concentrations. Depending on the soil particle size distribution and organic matter content, additional organic matter may need to be added to the dredged sediment prior to composting. This could significantly increase the volume of the dredged sediment to be treated. The treatment residual produced by composting is the treated dredged sediment. Sidestream wastes include off-gas and leachate, each of which may require further treatment/management. Off-gases with objectionable odors may be controlled by composting within an enclosed dome or structure to allow for off-gas collection and control.

Limitations of composting include:

- A large space is required;
- Questionable effectiveness for treatment of high molecular weight PAHs and highly chlorinated PCBs;
- Requires months of remediation/treatment time;

- Can generate odors; and,
- Collection of off-gas is difficult.

<u>*Slurry Bioremediation*</u>
Slurry bioremediation is the most engineered of the bioremediation treatment processes. Slurry biological treatment is similar to solid-phase bioremediation with the exception that the material is treated in an aqueous phase eliminating the need for extensive dewatering. Treatment is as follows: Contaminated material is excavated, de-rocked, pulverized, and slurried with water containing elevated concentrations of acclimated, cultured bacteria. The slurry is then pumped into the bio-treatment digester. Agitation and aeration maintain suspension of solids and dissolved oxygen levels. The aerobic biological degradation continues until the mandated treatment level is achieved. After reaching treatment levels, the slurry is pumped to an appropriate dewatering system. The damp soil is transferred to a stockpile. The water, containing the biomass, can be recycled to an incubator to "pump up" the concentration of bacteria after which it can be returned to the slurrying system for reuse. The treatment residual is the treated dredged sediment that can be used as topsoil or for other upland applications. Treatment costs range from \$24-\$1,300 per m^3 (\$18 to \$1,000 per yd^3).

Limitations of in-vessel bioremediation include:
- Ineffective for remediating inorganic contaminants;
- Most expensive of the bioremediation treatment processes; and,
- Emission controls for off-gas may be required.

4.1.3 Chemical Treatment - Reduction/Oxidation (redox)

Chemical reduction/oxidation technology uses chemical additives to detoxify target contaminants by conversion into less toxic or immobile forms. Chemical redox processes work by transferring electrons from the contaminant to the oxidizing agent. During this process the oxidizing agent, itself, becomes reduced. Typical oxidizing agents used in this remediation strategy include various forms of chlorine, potassium permanganate, hydrogen peroxide, persulfate, and ozone. These chemical oxidants may be catalyzed by ultraviolet radiation or other transitional metal additives to form free radicals, thereby enhancing their oxidation potential.

Typical treatment efficiencies for selected organic contaminants may attain 90 to 95% removal. Sediment residuals contain excess chemical agents, reaction by-products including dissolved gases that may require post-treatment monitoring prior to backfill. Sidestream wastes include wastewater from dewatering of the treated sediments and off-gas from the treatment vessel. Wastewater can be recycled into the extraction process. Costs for reduction/oxidation treatment range from \$26-\$261 per m^3 (\$20-\$200 per yd^3). Treatment residuals consist of treated sediment.

Limitations include:
- Incomplete oxidation may lead to the formation of intermediate contaminants that are more toxic than the original;

- Dewatering is required before and after treatment;
- High organic matter content increases the required reagent dosage;
- Potential foaming and gas emissions of treated products; and,
- Presence of non-target compounds may react with the reagent additives to increase the treatment cost.

4.1.4 Chemical Treatment – Silica Micro Encapsulation

Silica Micro-Encapsulation (SME) technology is used for the treatment of heavy metals and radionuclides in waters, soils and sludges. The technology uses a silica-based chemical formulation that entails chemisorption and micro-encapsulation of contaminants in a permanent silica matrix. Encapsulated particles settle quickly and are effectively isolated from the surrounding environment, producing a stable, non-hazardous sludge. SME technology has been developed to remediate the following types of contamination: Acid mine drainage, sediment/soil contamination, tailings pond waters, industrial/municipal wastewater, radioactive wastes, groundwater and water supply systems. Treatment applications can be batch or continuous and may be applied in a dry or slurried form. Cost for chemical treatment for SME ranges from $22-$83 per metric ton ($20-$75 per ton).

Limitations include:

- Complex organics and certain inorganics in media may necessitate pre or post treatment; and,
- Technology only treats metals and radionuclides.

4.1.5 Chemical Treatment – Molecular Bonding

Molecular Bonding Systems (MBS) is appropriate for all hazardous metals stabilization projects and is the premier technology for treating high contamination levels of multiple metals. MBS stabilize hazardous metals in soil and industrial slag, sludge, baghouse dust, and ash by creating a sulfide bond with contaminants, effectively converting leachable ions into non-leaching sulfide molecules. The process uses a patented, sulfide-based blend of powered chemical reagents that are project-specific formulated to optimize stabilization results. MBS technology can be implemented for both ex-situ and in-situ applications, and for batch or continuous processing. In-line applications stabilize hazardous waste byproducts at their production source, allowing for cost-efficient disposal at Subtitle D landfills. In addition, MBS is not pH sensitive, allowing concurrent stabilization of multiple metals, each with different solubility points. Cost for chemical treatment in the form of molecular bonding ranges from $17-$44 per metric ton ($15- $40 per ton).

Limitations include:

- Material must be screened to 6.35 cm (2.5 in) before treatment can begin;
- MBS technology is exclusively applicable to the stabilization of hazardous metals;
- MBS technology cannot treat organics or other contaminants by itself;

- MBS technology is unable to treat aqueous waste streams, approximately 40% solid content is required for process efficacy; and,
- The relatively uncommon occurrence of a waste stream with a chloride content in excess of 15% also negates treatment with the standard MBS process.

4.1.6 Dechlorination

This technology employs solvated electron technology (SET) to decontaminate, detoxify, or destroy a wide range of wastes including halogenated organic compounds such as PCBs, dioxins, pesticides, chlorofluorinated hydrocarbons (CFCs), chemical warfare agents (including nerve agents and blister agents), explosives, PAHs, and numerous other toxins in matrices ranging from soils and sludges to oils, contaminated surfaces, personal protective equipment (PPE), and building materials to bulk quantities of raw toxin.

The process uses alkali or alkaline earth metals such as sodium, calcium, lithium, etc. dissolved in any of a variety of solvents including ammonia, amines, and some ethers to produce a solution of free electrons and metal cations.

Halogenated organic compounds are "destroyed" by the SET process when halogens are selectively stripped from the parent hydrocarbon by the free electrons (dehalogenation) and captured by the metal cations to form salts (such as calcium chloride) and hydrogen-substituted organic compounds (such as saturated hydrocarbons in the case of PCBs). The process occurs at room temperature and is essentially instantaneous.

The unique nature of SET allows treatment of most wastes, including soils, sludges, debris, PPE, etc. Material handling problems associated with other technologies, especially when dealing with materials such as clays, are minimized when using SET. Unlike thermal processes and other dechlorination processes, SET does not damage the soil. In fact, the treated soil is enriched with nitrogen. After pH adjustment, soils are suitable to be returned to the environment and to productive use. Cost for dechlorination through SET ranges from $441-$1,323 per metric ton ($400-$1,200 per ton).

Limitations include:

- The SET process is not designed for treatment of aqueous waste streams.

4.1.7 Electrical Separation

Electro-kinetic remediation uses a series of electrodes placed in contaminated media to recover ionic contamination from soils, muds, ground water, dredgings, and other materials and was developed to treat toxic cations (heavy metals including Cu, Cr, Zn, Cd, Ni, Co, and so forth), toxic anions (As, CN, NO3, and so forth), toxic polar organics (phenols, dyestuffs, pesticides, herbicides) and radionuclides (U, Sr, and so forth).

Ion-permeable electrolyte casings are placed in the contaminated media and connected to a centralized electrolyte management system. Each casing has an electrode inside. Together, these form alternating rows of anodes and cathodes. Electrolyte is circulated in a closed loop between the electrode casings and an electrochemical ion exchange (EIX) based-electrolyte management system.

The electrodes are then energized. Electrolysis of water in the electrolyte results in the formation of hydrogen (H+) ions at the anodes and hydroxide (OH-) at the cathodes. These ions are then made to migrate through the casing into soil to generate a temporary and localized pH shift that desorbs contaminating ions. Acids are not pumped directly into the soil.

Once desorbed, the contaminating ions migrate under the influence of the applied potential (electro-migration) to their respective electrodes (anodes for anions, cathodes for cations). Here they pass through the electrode casing walls and are taken up by the circulating electrolytes.

Contamination is selectively recovered from the circulating electrolytes as they pass through the EIX units. Soluble but benign elements are returned to the soil to maintain soil properties.

Periodically the EIX units are regenerated offline. This recovers the contaminants in a concentrated, pure, and re-usable form.

This process has been operated at 2.4 m^3 (2 yd^3) and 5,658 m^3 (7,400 yd^3) in size. Batch times vary between eight hours and five days depending on electrode spacing and current loading. Treatment costs range from \$70-\$170 per m^3 (\$91-\$221 per yd^3).

Limitations include:

- Careful management of the pH and other electrolyte conditions within the electrode casings is the critical element in controlling system performance;
- Electro-kinetic remediation alone is ineffective with nonpolar or nonionic contamination such as many classes of organic materials;
- Asbestos and other ceramic, unreactive inorganic pollutants also fail to respond to electro-kinetic migration; and,
- Other difficult materials are buried metals and metal fragments.

4.1.8 Incineration

Incineration is one of the most commonly used remediation technologies. Incineration, or thermal oxidation, destroys contaminants using high temperatures in the presence of oxygen and is effective in destroying a wide range of organic contaminants. Incineration of wastes is generally not looked on favorably by the NJDEP, environmental groups, or the public. In addition, the American Ref-Fuel incinerator, located in Essex, NJ, cannot accept special wastes that contain PCBs or inhalable carcinogens.

Costs for incineration range from \$71–\$1,150 m^3 (\$55-\$880 per yd^3). Incineration costs increase for PCBs and dioxins. Ash is produced as a residual material. This ash typically contains high heavy metal concentrations and therefore may require further management/

treatment. Sidestream wastes produced include air emissions and wastewater (the latter generated as a by product of the air emission control systems required to operate an incinerator).

Limitations include:
- Requires a very low moisture content in sediments;
- Strict feedstock particle size limitations (2.54-5.08 cm (1-2 in) maximum);
- Gaseous discharges are a major potential contaminant emission pathway;
- Heavy metals are not removed or destroyed and are more leachable after incineration;
- Metals can react with chlorine or sulfur to form more toxic compounds;
- Incomplete combustion of PCBs may produce more toxic dioxins;
- Public opposition;
- Permitting difficulties; and,
- Residual material requires further management.

4.1.9 Pyrolysis

Pyrolysis involves the destruction of organic material in the absence of oxygen. The absence of oxygen allows separation of the waste into an organic fraction (gas) and an inorganic fraction (salts, metals, particulates) as char material. Pyrolysis is normally used to treat high concentrations of organics (e.g., semi-volatile organic compounds and pesticides) that are not conducive to conventional incineration. Residuals produced by the pyrolysis process consist of ash, often containing heavy metals. Sidestream wastes include air and wastewater. Air emissions typically contain carbon monoxide, hydrogen and methane. Wastewater is via pretreatment dewatering and via the second stage of the pyrolysis process when pyrolytic gases (produced during primary treatment) are destroyed in a secondary reaction chamber. The wastewater is generated by a scrubber system that removes particulate contaminants from the pyrolytic gases prior to release to the atmosphere. The wastewater may contain hydrogen, methane and some hydrocarbons.

Costs of pyrolysis are between \$130-\$261 per m^3 (\$100-\$200 per yd^3). Major factors affecting the cost are the condition and properties of the feed sediment (i.e., moisture, total contamination, and soil characterization).

Limitations include:
- Requires very low moisture content (<1%) in sediments (which requires pretreatment dewatering and sidestream wastewater requiring further treatment);
- Strict feedstock particle size limitations;
- Gaseous discharges are a major potential contaminant emission pathway;
- Heavy metals are not removed or destroyed, but are not more leachable after pyrolysis.

4.1.10 Soil Washing

Soil washing refers to the process of using water to physically separate the sediments by particle size into a reusable bulk fraction and a smaller fraction containing concentrated contaminants. Since organic contaminants are often sorbed to the finer silt and clay particles, separation of this fine fraction from the sandy sediments allows reuse of the typically non-contaminated sands and accomplishes a volume reduction of the total contaminated sediment mass. It is also possible to amend the wash water with surfactants to aid in dispersing soil particles; and chelating agents, acids, or bases to separate the contaminants from the sediment. Soil washing has the potential to treat a variety of contaminants including PAHs, PCBs, fuel oil, heavy metals, radionuclides, and pesticides.

The cost of soil washing ranges from \$26-\$288 per m^3 (\$20-\$220 per yd^3). Residuals include a sand fraction, a suspended fine particle fraction and a remaining soil fraction. The waste stream includes wash water with amendments and suspended fines.

Limitations include:

- Soil washing is only marginally effective for sediments composed primarily of clays and silts;
- Maximum particle size typically 0.5 cm (0.2 in);
- Removal of fines from wastewater may require the addition of polymer flocculent;
- Treatment and disposal of water from pre-treatment dewatering;
- Treatment and disposal of amended wash water,
- Treatment and disposal of post-treatment dewatering.

4.1.11 Solidification/Stabilization

Solidification/stabilization is effective at immobilizing contaminants and are among the most commonly used remediation technologies. Solidification/stabilization involves mixing reactive material with contaminated sediments to immobilize the contaminants. Contaminants are physically bound or enclosed within a stabilized mass (solidification), or undergo chemical reactions with the stabilizing agent to reduce their mobility (stabilization). Binding of the contaminants to the sediment reduces contaminant mobility via the leaching pathway. A typical treatment process includes homogenization of the feed material followed by mixing of solid or liquid reagents with the feed material in a pug mill. Three specific categories examined in this screening include asphalt, cement, and lime solidification/stabilization.

Solidification is the process of eliminating the free water in a semisolid by hydration with a setting agent or binder. Typical binder materials include cements, kiln dust, and pozzolans such as lime/fly ash. Solidification usually provides physical stabilization but not necessarily chemical stabilization.

Physical stabilization refers to improved engineering properties such as bearing capacity, trafficability, and permeability. Although solidification/stabilization technologies are not generally applied to organic contaminants, physical stabilization can also immobilize contaminants since the contaminants tend to be bound to the fines, which are physically bound in the solidified matrix.

Chemical stabilization is the alteration of the chemical form of the contaminants to make them resistant to aqueous leaching. The solubility of metals is reduced by formation of metal complexes, chelation bonds, or crystalline precipitates within the solid matrix, using chemical additives and through control of pH and alkalinity. Anions, which are more difficult to bind as insoluble compounds, may be immobilized by entrapment or micro-encapsulation. Chemical stabilization of organic compounds is not very reliable.

Results of reactions of binders to the contaminated sediment are not always predictable due to varying contaminant types and concentrations within the test material. Therefore, laboratory leach tests must be conducted on a sediment-specific basis.

Asphalt Batching

Asphalt batching is a commonly used technology in Massachusetts and has been proven effective in immobilizing total petroleum hydrocarbons (TPH), VOC, and PAH compounds. Contaminated solids are blended with asphalt emulsions in a pug mill. The asphalt-emulsion-coated material is stockpiled and allowed to cure for approximately two weeks. Pretreatment requirements include dewatering and size classification by screening or crushing to less than 7.62 cm (three in) diameter. End product can be recycled as a stabilized base material for parking lots or roadways.

Cement Solidification/Stabilization

Cement solidification/stabilization involves mixing the contaminated sediments with Portland cement and other additives to form a solid block of stabilized waste material with high structural integrity. Silicaceous materials such as fly ash may be added to stabilize a wider range of contaminants than cement alone. Cement solidification/stabilization is most effective for inorganic and metallic contaminants.

Lime Stabilization

Lime/fly ash pozzolanic processes combine the properties of lime and fly ash to produce low-strength cementation. Lime stabilization involves mixing the contaminated sediments with lime in a sufficient quantity to raise the pH to 12 or higher. Raising the pH results in chemical oxidation of the organic matter, destruction of bacteria, and reduction of odor. Lime stabilization is commonly used to treat wastewater sludge and is primarily effective for organic contaminants and microbial pathogens.

Costs range from \$26-\$431 per m^3 (\$20-\$330 per yd^3). Residuals produced from treatment are stabilized blocks of sediment material. Air emissions are the main sidestream waste produced during the treatment operation

Limitations include:

- May not be particularly effective for organic contaminants, particularly VOCs;
- Fine particles may bind to larger particles preventing effective bonding of the binder material;
- Inorganic salts may affect curing rates and reduce strength of stabilized product;
- Organic contaminants may volatilize due to heat generated during the reaction (possibly prompting the need for air emission permits); and,
- High moisture content requires increased amounts of reagent.

4.1.12 Solvent Extraction

Solvent extraction is similar to soil washing in that the technology produces a volume reduction of the total contaminated material, however, solvent extraction focuses on extracting the contaminants from the sediments using organic solvents. Contaminated material volume reductions of 20 times or more are attainable. Solvent extraction is targeted primarily at organic contaminants including PCBs, PAHs, VOCs, petroleum hydrocarbons, and chlorinated solvents. This technology is not particularly applicable to inorganics, with the exception of organically-bound metals which can be extracted. Residuals include the treated dredged sediment, often with traces of extraction solvent. Sidestream wastes include wastewater from pretreatment and post-treatment dewatering, off-gas from the treatment vessel, and spent solvent used during the extraction. The solvent is usually purified and recycled.

The cost of solvent extraction ranges from \$157-\$1,046 per m^3 (\$120-\$800 per yd^3).

Limitations include:

- Less effective for sediments composed primarily of clays and silts;
- Not typically effective for removal of inorganic compounds;
- Treated soil may contain residual concentrations of solvent;
- Maximum particle size 0.5 cm (0.2 in);
- Treatment and disposal of wastewater from dewatering; and,
- Dewatering is required after treatment.

4.1.13 Thermal Desorption

The thermal desorption technology employs high temperature to volatilize organic contaminants. Thermal desorption technologies are divided into high temperature and low temperature categories. Thermal desorption is a removal process that applies to contaminants that are volatile at the process operating temperatures. Primary targets of treatment are organic contaminants including PAHs, VOCs, pesticides, and chlorinated solvents. This technology is not applicable to inorganic compounds; however, volatile metals, such as mercury, can be extracted.

High-Temperature Thermal Desorption
The high-temperature process uses temperatures between 316° Celsius (C) and 538° C (600° Fahrenheit (F) and 1,000° F). At these temperatures, a greater range of contaminants are volatilized including some metals (which may not be desirable).

Low-Temperature Thermal Desorption
The low-temperature process uses temperatures between 148.9° C and 315.6° C (200° F and 600° F). The lower temperatures do not volatilize metals. Most commercial low-temperature thermal desorption units are of the rotary dryer or thermal screw design.

Treatment residual is the treated sediment. Sidestream wastes include air and water emissions. Pollution control devices are required to reduce particulates in the air emissions. Water wastes include pretreatment dewatering and wastewater produced by the air pollution control system. Costs for thermal desorption range from \$33-\$458 per m^3 (\$25-\$350 per yd^3).

Limitations include:
- Optimal moisture content less than 60%;
- Gaseous discharges are a major potential contaminant emission pathway;
- Feedstock particle size limited to 5.08 cm (2 in) maximum;
- Tightly bound contaminants in clayey and silty sediments increase residence time requirements; and,
- Most heavy metals are not removed or destroyed.

4.1.14 Vitrification

Vitrification technology uses high temperatures above 1593.3° C (2,900° F), to melt and convert contaminated sediments into oxide glasses, thus achieving destruction of organic contaminants and stabilization of inorganic contaminants. The resulting glass is nontoxic and suitable for recycling or landfilling as a non-hazardous material. Vitrification technology is applicable to all types of contaminants. Vitrification immobilizes inorganic contaminants in a solidified glass matrix and destroys organic contaminants with the high temperature involved in glass production.

Vitrification is one of the most expensive technologies; however, since vitrification can act as a stand-alone technology, the cost of vitrification can compete when a treatment train of other technologies is required. The cost of vitrification ranges from \$392-\$1,307 per m^3 (\$300-\$1,000 per yd^3).

Limitations include:
- Gaseous discharges are a major potential contaminant emission pathway;
- Creates a glass material that must be reused or disposed;
- More expensive than incineration; and,
- Molten product requires long cooling period.

4.1.15 Chelation

This process is a form of chemical stabilization that immobilizes metals. Chelation or complexation, is the process of forming a stable bond or complex between a metal cation and a ligand (chelating agent). Chelating agents or ligands, may form a single bond (monodentate) or multiple bonds (polydentate) with the target cation. The more bonds formed, the more stable the resulting complex and the greater degree of immobilization of the metal contaminant within the complex. Edetic Acid (also known as Ethylenediamine-tetra-acetic acid, or EDTA) is a commonly used polydentate chelating agent. Process efficiency is ion-specific depending upon the chelating agent, pH, and dosage.

The chelation process for metal immobilization may reduce the leachable metal concentrations adequately to meet the Toxicity Characteristic Leaching Procedure (TCLP) requirements. The TCLP determines the leachability of contaminants from a waste material. This testing procedure is used to determine if a waste is classified as "hazardous" based on its potential toxicity. Treated sediments are the only residuals generated by the chelation treatment process. Cost for chelation treatment is \$108 per m^3 (\$83 per yd^3).

Limitations include:

- Technology only effective on metals; and
- Sidestream waste produced from this treatment strategy consists of wastewater generated during the dewatering of the treated sediments.

4.1.16 Dehalogenation

Dehalogenation is a process that destroys or removes some of the halogen atoms from halogenated aromatic compounds such as PCBs, dioxins, furans, and pesticides by substitution of bicarbonate or glycol for the halogen (usually chlorine) atoms. The two most common dehalogenation treatment processes are base-catalyzed decomposition (BCD) and glycolate dehalogenation. The BCD treatment process combines a sodium bicarbonate reagent with the dewatered dredged sediment within a heated oil matrix to remove the halogen atoms from the target compound (e.g. chlorine atoms on the compound are exchanged for sodium atoms). The glycolate dehalogenation process uses a combination of alkali metal and polyethylene glycol reagents to degrade halogenated organic compounds such as PCBs, dioxins, pesticides, and chlorobenzenes. Costs for dehalogenation range from \$288-\$431 per m^3 (\$220-\$330 per yd^3).

Limitations include:

- Process does not treat metals;
- Sidestream wastes generated by the BCD process include the reaction media (oil with biphenyls, olefins, and sodium chloride and steam vapor that may contain volatile organic compounds); and
- Sidestream wastes generated by the glycolate dehalogenation process include process water containing water-soluable glycol ethers, hydroxylated compounds,

alkali metal salts, and water (steam) vapor that may contain volatile organic compounds.

4.1.17 Fungal Remediation

Fungal remediation is a particular subset of bioremediation that employs fungi rather than bacteria to degrade the contaminant. White rot fungus is the most commonly studied fungus because the enzymes secreted by the white rot fungus can degrade lignin, the complex organic building block of wood. White rot fungus has shown the ability to destroy complex organic compounds such as explosives, pesticides, PAHs, and PCBs. Although the potential of white rot fungus has been known for over 20 years, there have been few commercial applications of this remedial technology.

Costs for fungal remediation are \$216-\$345 per m^3 (\$165-\$264 per yd^3). Residuals include the treated sediments. No sidestream wastes are generated during this treatment process.

Limitations include:

- High contaminant concentrations may be toxic to the fungus;
- Does not treat metals;
- Unknown how salt water will affect white rot fungus;
- Short life of cultured fungi may require frequent reactor replacement; and,
- Removal efficiencies of approximately 50% are considered too low to effectively treat contaminated sediments (the concentration of contaminants may not meet upland disposal criteria).

Table 4-1
Comparative Summary of Treatment Technologies

Technology	Project Applicability	Cost Range
Acid Extraction	LOW – Inability to treat nonmetallic and organic contaminants	\$99 - \$261/m^3 (\$100 - \$200/yd^3)
Bioremediation		
Solid Phase	LOW - Inability to treat metals, slow process	\$7 - \$261/m^3 (\$5 - \$200/yd^3)
Slurry Phase	LOW - Inability to treat inorganic contaminants, sidestream wastes, high costs	\$24 - \$1,307/m^3 (\$18 - \$1,000/yd^3)
Chemical Treatment		
Reduction/Oxidation	LOW - Inability to treat metals and PAHs, sidestream wastes, high cost	\$26 - \$261/m^3 (\$20 - \$200/yd^3)
Silica Micro Encapsulation	LOW – Process only treats metals and radionuclides	\$22 - \$83/tonne (\$20 - \$75/ton)
Molecular Bonding	LOW – Technology only treats metals	\$17 - \$44/tonne (\$15 - \$40/ton)
Dechlorination	MED – Complex set up, high cost	\$441 - \$1,323/tonne (\$400 - \$1,200/yd^3)
Electrical Separation	LOW – treatment is ineffective for non-polar/nonionic and un-reactive contaminants, complex set up, high cost	\$70 - \$170/m^3 (\$91 - \$221/yd^3)
Incineration	LOW - Inability to treat metals, sidestream wastes,	\$71 - \$1,150/m^3 (\$55 - \$880/yd^3)
Pyrolysis	LOW - Inability to treat metals, sidestream wastes, high cost	\$130 - \$261/m^3 (\$100 - \$200/yd^3)
Soil Washing	MED - Not recommended for soil with >50% fines, dewatering after treatment required, sidestream wastes	\$26 - \$288/m^3 (\$20 - \$220/yd^3)
Solidification/ Stabilization	MED - Final product volume significantly larger than original dredged material, market demand, high costs, reduced effectiveness on VOCs, sidestream wastes	\$26 - \$431/m^3 (\$20 - \$330/yd^3)
Solvent Extraction	LOW – Inability to treat metals, sidestream wastes, high cost, reduced effectiveness in silt/clay soils	\$157 - \$1,046/m^3 (\$120 - \$800/yd^3)
Thermal Desorption	LOW - Inability to treat metals, sidestream wastes, low moisture content required, longer treatment times for silt and clay sediments, high cost	\$33 - \$458/m^3 (\$25 - \$350/yd^3)
Vitrification	MED - Sidestream wastes, high cost	\$392 - \$1,307/m^3 (\$300 - \$1,000/yd^3)
Chelation		\$108/m^3 (\$83/yd^3)
Dehalogenation		\$288 - \$431/m^3 (\$220 - \$330/yd^3)
Fungal Remediation		\$216 - \$345/ m^3 (\$165 - \$264/yd^3)

Shaded entries represent technologies described in the Gloucester DMMP but not generated during the EPA REACH IT database search.

5.0 THE PREFERRED DISPOSAL ALTERNATIVE FOR NWS EARLE

Several disposal alternatives were investigated during the preparation of this Dredged Material Disposal Alternatives Analysis. These disposal alternatives included ocean, nearshore and upland disposal options. The majority of the ocean and nearshore disposal alternatives had considerable associated construction and engineering costs and were not economically feasible when compared to other disposal options. Treatment technologies were also evaluated and deemed not to be economically feasible based on associated transport dewatering and handling costs. As a result, the preferred disposal alternative for the fraction of dredged material from NWS Earle that is not suitable for ocean disposal would be to use it in upland remediation projects provided the material meets all the criteria necessary for the upland application. It should be noted that substantial augmentation may be required in order for the material to meet the criteria necessary for upland application in a fill/remediation project. Augmentation may result in volumetric increases and would require increased material handling. These factors have the potential to increase the disposal costs to the point where they are no longer economically feasible. Should the material be deemed unsuitable for upland remediation projects and require substantial augmentation, it may be more cost effective to deliver the material to an upland processing facility for disposal. Any fraction of the material deemed suitable for ocean disposal should be disposed of at the HARS.

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Table A1-1 Disposal Cost Matrix for a 432,000 m^3 Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Landfill	Waste by Rail	Passive	\$9,100,000	included in dewatering cost	\$75/m^3 (\$57/yd^3)		\$96/m^3 (\$74/yd^3)
		Passive/ evaporative	\$11,672,843	included in dewatering cost			\$102/m^3 (\$78/yd^3)
		Mechanical	\$3,885,000	\$795,520			\$86/m^3 (\$66/yd^3)
		In-vessel	\$2,780,800	\$795,520			\$83/ m^3 (\$64/yd^3)
Beneficial Use/Reuse	Port Liberté Golf Course	Passive	\$9,100,000	included in dewatering cost	included in dewatering cost	\$3-\$4 m^3‡ \$2-\$3/yd^3)‡	\$24-\$25/m^3 (\$18-\$19/yd^3)
		Passive/ evaporative	\$11,672,843	included in dewatering cost	included in dewatering cost		\$30-\$31/m^3 (\$23-\$24/yd^3)
		Mechanical	\$3,885,000	\$795,520	**Truck:** \$4,618,368		\$25-\$26/m^3 (\$19-\$20/yd^3)
		In-vessel	\$2,780,800	\$795,520	**Truck:** \$4,618,368		\$22-\$23/m^3 (\$17-\$18/yd^3)
					Barge◊: \$196,240		\$12-\$13/m^3 (\$9-\$10/yd^3)
Upland Processors	OENJ	In-vessel	N/A	N/A	**Barge◊:** \$196,240	\$47/ m^3 (\$36/yd^3)	\$114/m^3 (\$88/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	\$2,780,800	\$795,520			
	CET/ PA Mines	Passive	N/A	N/A	\$40-45/yd^3		\$46-\$51/ m^3 (\$35-\$39/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	\$2,780,800	N/A			
	Bioearth	Passive	N/A	N/A	**Truck:** \$4,618,368 **Barge:** \$196,240	\$35/yd^3	**Truck:** \$48/ m^3 (\$37/yd^3) **Barge:** \$37/ m^3 (\$28/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	N/A	\$795,520			

Table A1-1 Disposal Cost Matrix for a 432,000 m³ Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Treatment	Dechlorination	Passive	$9,100,000	included in dewatering cost	**Truck:** $4,618,368	$441-$1,323/ metric ton $400-$1,200/ ton	$473-$1,355/ m³ ($364-$1,042/yd³)
					Barge◊: $196,240		$463-$1,345/ m³ ($335-$1,035/yd³)
		Passive/ evaporative	$11,672,843	included in dewatering cost	**Truck:** $4,618,368		$479-$1,361/ m³ ($368-$1,047/yd³)
					Barge◊: $196,240		$468-$1,350/ m³ ($360-$1,038/yd³)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$463-$1,345/ m³ ($356-$1,035/yd³)
					Barge◊: $196,240		$452-$1,334/ m³ ($348-$1,026/yd³)
		In-vessel	$2,780,800	$795,520	**Truck:** $4,618,368		$460-$1,342/ m³ ($354-$1,032/yd³)
					Barge◊: $196,240		$450-$1,332/ m³ ($585-$1,025/yd³)
	Soil Washing	Passive	$9,100,000	included in dewatering cost	**Truck:** $4,618,368	$26-$288/ m³ $20-$220/yd³	$58-$320/ m³ ($45-$246/yd³)
					Barge◊: $196,240		$48-$310/ m³ ($37-$238/yd³)
		Passive/ evaporative	$11,672,843	included in dewatering cost	**Truck:** $4,618,368		$64-$326/ m³ ($49-$253/yd³)
					Barge◊: $196,240		$53-$315/ m³ ($41-$242/yd³)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$48-$310/ m³ ($37-$238/yd³)
					Barge◊: $196,240		$37-$299/ m³ ($28-$230/yd³)
		In-vessel	$2,780,800	$795,520	**Truck:** $4,618,368		$45-$307/ m³ ($35-$236/yd³)
					Barge◊: $196,240		$35-$297/ m³ ($27-$228/yd³)

Table A1-1 Disposal Cost Matrix for a 432,000 m^3 Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Treatment	Solidification/ stabilization	Passive	$9,100,000	included in dewatering cost	**Truck:** $4,618,368	$26-$431/ m^3 $20-$330/yd^3	$58-$463/ m^3 ($45-$356/yd^3)
					Barge◊: $196,240		$48-$453/ m^3 ($37-$348/yd^3)
		Passive/ evaporative	$11,672,843	included in dewatering cost	**Truck:** $4,618,368		$64-$469/ m^3 ($49-$361/yd^3)
					Barge◊: $196,240		$53-$458/ m^3 ($41-$352/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$48-$453/ m^3 ($37-$348/yd^3)
					Barge◊: $196,240		$37-$442/ m^3 ($28-$340/yd^3)
		In-vessel	$2,780,800	$795,520	**Truck:** $4,618,368		$45-$450/ m^3 ($35-$346/yd^3)
					Barge◊: $196,240		$35-$440/ m^3 ($27-$338/yd^3)
	Vitrification	Passive	$9,100,000	included in dewatering cost	**Truck:** $4,618,368	$392-$1,307/ m^3 $300-$1,000/yd^3	$424-$1,339/ m^3 ($326-$1,030/yd^3)
					Barge◊: $196,240		$414-$1,329/ m^3 ($318-$1,022/yd^3)
		Passive/ evaporative	$11,672,843	included in dewatering cost	**Truck:** $4,618,368		$430-$1,345/ m^3 ($331-$1,035/yd^3)
					Barge◊: $196,240		$419-$1,356/ m^3 ($322-$1,043/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$414-$1,329/ m^3 ($318-$1,022/yd^3)
					Barge◊: $196,240		$403-$1,318/ m^3 ($310-$1,014/yd^3)
		In-vessel	$2,780,800	$795,520	**Truck:** $4,618,368		$411-$1,326/ m^3 ($133-$1,020/yd^3)
					Barge◊: $196,240		$401-$1,316/ m^3 ($308-$1,012/yd^3)

*Handling costs apply to material loading and unloading exclusive of the initial placement of material from the dredging area onto scows
** Totals are rounded up to whole numbers
‡ Disposal cost assumes material will be in a condition suitable for structural fill applications and meets the soil remediation standards for direct contact
◊ Assume two barges

Table A1-2 Disposal Cost Matrix for a 273,000 m^3 Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Landfill	Waste by Rail	Passive	\$5,733,000	included in dewatering cost	\$75/m^3 (\$57/yd^3)		\$96/m^3 (\$74/yd^3)
		Passive/ evaporative	\$8,081,552	included in dewatering cost			\$105/m^3 (\$81/yd^3)
		Mechanical	\$3,885,000	\$795,520			\$92/m^3 (\$71/yd^3)
		In-vessel	\$2,076,800	\$795,520			\$86/ m^3 (\$66/yd^3)
Beneficial Use/Reuse	Port Liberté Golf Course	Passive	\$5,733,000	included in dewatering cost	included in dewatering cost	\$3-\$4 m^3‡ (\$2-\$3/yd^3)‡	\$24-\$25/m^3 (\$18-\$19/yd^3)
		Passive/ evaporative	\$8,081,552	included in dewatering cost	included in dewatering cost		\$33-\$34/m^3 (\$25-\$26/yd^3)
		Mechanical	\$3,885,000	\$795,520	**Truck:** \$4,618,368		\$37-\$38/m^3 (\$28-\$29/yd^3)
		In-vessel	\$2,076,800	\$795,520	**Truck:** \$4,618,368		\$30-\$31/m^3 (\$23-\$24/yd^3)
					Barge◊: \$196,240		\$14-\$15/m^3 (\$11-\$12/yd^3)
Upland Processors	OENJ	In-vessel	N/A	N/A	**Barge◊:** \$196,240	\$47/ m^3 (\$36/yd^3)	\$58/m^3 (\$45/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	\$2,076,800	\$795,520			
	CET/ PA Mines	Passive	N/A	N/A	\$40-45/yd^3		\$48-\$53/ m^3 (\$37-\$41/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	\$2,076,800	N/A			
	Bioearth	Passive	N/A	N/A	**Truck:** \$4,618,368 **Barge:** \$196,240	\$35/yd^3	**Truck:** \$55/ m^3 (\$42/yd^3) **Barge:** \$39/ m^3 (\$30/yd^3)
		Passive/ evaporative	N/A	N/A			
		Mechanical	N/A	N/A			
		In-vessel	N/A	\$795,520			

Table A1-2 Disposal Cost Matrix for a 273,000 m^3 Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Treatment	Dechlorination	Passive	$5,733,800	included in dewatering cost	**Truck:** $4,618,368	$441-$1,323/ metric ton ($400-$1,200/ ton)	$479-$1,361/ m^3 ($368-$1,047/yd^3)
					Barge◊: $196,240		$463-$1,345/ m^3 ($335-$1,035/yd^3)
		Passive/ evaporative	$8,081,552	included in dewatering cost	**Truck:** $4,618,368		$488-$1,370/ m^3 ($375-$1,054/yd^3)
					Barge◊: $196,240		$471-$1,353/ m^3 ($362-$1,041/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$475-$1,357/ m^3 ($365-$1,044/yd^3)
					Barge◊: $196,240		$459-$1,341/ m^3 ($353-$1,032/yd^3)
		In-vessel	$2,076,800	$795,520	**Truck:** $4,618,368		$468-$1,350/ m^3 ($360-$1,038/yd^3)
					Barge◊: $196,240		$452-$1,334/ m^3 ($348-$1,026/yd^3)
	Soil Washing	Passive	$5,733,800	included in dewatering cost	**Truck:** $4,618,368	$26-$288/ m^3 ($20-$220/cy)	$64-$326/ m^3 ($49-$251/yd^3)
					Barge◊: $196,240		$48-$310/ m^3 ($37-$238/yd^3)
		Passive/ evaporative	$8,081,552	included in dewatering cost	**Truck:** $4,618,368		$73-$335/ m^3 ($56-$258/yd^3)
					Barge◊: $196,240		$56-$318/ m^3 ($43-$245/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$60-$322/ m^3 ($46-$248/yd^3)
					Barge◊: $196,240		$44-$306/ m^3 ($34-$235/yd^3)
		In-vessel	$2,076,800	$795,520	**Truck:** $4,618,368		$54-$315/ m^3 ($42-$242/yd^3)
					Barge◊: $196,240		$37-$299/ m^3 ($28-$230/yd^3)

Table A1-2 Disposal Cost Matrix for a 273,000 m³ Dredging Project

Option		Dewatering		Handling*	Transport	Disposal	TOTAL**
Treatment	Solidification/ stabilization	Passive	$5,733,800	included in dewatering cost	**Truck:** $4,618,368	$26-$431/ m^3 $20-$330/cy	$64-$469/ m^3 ($49-$361/yd^3)
					Barge◊: $196,240		$48-$453/ m^3 ($37-$348/yd^3)
		Passive/ evaporative	$8,081,552	included in dewatering cost	**Truck:** $4,618,368		$73-$478/ m^3 ($56-$368/yd^3)
					Barge◊: $196,240		$56-$461/ m^3 ($43-$355/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$60-$465/ m^3 ($46-$358/yd^3)
					Barge◊: $196,240		$44-$449/ m^3 ($34-$345/yd^3)
		In-vessel	$2,076,800	$795,520	**Truck:** $4,618,368		$54-$458/ m^3 ($42-$352/yd^3)
					Barge◊: $196,240		$37-$442/ m^3 ($28-$340/yd^3)
	Vitrification	Passive	$5,733,800	included in dewatering cost	**Truck:** $4,618,368	$392-$1,307/ m^3 $300-$1,000/cy	$429-$1,345/ m^3 ($330-$1,035/yd^3)
					Barge◊: $196,240		$414-$1,329/ m^3 ($318-$1,022/yd^3)
		Passive/ evaporative	$8,081,552	included in dewatering cost	**Truck:** $4,618,368		$439-$1,354/ m^3 ($338-$1,042/yd^3)
					Barge◊: $196,240		$422-$1,337/ m^3 ($325-$1,028/yd^3)
		Mechanical	$3,885,000	$795,520	**Truck:** $4,618,368		$426-$1,341/ m^3 ($318-$1,032/yd^3)
					Barge◊: $196,240		$410-$1,325/ m^3 ($310-$1,019/yd^3)
		In-vessel	$2,076,800	$795,520	**Truck:** $4,618,368		$419-$1,334/ m^3 ($322-$1,026/yd^3)
					Barge◊: $196,240		$403-$1,318/ m^3 ($310-$1,014/yd^3)

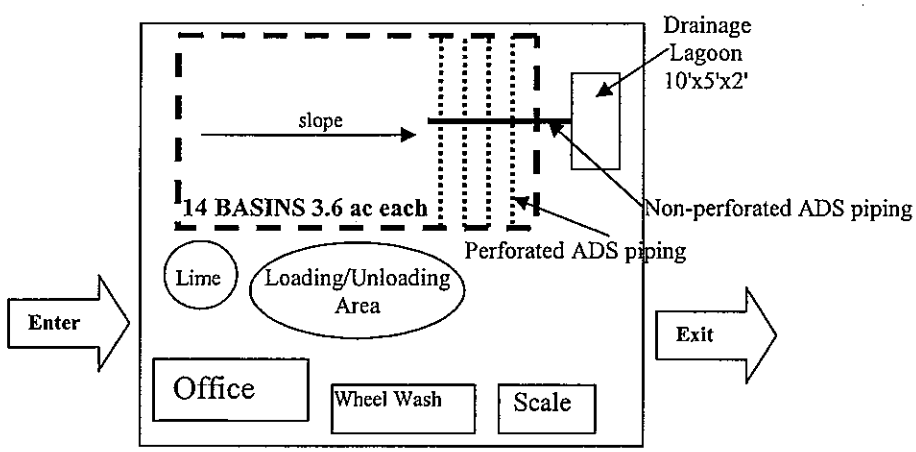
*Handling costs apply to material loading and unloading exclusive of the initial placement of material from the dredging area onto scows
** Totals are rounded up to whole numbers
‡ Disposal cost assumes material will be in a condition suitable for structural fill applications and meets the soil remediation standards for direct contact
◊ Assume two barges

PASSIVE DEWATERING WITH NO EVAPORATIVE DRYING ITEMIZED COSTS ANALYSIS

Passive Dewatering With No Evaporative Drying - Site Construction Costs

The cost to construct the dewatering site is dependent on the amount of engineering required for its design, the types of materials/equipment used and the size and schedule of the work crew. For this simple scenario, 14, 30,582 m^3 (40,000 yd^3) basins are to be constructed. The basins will be constructed with a sloping bottom and have walls constructed from 2m x 1m x 0.5m (6-ft x 3-ft x 2-ft) concrete construction blocks, stacked three high. The interior of the basin will be lined with 10-mil polyethylene sheeting. Subsurface drainage is achieved through the installation of perforated Advanced Drainage System (ADS) piping at the low end of the basin. The perforated ADS piping should be covered with filter fabric and/or sand and gravel to prevent clogging and will drain via non-perforated ADS piping into an adjacent lagoon where the water can be tested, treated (if necessary) and discharged. A portable pump can be used to decant surface water from the basin and/or to discharge water from the lagoon (Figure B-1). Each basin occupies approximately 1.5 ha (3.6 ac) and will hold approximately 30,582 m^3 (40,000 yd^3) of dredged material.

Figure A2-1 Schematic of a Passive Dewatering Site (Not to Scale)



In order to construct the dewatering site as described, the first step is to grade the site and place the concrete construction blocks. Since each basin perimeter is 500 m (1,640 linear feet [lf]), 820 blocks will be needed to construct each basin. These blocks can be placed at a rate of 110 blocks per day (RS Means, 2003). Therefore, each basin will take approximately eight days to construct. An itemized list of construction material, equipment and crew needed to construct one basin is contained in Table B-1 along with the raw cost for each item/worker. These costs are for site construction only and do not include operational costs. In addition, costs for land purchases/leases, permits, engineering, insurance and subcontractor overhead and profit are not included. This cost estimate also assumes; no land clearing or road building; no bedrock, high water table, or wetland site constraints; no contamination; and no delays due to equipment failure and/or inclement weather.

Table A2-1. Raw Costs for Passive Dewatering Site Basin Construction

STEP 1 grade site				
Materials/equipment/crew	**Quantity**	**Cost per**	**Duration**	**Total**
Grader 30,000 lb.	1	$457.20/day	1 day	$458
Operator	1	$260.80/day	1 day	$261
Laborer	1	$197.20/day	1 day	$198
				$917
STEP 2 construct basin and lagoon				
Materials/equipment/crew	**Quantity**	**Cost per**	**Duration**	**Total**
Concrete Construction Blocks	820	$31.00 each	N/A	$25,420
Labor foreman	1	$213.20/day	8 days	$1,706
Laborers	5	$197.20/day	8 days	$789
Crane operator	1	$269.60/day	8 days	$270
Crane oiler	1	$226.40/day	8 days	$227
Gradall, 3 ton,1/2 cy	1	$846.40/day	8 days	$6,772
Backhoe loader, 48 HP	1	$218.80/day	1 day	$219
Backhoe operator	1	$260.80/day	1 day	$261
				$35,664
STEP 3 install liners and ADS				
Materials/equipment/crew	**Quantity**	**Cost per**	**Duration**	**Total**
Filter fabric	100 lf	$0.29	N/A	$29
10-mil polyethylene sheeting	327,336 ft^2		N/A	
basin liner	*171,150* ft^2	$0.09	N/A	15,404
basin cover	*156,060* ft^2	$0.045	N/A	$7,023
lagoon liner	*126* ft^2	$0.09	N/A	$12
12"x10' ADS	600 lf	$7.40/ft	N/A	$4,440
Washed stone 3/4"	30 cy (30 tons)	$22/ton	N/A	$660
Labor foreman	1	$213.20/day	3 days	$640
Laborers	4	$197.20/day	3 days	$2,367
				$30,575
SINGLE BASIN CONSTRUCTION TOTAL				**$67,156**
CONSTRUCTION GRAND TOTAL - 14 BASINS				**$940,184**

SOURCE: RS Means, 2003

<u>*Passive Dewatering With No Evaporative Drying - Site Operational Costs*</u>

Once the construction costs have been estimated, the operational costs of the dewatering site can be estimated. Operational costs for a passive dewatering site are estimated in Table B-2. With regard to operational costs, the following assumptions were made:

- An application ratio of 1:100 will be used for odor control (lime).
- The configuration of the 23 ha (57 ac) dewatering site will be 4.8 ha (12 ac) x 4.8 ha (12 ac)

- Dewatering effluent will be collected once per week by a vacuum truck for discharge into sanitary sewers.
- Effluent will pass laboratory testing – No sidestream wastes to treat and dispose of.
- Dewatering site will be in operation for two years (104 weeks).

Based on these assumptions, approximately 4,320 m^3 (5,650 yd^3) of lime and 882 m (2,892 lf) of perimeter fencing would be needed for the dewatering operation.

Table A2-2. Raw Costs for Passive Dewatering Site Operation

Materials/Equipment/Crew	Quantity	Cost	Duration	Total
Office trailer (20'X8' w/air conditioning)	1	$184/month (mth)	24 mth	$4,416
Electricity/power	N/A	$47/mth	25 mth	$1,128
Electrician	1	$38/h	8 h	$304
Chemical toilet	1	$153/mth	24 mth	$3,672
Cellular phone service	1	$35/mth	24 mth	$840
Lime	5,650 tons	$200/ton	N/A	$1,130,000
Skid steer loader	1	1,275/mth	24 mth	$135,720
Operator	1	261/day	520 days	$67,808
Perimeter security fence	2,892 lf	$1.64/lf	N/A	$4,743
Night watchman	1	$15/h	8,320 h	$124,800
Site foreman	1	$40/h	4,160 h	$166,400
Pump 3"/300 gallons per minute (gpm)	1	$400/mth	24 mth	$9,600
3" hose	1	$96/mth	24 mth	$2,304
5,000 gallon vacuum truck w/ driver	1	$301/day	104 days	$31,304
TOTAL OPERATIONAL COST				**$1,683,039**

It should be noted that dewatering effluent is likely to be subject to testing prior to discharge, which can substantially increase dewatering costs. The testing parameters and frequency are determined by the NJDEP on a case-by-case basis and therefore, cannot be assessed at this time.

Passive Dewatering With No Evaporative Drying - Site Deconstruction Costs

The next component to determine the total passive dewatering costs is the cost of demobilization (Table B-3). Once the dewatering operation is completed the site must be dismantled and restored, as closely as possible, to its previous condition.

Table A2-3. Raw Costs for Passive Dewatering Site Deconstruction

STEP 1 remove and dispose liners and ADS from one basin				
Materials/equipment/crew	**Quantity**	**Cost/unit**	**Duration**	**Total**
Filter fabric	80 lbs (.03 tons)	$110-$550/ton	N/A	$4-$17
10-mil polyethylene sheeting	8,000 lbs* (3.3 tons)	$110-$550/ton	N/A	$363-$1,815
12"x10' ADS	4,800 lbs** (2 tons)	$110-$550/ton	N/A	$220-$1,100
Washed stone ¾"***	30 cy (30 tons)	$110-$550/ton	N/A	$660
Labor foreman	1	$213.20/day	1 day	$214
Laborers	4	$197.20/day	1day	$789
Backhoe loader, 48 hp	1	$218.80/day	1 day	$219
Backhoe operator	1	$260.80/day	1 day	$261
SINGLE BASIN TOTAL				**$2,729-$5,075**
14 BASIN TOTAL				**$38,206-$71,050**
STEP 2 dismantle one basin and lagoon				
Materials/equipment/crew	**Quantity**	**Cost/unit**	**Duration**	**Total**
Labor foreman	1	$213.20/day	8 days	$1,706
Laborers	5	$197.20/day	8 days	$789
Crane operator	1	$269.60/day	8 days	$270
Crane oiler	1	$226.40/day	8 days	$227
Gradall, 3 ton,1/2 cy	1	$846.40/day	8 days	$6,772
Backhoe loader, 48 hp	1	$218.80/day	1 day	$219
Backhoe operator	1	$260.80/day	1 day	$261
SINGLE BASIN TOTAL				**$10,244**
14 BASIN TOTAL				**$143,416**
STEP 3 grade and seed site				
Materials/equipment/crew	**Quantity**	**Cost/unit**	**Duration**	**Total**
Grader 30,000 lb.	1	$457.20/day	14 days	$6,400
Operator	1	$260.80/day	14 days	$3,651
Laborer	2	$197.20/day	14 days	$2,760
Grass seed (35lbs/ac)	1,995 lbs	$22/lb	N/A	$43,890
GRADING AND SEEDING TOTAL				**$56,701**
TOTAL DEWATERING SITE DECONSTRUCTION COSTS				**$238,323-$271,165**

* Source: John Fitzgerald, personal communication; Manufactured Plastics and Distribution, Inc.
** Source: ADS Piping, Inc. (48"x20'=640lbs.)
*** Source: Envirotech of Fairfield County Inc.

The last components to determine the total dewatering costs are to factor in the costs of material handling and transport. These handling and transport costs will be used as constants for all dewatering scenarios presented herein.

Material Handling Costs

Costs associated with material handling have the potential to substantially increase disposal costs. Therefore, dredged material should be handled as little as possible. The minimum amount of equipment needed to move the dredged material from scow into dump trucks is a crane and a loader. A 272-tonne (300-ton) crane is recommended because the crane must be large enough to support a bucket with a capacity of at least 4 m^3 (5 yd^3) in order to meet the required throughput rate. Since the throughput for this project is 1,946 m^3/day (2,568 yd^3/day) for a 432,000 m^3 (565,000 yd^3) project and 1,241 m^3 (1,623 yd^3/day) for a 273,000 m^3 (357,000 yd^3) project and each scow is assumed to hold 765 m^3 (1,000 yd^3), it is not feasible for the dredging crane to also offload the material from the scow. Therefore a second crane is necessary at the offloading site. Current labor and equipment estimates developed for the dewatering operation at the Tomlinson Bridge in New Haven, CT are as follows:

Loader - \$75/h
Loader operator - \$28/h
Crane with 5cy bucket - \$315/h
Crane operator - \$34/h

Based on these equipment/operator costs and assuming this equipment will be used throughout the entire dredging operation with no overtime the following calculations can be performed based on the projected volumes of dredged material:

(\$75 + \$28 + \$315 + \$34)	x	(1,760)	=	**\$795,520**
equipment and labor		work hours in 44 weeks		

Based on these calculations, the costs of dewatering the dredged material can be expected to increase by \$795,520 each time the material is handled. For most upland disposal options the dredged material must be handled twice, once to unload the material at the dewatering site (assuming a shoreside location) and once to load the dewatered material for final disposal. Because dump trucks will be utilized, there are no associated unloading costs.

Transport Costs

Because of the large volume of material to be dredged for this project, it is assumed that a large trucking company will be hauling the dredged material. Transport cost estimates for a 15 m^3 (20 yd^3) dump trailer with operator are estimated by RS Means to be \$656 per day for an eight-hour workday. Assuming a 5 day/ 44 week timeframe, transport costs can be estimated to be approximately \$144,320 per truck. It should be noted that should the dewatering/disposal site be so distant that each truck would only be able to deliver one load per day; a minimum of 150 trucks would be required to maintain the required throughput for a 432,000 m^3 (565,000 yd^3) project. For this analysis it is assumed that each truck to make a minimum of four trips per day. Under these conditions, 32 trucks would be needed to maintain the required throughput of 1,964 m^3 per day (2,568 yd^3 per day) for a 432,000 m^3 (565,000 yd^3) project and 20 trucks would be needed to maintain the required throughput of 1,241 m^3 per day (1,623 yd^3 per day) for a 273,000 m^3

(357,000 yd^3) project. As a result, trucking costs are estimated to be **$4,618,368** for a 432,000 m^3 (565,000 yd^3) project and **$2,886,400** for a 273,000 m^3 (357,000 yd^3) project.

These costs assume that the truck will be loaded to full capacity. However, due to the water weight of the material, it is likely that the truck would NOT be filled to capacity due to load weight restrictions.

<u>*Passive Dewatering With No Evaporative Drying - Total Cost*</u>

By adding the construction, operation, dismantling, transport and handling costs together (assume two handlings) a "de minimus" cost of approximately **$9,100,000** can be calculated for a passive dewatering operation with no evaporative drying for 432,000 m^3 (565,000 yd^3) of dredged material. Since direct relationships between volume, throughput and area have been made consistently throughout this analysis, any percentage of material suitable for ocean disposal should equally lower dewatering costs. Therefore, if 159,000 m^3 (208,000 yd^3) (37%) meets the requirements for ocean disposal then dewatering costs for the remaining material can be expected to decrease by 37% as well for a total cost of **$5,733,000.**

PASSIVE DEWATERING WITH EVAPORATIVE DRYING ITEMIZED COSTS ANALYSIS

Table A2-4. Passive Dewatering With Evaporative Drying Costs

Equipment/Crew	Cost/unit	Unit	TOTAL 273,000 m^3	TOTAL 432,000m^3
Site Construction			$2,979,297	$4,638,620
Site Operation				
Loader w/ 3-5yd bucket and Operator	$464.40/day	300days	$139,320	$139,320
Site Foreman	$40/hr	300days	$96,000	$96,000
Chemical toilet	$153/mth	15 mths	$2,295	$2,295
Dust control	$272/day	100*days	$27,200	$27,200
Handling (assume two handlings)			$1,591,040	$1,591,040
Trucking			$2,886,400	$4,618,368
Dismantling			$360,000	$560,000
TOTAL			**$8,081,552**	**$11,672,843**

*assumed

It should be noted that dewatering effluent is likely to be subject to contaminant testing prior to discharge, which can substantially increase dewatering costs. The testing parameters and frequency are determined by the NJDEP on a case-by-case basis and therefore, cannot be assessed at this time.

Appendix "B"

EXECUTIVE SUMMARY

The United States Navy (Navy) has prepared this Essential Fish Habitat (EFH) Assessment – Expanded Consultation to address potential impacts to marine fisheries as a result of proposed pier complex upgrades at the Naval Weapons Station Earle (NWS Earle) pier complex (project area) located in Sandy Hook Bay, Monmouth County, NJ. This project involves dredging of sediment and native parent material from the pier berths and beneath a portion of the existing Pier 3 at the pier complex. Parent material, deemed via physical, chemical, and biological testing to be suitable for unconfined open ocean disposal, would be disposed at the Historic Area Remediation Site (HARS), located in the New York Bight Apex, approximately 9.6 kilometers (six miles) east of Sandy Hook, NJ. Unconsolidated sediments, deemed via physical, chemical, and biological testing to be unsuitable for unconfined open ocean disposal, would be disposed at a state-approved upland disposal/reuse/treatment/recycling facility.

The Navy has prepared this expanded EFH consultation pursuant to Section 305(b)(2) of the Magnuson-Stevens Fisheries Conservation and Management Act (1996 amendments).

The potential impact to 15 federally managed marine fish species known to occur within EFH designated within Sandy Hook Bay is included in this assessment. Also included is an assessment of impact to their habitat and prey species. One species, the winter flounder (*Psuedopleuronectes americanus*), was found to be particularly susceptible to dredging impacts due to their demersal egg and larval stages and their estuarine-dependent habits. Winter flounder spawning begins once water temperatures in early winter fall below 10°C, which can be as late as early January in some years. Potential impact to migrating anadromous fish is also identified and discussed. Proposed impact avoidance and minimization techniques were offered to avoid, reduce, or minimize the identified impacts such that impact to the susceptible species as a result of the dredging and disposal would be insignificant on a regional basis.

Dredging within the pier berthing areas is proposed from June 1st to December 31st of each project year. Outside of this dredging window, dredging would be limited to a very small area under a portion of the seaward end of Pier 3. Use of this environmental window would minimize or avoid most impact to marine fisheries in and adjacent to the project area.

The report presented herein is offered to qualify statements made to address specific questions included in the National Marine Fisheries Service Northeast Regional Office EFH Assessment Worksheet (05/14/01 v.), which precedes this report.

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LIST OF ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this assessment:

ac	acre
ACOE	Army Corp of Engineers
AOE	Auxiliary-Oil-Explosives
ASI	Aqua Survey, Inc.
BOS	Battelle Oceanic Sciences
°C	degrees Celsius
CFR	Code of Federal Regulations
cm	Centimeters
cm/s	centimeters/second
cy	cubic yards
DO	Dissolved Oxygen
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
°F	degrees Fahrenheit
ft	feet
ft^2	square feet
FMCs	Fisheries Management Councils
ha	hectare
HAPC	Habitat Areas of Particular Concern
HARS	Historic Area Remediation Site
in	inches
km	kilometer
km^2	square kilometer
m	meter
mi	miles
mi^2	Square mile
mm	millimeter
m^2	square meters
m^3	cubic meters

MAFMC	Mid-Atlantic Fisheries Management Council
mg/L	milligrams per liter
MLW	Mean Low Water
MPRSA	Marine Protection, Research and Sanctuaries Act
n/a	not applicable
NED	New England Division
NEFMC	New England Fisheries Management Council
NERO	Northeast Regional Office
NJ	New Jersey
NJDEP	New Jersey Department of Environmental protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWS	Naval Weapons Station
NY	New York
NYD	New York District
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
pH	negative log of hydrogen ion concentration
ppt (°/₀₀)	parts per thousand
SAV	Submerged Aquatic Vegetation
SMMP	Site Management and Monitoring Plan
TL	Total Length
TSS	Total Suspended Solids
USFWS	United States Fish and Wildlife Service
USNS	United States Naval Ship
USS	United States Ship
YOY	Young of Year

1.0 INTRODUCTION

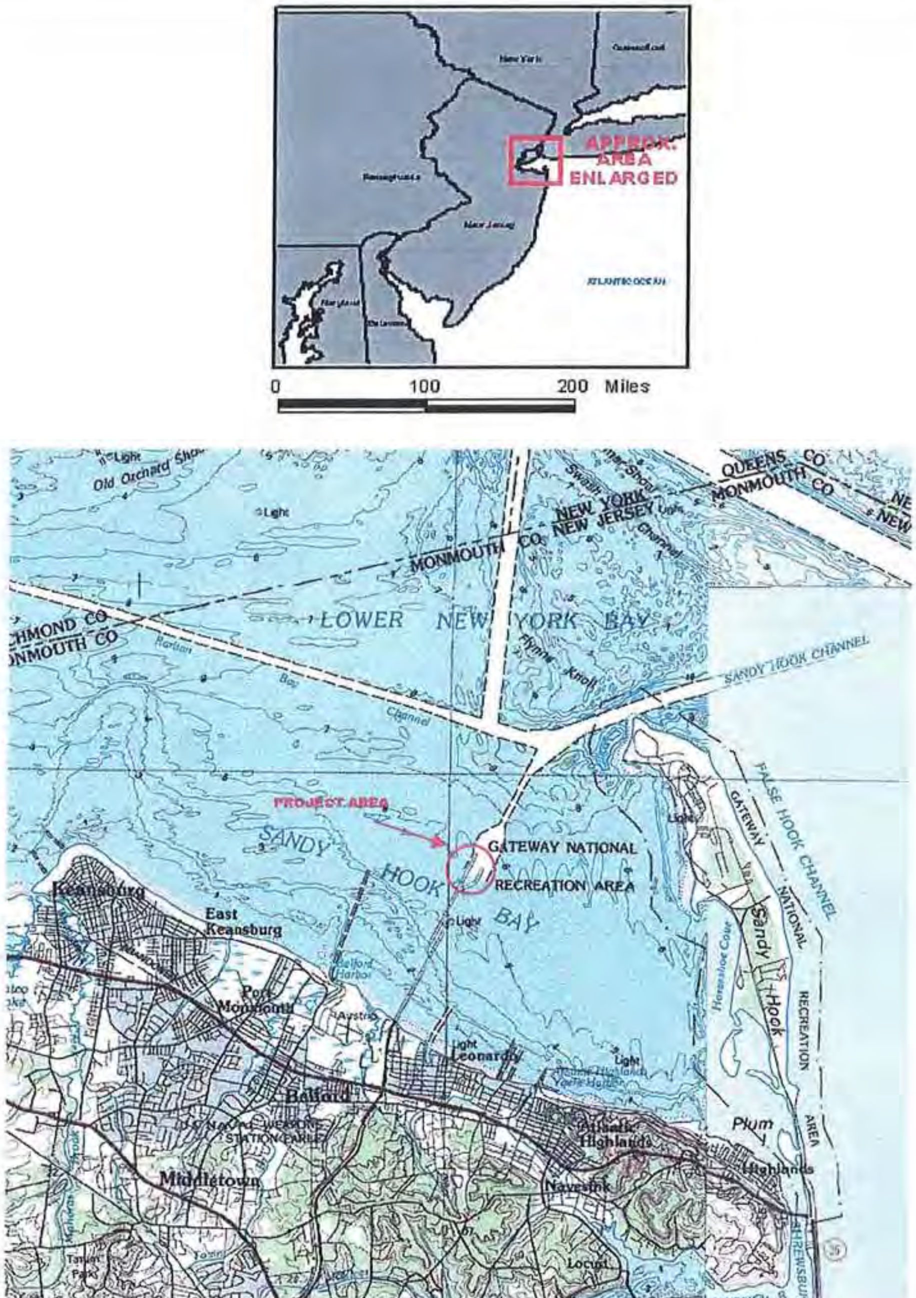
The Magnuson-Stevens Act of 1976 (the Act) was promulgated to promote fish conservation and management. Under the Act, the National Ocean and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) was granted legislative authority for fisheries regulation in the United States within a jurisdictional area located between five kilometers (km) three miles (mi) and 322 km (200 mi) offshore, depending on geographical location. Measures to ensure the proper management and harvest of fish and shellfish resources within these waters are outlined in Fisheries Management Plans prepared by eight councils for their respective geographic regions.

Recognizing that many marine fisheries are dependent on nearshore and estuarine environments for at least part of their life cycles, the Act was reauthorized, and amended extensively in 1996. The amendments, in part, stress the importance of habitat protection to healthy fisheries. The authority of the NMFS and their councils was strengthened by the reauthorization to promote more effective habitat management and protection of marine fisheries. The marine environments important to marine fisheries are referred to as essential fish habitat (EFH) in the Act and are defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

To delineate EFH, coastal littoral and continental shelf waters are first mapped by the regional Fisheries Management Council (FMC) and superimposed with 10-minute x 10-minute square coordinate grids. Then survey data, gray literature, peer review literature, and reviews by academic and government fisheries experts, are all used by the management councils to determine if these grids support EFH for federally managed species. The Mid-Atlantic Fisheries Management Council (MAFMC) has designated EFH in Sandy Hook Bay and surrounding waters of the Hudson-Raritan Bay Estuary. Both the New England Fisheries Management Council (NEFMC) and the Mid-Atlantic Fisheries Management Council have designated EFH in waters of the New York Bight (i.e., continental shelf waters of the United States Atlantic coast bound to the north by New York and to the west by New Jersey).

1.1 Applicability

Federal agencies that fund, permit, or undertake activities that may adversely effect EFH are required to consult with NMFS regarding the potential effects of their actions on EFH, and respond in writing to the NMFS's recommendations. The Navy has prepared this expanded EFH consultation, pursuant to the Act, as a result of the Navy's planned action to replace Pier 3 at the Naval Weapons Station Earle (NWS Earle) pier complex (project area) located in Sandy Hook Bay, NJ (Figure 1).



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NWS EARLE
ESSENTIAL FISH HABITAT ASSESSMENT
PIER COMPLEX REPLACEMENT

N

PROJECT LOCATION MAP **FIGURE 1-1**

1.2 Purpose

The purpose of undertaking the proposed action is to provide an adequate and efficient facility to satisfy the NWS Earle mission of providing four homeport services berths for Auxiliary-Oil-Explosive (AOE) class ships. The project will replace Pier 3 and connecting Trestle 3,with a new structure that is similar in design to Pier 4. The existing piers and trestles were constructed almost 60 years ago and have serious deficiencies that can no longer be economically repaired. Additionally, future homeporting and ordnance loading requirements specify the continued use of only four berths capable of berthing fully loaded AOE-class vessels. The removal of one pier and the replacement of another will allow NWS Earle to satisfy future mission requirements efficiently and effectively. The removal of Pier 2 will reduce future maintenance dredging requirements, resulting in defense budget savings and reduced environmental impact.

2.0 DESCRIPTION OF PROPOSED ACTION

2.1 Background

NWS Earle, located in Colts Neck, New Jersey, is one of three major ammunition depots serving fleet units on the East Coast; the others are located in Yorktown, Virginia, and Charleston, South Carolina. NWS Earle is 76 km (47 mi) south of New York City and 113 km (70 mi) northeast of Philadelphia, Pennsylvania. The facility occupies approximately 4,500 hectares (ha) [11,000 acres (ac)] and is located entirely within Monmouth County, New Jersey. Monmouth County is in east central New Jersey, which is bordered by the Atlantic Ocean to the east and Raritan Bay and Sandy Hook Bay to the north.

NWS Earle is comprised of two major parcels. The mainside, located in the interior of the county, primarily within Colts Neck Township, contains the main administration, housing, maintenance and ordnance storage facilities. The waterfront/Chapel Hill area is located on the shoreline of Sandy Hook Bay in the town of Leonardo. This area contains a few administration and maintenance facilities and the pier complex. The pier complex is a transshipment depot to facilitate the movement of ammunition and explosives. A 28-km (17-mi) road and rail corridor connects these two parcels.

NWS Earle's pier complex (Figure 2-1) is one of the longest finger piers in the world. It is comprised of a 3.2 km (2 mi) long trestle, which branches out to three finger piers - Piers 2, 3 and 4. The entire pier complex extends 3.5 km (2.2 mi) into Sandy Hook Bay. The trestle branches off to Pier 1, 1.6 km (1 mi) from the shore. At the junction of Piers 2, 3 and 4, a concrete platform supports the port operations building, a forklift/battery recharging shop and a recreation center. This area is known as the "wye".

The original piers and trestles were constructed in the early 1940's. The wye was constructed in 1981, Pier 4 was completed in 1990, and the new main trestle was constructed in 1993. The original piers and trestles were constructed of reinforced concrete slabs, 56 centimeters (cm) [22 inches (in)] thick, overlaid with a 5 cm (2-in) asphalt-wearing surface. More than 41,000 timber piles support the original piers and trestles. Elevated loading platforms line both sides of each pier.

The mission of NWS Earle is to provide fleet operational services and infrastructure management to support combat logistic homeporting, ordnance functions and tenant activities and execution of national military strategy. At the present, Pier 1 serves as a temporary holding yard for ordnance vans; Piers 2 and 4 are the homeport piers for the USS Detroit, the USNS Supply, the USNS Arctic and the USNS Mt. Baker; Pier 3 is the ordnance handling pier. The water depth at Pier 4 and the turning basin is dredged to -14 meters (m) mean low water (MLW) [-45 feet (ft) MLW)] to support these large ships. Piers 2 and 3 are dredged to –11 m (-35 ft) MLW. Since World War II, the pier complex has provided ammunition services to almost every class of vessel operated by the Navy and Coast Guard, as well as commercial supplies and vessels from a multitude of nations.

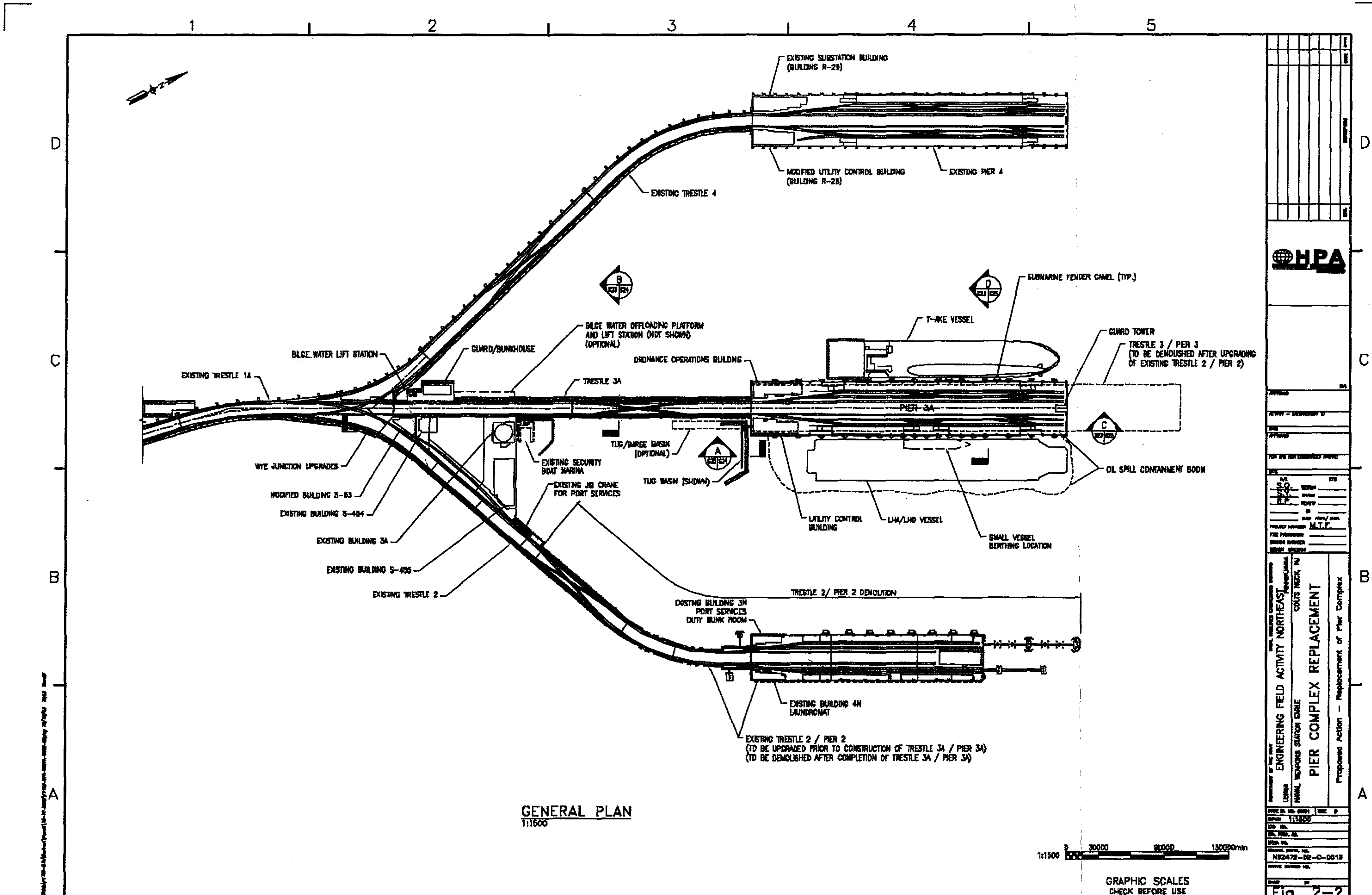
Figure 2-1. View of NWS Earle Pier Complex Looking Southeast into Sandy Hook Bay (Source: NWS Earle Engineering Dept., c.1990).

2.2 Proposed Action

Based on a projection of future homeport (ship) berth needs to continue service of the military weapons and supply vessels that visit the pier complex, the Navy is planning to replace Pier 3 and demolish Pier 2. Due to the age of the pier and adjoining trestle structures, the Navy has concluded that renovation of Pier 3 is not economically feasible. The Navy further proposes to dredge the ship berthing areas adjacent to Pier 3 to project depth. The replaced Pier 3 would be known as "3A" and would be rebuilt in place of existing Pier 3. The new Pier 3A would provide modern utilities to service homeported and berthed ships. Proposed upgrades to the pier complex are depicted on Figure 2-2. A detail of the proposed Pier 3A trestle is provided in Figure 2-3 and a detail of the proposed Pier 3A is provided in Figure 2-4.

There are three distinct aspects of the proposed action: pier demolition, dredging of ship berths, and dredged sediment disposal. These three aspects would occur progressively with in-water dredging work being conducted during open "dredging windows" until completion.

Construction associated with the pier complex replacement is likely to begin in Summer 2004. At commencement, construction activity would consist of upgrades to existing Pier 2. A likely construction phasing and anticipated construction schedule scenario for the major in-water work activities associated with the Pier Complex replacement is as follows:


EXISTING SUBSTATION BUILDING (BUILDING R-29)
MODIFIED UTILITY CONTROL BUILDING (BUILDING R-28)
EXISTING PIER 4
EXISTING TRESTLE 4
SUBMARINE FENDER CAMEL (TYP.)
T-AKE VESSEL
BILGE WATER OFFLOADING PLATFORM AND LIFT STATION (NOT SHOWN) (OPTIONAL)
BILGE WATER LIFT STATION
GUARD/BUNKHOUSE
ORDNANCE OPERATIONS BUILDING
GUARD TOWER
TRESTLE 3 / PIER 3 (TO BE DEMOLISHED AFTER UPGRADING OF EXISTING TRESTLE 2 / PIER 2)
EXISTING TRESTLE 1A
TRESTLE 3A
PIER 3A
TUG/BARGE BASIN (OPTIONAL)
TUG BASIN (SHOWN)
EXISTING SECURITY BOAT MARINA
EXISTING JIB CRANE FOR PORT SERVICES
OIL SPILL CONTAINMENT BOOM
WYE JUNCTION UPGRADES
MODIFIED BUILDING S-63
EXISTING BUILDING S-454
EXISTING BUILDING 3A
EXISTING BUILDING S-455
EXISTING TRESTLE 2
UTILITY CONTROL BUILDING
LHA/LHD VESSEL
SMALL VESSEL BERTHING LOCATION
TRESTLE 2/ PIER 2 DEMOLITION
EXISTING BUILDING 3N PORT SERVICES DUTY BUNK ROOM
EXISTING BUILDING 4N LAUNDROMAT
EXISTING TRESTLE 2 / PIER 2 (TO BE UPGRADED PRIOR TO CONSTRUCTION OF TRESTLE 3A / PIER 3A) (TO BE DEMOLISHED AFTER COMPLETION OF TRESTLE 3A / PIER 3A)
GENERAL PLAN
1:1500
1:1500
0 30000 90000 150000mm
GRAPHIC SCALES
CHECK BEFORE USE
HPA
M.T.F.
ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
Proposed Action – Replacement of Pier Complex
1:1500
N62472-02-C-0012
Fig. 2-2

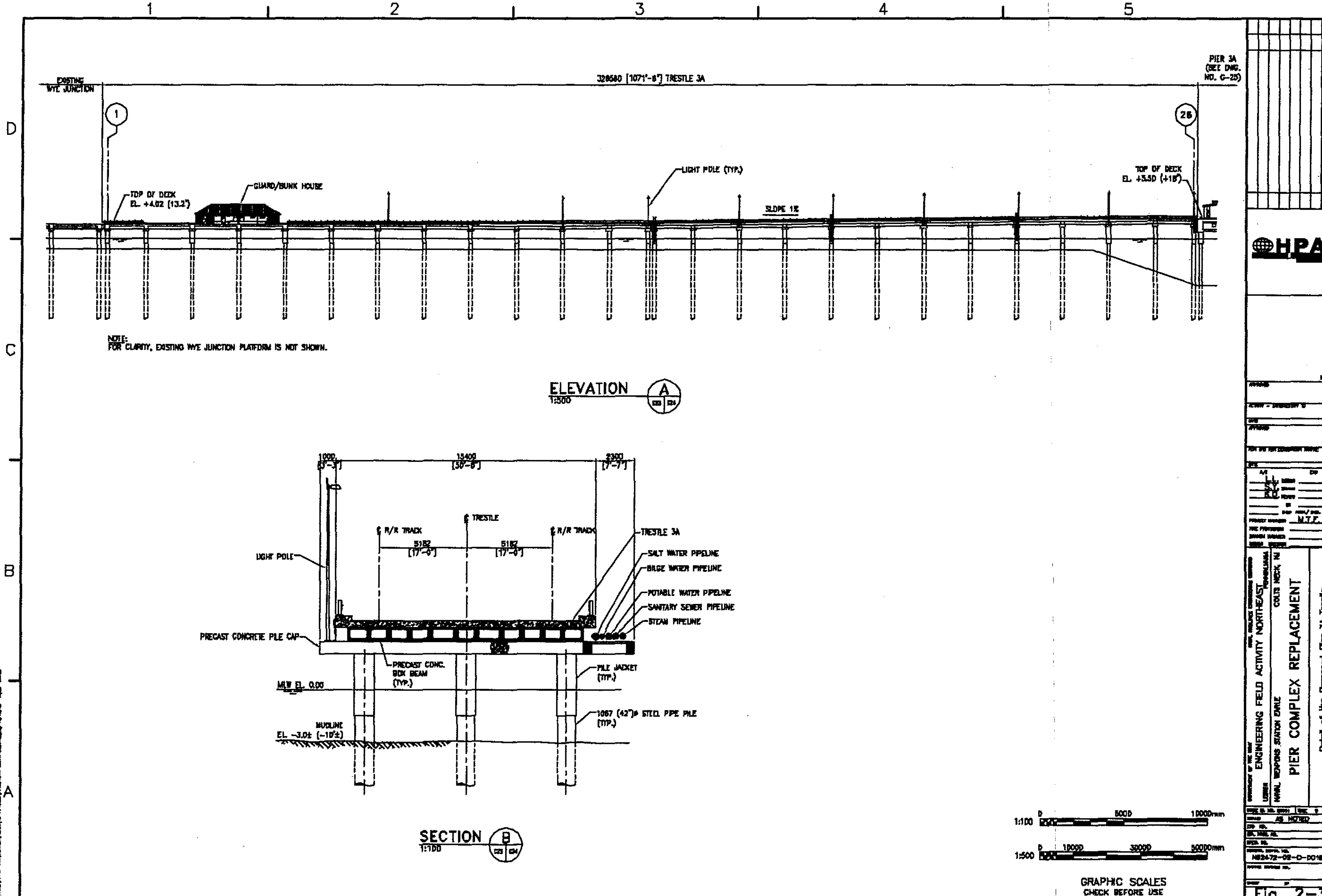
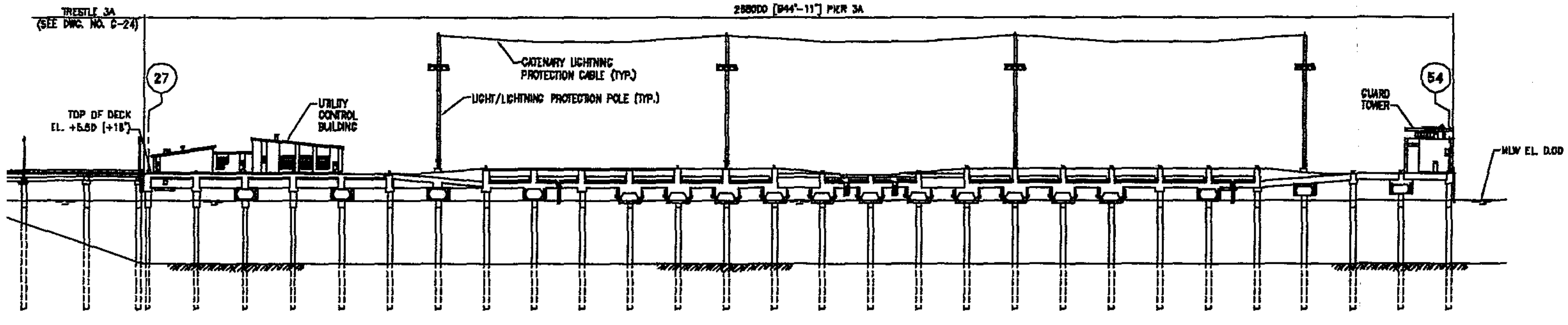
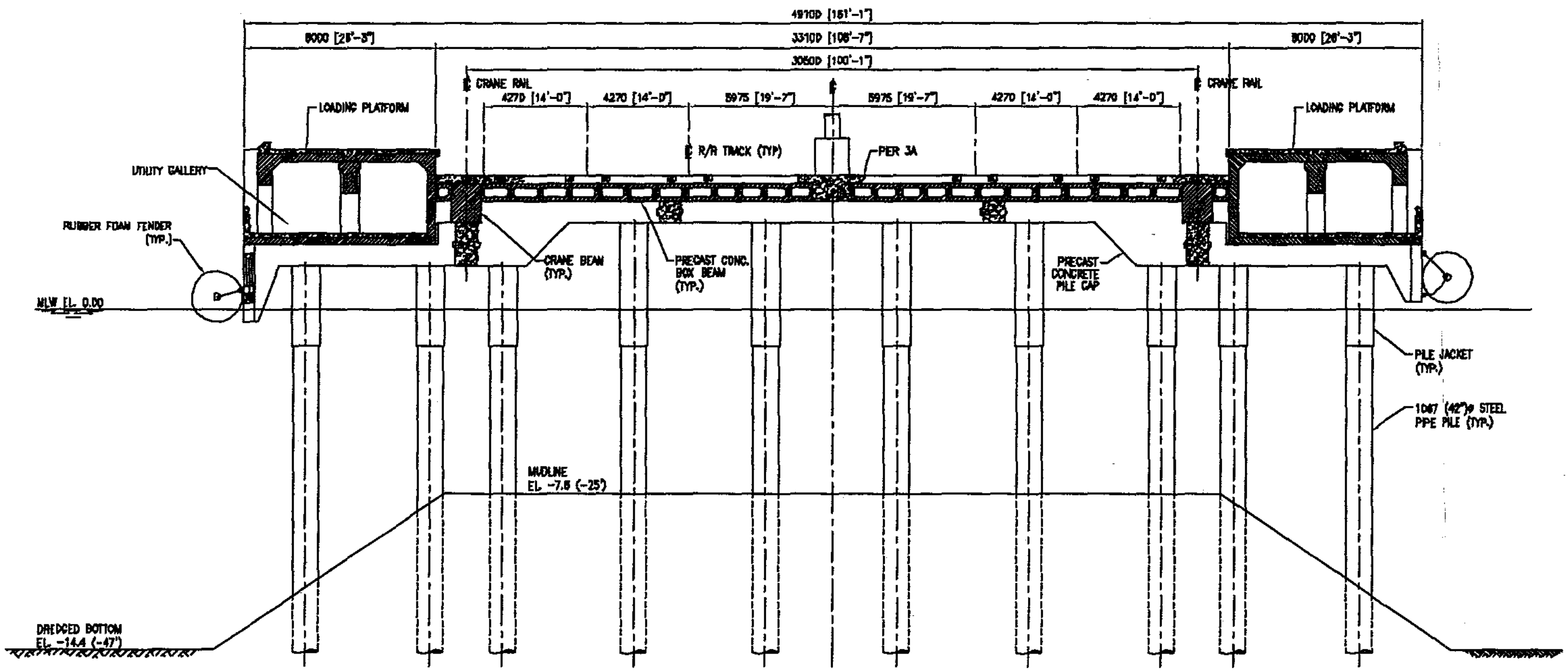

EXISTING WYE JUNCTION
328580 [1071'-8"] TRESTLE 3A
PIER 3A (SEE DWG. NO. C-25)
TOP OF DECK EL. +4.02 (13.2')
GUARD/BUNK HOUSE
LIGHT POLE (TYP.)
SLOPE 1%
TOP OF DECK EL. +3.50 (+18')
NOTE:
FOR CLARITY, EXISTING WYE JUNCTION PLATFORM IS NOT SHOWN.
ELEVATION A
1:500
1000 [3'-3"]
15400 [50'-6"]
2300 [7'-7"]
℄ TRESTLE
℄ R/R TRACK
5182 [17'-0"]
TRESTLE 3A
SALT WATER PIPELINE
BILGE WATER PIPELINE
POTABLE WATER PIPELINE
SANITARY SEWER PIPELINE
STEAM PIPELINE
LIGHT POLE
PRECAST CONCRETE PILE CAP
PRECAST CONC. BOX BEAM (TYP.)
PILE JACKET (TYP.)
MLW EL. 0.00
MUDLINE EL. -3.0± (-10'±)
1067 (42")ø STEEL PIPE PILE (TYP.)
SECTION B
1:100
1:100 0 5000 10000mm
1:500 0 10000 30000 50000mm
GRAPHIC SCALES
CHECK BEFORE USE
ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
Detail of the Proposed Pier 3A Trestle
AS NOTED
N62472-02-C-0018
M.T.F.

Fig. 2-3



ELEVATION C
1:500



SECTION D
1:100

1:100 0 5000 10000mm

1:500 0 10000 30000 50000mm

GRAPHIC SCALES
CHECK BEFORE USE

ENGINEERING FIELD ACTIVITY NORTHEAST

NAVAL WEAPONS STATION EARLE COLTS NECK, NJ

PIER COMPLEX REPLACEMENT

Detail of Proposed Pier 3A

M.T.F.

AS NOTED

N62472-02-C-0015

Fig. 2-4

- December 2004: Demolition of existing Pier 3 and Trestle 3; and pile-driving for new Pier 3 and Trestle 3 (duration approx. 94 days);

- August - September 2005: Phase 1 dredging under existing Pier 3 (approximately 53,000 m^3 (69,300 cubic yards (cy)), for a duration of approximately 15 days;

- July – August 2006: Phase 2 dredging in Pier 3 berth areas (approximately 220,000 m^3 (287,760 cy), for a duration of approximately 40 working days, or 8 weeks;

- January – June 2007: Demolition of Pier 2 and Trestle 2 (Approximate duration of 110 days).

2.2.1 Pier Demolition

Both Piers 2 and 3 will be demolished under the proposed action. However demolition of these piers would not occur simultaneously. Pier 3 would be demolished progressively beginning first at the seaward end of the pier, then progressing shoreward toward the trestle. New steel piles would be driven into place for the new Pier 3 through the deck of the old Pier 3, working in this same direction and preceding the demolition work. Once new piles were installed through the deck of the old pier, that section of the old pier would be demolished. Working in this manner, the construction contractors can use the existing Pier 3 deck for equipment staging during new pile installation.

Following demolition of the old Pier 3, the new Pier 3 would be constructed atop the newly installed steel piles. Once the new Pier 3 is constructed and is operational, Pier 2 will be demolished. It is anticipated that concrete demolition material generated from Piers 2 and 3 would be disposed of within one of New Jersey's artificial reef sites, upon approval from the New Jersey Department of Environmental Protection (NJDEP) Artificial Reef Program. Creosote timber piles generated from the demolition of Piers 2 and 3 would be sent to an upland disposal/recycling/reuse facility permitted to accept timber pile material.

Recovered steel (e.g., steel utility plates and railroad rails) removed from the pier surface prior to demolition would be collected and recycled as salvaged steel. Other material, such as utility piping and other remaining materials, would be disposed of at an upland facility permitted to accept demolition debris.

2.2.2 Dredged Sediment Disposal

Dredged material generated as a result of the deepening of the existing pier berths would be segregated into different reaches in accordance with the Army Corps of Engineers (ACOE) sampling testing and analysis plan and permitting. Recently deposited material considered unsuitable for open ocean disposal (e.g. unconsolidated or previously disturbed material lying atop undisturbed native marine geologic sediments or "parent material") would be disposed of at an available permitted upland disposal/reuse/recycling facility. Undisturbed native marine geologic sediments or "parent material" dredged from the project area and determined to be suitable for ocean disposal following bioaccumulation testing, would be disposed of at the Historic Area Remediation Site (HARS), located 9.6 km (6 mi) east of Sandy Hook, NJ and 17.7 km (11 mi) south of Rockaway, NY.

2.3 Description of the Project Area

The pier complex and the HARS both lay within areas designated as EFH for the Mid-Atlantic Groundfish Management plans. The Navy has prepared this EFH assessment to address the potential impacts to sub-tidal and water column EFH-designated areas associated with in-water activities (e.g., dredging and pile removal) pertaining to the proposed action at Pier 3.

The "Programmatic Essential Fish Habitat Assessment", prepared by the US Army Corps of Engineers Operations Division New York District, has addressed potential impact to the sub-tidal and water column EFH designated within the area of the HARS, and therefore addresses potential impact to EFH within the HARS as a result to dredged material disposal including the disposal of suitable dredged material to be generated as a result of the proposed action, and anticipated to be disposed of at the HARS.

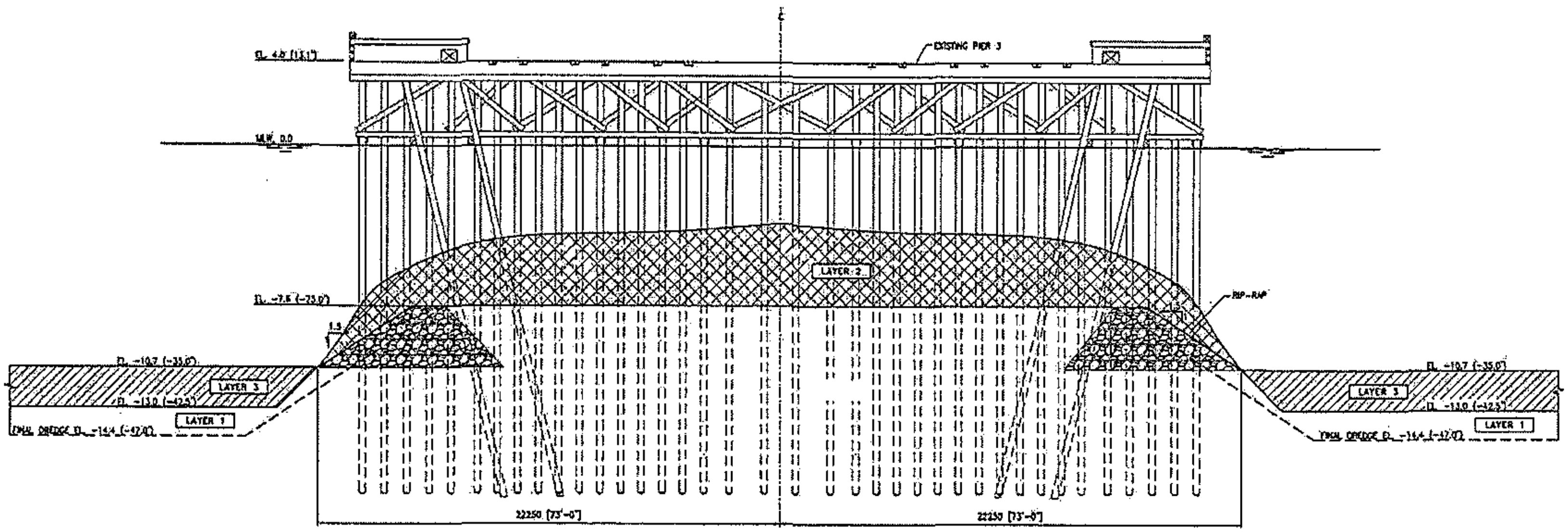
Suitability for ocean disposal of dredged sediment generated for this project was determined through analyses of sediment bulk chemistry and elutriate testing, as well as acute toxicity and bioaccumulation testing. Methods and materials for sediment testing are specified in the following documents:

- The Environmental Protection Agency's (EPA's) Ocean Dumping Regulations 40 Code of Federal Regulations (CFR) Part 227, "Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials"

- EPA/ACOE 1991, "Evaluation of Dredged Material Proposed for Ocean Disposal, Testing Manual" as amended (otherwise known as the Green Book) (EPA/ACOE, 1991); and

- EPA/ACOE-New York District (NYD). 1994, "Draft Guidance for Performing Tests on Dredged Material proposed for Ocean Disposal" (otherwise known as the Regional Testing Manual)(EPA/ACOE-NYD, 1994).

For sediments to meet ocean-disposal criteria, test results must indicate no unacceptable toxicity or bioaccumulation in biological test systems. Three distinct sediment layers associated with this project were identified and subject to physical, chemical, and biological testing to determine open-ocean suitability (Figure 2-5). Layer 1 is native parent material that underlies more recently deposited sediment underneath the Pier (Layer 2) and within the berthing areas (Layer 3).



EXISTING SEABED MATERIALS
1:200

HPA
HAN-PADRON ASSOCIATES
ENGINEERS

1:200 0 2500 5000 10000mm

NAVAL WEAPONS STATION EARLE
PIER COMPLEX REPLACEMENT
PIER 3A–EXISTING SEABED MATERIALS
AND PIER 3 CONFIGURATION

FIGURE 2-5 Sediment Layers

Sediment bulk chemistry and elutriate analysis, as well as acute and bioaccumulation testing have demonstrated suitability of Layer 1 material for disposal at the HARS. Layers 2 and 3 will be subject to upland disposal in accordance with NJDEP regulations. The interface depths between the parent layer (Layer 1) and the two surficial layers of unconsolidated materials (Layers 2 and 3) have been determined and are depicted in Figure 2-6, a map of the dredge envelope.

2.4 Project Area Characteristics

Characteristics of the HARS environment and associated habitat are described in the Supplement to the Environmental Impact Statement on the New York Dredged Material Disposal Site Designation for the HARS in the New York Bight Apex (EPA, 1997).

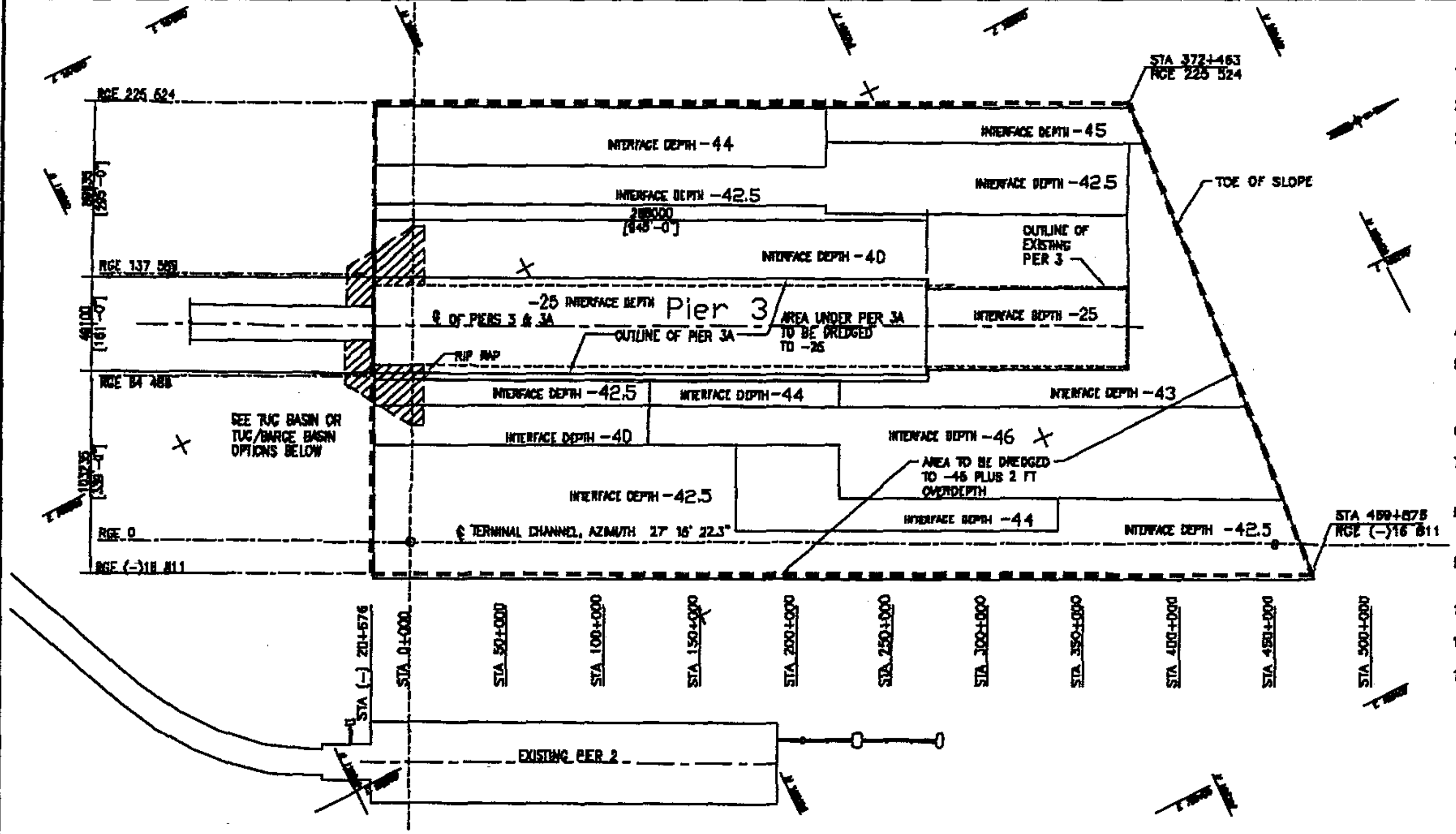
The estimated area of disturbance associated with this project is 8.8 hectares (ha) (21.7 ac). Disposal of dredge material suitable for disposal at the HARS would result in the creation of a 1 m (3.3 ft) cap over existing bottom sediments over a 159,000 square meter (m^2) (1,710,840 square feet (ft^2)) area designated for remediation by capping (ACOE/ EPA, 1997). Disposal activity at the HARS is managed in accordance with the "Site Management and Monitoring Plan for the Historic Area Remediation Site" (HARS SMMP).

NWS Earle pier complex is located within Sandy Hook Bay, Monmouth County, NJ. Sandy Hook Bay is located on the north shore of the New Jersey coast west of the Sandy Hook Peninsula. It is bordered by the communities of Leonardo and Atlantic Highlands to the east, and Belford to the west. The project area lies approximately 24 km (15 mi) north of NWS Earle, which is the major landside area of NWS Earle property located in Colts Neck, NJ. The Sandy Hook Bay shoreline is characterized by intermittent smaller embayments of Sandy Hook to the east; separated by beach, back beach, and primary dune uplands, or headlands. To the south, the bay shoreline is characterized by marinas and other developed areas within intermittent salt marsh systems at the mouth of various drainages.

2.4.1 Hydrography

Sandy Hook Bay is an embayment of the larger Hudson-Raritan Bay Estuary Complex formed by the Raritan River in New Jersey, and the Hudson River in New York. The bay mouth extends from Sandy Hook Point, west to Keansburg. The mean tidal range of Sandy Hook Bay is reported to be 1.4 m (4.6 ft) (USNAVY, 1990) to 1.7 m (5.5 ft) (MacKenzie, 1992; USFWS, 2001). Tides are semidiurnal.

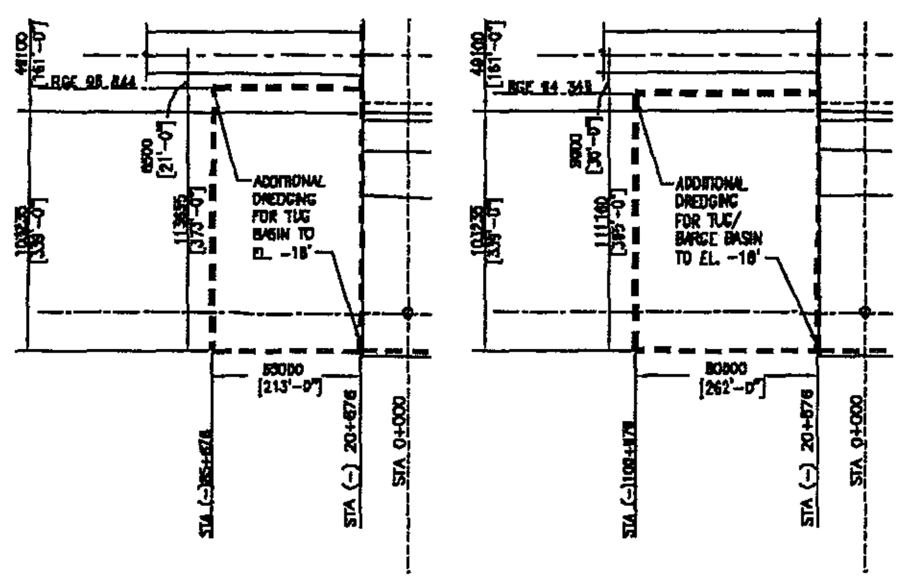
The Passaic, Matawan, Navesink, and Shrewsbury Rivers contribute freshwater flows to the Hudson-Raritan Bay in the vicinity of Sandy Hook Bay. Numerous smaller freshwater streams also empty into Sandy Hook Bay, including Ware Creek, which drains a 5.2 square kilometer (km^2) [2 square mile (mi^2)] wide area that includes portions of NWS Earle's waterfront and Chapel Hill areas. The major freshwater inputs of the Raritan and Hudson Rivers to the bay cause a net counterclockwise gyre of currents within the bay (MacKenzie, 1992). Within this



ESTIMATED MATERIAL QUANTITIES

	Dredging Depths (FT)		Estimated Quantities (CY)		
	Required Grade	Allowable Overdepth	Required Grade	Allowable Overdepth	Total CY
Contaminated Material					
Layer 2 (Under Pier 3)	Existing Grade to -25	None	18,500	0	18,500
Layer 2 (Under Pier 3A)	Existing Grade to -25	None	48,500	0	48,500
Layer 3 (Berth Areas)	Existing Grade to Interface	None	231,500	0	231,500
Total Pay Cubic Yards	Existing Grade to Interface	None	298,500	0	298,500
Clean Material					
Layer 1 (Under Pier 3)	Interface to -45	-45 to -47	35,500	4,000	39,500
Layer 1 (Berth Areas)	Interface to -45	-45 to -47	104,500	78,500	183,000
Total Pay Cubic Yards	Interface to -45	to -47	140,000	82,500	222,500
Combined Total Pay CY	Existing Grade to -45	to -47	438,500	82,500	521,000
Optional Dredging:					
Contaminated:					
Tug Berth	Existing Grade to -18	None	6,100	0	6,100
Tug & Barge Berth	Existing Grade to -18	None	9,200	0	9,200

Notes: "Under Pier 3" denotes materials within the footprint of the Pier 3 area to the north of Pier 3A

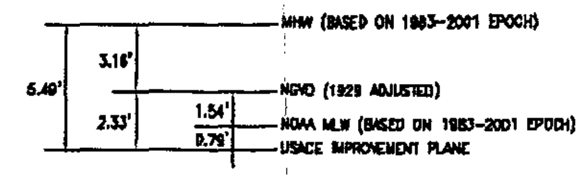


TUG BASIN OPTION
1:1500

TUG/BARGE BASIN OPTION
1:1500

GENERAL NOTES

1. ELEVATIONS AND SOUNDINGS ARE SHOWN IN FEET AND ARE REFERRED TO MEAN LOW WATER (MLW).
2. THE PLANE OF MLW IS REFERENCED AT 2.3 FT BELOW NGVD 1929
3. "NGVD", NATIONAL GEODETIC VERTICAL DATUM, IS THE DATUM OF GEODETIC LEVEL NET OF THE UNITED STATES.



4. THE COORDINATE GRID IS THE STATE OF NEW JERSEY MERCATOR (NAD 1983 METERS).
5. HYDROGRAPHIC SURVEYS WERE PERFORMED BY GAHAGAN & BRYANT ASSOCIATES, INC. ON DECEMBER 4, 2002. SURVEY DATA WAS OBTAINED WITH THE SURVEY VESSEL "SEA FOX" UTILIZING A TSS POS/MV OPS AND ODOM ECHOSCAN MULTIBEAM SYSTEM.
6. DIFFERENTIAL CORRECTIONS PROVIDED BY U.S.C.G. NAVBEACON SYSTEM
7. THE TEMPORARY REMOVAL OF AIDS TO NAVIGATION, IF REQUIRED, SHALL BE CARRIED OUT IN ACCORDANCE WITH THE SPECIFICATIONS.
8. BERTHING AREAS AND A PORTION OF PIER 3 FOOTPRINT TO BE DREDGE TO ELEVATION -45' + 2' OVERDEPTH (AS INDICATED). PIER 3A FOOTPRINT TO BE DREDGED TO 25' ELEV. (AS INDICATED)
9. PIER AND DOLPHIN DECK ELEVATIONS SHOWN ARE FROM NAVFAC FILE DRAWINGS AND HAVE NOT BEEN VERIFIED.
10. ALL DIMENSIONS ARE IN MILLIMETERS.
11. ALL ELEVATIONS ARE IN FEET.
12. MATERIALS TO BE DREDGED ARE CLASSIFIED AS CONTAMINATED (UNSUITABLE FOR OCEAN DISPOSAL) OR CLEAN (SUITABLE FOR OCEAN DISPOSAL) AND HAVE BEEN SEGREGATED INTO THREE VERTICAL LAYERS DEPENDING ON THEIR PHYSICAL LOCATION AS NOTED BELOW:
    - LAYER 1 – UNCONTAMINATED MATERIALS LYING BELOW THE INTERFACE TEMPLATE BENEATH THE EXISTING PIER 3 AND UNCONTAMINATED MATERIALS LYING BELOW THE INTERFACE TEMPLATE IN THE AREA ADJACENT TO PIER 3.
    - LAYER 2 – MATERIALS CONSIDERED CONTAMINATED (NOT SUITABLE FOR OCEAN DISPOSAL) LYING BENEATH THE EXISTING PIER 3 AND ABOVE OUTER SLOPES OF THE ROCK DYKES.
    - LAYER 3 – MATERIALS CONSIDERED CONTAMINATED (NOT SUITABLE FOR OCEAN DISPOSAL) LYING ABOVE THE INTERFACE TEMPLATE IN THE AREAS ADJACENT TO PIER 3.

LEGEND

– – – – UNITS OF DREDGING (TOE OF SLOPE)

1:1500 0 25 50 100 150m

GRAPHIC SCALES
CHECK BEFORE USE

HPA

GBA

M.T.F.

ENGINEERING FIELD ACTIVITY NORTHEAST
NAVAL WEAPONS STATION EARLE
COLTS NECK, NJ
PIER COMPLEX REPLACEMENT
Map of the Project Area Dredge Envelope

1:1500
N62472-02-C-0018

Fig. 2-6

gyre, and proximal to the NWS project area, the major flow patterns are east to west across the NWS Earle Terminal Channel; a predominant ebb flow along the Sandy Hook shore; and high currents around the tip of Sandy Hook (USNAVY, 1990). Closer to the pier, currents are slowed and weakened by the numerous piles beneath the pier complex.

2.4.2 Bathymetry

Depths within Sandy Hook Bay vary with location. To the east and just outside the berthing areas of the piers and the turning basin, depths range from 5 to 5.5 m (16 to 18 ft). East of the entrance channel to the project area, depths range from 6 to 9 m (21 to 28 ft). To the west and outside the berthing areas of the piers and the turning basin within the project area, depths range from 5 to 6 m (16 to 20 ft), while west of the entrance channel to the project area, depths average 8 m (26 ft) (NOAA, 2001). Figure 2-7 depicts the distribution of bay water depths within the project area. Bathymetric surveys conducted over a 120-year period indicate little natural change in the bottom configuration of the estuary. Therefore, most disturbance events altering the bathymetry are man-made (i.e., dredging of shipping lanes) (MacKenzie, 1992).

Current sedimentation rates in the main channel of Raritan Bay are reported to be 1.9 centimeters (cm) (0.75 in) per year (MacKenzie, 1992). Sediments deposited in the area of the pier complex originate from the west. These materials may be derived from either riverine transport within the Raritan River with subsequent deposition into Raritan Bay (MacKenzie, 1992), or via erosion of the south shore with subsequent littoral transport by prevailing west to east longshore currents within the bay (USNAVY, 1990).

2.4.3 Sediment Characteristics/Quality

The sediments found within Raritan Bay vary with region from north to south. Sands predominate in the Lower Bay Area, while a muddy bottom region lies east to west at mid bay, likely a result of river-transported sediment from the Raritan River. The south shore sediments are derived from Keansburg sands (MacKenzie, 1992). These sediments are generated largely by longshore currents eroding the south shore of the bay. These sediments are overlain in many areas adjacent to the project area by more recent deposits of finer sand, silt, clay and some organic debris.

Larger-grained sediment (fine to medium sand) occurs in the terminal channel proximal to the main navigation channel of Raritan Bay. Here, faster currents entering the estuary around the northern tip of Sandy Hook, especially during storm events, transport coarser-grained sediments into the bay from off-site sources. Once inside the bay, they are deposited in the relatively lower energy waters of the protected bay where current energy dissipates. The finer sediments within the project area (silts, clay, and organic detritus) occur adjacent to the project area, since wave energy is greatly reduced in this location by the numerous pier pilings. The patterns of sediment movement within Sandy Hook Bay appear to conform to the predominant circulation patterns and littoral processes of the Hudson – Raritan Bay Complex.

Results of toxicity testing revealed polyaromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in the sediment of Reaches 2 and 3 at bioaccumulative concentrations sufficient render the material unsuitable for open ocean disposal without treatment, capping, or both.


GENERAL NOTES
1. ELEVATIONS AND SOUNDINGS ARE SHOWN IN FEET AND TENTHS AND ARE REFERRED TO MEAN LOW WATER (MLW), WHICH IS ASSUMED AT THE USCE IMPROVEMENT PLANE.
2. THE PLANE OF MEAN LOW WATER (MLW) IS 2.33 FT. BELOW NGVD.
3. "NGVD", NATIONAL GEODETIC VERTICAL DATUM, IS THE DATUM OF GEODETIC LEVEL NET OF THE UNITED STATES.
MHW
4.66'
NGVD (1929)
2.33'
MLW - DATUM ASSUMED AT THE USCE IMPROVEMENT PLANE.
4. THE COORDINATE GRID IS THE STATE OF NEW JERSEY MERCATOR (NAD 1927).
5. HYDROGRAPHIC SURVEYS WERE PERFORMED BY GAHAGAN & BRYANT ASSOCIATES, INC. DURING THE PERIOD FROM 7-28-00 THRU 8-10-00. SURVEY DATA WAS OBTAINED WITH THE SURVEY VESSEL "SEA FIX" UTILIZING TRIMBLE DIFFERENTIAL GPS POSITIONING EQUIPMENT AND AN ODOM ECHOTRAC DUAL FREQUENCY FATHOMETER.
6. DIFFERENTIAL CORRECTIONS PROVIDED BY U.S.C.G. NAVBEACON SYSTEM
EXISTING PIER 4
NEW PIER 3 VOLUMES SOUTH
EXISTING PIER 3 VOLUMES NORTH
EXISTING PIER 2
RGE 1600
RGE 740
RGE (-) 735
STA (-) 0+63
STA 22+17 RGE 1600
STA 36+17 RGE 200
STA 32+17 RGE (-) 200
STA 18+17 RGE (-) 735
STA 22+17 RGE (-) 735
N 591000
N 592000
N 593000
N 594000
N 595000
N 590000
E 2170000
E 2171000
E 2172000
N
SOUNDING LEGEND
35' PROJECT
ABOVE 34.9' MLW
35' TO 36.9' MLW
BELOW 37' MLW
45' PROJECT
ABOVE 44.9' MLW
45' TO 46.9' MLW
BELOW 47' MLW
0 200 400
SCALE 1"= 200'
CHECK GRAPHIC SCALE BEFORE USING
STA (-) 5+00
STA (-) 2+00
STA 0+00
STA 5+00
STA 10+00
STA 15+00
STA 20+00
STA 25+00
STA 30+00
STA 35+00
STA 40+00
STA 45+00
GAHAGAN & BRYANT ASSOCIATES
REV. DESCRIPTION PREP BY DATE APPRVD
NORTHERN DIVISION
NAVAL WEAPONS STATION EARLE
PIERS 2, 3, AND 4 CONDITION SURVEY
BATHYMETRY
SEAL AREA
SCALE: 1" = 400'
NAVFAC DRAWING NO.
SHEET 2 OF 3
SIZE: D

Figure 2-7

2.4.4 Water Quality

Due to the relatively shallow depths that occur throughout the bay, the Sandy Hook Bay water column tends to be well-mixed with little difference in temperature between surface and bottom waters. The water quality of the bay is impacted by input from point and non-point sources discharging into the bay. Point source discharges include municipal wastewater discharges, industrial discharges, and combined sewer overflows. Non-point sources include leachate from landfills and other sources of contaminated groundwater, urban runoff, atmospheric deposition of contaminants, and illegal or accidental releases of oil or hazardous materials. Elevated concentrations of biochemical oxygen demand, fecal coliform, heavy metals, nutrients and PCBs have been identified within the Hudson-Raritan Estuary surface waters (BOS, 1992a) and sediments (BOS, 1992b; Long et al., 1995). The contributors of these contaminants to the system include municipal, industrial, combined sewer overflow, stormwater, tributary, leachate, atmospheric deposition, and accidental spills (Hydroqual, 1993). Temperatures within Sandy Hook Bay range from 0.5°C (33°F) in late January to 25.5°C (78°F) in late August (MacKenzie, 1992). Prevailing summer winds are from the south and southwest, while winter brings prevailing winds from the northwest.

2.4.5 Biosalinity Zones

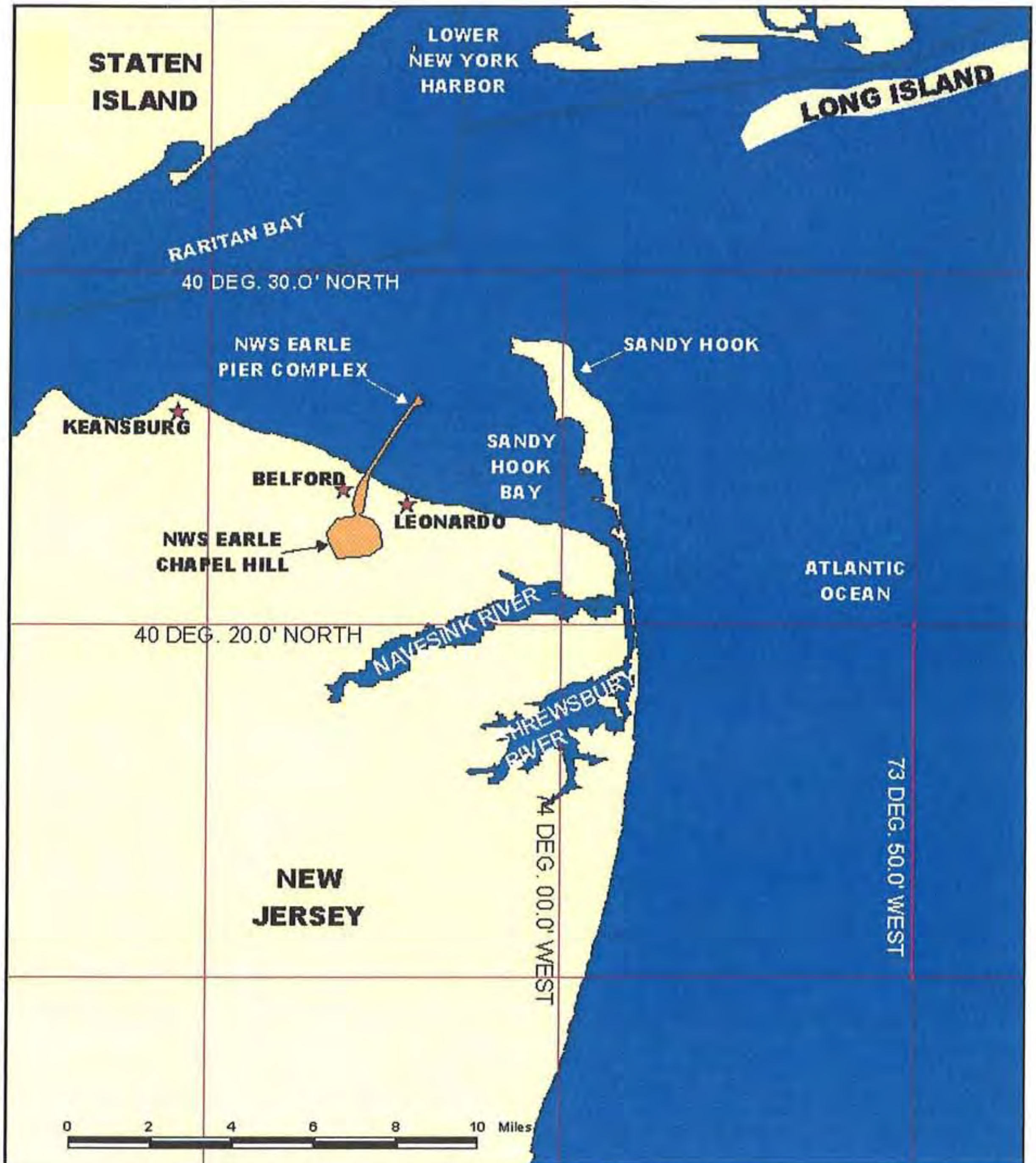
The project area is located approximately 4.8 km (3 mi) from shore near the northern limit of Sandy Hook Bay. Here the waters of the bay are reported to be within the seawater biosalinity zone (NMFS, 1999). Waters included within this biosalinity zone typically have a salinity of greater than 25.0 parts per thousand (ppt or ‰). An extensive mixing biosalinity zone lies to the southeast of the project area at the mouth of the Shrewsbury River, which lies at the southeast corner of Sandy Hook Bay (NMFS, 1999). Waters included in the mixing biosalinity zone normally have salinity between 0.5 and 25.0 ‰.

2.4.6 Unique Habitat Features

No Habitat Areas of Particular Concern (HAPC) are located within the project area. HAPC are described by NOAA as "subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important or located in an environmentally stressed area" (NOAA, 1998). Due to past maintenance dredging and the required maintenance depth, no extensive beds of submerged aquatic vegetation (SAV) are found within the project area.

2.5 Fisheries and Marine Resources of the Project Area

The project area lies within a 10 minute x 10 minute grid area designated as EFH by the MAFMC. The delineation of the EFH quadrant that encompasses the project area is depicted in Figure 2-8. The description of the EFH delineation is provided in Table 2-1. In addition to the federally managed species, the project area also supports important recreational fisheries and provides habitat for prey species of EFH and other fish species (Section 2.6).



NAVAL WEAPONS STATION EARLE

PIER COMPLEX REPLACEMENT
ESSENTIAL FISH HABITAT ASSESSMENT
LOCAL QUADRANTS

7/03 Source: TIGER/U.S. Census , NJDEP

FIGURE 2-8

Similar to the project area, the HARS lies within one or more 10 minute x 10 minute grid areas. The EFH designated species applicable to the HARS and resultant potential impacts to EFH associated with disposal of suitable dredged material has been addressed by a Programmatic Essential Fish Habitat Assessment for Placement of Category I Dredged Material at the Historic Area Remediation Site in the New York Bight Apex (ACOE/NYD, 2002).

The project area lies within waters designated as EFH for one or more life stages of 18 federally managed fish species. A description of the 10 minute x 10 minute square coordinate grid EFH delineation and the list of federally managed fish species with applicable life stages within this grid (which is inclusive of the project area) is provided in Table 2-1. A notation "X" within the table indicates that EFH has been designated within the square for a given species and life stage. A notation "n/a", if it appears in one or more life stage columns, denotes that that particular life stage does not occur for that particular species.

Table 2-1
Summary of Essential Fish Habitat (EFH) Designation

<u>Square Description:</u> The waters within the square within southeastern Raritan Bay including Sandy Hook Bay around Sandy Hook, NJ., and northeast New Jersey from Pt. Comfort north of Keansburg, NJ, southeast to Navesink Park, NJ. These waters are all north of Port Monmouth, NJ, Atlantic Highlands, NJ, and western Rumson Neck. Also, these waters are within the western part of the Navesink River, the northwest 1/4 of the Shrewsbury River, and surround Rumson, NJ, Fair Haven, NJ, including those waters in Little Silver Creek east of Little Silver, NJ, and Claypit Creek southeast of Navesink, NJ.

Boundary	North	East	South	West
Coordinate	40° 30.0' N	74° 00.0' W	40° 20.0' N	74° 10.0' W

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod *(Gadus morhua)*				
haddock *(Melanogrammus aeglefinus)*				
pollock *(Pollachius virens)*				
whiting *(Merluccius bilinearis)*				
offshore hake *(Merluccius albidus)*				
red hake *(Urophycis chuss)*		X	X	X
white hake *(Urophycis tenuis)*				
redfish *(Sebastes fasciatus)*	n/a			
witch flounder *(Glyptocephalus cynoglossus)*				
winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
yellowtail flounder *(Pleuronectes ferruginea)*				
windowpane flounder *(Scophthalmus aquosus)*	X	X	X	X
American plaice *(Hippoglossoides platessoides)*				
ocean pout *(Macrozoarces americanus)*				

Table 2-1
Summary of Essential Fish Habitat (EFH) Designation

Square Description: The waters within the square within southeastern Raritan Bay including Sandy Hook Bay around Sandy Hook, NJ., and northeast New Jersey from Pt. Comfort north of Keansburg, NJ, southeast to Navesink Park, NJ. These waters are all north of Port Monmouth, NJ, Atlantic Highlands, NJ, and western Rumson Neck. Also, these waters are within the western part of the Navesink River, the northwest 1/4 of the Shrewsbury River, and surround Rumson, NJ, Fair Haven, NJ, including those waters in Little Silver Creek east of Little Silver, NJ, and Claypit Creek southeast of Navesink, NJ.

Boundary	North	East	South	West
Coordinate	40° 30.0' N	74° 00.0' W	40° 20.0' N	74° 10.0' W

Species	Eggs	Larvae	Juveniles	Adults
Atlantic halibut *(Hippoglossus hippoglossus)*				
Atlantic sea scallop *(Placopecten magellanicus)*				
Atlantic sea herring *(Clupea harengus)*		X	X	X
monkfish *(Lophius americanus)*				
bluefish *(Pomatomus saltatrix)*			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		
short finned squid *(Illex illecebrosus)*	n/a	n/a		
Atlantic butterfish *(Peprilus triacanthus)*		X	X	X
Atlantic mackerel *(Scomber scombrus)*			X	X
summer flounder *(Paralichthys dentatus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a	X	X
black sea bass *(Centropristis striata)*	n/a		X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
ocean quahog *(Arctica islandica)*	n/a	n/a		
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
tilefish *(Lopholatilus chamaeleonticeps)*				
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
cobia *(Rachycentron canadum)*	X	X	X	X
little skate (*Leucoraja erinacea*),		X	X	
winter skate (*Leucoraja ocellata*)		X	X	
clearnose skate (*Raja eglanteria*).		X	X	
dusky shark *(Charcharinus obscurus)*		X		
sandbar shark *(Charcharinus plumbeus)*		X	X	X

Source: NMFS, 2003

2.6 Summary of Existing Fish Communities within the Project Area

Sandy Hook Bay lies within a larger, distinct faunal region in which the fish community is composed of both cold temperate and warm temperate contingents (Robins and Ray, 1986). This faunal region extends from Cape Cod, south to the entrance of Chesapeake Bay. The finfish community of Sandy Hook Bay is composed of species that represent numerous taxonomic families and various feeding guilds. Among the most abundant fish within the bay include Atlantic silverside (*Menidia menidia*), winter flounder *(Pseudopleuronectes americanus)*, striped killifish (*Fundulus majalis*), and Atlantic menhaden (*Brevoortia tyrannus*). Also common are bay anchovy (*Anchoa mitchilli*), mummichog (*Fundulus heteroclitus*), scup (porgy) *(Stenotomus chrysops)*, weakfish (*Cynoscion regalis*), summer flounder *(Paralichthys dentatus)*, and windowpane *(Scophthalmus aquosus)*. Blueback herring (*Alosa aestivalis*), spotted hake (*Urophycis regia*), bluefish *(Pomatomus saltatrix)*, striped searobin (*Prionotus evolans*), and northern pipefish (*Syngnathus fuscus*) are also found with regularity. Within the adjacent estuarine waters of the Shrewsbury River, mummichog, white perch (*Morone americanus*) and hogchockers (*Trinectes maculatus*) are abundant.

The abundance of many of these species can change in response to the varying seasons. For instance, scup, bluefish, and Atlantic silversides reach their peak abundances in the summer months, while species such as winter flounder reach their peak abundance from late winter to early spring. Still others, such as windowpane are caught in trawl nets during every month of the year. Sandy Hook Bay has been the site of numerous finfish sampling studies over the years. A summary of key studies is presented in Table 2-2. The marine resources of Sandy Hook Bay support both recreational and commercial fisheries in the area and, therefore, are important economic resources. The Sandy Hook Bay – Raritan Bay Complex supports the following recreational fisheries: weakfish, bluefish, winter flounder, summer flounder, striped bass (*Morone saxitilus*), black sea bass (*Centropristis striata*), tautog (*Tautoga onitis*), scup, and spot (*Leiostomus xanthurus*) (D. Bennett, personal communication; MacKenzie, 1992; F. Steimle, personal communication).

The Raritan Bay Complex also supports a commercial fishing industry based on both shellfishing and finfishing. Commercial finfish fisheries include American shad (*Alosa sapidissima*) and American eel (*Anguilla rostrata*). The area surrounding the pier and adjacent areas of Sandy Hook Bay have high densities of hard shell clams (*Mercenaria mercenaria*) (McCloy and Joseph 1985, NJDEP 2000) and has historically been recognized as having high commercial value for this species (DOI, 1963). This same area is recognized as a production area for soft clams (*Mya arenaria*). The commercial harvesting of shellfish proximal to the project area (i.e., outside of yet adjacent to the security zone) is allowed under special permit by the NJDEP, providing the shellfish are further processed either through depuration or relay (NJDEP, 2003).

In addition to their commercial value, shellfish have an important ecological role in the Raritan and Sandy Hook Bay area. As filter feeders, they play an important role in improving water quality in the bay. They also serve as a food source for a variety of fish that feed on the siphons of shellfish. In a study of the diets of winter flounder in the Hudson-Raritan Estuary (Steimle et al., 2000) found that the siphons of hard clams were an important part of the diet of winter flounder (*Pseudopleuronectes americanus*) in the estuary.

Table 2-2
Results of Fish Sampling Efforts Within Sandy Hook Bay

Study	Wilk and Silverman	Wilk	ACOE
Date	1976	1983	1984
Location	Sandy Hook Bay	Raritan Bay (including Sandy Hook Bay)	Raritan Bay (including Sandy Hook Bay)
Sampling Interval	Summer	30-month period	1982-1983
Species Richness	35 species	59 species	56 species
Most Abundant Species	red hake, butterfish, bluefish, summer and winter flounder, scup, and weakfish	sea robin, winter flounder, spotted hake, red hake, windowpane flounder	winter flounder, bay anchovy, butterfish, red hake
Other Findings	Abundant fish reported are summer residents	99% of total catch represented by 20 species; 99% of total catch weight represented by 27 species. Principal species represented both permanent residents and seasonally abundant species	Most abundant species collected from stations closest to NWS Earle were bay anchovy, winter flounder, red hake, scup, windowpane flounder, and weakfish

There is also a commercial crab fishery for blue crabs (*Callinectes sapidus*), a species that winters in the soft sediments of the bay. This species supports a winter dredge fishery within and proximal to the NWS Earle entrance channel (Steimle, personal communication), while adjacent rivers and harbors support recreational crabbing (D. Bennett, personal communication).

American lobster (*Homarus americanus*) is taken commercially from within the bay as well (USFWS, 2001). Shellfishing employs an estimated 200+ people full time per year, in the bay. Other commercial and recreational fisheries wax and wane within the bay with the abundance or demand for certain baitfish, foodfish or sport fish. An example is the horseshoe crab (*Limulus polyphemus*) fishery (D. Bennett, personal communication).

Several species of sea turtles including the threatened loggerhead (*Caretta caretta*), endangered Kemp's ridley (*Lepidochelys kempii*), and green (*Chelonia mydas*), also occur in the inshore waters of New Jersey. These turtles feed primarily on mollusks, crustaceans, sponges, and a variety of marine grasses and seaweeds. In addition, the endangered leatherback sea turtle (*Dermochelys coriacea*) may occupy the coastal waters of New Jersey foraging for jellyfish. Typically, sea turtles can be found in the New York Bight from June through November (Gorski, personal communication).

The endangered right whales (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*) are present in the mid-Atlantic waters off the coast of New Jersey in late winter through early spring. Fin whales (*Balaenoptera physalus*), which are the most likely species to occur in the coastal waters of New Jersey, are present throughout the year.

3.0 ESSENTIAL FISH HABITAT DESCRIPTIONS FOR FEDERALLY MANAGED FISH SPECIES

Information on habitat requirements for the listed EFH species of the 10 minute x 10 minute EFH quadrant, inclusive of the pier complex ("project area quadrant"), are discussed in this section. This information was synthesized from various publications from NOAA, NMFS, the MAFMC and other available literature. The information provided herein presents the special habitat requirements only for the specific life cycle stages of the EFH species listed for the project area quadrant. The applicable life cycle stages for each EFH-designated species is indicated by an "X" in Table 2-1. It should be noted that it is possible during dispersal, disturbance events, or as a result of other stimuli in the environment, for these listed EFH species to be found in habitats that deviate from those listed here. Potential seasonal and spatial variability of the conditions associated with these species are possible and should be expected.

3.1 Red Hake (*Urophycis chuss*)

Red hake, a commercially harvested species of the family Gadidae, ranges in North America from southern Labrador to North Carolina (Robins and Ray, 1986). The NWS Earle pier complex lies within a quadrant designated as EFH for larvae, juveniles, and adults of this species.

Larvae

Larvae are found in pelagic waters. They prefer sea surface temperatures below 19°C (66°F), water depths less than 200 m (656 ft), and a salinity of greater than 0.5‰. They appear from May to December with peak densities recorded in September and October (Steimle et al., 1999a).

Juveniles

Juvenile red hake seek out bottom habitat with shell fragment or live sea scallop bed substrates. Juveniles prefer water temperatures below 16°C (61°F), water depths less than 100 m (328 ft), and a salinity range from 31 to 33‰. Juveniles tend to avoid shallow waters warmer than 22°C (71°F). Juveniles remain pelagic until they reach a size of 25-30 millimeters (mm) total length (TL), after which they seek out sheltered areas. Juveniles are present along coastal regions from spring to fall (NEFMC, 1998; Steimle et al., 1999a). They are known to occur within the Hudson/Raritan Bay Estuary during cooler seasons.

Adults

Adults seek out bottom habitats, especially depressions with a substrate of sand and mud in areas where water temperatures are below 12°C (54°F). They prefer depths of 10 to 130 m (33 to 427 ft) and salinities between 33 and 34‰. Adults spawn in the depressions of sand and mud when water temperatures are less than 10°C (50°F), at depths of less than 100 m (328 ft) and where salinity falls to less than 25‰. Spawning typically occurs from May to November, with peak spawning activity occurring in June and July (NEFMC, 1998; Steimle et al., 1999a).

3.2 Winter Flounder (*Pseudopleuronectes americanus*)

Winter flounder is a right-eye flounder (family Pleuronectidae) that ranges in North America from Labrador, south to Georgia (Robins and Ray, 1986). The NWS Earle pier complex lies within a quadrant designated as EFH for winter flounder eggs, larvae, juveniles, and adults.

Eggs
Winter flounder eggs are found in bottom habitats with sand, mud, and gravel where water temperatures are less than 10°C (50°F), salinities range between 10 and 30‰, and water depths are less than 5 m (16 ft). Spawning areas occur where hydrodynamics function to keep the hatched larvae from being dispersed. Winter flounder seem to time their hatching to the advent of favorable environmental conditions (Pereira, et. al., 1999).

Larvae
Larvae inhabit open water and benthic habitats in areas where sea surface water temperatures are less than 15°C (59°F), and salinities range from 4 to 30°/$_{00}$. Within inshore waters such as Sandy Hook Bay, they are typically found in waters less than 6 m (17 ft) deep. Larvae are often observed from March to July with peaks in April and May (NEFMC, 1998; Pereira, et. al., 1999).

Juveniles
Juvenile winter flounder are found in bottom habitats with a substrate of mud or fine- grained sand. They are generally found in waters from 0.1 to 10 m (0.3 to 33 ft) deep, water temperatures below 28°C (82°F), and salinities between 5 and 33‰. Young of the year (YOY) flounder (i.e., those less than one year old) spend much of their first year in very shallow inshore waters. Yearling winter flounder (i.e., those that are greater than one year old) are year-round residents of the New York Bight (NMFS, 1999; Pereira, et. al., 1999).

Adults
Adults are also found in bottom habitats with sand, gravel, and mud substrates. The habitat is usually less than 6 m (17 ft) deep, with temperatures below 15°C (59°F), and salinities between 5.5 and 36‰ (NEFMC, 1998). Most adults captured during sampling within the Hudson-Raritan estuary were collected from waters between 4 and 12°C (39-54°F). Adults captured in the Hudson-Raritan estuary were found at salinities as low as 15 ‰, although most were found at greater than 22 ‰ (Pereira, et. al., 1999). Adults are present in Raritan Bay from the end of September, through the winter, and into early spring, after which they move to deeper water. Peak spawning occurs within the bay from February to mid April (ACOE, 1984; Pereira, et. al., 1999).

3.3 Windowpane (*Scophthalmus aquosus*)

Windowpane is a left-eye flounder (family Bothidae) ranging in North America from the Gulf of Saint Lawrence, south to northern Florida (Robins and Ray, 1986). The project area quadrant is designated as EFH for eggs, larvae, juveniles and adults of this species.

Eggs
Eggs of the windowpane flounder are found in surface waters with temperatures less than 20°C (68°F), and at water depths less than 70 m (230 ft). Eggs appear from February to November with peak densities occurring in July and August (NEFMC, 1998; Chang et al., 1999).

Larvae
Larvae inhabit pelagic waters where sea surface temperatures are less than 20°C (68°F) and water depths are less than 70 m (230 ft). Larvae appear from February to November, with peak densities occurring in July and into August (NEFMC, 1998; Chang et al., 1999).

Juveniles
Juveniles inhabit benthic areas with mud or fine-grained sand substrates where water temperatures are below 25°C (77°F), and depths range from one to 100 m (3 to 328 ft). They tolerate a wide range of salinity, between 5.5 and 36‰ (NEFMC, 1998). Surveys of Raritan Bay, summarized in Chang, et. al. (1999), indicate that juveniles were most abundant in the winter and summer months when most were collected from waters where bottom temperatures ranged from 5-23°C, depths ranged from 7-17 m, salinities ranged from 22-30 ‰, and dissolved oxygen (DO) levels ranged from 7-11 milligrams per liter (mg/l) (Wilk et al., 1996).

Adults
Adults inhabit benthic areas with mud or fine-grained sand substrates where water temperatures are below 27°C (80°F), and depths range from one to 75 m (3 to 246 ft). Adults also tolerate a wide range of salinity, between 5.5 and 36‰. Spawning conditions are met when water temperatures are below 21°C (70°F), water depths are between 1 and 75 m (3 and 246 ft) and salinity is between 5.5 and 36‰. Spawning normally occurs from February to December (NEFMC, 1998; Chang et al., 1999). Within the Hudson-Raritan Estuary, Wilk, et al., (1996) reported spawning during all seasons, adults were collected from bottom temperatures of 0-24°C, at depths < 25 m, at salinities of 15-33 ‰, and at DO levels of 2-13 mg/l. Wilk, et al., (1996) reported adult and juvenile windowpane were fairly evenly distributed throughout the Hudson-Raritan Estuary, but were more abundant in deeper channels in the summer.

3.4 Atlantic Sea Herring (*Clupea harengus*)

Atlantic sea herring is an economically important member of the family Clupeidae. This fish ranges in North America from Greenland and northern Labrador, south to North Carolina (Robins and Ray, 1986). The project area quadrant is designated as EFH for larvae, juveniles, and adult Atlantic sea herring.

Larvae
Herring larvae are typically pelagic. Larvae prefer waters where sea surface temperatures are below 16°C (61°F), water depths range from 50 to 90 m (164 and 295 ft), and salinities of 32‰ are found. Larvae are typically observed passing through Sandy Hook Bay from spawning grounds to deeper water from March to April with peak densities occurring from September through November (NEFMC, 1998; Reid et al., 1999).

Juveniles
Atlantic herring juveniles frequent open waters and bottom habitats with temperatures below 10°C (50°F). They prefer water depths between 15 and 135 m (49 to 443 ft) and a salinity range of 26 to 32‰ (NEFMC, 1998). Within the Hudson-Raritan Estuary, juvenile herring were found over a range of depths and salinities (Reid et al., 1999). Juveniles are most prevalent in the estuary in winter and remain through spring. They can often be found within the estuary in abundance. They are reported to be fairly common, on occasion, at the mouth of the estuary in summer, yet are rarely found in autumn.

Adults
Atlantic sea herring adults are found in open waters and bottom habitats. They generally prefer water temperatures below 10°C (50°F), inhabit water depths from 20 to 130 m (66 to 427 ft), and prefer salinities above 28‰. Atlantic herring adults use bottom habitats with gravel, sand, cobble or shell fragment substrate for spawning. Patches of aquatic macrophytes are also used. Spawning occurs in waters of more northern latitude. Spawning adults prefer water depths between 20 and 80 m (66 and 263 ft) and in salinities ranging from 32 to 33‰. Spawning occurs from July through November in areas of well-mixed water with tidal currents between 1.5 and 3.0 knots (NEFMC, 1998). Adults are present in smaller numbers in the spring and fall, and are typically not observed during the summer (Reid, et al., 1999).

3.5 Bluefish (*Pomatomus saltatrix*)

Bluefish (family Pomatomidae) is an important commercial and sport fish ranging from Nova Scotia, Canada, south to Argentina (Robins and Ray, 1986). The NWS Earle pier complex lies within a quadrant designated as EFH for bluefish juveniles and adults.

Juveniles
All major estuaries from Penobscot Bay, Maine, south to St. Johns River in Florida are considered EFH for bluefish juveniles. Juvenile bluefish prefer estuaries or shallow water with temperatures between 15 and 30°C (59 and 86°F). Typical salinities of waters frequented by this species range from 23 to 33‰. Preferred substrates include sand, mud, silt, and clay. Peak abundance for juveniles in Raritan Bay is from summer through fall. Fahay et al (1999) recounting the work of Reid et al (1999) summarized the occurrence of bluefish within the Hudson-Raritan Estuary based on NEFSC trawl survey data as follows:

> "Most bluefish collected in the Hudson-Raritan Estuary and Sandy Hook Bay trawl survey are juveniles (< 35 cm). There are no occurrences during winter and only a few adults are collected during spring. During summer and fall, juveniles occur throughout the area in all depths sampled, at bottom temperatures between 12 and 24°C. The largest collections were made near navigation channels or in a basin near Graves End Bay".

Foraging studies conducted on bluefish have found that bluefish diets may differ from one estuary to the next in response to the abundance of prey resources (Friedland et al, 1988). For instance, juvenile bluefish in Sandy Hook Bay may rely heavily on crustacean and polychaetes during some years when teleost prey is in low abundance.

Adults
Adult bluefish are most common in nearshore open waters with temperatures ranging from 15 to 25°C (59 to 77°F), and with seawater salinities. Adults are highly migratory, appearing in Raritan Bay from May through October, after which they migrate southward, returning to warmer waters (MacKenzie, 1992). They reportedly prefer salinities greater than 25‰. Most fish collected in the Raritan Bay and Sandy Hook Bay area are juveniles with some adults. The peak abundance for adults occurs from summer through fall.

3.6 Butterfish (*Peprilus triacanthus*)

This species is a commercially important member of the family Stromateidae, a family comprised largely of coastal and oceanic warm-water fish (Robins and Ray, 1986). These fish migrate shoreward in the spring. By summer, they can be found in loose schools inhabiting waters from sheltered bays, seaward to the edge of the mid-Atlantic shelf to depths of 200 m (656 ft). They then return to deeper and more southerly waters in the fall, as water temperatures again decrease (Cross et al., 1999). The NWS Earle pier complex lies within a quadrant designated as EFH for larvae, juveniles, and adults of this species.

Larvae
Larvae inhabit the upper layer of open waters, usually associated with floating cover such as cnidarians or *Sargassum* weed. They become more abundant at night near the water surface than during the day, suggesting a diel vertical migration behavior pattern (Kendall and Naplin, 1981). Larvae are reported from waters within their range at temperatures between 4.4 and 27.9°C (40 and 82°F), but prefer temperatures of between 9 and 19°C (48 and 66°F). They are found in mixing zone and seawater salinities (NMFS/NERO, 2003). Larvae are most frequently observed in July and August, with abundance sharply declining by the end of September.

Juveniles
Juvenile butterfish inhabit open waters from the surface to depth on the continental shelf. Juveniles typically occupy a vertical range in the water column of 10 to 330 m (33 to 1,082 ft). These fish are commonly observed in coastal bays and estuaries, and other inshore areas. Frequent sightings in the surf zone have also been documented. Juvenile butterfish can tolerate a wide range of salinity (3.0 to 37.4‰), hence their sightings in estuaries, bays, and in offshore waters. In previous sampling studies, the greatest numbers of fish collected were at sampling depths of 120 m (393 ft). The schools can be found over sandy to muddy substrates and prefer a temperature range from 4.4 to 29.7°C (40 to 85°F). However, their survival rate is reduced when the temperature falls below 10°C (50°F). Juveniles are generally present from spring through fall (Cross et al., 1999).

Sandy Hook Bay provides an important nursery area for this species. The juvenile butterfish grow quickly and migrate to deeper waters usually in late fall only to return to the shallow inshore areas in April. The diet of the non-resident butterfish consists of copepods, small fish, jellyfish and various marine polychaete worms (Cross et al. 1999).

Adults
Generally adult butterfish inhabit water columns between 10 to 366m (33 to 1200 ft) and are typically found in water with temperatures from 3-28 °C (37-82 °F) (Cross, et al., 1999; NMFS/NERO, 2001). Adult butterfish (120 mm to 305 mm standard length) most likely begin to congregate within the Hudson-Raritan Estuary following offshore spawning. Butterfish are harvested commercially, and they are another important prey source for many higher trophic level predators such as bluefish and striped bass. Due to the migratory nature and the schooling behavior of these fish, year-to-year abundance statistics in some inshore embayments have been found to be variable (Howes and Goehringer, 1996).

Based on the results of trawl surveys conducted from 1992-1997, juvenile and adult butterfish reach peak abundance within the Hudson-Raritan estuary during the summer season. By fall, abundance begins to decrease as butterfish move to deeper, warmer waters farther offshore. They are generally absent from Sandy Hook Bay and the Hudson-Raritan Estuary by winter, but return again during the spring season (Cross et al., 1999).

3.7 Atlantic Mackerel (*Scomber scombrus*)

Atlantic mackerel (family Scombridae) range in North America from southern Labrador to Cape Hatteras, North Carolina (Robins and Ray, 1986). The project area quadrant is designated as EFH for juveniles and adults of Atlantic mackerel.

Juveniles
Atlantic mackerel juveniles are found in both nearshore and offshore waters. In nearshore waters, such as Sandy Hook Bay, they are typically found in mixing water to seawater salinities, at depths ranging from zero to 320 m (zero to 1,050 ft) and temperatures between 4°C and 22°C (39 and 72°F) (NMFS/NERO, 2001). Juveniles tend to peak in density from May through August, with numbers declining sharply thereafter. Juveniles collected in otter trawl surveys in the Hudson-Raritan estuary during July 1997 were collected at depths ranging from 4.9 - 9.8 m (16 to 32 ft), salinities from 26.1-28.9‰, DO from 7.3-8.0 mg/l, and temperatures from 17.6 to 21.7 ° C (63 to 72°F).

Adults
Adults are found in both nearshore and offshore waters. In nearshore waters, such as the Hudson-Raritan Estuary, they are typically found in mixing water and seawater salinities, at depths ranging from zero to 381 m (zero to 1,250 ft) and at temperatures between 4°C and 16°C (39 and 61°F) (NMFS/NERO, 2001). Adult mackerel are present during the late winter to early spring, after which they migrate to deeper open water. A brief return of adults may occur in late fall.

Available trawl data show that Atlantic mackerel are not among the most abundant finfish of the Sandy Hook Bay ichthyofaunal community. Juveniles are more likely to occur than adults. In fact, no adult Atlantic mackerel were collected in otter trawl surveys in the Hudson-Raritan estuary from 1992 to 1997. All of the individuals collected (n=12) were juveniles ranging from 7-8 cm that were collected during July of the final year of the survey (1997). Most of these individuals were collected on the eastern edge of Staten Island. However, as fast swimmers, adults may be able to evade capture in otter trawl nets, and therefore, may be under-represented in trawl surveys. The presence of juvenile mackerel within the Hudson-Raritan Estuary suggests that the system (including Sandy Hook Bay) may provide a nursery area for this species.

Spawning begins when temperatures are 7 °C (peak 9-14 °C) and progresses from southern to northern waters along the Atlantic coast during adult migration. Mackerel within New York/New Jersey waters are part of the Southern Spawning Contingent, which spawns from mid-April to June. Most spawning activity occurs within the shoreward half of continental shelf waters; however some localized spawning activity also occurs on the shelf edge and beyond. Some spawning has been reported from open bays such as Cape Cod and Massachusetts Bays, but is less likely to occur in enclosed bays such as the Chesapeake, Delaware, and Hudson-Raritan Bays (Studholme et al., 1999).

3.8 Summer Flounder (*Paralichthys dentatus*)

Summer flounder is a left-eye flounder (family Bothidae) that ranges in North America from Maine and (rarely) Nova Scotia, south to northern Florida (Robins and Ray, 1986). The project area quadrant is designated as EFH for larvae, juveniles, and adults of this species.

Larvae

Larvae are typically found to be most abundant 19 to 83 km (11.8 to 51.6 mi) from shore in water column depths from 10 to 70 m (33 to 230 ft). The larvae proceed to migrate inshore, seeking coastal and estuarine nursery areas to start and complete metamorphosis. Temperature appears to have a significant bearing on the duration of metamorphosis. Mortality occurs when the water temperature reaches 2 to 4°C (35 to 39°F). The transforming larvae are sensitive to the types of predators present and modify their burying behavior accordingly (Packer et al., 1999). Peak existence of summer flounder larvae occurs from October through January.

Juveniles

The preferred habitat substrate of juveniles is sand. Estuarine marsh creeks, tidal flats and channels with depths of 0.5 to 1.5 m (1.6 to 4.9 ft) are preferred habitat areas for summer flounder. Increased temperature directly relates to a short metamorphic period. Juveniles experience a higher mortality when temperatures fall below 4°C (39°F) (Packer et al., 1999).

Adults

Adults prefer bottom habitats of both inshore (warmer months) and offshore (colder months) waters to depths of 152 m (500 ft). They tolerate both the mixing water and seawater salinities. Stands of submerged aquatic vegetation, sea grasses, and macroalgae are recognized as HAPC for this species by NMFS/NERO (2001).

3.9 Scup (*Stenotomus chrysops*)

This species is a member of the family Sparidae. It is found from Nova Scotia to Florida (Robins and Ray, 1986). The project area quadrant is designated as EFH for juveniles and adults of this species.

Juveniles

Juvenile scup are found in estuaries and bays with sand, mud, mussel, and eelgrass bed substrates. They generally require water above 16°C (61°F) and salinities greater than 15°/₀₀ (Steimle et al., 1999b). In the Hudson-Raritan estuary, juveniles were collected at temperatures ranging from 9° to 26°C, at salinities ranging from 18 to 33 ‰, and at DO concentrations > 4 mg/l. Scup is a temperate species and north of Cape Hatteras the stock inhabits waters above 6°C. Postlarval scup migrate to stay within required temperature ranges as bottom water temperatures in the northeast decline with the onset of winter (Steimle, 1990).

The Hudson-Raritan Estuary apparently does not contain major scup spawning grounds (Steimle, 1990). In Raritan Bay, juveniles were abundant in spring and summer; a few were collected in the fall and were not collected in winter. Juveniles occur in the larger bays, such as Raritan Bay, they are not reported in any appreciable concentrations in Sandy Hook Bay outside of the spring and summer seasons. Even during spring and summer seasons, their abundance within the Bay is exceeded by concentrations north of the Bay at the seaward side of the Hudson-Raritan estuary. Smaller fish tend to occupy more saline (> 15 ‰) waters within shallow bays and parts of estuaries.

Adults

Adult scup are also found in estuaries with mixing to seawater salinity ranges and temperatures above 16°C (61°F). They prefer depths of 2 – 38 m (6.6 – 125 ft) and are generally found in areas with fine to silty sand, mud, mussel beds, rock, artificial reefs, wrecks, and other structures (Steimle et al., 1999b). Adult scup in the Hudson-Raritan estuary were collected at salinities ranging primarily from 20 to 31 ‰, similar to juveniles in the Hudson-Raritan Estuary. Most adults were collected at DO concentrations greater than 4mg/l.

3.10 Black Sea Bass (*Centropristis striata*)

Black sea bass (family Serranidae) range in North America from Maine to northeastern Florida, and the eastern Gulf of Mexico (Robins and Ray, 1986). The project area quadrant is designated as EFH for black sea bass juveniles and adults.

Juveniles

Winter juveniles and YOY fish migrate from the Middle Atlantic Bight northward to the Gulf of Maine and then into estuaries upon further development. Juvenile habitat ranges from estuarine to coastal waters, and from the water surface to a depth of 38 m (125 ft). Juvenile sea bass may be found around the edges of salt marshes and channels. Substrate most likely inhabited by the black sea bass consists of rough bottom in and amongst shellfish, sponge, eelgrass beds, nearshore shell patches, or man-made objects (Steimle et al., 1999c).

Adults
Adults are typically found within inshore waters of mixing water to seawater salinities. The adults prefer rock jetties and rocky bottom substrate areas, but may also be found in sand and shell fragment substrates. These fish enter nearshore waters in greatest abundance from May through October. They require a minimum water temperature of 6°C (43°F) (Steimle et al., 1999c).

3.11 King Mackerel (*Scomberomorus cavalla*)

King mackerel (family *Scombridae*) range in North America from Massachusetts and the northern Gulf of Mexico to southern Brazil. It is an important food and game fish typically caught by trolling over deep water (Robins and Ray, 1986). The project area quadrant is designated as EFH for king mackerel eggs, larvae, juveniles, and adults.

EFH for all life stages of this federally managed species is defined as "sandy shoals of capes and offshore bars, high profile rocky bottom and barrier island ocean-side waters, from the surf to the shelf break zone, but from the Gulf Stream shoreward". *Sargassum* also provides EFH for this species, as do all coastal inlets and all state-designated nursery habitats known to support coastal migratory species. King mackerel are typically found in waters with salinities >30‰, and temperatures >20°C (68°F) (NMFS/NERO, 2001).

3.12 Spanish Mackerel (*Scomberomorus maculatus*)

Spanish mackerel (family Scombridae) range in North America from Cape Cod, south to southern Florida and the Gulf of Mexico. However, it is reportedly rare north of the Chesapeake Bay (Robins and Ray, 1986). Like other Scombrids, it is a popular food and game fish. It typically enters shallow bays and may sometimes be caught by fisherman fishing from bridges and causeways (Robins and Ray, 1986). The project area quadrant is designated as EFH for Spanish mackerel eggs, larvae, juveniles, and adults.

EFH for all life stages of this federally managed species is the same as that defined for king mackerel. Spanish mackerel are typically found in water with salinities greater than 30‰, and temperatures greater than 20°C (68°F), preferably between 21 and 31°C (70 and 88°F), and rarely below 18°C (64°F). Spanish mackerel spawn off the coast between late spring and late summer (NMFS/NERO, 2003).

3.13 Cobia (*Rachycentron canadum*)

Most closely related to remoras and jacks, cobia is the only extant member of the family Rachycentridae. They range from Massachusetts south to Argentina and are valued as food and game fish (Robins and Ray, 1986). The project area quadrant is designated as EFH for all life stages of cobia eggs, larvae, juveniles, and adults. Areas designated as essential fish habitat for cobia are the same as for king and Spanish mackerel. Additionally, the Gulf Stream is designated EFH for cobia since it is essential to the dispersal of coastal migratory pelagic larvae of this species. Cobia are typically found in waters with salinities greater than 30‰, and temperatures greater than 20°C (68°F) (NMFS/NERO, 2001).

3.14 Little Skate (*Leucoraja erinacea*)

The little skate (family Rajidae) ranges from south of the Gulf of St. Lawrence and Nova Scotia to North Carolina (Robins and Ray, 1986). Both juveniles and adults are usually found on sandy or gravelly bottoms but also occur on mud substrates as well (McEachran, 2002). They are found from shoreline to depths of 384 meters (1,260 ft) but prefer depths of less than 111m (364 ft) and water temperatures between 2° and 15° C (36 to 60 ° F). They are more common within inshore waters during the winter in the northeast (McEachran, 2002) therefore they are most likely to be common within Sandy Hook Bay at this time as well.

Larvae/Juvenile
Little skate young have external gill filaments from 25-30 days to 90-95 days after emerging from the egg capsule. The young are 93-102 mm (3.7-4 in) at hatching (McEachran, 2002).

Adults
The adult little skate is disc-heart shaped, snout obtuse with a moderately long tail. Their dorsal surface color is grayish to dark brown with scattered small round darker spots. At maturity they are found to be 350-500 mm (13.8-19.7 in) in length. More northern specimens tend to be larger in size. Their temperature range is 2-21 °C (36 to 60 ° F) (McEachran, 2002). Adult females lay one fertilized egg in an egg capsule, which is deposited on the bottom. The egg capsules are greenish brown and approximately 44-63 mm (1.7-2.5 in) long and 30-45 mm (1.2-1.8 in) wide with a long horn at the corners. The anterior horns are curved inwards and are about 25 mm (1 in) in length. The posterior horns are relatively straight or curve outwards and the capsules length is about the same as the capsules. The horns help to anchor the egg capsule on the bottom. The gestation period is 6 months or more. Egg capsules are most frequently found from late October to January, but can be found year round partially or fully developed in mature females (McEachran, 2002).

3.15 Winter Skate (*Leucoraja ocellata*)

The winter skate (family Rajidae) ranges from the Newfoundland banks and south of Gulf of St. Lawrence to North Carolina. The winter and little skates are very similar in appearance and can be distinguished by the fact that winter skates have more rows of teeth in their upper jaw (Robins and Ray, 1986). Winter skate are usually found on sandy to gravelly bottoms (McEachran, 2002). They are found from shoreline to depths of 371 meters (1,217 ft) but prefer depths of less than 111m (364 ft) and water temperatures between 2° and 15° C (36 to 60 ° F) (McEachran, 2002).

Larvae/Juveniles
Female winter skates with fully formed egg capsules are abundant during summer and fall months. However, as with most other locally common skates, some reproduction is expected to occur throughout the year. The length of incubation time has not been documented but young hatch at 112-127 mm (4.4-5.0 in) TL.

Adult
Adult females deposit a single fertilized egg in an amber to a brown, rectangular, striated egg capsule that is covered with fibrous tendrils. Each corner of the capsule has a curved horn that, along with the fibrous tendrils, help to anchor the capsule to the bottom. Reproduction occurs mainly in the summer and fall, but may also take place throughout the year. The length of incubation is unknown (McEachran, 2002).

3.16 Clearnose Skate (*Raja eglanteria*)

The Clearnose skate (family Rajidae) ranges from Massachusetts to northeastern Florida. They are usually found on soft bottoms of the continental shelf but also occur in rocky of gravelly substrates. They are found from the shore zone to a depth of 329 meters (1079 ft) but are most abundant at depths of less than 111m (364 ft). They are found in waters ranging from 9° and 30° C (48-but prefer temperatures ranging from 9° to 20° C (48-68 °F). Clearnose skate are most abundant in the Middle Atlantic Bight in the spring and summer (Able and Fahay, 1998). They move offshore and southward in the fall and early winter.

Juveniles
Juveniles inhabit soft bottoms of the continental shelf but also occur in rocky of gravelly substrates. Age 1 juveniles reach approximately 210 mm (8.3 in) disc width.

Adults
Adult clearnose skates lay one fertilized egg in an amber to light brown egg capsule, which is deposited on the bottom in the spring or summer. The incubation period is approximately 3 months or more.

3.17 Dusky Shark (*Carcharhinus obscurus*)

A member of the requiem sharks (family Carcharhinidae), the dusky shark ranges in the western Atlantic from Georges Bank and Cape Cod, south to Brazil (Robins and Ray, 1986). The project area quadrant is designated as EFH for dusky shark larvae (neonate/ early juveniles).

Neonate / early juveniles
Within temperate regions, dusky shark neonate/early juveniles prefer shallow coastal waters, inlets and estuaries up to the 25 m (82 ft) isobath (NMFS/NERO, 2001).

3.18 Sandbar Shark (*Carcharhinus plumbeus*)

A member of the requiem sharks (family Carcharhinidae), the sandbar shark inhabits the western Atlantic from Massachusetts to southern Brazil (Robins and Ray, 1986). The project area quadrant is designated as EFH for sandbar shark larvae, juveniles, and adults.

Neonates / early juveniles
Early juvenile sandbar sharks inhabit shallow coastal areas to the 25 m (82 ft) isobath from Montauk, Long Island, NY south to Cape Canaveral, Florida, including the Delaware and

Chesapeake Bays. This shark prefers waters with salinities greater than 22‰ and temperatures greater than 21° C (70°F) (NMFS/NERO, 2001).

Late juveniles / subadults

Sandbar sharks are found in all waters, both coastal and pelagic, ranging from Barnegat Inlet, New Jersey to the Florida Keys, and also along the west coast of Florida. They have also been found in the Mid-Atlantic Bight, at the shelf break in the water column from 25 to 200 m (82 to 656 ft) (NMFS/NERO, 2001).

HAPC have been identified south of the project area in shallow areas and in estuaries of Great Bay, New Jersey, lower and middle Delaware Bay, lower Chesapeake Bay, Maryland and near the Outerbanks in North Carolina. These identified areas are important nursing and pupping grounds (NMFS/NERO, 2001).

Adults

Adult sandbar sharks inhabit shallow, muddy, coastal waters to the 50 m (165 ft) isobath from Nantucket, Massachusetts, south to Miami Florida. They also inhabit waters surrounding peninsular Florida, west to the Florida panhandle at water temperatures up to 30°C (85°F), and saline portions of Florida Bay (NMFS/NERO, 2001). This species is known to migrate south in winter to wintering grounds from North Carolina, south to Florida and the Caribbean Sea.

4.0 ANALYSIS OF PROJECT IMPACTS TO FISH AND EFH

Dredging and dredged material disposal, if not conducted properly with adequate planning and proper engineering controls, may adversely affect fish and fish habitat. Potential adverse effects to fish and fish habitat related to typical dredging projects include destruction of benthic habitat, temporary impairment of water quality and the direct (e.g., toxicological) and indirect (e.g., habitat alteration) effects on the fish and their prey species. Table 4-1 lists the impacts or effects of human-induced alterations on food source, water quality, habitat structure, flow regime and biotic interactions. The extent of the effect depends on hydrologic processes; sediment texture and composition; chemical content of the sediment and pore water matrices; and the behavior or life stage of the receptor species.

4.1 Impairment of Water Quality

Water quality impacts from dredging and dredge disposal include physical, chemical and biological impacts. Changes in water quality have concurrent impacts to the system that affect fish and EFH in various ways (Table 4-1). Changes to the water turbidity, pH, and DO are expected both during the actual dredging activity at the NWS Earle pier complex, and during disposal of suitable material at the HARS.

At the pier complex, the proposed action would temporarily generate wastewater during dewatering of the dredged sediment unsuitable for ocean disposal (material generated from Layers 2 and 3). This material would be dewatered through decanting on the disposal scow or via some other method at the pier complex, prior to shipment via barges to a shoreside transport locality for final upland disposal/treatment/recycling.

Dredged sediment suitable for ocean disposal (Layer 1 material) would be dewatered via barge overflow during transport to the HARS in compliance with policies and procedures identified under the HARS Site Management and Monitoring Plan (SMMP) (ACOE/EPA, 1997), and any applicable project-specific permit conditions.

However, the impacts to water quality that are expected during dredging and dredged material disposal associated with this project would be temporary and diminish with the cessation of in-water activity (e.g., dredging, pier pile removal, disposal). Using proper controls, the impacts would be minimized and the anticipated changes to the water quality of the marine system would return to pre-project conditions once the project is completed. No appreciable or permanent changes to the salinity regime, tidal cycle, or current patterns are anticipated.

4.1.1 Physical Impairment

Physical impairment of the water column, resulting from dredging and dredge disposal, occurs from changes in DO, salinity, pH, and turbidity with a resultant decrease in light penetration. The degree of change or alteration of the water column's physical components depends on various physical and chemical parameters of the sediment (e.g., pH, oxidation-reduction potential, sediment size, organic matter content, concentration of reactive iron and manganese, etc.).

Table 4-1
Impact of Human-Induced Alterations to Various Ecological Attributes

Ecological Attribute	Impact
1. Food (energy) source -type, amount, and particle size of organic material entering the system -seasonal pattern of available energy -primary production of the basin	-decreased coarse particulate organic matter to estuary -increased fine particulate organic matter to estuary -increased algal production in basin -shifts in feeding guilds
2. Water Quality -temperature -turbidity -dissolved oxygen -nutrients (primarily nitrogen, phosphorus) -organic and inorganic chemicals -heavy metals and other toxic substances -pH and salinity	-expanded temperature extremes -increased turbidity -altered diurnal cycle of dissolved oxygen -increased nutrients (especially soluble nitrogen and phosphorus) -increased suspended solids -increased toxics -altered salinity
3. Habitat Structure -substrate type -water depth and current tidal velocity -spawning, nursery, and hiding places -diversity/complexity (woody debris, SAV, shell beds, sand wave ripples, reefs, wrecks, and other structure in basin -basin size and shape	-decreased stability of substrate, banks and shoreline due to erosion and sedimentation -more uniform water depth -reduced habitat heterogeneity -reduced habitat areas removed structures or debris -decreased cover and vegetation
4. Flow Regime -water volume -temporal distribution of floods, tides, low flows of tributary streams	-altered flow extremes (both magnitude and frequency of high and low flows) -increased maximum flow velocity -decreased minimum flow velocity -reduced diversity of microhabitat velocities -fewer protected sites
5. Biotic Interactions -competition -predation -disease -parasitism -mutualism -introduction of non-native organisms	-increased frequency of diseased fish -altered primary and secondary production -altered trophic structure -altered decomposition rates and timing -disruption of seasonal biorhythms -shifts in species composition and relative abundance -shifts in invertebrate functional groups (e.g. filler feeders vs. suspension feeders) -shifts in trophic guilds (e.g. increased omnivores and decreased piscivores) -increased frequency of fish hybridization -increased frequency of exotic species

Source: Adapted to marine systems from Karr (1991) and other sources.

The water column proximal to the proposed action would experience temporary physical impairment due to increased turbidity during dredging and pile removal. Likewise, the water column proximal to the disposal area at the HARS would also be impacted by increased turbidity during disposal. Temporary water quality impacts that can be expected include the release of dissolved hydrogen sulfides into the water column, as well as an increase in Total Suspended Solids (TSS).

A concurrent decrease in DO would be anticipated in response to the increased TSS. The temporary increase in TSS is expected to be of comparable magnitude to that of naturally occurring events in the Hudson-Raritan Bay Estuarine Complex, such as peak seasonal river discharges and storm events. The temporary impacts to the water column associated with turbidity will cease following completion of in-water activity associated with the construction of the new Pier 3.

4.1.2 Chemical Impairment

Chemical impairment of the water column produced by dredging and dredge disposal is caused by release of various chemical contaminants that may occur within the sediment. Such contaminants typically include heavy metals, organochlorine compounds, polyaromatic hydrocarbons, total petroleum hydrocarbon, pesticides, and other anthropogenic compounds or materials. These compounds are introduced into the bay sediment via a variety of sources including but not limited to surface runoff (non-point sources), municipal wastewater treatment effluent, industrial discharge, accidental and incidental oil and chemical spills, illegal discharges, etc. Depending on basin characteristics, and composition of the receiving matrix (i.e., sediment) concentrations of the chemicals can be greatest at the point of discharge or away (i.e., downcurrent) from the discharge.

Contaminants that occur in the material to be dredged at detectable concentrations are PAHs, polychlorinated biphenyls (PCBs), heavy metals, pesticides and trace concentrations of dioxins/furans. Many of these compounds are ubiquitous in sediments of multi-use estuaries. At elevated concentrations, exposure of fish to these chemicals in the water column or sediment matrices can cause various acute and chronic toxicological effects to fish and shellfish (Sinderman, 1979; Malins et al., 1988; Johnson et al., 1992).

The concentrations of the chemicals detected in the sediment of the project area are not considered hazardous, and therefore their handling and disposal as hazardous materials in accordance with 40 CFR 260-268 is not required by law. However, results of bioaccumulation testing on composite sediments collected from the berthing areas around Pier 3, and from sediments beneath the pier, show that the material in the surficial layers (i.e., Layers 2 and 3) is unsuitable for ocean disposal due to the presence of PCBs concentrations that have been shown to bioaccumulate in marine indicator test organisms in excess of federal guidelines (ASI, 2003). These federal guidelines are established in the National Ocean Disposal Testing Manual (the "Green Book") jointly developed by the EPA Region 2 and the ACOE - New York District (NYD) (EPA, 1995). Sediments from the deeper undisturbed parent material (i.e., Layer 1) were determined to be suitable for ocean disposal using these same guidelines and biological testing regime.

4.1.3 Biological Impairment

Microorganisms such as bacteria, viruses, and plankton cause biological impairment of water quality. Biological impairment can occur when introduction of dredge material into the water column kills submerged aquatic vegetation and macroalgae (either through direct smothering or via impaired light penetration) leading to higher rates of bacterial decomposition and a resultant increase in bacterial oxygen demand. Disposal of material contaminated by wastewater treatment effluent, failing sewer pipes, or failing septic systems may introduce disease-causing organisms (i.e., bacteria and viruses) into the water column and into the biota proximal to the disposal site.

No sewage outfalls or disposal areas occur within the vicinity of the proposed action. However, pathogens may exist within the water column of the project area, since the Sandy Hook Bay area is closed to the harvest of shellfish for direct sales without depuration (Gastrich et al., 1990). Harvest of shellfish within Sandy Hook Bay is regulated by special permit from the NJDEP (NJDEP, 2001). Disposal of the material at the HARS is unlikely to cause irreversible impact to marine resources due to biological impairment since the area is not used for shellfishing and no submerged aquatic vegetation areas occur at the HARS. Furthermore, the location of the disposal site outside Sandy Hook Bay offers more efficient flushing of ambient marine water, further dispersing any pathogens that may be in the discharged sediments, and further reducing pathogen concentrations.

4.2 Adverse Effects to Benthic Habitat

Dredging and dredge material disposal may result in adverse effects to benthic habitat either by direct removal of the benthic substrate during the dredging operation itself, or via disposal of dredged material onto the benthic habitat at the disposal site. Either operation may result in the change in substrate composition, rendering the formerly suitable benthic substrate unsuitable for certain benthic organisms or disrupting existing ecological processes or interactions between resident benthic and water column communities.

Changes to the bathymetry of both the project area (due to the removal of sediment) and the disposal site (due to disposal of the dredged sediment) would occur. The existing bathymetry of the project area would change from its present depth of 10.7 m (35 ft) to the anticipated project depth of -13.7 m (-45 ft) plus a -0.6 m (-2 ft) overdredge. The elevation at the disposal site would increase by 1.0 m (3.3 ft) – the specified depth of capping within the remediation cells of the HARS (ACOE/EPA, 1997). Resultant impact to the EFH species that inhabit these areas would vary based on the mobility, life history, and behavior of the species. For instance, sessile and slow-moving invertebrate species and taxa would be removed by dredging within the pier berths and under the seaward end of Pier 3. Similar creatures would be covered over at the HARS during dredge material disposal. Highly mobile species and taxa such as adult pelagic fish and mobile megainvertebrates would likely avoid the disturbance areas.

Based upon sediment core data collected within the project area, sediment texture is initially expected to change. Largely unconsolidated, fine-grained material would be removed from the areas to be dredged, exposing underlying parent material that may vary from fine-grained clay or silt to coarse sands. The parent material is expected to be more consolidated. Eventually, the fine-grained material removed by dredging would be replaced by other fine-grained material settling out of the water column due to natural processes. These areas have been subjected to maintenance dredging in the past. The majority of the sediment to be removed is fine-grained unconsolidated material (i.e., silt and other fines).

4.2.1 Direct Removal of Benthic Substrate

Sediment: Direct removal of suitable benthic substrate via dredging typically impacts EFH by changing the ambient depths and topography, which may therefore change the suitability of the habitat in terms of depth requirement or availability of epibenthic invertebrate prey. This allows different species (both prey and non-prey) to establish themselves gradually. Together, these adverse effects may drive out the EFH-designated species. Recolonization of the newly exposed substrate after dredging is a factor not only of site-specific basin characteristics (e.g., wave or tidal energy, bathymetry, etc.) but also of substrate requirements of the larvae of recolonizing species (Rhoads and Germano, 1982).

Removal of benthic sediment by dredging also homogenizes the bottom substrate, reduces structural complexity within the bottom sediments, and may result in the release of hydrogen sulfide at concentrations that exceed the ability of natural processes to dilute soluble chemicals. These factors tend to discourage recruitment of benthic invertebrates, which are the food of many demersal fish.

This impact is of even greater importance in areas where the benthos was formerly dominated by organisms with special microhabitat requirements that have been removed via dredging. Even small structures or inconsistencies in the sea floor are exploited by various species of benthic invertebrates or demersal fish species. Examples of these smaller structures include sand ripples; thalassinid crustacean mounds; sea cucumber fecal deposits; pits left by feeding elasmobranchs and crabs; submerged aquatic vegetation blades; urchin spines, kelp holdfasts and stipes; sponge, sea pen and bryozoan colonies; and annelid worm, amphipod crustacean, vermetid gastropod, and cerianthid anemone tubes (Norse and Watling, 1999). Regardless of the sizes of the structure, structural complexity provides smaller species with living space, increased food abundance, and refuge from predation.

Certain species of demersal fish prefer one substrate over another for fishing or spawning. For instance, red hake are known to exploit the downcurrent side of sand wave crests catching prey items by surprise as the prey are carried by bottom currents over the sand wave (Norse and Watling, 1999). Black sea bass occupy areas around the base of boulders and rock reefs. As a general rule, both prey and fish species diversity increases with habitat complexity, therefore, the more structurally complex the marine habitat the greater the organism diversity. This is illustrated in the diverse communities that form among coral reefs (Kaplan, 1982) and rocky intertidal zones (Hughes, 1986).

Since the majority of the project area lies within a routinely disturbed berthing area, a complex biologically diverse bottom substrate is not expected relative to other areas of Sandy Hook Bay. Therefore, impact to marine resources due to direct removal of the benthic habitat is expected to be minimal. Regionally, it is a small-scale, and temporary impact to the system. No removal of undisturbed SAV areas (e.g., eelgrass beds) would occur since they are not present within the project area.

Pier Piles: Removal of in-water structures such as, reefs, rock ledges, jetties, vertical bulkhead or seawalls, and even wrecks could impact fish and EFH. This action is sometimes necessary to maintain safe navigation channels. The removal of navigational obstructions such as derelict pilings, dilapidated wharves, and shipwrecks and other long established structures, reefs, rock ledges, jetties, and bulkhead walls, could remove productive marine communities living within, on, or in association with the given structure. It acts to reduce habitat complexity, remove shelter, breeding, and feeding substrates. In addition, the removal of these structures produces turbidity, may subject land areas to erosion, and may alter flows in embayments and tidal creeks. Removal of woody debris also removes a substrate available for wood boring marine organisms, which tend to create a source of detrital nutrients by mechanically breaking down woody substrates. Norse and Watling (1999) cite various studies that have shown that the removal of some structures and the reduction of habitat structural complexity have resulted in the favoring of sand-loving fish species and the loss of some commercially important species such as grouper and cod.

However, the removal of Piers 2 and 3 would not have a lasting negative impact to EFH. The majority of the piles associated with Pier 3 has been treated with creosote and therefore are not regarded as an essential source of detrital nutrients to the marine environment. In fact, their removal represents the elimination of a potential source of PAH from the marine environment. The pier complex itself is a massive structure with a concrete deck that blocks light penetration to the marine water beneath it. Therefore, epibenthic growth is limited. Large pile-supported piers of this type are typically not high quality fish habitat due to the lack of prey items beneath the pier, the absent of light sufficient to promote algal growth (a source of primary productivity), reduced feeding success in sight feeding fish species, and possibly the reluctance of some fish species to leave the relative safety of the cover for more productive feeding areas (Duffy-Anderson et al., 2003). Cage experiments involving two estuarine fish species have demonstrated that growth rates below large urban piers are negative and comparable to laboratory starved control fish in contrast to caged fish in adjacent open waters (Duffy-Anderson and Able, 1999). Duffy-Anderson et al., (2003) have found fish species richness under large pile-supported piers to be lower than adjacent pile fields, wrecks, and open water habitat.

4.2.2 Disposal of Material Onto Benthic Substrate

Disposal of the material directly onto the substrate may impact EFH by burying food sources, changing microhabitat requirements, destroying spawning areas, and changing basin hydrology and bathymetry. In addition, the disposal of the material into the water column above the benthic substrate could impact the physical, chemical, and biological suitability of the water column within the EFH (Section 4.1). Recolonization of dredged material disposal areas typically follow successive and progressive steps ecologically similar to the revegetation and recolonization successional phases of clear-cut or catastrophically disturbed terrestrial systems. Opportunistic pioneer organisms with high reproductive rates typically characterize the initial communities that form on dredged materials. Slower growing specialists with lower reproductive rates and narrower niche requirements eventually replace these organisms. Eventually, the community on the recolonized surface trends toward pre-disturbance levels of diversity (Kaplan et al., 1975; Rhoads and Germano 1982, 1986; Zajac and Whitlach, 1982; Gallagher and Keay, 1998).

Since the HARS is designated as a remediation area, the disposal site is scheduled to receive capping material regardless of the generator, provided it meets open water disposal criteria to prevent toxicity to marine organisms. As a result, the HARS would receive direct impact to the benthic invertebrate community regardless of whether or not the NWS Earle project is permitted. The HARS is subject to recurring disturbance as a result of the remediation activities (i.e., disposal of material for capping). Therefore, the finfish benthic habitat functions and values at the HARS has been, and will continue to be, disturbed by disposal of dredged sediment (suitable for ocean disposal) generated by various sources. Impact to EFH and EFH designated species due to dredged material disposal at the HARS has been addressed by the Programmatic Essential Fish Habitat Assessment for Placement of Category I Dredged Material at the Historic Area Remediation Site in the New York Bight Apex (ACOE-NYD, 2002).

4.3 Adverse Effects On Organisms

Dredging and dredged material disposal can cause adverse direct impact (e.g., toxicity) and indirect impact (e.g., disruption of ecosystem attributes) to marine organisms.

4.3.1 Direct Effects

Direct effects of disposal of dredge materials include behavioral impairment (e.g., inhibition of migration patterns), destruction of eggs or spawning areas, physical impairment (e.g., turbidity-induced clogged gills resulting in suffocation, or abrasion of sensitive epithelial tissue), or physiological impairment due to acute or chronic toxicity to contaminants within the dredge sediments (Refer to Sinderman, 1979, for a comprehensive review of pollution associated diseases and abnormalities).

In some cases physical impairment of resident fish species within the project and disposal areas would be expected, especially to more susceptible life stages such as eggs and larvae, and to those species that reside on the bottom (Pelagic fish are more likely to avoid the turbidity plumes by leaving the disturbance area). However in other cases, benthic species or life stages are not as susceptible. For instance the eggs of skates develop inside a tough leathery capsule, or egg case, which provides protection against abrasion from coarse bottom sediments. Skate eggs that are not deeply buried are likely to survive due to the durability of their casing. However, larvae hatching from eggs that are deeply buried would likely not survive.

Of the 18 EFH fish species listed for the project area, four are considered estuarine dependent. They are summer flounder, winter flounder, scup, and the black sea bass. Estuarine dependent fish are those species of fish that require estuarine habitats for some, if not all, of their life cycle (Day et al., 1989). Typically, the primary estuarine habitats such as tidal creeks, salt marshes, and sea grass beds are used as nursery areas by many marine fish. These nursery areas are sought out by larval and juvenile life stages of the estuarine dependent fish, since not only do the estuaries tend to provide relative safety or protection from predators, but they also supply an abundant food source (through detrital food chains) with reduced competition at critical trophic levels (Day et. al., 1989). Typically, these species are adapted to survive in a dynamic environment subject to frequent environmental fluctuations. However, prolonged or permanent alterations of the physiochemical parameters of their environment (e.g., temperature, salinity, turbidity, dissolved oxygen) due to human-induced impact can be detrimental to the fish that reside in these estuarine habitats.

Temporary disturbance generated by the proposed action could indirectly impact the four estuarine-dependent EFH fish species and additional anadromous fish (many of which are prey for EFH species) by generating turbidity in the bay, preventing or confounding movement of these species between the Navesink - Shrewsbury River Estuary and more distal seawater offshore. This impact can have an additive negative effect on the ichthyofauna if coincident with other biotic and abiotic disturbances in the bay. Potential impact could be avoided by limiting dredging activity during anadromous fish seasonal movements.

4.3.2 Indirect Effects

Ecological impacts of dredging and dredged material disposal, if implemented without the proper controls and planning, can affect various ecological attributes of the system, including energy flow, habitat structure, and biotic interactions.

Energy Flow

Food sources enter the system based on organic material input and via primary productivity by phytoplankton, algae, and emergent or submerged aquatic vegetation. Phytoplankton productivity is a major source of primary food-energy for temperate zone estuaries (Day et al., 1989). These organisms have metabolic pathways that convert light energy into biological energy with the resultant fixation of carbon dioxide and the production of oxygen and carbohydrates. Phytoplankton production typically exhibits spring and fall maxima, with the highest rates typically occurring during annual water temperature maxima. These seasonal patterns are usually a result of various environmental factors including salinity, turbidity, nutrients, turbulence, and depth.

Energy from phytoplankton production is transported to primary consumers such as zooplankton and benthic marine invertebrates. These primary consumers, in turn, provide prey for secondary consumers and higher trophic level organisms. Disruption in seasonal patterns of salinity, turbidity, nutrients, turbulence, and depth can impact phytoplankton productivity and therefore the flow of energy from primary producers to higher trophic level consumers. Many organisms have evolved migration patterns and spawning activity to coincide or correspond with increased inputs of energy into the system. Disruption in these energy flow patterns could, therefore, disrupt these aspects of the organism's life cycle.

The abundance and local distribution of prey species for biota may indirectly be impacted during dredging and structure removal. Many of the finfish species identified within the project area prey on benthic marine organisms living in or on the sediment or pier pilings. Direct impact to these prey species will occur via dredging and substrate removal. For instance, Steimle et al. (2000) has documented that blue crabs are an important food source for several state and federally managed fish species including winter flounder, little skate, winter skate, scup, and summer flounder. Should dredging occur during winter months, any blue crabs that are overwintering in the soft muds of the channel and slough areas would be removed from system and therefore become unavailable as a food source.

Indirect impact may occur based on temporary changes in the water quality such as impact from TSS concentrations, and the release of hydrogen sulfide, which may discourage or prevent successful settlement of many sessile, benthic invertebrate prey species (See Teodora [1992] for a discussion of sulfides as an environmental factor and toxicant and the resultant adaptations demonstrated by aquatic organisms). A loss of prey (e.g., lower trophic level) species may temporarily degrade the habitat value of higher trophic level biota inhabiting the area of the candidate sites by depleting the food sources of those organisms. The major prey items of each of the most abundant finfish, shellfish and mobile megainvertebrates are presented in Table 4-2.

The anticipated impact to the prey species is considered temporary, as the benthic community will eventually shift toward pre-impact conditions via recolonization over time. The return to pre-impact conditions will not occur immediately, but rather in phases as various invertebrates re-colonize disturbance areas in successive stages over a temporal scale. Re-colonization of dredged material disposal areas typically follow successive and progressive steps ecologically similar to the re-vegetation and re-colonization successional phases of clear-cut or catastrophically disturbed terrestrial systems. Opportunistic organisms with high reproductive rates typically characterize the initial communities that form on exposed, disturbed, or dredged sediment materials. Slower growing specialists with lower reproductive rates and narrower niche requirements eventually replace these organisms. Eventually, over time, the community on the re-colonized surface will begin to succeed toward pre-disturbance levels of diversity as discussed in Section 4.2.2. Therefore, the anticipated impact to the prey species that occur within the disturbance areas is considered temporary in an ecological context, as the benthic community will succeed back to pre-impact conditions over time, following cessation of the activity.

Additionally, it is possible for the food supply of some fish to be enhanced as a result of disturbance; the increased organic content of some dredged material relative to the ambient sediments can result in greater densities of early colonizing organic enrichment opportunists, which can settle in large numbers in organically enriched sediment (Gallagher and Keay 1998) Since demersal finfish can exploit aggregations of resources (McCall 1977), this induced abundance of recently colonized organisms can provide a ready food source for some demersal finfish.

Habitat Structure

Habitat structural attributes vary with water depth, current and tidal velocity, basin size and shape, and the diversity or complexity of substrate types. Examples of the diverse sediment types typically found in marine and estuarine environments include, but are not limited to, the presence or absence of depressions, sediment wave ripples, woody debris, SAV, shell beds, structures, reefs, and wrecks. Potential dredging and dredge material disposal activities can alter these structural attributes resulting in dramatic change or homogenization of habitat structure by decreasing the stability of the substrate, creating a more uniform water depth, reducing habitat heterogeneity, reducing habitat area, and decreasing availability of cover.

Generally speaking, the more complex the bottom habitat, the more susceptible the habitat is to negative impact from disturbance (Watling and Norse, 1998). Boulder and rock reef areas can be raked by dredges that could potentially overturn boulders, thereby killing the sessile invertebrates that have colonized the rock surfaces. These sessile creatures include sponges, cnidarians, bryozoans, echinoderms, etc., which are prey species for a number of EFH fish (Table 4-2).

On smaller textured substrates such as cobbles, pebbles, sands, and mud, impacts incurred by use of various dredging techniques typically result in a loss of substrate complexity as a result of a homogenization of substrate types (Eckelbarger, no date). The homogenization of bottom substrates impacts EFH because it results in the reduction of the habitat's suitability to the demersal life stages of various larval fish species or it discourages settlement of sessile invertebrate prey species. For instance a study conducted by Lindholm, et al., (1999) has shown that any benthic structure has value in increasing survival time and total number of young cod when the young are subjected to predation.

Dredging in soft bottom sediments such as mud can destroy invertebrate burrows, killing the inhabitants. This results in reducing bioturbation rates and, thus sediment aeration, producing areas that may have shallow to no aerobic surface layers. Disturbance of sediments with shallow to no aerobic surface layers can result in the release of hydrogen sulfide to the water column, which may discourage settlement of benthic, invertebrate larvae. The negative impact that dredging may have on a fisheries resource are greater when the dredging gear disturbs or destroys special habitat areas known to take many years to form such as kelp beds, SAV beds (Stephan et al., 2000), or coral reefs (Kaplan, 1982). The area to be dredged at NWS Earle is neither structurally complex, nor does it support SAV beds. The HARS is subject to recurring disturbance as a result of the remediation activities (i.e., disposal of material for capping). Therefore, the benthic and water column habitat functions and values at the HARS has been, and will continue to be, compromised by disposal of dredged sediment (suitable for ocean disposal) generated by various sources. This periodic disturbance limits the value of the habitat to EFH species, their predators, and their prey.

Biotic Interactions

Indirect effects on fish biotic interactions produced by dredging and dredge material disposal occur through the disruption of the symbiotic associations and ecological principles that govern the fish community, especially predator - prey relationships. Predator - prey relationships can be locally disrupted by direct impact to the prey organism's population. Prey species are impacted by direct removal of prey populations living in the sediment to be dredged, coverage of the organism during dredge material disposal, impact to egg and/or propagule settlement rate (either through removal of suitable substrate or via release of hydrogen sulfide), destruction of prey species habitat, or other impact to predator or prey species fecundity, survivorship, recruitment, settlement, or colonization rates. The degree or complexity of symbiotic interactions among many fish species is not completely understood; therefore, impacts to one species may have unknown or currently unobserved impacts to others.

Animals that have been stressed by the various negative impacts associated with dredging and dredge disposal can also succumb to parasitism, disease, predation, intense competition or other stresses. The loss of one species in an obligatory mutualistic relationship will result in the demise of the other. Finally, the interbasin transfer of sediment may promote the spread of non-native species. These exotic species may add additional predation or competition pressure on the native organisms, and may also introduce exotic diseases from which the native organisms may have little natural resistance.

The abundance and local distribution of prey species for EFH designated fish, may directly and indirectly be impacted during dredging and dredged material disposal. Many of the EFH designated fish species prey on benthic marine organisms living in or on the sediment. Direct impact to these prey species will occur through removal at the dredge site and burying at the disposal site. Indirect impact could occur as a result of the temporary changes in the water quality as discussed in Section 4.1, such as impact from TSS concentrations (which could result in local depletion of DO), and the release of hydrogen sulfide (which may discourage settlement of the propagules of many sessile, benthic invertebrate prey species). Benthic invertebrates can comprise a major portion of the diet of some EFH species (e.g., 35.6% of diet of winter flounder in the Northwest Atlantic) (Bowman et al., 2000).

Diadromous fish are also a major source of prey to many EFH fish species. Sediment plumes may interfere with diadromous fish species movements to and from spawning areas, or they may avoid returning to their spawning areas altogether, potentially affecting their reproductive success for the season (Gibson, 1987). Diadromous fish are fish that partake in regular, periodic (typically seasonal), and obligatory movements between fresh and marine water habitats. These movements are further classified into one of three categories: anadromy, catadromy, and amphidromy, defined below (Matthews, 1998):

- Anadromy: the periodic and obligatory migration of fish from marine waters into fresh water to spawn. Examples in the Sandy Hook Bay and New York Bight fish communities would be the alewife, blueback herring, shad, and striped bass (MacKenzie, 1992). Herrings are important prey species for summer flounder, Atlantic cod, and bluefish (Bowman et al., 2000).
- Catadromy: the periodic and obligatory migration of fish from fresh water into marine waters to spawn. An example in the Sandy Hook Bay and New York Bight fish communities would be the American eel (MacKenzie, 1992).
- Amphidromy: the periodic movement of immature or juvenile fish between fresh and marine waters. Winter flounder, which tolerate a wide range of salinity from fresh water to seawater salinities (Pereira, 1999), would be an example of an amphidromous fish species known to inhabit the Sandy Hook Bay and New York Bight fish communities. Winter flounder are prey to higher trophic level piscivores such as bluefish and striped bass (Bowman et al., 2000).

Many EFH species are food sources to other higher trophic level EFH species. A loss of these lower trophic level species may degrade the habitat value for higher trophic level fish by depleting the food sources of those fish. Examples of EFH species that are commonly preyed upon by other EFH species include butterfish (known to be eaten by bluefish), mackerel (known to be eaten by dusky shark) and Atlantic cod (known to be eaten by larger Atlantic cod) (Bowman et al., 2000). The prey of each of the EFH species and their various life stages are presented in Table 4-2.

The anticipated impact to the prey species is considered temporary, as the benthic community will eventually return to pre-impact conditions over time. However, return to pre-impact conditions will not occur immediately, but rather in phases as discussed in Section 4.2.2. The project area is frequently disturbed by ship traffic and by the five-year maintenance dredging cycle. Likewise, the disposal area is disturbed more frequently as part of the on-going remediation efforts that have occurred since designation of the site for remediation in 1997.

Table 4-2
Essential Fish Habitat Species and their Respective Prey

Species	Life Stage	Likely Prey Species in Project Area	Source
red hake (*Urophycis chuss*)	Larvae	Copepods, microcrustaceans	Steimle et al., 1999a
	Juvenile	Mostly crustaceans such as Crangon, but also amphipods and polychaetes	
	Adult	Fish and Crustaceans	
winter flounder (*Pseudopleuronectes americanus*)	Larvae	Nauplii, invertebrate eggs, protozoans, polychaetes	Pereira et al., 1999
	Juvenile	Sand dollar, bivalve siphons, polychaetes, amphipods,	
	Adult	Amphipods, polychaetes, bivalves or siphons, capelin eggs, crustaceans	
Windowpane (*Scophthalmus aquosus*)	Larvae	Copepods and other zooplankton	Chang et al., 1999
	Juvenile	Polychaetes and small crustaceans such as mysids	
	Adults	Polychaetes, mysids, decapods, shrimp, hake, and tomcod	
Atlantic sea herring (*Clupea harengus*)	Juvenile	Selective opportunistic feeders, mostly copepods	Reid et al., 1999
	Adult	Euphausiid, chaetognaths, and copepods	
bluefish (*Pomatomus saltatrix*)	Larvae	Copepods	Fahay et al., 1999b
	Juvenile	Crustaceans, fish, and polychaetes	
	Adult	Sight feed on other fish such as silversides, spot, weakfish. Also eat shrimp, crabs, and worms	Mackenzie, 1992
Atlantic butterfish (*Peprilus triacanthus*)	Larvae	Undetermined	Cross et al., 1999
Atlantic mackerel (*Scomber scombrus*)	Juvenile	Small crustaceans, such as copepods, euphausiids, amphipods, mysid, shrimp, and decapod larvae	Studholme et al., 1999
	Adults	Similar to juvenile but with selection of larger fish such as, euphausiid, pandalid, and crangonid shrimp	
summer flounder (*Paralichthys dentatus*)	Larvae	Polychaete tentacles, harpactacoid copepods, and clam siphons	Packer et al., 1999
	Juvenile	Crustaceans, polychaetes, and invertebrate parts	
	Adult	Invertebrates, shrimp, weakfish, mysids, anchovies, squid, Atlantic silversides, herring, and hermit crabs	

Table 4-2
Essential Fish Habitat Species and their Respective Prey

Species	Life Stage	Likely Prey Species in Project Area	Source
scup (*Stenotomus chrysops*)	Juvenile	Small benthic invertebrates	Steimle et al., 1999b
	Adult	Benthic and near bottom invertebrates and small fish	
black sea bass (*Centropristus striata*)	Juvenile	Small epibenthic invertebrates such as crustaceans	Steimle et al., 1999c
	Adult	Benthic, near-bottom invertebrates, and small fish	
king mackerel (*Scomberomorus cavalla*)	Larvae	Larval fish, especially carangids, clupeids, and engraulids; also some crustaceans	NERO/NMFS no date
	Juvenile	Small fish such as anchovies, shad, sardines	
	Adult	Jacks and herrings; also squid and shrimp	
Spanish mackerel (*Scomberomorus maculatus*)	Larvae	Larval fish, especially carangids, clupeids, and engraulids; also some crustaceans	NERO/NMFS no date
	Juvenile	Small fish, shrimp and squid	
	Adult	Jacks and herrings; also squid and shrimp	
cobia (*Rachycentron canadum*)	Larvae	Zooplankton, dominated by copepods	NERO/NMFS no date
	Juvenile	Carnivorous fish, shrimp, and squid	
	Adult	Crustaceans and fishes, primarily crabs	
little skate (*Leucoraja erinacea*)	Juvenile	A variety of benthic creatures including the following: anthozoans, bryozoans, hydrozoans, gastropods, bivalve mollusks, squids, polychaetes, copepods, cumaceans, isopods, amphipods, various shrimp (mysids, eupausiids, pandalid, crangon); hermit, cancer, and portunid crabs, holothuroideans, and numerous fish species	Bowman, 2000; McEachran, 2002
	Adult	Crabs, shrimps, worms, amphipods, ascidians, bivalves, squid, small fish (lance, alewives, herring, cunner, silverside, tomcod, silver hake)	
winter skate (*Leucoraja ocellata*)	Juveniles	Similar to little skate but also includes squid and echinoderms. Amphipods and polychaetes are primary food items	McEachran, 2002
	Adults	Similar to juveniles however in general larger individual skates consume relatively more decapods, polychaetes, and fishes. Individuals larger than 70 cm TL prey on skates, margined snake eel, herring, alewife, blueback herring, menhaden, round herring, hakes, tomcod, cod, smelt, sculpins, sand lance, cunner, butterfish, summer and yellowtail flounders	McEachran, 2002

Table 4-2
Essential Fish Habitat Species and their Respective Prey

Species	Life Stage	Likely Prey Species in Project Area	Source
clearnose skate (*Raja eglanteria*)	Juveniles	A variety of benthic creatures including the following: bivalve mollusks, squids, polychaetes, mysids and other shrimps, hermit and other crabs, and small bony fish	McEachran, 2002
	Adults	Fish, such as weakfish and butterfish, become more important in the diet at 50 cm TL	McEachran, 2002
dusky shark (*Carcharhinus obscurus*)	Neonate/ early juveniles	Oviphagous and cannibalistic inside uterus	NMFS, 2003
	Late juveniles/ subadults	Numerous bony fishes and smaller elasmobranches	
sandbar shark (*Carcharhinus plumbeus*)	Neonate/ early juveniles	Yolk, placental and other maternal tissues	CBP, 2001
	Late juveniles/ subadults	Blue crabs, sardines, shad, menhaden, eels, mackerel, flounder, various elasmobranches, squid, shrimp, mollusks.	
	Adult	Finfish, rays, benthic fauna, seabirds, sea turtles	
	Late juvenile/ subadult	Primarily fish including pelagic and flatfishes and squid. Opportunistic feeder, will eat almost anything.	

5.0 IMPACT AVOIDANCE, MINIMIZATION, MITIGATION

The dredging activities conducted for the project area are likely to have some temporary impacts on EFH species in Sandy Hook Bay. However impacts will be minimized through compliance with the dredging window specified in the dredging permit. Generally, eggs and larvae are life cycle stages that are more vulnerable to dredging-related impacts than juveniles or adults. The relative immobility of the former two life stages prevents them from avoiding the dredging and disposal-related disturbance by leaving the impact area, unlike juveniles and adults. (ACOE-NED, 2001).

Not all fish species will incur the same degree of impact. Demersal fish species, such as flounders, are more susceptible to impacts than pelagic species since most dredging related disturbance occurs near the bottom (ACOE-NED, 2001). Species with demersal eggs are highly susceptible to impacts of dredging, as compared to those with pelagic (planktonic) eggs suspended within the water column. The eggs and larvae of species with demersal eggs may be killed from exposure to elevated concentrations of suspended solids and associated water quality impacts. While adult and juvenile demersal and pelagic fish can avoid a sediment plume produced by dredging, small larval fish (and juvenile fish of species that reside on the bottom following metamorphosis from their larval stage) are less able to swim away from impact areas. However, the area beneath Pier 3 and the Pier 3 berths most likely provide poor habitat compared to other areas of Sandy Hook Bay due to repeated disturbance by Navy ships using those areas. Therefore, it is unlikely these areas successfully support robust populations of these fish.

Avoidance and mitigation measures would be implemented to reduce potential impact of the proposed action on fisheries resources. Avoidance and mitigation strategies specific to the identified work areas are discussed below.

5.1 Project Areas

The following avoidance, minimization, and mitigation measures will be taken within the project area to avoid or minimize impact to fish and EFH in those locations:

- The Navy will comply with any specified permit conditions in order to avoid generating excessive amounts of sediment and avoid causing irreversible impact to marine resources during dredging and dredged material disposal activities.

- The Navy will avoid dredging activity within the berthing areas during peak reproductive activity of the federally managed (i.e., EFH) fish species most susceptible to dredging impacts. Refraining from dredging during the late winter months will avoid impacting peak winter flounder spawning activity, which occurs from February to mid-April within Sandy Hook Bay. Winter flounder are especially susceptible to dredging impacts because their eggs are demersal and attach to benthic sediment.

  Delaying commencement of dredging within the berthing area until June would ensure dredging does not occur until after peak migratory activity of returning anadromous fish to the local watershed drainages, especially the Navesink and Shrewsbury Rivers. This time period would also avoid destruction of blue crabs that may be over-wintering in the mud within the berthing areas.

- Sensitive time periods include late river herring (i.e., alewife and blueback herring) runs, and the return of shad in early spring. Although shad and river herring are not listed EFH species, they are important prey for many of the federally managed, predatory finfish species. Therefore, dredging within the berthing areas is proposed for the time period from 1 June to 14 November of each year during the length of the project. In recognition of the fact that large pile-supported piers can be considered sub-optimal fisheries habitat (Duffy-Anderson and Able, 1999), no seasonal limitations (i.e., closed environmental window) is proposed for pier demolition and other activity scheduled within the limited area under the existing pier.

Efforts will be made to expedite dredging within the project area in order to minimize the duration of dredge-associated impacts.

5.2 HARS

Release of dredged material at the HARS during disposal creates a continuous rain of sediment material descending upon the bottom, which prevents recolonization of benthic biota. Only transient species abound in these areas. The potential for habitat is low. Therefore, no mitigation measures are required for disposal of dredged sediment (suitable for ocean disposal) at the HARS, and no set disposal window was recommended in the Programmatic Essential Fish Habitat Assessment prepared by the USACE for placement of remediation material at the HARS (ACOE, 2002). The following avoidance and minimization measures will be taken within the disposal area at the HARS to avoid or minimize impact to fish and EFH at this location:

- Disposal of dredged sediment at the HARS will be in accordance with procedures outlined in the HARS SMMP (ACOE/EPA, 1997).
- The Navy will comply with any additional permit conditions specified for dredged material disposal.
- Dredged sediments would be dewatered via barge overflow during loading at the project area to reduce turbidity during disposal at the HARS.

6.0 CONCLUSIONS

Barring anthropogenic disturbances, the four main factors influencing fish habitat preference within a marine environment are temperature, salinity, depth and substrate. Although the EFH designation quadrants include 18 species for the 10 minute x 10 minute coordinate EFH quadrant applicable to the project area, variations in environmental factors typically prevent these species from being uniformly distributed throughout the quadrant's areal coverage.

Therefore, to accurately assess impacts to the EFH listed species, the temperature, salinity, depth, and substrate of the marine environment within the areal extent of the project limit as well as within influence of the project limits (e.g., down current, or adjacent, etc.) were considered when assessing impact to EFH species. Table 6-1 is provided as a summation of the EFH species habitat requirements. The information provided in Table 6-1 was used as a screening tool to determine which species may likely occur within the thermal, salinity, and depth ranges of the proposed project area. Existing literature data gaps are denoted as "⊗" in the table and reflect areas where more research may be currently needed.

The proposed action at the NWS Earle Pier 3 could result in local, temporary impact to EFH for at least one federally managed fisheries resource, and could impact various prey organisms of other EFH species. Potential impacts generated by the proposed actions include localized impairment to water quality, destruction of benthic habitat, and direct effects to EFH species and other marine organisms. Indirect effects to EFH species and other marine organisms within the area may occur due to the alterations of energy flow, habitat structure, and biotic interaction. Certain fisheries resources within the bay were identified as particularly sensitive to dredging and turbidity-induced impacts due to their demersal egg and larval stages, or due to their migration or hibernation habits.

The fisheries resources within Sandy Hook Bay identified as particularly susceptible to dredging and turbidity-induced impacts include the winter flounder and anadromous fish. Winter flounder eggs are demersal and attach to benthic substrate and, therefore, are susceptible to removal via dredging and via smothering during the re-settlement of sediment from the water column. Winter flounder begin spawning once water temperatures reach 8-9°C (46-48°F). In Sandy Hook Bay, peak spawning typically occurs from Janurary to early April (Figure 6-1). Anadromous fish runs between Sandy Hook Bay and local drainages connected to the bay occur from late winter to early spring. Therefore, dredging should be prohibited during these sensitive time periods to minimize impact to peak spawning of winter flounder in February, and returning anadromous fish runs in late winter and early spring. Therefore within the berthing areas, dredging should not commence until after mid-May and should not continue past mid-November within each year during the duration of the project. In recognition of the fact that large pile-supported piers can be considered sub-optimal fisheries habitat (Duffy-Anderson and Able, 1999), no seasonal limitation (i.e., closed environmental window) is proposed for pier demolition and other under-pier activity.

The magnitude of TSS released or generated during dredging can be minimized using best management practices such as the deployment of appropriate dredging equipment and techniques. Use of barge overflow to dewater the dredged material will reduce turbidity at the

Table 6-1
Summary of Temperature, Salinity, Depth and Substrate Requirements of Fish Species Listed for the EFH Quadrant inclusive of the Project Area

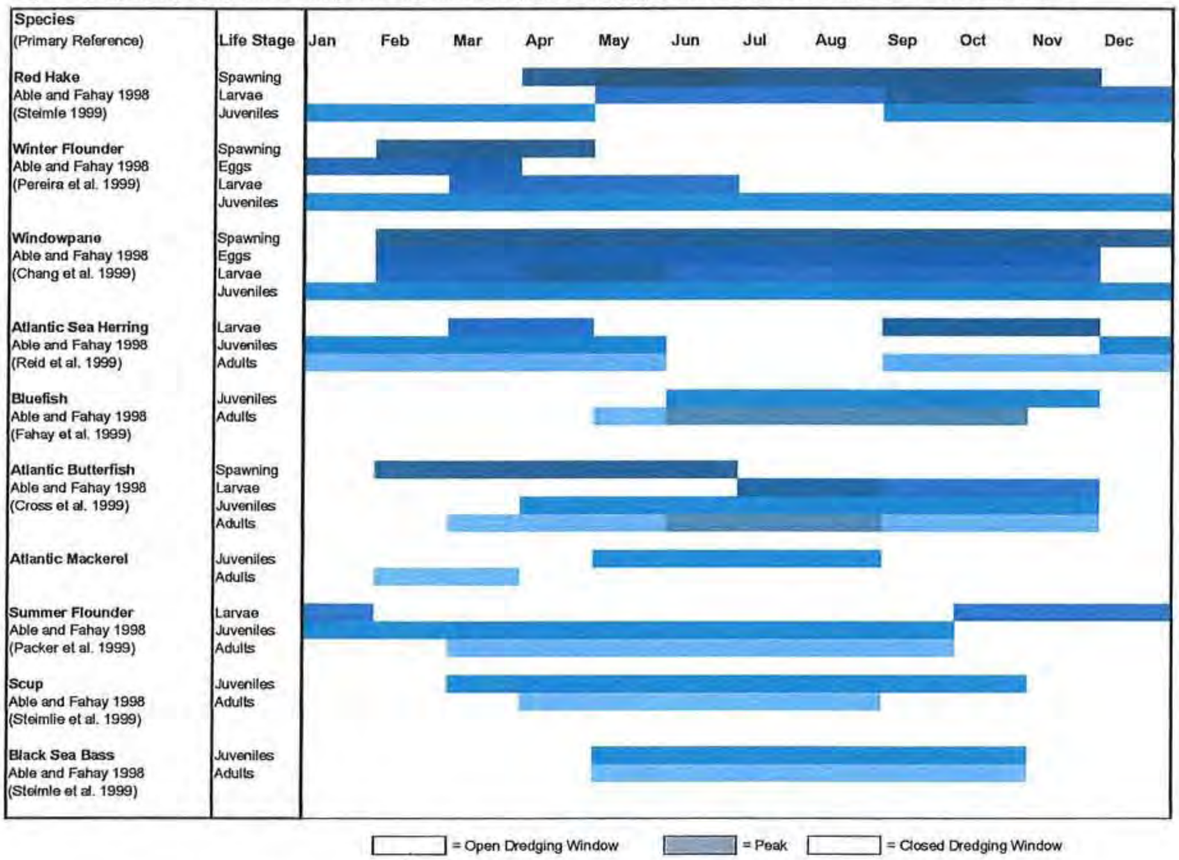
Species	Life History Stages	Temperature (°C)	Salinity (ppt)	Depth (meters)	Substrate
Red Hake	Larvae	<19	>0.5	<200	none (water column)
	Juveniles	<16	31-33	<100	shell fragment or live sea scallop bed
	Adults	<12	33-34	10-130	sand and mud
Winter Flounder	Eggs	<10	10 – 30	<5	sand, mud, gravel
	Larvae	<15	4-30	<6	⊗
	Juveniles	<28	5-33	0.1-10	mud, fine sand
	Adults	<15	5.5-36	<6	sand, mud, gravel
Windowpane Flounder	Eggs	<20	⊗	<70	⊗
	Larvae	<20	⊗	<70	⊗
	Juveniles	<25	5.5-36	1-100	mud or fine sand
	Adults	<27	5.5-36	1-75	sand
Atlantic Sea Herring	Larvae	<16	32	50-90	⊗
	Juveniles	<10	26-32	15-135	⊗
	Adults	<10	>28	20-130	sand, gravel, cobble, shell fragment
Bluefish	juveniles	15-30	23-33	shallow	sand, silt, mud, clay
	adults	15-25	>25	⊗	⊗
Atlantic Butterfish	larvae	4.4-27.9	0.5-25	near surface	associated with floating cover
	juveniles	4.4-29.7	3-37.4	10-330	sand and mud
	adults	4.4-26	3.8-33	10-420	⊗
Atlantic Mackerel	juveniles	4-22	0.5->25	0-320	⊗
	adults	4-16	0.5->25	0-381	sand and mud
Summer Flounder	larvae	>4	>25	10-70	none (water column)
	juveniles	>4	0.5-25	0.5-1.5	sand
	adults	⊗	0.5->25	up to 152	submerged aquatic vegetation

Table 6-1
Summary of Temperature, Salinity, Depth and Substrate Requirements of Fish Species Listed for the EFH Quadrant inclusive of the Project Area

Species	Life History Stages	Temperature (°C)	Salinity (ppt)	Depth (meters)	Substrate
Scup	juveniles	>16	>15	⊗	sand, mud, mussel, eelgrass
	adults	>16	0.5->25	<30	⊗
Black Sea Bass	juveniles	⊗	⊗	surface-38	rough bottom
	adults	>6	0.5->25	⊗	rocky
King Mackerel	all life stages	>20	>30	surf to shelf break zone	sandy shoals and high profile, rocky bottoms
Spanish Mackerel	all life stages	>20	>30	surf to shelf break zone	sandy shoals and high profile, rocky bottoms
Little skate	all life stages	2 - 15	⊗	Shoreline to 111	Sandy, gravelly bottoms, also mud
Winter Skate	all life stages	2 - 15	⊗	Shoreline to 111	Sand, gravelly bottoms
Clearnose Skate	all life stages	9 - 20	⊗	Shoreline to 111	Soft bottoms
Cobia	all life stages	>20	>30	surf to shelf break zone	sandy shoals and high profile, rocky bottoms, *sargassum* and seagrass beds
Dusky Shark	neonates/ early juveniles	⊗	⊗	shallow coastal waters to the 25 m isobath	none (water column)
	late juveniles/ subadults	⊗	⊗	between the 25 and 200 m isobaths	none (water column)
Sandbar Shark	neonates/ early juveniles	>21	>22	coastal areas to the 25 m isobath	none (water column)
	late juveniles/subadults	⊗	⊗	25-200	none (water column)
	adults	30	high	coastal waters to 200	none (water column)

Source: NOAA, NMFS and MAFMC
⊗ = Information not available

Figure 6-1: Important EFH Species of Sandy Hook Bay Most Susceptible to Dredging-related Activities - Seasonal Occurrence of Life Stages



disposal site. Acute and chronic bioassays conducted with the dredged sediment has identified that the surficial sediment layer is unsuitable for open ocean disposal, and that the deeper elevation parent material is suitable for open ocean disposal as capping material at the HARS (ASI, 2003). Unsuitable material will be removed for upland disposal/reuse/recycling in accordance with applicable state and federal regulations and permit conditions of the receiving facility.

Impact to EFH by disposal of dredged material at the HARS has been addressed by the USACE in their document entitled "Programmatic Essential Fish Habitat Assessment for Placement of Category I Dredged Material at the Historic Area Remediation Site in the New York Bight Apex" (ACOE, 2002). Conclusions of the programmatic assessment are summarized as follows:

- Potential turbidity-induced impacts to the water column have been determined to be within the magnitude of natural and ephemeral events incurred during seasonal storms and peak discharges from the Hudson and Raritan Rivers. The duration of increased turbidity of the water column during dredged sediment disposal activity at the HARS is estimated to be less than one hour. Therefore, water column turbidity should return to pre-disposal conditions (ACOE, 2002).

- Other water quality parameters (such as DO, chlorophyll a concentration, nutrients, and contaminant concentrations) are predicted to cause minimal temporal changes to the water column at the HARS and, therefore, are not expected to have a permanent adverse impact to EFH species (ACOE, 2002).

- No historical evidence has been presented that directly links sediment disposal at the HARS to increased fish mortality. The fish community in the area of the HARS continues to thrive and no apparent adverse effect on the local or regional biota due to sediment disposal has been established (ACOE, 2002).

- Impact to motile marine life, especially finfish species, due to bodily injury from descending sediments would be minimized by various factors. These factors include: regulating disposal to a relatively small contact area, sequential placement of the sediment within a pre-determined remediation grid, and increased chance of finfish flight caused by vessels operating within the relatively shallow waters of the HARS (ACOE, 2002).

- Local disruptions to the predator/prey cycle within the HARS may occur during discharge of the sediment since many EFH species are known to feed on organisms inhabiting the HARS, especially benthic invertebrates that have colonized the sediment within the HARS. Many of the EFH species and certain motile invertebrate prey species will flee the disposal area during release of the sediment. Other prey species such as sessile invertebrates (e.g., anemones, shellfish, and colonial invertebrates) would be buried. Some invertebrates are capable of digging themselves out once covered by sediment, whereas others would be eliminated. Recolonization of the sediment surface would occur following cessation of dumping within the remediation cell. Those EFH species that feed on pelagic and planktonic organisms would experience minimal disruption to their feeding (ACOE, 2002).

Based on the results of this EFH assessment, potential impact to susceptible federally managed (EFH) fish species from the proposed action appears to be limited to winter flounder. Avoidance and minimization techniques outlined in Section 5 would ensure the impact is negligible. Impact to prey species such as anadromous fish could also occur but would be minimized by avoidance of dredging during sensitive life cycle habits such as migration and hibernation periods. Other prey species, such as sessile benthic marine invertebrates, would be directly impacted by removal of sediment from the project area and disposal of the sediment at the HARS. However, this impact would only be temporary as adjacent source populations are expected to recolonize the disturbance areas. Other mitigation techniques outlined in Section 5 would further reduce the potential impact of dredging and disposal.

Therefore within the berthing areas, the recommended dredging window (i.e., the period of time open to dredging activity within the pier berths) is from mid-May to mid-November within each year during the duration of the project. In recognition of the fact that large pile-supported piers can be considered sub-optimal fisheries habitat (Duffy-Anderson and Able, 1999), no seasonal limitation (i.e., closed environmental window) is proposed for pier demolition and other under-pier activity.

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- Bluefish (*Pomatomus saltatrix*)
- Butterfish (*Peprilus triacanthus*)
- Cobia (*Rachycentron canadum*)
- Dusky shark (*Charcharhinus obscurus*)
- King mackerel (*Scomberomorus cavalla*)
- Sandbar shark (*Charcharhinus plumbeus*)

- Spanish mackerel (*Scomberomorus maculatus*)
- Summer flounder (*Paralichthys dentatus*)
- Scup (*Stenotomus chrysops*)

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EFH ASSESSMENT WORKSHEET (05/14/01 v.)

PROJECT NAME: Pier Complex Replacement – NWS Earle
DATE: January 2004
PROJECT NO.:
LOCATION: NWS Earle Pier Complex Monmouth Co., NJ
PREPARER: US NAVY

Step 1. Generate the species list from the EFH website for the geographic area of interest. Use the species list as part of the initial screening process to determine if EFH occurs in the vicinity of the proposed action. Attach that list to the worksheet because it will be used in later steps. Make a preliminary determination on the need to conduct an EFH Consultation.

1. INITIAL CONSIDERATIONS		
EFH Designations	YES	NO
Is action located in or adjacent to EFH?	X	
Is EFH designated for eggs?	X	
Is EFH designated for larvae?	X	
Is EFH designated for juveniles?	X	
Is EFH designated for adults?	X	
Is there Habitat Areas of Particular Concern (HAPC) at or near project site?		X
Does action have the potential to adversely affect EFH for any life stages checked above to any degree? If no, consultation is not required. If yes, consultation is required —complete remainder of worksheet.	X	

Step 2. In order to assess impacts, it is critical to know the habitat characteristics of the site before the activity is undertaken. Use existing information, to the extent possible, in answering these questions. Please note that, there may be circumstances in which new information must be collected to appropriately characterize the site and assess impacts.

2. SITE CHARACTERISTICS	
Site Characteristics	**Description**
Is the site intertidal/sub-tidal/water column?	Sub-tidal
What are the sediment characteristics?	Section 2.4.3 (page 2-11)
Is there HAPC at the site, if so what type, size, characteristics?	No
Is there submerged aquatic vegetation (SAV) at or adjacent to project site? If so describe aerial extent.	No
What is typical salinity and temperature regime/range?	Section 2.4.4 (temperature- Page 2-13) and 2.4.5 (salinity page 2-13)
What is the normal frequency of site disturbance, both natural and man-made?	Negligible annual natural disturbance (i.e. storms, peak discharge) sufficient to alter bottom bathymetry. Approximate 5-year cycle of man-made disturbance via maintenance dredging. Additional periodic localized disturbance within berthing areas due to ship movements/maneuvering.
What is the area of proposed impact (work footprint & far afield)?	Footprint = 8.8 hectares (22 acres).

Step 3. This section is used to describe the anticipated impacts from the proposed action on the physical/chemical/biological environment at the project site and areas adjacent to the site that may be affected.

3. DESCRIPTION OF IMPACTS			
Impacts	**Yes**	**No**	**Description**
Nature and duration (days) of activity(s)			Pile testing: 15d Pile Driving at Pier 3 and trestle: intermittently during 10 months Demolition of Pier 3 and Trestle: intermittently during 6.5 months; Dredging of unsuitable material beneath existing Pier 3 (phase 1 dredging): 15d; Dredging of Pier Berths (Phase 2): 40 days
Will benthic community be disturbed?	X		Section 4.2 (pages 4-4 to 4-7)
Will SAV be impacted?		X	
Will sediments be altered and/or sedimentation rates changed?	X		Unconsolidated recently deposited sediments and some consolidated native parent material will be removed from the berthing areas of Pier 3. Sedimentation rates are not expected to change as a result of the proposed action
Will turbidity increase?	X		Temporary increase in turbidity will occur during dredge and demolition activity – Section 4.1 (page 4-1 to 4-4)
Will water depth change?	X		Currently within the Pier 3 berthing areas, the existing depth is maintained at –35 ft MLW. The proposed project would create deeper draft pier berths that would be maintained at –45 ft MLW
Will contaminants be released into sediments or water column?	X		Concentrations of certain contaminants have historically been detected in project area sediments – Section 2.4.4 (page 2-13)
Will tidal flow, currents or wave patterns be altered?		X	
Will ambient salinity or temperature regime change?		X	
Will water quality be altered?	X		Temporary changes to water turbidity, pH and dissolved oxygen are expected – Section 4.1 (pages 4-1 to 4-4)

Step 4. This section is used to evaluate the consequences of the proposed action on the functions and values of EFH as well as the vulnerability of the EFH species and their life stages. Identify which species from the EFH species list (generated in Step 1) will be adversely impacted from the action. Assessment of EFH impacts should be based upon the site characteristics identified in Step 2 and the nature of the impacts described in Step 3. The Guide to EFH Descriptions on the website should be used during this assessment to determine the ecological parameters/preferences associated with each species listed and the potential impact to those parameters.

4. EFH ASSESSMENT			
Functions and Values	**Yes**	**No**	**Describe habitat type, species and life stages to be adversely impacted**
Will functions and values of EFH be impacted for:			
Spawning		X	With proposed avoidance/ mitigation strategies (Section 5.1 – 5.2), impact to spawning winter flounder, their eggs and larvae would be negligible.
Nursery		X	
Forage	X		Various finfish species could temporarily lose a source of forage from removal of benthic marine invertebrates from the project area – Section 4.3.2 (page 4-8)
Shelter		X	
Will impacts be temporary or permanent?			With proposed avoidance and minimization strategies, impact to regional fisheries would be temporary and reversible.
Will compensatory mitigation be used?		X	Avoidance and minimization strategies are proposed – Section 5.0

Appendix “C”

State of New Jersey
Department of Environmental Protection
Division of Parks and Forestry
Office of Natural Lands Management
Natural Heritage Program
P.O. Box 404
Trenton, NJ 08625-0404
Tel. #609-984-1339
Fax. #609-984-1427

James E. McGreevey
Governor

Bradley M. Campbell
Commissioner

October 23, 2002

Anthony Zemba
Maguire Group Inc.
One Court Street
New Britain, CT 06051

Re: NWS Earle Pier 3 Replacement

Dear Mr. Zemba:

Thank you for your data request regarding rare species information for the above referenced project site in Sandy Hook Bay, Monmouth County.

The Natural Heritage Data Base does not have any records for rare plants or natural communities on the site.

The Landscape Project (Version 1.0) does not have any records for suitable habitat or rare species on the project site.

Attached is a list of rare species and natural communities that have been documented from Monmouth County. This county list can be used as a master species list for directing further inventory work. If suitable habitat is present at the project site, these species have potential to be present. If you have questions concerning the wildlife records or wildlife species mentioned in this response, we recommend you contact the Division of Fish and Wildlife, Endangered and Nongame Species Program.

PLEASE SEE THE ATTACHED 'CAUTIONS AND RESTRICTIONS ON NHP DATA'.

Thank you for consulting the Natural Heritage Program. The attached invoice details the payment due for processing this data request. Feel free to contact us again regarding any future data requests.

Sincerely,

Herbert A. Lord

Herbert A. Lord
Data Request Specialist

cc: Thomas F. Breden
Lawrence Niles
NHP File No. 02-4007348

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building
Pleasantville, New Jersey 08232
Tel: 609-646-9310
Fax: 609-646-0352
http://njfieldoffice.fws.gov

IN REPLY REFER TO:
ES-02/700

OCT 23 2002

Anthony J. Zemba, Senior Environmental Scientist
Maguire Group Inc.
One Court Street
New Britain, Connecticut 06051
Fax Number: (860) 224-9147

Reference: Threatened and endangered species review within the proposed Pier 3 replacement at Naval Weapons Station Earle Pier Complex, Sandy Hook Bay, Monmouth County, New Jersey.

The U.S. Fish and Wildlife Service (Service) has reviewed the above-referenced proposed project pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of federally listed endangered and threatened species. The following comments do not address all Service concerns for fish and wildlife resources and do not preclude separate review and comment by the Service as afforded by other applicable environmental legislation.

Except for an occasional transient bald eagle (*Haliaeetus leucocephalus*), no other federally listed or proposed threatened or endangered flora or fauna under Service jurisdiction are known to occur within the vicinity of the proposed project site. Therefore, no consultation pursuant to Section 7 of the Endangered Species Act is required between the federal action agency and the Service. If additional information on federally listed species becomes available, or if project plans change, this determination may be reconsidered.

Enclosed is current information regarding federally listed and candidate species occurring in New Jersey. The Service encourages federal agencies and other planners to consider candidate species in project planning. The addresses of State agencies that may be contacted for current site-specific information regarding federal candidate and State-listed species are also enclosed.

Reviewing Biologist: ________________

Authorizing Supervisor: ________________

Enclosures: Current summaries of federally listed and candidate species in New Jersey
Addresses for additional information on candidate and State-listed species

No part of this response should be used out of context and if reproduced, should appear in its entirety.

K:\forms\esfax_nopot.wpd 7/19/02

SPECIES REFERRALS TO OTHER AGENCIES

X MARINE SPECIES/ENVIRONMENT

X The proposed project is located in or may affect the following marine or estuarine environment: Sandy Hook Bay.

☐ The following federally listed marine species occurs in the vicinity of the project site:

The Service provides the enclosed determination with respect to federally listed or proposed threatened or endangered flora and fauna under Service jurisdiction only. Principal responsibility for threatened and endangered marine species is vested with the National Marine Fisheries Services (NMFS). Therefore, the NMFS must be contacted to fulfill consultation requirements pursuant to Section 7(a)(2) of the Endangered Species Act.

National Marine Fisheries Service
Habitat and Protected Resources Division
Sandy Hook Laboratory
Highlands, New Jersey 07732
(732) 872-3023

____ OTHER SPECIES OF CONCERN

Plants

There is a known occurrence of the following plant species in the vicinity of the project site:

- ☐ State-listed as endangered:
- ☐ plant species of concern in New Jersey:

The Service recommends that:

- ☐ project proponents contact the New Jersey Natural Heritage Program (address also enclosed) for recommendations to avoid adverse effects to rare or State-endangered plant species.
- ☐ a qualified botanist survey the project site for the presence or absence of the above species. Any field surveys should be coordinated with the New Jersey Natural Heritage Program.

Animals

There is a known occurrence of the following animal species in the vicinity of the project site:

- ☐ State-listed as endangered:
- ☐ State-listed as threatened:
- ☐ animal species of concern in New Jersey:

The Service recommends that:

- ☐ project proponents contact the New Jersey Endangered and Nongame Species Program (address also enclosed) for recommendations to avoid adverse effects to rare or State-listed animal species.
- ☐ a qualified biologist survey the project site for the presence or absence of the above species. Any field surveys should be coordinated with the New Jersey Endangered and Nongame Species Program.

____ COMMENTS

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

An **ENDANGERED** species is any species that is in danger of extinction throughout all or a significant portion of its range.

A **THREATENED** species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

	COMMON NAME	SCIENTIFIC NAME	STATUS
FISHES	Shortnose sturgeon*	*Acipenser brevirostrum*	E
REPTILES	Bog turtle	*Clemmys muhlenbergii*	T
	Atlantic Ridley turtle*	*Lepidochelys kempii*	E
	Green turtle*	*Chelonia mydas*	T
	Hawksbill turtle*	*Eretmochelys imbricata*	E
	Leatherback turtle*	*Dermochelys coriacea*	E
	Loggerhead turtle*	*Caretta caretta*	T
BIRDS	Bald eagle	*Haliaeetus leucocephalus*	T
	Piping plover	*Charadrius melodus*	T
	Roseate tern	*Sterna dougallii dougallii*	E
MAMMALS	Eastern cougar	*Felis concolor couguar*	E+
	Indiana bat	*Myotis sodalis*	E
	Gray wolf	*Canis lupus*	E+
	Delmarva fox squirrel	*Sciurus niger cinereus*	E+
	Blue whale*	*Balaenoptera musculus*	E
	Finback whale*	*Balaenoptera physalus*	E
	Humpback whale*	*Megaptera novaeangliae*	E
	Right whale*	*Balaena glacialis*	E
	Sei whale*	*Balaenoptera borealis*	E
	Sperm whale*	*Physeter macrocephalus*	E

	COMMON NAME	SCIENTIFIC NAME	STATUS
INVERTEBRATES	Dwarf wedgemussel	*Alasmidonta heterodon*	E
	Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T
	Mitchell's satyr butterfly	*Neonympha m. mitchellii*	E+
	American burying beetle	*Nicrophorus americanus*	E+
PLANTS	Small whorled pogonia	*Isotria medeoloides*	T
	Swamp pink	*Helonias bullata*	T
	Knieskern's beaked-rush	*Rhynchospora knieskernii*	T
	American chaffseed	*Schwalbea americana*	E
	Sensitive joint-vetch	*Aeschynomene virginica*	T
	Seabeach amaranth	*Amaranthus pumilus*	T

STATUS			
E	endangered species	PE	proposed endangered
T	threatened species	PT	proposed threatened
+	presumed extirpated**		

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

** Current records indicate the species does not presently occur in New Jersey, although the species did occur in the State historically.

Note: for a complete listing of Endangered and Threatened Wildlife and Plants, refer to 50 CFR 17.11 and 17.12.

For further information, please contact:

U.S. Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232
Phone: (609) 646-9310
Fax: (609) 646-0352

Revised 12/06/00

FEDERAL CANDIDATE SPECIES IN NEW JERSEY

CANDIDATE SPECIES are species that appear to warrant consideration for addition to the federal List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the U.S. Fish and Wildlife Service encourages federal agencies and other planners to give consideration to these species in the environmental planning process.

SPECIES	SCIENTIFIC NAME
Bog asphodel	*Narthecium americanum*
Hirst's panic grass	*Panicum hirstii*

Note: *For complete listings of taxa under review as candidate species, refer to Federal Register Vol. 64, No. 205, October 25, 1999 (Endangered and Threatened Wildlife and Plants, Review of Plant and Animal Taxa that are Candidates for Listing as Endangered or Threatened Species).*

Revised 11/99

FEDERAL CANDIDATE AND STATE-LISTED SPECIES

Candidate species are species under consideration by the U.S. Fish and Wildlife Service (Service) for possible inclusion on the List of Endangered and Threatened Wildlife and Plants. Although these species receive no substantive or procedural protection under the Endangered Species Act, the Service encourages federal agencies and other planners to consider federal candidate species in project planning.

The New Jersey Natural Heritage Program maintains the most up-to-date information on federal candidate species and State-listed species in New Jersey and may be contacted at the following address:

Mr. Thomas Breden
Natural Heritage Program
Division of Parks and Forestry
P.O. Box 404
Trenton, New Jersey 08625
(609) 984-0097

Additionally, information on New Jersey's State-listed wildlife species may be obtained from the following office:

Dr. Larry Niles
Endangered and Nongame Species Program
Division of Fish and Wildlife
P.O. Box 400
Trenton, New Jersey 08625
(609) 292-9400

If information from either of the aforementioned sources reveals the presence of any federal candidate species within a project area, the Service should be contacted to ensure that these species are not adversely affected by project activities.

Revised 08/00

State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection
Division of Parks & Forestry
Historic Preservation Office
PO Box 404
Trenton, NJ 08625-0404
TEL: (609)292-2023
FAX: (609)984-0578

Robert C. Shinn, Jr.
Commissioner

January 29, 2001
HPO-A2001-275 PROD

Tina A. Deininger
Historic Preservation Officer
Department of the Navy
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway
Mail Stop, # 82
Lester, PA 19113-2090

Dear Ms. Deininger:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published on December 12, 2000 in the Federal Register 65(239): 77725-77739, I am providing **Consultation Comments** for the following project:

Monmouth County, Middletown, Colts Neck, Howell,
Tinton Falls and Wall Townships
Naval Weapons Station Earle
Naval Ammunition Depot Earle Historic District
Department of the Navy

Summary:

Naval Weapons Station Earle (NWS Earle) is eligible for listing on the National Register of Historic Places as a historic district under Criteria A and C. The entire site retains a high level of integrity of historic fabric and conveys the massive scale of the effort necessary to supply the United States Military with ammunition in WW II and the Korean War. Though reference was made to the Naval Ammunition Depot Earle Historic District in a letter dated 25 August 1999 (HPO-H99-180) this is a **new SHPO opinion** identifying the boundaries of the historic district and the contributing structures and buildings within the district.

800.4 Identifying Historic Properties

It is my opinion that NWS Earle is eligible for listing on the National Register of Historic Places as **Monmouth County, Middletown, Colts Neck, Howell, Tinton Falls and Wall Townships, Naval Ammunition Depot Earle Historic District**. The period of significance of this district is from the beginning of construction in 1943 to the end of the Korean War in 1953. As the name of the station during this period was Naval Ammunition Depot Earle, the appropriate name for the historic district is **Naval Ammunition Depot Earle Historic District**. This opinion is based, in part, on the 1996 *Draft Architectural Resources Survey* prepared by Louis Berger and Associates, Inc., from which the following narrative is largely adapted.

Naval Weapons Station (NWS) Earle was constructed largely between August 1943 and June of 1944 under significant pressure to provide a large-scale ammunitions depot along the Atlantic Coast that was safely removed from nearby communities. The massive construction effort resulted in the commission of NWS Earle, which continues to function in essentially the same capacity as was originally intended. Initially known as Naval Ammunition Depot Earle, the facility was created to receive, temporarily store, reorganize and ship arms for WW II efforts. The scale of this operation was massive and by the end of June of 1945, Earle had shipped over 731,000 thousands tons of ammunition and indeed "most of the ammunition used in the European Theater of Operations by the Army was shipped out of Earle." The significance of this effort cannot be understated. The collection of buildings, barricaded railroad sidings, ammunition magazines and other supporting structure, along with the transportation system within NWS Earle possess a high degree of integrity from the period of significance. If a Navy officer who worked at the depot in 1944 were to return to the station today he would largely recognize the landscape in which he served over fifty years ago. NWS Earle is one of the last and best sites in New Jersey that conveys the magnitude of America's stateside role in WW II. The Army Munitions facility at Pedricktown is gone; Fort Dix would be unrecognizable to a WW II soldier who passed through Fort Dix on his way to the European Theater; and Camp Kilmer is almost non-existent. NWS Earle, through its size and scale, conveys the massive American effort to supply our fighting men with the ammunition needed to prevail in Europe. Because of the high integrity of the site as a whole, Naval Weapons Station Earle (including the Chapel Hill, Waterfront and Pier Areas; Normandy Road; the Mainside Area; and the Army Wayside Area) is eligible for listing on the National Register of Historic Places as a historic district under Criteria A and C. It is true that "the built environment of NWS Earle does not demonstrate qualities of significance in terms of design or construction that would support National Register eligibility as a base-wide historic district." (Louis Berger & Associates, Inc.: 59) The built environment does, however, possess exceptional significance for its association to the historic events that occurred there during WW II and the Korean War. In addition, much of the built environment, including the railroad sidings, ammunition magazines and the piers, are eligible under Criterion C due to the "distinctive characteristics of a type, period or method of construction."

Clearly the most significant period of history surrounding NAD Earle is the period from 1943, when construction began, to the end of WW II. During the Korean War, however, and specifically from 1951 to 1953, more ordnance was shipped from NAD Earle than during operations supporting WW II. No one would argue that the Korean War was as significant as WW II was on a national or global scale, however, the significance of the role that NAD Earle played in this later campaign cannot be dismissed. Though no individual buildings or structures at NAD Earle possess the exceptional significance that would enable them to be eligible under Criteria Consideration G (*properties that have achieved significance within the past fifty years*), the site as a whole does. One of the examples of properties that might be eligible under Consideration G is "A property that continues to achieve significance into a period less than fifty years before the nomination." Therefore, a strong argument can be made that the period of significance of NWS Earle extends through the end of the Korean War.

Another piece of the history of NWS Earle that needs to be included in the discussion of the significance of the site is the story of enlisted African American seamen who were stationed there. Through 1942 naval policy generally excluded African Americans from service. In 1942, under pressure from President Roosevelt, the Secretary of the Navy reversed that opinion and allowed African Americans to enlist for "general service" in the Naval Reserve, Marine Corps and Coast Guard. This still restricted black volunteers to serve in positions at "shore establishments, navy yards, with construction crews, and with battalions at advanced bases." As a result of this policy a disproportionately high percentage of African American enlisted men served at NAD Earle and other stations where they were assigned to manual labor and less desirable and potentially dangerous jobs typical of ordnance stations and ammunition depots. This situation resulted in widespread protest among African Americans and others. In response to this protest and the Port Chicago disaster, the Navy embarked on a new policy with regard to stationing of personnel at ammunition depots. "Specifically, the Navy ordered that all naval forces should be, whenever possible, ten percent black—a truer reflection of the composition of the nation's population—and that a wider variety of tasks be available to the African-American sailor." (Louis Berger & Associates, Inc.: 16)

In addition to early efforts to integrate the armed forces as represented in the history of NWS Earle, there was also a significant effort towards education of African American seamen. Prior to actual implementation of the Navy's new integration policy, an informal program of primary education in reading, writing and arithmetic was being conducted for the largely uneducated population of black seamen at NAD Earle. This program continued in a more formal and compulsory manner in 1945 and by December of that year enrollment in the program reached over 1,000, all of whom were African American. "In the historical literature, this effort at change is recognized as an important development in the resurgence of the civil rights movement, after a long spell of repression, in the mid-twentieth century." (Louis Berger & Associates, Inc.: 16)

The story of African American seamen in the early years of NWS Earle is a very important part of the history of the site and the civil rights movement in this country. This story must be considered in establishing the significance of the NAD Earle Historic District and establishing the boundaries for the district.

The buildings, structures and transportation routes of NWS Earle reflect the significance of the entire station. In determining the boundary of the historic district it was obvious that the entire boundary of NWS Earle must be included, as the entire site represents an interrelated system established to serve a common goal. This boundary includes the Pier Area, which the report recognizes as a historic district; the Waterfront and Chapel Hill Areas; Normandy Road; the Mainside Area and the Army Wayside Area. An area that may be excluded from the Mainside Area of the Historic District is the area at the northeast edge, which is comprised of modern housing units (Buildings 700-755 and 801-850). More difficult was a determination of which buildings and structures contribute to the significance of the district and which can be considered non-contributing. As the significance of NWS Earle lies, in part, in the massive scale of the development of the self-sustaining complex, we have determined that any structure constructed during the period of significance contributes to the historic significance of the station. Additional analysis may have to be conducted to determine which buildings no longer contribute to the significance of the district due to a loss of integrity. Enclosed is a copy of the list of buildings and structures at NWS Earle from the *Architectural Resources Survey*, which has been amended to include an indication of which buildings are contributing and which are non-contributing.

Additional Comments

NWS Earle is very clearly significant as a historic district. We recognize that NWS Earle is an active station and must continue to fulfill its mission as an ammunition storage and supply depot, which requires changes and updates to the station facilities. And further, due to the role of NWS Earle as an active station the opportunity of public benefit resulting from the interpretation of the history of the site is very limited. On the other hand, it is not acceptable to disregard the significance of the site as a complete and interrelated system and select only certain elements out of that system as eligible for the National Register. Therefore, I recommend that a Programmatic Agreement be developed that provides guidelines for the documentation and treatment of the cultural resources within the boundaries of Naval Ammunition Depot Earle Historic District. We feel that as part of the PA an exceptional effort should be made towards collecting and telling these stories before the integrity of the resource is further jeopardized through the incremental loss of historic fabric. Towards this end, we suggest the following as possibilities for the documentation of NWS Earle:

1. Oral History

- A plan should be developed and implemented for the collection of oral histories from men who served at NWS Earle during the period of significance. A collection of oral histories will be a critical element in the documentation of the history of NWS Earle. Many of the men who were stationed at NAD Earle during WW II and the Korean War may no longer be living and it will be important to get oral histories from those who are living. As the role of African American Seamen at NAD Earle was an important part of the history of the station, oral history documentation should highlight this aspect of the history of NAD Earle. The Naval Historical Center (NHC) has prepared a guide for conducting oral history interviews. This guide is available on-line (a paper copy is enclosed), along with information concerning contacts at the NHC and the Naval Historical Foundation (NHF) who can offer additional guidance with regard to oral history interviews.

2. Collection of historic film footage and photographs

3. Documentary Film

- Create a documentary film using historic film footage, oral histories, photography etc. to tell the history NWS Earle.

4. Classroom Curriculum Guide

5. Digital Mapping

- The documentation of NWS Earle should include a digital map of the district, which includes information regarding types of construction, use, dates of construction, significance, etc. A map of this type, produced using current GIS technologies can be an extremely useful tool in the documentation and planning at a site such as this.

6. **Documentation of buildings prior to demolition**

- As the significance of buildings and structures at NWS Earle varies widely, minimal documentation of certain buildings prior to demolition should be required, while more extensive documentation of more significant structures should be required. This should not be viewed as the documentation of isolated individual buildings but as contributing to the documentation of the entire district. As an example, documentation prior to the demolition of one of the small sewage-treatment facility buildings may include simply a survey card with a single original exterior photograph. On the other hand, the demolition of a building such as C-16, or one of the ammunition sidings, should include more extensive graphic and historic documentation of the building.

The extant resources of NWS Earle represent an excellent opportunity to tell the nationally significant stories associated with this site. Prior to moving ahead with additional memoranda of agreement regarding the demolition of buildings at NWS Earle, a programmatic agreement needs to be developed that addresses the long-term documentation plans for the entire NAD Earle Historic District. We look forward to working with you in developing the programmatic agreement and hope that full advantage can be taken of the opportunities presented here. If you have any further questions please contact Kurt Leasure of my staff at (609) 777-3930.

Sincerely,

Dorothy P. Guzzo

Dorothy P. Guzzo
Deputy State Historic
Preservation Officer

KL/00-0384

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHEAST
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP: 82
LESTER, PA 19113-2090

IN REPLY REFER TO
11010
Code EV33/JP
June 7, 2002

Ms. Dorothy Guzzo
Historic Preservation Office
P. O. Box 404
Trenton, New Jersey 08625-0404

Re: PIER COMPLEX REPLACEMENT AT NAVAL WEAPONS STATION EARLE, NJ

Dear Ms. Guzzo:

The Navy is planning to upgrade the Naval Weapons Station (NWS) Earle Pier Complex. This includes upgrading Pier 2 and then replacing Piers and Trestles 2 and 3 with one new Pier. Our intent is to build a new pier and associated trestle and then demolish Piers and Trestles 2 and 3. Piers 1 and 4 will remain in service and are not part of this project. As we have agreed, the entire Pier Complex is considered eligible for listing on the National Register of Historic Places. We have enclosed a project description for your information.

The Pier Complex Replacement Project is required to support the NWS Earle's mission of providing four homeport service berths for AOE class ships. These facilities were constructed in 1944 and have reached their physical and economical limits. Continued use of existing Piers and Trestles 2 and 3 will eventually result in structural failures that will significantly affect and diminish NWS Earle's ability to perform its mission.

In accordance with 36 CFR Part 800, the Navy has determined that the proposed Pier Complex Replacement Project will have an adverse effect on historic properties. We request your concurrence with this determination. Upon your concurrence, we plan to initiate discussions with you regarding appropriate mitigation.

We appreciate your attention to this proposed project and request your response at your earliest convenience. Please contact Ms. Jeanette Palma at (610) 595-0758 for further information.

Sincerely,

TINA A. DEININGER
Historic Preservation Officer
By direction of the
Commanding Officer

Enclosure: 1. DD Form 1391 (Project Description) P-032, Pier Complex Replacement, NWS Earle, NJ of 5/8/02

Blind electronic copy to:
CO NWS Earle, NJ (Attn: J. Mahoney)

Internal copies to: (w/o encl)
Code EV/RF, EV33/RF, EV33/JP-RF, EV33/TD-RF

Internal electronic copies to: (w/o encl)
Code EV33/PF, EV33/RKO, DV/MH, DV/TC

HPO-G2002-35 PROD
Log #02-2154

State of New Jersey
Department of Environmental Protection
Division of Parks & Forestry, Historic Preservation Office
PO Box 404, Trenton, NJ 08625
TEL: (609) 292-2023 FAX: (609) 984-0578
www.state.nj.us/dep/hpo

James E. McGreevey
Governor

Bradley M. Campbell
Commissioner

July 3, 2002

Tina A. Deininger
Historic Preservation Officer
Department of the Navy, Northern Division
Naval facilities Engineering Command
10 Industrial Highway, Mail Stop, #82
Lester, PA 19113-2090

Dear Ms. Deininger:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published on December 12, 2000, in the Federal Register 65(239): 77725-77739, I am providing **Consultation Comments** for the following project:

Monmouth County, Middletown, Colts Neck, Howell,
Tinton Falls and Wall Townships
Naval Weapons Station Earle
Demolition of Piers and Trestles 2 and 3
Department of the Navy

Summary:

The demolition of Piers and Trestles 2 and 3 will have an **adverse effect** on those characteristics for which the **Naval Ammunition Depot (NAD) Earle Historic District** and the contributing Pier Complex are eligible for listing in the National Register of Historic Places.

800.4 Identification of Historic Properties

It is my opinion, as Deputy State Historic Preservation Officer, that the Pier Complex at NWS Earle is eligible for listing on the National Register of Historic Places as contributing to the **NAD Earle Historic District**, which received a SHPO Opinion of Eligibility on January 29, 2001 (attached). The entire site retains a high level of integrity of historic fabric and conveys the massive scale of the effort to supply the United States Military with ammunition in WW II and the Korean War. The Pier Complex was an integral element in the overall successful operation of the Depot in carrying out this mission.

800.5 Assessment of Adverse Effects

I concur with your determination that the demolition of Piers and Trestles 2 and 3 will have an **adverse effect** on the characteristics for which the Pier Complex is eligible for listing in the National Register of Historic Places.

Additional Comments

As we have indicated previously, due to the exceptional significance of NWS Earle, we feel that a more comprehensive plan for the documentation of the site should be established as mitigation for adverse effects resulting from the continued operation of NWS Earle as an active military installation. Rather than continuing to develop separate memoranda of agreement establishing mitigation programs on a project by project basis, we would like to have a Programmatic Agreement establishing guidelines for the comprehensive documentation of NWS Earle and the historically significant events associated with the site. It is important to recognize that as time passes there are fewer opportunities to collect oral histories, which would be an important element in a comprehensive documentation project. The current proposal to demolish a portion of the Pier Complex presents an excellent opportunity to begin to discuss comprehensive documentation of the site. We look forward to further discussions with regard to a plan for mitigation for the proposed project.

If you have any questions or would like to discuss the project further, please contact Kurt Leasure of my staff at (609) 777-3930.

Sincerely,

Dorothy P. Guzzo
Deputy State Historic
Preservation Officer

C: my documents \ ... \ 02-2154.doc
DPG/kl/df

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHEAST
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP, #82
LESTER, PA 19113-2090

IN REPLY REFER TO
11010
EV33/TD
July 31, 2002

Dorothy P. Guzzo
Deputy State Historic Preservation Officer
Historic Preservation Office, Division of Parks and Forestry
Department of Environmental Protection and Energy, CN 404
Trenton, NJ 08625-0404

Dear Ms. Guzzo:

Thank you for your July 3, 2002 comments on our undertaking, "Pier Complex Replacement" at the Naval Weapons Station Earle, NJ (Station). There are a few issues that we would like to discuss to facilitate our current consultation. We would like to meet with you or your staff to discuss these issues at your earliest convenience.

We have initiated National Historic Preservation Act (NHPA) Section 106 consultation on the undertaking that will replace the Pier Complex at the Station. We have determined that this undertaking will have an adverse effect on historic properties. In the future, we would like to consider a Programmatic Agreement that would streamline the NHPA Section 106 process for the Station, however we are not in a position to initiate such action at this time.

We propose to mitigate the adverse effect of the Pier Complex Replacement undertaking by preparing written and photographic recordation documentation of the Pier Complex to HAER standards, for state review and acceptance.

Other issues raised in your letter go beyond the scope of the current undertaking. We look forward to discussing these issues when we meet. Thank you for your assistance with this project. We are anxious to meet with you, please contact Ms. Jeanette Palma at (610) 595-0758 to arrange an appropriate date and location.

Sincerely,

TINA A. DEININGER
Historic Preservation Officer
By Direction of the
Commanding Officer

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHEAST
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP, #82
LESTER, PA 19113-2090

IN REPLY REFER TO
11010
Code EV33/JP
September 27, 2002

Ms. Dorothy Guzzo
Deputy State Historic Preservation Officer
Historic Preservation Office, Division of Parks and Forestry
P. O. Box 404
Trenton, New Jersey 08625-0404

Re: PIER COMPLEX REPLACEMENT AT NAVAL WEAPONS STATION EARLE (NWS), COLTS NECK, NJ (HPO-G2002-35 PROD Log #02-2154)

Dear Ms. Guzzo:

I would like to thank you for the opportunity to meet with Mr. Kurt Leasure of your staff on September 6, 2002, to discuss Military Construction Project P-032 Pier Complex Replacement Project at Naval Weapons Station Earle. We appreciate your efforts in working with the Navy on this critical project. As stated in our letter of June 7, 2002, demolition is required for Piers/Trestles 2 and 3 due to the fact that the continued use of existing Piers /Trestles 2 and 3 will result in structural failures that will significantly affect and diminish NWS Earle's ability to perform its mission.

During the above meeting, we discussed mitigation concerning the Pier Complex and agreed to consider the following: Written and photographic recordation of Piers/Trestles 2 and 3, Oral History of the Pier Complex, and some level of Digital Mapping.

After all specifics are known, the Navy will draft a Memorandum of Agreement for your review and signature. The Navy looks forward to working with you and your staff at the NJSHPO to create a reasonable plan of action for the mitigation of our Pier Complex Replacement Project.

If you have any questions, please contact Ms. Jeanette Palma at (610) 595-0758.

Sincerely,

TINA A. DEININGER
Historic Preservation Officer
By direction of the
Commanding Officer

Blind electronic copy to:
CO NWS Earle, NJ (Attn: J. Mahoney)

Internal copies to:
Code EV/RF, EV33/RF, EV33/PF, EV33/JP-RF, EV33/TD-RF

Internal electronic copies to:
Code EV33/RKO, EV33/KG, DV/MH, DV/TC, OPS/DG

HPO-L2002- 95 PROD
Log # 03-0555-1

State of New Jersey

James E. McGreevey
Governor

Department of Environmental Protection
Division of Parks & Forestry, Historic Preservation Office
PO Box 404, Trenton, NJ 08625
TEL: (609) 292-2023 FAX: (609) 984-0578
www.state.nj.us/dep/hpo

Bradley M. Campbell
Commissioner

December 16, 2002

Tina A. Deininger 12/27/02
Historic Preservation Officer
Department of the Navy, Northern Division
Naval facilities Engineering Command
10 Industrial Highway, Mail Stop, #82
Lester, PA 19113-2090

Dear Ms. Deininger:

Thank you for your recent submission of the MOA for the demolition of Piers 2 &3 and Trestles 2 &3 at Naval Weapons Station Earle. The stipulations for mitigation contained within the MOA will provide appropriate recordation of the Pier Complex, in addition to taking the initial steps towards more comprehensive documentation efforts at NWS Earle. We appreciate the efforts of the Navy in working with my staff to develop creative mitigation measures for the Pier demolition project. Enclosed please find the signed copy of the MOA.

We look forward to continuing to work with the Navy to develop a valuable standard of documentation for future projects affecting the historic resources at Earle. If you have any questions please contact Kurt Leasure of my staff at (609) 777-3930.

Sincerely,

Dorothy P. Guzzo
Deputy State Historic
Preservation Officer

C:\my documents \....\03-0555-1_Pier Complex.doc
DPG/kl

MEMORANDUM OF AGREEMENT

BETWEEN THE DEPARTMENT OF THE NAVY AND
THE NEW JERSEY STATE HISTORIC PRESERVATION OFFICER
PURSUANT TO 36 CFR 800

REGARDING THE PIER COMPLEX REPLACEMENT PROJECT
NAVAL WEAPONS EARLE, COLTS NECK, NEW JERSEY

WHEREAS, the Department of the Navy (Navy) and the New Jersey State Historic Preservation Officer (NJSHPO) have determined that the Pier Complex Replacement Project at the Naval Weapons Station Earle will have an adverse effect on resources that are eligible for inclusion in the National Register of Historic Places; and

WHEREAS, the Navy has consulted with the NJSHPO pursuant to 36 CFR 800 regulations implementing Section 106 of the National Historic Preservation Act, 16 U.S.C. 470 (the Act); and

NOW, THEREFORE, the Navy and the NJSHPO agree that this undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Pier Complex Replacement Project.

Stipulations

The Navy will ensure that the following stipulations are implemented:

I. Recordation of Historic Properties

The Department of the Navy will prepare *Historic American Engineering Record (HAER)* recordation documentation of Piers 2 & 3 and Trestles 2 & 3 in accordance with a Schedule of Documentation to be obtained by the Navy from the National Park Service (NPS). Navy will submit this documentation to the NPS for their acceptance and retention.

II. Oral History

The Department of the Navy will prepare an oral history of the Pier Complex at Naval Weapons Station Earle. A minimum of three (3) individuals will be interviewed, as available. The Navy will distribute copies of the oral history to appropriate local, state, and federal agencies, schools, museums, historical societies and repositories. This oral history will be the first component of a larger oral history program for Naval Weapons Station Earle, this larger program is not a part of this Memorandum of Agreement.

III. Digital Mapping

The Department of the Navy will enhance the existing digital mapping system at the Naval Weapons Station Earle. This will include a layer of historic buildings/structures/railways and a related database of Form Ks.

ADMINISTRATIVE CLAUSES

IV. Dispute Resolution

Should the NJSHPO object within thirty (30) days to the documentation provided for review pursuant to this agreement, the Navy shall consult with the NJSHPO to resolve the objection. If the Navy determines that the objection cannot be resolved, the Navy shall request comments of the Advisory Council on Historic Preservation pursuant to 36 CFR 800.

V. Anti-Deficiency Act

All requirements set forth in this Agreement requiring the expenditure of Navy funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 U.S.C. Section 1341). No obligation undertaken by the Navy under the terms of this Agreement shall require or be interpreted to require a commitment to expend funds not appropriated for a particular purpose.

If the Navy cannot perform any obligation set forth in this Agreement due to the unavailability of funds, the Navy and the NJSHPO intend the remainder of the Agreement to be executed. Any obligation under the Agreement which cannot be performed due to the unavailability of funds must be re-negotiated between the Navy and the NJSHPO.

VI. Amendments

Any party to this Agreement may request that it be amended, whereupon the parties will consult to consider such amendment in accordance with 36 CFR 800.

VII. Personnel Qualifications

All professionals shall, at a minimum, meet the Secretary of the Interior's Historic Preservation Professional Qualification Standards and Guidelines.

Execution of the Memorandum of Agreement by the Navy and the NJSHPO, implementation of its terms, evidence that the Navy has afforded the Advisory Council on Historic Preservation the opportunity to comment on the Pier Complex Replacement Project at the Naval Weapons Station Earle and its effects on potential historic properties, and that the Navy has completed its requirements pursuant to the Act for any effects of the project on potential historic properties and may proceed with the project.

DEPARTMENT OF THE NAVY

By: ______________________ Date: 11/27/02

NEW JERSEY STATE HISTORIC PRESERVATION OFFICER

By: ______________________ Date: 12/16/02
Deputy

State of New Jersey
Department of Environmental Protection

James E. McGreevey
Governor

Bradley M. Campbell
Commissioner

Land Use Regulation Program
Bureau of Tidelands Management
P. O. Box 439
Trenton, New Jersey 08625-0439
Tel. # 609-292-2573
Fax. # 609-633-6493

January 13, 2004

BY FAX ONLY: 610-595-0555
Ms. Nancy Kuntzleman
Environmental Department
Department of the Navy

RE: NAVAL WEAPONS STATION EARL, Sandy Hook Bay, Middletown Twp., Monmouth County

FILE: 1331-04

Dear Ms. Kuntzleman:

As per our discussion on Friday, and after receiving and reviewing your FAX, I discussed the issue of the need for the Navy to obtain tidelands instruments with our attorney, DAG William E. Andersen. Mr. Andersen confirmed what I had told you on the phone. Federal navigational servitude is the only use of tidelands (for structures or for dredging) which does NOT need a tidelands conveyance. In other words, use for national defense "trumps" the State's ownership of its tidelands. It is our position, however, that if the military dredges an area for access to a channel, that area is not then owned by the Navy; but the Navy may dredge without paying a royalty for removal of the material. It is also our position that if the area of the piers is ever abandoned by the military, the ownership of the area would revert to the State. Conceivably, there could be military related uses which do not fall under this doctrine, such as the use of State owned lands for a marina for an officers' club. However, that is not the issue here.

I hope this clarifies the issue for you. And I apologize if there has been confusion in the past.

Sincerely,

Jo Ann Cubberley, CP (ASPRS)
Manager
Bureau of Tidelands Management

USACOE SAMPLING SCHEME AND SAMPLING RESULTS
20 JUNE 2002
(Reaches 1, 2, 3)

REV. 4/98

SAMPLING SCHEME and LIST of REQUIRED TESTING as OUTLINED in the 1992 ACENYD/EPA REGION II REGIONAL IMPLEMENTATION MANUAL on Dredged Material Proposed for Ocean Disposal and the 1991 GREEN BOOK

Applicant US NAVY – NAVAL WEAPONS STATION EARLE - Pier 3 Replacement .

Applicant No. 2002-00367-OD .

Address MONMOUTH COUNTY, NJ .

Waterway SANDY HOOK BAY .

Proposed Volume: 635,000 cubic yards (based on 8 / 10 / 2000 bathymetric survey)

Project Depth in feet: -45' MLW .

(NOTE: The applicant is required to collect cores from each sampling location to project depth plus 2 ft)

A preapplication meeting X was held on 3 / 14 / 2002 at NY District Offices in New York

_____ was not held at the NY District Offices in New York.

The applicant has indicated that testing will be performed by the following laboratories:

Biological: not available Analytical: not available Dioxin: not available .

The sampling scheme and required testing described on the reverse side was approved for the proposed project area based upon the information contained in the attached map.

Sample dredging sites are indicated on attached map.

The proposed dredging area is subdivided into THREE ~~TWO~~ reaches for sampling and testing purposes:

- Reach "1": 11 locations: Bottom sediments from Berthing area and under Pier 3 (#1–11)
- Reach "2": 3 locations: Top sediments from under Pier 3 (#1-3)
- Reach "3": 8 locations: Top sediments from Berthing area (#4–11)

NOTE: **"TOP" and "BOTTOM" are defined by the cutoff between black silty mud ("TOP") and brown sand ("BOTTOM")** observed in each collected core.

COMMENTS:

1. If there is any evidence of stratification in core samples, contact NYD prior to compositing.
2. Additional cores may have to be taken from each station in order to ensure adequate volumes of sediment to meet testing requirements. If so, the same number of cores must be taken and composited from each location.
3. Core locations may have to be moved if shoaling patterns have changed. If so, contact NYD during sampling to confirm new locations.
4. The District reserves the right to require additional sampling and testing at any time.

* If you have any questions regarding sampling, test protocols, test species, QA/QC, etc. please contact the Dredged Material Management Section of the USACE/NYD at (212)-264-5620 or extension of person completing this form.

Rev. 20 JUNE 2002
~~Rev. 8 MAY 2002~~

PREPARED BY: OKSANA YAREMKO DATE: ~~25 APRIL 2002~~ PHONE: 212-264-9268

SEE REVERSE SIDE FOR SAMPLING AND TESTING REQUIREMENTS

APPLICANT: #2002-00367-OD – USNWS Earle Pier 3 Replacement

Any Box Checked Off Indicates an Analysis or Assay that is Required for a Given Project.
Archiving requires saving a sample for possible analysis at a later time pending further instruction.

X=Per Homogenized Sediment Core + Reference (Composited Grabs) + Control
C=Per Bioassay Sediment Composite
A=Archive
W=Site Water and Elutriate
T=Per Tissue Replicate (Ref, Test, Pre-test, A=Archive Ctl and any remaining tissue from Ref, Test, Pre-test)

1. SEDIMENT PHYSICAL ANALYSIS (If stratification is observed, each stratum within a core must be analyzed separately)
   a. X **Grain Size Analysis** (% sand, % silt, & % clay)
   b. X **% Moisture**
   c. C **Specific Gravity**
   d. C **Bulk Density**
   e. C **Plastic and Liquid limits (Atterberg limits)**

2. SEDIMENT CHEMICAL ANALYSIS

   REQUIRED

   a. X **% Total Organic Carbon**

   CASE BY CASE BASIS

   a. C A **Metals** (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. C A **PAHs (LMWs:** acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   c. C A **PAHs (HMWs:** benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthrene, indeno(1,2,3-c,d)pyrene, pyrene)
   d. C A **Semi-volatiles** (1,4 dichlorobenzene)
   e. C A **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptaclor, heptachlor epoxide)
   f. C A **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   g. ___ **PCB coplanar** (#77,126,156,169)
   h. C A **Dioxins/Furans** (2,3,7,8 - substituted isomers, n=17)
   i. ___ **Other:**
   j. ___ **LIS pesticides**
   k. ___ **LIS PAHS**

3. CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

   REQUIRED

   a. W **Metals** (Ag, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. W **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   c. W **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptaclor, heptachlor epoxide)
   d. ___ **Other:**

   CASE BY CASE BASIS

   a. ___ **PAHs** (_ all 16, _ LMW, _ HMW, _ as specified)
   b. ___ **2,3,7,8-TCDD**
   c. ___ **2,3,7,8-TCDF**
   d. ___ **PCB coplanar** (#77,126,156,169)
   e. ___ **LIS pesticides**
   d. ___ **Other:**

4. BIOASSAYS (species listed in guidance manual)
   a. C **Water Column Acute Tox.** (bivalve larvae, M. bahia, Menidia sp.)
   b. C **10-Day Benthic Acute Tox.** (A. abdita, R. abronius, E. estuarius, or L. plumulosus)
   c. C **10-Day Benthic Acute Tox.** (M. bahia)
   d. C **28-Day Bioaccumulation** (N. virens, and Macoma secta or M. nasuta) - INCLUDING DIOXIN,
   e. ___ **28-Day Bioaccumulation** (N. virens and Macoma secta or M. nasuta)): DIOXIN ONLY

5. 28-DAY WHOLE-SEDIMENT BIOACCUMULATION TISSUE ANALYSIS

   REQUIRED

   a. T A **Metals** (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. T A **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin,p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptachlor, heptachlor epoxide)
   c. T A **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209
   d. T A **Semi-volatiles** (1,4 dichlorobenzene)
   e. T A **PAHs (LMWs:** acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   f. T A **PAHs (HMWs:** benzo(a)anthracene, benzo(a)pyrene,benzo(g,h,i)perylene,benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthrene, indeno(1,2,3-c,d)pyrene, pyrene)

   CASE BY CASE BASIS

   a. T A **Dioxins/Furans** (2,3,7,8 - substituted isomers, n=17)
   b. ___ **LIS pesticides**
   c. ___ **LIS PAHs**
   d. ___ **PCB coplanar** (#77,126,156,169)
   e. ___ **Other:**

REFER TO COMMENT SECTION ON REVERSE SIDE FOR ADDITIONAL INFORMATION

CENAN-OP-SD 20 June 2002

MEMORANDUM FOR: The Record

SUBJECT: Revision to Sampling Scheme and Required Testing for Application No. 2002-00367-OD by the US Naval Weapons Station Earle – Pier 3 Reconstruction, Sandy Hook Bay, Middletown, Monmouth County, NJ

1. A sediment sampling scheme and checklist of required testing for the proposed dredging and pier reconstruction project was prepared on 8 May 2002 (copy enclosed).

2. Sampling of the project area was initiated on 10 June 2002 by Aqua Survey Inc (ASI). On 11 June 2002, Jim Todd, ASI, informed Oksana Yaremko, CENAN-OP-SD, that each of the sample cores exhibited two separate strata: black silty mud on top, and brown sand and red/grey clays, extending from 1 to 5 feet in length, on the bottom. Coring logs provided by ASI were forwarded to EPA by letter dated 18 June 2002 to see whether the original sampling scheme would need to be modified on the basis of this new information.

3. By letter dated 19 June 2002, EPA indicated that the bottom sand and clay fraction would need to be tested as a separate additional composite. The sampling and testing scheme has therefore been modified to break out the top and bottom strata within the project area. The modified sampling scheme is summarized below. Note that sample locations and the number of samples have **not** changed. Also, "top" and "bottom" are defined by the actual cutoff between strata observed in each collected core.

   - REACH 1: Bottom sediments from the whole project area (all core locations, #1-11).

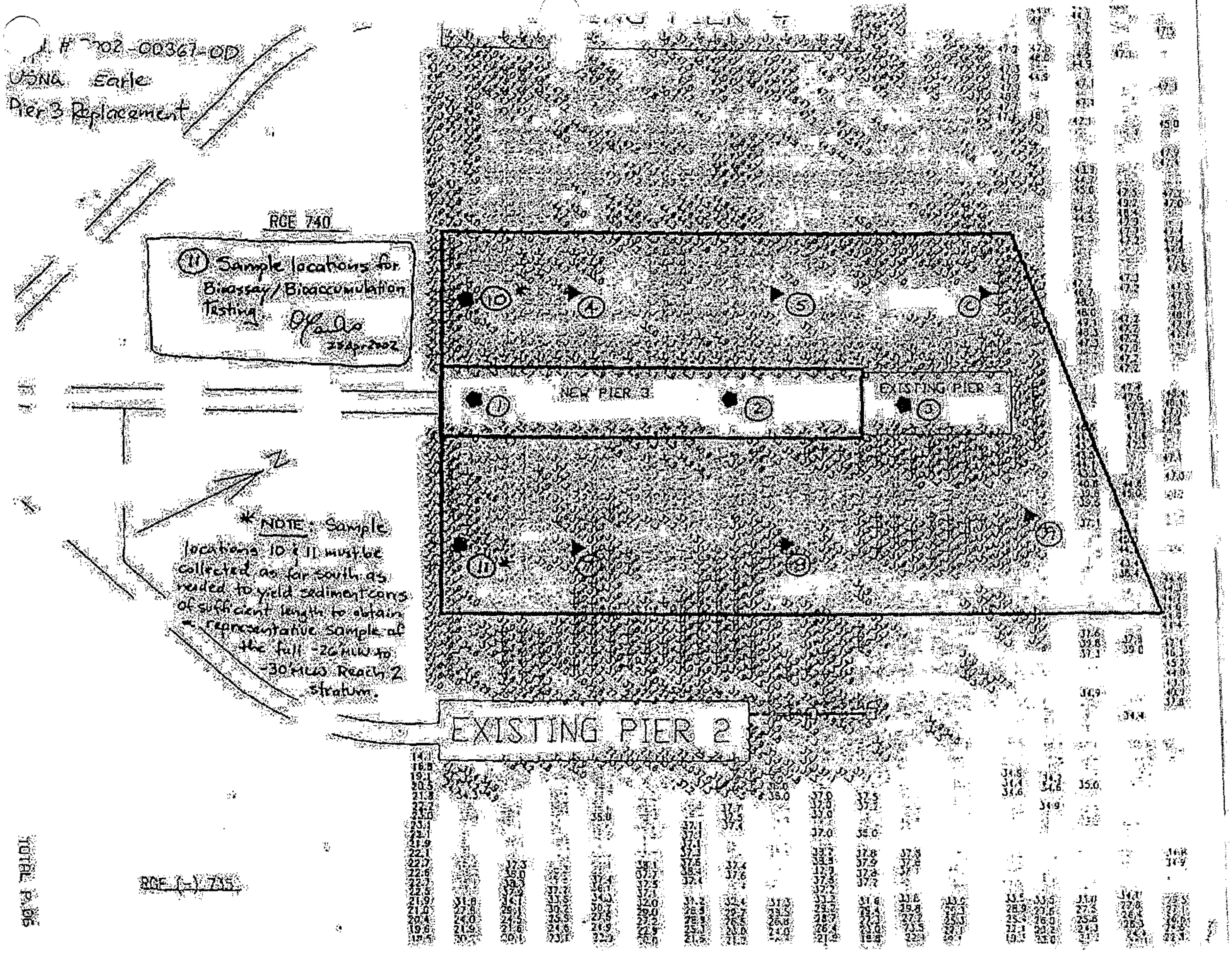
   - REACH 2: Top sediments from under Pier 3 (3 core locations: #1-3).

   - REACH 3: Top sediments from berthing area (8 core locations: #4-11).

4. All three test reaches have identical testing requirements, as summarized in the attached Sampling and Required Testing checklist.

OKSANA YAREMKO
Environmental Engineer
CENAN-OP-SD

Enclosures



702-00367-OD
USNA Earle
Pier 3 Replacement
RGE 740
(11) Sample locations for Bioassay/Bioaccumulation Testing.
28Apr2002
NEW PIER 3
EXISTING PIER 3
EXISTING PIER 2
N
* NOTE: Sample locations 10 & 11 must be collected as far south as needed to yield sediment cores of sufficient length to obtain a representative sample of the full -26 MLW to -30 MLW Reach 2 stratum.
RGE (-) 735

PUBLIC NOTICE TABLES

REACH 1

TABLE 1. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

NWS Pier 3 Replacement Reach 1

	SITE WATER		ELUTRIATE	
CONSTITUENTS	DETECTION LIMITS	CONCENTRATION	DETECTION LIMITS	CONCENTRATION
Metals	**ppb**	**ppb**	**ppb**	**ppb**
Ag		0.010		0.019
Cd		0.224		0.013
Cr		0.271		0.886
Cu		1.43		0.879
Hg		0.003		0.006
Ni		0.83		1.63
Pb		1.06		0.54
Zn		4.76		2.53
Pesticides	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
Aldrin	2.83	ND	2.83	ND
a-Chlordane		0.5		0.254
trans Nonachlor	1.01	ND		0.163
Dieldrin	0.98	ND	0.98	ND
4,4'-DDT	0.56	ND	0.56	ND
2,4'-DDT	1.99	ND	1.99	ND
4,4'-DDD	0.60	ND	0.60	ND
2,4'-DDD	0.75	ND	0.75	ND
4,4'-DDE		1.8		2.99
2,4'-DDE	1.71	ND	1.71	ND
Total DDT		**4.6**		**5.8**
Endosulfan I	1.11	ND	1.11	ND
Endosulfan II	0.51	ND	0.51	ND
Endosulfan sulfate	0.57	ND	0.57	ND
Heptachlor	1.17	ND	1.17	ND
Heptachlor epoxide	0.95	ND	0.95	ND
Industrial Chemicals	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
PCB 8	16.00	ND	16.00	ND
PCB 18		1.09		1.92
PCB 28	1.73	ND		0.3
PCB 44	1.45	ND	1.45	ND
PCB 49		0.30	1.49	ND
PCB 52	1.44	ND	1.44	ND
PCB 66	1.49	ND		1.47
PCB 87	1.13	ND	1.13	ND
PCB 101	1.15	ND		0.41
PCB 105	0.58	ND	0.58	ND
PCB 118	0.87	ND	0.87	ND
PCB 128		0.30		0.28
PCB 138		0.42		0.62
PCB 153		0.16		0.40
PCB 170	1.02	ND	1.02	ND
PCB 180		0.18		0.25
PCB 183	0.93	ND	0.93	ND
PCB 184	0.92	ND	0.92	ND
PCB 187		0.20		0.23
PCB 195	1.09	ND		0.09
PCB 206	1.22	ND		0.06
PCB 209	1.27	ND	1.27	ND
Total PCB		**69.8**		**66.3**

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.

TABLE 2

NWS Pier 3 Reconstruction
TOXICITY TEST RESULTS
Reach 1

ASI JOB No. 22-245

Suspended Particulate Phase

Test Species	Test Duration	LC50/EC50	LPC (a)
Menidia beryllina	96 hours	(b) >100%	1.00
Mysidposis bahia	96 hours	(b) >100%	1.00
Mytilus edulis (larval survival)	48 hours	(b) >100%	1.00
Mytilus edulis (larval normal develop.)	48 hours	(c) 66.0%	0.66

(a) Limiting Permissible Concentration (LPC) is the LC 50 or EC 50 times 0.01.

(b) Median Lethal Concentration (LC50) resulting in 50% mortality at test termination.

(c) Median Effective Concentration (EC50) based on normal development to the D-cell, prodissoconch 1 stage.

Whole Sediment (10 days)

Test Species	% Survival in Reference	% Survival	% Difference Reference -Test	Is difference statistically significant? (a=0.05)
Ampelisca abdita	85%	91%	-6%	No
Mysidopsis bahia	100%	99%	1%	No

Table 2.xls

NWS EARLE Pier 3 Replacement, Reach 1
TABLE 3. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
Wet weight concentrations

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
Metals	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
Ag		0.04		0.04		0.03		0.02
As		2.51		* 2.80		3.81		3.18
Cd		0.03		0.02		0.05		0.05
Cr		0.61		0.63		0.42		0.40
Cu		1.97		2.21		1.35		1.28
Hg		0.01		* 0.01		0.02		0.02
Ni		0.34		* 0.52		0.21		* 0.30
Pb		0.21		* 0.33		0.12		0.13
Zn		12.74		13.38		25.03		32.28
Pesticides	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Aldrin		0.02	0.04	ND	0.07	ND	0.05	ND
a-Chlordane		0.06	0.04	ND		0.15		0.12
trans Nonachlor		0.02		* 0.14		0.45		0.40
Dieldrin		0.10		0.07		0.25		0.26
4,4'-DDT		0.04	0.04	ND		0.10		0.05
2,4'-DDT	0.06	ND	0.06	ND		0.07	0.07	ND
4,4'-DDD		0.08		* 1.54		0.17		0.29
2,4'-DDD		0.05		0.06		0.14		* 0.41
4,4'-DDE		0.09		* 5.26		0.24		* 1.67
2,4'-DDE	0.16	ND	0.16	ND	0.27	ND		0.12
Total DDT		**0.37**		* **6.99**		**0.81**		* **2.57**
Endosulfan I	0.06	ND		* 0.79	0.10	ND	0.07	ND
Endosulfan II	0.08	ND	0.08	ND	0.14	ND	0.10	ND
Endosulfan sulfate		0.11		0.13		0.39		0.09
Heptachlor	0.05	ND		0.03		0.80	0.06	ND
Heptachlor epoxide	0.03	ND	0.03	ND		0.03	0.04	ND
Industrial Chemicals	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
PCB 8	0.55	ND	0.56	* ND	0.93	ND	0.66	* ND
PCB 18		0.04	0.06	ND	0.10	ND	0.07	ND
PCB 28		0.11		* 0.37		0.11		* 0.30
PCB 44		0.15		* 0.50		0.16		0.15
PCB 49		0.02		* 0.33		0.11		* 0.38
PCB 52		0.16		* 1.43		0.17		* 0.69
PCB 66		0.08		* 0.35		0.07	0.06	ND
PCB 87		0.05		* 0.49		0.08		* 0.16
PCB 101		0.02		* 1.33		0.32		* 0.80
PCB 105		0.03		* 0.27		0.20		* 0.31
PCB 118		0.06		* 0.75		0.25	0.07	ND
PCB 128	0.15	ND	0.15	ND		0.12		0.07
PCB 138		0.21		0.22		1.74		1.89
PCB 153		0.11		* 0.60		2.21		2.40
PCB 170		0.03		0.02		0.41		0.36
PCB 180		0.09		* 0.24		1.26		1.37
PCB 183		0.03		* 0.10		0.33		0.39
PCB 184	0.08	ND		0.05	0.14	ND	0.10	ND
PCB 187	0.07	ND		* 0.15		0.54		0.64
PCB 195		0.03		* 0.05		0.14		0.15
PCB 206		0.02		* 0.06		0.19		* 0.26
PCB 209		0.05		* 0.09		0.19		0.19
Total PCB		**2.90**		* **16.13**		**17.44**		* **22.82**
1,4-Dichlorobenzene		0.81		0.74		0.40		* 1.54

TABLE 3. (Continued) **Reach 1**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
PAH's	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Naphthalene		2.80		* 13.57		3.94		* 7.92
Acenaphthylene		0.03		* 1.75		0.11		* 0.53
Acenaphthene		0.92		* 67.80		1.90		* 31.66
Fluorene		0.55		* 71.51		0.38		* 7.37
Phenanthrene		1.61		* 407.34		0.50		* 30.64
Anthracene		0.25		* 69.09	0.09	ND		* 2.35
Fluoranthene		2.59		* 469.42	1.13	ND		* 113.49
Pyrene		2.31		* 268.09		0.47		* 50.15
Benzo(a)anthracene		0.38		* 104.47		0.31		* 4.64
Chrysene		1.11		* 96.31		0.41		* 16.13
Benzo(b)fluoranthene		0.53		* 26.72	0.09	ND		* 2.55
Benzo(k)fluoranthene		0.43		* 16.29	0.11	ND		* 2.46
Benzo(a)pyrene		0.35		* 22.74	0.13	ND		* 1.68
Indeno(1,2,3-cd)pyrene	0.01	ND		* 2.28		0.06		* 0.46
Dibenzo(a,h)antracene	0.03	ND		* 1.14	0.09	ND		* 0.14
Benzo(g,h,i)perylene	0.02	ND		* 4.00		0.17		* 0.66
Total PAH's		**13.90**		* **1642.51**		**9.06**		* **272.83**
Dioxins	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)
2378 TCDD	0.45	ND	0.43	ND	1.02	ND	0.42	ND
12378 PeCDD		0.29	0.32	ND	1.11	ND	0.67	ND
123478 HxCDD	0.33	ND	0.25	ND	1.00	ND	0.90	ND
123678 HxCDD		0.26	0.25	ND		0.53		0.51
123789 HxCDD		0.21	0.22	ND	0.95	ND	0.81	ND
1234678 HpCDD		1.17		0.59		1.36		1.75
1234789 OCDD		13.78		5.40		8.80		* 16.07
2378 TCDF		0.40		0.23		1.22		1.69
12378 PeCDF		0.56	0.33	ND	1.00	ND		0.39
23478 PeCDF		0.53	0.35	ND		0.58		0.32
123478 HxCDF		1.22	0.41	ND	0.73	ND	0.63	ND
123678 HxCDF		0.56	0.18	ND	1.28	ND	0.94	ND
234678 HxCDF		0.31	0.22	ND	0.70	ND	0.73	ND
123789 HxCDF	0.36	ND	0.24	ND	0.78	ND	0.81	ND
1234678 HpCDF		1.81	0.47	ND	1.03	ND		3.46
1234789 HpCDF		0.32	0.41	ND	1.17	ND	1.33	ND
12346789 OCDF		6.80		0.47		0.84		60.87

ND = Not detected
Total PAH = Sum of all PAH's.
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level.

Appendix "D"

USACOE SAMPLING SCHEME AND
SAMPLING RESULTS
20 JUNE 2002
(Reaches 1, 2, 3)

REV. 4/98

SAMPLING SCHEME and LIST of REQUIRED TESTING as OUTLINED in the 1992 ACENYD/EPA REGION II REGIONAL IMPLEMENTATION MANUAL on Dredged Material Proposed for Ocean Disposal and the 1991 GREEN BOOK

Applicant US NAVY – NAVAL WEAPONS STATION EARLE - Pier 3 Replacement

Applicant No. 2002-00367-OD

Address MONMOUTH COUNTY, NJ

Waterway SANDY HOOK BAY

Proposed Volume: 635,000 cubic yards (based on 8 / 10 / 2000 bathymetric survey)

Project Depth in feet: -45' MLW

(NOTE: The applicant is required to collect cores from each sampling location to project depth plus 2 ft)

A preapplication meeting X was held on 3 / 14 / 2002 at NY District Offices in New York

____ was not held at the NY District Offices in New York.

The applicant has indicated that testing will be performed by the following laboratories:

Biological: not available Analytical: not available Dioxin: not available

The sampling scheme and required testing described on the reverse side was approved for the proposed project area based upon the information contained in the attached map.

Sample dredging sites are indicated on attached map.

The proposed dredging area is subdivided into THREE ~~TWO~~ reaches for sampling and testing purposes:

- Reach "1": 11 locations: Bottom sediments from Berthing area and under Pier 3 (#1–11)
- Reach "2": 3 locations: Top sediments from under Pier 3 (#1-3)
- Reach "3": 8 locations: Top sediments from Berthing area (#4–11)

NOTE: **"TOP" and "BOTTOM" are defined by the cutoff between black silty mud ("TOP") and brown sand ("BOTTOM")** observed in each collected core.

COMMENTS:

1. If there is any evidence of stratification in core samples, contact NYD prior to compositing.
2. Additional cores may have to be taken from each station in order to ensure adequate volumes of sediment to meet testing requirements. If so, the same number of cores must be taken and composited from each location.
3. Core locations may have to be moved if shoaling patterns have changed. If so, contact NYD during sampling to confirm new locations.
4. The District reserves the right to require additional sampling and testing at any time.

* If you have any questions regarding sampling, test protocols, test species, QA/QC, etc. please contact the Dredged Material Management Section of the USACE/NYD at (212)-264-5620 or extension of person completing this form.

PREPARED BY: OKSANA YAREMKO DATE: Rev. 20 JUNE 2002 ~~Rev. 8 MAY 2002~~ ~~25 APRIL 2002~~ PHONE: 212-264-9268

SEE REVERSE SIDE FOR SAMPLING AND TESTING REQUIREMENTS

APPLICANT: #2002-00367-OD – USNWS Earle Pier 3 Replacement

Any Box Checked Off Indicates an Analysis or Assay that is Required for a Given Project.
Archiving requires saving a sample for possible analysis at a later time pending further instruction.

X=Per Homogenized Sediment Core + Reference (Composited Grabs) + Control
C=Per Bioassay Sediment Composite
A=Archive
W=Site Water and Elutriate
T=Per Tissue Replicate (Ref, Test, Pre-test, A=Archive Ctl and any remaining tissue from Ref, Test, Pre-test)

1. SEDIMENT PHYSICAL ANALYSIS **(If stratification is observed, each stratum within a core must be analyzed separately)**
   - a. X **Grain Size Analysis** (% sand, % silt, & % clay)
   - b. X **% Moisture**
   - c. C **Specific Gravity**
   - d. C **Bulk Density**
   - e. C **Plastic and Liquid limits (Atterberg limits)**

2. SEDIMENT CHEMICAL ANALYSIS

   REQUIRED
   - a. X **% Total Organic Carbon**

   CASE BY CASE BASIS
   - a. C A **Metals** (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   - b. C A **PAHs (LMWs:** acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   - c. C A **PAHs (HMWs:** benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthrene, indeno(1,2,3-c,d)pyrene, pyrene)
   - d. C A **Semi-volatiles** (1,4 dichlorobenzene)
   - e. C A **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptaclor, heptachlor epoxide)
   - f. C A **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   - g. ____ **PCB coplanar** (#77,126,156,169)
   - h. C A **Dioxins/Furans** (2,3,7,8 - substituted isomers, n=17)
   - i. ___ **Other:**
   - j. ___ **LIS pesticides**
   - k. ___ **LIS PAHS**

3. CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

   REQUIRED
   - a. W **Metals** (Ag, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   - b. W **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   - c. W **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptaclor, heptachlor epoxide)
   - d. ___ **Other:**

   CASE BY CASE BASIS
   - a. ___ **PAHs** (_ all 16, _ LMW, _ HMW, _ as specified)
   - b. ___ **2,3,7,8-TCDD**
   - c. ___ **2,3,7,8-TCDF**
   - d. ___ **PCB coplanar** (#77,126,156,169)
   - e. ___ **LIS pesticides**
   - d. ___ **Other:**

4. BIOASSAYS (species listed in guidance manual)
   - a. C **Water Column Acute Tox.** (bivalve larvae, M. bahia, Menidia sp.)
   - b. C **10-Day Benthic Acute Tox.** (A. abdita, R. abronius, E. estuarius, or L. plumulosus)
   - c. C **10-Day Benthic Acute Tox.** (M. bahia)
   - d. C **28-Day Bioaccumulation** (N. virens, and Macoma secta or M. nasuta) - INCLUDING DIOXIN,
   - e. ___ **28-Day Bioaccumulation** (N. virens and Macoma secta or M. nasuta)): DIOXIN ONLY

5. 28-DAY WHOLE-SEDIMENT BIOACCUMULATION TISSUE ANALYSIS

   REQUIRED
   - a. T A **Metals** (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   - b. T A **Pesticides** (aldrin, alpha chlordane, trans nonachlor, dieldrin,p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptachlor, heptachlor epoxide)
   - c. T A **PCBs** (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209
   - d. T A **Semi-volatiles** (1,4 dichlorobenzene)
   - e. T A **PAHs (LMWs:** acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   - f. T A **PAHs (HMWs:** benzo(a)anthracene, benzo(a)pyrene,benzo(g,h,i)perylene,benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthrene, indeno(1,2,3-c,d)pyrene, pyrene)

   CASE BY CASE BASIS
   - a. T A **Dioxins/Furans** (2,3,7,8 - substituted isomers, n=17)
   - b. ____ **LIS pesticides**
   - c. ____ **LIS PAHs**
   - d. ____ **PCB coplanar** (#77,126,156,169)
   - e. ____ **Other:**

REFER TO COMMENT SECTION ON REVERSE SIDE FOR ADDITIONAL INFORMATION

CENAN-OP-SD 20 June 2002

MEMORANDUM FOR: The Record

SUBJECT: Revision to Sampling Scheme and Required Testing for Application No. 2002-00367-OD by the US Naval Weapons Station Earle – Pier 3 Reconstruction, Sandy Hook Bay, Middletown, Monmouth County, NJ

1. A sediment sampling scheme and checklist of required testing for the proposed dredging and pier reconstruction project was prepared on 8 May 2002 (copy enclosed).

2. Sampling of the project area was initiated on 10 June 2002 by Aqua Survey Inc (ASI). On 11 June 2002, Jim Todd, ASI, informed Oksana Yaremko, CENAN-OP-SD, that each of the sample cores exhibited two separate strata: black silty mud on top, and brown sand and red/grey clays, extending from 1 to 5 feet in length, on the bottom. Coring logs provided by ASI were forwarded to EPA by letter dated 18 June 2002 to see whether the original sampling scheme would need to be modified on the basis of this new information.

3. By letter dated 19 June 2002, EPA indicated that the bottom sand and clay fraction would need to be tested as a separate additional composite. The sampling and testing scheme has therefore been modified to break out the top and bottom strata within the project area. The modified sampling scheme is summarized below. Note that sample locations and the number of samples have **not** changed. Also, "top" and "bottom" are defined by the actual cutoff between strata observed in each collected core.

   - REACH 1: Bottom sediments from the whole project area (all core locations, #1-11).
   - REACH 2: Top sediments from under Pier 3 (3 core locations: #1-3).
   - REACH 3: Top sediments from berthing area (8 core locations: #4-11).

4. All three test reaches have identical testing requirements, as summarized in the attached Sampling and Required Testing checklist.

OKSANA YAREMKO
Environmental Engineer
CENAN-OP-SD

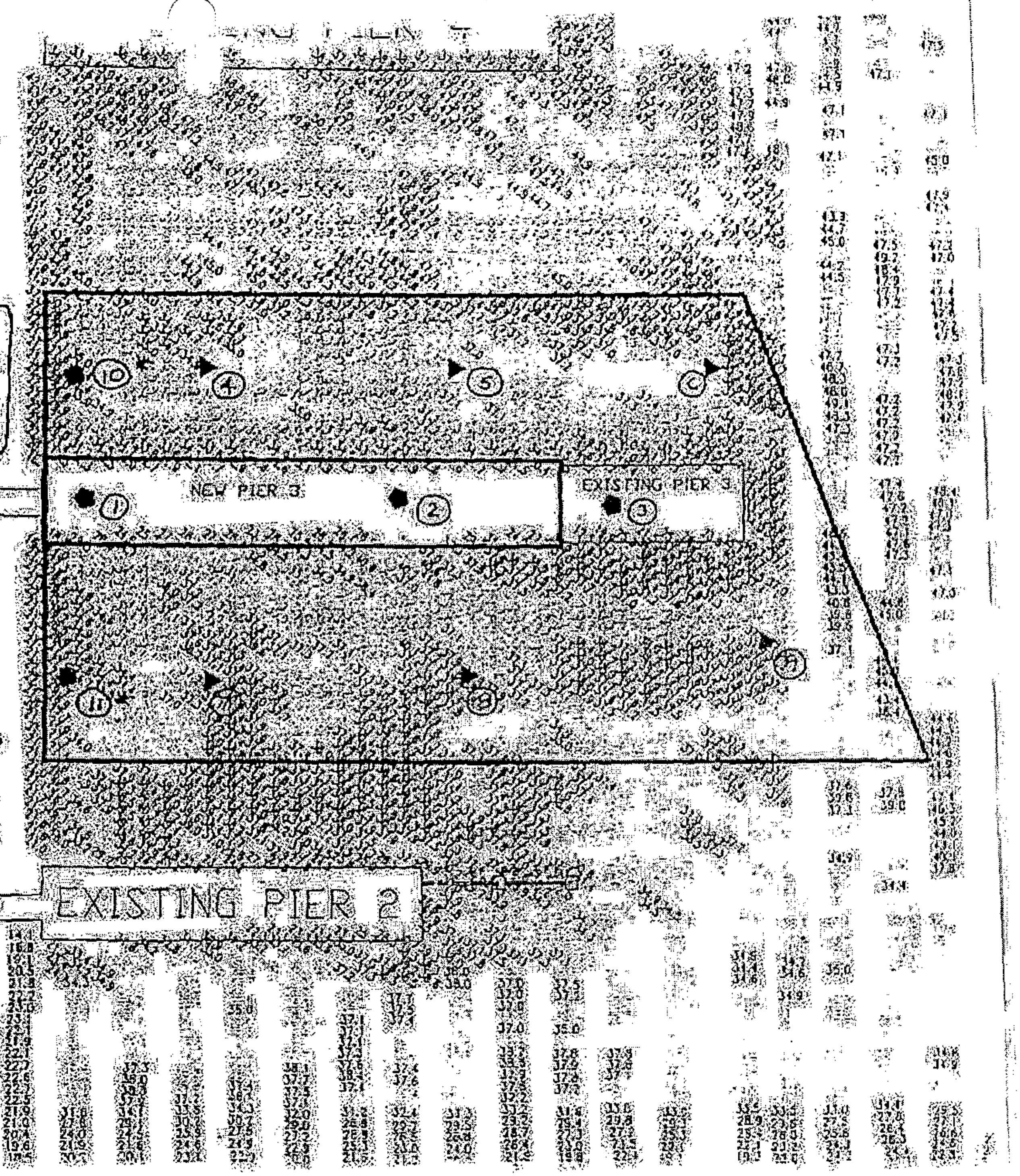
Enclosures

mpl. # 2002-00367-OD
USNA Earle
Pier 3 Replacement

RGE 740

(11) Sample locations for Bioassay / Bioaccumulation testing.
[signature]
28 Apr 2002

* NOTE: Sample locations 10 & 11 must be collected as far south as needed to yield sediment cores of sufficient length to obtain a representative sample of the full -26' MLW to -30' MLW Reach 2 stratum.



RGE (-) 735

PUBLIC NOTICE TABLES

REACH 1

TABLE 1. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

NWS Pier 3 Replacement Reach 1

	SITE WATER		ELUTRIATE	
CONSTITUENTS	DETECTION LIMITS	CONCENTRATION	DETECTION LIMITS	CONCENTRATION
Metals	**ppb**	**ppb**	**ppb**	**ppb**
Ag		0.010		0.019
Cd		0.224		0.013
Cr		0.271		0.886
Cu		1.43		0.879
Hg		0.003		0.006
Ni		0.83		1.63
Pb		1.06		0.54
Zn		4.76		2.53
Pesticides	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
Aldrin	2.83	ND	2.83	ND
a-Chlordane		0.5		0.254
trans Nonachlor	1.01	ND		0.163
Dieldrin	0.98	ND	0.98	ND
4,4'-DDT	0.56	ND	0.56	ND
2,4'-DDT	1.99	ND	1.99	ND
4,4'-DDD	0.60	ND	0.60	ND
2,4'-DDD	0.75	ND	0.75	ND
4,4'-DDE		1.8		2.99
2,4'-DDE	1.71	ND	1.71	ND
Total DDT		**4.6**		**5.8**
Endosulfan I	1.11	ND	1.11	ND
Endosulfan II	0.51	ND	0.51	ND
Endosulfan sulfate	0.57	ND	0.57	ND
Heptachlor	1.17	ND	1.17	ND
Heptachlor epoxide	0.95	ND	0.95	ND
Industrial Chemicals	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
PCB 8	16.00	ND	16.00	ND
PCB 18		1.09		1.92
PCB 28	1.73	ND		0.3
PCB 44	1.45	ND	1.45	ND
PCB 49		0.30	1.49	ND
PCB 52	1.44	ND	1.44	ND
PCB 66	1.49	ND		1.47
PCB 87	1.13	ND	1.13	ND
PCB 101	1.15	ND		0.41
PCB 105	0.58	ND	0.58	ND
PCB 118	0.87	ND	0.87	ND
PCB 128		0.30		0.28
PCB 138		0.42		0.62
PCB 153		0.16		0.40
PCB 170	1.02	ND	1.02	ND
PCB 180		0.18		0.25
PCB 183	0.93	ND	0.93	ND
PCB 184	0.92	ND	0.92	ND
PCB 187		0.20		0.23
PCB 195	1.09	ND		0.09
PCB 206	1.22	ND		0.06
PCB 209	1.27	ND	1.27	ND
Total PCB		**69.8**		**66.3**

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.

TABLE 2

NWS Pier 3 Reconstruction
TOXICITY TEST RESULTS
Reach 1

ASI JOB No. 22-245

Suspended Particulate Phase

Test Species	Test Duration	LC50/EC50	LPC (a)
Menidia beryllina	96 hours	(b) >100%	1.00
Mysidposis bahia	96 hours	(b) >100%	1.00
Mytilus edulis (larval survival)	48 hours	(b) >100%	1.00
Mytilus edulis (larval normal develop.)	48 hours	(c) 66.0%	0.66

(a) Limiting Permissible Concentration (LPC) is the LC 50 or EC 50 times 0.01.

(b) Median Lethal Concentration (LC50) resulting in 50% mortality at test termination.

(c) Median Effective Concentration (EC50) based on normal development to the D-cell, prodissoconch 1 stage.

Whole Sediment (10 days)

Test Species	% Survival in Reference	% Survival	% Difference Reference -Test	Is difference statistically significant? (a=0.05)
Ampelisca abdita	85%	91%	-6%	No
Mysidopsis bahia	100%	99%	1%	No

Table 2.xls

NWS EARLE Pier 3 Replacement, Reach 1
TABLE 3. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
Wet weight concentrations

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
Metals	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
Ag		0.04		0.04		0.03		0.02
As		2.51		* 2.80		3.81		3.18
Cd		0.03		0.02		0.05		0.05
Cr		0.61		0.63		0.42		0.40
Cu		1.97		2.21		1.35		1.28
Hg		0.01		* 0.01		0.02		0.02
Ni		0.34		* 0.52		0.21		* 0.30
Pb		0.21		* 0.33		0.12		0.13
Zn		12.74		13.38		25.03		32.28
Pesticides	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Aldrin		0.02	0.04	ND	0.07	ND	0.05	ND
a-Chlordane		0.06	0.04	ND		0.15		0.12
trans Nonachlor		0.02		* 0.14		0.45		0.40
Dieldrin		0.10		0.07		0.25		0.26
4,4'-DDT		0.04	0.04	ND		0.10		0.05
2,4'-DDT	0.06	ND	0.06	ND		0.07	0.07	ND
4,4'-DDD		0.08		* 1.54		0.17		0.29
2,4'-DDD		0.05		0.06		0.14		* 0.41
4,4'-DDE		0.09		* 5.26		0.24		* 1.67
2,4'-DDE	0.16	ND	0.16	ND	0.27	ND		0.12
Total DDT		**0.37**		* **6.99**		**0.81**		* **2.57**
Endosulfan I	0.06	ND		* 0.79	0.10	ND	0.07	ND
Endosulfan II	0.08	ND	0.08	ND	0.14	ND	0.10	ND
Endosulfan sulfate		0.11		0.13		0.39		0.09
Heptachlor	0.05	ND		0.03		0.80	0.06	ND
Heptachlor epoxide	0.03	ND	0.03	ND		0.03	0.04	ND
Industrial Chemicals	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
PCB 8	0.55	ND	0.56	* ND	0.93	ND	0.66	* ND
PCB 18		0.04	0.06	ND	0.10	ND	0.07	ND
PCB 28		0.11		* 0.37		0.11		* 0.30
PCB 44		0.15		* 0.50		0.16		0.15
PCB 49		0.02		* 0.33		0.11		* 0.38
PCB 52		0.16		* 1.43		0.17		* 0.69
PCB 66		0.08		* 0.35		0.07	0.06	ND
PCB 87		0.05		* 0.49		0.08		* 0.16
PCB 101		0.02		* 1.33		0.32		* 0.80
PCB 105		0.03		* 0.27		0.20		* 0.31
PCB 118		0.06		* 0.75		0.25	0.07	ND
PCB 128	0.15	ND	0.15	ND		0.12		0.07
PCB 138		0.21		0.22		1.74		1.89
PCB 153		0.11		* 0.60		2.21		2.40
PCB 170		0.03		0.02		0.41		0.36
PCB 180		0.09		* 0.24		1.26		1.37
PCB 183		0.03		* 0.10		0.33		0.39
PCB 184	0.08	ND		0.05	0.14	ND	0.10	ND
PCB 187	0.07	ND		* 0.15		0.54		0.64
PCB 195		0.03		* 0.05		0.14		0.15
PCB 206		0.02		* 0.06		0.19		* 0.26
PCB 209		0.05		* 0.09		0.19		0.19
Total PCB		**2.90**		* **16.13**		**17.44**		* **22.62**
1,4-Dichlorobenzene		0.81		0.74		0.40		* 1.54

TABLE 3. (Continued) **Reach 1**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
PAH's	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Naphthalene		2.80		* 13.57		3.94		* 7.92
Acenaphthylene		0.03		* 1.75		0.11		* 0.53
Acenaphthene		0.92		* 67.80		1.90		* 31.66
Fluorene		0.55		* 71.51		0.38		* 7.37
Phenanthrene		1.61		* 407.34		0.50		* 30.64
Anthracene		0.25		* 69.09	0.09	ND		* 2.35
Fluoranthene		2.59		* 469.42	1.13	ND		* 113.49
Pyrene		2.31		* 268.09		0.47		* 50.15
Benzo(a)anthracene		0.38		* 104.47		0.31		* 4.64
Chrysene		1.11		* 96.31		0.41		* 16.13
Benzo(b)fluoranthene		0.53		* 26.72	0.09	ND		* 2.55
Benzo(k)fluoranthene		0.43		* 16.29	0.11	ND		* 2.46
Benzo(a)pyrene		0.35		* 22.74	0.13	ND		* 1.68
Indeno(1,2,3-cd)pyrene	0.01	ND		* 2.28		0.06		* 0.46
Dibenzo(a,h)antracene	0.03	ND		* 1.14	0.09	ND		* 0.14
Benzo(g,h,i)perylene	0.02	ND		* 4.00		0.17		* 0.66
Total PAH's		**13.90**		* **1642.51**		**9.06**		* **272.83**
Dioxins	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)
2378 TCDD	0.45	ND	0.43	ND	1.02	ND	0.42	ND
12378 PeCDD		0.29	0.32	ND	1.11	ND	0.67	ND
123478 HxCDD	0.33	ND	0.25	ND	1.00	ND	0.90	ND
123678 HxCDD		0.26	0.25	ND		0.53		0.51
123789 HxCDD		0.21	0.22	ND	0.95	ND	0.81	ND
1234678 HpCDD		1.17		0.59		1.36		1.75
1234789 OCDD		13.78		5.40		8.80		* 16.07
2378 TCDF		0.40		0.23		1.22		1.69
12378 PeCDF		0.56	0.33	ND	1.00	ND		0.39
23478 PeCDF		0.53	0.35	ND		0.58		0.32
123478 HxCDF		1.22	0.41	ND	0.73	ND	0.63	ND
123678 HxCDF		0.56	0.18	ND	1.28	ND	0.94	ND
234678 HxCDF		0.31	0.22	ND	0.70	ND	0.73	ND
123789 HxCDF	0.36	ND	0.24	ND	0.78	ND	0.81	ND
1234678 HpCDF		1.81	0.47	ND	1.03	ND		3.46
1234789 HpCDF		0.32	0.41	ND	1.17	ND	1.33	ND
12346789 OCDF		6.80		0.47		0.84		60.87

ND = Not detected
Total PAH = Sum of all PAH's.
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level.

Physical and Chemical Analyses of Site Water, Elutriate, Bulk Sediment and Tissue

REACH 1

TABLE 4	RESULTS OF CHEMICAL ANALYSIS OF SITE WATER							
				NWS Pier 3 Replacement Reach 1				22-245
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		V5852		V5852 Dup		V5852 Trip		
ASI ID#		2021429		2021429		2021429		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.014	ND	0.014	ND	0.016		0.010
Cd	0.02	0.223		0.224		0.226		0.22
Cr	0.06	0.267		0.268		0.278		0.27
Cu	0.15	1.42		1.42		1.45		1.43
Hg	0.002	0.003		0.003		0.003		0.003
Ni	0.04	0.82		0.84		0.83		0.83
Pb	0.04	1.04		1.07		1.07		1.06
Zn	0.09	4.70		4.75		4.83		4.76
Battelle-ID#		V5852		V5852 Dup		V5852 Trip		
ASI ID#		2021429		2021429		2021429		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.47	J	0.46	J	0.44	J	0.46
trans Nonachlor	14.0	1.01	ND	1.01	ND	1.01	ND	0.51
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.00	2.21		1.64		1.70		1.85
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		5.004		4.434		4.493		4.644
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	1.04	J	1.13	J	1.09	J	1.09
PCB 28	0.50	1.73	ND	1.73	ND	1.73	ND	1.73
PCB 44	0.50	1.45	ND	1.45	ND	1.45	ND	1.45
PCB 49	0.50	0.33	J	0.32	J	0.26	J	0.30
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.49	ND	1.49	ND	1.49	ND	1.49
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	1.15	ND	1.15	ND	1.15	ND	1.15
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.87	ND	0.87	ND	0.87	ND	0.87
PCB 128	0.50	0.33	J	0.28	J	0.29	J	0.30
PCB 138	0.50	0.44	J	0.38	J	0.45	J	0.42
PCB 153	0.50	0.18	J	0.16	J	0.13	J	0.16
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.20	J	0.17	J	0.16	J	0.18
PCB 183	0.50	0.93	ND	0.93	ND	0.93	ND	0.93
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.22	J	0.20	J	0.17	J	0.20
PCB 195	0.50	1.09	ND	1.09	ND	1.09	ND	1.09
PCB 206	0.50	1.22	ND	1.22	ND	1.22	ND	1.22
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		69.997		69.781		69.617		69.798

ND = Not detected

J = Detection limit below the reporting limit or is an estimated value

E = Reporting limit raised due to matrix interference

B = Analyte detected in sample is <5x blank value

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 5	RESULTS OF CHEMICAL ANALYSIS OF ELUTRIATE							
		NWS Pier 3 Replacement Reach 1						22-245
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		V5844+V5852		V5844+V5852		V5844+V5852		
ASI ID#		2021429/ 2021322		2021429/ 2021322		2021429/ 2021322		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.02		0.02		0.02		0.02
Cd	0.02	0.02		0.01		0.01		0.01
Cr	0.06	0.98		0.81		0.87		0.89
Cu	0.15	0.88		0.87		0.88		0.88
Hg	0.002	0.006		0.006		0.006		0.01
Ni	0.04	1.64		1.61		1.65		1.63
Pb	0.04	0.54		0.53		0.54		0.54
Zn	0.09	2.59		2.48		2.53		2.53
Battelle ID#		V5855/V5852		V5855/V5852		V5855/V5852		
ASI ID#		2021429/ 2021322		2021429/ 2021322		2021429/ 2021322		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.27	J	0.24	J	0.26	J	0.25
trans Nonachlor	14.0	0.19	J	0.14	J	0.16	J	0.16
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.0	3.08		2.93		2.97		2.99
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		5.88		5.72		5.77		5.79
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	2.06		1.83		1.87		1.92
PCB 28	0.50	0.35	J	0.41	J	0.28	J	0.34
PCB 44	0.50	1.45	ND	1.45	ND	1.45	ND	1.45
PCB 49	0.50	1.49	ND	1.49	ND	1.49	ND	1.49
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.53		1.51		1.37	J	1.47
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	0.44	J	0.37	J	0.43	J	0.41
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.87	ND	0.87	ND	0.87	ND	0.87
PCB 128	0.50	0.26	J	0.33	J	0.26	J	0.28
PCB 138	0.50	0.58	J	0.66	J	0.64	J	0.62
PCB 153	0.50	0.41	J	0.33	J	0.47	J	0.40
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.25	J	0.25	J	0.25	J	0.25
PCB 183	0.50	0.93	ND	0.93	ND	0.93	ND	0.93
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.22	J	0.24	J	0.22	J	0.23
PCB 195	0.50	0.09	J	0.09	J	0.08	J	0.09
PCB 206	0.50	0.07	J	0.05	J	0.07	J	0.06
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		68.7		66.3		66.0		66.3

ND = Not detected
J = Detection limit below the reporting limit or is an estimated value
E = Reporting limit raised due to matrix interference
B = Analyte detected in sample is <5x blank value
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 6 RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT

Maguire-NWS Pier 3 Replacement Reach 1 ASI Job No. 22-245

CONSTITUENTS	DL	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		V5844						
Battelle-Duxbury ID#		V5844		V5844		V5844		
ASI ID#		2021332		2021332		2021332		2021332
Metals	ppm (ug/g)							
Ag	0.04	0.30						0.302
As	0.3	11.90						11.9
Cd	0.02	0.12						0.12
Cr	0.04	42.8	B					42.8
Cu	0.1	15.60						15.6
Hg	0.0016	0.09						0.091
Ni	0.2	16.7						16.7
Pb	0.1	13.9						13.9
Zn	0.4	64.1						64.1
Pesticides	ppb (ng/g)	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)
Aldrin	0.035	0.04	ND	0.04	ND	0.04	ND	0.06
a-Chlordane	0.022	0.02	J	0.02	J	0.02	J	0.02
trans Nonachlor	0.044	0.03	J	0.02	J	0.02	J	0.02
Dieldrin	0.032	0.04	J	0.07	J	0.04	J	0.05
4,4'-DDT	0.040	0.05	J	0.04	J	0.06	J	0.05
2,4'-DDT	0.158	0.08	ND	0.08	ND	0.08	ND	0.04
4,4'-DDD	0.091	1.02		0.99		1.03		1.01
2,4'-DDD	0.042	0.44		0.50		0.44		0.46
4,4'-DDE	0.050	2.34		2.46		2.67		2.49
2,4'-DDE	0.154	0.09	ND	0.09	ND	0.09	ND	0.045
Total DDT		3.923		4.082		4.284		4.10
Endosulfan I	0.095	0.07	ND	0.07	ND	0.07	ND	0.035
Endosulfan II	0.043	0.06	ND	0.07	ND	0.06	ND	0.032
Endosulfan sulfate	0.047	0.07	ND	0.07	ND	0.07	ND	0.035
Heptachlor	0.056	0.05	ND	0.05	ND	0.05	ND	0.025
Heptachlor epoxide	0.020	0.05	ND	0.05	ND	0.05	ND	0.025
Industrial Chemicals		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)
PCB 8	0.080	0.76		0.89		1.12		0.92
PCB 18	0.084	0.36		0.46		0.39		0.40
PCB 28	0.048	0.45		0.45		0.41		0.44
PCB 44	0.075	0.29		0.28		0.30		0.29
PCB 49	0.069	0.25		0.25		0.23		0.24
PCB 52	0.084	0.39		0.38		0.40		0.39
PCB 66	0.051	0.28		0.28		0.28		0.28
PCB 87	0.023	0.16		0.16		0.16		0.16
PCB 101	0.129	0.48		0.50		0.46		0.48
PCB 105	0.053	0.11		0.11		0.13		0.12
PCB 118	0.048	0.34		0.35		0.34		0.34
PCB 128	0.048	0.25		0.63		0.18		0.36
PCB 138	0.062	0.35		0.38		0.39		0.37
PCB 153	0.084	0.53		0.52		0.53		0.52
PCB 170	0.047	0.06	ND	0.06	ND	0.06	ND	0.03
PCB 180	0.028	0.21		0.22		0.21		0.21
PCB 183	0.031	0.09		0.09		0.08		0.09
PCB 184	0.013	0.05	ND	0.05	ND	0.05	ND	0.03
PCB 187	0.019	0.21		0.21		0.21		0.21
PCB 195	0.024	0.06	ND	0.06	ND	0.06	ND	0.03
PCB 206	0.031	0.17		0.19		0.16		0.17
PCB 209	0.042	0.25		0.22		0.26		0.25
Total PCB		12.05		13.29		12.63		37.96
1-4, Dichlorobenzene		1.20		1.35		1.28		1.28

TABLE 6 Continued **RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT**

Maguire-NWS Pier 3 Replacement **Reach 1** **ASI Job No. 22-245**

CONSTITUENTS	MDL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
BATTELLE ID#		V5844			V5844			V5844			
ASI ID#		2021332			2021332			2021332			
PAH's	ppb (ng/g)	ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
Naphthalene		427.08			555.68			416.51			466.42
Acenaphthylene		8.91			21.11			7.98			12.67
Acenaphthene		194.29			212.71			190.61			199.20
Fluorene		168.81			186.31			170.66			175.26
Phenanthrene		479.49			551.76			527.66			519.64
Anthracene		82.36			127.11			88.47			99.31
Fluoranthene		291.29			460.68			344.80			365.59
Pyrene		199.85			353.20			235.33			262.79
Benzo(a)anthracene		75.31			137.62			83.86			98.93
Chrysene		83.96			160.74			88.72			111.14
Benzo(b)fluoranthene		59.93			94.20			70.21			74.78
Benzo(k)fluoranthene		51.25			86.64			57.31			65.07
Benzo(a)pyrene		59.64			104.74			63.84			76.07
Indeno(1,2,3-c,d)pyrene		38.52			65.63			43.36			49.17
Dibenzo(a,h)anthracene		9.32			15.53			10.33			11.73
Benzo(g,h,i)perylene		29.35			48.75			32.43			36.84
Total PAH's		**2259.4**			**3182.4**			**2432.1**			**2624.61**
Philip A.S. ID #		039490 02			039490 02			039490 02			
ASI ID#		2021332			2021332			2021332			**Mean**
Dioxins	pptr(pg/g)	pptr(pg/g)			pptr(pg/g)			pptr(pg/g)			pptr(pg/g)
2378 TCDD		0.18	ND								0.09
12378 PeCDD		0.29	ND								0.15
123478 HxCDD		0.33									0.33
123678 HxCDD		2.2									2.2
123789 HxCDD		3.0									3.0
1234678 HpCDD		46									46
12346789 OCDD		1200									1200
2378 TCDF		1.2									1.2
12378 PeCDF		0.19	ND								0.10
23478 PeCDF		0.75									0.75
123478 HxCDF		1.6									1.6
123678 HxCDF		0.61	ND								0.31
234678 HxCDF		0.64									0.64
123789 HxCDF		0.30	ND								0.15
1234678 HpCDF		10									10.00
1234789 HpCDF		0.5	ND								0.27
12346789 OCDF		9.8									9.80

B - Analyte concentration in blank > 3 times target
E - Estimate due to co- on chromotography column
J = Detection limit below the reporting limit or is an estimated value
ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values.
d - Analyte reported from a dilution.

Table 7 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

Job # 22-245

		Macoma nasuta																													
		PRETEST						REFERENCE										REACH 1 TEST													
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022576		2022575		2022577		2022578		2022579	
Battelle ID #		U0554		U0555		U0556		U0217		U0218		U0219		U0220		U0221		U0222		U0223		U0224		U0225		U0226	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.036		0.026		0.026		0.046		0.048		0.056		0.031		0.033		0.030		0.050		0.032		0.040		0.050	
Arsenic	1.00	2.921		2.644		2.563		2.558		2.275		2.875		2.505		2.534		2.750		2.592		3.094		2.857		2.685	
Cadmium	0.10	0.030		0.030		0.031		0.022		0.024		0.029		0.029		0.026		0.022		0.027		0.024		0.025		0.023	
Chromium	0.20	0.267		0.248		0.312		0.683		0.530		0.855		0.427		0.539		0.540		0.668		0.613		0.633		0.721	
Copper	1.00	1.773		1.311		1.495		2.153		2.249		2.020		1.593		1.810		1.937		1.933		1.871		2.193		3.118	
Mercury	0.02	0.006		0.007		0.009		0.010		0.009		0.011		0.007		0.007		0.012		0.014		0.013		0.012		0.012	
Nickel	0.10	0.289		0.271		0.300		0.331		0.354		0.348		0.358		0.294		0.452		0.475		0.550		0.539		0.559	
Lead	0.10	0.116		0.092		0.119		0.250		0.226		0.209		0.174		0.188		0.278		0.351		0.299		0.342		0.353	
Zinc	1.00	11.829		11.403		12.166		11.935		13.019		12.855		14.263		11.641		14.934		14.112		12.885		11.685		13.269	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.01	J	0.03	J	0.04	ND	0.04	ND	0.02	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
a-Chlordane	0.4	0.09		0.09		0.10		0.06		0.07		0.06		0.06		0.05		0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
trans Nonachlor	0.4	0.04	ND	0.02	J	0.03	J	0.02	J	0.04	ND	0.04	ND	0.01	J	0.01	J	0.11		0.14		0.16		0.14		0.15	
Dieldrin	0.4	0.04	ND	0.13		0.17		0.11		0.04	ND	0.13		0.13		0.11		0.04	ND	0.07		0.21		0.04	ND	0.04	ND
4,4'-DDT	0.4	0.04	ND	0.04	ND	0.04	ND	0.06		0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
2,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
4,4'-DDD	0.4	0.16		0.07	ND	0.15		0.11		0.05	J	0.10		0.06	J	0.06		1.37		1.53		1.25		1.83		1.73	
2,4'-DDD	0.4	0.05	ND	0.05	ND	0.05	ND	0.06		0.05	ND	0.06		0.07		0.05	J	0.05	ND	0.05	ND	0.05	ND	0.10		0.11	
4,4'-DDE	0.4	0.07		0.19		0.10		0.11		0.09		0.08		0.09		0.08		4.88		5.21		4.29		6.39		5.53	
2,4'-DDE	0.4	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND
Total DDT		0.640		0.570		0.560		0.580		0.460		0.500		0.480		0.470		6.560		7.080		5.850		8.580		7.630	
Endosulfan I	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.98		0.79		0.52		0.97		0.71	
Endosulfan II	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.06	ND	0.09	ND	0.09	ND	0.06	ND	0.08	ND	0.06	ND
Endosulfan sulfate	0.4	0.09	ND	0.07	J	0.12		0.09	ND	0.09	ND	0.21		0.06	J	0.15		0.29		0.14		0.09	ND	0.12		0.06	J
Heptachlor	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.04	J	0.05	ND
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x),where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022575		2022576		2022577		2022578		2022579	
Battelle ID #		U0564		U0565		U0566		U0217		U0218		U0219		U0220		U0221		U0222		U0223		U0224		U0225 NF		U0226	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.57	ND	0.56	ND	0.55	ND	0.55	ND	0.55	ND	0.56	ND	0.56	ND	0.55	ND	0.56	ND	0.56	ND	0.55	ND	0.55	ND	0.56	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06		0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
PCB 28	0.4	0.06	J	0.09		0.05	J	0.17		0.08	J	0.11		0.08		0.09		0.12		0.30		0.48		0.43		0.53	
PCB 44	0.4	0.14		0.18		0.12		0.23		0.11		0.12		0.18		0.12		0.56		0.43		0.56		0.44		0.53	
PCB 49	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.01	J	0.05	ND	0.05	ND	0.25		0.22		0.34		0.38		0.50	
PCB 52	0.4	0.07		0.06		0.04		0.48		0.08		0.08		0.10		0.08		1.47		1.23		1.30		1.59		1.58	
PCB 66	0.4	0.05	ND	0.03	J	0.04	J	0.12		0.09		0.07		0.06		0.07		0.24		0.31		0.46		0.32		0.40	
PCB 87	0.4	0.04	J	0.05		0.09		0.06		0.05	J	0.07		0.04	J	0.04	J	0.43		0.84		0.51		0.38		0.49	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.02	J	0.02	J	1.31		1.29		1.24		1.48		1.31	
PCB 105	0.4	0.07	ND	0.02	J	0.02	J	0.04	J	0.03	J	0.03	J	0.02	J	0.02	J	0.28		0.31		0.22		0.29		0.25	
PCB 118	0.4	0.06	ND	0.02	J	0.06	ND	0.11		0.05	J	0.04	J	0.04	J	0.04	J	0.81		0.82		0.86		0.75		0.73	
PCB 128	0.4	0.16	ND	0.16	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.16	ND	0.15	ND	0.16	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND
PCB 138	0.4	0.07	ND	0.15		0.15		0.30		0.18		0.18		0.13		0.27		0.17		0.13		0.15		0.27		0.36	
PCB 153	0.4	0.12	ND	0.05	J	0.03	J	0.21		0.07	J	0.11	J	0.08	J	0.09	J	0.67		0.59		0.53		0.65		0.66	
PCB 170	0.4	0.06	ND	0.06	ND	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.03	J	0.06	ND		J	0.06	ND	0.06	ND	0.06	ND
PCB 180	0.4	0.07	ND	0.08		0.08		0.13		0.08		0.09		0.07		0.08		0.23		0.21		0.27		0.23		0.27	
PCB 183	0.4	0.06	ND	0.01	J	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.16		0.15		0.07		0.07	
PCB 184	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.05	J	0.08	ND	0.09	ND	0.09	ND
PCB 187	0.4	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.12		0.13		0.14		0.14		0.21	
PCB 195	0.4	0.06	ND	0.02	J	0.01	J	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.02	J	0.03	J	0.03	J	0.07		0.05	J	0.06	J
PCB 206	0.4	0.06	ND	0.00	J	0.01	J	0.02	J	0.06	ND	0.06	ND	0.06	ND	0.01	J	0.06		0.07		0.06		0.05	J	0.06	
PCB 209	0.4	0.06	J	0.05	J	0.07		0.06	J	0.06	ND	0.06	J	0.04	J	0.05	J	0.08		0.10		0.09		0.08		0.12	
Total PCB		4.180		3.800		3.780		6.100		4.240		4.320		4.180		4.100		16.440		15.560		16.260		18.880		18.100	
1,4-Dichlorobenzene	0.4	1.47	ND	0.64		0.57	ND	0.83		0.84		0.71		1.05		0.64		0.84		0.58	ND	0.76		0.86	ND	0.64	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022575		2022576		2022577		2022578		2022579	
Battelle ID #		U0554		U0555		U0556		U0217		U0218		U0219		U0220		U0221		U0222		U0223		U0224		U0225 NF		U0226	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.78	ND	1.84		1.47		3.45		2.88		2.10		2.78		2.79		12.18		15.87		12.07		16.35		11.58	
Acenaphthylene	4	0.06	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.11	J	0.03	ND	1.33		1.93		1.31		2.55		1.65	
Acenaphthene	4	0.25	J	0.04	ND	0.33	J	1.09		1.01		0.80		0.99		0.92		64.79		75.50		50.80		79.83		68.07	
Fluorene	4	0.24	J	0.30	J	0.29	J	0.85		0.59		0.38	J	0.56	J	0.58	J	72.11		74.05		50.72		86.15		74.54	
Phenanthrene	4	0.96	J	1.63		0.98		1.90		1.69		1.24		1.71		1.59		418.96		413.99		291.64		481.17		430.91	
Anthracene	4	0.12	J	0.13	J	0.09	J	0.32		0.15	J	0.13	J	0.31	J	0.33	J	73.49		68.52		48.22		88.69		66.55	
Fluoranthene	4	2.51		2.96		2.80		2.97		2.60		2.00		2.34		3.05		485.31		568.40		352.66		541.46		419.26	
Pyrene	4	1.77		2.02		2.04		2.59		2.18		2.23		2.08		2.48		294.82		299.22		195.14		306.91		244.35	
Benzo(a)anthracene	4	0.23	J	0.23	J	0.18	J	0.86		0.33	J	0.24	J	0.36	J	0.31	J	99.88		111.09		76.13		140.24		93.01	
Chrysene	4	0.70	J	0.87		0.71		1.56		0.94		0.94		0.98		1.14		93.23		102.61		72.59		124.10		88.80	
Benzo(b)fluoranthene	4	0.07	ND	0.61		0.27	J	0.93		0.47	J	0.38	J	0.38	J	0.49	J	26.84		33.21		18.13		34.22		21.19	
Benzo(k)fluoranthene	4	0.06	ND	0.33	J	0.17	J	0.86		0.27	J	0.33	J	0.31	J	0.39	J	15.22		19.98		12.47		19.39		14.37	
Benzo(a)pyrene	4	0.10	ND	0.18	J	0.07	J	0.77		0.23	J	0.25	J	0.25	J	0.26	J	21.60		27.55		15.19		31.00		18.36	
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.02	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	3.47		2.29		3.17		2.45	
Dibenzo(a,h)anthracene	4	0.07	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	1.50		1.13		1.94		1.10	
Benzo(g,h,i)perylene	4	0.05	ND	0.37	J	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	2.30		4.14		3.17		6.60		3.60	
Total PAH's		9.050		11.590		9.490		17.840		13.310		10.918		13.220		14.420		1642.120		1821.030		1205.660		1963.770		1569.990	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022575		2022576		2022577		2022578		2022579	
Philip Analytical ID #		080375 02		080376 02		080377 02		080356 02		080357 02		080358 02		080359 02		080360 02		080361 02		080362 02		080363 02		080364 02		080365 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.33	ND	0.24	ND	0.22	ND	0.22	ND	0.30	ND	0.18	ND	0.26	ND	1.30	ND	0.41	ND	0.56	ND	0.43	ND	0.43	ND	0.33	ND
12378 PeCDD	5	0.32	ND	0.29	ND	0.22	ND	0.28	ND	0.55	J	0.19	ND	0.27	ND	1.10	ND	0.23	ND	0.42	ND	0.30	ND	0.32	ND	0.35	ND
123478 HxCDD	5	0.23	ND	0.25	ND	0.28	J	0.27	ND	0.30	ND	0.33	ND	0.30	ND	0.46	ND	0.24	ND	0.31	ND	0.21	ND	0.27	ND	0.20	ND
123678 HxCDD	5	0.23	ND	0.25	ND	0.33	J	0.26	ND	0.65	J	0.31	ND	0.28	ND	0.43	ND	0.24	ND	0.31	ND	0.21	ND	0.27	ND	0.20	ND
123789 HxCDD	5	0.21	ND	0.24	ND	0.41	ND	0.24	ND	0.42	J	0.29	ND	0.27	ND	0.41	ND	0.22	ND	0.28	ND	0.19	ND	0.25	ND	0.18	ND
1234678 HpCDD	5	0.65	J	0.74	J	1.5	J	1.10	J	2.10	J	0.32	J	2.00	J	0.62	ND	0.70	J	0.70	J	0.61	J	0.63	ND	0.63	J
12346789 OCDD	10	2.30	J	3.1	J	9.0	J	7.80	J	5.40	J	1.20	J	48.00		8.50	J	5.20	J	6.30	J	4.30	J	6.40	J	4.80	J
2378 TCDF	1	0.22	ND	0.15	ND	0.13	ND	0.16	ND	1.50	J	0.28	ND	0.51	ND	1.50	ND	0.33	ND	0.49	ND	0.43	J	0.30	ND	0.28	ND
12378 PeCDF	5	0.24	ND	0.20	ND	0.17	ND	0.52	ND	1.50	J	0.52	ND	0.35	ND	1.20	ND	0.22	ND	0.47	ND	0.30	ND	0.30	ND	0.37	ND
23478 PeCDF	5	0.25	ND	0.21	ND	0.28	J	0.53	ND	1.30	J	0.54	ND	0.36	ND	1.30	ND	0.23	ND	0.50	ND	0.32	ND	0.32	ND	0.39	ND
123478 HxCDF	5	0.28	ND	0.20	ND	0.56	ND	0.55	J	5.00	J	0.18	J	0.28	ND	0.48	ND	0.72	ND	0.38	ND	0.22	ND	0.34	ND	0.40	ND
123678 HxCDF	5	0.20	J	0.14	ND	0.24	ND	0.33	ND	2.20	J	0.15	ND	0.26	ND	0.48	ND	0.16	ND	0.24	ND	0.17	ND	0.20	ND	0.15	ND
234678 HxCDF	5	0.19	J	0.16	ND	0.46	J	0.39	ND	0.82	J	0.17	ND	0.31	ND	0.54	ND	0.19	ND	0.28	ND	0.20	ND	0.23	ND	0.18	ND
123789 HxCDF	5	0.18	J	0.18	ND	0.26	J	0.43	ND	0.22	ND	0.19	ND	0.34	ND	0.60	ND	0.21	ND	0.31	ND	0.23	ND	0.26	ND	0.20	ND
1234678 HpCDF	5	0.32	ND	0.51	ND	0.91	ND	1.10	J	7.20	J	0.22	J	0.37	J	0.35	ND	0.55	ND	0.58	ND	0.42	ND	0.43	ND	0.38	ND
1234789 HpCDF	5	0.26	ND	0.43	J	0.51	ND	0.34	ND	1.00	J	0.20	ND	0.22	ND	0.44	ND	0.47	ND	0.54	ND	0.25	ND	0.51	ND	0.26	ND
12346789 OCDF	10	1.10	ND	2.8	J	6.2	J	15.00	J	14.00	J	0.71	J	1.20	J	3.10	J	0.92	J	0.67	ND	0.47	ND	0.52	ND	0.59	J

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Nereis virens																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021766		2021767		2021768		2021769		2021770	
Battelle ID #		V7425		V7426		V7427		V7428		V7429		V7430		V7431		V7432		V7434		V7435		V7436		V7437		V7447	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.018		0.015		0.018		0.039		0.030		0.036		0.034		0.030		0.020		0.017		0.015		0.018		0.023	
Arsenic	1	2.833		2.969		2.816		3.833		3.884		3.760		3.821		3.729		3.117		3.001		3.033		3.022		3.706	
Cadmium	0.1	0.044		0.033		0.037		0.050		0.048		0.052		0.040		0.043		0.047		0.047		0.043		0.048		0.061	
Chromium	0.2	0.533		0.471		0.489		0.433		0.425		0.317		0.520		0.382		0.410		0.310		0.342		0.348		0.603	
Copper	1	1.095		0.786		0.853		1.265		1.293		1.454		1.429		1.321		1.293		1.218		1.294		1.164		1.426	
Mercury	0.02	0.015		0.014		0.013		0.018		0.016		0.019		0.016		0.018		0.017		0.016		0.014		0.016		0.014	
Nickel	0.1	0.213		0.214		0.206		0.179		0.190		0.178		0.274		0.214		0.299		0.242		0.320		0.301		0.333	
Lead	0.1	0.132		0.087		0.098		0.106		0.126		0.118		0.134		0.119		0.110		0.192		0.115		0.115		0.103	
Zinc	1	17.936		18.050		20.616		29.869		15.351		34.957		24.578		20.396		57.438		18.325		24.819		26.642		34.193	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.06	ND	0.07	ND	0.11	ND	0.07	ND	0.04	ND	0.05	ND	0.05	ND	0.06	ND	0.04	ND	0.04	ND
a-Chlordane	0.4	0.12		0.13		0.15		0.15		0.14		0.23		0.10		0.11		0.14		0.08		0.13		0.16		0.11	
trans Nonachlor	0.4	0.47		0.47		0.50		0.44		0.47		0.64		0.35		0.33		0.40		0.35		0.41		0.42		0.40	
Dieldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.24		0.36		0.39		0.06	ND	0.21		0.26		0.25		0.29		0.26		0.26	
4,4'-DDT	0.4	0.08		0.12		0.34		0.12		0.24		0.12	ND	0.08	ND	0.05	ND	0.05	ND	0.09		0.07	ND	0.04	ND	0.08	
2,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.10	ND	0.16	ND	0.16		0.08	ND	0.07	ND	0.07	ND	0.09	ND	0.06	ND	0.06	ND
4,4'-DDD	0.4	0.07	ND	0.07	ND	0.07	ND	0.17		0.15		0.31		0.13		0.10		0.06	ND	0.08	ND	0.11	ND	0.07	ND	1.29	
2,4'-DDD	0.4	0.05	ND	0.04	ND	0.05	ND	0.29		0.18		0.18		0.08	ND	0.05	ND	0.39		0.42		0.45		0.44		0.34	
4,4-DDE	0.4	0.06		0.07		0.13		0.05	J	0.10	ND	1.00		0.11	ND	0.03	J	1.75		1.74		1.74		1.58		1.63	
2,4'-DDE	0.4	0.16	ND	0.15	ND	0.15	ND	0.16	ND	0.26	ND	0.44	ND	0.28	ND	0.17	ND	0.20		0.18	ND	0.25	ND	0.16	ND	0.06	J
Total DDT		0.480		0.510		0.800		0.870		1.030		2.210		0.840		0.480		2.540		2.583		2.710		2.350		3.374	
Endosulfan I	0.4	0.06	ND	0.05	ND	0.06	ND	0.06	ND	0.10	ND	0.16	ND	0.10	ND	0.06	ND	0.07	ND	0.07	ND	0.09	ND	0.06	ND	0.06	ND
Endosulfan II	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.10	ND	0.10	ND	0.13	ND	0.08	ND	0.09	ND
Endosulfan sulfate	0.4	0.13		0.27		0.22		0.47		0.59		0.58		0.13	J	0.17		0.11	ND	0.11	ND	0.14	ND	0.21		0.09	ND
Heptachlor	0.4	0.16		0.12		0.05	ND	0.89		1.39		1.64		0.08	ND	0.05	ND	0.05	ND	0.06	ND	0.07	ND	0.05	ND	0.05	ND
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.04	ND	0.05	ND	0.09	ND	0.06	ND	0.04		0.04	ND	0.04	ND	0.05	ND	0.03	ND	0.03	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

B - Analyte concentration in blank > 3 times target

TABLE 8 continued		28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE NWS- Pier 3 Replacement Reach 1																													
		Nereis virens																													
		PRETEST						REFERENCE												REACH 1 TEST											
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021766		2021767		2021768		2021769		2021770	
Battelle ID#		V7425		V7426		V7427		V7428		V7429		V7430		V7431		V7432		V7434		V7435		V7436		V7437		V7447	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.55	ND	0.53	ND	0.54	ND	0.62	ND	0.92	ND	1.54	ND	0.99	ND	0.60	ND	0.65	ND	0.65	ND	0.87	ND	0.55	ND	0.56	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.17	ND	0.11	ND	0.06	ND	0.07	ND	0.07	ND	0.09	ND	0.06	ND	0.06	ND
PCB 28	0.4	0.08	ND	0.07	ND	0.08	ND	0.10		0.12	J	0.22	ND	0.10	J	0.11		0.31		0.27		0.31		0.31		0.28	
PCB 44	0.4	0.05	ND	0.05	ND	0.05	ND	0.12		0.14		0.25		0.14		0.13		0.06	ND	0.06	ND	0.08	ND	0.34		0.29	
PCB 49	0.4	0.05	ND	0.04	ND	0.04	ND	0.24		0.17		0.13	ND	0.08	ND	0.05	ND	0.51		0.30		0.38		0.35		0.38	
PCB 52	0.4	0.04	ND	0.04	ND	0.04	ND	0.14		0.22		0.24		0.16		0.11		0.69		0.63		0.69		0.75		0.70	
PCB 66	0.4	0.05	ND	0.06	ND	0.05	ND	0.13		0.06	J	0.08	J	0.09	ND	0.05	J	0.06	ND	0.06	ND	0.08	ND	0.05	ND	0.05	ND
PCB 87	0.4	0.05	ND	0.05	ND	0.05	ND	0.07		0.11		0.14		0.09	ND	0.05	ND	0.14		0.16		0.18		0.16		0.15	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.26		0.29		0.49		0.31		0.23		1.24		0.62		0.64		0.83		0.67	
PCB 105	0.4	0.25		0.26		0.28		0.20		0.27		0.31		0.17		0.08	ND	0.34		0.31		0.28		0.33		0.30	
PCB 118	0.4	0.37		0.27		0.35		0.26		0.29		0.35		0.18		0.18		0.07	ND	0.07	ND	0.10	ND	0.06	ND	0.06	ND
PCB 128	0.4	0.15	ND	0.15	ND	0.15	ND	0.17	ND	0.28	ND	0.17	J	0.27	ND	0.17	ND	0.05	J	0.07	J	0.24	ND	0.04	J	0.15	ND
PCB 138	0.4	1.50		1.72		1.72		1.85		1.76		2.30		1.33		1.46		1.96		1.68		2.01		1.89		1.69	
PCB 153	0.4	2.04		2.13		2.28		2.24		2.34		2.70		1.77		1.98		2.46		2.06		2.57		2.41		2.47	
PCB 170	0.4	0.37		0.40		0.40		0.40		0.40		0.48		0.34		0.41		0.40		0.22		0.40		0.41		0.39	
PCB 180	0.4	1.19		1.23		1.29		1.25		1.31		1.82		0.97		1.15		1.46		1.17		1.42		1.41		1.41	
PCB 183	0.4	0.31		0.33		0.32		0.33		0.34		0.38		0.27		0.35		0.33		0.31		0.42		0.44		0.43	
PCB 184	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.10	ND	0.10	ND	0.13	ND	0.08	ND	0.09	ND
PCB 187	0.4	0.53		0.60		0.56		0.53		0.58		0.69		0.41		0.51		0.65		0.54		0.69		0.71		0.63	
PCB 195	0.4	0.10		0.11		0.11		0.12		0.14		0.18		0.12		0.13		0.15		0.15		0.17		0.18		0.14	
PCB 206	0.4	0.14		0.16		0.15		0.18		0.18		0.24		0.18		0.19		0.30		0.19		0.24		0.29		0.28	
PCB 209	0.4	0.13		0.23		0.29		0.28		0.22		0.15	J	0.13		0.18		0.27		0.10		0.14		0.29		0.16	
Total PCB		15.290		17.200		17.780		19.300		20.720		26.140		15.720		16.540		24.540		19.620		24.220		23.880		22.984	
1,4-Dichlorobenzene	0.4	1.43	ND	1.37	ND	1.39	ND	1.06	ND	2.27	ND	4.01	ND	1.16		0.85		1.58	ND	1.68	ND	2.28	ND	0.85		1.45	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

Nereis virens

		PRETEST						REFERENCE					
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763	
Battelle ID#		V7425-R1		V7426-R1		V7427-R1		V7428-R1		V7429-R1		V7430-R1	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.73	ND	1.67	ND	1.69	ND	3.85		3.13		4.91	
Acenaphthylene	4	0.11	J	0.13	J	0.10	J	0.09	ND	0.13	J	0.23	ND
Acenaphthene	4	1.00	J	0.88	J	1.07	J	1.66		1.59	J	3.52	J
Fluorene	4	0.34	J	0.36	J	0.41	J	0.34	J	0.33	J	0.67	J
Phenanthrene	4	0.78	J	0.79	J	0.68	J	0.75	ND	1.07	ND	1.90	ND
Anthracene	4	0.07	ND	0.06	ND	0.08	ND	0.07	ND	0.10	ND	0.18	ND
Fluoranthene	4	2.17		1.60		2.01		0.95	ND	1.35	ND	2.39	ND
Pyrene	4	2.58		1.74		2.00		0.67	J	0.88	ND	1.56	ND
Benzo(a)anthracene	4	0.07	ND	0.15	J	0.16	J	0.17	J	0.17	J	0.64	J
Chrysene	4	1.75		1.33	J	1.45		0.45	J	0.69	J	0.57	J
Benzo(b)fluoranthene	4	0.38	J	0.29	J	0.41	J	0.08	ND	0.11	ND	0.20	ND
Benzo(k)fluoranthene	4	0.44	J	0.28	J	0.42	J	0.09	ND	0.13	ND	0.23	ND
Benzo(a)pyrene	4	0.10	ND	0.09	ND	0.21	J	0.11	ND	0.15	ND	0.27	ND
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.04	ND	0.20	J	0.04	ND	0.18	J	0.10	ND
Dibenzo(a,h)anthracene	4	0.07	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.18	ND
Benzo(g,h,i)perylene	4	0.46	J	0.37	J	0.05	ND	0.14	J	0.30	J	0.38	J
Total PAH's		12.870		9.830		11.190		9.540		10.410		17.910	

	REFERENCE				REACH 1 TEST									
CONSTITUENTS	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #	2021764		2021765		2021766		2021767		2021768		2021769		2021770	
Battelle ID#	V7431		V7432		V7434-R1		V7435-R1		V7436-R1		V7437		V7447-R1	
PAH's (wet weight)	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	3.97		3.82		14.90		4.92		6.57		4.80		8.43	
Acenaphthylene	0.13	J	0.12	J	0.68	J	0.44	J	0.45	J	0.52	J	0.57	J
Acenaphthene	1.18		1.54		49.47		25.07		24.41		25.88		33.48	
Fluorene	0.27	J	0.31	J	14.21		5.49		4.74		5.44		6.97	
Phenanthrene	0.49	ND	0.41	J	48.69		25.59		22.75		26.68		29.47	
Anthracene	0.05	ND	0.03	ND	3.29		2.38		1.53	J	2.06		2.50	
Fluoranthene	0.61	ND	0.37	ND	129.72		107.21		115.30		94.88		120.32	
Pyrene	0.40	ND	0.26	J	55.51		45.66		54.26		43.59		51.73	
Benzo(a)anthracene	0.31	J	0.24	J	5.05		5.20		4.26		3.92		4.74	
Chrysene	0.14	J	0.22	J	16.85		15.66		16.06		14.90		17.16	
Benzo(b)fluoranthene	0.05	ND	0.03	ND	2.80		2.58		2.74		2.09		2.56	
Benzo(k)fluoranthene	0.06	ND	0.04	ND	2.45		2.43		2.63		2.40		2.41	
Benzo(a)pyrene	0.07	ND	0.04	ND	1.57	J	1.95		1.48	J	1.81		1.79	
Indeno(1,2,3-cd)pyrene	0.03	ND	0.02	ND	0.40	J	0.50	J	0.52	J	0.34	J	0.52	J
Dibenzo(a,h)anthracene	0.05	ND	0.03	ND	0.10	J	0.13	J	0.17	J	0.15	J	0.16	J
Benzo(g,h,i)perylene	0.04	ND	0.02	ND	0.70	J	0.63	J	0.68	J	0.49	J	0.78	J
Total PAH's	7.850		7.500		346.390		245.840		258.590		229.780		283.590	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Nereis virens																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	R1	Q	R2	Q	R3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021766		2021766		2021767		2021768		2021769		2021770	
Philip Analytical ID #		078515 02		078516 02		078517 02		078519 02		078520 02		078521 02		078522 02		078523 02		078528 02		078529 02		078530 02		078531 02		078541 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.16	ND	0.20	J	0.23	ND	0.80	ND	0.86	ND	1.30	ND	2.00	ND	0.34	ND	0.33	ND	0.39	ND	0.29	ND	0.23	ND	0.85	ND
12378 PeCDD	5	0.17	ND	0.16	ND	0.20	ND	0.76	ND	0.70	ND	1.50	ND	2.30	ND	0.29	ND	0.36	ND	0.52	ND	0.37	ND	0.31	ND	1.80	ND
123478 HxCDD	5	0.31	ND	0.14	ND	0.12	ND	1.10	ND	0.42	ND	1.20	ND	2.10	ND	0.20	ND	0.36	ND	0.39	ND	0.27	ND	0.31	ND	3.13	ND
123678 HxCDD	5	0.29	ND	0.45	J	0.42	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.36	J	0.50	J	0.37	ND	0.25	ND	0.36	ND	3.13	ND
123789 HxCDD	5	0.29	ND	0.22	J	0.18	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.18	ND	0.26	ND	0.37	ND	0.25	ND	0.29	ND	2.87	ND
1234678 HpCDD	5	1.90	J	2.00	J	1.90	ND	1.90	J	1.00	J	1.40	J	1.60	ND	1.70	J	2.00	J	1.40	ND	1.60	ND	2.10	J	3.17	
12346789 OCDD	10	11.00	J	10.00	J	12.00	J	11.00	J	6.70	J	5.10	J	8.20	J	13.00	J	13.00	J	11.00	ND	21.00		16.00	J	19.33	
2378 TCDF	1	1.50	J	1.50	J	1.70	J	2.20	J	1.30	J	1.30	J	1.50	ND	1.30	J	1.70	J	2.10		1.60	J	1.50	J	1.57	J
12378 PeCDF	5	0.51	ND	0.28	ND	0.50	ND	0.84	ND	0.67	ND	1.40	ND	1.80	ND	0.27	ND	0.91	J	0.35	ND	0.27	ND	0.36	ND	1.10	ND
23478 PeCDF	5	0.40	J	0.44	J	0.44	J	0.88	ND	0.70	ND	1.40	ND	1.90	ND	0.45	J	0.40	J	0.37	ND	0.56	ND	0.27	ND	1.16	ND
123478 HxCDF	5	0.11	ND	0.11	ND	0.12	ND	0.51	ND	0.25	ND	0.75	ND	1.30	ND	0.85	ND	0.27	ND	0.35	ND	0.21	ND	0.21	ND	2.13	ND
123678 HxCDF	5	1.40	ND	0.88	ND	1.90	ND	1.90	ND	0.63	ND	1.60	ND	2.10	ND	0.16	ND	0.27	ND	0.35	ND	0.21	ND	1.80	ND	2.07	ND
234678 HxCDF	5	0.13	ND	0.20	J	0.14	ND	0.51	ND	0.30	ND	0.90	ND	1.50	ND	0.16	ND	0.32	ND	0.42	ND	0.25	ND	0.25	ND	2.43	ND
123789 HxCDF	5	0.14	ND	0.15	ND	0.16	ND	0.67	ND	0.32	ND	0.99	ND	1.70	ND	0.20	ND	0.35	ND	0.46	ND	0.28	ND	0.28	ND	2.70	ND
1234678 HpCDF	5	2.40	J	0.86	ND	1.00	ND	0.74	ND	0.51	ND	0.97	ND	2.00	ND	0.93	ND	0.57	ND	0.59	ND	0.82	ND	0.86	ND	15.87	
1234789 HpCDF	5	1.10	ND	0.22	ND	0.27	J	0.97	ND	0.59	ND	1.30	ND	2.80	ND	0.37	ND	0.34	ND	0.54	ND	0.25	ND	0.27	ND	5.23	ND
12346789 OCDF	10	0.98	J	0.99	J	2.00	J	1.20	ND	0.72	ND	1.50	ND	2.60	ND	1.20	J	0.87	ND	0.74	J	2.20	J	1.90	ND	300.00	

= Value from second column confirmation

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

Q = Indicates presence of QC ion instabilities caused by quantitative interferences

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

PUBLIC NOTICE TABLES

REACH 2

TABLE 1. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

NWS Pier 3 Replacement Reach 2

	SITE WATER		ELUTRIATE	
CONSTITUENTS	DETECTION LIMITS	CONCENTRATION	DETECTION LIMITS	CONCENTRATION
Metals	ppb	ppb	ppb	ppb
Ag		0.013		0.016
Cd		0.554		0.026
Cr		0.392		0.787
Cu		1.50		0.94
Hg		0.003		0.009
Ni		0.85		2.04
Pb		0.877		0.669
Zn		4.56		2.51
Pesticides	pptr (ng/L)	pptr (ng/L)	pptr (ng/L)	pptr (ng/L)
Aldrin	2.83	ND	2.83	ND
a-Chlordane		0.5		0.296
trans Nonachlor	1.01	ND		0.136
Dieldrin	0.98	ND	0.98	ND
4,4'-DDT	0.56	ND	0.56	ND
2,4'-DDT	1.99	ND	1.99	ND
4,4'-DDD	0.60	ND	0.60	ND
2,4'-DDD	0.75	ND	0.75	ND
4,4'-DDE		1.9		4.48
2,4'-DDE	1.71	ND	1.71	ND
Total DDT		4.7		7.3
Endosulfan I	1.11	ND	1.11	ND
Endosulfan II	0.51	ND	0.51	ND
Endosulfan sulfate	0.57	ND	0.57	ND
Heptachlor	1.17	ND	1.17	ND
Heptachlor epoxide	0.95	ND	0.95	ND
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)	pptr (ng/L)	pptr (ng/L)
PCB 8	16.00	ND	16.00	ND
PCB 18		1.14		2.25
PCB 28	1.73	ND		0.8
PCB 44	1.45	ND	1.45	ND
PCB 49		0.25		0.88
PCB 52	1.44	ND	1.44	ND
PCB 66	1.49	ND	1.49	ND
PCB 87	1.13	ND	1.13	ND
PCB 101	1.15	ND		0.70
PCB 105	0.58	ND	0.58	ND
PCB 118	0.87	ND		0.19
PCB 128	1.40	ND		0.26
PCB 138	1.33	ND		0.81
PCB 153	1.07	ND		0.63
PCB 170	1.02	ND	1.02	ND
PCB 180	0.96	ND	0.96	ND
PCB 183	0.93	ND	0.93	ND
PCB 184	0.92	ND	0.92	ND
PCB 187		0.18		0.28
PCB 195	1.09	ND		0.25
PCB 206	1.22	ND	1.22	ND
PCB 209	1.27	ND	1.27	ND
Total PCB		77.2		70.9

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.

TABLE 2 — **NWS Pier 3 Reconstruction** / **TOXICITY TEST RESULTS** / **Reach 2** — **ASI JOB No. 22-245**

Suspended Particulate Phase

Test Species	Test Duration	LC50/EC50	LPC (a)
Menidia beryllina	96 hours	(b) 60.0%	0.60
Mysidposis bahia	96 hours	(b) >100%	1.00
Mytilus edulis (larval survival)	48 hours	(b) >100%	1.00
Mytilus edulis (larval normal develop.)	48 hours	(c) 20.0%	0.20

(a) Limiting Permissible Concentration (LPC) is the LC 50 or EC 50 times 0.01.

(b) Median Lethal Concentration (LC50) resulting in 50% mortality at test termination.

(c) Median Effective Concentration (EC50) based on normal development to the D-cell, prodissoconch 1 stage.

Whole Sediment (10 days)

Test Species	% Survival in Reference	% Survival	% Difference Reference -Test	Is difference statistically significant? (a=0.05)
Ampelisca abdita	96%	94%	2%	No
Mysidopsis bahia	100%	85%	15%	No

Table 2.xls

NWS EARLE Pier 3 Replacement, Reach 2
TABLE 3. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
Wet weight concentrations

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
Metals	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
Ag		0.04		0.04		0.03		0.02
As		2.51		* 3.05		3.81		2.85
Cd		0.03		0.03		0.05		0.05
Cr		0.61		0.68		0.42		0.40
Cu		1.97		2.08		1.35		1.11
Hg		0.01		* 0.01		0.02		0.01
Ni		0.34		* 0.48		0.21		* 0.27
Pb		0.21		* 0.41		0.12		0.14
Zn		12.74		13.43		25.03		32.27
Pesticides	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Aldrin		0.02	0.04	ND	0.07	ND	0.04	ND
a-Chlordane		0.06	0.04	ND		0.15		* 0.29
trans Nonachlor		0.02		* 0.16		0.45		0.49
Dieldrin		0.10		0.04		0.25		0.33
4,4'-DDT		0.04	0.04	ND		0.10		* 0.18
2,4'-DDT	0.06	ND	0.06	ND		0.07	0.06	ND
4,4'-DDD		0.08		* 0.63		0.17		* 2.29
2,4'-DDD		0.05		* 0.20		0.14		* 0.83
4,4'-DDE		0.09		* 2.99		0.24		* 3.90
2,4'-DDE	0.16	ND		0.20	0.27	ND	0.17	ND
Total DDT		**0.37**		* **4.07**		**0.81**		* **7.32**
Endosulfan I	0.06	ND		0.09	0.10	ND	0.06	ND
Endosulfan II	0.08	ND	0.09	ND	0.14	ND	0.09	ND
Endosulfan sulfate		0.11		0.20		0.39		0.37
Heptachlor	0.05	ND	0.05	ND		0.80		0.03
Heptachlor epoxide	0.03	ND	0.03	ND		0.03	0.03	ND
Industrial Chemicals	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
PCB 8	0.55	ND	0.55	* ND	0.93	ND	0.59	* ND
PCB 18		0.04		0.13	0.10	ND		* 1.28
PCB 28		0.11		* 2.00		0.11		* 2.55
PCB 44		0.15		* 1.19		0.16		* 2.04
PCB 49		0.02		* 1.40		0.11		* 2.22
PCB 52		0.16		* 3.32		0.17		* 4.18
PCB 66		0.08		* 1.32		0.07		* 2.26
PCB 87		0.05		* 0.65		0.08		* 0.85
PCB 101		0.02		* 1.95		0.32		* 3.65
PCB 105		0.03		* 0.54		0.20		* 1.17
PCB 118		0.06		* 1.24		0.25		* 2.15
PCB 128	0.15	ND	0.15	ND		0.12		0.20
PCB 138		0.21		* 0.43		1.74		* 3.25
PCB 153		0.11		* 0.99		2.21		* 4.07
PCB 170		0.03	0.06	ND		0.41		* 0.72
PCB 180		0.09		* 0.29		1.26		* 2.12
PCB 183		0.03		* 0.16		0.33		* 0.76
PCB 184	0.08	ND	0.09	ND	0.14	ND	0.09	ND
PCB 187	0.07	ND		* 0.28		0.54		* 1.26
PCB 195		0.03		* 0.07		0.14		* 0.27
PCB 206		0.02		0.03		0.19		* 0.32
PCB 209		0.05		0.06		0.19		* 0.28
Total PCB		**2.90**		* **33.50**		**17.44**		* **72.46**
1,4-Dichlorobenzene		0.81		* 1.04		0.40		* 0.88

TABLE 3. (Continued) **Reach 2**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
PAH's	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Naphthalene		2.80		* 14.61		3.94		* 15.79
Acenaphthylene		0.03		* 1.64		0.11		* 2.21
Acenaphthene		0.92		* 65.65		1.90		* 124.72
Fluorene		0.55		* 66.16		0.38		* 37.62
Phenanthrene		1.61		* 394.42		0.50		* 162.25
Anthracene		0.25		* 70.95	0.09	ND		* 25.51
Fluoranthene		2.59		* 924.88	1.13	ND		* 668.93
Pyrene		2.31		* 518.00		0.47		* 341.17
Benzo(a)anthracene		0.38		* 148.40		0.31		* 33.42
Chrysene		1.11		* 127.91		0.41		* 98.05
Benzo(b)fluoranthene		0.53		* 54.33	0.09	ND		* 15.69
Benzo(k)fluoranthene		0.43		* 34.27	0.11	ND		* 14.83
Benzo(a)pyrene		0.35		* 37.32	0.13	ND		* 12.36
Indeno(1,2,3-cd)pyrene	0.01	ND		* 4.63		0.06		* 1.87
Dibenzo(a,h)antracene	0.03	ND		* 1.68	0.09	ND		* 0.77
Benzo(g,h,i)perylene	0.02	ND		* 4.60		0.17		* 3.67
Total PAH's		**13.90**		* **2469.44**		**9.06**		* **1558.87**
Dioxins	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)
2378 TCDD	0.45	ND	0.86	* ND	1.02	ND		* 0.86
12378 PeCDD		0.29	0.94	ND	1.11	ND	0.80	ND
123478 HxCDD	0.33	ND	0.67	* ND	1.00	ND	0.49	ND
123678 HxCDD		0.26	0.67	ND		0.53		0.48
123789 HxCDD		0.21	0.61	ND	0.95	ND	0.45	ND
1234678 HpCDD		1.17		0.68		1.36		1.28
1234789 OCDD		13.78		7.12		8.80		5.71
2378 TCDF		0.40	1.28	* ND		1.22		* 3.71
12378 PeCDF		0.56	0.82	ND	1.00	ND		0.48
23478 PeCDF		0.53	0.88	ND		0.58		* 1.03
123478 HxCDF		1.22		0.46	0.73	ND		* 3.90
123678 HxCDF		0.56	0.47	ND	1.28	ND	0.68	ND
234678 HxCDF		0.31	0.55	ND	0.70	ND		0.45
123789 HxCDF	0.36	ND	0.60	ND	0.78	ND	0.78	ND
1234678 HpCDF		1.81	0.74	ND	1.03	ND		1.72
1234789 HpCDF		0.32	0.74	ND	1.17	ND	0.86	ND
12346789 OCDF		6.80		2.05		0.84		* 39.80

ND = Not detected
Total PAH = Sum of all PAH's.
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level.

Physical and Chemical Analyses of Site Water, Elutriate, Bulk Sediment and Tissue

REACH 2

TABLE 9	RESULTS OF CHEMICAL ANALYSIS OF SITE WATER							
			NWS Pier 3 Replacement Reach 2					22-245
CONSTITUENTS	**DL'S**	**SINGLE**	**Q**	**DUPLICATE**	**Q**	**TRIPLICATE**	**Q**	**MEAN**
Battelle-Sequim ID#		V5853		V5853 Dup		V5853 Trip		
ASI ID#		2021430		2021430		2021430		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.016		0.014	ND	0.016		0.013
Cd	0.02	0.544		0.548		0.571		0.55
Cr	0.06	0.348		0.294		0.533		0.39
Cu	0.15	1.50		1.49		1.52		1.50
Hg	0.002	0.003		0.003		0.003		0.003
Ni	0.04	0.85		0.86		0.85		0.85
Pb	0.04	0.87		0.88		0.89		0.88
Zn	0.09	4.51		4.58		4.58		4.56
Battelle-ID#		V5853		V5853 Dup		V5853 Trip		
ASI ID#		2021430		2021430		2021430		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.53	J	0.45	J	0.38	J	0.45
trans Nonachlor	14.0	1.01	ND	1.01	ND	1.01	ND	0.51
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.00	2.81		1.47		1.53		1.93
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		5.603		4.268		4.321		4.730
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	1.15	J	1.33	J	0.93	J	1.14
PCB 28	0.50	1.73	ND	1.73	ND	1.73	ND	1.73
PCB 44	0.50	1.45	ND	1.45	ND	1.45	ND	1.45
PCB 49	0.50	0.20	J	0.25	J	0.30	J	0.25
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.49	ND	1.49	ND	1.49	ND	1.49
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	1.15	ND	1.15	ND	1.15	ND	1.15
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.87	ND	0.87	ND	0.87	ND	0.87
PCB 128	0.50	1.40	ND	1.40	ND	1.40	ND	1.40
PCB 138	0.50	1.33	ND	1.33	ND	1.33	ND	1.33
PCB 153	0.50	1.07	ND	1.07	ND	1.07	ND	1.07
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.96	ND	0.96	ND	0.96	ND	0.96
PCB 183	0.50	0.93	ND	0.93	ND	0.93	ND	0.93
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.22	J	0.16	J	0.15	J	0.18
PCB 195	0.50	1.09	ND	1.09	ND	1.09	ND	1.09
PCB 206	0.50	1.22	ND	1.22	ND	1.22	ND	1.22
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		77.161		77.502		76.790		77.151

ND = Not detected

J = Detection limit below the reporting limit or is an estimated value

E = Reporting limit raised due to matrix interference

B = Analyte detected in sample is <5x blank value

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 10 RESULTS OF CHEMICAL ANALYSIS OF ELUTRIATE

NWS Pier 3 Replacement Reach 2 — 22-245

CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		V5842/V5853		V5842/V5853		V5842/V5853		
ASI ID#		2021430/ 2021327		2021430/ 2021327		2021430/ 2021327		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.02		0.02		0.02		0.02
Cd	0.02	0.02		0.03		0.03		0.03
Cr	0.06	0.77		0.77		0.82		0.79
Cu	0.15	0.92		0.94		0.95		0.94
Hg	0.002	0.009		0.009		0.010		0.01
Ni	0.04	2.03		2.05		2.04		2.04
Pb	0.04	0.66		0.67		0.67		0.67
Zn	0.09	2.49		2.52		2.51		2.51
Battelle ID#		V5842/V5853		V5842/V5853		V5842/V5853		
ASI ID#		2021430/ 2021327		2021430/ 2021327		2021430/ 2021327		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.34	J	0.31	J	0.24	J	0.30
trans Nonachlor	14.0	0.15	J	0.14	J	0.12	J	0.14
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.0	4.33		5.03		4.06		4.48
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		7.13		7.83		6.86		7.27
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	2.87		2.48		1.39	ND	2.25
PCB 28	0.50	0.95	J	0.91	J	0.64	J	0.83
PCB 44	0.50	1.45	ND	1.45	ND	1.45	ND	1.45
PCB 49	0.50	0.56	J	0.60	J	1.49	ND	0.88
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.49	ND	1.49	ND	1.49	ND	1.49
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	0.83	J	0.67	J	0.61	J	0.70
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.16	J	0.25	J	0.15	J	0.19
PCB 128	0.50	0.22	J	0.29	J	0.27	J	0.26
PCB 138	0.50	0.89	J	0.92	J	0.62	J	0.81
PCB 153	0.50	0.65	J	0.67	J	0.57	J	0.63
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.96	ND	0.96	ND	0.96	ND	0.96
PCB 183	0.50	0.93	ND	0.93	ND	0.93	ND	0.93
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.30	J	0.30	J	0.25	J	0.28
PCB 195	0.50	0.29	J	0.24	J	0.21	J	0.25
PCB 206	0.50	1.22	ND	1.22	ND	1.22	ND	1.22
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		72.2		71.4		69.2		70.9

ND = Not detected
J = Detection limit below the reporting limit or is an estimated value
E = Reporting limit raised due to matrix interference
B = Analyte detected in sample is <5x blank value
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 11	RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT										
Maguire-NWS Pier 3 Replacement					Reach 2			ASI Job No. 22-245			
CONSTITUENTS	DL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
Battelle-Sequim ID#											
Battelle-Duxbury ID#		V5842			V5842			V5842			
ASI ID#		2021327			2021327			2021327			
Metals	ppm (ug/g)										ppm (ug/g)
Ag	0.04	1.34									1.34
As	0.3	20.2									20.2
Cd	0.02	0.86									0.86
Cr	0.04	110	B								110
Cu	0.1	89.8									89.8
Hg	0.0016	0.695									0.695
Ni	0.2	43.0									43.0
Pb	0.1	57.5									57.5
Zn	0.4	201.0									201.0
Pesticides	ppb (ng/g)	ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
Aldrin	0.035	0.05	ND								0.02
a-Chlordane	0.022	0.34									0.34
trans Nonachlor	0.044	0.14									0.14
Dieldrin	0.032	0.52									0.52
4,4'-DDT	0.040	0.14									0.14
2,4'-DDT	0.156	0.10	ND								0.05
4,4'-DDD	0.091	7.49									7.49
2,4'-DDD	0.042	3.10									3.10
4,4'-DDE	0.050	8.33									8.33
2,4'-DDE	0.154	0.10	ND								0.05
Total DDT		19.170			0.000			0.000			19.17
Endosulfan I	0.095	0.08	ND								0.04
Endosulfan II	0.043	0.08	ND								0.04
Endosulfan sulfate	0.047	0.08	ND								0.04
Heptachlor	0.056	0.06	ND								0.03
Heptachlor epoxide	0.020	0.06	ND								0.03
Industrial Chemicals		ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
PCB 8	0.080	2.04									2.04
PCB 18	0.084	2.70									2.70
PCB 28	0.048	5.07									5.07
PCB 44	0.075	3.46									3.46
PCB 49	0.069	9.42									9.42
PCB 52	0.084	4.41									4.41
PCB 66	0.051	3.40									3.40
PCB 87	0.023	1.25									1.25
PCB 101	0.129	3.95									3.95
PCB 105	0.053	1.26									1.26
PCB 118	0.048	2.67									2.67
PCB 128	0.048	0.68									0.68
PCB 138	0.062	2.57									2.57
PCB 153	0.084	3.61									3.61
PCB 170	0.047	0.08	ND								0.04
PCB 180	0.028	2.22									2.22
PCB 183	0.031	0.48									0.48
PCB 184	0.013	0.06	ND								0.03
PCB 187	0.019	1.00									1.00
PCB 195	0.024	0.07	ND								0.03
PCB 206	0.031	0.38									0.38
PCB 209	0.042	0.69									0.69
Total PCB		102.69			0.00			0.00			102.69
1-4, Dichlorobenzene		8.49									8.49

TABLE 11 Continued **RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT**

Maguire-NWS Pier 3 Replacement **Reach 2** **ASI Job No. 22-245**

CONSTITUENTS	MDL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
BATTELLE ID#		V5842			V5842			V5842			
ASI ID#		2021327			2021327			2021327			
PAH's	ppb (ng/g)	ppb (ng/g)									ppb (ng/g)
Naphthalene		2303.23	d								2303.23
Acenaphthylene		73.35									73.35
Acenaphthene		1987.51	d								1987.51
Fluorene		1303.82	d								1303.82
Phenanthrene		3896.07	d								3896.07
Anthracene		940.19									940.19
Fluoranthene		4508.90	d								4508.90
Pyrene		3177.40	d								3177.40
Benzo(a)anthracene		977.14									977.14
Chrysene		1049.28									1049.28
Benzo(b)fluoranthene		668.02									668.02
Benzo(k)fluoranthene		564.37									564.37
Benzo(a)pyrene		596.29									596.29
Indeno(1,2,3-c,d)pyrene		322.95									322.95
Dibenzo(a,h)anthracene		84.51									84.51
Benzo(g,h,i)perylene		251.82									251.82
Total PAH's		**22704.9**			**0.0**			**0.0**			**22704.87**
Philip A.S. ID #		**039488 02**			**039488 02**			**039488 02**			
ASI ID#		**2021327**			**2021327**			**2021327**			
Dioxins	pptr(pg/g)	pptr(pg/g)			pptr(pg/g)			pptr(pg/g)			pptr(pg/g)
2378 TCDD	-	4.9									4.9
12378 PeCDD		1.7									1.7
123478 HxCDD		1.4									1.4
123678 HxCDD		13									13
123789 HxCDD		5.4									5.4
1234678 HpCDD		120									120
12346789 OCDD		60									60
2378 TCDF		16									16
12378 PeCDF		3.0									3.0
23478 PeCDF		4.1									4.1
123478 HxCDF		9.5									9.5
123678 HxCDF		3.4									3.4
234678 HxCDF		2.3									2.30
123789 HxCDF		0.44	ND								0.2
1234678 HpCDF		51									51.0
1234789 HpCDF		2.7	ND								1.35
12346789 OCDF		1400									1400

B - Analyte concentration in blank > 3 times target
E - Estimate due to co- on chromotography column
J = Detection limit below the reporting limit or is an estimated value
ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values.
d - Analyte reported from a dilution.

TABLE 12 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

Job # 22-245

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 2 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022580		2022581		2022582		2022583		2022584	
Battelle ID #		U0554		U0555		U0556		U0217		U0218		U0219		U0220		U0221		U0227		U0228		U0229		U0230		U0231	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.036		0.026		0.028		0.046		0.046		0.058		0.031		0.033		0.037		0.033		0.041		0.041		0.053	
Arsenic	1.00	2.921		2.644		2.563		2.656		2.275		2.675		2.506		2.534		3.130		2.467		2.793		2.600		4.043	
Cadmium	0.10	0.030		0.030		0.031		0.022		0.024		0.029		0.029		0.026		0.035		0.025		0.023		0.034		0.039	
Chromium	0.20	0.267		0.248		0.312		0.683		0.530		0.655		0.427		0.539		0.583		0.838		0.614		0.623		0.750	
Copper	1.00	1.773		1.311		1.495		2.153		2.249		2.020		1.593		1.810		1.778		2.407		1.819		2.017		2.386	
Mercury	0.02	0.008		0.007		0.009		0.010		0.009		0.011		0.007		0.007		0.012		0.009		0.011		0.011		0.015	
Nickel	0.10	0.289		0.271		0.300		0.331		0.354		0.348		0.358		0.294		0.434		0.490		0.423		0.500		0.562	
Lead	0.10	0.118		0.092		0.119		0.250		0.226		0.209		0.174		0.188		0.411		0.415		0.344		0.384		0.481	
Zinc	1.00	11.829		11.403		12.166		11.935		13.019		12.855		14.263		11.641		12.670		13.495		11.144		15.206		14.657	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.01	J	0.03	J	0.04	ND	0.04	ND	0.02	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
a-Chlordane	0.4	0.09		0.09		0.10		0.08		0.07		0.08		0.06		0.05		0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.03	ND
trans Nonachlor	0.4	0.04	ND	0.02	J	0.03	J	0.02	J	0.04	ND	0.04	ND	0.01	J	0.01	J	0.04	ND	0.22		0.20		0.15		0.19	
Dieldrin	0.4	0.04	ND	0.13		0.17		0.11		0.04	ND	0.13		0.13		0.11		0.12		0.04	ND	0.04	ND	0.04	ND	0.04	ND
4,4'-DDT	0.4	0.04	ND	0.04	ND	0.04	ND	0.08		0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
2,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
4,4'-DDD	0.4	0.16		0.07	ND	0.15		0.11		0.05	J	0.10		0.06	J	0.08		0.48		0.52		0.93		0.49		0.73	
2,4'-DDD	0.4	0.05	ND	0.05	ND	0.05	ND	0.08		0.05	ND	0.08		0.07		0.05	J	0.34		0.15		0.11		0.30		0.10	
4,4'-DDE	0.4	0.07		0.19		0.10		0.11		0.09		0.08		0.09		0.08		2.65		3.08		2.80		2.75		3.65	
2,4'-DDE	0.4	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.68	
Total DDT		0.540		0.578		0.660		0.580		0.480		0.500		0.480		0.478		3.730		4.010		4.100		3.800		5.260	
Endosulfan I	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.33		0.06	ND	0.06	ND	0.06	ND	0.05	ND
Endosulfan II	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.08	ND
Endosulfan sulfate	0.4	0.09	ND	0.07	J	0.12		0.09	ND	0.09	ND	0.21		0.08	J	0.15		0.09	ND	0.25		0.30		0.16		0.25	
Heptachlor	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.06	ND	0.05	ND	0.05	ND	0.05	ND	0.04	ND
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x),where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 12 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

		Macoma nasuta																													
		PRETEST						REFERENCE										REACH 2 TEST											
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022580		2022581		2022582		2022583		2022584	
Battelle ID #		U0554		U0555		U0556		U0217		U0218		U0219		U0220		U0221		U0227		U0228		U0229		U0230		U0231	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.57	ND	0.56	ND	0.55	ND	0.55	ND	0.55	ND	0.56	ND	0.58	ND	0.55	ND	0.56	ND	0.56	ND	0.55	ND	0.56	ND	0.54	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06		0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.51	
PCB 28	0.4	0.06	J	0.09		0.05	J	0.17		0.08	J	0.11		0.08		0.09		1.43		2.19		1.75		2.21		2.43	
PCB 44	0.4	0.14		0.18		0.12		0.23		0.11		0.12		0.18		0.12		0.87		1.27		1.23		1.12		1.45	
PCB 49	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.01	J	0.05	ND	0.05	ND	1.15		1.26		1.41		1.63		1.52	
PCB 52	0.4	0.07		0.06		0.04		0.48		0.08		0.06		0.10		0.08		2.47		3.47		3.13		3.30		4.21	
PCB 66	0.4	0.05	ND	0.03	J	0.04	J	0.12		0.09		0.07		0.06		0.07		0.88		1.39		1.27		1.47		1.57	
PCB 87	0.4	0.04	J	0.05		0.09		0.06		0.05	J	0.07		0.04	J	0.04	J	0.46		0.70		0.56		0.89		0.66	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.02	J	0.02	J	1.23		2.39		2.31		1.82		2.02	
PCB 105	0.4	0.07	ND	0.02	J	0.02	J	0.04	J	0.03	J	0.03	J	0.02	J	0.02	J	0.42		0.50		0.58		0.55		0.65	
PCB 118	0.4	0.06	ND	0.02	J	0.06	ND	0.11		0.05	J	0.04	J	0.04	J	0.04	J	0.87		1.28		1.19		1.29		1.58	
PCB 128	0.4	0.16	ND	0.16	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.18	ND	0.15	ND	0.16	ND	0.15	ND	0.15	ND	0.16	ND	0.15	ND
PCB 138	0.4	0.07	ND	0.15		0.15		0.30		0.18		0.16		0.13		0.27		0.36		0.42		0.39		0.52		0.44	
PCB 153	0.4	0.12	ND	0.05	J	0.03	J	0.21		0.07	J	0.11	J	0.08	J	0.09	J	0.79		0.95		0.98		1.09		1.15	
PCB 170	0.4	0.06	ND	0.06	ND	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.03	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
PCB 180	0.4	0.07	ND	0.06		0.08		0.13		0.06		0.09		0.07		0.08		0.23		0.26		0.33		0.26		0.38	
PCB 183	0.4	0.06	ND	0.01	J	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.14		0.24		0.21		0.08		0.12	
PCB 184	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.08	ND
PCB 187	0.4	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.17		0.27		0.33		0.28		0.37	
PCB 195	0.4	0.06	ND	0.02	J	0.01	J	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.02	J	0.05	J	0.08		0.10		0.02	J	0.09	
PCB 206	0.4	0.06	ND	0.00	J	0.01	J	0.02	J	0.06	ND	0.06	ND	0.06	ND	0.01	J	0.02	J	0.03	J	0.04	J	0.01	J	0.04	J
PCB 209	0.4	0.06	J	0.05	J	0.07		0.06	J	0.06	ND	0.06	J	0.04	J	0.05	J	0.08		0.04	J	0.05	J	0.04	J	0.10	
Total PCB		4.180		3.800		3.780		6.100		4.240		4.320		4.180		4.100		25.100		36.360		33.820		36.041		40.182	
1,4-Dichlorobenzene	0.4	1.47	ND	0.64		0.57	ND	0.63		0.84		0.71		1.05		0.64		1.02		0.87	ND	1.16		0.86		1.30	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 12 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

Macoma nasuta

		PRETEST						REFERENCE									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574	
Battelle ID #		V2775-R		V2776-R		V2777-R		U0217		U0218		U0219		U0220		U0221	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.78	ND	1.84		1.47		3.45		2.88		2.10		2.78		2.79	
Acenaphthylene	4	0.08	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.11	J	0.03	ND
Acenaphthene	4	0.25	J	0.04	ND	0.33	J	1.09		1.01		0.60		0.99		0.92	
Fluorene	4	0.24	J	0.30	J	0.29	J	0.65		0.59		0.38	J	0.56	J	0.58	J
Phenanthrene	4	0.96	J	1.63		0.98		1.90		1.59		1.24		1.71		1.59	
Anthracene	4	0.12	J	0.13	J	0.09	J	0.32		0.15	J	0.13	J	0.31	J	0.33	J
Fluoranthene	4	2.51		2.96		2.80		2.97		2.60		2.00		2.34		3.05	
Pyrene	4	1.77		2.02		2.04		2.59		2.18		2.23		2.08		2.48	
Benzo(a)anthracene	4	0.23	J	0.23	J	0.18	J	0.66		0.33	J	0.24	J	0.38	J	0.31	J
Chrysene	4	0.70	J	0.87		0.71		1.56		0.94		0.94		0.98		1.14	
Benzo(b)fluoranthene	4	0.07	ND	0.61		0.27	J	0.93		0.47	J	0.38	J	0.38	J	0.49	J
Benzo(k)fluoranthene	4	0.08	ND	0.33	J	0.17	J	0.68		0.27	J	0.33	J	0.31	J	0.39	J
Benzo(a)pyrene	4	0.10	ND	0.18	J	0.07	J	0.77		0.23	J	0.25	J	0.25	J	0.26	J
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.02	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND
Dibenzo(a,h)anthracene	4	0.07	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND
Benzo(g,h,i)perylene	4	0.05	ND	0.37	J	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND
Total PAH's		9.050		11.590		9.490		17.840		13.310		10.910		13.220		14.420	

		REACH 2 TEST									
CONSTITUENTS	DL's	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022580		2022581		2022582		2022583		2022584	
Battelle ID #		U0227		U0228 NF		U0229		U0230		U0231	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	9.09		16.52		17.01		9.11		21.32	
Acenaphthylene	4	1.27		1.81		1.58		1.35		2.20	
Acenaphthene	4	50.61		69.41		68.90		39.71		99.60	
Fluorene	4	52.49		68.29		88.59		39.59		101.83	
Phenanthrene	4	350.28		421.91		366.94		251.89		581.10	
Anthracene	4	59.60		79.77		64.43		48.36		102.58	
Fluoranthene	4	786.69		1107.45		783.39		782.30		1204.56	
Pyrene	4	433.24		603.92		428.42		433.29		691.12	
Benzo(a)anthracene	4	126.85		190.87		123.57		114.85		185.84	
Chrysene	4	110.56		155.29		110.92		101.13		161.65	
Benzo(b)fluoranthene	4	44.29		67.47		44.55		45.09		70.25	
Benzo(k)fluoranthene	4	28.81		37.90		36.81		28.87		39.14	
Benzo(a)pyrene	4	31.22		48.15		31.61		26.80		46.83	
Indeno(1,2,3-cd)pyrene	4	3.73		6.23		4.13		3.63		5.44	
Dibenzo(a,h)anthracene	4	1.43		2.00		1.60		1.39		1.98	
Benzo(g,h,i)perylene	4	3.63		6.25		4.20		3.58		5.33	
Total PAH's		2093.790		2883.240		2138.850		1912.740		3320.770	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = Σ(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 12 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

		Macoma nasuta																													
		PRETEST						REFERENCE										REACH 2 TEST													
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022580		2022581		2022582		2022583		2022584	
Philip Analytical ID #		080375 02		080376 02		080377 02		080356 02		080357 02		080358 02		080359 02		080360 02		080366 02		080367 02		080368 02		080369 02		080370 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.33	ND	0.24	ND	0.22	ND	0.22	ND	0.3	ND	0.18	ND	0.26	ND	1.30	ND	0.68	ND	0.95	ND	0.50	ND	1.10	ND	1.08	ND
12378 PeCDD	5	0.32	ND	0.29	ND	0.22	ND	0.28	ND	0.55	J	0.19	ND	0.27	ND	1.10	ND	0.59	ND	1.20	ND	0.66	ND	1.40	ND	0.83	ND
123478 HxCDD	5	0.23	ND	0.25	ND	0.28	J	0.27	ND	0.3	ND	0.33	ND	0.300	ND	0.46	ND	0.44	ND	0.88	ND	0.48	ND	1.00	ND	0.75	ND
123678 HxCDD	5	0.23	ND	0.25	ND	0.33	J	0.26	ND	0.65	J	0.31	ND	0.280	ND	0.43	ND	0.44	ND	0.68	ND	0.46	ND	1.00	ND	0.75	ND
123789 HxCDD	5	0.21	ND	0.24	ND	0.41	ND	0.24	ND	0.42	J	0.29	ND	0.270	ND	0.41	ND	0.40	ND	0.62	ND	0.42	ND	0.95	ND	0.68	ND
1234678 HpCDD	5	0.65	J	0.74	J	1.5	J	1.10	J	2.1	J	0.32	J	2.00	J	0.62	ND	0.74	ND	1.10	ND	0.64	ND	1.80	ND	1.38	
12346789 OCDD	10	2.3	J	3.1	J	9.0	J	7.8	J	5.4	J	1.20	J	46.00		8.50	J	8.30	J	6.50	J	5.70	J	8.10	J	11.02	
2378 TCDF	1	0.22	ND	0.15	ND	0.13	ND	0.16	ND	1.5	J	0.28	ND	0.51	ND	1.50	ND	0.74	ND	1.50	ND	1.30	ND	1.60	ND	1.25	ND
12378 PeCDF	5	0.24	ND	0.20	ND	0.17	ND	0.52	ND	1.5	J	0.52	ND	0.35	ND	1.20	ND	0.98	ND	1.20	ND	0.55	ND	1.00	ND	0.49	ND
23478 PeCDF	5	0.25	ND	0.21	ND	0.28	J	0.53	ND	1.3	J	0.64	ND	0.36	ND	1.30	ND	0.81	ND	1.30	ND	0.58	ND	1.10	ND	0.51	ND
123478 HxCDF	5	0.26	ND	0.20	ND	0.56	ND	0.55	J	5	J	0.180	J	0.28	ND	0.48	ND	0.46	ND	0.56	ND	0.37	ND	0.79	ND	1.22	
123678 HxCDF	5	0.20	J	0.14	ND	0.24	ND	0.33	ND	2.2	J	0.150	ND	0.26	ND	0.46	ND	0.35	ND	0.53	ND	0.29	ND	0.78	ND	0.38	ND
234678 HxCDF	5	0.19	J	0.16	ND	0.46	J	0.39	ND	0.82	J	0.170	ND	0.31	ND	0.54	ND	0.41	ND	0.82	ND	0.34	ND	0.92	ND	0.45	ND
123789 HxCDF	5	0.18	J	0.16	ND	0.26	J	0.43	ND	0.22	ND	0.190	ND	0.34	ND	0.60	ND	0.45	ND	0.69	ND	0.38	ND	1.00	ND	0.50	ND
1234678 HpCDF	5	0.32	ND	0.51	ND	0.91	ND	1.10	J	7.2	J	0.22	J	0.37	J	0.35	ND	0.58	ND	0.56	ND	0.60	ND	0.88	ND	1.09	ND
1234789 HpCDF	5	0.26	ND	0.43	J	0.51	ND	0.34	ND	1	J	0.20	ND	0.22	ND	0.44	ND	0.54	ND	0.71	ND	0.47	ND	1.20	ND	0.78	ND
12346789 OCDF	10	1.10	ND	2.6	J	6.2	J	15.00	J	14	J	0.71	J	1.20	J	3.10	J	1.70	ND	3.30	J	1.40	J	3.90	ND	2.74	

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 13 - 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

		Nereis virens																									
		PRETEST						REFERENCE										REACH 2 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021771		2021772		2021773		2021774		2021775	
Battelle ID #		V7425		V7426		V7427		V7428		V7429		V7430		V7431		V7432		V7438		V7439		V7440		V7441		V7442	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.018		0.015		0.016		0.039		0.030		0.036		0.034		0.030		0.017		0.019		0.021		0.023		0.040	
Arsenic	1	2.833		2.969		2.816		3.833		3.884		3.760		3.821		3.729		2.636		2.739		3.032		3.253		2.593	
Cadmium	0.1	0.044		0.033		0.037		0.050		0.046		0.052		0.040		0.043		0.039		0.042		0.036		0.046		0.078	
Chromium	0.2	0.533		0.471		0.469		0.433		0.425		0.317		0.520		0.392		0.318		0.353		0.650		0.458		0.231	
Copper	1	1.085		0.786		0.853		1.265		1.293		1.454		1.429		1.321		1.000		1.010		1.241		1.157		1.152	
Mercury	0.02	0.015		0.014		0.013		0.016		0.016		0.019		0.016		0.018		0.013		0.013		0.015		0.013		0.014	
Nickel	0.1	0.213		0.214		0.206		0.179		0.190		0.178		0.274		0.214		0.262		0.263		0.300		0.275		0.268	
Lead	0.1	0.132		0.067		0.098		0.106		0.128		0.116		0.134		0.119		0.103		0.124		0.207		0.103		0.138	
Zinc	1	17.936		18.050		20.616		29.869		15.351		34.957		24.578		20.396		38.266		27.696		36.820		20.921		37.645	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.07	ND	0.11	ND	0.07	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND
a-Chlordane	0.4	0.12		0.13		0.15		0.15		0.14		0.23		0.10		0.11		0.26		0.23		0.26		0.44		0.23	
trans Nonachlor	0.4	0.47		0.47		0.50		0.44		0.47		0.64		0.35		0.33		0.44		0.41		0.49		0.67		0.44	
Dieldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.24		0.36		0.39		0.08	ND	0.21		0.27		0.22		0.44		0.48		0.24	
4,4'-DDT	0.4	0.08		0.12		0.34		0.12		0.24		0.12	ND	0.08	ND	0.05	ND	0.15		0.14		0.17		0.21		0.25	
2,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.10	ND	0.16	ND	0.16		0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.06	ND
4,4'-DDD	0.4	0.07	ND	0.07	ND	0.07	ND	0.17		0.15		0.31		0.13		0.10		2.05		2.35		2.29		2.52		2.25	
2,4'-DDD	0.4	0.05	ND	0.04	ND	0.05	ND	0.29		0.18		0.18		0.08	ND	0.05	ND	0.83		0.69		0.88		1.22		0.72	
4,4-DDE	0.4	0.06		0.07		0.13		0.05	J	0.10	ND	1.00		0.11	ND	0.03	J	3.49		3.35		4.24		4.91		3.52	
2,4'-DDE	0.4	0.16	ND	0.15	ND	0.15	ND	0.18	ND	0.26	ND	0.44	ND	0.28	ND	0.17	ND	0.16	ND	0.16	ND	0.17	ND	0.20	ND	0.15	ND
Total DDT		0.480		0.810		0.800		0.870		1.030		2.210		0.840		0.460		6.540		6.780		7.810		9.130		6.937	
Endosulfan I	0.4	0.06	ND	0.05	ND	0.06	ND	0.06	ND	0.10	ND	0.18	ND	0.10	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.06	ND
Endosulfan II	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.11	ND	0.08	ND
Endosulfan sulfate	0.4	0.13		0.27		0.22		0.47		0.59		0.58		0.13	J	0.17		0.38		0.35		0.45		0.35		0.33	
Heptachlor	0.4	0.16		0.12		0.05	ND	0.89		1.39		1.64		0.06	ND	0.05	ND	0.03	J	0.05	ND	0.05	ND	0.06	ND	0.05	ND
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.04	ND	0.05	ND	0.09	ND	0.06	ND	0.04		0.03	ND	0.03	ND	0.03	ND	0.04	ND	0.03	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

B - Analyte concentration in blank > 3 times target

TABLE 13 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

Nereis virens

		PRETEST						REFERENCE										REACH 2 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021771		2021772		2021773		2021774		2021775	
Battelle ID#		V2789		V2790		V2791		V2778		V2779		V2780		V2781		V2782		V2783		V2784		V2785		V2786		V2787	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.55	ND	0.53	ND	0.54	ND	0.62	ND	0.92	ND	1.54	ND	0.99	ND	0.60	ND	0.56	ND	0.55	ND	0.59	ND	0.72	ND	0.54	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.17	ND	0.11	ND	0.06	ND	1.52		0.97		1.40		1.46		1.04	
PCB 28	0.4	0.08	ND	0.07	ND	0.08	ND	0.10		0.12	J	0.22	ND	0.10	J	0.11		2.68		2.10		2.73		3.00		2.26	
PCB 44	0.4	0.05	ND	0.05	ND	0.05	ND	0.12		0.14		0.25		0.14		0.13		1.97		1.73		2.34		2.41		1.76	
PCB 49	0.4	0.05	ND	0.04	ND	0.04	ND	0.24		0.17		0.13	ND	0.08	ND	0.05	ND	2.32		1.85		2.44		2.48		2.02	
PCB 52	0.4	0.04	ND	0.04	ND	0.04	ND	0.14		0.22		0.24		0.16		0.11		4.47		3.50		4.56		4.66		3.72	
PCB 66	0.4	0.05	ND	0.05	ND	0.05	ND	0.13		0.06	J	0.08	J	0.09	ND	0.05	J	2.23		1.75		2.53		2.88		1.90	
PCB 87	0.4	0.05	ND	0.05	ND	0.05	ND	0.07		0.11		0.14		0.09	ND	0.05	ND	0.65		0.66		0.97		1.26		0.72	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.26		0.29		0.49		0.31		0.23		3.40		3.18		3.83		4.53		3.33	
PCB 105	0.4	0.25		0.26		0.26		0.20		0.27		0.31		0.17		0.08	ND	1.16		1.06		1.27		1.29		1.06	
PCB 118	0.4	0.37		0.27		0.35		0.28		0.29		0.35		0.18		0.18		1.95		1.95		2.30		2.46		2.08	
PCB 128	0.4	0.15	ND	0.15	ND	0.15	ND	0.17	ND	0.26	ND	0.17	J	0.27	ND	0.17	ND	0.23		0.48		0.07	J	0.12	J	0.11	J
PCB 138	0.4	1.50		1.72		1.72		1.85		1.76		2.30		1.33		1.46		2.98		3.10		3.48		3.61		3.10	
PCB 153	0.4	2.04		2.13		2.26		2.24		2.34		2.70		1.77		1.98		3.76		3.85		4.38		4.44		3.92	
PCB 170	0.4	0.37		0.40		0.40		0.40		0.40		0.48		0.34		0.41		0.66		0.62		0.90		0.68		0.72	
PCB 180	0.4	1.19		1.23		1.29		1.25		1.31		1.62		0.97		1.15		2.07		2.00		2.14		2.35		2.05	
PCB 183	0.4	0.31		0.33		0.32		0.33		0.34		0.38		0.27		0.35		0.81		0.73		0.81		0.75		0.72	
PCB 184	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.09	ND	0.08	ND	0.09	ND	0.11	ND	0.08	ND
PCB 187	0.4	0.53		0.60		0.56		0.53		0.58		0.69		0.41		0.51		1.25		1.16		1.31		1.41		1.17	
PCB 195	0.4	0.10		0.11		0.11		0.12		0.14		0.18		0.12		0.13		0.28		0.22		0.29		0.28		0.25	
PCB 206	0.4	0.14		0.16		0.15		0.18		0.18		0.24		0.18		0.19		0.34		0.27		0.34		0.33		0.30	
PCB 209	0.4	0.13		0.23		0.29		0.28		0.22		0.15	J	0.13		0.18		0.29		0.21		0.31		0.30		0.27	
Total PCB		16.280		17.200		17.780		19.300		20.720		26.140		16.720		16.540		71.340		64.000		78.160		83.080		66.184	
1,4-Dichlorobenzene	0.4	1.43	ND	1.37	ND	1.39	ND	1.06	ND	2.27	ND	4.01	ND	1.16		0.85		0.76		0.83		0.85		1.07		0.86	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

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TABLE 13 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

		Nereis virens																														
		PRETEST						REFERENCE										REACH 2 TEST														
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761	·	2021762		2021763		2021764		2021765		2021771		2021772		2021773		2021774		2021775	
Battelle ID#		V7425-R1		V7426-R1		V7427-R1		V7428-R1		V7429-R1		V7430-R1		V7431		V7432		V7438		V7439		V7440		V7441		V7448	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.73	ND	1.67	ND	1.69	ND	3.65		3.13		4.91		3.97		3.82		13.86		14.66		9.96		15.07		25.40	
Acenaphthylene	4	0.11	J	0.13	J	0.10	J	0.09	ND	0.13	J	0.23	ND	0.13	J	0.12	J	1.98		2.20		2.09		2.48		2.32	
Acenaphthene	4	1.00	J	0.88	J	1.07	J	1.86		1.59	J	3.52	J	1.18		1.54		119.96		119.47		115.10		150.50		118.55	
Fluorene	4	0.34	J	0.35	J	0.41	J	0.34	J	0.33	J	0.67	J	0.27	J	0.31	J	38.17		33.68		35.54		47.48		35.22	
Phenanthrene	4	0.78	J	0.79	J	0.88	J	0.76	ND	1.07	ND	1.90	ND	0.49	ND	0.41	J	157.29		138.92		164.34		212.56		138.16	
Anthracene	4	0.07	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.18	ND	0.05	ND	0.03	ND	19.94		25.35		24.22		31.18		26.87	
Fluoranthene	4	2.17		1.60		2.01		0.95	ND	1.35	ND	2.39	ND	0.61	ND	0.37	ND	611.50		610.28		675.36		776.27		671.25	
Pyrene	4	2.58		1.74		2.00		0.67	J	0.88	ND	1.56	ND	0.40	ND	0.26	J	332.16		293.29		388.80		373.81		317.78	
Benzo(a)anthracene	4	0.07	ND	0.15	J	0.16	J	0.17	J	0.17	J	0.64	J	0.31	J	0.24	J	25.97		33.38		31.64		36.22		39.87	
Chrysene	4	1.75		1.33	J	1.45		0.45	J	0.69	J	0.57	J	0.14	J	0.22	J	82.75		91.75		101.98		106.92		106.86	
Benzo(b)fluoranthene	4	0.36	J	0.29	J	0.41	J	0.08	ND	0.11	ND	0.20	ND	0.05	ND	0.03	ND	13.05		14.79		15.67		16.99		17.95	
Benzo(k)fluoranthene	4	0.44	J	0.26	J	0.42	J	0.09	ND	0.13	ND	0.23	ND	0.06	ND	0.04	ND	12.16		13.48		15.13		15.74		17.66	
Benzo(a)pyrene	4	0.10	ND	0.09	ND	0.21	J	0.11	ND	0.15	ND	0.27	ND	0.07	ND	0.04	ND	7.94		13.02		10.59		12.23		18.04	
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.04	ND	0.20	J	0.04	ND	0.16	J	0.10	ND	0.03	ND	0.02	ND	1.45		1.64		1.96		1.97		2.33	
Dibenzo(a,h)anthracene	4	0.07	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.18	ND	0.05	ND	0.03	ND	0.72		0.75		0.70		0.75		0.91	
Benzo(g,h,i)perylene	4	0.46	J	0.37	J	0.05	ND	0.14	J	0.30	J	0.36	J	0.04	ND	0.02	ND	2.59		3.50		3.58		3.90		4.78	
Total PAH's		12.070		9.830		11.180		9.540		18.410		17.910		7.850		7.500		1439.490		1410.180		1694.580		1804.070		1543.950	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 13 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 2

CONSTITUENTS	DL's	*Nereis virens*																									
		PRETEST						REFERENCE										REACH 2 TEST									
		R1	Q	R2	Q	R3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021771		2021772		2021773		2021774		2021775	
Philip Analytical ID #		078515 02		078516 02		078517 02		078519 02		078520 02		078521 02		078522 02		078523 02		078532 02		078533 02		078534 02		078535 02		078542 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.18	ND	0.20	J	0.23	ND	0.80	ND	0.66	ND	1.30	ND	2.00	ND	0.34	ND	0.94	J	0.75	J	0.80	J	0.85	ND	1.37	ND
12378 PeCDD	5	0.17	ND	0.16	ND	0.20	ND	0.76	ND	0.70	ND	1.50	ND	2.30	ND	0.29	ND	0.24	ND	0.59	ND	0.73	ND	1.10	ND	1.32	ND
123478 HxCDD	5	0.31	ND	0.14	ND	0.12	ND	1.10	ND	0.42	ND	1.20	ND	2.10	ND	0.20	ND	0.38	ND	0.22	ND	0.33	ND	0.87	ND	0.65	ND
123678 HxCDD	5	0.29	ND	0.45	J	0.42	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.36	J	0.59	ND	0.43	J	0.47	J	0.82	ND	0.77	
123789 HxCDD	5	0.29	ND	0.22	J	0.18	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.18	ND	0.38	ND	0.19	ND	0.30	ND	0.78	ND	0.63	ND
1234678 HpCDD	5	1.90	J	2.00	J	1.90	ND	1.90	J	1.00	J	1.40	J	1.60	ND	1.70	J	1.30	J	1.10	J	1.00	J	2.10	ND	1.95	J
12346789 OCDD	10	11.00	J	10.00	J	12.00	J	11.00	J	6.70	J	5.10	J	6.20	J	13.00	J	4.10	J	3.60	J	5.30	J	4.80	ND	13.13	J
2378 TCDF	1	1.50	J	1.50	J	1.70	J	2.20	J	1.30	J	1.30	J	1.50	ND	1.30	J	3.70		3.60	J	3.70	J	3.80	J	3.77	
12378 PeCDF	5	0.51	ND	0.28	ND	0.50	ND	0.84	ND	0.67	ND	1.40	ND	1.80	ND	0.27	ND	0.32	ND	0.33	ND	0.52	ND	0.92	ND	1.37	
23478 PeCDF	5	0.40	J	0.44	J	0.44	J	0.88	ND	0.70	ND	1.40	ND	1.90	ND	0.45	J	0.92	J	0.81	J	0.73	J	1.10	J	1.60	
123478 HxCDF	5	0.11	ND	0.11	ND	0.12	ND	0.51	ND	0.25	ND	0.75	ND	1.30	ND	0.65	ND	0.27	ND	2.80	ND	3.70	ND	11.00	ND	5.12	
123678 HxCDF	5	1.40	ND	0.88	ND	1.90	ND	1.90	ND	0.63	ND	1.60	ND	2.10	ND	0.16	ND	0.62	ND	0.31	ND	0.45	ND	1.20	ND	0.80	ND
234678 HxCDF	5	0.13	ND	0.20	J	0.14	ND	0.81	ND	0.30	ND	0.90	ND	1.50	ND	0.18	ND	0.32	ND	0.37	ND	0.53	ND	1.40	ND	0.98	
123789 HxCDF	6	0.14	ND	0.15	ND	0.16	ND	0.67	ND	0.32	ND	0.99	ND	1.70	ND	0.20	ND	0.35	ND	0.41	ND	0.59	ND	1.50	ND	1.05	ND
1234678 HpCDF	5	2.40	J	0.86	ND	1.00	ND	0.74	ND	0.51	ND	0.97	ND	2.00	ND	0.93	ND	0.70	ND	0.40	J	0.81	J	2.70	J	4.24	
1234789 HpCDF	5	1.10	ND	0.22	ND	0.27	J	0.97	ND	0.59	ND	1.30	ND	2.60	ND	0.37	ND	0.36	ND	0.41	ND	0.51	ND	1.50	ND	1.52	ND
12346789 OCDF	10	0.98	J	0.99	J	2.00	J	1.20	ND	0.72	ND	1.50	ND	2.80	ND	1.20	J	7.60	J	0.79	J	5.30	J	23.00	J	162.30	

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

Q = Indicates presence of QC ion instabilities caused by quantitative interferences

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

PUBLIC NOTICE TABLES

REACH 3

TABLE 1. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

NWS Pier 3 Replacement Reach 3

	SITE WATER		ELUTRIATE	
CONSTITUENTS	DETECTION LIMITS	CONCENTRATION	DETECTION LIMITS	CONCENTRATION
Metals	**ppb**	**ppb**	**ppb**	**ppb**
Ag		0.01		0.02
Cd		0.043		0.005
Cr		0.364		1.63
Cu		1.51		1.26
Hg		0.003		0.025
Ni		0.85		2.34
Pb		0.299		1.36
Zn		4.07		2.96
Pesticides	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
Aldrin	2.83	ND	2.83	ND
a-Chlordane		0.28		0.40
trans Nonachlor	1.01	ND		0.24
Dieldrin	0.98	ND	0.98	ND
4,4'-DDT	0.56	ND	0.56	ND
2,4'-DDT	1.99	ND	1.99	ND
4,4'-DDD	0.60	ND	0.60	ND
2,4'-DDD	0.75	ND	0.75	ND
4,4'-DDE		1.72		3.49
2,4'-DDE	1.71	ND	1.71	ND
Total DDT		**4.52**		**6.28**
Endosulfan I	1.11	ND	1.11	ND
Endosulfan II	0.51	ND	0.51	ND
Endosulfan sulfate	0.57	ND	0.57	ND
Heptachlor	1.17	ND	1.17	ND
Heptachlor epoxide	0.95	ND	0.95	ND
Industrial Chemicals	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**	**pptr (ng/L)**
PCB 8	16.00	ND	16.00	ND
PCB 18		0.98		3.04
PCB 28	1.73	ND		1.72
PCB 44	1.45	ND		1.30
PCB 49		0.39		1.48
PCB 52	1.44	ND	1.44	ND
PCB 66	1.49	ND		1.41
PCB 87	1.13	ND	1.13	ND
PCB 101	1.15	ND		1.30
PCB 105	0.58	ND	0.58	ND
PCB 118	0.87	ND		0.53
PCB 128		0.33		0.30
PCB 138	1.33	ND		1.01
PCB 153		0.19		1.25
PCB 170	1.02	ND	1.02	ND
PCB 180		0.23		0.56
PCB 183	0.93	ND		0.22
PCB 184	0.92	ND	0.92	ND
PCB 187		0.19		0.49
PCB 195	1.09	ND	1.09	ND
PCB 206	1.22	ND		0.10
PCB 209	1.27	ND	1.27	ND
Total PCB		**71.8**		**76.3**

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.

TABLE 2

NWS Pier 3 Reconstruction
TOXICITY TEST RESULTS
Reach 3

ASI JOB No. 22-245

Suspended Particulate Phase

Test Species	Test Duration	LC50/EC50	LPC (a)
Menidia beryllina	96 hours	(b) 18.3%	0.18
Mysidposis bahia	96 hours	(b) 28.5%	0.29
Mytilus edulis (larval survival)	48 hours	(b) 63.9%	0.64
Mytilus edulis (larval normal develop.)	48 hours	(c) 20.0%	0.20

(a) Limiting Permissible Concentration (LPC) is the LC 50 or EC 50 times 0.01.

(b) Median Lethal Concentration (LC50) resulting in 50% mortatlity at test termination.

(c) Median Effective Concentration (EC50) based on normal development to the D-cell, prodissoconch 1 stage.

Whole Sediment (10 days)

Test Species	% Survival In Reference	% Survival	% Difference Reference -Test	Is difference statistically significant? (a=0.05)
Ampelisca abdita	96%	93%	3%	No
Mysidopsis bahia	98%	89%	9%	Yes

Table 2.xls

NWS EARLE Pier 3 Replacement Reach 3
TABLE 3. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
Wet weight concentrations

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
Metals	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
Ag		0.04		* 0.06		0.03		0.04
As		2.51		* 3.00		3.81		3.47
Cd		0.03		* 0.04		0.05		0.05
Cr		0.61		0.79		0.42		* 0.64
Cu		1.97		* 2.70		1.35		1.39
Hg		0.01		* 0.02		0.02		0.01
Ni		0.34		* 0.52		0.21		* 0.30
Pb		0.21		* 0.69		0.12		0.12
Zn		12.74		13.52		25.03		29.96
Pesticides	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Aldrin		0.02	0.04	ND	0.07	ND		0.03
a-Chlordane		0.06		* 0.22		0.15		* 0.50
trans Nonachlor		0.02		* 0.12		0.45		0.55
Dieldrin		0.10		* 0.24		0.25		* 0.73
4,4'-DDT		0.04		0.05		0.10		0.15
2,4'-DDT	0.06	ND		0.05		0.07		0.09
4,4'-DDD		0.08		* 0.51		0.17		* 1.31
2,4'-DDD		0.05		* 0.39		0.14		* 0.64
4,4'-DDE		0.09		* 1.97		0.24		* 2.31
2,4'-DDE	0.16	ND		0.11	0.27	ND		* 0.16
Total DDT		**0.37**		* **3.07**		**0.81**		* **4.66**
Endosulfan I	0.06	ND		0.06	0.10	ND	0.07	ND
Endosulfan II	0.08	ND	0.08	ND	0.14	ND	0.10	ND
Endosulfan sulfate		0.11		0.15		0.39		0.45
Heptachlor	0.05	ND		* 0.07		0.80		0.24
Heptachlor epoxide	0.03	ND	0.03	ND		0.03	0.04	ND
Industrial Chemicals	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
PCB 8	0.55	ND	0.55	* ND	0.93	ND	0.67	* ND
PCB 18		0.04		* 0.40	0.10	ND		* 2.44
PCB 28		0.11		* 3.17		0.11		* 4.61
PCB 44		0.15		* 1.17		0.16		* 2.87
PCB 49		0.02		* 2.64		0.11		* 4.39
PCB 52		0.16		* 3.25		0.17		* 6.23
PCB 66		0.08		* 2.71		0.07		* 4.32
PCB 87		0.05		* 0.53		0.08		* 0.60
PCB 101		0.02		* 2.41		0.32		* 4.81
PCB 105		0.03		* 0.59		0.20		* 1.17
PCB 118		0.06		* 1.54		0.25		* 3.25
PCB 128	0.15	ND		0.10		0.12		* 0.28
PCB 138		0.21		* 1.44		1.74		* 5.26
PCB 153		0.11		* 2.01		2.21		* 6.18
PCB 170		0.03		* 0.17		0.41		* 1.02
PCB 180		0.09		* 0.47		1.26		* 2.57
PCB 183		0.03		* 0.17		0.33		* 0.85
PCB 184	0.08	ND	0.08	ND	0.14	ND	0.11	ND
PCB 187	0.07	ND		* 0.40		0.54		* 1.63
PCB 195		0.03		* 0.07		0.14		* 0.34
PCB 206		0.02		* 0.07		0.19		* 0.39
PCB 209		0.05		0.07		0.19		* 0.29
Total PCB		**2.90**		* **47.93**		**17.44**		* **108.42**
1,4-Dichlorobenzene		0.81		1.16		0.40		* 1.19

TABLE 3. (Continued) **Reach 3**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
PAH's	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Naphthalene		2.80		3.22		3.94		3.88
Acenaphthylene		0.03		* 0.60		0.11		0.24
Acenaphthene		0.92		* 9.73		1.90		* 4.35
Fluorene		0.55		* 8.22		0.38		* 0.96
Phenanthrene		1.61		* 39.09		0.50		* 2.54
Anthracene		0.25		* 8.33	0.09	ND		* 0.53
Fluoranthene		2.59		* 110.09	1.13	ND		* 38.01
Pyrene		2.31		* 82.13		0.47		* 37.84
Benzo(a)anthracene		0.38		* 21.78		0.31		* 2.10
Chrysene		1.11		* 24.29		0.41		* 10.57
Benzo(b)fluoranthene		0.53		* 10.77	0.09	ND		* 1.72
Benzo(k)fluoranthene		0.43		* 7.73	0.11	ND		* 1.82
Benzo(a)pyrene		0.35		* 7.89	0.13	ND		* 2.02
Indeno(1,2,3-cd)pyrene	0.01	ND		* 2.65		0.06		* 0.46
Dibenzo(a,h)antracene	0.03	ND		* 0.71	0.09	ND		* 0.21
Benzo(g,h,i)perylene	0.02	ND		* 3.10		0.17		* 0.99
Total PAH's		**13.90**		* **340.34**		**9.06**		* **108.25**
Dioxins	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)
2378 TCDD	0.45	ND	0.54	* ND	1.02	ND		* 0.82
12378 PeCDD		0.29		0.45	1.11	ND	0.64	ND
123478 HxCDD	0.33	ND		0.42	1.00	ND	0.42	ND
123678 HxCDD		0.26		* 0.82		0.53		0.54
123789 HxCDD		0.21		0.49	0.95	ND	0.37	ND
1234678 HpCDD		1.17		* 2.70		1.36		* 2.62
1234789 OCDD		13.78		17.00		8.80		* 23.56
2378 TCDF		0.40		* 1.54		1.22		* 3.34
12378 PeCDF		0.56		0.45	1.00	ND	0.56	ND
23478 PeCDF		0.53		0.72		0.58		* 1.01
123478 HxCDF		1.22		0.98	0.73	ND	5.76	* ND
123678 HxCDF		0.56		0.57	1.28	ND	0.39	ND
234678 HxCDF		0.31		0.48	0.70	ND	0.45	ND
123789 HxCDF	0.36	ND		0.46	0.78	ND		0.54
1234678 HpCDF		1.81	1.68	ND	1.03	ND		* 7.80
1234789 HpCDF		0.32		0.57	1.17	ND		1.25
12346789 OCDF		6.80		5.05		0.84		* 195.98

ND = Not detected
Total PAH = Sum of all PAH's.
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level.

Physical and Chemical Analyses of
Site Water, Elutriate, Bulk Sediment and Tissue

REACH 3

TABLE 1 4	RESULTS OF CHEMICAL ANALYSIS OF SITE WATER							
			NWS Pier 3 Replacement Reach 3					22-245
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		V5854		V5854 Dup		V5854 Trip		
ASI ID#		2021431		2021431		2021431		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.014	ND	0.016		0.014	ND	0.010
Cd	0.02	0.044		0.039		0.046		0.04
Cr	0.06	0.376		0.399		0.318		0.36
Cu	0.15	1.50		1.51		1.52		1.51
Hg	0.002	0.003		0.003		0.003		0.003
Ni	0.04	0.84		0.86		0.84		0.85
Pb	0.04	0.30		0.30		0.30		0.30
Zn	0.09	4.07		4.01		4.14		4.07
Battelle-ID#		V5854		V5854 Dup		V5854 Trip		
ASI ID#		2021431		2021431		2021431		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.28	J	0.24	J	0.31	J	0.28
trans Nonachlor	14.0	1.01	ND	1.01	ND	1.01	ND	0.51
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.00	1.83		1.42		1.93		1.72
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		4.621		4.211		4.723		4.518
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	0.96	J	0.85	J	1.13	J	0.98
PCB 28	0.50	1.73	ND	1.73	ND	1.73	ND	1.73
PCB 44	0.50	1.45	ND	1.45	ND	1.45	ND	1.45
PCB 49	0.50	0.30	J	0.42	J	0.43	J	0.39
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.49	ND	1.49	ND	1.49	ND	1.49
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	1.15	ND	1.15	ND	1.15	ND	1.15
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.87	ND	0.87	ND	0.87	ND	0.87
PCB 128	0.50	0.34	J	0.32	J	0.33	J	0.33
PCB 138	0.50	1.33	ND	1.33	ND	1.33	ND	1.33
PCB 153	0.50	0.24	J	0.18	J	0.16	J	0.19
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.19	J	0.31	J	0.19	J	0.23
PCB 183	0.50	0.93	ND	0.93	ND	0.93	ND	0.93
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.18	J	0.25	J	0.15	J	0.19
PCB 195	0.50	1.09	ND	1.09	ND	1.09	ND	1.09
PCB 206	0.50	1.22	ND	1.22	ND	1.22	ND	1.22
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		71.611		71.818		71.941		71.790

ND = Not detected
J = Detection limit below the reporting limit or is an estimated value
E = Reporting limit raised due to matrix interference
B = Analyte detected in sample is <5x blank value
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 15	RESULTS OF CHEMICAL ANALYSIS OF ELUTRIATE							
			NWS Pier 3 Replacement Reach 3					22-245
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		ZU 50 ELUT		ZU 50 ELUT		ZU 50 ELUT		
ASI ID#		2021429/ 2021328		2021429/ 2021328		2021429/ 2021328		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.02		0.02		0.03		0.02
Cd	0.02	0.007	ND	0.007	ND	0.007		0.00
Cr	0.06	1.76		1.56		1.57		1.63
Cu	0.15	1.27		1.26		1.25		1.26
Hg	0.002	0.025		0.026		0.026		0.03
Ni	0.04	2.34		2.32		2.35		2.34
Pb	0.04	1.37		1.36		1.36		1.36
Zn	0.09	2.99		2.90		2.98		2.96
Battelle ID#		V5843/V5854		V5843/V5854		V5843/V5854		
ASI ID#		2021429/ 2021328		2021429/ 2021328		2021429/ 2021328		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	2.83	ND	2.83	ND	2.83	ND	1.41
a-Chlordane	14.0	0.40	J	0.40	J	0.40	J	0.40
trans Nonachlor	14.0	0.22	J	0.22	J	0.28	J	0.24
Dieldrin	2.00	0.98	ND	0.98	ND	0.98	ND	0.49
4,4'-DDT	12.0	0.56	ND	0.56	ND	0.56	ND	0.28
2,4'-DDT	20.0	1.99	ND	1.99	ND	1.99	ND	0.99
4,4'-DDD	11.0	0.60	ND	0.60	ND	0.60	ND	0.30
2,4'-DDD	20.0	0.75	ND	0.75	ND	0.75	ND	0.37
4,4'-DDE	4.0	3.24		3.69		3.53		3.49
2,4'-DDE	20.0	1.71	ND	1.71	ND	1.71	ND	0.85
Total DDT		6.04		6.48		6.32		6.28
Endosulfan I	14.0	1.11	ND	1.11	ND	1.11	ND	0.56
Endosulfan II	4.00	0.51	ND	0.51	ND	0.51	ND	0.26
Endosulfan sulfate	10.0	0.57	ND	0.57	ND	0.57	ND	0.28
Heptachlor	3.00	1.17	ND	1.17	ND	1.17	ND	0.59
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	16.00	ND	16.00	ND	16.00	ND	16.00
PCB 18	0.50	3.13		3.08		2.91		3.04
PCB 28	0.50	1.74		1.63	J	1.81		1.7
PCB 44	0.50	1.27	J	1.26	J	1.37	J	1.30
PCB 49	0.50	1.34	J	1.51		1.59		1.48
PCB 52	0.50	1.44	ND	1.44	ND	1.44	ND	1.44
PCB 66	0.50	1.38	J	1.33	J	1.54		1.41
PCB 87	0.50	1.13	ND	1.13	ND	1.13	ND	1.13
PCB 101	0.50	1.28		1.32		1.29		1.30
PCB 105	0.50	0.58	ND	0.58	ND	0.58	ND	0.58
PCB 118	0.50	0.49	J	0.55	J	0.56	J	0.53
PCB 128	0.50	0.32	J	0.36	J	0.23	J	0.30
PCB 138	0.50	1.06	J	0.98	J	0.98	J	1.01
PCB 153	0.50	1.25		1.26		1.25		1.25
PCB 170	0.50	1.02	ND	1.02	ND	1.02	ND	1.02
PCB 180	0.50	0.55	J	0.63	J	0.51	J	0.56
PCB 183	0.50	0.22	J	0.23	J	0.20	J	0.22
PCB 184	0.50	0.92	ND	0.92	ND	0.92	ND	0.92
PCB 187	0.50	0.53	J	0.50	J	0.45	J	0.49
PCB 195	0.50	1.09	ND	1.09	ND	1.09	ND	1.09
PCB 206	0.50	0.09	J	0.10	J	0.10	J	0.10
PCB 209	0.50	1.27	ND	1.27	ND	1.27	ND	1.27
Total PCB		76.1		76.3		76.4		76.3

ND = Not detected

J = Detection limit below the reporting limit or is an estimated value

E = Reporting limit raised due to matrix interference

B = Analyte detected in sample is <5x blank value

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

TABLE 16 RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT

Maguire-NWS Pier 3 Replacement Reach 3 ASI Job No. 22-245

CONSTITUENTS	DL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
Battelle-Sequim ID#		1693-7 R1			1693-7 R2			1693-7 R3			
Battelle-Duxbury ID#		V5843			V5843			V5843			
ASI ID#		2021328			2021328			2021328			
Metals	ppm (ug/g)										ppm (ug/g)
Ag	0.04	4.830			4.860			4.560			4.75
As	0.3	26.60			27.90			25.20			26.6
Cd	0.02	2.520			2.160			1.930			2.20
Cr	0.04	181.0	B		183.0	B		179.0	B		181
Cu	0.1	165.0			166.0			158.0			163
Hg	0.0016	2.348			2.373			2.081			2.27
Ni	0.2	40.6			41.0			39.6			40.4
Pb	0.1	170.0			168.0			158.0			165.3
Zn	0.4	390.0			409.0			384.0			394.3
Pesticides	ppb (ng/g)	ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
Aldrin	0.035	0.08	ND								0.04
a-Chlordane	0.022	1.33									1.33
trans Nonachlor	0.044	0.95									0.95
Dieldrin	0.032	1.52									1.52
4,4'-DDT	0.040	0.81									0.81
2,4'-DDT	0.156	0.15	ND								0.07
4,4'-DDD	0.091	8.69									8.69
2,4'-DDD	0.042	4.31									4.31
4,4'-DDE	0.050	14.69									14.69
2,4'-DDE	0.154	0.16	ND								0.08
Total DDT		28.6611			0.00			0.0000			28.66
Endosulfan I	0.095	0.12	ND								0.06
Endosulfan II	0.043	0.12	ND								0.06
Endosulfan sulfate	0.047	0.12	ND								0.06
Heptachlor	0.056	0.10	ND								0.05
Heptachlor epoxide	0.020	0.09	ND								0.05
Industrial Chemicals		ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
PCB 8	0.080	6.34									6.34
PCB 18	0.084	11.06									11.06
PCB 28	0.048	34.37									34.37
PCB 44	0.075	15.98									15.98
PCB 49	0.069	17.79									17.79
PCB 52	0.084	23.41									23.41
PCB 66	0.051	24.39									24.39
PCB 87	0.023	3.65									3.65
PCB 101	0.129	16.61									16.61
PCB 105	0.053	3.34									3.34
PCB 118	0.048	14.40									14.40
PCB 128	0.048	3.08									3.08
PCB 138	0.062	14.35									14.35
PCB 153	0.084	21.90									21.90
PCB 170	0.047	3.19									3.19
PCB 180	0.028	6.32									6.32
PCB 183	0.031	2.15									2.15
PCB 184	0.013	0.09	ND								0.04
PCB 187	0.019	5.30									5.30
PCB 195	0.024	0.11	ND								0.05
PCB 206	0.031	1.83									1.83
PCB 209	0.042	2.36									2.36
Total PCB		463.85			0.00			0.00			463.85
1-4, Dichlorobenzene		40.08									40.08

TABLE 16 Continued	RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT										
Maguire-NWS Pier 3 Replacement					Reach 3			ASI Job No. 22-245			
CONSTITUENTS	MDL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
BATTELLE ID#		V5843			V5843			V5843			
ASI ID#		2021328			2021328			2021328			
PAH's	ppb (ng/g)	ppb (ng/g)									ppb (ng/g)
Naphthalene		147.31									147.31
Acenaphthylene		50.80									50.80
Acenaphthene		132.22									132.22
Fluorene		144.44									144.44
Phenanthrene		373.54									373.54
Anthracene		177.96									177.96
Fluoranthene		758.23									758.23
Pyrene		666.94									666.94
Benzo(a)anthracene		346.87									346.87
Chrysene		432.88									432.88
Benzo(b)fluoranthene		371.02									371.02
Benzo(k)fluoranthene		361.49									361.49
Benzo(a)pyrene		401.95									401.95
Indeno(1,2,3-c,d)pyrene		322.43									322.43
Dibenzo(a,h)anthracene		71.47									71.47
Benzo(g,h,i)perylene		246.55									246.55
Total PAH's		5006.1			0.0			0.0			5006.10
Philip A.S. ID #		039489 02			039489 02			039489 02			
ASI ID#		2021328			2021328			2021328			Mean
Dioxins	pptr(pg/g)	pptr(pg/g)			pptr(pg/g)			pptr(pg/g)			pptr(pg/g)
2378 TCDD		21			29			25			25.0
12378 PeCDD		6.3			6.5			6.9			6.57
123478 HxCDD		6.2			6.0			5.9			6.03
123678 HxCDD		60			61			61			60.7
123789 HxCDD		27			23			25			25.0
1234678 HpCDD		490			510			510			503
12346789 OCDD		5000			5400			5200			5200
2378 TCDF		51			46			48			48.3
12378 PeCDF		12			11			11			11.3
23478 PeCDF		15			16			14			15.0
123478 HxCDF		38			38			40			39
123678 HxCDF		13			13			13			13.0
234678 HxCDF		8.7			6.5			6.8			7.33
123789 HxCDF		2.9			2.90			2.90			2.9
1234678 HpCDF		160			170			170			166.7
1234789 HpCDF		0.46	ND		8.3	ND		14			6.1
12346789 OCDF		280			290			280			283

B - Analyte concentration in blank > 3 times target
E - Estimate due to co- on chromotography column
J = Detection limit below the reporting limit or is an estimated value
ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values.
d - Analyte reported from a dilution.

TABLE 17	28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE NWS- Pier 3 Replacement Reach 3												Job # 22-245																		
		Macoma nasuta																													
		PRETEST						REFERENCE										REACH 3 TEST													
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022585		2022586		2022587		2022588		2022589	
Battelle ID #		U0554		U0555		U0556		U0217		U0218		U0219		U0220		U0221		U0232		U0233		U0234		U0235		U0236	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.036		0.026		0.028		0.048		0.048		0.056		0.031		0.033		0.060		0.061		0.058		0.049		0.074	
Arsenic	1.00	2.921		2.644		2.563		2.558		2.275		2.675		2.505		2.534		3.034		2.849		2.303		3.349		3.841	
Cadmium	0.10	0.030		0.030		0.031		0.022		0.024		0.029		0.029		0.026		0.034		0.033		0.026		0.042		0.041	
Chromium	0.20	0.267		0.248		0.312		0.883		0.530		0.855		0.427		0.539		0.962		0.859		0.752		0.834		0.927	
Copper	1.00	1.773		1.311		1.495		2.153		2.249		2.020		1.593		1.810		2.745		2.778		2.985		1.976		2.993	
Mercury	0.02	0.006		0.007		0.009		0.010		0.009		0.011		0.007		0.007		0.020		0.015		0.016		0.013		0.021	
Nickel	0.10	0.269		0.271		0.300		0.331		0.354		0.348		0.356		0.294		0.524		0.453		0.466		0.550		0.601	
Lead	0.10	0.118		0.092		0.119		0.250		0.228		0.209		0.174		0.188		0.800		0.614		0.657		0.534		0.827	
Zinc	1.00	11.829		11.403		12.186		11.935		13.019		12.855		14.263		11.641		13.161		12.530		12.512		14.136		15.267	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.01	J	0.03	J	0.04	ND	0.04	ND	0.02	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
a-Chlordane	0.4	0.09		0.09		0.10		0.06		0.07		0.06		0.06		0.05		0.17		0.18		0.16		0.32		0.23	
trans Nonachlor	0.4	0.04	ND	0.02	J	0.03	J	0.02	J	0.04	ND	0.04	ND	0.01	J	0.01	J	0.16		0.11		0.07		0.15		0.11	
Dieldrin	0.4	0.04	ND	0.13		0.17		0.11		0.04	ND	0.13		0.13		0.11		0.33		0.29		0.28		0.30		0.04	ND
4,4'-DDT	0.4	0.04	ND	0.04	ND	0.04	ND	0.08		0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.04	ND	0.19		0.04	ND
2,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.11	
4,4'-DDD	0.4	0.16		0.07	ND	0.15		0.11		0.05	J	0.10		0.06	J	0.06		0.54		0.45		0.49		0.43		0.63	
2,4'-DDD	0.4	0.05	ND	0.05	ND	0.05	ND	0.06		0.05	ND	0.06		0.07		0.05	J	0.36		0.38		0.53		0.25		0.44	
4,4'-DDE	0.4	0.07		0.19		0.10		0.11		0.09		0.08		0.09		0.08		2.09		2.00		1.81		1.41		2.53	
2,4'-DDE	0.4	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.16	ND	0.18	ND	0.16	ND	0.16	ND	0.21		0.16	ND
Total DDT		0.840		0.570		0.560		0.580		0.480		0.600		0.480		0.470		3.250		3.090		3.090		2.560		3.910	
Endosulfan I	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.09		0.06	ND	0.12	
Endosulfan II	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.08	ND	0.08	ND
Endosulfan sulfate	0.4	0.09	ND	0.07	J	0.12		0.09	ND	0.09	ND	0.21		0.08	J	0.15		0.18		0.14		0.17		0.12		0.14	
Heptachlor	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.07		0.10		0.14	
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x),where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 17 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 3 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022670		2022671		2022672		2022673		2022674		2022585		2022586		2022587		2022588		2022589	
Battelle ID #		V2775-R		V2776-R		V2777-R		U0217		U0218		U0219		U0220		U0221		U0232		U0233		U0234-R1		U0235-R1		U0236-R1	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.57	ND	0.58	ND	0.55	ND	0.55	ND	0.55	ND	0.56	ND	0.56	ND	0.55	ND	0.55	ND	0.55	ND	0.56	ND	0.55	ND	0.55	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06		0.06	ND	0.06	ND	0.06	ND	0.57		0.63		0.72	
PCB 28	0.4	0.06	J	0.09		0.05	J	0.17		0.08	J	0.11		0.08		0.09		3.45		3.21		2.66		2.50		4.01	
PCB 44	0.4	0.14		0.18		0.12		0.23		0.11		0.12		0.18		0.12		1.41		1.47		0.89		0.96		1.14	
PCB 49	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.01	J	0.05	ND	0.05	ND	2.98		2.83		2.04		2.08		3.29	
PCB 52	0.4	0.07		0.08		0.04		0.48		0.08		0.08		0.10		0.08		3.58		3.71		2.72		2.35		3.89	
PCB 66	0.4	0.05	ND	0.03	J	0.04	J	0.12		0.09		0.07		0.08		0.07		3.04		2.82		2.38		2.10		3.19	
PCB 87	0.4	0.04	J	0.05		0.09		0.06		0.05	J	0.07		0.04	J	0.04	J	0.56		0.52		0.50		0.46		0.60	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.04		0.04	ND	0.04	ND	0.02	J	0.02	J	2.41		2.27		2.13		2.38		2.85	
PCB 105	0.4	0.07	ND	0.02	J	0.02	J	0.04	J	0.03	J	0.03	J	0.02	J	0.02	J	0.71		0.64		0.56		0.43		0.60	
PCB 118	0.4	0.06	ND	0.02	J	0.06	ND	0.11		0.05	J	0.04	J	0.04	J	0.04	J	1.63		1.82		1.33		1.09		1.84	
PCB 128	0.4	0.16	ND	0.16	ND	0.15	ND	0.15	ND	0.15	ND	0.15	ND	0.16	ND	0.15	ND	0.11	J	0.05	J	0.13	J	0.15	ND	0.13	J
PCB 138	0.4	0.07	ND	0.15		0.15		0.30		0.18		0.16		0.13		0.27		1.44		1.52		1.34		1.00		1.92	
PCB 153	0.4	0.12	ND	0.06	J	0.03	J	0.21		0.07	J	0.11	J	0.08	J	0.09	J	2.24		2.08		1.82		1.30		2.63	
PCB 170	0.4	0.06	ND	0.06	ND	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.03	J	0.10		0.16		0.20		0.15		0.24	
PCB 180	0.4	0.07	ND	0.08		0.08		0.13		0.08		0.09		0.07		0.08		0.50		0.49		0.47		0.33		0.55	
PCB 183	0.4	0.06	ND	0.01	J	0.06	ND	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.21		0.17		0.16		0.12		0.20	
PCB 184	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.08	ND	0.08	ND
PCB 187	0.4	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.44		0.39		0.34		0.25		0.56	
PCB 195	0.4	0.06	ND	0.02	J	0.01	J	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.02	J	0.08		0.09		0.06	J	0.05	J	0.08	
PCB 206	0.4	0.06	ND	0.00	J	0.01	J	0.02	J	0.06	ND	0.06	ND	0.06	ND	0.01	J	0.05	J	0.04	J	0.12		0.03	J	0.09	
PCB 209	0.4	0.06	J	0.05	J	0.07		0.06	J	0.06	ND	0.06	J	0.04	J	0.05	J	0.05	J	0.11		0.11		0.03	J	0.06	J
Total PCB		4.180		3.800		3.788		6.180		4.240		4.320		4.180		4.100		51.360		50.160		42.400		37.980		58.440	
1,4-Dichlorobenzene	0.4	1.47	ND	0.64		0.57	ND	0.83		0.84		0.71		1.05		0.84		0.94		0.57	ND	1.45	ND	1.42	ND	1.43	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 17 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

		Macoma results																									
		PRETEST						REFERENCE										REACH 3 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2022336		2022337		2022338		2022570		2022571		2022572		2022573		2022574		2022585		2022586		2022587		2022588		2022589	
Battelle ID #		V2775-R		V2776-R		V2777-R		U0217		U0218		U0219		U0220		U0221		U0232		U0233		U0234-R1		U0235-R1		U0236-R1	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.78	ND	1.84		1.47		3.45		2.86		2.10		2.76		2.79		3.81		2.40		2.88		3.04		3.96	
Acenaphthylene	4	0.06	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.11	J	0.03	ND	0.77		0.65		0.45	J	0.39	J	0.75	J
Acenaphthene	4	0.25	J	0.04	ND	0.33	J	1.09		1.01		0.60		0.99		0.92		6.04		4.96		12.94		14.66		10.04	
Fluorene	4	0.24	J	0.30	J	0.29	J	0.65		0.59		0.36	J	0.56	J	0.58	J	5.06		4.57		10.31		12.42		8.72	
Phenanthrene	4	0.96	J	1.63		0.98		1.90		1.59		1.24		1.71		1.59		23.47		21.21		46.95		60.83		42.99	
Anthracene	4	0.12	J	0.13	J	0.09	J	0.32		0.15	J	0.13	J	0.31	J	0.33	J	7.51		6.03		8.31		9.83		9.98	
Fluoranthene	4	2.51		2.96		2.60		2.97		2.60		2.00		2.34		3.05		80.63		81.27		131.60		121.20		135.73	
Pyrene	4	1.77		2.02		2.04		2.59		2.18		2.23		2.08		2.48		65.44		69.09		91.79		84.70		99.62	
Benzo(a)anthracene	4	0.23	J	0.23	J	0.18	J	0.66		0.33	J	0.24	J	0.36	J	0.31	J	18.89		17.19		24.97		18.60		29.27	
Chrysene	4	0.70	J	0.87		0.71		1.58		0.94		0.94		0.98		1.14		22.86		20.99		26.23		20.52		30.86	
Benzo(b)fluoranthene	4	0.07	ND	0.61		0.27	J	0.93		0.47	J	0.36	J	0.38	J	0.49	J	11.32		9.83		10.83		8.02		13.87	
Benzo(k)fluoranthene	4	0.06	ND	0.33	J	0.17	J	0.86		0.27	J	0.33	J	0.31	J	0.39	J	7.90		6.89		8.23		5.66		9.99	
Benzo(a)pyrene	4	0.10	ND	0.18	J	0.07	J	0.77		0.23	J	0.25	J	0.25	J	0.26	J	8.98		6.85		7.65		6.17		9.80	
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.02	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	0.01	ND	2.39		1.85		3.06		2.14		3.83	
Dibenzo(a,h)anthracene	4	0.07	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.56	J	0.82		0.96	J	0.36	J	1.04	J
Benzo(g,h,i)perylene	4	0.05	ND	0.37	J	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	0.02	ND	2.43		2.19		3.53		2.54		4.81	
Total PAH's		9.060		11.880		9.490		17.840		13.310		10.910		13.220		14.420		268.080		256.890		390.490		371.880		415.260	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 17 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

Macoma nasuta

CONSTITUENTS	DL's	PRETEST 1	Q	2	Q	3	Q	REFERENCE R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		2022336		2022337		2022338		2022670		2022671		2022672		2022673		2022674	
Philip Analytical ID #		080375 02		080376 02		080377 02		080356 02		080357 02		080358 02		080359 02		080360 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.33	ND	0.24	ND	0.22	ND	0.22	ND	0.3	ND	0.18	ND	0.26	ND	1.30	ND
12378 PeCDD	5	0.32	ND	0.29	ND	0.22	ND	0.28	ND	0.55	J	0.19	ND	0.27	ND	1.10	ND
123478 HxCDD	5	0.23	ND	0.25	ND	0.28	J	0.27	ND	0.3	ND	0.33	ND	0.300	ND	0.46	ND
123678 HxCDD	5	0.23	ND	0.25	ND	0.33	J	0.26	ND	0.66	J	0.31	ND	0.260	ND	0.43	ND
123789 HxCDD	5	0.21	ND	0.24	ND	0.41	ND	0.24	ND	0.42	J	0.29	ND	0.270	ND	0.41	ND
1234678 HpCDD	5	0.65	J	0.74	J	1.5	J	1.10	J	2.1	J	0.32	J	2.00	J	0.62	ND
12346789 OCDD	10	2.3	J	3.1	J	9.0	J	7.8	J	5.4	J	1.20	J	46.00		8.50	J
2378 TCDF	1	0.22	ND	0.15	ND	0.13	ND	0.16	ND	1.5	J	0.28	ND	0.51	ND	1.50	ND
12378 PeCDF	5	0.24	ND	0.20	ND	0.17	ND	0.52	ND	1.5	J	0.52	ND	0.35	ND	1.20	ND
23478 PeCDF	5	0.25	ND	0.21	ND	0.28	J	0.53	ND	1.3	J	0.54	ND	0.36	ND	1.30	ND
123478 HxCDF	5	0.26	ND	0.20	ND	0.56	ND	0.55	J	5	J	0.160	J	0.26	ND	0.48	ND
123678 HxCDF	5	0.20	J	0.14	ND	0.24	ND	0.33	ND	2.2	J	0.150	ND	0.26	ND	0.46	ND
234678 HxCDF	5	0.19	J	0.16	ND	0.46	J	0.39	ND	0.62	J	0.170	ND	0.31	ND	0.54	ND
123789 HxCDF	5	0.18	J	0.18	ND	0.26	J	0.43	ND	0.22	ND	0.190	ND	0.34	ND	0.60	ND
1234678 HpCDF	5	0.32	ND	0.51	ND	0.91	ND	1.10	J	7.2	J	0.22	J	0.37	J	0.35	ND
1234789 HpCDF	5	0.26	ND	0.43	J	0.51	ND	0.34	ND	1	J	0.20	ND	0.22	ND	0.44	ND
12346789 OCDF	10	1.10	ND	2.8	J	8.2	J	15.00	J	14	J	0.71	J	1.20	J	3.10	J

CONSTITUENTS	REACH 3 TEST T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #	2022685		2022686		2022687		2022688		2022689	
Philip Analytical ID #	080371 02		080372 02		080373 02		080374 02		080378 02	
Dioxins	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	0.72	ND	0.51	ND	0.46	ND	0.47	ND	0.52	ND
12378 PeCDD	0.83	ND	0.64	ND	0.55	ND	1.10	J	0.24	ND
123478 HxCDD	0.45	ND	0.54	ND	0.36	ND	1.30	J	0.22	ND
123678 HxCDD	0.62	ND	0.54	ND	0.82	J	1.80	J	0.90	J
123789 HxCDD	0.41	ND	0.49	ND	0.33	ND	1.60	J	0.47	ND
1234678 HpCDD	2.40	J	2.10	J	2.50	J	3.00	J	3.5	J
12346789 OCDD	18.00		14.00		15.00		12.00		26	
2378 TCDF	1.40	ND	1.40	ND	1.80	ND	1.20	J	1.90	ND
12378 PeCDF	0.66	ND	0.68	ND	0.53	ND	1.00	J	0.33	J
23478 PeCDF	0.69	ND	0.71	ND	0.79	J	1.50	J	0.63	J
123478 HxCDF	0.74	ND	0.58	ND	2.10	J	1.50	J	0.63	J
123678 HxCDF	0.28	ND	0.29	ND	0.83	J	1.40	J	0.34	J
234678 HxCDF	0.33	ND	0.34	ND	0.26	ND	1.60	J	0.31	J
123789 HxCDF	0.36	ND	0.38	ND	0.28	ND	1.70	J	0.18	ND
1234678 HpCDF	1.20	ND	0.79	ND	2.90	ND	1.90	ND	1.60	ND
1234789 HpCDF	0.44	ND	0.47	ND	0.48	ND	2.00	J	0.35	ND
12346789 OCDF	1.30	ND	1.20	ND	8.00	J	4.00	J	12	J

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 18 — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

Nereis virens

		PRETEST						REFERENCE										REACH 3 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021776		2021777		2021778		2021779		2021780	
Battelle ID #		V7425		V7426		V7427		V7428		V7429		V7430		V7431		V7432		V7442		V7443		V7444		V7445		V7446	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.016		0.015		0.018		0.039		0.030		0.036		0.034		0.030		0.054		0.030		0.033		0.027		0.030	
Arsenic	1	2.833		2.969		2.816		3.833		3.884		3.760		3.821		3.729		3.022		3.870		3.447		3.646		3.547	
Cadmium	0.1	0.044		0.033		0.037		0.050		0.046		0.052		0.040		0.043		0.045		0.062		0.045		0.045		0.049	
Chromium	0.2	0.533		0.471		0.489		0.433		0.425		0.317		0.520		0.392		0.586		0.558		0.450		0.758		0.626	
Copper	1	1.095		0.786		0.853		1.265		1.293		1.454		1.429		1.321		1.312		1.425		1.382		1.380		1.465	
Mercury	0.02	0.015		0.014		0.013		0.016		0.016		0.019		0.016		0.018		0.014		0.015		0.013		0.014		0.014	
Nickel	0.1	0.213		0.214		0.206		0.179		0.190		0.178		0.274		0.214		0.280		0.383		0.306		0.276		0.259	
Lead	0.1	0.132		0.087		0.098		0.106		0.128		0.118		0.134		0.119		0.104		0.148		0.134		0.120		0.103	
Zinc	1	17.936		18.050		20.616		29.869		15.351		34.957		24.576		20.398		23.491		17.885		48.188		32.348		27.881	
Pesticides	ug/kg																										
Aldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.07	ND	0.11	ND	0.07	ND	0.04	ND	0.05	ND	0.04	ND	0.06		0.05	ND	0.05	ND
a-Chlordane	0.4	0.12		0.13		0.15		0.15		0.14		0.23		0.10		0.11		0.44		0.52		0.56		0.48		0.50	
trans Nonachlor	0.4	0.47		0.47		0.50		0.44		0.47		0.64		0.35		0.33		0.50		0.59		0.63		0.53		0.48	
Dieldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.24		0.38		0.39		0.08	ND	0.21		0.69		0.71		0.78		0.68		0.79	
4,4'-DDT	0.4	0.08		0.12		0.34		0.12		0.24		0.12	ND	0.08	ND	0.05	ND	0.15		0.14		0.30		0.15		0.08	ND
2,4'-DDT	0.4	0.08	ND	0.06	ND	0.08	ND	0.08	ND	0.10	ND	0.16	ND	0.16		0.06	ND	0.07	ND	0.08	ND	0.07	ND	0.18		0.17	
4,4'-DDD	0.4	0.07	ND	0.07	ND	0.07	ND	0.17		0.15		0.31		0.13		0.10		1.30		1.25		1.52		1.19		1.27	
2,4'-DDD	0.4	0.06	ND	0.04	ND	0.05	ND	0.29		0.18		0.16		0.08	ND	0.05	ND	0.54		0.65		0.63		0.58		0.79	
4,4-DDE	0.4	0.06		0.07		0.13		0.05	J	0.10	ND	1.00		0.11	ND	0.03	J	2.44		1.97		2.42		1.90		2.80	
2,4'-DDE	0.4	0.16	ND	0.15	ND	0.15	ND	0.18	ND	0.26	ND	0.44	ND	0.28	ND	0.17	ND	0.18	ND	0.16	ND	0.20	ND	0.27		0.28	
Total DDT		0.480		0.510		0.800		0.870		1.030		2.210		0.840		0.460		4.680		4.230		5.140		4.270		5.370	
Endosulfan I	0.4	0.06	ND	0.05	ND	0.06	ND	0.06	ND	0.10	ND	0.18	ND	0.10	ND	0.08	ND	0.07	ND	0.06	ND	0.07	ND	0.08	ND	0.07	ND
Endosulfan II	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.10	ND	0.09	ND	0.11	ND	0.11	ND	0.11	ND
Endosulfan sulfate	0.4	0.13		0.27		0.22		0.47		0.69		0.58		0.13	J	0.17		0.43		0.39		0.44		0.40		0.58	
Heptachlor	0.4	0.16		0.12		0.05	ND	0.89		1.39		1.64		0.08	ND	0.05	ND	0.04	J	0.01	J	0.06	ND	0.58		0.53	
Heptachlor epoxide	0.4	0.03	ND	0.03	ND	0.03	ND	0.04	ND	0.05	ND	0.09	ND	0.06	ND	0.04		0.04	ND	0.03	ND	0.04	ND	0.04	ND	0.04	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

B - Analyte concentration in blank > 3 times target

TABLE 18 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

		Nereis virens																													
		PRETEST						REFERENCE										REACH 3 TEST													
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021776		2021777		2021778		2021779		2021780	
Battelle ID#		V7425-R1		V7426-R1		V7427-R1		V7428-R1		V7429-R1		V7430-R1		V7431		V7432		V7442		V7443		V7444		V7445-R1		V7446-R1	
Industrial Chemicals	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
PCB 8	0.4	0.55	ND	0.53	ND	0.54	ND	0.62	ND	0.92	ND	1.54	ND	0.99	ND	0.60	ND	0.63	ND	0.56	ND	0.70	ND	0.75	ND	0.71	ND
PCB 18	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.17	ND	0.11	ND	0.06	ND	2.58		2.49		2.63		2.03		2.45	
PCB 28	0.4	0.08	ND	0.07	ND	0.08	ND	0.10		0.12	J	0.22	ND	0.10	J	0.11		4.98		4.61		5.13		3.80		4.54	
PCB 44	0.4	0.05	ND	0.05	ND	0.05	ND	0.12		0.14		0.25		0.14		0.13		3.13		2.65		3.23		2.24		2.92	
PCB 49	0.4	0.05	ND	0.04	ND	0.04	ND	0.24		0.17		0.13	ND	0.08	ND	0.05	ND	4.74		4.12		4.71		3.75		4.61	
PCB 52	0.4	0.04	ND	0.04	ND	0.04	ND	0.14		0.22		0.24		0.16		0.11		6.57		5.92		6.72		5.49		6.46	
PCB 66	0.4	0.05	ND	0.05	ND	0.05	ND	0.13		0.08	J	0.08	J	0.09	ND	0.05	J	4.73		4.18		4.81		3.46		4.43	
PCB 87	0.4	0.05	ND	0.05	ND	0.05	ND	0.07		0.11		0.14		0.09	ND	0.05	ND	0.68		0.52		0.61		0.48		0.73	
PCB 101	0.4	0.04	ND	0.04	ND	0.04	ND	0.26		0.29		0.49		0.31		0.23		4.98		4.35		4.81		4.48		5.43	
PCB 105	0.4	0.25		0.26		0.26		0.20		0.27		0.31		0.17		0.08	ND	1.18		1.04		1.16		0.97		1.49	
PCB 118	0.4	0.37		0.27		0.35		0.26		0.29		0.35		0.18		0.18		3.49		2.79		3.26		2.74		3.95	
PCB 128	0.4	0.15	ND	0.15	ND	0.15	ND	0.17	ND	0.26	ND	0.17	J	0.27	ND	0.17	ND	0.19		0.28		0.17	J	0.21	ND	0.64	
PCB 138	0.4	1.50		1.72		1.72		1.85		1.76		2.30		1.33		1.46		5.33		4.74		5.29		4.82		6.12	
PCB 153	0.4	2.04		2.13		2.26		2.24		2.34		2.70		1.77		1.98		6.27		5.59		6.38		5.55		7.10	
PCB 170	0.4	0.37		0.40		0.40		0.40		0.40		0.48		0.34		0.41		1.11		1.11		0.86		0.89		1.11	
PCB 180	0.4	1.19		1.23		1.29		1.25		1.31		1.62		0.97		1.15		2.62		2.50		2.70		2.31		2.73	
PCB 183	0.4	0.31		0.33		0.32		0.33		0.34		0.38		0.27		0.35		0.85		0.83		0.87		0.76		0.94	
PCB 184	0.4	0.08	ND	0.08	ND	0.08	ND	0.09	ND	0.14	ND	0.24	ND	0.15	ND	0.09	ND	0.10	ND	0.09	ND	0.11	ND	0.12	ND	0.11	ND
PCB 187	0.4	0.53		0.60		0.56		0.53		0.58		0.69		0.41		0.51		1.67		1.51		1.81		1.36		1.80	
PCB 195	0.4	0.10		0.11		0.11		0.12		0.14		0.18		0.12		0.13		0.33		0.34		0.40		0.29		0.33	
PCB 206	0.4	0.14		0.16		0.15		0.16		0.18		0.24		0.18		0.19		0.39		0.41		0.40		0.38		0.37	
PCB 209	0.4	0.13		0.23		0.29		0.28		0.22		0.15	J	0.13		0.18		0.33		0.38		0.30		0.21		0.24	
Total PCB		16.260		17.200		17.780		19.300		20.720		26.140		16.720		16.540		113.760		102.420		114.120		94.140		118.420	
1,4-Dichlorobenzene	0.4	1.43	ND	1.37	ND	1.39	ND	1.06	ND	2.27	ND	4.01	ND	1.16		0.85		1.05		0.82		1.03		1.95	ND	1.11	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 18 continued	28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE NWS- Pier 3 Replacement Reach 3																													
		Nereis virens																												
		PRETEST						REFERENCE										REACH 3 TEST												
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021776		2021777		2021778		2021779		2021780	
Battelle ID#		V7425-R1		V7426-R1		V7427-R1		V7428-R1		V7429-R1		V7430-R1		V7431		V7432		V7442		V7443		V7444		V7445-R1		V7446-R1	
PAH's (wet weight)	ug/kg	(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)		(ug/kg)	
Naphthalene	4	1.73	ND	1.67	ND	1.69	ND	3.65		3.13		4.91		3.97		3.82		4.73		3.91		3.82		4.29		2.67	
Acenaphthylene	4	0.11	J	0.13	J	0.10	J	0.09	ND	0.13	J	0.23	ND	0.13	J	0.12	J	0.04	ND	0.38	J	0.37	J	0.29	J	0.14	J
Acenaphthene	4	1.00	J	0.88	J	1.07	J	1.86		1.59	J	3.52	J	1.16		1.54		4.30		4.32		4.93		5.48		2.74	
Fluorene	4	0.34	J	0.35	J	0.41	J	0.34	J	0.33	J	0.67	J	0.27	J	0.31	J	0.93		1.15		1.19		0.92	J	0.60	J
Phenanthrene	4	0.78	J	0.79	J	0.88	J	0.76	ND	1.07	ND	1.90	ND	0.49	ND	0.41	J	2.18		3.17		3.22		2.61		1.52	
Anthracene	4	0.07	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.18	ND	0.05	ND	0.03	ND	0.48	J	0.78		0.64	J	0.46	J	0.30	J
Fluoranthene	4	2.17		1.60		2.01		0.95	ND	1.35	ND	2.39	ND	0.61	ND	0.37	ND	29.93		47.32		46.04		42.67		22.09	
Pyrene	4	2.58		1.74		2.00		0.67	J	0.88	ND	1.56	ND	0.40	ND	0.26	J	32.42		46.65		47.64		40.69		21.60	
Benzo(a)anthracene	4	0.07	ND	0.15	J	0.16	J	0.17	J	0.17	J	0.64	J	0.31	J	0.24	J	1.32		3.06		2.35		2.20		1.59	
Chrysene	4	1.75		1.33	J	1.45		0.45	J	0.69	J	0.57	J	0.14	J	0.22	J	10.17		12.63		12.39		10.42		7.24	
Benzo(b)fluoranthene	4	0.36	J	0.29	J	0.41	J	0.08	ND	0.11	ND	0.20	ND	0.05	ND	0.03	ND	1.77		2.03		1.86		1.69	J	1.24	
Benzo(k)fluoranthene	4	0.44	J	0.28	J	0.42	J	0.09	ND	0.13	ND	0.23	ND	0.06	ND	0.04	ND	1.78		2.24		2.12		1.63	J	1.35	
Benzo(a)pyrene	4	0.10	ND	0.09	ND	0.21	J	0.11	ND	0.15	ND	0.27	ND	0.07	ND	0.04	ND	1.33		2.23		1.51		3.88		1.16	
Indeno(1,2,3-cd)pyrene	4	0.04	ND	0.04	ND	0.20	J	0.04	ND	0.18	J	0.10	ND	0.03	ND	0.02	ND	0.42	J	0.44	J	0.45	J	0.56	J	0.43	J
Dibenzo(a,h)anthracene	4	0.07	ND	0.06	ND	0.06	ND	0.07	ND	0.10	ND	0.18	ND	0.05	ND	0.03	ND	0.19	J	0.27	J	0.22	J	0.17	J	0.18	J
Benzo(g,h,i)perylene	4	0.46	J	0.37	J	0.05	ND	0.14	J	0.30	J	0.36	J	0.04	ND	0.02	ND	1.10		1.15		0.96		0.94	J	0.81	J
Total PAH's		12.070		9.830		11.180		9.840		10.410		17.910		7.850		7.600		93.070		131.720		131.710		118.900		65.840	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 18 continued 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 3

		Nereis virens																									
		PRETEST						REFERENCE										REACH 3 TEST									
CONSTITUENTS	DL's	R1	Q	R2	Q	R3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		2021487		2021488		2021489		2021761		2021762		2021763		2021764		2021765		2021776		2021777		2021778		2021779		2021780	
Philip Analytical ID #		078515 02		078516 02		078517 02		078519 02		078520 02		078521 02		078522 02		078523 02		078536 02		078537 02		078538 02		078539 02		078540 02	
Dioxins	(pptr)	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.18	ND	0.20	J	0.23	ND	0.80	ND	0.86	ND	1.30	ND	2.00	ND	0.34	ND	0.90	J	0.63	J	1.30	ND	0.92	J	0.65	ND
12378 PeCDD	5	0.17	ND	0.16	ND	0.20	ND	0.76	ND	0.70	ND	1.50	ND	2.30	ND	0.29	ND	0.44	ND	0.35	ND	1.10	ND	0.44	ND	0.88	ND
123478 HxCDD	5	0.31	ND	0.14	ND	0.12	ND	1.10	ND	0.42	ND	1.20	ND	2.10	ND	0.20	ND	0.22	ND	0.32	ND	0.67	ND	0.31	ND	0.57	ND
123678 HxCDD	5	0.29	ND	0.45	J	0.42	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.36	J	0.71	J	0.63	J	0.86	ND	0.70	J	0.70	ND
123789 HxCDD	5	0.29	ND	0.22	J	0.18	ND	1.00	ND	0.39	ND	1.20	ND	2.00	ND	0.18	ND	0.19	ND	0.29	ND	0.60	ND	0.28	ND	0.51	ND
1234678 HpCDD	5	1.90	J	2.00	J	1.90	ND	1.90	J	1.00	J	1.40	J	1.60	ND	1.70	J	1.60	J	2.10	J	2.00	J	4.20	J	3.20	J
12346789 OCDD	10	11.00	J	10.00	J	12.00	J	11.00	J	6.70	J	5.10	J	8.20	J	13.00	J	8.80	J	14.00	J	12.00	ND	34.00	J	49.00	
2378 TCDF	1	1.50	J	1.50	J	1.70	J	2.20	J	1.30	J	1.30	J	1.50	ND	1.30	J	3.10	J	3.20	J	3.00	J	3.40	J	4.00	
12378 PeCDF	5	0.51	ND	0.28	ND	0.50	ND	0.84	ND	0.67	ND	1.40	ND	1.80	ND	0.27	ND	0.25	ND	0.37	ND	1.30	ND	0.51	ND	0.38	ND
23478 PeCDF	5	0.40	J	0.44	J	0.44	J	0.88	ND	0.70	ND	1.40	ND	1.90	ND	0.45	J	0.96	J	1.00	J	1.60	J	1.10	J	0.82	ND
123478 HxCDF	5	0.11	ND	0.11	ND	0.12	ND	0.51	ND	0.25	ND	0.75	ND	1.30	ND	0.85	ND	3.10	ND	3.90	ND	9.90	ND	6.80	ND	5.10	ND
123678 HxCDF	5	1.40	ND	0.68	ND	1.90	ND	1.90	ND	0.63	ND	1.60	ND	2.10	ND	0.16	ND	0.20	ND	0.30	ND	0.89	ND	0.32	ND	0.26	ND
234678 HxCDF	5	0.13	ND	0.20	J	0.14	ND	0.61	ND	0.30	ND	0.90	ND	1.50	ND	0.18	ND	0.24	ND	0.35	ND	1.00	ND	0.37	ND	0.31	ND
123789 HxCDF	5	0.14	ND	0.15	ND	0.16	ND	0.67	ND	0.32	ND	0.99	ND	1.70	ND	0.20	ND	0.45	J	0.53	J	1.20	ND	0.52	J	0.61	J
1234678 HpCDF	5	2.40	J	0.86	ND	1.00	ND	0.74	ND	0.51	ND	0.97	ND	2.00	ND	0.93	ND	2.50	J	21.00		12.00	J	2.40	J	1.10	J
1234789 HpCDF	5	1.10	ND	0.22	ND	0.27	J	0.97	ND	0.59	ND	1.30	ND	2.60	ND	0.37	ND	0.50	J	2.50	J	2.50	J	0.44	ND	0.52	J
12346789 OCDF	10	0.98	J	0.99	J	2.00	J	1.20	ND	0.72	ND	1.50	ND	2.60	ND	1.20	J	61.00		760.00		130.00		22.00	J	6.90	J

= Value from second column confirmation

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

Q = Indicates presence of QC Ion instabilities caused by quantitative interferences

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

USACOE SAMPLING SCHEME AND SAMPLING RESULTS
10 JULY 2003
(Reconfigured Reach 1)

REV. 8/99

SAMPLING SCHEME and LIST of REQUIRED TESTING as OUTLINED in the 1992 ACENYD/EPA REGION II REGIONAL IMPLEMENTATION MANUAL on Dredged Material Proposed for Ocean Disposal and the 1991 GREEN BOOK

Applicant: US NAVY – NAVAL WEAPONS STATION EARLE - Pier 3 Replacement

Applicant No.: 2002-00357-OD

Address: MONMOUTH COUNTY, NJ

Waterway: SANDY HOOK BAY

Proposed Volume: 209,000 cubic yards (based on 07/10/2000 bathymetric survey)

Project Depth in feet: -45' MLW

(NOTE: The applicant is required to collect cores from each sampling location to project depth plus 2 ft)

A preapplication meeting ____ was held on ____________ at NY District Offices in New York

X was not held at the NY District Offices in New York.

The applicant has indicated that testing will be performed by the following laboratories:

Biological: not available Analytical: not available Dioxin: not available

The sampling scheme and required testing described on the reverse side was approved for the proposed project area based upon the information contained in the attached map.

Sample dredging sites are indicated on attached map.

The proposed dredging area is subdivided into ONE reach for sampling and testing purposes:

- Reach "1": 9 locations:

#1-4, 6-9: Material from -42.5' MLW to -47' MLW (Lower layer of sediment from berthing areas)
#5: Material from -25' MLW to -47' MLW (Lower layer of sediment from under current Pier 3)

The District reserves the right to require additional sampling and testing at any time.

COMMENTS:

1. If there is any evidence of stratification in core samples, contact NYD prior to compositing.

2. Additional cores may have to be taken from each station in order to ensure adequate volumes of sediment to meet testing requirements. If so, the same number of cores must be taken and composited from each location.

3. Core locations may have to be moved if shoaling patterns have changed. If so, contact NYD during sampling to confirm new locations.

* If you have any questions regarding sampling, test protocols, test species, QA/QC, etc. please contact the Dredged Material Management Section of the USACE/NYD at (212) 264-5620 or extension of person completing this form.

PREPARED BY: OKSANA YAREMKO [signature] 7/10/03 DATE: 10 JULY 2003 PHONE: 212-264-9268

SEE REVERSE SIDE FOR SAMPLING AND TESTING REQUIREMENTS

Any Box Checked Off Indicates an Analysis or Assay that is Required for a Given Project.
Archiving requires saving a sample for possible analysis at a later time pending further instruction.

X=Per Homogenized Sediment Core + Reference (Composited Grabs) + Control
C=Per Bioassay Sediment Composite
A=Archive
W=Site Water and Elutriate
T=Per Tissue Replicate (Ref, Test, Pre-test, A=Archive Ctl and any remaining tissue from Ref, Test, Pre-test)

1. SEDIMENT PHYSICAL ANALYSIS (If stratification is observed, each stratum within a core must be analyzed separately)
   a. X Grain Size Analysis (% sand, % silt, & % clay)
   b. X % Moisture
   c. C Specific Gravity
   d. C Bulk Density
   e. C Plastic and Liquid limits (Atterberg limits)

2. SEDIMENT CHEMICAL ANALYSIS

REQUIRED

   a. X % Total Organic Carbon

CASE BY CASE BASIS

   a. C,A Metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. C,A PAHs (LMWs: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   c. C,A PAHs (HMWs: benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene)
   d. C,A Semi-volatiles (1,4 dichlorobenzene)
   e. C,A Pesticides (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptachlor, heptachlor epoxide)
   f. C,A PCBs (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   g. ___ PCB coplanar (#77,126,156,169)
   h. C,A Dioxins/Furans (2,3,7,8 - substituted isomers, n=17)
   i. ___ Other:
   j. ___ LIS pesticides
   k. ___ LIS PAHS

3. CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

REQUIRED

   a. W Metals (Ag, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. W PCBs (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209)
   c. W Pesticides (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptachlor, heptachlor epoxide)
   d. ___ Other:

CASE BY CASE BASIS

   a. ___ PAHs (_ all 16, _ LMW, _ HMW, _ as specified)
   b. ___ 2,3,7,8-TCDD
   c. ___ 2,3,7,8-TCDF
   d. ___ PCB coplanar (#77,126,156,169)
   e. ___ LIS pesticides
   d. ___ Other:

4. BIOASSAYS (species listed in guidance manual)
   a. C Water Column Acute Tox. (bivalve larvae, M. bahia, Menidia sp.)
   b. C 10-Day Benthic Acute Tox. (A. abdita, R. abronius, E. estuarius, or L. plumulosus)
   c. C 10-Day Benthic Acute Tox. (M. bahia)
   d. C 28-Day Bioaccumulation (N. virens and Macoma nasuta or M. nasuta) - INCLUDING DIOXIN
   e. ___ 28-Day Bioaccumulation (N. virens and Macoma nasuta or M. nasuta): DIOXIN ONLY

5. 28-DAY WHOLE-SEDIMENT BIOACCUMULATION TISSUE ANALYSIS

REQUIRED

   a. T,A Metals (Ag, As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
   b. T,A Pesticides (aldrin, alpha chlordane, trans nonachlor, dieldrin, p,p' and o,p' DDT/DDD/DDE, endosulfans(I,II, and sulfate), heptachlor, heptachlor epoxide)
   c. T,A PCBs (#8,18,28,44,49,52,66,87,101,105,118,128,138,153,170,180,183,184,187,195,206,209
   d. T,A Semi-volatiles (1,4 dichlorobenzene)
   e. T,A PAHs (LMWs: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene)
   f. T,A PAHs (HMWs: benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, pyrene)

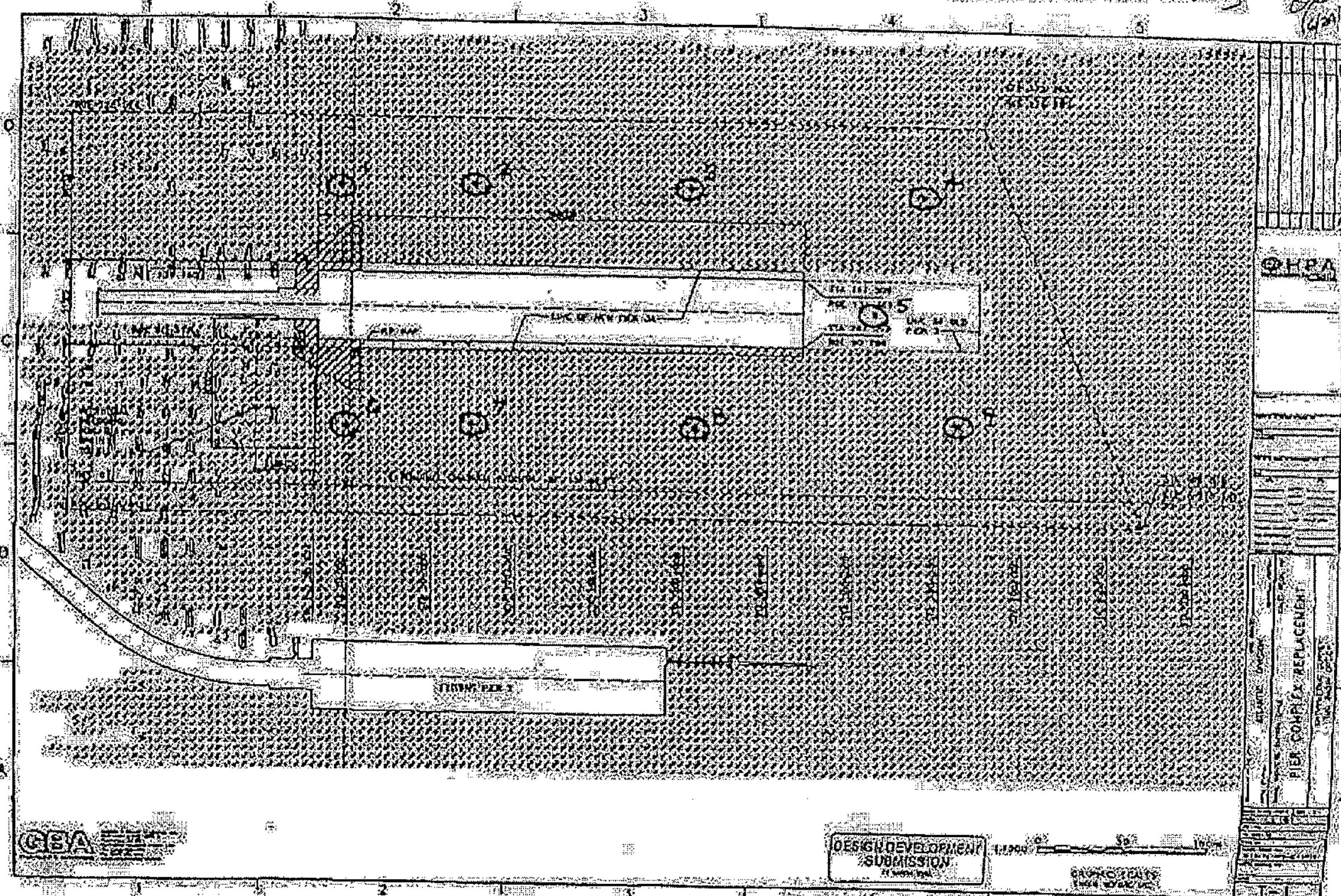
CASE BY CASE BASIS

   a. T,A Dioxins/Furans (2,3,7,8 - substituted isomers, n=17)
   b. ___ LIS pesticides
   c. ___ LIS PAHs
   d. ___ PCB coplanar (#77,126,156,169)
   e. ___ Other:

REFER TO COMMENT SECTION ON REVERSE SIDE FOR ADDITIONAL INFORMATION

Appl # 2002-00361-OD
USNWS Earle - Pier 3 Replacement

⊙ 9 locations for bioassay / bioaccumulation testing



PUBLIC NOTICE TABLES

REACH 1

TABLE 1. RESULTS OF CHEMICAL ANALYSIS OF SITE WATER AND ELUTRIATE

NWS Pier 3 Replacement Reach 1

	SITE WATER		ELUTRIATE	
CONSTITUENTS	DETECTION LIMITS	CONCENTRATION	DETECTION LIMITS	CONCENTRATION
Metals	ppb	ppb	ppb	ppb
Ag		0.059		0.045
Cd		0.055		0.025
Cr		0.383		2.850
Cu		1.79		2.630
Hg		0.004		0.008
Ni		1.17		3.46
Pb		0.46		1.05
Zn		3.12		4.44
Pesticides	pptr(ng/L)	pptr(ng/L)	pptr(ng/L)	pptr(ng/L)
Aldrin	0.24	ND	0.24	ND
a-Chlordane	0.23	ND	0.23	ND
trans Nonachlor	0.24	ND	0.24	ND
Dieldrin	0.46	ND	0.46	ND
4,4'-DDT	0.35	ND	0.35	ND
2,4'-DDT	0.29	ND	0.29	ND
4,4'-DDD	0.57	ND	0.57	ND
2,4'-DDD	0.49	ND	0.49	ND
4,4'-DDE		0.1	0.41	ND
2,4'-DDE	0.41	ND	0.41	ND
Total DDT		**1.2**		**1.3**
Endosulfan I	0.16	ND	0.16	ND
Endosulfan II	0.41	ND	0.41	ND
Endosulfan sulfate	0.39	ND	0.39	ND
Heptachlor		0.18	0.35	ND
Heptachlor epoxide	0.95	ND	0.95	ND
Industrial Chemicals	pptr(ng/L)	pptr(ng/L)	pptr(ng/L)	pptr(ng/L)
PCB 8		1.08	0.24	ND
PCB 18		0.55	0.48	ND
PCB 28		0.74		0.5
PCB 44	0.28	ND	0.28	ND
PCB 49		0.62	0.23	ND
PCB 52		0.56		0.56
PCB 66	0.24	ND	0.24	ND
PCB 87	0.42	ND	0.42	ND
PCB 101	0.23	ND	0.23	ND
PCB 105	0.45	ND	0.45	ND
PCB 118	0.41	ND	0.41	ND
PCB 128	0.38	ND	0.38	ND
PCB 138	0.39	ND	0.39	ND
PCB 153	0.39	ND	0.39	ND
PCB 170		0.15	0.34	ND
PCB 180		0.17		0.12
PCB 183	0.39	ND	0.39	ND
PCB 184	0.44	ND	0.44	ND
PCB 187	0.34	ND	0.34	ND
PCB 195		0.10	0.28	ND
PCB 206		0.09	0.23	ND
PCB 209		0.09	0.25	ND
Total PCB		**12.68**		**8.85**

ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = sum of congeners reported x 2
Concentrations shown are the mean of three replicate analyses.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.

RF 10/9/03

TABLE 2

NWS Pier 3 Replacement
TOXICITY TEST RESULTS
Reach 1

ASI JOB No. 23-127

Suspended Particulate Phase

Test Species	Test Duration	LC50/EC50	LPC (a)
Menidia beryllina	96 hours	(b) >100%	1.00
Mysidposis bahia	96 hours	(b) >100%	1.00
Mytilus edulis (larval survival)	48 hours	(b) >100%	1.00
Mytilus edulis (larval normal develop.)	48 hours	(c) 22.4%	0.22

(a) Limiting Permissible Concentration (LPC) is the LC 50 or EC 50 times 0.01.

(b) Median Lethal Concentration (LC50) resulting in 50% mortality at test termination.

(c) Median Effective Concentration (EC50) based on normal development to the D-cell, prodissoconch 1 stage.

Whole Sediment (10 days)

Test Species	% Survival In Reference	% Survival	% Difference Reference -Test	Is difference statistically significant? (a=0.05)
Ampelisca abdita	98%	96%	2%	No
Mysidopsis bahia	96%	98%	-2%	No

Table 2-R1.xls

NWS EARLE Pier 3 Replacement, Reach 1
TABLE 3. 28 DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE
Wet weight concentrations **Job # 23-127**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
Metals	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)	ppm (mg/kg)
Ag		0.02		0.02		0.02		0.01
As		2.29		2.39		3.93		2.47
Cd		0.02		0.02		0.06		0.06
Cr		0.24		* 0.33		0.15		0.15
Cu		1.26		1.18		1.41		1.31
Hg		0.01		0.01		0.02		0.02
Ni		0.24		* 0.37		0.16		* 0.28
Pb		0.14		0.12		0.08		0.07
Zn		7.91		7.22		15.93		23.55
Pesticides	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Aldrin	0.042	ND	0.04	ND	0.08	ND	0.06	ND
a-Chlordane		0.05		0.04		0.10		0.08
trans Nonachlor		0.01	0.06	* ND		0.27		0.26
Dieldrin	0.04	ND	0.04	ND	0.08	ND	0.06	ND
4,4'-DDT	0.06	ND	0.06	ND		0.07		0.06
2,4'-DDT	0.05	ND	0.05	ND		0.08		0.06
4,4'-DDD		0.07	0.05	ND		0.16		0.12
2,4'-DDD		0.02	0.04	ND		0.08		0.06
4,4'-DDE		0.05		0.03		0.04		0.02
2,4'-DDE	0.03	ND	0.03	ND	0.06	ND	0.04	ND
Total DDT		**0.21**		**0.14**		**0.45**		**0.34**
Endosulfan I	0.06	ND	0.06	ND	0.12	ND	0.10	ND
Endosulfan II	0.05	ND	0.05	ND	0.09	ND	0.08	ND
Endosulfan sulfate	0.07	ND	0.07	ND	0.13	ND		0.07
Heptachlor	0.06	ND	0.06	ND	0.11	ND	0.09	ND
Heptachlor epoxide	0.04	ND	0.04	ND	0.08	ND		0.04
Industrial Chemicals	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
PCB 8	0.09	ND	0.09	ND	0.18	ND	0.15	ND
PCB 18		0.04		* 0.05		0.05		0.05
PCB 28		0.04		0.03		0.07		0.06
PCB 44		0.03		0.03		0.06		0.07
PCB 49		0.05		0.03		0.12		0.09
PCB 52		0.05		0.03		0.15		0.15
PCB 66		0.03	0.07	ND		0.06		0.06
PCB 87	0.04	ND	0.04	ND	0.07	ND	0.05	ND
PCB 101		0.04	0.06	ND		0.35		0.32
PCB 105		0.02	0.04	ND		0.17		0.15
PCB 118		0.03	0.06	ND		0.19		0.18
PCB 128		0.03	0.07	ND		0.18		0.16
PCB 138		0.07	0.07	ND		1.17		1.08
PCB 153		0.07		0.03		1.72		1.60
PCB 170		0.01	0.04	* ND		0.30		0.27
PCB 180		0.04	0.05	ND		0.86		0.81
PCB 183		0.01	0.03	ND		0.29		0.28
PCB 184	0.04	ND	0.04	ND	0.09	ND	0.07	ND
PCB 187		0.02	0.04	ND		0.60		0.54
PCB 195		0.02	0.04	ND		0.13		0.12
PCB 206		0.01	0.05	* ND		0.21		0.19
PCB 209		0.01		0.01		0.17		0.15
Total PCB		**1.42**		**1.21**		**13.99**		**12.97**
1,4-Dichlorobenzene		0.19		0.13		1.30		1.14

TABLE 3. (Continued) **Reach 1**

CONSTITUENTS	*Macoma nasuta*				*Nereis virens*			
	REFERENCE		TEST		REFERENCE		TEST	
	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION	DETECTION LIMITS	CONCEN TRATION
PAH's	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)	ppb (ug/kg)
Naphthalene		0.53		0.40		1.07		1.00
Acenaphthylene		0.08		0.05		0.11		0.10
Acenaphthene		0.13		* 0.25		0.10		* 0.22
Fluorene		0.16		* 0.21		0.09		0.08
Phenanthrene		0.49		* 1.04		0.13		* 0.19
Anthracene		0.14		* 0.33		0.04		0.05
Fluoranthene		1.46		* 3.32		0.24		* 0.91
Pyrene		1.71		* 2.71		0.27		* 0.88
Benzo(a)anthracene		0.20		0.23		0.06		0.04
Chrysene		0.73		0.72		0.29		0.32
Benzo(b)fluoranthene		0.30		0.19		0.09	0.14	ND
Benzo(k)fluoranthene		0.29		0.15		0.06	0.10	ND
Benzo(a)pyrene		0.12	0.08	ND		0.07		0.06
Indeno(1,2,3-cd)pyrene		0.05	0.06	ND	0.11	ND	0.09	ND
Dibenzo(a,h)antracene	0.07	ND	0.05	ND	0.10	ND	0.08	ND
Benzo(g,h,i)perylene	0.06	ND	0.04	ND		0.06		0.04
Total PAH's		**6.46**		* **9.72**		**2.78**		* **4.09**
Dioxins	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)	pptr(ng/kg)
2378 TCDD	0.12	ND	0.22	ND		0.14		0.15
12378 PeCDD	0.15	ND	0.25	ND		0.15		0.17
123478 HxCDD		0.19		0.14	0.23	ND		0.08
123678 HxCDD		0.22		0.14		0.15		* 0.38
123789 HxCDD		0.39		0.39	0.23	ND		* 0.42
1234678 HpCDD		0.80		* 1.28		1.09		* 3.17
1234789 OCDD		4.61		* 17.98		6.40		* 31.25
2378 TCDF		0.08	0.16	ND		1.23		1.17
12378 PeCDF	0.19	ND	0.32	ND		0.17		0.22
23478 PeCDF	0.18	ND	0.29	ND		0.24		0.25
123478 HxCDF		0.14		0.12		0.14		0.14
123678 HxCDF		0.08		0.10		0.10		0.10
234678 HxCDF		0.22		0.13	0.20	ND		0.10
123789 HxCDF		0.16		0.15	0.24	ND	0.26	ND
1234678 HpCDF		0.45		0.29		0.41		0.28
1234789 HpCDF		0.27		0.26		0.18		0.11
12346789 OCDF		1.24		0.99		0.88		0.52

ND = Not detected
Total PAH = Sum of all PAH's.
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
Concentrations shown are the mean of 5 replicate analyses in wet weight.
Means were determined using conservative estimates of concentrations of constituents that were at concentrations below the detection limit.
* = Statistically significant at the 95% confidence level.

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TABLE 4		RESULTS OF CHEMICAL ANALYSIS OF SITE WATER NWS Pier 3 Replacement						23-127
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		T5895		T5895DUP		T5895TRP		
ASI ID#		20030990		20030990		20030990		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.058		0.061		0.059		0.059
Cd	0.02	0.053		0.054		0.059		0.06
Cr	0.06	0.369		0.393		0.386		0.38
Cu	0.15	1.79		1.79		1.80		1.79
Hg	0.002	0.004		0.005		0.004		0.004
Ni	0.04	1.20		1.17		1.15		1.17
Pb	0.04	0.45		0.46		0.46		0.46
Zn	0.09	3.01		3.17		3.17		3.12
Battelle-ID#		V5852		V5852 Dup		V5852 Trip		
ASI ID#		20030989		20030989		20030989		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	0.24	ND	0.24	ND	0.24	ND	0.12
a-Chlordane	14.0	0.23	ND	0.23	ND	0.23	ND	0.11
trans Nonachlor	14.0	0.24	ND	0.24	ND	0.24	ND	0.12
Dieldrin	2.00	0.46	ND	0.46	ND	0.46	ND	0.23
4,4'-DDT	12.0	0.35	ND	0.35	ND	0.35	ND	0.18
2,4'-DDT	20.0	0.29	ND	0.29	ND	0.29	ND	0.15
4,4'-DDD	11.0	0.57	ND	0.57	ND	0.57	ND	0.29
2,4'-DDD	20.0	0.49	ND	0.49	ND	0.49	ND	0.24
4,4'-DDE	4.00	0.16	J	0.11	J	0.07	J	0.11
2,4'-DDE	20.0	0.41	ND	0.41	ND	0.41	ND	0.21
Total DDT		1.22		1.17		1.13		1.17
Endosulfan I	14.0	0.16	ND	0.16	ND	0.16	ND	0.08
Endosulfan II	4.00	0.41	ND	0.41	ND	0.41	ND	0.21
Endosulfan sulfate	10.0	0.39	ND	0.39	ND	0.39	ND	0.20
Heptachlor	3.00	0.18	J	0.23	J	0.12	J	0.18
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	1.11		0.94		1.19		1.08
PCB 18	0.50	0.51		0.51		0.64		0.55
PCB 28	0.50	0.74		0.74		0.75		0.74
PCB 44	0.50	0.28	ND	0.28	ND	0.28	ND	0.14
PCB 49	0.50	0.66		0.52		0.69		0.62
PCB 52	0.50	0.55		0.59		0.55		0.56
PCB 66	0.50	0.24	ND	0.24	ND	0.24	ND	0.12
PCB 87	0.50	0.42	ND	0.42	ND	0.42	ND	0.21
PCB 101	0.50	0.23	ND	0.23	ND	0.23	ND	0.12
PCB 105	0.50	0.45	ND	0.45	ND	0.45	ND	0.22
PCB 118	0.50	0.41	ND	0.41	ND	0.41	ND	0.21
PCB 128	0.50	0.38	ND	0.38	ND	0.38	ND	0.19
PCB 138	0.50	0.39	ND	0.39	ND	0.39	ND	0.20
PCB 153	0.50	0.39	ND	0.39	ND	0.39	ND	0.20
PCB 170	0.50	0.11	J	0.34	ND	0.34	ND	0.15
PCB 180	0.50	0.20	J	0.17	J	0.13	J	0.17
PCB 183	0.50	0.39	ND	0.39	ND	0.39	ND	0.19
PCB 184	0.50	0.44	ND	0.44	ND	0.44	ND	0.22
PCB 187	0.50	0.34	ND	0.34	ND	0.34	ND	0.17
PCB 195	0.50	0.10	J	0.06	J	0.28	ND	0.10
PCB 206	0.50	0.10	J	0.06	J	0.23	ND	0.09
PCB 209	0.50	0.09	J	0.05	J	0.25	ND	0.09
Total PCB		12.71		11.94		13.40		12.68

ND = Not detected

J = Detection limit below the reporting limit or is an estimated value

E = Reporting limit raised due to matrix interference

B = Analyte detected in sample is <5x blank value

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

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TABLE 5	RESULTS OF CHEMICAL ANALYSIS OF ELUTRIATE NWS Pier 3 Replacement							23-127
CONSTITUENTS	DL'S	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		T5926		T5926DUP		T5926TRP		
ASI ID#		20031010 & 20030989		20031010 & 20030989		20031010 & 20030989		
Metals	ppb	ppb		ppb		ppb		ppb
Ag	0.02	0.04		0.05		0.05		0.04
Cd	0.02	0.03		0.03		0.02		0.02
Cr	0.06	2.86		2.84		2.85		2.85
Cu	0.15	2.67		2.59		2.63		2.63
Hg	0.002	0.008		0.008		0.008		0.01
Ni	0.04	3.57		3.41		3.41		3.46
Pb	0.04	1.04		1.08		1.04		1.05
Zn	0.09	4.46		4.47		4.40		4.44
Battelle ID#		T5926		T5926DUP		T5926TRP		
ASI ID#		20031010 & 20030989		20031010 & 20030989		20031010 & 20030989		
Pesticides	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
Aldrin	4.00	0.24	ND	0.24	ND	0.24	ND	0.12
a-Chlordane	14.0	0.23	ND	0.23	ND	0.23	ND	0.11
trans Nonachlor	14.0	0.24	ND	0.24	ND	0.24	ND	0.12
Dieldrin	2.00	0.46	ND	0.46	ND	0.46	ND	0.23
4,4'-DDT	12.0	0.35	ND	0.35	ND	0.35	ND	0.18
2,4'-DDT	20.0	0.29	ND	0.29	ND	0.29	ND	0.15
4,4'-DDD	11.0	0.57	ND	0.57	ND	0.57	ND	0.29
2,4'-DDD	20.0	0.49	ND	0.49	ND	0.49	ND	0.24
4,4'-DDE	4.0	0.41	ND	0.41	ND	0.41	ND	0.21
2,4'-DDE	20.0	0.41	ND	0.41	ND	0.41	ND	0.21
Total DDT		1.26		1.26		1.26		1.26
Endosulfan I	14.0	0.16	ND	0.16	ND	0.16	ND	0.08
Endosulfan II	4.00	0.41	ND	0.41	ND	0.41	ND	0.21
Endosulfan sulfate	10.0	0.39	ND	0.39	ND	0.39	ND	0.20
Heptachlor	3.00	0.35	ND	0.35	ND	0.35	ND	0.18
Heptachlor epoxide	100.0	0.95	ND	0.95	ND	0.95	ND	0.47
Industrial Chemicals	pptr (ng/L)	pptr (ng/L)		pptr (ng/L)		pptr (ng/L)		pptr (ng/L)
PCB 8	0.50	0.24	ND	0.24	ND	0.24	ND	0.12
PCB 18	0.50	0.48	ND	0.48	ND	0.48	ND	0.24
PCB 28	0.50	0.52		0.49	J	0.60		0.54
PCB 44	0.50	0.28	ND	0.28	ND	0.28	ND	0.14
PCB 49	0.50	0.23	ND	0.23	ND	0.23	ND	0.12
PCB 52	0.50	0.53		0.54		0.63		0.56
PCB 66	0.50	0.24	ND	0.24	ND	0.24	ND	0.12
PCB 87	0.50	0.42	ND	0.42	ND	0.42	ND	0.21
PCB 101	0.50	0.23	ND	0.23	ND	0.23	ND	0.12
PCB 105	0.50	0.45	ND	0.45	ND	0.45	ND	0.22
PCB 118	0.50	0.41	ND	0.41	ND	0.41	ND	0.21
PCB 128	0.50	0.38	ND	0.38	ND	0.38	ND	0.19
PCB 138	0.50	0.39	ND	0.39	ND	0.39	ND	0.20
PCB 153	0.50	0.39	ND	0.39	ND	0.39	ND	0.20
PCB 170	0.50	0.34	ND	0.34	ND	0.34	ND	0.17
PCB 180	0.50	0.26	ND	0.11	J	0.11	J	0.12
PCB 183	0.50	0.39	ND	0.39	ND	0.39	ND	0.19
PCB 184	0.50	0.44	ND	0.44	ND	0.44	ND	0.22
PCB 187	0.50	0.34	ND	0.34	ND	0.34	ND	0.17
PCB 195	0.50	0.28	ND	0.28	ND	0.28	ND	0.14
PCB 206	0.50	0.23	ND	0.23	ND	0.23	ND	0.11
PCB 209	0.50	0.25	ND	0.25	ND	0.25	ND	0.13
Total PCB		8.77		8.70		9.09		8.85

ND = Not detected
J = Detection limit below the reporting limit or is an estimated value
E = Reporting limit raised due to matrix interference
B = Analyte detected in sample is <5x blank value
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values if the ND is less than or equal to the target detection level in the Regional Testing Manual, otherwise the full value is used.

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TABLE 6	RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT							
Maguire-NWS Pier 3 Replacement				Reach 1		ASI Job No. 23-127		
CONSTITUENTS	DL	SINGLE	Q	DUPLICATE	Q	TRIPLICATE	Q	MEAN
Battelle-Sequim ID#		T5894		T5894DUP		T5894TRP		
Battelle-Duxbury ID#		V5844		V5844		V5844		
ASI ID#		20031010		20031010		20031010		
Metals	ppm (ug/g)							
Ag	0.04	0.143		0.147		0.108		0.133
As	0.3	7.66		7.14		6.34	B	7.05
Cd	0.02	0.262		0.256		0.209		0.242
Cr	0.04	39.6		45.6		32.9		39.4
Cu	0.1	6.82		6.83		6.19		6.61
Hg	0.0016	0.0241		0.0104		0.0179		0.017
Ni	0.2	14.5		14.7		12.3		13.8
Pb	0.1	5.92		5.84		5.65		5.80
Zn	0.4	37.3		36.6		31.3		35.1
Pesticides	ppb (ng/g)	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)
Aldrin	0.035	0.06	ND	0.06	ND	0.06	ND	0.03
a-Chlordane	0.022	0.06	ND	0.06	ND	0.06	ND	0.03
trans Nonachlor	0.044	0.06	ND	0.06	ND	0.06	ND	0.03
Dieldrin	0.032	0.07	ND	0.07	ND	0.07	ND	0.03
4,4'-DDT	0.040	0.06	ND	0.06	ND	0.06	ND	0.03
2,4'-DDT	0.156	0.07	ND	0.07	ND	0.07	ND	0.03
4,4'-DDD	0.091	0.10	ND	0.10	ND	0.10	ND	0.05
2,4'-DDD	0.042	0.07	ND	0.07	ND	0.07	ND	0.03
4,4'-DDE	0.050	0.03	J	0.02	J	0.02	J	0.02
2,4'-DDE	0.154	0.05	ND	0.05	ND	0.05	ND	0.026
Total DDT		**0.208**		**0.203**		**0.197**		**0.20**
Endosulfan I	0.095	0.07	ND	0.07	ND	0.07	ND	0.035
Endosulfan II	0.043	0.07	ND	0.07	ND	0.07	ND	0.034
Endosulfan sulfate	0.047	0.08	ND	0.08	ND	0.08	ND	0.040
Heptachlor	0.056	0.06	ND	0.06	ND	0.06	ND	0.032
Heptachlor epoxide	0.020	0.06	ND	0.06	ND	0.06	ND	0.029
Industrial Chemicals		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)
PCB 8	0.080	0.05	ND	0.05	ND	0.05	ND	0.03
PCB 18	0.084	0.06	ND	0.06	ND	0.06	ND	0.03
PCB 28	0.048	0.03	J	0.03	J	0.03	J	0.03
PCB 44	0.075	0.06	ND	0.06	ND	0.06	ND	0.03
PCB 49	0.069	0.05	J	0.05	J	0.02	J	0.04
PCB 52	0.084	0.04	J	0.04	J	0.04	J	0.04
PCB 66	0.051	0.07	ND	0.07	ND	0.07	ND	0.04
PCB 87	0.023	0.07	ND	0.07	ND	0.07	ND	0.04
PCB 101	0.129	0.07	ND	0.03	J	0.02	J	0.03
PCB 105	0.053	0.06	ND	0.06	ND	0.06	ND	0.03
PCB 118	0.048	0.08	ND	0.08	ND	0.02	J	0.03
PCB 128	0.048	0.05	ND	0.05	ND	0.05	ND	0.03
PCB 138	0.062	0.08	ND	0.08	ND	0.08	ND	0.04
PCB 153	0.084	0.09	ND	0.09	ND	0.09	ND	0.05
PCB 170	0.047	0.07	ND	0.08	ND	0.07	ND	0.04
PCB 180	0.028	0.07	ND	0.07	ND	0.01	J	0.03
PCB 183	0.031	0.09	ND	0.09	ND	0.09	ND	0.04
PCB 184	0.013	0.08	ND	0.08	ND	0.08	ND	0.04
PCB 187	0.019	0.06	ND	0.07	ND	0.06	ND	0.03
PCB 195	0.024	0.08	ND	0.08	ND	0.08	ND	0.04
PCB 206	0.031	0.07	ND	0.08	ND	0.07	ND	0.04
PCB 209	0.042	0.08	ND	0.08	ND	0.68		0.25
Total PCB		**1.62**		**1.61**		**2.73**		**1.99**
1-4, Dichlorobenzene		0.13	J	0.12	J	0.13	J	0.13

TABLE 6 Continued	RESULTS OF CHEMICAL ANALYSIS OF BULK SEDIMENT										
Maguire-NWS Pier 3 Replacement					Reach 1			ASI Job No. 23-127			
CONSTITUENTS	MDL	SINGLE	Q		DUPLICATE	Q		TRIPLICATE	Q		MEAN
BATTELLE ID#		V5844			V5844			V5844			
ASI ID#		20031010			20031010			20031010			
PAH's	ppb (ng/g)	ppb (ng/g)			ppb (ng/g)			ppb (ng/g)			ppb (ng/g)
Naphthalene		1.48			1.41			1.77			1.55
Acenaphthylene		0.09	J		0.09	J		0.10	J		0.09
Acenaphthene		0.58			0.66			0.62			0.62
Fluorene		0.52			0.70			0.56			0.59
Phenanthrene		2.70			3.09			3.52			3.10
Anthracene		1.15			1.23			1.32			1.23
Fluoranthene		6.73			7.61			9.77			8.04
Pyrene		4.98			5.54			7.16			5.89
Benzo(a)anthracene		1.56			1.56			2.39			1.84
Chrysene		1.78			1.89			3.27			2.31
Benzo(b)fluoranthene		1.29			1.44			2.08			1.60
Benzo(k)fluoranthene		1.02			1.12			1.81			1.32
Benzo(a)pyrene		0.86			0.92			1.38			1.05
Indeno(1,2,3-c,d)pyrene		0.56			0.62			0.81			0.66
Dibenzo(a,h)anthracene		0.14	J		0.16	J		0.21	J		0.17
Benzo(g,h,i)perylene		0.57			0.64			0.79			0.67
Total PAH's		26.0			28.7			37.6			30.75
BATTELLE ID#		V5844			V5844			V5844			
ASI ID#		20031010			20031010			20031010			Mean
Dioxins	pptr(pg/g)	pptr(pg/g)			pptr(pg/g)			pptr(pg/g)			pptr(pg/g)
2378 TCDD		0.13	ND		0.13			0.09			0.10
12378 PeCDD		0.07	J		0.12	ND		0.09	ND		0.06
123478 HxCDD		0.04	ND		0.12			0.10			0.08
123678 HxCDD		1.13			1.25			1.33			1.24
123789 HxCDD		1.91			2.36			2.45			2.24
1234678 HpCDD		20.9			22.5			26.1			23.19
12346789 OCDD		357.8			390.6			437.0			395.1
2378 TCDF		0.12			0.19			0.08			0.13
12378 PeCDF		0.10	ND		0.12			0.05	ND		0.07
23478 PeCDF		0.06	J		0.09			0.06			0.07
123478 HxCDF		0.12			0.12			0.11			0.12
123678 HxCDF		0.04	J		0.08			0.04	J		0.05
234678 HxCDF		0.08			0.09			0.07	J		0.08
123789 HxCDF		0.06	ND		0.05	ND		0.08	ND		0.03
1234678 HpCDF		0.27	ND		0.24	ND		0.12	J		0.13
1234789 HpCDF		0.15	J		0.12	J		0.24	ND		0.13
12346789 OCDF		0.92			0.85			0.75			0.84

B - Analyte concentration in blank > 3 times target
E - Estimate due to co- on chromotography column
J = Detection limit below the reporting limit or is an estimated value
ND = Not detected
Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT
Total PCB = 2(x), where x = sum of PCB congeners
For values reported as ND (not detected), one-half of the detection limit is used in the calculation of the mean concentration or total values.
d - Analyte reported from a dilution.

Table 7	28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE NWS- Pier 3 Replacement Reach 1															Job #: 23-127											
		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031035		20031036		20031037		20031282		20031283		20031284		20031285		20031286		20031287		20031288		20031289		20031290		Mean 20031291	
Battelle ID #		T6717		T6718		T6719		T6724		T6725		T6726		T6723		T6722		T6721		T6728		T6727		T6729		T6730	
Sequim Battelle ID #		2066-17		2066-18		2066-19		2066-24		2066-25		2066-26		2066-23		2056-22		2066-21		2066-28		2066-27		2066-29		2066-30 mean	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.018		0.057		0.030		0.024		0.021		0.021		0.034		0.019		0.029		0.020		0.017		0.018		0.021	
Arsenic	1.00	2.810		3.490		3.040		2.270		2.100		2.120		2.460		2.480		2.540		2.530		2.320		2.220		2.340	
Cadmium	0.10	0.017		0.031		0.022		0.016		0.017		0.017		0.016		0.018		0.017		0.017		0.016		0.018		0.022	
Chromium	0.20	0.175		0.210		0.223		0.277		0.219		0.214		0.242		0.245		0.336		0.286		0.359		0.312		0.359	
Copper	1.00	1.040		2.000		1.380		1.200		1.310		1.280		1.500		0.990		1.450		1.250		0.870		1.010		1.297	
Mercury	0.02	0.007		0.011		0.008		0.007		0.007		0.007		0.006		0.007		0.007		0.007		0.007		0.007		0.007	
Nickel	0.10	0.268		0.384		0.296		0.248		0.227		0.227		0.234		0.242		0.379		0.333		0.362		0.381		0.390	
Lead	0.10	0.086		0.183		0.132		0.155		0.140		0.143		0.151		0.132		0.132		0.105		0.116		0.110		0.121	
Zinc	1.00	7.380		10.200		10.100		7.600		8.140		7.620		8.350		7.850		7.520		7.060		6.230		7.260		8.017	
Pesticides	ppb	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
Aldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
a-Chlordane	0.4	0.03	J	0.04	J	0.03	J	0.04	J	0.05	J	0.04	J	0.04	J	0.06	J	0.03	J	0.04	J	0.03	J	0.04	J	0.04	J
trans Nonachlor	0.4	0.06	ND	0.06	ND	0.06	ND	0.01	J	0.02	J	0.01	J	0.01	J	0.02	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
Dieldrin	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
4,4'-DDT	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
2,4'-DDT	0.4	0.05	ND	0.05	ND	0.05	ND	0.06	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND
4,4'-DDD	0.4	0.05	ND	0.05	ND	0.05	ND	0.06	J	0.07		0.06	J	0.07		0.08		0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND
2,4'-DDD	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND	0.04	ND	0.04	ND	0.03	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
4,4'-DDE	0.4	0.04	J	0.08		0.03	J	0.04	J	0.05	J	0.04	J	0.05	J	0.05	J	0.03	J	0.03	J	0.02	J	0.03	J	0.03	J
2,4'-DDE	0.4	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND
Total DDT		0.270		0.290		0.260		0.310		0.300		0.280		0.300		0.300		0.260		0.260		0.250		0.260		0.260	
Endosulfan I	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.06	ND	0.06	ND	0.06	ND	0.08	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
Endosulfan II	0.4	0.05	ND	0.05	ND	0.05	ND	0.06	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND
Endosulfan sulfate	0.4	0.07	ND	0.07	ND	0.07	ND	0.08	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND
Heptachlor	0.4	0.06	ND	0.06	ND	0.06	ND	0.07	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
Heptachlor epoxide	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031035		20031036		20031037		20031282		20031283		20031284		20031285		20031286		20031287		20031288		20031289		20031290		[illegible] 20031291	
Battelle ID #		T6717		T6718		T6719		T6724		T6725		T6726		T6723		T6722		T6721		T6728		T6727		T6729		T6730	
Industrial Chemicals	ng/g	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
PCB 8	0.4	0.09	ND	0.09	ND	0.09	ND	0.11	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.09	ND
PCB 18	0.4	0.05	ND	0.04	J	0.05	ND	0.05	J	0.05	J	0.04	J	0.04	J	0.04	J	0.06	J	0.05	J	0.05	J	0.05	J	0.05	J
PCB 28	0.4	0.07	ND	0.04	J	0.07	ND	0.04	J	0.04	J	0.03	J	0.04	J	0.05	J	0.03	J	0.03	J	0.02	J	0.02	J	0.03	J
PCB 44	0.4	0.05	ND	0.04	J	0.05	ND	0.03	J	0.04	J	0.03	J	0.03	J	0.04	J	0.03	J	0.04	J	0.03	J	0.03	J	0.03	J
PCB 49	0.4	0.03	J	0.03	J	0.03	J	0.05	J	0.04	J	0.04	J	0.05	J	0.08	J	0.04	J	0.03	J	0.02	J	0.03	J	0.03	J
PCB 52	0.4	0.03	J	0.05	J	0.03	J	0.04	J	0.05	J	0.04	J	0.04	J	0.08	J	0.03	J	0.03	J	0.02	J	0.03	J	0.03	J
PCB 66	0.4	0.07	ND	0.07	ND	0.07	ND	0.03	J	0.03	J	0.07	ND	0.03	J	0.04	J	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND
PCB 87	0.4	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 101	0.4	0.06	ND	0.06	ND	0.06	ND	0.04	J	0.04	J	0.03	J	0.04	J	0.06		0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
PCB 105	0.4	0.04	ND	0.04	ND	0.04	ND	0.02	J	0.02	J	0.01	J	0.01	J	0.02	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 118	0.4	0.06	ND	0.06	ND	0.06	ND	0.04	J	0.03	J	0.02	J	0.03	J	0.04	J	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.06	ND
PCB 128	0.4	0.07	ND	0.07	ND	0.07	ND	0.08	ND	0.02	J	0.07	ND	0.07	ND	0.01	J	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND
PCB 138	0.4	0.07	ND	0.07	ND	0.07	ND	0.07	J	0.07		0.05	J	0.07		0.07		0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.07	ND
PCB 153	0.4	0.07	ND	0.07	ND	0.07	ND	0.08		0.07		0.06	J	0.06		0.08		0.07	ND	0.03	J	0.07	ND	0.03	J	0.04	J
PCB 170	0.4	0.04	ND	0.01	J	0.04	ND	0.01	J	0.01	J	0.04	ND	0.01	J	0.01	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 180	0.4	0.05	ND	0.03	J	0.05	ND	0.04	J	0.04	J	0.03	J	0.03	J	0.04	J	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND
PCB 183	0.4	0.03	ND	0.03	ND	0.03	ND	0.04	ND	0.01	J	0.03	ND	0.03	ND	0.01	J	0.03	ND	0.03	ND	0.03	ND	0.03	ND	0.03	ND
PCB 184	0.4	0.04	ND	0.04	ND	0.04	ND	0.05	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 187	0.4	0.04	ND	0.04	ND	0.04	ND	0.02	J	0.02	J	0.01	J	0.04	ND	0.02	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 195	0.4	0.04	ND	0.01	J	0.04	ND	0.05	ND	0.01	J	0.04	ND	0.04	ND	0.01	J	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND
PCB 206	0.4	0.05	ND	0.01	J	0.05	ND	0.01	J	0.01	J	0.005	J	0.05	ND	0.01	J	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND
PCB 209	0.4	0.05	ND	0.02	J	0.01	J	0.01	J	0.02	J	0.01	J	0.01	J	0.01	J	0.01	J	0.01	J	0.01	J	0.01	J	0.01	J
Total PCB		2.280		1.920		2.200		1.900		1.580		1.650		1.780		1.700		2.120		2.020		2.020		1.980		2.020	
1,4-Dichlorobenzene	0.4	0.25	J	0.21	J	0.22	J	0.38	J	0.12	J	0.13	J	0.17	J	0.13	J	0.14	J	0.12	J	0.11	J	0.17	J	0.13	J

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued	28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE NWS- Pier 3 Replacement Reach 1																														
		Macoma nasuta																													
		PRETEST						REFERENCE												REACH 1 TEST											
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031035		20031036		20031037		20031282		20031283		20031284		20031285		20031286		20031287		20031288		20031289		20031290		Mean 20031291	
Battelle ID #		T6717		T6718		T6719		T6724		T6725		T6726		T6723		T6722		T6721		T6728		T6727		T6729		T6730	
PAH's (wet weight)	ng/g	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
Naphthalene	4	0.47	B	0.82		0.62		0.90		0.41	B	0.46	B	0.44	B	0.45	B	0.37	B	0.40	B	0.40	B	0.40	J	0.45	B
Acenaphthylene	4	0.09	J	0.19	J	0.09	J	0.15	J	0.07	J	0.08	J	0.06	J	0.06	J	0.07	J	0.04	J	0.06	J	0.05	J	0.05	J
Acenaphthene	4	0.07	J	0.11	J	0.08	J	0.17	J	0.10	J	0.21	J	0.09	J	0.09	J	0.14	J	0.29		0.30		0.26	J	0.24	
Fluorene	4	0.21	J	0.29		0.20	J	0.24	J	0.13	J	0.16	J	0.14	J	0.15	J	0.20	J	0.23	J	0.19	J	0.22	J	0.22	J
Phenanthrene	4	0.85		1.38		0.89		0.64		0.40		0.48		0.44		0.48		1.09		1.01		0.98		1.08		1.03	
Anthracene	4	0.09	J	0.12	J	0.08	J	0.20	J	0.11	J	0.12	J	0.11	J	0.16	J	0.32		0.31		0.33		0.39	J	0.30	
Fluoranthene	4	2.10		3.67		1.93		1.78		1.10		1.60		1.24		1.60		3.51		3.05		3.09		3.67		3.08	
Pyrene	4	1.49		2.14		1.33		2.21		1.49		1.74		1.33		1.79		2.96		2.46		2.85		2.84		2.44	
Benzo(a)anthracene	4	0.08	J	0.39		0.19	J	0.22	J	0.14	J	0.20	J	0.19	J	0.25	J	0.27	J	0.19	J	0.22	J	0.23	J	0.23	J
Chrysene	4	0.53		1.03		0.68		0.96		0.64		0.59		0.67		0.81		0.80		0.88		0.75		0.67		0.72	
Benzo(b)fluoranthene	4	0.22	J	0.29		0.30		0.42	J	0.25	J	0.20	J	0.24	J	0.38		0.22	J	0.18	J	0.19	J	0.17	J	0.19	J
Benzo(k)fluoranthene	4	0.17	J	0.30		0.17	J	0.41	J	0.22	J	0.21	J	0.26	J	0.33		0.20	J	0.13	J	0.16	J	0.10	J	0.14	J
Benzo(a)pyrene	4	0.24	ND	0.19	J	0.07	J	0.09	J	0.10	J	0.17	J	0.07	ND	0.19	J	0.07	ND	0.07	ND	0.07	ND	0.11	ND	0.07	ND
Indeno(1,2,3-cd)pyrene	4	0.17	ND	0.09	ND	0.10	ND	0.20	ND	0.08	J	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.08	ND	0.05	ND
Dibenzo(a,h)anthracene	4	0.15	ND	0.08	ND	0.09	ND	0.18	ND	0.04	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.04	ND	0.07	ND	0.05	ND
Benzo(g,h,i)perylene	4	0.05	J	0.07	ND	0.09	ND	0.16	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.06	ND	0.04	ND
Total PAH's		6.890		10.960		6.910		8.910		5.300		6.360		5.420		6.880		10.360		9.160		9.720		10.600		9.300	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 7 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Macoma nasuta																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031035		20031036		20031037		20031282		20031283		20031284		20031285		20031286		20031287		20031288		20031289		20031290		20031291	
Battelle ID #		T6717		T6718		T6719		T6724		T6725		T6726		T6723		T6722		T6721		T6728		T6727		T6729		T6730	
Dioxins	pg/g	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.16	ND	0.19	ND	0.11	ND	0.06	ND	0.06	ND	0.27	ND	0.10	ND	0.12	ND	0.08	ND	0.18	ND	0.28	ND	0.20	ND	0.37	ND
12378 PeCDD	5	0.26	ND	0.22	ND	0.16	ND	0.10	ND	0.07	ND	0.26	ND	0.25	ND	0.09	ND	0.14	ND	0.10	ND	0.23	ND	0.16	ND	0.55	ND
123478 HxCDD	5	0.36		0.31		0.15	ND	0.08	ND	0.15		0.31		0.27		0.16		0.18		0.06	J	0.14	J	0.17	ND	0.49	ND
123678 HxCDD	5	0.56		0.37		0.15	ND	0.06	ND	0.15		0.44		0.24		0.25		0.17	ND	0.09	J	0.20		0.18	ND	0.49	ND
123789 HxCDD	5	0.66		0.67		0.15	ND	0.06	ND	0.29		0.84		0.36		0.38		0.60		0.34		0.41		0.17	ND	0.32	
1234678 HpCDD	5	0.93	J	0.90	J	0.94	J	0.80		0.87		0.51	J	0.97	J	0.73	J	1.13	ND	1.23		1.56		1.33		1.69	
12346789 OCDD	10	4.72		4.56		5.13		4.73		5.27		2.48		6.35		4.24		16.52		15.45		19.60		15.67		20.65	
2378 TCDF	1	0.19	ND	0.12	ND	0.09	ND	0.10		0.10		0.18	ND	0.09	ND	0.11	ND	0.11	ND	0.10	ND	0.17	ND	0.12	ND	0.28	ND
12378 PeCDF	5	0.33	ND	0.27	ND	0.12	ND	0.12	ND	0.16	ND	0.35	ND	0.19	ND	0.13	ND	0.22	ND	0.30	ND	0.25	ND	0.21	ND	0.62	ND
23478 PeCDF	5	0.29	ND	0.24	ND	0.12	ND	0.10	ND	0.13	ND	0.34	ND	0.19	ND	0.12	ND	0.20	ND	0.25	ND	0.21	ND	0.18	ND	0.62	ND
123478 HxCDF	5	0.33	J	0.25		0.21		0.08	J	0.09	ND	0.30		0.19	J	0.17	ND	0.17		0.09	J	0.18	ND	0.11	ND	0.39	ND
123678 HxCDF	5	0.33		0.21	J	0.16		0.09	ND	0.06	ND	0.25	ND	0.10	J	0.08	J	0.12	J	0.05	J	0.17	ND	0.11	ND	0.18	
234678 HxCDF	5	0.32	J	0.30		0.20		0.14		0.06	ND	0.57		0.27		0.16	ND	0.23		0.16	ND	0.17	ND	0.11	ND	0.37	ND
123789 HxCDF	5	0.30	J	0.29		0.30		0.10	ND	0.10	ND	0.40		0.21	J	0.19	ND	0.21		0.08	J	0.16	J	0.13	ND	0.45	ND
1234678 HpCDF	5	0.60	J	0.70	J	0.53	J	0.30	J	0.33	J	0.59	J	0.55	J	0.46	J	0.53	J	0.17	J	0.30	J	0.15	J	0.28	
1234789 HpCDF	5	0.31	J	0.23	J	0.25	J	0.20	J	0.26	J	0.32	J	0.31	J	0.24	J	0.25	J	0.20	J	0.28	J	0.19	J	0.40	
12346789 OCDF	10	1.26		1.14		1.10		1.41		1.52		0.61		1.56		1.12		1.27		0.57		0.61		0.59		1.89	

ND = Not detected

B = indicates analyte detected in method blank as well as associated field sample

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

Nereis virens

		PRETEST						REFERENCE									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		20031028		20031029		20031030		20031188		20031189		20031190		20031191		20031192	
Battelle ID #		T6703		T6704		T6706		T6709		T6714		T6707		T6712		T6708	
Sequim Battelle ID#		2066-31		2066-32		2066-5		2066-9		2066-14		2066-7		2066-12		2066-8	
Metals (wet weight)	ppm	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.05	0.018		0.017		0.016		0.017		0.014		0.011		0.017		0.015	
Arsenic	1	2.430		2.330		2.290		3.990		4.010		3.980		3.580		4.070	
Cadmium	0.1	0.048		0.052		0.046		0.050		0.053		0.048		0.056		0.066	
Chromium	0.2	0.149		0.155		0.167		0.155		0.145		0.156		0.130		0.152	
Copper	1	1.80		1.77		1.73		1.42		1.38		1.49		1.45		1.30	
Mercury	0.02	0.023		0.023		0.021		0.025		0.024		0.026		0.026		0.021	
Nickel	0.1	0.156		0.176		0.200		0.177		0.158		0.178		0.116		0.169	
Lead	0.1	0.063		0.057		0.063		0.096		0.076		0.068		0.068		0.091	
Zinc	1	21.2		11.8		12.7		14.1		8.570		25.1		13.7		18.200	
Pesticides	ppb	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
Aldrin	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.12	ND	0.06	ND	0.06	ND	0.10	ND
a-Chlordane	0.4	0.11		0.09	J	0.07	J	0.09	J	0.12	J	0.11		0.11		0.09	J
trans Nonachlor	0.4	0.28		0.22		0.18		0.26		0.31		0.25		0.28		0.29	
Dieldrin	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.12	ND	0.06	ND	0.06	ND	0.10	ND
4,4'-DDT	0.4	0.08	J	0.06	J	0.06	J	0.05	J	0.07	J	0.07	J	0.06	J	0.08	J
2,4'-DDT	0.4	0.08	J	0.06	J	0.06	J	0.07	J	0.08	J	0.08	J	0.07	J	0.08	J
4,4'-DDD	0.4	0.25		0.15		0.15		0.12		0.20		0.18		0.17		0.13	J
2,4'-DDD	0.4	0.10		0.06	J	0.06	J	0.08	J	0.09	J	0.09		0.09	J	0.07	J
4,4-DDE	0.4	0.06	J	0.03	J	0.03	J	0.02	J	0.03	J	0.03	J	0.03	J	0.16	ND
2,4'-DDE	0.4	0.04	ND	0.04	ND	0.04	ND	0.04	ND	0.08	ND	0.04	ND	0.04	ND	0.07	ND
Total DDT		0.438		0.420		0.390		0.380		0.560		0.470		0.448		0.590	
Endosulfan I	0.4	0.09	ND	0.09	ND	0.09	ND	0.09	ND	0.18	ND	0.09	ND	0.09	ND	0.14	ND
Endosulfan II	0.4	0.07	ND	0.07	ND	0.07	ND	0.07	ND	0.14	ND	0.07	ND	0.07	ND	0.11	ND
Endosulfan sulfate	0.4	0.10	ND	0.10	ND	0.10	ND	0.10	ND	0.20	ND	0.10	ND	0.10	ND	0.16	ND
Heptachlor	0.4	0.09	ND	0.09	ND	0.08	ND	0.08	ND	0.17	ND	0.08	ND	0.09	ND	0.14	ND
Heptachlor epoxide	0.4	0.06	ND	0.06	ND	0.06	ND	0.06	ND	0.12	ND	0.06	ND	0.06	ND	0.10	ND

	REACH 1 TEST									
CONSTITUENTS	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #	20031193		20031194		20031195		20031196		Mean 20031197	
Battelle ID #	T6713		T6711		T6710		T6716		T6715	
Sequim Battelle ID#	2066-13		2066-11		2066-10		2066-15		2066-16 Mean	
Metals (wet weight)	ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)		ppm (mg/kg)	
Silver	0.006	ND	0.006	ND	0.006	ND	0.008		0.008	
Arsenic	2.320		2.340		2.550		2.530		2.603	
Cadmium	0.047		0.059		0.052		0.058		0.065	
Chromium	0.124		0.177		0.184		0.155		0.130	
Copper	1.27		1.26		1.35		1.37		1.32	
Mercury	0.023		0.020		0.023		0.025		0.024	
Nickel	0.247		0.291		0.291		0.294		0.280	
Lead	0.061		0.074		0.062		0.067		0.066	
Zinc	31.400		30.700		15.500		19.700		20.433	
Pesticides	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
Aldrin	0.06	ND	0.08	ND	0.06	ND	0.06	ND	0.06	ND
a-Chlordane	0.09	J	0.07	J	0.08	J	0.08	J	0.07	J
trans Nonachlor	0.29		0.24		0.23		0.27		0.25	
Dieldrin	0.06	ND	0.08	ND	0.06	ND	0.06	ND	0.06	ND
4,4'-DDT	0.06	J	0.05	J	0.05	J	0.08	J	0.04	J
2,4'-DDT	0.07	J	0.11	ND	0.06	J	0.07	J	0.06	J
4,4'-DDD	0.11		0.08	J	0.12		0.14		0.12	
2,4'-DDD	0.07	J	0.05	J	0.07	J	0.07	J	0.06	J
4,4-DDE	0.02	J	0.02	J	0.02	J	0.02	J	0.02	J
2,4'-DDE	0.04	ND	0.06	ND	0.04	ND	0.04	ND	0.04	ND
Total DDT	0.370		0.380		0.360		0.420		0.340	
Endosulfan I	0.09	ND	0.12	ND	0.09	ND	0.09	ND	0.09	ND
Endosulfan II	0.07	ND	0.10	ND	0.07	ND	0.07	ND	0.07	ND
Endosulfan sulfate	0.10	ND	0.13		0.10	ND	0.10	ND	0.10	ND
Heptachlor	0.08	ND	0.11	ND	0.08	ND	0.09	ND	0.09	ND
Heptachlor epoxide	0.04	J	0.08	ND	0.06	ND	0.04	J	0.06	ND

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

B - Analyte concentration in blank > 3 times target

TABLE 8 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Nereis virens																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031028		20031029		20031030		20031188		20031189		20031190		20031191		20031192		20031193		20031194		20031195		20031196		Mean 20031197	
Sequim Battelle ID#		T6703		T6704		T6705		T6709		T6714		T6707		T6712		T6708		T6713		T6711		T6710		T6715		T6716	
Industrial Chemicals	ng/g	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
PCB 8	0.4	0.07	J	0.14	ND	0.14	ND	0.14	ND	0.28	ND	0.14	ND	0.14	ND	0.22	ND	0.14	ND	0.19	ND	0.14	ND	0.14	ND	0.14	ND
PCB 18	0.4	0.05	J	0.05	J	0.08	ND	0.08	ND	0.15	ND	0.08	ND	0.05	J	0.06	J	0.05	J	0.10	ND	0.06	J	0.05	J	0.06	J
PCB 28	0.4	0.10		0.08	J	0.08	J	0.04	J	0.09	J	0.06	J	0.07	J	0.07	J	0.06	J	0.05	J	0.08	J	0.08	J	0.06	J
PCB 44	0.4	0.04	J	0.03	J	0.08	ND	0.04	J	0.07	J	0.06	J	0.07	J	0.06	J	0.07	J	0.05	J	0.08	J	0.07	J	0.06	J
PCB 49	0.4	0.11		0.11		0.09		0.11		0.14	J	0.10		0.09	J	0.14	J	0.08	J	0.09	J	0.09		0.10		0.11	
PCB 52	0.4	0.17		0.16		0.13		0.12		0.17	J	0.16		0.14		0.14	J	0.18		0.12	J	0.14		0.15		0.14	
PCB 66	0.4	0.11		0.06	J	0.06	J	0.10	ND	0.06	J	0.07	J	0.06	J	0.16	ND	0.05	J	0.05	J	0.06	J	0.07	J	0.06	J
PCB 87	0.4	0.05	ND	0.05	ND	0.05	ND	0.05	ND	0.11	ND	0.05	ND	0.05	ND	0.08	ND	0.05	ND	0.07	ND	0.05	ND	0.05	ND	0.05	ND
PCB 101	0.4	0.47		0.37		0.30		0.29		0.38		0.41		0.37		0.32		0.36		0.26		0.32		0.35		0.32	
PCB 105	0.4	0.20		0.16		0.13		0.15		0.19		0.19		0.16		0.15		0.17		0.13		0.15		0.17		0.15	
PCB 118	0.4	0.30		0.20		0.19		0.14		0.20		0.24		0.19		0.17		0.20		0.14		0.18		0.21		0.18	
PCB 128	0.4	0.19		0.15		0.13		0.16		0.20		0.19		0.17		0.16		0.18		0.13		0.15		0.18		0.16	
PCB 138	0.4	1.25		1.04		0.83		1.03		1.31		1.27		1.12		1.10		1.23		0.91		1.03		1.17		1.06	
PCB 153	0.4	1.85		1.52		1.18		1.57		1.94		1.81		1.63		1.63		1.78		1.33		1.53		1.78		1.61	
PCB 170	0.4	0.34		0.27		0.22		0.27		0.30		0.36		0.28		0.28		0.29		0.22		0.26		0.28		0.28	
PCB 180	0.4	1.15		0.85		0.63		0.77		0.97		0.88		0.85		0.82		0.90		0.72		0.75		0.85		0.84	
PCB 183	0.4	0.39		0.27		0.21		0.26		0.33		0.31		0.28		0.28		0.31		0.24		0.27		0.30		0.28	
PCB 184	0.4	0.07	ND	1.24		0.07	ND	0.07	ND	0.13	ND	0.07	ND	0.07	ND	0.10	ND	0.07	ND	0.09	ND	0.07	ND	0.07	ND	0.07	ND
PCB 187	0.4	0.71		0.54		0.40		0.53		0.71		0.63		0.56		0.56		0.60		0.45		0.54		0.59		0.54	
PCB 195	0.4	0.17		0.12		0.10		0.12		0.15	J	0.15		0.12		0.13	J	0.14		0.09	J	0.11		0.13		0.12	
PCB 206	0.4	0.26		0.19		0.15		0.19		0.22		0.23		0.20		0.20		0.22		0.15		0.19		0.21		0.19	
PCB 209	0.4	0.18		0.15		0.13		0.16		0.18	J	0.18		0.16		0.18		0.19		0.12	J	0.15		0.18		0.15	
Total PCB		16.420		15.560		10.760		12.780		16.520		15.280		13.860		13.980		14.640		11.400		12.760		14.280		13.260	
1,4-Dichlorobenzene	0.4	1.04	B	1.01	B	0.93	B	1.21	B	2.16	B	1.04	B	0.91	B	1.16	B	1.01	B	1.37	B	1.02	B	1.21	B	1.10	B

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = Indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement Reach 1

		Nereis virens																									
		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	1	Q	2	Q	3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	T1	Q	T2	Q	T3	Q	T4	Q	T5	Q
ASI ID #		20031028		20031029		20031030		20031188		20031189		20031190		20031191		20031192		20031193		20031194		20031195		20031196		Mean 33381147	
Battelle ID#		T6703		T6704		T6705		T6709		T6714		T6707		T6712		T6708		T6713		T6711		T6710		T6715		T6716	
PAH's (wet weight)	ng/g	ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)		ppb (ng/g)	
Naphthalene	4	0.94		0.77		0.53	B	1.37		1.05		1.25		0.77		0.91		1.06		0.91		0.97		0.98		1.08	
Acenaphthylene	4	0.21	J	0.18	J	0.13	J	0.11	J	0.12	J	0.13	J	0.08	J	0.12	J	0.10	J	0.09	J	0.11	J	0.10	J	0.09	J
Acenaphthene	4	0.20	J	0.16	J	0.09	J	0.10	J	0.07	J	0.09	J	0.14	J	0.09	J	0.22	J	0.19	J	0.26	J	0.19	J	0.23	J
Fluorene	4	0.15	J	0.11	J	0.10	J	0.07	J	0.09	J	0.08	J	0.12	J	0.09	J	0.08	J	0.09	J	0.08	J	0.08	J	0.08	J
Phenanthrene	4	0.63		0.52		0.44	J	0.12	J	0.12	J	0.16	J	0.15	J	0.12	J	0.21	J	0.14	J	0.24	J	0.19	J	0.19	J
Anthracene	4	0.07	J	0.11	ND	0.04	J	0.04	J	0.08	J	0.05	J	0.02	J	0.03	J	0.04	J	0.15	ND	0.07	J	0.04	J	0.04	
Fluoranthene	4	0.93		0.61		0.41	J	0.21	J	0.31	J	0.24	J	0.25	J	0.18	J	1.18		0.57	J	1.06		0.86		0.86	
Pyrene	4	1.21		0.79		0.56		0.23	J	0.32	J	0.31	J	0.25	J	0.25	J	1.21		0.63		0.95		0.80		0.81	
Benzo(a)anthracene	4	0.08	J	0.05	J	0.05	J	0.11	ND	0.22	ND	0.08	J	0.04	J	0.02	J	0.07	J	0.02	J	0.03	J	0.05	J	0.05	J
Chrysene	4	1.08		0.85		0.58		0.26	J	0.34	J	0.32	J	0.25	J	0.27	J	0.44	J	0.23	J	0.29	J	0.31	J	0.31	J
Benzo(b)fluoranthene	4	0.14	J	0.10	J	0.13	ND	0.14	ND	0.27	ND	0.09	J	0.04	J	0.22	ND	0.13	ND	0.18	ND	0.13	ND	0.14	ND	0.14	ND
Benzo(k)fluoranthene	4	0.17	J	0.09	J	0.09	ND	0.09	ND	0.18	ND	0.09	ND	0.04	J	0.14	ND	0.09	ND	0.12	ND	0.09	ND	0.09	ND	0.09	ND
Benzo(a)pyrene	4	0.09	J	0.12	ND	0.06	J	0.12	ND	0.24	ND	0.06	J	0.03	J	0.19	ND	0.12	ND	0.05	J	0.12	ND	0.12	ND	0.12	ND
Indeno(1,2,3-cd)pyrene	4	0.08	ND	0.08	ND	0.08	ND	0.08	ND	0.17	ND	0.08	ND	0.08	ND	0.13	ND	0.08	ND	0.11	ND	0.08	ND	0.08	ND	0.08	ND
Dibenzo(a,h)antracene	4	0.08	ND	0.08	ND	0.08	ND	0.08	ND	0.15	ND	0.08	ND	0.08	ND	0.12	ND	0.08	ND	0.10	ND	0.08	ND	0.08	ND	0.08	ND
Benzo(g,h,i)perylene	4	0.12	J	0.18	J	0.09	J	0.07	ND	0.14	ND	0.09	J	0.07	ND	0.11	ND	0.07	ND	0.06	J	0.07	ND	0.07	ND	0.07	ND
Total PAH's		6.180		4.800		3.460		3.200		3.850		3.180		2.410		2.990		5.170		3.640		4.630		4.180		4.320	

ND = Not detected

J = (Detection limit below the reporting limit or is an estimated value)

B = indicates analyte detected in method blank as well as associated field sample

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

TABLE 8 continued — 28-DAY BIOACCUMULATION TEST RESULTS: CHEMICAL ANALYSIS OF TISSUE

NWS- Pier 3 Replacement   Reach 1

Nereis virens

		PRETEST						REFERENCE										REACH 1 TEST									
CONSTITUENTS	DL's	R1	Q	R2	Q	R3	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q	R1	Q	R2	Q	R3	Q	R4	Q	R5	Q
ASI ID #		20031028		20031029		20031030		20031188		20031189		20031190		20031191		20031192		20031193		20031194		20031195		20031196		Mean 20031197	
Battelle ID #		T6703		T6704		T6705		T6709		T6714		T6707		T6712		T6708		T6713		T6711		T6710		T6715		T6716	
Dioxins	pg/g	(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)		(pptr)	
2378 TCDD	1	0.14	J	0.13	J	0.20	ND	0.17		0.23	ND	0.16		0.36	ND	0.07	ND	0.25	ND	0.36	ND	0.15		0.17		0.14	
12378 PeCDD	5	0.15	ND	0.31	ND	0.17	ND	0.23	ND	0.35	ND	0.17	J	0.44	ND	0.09	ND	0.39	ND	0.58	ND	0.09	ND	0.18	J	0.13	
123478 HxCDD	5	0.18	ND	0.09	J	0.09	J	0.07	ND	0.28	ND	0.22	ND	0.48	ND	0.10	ND	0.34	ND	0.03	J	0.06		0.05	J	0.07	
123678 HxCDD	5	0.18		0.22		0.23		0.16		0.28	ND	0.23	ND	0.16	J	0.17		0.36		0.23	J	0.49		0.43		0.40	
123789 HxCDD	5	0.17	ND	0.18		0.09	J	0.07	ND	0.28	ND	0.22	ND	0.47	ND	0.10	ND	0.40		0.42		0.42		0.47		0.38	
1234678 HpCDD	5	1.26		1.47		1.45		1.01		0.98		1.28		1.25		0.92		3.23		2.88		3.40		3.31		3.03	
12346789 OCDD	10	7.76		10.30		10.19		5.30		5.56		8.28		6.76		8.08		31.87		32.55		32.25		31.17		28.40	
2378 TCDF	1	1.61	#	1.38	#	1.24	#	1.06	#	1.16	#	1.45	#	1.38	#	1.06	#	1.22	#	1.00	#	1.27	#	1.33	#	1.05	#
12378 PeCDF	5	0.28		0.19	J	0.26		0.13	ND	0.22	J	0.22	J	0.21	J	0.14		0.50	ND	0.04	ND	0.16		0.33	ND	0.16	
23478 PeCDF	5	0.28		0.28		0.25		0.19		0.23	J	0.25	J	0.31	J	0.20		0.45	ND	0.58	ND	0.24		0.26	J	0.24	
123478 HxCDF	5	0.13		0.16	J	0.13	ND	0.13		0.14	J	0.17	ND	0.41	ND	0.13		0.13	J	0.40	ND	0.13	J	0.12	J	0.12	
123678 HxCDF	5	0.08	J	0.08	J	0.13	ND	0.10	ND	0.06	J	0.17	ND	0.39	ND	0.09	J	0.23	ND	0.37	ND	0.06	J	0.06	J	0.11	ND
234678 HxCDF	5	0.11	J	0.20	ND	0.13	ND	0.10	ND	0.21	ND	0.17	ND	0.41	ND	0.13	ND	0.24	ND	0.41	ND	0.13	ND	0.06	J	0.07	
123789 HxCDF	5	0.15	ND	0.24	ND	0.15	ND	0.12	ND	0.25	ND	0.21	ND	0.50	ND	0.14	ND	0.28	ND	0.50	ND	0.16	ND	0.24	ND	0.14	ND
1234678 HpCDF	5	0.50		0.61		0.54		0.39		0.33		0.57		0.43		0.33		0.34	J	0.23	J	0.29		0.30		0.26	
1234789 HpCDF	5	0.17	J	0.14	J	0.11	J	0.30	ND	0.32	ND	0.29	J	0.22	J	0.07	J	0.09	J	0.13	J	0.16	ND	0.26	ND	0.12	
12346789 OCDF	10	1.20		1.17		0.83		0.45		0.59		1.46		1.44		0.47		0.68		0.49	J	0.40		0.63		0.39	

= Value from second column confirmation

ND = Not detected

B = Indicates analyte detected in method blank as well as associated field sample

Q = Indicates presence of QC ion instabilities caused by quantitative interferences

J = (Detection limit below the reporting limit or is an estimated value)

Total PAH's = Sum of all PAH's

Total DDT = sum of 2,4'- and 4,4'-DDD, DDE, and DDT

Total PCB = 2(x), where x = sum of PCB congeners

For values reported as ND (not detected) in Test Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the full value was used.

For values reported as ND (not detected) in Reference Tissues, one-half of the detection limit is used in the calculation of the mean concentration if the target detection levels enumerated in the Regional Testing Manual were met, otherwise the value of zero (0) was used.

Appendix “E”

APPENDIX E – HYDRODYNAMIC MODELING

1.0 HYDRODYNAMIC MODEL APPLICATION

1.1 Description of Hydrodynamic Model WQMAP/BFHYDRO

Applied Science Associates, Inc. (ASA) has developed and applied evolving versions of sophisticated model systems (Swanson 1986, Spaulding et al., 1999) for use in studies of coastal waters for more than two decades. WQMAP, as the ASA model system is known, uses a three dimensional boundary-fitted finite difference hydrodynamic model (BFHYDRO) developed by Muin and Spaulding (1997a and b). The model has undergone extensive testing against analytical solutions and used for numerous water quality studies. Some hydrodynamic applications supporting dredging studies in the northeastern United States are:

- Water quality impacts of dredging and disposal operations in Boston Harbor (Swanson and Mendelsohn 1996)
- Dredged material plume for the Providence River and Harbor Maintenance Dredging Project (Swanson et al., 2000)
- Simulations of sediment deposition from jet plow operations in New Haven Harbor (Swanson et al., 2001)
- Simulations of sediment transport and deposition from jet plow and excavation operations in the Hudson River (Galagan et al., 2001)

The grid system used in the boundary-fitted coordinate model system is unique in that grid cells can be aligned to shorelines and bathymetric features (like dredged channels) to best characterize the study area. In addition, grid resolution can be refined to obtain more detail in areas of concern. This gridding flexibility is important in representing the waters of Sandy Hook Bay where geometry is highly variable and complex.

1.2 Sandy Hook Bay Model Grid

The domain of the hydrodynamic model for this application includes all of the New York Harbor area, as well as substantial portions of the Hudson and East Rivers and Jamaica Bay (Figure 1-1).

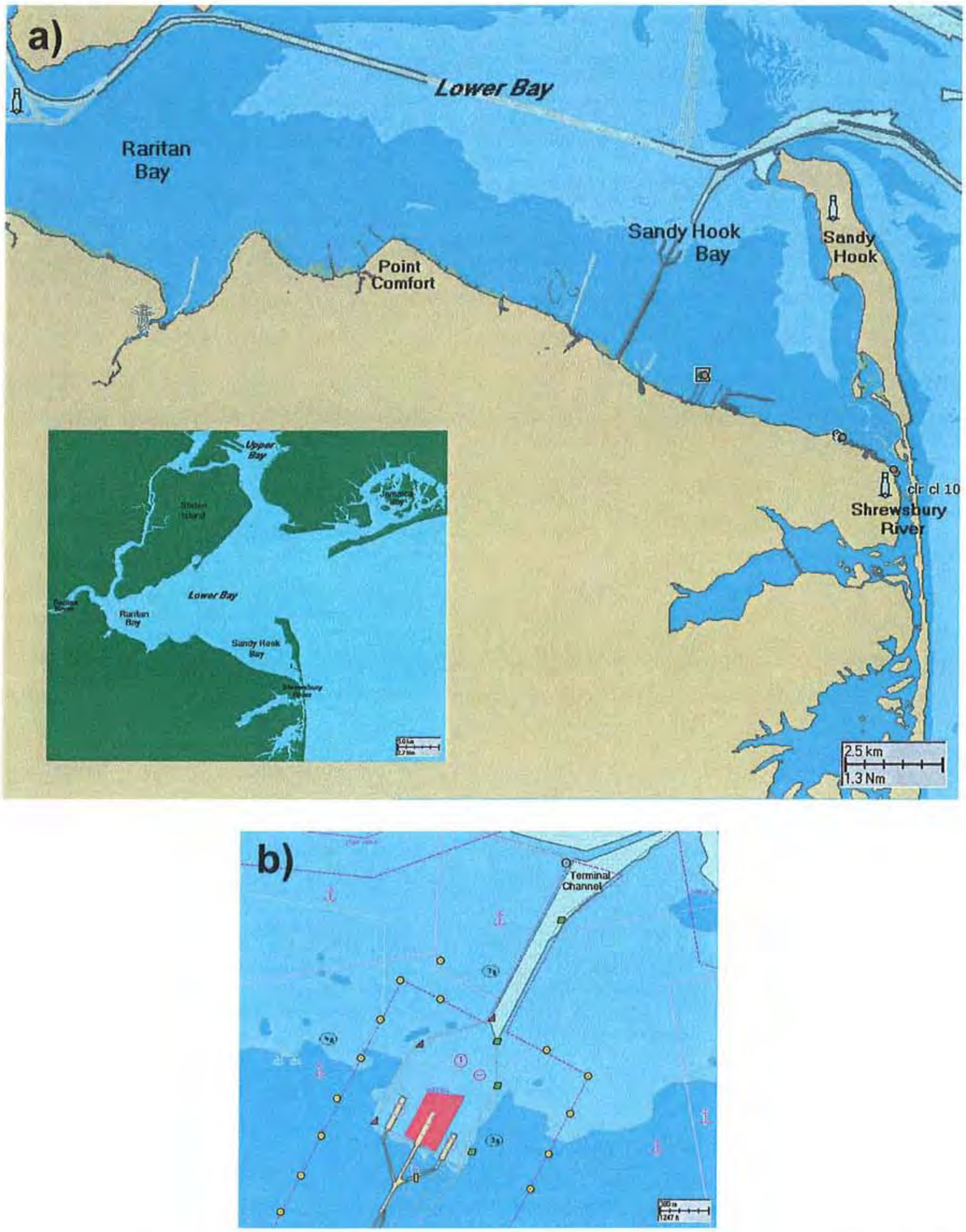

Figure 1-1. a) Map of Sandy Hook Bay. Inset shows location of study area within broader context of Hudson-Raritan estuary system. b) Detailed map of NWS Earle pier complex in Sandy Hook Bay. Proposed dredging area is shown in red.

Sankaranarayanan and French McCay (2003) recently studied two-dimensional circulation in the New York harbor region using BFHYDRO. The modeling domain encompassed the Hudson River up to Dobbs Ferry, Long Island Sound up to Willets Point, the East River, Raritan Bay and Newark Bay. The model predicted surface elevations and currents showed very good comparison with the observed data obtained from NOAA's New York-New Jersey Physical Oceanographic Real Time Systems (PORTS). Mean error in the model predicted surface elevations and currents were less than 4 % and 10 %, respectively, with corresponding correlation coefficients of greater than 0.99 and 0.93. The semi-diurnal tidal ranges and spring and neap tidal cycles of surface elevations and currents were well reproduced in the model at all stations. Details of the model calibration and validation can be found in Sankaranarayanan and McCay (2003).

For the present study, a modification of the Sankaranarayanan and French McCay (2003) grid is used (Figure 1-2). This version of the grid incorporates high resolution in Sandy Hook and Raritan Bays, with cell sizes on the order of 300 x 200 m (984 x 656 ft) (Figure 1-3). The grid consists of a total of 10,984 water cells in the horizontal plane.

Figure 1-2. Boundary-fitted grid for the study region

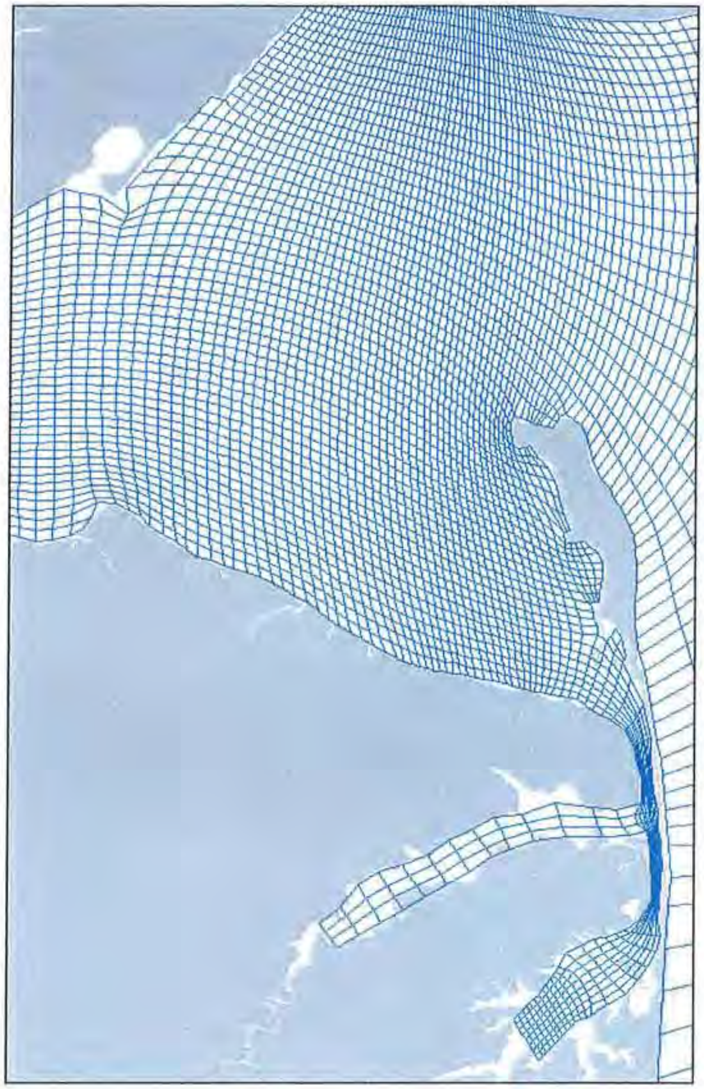

Figure 1-3. Detail of the boundary-fitted grid, showing grid refinement in Sandy Hook and Raritan Bays. This clearly demonstrates the ability of the boundary-fitted grid system to use variable grid sizes.

Bathymetry used in the model was taken from digitized NOAA bathymetry and NOAA charts. Additional high resolution bathymetry obtained during a recent survey by Gahagan and Bryant was also used in the vicinity of the NWS Earle pier complex. The bathymetry was mapped onto the boundary-fitted grid (Figure 1-4).

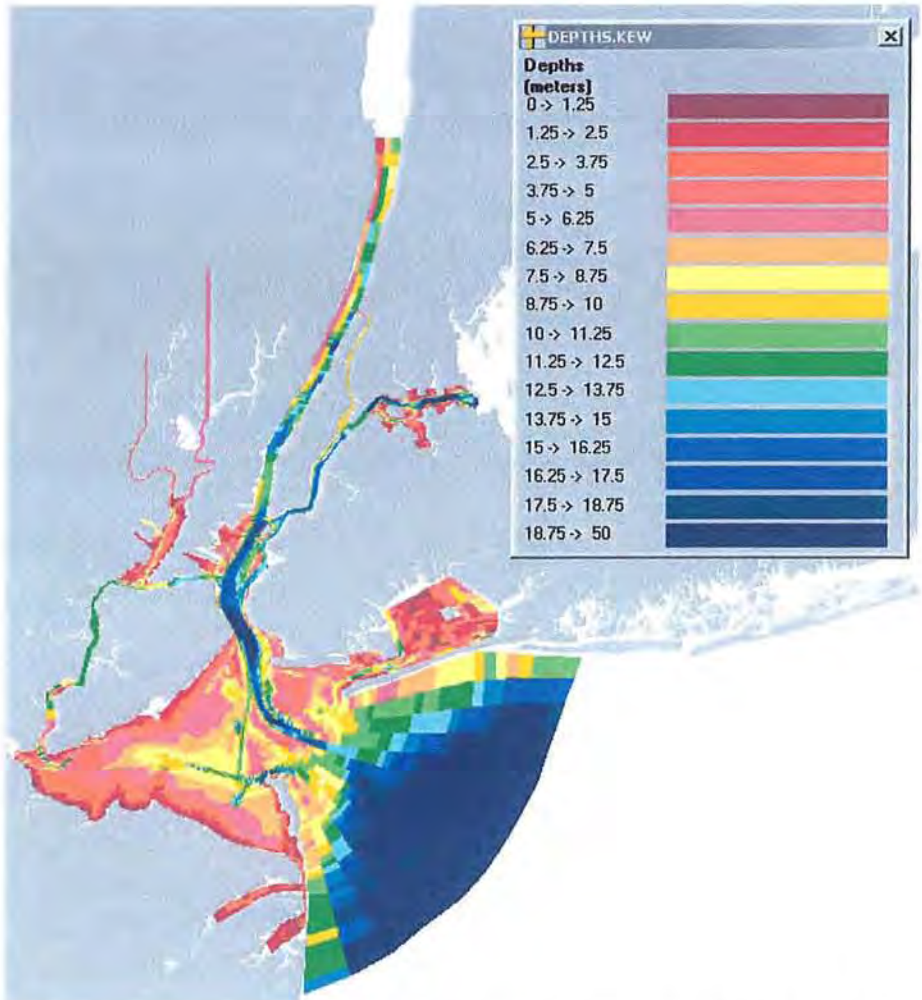

Figure 1-4. Bathymetry of the study area mapped onto the boundary-fitted grid.

1.3 Model Input

The major tidal constituents for the tidal station at Ambrose (Moody et al, 1984) and Willets Point (NOS) were used to drive the model at the open boundaries (Table 1-1). The amplitudes of the M_2 tidal constituent at the open boundaries were multiplied by factors of 1.4 and 0.65, respectively for simulating the spring and neap currents for later water quality and suspended sediment transport modeling based on the station data.

Table 1-1. Observed amplitudes and phases of different tidal constituents in Ambrose and Willets Point.

	Ambrose (Moody et al., 1984)		Willets Point (NOAA)	
Constituent	Amp (m)	Phase (deg)	Amp (m)	Phase (deg)
M2	0.650	208.1	1.103	331.2
N2	0.156	193.8	0.224	312.1
S2	0.135	228.0	0.183	352.2
K1	0.103	100.8	0.099	117.8
O1	0.063	88.3	0.064	150.9
K2			0.054	350.8
L2			0.052	353.2
NU2			0.050	312.4
P1			0.029	131.3
2N2			0.027	293.4
M4			0.036	217.4
M6			0.077	85.2

The mean river flows from the Hudson, Raritan, East, Passaic, and Hackensack Rivers and tributaries to Jamaica Bay were taken into account (Table 1-2).

Table 1-2. Mean freshwater flows into New York Harbor, including sewage (Oey, 1985a,b).

River	**Mean Flow (m^3/s)**
Hudson	130
Raritan	8
Passaic	3
East	40
Hackensack	5
Jamaica Bay	14

1.4 Simulation Results

A validation of the model application was performed by comparing the model predicted surface elevation with predicted elevations for the Sandy Hook station. Model predicted currents were compared to predictions from a harmonic analysis of tidal currents performed by NOAA (Tides and Currents, Nobeltec Corporation), evaluated at two stations in Sandy Hook Bay. The location of these stations is shown in Figure 1-5.

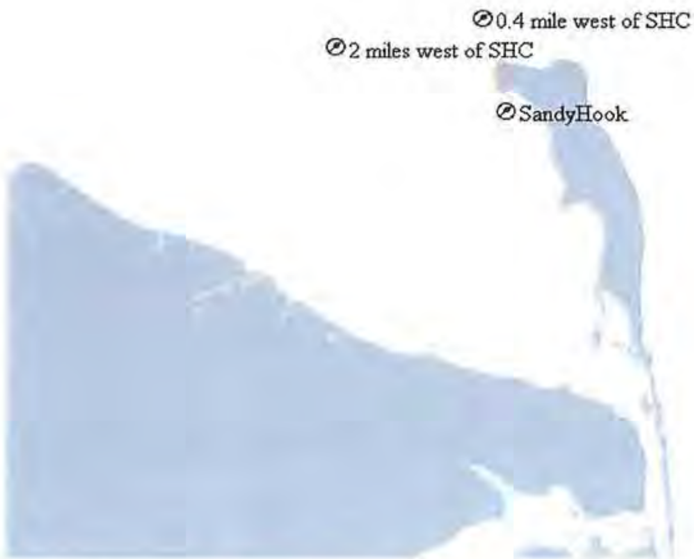

Figure 1-5. Location of tidal and tidal current stations near Sandy Hook Channel used for model validation.

The model predicted surface elevation shows very good comparison with the observed surface elevations from NOAA's PORTS station at Sandy Hook (40° 28.0'N, 74° 0.6'W), with a correlation coefficient of 0.980 (Figure 1-6).

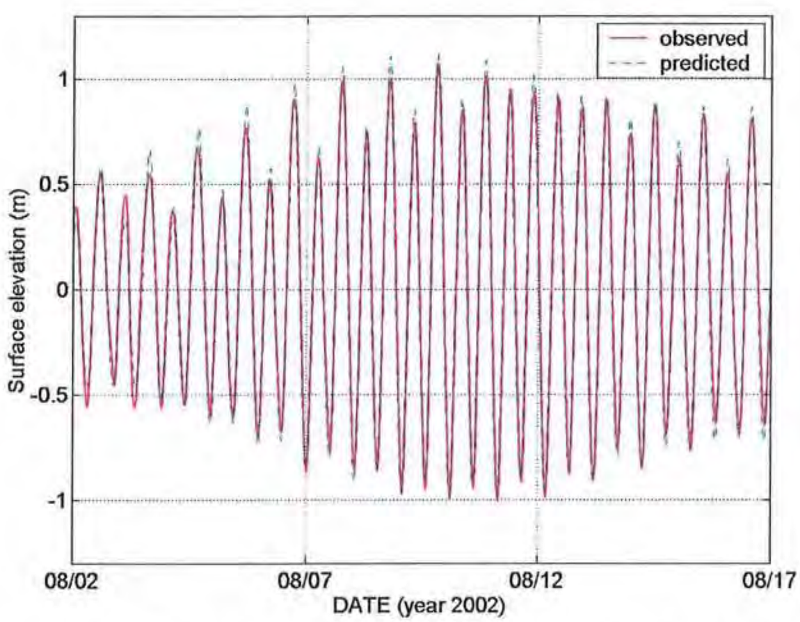

Figure 1-6. Comparison of predicted tidal elevations to observations at Sandy Hook.

Model predicted currents were slightly over -predicted but in general, compare well with currents observed at the two stations near Sandy Hook channel (Figures 1-7 and 1-8). In both cases the correlation coefficients exceed 0.920.

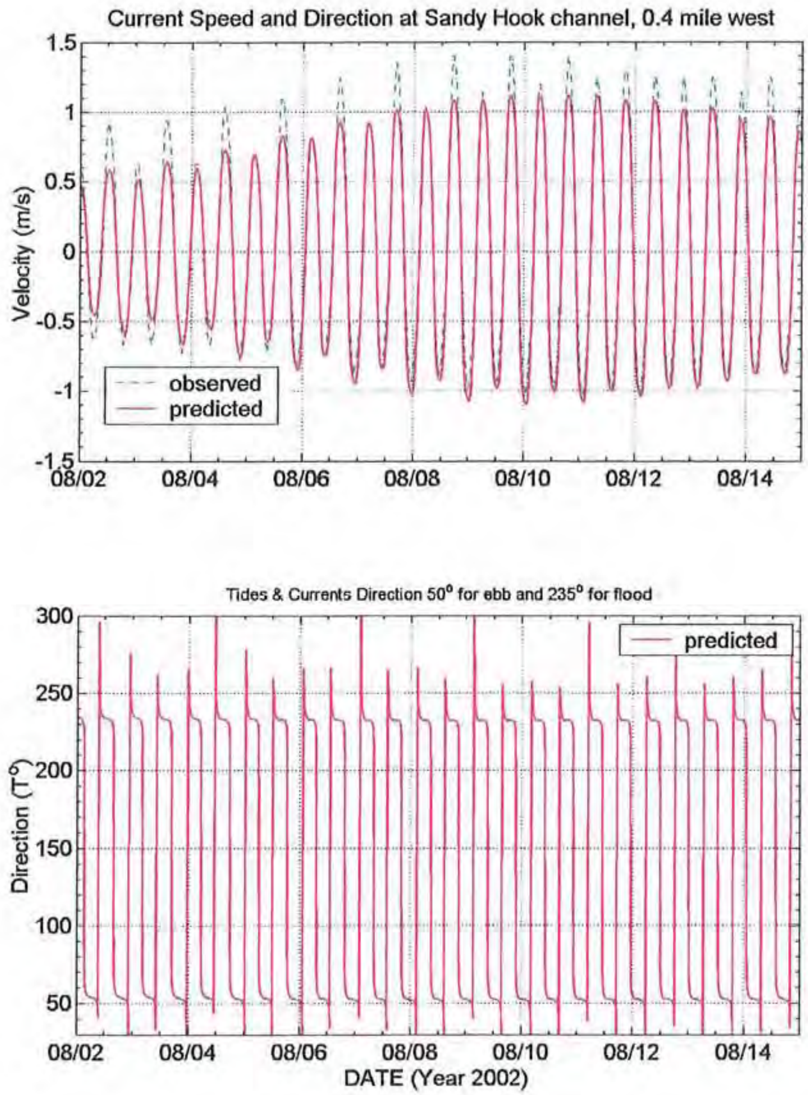

Figure 1-7. Comparison of currents predicted from model and NOAA harmonic analysis predictions.

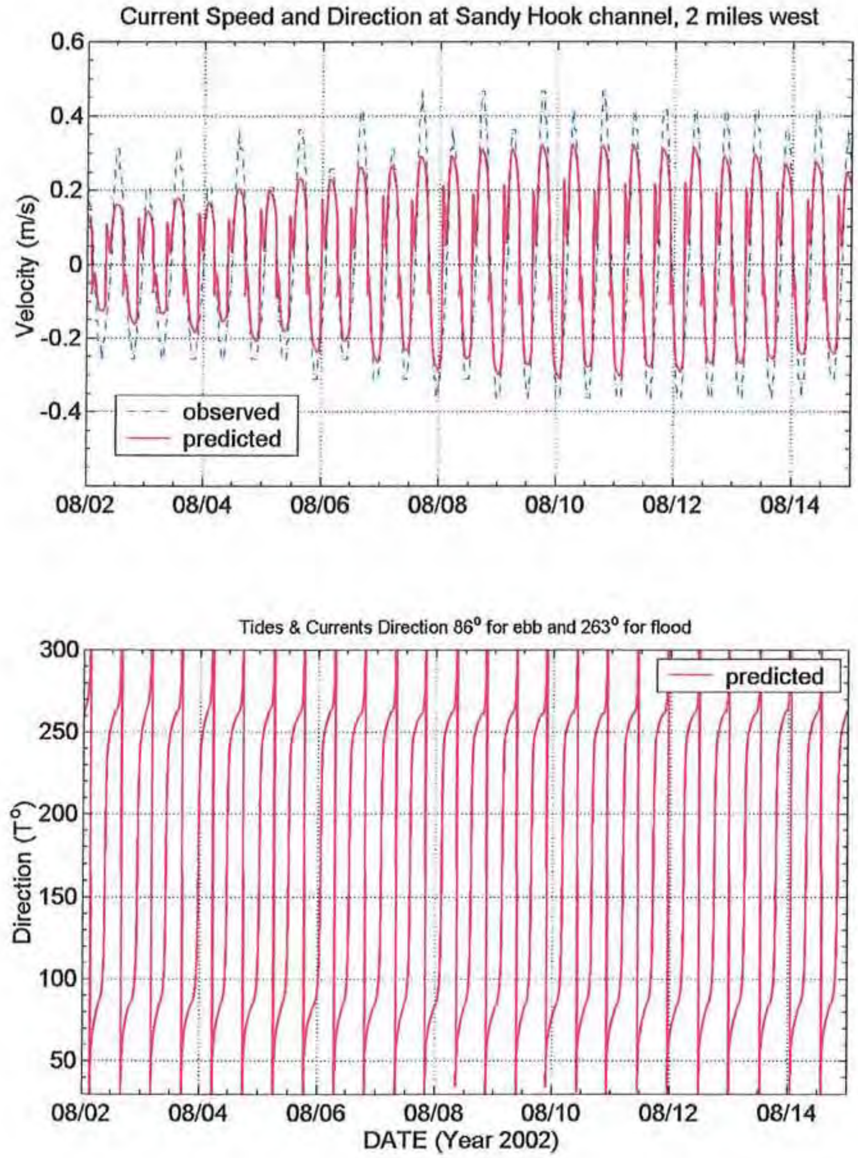

Figure 1-8. Comparison of currents predicted from model and NOAA harmonic analysis predictions.

2.0 DREDGED MATERIAL MODELING USING SSFATE

This section evaluates characteristic increases in total suspended solids (TSS) in the water column due to clamshell bucket dredging operations. In normal operation, a clamshell bucket is lowered to the bottom (9-15 m [30-50 ft]), where it grabs sediment. The sediment-filled bucket is then raised to the surface and the sediment is dropped into a nearby barge. This cycle repeats itself every 60 to 90 seconds until the total volume is excavated (i.e., for several weeks or months).

Increases in TSS occur in the water column if some portion of the sediment becomes waterborne. For example, some sediment release takes place when the bucket disturbs the seafloor. Sediment can also escape into the water column from the bucket as the bucket travels upwards if the overlying water is vented or the bucket is not well sealed. The total amount of sediment released (i.e., the TSS source strength) varies, depending upon the type of bucket employed. This sediment loss becomes a constant TSS source to nearby water for the entire period of operation. The distribution of TSS in the water column away from the immediate site of operation is a function of how the sediment is carried away and dispersed by ambient currents and how it settles, in addition to the initial source strength. SSFATE (Suspended Sediment FATE) is used to model these processes.

SSFATE, developed jointly by ASA and the US Army Corps of Engineers (ACOE), Environmental Research and Development Center, is one member of a suite of ACOE models that simulate various dredging related activities. Other models in this group include STFATE (dredged material disposal), MDFATE (multiple dump disposals) and LTFATE (long-term mound stability). SSFATE has been documented in a series of ACOE Dredging Operations and Environmental Research (DOER) Program technical notes (Johnson et al., 2000 and Swanson et al., 2000).

2.1 Estimation of TSS Source Strength

Operation of a clamshell bucket inevitably disturbs the bottom sediments and causes them to become suspended in the water column. Typical loss rates range from 1.5 to 2 % for modern buckets, depending on the type of bucket used (Table 2-1).

Table 2-1. Sediment loss rates for various dredge buckets. From *DOER Technical Notes Collection* (ERDC TN-DOER-E12).

Bucket Type	Loss Rate (%)
Conventional bucket	2.0
Environmental bucket	1.5

The use of two types of bucket is planned: an environmental bucket (22.9 m^3 [30 yd^3]) for dredging soft sediment and a conventional bucket (10.7 – 16.1 m^3 [14-21 yd^3]) for hard sediment. The study of sediment cores from the dredge site suggests the existence of distinct layers of soft and hard sediment (ASI/Maguire, 2003). Environmental buckets are designed with a number of features that minimize re-suspension. These include better venting, a rubber sealed bucket and level cut capability, which reduces side collapsing. The environmental bucket will be applied wherever operation is feasible (i.e., in soft sediment layers). A conventional bucket is to be used primarily for harder and deeper sediment layers.

The actual TSS source strength is determined by a unique set of parameters for each of the buckets (Table 2-2). Production rates reflect an average down time due to maintenance and scow waiting of seven hours per day (17 of 24 hrs operating). The mean release rate of sediments is the product of the loss rate, the production, the solid fraction and the density, i.e.

Mean release rate = (loss rate) x (production) x (solid fraction) x (density)

Although the conventional bucket has a smaller capacity (13.4 m^3 [17.5 yd^3] versus 22.9 m^3 [30 yd^3]), and therefore a lower production rate, the sediment release rate is higher with the conventional bucket (relative to the environmental bucket) because of the higher loss rate and greater solid fraction.

Table 2-2. TSS source strength parameters used for modeling dredging with environmental and conventional bucket.

Parameter	Bucket Type: Environmental (soft sediments)	Bucket Type: Conventional (hard sediments)
Bucket size [m(yd^3)]	22.9 (30)	13.4 (17.5)
Operation cycle [s]	60	60
Production rate [yd^3/hr]	1275	743.7
Solid fraction [%]	40.6	76.3
Sediment density [kg/m^3]	2600	2600
Mean release rate [kg/s]	4.28	6.26

2.2 Sediment Characteristics near the Dredging Site

One of the principal factors controlling TSS concentration is the rate at which sediment settles out of the water column. In general, coarser materials have higher settling velocities and remain suspended for shorter durations than finer sediments. Basic settling characteristics may be determined by examining the distribution of sediment types for the site. SSFATE characterizes sediments as belonging to one of five distinct size classes (Table 2-3).

Table 2-3. Classes of sediments within SSFATE.

Class	Size Range (microns)	Name
1	0 – 7	clay
2	8 – 35	fine silt
3	36 – 74	coarse silt
4	75 – 130	find sand
5	> 130	coarse sand

Figure 2-1 shows the fractional distribution of sediment types obtained from the proposed NWS Earle Pier 3 dredging site (ASI/Maguire Group, 2003), while Figure 2-2 shows the water content of the samples. Composite samples R3-C (Reach 3 composite) and R1-C (Reach 1 composite) were chosen as representative of soft sediments (sediments accumulated since the last dredging of the basin) and hard sediments (sediments below the soft sediment layer), respectively. These values were then used in the SSFATE model (Table 2-4). It is important to note that sediment size distribution and water content are significantly different between the two sediment types. In particular, the soft sediments (i.e., R3-C) have significantly higher clay, silt and water content than the hard sediments (R1-C). Conversely, the hard sediments have higher proportions of sand. Hence the hard sediment is expected to settle significantly faster than the soft sediment.

Table 2-4. Composition of representative soft and hard sediments from NWS Earle Pier 3 site.

		Distribution (%)	
Class	Name	Soft	Hard
1	clay	34.5	12.3
2	fine silt	27.0	6.0
3	coarse silt	27.0	6.0
4	fine sand	4.5	35.3
5	coarse sand	7.0	40.4

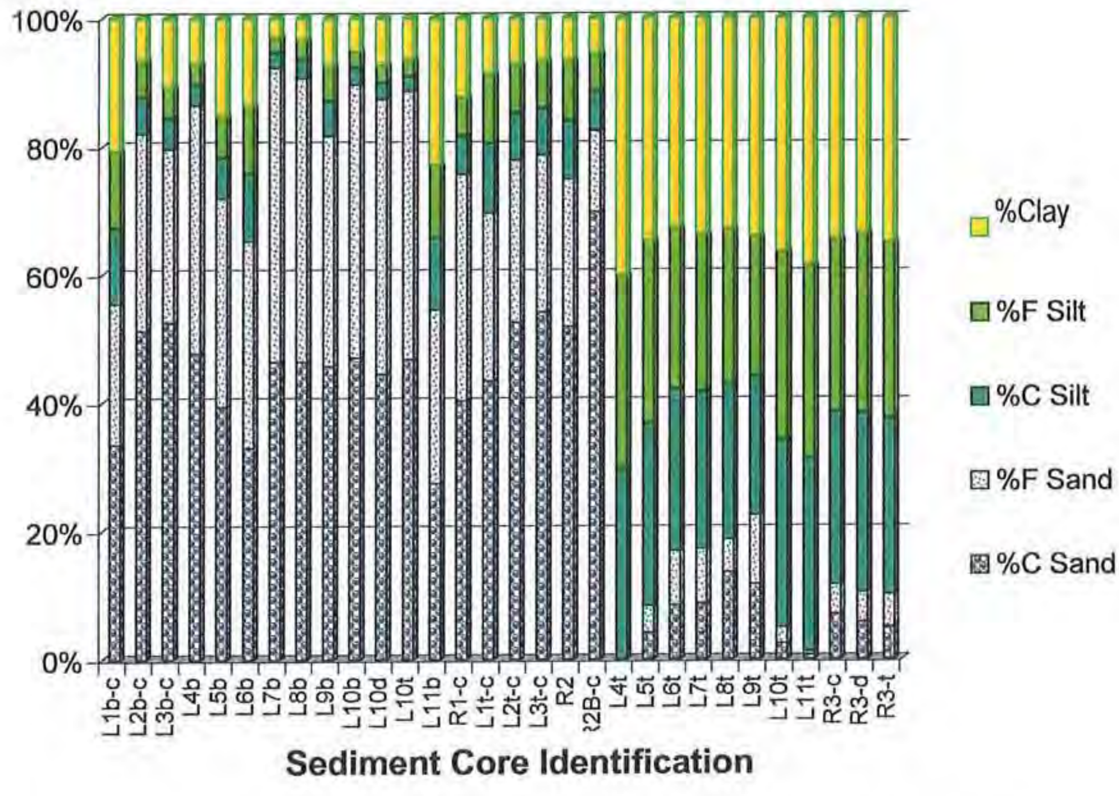

Figure 2-1. Sediment type distributions near the NWS Earle Pier 3 site.

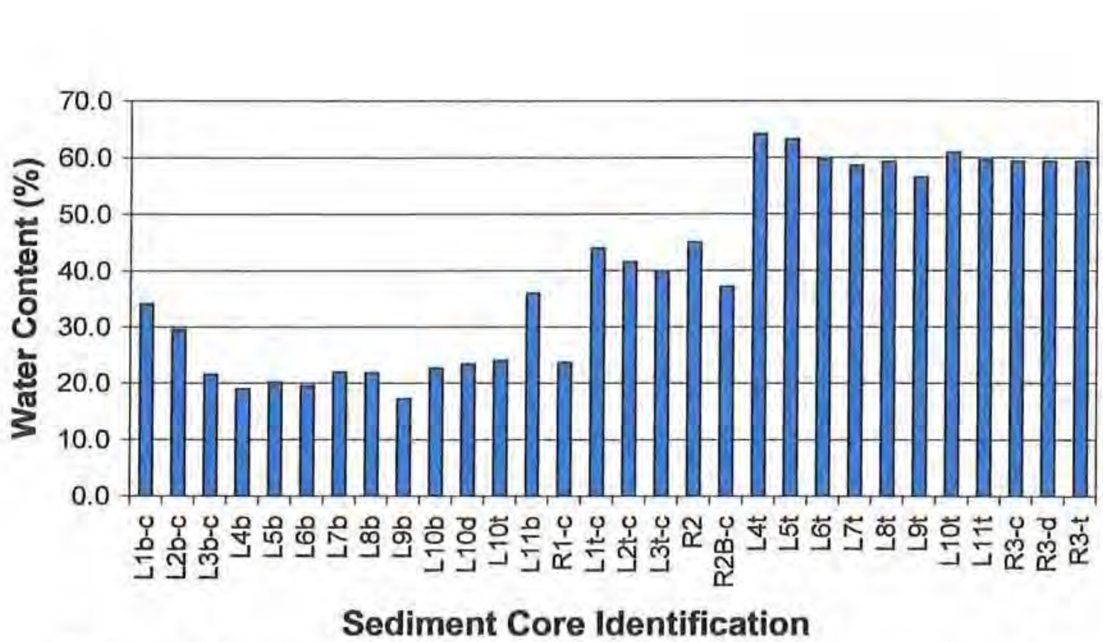

Figure 2-2. Water content corresponding to sediment core samples in Figure 2-1.

2. 3 Predicted TSS Concentrations

SSFATE simulations of clamshell (i.e., environmental and conventional bucket) dredging were performed for the three tidal conditions (neap, mean, and spring). The center coordinate of NWS Earle Pier 3 was designated as the representative dredging operation location, which remained fixed for the duration of the simulation. The distribution of excess TSS concentrations in the water column due to the clamshell dredging became quasi-steady state after approximately two tidal cycles (~one day). All simulations were run for three days.

The simulation results are presented in two ways,

1. Horizontal and vertical views of TSS distribution.
2. Area exceeding various concentration levels.

Figures 2-3 and 2-4 show maximum excess TSS concentrations over the duration of the simulation (three days) for various combinations of bucket type and tidal forcing condition. This graphic shows the extent of the sediment plume integrated in time to depict the maximum area covered. The actual plume at any instant in time would be significantly smaller. Associated section views reveal vertical variations in TSS concentration. Within a given simulation, the TSS plume reaches its maximum spatial extent when the tide ebbs and water flows out toward Sandy Hook. When the tide floods, the spread of the plume is limited by the flow of water entering the bay. This results in higher TSS concentrations within the plume.

Overall, the size of the sediment plume reflects the strength of the tidal forcing. Spring tide conditions lead to plumes covering larger areas while neap tide conditions result in smaller plumes and proportionally higher TSS concentrations. This behavior holds for simulations with both the environmental bucket (Figure 2-3) and the conventional bucket (Figure 2-4). TSS concentrations are lower overall in the conventional bucket simulations, owing to the high sand portion (and therefore fast settling rate) of the hard sediments and the smaller bucket size.

It is important to note that the instantaneous concentrations, which vary widely in time, are significantly smaller than the maximum excess TSS concentrations presented here. Instantaneous concentrations provide a more accurate picture of the potentially affected area. Figure 2-5 is provided as an example of instantaneous concentrations. Inter-tidal variations in the size of the plume are readily apparent.

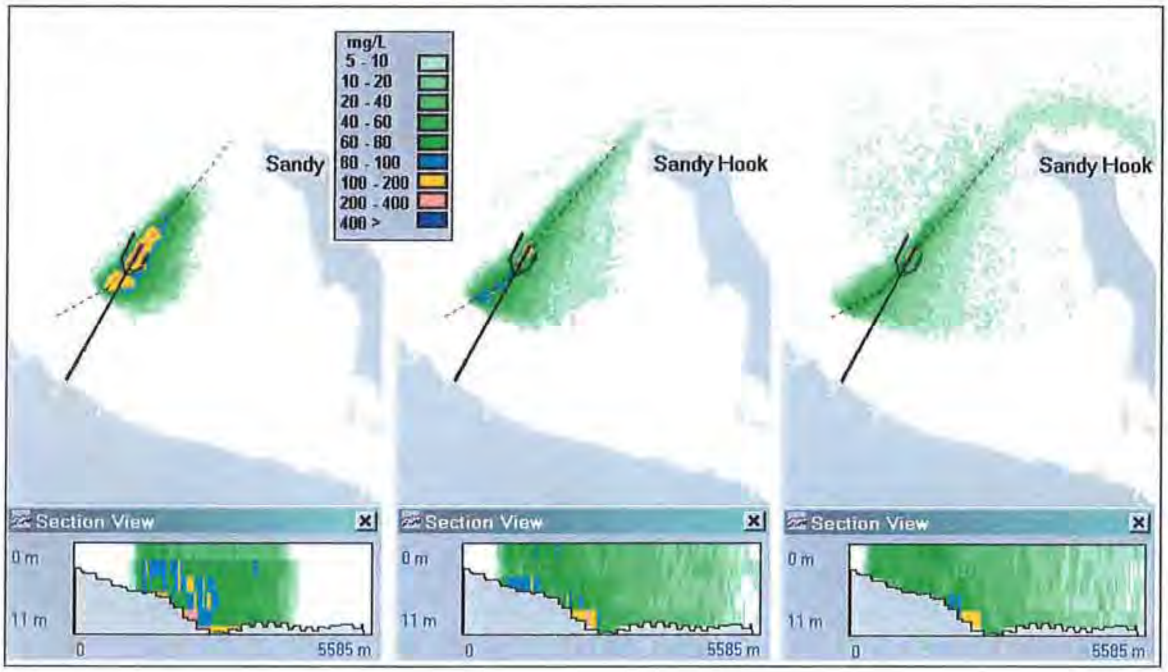

Figure 2-3. Maximum TSS concentrations throughout the water column for simulations with the environmental bucket and neap (left), mean (center) and spring (right) tidal forcing. The section views are made along the dotted lines shown.

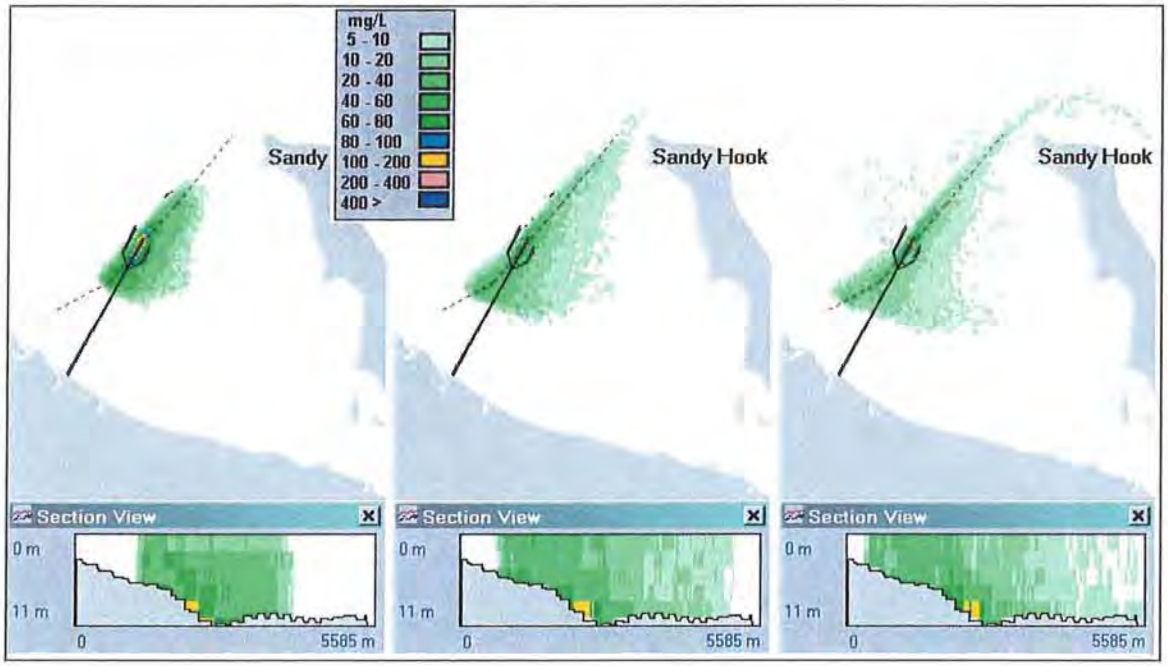

Figure 2-4. Maximum TSS concentrations throughout the water column for simulations with the conventional bucket and neap (left), mean (center) and spring (right) tidal forcing. The section views are made along the dotted lines shown.

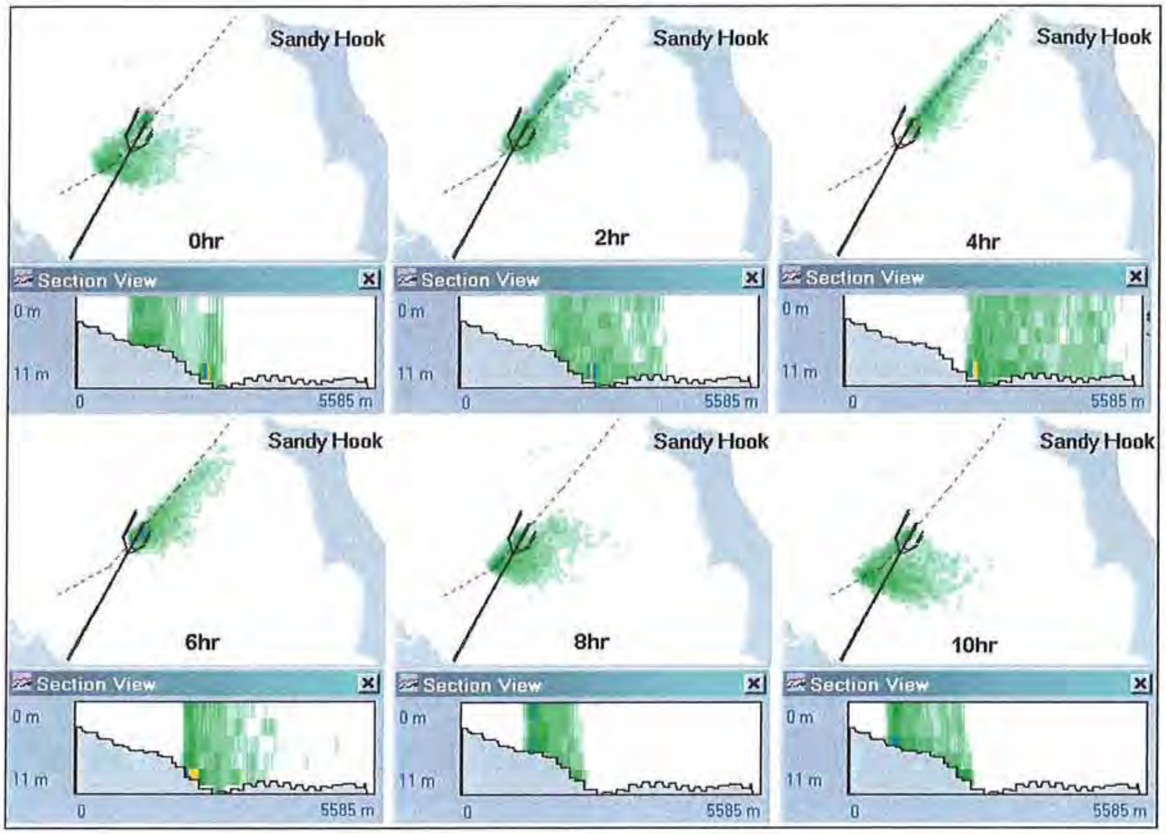

Figure 2-5. Snapshots of TSS concentrations at two hour intervals for a simulation with the environmental bucket and mean tidal forcing. Map views show maximum TSS concentration in the water column at that point at the given time. Section views are made along the dotted lines shown.

Figure 2-6 and 2-7 show the area (acres) exceeding fixed TSS concentration levels for the various tidal forcing conditions. This is essentially the same information as presented in Figures 2-3 and 2-4, but in a more quantitative format. As demonstrated qualitatively in Figures 2-3 and 2-4, the environmental bucket leads to larger plumes than the conventional bucket because of both the larger bucket size and the larger proportion of fine sediments

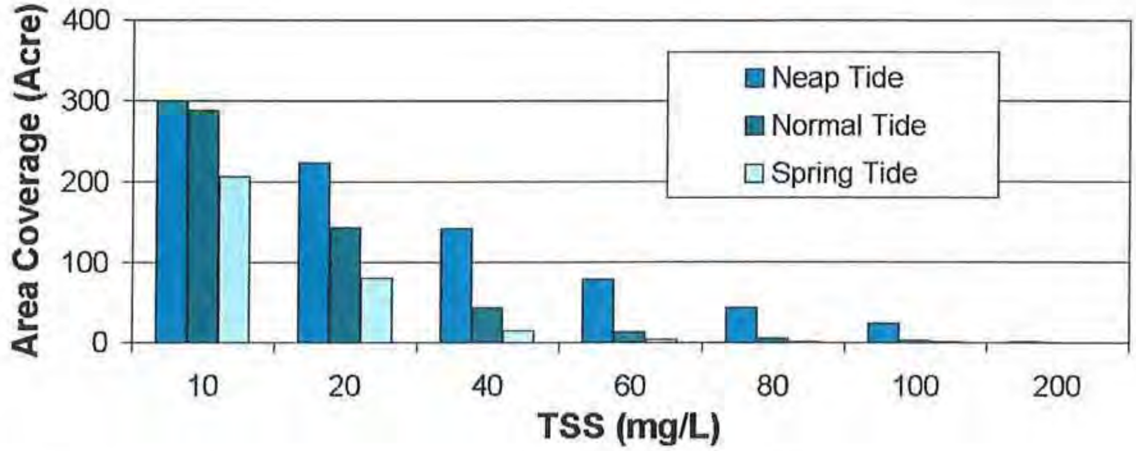

Figure 2-6. Area (acres) exceeding fixed TSS concentration levels for simulations with the environmental bucket.

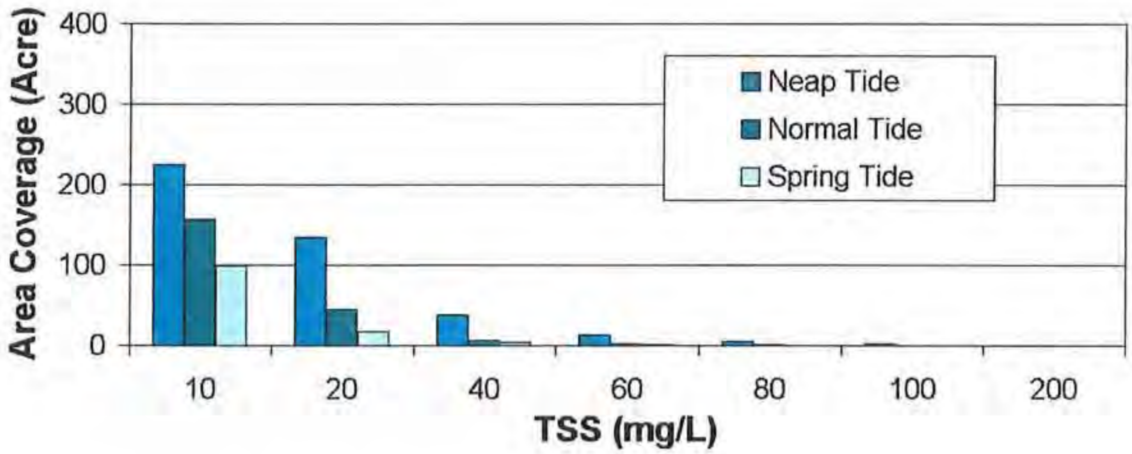

Figure 2-7. Area (acres) exceeding fixed TSS concentration levels for simulations with the conventional bucket.

3.0 POLLUTANT TRANSPORT MODELING

3.1 BFMASS Model

The BFMASS model, a component of ASA's WQMAP model system, is a pollutant transport model, which includes first order reaction terms. This model is suitable for a single constituent contaminant that is conservative, settles, decays, or grows. BFMASS was used in this application to predict the temporally and spatially varying concentrations associated with transport of equilibrated sediment contaminants in dissolved phase (i.e., a conservative constituent).

In BFMASS, the two- or three-dimensional advection-diffusion equation is solved on the same boundary conforming grid as the hydrodynamic model, BFHYDRO. The model obtains the face-centered, contra-variant velocity vector components from the hydrodynamic model. This procedure eliminates the need for aggregation or spatial interpolation of the flows from the hydrodynamic model and assures mass conservation. The transport model is solved using a simple explicit finite difference technique on the boundary conforming grid (ASA, 1997). The vertical diffusion, however, is represented implicitly to ease the time step restriction caused by the normally small vertical length scales that characterize many coastal applications. The horizontal diffusion term is solved by a centered-in-space, explicit technique. The solution to the advection-diffusion equation has been validated by comparison to one- and two-dimensional analytic solutions for constant plane and line source loads in a uniform flow field and for a constant step function at the upstream boundary. The model has also been tested for salinity intrusion in a channel (Muin, 1993).

3.2 Pollutant Source

For dredging operations, the source is simulated as a continuous release of pollutant into the water column. A generic conservative pollutant with a concentration of one μg/L is assumed for modeling. The results for this representative pollutant may then be applied to other conservative pollutants by simply scaling according to their relative concentrations in the source, as determined by elutriate analysis of the sediments in question. For example, to scale to a pollutant with an elutriate concentration of ten μg/L, one need simply multiply concentrations from the simulation for a generic pollutant by a scale factor of (10 μg/L)/(1 μg/L) or 10.

3.3 Toxic Pollutants

An analysis of elutriate concentrations prepared from sediment samples from the area surrounding NWS Earle Pier 3 reveals that pollutant concentrations are well below established water quality criteria for all constituents with the exception of Total PCBs (ASA/Maguire Group, 2003) (Table 3-1). The chronic water quality concentration criterion for Total PCBs in coastal waters, as established by the New Jersey Department of Environmental Protection, is 0.03 μg/L (NJDEP, 2002). Elutriate concentrations for all three reaches of sediment at this site exceed this criterion (Reach 1: 0.0663 μg/L, Reach 2: 0.0709 μg/L, Reach 3: 0.0763 μg/L).

Pollutant concentrations in site water show a pattern similar to that seen in the elutriate analysis (ASA/Maguire Group, 2003) (Table 3-2). Again, PCBs are the only pollutant to exceed chronic water quality. In fact, PCB concentrations in the water column exceed elutriate concentrations for Reach 1 and Reach 3.

A dilution factor can be calculated as the ratio of the elutriate concentration to chronic water quality concentration. For Total PCBs at the NWS Earle Pier 3 site, this dilution is between 2 and 3 for all sediment reaches (Table 3-1).

Table 3-1. Pollutant constituents, elutriate concentrations, source strengths and dilutions for dredging operations at the NWS Earle pier complex. Dilution is the ratio of elutriate concentration and chronic criteria concentration. Elutriate concentrations that exceed chronic criteria are shown in bold italics. Dilutions exceeding 1.0 are shown in bold.

	Substance	Elutriate Concentration (μg/L)	WQ Chronic (μg/L)	Dilution
Reach 1	Ag	0.02	NA	NA
	Cd	0.01	8.8(a)	0.001
	Cr	0.89	50(a)	0.02
	Cu	0.88	5.6(b)	0.2
	Hg	0.01	0.94(a)	0.01
	Ni	1.63	8.2(a)	0.2
	Pb	0.54	24(b)	0.02
	Zn	2.53	81(a)	0.03
	Chlordane	0.00025	0.0040(b)	0.06
	Total DDT	0.00579	NA	NA
	Total PCB	***0.0663***	0.03(b)	**2.21**
Reach 2	Ag	0.02	NA	NA
	Cd	0.03	8.8(a)	0.003
	Cr	0.79	50(a)	0.02
	Cu	0.94	5.6(b)	0.2
	Hg	0.01	0.94(a)	0.01
	Ni	2.04	8.2(a)	0.2
	Pb	0.67	24(b)	0.03
	Zn	2.51	81(a)	0.03
	Chlordane	0.00030	0.0040(b)	0.08
	Total DDT	0.00727	NA	NA
	Total PCB	***0.0709***	0.03(b)	**2.36**
Reach 3	Ag	0.02	NA	NA
	Cd	0.007	8.8(a)	0.0008
	Cr	1.63	50(a)	0.03
	Cu	1.26	5.6(b)	0.2
	Hg	0.03	0.94(a)	0.03
	Ni	2.34	8.2(a)	0.3
	Pb	1.36	24(b)	0.06
	Zn	2.96	81(a)	0.04
	Chlordane	0.00040	0.0040(b)	0.1
	Total DDT	0.00628	NA	NA
	Total PCB	***0.0763***	0.03(b)	**2.54**

(a) United States Environmental Protection Agency criterion (USEPA, 2002)
(b) New Jersey Department of Environmental Protection criterion (NJDEP, 2002)

Table 3-2. Summary of site water analyses and relevant water quality criteria. Concentrations shown in bold italics exceed chronic exposure levels as established by either the New Jersey Department of Environment Protection (NJDEP, 2002) or the US Environmental Protection Agency (EPA, 2002), as listed.

	Site Water Concentrations (ppb)			NJ Criteria (ppb)			EPA Criteria (ppb)	
Substance	**Reach 1**	**Reach 2**	**Reach 3**	**Acute**	**Chronic**	**Human Health**	**Acute**	**Chronic**
Ag	0.010	0.013	0.01			164*	1.9	
Cd	0.224	0.554	0.043			10*	40	8.8
Cr	0.271	0.392	0.364			3230*	1100	50
Cu	1.43	1.50	1.51	7.9	5.6		4.8	3.1
Hg	0.003	0.003	0.003			0.146*	1.8	0.94
Ni	0.83	0.85	0.85			3900*	74	8.2
Pb	1.06	0.877	0.299	210	24		210	8.1
Zn	4.76	4.56	4.07				90	81
Chlordane	0.0005	0.0005	0.00028	0.09	0.0040		0.09	0.004
Total DDT	0.0046	0.0047	0.00452					
Total PCB	***0.0698***	***0.0772***	***0.0718***		0.03	0.00017(hc)		0.03

* Concentration criteria refers to total recoverable substance.

(hc) - Carcinogenic effect-based human health criterion as a 70-year average.

3.4 BFMASS Modeling Results

Simulations were conducted for a representative conservative pollutant with a source concentration of one μg/L under three different tidal forcings (neap, mean and spring). Results give excess pollutant concentrations (i.e., concentrations above ambient). Figure 3-1 shows quasi-steady state dilutions of this test pollutant for each of the three tidal forcings. This figure shows the maximum concentrations over the tide cycle, combining both the flood and ebb tide locations of the pollutant plume. Spring tide forcing results in the largest plume of pollutant, but also the greatest overall dilution (and therefore the lowest concentrations). Neap tide forcing leads to a relatively small pollutant plume but also relatively little dilution (and therefore high concentrations).

A more quantitative analysis of the results can be achieved by considering the total area exceeding various concentrations (or dilutions) each of the various simulations (Figure 3-2). Spring tides yield the greatest dilutions (i.e., smallest area with dilutions below a given threshold).

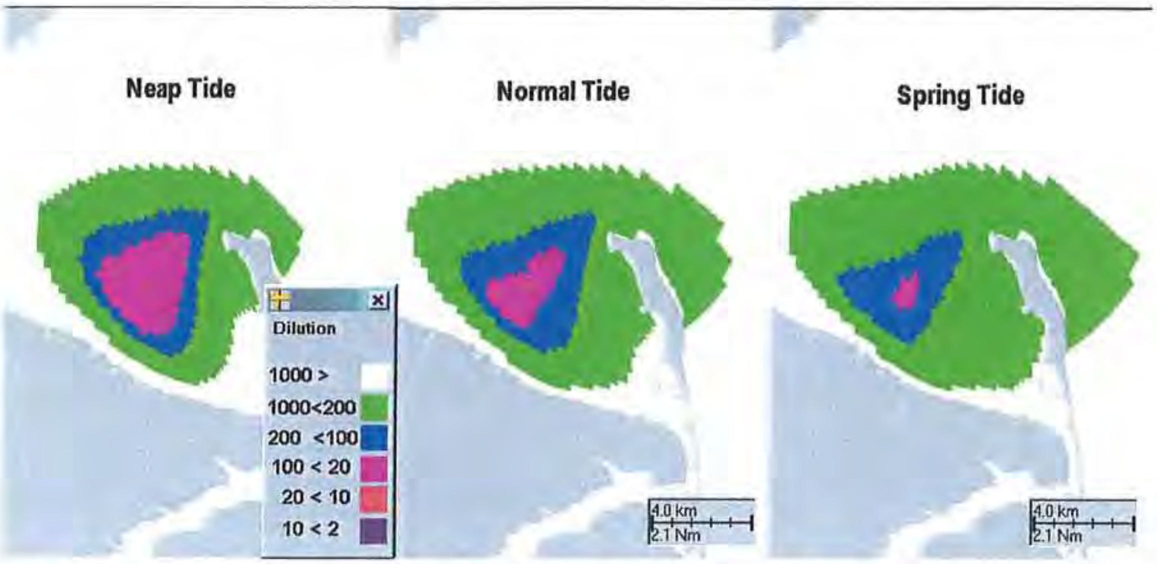

Figure 3-1. Simulated contaminant dilution as a function of location for simulations with neap (left), mean (center) and spring (right) tidal forcing.

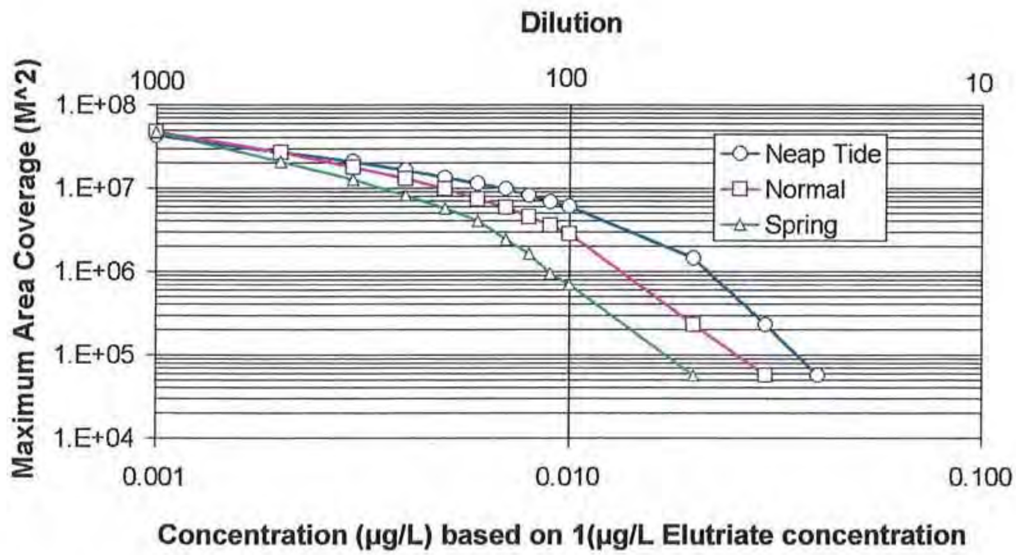

Figure 3-2. Maximum area coverage (y-axis) of contaminants vs. concentrations (or dilution) for three different tidal forcing conditions (neap, normal and spring) for a generic conservative pollutant (source concentration of one µg/L). Both x- and y- axes are logarithmic scales.

These results can be scaled directly to PCBs as described above. For example, dilutions for Reach 3, which has the highest elutriate concentrations of Total PCBs amongst the various sediments at the sites, are shown in Figure 3-3. All concentrations fall below the elutriate (source) concentration because of the initial dilution around the dredge.

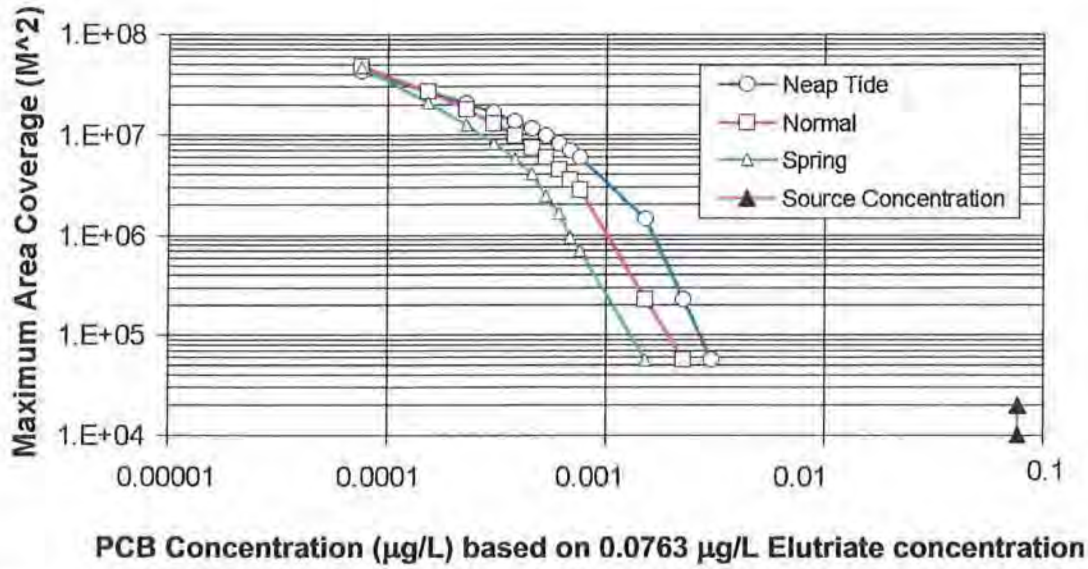

Figure 3-3. Maximum area coverage (y-axis) of contaminants vs. concentrations (or dilution) for three different tidal forcing conditions (neap, normal and spring) for Total PCBs for Reach 3 sediments. Both x- and y- axes are logarithmic scales.

While results show significant dilution of PCBs introduced to the water column by the dredging process, it is important to keep in mind that these concentrations represent concentrations in excess of the pollutant concentrations in the ambient water. A chemical analysis of site water from NWS Earle Pier 3 (ASA/Maguire Group, 2003) shows that ambient concentrations of Total PCBs exceed the chronic water quality concentrations for all three sediment reaches (Table 3-2). The impact of the addition of PCBs to the water column from sediments during the dredging process will therefore be negligible.

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Appendix “F”

APPENDIX F – CLEAN AIR ACT GENERAL CONFORMITY RULE APPLICABILITY ANALYSIS

EXECUTIVE SUMMARY

Pursuant to the requirements of the Clean Air Act General Conformity Rule (GCR), this document was prepared to determine the applicability of the GCR to the proposed action. The project is titled, Pier Complex Replacement, Naval Weapons Station (NWS) Earle, Colts Neck, NJ. The proposed action will replace deteriorating Piers 2 and 3 with one new modern pier.

An analysis of ozone precursors emissions is required to determine if a formal Conformity Determination is required. Determination of applicability was made by comparing estimated emissions from the proposed action to the *de minimis* levels specified under the GCR (40 CFR 93.153). The proposed action is located in Monmouth County, NJ. This area is in attainment for the following criteria pollutants: sulfur dioxide, lead, carbon monoxide and particulate matter. Therefore, an applicability analysis is not required for these pollutants. However, this area is classified as severe non-attainment for ozone. The GCR specifies a *de minimis* level of 23 metric tons/year (25 tons/year) for the ozone-precursor nitrogen oxides (NO_x) and 23 metric tons/year (25 tons/year) for the ozone-precursor volatile organic compounds (VOCs) in areas classified as severe non-attainment.

Potential emissions that could result from the proposed action were calculated for the selected criteria pollutants emitted during construction and the first year of operation. The determined emissions values are well below the *de minimis* level of 23 metric tons per year (25 tons per year) for VOC and NO_x, therefore, a formal Conformance Determination is not required.

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I. INTRODUCTION

A. Background

Naval Weapons Station (NWS) Earle, located in Colts Neck, New Jersey, is one of three major ammunition depots serving fleet units on the east coast; the others are located in Yorktown, Virginia, and Charleston, South Carolina. NWS Earle is 76 kilometers (km) (47 miles (mi)) south of New York City and 113 km (70 mi) northeast of Philadelphia, Pennsylvania (Figure 1). The 4,499 hectare (11,118-acre) facility is located entirely in Monmouth County, New Jersey. Monmouth County is in east central New Jersey and is bordered by the Atlantic Ocean to the east and Raritan Bay and Sandy Hook Bay to the north. NWS Earle is comprised of two major parcels: Mainside, located in the interior of the county, and the Waterfront/Chapel Hill, located on the shoreline of Sandy Hook Bay. A 21 km (17 mi) road and rail corridor connects these two parcels.

The Mainside area is located primarily in Colts Neck Township. This area contains the Station's main administration, housing, maintenance and ordnance storage facilities.

The Waterfront area is in the town of Leonardo. This area contains a few administration and maintenance facilities and the pier complex. The pier complex is a transshipment depot to facilitate the movement of ammunition and explosives.

NWS Earle's pier complex is one of the longest "finger piers" in the world. It is comprised of a three km (two mi) long trestle that branches out to three finger ship berthing piers - Piers 2, 3 and 4. The entire pier complex extends about three km (two mi) into Sandy Hook Bay. Two km (one mi) from the shore the trestle branches off to Pier 1. Pier 1 is no longer used for ship or barge berthing. At the junction of Trestles 2, 3 and 4, a concrete platform supports the port operations building, a forklift/battery recharging shop and a recreation center. This area is known as the "wye".

The original piers and trestles were constructed in the early 1940s. The wye was constructed in 1981, Pier 4 was added in 1990, and a new main (replacement) trestle was constructed in 1993. The original piers and trestles were constructed of reinforced concrete slabs, 56 centimeters (cm) (22 in) thick and overlaid with a 5 cm (2 in) asphalt-wearing surface. More than 41,000 timber piles support the original piers and trestles. Elevated loading platforms line both sides of each pier. Pier 4 and the new trestle are constructed of pre-stressed concrete box girders, topped by a cast-in-place reinforced concrete deck, supported on pre-cast concrete pile caps and steel pipe piles. A unique feature of Pier 4 is its double-deck-utility-galley/loading platform.

The mission of NWS Earle is to provide fleet operational services and infrastructure management to support Combat Logistics Force homeporting, ordnance functions and tenant activities in execution of the National Military Strategy. NWS Earle is the primary east coast Fleet Support Activity providing ammunition logistics to Navy, Marine Corps, and Coast Guard units and shore activities in the northeastern United States.

Some existing, and all future, Navy ammunition ships, known as Auxiliary-Oil-Explosives ships, or AOEs, will be manned and operated by civilian personnel of the Military Sealift Command (MSC). Currently, some existing ships homeported at NWS Earle are manned by MSC crews, though a small contingent of US Navy officers and sailors will continue to be aboard these ships. In the future, all homeported AOEs at NWS Earle will be manned by a mix of MSC personnel and US Navy sailors. This will ultimately reduce the number of Navy sailors and their families stationed at NWS Earle.

At the present, Pier 1 serves as a temporary holding yard for ordnance vans; Piers 2 and 4 are the homeport piers for the USS Detroit, the USNS Supply, the USNS Arctic and the USNS Mt. Baker; Pier 3 is the ordnance handling pier. In support of these large ships, the water depth at Pier 4 and the turning basin is dredged to –13.7 meters (m) (-45 feet (ft)) mean low water (MLW); Piers 2 and 3 are dredged to –10.7 m (-35 ft) MLW. Since World War II, the pier complex has provided ammunition services to almost every class of vessel operated by the Navy and Coast Guard, as well as commercial supplies/vessels from a multitude of nations.

B. Proposed Action Description

The Department of the Navy has determined that future AOE ship homeporting and ordnance handling requirements at NWS Earle will require a total of four operational berths (two piers). This requirement, combined with the high cost of maintaining the current three-pier complex, has resulted in the proposed action to replace Pier 3 with a modern pier facility and the subsequent removal of Pier 2 (Figure 3). Based on the preliminary design concept for the replacement pier, the demolition of the existing pier and the subsequent construction of the new pier would likely occur as follows:

- *Provide temporary, upgraded utility services at Pier 2*

  During the construction period for the new pier, ship berthing and ordnance offloading operations will be shifted to Pier 2. Some utilities upgrading and minor structural repairs will be made to Pier 2 to support berthing and ordnance handling operations until the new pier is completed.

- *Initiate dismantling/demolition of Pier 3*

  Once ship berth upgrades have been completed at Pier 2, work would begin to dismantle Pier 3 including the removal of support buildings, utilities and rail tracks. Removal of the concrete deck would then commence working from the seaward end of the pier. As sections of the deck are removed, wood support piles would be removed as they are exposed. At the same time, steel support piles for the new pier would be driven at appropriate locations.

Using this technique, the existing concrete deck and wood piles can be removed and new steel piles installed by equipment working from the existing pier. The approximately 15,300 cubic meters (m^3) (20,000 cubic yards (yd^3)) of concrete from the Pier 3 deck will be salvaged and may be used to create artificial reefs off the NJ coast. The creosoted-wood piles that support the deck will be disposed at an approved and permitted upland disposal/reuse/recycling facility.

- *Initiate first phase of dredging*

  After the existing pier deck and support piles have been removed, the first of two dredging operations would commence. Sediment testing has determined that two of the three reaches or layers of sediment that must be dredged for this project consist of contaminated sediments while the remaining reach consists of "clean" sediments. Clean sediment will be disposed at the in-water disposal site known as the Historic Area Remediation Site (HARS) while all contaminated sediments will be transported to an approved upland disposal location. The first phase of the dredging program would remove 51,000 m^3 (67,000 yd^3) of contaminated sediment from under the existing pier.

- *Construct a new modern pier, connecting trestle and utility support services in the approximate "footprint" of the existing Pier 3*

  Following the dredging contaminated sediments from under the pier, construction of the new pier and connecting trestle would commence. The new pier will be located in the footprint of the existing pier but it will be approximately 104.2 m (342 ft) shorter in length. The new pier will have complete utility services to provide "cold iron" utility service to homeported ships. ("Cold iron" refers to a ship's boilers that are shut down, or cold, when the ship is provided with shore-side utilities.) The new pier will be 288 m (945 ft) long and 49.1 m (161 ft) wide and will be configured with a partial double deck system providing below deck utility galleys, loading platforms and access ramps. The new pier will have six railroad tracks, two vehicle traffic lanes, complete cold iron services, lightning protection, an oil boom retention system, waterfront operations building, and a utility control building. The new connecting trestle will be approximately 326 m (1,071 ft) long and 18.9 m (62 ft) wide, with two railroad tracks and two traffic lanes.

- *Initiate second phase of dredging*

  Following construction of the new pier, the second phase of dredging to establish the required depths in the pier berths would commence. Both contaminated and clean sediments (176,000 m^3 (232,000 yd^3)) and 136,000 m^3 (179,000 yd^3)), respectively) would be removed from the berthing areas, providing a final dredge depth of -13.7 m (45 ft) MLW.

- *Discontinue ship berthing at Pier 2*

  Upon completion of construction, ship berthing and ordnance operations will return to Pier 3 and Pier 2 will be abandoned.

- *Demolish Pier 2 and Trestle 2*

  Following completion of the new Pier 3, Pier 2 will be demolished.

For the purpose of this determination the project was separated into three phases.

The scope of Phase I includes the following:

1. Temporary upgrades to Pier 2
2. Demolition of Pier/Trestle 3
3. Initial dredging

The scope of Phase II includes the following:

1. Construction of the foundation for the new Pier 3/Trestle 3
2. Construction of the concrete deck and finish the wye area
3. Upgrade the existing utilities.
4. Wrap the timber piles located beneath the utility building at the wye.

The scope of Phase III includes the following:

1. Completion of the new pier and trestle
2. Construction of a tug and barge berth area.
3. Completion of mechanical and electrical systems.
4. Completion of dredging
5. Demolition of Pier/Trestle 2

The location of the NWS Earle and the Piers are depicted in Figures 1, 2 & 3.

Figure 1 - General Vicinity Map, Sandy Hook Bay, New Jersey

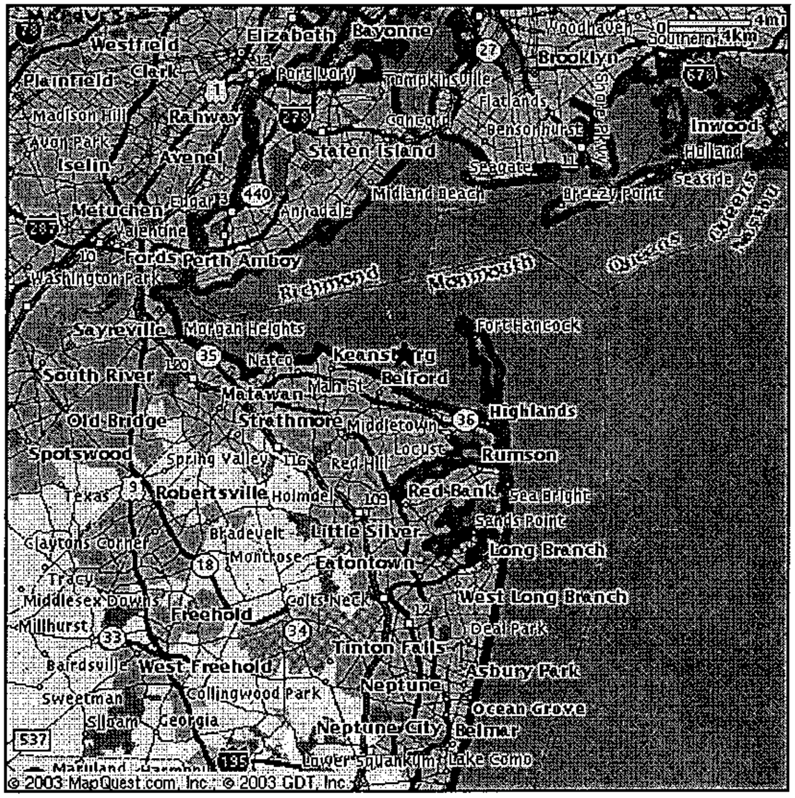

Figure 2 - Vicinity Map, NWS Earle

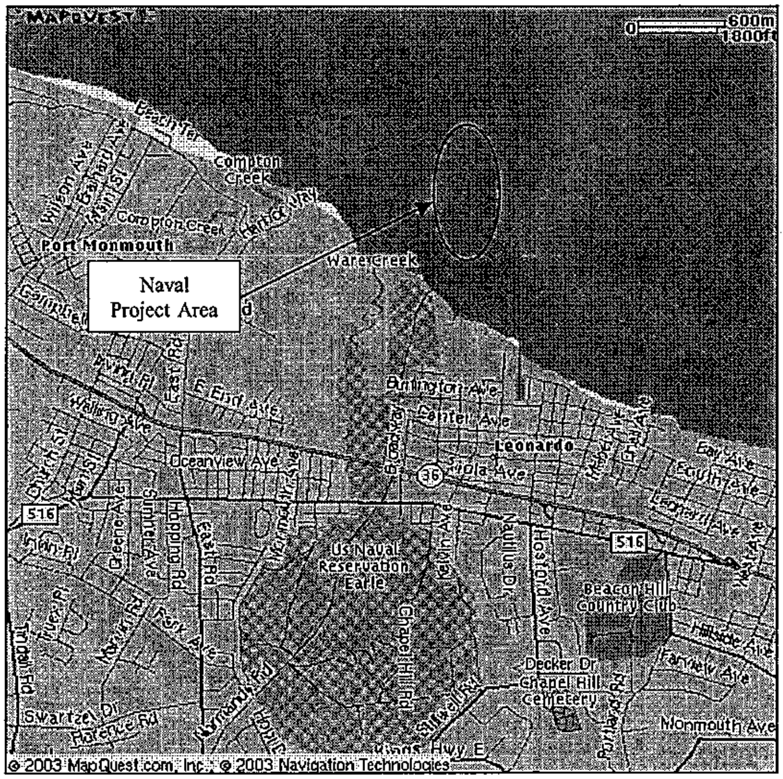

Figure 3 – Proposed Action Site, Piers 2 and 3

According to the United States Environmental Protection Agency (EPA), Monmouth County, New Jersey is part of the New York-Northern New Jersey-Long Island, NY-NJ-CT Severe Ozone Non-attainment Area.

Under the *Draft Chief of Naval Operations Interim Guidance on Compliance with the Clean Air Act General Conformity Rule* (Navy, 1994) (Guidance Manual), emissions of ozone precursors volatile organic compounds (VOC) and nitrogen oxides (NO_x) for on-going operations and construction activities associated with a project that is in a non-attainment area for a given pollutant must be below *de minimis* levels for that pollutant to be exempt from a formal conformity determination under the General Conformity Rule (GCR). The *de minimis* levels for VOC and NO_x emissions are 23 metric tons/year (25 tons/year) for proposed actions in a severe non-attainment area. Projects that contribute less than these amounts are exempt from the GCR. Projects that exceed these thresholds in any given year must undergo a more detailed analysis, and a formal conformity determination would be required. Finally, if the detailed analysis indicates an exceedance of the *de minimis* levels, then mitigation would be required.

II. METHODOLOGY

In accordance with the Guidance Manual, the incremental increase in emissions above the existing conditions has been considered and includes reasonably foreseeable direct and indirect emissions. Emissions include all vehicular emissions associated with site preparation, demolition and construction activities and worker vehicular movement within the station boundaries (i.e., on Navy property).

Construction schedules, required equipment and work crews were provided by Han-Padron Associates (MOT, 2003).

A. Construction Equipment

Privately Owned Vehicles

Emissions factors for automobiles for VOC, and NO_x were derived from MOBILE 6 model runs, for light duty gasoline-fueled vehicles traveling an average speed of 21 kilometers per hour –kmph (13 miles per hour - mph) while on base during summer months. Workers would travel to the construction site and park their vehicles throughout all phases of construction. It is assumed that each worker would have their own vehicle, travel to and from the site, and would also travel outside the property and back during lunch. Vehicular travel on the Station is included in the emissions calculation as it is the only portion of the trip that is under the control of the US Government. It is estimated that the total distance each vehicle would travel (on Station) would be about 19 km (12 mi) per day. The emissions factors for each construction vehicle type (except automobiles) were derived from EPA's, *Compilation of Air Pollutant Emission Factors, Fifth Edition (AP-42).* Supplemental emissions data for marine vehicles were derived from EPA's Commercial Marine Emissions Inventory (EPA-420). The proposed action is to be carried out in three phases as indicated.

Phase I – Upgrade and Repair Pier 2, Demolition of Pier 3 Superstructure

Emissions resulting from Phase I activities were estimated based on the expected number, type and duration of construction/demolition vehicles needed to complete the repair of Pier 2 and demolition of Pier 3 including decking, abutments, piers, the removal of the timber piles, and the dredging and removal of sediment.

Utility upgrading and minor structural repairs at Pier 2 will take approximately 20 days to complete and will require a barge with a 73 metric ton (80 ton) crane, and crew of nine men, including a foreman, crane operator, two electricians and five laborers.

The existing Pier 3 structure consists of a pre-stressed deck unit superstructure supported on a timber pile substructure. The existing superstructure will be removed along with the existing pier, timber pilings, railings, all below-deck conduit / utilities and steel channel supports. After removal of the concrete decking, the timber piles will be removed and new steel support piles installed. Once the deck has been removed, the initial phase of dredging will commence to remove the contaminated sediment from under the pier.

Removal of the decking from the trestle is anticipated to take approximately 50 days. This operation will include two barge cranes, one – 181 metric ton (200-ton) and one – 73 metric ton (80-ton), compressors, generators, welding equipment. It is anticipated that the 181 metric ton (200-ton) crane will operate for about two thirds of the time and the 73 metric ton (80-ton) crane will be utilized for the remaining one third. Nine men, including a foreman and crane operators will be required for each barge.

Removal of the pier and timber piles is anticipated to take 250 days. This operation will require approximately four concrete saws capable of cutting through 56 cm (22-in) thick concrete and will require the operation of the 181 metric ton (200-ton) crane for 190 days and the 73 metric ton (80-ton) crane for 60 days. Each barge will require crews of nine men each and the concrete saws will require crews of eight men including foremen and equipment operators.

Included in the removal of Pier 3 is the demolition of associated buildings on the pier. Building demolition is anticipated to take approximately 30 days and will require one flat bed mounted crane, a hydraulic excavator, two equipment operators, a foreman and seven laborers.

Also required in this phase and prior to demolition, is the removal of existing hazardous and other regulated materials on-site, including the first of two dredging operations. Dredging during this phase will remove 86,000 m^3 (113,000 yd^3) of contaminated sediment from under the existing pier. Contaminated sediments will be transported to an approved upland disposal location. This is anticipated to take 20 days, and will require skid equipment, compressors, hauling equipment (two-4.5 metric ton (five-ton) dump trucks), and seven laborers, two barge cranes and crews.

One tugboat with scow and a crew of four will also be required to collect and remove debris during demolition and dredging. Additional laborers from the barge crews will assist in dismantling pieces of the superstructure and placing them on the scow. Timber debris will be placed on scows for transport to an upland facility through the use of the 4.5 metric-ton (five-ton) dump trucks. Concrete debris will be hauled to an artificial reef site under the New Jersey Artificial Reef Program using one of the existing barges.

<u>Phase II – Construct New Pier 3</u>

The construction of the new Pier 3 will require three marine rigs with barge cranes and two truck mounted cranes on deck. For the installation of the sheet piling cofferdams and driving the new piles, a 22,812 kilogram-force meter (165,000 foot pound) vibratory hammer will be required. It is assumed that the hammer will be mounted on cranes already at use on the site. New piles are to be driven at locations of the existing piles and sheet pile cofferdams are to be installed around the abutments. For each rig, a crew of seven laborers and one foreman would be required to assist the crane operators in assembling the superstructure and connecting the pieces on the piers.

One 20.4 metric ton (22.5 ton) lowboy trailer would be used to transport construction materials (e.g., piers, pilings, steel re-bar reinforcement rods, concrete block, etc.) on-site for staging before construction. Materials would be off-loaded from the trailer and staged on-site using a single 22.7 metric ton (25-ton) crane or lifting truck with telescoping boom. It is assumed that new material would be continually delivered to the site during the construction process.

Phase III – Complete Pier 3 Superstructure, Final Dredging, Associated Items & Demolish Pier 2.

Emissions resulting from finalization of the pier structure and approach areas were estimated based on the expected number, type, and duration of construction and other vehicles needed to complete all areas.

The new trestle and pier would be surfaced with concrete. The concrete would be batched, mixed, laid, leveled and finished using a concrete paver. This vehicle is capable of laying a linear strip of finished concrete four m (12 ft wide) with each pass, with a daily output of approximately 1,505 m^2 (16,200 ft^2) (R.S. Means, 2000a). These values were divided into quantified coverage areas of the proposed actions to calculate total anticipated run time of the equipment for each project analysis. It is assumed all concrete surfacing paving would occur during Phase III.

Upon the completion of construction of Pier 3, Pier 2 will be demolished. Assumptions for the demolition of Pier 2 are the same as those applied to Pier 3 under Phase I (MOT, 2003) with the inclusion of the second phase of dredging.

During the second phase of dredging, both contaminated and clean sediments (176,000 m^3 (232,000 yd^3)) and 136,000 m^3 (179,000 yd^3)), respectively) would be removed from the berthing areas. Contaminated sediment will be transported to an approved upland disposal location. Clean sediment will be hauled, using a barge, out to open water disposal. This is anticipated to take 140 days, and will require skid equipment, compressors, hauling (two-4.5 metric ton (five-ton) dump trucks), and seven laborers in addition to the existing barge crews.

One tugboat with scow and a crew of four will also be required to collect and remove debris during demolition. Additional laborers from the barge crews will assist in dismantling pieces of the superstructure and placing them on the scow. Timber debris will be placed on scows for transport to an upland facility through the use of the 4.5 metric-ton (five-ton) dump trucks. Concrete debris will be hauled to an artificial reef site under the New Jersey Artificial Reef Program using one of the existing barges.

Phase III is anticipated to take approximately 350 days to complete.

B. New Facility Operation

Privately owned vehicles (POVs) driven by government personnel traversing the new pier, and government vehicles using the structure are not included in this applicability analysis since these vehicles already operate on the station. Construction of the new pier would result in a transfer of operations from the old structures to the new structure.

III. PROCEDURE & CALCULATIONS

The following steps followed the Guidance Manual for determining air quality conformance.

Applicability

Step 1: Is the action located in an air quality non-attainment or maintenance area?

***Response*: The proposed action will take place in an area designated as severe non-attainment for ozone.**

Step 2: Does the action result in the emission of criteria pollutants?

***Response*: Yes, the proposed action involves demolition and construction activities that will emit volatile organic compounds (VOCs) and nitrogen oxides (NO_x), which are ozone precursors. The proposed activities would involve the use of diesel and gas-powered construction and demolition equipment.**

Step 3: Is the action, or portion of the action, exempt from conformity requirements?

***Response*: Yes, the equipment usage outside of the NWS boundaries is not included in the emissions inventory. All activities within the NWS boundaries are included.**

Step 4: Is the action presumed to conform?

***Response*: No, no "presumed to conform" categories exist at this time.**

Step 5: Are the direct emissions associated with the action reasonably foreseeable?

***Response*: Yes, a contract will be awarded for the construction and paving work.**

Step 6: Are the indirect emissions associated with the action reasonably foreseeable?

***Response*: The indirect sources are reasonably foreseeable and include vehicular emissions from the workers' commuting vehicles, as well as typical construction equipment.**

Step 7: Can the indirect emissions associated with the action be practicably controlled due to continuing program responsibilities?

Response: **Indirect emissions cannot be practicably controlled off the site.**

Step 8: Determination of Emissions

Response: **The direct and indirect emissions from the proposed action were calculated as presented in Section III below.**

Step 9: Are the total emissions from the action below *de minimis* levels?

Response: **The total emissions from the proposed action are less than the *de minimis* levels specified in the GCR, therefore, a formal Conformity Determination will not be required. The results and conclusion are presented in Section IV.**

Step 10: Is the action regionally significant?

Response: **No.**

A. Construction Emissions

Construction Vehicles

Emission factors, in grams of pollutant per hour per horsepower, were multiplied by the estimated running time and equipment-associated average horsepower and load factor to calculate total grams of pollutant from each piece of equipment. Average running time, horsepower, and load factors were provided by the EPA. Total grams of pollutant were converted to metric tons for comparison to the *de minimis* levels.

The EPA recommends the following formula to calculate hourly emissions from non-road engine sources.

$$M_i = N \times HP \times LF \times EF_i$$

where:

M_i = mass of emissions of *i*th pollutants during inventory period;
N = source of pollution (units);
HP = average rated horsepower;
LF = typical load factor;
EF_i = average emissions of *i*th pollutant per unit of use (e.g., grams per horsepower-hour)

The calculations assume that work is performed over an eight-hour day (Monday through Friday) over a 52-week period (260 work days a year). However, some actions will require multiple years to complete and the work would be done in phases. Phase I involves demolition of the existing Pier 3. Phase II involves the construction of the new Pier 3. Phase III involves other associated construction work and the demolition of Pier 2.

Phase I is expected to take all crews working a combined 350 days to remove the pier deck and piers, demolitions the buildings, remove all hazardous material and complete the first of two dredging operations.

Phase II is expected to take approximately 780 work days (260 multiplied by three years) to drive the new pilings and construct the new pier.

Phase III is expected to take a combined 350 work days to complete the construction of the new Pier 3, demolish Pier 2 and complete the second dredging operation.

Total emissions data from all construction vehicles anticipated to complete the three phases (1,480 work days [5.7 years]) of the proposed action, is presented in Tables 1, 2 and 3.

Table 1. Estimated Emissions from Construction Equipment during Phase I

Equipment	Estimated Hours of Use During 16-Month (350 Working Days) Period	Exhaust Hydrocarbons[1] kg (lbs)	NO_x kg (lbs)
Dump truck	240	9 (20)	204 (450)
Wheeled front-end loader	240	20 (44)	180 (397)
Hydraulic excavator	120	27 (59)	182 (402)
Skidder	120	6 (13)	81 (179)
Welder	120	2 (5)	15 (33)
Compressor	240	7 (15)	46 (101)
Generator	240	11 (23)	71 (156)
Cranes[2]	2,280	123 (271)	2,008 (4,426)
Concrete Saws	2,400	189 (417)	1,478 (3,259)
Tug	2,000	450 (992)	11,025 (24,306)
Total per 16 mo. Period	8,000	844 (1,861)	15,291 (33,711)
Total metric-tons/ period pollutant		0.84	15.29
Total tons/ period pollutant		(0.93)	(16.86)

[1] Includes VOCs and other non-VOC compounds

[2] Includes dredging

Table 2. Estimated Emissions from Construction Equipment during Phase II

Equipment	**Estimated Hours of Use During 36-Month (780 Working Days) Period**	**Exhaust Hydrocarbons[1] kg (lbs)**	**NO_x kg (lbs)**
Flat Bed/ Low Boy Trailer	1,872	75 (165)	1,203 (2,652)
Crane	12,480	673 (1,484)	10,990 (24,229)
Total per 36 month period	14,352	748 (1,649)	12,193 (26,881)
Sub-Total metric-tons/ year pollutant		0.75	12.19
Sub-Total tons/ year pollutant		0.82	13.44

[1] Includes VOCs and other non-VOC compounds

Table 3. Estimated Emissions from Construction Equipment during Phase III

Equipment	Estimated Hours of Use During 16-Month (350 Working Days) Period	Exhaust Hydrocarbons[1] kg (lbs)	NO_x kg (lbs)
Dump truck	816	31 (69)	694 (1,529)
Wheeled front-end loader	816	67 (149)	613 (1,351)
Hydraulic excavator	408	92 (202)	619 (1,366)
Skidder	408	21 (45)	276 (609)
Welder	240	5 (10)	30 (67)
Compressor	240	7 (15)	46 (101)
Generator	240	11 (23)	71 (156)
Cranes[2]	2,856	154 (340)	2,515 (5,545)
Concrete Saws	2,400	189 (417)	1,478 (3,259)
Concrete Paver	90	5 (11)	65 (143)
Tug	2,000	450 (992)	11,025 (24,306)
Total per 16 mo. Period	10,514	1,031 (2,274)	17,433 (38,432)
Total metric-tons/ year pollutant		1.03	17.43
Total tons/ year pollutant		1.14	19.22

[1] Includes VOCs and other non-VOC compounds

[2] Includes Dredging

Automobiles

Emissions data from construction worker automobiles on-site is presented in Table 4. It is estimated that workers would travel approximately 19 km (12 mi) while on Navy property. This assumes going to and from the job site and travel to and from the job site for lunch. Calculations for each phase of construction follow.

Phase I
Based on the work crews estimated in Section II, 18 workers would be required during the 50 day period during which the pier deck would be dismantled; 35 workers would be used on-site during the 250 day period required for the removal of the pier; ten workers would be required for the 30 day-period in which the existing buildings would be demolished; Seven laborers and a nine-man barge crew, would be required during the 20-day period for the dredging and removal of hazardous material; and a crew of four is anticipated for tug-boat related duties. Assuming that vehicles would travel approximately 12 mi per day results in a total of 143,400 mi. Emission rates of 2.456 grams per mi (0.005 pounds [lbs] per mi) for VOCs and 1.2 grams per mi (0.002 lbs per mi) for NO_x were applied from MOBILE 6 runs. To calculate emissions of VOCs and NO_x, the emission factors were multiplied by the number of miles traveled as follows:

- *143,400 mi x 2.456 grams/ mi (0.005 lbs/ mi) = 352,190 grams (717 lbs.) VOC*
- *143,400 mi x 1.2 grams/ mi (0.002 lbs/ mi) = 172,080 grams (287 lbs.) NO_x*

Phase II
For the construction of the new Pier 3, the number of contractor automobiles would be approximately 45. Therefore, 45 vehicles for 780 work days during Phase II results in 35,100 vehicle days. Assuming vehicles would travel 12 mi per day results in a total of 421,200 mi. Based on emission rates of 2.456 grams per mi (0.005 lbs per mi) for VOCs and 1.2 grams per mi (0.002 lbs per mi) for NO_x, total emissions were calculated as follows:

- *421,200 mi x 2.456 grams/ mi (0.005 lbs/ mi) = 1,034,467 grams (2,106 lbs.) VOC*
- *421,200 mi x 1.2 grams/ mi (0.002 lbs/ mi) = 505,440 grams (842 lbs.) NO_x*

Phase III
In order to complete the construction of Pier 3 and demolish Pier 2, the following work crews would be required; 18 workers would be required during the 50-day period during which the pier deck would be dismantled; 35 workers would be used on-site during the 250-day period required for the removal of the pier; ten workers would be required for the 30-day period in which the existing buildings would be demolished; seven laborers and a nine-person barge crew would be required during the 170-day period for the dredging and removal of hazardous material; and a crew of four is anticipated for tug-boat related duties. Assuming that vehicles would travel approximately 12 mi per

day results in a total of 180,840 mi. Emission rates of 2.456 grams per mi (0.005 pounds [lbs] per mi) for VOCs and 1.2 grams per mi (0.002 lbs per mi) for NO_x were applied from MOBILE 6 runs. To calculate emissions of VOCs and NO_x, the emission factors were multiplied by the number of miles traveled as follows:

- *180,840 mi x 2.456 grams/ mi (0.005 lbs/ mi) = 444,143 grams (904 lbs.) VOC*
- *180,840 mi x 1.2 grams/ mi (0.002 lbs/ mi) = 217,008 grams (362 lbs.) NO_x*

Painting

Following construction of the pier, line painting would be required for all aspects of traffic direction and control; a total of 262 m^2 (2,820 ft^2) was estimated.

Paints emit VOCs at varying concentrations, depending on the type and brand of paint. For this analysis, the use of paint assumed an average VOC content of one lb of VOC per gallon. 3.8 l (one gallon) would cover approximately 37 m^2 (400 ft^2) of surface area. It is estimated that 262 m^2 (2,820 ft^2) of surface area within the new facility would require painting, and that two coats would be applied, resulting in 524 m^2 (5,640 ft^2) of painted surface. Therefore, approximately 54 l (14 gallons) of paint would be required to provide 524 m^2 (5,640 ft^2) of coverage, resulting in 6 kg, or 0.01 metric tons (14 lbs, or 0.01 tons) of VOC emission.

Table 4. Estimated Total Emissions from Proposed Action

Activity	VOC		NO_x	
	kg (lbs)	**Metric tons (tons)**	**kg (lbs)**	**Metric tons (tons)**
Construction Vehicles	2,551 (5,624)	2.60 (2.80)	43,729 (96,405)	43.67 (48.22)
Automobiles	1,690 (3,727)	1.70 (2.00)	676 (1,491)	0.68 (0.75)
Paint	6 (14)	0.01 (0.01)	N/A (N/A)	N/A (N/A)
TOTAL	4,248 (9,365)	4.31 (4.81)	44,405 (97,896)	43.36 (48.88)

B. Long-Term Emissions from Operations

There is no anticipated increase in emissions from first year operation activities. The proposed action will not increase the overall population of the Station, nor will it result in an increase in traffic or emissions from daily operations.

IV. RESULTS AND CONCLUSION

The proposed action would result in short-term emissions associated with the repair and replacement of Piers 2 and 3 respectively. The proposed action would result in total emissions of 4.31 metric tons (4.81 tons) of VOC and 43.36 metric tons (48.88 tons) of NO_x. As this is a multi-year action, the emissions will be distributed over the total number of years during which the proposed action will occur.

Emissions per phase of the proposed action would occur as presented in Table 5 below.

Table 5. Emission Totals by Estimated Construction Phase.

	VOC		NO_x	
	Metric Tons	Tons	Metric Tons	Tons
Phase I	1.15	1.33	15.41	16.97
Phase II	1.67	1.84	11.39	12.51
Phase III	1.43	1.64	17.63	19.42

The phases of the proposed action and resulting emissions would be distributed throughout the construction period of 1,480 workdays (5.7 years) as presented in Table 6.

Table 6. Estimated Annual Emissions through Implementation of Proposed Action

Construction Year	1		2				3		4		5				6	
Phase	I		I		II		II		II		II		III		III	
Months per Phase	12		4		8		12		12		4		8		8	
Percentage of Phase Complete	75%		25%		22.20%		33.30%		33.30%		11.10%		50%		50%	
Emissions	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x	VOC	NO_x
Metric Tons	0.86	11.56	0.29	3.85	0.37	2.53	0.56	3.79	0.55	3.80	0.19	1.27	0.71	8.81	0.72	8.82
(Tons)	(1.00)	(12.73)	(0.33)	(4.24)	(0.41)	(2.78)	(0.61)	(4.17)	(0.62)	(4.17)	(0.20)	(1.39)	(0.82)	(9.71)	(0.82)	(9.71)

The determined emissions values are well below the *de minimis* level of 23 metric tons per year (25 tons per year) for VOC and NO_x, therefore, a formal Conformance Determination is not required.

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Appendix "G"

APPENDIX G - COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION

1.0 DESCRIPTION OF PLANNED ACTIVITY

The Navy is proposing to upgrade the Naval Weapons Station (NWS) Earle pier complex by replacing existing Pier 3 and its connecting trestle with a new pier and trestle, essentially in the "footprint" of the existing pier, and then removing (and not replacing) existing Pier 2. These piers and their connecting trestles are approaching 60 years old, have reached their physical and economic limits and do not satisfy the Station's mission requirement of providing four homeport service berths for AOE class ships. Included in the proposed action is deepening the berths adjacent to Pier 3 from the current depth of -10.7 meters (m) (-35 feet (ft)) Mean Low Water (MLW) to -13.7 m (-45 ft) MLW. Approximately 405,000 m^3 (530,000 yd^3) of sediment would be dredged to allow a fully loaded AOE vessel to berth at the new Pier 3. Approximately 236,000 m^3 (308,000 yd^3) of the dredge sediments have been determined to be unsuitable for in-water disposal and therefore would be transported to an approved upland location for disposal. The remainder – 169,000 m^3 (222,000 yd^3) – are clean sediments and would be disposed of at the Historic Area Remediation Site (HARS) located off the New Jersey coast.

Pier 2 would remain in service during the construction of the new Pier 3 and would be temporarily upgraded to provide improved utility services to homeported vessels. Upon its removal, the berthing areas adjacent to this pier would no longer be maintained and over time, the water depth would return to depths typically found in this area of Sandy Hook Bay. Demolition debris, consisting of the concrete decking and steel railroad track from the removal of the piers would be used to create new or add to existing artificial reefs off the New Jersey shore in accordance with the state's artificial reef program.

The existing pier complex (excluding Pier 4) is eligible for listing on the National Register of Historic Places (NRHP) and the removal of Piers 2 and 3 and their connecting trestles constitutes an adverse effect on this historic World War II resource. The Navy and the New Jersey State Historic Preservation Office (SHPO) have agreed on appropriate mitigation for the loss of the pier complex.

2.0 LOCATION AND PURPOSE OF PLANNED ACTIVITY

Location

NWS Earle is located in Monmouth County in east central New Jersey. The Station consists of a waterfront area and a mainside area occupying approximately 4,500 hectares (ha) (11,000 acres (ac)). The waterfront area borders Sandy Hook Bay; however, the majority of the waterfront facilities are approximately 2.9 kilometers (km) (1.8 miles (mi)) from the water's edge with only approximately 0.40 km (0.25 mi) fronting the bay. Ammunition ships of the US Atlantic Fleet utilize the piers to load and offload munitions. A substantial portion of the ordnance used to support the war effort in Iraq was shipped from NWS Earle.

Current Situation/Purpose

Existing Station piers include only one pier (Pier 4) capable of berthing a fully loaded AOE. AOE vessels of the US Navy are large vessels that deliver cargo fuel, ordnance and other supplies to aircraft carrier battle groups. The depth of water required to berth these vessels in a fully loaded condition is -13.7 m (- 45 ft). Water depth at Piers 2 and 3 is only -10.7 m (-35 ft) requiring an AOE arriving at either pier to have only approximately 25 % of its cargo fuel onboard. Navy ordnance handling/loading requirements mandate that a ship's ordnance cargo be loaded last and just before ship deployment. Because of the available water depth at Piers 2 and 3, AOE vessels berthed at these piers must, upon deployment from the Station and after its ordnance cargo has been loaded, transit to a fuel depot in Virginia to receive its fuel cargo. This adds additional deployment time and violates Navy ordnance handling/loading requirements.

In order to provide four fully capable AOE berths at the Station, a new pier is required. Deepening the berths at the either Pier 2 or 3 would undermine the piles supporting these structures increasing the risk of pier collapse. Additionally, both piers are over 55 years old and are extremely costly to maintain. The 14,000 timber piles that support these piers are continually in need of replacement and/or protection against marine borer infestation. The removal of these structures and the construction of a new, modern, steel pile-supported pier has been determined to be the most cost effective action and by eliminating one of the piers, the dredge (berthing) area that is currently maintained would be reduced by about 10.5 ha (26 ac).

3.0 ALTERNATIVES

Replace Pier 3 (Proposed Action)

The proposed action includes a new replacement pier – approximately 25 % shorter than the existing Pier 3. The new pier would be about 288 m (945 ft) long by 49.1 m (161 ft) wide and the associated pier-side dredging would deepen the berths to -13.7 m (- 45 ft) MLW. Upon completion of construction, existing Pier 2 and Trestle 2 would be demolished thus reducing future dredging requirements. Pier 4, located to the west, would be approximately 214 m (700 ft) from the new Pier 3. Dredging requirements for this pier location include approximately 404,000 m^3 (530,000 yd^3), of which 236,000 m^3 (308,000 yd^3) is unsuitable for in-water disposal at the HARS and must be transported to an approved upland location.

Replace Pier 2 (New pier adjacent to Pier 2)

Under this alternative, a new pier would be constructed adjacent to Pier 2 and the western berth would remain in service during the construction of the new pier. Following construction, Piers 2 and 3 would be demolished. Under this alternative, the pier complex would consist of Pier 4 and a new Pier 2 separated by approximately 488 m (1,600 ft). This additional pier separation distance, compared to the proposed action, marginally increases ordnance loading operational safety, but it requires a much larger dredging project as well as a larger dredge area to be maintained. Dredging requirements for this alternative have been estimated at 1,045,000 m^3 (1,375,000 yd^3) and of this amount, it is estimated that over 627,000 m^3 (825,000 yd^3) may be unsuitable for in-water disposal. This alternative is substantially more costly in terms of initial construction cost, future maintenance cost, and greater environmental impact (due to increased dredging requirements). The limited benefit of providing a greater pier separation distance is not justified in these higher costs and this alternative is not preferred.

No Action Alternative

Under the No Action Alternative, the existing pier complex would be retained in its current condition. Adequate and fully compliant ship berthing and ordnance offloading cannot be achieved under the No Action Alternative. Continued high maintenance costs would be incurred to allow use of the pier complex. Finally, future ship homeporting requirements dictate the need for only four berths (two piers) and maintaining a third pier, even in the most limited condition, is an unnecessary cost. Therefore, the No Action Alternative is unacceptable.

4.0 ANALYSIS

The New Jersey Coastal Zone Management Program is defined by the following eight basic coastal policies:

1. Protect and enhance the coastal ecosystem.
2. Concentrate, rather than disperse the pattern of coastal residential, commercial, industrial, and resort development, encourage the preservation of open space, and ensure the availability of suitable waterfront areas for water dependent activities.
3. Employ a method for decision making which allows each coastal location to be evaluated in terms of both the advantages and the disadvantages it offers for development.
4. Protect the health, safety and welfare of people who reside, work and visit the coastal zone.
5. Promote public access to the waterfront through protection and creation of meaningful access points and linear walkways and at least one waterfront park in each waterfront municipality.
6. Maintain active port and industrial facilities, and provide for necessary expansion in adjacent sites.
7. Maintain and upgrade existing energy facilities, and site additional energy facilities in a manner consistent with the rules of this Coastal Management Program.
8. Encourage residential, commercial, and recreational mixed-use redevelopment of the developed waterfront.

The following New Jersey Coastal Management Program Rules pursuant to NJAC 7:7E are considered applicable to the proposed Pier 3 Replacement and Dredging Project:

7:7E-3.13 Shipwrecks and Artificial Reefs

(a) A "shipwrecks and artificial reefs" special area includes all permanently submerged or abandoned remains of vessels which serve as a special marine habitat or are fragile historic and cultural resources. This policy applies to tidal and ocean waters of the State of New Jersey three- mile territorial sea, but outside of navigation channels.

2. Also included in this category are artificial fishing reefs which serve the same natural function as a habitat for living marine resources. (See also 7:7E-3.35, Historic and Archeological Resources).

(b) Acceptable uses of these submerged habitats include recreational and commercial finfishing and shellfishing, and scuba diving. In addition, construction of new or expanded artificial reefs by the deposition of weighted non-toxic material is conditionally acceptable provided that:

1. It can be demonstrated that the material will not wash ashore and interfere with either navigation as regulated by U.S. Coast Guard or commercial fishing operations; and

2. Placement of the material and ultimate management of the habitat is coordinated with the DEP Division of Fish, Game and Wildlife.

The proposed removal of Piers 2 and 3 and their connecting trestles will result in large amounts of demolition debris including approximately 15,300 m^3 (20,000 yd^3) of concrete and 9,760 m (32,000 ft) of railroad trackage. One option for the disposal of this material would be to dispose of it at one or more artificial reef sites located off the New Jersey coast in accordance with New Jersey's Artificial Reef program. Only material suitable and approved for use in reef construction would be placed at these reefs. Other demolition debris, including the 14,000 creosoted-wood piles that support the piers and trestles, would be deposited at approved landfills. Another option for the disposal of the wood piles would be to transport the piles to a licensed facility that converts creosoted piles into energy by incineration.

<u>7:7E-3.36 Historic and Archaeological Resources</u>

(a) Historic and archaeological resources include objects, structures, shipwrecks, buildings, neighborhoods, districts, and man-made or man-modified features of the landscape and seascape, including historic and prehistoric archaeological sites, which either are on, or are eligible for inclusion on, the New Jersey or National Register of Historic Places.

The existing pier complex (excluding Pier 4 and new trestle constructed in 1990 and 1993 respectively) was constructed in 1943-1944 and has been determined eligible for listing on the NRHP under Criterion A – Association with Significant Events (World War II).

The *Alexander Hamilton*, a privately-owned, side-paddle, excursion sight-seeing tour boat, is a National Register-listed vessel that sunk while moored at Pier 1 in 1985. This vessel was temporarily moored at Pier 1 to allow a US Coast Guard inspection of the vessel prior to it being transported to a permanent mooring in the Hudson River. The vessel was damaged during a storm and before it could be moved, sunk and has subsequently deteriorated. Remnants of the ship are still located in the waters adjacent to Pier 1.

(d) Scientific recording and/or removal of the historic and archaeological resources or other mitigation measures must take place if the proposed development would irreversibly and/or adversely affect historic and archaeological resources.

The proposed action would demolish Piers 2 and 3 and their connecting trestles thus removing these Register-eligible resources. The Navy and the New Jersey SHPO have entered into a memorandum of agreement specifying the appropriate mitigation for this adverse effect. The mitigation would include, in part, recordation of the piers and trestles in accordance with the Historic American Engineering Record standards.

The remnants of the *Alexander Hamilton* would not be affected by the proposed action.

7:7E-3.42 Excluded Federal Lands

"Excluded Federal lands" are those lands that are owned, leased, held in trust or whose use is otherwise by law subject solely to the discretion of the United States of America, its officers or agents, and are excluded from New Jersey's Coastal Zone as required by the Federal Coastal Zone Management Act.

NWS Earle is an installation owned by the US Government and is therefore excluded from New Jersey's coastal zone as required by the federal Coast Zone Management Act. This document addresses project consistency with the state rules on impacts to coastal resources of the State of New Jersey beyond the boundaries of NWS Earle.

7:7E-4.2 Acceptability Conditions for Uses

"Docks and piers (for cargo and passenger movement and commercial fisheries)" are structures supported on pilings driven into the bottom substrate or floating on the water surface, used for loading and unloading passengers or cargo, including fluids, connected to or associated with a single industrial or manufacturing facility or to commercial fishing facilities.

Docks and piers for cargo and passenger movement and commercial fisheries are conditionally acceptable in most General Water Areas, provided that:

- *i. The width and length of the piers are limited to only what is necessary for the proposed use;*
- *ii. They will not pose a hazard to navigation; and*
- *iii. The associated use of the adjacent land meets all Coastal Resource and Development Policies.*

The proposed new pier would be 288 m (945 ft) long and 49.1 m (161 ft) wide and would be constructed in the "footprint" of existing Pier 3 that it located approximately 3.2 km (2 mi) from shore connected by a 305 m (10,000 ft) trestle. Following construction of the new pier, existing Pier 2 and Trestle 2 would be demolished and removed. As the proposed action is wholly within the Station's restricted area, the new pier will not pose a hazard to navigation.

1. "New dredging" is the removal of sediment from the bottom of a water body that has not been previously dredged, for the purpose of increasing water depth, or the widening or deepening of navigable channels to a newly authorized depth or width.

2. Acceptability conditions for new dredging are as follows:

i. New dredging is conditionally acceptable in all General Water Areas for boat moorings, navigation channels or anchorages (docks) provided that:

1. *There is a demonstrated need that cannot be satisfied by existing facilities;*
2. *The facilities served by the new dredging satisfy the location requirements for Special Water's Edge Areas;*
3. *The adjacent water areas are currently used for recreational boating, commercial fishing or marine commerce;*
4. *The dredge area causes no significant disturbance to Special Water or Water's Edge Areas;*
5. *The adverse environmental impacts are minimized to the maximum extent feasible;*
6. *Dredging will be accomplished consistent with all conditions described under the maintenance dredging provisions, (f)2(i) through vii below, as appropriate to the dredging method;*
7. *An acceptable dredge spoil disposal site exists;*
8. *The dredge area is reduced to the minimum practical;*
9. *The maximum depth of the newly dredged area will not exceed that of the connecting access or navigation channel necessary for vessel passage to bay or ocean; and*
10. *Dredging will have no adverse impacts on groundwater resources.*

Deepening the berths at the new pier from the current depth of -10.7 m (- 35 ft) MLW to -13.7 m (-45 ft) MLW (plus a 0.6 m (2 ft) allowable overdredge) is necessary to allow access by assigned (homeported) vessels. Large ordnance and cargo fuel supply ships, known as AOEs, require this depth to allow unrestricted access to the pier. This depth is currently maintained at Pier 4, the ship turning basin and the Terminal (entrance) Channel to the pier complex. Dredging would be limited to the berthing areas around existing Pier 3 located approximately 3.2 km (2 mi) offshore in Sandy Hook Bay. While the Bay supports a number of recreational and commercial activities, the pier complex is surrounded by a sercurity area that restricts access to and around the piers to authorized users.

Maintenance dredging is conditionally acceptable to the authorized depth, length and width within all General Water Areas to ensure that adequate water depth is available for safe navigation, provided that:

i. An acceptable dredged material disposal site with sufficient capacity exists (see (g) below and N.J.A.C. 7:7E-7.12 for rules on dredged material disposal).

Sediment to be dredged includes both contaminated and uncontaminated sediments. The clean (uncontaminated) sediment (approximately 169,000 m^3 (222,000 yd^3)) is planned for disposal at the HARS located in the Atlantic Ocean off Sandy Hook. The balance (236,000 m^3 (308,000 yd^3)) would be transported to an approved upland facility. A number of facilities, with barge access capabilities, are located in the region.

ii. Pre-dredging chemical and physical analysis of the dredged material and/or its elutriate may be required where the Department suspects contamination of sediments. Additional testing, such as bioaccumulation testing, and bioassay of sediments, may also be required. The results of these tests will be used to determine if contaminants may be re-suspended at the dredging site *and what methods may be needed to control their escape. The results will also be used to determine acceptability of the proposed disposal method.*

Dredge sediment testing, including bioassay & bioaccumulation testing, was conducted in accordance with the testing plan provided the US Army Corps of Engineers (ACOE) and the US Environmental Protection Agency (EPA). Test data will be submitted to the ACOE and the EPA in support of the proposed dredge material disposal activities regulated by the ACOE under Section 404 of the Clean Water Act (CWA) and Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). The Navy will also submit test data to the New Jersey Department of Environmental Protection (NJDEP) as part of an application for water quality certification in accordance with Section 401 of the CWA. Preliminary test results indicate that a portion of the material (169,000 m^3 (222,000 yd^3)) is suitable for disposal at the HARS for the purpose of remediation. The remainder will be transported to an approved upland facility.

iii. Turbidity concentrations (that is, suspended sediments) and other water quality parameters at, downstream, and upstream of the dredging site, and slurry water overflows shall meet applicable State Surface Water Quality Standards in N.J.A.C. 7:9-4. NJDEP may require the permittee to conduct biological, physical and chemical water quality monitoring before, during and after dredging and disposal operations to ensure that water quality standards will not be exceeded.

Water quality monitoring is not anticipated as being required to implement the proposed dredging project.

iv. If predicted water quality parameters are likely to exceed State Surface Water Quality Standards, or if pre-dredging chemical analysis of dredged material or elutriate reveals significant contamination, then the Department will work cooperatively with the applicant to fashion acceptable control measures and will impose seasonal restrictions under the specific circumstances identified below.

The Navy has prepared an Essential Fish Habitat Analysis (to be forwarded under separate cover) and based on this study, has concluded that the dredging should be conducted within a specified dredge window, likely between May 15th and November 15th.

v. For maintenance dredging using mechanical dredges such as clamshell bucket, dragline, grab, orange peel, or ladders, deploying silt curtains at the dredging site may be required, if feasible based on site conditions. In sites at which the use of silt curtains is infeasible, dredging using closed watertight buckets or lateral digging buckets will be examined. NJDEP may decide not to allow mechanical dredging of highly contaminated sites even if turbidity control measures were planned.

An environmental dredge bucket will be utilized for the removal of the contaminated sediments. It is anticipated that an open clamshell dredge bucket will be utilized for the clean sediments. The use of silt curtains is not currently included in this project.

7:7E-7.12 Dredged Material Disposal on Land

(a) Dredged material disposal is the discharge of sediments, removed during dredging operations. The following rules govern Land and Water's Edge disposal only. The rule regulating dredged material disposal in Water Areas are found in N.J.A.C. 7:7E-4.2.

(b) Dredged material disposal is conditionally acceptable under the following conditions: sediments are covered with appropriate clean material that is similar in texture to surrounding soils, and the sediments will not pollute the groundwater table by seepage, degrade surface water quality, present an objectionable odor in the vicinity of the disposal area, or degrade the landscape.

1. Dredged material disposal is prohibited on wetlands unless the disposal satisfies the criteria found at N.J.A.C. 7:7E-3.27.

2. The use of uncontaminated dredged material of appropriate quality and particle size for beach nourishment is encouraged. Creation of useful materials such as bricks and lightweight aggregate from the dredged material is encouraged.

3. The use of uncontaminated dredged material for purposes such as restoring landscape, enhancing farming areas, creating recreation-oriented landfill sites, including beach protection and general land reclamation, creating marshes, capping contaminated dredged material disposal areas, and making new wildlife habitats is encouraged.

4. Effects associated with the transfer of the dredged materials from the dredging site to the disposal site shall be minimized to the maximum extent feasible.

A Dredged Material Disposal Alternatives Analysis has been prepared, pursuant to the 1972 MPRSA for dredging activities associated with the proposed replacement of Pier 3 and Trestle 3 at the NWS Earle. Several aquatic, near-shore and upland disposal/reuse alternatives were considered. The upland disposal/reuse alternatives investigated were located both on and off of NWS Earle property and included several New Jersey Dredged Materials Management Areas. The decision as to which facility will be used for the disposal of contaminated sediments will likely be determined by the lowest cost for such disposal and will be determined at the time of construction award. Any site selected would have to meet NJDEP requirements for the use of contaminated sediments.

7:7E-7.13 National Defense Facilities Use Rule

A "national defense facility" is any building, group of buildings, marine terminal, or land area owned or operated by a defense agency (Army, Navy, Air Force, Marines, Coast Guard) and used for training, research, material support, or any other defense-related use.

National Defense facilities are conditionally acceptable, and will be approved if one of two findings can be made:

1. *The proposed facility is consistent with all relevant Coastal Resource and Development Policies; or*
2. *The proposed facility is coastally dependent, will be constructed and operated with maximum possible consistency with Coastal Resource and Development Policies, and will result in minimal feasible degradation of the natural environment.*

NWS Earle is a US Government-owned port facility providing ammunition storage, loading and offloading to ships of the US Atlantic Fleet and other carriers and as such, is coastally dependent to allow fulfillment of its mission. Operations are implemented in a manner to prevent or minimize degradation of the natural environment.

7:7E-8.2 Marine Fish and Fisheries

Coastal actions are conditionally acceptable to the extent that minimal feasible interference is caused to the natural functioning of marine fish and fisheries, including the reproductive and migratory patterns of estuarine and marine estuarine-dependent species of finfish and shellfish.

The EFH Analysis evaluated the impact of the proposed action on marine species and concluded the dredging can be conducted without significant impact to these species or their habitat. Impacts are expected to be temporal and localized.

7:7E-8.4 Water Quality

As required by Section 307(f) of the Federal Coastal Zone Management Act (P.L. 92 583), Federal, State and local water quality requirements established under the Clean Water Act (33 U.S.C. § 1251) shall be the water resource standards of the coastal management program. These requirements include not only the minimum requirements imposed under the Clean Water Act but also the additional requirements adopted by states, localities, and interstate agencies pursuant to Section 510 of the Clean Water Act and such statutes as the New Jersey Water Pollution Control Act.

The Navy will submit an application to the NJDEP for a Section 401 Water Quality Certification for the proposed action. Issuance of a water quality certificate is anticipated.

5.0 DETERMINATION

The proposed action is not considered to be significantly adverse nor will it alter the future development, use, or quality of New Jersey's coastal resources. The Navy has, therefore, determined that this project will be conducted in a manner consistent, to the maximum extent practicable, with New Jersey's Coastal Zone Management Program.